

Microbial Activity during Biodegradation and its Effects on Groundwater Velocity in
a Contaminated Aquifer

by

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Abstract

A petroleum hydrocarbon plume was introduced into a controlled flow gate within the relatively homogenous Borden aquifer, Canada. Down-gradient of the release, O₂ was added to stimulate microbial activity and biodegradation in the aquifer. Changes in groundwater velocity associated with biological activity, were measured with point velocity probes (PVPs) arranged into multilevel standpipes and installed into the flow gate. PVP results were compared with electromagnetic wave velocity measurements from a ground penetrating radar (GPR) survey conducted in the same flow gate. Following the addition of O₂, PVP and GPR measured velocities nearest the O₂ source changed in a consistent manner throughout the experiment. GPR velocities measured outside the influence of the added O₂ did not indicate the same trend. Results from flow modeling combined with gas and biomass measurements, show that PVP and GPR velocity changes were likely caused by factors related to elevated levels biological activity in the aquifer.

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Chapter 1: Introduction

1.1 The Importance of Groundwater Velocity in Aquifer Remediation

Groundwater velocity is often considered one of the most important parameters for calculating the fate and transport of solutes and contaminants (Ballard 1996; Kearn 1997; Labaky *et al.*, 2007). Effective remediation strategies, especially when the treatment methods are *in situ*, require accurate estimates of groundwater velocity during aquifer characterization in order to anticipate contaminant pathways, loadings, and residence times in selected portions of aquifers. Passive *in situ* methods, such as permeable reactive barriers (PRBs) or natural attenuation rely on highly accurate characterization of flow systems so they can be designed to intercept the contaminated fraction of groundwater flow completely. Conventional strategies to determine groundwater velocity only provide estimates of velocity at the decimeter scale, or greater, using Darcy's Law. Since PRBs may be one meter thick or less, the decimeter scale is larger than desirable.

A novel tool, the point velocity probe (PVP), developed by Devlin and tested by Di Biase (1999), Donald (2001), and field tested by Labaky (2004) can directly measure point velocities at the centimeter scale. The PVP is installed in direct contact with the aquifer and therefore functions without a well and requires no calibration step to compensate for well-bore effects (Labaky 2004). Point velocity probes operate based on the injection and detection of small volumes of saline tracer that are not in large contrast with the ambient groundwater density as to not induce false vertical gradients. Point velocity probes are inexpensive to manufacture and once installed, the PVPs can be used multiple times. In addition, the PVP provides velocity estimates

without involving Darcy's Law or hydraulic conductivity. Therefore, the development of the PVP makes it possible to observe small scale velocity changes associated spatial and time varying heterogeneities within an aquifer that might be obscured by other methods (McGlashan *et al.*, 2005). Moreover, an array of PVPs can measure groundwater velocity and its changes throughout designated aquifer zones, potentially providing information concerning 2-D and 3-D flow patterns. This makes the probe a potentially useful tool for tracking transient heterogeneity caused by geochemical or microbiological processes such as precipitate formation, mineral dissolution, gas generation, or biomass accumulation.

1.2 Impact of Biological Activity on Groundwater Velocity in Remediating Aquifers

Groundwater flow is sensitive to changes in permeability and porosity. Such changes can occur as a result of pore throat restrictions or clogging (Seki *et al.*, 2006; Engesgaard *et al.*, 2004; Kildsgaard and Engesaard 2002; Holm 2000; Baveye *et al.*, 1998; Taylor and Jaffé 1990a). Biological clogging of porous media is caused by the accumulation of microbial cells, formation of extracellular polymers, entrapment of gaseous metabolic products, and microbially mediated inorganic precipitates (Baveye *et al.*, 1998). In some cases, more than one mechanism may contribute to clogging simultaneously (Baveye *et al.*, 1998). All of these mechanisms can occur in response to a microbial stimulant such as a carbon growth substrate (Holm 2000). Biological clogging has been documented in many laboratory studies and it has been numerically modeled (Baveye *et al.*, 1998; Engesgaard *et al.*, 2004; Holm 2000; Taylor and Jaffé 1990a and 1990b). While laboratory and numerical studies exist to confirm the

effects of biological clogging, there remains a need to study this effect in a field setting.

1.3 Current Techniques for Determining Groundwater Velocity

The PVP technology was selected to study the impact of bioclogging in porous media at the field-scale because it alone provides a method of measuring seepage velocity at a scale small enough to observe the effects of microbial activity on flow, without much vertical averaging. However, a variety of methods exist for direct velocity measurement, and these are briefly reviewed below for the sake of comparison. Current methods used for determine groundwater velocity fall into two main categories: indirect and direct techniques.

1.3.1 Indirect Techniques

Indirect techniques are those that require the use of the Darcy equation to calculate groundwater velocity:

$$v = \frac{q}{n} = \frac{Ki}{n} \quad [1.1]$$

where v is the average linear groundwater velocity [L/T], q is the specific discharge defined with units [L³/TL²] or [L/T], n is the porosity [L³/L³], K is the hydraulic conductivity of the porous material [L/T], and i is the hydraulic gradient [L/L]. Of the parameters above, the one that has received the greatest attention for its estimation, and its effects on flow systems, is the hydraulic conductivity. Despite these efforts, hydraulic conductivity measurements often have large uncertainties (Labaky *et al.*, 2007). Also, because K can vary considerably over short distances, its distribution in aquifers is difficult to establish in detail. In addition to these problems, the hydraulic

gradient is often measured on scales different (usually larger) than the scale of interest for the velocity calculation (Devlin and McElwee 2007).

Commonly applied techniques for K estimation include slug tests and aquifer tests. Aquifer tests, or pumping tests, are appropriate when large scale measurements of K are required. They involve continuous pumping of a well while hydraulic response is monitored at nearby piezometers. The responses can be related to aquifer storage and hydraulic conductivity. Slug tests are used when smaller scale measurements of hydraulic conductivity are needed. These methods involve the perturbation of the flow system in the immediate vicinity of a single piezometer. The recovery of the flow system to pre-test conditions is a function of the hydraulic conductivity next to the piezometer. High resolution slug testing (Zemanski and McElwee 2005) and hydraulic tomography techniques (Butler 1999; Yeh and Liu 2000) are being developed to better ascertain the local variability of K vertically, and between borehole-pairs in the field.

Additional indirect techniques include the use of borehole flow meters (electromagnetic, mechanical, and thermal), which can provide relative vertical variability in K by logging cumulative discharge as a function of depth in a fully screened, pumping well (Morin *et al.*, 1988; Moltz *et al.*, 1994). Also, hydraulic conductivity of unconsolidated sediment samples, reworked or as minimally altered core sections is estimated in the lab on the basis of grain-sizes, empirical formulas, or permeameter tests (Fetter 2001).

1.3.2 Direct Techniques

Direct techniques of groundwater velocity estimation do not require the Darcy equation, thereby avoiding the limitations of needing accurate estimates of K and i . Field technologies for direct measurements of groundwater velocity require calibration steps and or shape factors to correct for thermal variations, converging flow, and well geometry. The natural gradient tracer test is an example of a direct technique. Tracers used in such tests fall into two main categories: (1) environmental tracers, typically isotopes, used to estimate groundwater velocity at large scales (up to several hundred kilometers) (Clark and Fritz 1997). (2) Injected tracers, which are applied at smaller scales (up to tens of meters) (Davis *et al.*, 1985). Injected tracer tests have been applied to groundwater contamination sites where dispersivity, groundwater velocity, preferential flow, advective phenomena, and effects of heterogeneity can be determined for use in later calculations and modeling (MacKay *et al.*, 1986; Garabedian *et al.*, 1991). In field studies of alluvial aquifers, Slichter (1905) used an injection well and three observation wells to perform a natural gradient tracer test with an electrolyte tracer. Groundwater velocity was calculated using tracer breakthrough data from the observation well that received the strongest tracer signal. The relative flow direction was estimated approximately from the position of the same observation well relative to the injection well. Interestingly, Slichter (1905), performed lab experiments to validate his method, in which he added formaldehyde to prevent the “progressive reduction in flow over a considerable length of time” from the clogging of the pore spaces by the “growth of organisms” (Slichter, 1905 pg 32, 35). In general, natural gradient tracer tests provide velocities

averaged over the distance between the injection wells and monitoring wells. As a result, some detail is lost compared to velocity data from more localized methods (Labaky *et al.*, 2007). Over the past 30 years, new technologies have been introduced to directly measure groundwater velocity at more defined scales.

1.3.2.1 Tools that Require Heat or Chemical Tracers

Point dilution techniques use repeated fluid column profiling after the injection of a tracer of finite mass into a well. The concept is based on the principal that the loss of tracer mass from a screened interval of a well can be related to the horizontal flow component of the groundwater velocity. The theory for measuring borehole tracer dilution has been established since the late 1950's (Pitrak *et al.*, 2007). The method has been used in numerous field studies (Novakowski *et al.*, 2006; Ronen *et al.*, 1986; Drost *et al.*, 1968), but requires calibration due to flow irregularities around the well screen.

An unnamed logging tool developed by Mares *et al.* (2003) was used to obtain groundwater velocity direction data. The tool uses a photometric sensor to monitor the progression of a color tracer plume located in a lit field once the probe is lowered into a saturated borehole. Temporal voltage data from phototransistors in the photometric sensor are relayed to an onboard compass and surface computer that tracks and records the azimuth data of the groundwater flow.

A borehole tool is currently being developed by Kessels *et al.* (2002) that functions primarily on the injection and detection of a saline tracer into a well. An array of electrodes placed along the outside of a packer or along the inside of the casing, monitor the progression of the tracer added to the water column.

Measurements taken before, during, and after tracer injection provide data that can be related to the direction and magnitude of the groundwater velocity as well as dispersivity. This technique requires large quantities of saline tracer and flow behavior characteristic of the density contrast between the tracer solution and the groundwater, must be corrected at the data interpretation stage.

The Geoflo® Meter, developed by Kerfoot Technologies Inc., measures groundwater velocity in a well screen by tracing a heat pulse as it migrates by an array of thermistors. Thermistors down-gradient from the source register a temperature difference that can be related to the groundwater flow direction, and the arrival time of the pulse can be related to velocity magnitude (Melville *et al.*, 1985).

The In Situ Permeable Flow Sensor (SPFS) developed by the Sandia National Laboratory operates on the principal of heat conduction (Ballard, 1996). Heat is uniformly generated on the surface of the probe by a 100 W source. An array of 30 thermistors records the temperature distribution along the surface of the probe. Heat is redistributed on the probe surface by groundwater flow, resulting in higher relative temperatures on the downstream side of the probe and lower relative temperatures on the upstream side of the probe. In addition, vertical components to the flow are recorded as a vertical shift in the temperature profile. Data from the thermistors are inverted using a SIMPLEX algorithm to produce estimates of the groundwater velocity vector averaged over the probe surface (direction and magnitude). The SPFS differs from other technologies in that it is placed in direct contact with the aquifer material rather than in a borehole or well. Additionally, it differs from the Geoflo®

Meter by measuring velocities characteristic of $\sim 1 \text{ m}^3$ compared to the $\sim 0.001 \text{ m}^3$ of the Geoflo® Meter (Ballard 1996).

The Thermo-time domain reflectometry (TDR) probe is a technique that uses a heat pulse to determine soil water flux and pore-water velocity of soil samples in the laboratory. The Thermo-TDR probe operates by utilizing a line of three parallel and equidistant hypodermic needles outfitted with a heater wire and thermocouple lying in a common plane, orientated in the direction of water flow. The central needle emits a heat pulse where the outer needles monitor the asymmetrical temperature changes as a function of time caused by the advection of water. Heat transfer theory is then used to relate the maximum temperature difference between the upstream and downstream sensors to the soil water flux or pore-water velocity if the volumetric water content is known (Ren *et al.*, 2000).

Heat based sensors such as Geoflo® Meter, SPFS, and Thermo TDR probe suffer from problems associated with the heterogeneity of thermal properties of the geologic materials. Vertical variation of thermal properties due to sediment stratification has been simulated to produce false vertical gradients (Su *et al.*, 2006).

1.3.2.2 Tools that do not Require Injected Tracer

The Laser Doppler Velocimeter developed by Momii *et al.* (1993) estimates the horizontal groundwater velocity by observing the Doppler shift in the frequency of laser light scattered from small particles suspended in the borehole water at the measuring point (confluence of two laser beams). The Doppler shift frequency varies linearly with the particle velocity magnitudes in the borehole. An approximated Bessel function calibrates the particle velocities in the borehole to the average

horizontal groundwater velocity magnitude. The directional component of the velocity vector in a borehole is calculated by measuring two orthogonal velocity components and taking the inverse tangent of their ratio.

The colloidal borescope, developed by the Oak Ridge National Laboratory, utilizes a camera that tracks the movement of colloids inside a well screen. Each colloid is tracked between scans and assigned a set of pixel coordinates. Knowing the discrete time interval between scans and distance of travel, velocity magnitude estimates can be made. Velocity direction (azimuth of the mean velocity vector) is determined by comparing the average distribution of particles along the flow path to an internal compass (Kearl 1997). As with previously mentioned borehole tools, flow irregularities around the well screen must be compensated by calibration.

Pulse field gradient nuclear magnetic resonance (PFG NMR) techniques have been used in the laboratory to establish the flow velocity through saturated core samples and glass beads. PFG NMR operates by inducing a series of magnetic field gradients to cause protons in water to become oriented and precess in the transverse magnetic field of the applied gradient. Precession is not indefinite and protons fall out of phase with one another with a characteristic angle, ϕ_1 . As the protons dephase, a magnetic field is reapplied at a different angle causing the protons to rephase by angle ϕ_2 (Deurer *et al.*, 2002). The difference in the angles provides a velocity dependant phase shift that is proportional to the amplitude of the received signal (Deurer *et al.*, 2002). Geophysical field applications of the NMR principal, such as magnetic resonance sounding (MRS), do not currently measure groundwater velocity

directly, however, estimates of K can be obtained through field calibration and empirical formulas (Lubczynski and Roy, 2004).

1.4 Developed PVP Theory

The PVP method is based on idealized flow around a submerged circular cylinder in a laminar flow field with no porous medium, where the average linear velocity beyond the influence of the probe can be calculated from a measured apparent velocity along the circumference of the probe by the following equation (Bird *et al.* 1960):

$$|v(\theta)|^2 = 4v_{\infty}^2 \sin^2 \theta \quad [1.2]$$

where $v(\theta)$ is a point velocity on the perimeter of the circular cylinder and v_{∞} is the average linear velocity beyond the influence of the cylinder. θ is the angle formed between a ray, aligned with the average flow direction, and directed through the center of the cylinder, with a second ray passing from the center of the cylinder to a point on the cylinder's surface, where the velocity is measured. The equation applies for all values of θ except 0° and 180° which are stagnation points where velocities approach zero (Labaky 2004).

Di Biase (1999) applied the above equation to porous media where the injection and detection of a tracer could be measured at a single point along the circumference of a probe and related to groundwater velocity. By integrating Equation (1.2) over infinitesimal arc sections, and averaging results between α and

$\alpha + \gamma$ (**Figure 1.1**), the magnitude of the velocity vector was calculated as follows:

$$v_{\infty} = v_{app} \times \frac{0.5}{\gamma} \times \ln \left[\frac{\tan\left(\frac{\alpha + \gamma}{2}\right)}{\tan\left(\frac{\alpha}{2}\right)} \right] \quad [1.3]$$

where α is the orientation of the injection port with respect to the flow direction, v_{app} is an apparent velocity measured at a detector and γ is the fixed angle between the injection port and detector. Flow direction was determined by Di Biase (1999) by solving Equation (1.3) for two different injector positions (α and $\alpha + \Delta\alpha$) created by performing a test, rotating the probe, and then repeating the test. The direction angle, α , was calculated using a nonlinear optimizer routine, SOLVER, in the Excel[®] spreadsheet to solve the following, which equates v_{app} calculated for each test:

$$v_{app1} \times \ln \left[\frac{\tan\left(\frac{\alpha + \gamma}{2}\right)}{\tan\left(\frac{\alpha}{2}\right)} \right] = v_{app2} \times \ln \left[\frac{\tan\left(\frac{\alpha \pm \Delta\alpha + \gamma}{2}\right)}{\tan\left(\frac{\alpha \pm \Delta\alpha}{2}\right)} \right] \quad [1.4]$$

where v_{app1} and v_{app2} are the apparent velocities at orientations α and $\alpha + \Delta\alpha$ respectively. In Equation (1.4), $\Delta\alpha$ (degrees of manual rotation), and γ are known. All the instruments constructed to date have been equipped with detectors that measure electrical conductivity created by a saline tracer. Apparent velocities were calculated from the arrival times of the tracer pulses on the PVP surface. Each injection results in an asymmetrical breakthrough curve that represents the arrival of the tracer. A simplex optimizer routine (PULSEPE) was used to fit a 1-D solution to the advection-dispersion equation to the tracer breakthrough curves (Devlin 1994a). Apparent velocities v_{app1} and v_{app2} were applied to Equation (1.4) to calculate the orientation angle of the injection port with respect to the flow direction α .

Donald (2001) modified the PVP design used by Di Biase by constructing the probe with a second detector in order to obtain α estimates from a single test (**Figure 1.1**). Equation (1.4) was modified for the new design as follows:

$$\frac{v_{app1}}{\gamma_1} \times \ln \left[\frac{\tan\left(\frac{\alpha + \gamma_1}{2}\right)}{\tan\left(\frac{\alpha}{2}\right)} \right] = \frac{v_{app2}}{\gamma_2} \times \ln \left[\frac{\tan\left(\frac{\alpha + \gamma_2}{2}\right)}{\tan\left(\frac{\alpha}{2}\right)} \right] \quad [1.5]$$

where v_{app1} and v_{app2} are the apparent velocities for detector 1 and 2 respectively. The fixed angles between the injection port and detectors 1 and 2 are γ_1 and γ_2 respectively. A simplex optimizer routine was again needed to solve for α .

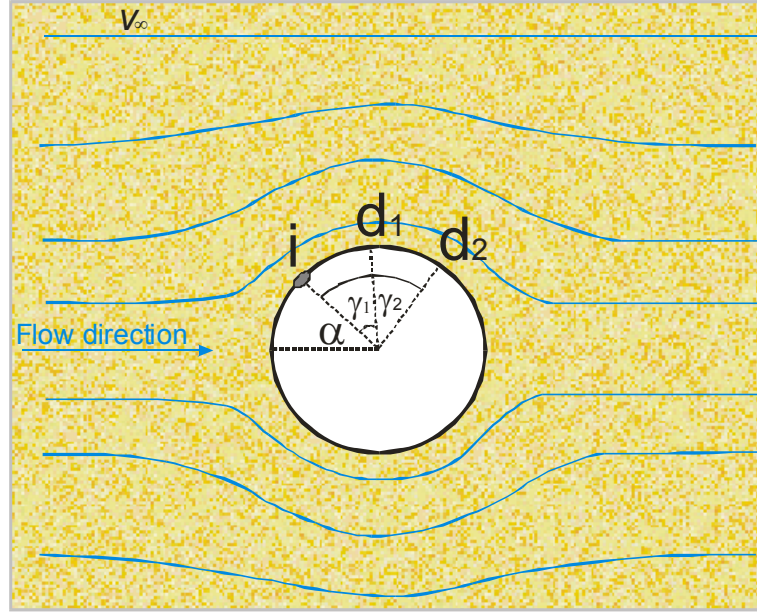


Figure 1.1: A plan-view schematic of a PVP submerged in a porous media flow field (Labaky *et al.*, 2007, in press). The PVP requires the use of an injection port (i) and two detectors d_1 and d_2 placed at known angles γ_1 and γ_2 to determine the orientation angle of i to the average flow direction (α) and magnitude (V_∞) of the groundwater velocity vector.

Labaky (2004) developed an alternative to Equation (1.3) to solve for α without the use of an optimizer routine. By expressing the $v(\theta)$ as an angular velocity and then integrating the apparent point velocities in Equation (1.3) over infinitesimal arc sections, and averaging results between α and $\alpha+\gamma$, the magnitude of the average apparent angular velocity was calculated as follows:

$$v_\infty = \frac{v_{app} \gamma}{2(\cos \alpha - \cos(\alpha + \gamma))} \quad [1.6]$$

Equating v_∞ calculated from two detectors, and substituting from Equation (1.6), a single equation for α was derived:

$$\alpha = \tan^{-1} \left[\frac{v_{app1} \gamma_1 (\cos \gamma_2 - 1) + v_{app2} \gamma_2 (1 - \cos \gamma_1)}{v_{app1} \gamma_1 \sin \gamma_2 - v_{app2} \gamma_2 \sin \gamma_1} \right] \quad [1.7]$$

Labaky *et al.*, (2007) tested the above theory in numerical finite element simulations prior to field application. SALTFLOW 3.0 (Molson and Frind, 2002) was used to simulate tracer movement around the probe, accounting for 3-D flow and density effects. Results validated the theory for velocities ranging from 1 to 320 cm/day (the entire range of velocities tested). The use of the 1-D optimizer routine (PULSEPE) was not found to introduce significant error to the estimated velocities. Skin effects due to installation modeled as zones of higher or lower K immediately next to the probe surface were shown to impact velocity magnitude but not direction. The magnitude of the bias was found to be directly proportional to the difference in K from the aquifer to the skin (Labaky 2004). The PVP used by Labaky (2004) in both field and laboratory experiments was an adaptation of both prototypes used by Di Biase (1999) and Donald (2001), but modified for field application and the additional stresses from installation. During laboratory tests, the PVP demonstrated that it could effectively determine the average linear groundwater velocity with accuracy (-2.2% mean relative error) and precision (7.8% mean relative standard deviation) compared to a known control velocity. Results from comparative testing show that the PVP provided the most accurate velocity estimates compared to four other direct techniques, the Geoflo® Meter, drive-point and borehole point dilution probes, and the colloidal borescope in a constructed flow cell in the Borden aquifer.

1.5 PVP Design for Bioclogging Experiment

PVPs used in this study were essentially of the same design as those used by Donald (2001), with the exception of a minor modification to the injection design. Two syringes connected to the injection line through a Y-connector permitted

repeated injections of identical tracer volume (± 0.05 ml). Schedule-40 flush-thread PVC casing was used to construct the probe body, two stainless steel wire detectors were built-in, and the injection port consisted of a diffusive sphere painted to restrict the flow of tracer to a small section of the surface (**Figure 1.2**). The stainless steel wire detectors soldered to insulated copper wire, which carried signals to the surface, helped prolong the service life of the tool by resisting corrosion from long-term field monitoring. The use of flush-thread PVC casing allowed the PVPs to be arranged in multilevel fashion to attain *in situ* groundwater velocity information at various depths (**Figure 1.2**). This modification was essential for the long-term and relatively high resolution monitoring required by this study.

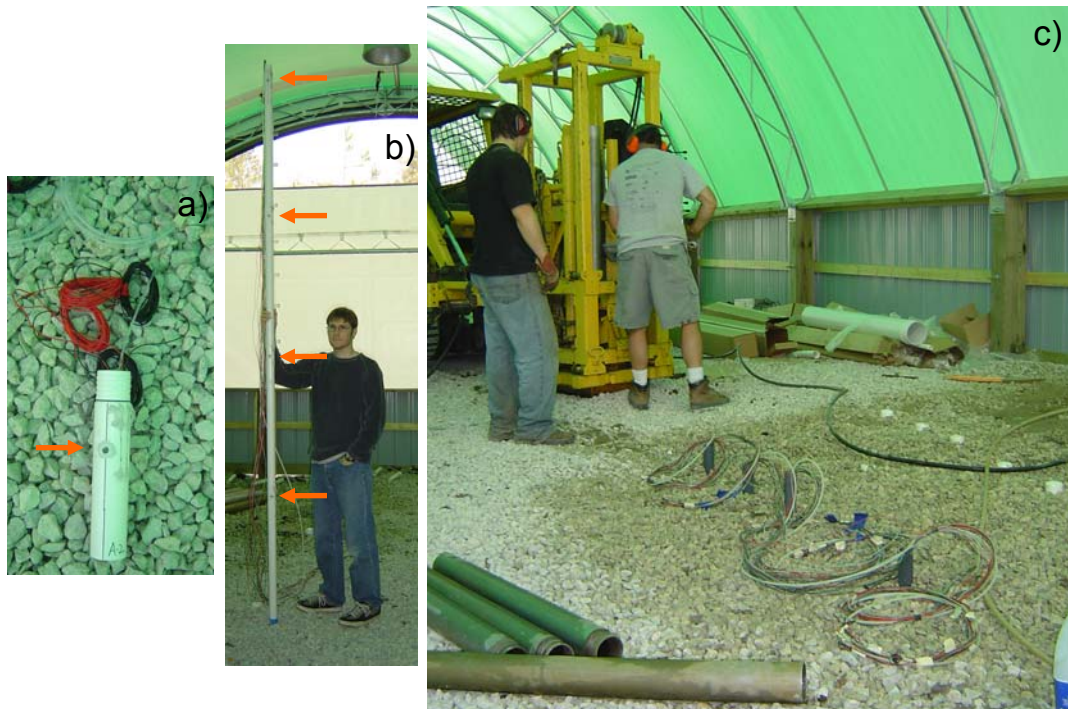


Figure 1.2: Single PVPs used in this study (a) were arranged with three other PVPs in a multilevel configuration (b). Injection ports are identified with orange arrows in a) and b). PVP mutlievels (grey, vertical standpipes at the surface with black and red wires) were installed at via jetting into a flow gate at the Borden aquifer (c).

1.6 Outline of the Study

1.6.1 Statement of Goals and Objectives

Elevated populations of bacteria have been shown to change the hydraulic properties of porous media in laboratory tests (Seki *et al.*, 2006; Engesgaard *et al.*, 2004; Thullner 2002; Kildsgaard and Engesaard 2002; Holm 2000; Baveye *et al.*, 1998; Taylor and Jaffé 1990a and 1990b). There remains a need to study this phenomenon at the field-scale where passive remediation strategies, such as PRBs, require a well characterized groundwater velocity field to demonstrate successfully that design objectives are being met. The objective of this work was to evaluate the PVPs as tools that might meet this need. One approach to making such field studies is to examine changes in the groundwater velocity, caused by biological activity, with an array of multilevel PVPs. Such an array was used investigate a biodegrading petroleum hydrocarbon plume within a sheet pile alleyway (**Figure 1.3 a**).

The plume was treated with dissolved oxygen (DO) using Oxygen Release Compound[®] (ORC) deployed in fully screened delivery wells (**Figure 1.3 b**). A second objective of this study was to demonstrate the transient nature of flow resulting from biostimulation during groundwater remediation. To achieve this, multilevel PVPs were installed 1 m down-gradient of the ORC wells, a location expected to be affected by enhanced biological activity, to measure temporal changes in groundwater velocity. In response to the addition of ORC, hydrocarbon concentrations, determined from multilevel monitoring wells (**Figure 1.3 b**), were expected to attenuate over time from biodegradation processes. Furthermore, these

concentrations were expected to be distributed in a fashion consistent with groundwater velocity directions measurable by the PVPs.

Changes in groundwater velocity were also expected from seasonal variations in the groundwater gradient. Therefore, a further goal of this experiment was to demonstrate that any changes in groundwater velocity measured by PVPs were not entirely explainable by seasonal variations. The objective was approached by a combination of flow modeling, geochemical measurements, and biomass concentrations determined from core extracted from the aquifer. Locations of relatively higher or lower biological activity were used to link groundwater velocity variations to biological activity (**Figure 1.4**).



Figure 1.4: Location of the 15 source release wells that introduced the petroleum hydrocarbon into the aquifer (a). Note the sheet piling to the right and left of the 2” white well heads. Three rows of multilevel sampling wells (grey) can be noted outside the green structure. The green structure is ~ 13 m directly down-gradient and due north of the release wells. Inside the green structure is the primary monitoring area for this study (b). Five PVP multilevels are shown as short standpipes with red and black wires emerging from the tops. ORC wells are directly up-gradient (south) of the three central PVPs. Multilevel sampling wells, shown by bundles of orange flagged tubing, and cased GRP boreholes, shown as white, 2” PVC capped wells, are directly down-gradient (north) of the PVPs.



Figure 1.4: Core extraction for biomass analysis was done by hammering aluminum core sleeves into the subsurface (a). In the lab, the cores were sectioned at ~ 25 cm intervals and the centers were removed with a modified syringe barrel leaving behind a small rind in the core sleeve (b). Core centers were freeze dried and homogenized for later phospholipid extraction and spectrophotometric quantification to estimate the total viable biomass per gram dry weight sediment (c).

Enhanced biological activity can alter the conductive, dielectric, and physical properties of a porous medium (Carstensen 1967; Asami *et al.*, 1980; Cassidy, *et al.*, 2001; Claycomb *et al.*, 2002; Ong *et al.*, 2002; Atekwana *et al.*, 2004a; Atekwana *et al.*, 2004b; Abdel *et al.*, 2004; Williams *et al.*, 2005; Miller *et al.*, 2005; Ntarlagiannis *et al.*, 2005a; Ntarlagiannis *et al.*, 2005b) while simultaneously reducing the permeability. Geophysical techniques such as ground penetrating radar (GPR) are sensitive to alterations in conductive, dielectric, and physical properties of the aquifer.

This suggests that GPR coupled with tomographic methods may be an appropriate technique to supplement PVP data. A final goal for this study was to assess any consistent trends that might exist between PVP velocities and GPR signals. If PVP and GPR measurements are shown to change in a consistent manner, then results from each method can be combined with geochemical and geobiological analysis to investigate probable mechanisms for the observed changes. The borehole GPR data used for comparison with PVP results were acquired by McGlashan (2007) from 14 borehole-pairs in a $2 \times 4 \text{ m}^2$ area enclosing four of the PVP multilevel stands. This dataset was used to generate a high resolution survey of the aquifer in 3-dimensions (**Figure 1.5**).

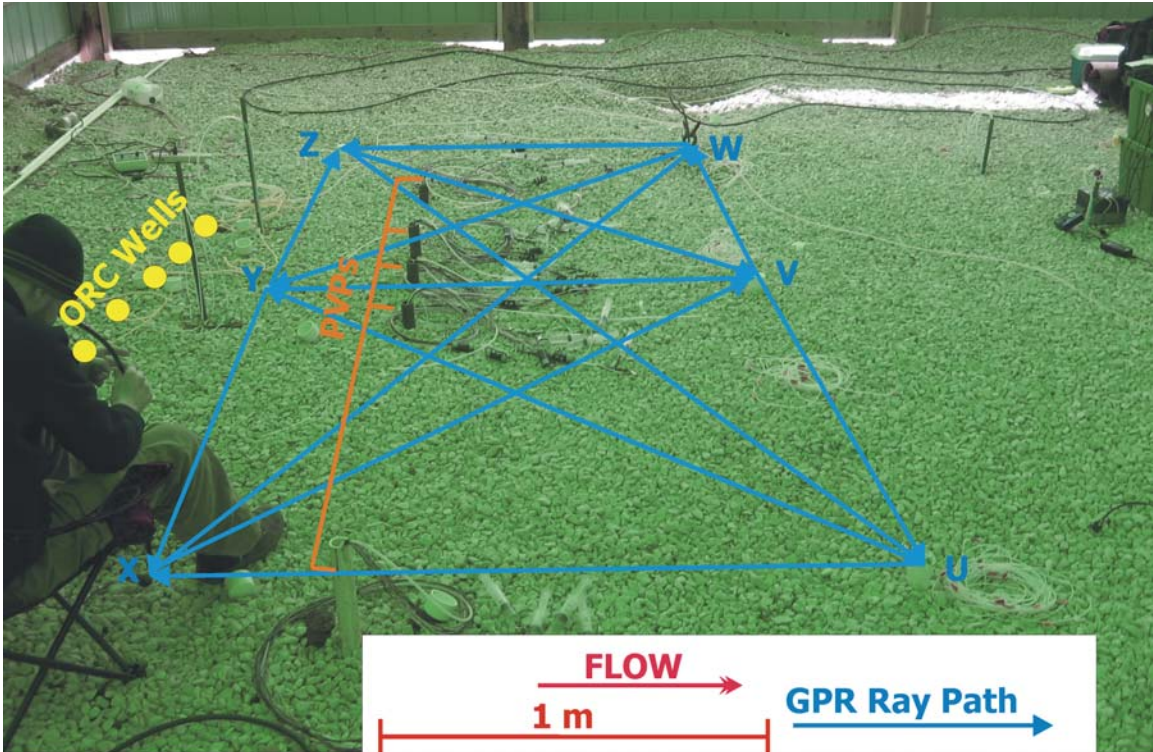


Figure 1.5: Photo from the monitoring area showing the spatial relationships between the ORC wells, PVPs, and GPR cased boreholes (labeled U-Z). R-4 multilevel sampling wells are located along the W-V-U borehole-pairs and KUML multilevel sampling wells are located between the ORC wells and borehole-pairs X-Y-Z. For this study GPR ray path data from X-Y and Y-Z are compared to U-V and V-W to identify cross-sectional trends associated with ORC release.

1.6.2 Borehole GPR Data Acquisition and Background for this Study

Borehole GPR data was acquired by McGlashan (2007) by using transillumination mode zero-offset profile (ZOP) and multiple-offset gather (MOG) surveys (**Figure 1.6**). Transillumination mode requires two cased boreholes to form a borehole-pair. The area of aquifer between the cased boreholes is characterized by the transmission and receiving of an electromagnetic source from one cased borehole to another. Zero-offset profile surveys require that both transmitter and receiver antennas be lowered down the cased boreholes simultaneously at the same elevation

while transmitting and recording data at the same depth intervals. Multiple-offset gather surveys fix the position of one antenna (stationary antenna), while the other is lowered down a cased borehole transmitting or recording data at predetermined depth intervals. Once complete, the stationary antenna is lowered one depth interval and the process is repeated until the stationary antenna reaches the last depth interval (**Figure 1.6**). The MOG survey provides a high level of characterization between borehole-pairs that can serve as the basis for tomography.

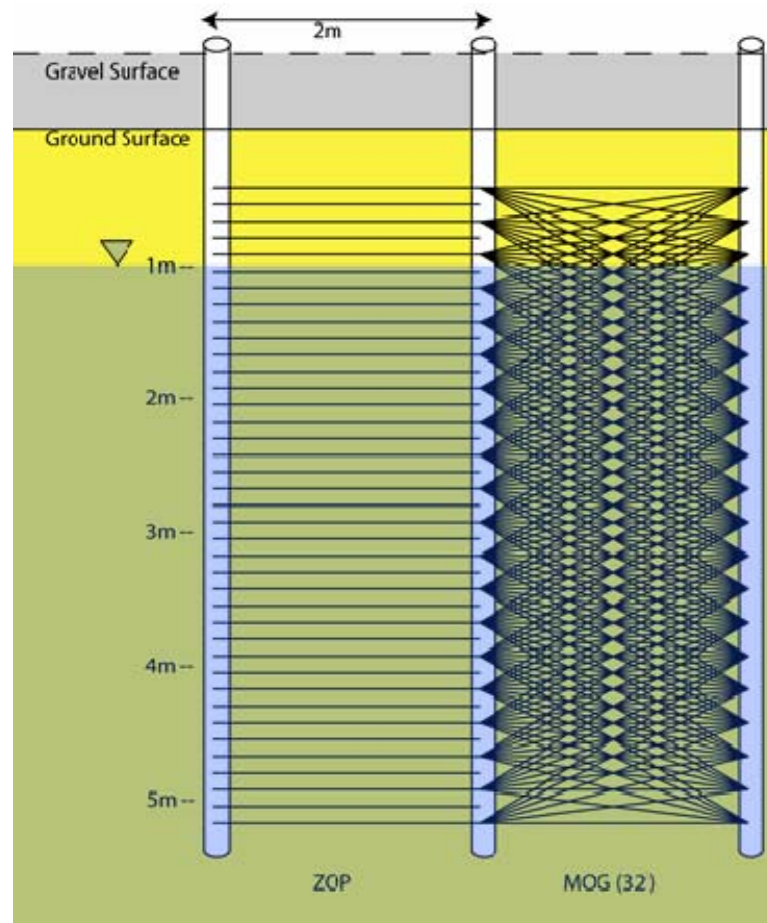


Figure 1.6: GPR ray path schematic adapted from McGlashan (2007, pg. 8) to illustrate the position of the water-table and the spatial density of ZOP and MOG surveys. The MOG data used for tomography, has a maximum offset of 32° . Multiple-offset gather data has excellent spatial resolution per borehole-pair with 190 traces collected whereas ZOP data only collects 39 tracers per borehole-pair.

By the transmission and detection (transillumination) of an electromagnetic wave through an aquifer from a known source, the bulk dielectric properties of the aquifer can be determined. The velocity of the wave propagation (v) through the aquifer is given by:

$$v = \frac{d}{t_1} \quad [1.8]$$

where d is the length of the ray-path [L] and t_1 is the calculated arrival time [T]. The velocity found in **Equation 1.8** can be used to determine the bulk dielectric constant of the aquifer or medium (ϵ_r) through the following:

$$\epsilon_r = \left(\frac{c}{v} \right)^2 \quad [1.9]$$

where c is the speed of light (0.3 m/ns). Various materials found in aquifers possess different dielectric properties (**Table 1.1**). Therefore, the bulk ϵ_r will be a weighted average of the aquifer materials plus the ϵ_r of the accumulated biomass, a quantity that is poorly understood outside of aqueous cell suspensions in laboratory pure cultures.

Table 1.1: Typical values for dielectric constant (ϵ_r), electrical conductivity (σ), velocity (v), and attenuation (α) for common geologic materials at 100 MHz (Davis and Annan, 1989; McGlashan, 2007).

Material	ϵ_r	σ (mS/m)	v (m/ns)	α (db/m)
Air	1	0	0.3	0
Distilled Water	80	0.01	0.033	2×10^{-3}
Fresh Water	80	0.5	0.033	0.1
Sand (Dry)	3-5	0.01	0.15	0.01
Saturated Sand	20-30	0.1-1.0	0.06	0.03-0.3
Silts (Dry)	5-30	1-100	0.07	1-100
Clays (Dry)	5-40	2-1000	0.06	1-300
Carbonate (Dry)	4-8	0.5-2	0.12	0.4-1

To isolate the dielectric response of bacteria, seasonal variables such as temperature had to be taken into account. Temperature changes influence the measured dielectric response of water and ultimately the bulk dielectric constant of the medium. Therefore, the dielectric constant of the water component (ϵ_w) was corrected using **Equation 1.10** (Wraith and Or, 1999) and recorded values of water temperature (T) measurements were made throughout the experiment.

$$\epsilon_w = 78.54[1 - 4.579 \times 10^{-3}(T - 25) + 1.19 \times 10^{-5}(T - 25)^2 - 2.8 \times 10^{-8}(T - 25)^3]$$

[1.10]

The corrected water component was inserted into the Complex Refractive Index Method (CRIM) equation (Wharton *et al.*, 1980) to correct ϵ_r for temperature differences as follows:

$$\sqrt{\epsilon_r} = \phi S_w \sqrt{\epsilon_w} + (1 - \phi) \sqrt{\epsilon_s} + \phi(1 - S_w) \sqrt{\epsilon_a} \quad [1.11]$$

where ϵ_s is the dielectric constant of dry geologic material, ϵ_a is the dielectric constant of air, S_w is water saturation, and ϕ is porosity assumed from the

volumetric water content from the Topp *et al.* (1980) equation. The temperature corrected ε_w was used to calculate an electromagnetic (EM) wave velocity adjustment that was applied to all datasets (McGlashan, 2007). After correcting for temperature, EM wave velocities were assumed to reflect real changes in aquifer dielectric properties as a result of enhanced biological activity. Radar data that were acquired in May, 2005, prior to the addition of ORC, served as background data where 100% water saturation was assumed and ε_s was isolated using **Equation 1.11**. After May, 2005 and introduction of ORC, unexpected changes in the measured ε_r from the temperature corrected ε_r , were hypothesized to be changes in the relative content of water (mineral precipitation or dissolution), geologic material (mineral precipitation or dissolution), or air (biogenic gas) as a result of biostimulation (McGlashan, 2007).

Chapter 2.

Transient Heterogeneity and Groundwater Velocity Variations in a Bioremediating Hydrocarbon Plume

Chapter Summary

The development of localized and transient low hydraulic conductivity (K) zones was studied at the field-scale using a novel array of multilevel, *in situ* velocity probes to directly characterize the groundwater velocity distribution in a bioremediating BTEX plume in the Borden aquifer, Ontario, Canada. The velocity probes (PVPs) were capable of measuring changes in direction and magnitude of the velocity vector at the centimeter scale making them ideal to monitor small scale changes in K. Velocities were shown to vary greatly when a source of oxygen was established down-gradient of a petroleum spill. Local velocity variations occurred but the average velocity of the 7 m X 20 m sheet-piled test area remained quite constant. A persistent zone exhibiting low groundwater velocity also developed after the addition of oxygen to the aquifer. The non-uniform nature of the variations of the velocity across the gate indicate the changes were not due to seasonal hydraulic gradient fluctuations alone. Native microbial biomass growth in native aquifer sediments increased ~ 1 order of magnitude in the oxygenated plume compared to the fringe of the plume and uncontaminated portions of the aquifer. These data suggest that the transient heterogeneity observed in the flow gate was, at least in part, a response to enhanced biological activity caused by the addition of oxygen.

2.1 Introduction

The natural attenuation of hydrocarbons has been intensively studied over the past few decades (Alvarez and Illman 2006). Permeable reactive barriers (PRBs) using biostimulation techniques are being utilized as a relatively inexpensive, passive, *in situ* treatment alternatives for petroleum derived hydrocarbons such as benzene, toluene, ethylbenzene, and xylene isomers (BTEX) (Yerushalmi *et al.*, 1999; Landmeyer and Bradley 2003). Such passive methods rely on the ambient groundwater velocity to deliver contaminants to the reactive zone. Biostimulation techniques operate on the principal that nutrients and electron acceptors, such as O₂, enhance biodegradation of petroleum hydrocarbons when injected into aquifers

contaminated with these compounds (Alvarez and Illman 2006). This enhancement of biological activity can lead to aquifer permeability reductions caused by the accumulation of microbial cells (Vandevivere and Baveye 1992a), the formation of extracellular polymers (Vandevivere and Baveye 1992b), the entrapment of gaseous metabolic products (Sanchez de Lozada *et al.*, 1994), and microbially mediated reactions leading to the accumulation of inorganic precipitates in pore spaces (Williams *et al.*, 2005). Biological clogging of porous media has been well documented in many laboratory studies, and it has been investigated with numerical simulations (Engesgaard *et al.*, 2004; Thullner *et al.*, 2002; Baveye *et al.*, 1998; Cunningham *et al.*, 1991; Taylor and Jaffé 1990a, and 1990b). To compliment these efforts, there is a need to develop and apply methods for studying this effect in a field setting.

Most laboratory studies evaluate biological clogging in one-dimensional columns using the onset of high pressure gradients to indicate significant flow occlusion (Sanchez de Lozada *et al.*, 1994; Vandevivere and Baveye 1992a and 1992b; Cunningham *et al.*, 1991; Taylor and Jaffé 1990a). The one-dimensional nature of the experiments can affect the extent of the clogging. This is illustrated by two-dimensional tracer experiments that show preferential flow around local zones of decreased hydraulic conductivity (K) (Kildsgaard and Engesgaard 2002; Seki *et al.*, 2006). Such clogged zones may be detrimental to PRB performances because they redirect groundwater flow and contaminants through more permeable but less bioactive zones, where residence times and transformation potential are lower (Seki *et al.*, 2006). The zones of decreased K develop on a local-scale; measuring bulk

hydraulic conductivities at larger scales does not necessarily indicate any substantial changes in K (Seki *et al.*, 2006; Kildsgaard and Engesgaard 2002; Thullner *et al.*, 2002; and Kildsgaard and Engesgaard 2001). These authors suggest that bioclogging may be detrimental to remediation efforts by changes in the advective flow field resulting in redirection of contaminants. Increased dispersivities observed in laboratory columns as a result of bioclogging imply that changes in the hydrodynamic dispersion may also result from biological activity in field settings (Bielefeldt *et al.*, 2004; Bielefeldt *et al.*, 2002; Taylor and Jaffe 1990b). The term ‘bioclogging’ invokes the image of nearly complete blockages developing in an aquifer. Intentionally bioclogging aquifers by selectively altering the hydraulic properties to form a biobarrier have been explored at the field-scale for the purposes of contaminant containment (Cunningham *et al.*, 2003; Tefry *et al.*, 1998). However, much less dramatic reductions in K can also hurt remediation efforts because they redirect flow to less bioactive zones. It is hypothesized here that this subtle form of flow impedance is common, and because it is less extreme than complete bioclogging it is probably more common than complete bioclogging.

In order to adequately characterize bioclogging and biological flow impedance in the field, small-scale measurements of K, or groundwater velocity, are desirable. Current methods for making those measurements, such as conventional slug-testing and aquifer testing are either performed at scales too large to detect small localized changes, or they impose flow perturbations that could change local biological conditions and related permeabilities. Natural gradient tracer tests may provide data related to reductions in K or velocity magnitude, but they require a high

density of multilevel sampling wells to identify preferential flow paths, they are very time intensive, and the data tend to be averaged over large horizontal distances (from source to monitor). Various borehole/well velocimeters such as the Colloidal Borescope (Kearl 1997), Geoflo® Meter (Melville 1985), and Laser Doppler Velocimeter (Momii *et al.*, 1993) provide direct measurements of groundwater velocity, but require calibration steps to compensate for well geometry. A thermal device that is installed in direct contact with aquifer materials, the In Situ Permeable Flow Sensor (Ballard 1996), is sensitive to thermal heterogeneities of the aquifer material, and yields velocities representative of scales on the order of approximately 1.0 vertical meter. Another tool, the point velocity probe (PVP), can directly measure groundwater velocities at the centimeter scale (Labaky *et al.*, 2007). The PVP provides velocity estimates without invoking Darcy's Law or K. The instrument functions without a well and therefore requires no calibration step to compensate for well-bore effects (Labaky *et al.*, 2007). The PVP method requires the injection and detection of a small tracer volume (less than half a milliliter) and measures an apparent velocity (v_{app}) of the tracer around the outside circumference of the tool, which is related to the average linear velocity of the groundwater beyond the influence of the probe (v_{∞}). The ability of the PVP to measure velocity changes at the centimeter scale suggests an array of PVPs could measure the hydraulic effects of enhanced biological activity over the scale of a plume.

Previous field studies documented the hydraulic effects of bioclogging as the mechanism responsible for hydraulic conductivity losses in landfill leachate drainage gravel (Fleming *et al.*, 1999), increased injection well heads in biostimulation efforts

(McCarty *et al.*, 1998), and increased gradients near waste-water injection wells (Oberdorfer and Peterson 1985). To the best of the author's knowledge, all previous investigations involving detailed assessments of multi-dimensional transient flow fields developed following biostimulation, have been in laboratory settings using plan-view tracer analysis, an array of manometers, and modeling. The purpose of this study is to investigate the development of local-scale transient heterogeneities in groundwater velocity caused by enhanced biological activity in a petroleum plume. An array of PVPs was deployed in multilevel fashion across such a plume in a sheet-pile gate at CFB Borden, Ontario, Canada. An oxygen source was emplaced to stimulate microbial activity and changes to the groundwater velocity were monitored over time.

2.2 Field Site

2.2.1 Site Geology

Field experimentation was carried out at the well studied CFB Borden site, in a sheet-pile alleyway, hereafter referred to as the gate, located in a sand quarry about 350 m north of a former municipal landfill. The unconfined Borden aquifer comprises primarily fine to medium-grained sand that extends 7.0 m below the surface to a thick, silty clay aquitard. Beds are primarily horizontal and parallel with some cross-bedding and convolute bedding along with other minor structural features visible in cores (Mackay *et al.*, 1986). Larger structures, indicative of the aquifer's glaciofluvial origin, are composed of complex distributions of fine, medium, and coarse-grained lenses along with layers of considerable silt content (MacFarlane *et al.*, 1983). These structures lead to local heterogeneities, though the Borden aquifer is considered to be

quite homogenous (Mackay *et al.*, 1986). The groundwater flow direction at Borden is generally to the northeast with seasonal oscillations throughout the year due to mounding at the nearby landfill site. (Mackay *et al.*, 1986 and MacFarlane *et al.*, 1983). Natural gradient tracer tests conducted in 1979 and 1984 also confirm a predominantly northeastern flow direction (N45°E) with seasonal oscillations of 14° and an average gradient of 4.3×10^{-3} (Sudicky 1986). Farrell *et al.* (1994), at a site ~ 150 m north from the 1986 natural-gradient tracer site, established flow to be predominantly north with short, easterly components associated with spring recharge. The maximum annual variability in the hydraulic gradient was found to be from $\sim 6.5 \times 10^{-3}$ in early spring to $\sim 3.2 \times 10^{-3}$ in early autumn with a flow angle varying over 39°. This variation is substantially greater than the 14° reported by Sudicky (1986), and may be due to more frequent sampling (Farrell *et al.*, 1994). The accepted mean solute velocity for conservative tracers under natural gradient conditions at Borden has been estimated to be 9.1 cm/day (Mackay *et al.*, 1986). Permeameter tests with core samples yielded a mean K of 842.4 cm/day with a range of 51.84 cm/day to 1728 cm/day (Sudicky 1986).

2.2.2 Borden Geochemistry and Geobiology

The Borden aquifer solids are composed of quartz (58%), feldspars (19%), and carbonates (14%) with smaller amounts of amphiboles (7%) and chlorite (2%) (Mackay *et al.*, 1986; Ball *et al.*, 1990). Calcite is the predominant carbonate mineral comprising 12.6% of total mineral volume (Ball *et al.*, 1990).

The Borden groundwater geochemistry is dominated by Ca^{+2} (52 to 112 mg/l) and HCO_3^- (122 to 305 mg/l) and has a notable concentration of SO_4^{-2} (9.6 to 22.8

mg/L) (**Table 2.1**). The redox potential of the aquifer ranges from aerobic to sulfate reducing, in the presence of organic carbon, with no pronounced intermediate zones (Nicholson *et al.*, 1983). Devlin and Barker (1996) and King *et al.* (1999) noted sulfate reduction as the dominant anaerobic process, with methanogenesis, and iron and manganese reduction occasionally observable as well. Biodegradation (King *et al.*, 1999; Barbaro and Barker, 2000) and microbial characterization studies (Barbaro *et al.*, 1994; Butler *et al.*, 1997) indicate a very limited potential for nitrate reduction due to low nitrate concentrations.

Table 2.1: Summary of averaged uncontaminated groundwater chemistry adapted from Nicholson *et al.*, 1983 (converted from mM); Barbaro *et al.*, 1994; Mackay *et al.*, 1986; and Devlin 1994b.

Parameter	Units	Uncontaminated Concentrations
Ca ²⁺	mg/l	52 - 112
Mg ²⁺	mg/l	2.4 - 6.1
Na ⁺	mg/l	0.9 - 2.1
K ⁺	mg/l	0.1 - 1.2
Fe ²⁺	mg/l	0
Mn ²⁺	mg/l	0
Alkalinity as (CaCO ₃)	mg/l	100 - 250
Cl ⁻	mg/l	1.1 - 2.8
SO ₄ ²⁻	mg/l	9.6 - 28.8
NO ₃ ⁻	mg/l	<0.6
NH ₄ ⁺	mg/l	<0.2 - 0.4
CH ₄	mg/l	0
DO *	mg/l	<1.0 - 6.3
FOC *	%	0.02 - 0.05
DOC *	mg/l	2.4 - 6.4
pH	dim	6.8 - 8.0
Temperature**	°C	6 - 15
Conductivity***	µS/cm	281 - 325
TDS	mg/l	380 - 500

* Values from Barbaro *et al.*, 1994

** Values from Mackay *et al.*, 1986

*** Values from Devlin 1994b

In general, the Borden aquifer's microbial population is characterized as aerobic and heterotrophic with oligotrophic and psychrotrophic components (Butler *et al.*, 1997). Chemolithotrophs and sulfate reducers are rare in pristine samples (Butler *et al.*, 1997). Direct plate counts from Borden core material show a viable population of 1.0E+03 to 1.0E+06 CFU/gdw (colony forming units/ gram dry weight sediment) strongly correlated with dissolved oxygen (DO) and inversely correlated with depth, indicating a largely aerobic consortium near the water-table (Barbaro *et al.*, 1994). Generally, the population density within the Borden aquifer is relatively

heterogeneous (Butler *et al.*, 1997) with localized communities limited by dissolved organic carbon (DOC) and DO (Barbaro *et al.*, 1994). The DO threshold for indigenous aerobes is thought to be about 3.0 mg/L, which is met or exceeded above depths of about 2.0 to 2.5 m BGS in uncontaminated portions of the aquifer (Barbaro *et al.*, 1994). Phospholipid fatty acid (PLFA) analysis of cores collected from an uncontaminated portion of the Borden aquifer and a coal tar creosote plume within the Borden aquifer reported a range of 15 to 90 picomoles PLFA / gram dry sand respectively (King *et al.*, 1999). Using a standard conversion factor reported by Green and Scow (2000) of 2.0×10^4 cells / pmol PLFA, average biomass results from King *et al.* (1999) are $\sim 3.0 \times 10^5$ cells / gram dry sand and $\sim 1.8 \times 10^6$ cells / gram dry sand for the uncontaminated and contaminated cores, respectively.

2.2.3 Gate Construction

A sealable sheet-pile gate (Starr *et al.*, 1992) consisting of two lengths of connected and sealed sheet piling (~ 20 m in length, 7 m deep, 7 m wide) was installed parallel to the average ambient groundwater flow direction (**Figure 2.1**). The gate prevented seasonal fluctuations in average groundwater direction within the experimental zone. A building was erected on a gravel pad, which was laid over part of the alleyway to prevent flooding of the experimental area during spring snow melt. This arrangement allowed for year-round data collection and protection from the elements. A fully screened pumping well, located at the effluent end of the flow gate, continuously discharged water at a rate of 500 ml/min to dampen seasonal effects on velocity and maintain a minimum average flow of ~ 5 cm/d through the gate.

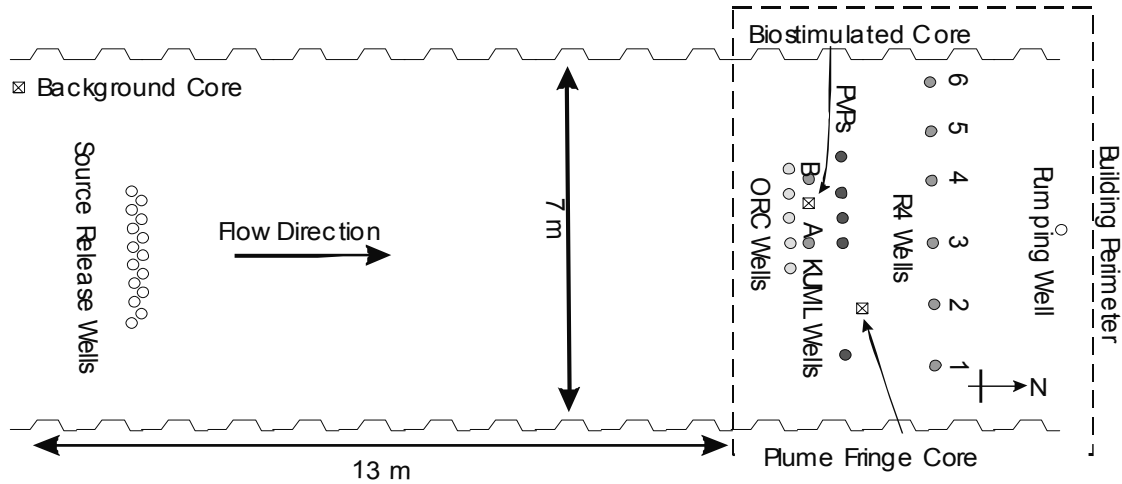


Figure 2.1: Map of Borden flow gate bounded to the east and west by sheet piling. Spatial relationships are shown between the KUMIL and R4 (row 4) multilevel sampling wells used in the analysis, PVP array, Oxygen Release Compound (ORC) wells, pumping well, hydrocarbon source release wells and core locations. Flow direction in the gate is established to be due North to the pumping well.

2.3 Methods

2.3.1 Velocity Probe Design and Operation

The PVP method is based on idealized flow around a submerged circular cylinder, where the average linear velocity beyond the influence of the probe (v_{∞}) can be calculated from a measured apparent velocity of a tracer along the circumference of a cylindrical probe (Bird *et al.*, 1960) (**Figure 2.2**). Apparent velocities (v_{app}) are estimated based on tracer movement from an injector port to each of two detectors. These are used to calculate the orientation angle of the injection port with respect to the flow direction (α) using the following equation (Labaky *et al.*, 2007):

$$\alpha = \tan^{-1} \left[\frac{v_{app1} \gamma_1 (\cos \gamma_2 - 1) + v_{app2} \gamma_2 (1 - \cos \gamma_1)}{v_{app1} \gamma_1 \sin \gamma_2 - v_{app2} \gamma_2 \sin \gamma_1} \right] \quad [2.1]$$

where v_{app1} and v_{app2} are the apparent velocities for detectors 1 and 2, respectively.

The fixed angles between the injection port and detectors 1 and 2 are γ_1 and γ_2 ,

respectively (**Figure 2.2**). With α known, the apparent velocity at either detector can be used to calculate the average linear groundwater velocity beyond the influence of the probe with the following equation (Labaky *et al.*, 2007):

$$v_{\infty} = \frac{v_{app} \gamma}{2(\cos \alpha - \cos(\alpha + \gamma))} \quad [2.2]$$

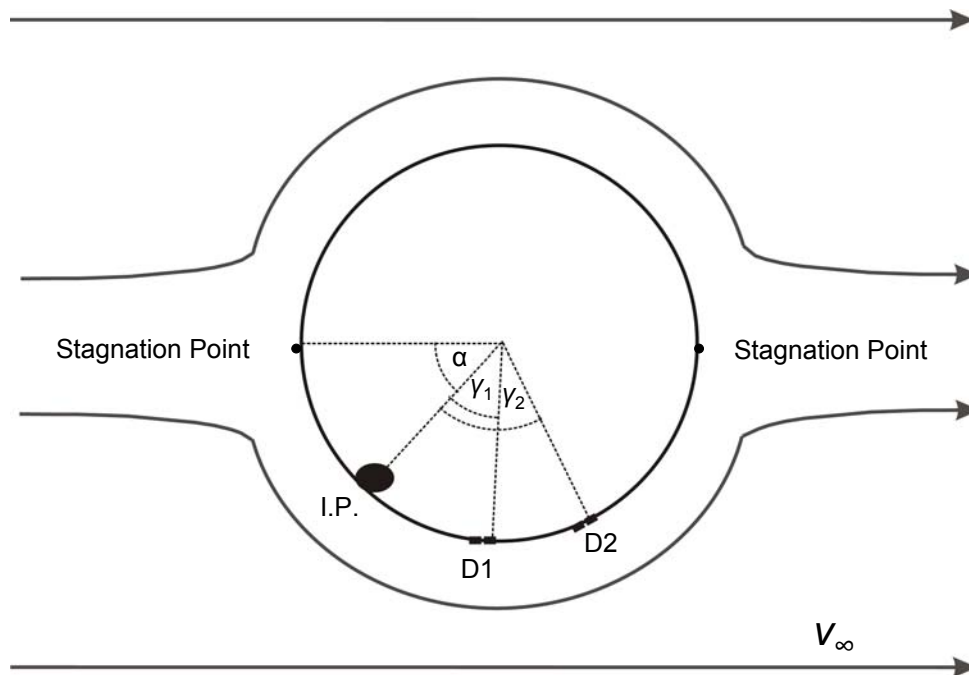


Figure 2.2: Plan-view conceptualization of a PVP in an ideal flow field. Flow lines are shown as gray arrows. Tracer injected from injection port I.P. travels to detectors D1 and D2 spaced γ_1 and γ_2 degrees apart to measure two apparent velocities. Two apparent velocities are required to determine α . Angle α is used with either of the apparent velocities to calculate the average linear groundwater velocity (v_{∞}) beyond the influence of the probe. Theoretical stagnation points are located at $\alpha = 0^{\circ}$ and 180° .

PVPs in this study were constructed from 3.81 cm diameter schedule 40, flush-thread PVC casing. A 2.54 cm gas diffusing stone served as an injection port. The gas diffusing stone is ideal for tracer delivery in unconsolidated sediment because it enables the injection port to be in direct contact with the aquifer without concern of clogging by sand or air-bubble release during or between injection events.

Polytetrafluoroethylene (PTFE) tubing contained within the PVC casing, extended from the porous sphere to the surface where it was split to two syringes. One syringe (60 ml) served as an inline tracer reservoir while the other syringe (1 ml) was used to inject tracer (**Figure 2.3**). The PTFE tubing was filled with a tracer solution consisting of 1 g/l of NaCl in site groundwater. This provided an appropriate contrast in electrical conductance between the Borden groundwater and the tracer, without inducing substantial density driven flow of the tracer. The NaCl solution was released into the aquifer by first measuring 0.5 ml of tracer via a transfer from the reservoir syringe to the injection syringe, and then direct injection through the gas diffusing stone into the aquifer.

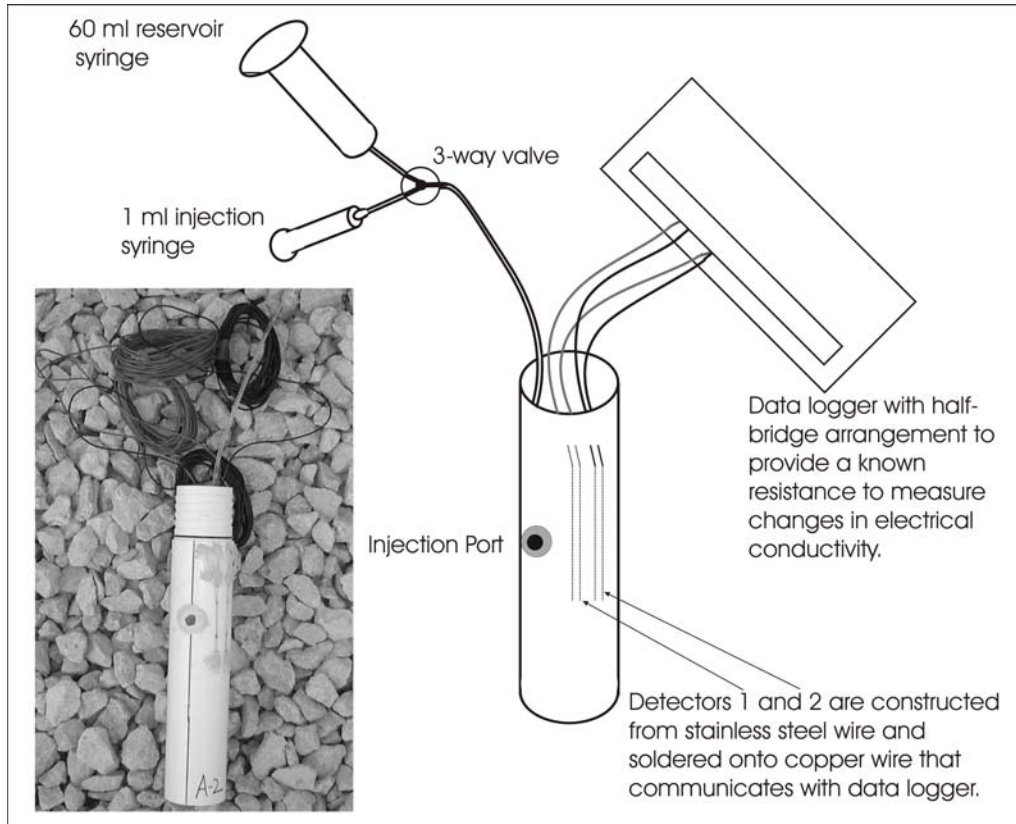


Figure 2.3: Schematic (right) and photo (inset) of a single PVP. The figure depicts a generalized schematic of the datalogger, and the PVP tool. Injection syringes shown at the top of the figure, and the datalogger, are located on the surface while the injection port and detectors are placed into direct contact with the aquifer material.

Four stainless steel wires, running vertically in two pairs along the probe body, formed the two detectors. The wire pairs were located 40° (γ_1) and 70° (γ_2) away from the injection port. Inside the probe body, they were soldered to solid copper insulated wire that ran from the detectors to the surface. Each detector was powered by an alternating current generated by the datalogger. The two wires of each detector were placed in a half-bridge circuit that made measurement of groundwater resistance possible (Detailed in **Appendix A**). The datalogger was programmed to collect and record electrical resistivity measurements every 2 minutes (**Appendix D**).

A sample of raw data recorded by the datalogger is shown in **Figure 2.4**. A complete record of raw and fitted data is provided in **Appendix C**. The peak amplitude of the breakthrough curve is proportional to the maximum tracer concentration, or electrical conductance measured at the respective detector, whereas the width is related to dispersion processes. Apparent velocities were calculated by fitting the 1-D advection-dispersion equation to the tracer breakthrough curves using a simplex optimizer routine (PULSEPE) (Devlin 1994a) (**Figure 2.4**). Apparent velocities were converted to average linear groundwater velocities through **Equations 2.1** and **2.2** (Labaky *et al.*, 2007).

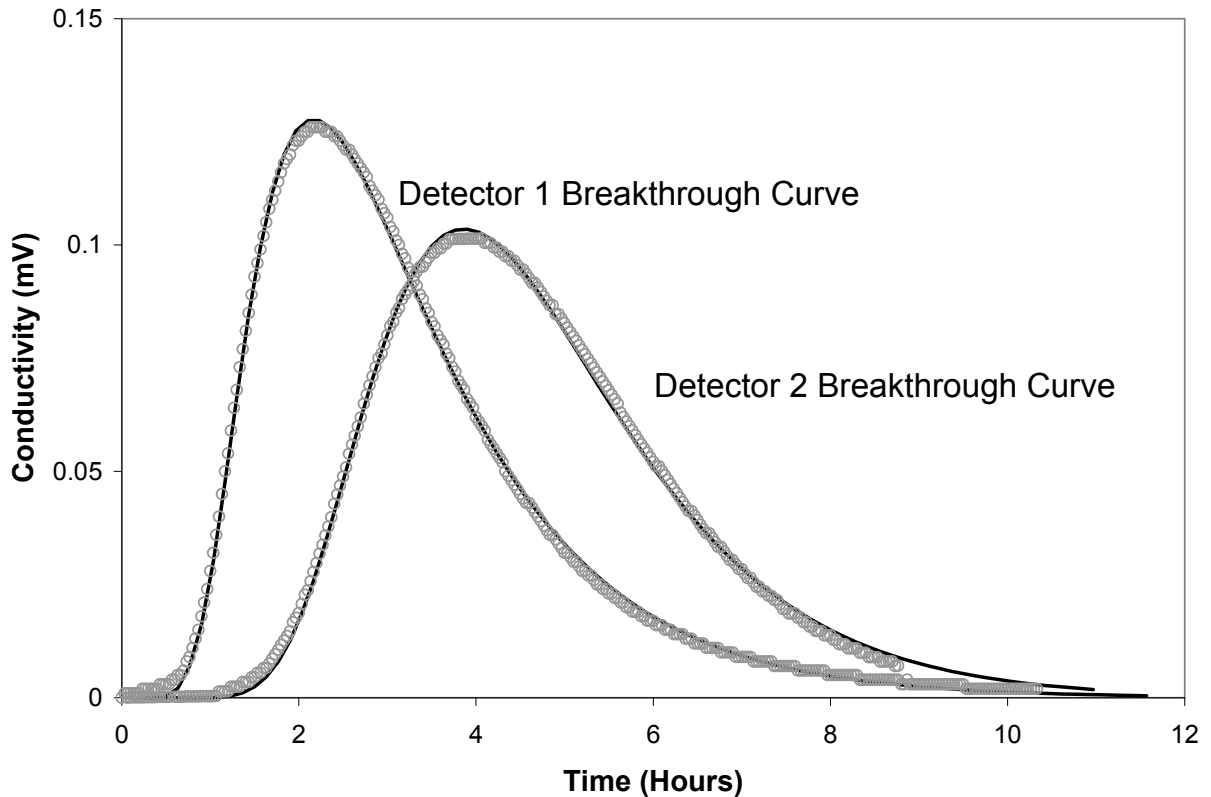


Figure 2.4: A pair of breakthrough curves from detectors 1 and 2 (open circles) from a PVP at Borden demonstrating typical quality of fit from the 1-D advection-dispersion equation (solid line). Detailed processing steps are found in Appendix A.

2.3.2 PVP Installation

In order to adequately characterize the groundwater velocity distribution of a given cross-sectional area in the flow gate, an array of five multilevel PVPs was installed across the monitoring area. The probes were built using flush-thread schedule 40 PVC. Each multilevel contained four PVPs stacked vertically 0.8 m apart, from the water-table to 4.87 m (BGS). This provided 20 in-situ velocity estimation points across a 4 x 4 m² cross-section of the gate (**Figure 2.5**). Each multilevel stack measured groundwater velocities at 1.6, 2.4, 3.2, and 4.1 m below the surface. For each multilevel stack, injection ports and detectors were inline with one

another to ensure the same α angle (**Figure 2.2**). Point velocity probes were installed by jetting, a process in which a core barrel is driven into the aquifer and flushed out with a high pressure jet of water. The PVP casing is lowered into the water-filled core barrel, which is subsequently pulled back and removed, and the formation is allowed to collapse around the PVP. The method results in a disturbed zone only slightly greater than the wall thickness of the core barrel. Point velocity probes installation was completed in May 2005. Several months of equilibration was allowed prior to the introduction of the ORC. Upon installation, injection ports were angled $\sim N50^{\circ}E$ from the average expected flow direction. The probe designated F2 (**Figure 2.5**) sustained damage during installation and was not available for use in the analysis of groundwater velocity data. The hydrocarbon plume was expected to intercept the three center PVP multilevels, thus leaving PVP multilevels to be located in the uncontaminated aquifer on either side of the plume.

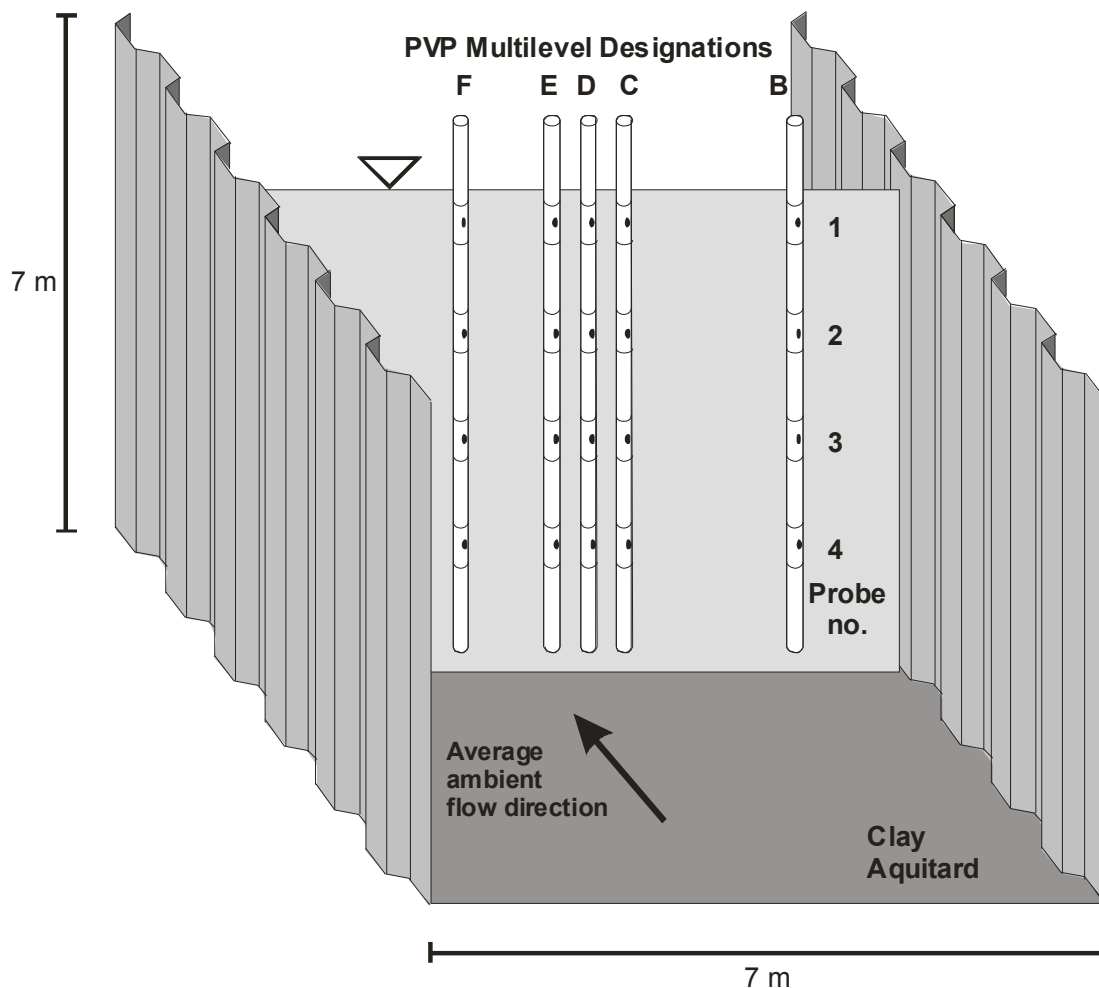


Figure 2.5: A 3-D cutaway of the aquifer showing the spatial relation of the PVP multilevels. The expected direction of flow is shown by arrow. Point velocity probe multilevels are designated B, C, D, E, and F with the shallowest probe on any multilevel assigned the number 1 and the deepest assigned number 4. The length of the gate is an arbitrary distance in this figure. The plume center of mass was expected to intercept multilevels C, D, and E with multilevels B and F on the periphery.

2.3.3 Generation and Monitoring of the Hydrocarbon Source

In October 2004, approximately 50 L of a blend of 90% gasoline and 10% ethanol (E10) was released from 15 wells screened between 2.5 and 4.0 m below ground surface (BGS) at the up-gradient end of the gate. The ethanol moved rapidly through the gate, before the PVPs were installed, so that throughout this experiment, the plume consisted only of hydrocarbon compounds from gasoline. The hydrocarbon

plume served as an organic carbon substrate to stimulate growth of the native microbial consortium. Across the gate, 38 multilevel sampling wells were arranged in seven rows of which one (R4) was monitored for this work (**Figure 2.1**). Each multilevel sampling well contained 15 equi-spaced sampling ports located from 1.5 m BGS to 5.5 m BGS. Samples taken from multilevel sampling wells were collected in 40 ml VOA bottles within a few days of PVP data acquisition. Collected samples were analyzed by the Organic Analysis Laboratory at the University of Waterloo to determine concentrations of benzene, toluene, ethylbenzene, and xylene isomers with methods developed by Henderson *et al.* (1976) for gas chromatography.

2.3.4 Enhanced Biodegradation of the Hydrocarbon Plume

Five fully screened oxygen release wells were installed 1 m up-gradient of the PVP fence to stimulate aerobic biodegradation by increasing DO concentrations within the groundwater. The wells were spaced 0.3 m apart and reached a depth of 4.5 m. In September 2005, four socks of Oxygen Release Compound[®] (ORC) were introduced into each well. A sock contains 2 to 3 kg of ORC that can be lowered into a well to activate oxygen release. Two ORC socks were added into each well in February 2006. Finally, all of the ORC socks were replaced in September 2006. Two additional multilevel sampling wells, designated KUML were installed 0.3 m down-gradient of the ORC wells to characterize geochemical changes near the O₂ source at depths of approximately 2.30, 3.15, 4.00, and 4.85 m BGS. Dissolved oxygen and pH levels were monitored at multiple depths in the ORC wells, and at the KUML and R4 multilevel sampling points (**Figure 2.1**), using an Orion 835 meter and 083025 probe

in a flow cell. A PVP dataset was collected in August, 2005, and analyzed prior to oxygen release, to document background conditions

2.3.5 Quantification of Biomass

At the end of the experiment (early December, 2006), core samples were extracted from three locations to characterize the biomass distribution at the field site from 0.60 m to 4.65 m bgs. Three core locations were selected to reflect various expected levels of biological activity. The core locations included a) 0.30 m down-gradient of the ORC fence to represent a region of high activity, b) on the plume boundary near the B PVP stack, representing a location where O₂ and plume water might mix naturally, and c) at the far southwest corner of the flow gate, 2.65 m up-gradient of the nearest source well, representative of background conditions (**Figure 2.1**). Biomass concentrations were determined with PLFA analysis since lipid-based methods do not require culturing and provides quantitative data on the viable portion of the microbial community (Green and Scow 2000). Aseptic methods were used in the handling of core materials and tools (Barbaro *et al.*, 1994). Cores were extracted, sectioned into 25 cm lengths, homogenized, freeze dried and stored in the dark at -80° C to prevent phospholipid degradation. Storage time did not exceed 5 months. A total of 15 samples were used in the analysis of both the biostimulated plume and plume boundary cores. Six samples were analyzed to establish background concentrations. All samples were extracted and analyzed in duplicate. Freeze dried samples were weighed in duplicate prior to PLFA extraction. Phospholipids were extracted by delivering sediment samples into a single-phase solution containing CHCl₃, CH₃OH, and 50 mM phosphate buffer. The single-phase solution was

extracted into water to remove the CH₃OH and concentrate the phospholipids in the CHCl₃ phase. The phospholipids containing CHCl₃ phase was withdrawn, passed through a NaSO₄ glass-fiber filter, and evaporated in a 37° C water-bath to concentrate the phospholipids. The samples were then digested by combining the extracted phospholipids with 5% (weight to volume) acid persulfate and reacted at 95° C overnight. Concurrently, orthophosphate standards (blank, 1.5 nM, 3 nM, 6 nM, 10 nM, and 15 nM) made from 0.1 mmol glycerol phosphate were processed in duplicate with samples. In preparation for analysis, samples and standards were combined with ammonium molybdate and malachite green solutions and decanted into a cuvette where absorbance was recorded at 610 nm by a Spectronic GENESYS 20 spectrophotometer. The absorbance was related to concentrations of phosphate using the calibration standards. Phosphate content of each sample was related to cell mass using the average of a range of conversion factors reported by Dobbs and Findlay (1993) (3.4E+07 to 2.0E+09 cells/nmol PO₄) and the average concentration of cells/gram dry weight aquifer material (core) was estimated for each sample. In each case the averages used were assumed correct and ranges of variation for these parameters were ignored. The result of this assumption is that the calculated data are most meaningful when compared in a relative sense. Absolute values of the calculated biomass are presented for convenience, but should only be regarded on a semi quantitative basis. Additional details of the procedures followed for extraction, reagent composition, and glassware protocol are listed in **Appendix E**.

2.3.6 Aqueous CO₂, H₂S, and CH₄ Concentrations

Samples for dissolved gas were collected from multilevel sampling points along Row 4 and KUML monitors in May and October, 2006. Samples were collected in 70 ml serum bottles filled under vacuum. Prior to arriving at the field site, mercuric chloride was added to serum bottles as a preservative. Serum vials were then capped and crimped in the laboratory prior to traveling to the field site. Once at the field site, the serum bottles were put under vacuum by removing 120 ml of air using a 60 ml syringe. Ground water was pumped from the multilevel sampling points using a peristaltic pump under low flow rate to minimize possible gas loss due to degassing. Not less than 120 ml was purged from the multilevel point prior to sampling. Samples were pumped into 60 ml syringes with sufficient pressure to drive the plunger out of the barrel partway. This procedure ensured no gas loss during sample collection. Water was transferred directly into the serum bottles from the syringes using the internal vacuum previously created in the bottles, until atmospheric pressure was reached in the serum bottles. In this way, approximately 49 ml of groundwater and 22 ml headspace was present in each vial for each sample. After a sample was collected, serum bottles were immediately sealed with silicone cement to prevent headspace gas loss through the septa. Samples were stored on ice, in the dark, and time from collection to analysis did not exceed 5 days. Headspace gas (250 µl) was sampled and analyzed with a gas chromatograph equipped with a Haysept Q 80/100 1/8 in x 6 ft stainless steel column using both the thermal conductivity detector (TCD) and a flame ionization detector (FID). Reagent grade methane (1%), carbon dioxide (1%), and hydrogen sulphide water (.004%) were used as standards. Henry's law was used to

calculate the aqueous concentrations from measured headspace gas concentrations. To determine if any of the above mentioned species existed as bubbles under the conditions in the aquifer, aqueous concentrations were compared to calculated solubilities from thermodynamic models of binary systems published by Duan *et al.* (2007), Duan and Mao (2006), and Duan *et al.* (2006). Carbon dioxide concentrations and pH measured at selected KUML and R4 multilevel sampling wells along with pH measurements made at the ORC wells were further used in geochemical calculations to assess the saturation of calcite at the KUML and R4 multilevel sampling wells and the ORC wells (**Appendix H**). On the basis of these data, and assuming Ca^{2+} concentrations in the range reported in **Table 2.1** (1.3E-03 M to 2.8E-03 M), the range of possible calcite saturation indices that might have existed in the bioactive zone were calculated. Note that CO_2 was not determined in the ORC wells, so CO_2 concentrations from the KUML wells were assumed to apply.

2.4 Results

2.4.1 Hydrocarbon and DO Distributions

Total BTEX concentrations were determined for samples collected from R4-1, R4-2, R4-3, R4-4, and R4-5 multilevel sampling wells. Comparing plume concentration distributions to the area of release (**Figure 2.6**), it is apparent that flow was slightly downward and to the east. The later aspect of directionality was confirmed by the PVP measurements. Based on volatile organic carbon (VOC) measurements, the plume was significantly attenuated between August 2005 and October 2006. The highest measured total BTEX concentration fell from 52,626 $\mu\text{g}/\text{l}$ before ORC addition to 16,165 $\mu\text{g}/\text{l}$ after ORC addition. Overall plume strength also

declined considerably, so that in most locations BTEX was present at less than 1 mg/l by the end of the experiment (**Figure 2.6**).

Dissolved oxygen in the ORC wells was found to be 8.14 mg/l, on average, with a range of 1.6 mg/l to 23.4 mg/l. Higher concentrations of DO were typically found at the shallower depths in the ORC wells. R4 multilevel sampling wells indicated minimal oxygenation from the ORC with maximum DO levels < 3.0 mg/l. This was the condition of the aquifer a few days after the PVP measurements in October, 2005. In general, ORC generated DO levels in the aquifer declined slightly throughout the experiment. An exception was noted on October, 2006 and December, 2006 when R4-4 exhibited relatively high DO levels, ranging from 6.0 to 9.6 mg/l, corresponding to depths of 2.40 to 3.12 m BGS. From October, 2006 until the time core extraction took place (December, 2006), DO changed minimally.

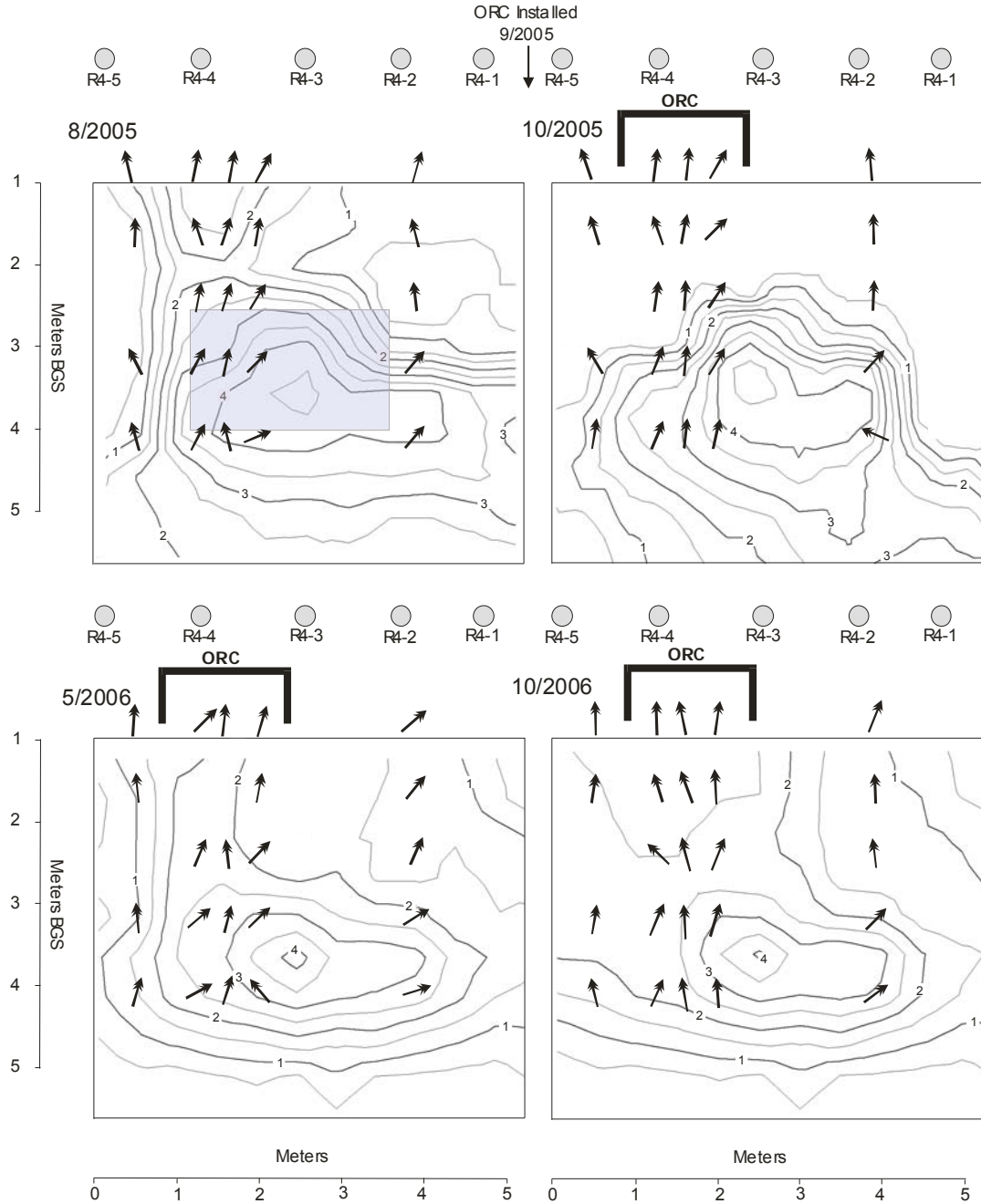


Figure 2.6: Cross-sectional diagrams of contoured plume concentrations in log space $\mu\text{g/l}$ BTEX for August, 2005, October, 2005, May, 2006, and October, 2006, respectively. Cross-sections are orientated such that the estimated average groundwater flow direction is into the plane of the page. Groundwater velocity directions, representing flow measured 1 m up-gradient of the multilevel fence, are indicated with arrows. Arrows are presented on a rotated plane such that vertical arrows signify flow into the page. The average flow direction for each PVP multilevel, the horizontal location of each multilevel sampling well, and the zone of ORC application are shown at the top of each cross-section. The shadow

of the source area is shown as a transparent grey square superimposed onto the August 2005 dataset. Non-detect concentrations were assigned values of 1 µg/l, the detection limit, for the purpose of display. To aide the algorithm in contouring concentrations, up to seven grid nodes were assigned concentrations of 1 µg/l BTEX along the boundaries of the May and October, 2006, datasets.

2.4.2 Groundwater Velocity

Faster groundwater velocities were typically observed in the eastern half of the gate (**Figure 2.7**). Using the pre-ORC dataset (August, 2005) as a baseline, it is apparent that changes in groundwater velocity direction and magnitude occurred throughout the monitored area after ORC addition. Groundwater velocities decreased across the entire cross-section by an average of ~1.5 cm/day between August, 2005, and October, 2005, though flow directions changed little except at depth. By May, 2006, with continuous ORC application, groundwater velocity magnitudes exceeded baseline conditions in the eastern half of the cross-section while the western half remained depressed. Flow directions began to show increased variability in May, 2006. During the acquisition of the May, 2006, dataset, probes D1 and E1 failed to return signals and were omitted from the data analysis. Both D1 and E1 were functional for the remainder of the experiment and were included in subsequent analysis. By October, 2006, velocities decreased significantly in the upper ~ 1.5 m of the eastern half of the gate, returning to near baseline conditions or lower, whereas the western half of the gate retained its characteristic lower velocities. Total discharge calculations indicated that the overall discharge through the gate was constant to within $\pm 10\%$ throughout the experiment, suggesting minimal seasonal effects on groundwater velocity (**Appendix M**).

During the course of the experiment, the mean groundwater velocity established inside the gate was calculated to be 7.38 cm/day and the mean flow direction was N12°E with standard deviations of 4.39 cm/day and 26.8°, respectively. Recall, the sheet-piling at the site is oriented due north. The maximum values for velocity magnitude and direction were found to be 34.96 cm/day (Probe B4 May 2006) and N68°E (Probe C4 August 2005), respectively. The minimum values for velocity magnitude and direction were found to be 2.58 cm/day (Probe F1 October 2006) and N66°W (Probe B4 October 2005), respectively. However, the mean velocity magnitudes (calculated for each dataset and reported in **Figure 2.7** caption) exhibited less variability from one date to another, and were found to have a standard deviation of only 1.46 cm/day. The mean velocity directions for each data set were also less variable, with a standard deviation of N8.60°E. The average velocity direction and magnitude results are consistent with those published in the literature for the Borden site reported by Sudicky (1986), Mackay *et al.* (1986), and Farrell *et al.* (1994).

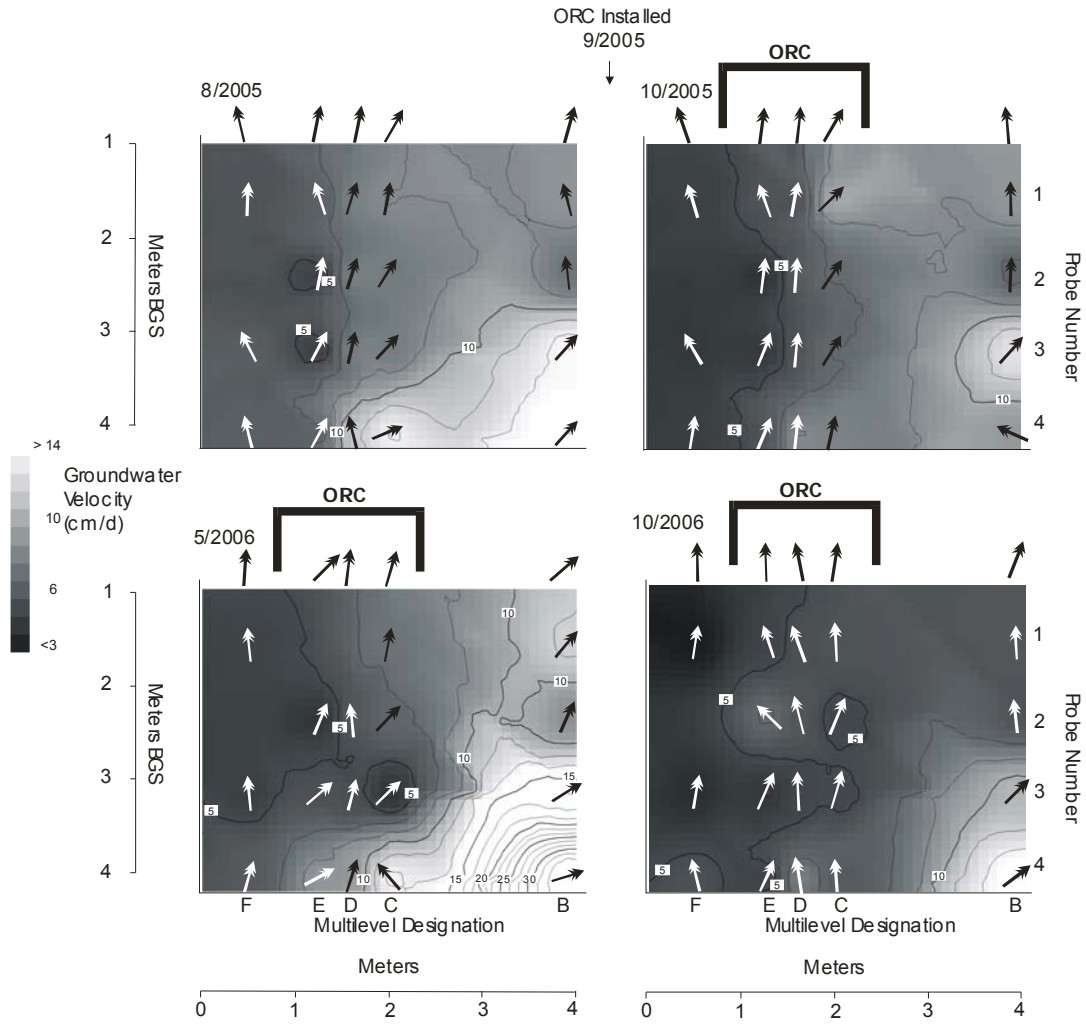


Figure 2.7: Cross-sectional diagrams of contoured groundwater velocity magnitudes are shown for August, 2005, October, 2005, May, 2006, and October, 2006, respectively. Cross-sections are oriented such that the estimated average groundwater flow direction is north, into the plane of the page. Arrows are presented on a rotated plane such that vertical arrows signify flow into the page. Arrow color was selected for clarity of presentation only. The average flow direction for each PVP multilevel and zone of ORC application is shown at the top of each cross-section. Contour interval for velocity magnitude is 2.5 cm/d. The data clearly show the transient nature of the flow field both in magnitude and direction. The average velocity for August, 2005, October, 2005, May, 2006, and October, 2006 datasets were 8.16, 6.57, 9.08, and 5.87 cm/day, respectively.

2.4.3 Biomass Quantification

Estimates of viable microbial populations were obtained from cores collected near the ORC wells, on the plume periphery and up-gradient of the gasoline source. It was found that near the ORC wells, microbial numbers were ~1 order of magnitude higher than at other locations, with an average viable biomass of $1.49\text{E}+09$ cells/g (dry weight sediment) and a range of $6.88\text{E}+08$ to $3.60\text{E}+09$ cells/g (**Figure 2.8**). Core extracted from the plume fringe contained an average viable biomass of $2.68\text{E}+08$ cells/g with a range of $7.37\text{E}+06$ to $1.17\text{E}+09$ cells/g. Core extracted from background contained an average viable biomass of $7.77\text{E}+07$ cells/g with a range of $2.87\text{E}+07$ and $1.97\text{E}+08$ cells/g. These results are higher than the inferred average biomass values from total PLFA concentrations reported by King *et al.* (1999) for the uncontaminated portion of the Borden aquifer ($3.00\text{E}+05$ cells/g), possibly due to the slight differences in enumeration techniques and converting total PLFA/g and total lipids/g to cells/g. Factors such as heterogeneity in the microbial distribution within the aquifer may also be reflected in the comparison. Background and plume periphery cores yielded similar population numbers, except at the most shallow depths, where populations in the plume fringe core were greater and similar to representative of populations receiving DO from ORC. It is likely that O_2 was available to the shallow fringe populations via transport from the surface. Careful visual inspection of the cores revealed no evidence of entrapped gas bubbles or large zones of mineral precipitation other than small quantities of black precipitates, possibly sulfides that occurred occasionally in the biostimulated core. Additional,

more detailed microscopic inspections are needed to better evaluate the presence or absence of precipitates with more accuracy.

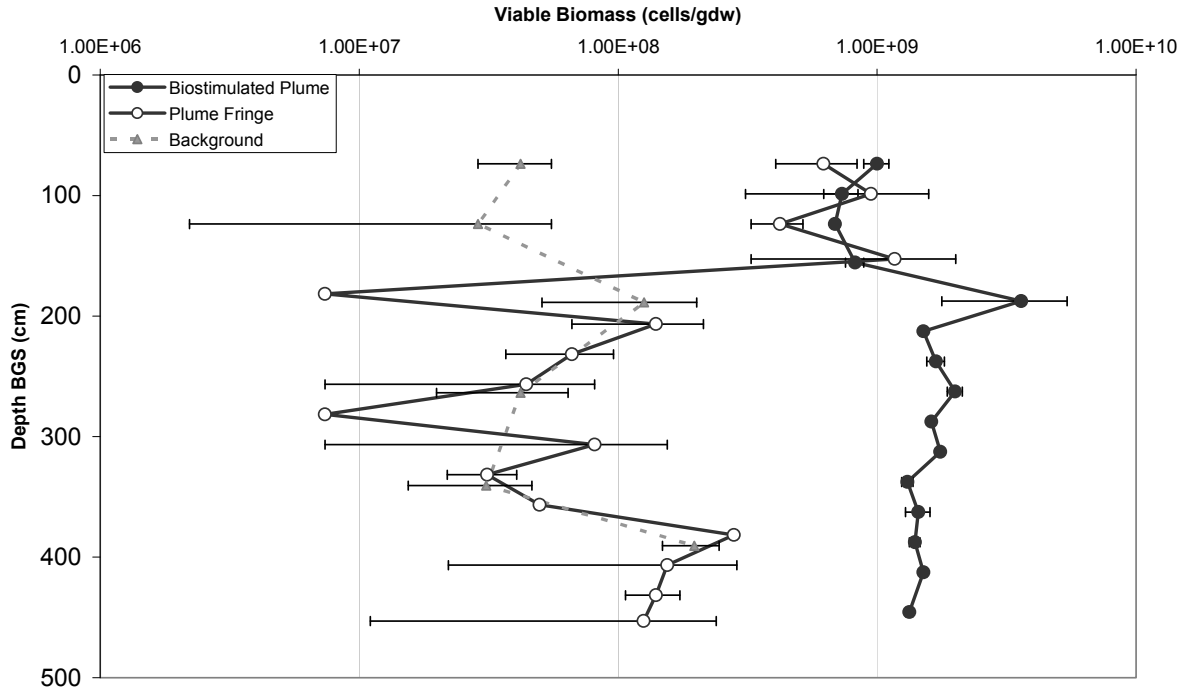


Figure 2.8: Calculations of biomass determined from PLFA analysis of three cores extracted from the Borden Aquifer. Data points represent the central location of measurements made with homogenized aquifer material in 25 cm intervals. Higher populations of microorganisms are coincident with areas of elevated DO found at shallow depths and the biostimulated plume. Error bars represent the range of error from duplicate samples. Where error bars are not shown, they are smaller than the size of the symbol.

2.4.4 Geochemical Calculations and Dissolved Gas Analysis

Geochemical calculations of saturation indices indicate that calcite was likely supersaturated at the ORC, KUML, and R4 wells (**Appendix H**). These calculations ignore Mg^{2+} and dolomite, and are therefore only preliminary in nature. Nevertheless, they provide some indication of whether chemical precipitates might have formed in the monitored zone. The calculations were performed for the highest and lowest measured concentrations of CO_2 and pH at each location, and for the highest and

lowest estimated concentrations of Ca^{2+} . Conditions change from moderately alkaline pHs at ORC wells (8.2 to 9.4) to slightly acidic pHs, 0.3 m down-gradient of the ORC wells, only at 4.85 m BGS in the KUML multilevels (6.7 to 6.8) and then reach neutral pHs, 1.5 m down-gradient of the ORC wells, by the R4 multilevels. Visual inspection of the core material used for determining biomass did not reveal extensive calcite or any other precipitates near the ORC wells. However, microscopic examination might have revealed more. Gas analysis of samples collected from multilevel sampling wells indicated that at KUML B (4.85 m BGS) in May, 2006, and at KUML A (4.85 m BGS) in October, 2006, CO_2 levels were within 30% of saturation and could have been locations of biogenic gas production (**Table 2.1**). Elsewhere, it seems there was little potential for gas-phase CO_2 , H_2S , and CH_4 in the aquifer affecting PVP measurements.

Table 2.1: Saturation ranges for multilevel measurements compiled from all sampling ports on each well to determine the possibility of gas production.

Multilevel Sampling Well	May 2006			October 2006		
	CO_2 %	H_2S %	CH_4 %	CO_2 %	H_2S %	CH_4 %
	Saturated	Saturated	Saturated	Saturated	Saturated	Saturated
R4-1	19 - 21	0	0	4 - 12	0	0
R4-2	18 - 22	0	0	4 - 8	0	0
R4-3	19 - 23	0	0	4 - 10	0	0
R4-4	20 - 25	0	0	2 - 8	0	0
R4-5	18 - 20	0	0	4	0	0
KUML A	15 - 62	0	0 - 1	3 - 79	0	0
KUML B	14 - 92	0	0 - 1	5 - 69	0	0 - 1

2.5 Discussion

The Borden aquifer is known to contain a spatially variable K field (Sudicky, 1986). Experimental results from this work show that the western portion of the

aquifer, inside the gate, is characterized by lower groundwater velocity than the eastern portion. Groundwater velocity directions indicated the water diverged around relatively low velocity zones and converged on areas of higher velocity in all cross-sections (**Figure 2.7**).

While velocities varied locally over time, decreases in velocity in some locations were compensated by increases in velocity in other locations so that the overall mean velocity changed little from dataset to dataset. This result is similar to observations made by Seki *et al.* (2006) and Kildsgaard and Engesaard (2002) in 2-D biological clogging tank experiments. The variability in the mean velocity magnitude for each dataset is explainable as seasonal variations in the gradient. The seasonal overprint results in lower mean velocities in October and higher mean velocities in May and August. The large, local variations are more difficult to explain on the basis of seasonal variations alone. Modeling with Flowpath[®], showed that when gradient changes occur across a gate, velocity magnitude within in the gate varies proportionately throughout, but direction does not change even when the aquifer is heterogeneous (**Appendix J**). Hence, the observed changes in groundwater velocity direction and non-proportional changes in magnitude, in the gate are likely a result of processes other than simple seasonal effects. A likely candidate for the cause of these variations is biological activity. The large standard deviation in velocity direction change (3.8-119.1^o) found in this study is consistent with expectations based on laboratory and modeling studies demonstrating that local flow can be strongly affected by biological activity (Seki *et al.*, 2006; Kildsgaard and Engesaard, 2002). Such large changes in velocity direction could explain the failure of the adjacent

probes D1 and E1 (**Figure 2.5**) in May 2006 where the injected tracer may have been transported away from the probe body prior to being detected.

If biological activity was responsible for flow variations in the gate, the greatest change in groundwater velocity would be expected to be in the area with the greatest biological activity. Biomass data indicated that the portions of the contaminated aquifer receiving DO amendments were approximately an order of magnitude higher in cell mass than those on the plume fringe below ~ 1.5 m depth. Elevated biomass concentrations in the upper ~ 1.5 m of the plume fringe core may be attributed to the penetration of atmospheric O₂ by the end of the experiment. The average background cell concentration was low compared to other locations, though a slight increase in microbial numbers at depth in the background core suggests some influence of that landfill leachate that migrates beneath the site.

In addition to the biomass data, enhanced biological activity downstream of the ORC wells was indicated by patterns of DO depletion. Prior to October, 2006, DO was not detectable above 1 mg/l at the R4 multilevel fence. Dissolved oxygen concentrations measured in October and December, 2006, ranged from 6.0 to 9.6 mg/l in multilevel R4-4, coincided with low BTEX concentrations. This suggests that the DO demand at the R4-4 declined substantially during the experiment. The delivery of DO from the ORC wells to the R4-4 multilevel may have been facilitated by a small increase in groundwater velocity (3.84 to 6.79 cm/day). Such an increase was measured in October, 2006 by probe E2 (**Figure 2.7**).

Moderate biological flow impedance near the ORC wells would cause local flow diversion around the zone of decreased K into new preferred flow paths. As

expected, areas directly down-gradient of the ORC wells exhibited decreases in velocity while DO and BTEX were present in abundance. In all datasets, a transient zone of relatively high velocity was persistent in the lower eastern portion of the aquifer that did not receive DO from ORC. These changes in flow velocity magnitude illustrate how the local addition of ORC may have led to reductions in flow in portions of the aquifer, causing redirection of flow to other portions. As discussed previously, seasonal variations in the hydraulic gradient alone cannot explain these observations, so biological activity is implicated to have indirectly influenced the velocity changes in the eastern portion of the aquifer. The waxing and waning of these preferred flow paths was indicated by observed velocity direction and magnitude changes that appeared to be related to the variations in timing and quantity of the ORC applications. For example, the October, 2005, and October, 2006, datasets were acquired one month after fresh ORC was added to the aquifer, and noticeably low velocities were observed. The May, 2006, dataset was acquired three months after two additional ORC socks were added to each well and the pattern of velocity variations returned to those of August, 2005. After the replacement of all ORC socks, the October, 2006, dataset shows the expansion of the low velocity zone into the upper two meters of the eastern portion of the aquifer (**Figure 2.7**). By this time, the measured carbon flux had considerably increased in the upper two meters of the eastern portion of the aquifer and atmospheric O₂ may have been able to enhance cell growth. Biomass concentrations taken from the upper ~ 1.5 m of the plume fringe core support this argument since they are similar in magnitude to concentrations from the near ORC location.

The possibility that the observed changes were due to secondary gas formation was investigated. Methane, hydrogen sulfide, and carbon dioxide were detected in the water, but at concentrations too low to come out of solution as a gaseous phase (**Table 2.1**). Precipitate formation couldn't be ruled out, however, there were no visible precipitates present throughout all but a small fraction of the recovered core. Visual observations cannot rule out the possibility of calcite precipitation. Additional work, such as microscopic analysis, is needed to conclusively resolve the issue of inorganic precipitate formation. Biomass remains a possible cause of the flow variations.

The zone of enhanced biological activity located in the vicinity of the ORC wells, and perhaps in the upper ~ 1.5 m of the aquifer, is sufficient to significantly decrease K in those areas, based on previous laboratory experiments documented in the literature. Preliminary calculations assuming an average cell volume of $2.4 \mu\text{m}^3/\text{cell}$ (Vandevivere and Baveye 1992b) and concentration of $1.0\text{E}+09$ cells/gram dry weight (**Figure 2.8**, biostimulated plume), suggest that cell volume would occupy $2.4 \mu\text{L}/\text{gram}$ dry weight sediment or approximately 1.3% of the total pore volume. Holm (2000), found that when biomass increased from $3.89\text{E}+07$ cells/g dry weight to $3.43\text{E}+08$ cells/g dry weight, an 80% loss in K resulted in column experiments using medium-grained sand. Similarly, Vandevivere and Baveye (1992a) determined, through a phospholipid-based assay, that an increase in biomass from $2.3\text{E}+08^*$ cells/g dry weight to $2.3\text{E}+09^*$ cells/g dry weight resulted in a 90% decrease in K. These cell concentration changes are similar in magnitude to those observed in this study (one order of magnitude), and support the notion that field K could be reduced

with the observed biomass levels above $1.0E+08$ cells/g dry weight. Furthermore, Vandevivere and Baveye (1992a) determined the measured biomass corresponding with a 90% decrease in K, occupied 2.4% of the pore volume. A total of 1.6% of the pore volume occupied by biomass was determined to reduce K by 50% (Vandevivere and Baveye 1992b). These results suggest the 1.3% of the pore volume occupied by biomass in this study is sufficient to significantly reduce K in the field.

Experiments by Vandevivere and Baveye (1992a) and Holm (2000) were conducted in relatively homogenous sand whereas the Borden site is known to contain a naturally variable K distribution. This raises the question as to the effect of heterogeneity on biomass and induced K reduction. The degree to which microbial biomass accumulation can impede flow is still debated in the literature. Hydraulic conductivity reductions are thought to occur either via the clogging of pore throats by a small population of aggregate colonies (Vandevivere, *et al.*, 1995) or by the development of a continuous biofilm around the grains (Taylor and Jaffé 1990a). Thullner *et al.* (2002) modeled bioclogging of heterogeneous and homogenous pore networks with both aggregate and biofilm methods to determine that bioclogging of heterogeneous pore networks required less biomass than homogenous pore networks, regardless of the mechanism of clogging. Therefore, the small-scale heterogeneities in the Borden aquifer would allow for biological flow impedance to occur more rapidly with less biomass than homogenous laboratory sands.

2.6 Conclusions

Transient flow changes occurring in a petroleum hydrocarbon plume, beyond those predicted by seasonal effects, were measurable by PVPs. Point velocity probes,

arranged in multilevel fashion, provided detailed velocity data in a cross-section of a sheet pile gate. The zone of enhanced microbial activity and biomass was attributed in part to increased DO levels following the installation of ORC, and possibly due to atmospheric O₂ diffusion into the shallow part of the hydrocarbon plume. Throughout the experiment, measured groundwater velocities within the gate were highly variable in direction and magnitude, while the overall mean velocity magnitude within the gate changed little, suggesting a microbial influence rather than seasonal variation alone. This local-scale variability in groundwater velocity was consistent with observations of K changes in 2-D biofouling experiments documented in the literature. Those studies showed that the increases in biomass on the order of those measured in this work can influence flow. Therefore, it is plausible that the enhanced biological activity observed caused local-scale changes to the flow. Despite these indications, visual inspection of core materials, geochemical modeling, and gas analysis did not show signs of extensive mineral precipitation or cavitation to suggest biomass accumulation as the predominant mechanism for clogging.

This study is the first to report centimeter-scale, direct velocity field measurements made in a bioactive plume. The use of the PVPs in a multilevel arrangement made it possible to map the observed flow transients for analysis in a 2-D section of the aquifer. This approach could be enhanced with the development of complimentary, non-invasive methods to gather information between the PVP measurement points. Such a method is explored in Chapter 3.

^{*}Calculation in **Appendix K**

Chapter 3

Using Point Velocity Probes (PVPs) and Ground Penetrating Radar (GPR) to characterize a biostimulated aquifer.

Chapter Summary

Enhanced biological activity in saturated sediments is known to cause changes to groundwater flow and to the petrophysical properties of porous media. These changes result from biomass accumulation, gas production, mineral dissolution, and mineral precipitation. In this study, a correspondence between measured changes in groundwater velocity and electromagnetic wave velocity is attributed to enhanced biological activity in a petroleum contaminated controlled-flow gate, in the Borden aquifer. Groundwater velocity measurements were conducted with a point velocity probe (PVP) array consisting of five, four-point multilevel stands oriented perpendicular to the average groundwater flow direction. Six cased Ground Penetrating Radar (GPR) boreholes surrounded a 4 x 2 x 5 m³ volume of the aquifer around the PVP array. Up-gradient of the PVP and GPR monitoring area, Oxygen Release Compound[®] (ORC) was deployed in wells to enhance the biological activity. Following the addition of dissolved oxygen, groundwater velocity and electromagnetic wave velocity near the ORC wells changed in a consistent manner throughout the experiment. Electromagnetic wave velocities measured further down-gradient, outside the influence of the ORC, did not trend in a consistent manner with electromagnetic wave velocities measured near the ORC wells. Preliminary laboratory experimentation using GPR in a biostimulated tank is consistent with results observed in the field. This suggests that the observed changes in GPR data are real and can be combined with PVP data to evaluate the effects of biological activity in contaminated aquifers.

3.1 Introduction

Petroleum hydrocarbons, serving as electron donors, are known to increase microbial numbers and activity in field and laboratory studies (Alvarez and Illman 2006). Baveye *et al.* (1998) reviewed several studies where elevated biological activity in porous media eventually led to changes in hydraulic conductivity and porosity through a variety of mechanisms such as biomass accumulation, production of extracellular polysaccharides, gas accumulation, and mineral precipitation. Seki *et al.*, (2006) suggested that localized development of bioclogged zones maybe detrimental to groundwater remediation efforts where contaminants could be

redirected to less bioactive or previously uncontaminated zones. Elevated levels of biological activity in a petroleum contaminated aquifer have been associated with mineral dissolution and enhanced microporosity as a result of organic acid production (McMahon *et al.*, 1995). Measurable hydrological, geochemical, and petrophysical changes associated with biological activity are known to occur at the pore-scale, which can lead to observable changes at larger scales if the activity is wide-spread. For example, groundwater velocity variations, measured with point velocity probes (PVPs), across a 7 m sheet-pile gate in the Borden aquifer have been attributed to locally enhanced biological activity (Chapter 2, this document). Point velocity probe data were shown to identify the zones directly and indirectly influenced by biological activity in the Borden aquifer. However, the physical changes that occurred in the aquifer were inferred from biogeochemical analysis of data acquired from a dense grid of multilevel sampling wells and sediment cores (Chapter 2, this document). The combination of PVPs with minimally invasive geophysical methods that are sensitive to physical changes in bioactive aquifers would provide complimentary datasets for interpreting the relative extent of biological activity in the field.

Recently, researchers began investigating the electrical response of biological activity in sediments (Cassidy, *et al.*, 2001; Atekwana *et al.*, 2004a; Atekwana *et al.*, 2004b; Abdel Aal *et al.*, 2004; Ntarlagiannis *et al.*, 2005a; Williams *et al.*, 2005). Investigations of low frequency electrical polarization (Ntarlagiannis *et al.*, 2005b), frequency dependence of the dielectric constant (dielectric spectroscopy), and other forms of dielectric monitoring have been used to characterize live cell suspensions and monitor microbial response to growth nutrients (Carstensen 1967; Asami *et al.*,

1980; Bao *et al.*, 1994; Claycomb *et al.*, 2002; Ong *et al.*, 2002; Mietchen *et al.*, 2002; Miller *et al.*, 2005). Dielectric spectroscopy for suspensions of *Escherichia coli* and unidentified species of *Micrococcus* sp. from 1 to 200 MHz was investigated by Carstensen (1967) who found that at 200 MHz and 25°C, the dielectric constant of *E. coli* and *Micrococcus* sp. was ~55 and ~80, respectively. Asami *et al.*, (1980) investigated the dielectric spectroscopy for suspensions of *E. coli* from 1-100 MHz. The high frequency limiting value for the dielectric constant was found to be ~ 72. These results provide encouraging evidence that high frequency EM methods such as ground penetrating radar (GPR) could be used to identify zones of contrasting biological activity because the dielectric constant of bacteria is different from that of water or sediment. Since the dielectric constant of bacteria is nearest that of water at high frequencies, small, measurable changes in the velocity of the EM wave would be expected in a water-saturated medium such as aquifer.

Few studies have investigated biological activity in geologic materials using GPR. Comas *et al.* (2005) used GPR to reveal biogenic gas accumulations in peatlands as anomalous increases in electromagnetic (EM) wave velocity. Österreicher-Cunha *et al.* (2004) investigated temporal changes in GPR attenuation, dielectric constant, and culturable microbial biomass of unsaturated soil blocks contaminated with a gasoline-ethanol blend. Time domain reflectometry (TDR) was also used to monitor temporal shifts in dielectric constant synchronous with biodegradation of a gasoline-ethanol source in the unsaturated soil blocks, but little relative change was observed over time (Österreicher-Cunha *et al.*, 2007). Neither study could conclusively link changes in bulk dielectric constant to biomass. Any

signal generated by biomass was obscured by changes in saturated water content over time. Furthermore, culturable biomass techniques, such as those used by Österreicher-Cunha *et al.* (2004) and Österreicher-Cunha *et al.* (2007), are known to provide biased estimates of population numbers since only cells that thrive under the selective conditions of the test are enumerated (Madsen 1998). The problem of saturation variations encountered by Österreicher-Cunha *et al.* (2004) and Österreicher-Cunha *et al.* (2007) was simplified in this study by working in fully saturated media, *in situ*. Selective microbial enumeration limitations were also addressed in this study by evaluating the viable biomass from sediment cores using a phospholipid quantification technique. At this time, the dielectric response of biomass in earth materials or in a field setting has not been successfully measured at the operating frequency of GPR.

The purpose of this study was to compare two synchronous field observations: EM wave velocity measurements from GPR (McGlashan 2007) and groundwater velocity measurements from PVPs (Chapter 2, this document) in the same contaminated aquifer, and to establish if GPR and PVPs respond to zones of enhanced biological activity in a consistent fashion. Ground penetrating radar is sensitive to changes in the dielectric and geoelectric properties of the pore-fluid and aquifer material whereas PVPs are sensitive to changes in groundwater flow. Therefore the comparison of GPR and PVP data could provide complimentary and independent evidence for pore-scale changes associated with enhanced biological activity. A further goal of this work was to duplicate any observed trends linking changes in EM wave velocity changes to biomass accumulation in a laboratory setting.

3.2 Field Site

3.2.1 Borden Hydrogeology

Field experimentation for this study was carried out at the CFB Borden test site. The unconfined Borden aquifer comprises fine to medium-grained sand and extends from the surface to a clay aquitard 7 m below ground surface (BGS). The water-table in this study was found at an average depth of 1 m BGS. Under natural gradient conditions, the mean seepage velocity for conservative tracers at Borden is estimated to be 9.1 cm/d (Mackay *et al.*, 1986). Hydraulic conductivity at the Borden aquifer, measured by Sudicky (1986), ranges from 52 to 1728 cm/d with a geometric mean of 842 cm/d. Natural gradient conditions favor a predominantly north to northeast flow direction with seasonal oscillations as much as 39 ° (Farrell *et al.*, 1994), and an average gradient magnitude of 4.3×10^{-3} (Sudicky, 1986). The Borden aquifer is widely considered to be “quite homogenous” (Mackay *et al.*, 1986 pg. 2019) which makes it a relatively simple aquifer in which the detection of transient heterogeneity and variations in the porous medium’s dielectric properties, caused by enhanced biological activity should be possible. Microbiological studies at Borden indicate a sparsely populated aerobic consortium occurring primarily in the top meter of the aquifer. Activity is limited by dissolved oxygen (DO) levels, which are below 3 mg/l almost everywhere below the water table, and low dissolved organic carbon content (Barbaro *et al.*, 1994). Previous measurements of microbial biomass in uncontaminated core samples of the Borden aquifer material, using with plate count enumeration techniques, report a range of $< 1.0E+01$ to $1.0E+04$ colony forming units / gram dry weight (Barbaro *et al.*, 1994; Butler *et al.*, 1997). Phospholipid fatty acid

(PLFA) analysis of Borden core extracted from an uncontaminated portion of the aquifer indicated a total viable biomass range from $1.0E+06$ to $1.0E+08$ cells/gdw (cells/gram dry weight sediment) with the higher populations found at depth, suggesting influence from an underlying leachate plume (Chapter 2, section 2.4.3).

3.3 Methods

In order to evaluate the changes in groundwater flow and EM wave velocities resulting from microbial activity in the field, a sheet-pile gate was constructed. A petroleum source was emplaced at the up-gradient end of the gate. Within the gate, seasonal variations in groundwater flow direction and transport of the dissolved petroleum hydrocarbons was controlled. Also within the gate, an array of PVPs measured changes in groundwater velocity, while borehole GPR surveys characterized changes in the dielectric properties of the aquifer surrounding the PVP array. Up-gradient of the GPR cased boreholes and PVP array, DO was released into the contaminated aquifer to enhance aerobic biological activity. Changes in PVP and GPR signals were compared to geochemical measurements, geochemical modeling, and biomass measurements to investigate possible mechanisms for the changes (i.e. gas production, biomass accumulation, mineral precipitation, mineral dissolution). To evaluate the reproducibility of the observed trends, a preliminary laboratory experiment was conducted to determine if the field response was reproducible in a more controlled setting.

3.3.1 The Gate

A sheet-pile bounded alley-way, hereafter referred to as the gate, was constructed in the CFB Borden aquifer. The gate measured 20 m long, 7 m wide, and 7 m deep and was installed parallel to the ambient groundwater flow direction to

restrict the average direction of groundwater flow in the experimental zone. Near the influent portion of the gate, a series of 15 petroleum source wells was installed for the release of ~ 50 L of gasoline at depths of 2.5 to 4.0 m BGS (**Figure 3.1**). A fully-screened pumping well was operated at the down-gradient end of the gate to dampen seasonal changes in groundwater velocity magnitude. A minimum average linear velocity of ~ 5 cm/d was maintained through the gate at all times. Also at the down-gradient end of the gate, a small building was erected on top of a gravel pad to protect instrumentation and monitoring equipment from the elements, and prevent flooding of the work area during spring snow melt. Within the building, five fully screened Oxygen Release Compound[®] (ORC) delivery wells were installed to introduce DO to the hydrocarbon plume and enhance biological activity (**Figure 3.1**). Four ORC socks (a sock contains 2 to 3 kg of ORC and is suspended in a well to enhance aquifer DO) were delivered to each well beginning in September, 2005, with two additional socks per well added in February, 2006. Finally, all 30 socks were replaced in September, 2006. Two series of multilevel sampling wells were used to measure water chemistry. The KUML multilevel sampling well series was used to collect samples for DO, pH, electrical conductivity and aqueous gas concentrations 0.3 m down-gradient of the ORC wells, at depths of approximately 2.3, 3.15, 4.0, and 4.85 m BGS (**Figure 3.1**). The R4 series multilevel sampling wells were located 2.5 m down-gradient of the ORC wells and were constructed with 15 sampling points each, spaced 25 cm apart from 1.5 to 5.5 m BGS. R4 multilevels were used to document concentrations of benzene, toluene, ethylbenzene, xylene isomers (BTEX), as well as monitor DO, pH and electrical conductivity in detail (**Figure 3.1**). Point velocity probes and cased

boreholes for GPR data acquisition were installed down-gradient of the ORC wells. Viable microbial biomass was evaluated at the end of the experiment (December, 2006) by examining the phospholipid fatty acid (PLFA) content of three cores extracted from (1) 0.3 m down-gradient of the ORC wells where biological activity was expected to be highest, (2) on the fringe of the plume, and (3) up-gradient of the source (Chapter 2, this document) (**Figure 3.1**). Aqueous biomass measurements reported in this study were collected in October 2005 from R4 series multilevels by pumping 2 L of groundwater through Millipore[®] 1 µm glass-fiber filters. The PLFA content of each filter was measured in the same manner as cores. For additional details concerning the gate installation, sampling methods, analyses, and results, the reader is directed to Chapter 2.

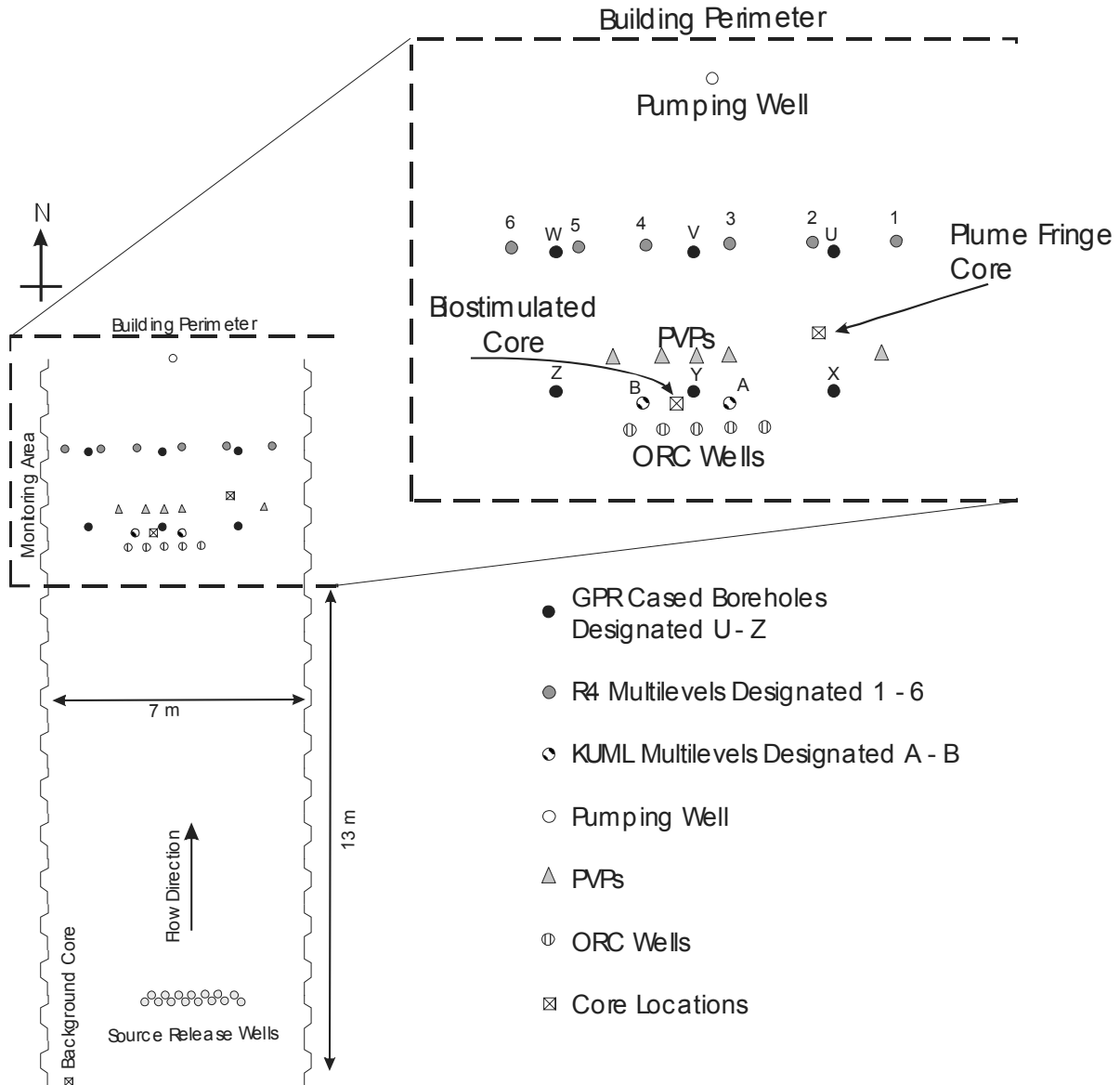


Figure 3.1: Map of the experimental Borden gate bounded to the east and west by sheet piling. Spatial relationships are shown between the KUML and R4 multilevel sampling wells used in the analysis, PVP array, cased GPR boreholes, Oxygen Release Compound (ORC) wells, pumping well, hydrocarbon source release wells and core locations. Flow direction in the gate is established to be due Northward, to the pumping well.

3.3.2 Determining Groundwater Velocity

Groundwater velocity magnitude and direction were determined using PVPs. A total of 5 multilevel stands, each containing 4 PVPs, provided 20 groundwater velocity measurements to characterize a 4.0 X 4.0 m² cross-section of the gate, 1.0 m down-gradient of the oxygen release wells (**Figure 3.1**). Point velocity probes were installed in May, 2005. One probe (designated F2, see **Figure 2.5**) never returned a usable signal either because it was damaged during installation or because the local flow was very different from the average, leading to misalignment of the probe. Two probes, D1 and E1, failed to return signals in May, 2006, and were omitted from analysis during that time (**Figure 2.5**). These failures were likely due to large local changes in the flow direction that were beyond the detectable directions of the probe. Velocities were measured at depths of 1.6, 2.4, 3.2, and 4.1 m BGS. Velocity measurements were collected in August, 2005, (prior to the addition of ORC), October, 2005, May, 2006, and October, 2006. Details of PVP data collection procedures are given in Chapter 2, Sections 2.3.1 and 2.3.2, and **Appendix A**.

3.3.3 GPR Acquisition and Processing

A total of six cased GPR boreholes, constructed from 5.08 cm diameter PVC, were installed in the sheet-pile gate from the surface to a depth of 5 m BGS. Cased boreholes were installed in two lines of three boreholes, oriented east to west, equidistantly spaced at 2 m intervals (**Figure 3.1**). Borehole GPR data acquisition occurred within hours of the PVP data acquisition, with the exception of the first GPR dataset, which was acquired in May, 2005, three months before the first PVP data were acquired. The delay was necessary due to travel time constraints. This delay also

permitted the aquifer ample time to re-equilibrate after the PVP installation in May, 2005. Data from two cased borehole-pairs (labeled X-Y and Y-Z) in a cross-section of the aquifer 0.5 m down-gradient of the ORC source and 0.5 m up-gradient of the PVP fence, were used to assess dielectric changes in the aquifer where the highest degree of biological activity was expected (**Figure 3.1**). Data from two additional borehole-pairs (labeled W-V and V-U) were used to evaluate aquifer conditions 2.5 m down-gradient of the ORC release wells where less biological activity was expected early in the experiment, due to oxygen limitations (Chapter 2, Section 2.4.1) (**Figure 3.1**).

Each of the GPR surveys was conducted using the PulseEKKO[®] 100 borehole radar system with 200 MHz antennas, a 400 V transmitter, a 200 ps sampling interval, 150 ns time window, and 64 stacks. The transmitter and receiver were lowered into cased boreholes at 0.125 m intervals during the Zero Offset Profile (ZOP) surveys and 0.25 m intervals during the Multiple Offset Gather (MOG) surveys. First energy arrival time and amplitude data were collected in Sensors and Software[®] processing software. Arrival time data were corrected for water temperature and used to produce tomographic images of EM wave velocity using MIGRATOM[®] (McGlashan 2007).

3.3.4 Preliminary Laboratory Experimentation

A preliminary laboratory mesocosm experiment was conducted to verify that the GPR response in the presence of enhanced biological activity in the field could be reproduced in the lab. The experiment was conducted in a sandbox tank with dimensions 1.0 m x 0.3 m x 1.0 m (L x W x H). In the center of the tank, three fully screened 1.27 cm diameter injection wells were installed perpendicular to the flow

field. These were used to introduce amendments promoting biological activity on the down-gradient side of the tank. The up-gradient half of the tank served as a control throughout the experiment. Prior to packing, the tank and injection wells were sterilized with 70% isopropyl alcohol. The reactor was packed with a kiln-dried, homogenous, quartz sand mixture which was found through biostimulation tests, to be as sterile as autoclaved sand. The tank was flooded with untreated ground water from the Kansas River alluvial aquifer, which served as an inoculum. The ground water used is known to be weak in nitrate, iron, and manganese, but it contains substantial sulfate (~ 30 mg/L) (McElwee *et al.*, 1995). Therefore sulfate reduction was expected to be the dominant anaerobic process in the tank, just as it was in the Borden aquifer. A Mariotte bottle assembly was used to drive flow through the tank. Except during sampling, the tank was kept at room temperature, in the dark.

A nutrient solution concentrate of 5.0 g of Tryptic soy broth (TSB) and 5.0 g of sodium acetate dissolved in 1.0 L of deionized water was prepared for injection into the tank on a semi-weekly basis to promote microbial growth. The nutrient concentrate was autoclaved at 110 ° C for 20 minutes and immediately stored at 4 ° C until it was introduced to the tank. Immediately prior to injection, the concentrate was diluted with 2 L of tap water to reproduce the background electrical conductivity of the Kansas River aquifer water. Each of the three release wells in the tank received 1.0 L of diluted nutrient solution per injection.

Radar data were acquired with a Sensors & Software pulseEKKO PRO[®] with 1000 MHz shielded antennas, 185 V transmitter, 0.10 ns sampling interval, and 25 ns time window. Surveys were conducted in transillumination ZOP mode measuring

arrival times at six locations down-gradient of the nutrient injection wells and three locations up-gradient of the nutrient injection wells. One of the up-gradient locations was placed in close proximity to the nutrient injection wells to indicate EM wave velocity changes near the release location. Data were collected with no gain, and in stacks of eight to amplify the signal to noise ratio. Radar data were acquired twice per week along with pH, electrical conductivity, and water temperature for both up-gradient and down-gradient locations over a 40 day period. Aqueous biomass concentration estimates were made at the beginning and end of the experiment using a direct-count enumeration method (Yu *et al.*, 1995). The cells were stained with DAPI, visualized, and counted on a Nikon E400 with 100X objective. Slides were prepared for both up-gradient and down-gradient locations. Background was established by counting three fields of view for each slide, while five fields of view were used to characterize biostimulated conditions.

3.4 Results and Discussion

3.4.1 Groundwater Velocity

These results were discussed in detail in Chapter 2. For convenience, they are briefly reviewed here. Early in this study, groundwater velocity in the western portion of the aquifer was characterized as being slower than in the eastern portion. In general, the measured groundwater velocity directions indicated movement towards regions of high velocity magnitude, diverging around locations of lower velocity magnitude (**Figure 3.2**). A simple arithmetic average of groundwater velocity magnitudes and directions for all locations in all datasets was calculated to be 7.38 cm/d and N12°E (sheet-pile gate was oriented due north) with standard deviations of

4.39 cm/d and 26.8° , respectively. However, weighting the measured velocities by the cross-sectional areas they represent, it leads to an average velocity of 6.71 cm/d with a standard deviation of only ± 1.45 cm/d. The standard deviations on the mean velocities from each dataset was only 1.46 cm/d and $N8.6^\circ E$ for magnitude and direction, respectively, showing little gate-wide variation throughout. The fact that these dataset averages varied minimally throughout the experiment while the variation at individual points was so much larger is at first glance exactly what is expected from a statistical point of view. However the time dependent nature of the individual point velocity variations suggests a deeper meaning to the variation. Modeling with FLOWPATH[®] showed that seasonal variations cause velocity changes to occur everywhere in the gate proportionally without altering flow direction, unlike what was observed in the experiment (**Appendix J**). This suggests that at least some component of the observed changes is connected with the plume and the biostimulation with ORC.

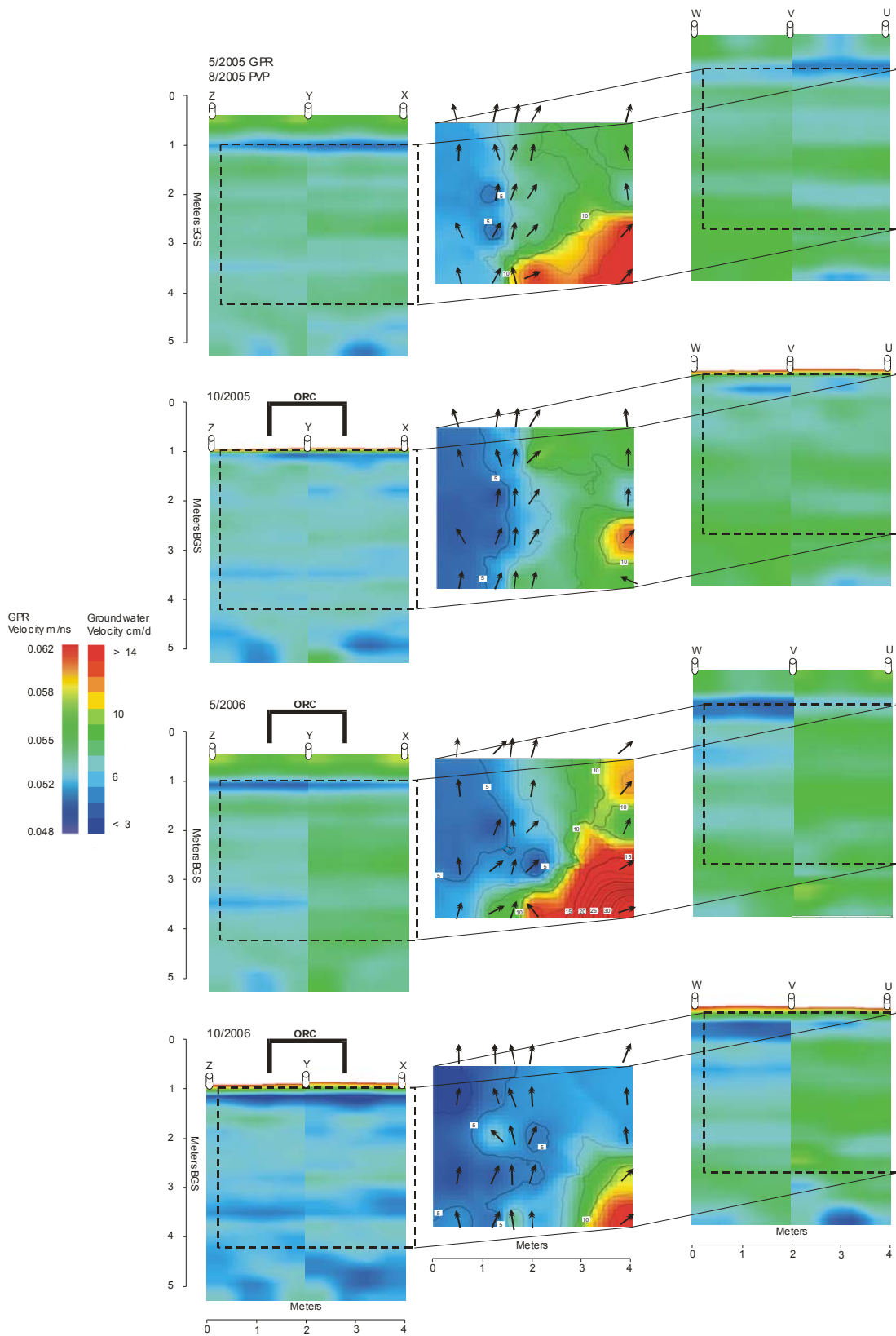


Figure 3.2: Ground penetrating radar and PVP data represent conditions from three cross-sections of the gate. For each date of data acquisition, cross-sections from left to right are in order of increasing distance from the ORC wells. They are: GPR velocity tomograms for borehole-pairs X-Y and Y-Z, groundwater velocity direction (black arrows) and magnitude from PVPs, and GPR velocity tomograms for borehole-pairs W-V and V-U. Point velocity probe flow arrows represent groundwater flow in the horizontal plane. The arrows are tipped up to a vertical orientation for visual clarity. The average flow direction for each PVP multilevel is shown as a flow arrow above the section.

3.4.2 Comparing Groundwater Velocity with GPR Measurements

Point velocity probe and GPR signals changed synchronously and consistently within the gate over time. As discussed above, in Section 3.4.1, seasonal variations to the flow system may have contributed to the observed groundwater velocity magnitude changes in the gate. However, seasonality is only expected to affect GPR signals through water temperature fluctuations, and these were accounted for in data processing. Therefore, the changes in temperature-corrected GPR data provided additional evidence that more than simple seasonal variations were at work in the aquifer.

Ground penetrating radar results for May, 2005, and PVP data acquired in August, 2005, represent aquifer conditions prior to the release of ORC. Following the introduction of ORC to the aquifer in September, 2005, groundwater velocity magnitudes and EM wave velocities for borehole-pairs X-Y and Y-Z decreased (see October, 2005, **Figure 3.1**). Electromagnetic wave velocities for borehole-pairs W-V and V-U changed comparatively little during this time. Little change was noted in groundwater velocity directions between August and October, 2005.

Following the introduction of additional ORC to the aquifer in February, 2006, notable changes in GPR EM wave velocity, and the groundwater velocity field,

became evident (see May, 2006, **Figure 3.1**). Groundwater velocity remained low in the western portion of the gate as did EM wave velocities for western borehole-pair Y-Z. Likewise, increases in groundwater velocity for the eastern portion of the gate were coincident with increases in EM wave velocity measured in eastern borehole-pairs X-Y. Analysis of the petroleum hydrocarbon concentrations showed considerable plume attenuation between October, 2005 and May, 2006 (Chapter 2, Section 2.4.1, and **Figure 2.6**).

In October, 2006, following the complete replacement of ORC socks during September, 2006, the western half of the gate, continued to remain low in groundwater velocity magnitude while the shallow zone of the eastern half began to decline in groundwater velocity magnitude. Electromagnetic wave velocities decreased considerably near the ORC wells as shown by borehole-pairs X-Y and Y-Z while borehole-pairs further down-gradient (W-V and V-U) showed a small decrease. Hydrocarbon plume concentrations at this time indicated extensive attenuation of BTEX compared to August and October, 2005 concentrations (**Figure 2.6**).

The changes in groundwater velocity (magnitude and direction) and EM wave velocity appear to correspond to the timing and quantity of ORC additions (Chapter 2, this document). Datasets collected in October, 2005, and October, 2006, represent times within a month of the replacement of all 30 ORC socks in the aquifer. These datasets show the greatest degree of change in EM wave velocity for borehole-pairs near the ORC wells (X-Y and Y-Z). Borehole-pairs further down-gradient (W-V and V-U) show more subtle changes that may not be due to the same causes since the DO concentrations at W-V and V-U were too low to measure (< 1 mg/L) until

October, 2006, when high levels of DO were measured at R4-4 between 2.40 and 3.12 m BGS. It should be noted that the changes in EM wave velocity were small in all cases, on the order of ~ 0.01 m/ns (McGlashan 2007). Although these changes are small, they are considered real since all GPR data were acquired in saturated media and processed exactly the same way with unbiased first energy arrival picks, wave distortion removal, and temperature correction. Any systematic error during data processing would have resulted in a bulk shift in velocities over time, which was not observed (McGlashan 2007).

Ground penetrating radar velocity changes for borehole-pairs X-Y and Y-Z trend well with measured PVP velocities in all datasets. Non parametric statistical analysis suggests that decreases in EM wave velocity corresponding to decreases in groundwater velocity are significant at the 99% confidence level (Finkelstein and Levin, 2001; Lowry, 2008). However, direct correlations between the magnitudes of EM wave velocities and groundwater velocities were found to be too weak for use as a quantitative tool. Given that these two measurements are responses to different phenomena, this result is not surprising. The correspondence in the nature of the changes (positive or negative) is all the more notable for this reason. Borehole-pairs W-V and V-U represent a cross-section of the aquifer 2 m down-gradient of borehole-pairs X-Y and Y-Z and do not trend as well with groundwater velocity data suggesting that there was a time lag before the down-gradient borehole-pairs were affected by the ORC additions, if indeed the observed changes are at all related to the ORC additions.

Spatial trends in groundwater velocity changes did not exactly coincide with spatial changes observed in GPR responses at borehole-pairs X-Y and Y-Z (May, 2006, near the center of the monitored area). Some of this apparent discrepancy might be because the PVP results were interpolated across the gate using a maximum of only 19 measurements. In contrast, the GPR tomograms in **Figure 3.2** were generated using between 760 and 800 traces per gate cross-section (380 and 400 traces per borehole-pair) (McGlashan 2007). The high-resolution GPR measurements led to higher resolution of aquifer structure and stratigraphy than could be achieved with the groundwater point velocity measurements.

3.4.3 Preliminary Laboratory Experimentation

The preliminary laboratory experiment confirmed that small decreases in EM wave velocity occurred in areas where biological activity was enhanced (**Figure 3.3**). After 40 days of biweekly carbon injection, evidence accumulated of significant biological activity in the down-gradient end of the tank. The evidence included declines in pH and GPR amplitude, increases in electrical conductivity and aqueous biomass concentrations, and the appearance of black precipitates, thought to be iron sulfides, that later changed color to orange once exposed to the atmosphere. The pH changed a maximum of half a pH unit, and down-gradient pH values were consistently lower than up-gradient values (**Table 3.2**). Electrical conductivity measurements ranged from 669 to 694 $\mu\text{S}/\text{cm}$ in the up-gradient location and 669 to 1410 $\mu\text{S}/\text{cm}$ in the down-gradient location (**Table 3.2**). Ground penetrating radar amplitude data were shown to attenuate by an average of 4% in the down-gradient location, corresponding to the increased electrical conductivity of the pore-water

there. The up-gradient location showed no significant attenuation. The black precipitates along with gas bubbles were found predominantly in the down-gradient location of the tank. The results of this preliminary experiment are qualitatively consistent with the results reported by McGlashan (2007). The magnitudes of the EM wave velocity decreases are approximately an order of magnitude less than those reported by McGlashan (2007). However, the distance over which the signal was propagated was 0.3 m in the laboratory compared to 2.0 m in the field. This evidence supports the hypothesis that changes in EM wave velocities in a bioactive porous medium are a result of direct or indirect effects of the biological activity.

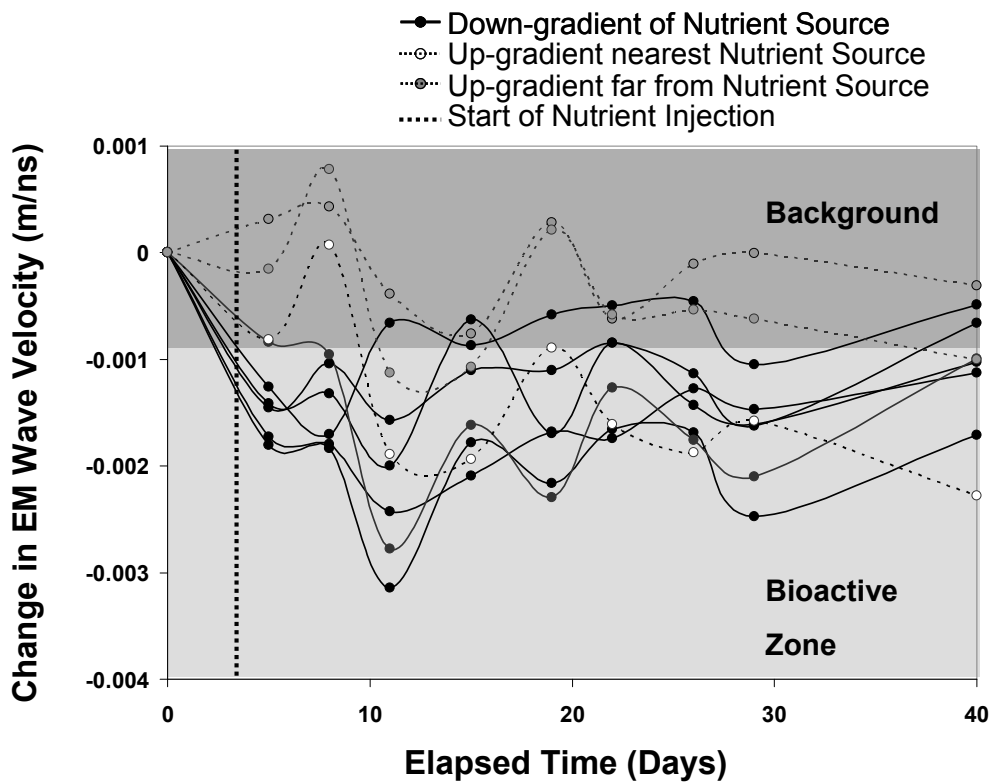


Figure 3.3: Changes in EM wave velocity associated with the injection of nutrient solution over the 40 days of experimentation. Each curve represents the temporal changes in EM wave velocity at one location. Curves in the dark grey zone are interpreted to be background readings while curves in the light grey zone are interpreted to be from biological activity. One curve near the injection wells, slightly up-gradient of their location, indicates velocity changes more characteristic of those down-gradient from the injection wells.

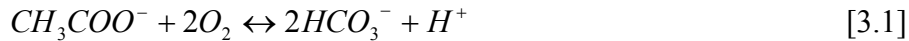
Aqueous biomass measurements indicated ~ 1 order of magnitude increase in aqueous microbial population in the down-gradient pore-water compared to up-gradient, which did not change measurably over the course of the 40 day experiment (**Table 3.2**). The magnitude of the biomass measurements made in the laboratory experiment was surprisingly low, possibly resulting from a later noted weakened DAPI solution or inherently high error within the method. Aqueous biomass measured at the Borden site in October, 2005, also showed an order of magnitude increase in biomass concentration based on the comparison of samples collected from the background and ORC wells approximately one month after ORC application (**Table 3.1**). Attached biomass from the Borden aquifer showed a similar increase after about 450 days of biostimulation, based on the comparison between biostimulated and background cores (**Table 3.1**). Cells sorbed onto mineral grains have been shown to be higher in concentration than suspended cells in the Bemidji petroleum contaminated aquifer, where only 15% of the total population was measured to be suspended (Bekins *et al.*, 1999). Therefore, biomass concentrations in the laboratory experiment are expected to be significantly higher than concentrations reported. Laboratory aqueous biomass concentrations were noted to be lower than field aqueous biomass concentrations, speculatively resulting from differences in community compositions, nutrient adaptation, and growth kinetics.

Table 3.1: Comparison between field and laboratory biogeochemical parameters compiled from sediment cores and aqueous samples. Biomass was determined with the DAPI method in the laboratory, while PLFA was used to determine field biomass.

	Field Background	Field Non-Biostimulated Plume	Field Biostimulated	Lab Up-gradient Background	Lab Up-gradient After Biostimulation	Lab Down-gradient Background	Lab Down-gradient After Biostimulation
Mean Aqueous Biomass (cells/ml)	3.64E+05*	3.15E+05*	2.36E+06*	1.50E+05 stdev = 13.89E+04	4.60E+04 stdev = 5.03E+04	1.40E+04 stdev = 6.94E+04	7.00E+05 stdev = 50.96E+04
Mean Attached Biomass (cells/gdw sediment)	7.77E+07***	2.68E+08***	1.49E+09***	NA	NA	NA	NA
pH	6.8 - 8.0****	7.48**	7.99**	7.57	6.96	7.46	6.82
Electrical Conductivity (µS/cm)	281 - 325****	714**	734**	669	694	669	1410

* Data From October 2005
 ** Data From October 2006
 *** Data from December 2006
 **** Data from Table 3.2
 NA = Not Available

Pore-water electrical conductivity and pH changes were different between field and laboratory experiments (Table 3.1). In the field experiments, pH was found to increase within the biostimulated zone, while in the laboratory experiment, pH decreased with biostimulation. Decreasing pH in the laboratory experiment was expected with aerobic biotransformation of the sodium acetate/TSB mixture as follows:



The increasing pH in the field experiment was expected since ORC disassociates to release OH⁻ in the process of releasing and O₂ (Schäfer *et al.*, 2006). Pore-water electrical conductivities were noted in both field and laboratory studies to be higher in biostimulated zones compared to non-biostimulated locations and background measurements (Table 3.2). Increased pore-water electrical conductivity may result from biological activity causing mineral dissolution or production of organic acids and biosurfactants (Cassidy *et al.*, 2001). Laboratory results showed higher pore-water electrical conductivities than were observed at Borden for the

possible reason that the carbon substrate was consumed rapidly, releasing carbonate species and acid. This process was more pronounced in the confines of the tank than it was in the field.

3.4.4 GPR Response Mechanisms

Increases to the EM wave velocity results from a decrease in the bulk dielectric constant (ϵ_r), which could be caused by increasing the mineral or air component of a bulk medium (Davis and Annan, 1989), i.e., by mineral precipitation or biogenic gas production. Small EM wave velocity increases were noted throughout the experiment in the eastern portion of the aquifer, between boreholes V and U and in May, 2006, between boreholes X and Y. Gas analysis of samples collected from multilevel sampling wells KUML B (4.85 m BGS) in May, 2006, and KUML A (4.85 m BGS) in October, 2006, indicated that these could have been locations of biogenic CO₂ gas production (**Table 2.1**). Elsewhere, it seems there was little potential for gas-phase CO₂, H₂S, and CH₄ in the aquifer affecting GPR and PVP measurements. Visual inspection of the core material used for determining biomass (Chapter 2) did not reveal extensive calcite or any other precipitate formation at that scale, leaving the possibility of pore-scale cementation occurring near the ORC wells. Microscopic analysis of the core material might reveal evidence of precipitate formation. Geochemical calculations (**Appendix H**) results indicate that calcite precipitation was most likely in the immediate vicinity of the ORC wells, though the possibility of calcite precipitation as far away as the R4 multilevels cannot be discounted. Additional water analysis is needed to be more definitive in these conclusions.

From May, 2006, to October, 2006, western borehole-pairs (Y-Z and W-V), typically showed decreasing EM wave velocity (increases in ϵ_r). Mineral dissolution is possible mechanism to explain these changes because it involves the replacement of mineral grains with water. However, conditions suitable for mineral dissolution (calcite) were not found (**Appendix H**). Therefore, this mechanism is not thought to be the primary one at work.

Another possible mechanism to explain the GPR responses, is the effect of the biomass itself. Ground penetrating radar has not previously been shown to directly detect biomass in geological materials. Despite this, field and preliminary laboratory experimentation in this study identified a consistent trend that indicated that a decrease in EM wave velocity is associated with increases in biological activity both in the ORC stimulated, carbonate rich sand aquifer, and in the silica sand laboratory tank experiment. Total biomass collected from cores at the Borden gate was elevated by an order of magnitude near the X-Y and Y-Z borehole-pairs, in the biostimulated zone, relative to measurements made in the non-biostimulated and background (**Table 3.2**, also see Sections 2.3.5 and 2.4.3 for details). In order for the decrease in EM wave velocity to be attributable to biomass accumulation, the accumulated cells must increase the bulk dielectric constant of the medium compared to the ambient pore-water, at 200 MHz. Aqueous suspensions of pure culture bacteria and erythrocyte cells have been shown to exhibit dielectric constants near that of water between 100 and 200 MHz (Carstensen 1967; Asami *et al.*, 1980; Bao *et al.*, 1994). However there are no studies reporting the effects of biomass in porous media on the bulk dielectric constant. At this stage, it is only possible to speculate that a microbial

consortia interacting with mineral grains in saturated sediment could have dielectric constants different than aqueous suspensions of pure cultures.

3.5 Conclusions

Point velocity probe and GPR measurements exhibited corresponding trends in the field where both techniques measured changes associated with biostimulation. The GPR response was delayed > 2 m down-gradient from the PVPs, outside the immediate influence of ORC. However, late in the experiment, the expected response began to appear in some down-gradient locations. Groundwater velocity data coupled with GPR data provided complementary datasets that might be used to visualize the extent of aerobic biological activity in a contaminated aquifer. Though many microbially-related processes were likely occurring in the aquifer, including gas production, and mineral precipitation, none of these could be proven to be sufficiently extensive to explain both the PVP and GPR results, leaving the possibility that biomass or mineral dissolution was responsible for the changes. The results of a preliminary laboratory experiment appeared to corroborate the field observation that EM wave velocities declined in locations of enhanced biological activity and elevated concentrations of biomass, supporting the notion that microbial activity, either directly or indirectly exerts measurable effects on radar waves in a porous medium. These effects can be tracked in space and time and they are statistically correlated to changes groundwater flow. Further work is necessary to explore the details of this correlation, but as it becomes better understood, GPR has the potential of becoming a valuable tool for the characterization of aquifers undergoing biostimulation.

Chapter 4: Conclusions and Recommendations

4.1 Conclusions

Point velocity probes, arranged in multilevel fashion, provided detailed velocity data across a petroleum contaminated aquifer bounded by a sheet-pile gate. These multilevel PVPs were able to measure transient flow changes occurring in the petroleum hydrocarbon plume, beyond those predicted by seasonal effects. The spatial distribution of hydrocarbon plume mass shifted toward the parts of the aquifer where PVP data indicated groundwater velocities were high. The shift was also consistent with PVP flow directions. Data from core material indicated that zones of enhanced biomass occurred in locations where there was a combination of labile DOC from the petroleum hydrocarbon, and increased DO concentrations from either the ORC or atmospheric O₂ diffusing from the surface. Groundwater velocity throughout the gate was highly variable in direction and magnitude while the overall mean velocity magnitude changed little. This suggests that microbial influence rather than seasonal variations dominated the transient variability in groundwater velocity. The extent and exact mechanism of the changes requires further investigation. Ground penetrating radar was employed to address this need.

Ground penetrating radar data (McGlashan, 2007) were compared to the PVP results. Ground penetrating radar measurements are independent of changes in groundwater flow. Therefore, consistent trends between PVPs and GPR argue against seasonal variations in groundwater gradient, which only affect PVP observations. Point velocity probe and GPR measurements changed in a consistent fashion that was found to be statistically significant. Decreases in both groundwater and EM wave

velocities occurred in the zones of elevated biomass and suspected biological activity. The mechanism for the changes in PVP and GPR responses was likely a combination of processes. Gas production, mineral precipitation, and abiotic mineral dissolution were found to be possible in the aquifer, locally. Biomass accumulation was expected to be relatively more widespread and was consistent with the observed PVP and GPR results. Groundwater velocity data coupled with GPR data provide complimentary datasets that may be used for interpreting the relative extent of aerobic biological activity in a contaminated aquifer.

4.2 Recommendations for Improved Interpretive Ability

Laboratory mesocosm experiments, such as the one described in the previous chapter, permit a high degree of control to be maintained while data are collected. This facilitates the interpretation of field observations. Nevertheless, some additional field data would be of enormous assistance in future experiments of this kind. For example, greater confidence in interpreting a mechanism for the PVP and GPR velocity changes could be achieved with more geochemical monitoring and modeling. Sulfate reduction has been identified as the predominant anaerobic process in the Borden aquifer (King *et al.*, 1999; Devlin and Barker 1996; Nicholson *et al.*, 1983). Production of HS^- and precipitation of FeS were likely occurring within the anoxic portions of the aquifer, but were not measured. If this or other precipitation reactions could be shown to be important, there could be consequences for PVP and GPR studies. Williams *et al.*, (2005) showed that bacterial cells were nucleation sites for insoluble metal sulfides. Such encrusted cells might require lower populations of cells to cause variations in flow. Furthermore, the changes in the dielectric properties of

the aquifer associated with metal sulfide precipitation or with a mixed consortium of microbes are unknown. Transmission electron microscopy/electron energy-loss spectroscopy (TEM/EELS) analysis of aquifer materials from core collected from a highly controlled laboratory experiment or core collected from the field site could confirm the relative predominance of mineral precipitation or dissolution and validate the petrophysical interpretation of GPR data.

Frequent measurements of pH, electrical conductivity, alkalinity, and dissolved ion concentrations would also aid the interpretation of GPR petrophysical analysis by providing independent spatial and temporal data to be used in geochemical modeling for the purposes of better defining the extent of mineral precipitation or dissolution.

More frequent trips for sampling and PVP and GPR data acquisition would remove the possibility of temporal aliasing of the data and offer a more complete dataset to characterize seasonal variations at the study site. In addition, the source history of DO could be better defined and its effect on the groundwater velocity studied in more detail. It is recommended that direct head measurements from fully screened wells be gathered to provide a conventional groundwater velocity estimate for comparison with the PVP measurements. Such data would provide boundary conditions for numerical models.

Dielectric spectroscopy studies have indicated that cells in aqueous suspensions vary in dielectric constant as a function of EM wave frequency, where lower frequencies produce higher dielectric constants (Carstensen, 1967; Asami *et al.*, 1980; Claycomb *et al.*, 2002; Ong *et al.*, 2002; Miller Jr. *et al.*, 2005). Therefore, a

surface GPR reflection survey with antenna frequencies lower than 200 MHz would allow for a greater contrast in biomass relative permittivity compared to water, providing an independent confirmation of elevated biomass concentrations. In addition, a reflection survey would provide two-way travel times that would measure the effect of the biological activity twice as opposed to a transillumination survey conducted in either field or laboratory experiments.

Further efforts to identify and quantify the contribution of extracellular polysaccharides to the partial clogging of both field and laboratory experiments would be beneficial toward understanding the biomass required for effective pore volume blockage. Most prokaryotic organisms known to produce extracellular polysaccharides are ubiquitous in natural systems and are commonly identified in clogged media under conditions of increased carbon loading (Baveye 1998). Scanning or transmission electron microscope images from sediment samples collected from both field and laboratory experiments could be acquired to identify the production of extracellular polysaccharides.

Laboratory efforts to demonstrate the repeatability of the field observations could be improved with microbial biomass characterization of the attached fraction. Temporal monitoring of both aqueous and attached biomass data would better demonstrate any linkages between biomass concentration and measured dielectric changes. The former could be measured repeatedly while the later could be measured at the beginning and end of the experiment. Aqueous biomass measurements used in this study could have been improved by evaluating 10 or more fields of view during

the microscopy stage of the DAPI enumeration to increase the statistical significance and provide a more representative number.

4.3 The Role of the PVP and Recommendations for Future Development

A better understanding of how flow changes in response to biological activity in contaminated aquifers is desirable for both theoretical and applied purposes. Numerical models are currently being developed to quantify changes in flow properties, due to microbial activity, observed in both laboratory and field studies (Thullner *et al.*, 2002) and these will need to be validated. In applied disciplines, scientists and engineers responsible for the remediation of subsurface contaminants must understand, plan for, and identify preferential flow path development when assessing biobarriers, bioaugmentation, and PRB performance and efficiency. Tools such as the PVP, alone or in combination with other methods, such as GPR, can provide data to aid in this assessment by providing high spatial resolution of data and therefore better site characterization and monitoring than current industry standards. Point velocity probe theory and design should evolve to realize the full potential of the tool. The importance of vertical groundwater gradients can be addressed by placing additional detectors below and above the injection port. The use of three detectors and injection ports spaced at 60° intervals would allow the probe to be deployed without having any prior knowledge of the flow field (Berg, 2007). If multiple probes are deployed across a large region, the process of injection and data acquisition could be automated and activated remotely to save time and money (Berg, 2007). Single or multilevel PVPs used with direct push rigs such as Geoprobe® could be temporarily deployed at a site to measure groundwater velocities at multiple

locations. Since PVPs are not wells, there is no regulatory standard that would require repeated monitoring. Potential also exists for PVPs to be modified for use in consolidated media where characterization of dual-porosity aquifers will require advances in theory and design.

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Appendix A: Detailed PVP Data Collection and Processing Procedures

Wires soldered to PVP detectors are contained within the casing of PVPs. At the surface, each wire is labeled according to its specific detector and plugged into one of the Campbell Scientific CR1000 datalogger's 16 non-ground channels. Non-ground channels, used for excitation, are outfitted with a 0.25 watt, 2.2 ohm (700 mV) resistor soldered to solid, insulated copper wire. The resistors for eight non-ground channels are then soldered to a common solid, insulated copper wire that connects the eight non-ground channels to an excitation channel. This is repeated with the other eight non-ground channels for the datalogger to generate a half-bridge circuit for all 16 channels, enabling the datalogger to act as a resistance measuring network for up to 16 detectors.

The datalogger is interfaced to a Panasonic Toughbook via CS I/O RS-232 serial port. Power is carried through a PS100 12V power supply with charging regulator and battery directly to the datalogger. Programs written in CRBasic (**Appendix D**) specify data output table format, sample interval, and measurement units; thus allowing for customized data collection and storage process.

Data can be collected once PVP wires and resistors are properly connected to the datalogger. Data is downloaded from the datalogger using PC200W, a communication program that allows the user to monitor, collect, and save data as well as select the appropriate CRBasic program prior to tracer injection.

Data is initially collected by the datalogger for a few sample intervals prior to tracer injection to establish a baseline. An appropriate baseline has been established once the monitored resistance values for each detector are stable. Tracer injection

begins once the baseline is established. One clamp on the PTFE tubing is removed to allow tracer transfer from the reservoir syringe (60 ml) to the injection syringe (1 ml). The clamp is reattached near the reservoir syringe while another clamp is removed to facilitate tracer transfer from the injection syringe to the saturated PTFE tubing. A total of 0.5 ml of solution is transferred to the injection syringe into the saturated PTFE tubing. Immediately following tracer injection, the timestamp recorded by the datalogger is noted and serves as the initial time of the experiment (t_0). As the tracer crosses the respective detectors, resistance measurements will decrease due to the increase of conductance by the saline tracer resulting in an asymmetrical, concave breakthrough curve. Once the tracer is transported past the last detector, signified by reaching baseline resistance values, collected data is brought into Microsoft Excel for processing.

During processing, data must be adjusted for t_0 and converted from resistance to conductance in order to produce a convex (positive) curve that can be fitted with a simplex optimizer algorithm (PULSEPE) (Devlin 1994a). Occasionally, the observed data may reach a new baseline that is either above or below the original baseline prior to tracer injection. Corrections are made to normalize the observed data onto a common datum (zero conductance). Data reduction is necessary to comply with maximum data input requirements specified by PULSEPE. Visual Basic for Applications (VBA) code written in Excel reduces the number of data points to less than or equal to 100 and creates a separate file that can transfer data into the input file used by PULSEPE.

PULSEPE functions as a fitting tool that geometrically fits a curve to observed data by adjusting a number of known parameters in the advection-dispersion equation to reach a minimum residual sum of squares (RSS). Convergence is met when one of the optimized parameters (dispersivity, pulse width, or groundwater velocity) reaches a sufficiently low RSS or percent change. Nonlinear equations may result in several local minima along with the global minima to which convergence criteria can be met. To correct for this, the program requires initial estimates of dispersivity, pulse width, initial concentration, retardation factor, and velocity to reach convergence on the global minimum rather than a local minimum (Devlin 1994a).

PULSEPE output files contain the optimized parameter estimates for dispersivity, pulse width, initial concentration, retardation factor, and velocity. RSS values contained in the output file serve as a proxy for the graphical fit between the observed data and the calculated output from PULSEPE. A poor fit can be determined when RSS values are relatively high or a visual difference with the observed data exists. Poor fits are often a result of either noise abundance or inaccurate initial guesses for the above mentioned parameters. Initial parameters estimates can be adjusted to calibrate PULSEPE by changing tracer mass (initial concentration and pulse width), dispersivity, and/or velocity for an optimal fit.

Optimized velocity estimates are the apparent velocities applied in Equation (1.7) to yield α and solve for the average linear velocity outside the influence of the probe in Equation (1.6).

Appendix B: Tabulated PVP Velocity Magnitudes and Directions

	May-05	Aug-05	Oct-05	May-06	Oct-06
Probe	Velocity	cm/d			
B1	9.215748	8.77285	8.880605	11.81694	5.652637
B2	7.712625	7.169436	6.489148	8.608333	5.478185
B3	21.03436	13.81658	12.65908	15.45995	10.43842
B4	23.31854	14.60343	8.982853	34.96331	14.46032
C1	19.33219	8.369289	9.922021	7.150301	5.40661
C2		7.462551	6.738254	6.486698	4.746088
C3	21.34152	7.642369	6.71938	3.720324	4.865961
C4	24.12039	13.36593	7.912154	13.56641	5.785864
D1	8.314835	7.806194	5.333175		5.277452
D2	9.377324	7.869618	5.902669	5.750464	5.59866
D3	6.64474	7.765603	5.49443	5.157654	4.754374
D4		11.45922	8.375575	8.954416	7.770138
E1	8.71006	6.058215	5.484846		4.585608
E2	3.439998	4.552361	3.706237	3.836171	6.786346
E3	10.82244	4.444129	4.073555	5.282289	3.952355
E4	7.091512	6.308453	5.346439	8.960813	4.61658
F1	6.707897	5.428656	4.414578	4.61745	2.588118
F3		5.966536	3.995939	4.378589	3.509896
F4		6.109439	4.306176	5.725909	5.346015

	Aug-05	Oct-05	May-06	Oct-06
Probe	Degrees East from North			
B1	-13.9	-1.5	30.9	-2.6
B2	-6.1	3.0	14.4	-6.3
B3	40.8	42.7	50.0	43.9
B4	42.5	-66.0	62.9	54.8
C1	10.5	45.9	10.3	-3.0
C2	32.7	33.8	44.4	22.2
C3	43.6	30.1	46.9	16.4
C4	67.8	12.7	-40.8	-4.5
D1	28.6	10.8		-20.9
D2	18.7	3.0	-6.2	-15.0
D3	12.3	5.8	14.6	-2.6
D4	-13.7	6.2	14.1	-10.0
E1	-18.9	-18.1		-18.4
E2	10.0	7.9	22.1	-45.6
E3	28.4	27.8	50.0	23.3
E4	28.2	28.3	61.5	32.7
F1	2.3	-16.5	-5.7	9.2
F3	-26.8	-30.7	-0.8	10.3
F4	-14.1	9.2	16.9	-23.4

Appendix C PULSEPE Output Files

Each page presents two PULSPE output files. The first file shows the results for detector one, while the second file shows the results from detector two. Results represent a single tracer test for a given probe on a given day.

May 2005
B1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
- 7) THE DISPERSIVITY (M) : 0.1300E-01
- 8) THE PULSE WIDTH (M) : -0.1200E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2060E-05
DISPERSIVITY= 0.7119E-02
WIDTH= 0.1200E-02
RF= 1.000
CO= 49.99
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 2.427

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72
THE CRITICAL RSS IS: 2.660

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.06E-06	1.96E-06	2.16E-06
X(2)	7.12E-03	6.34E-03	7.97E-03
X(5)	49.99	47.49	52.49

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1	6.49E-02	2.60E-07	6.49E-02
0.2167	0.1927	5.23E-03	0.1875
0.3333	0.5455	0.1107	0.4348
0.45	0.9683	0.4593	0.509
0.5667	1.315	0.9438	0.3712
0.6833	1.391	0.1913	1.2
0.8	1.737	1.73	6.99E-03
0.9167	1.828	1.958	-0.1304
1.033	1.881	2.092	-0.2142
1.15	1.907	2.164	-0.2574
1.267	1.916	2.184	-0.2683
1.383	1.913	2.17	-0.2571
1.5	1.901	2.132	-0.2315
1.617	1.883	2.079	-0.1962
1.733	1.861	2.017	-0.1557
1.85	1.834	1.948	-0.1136
1.967	1.805	1.875	-7.03E-02
2.083	1.775	1.804	-2.74E-02
2.2	1.743	1.729	1.40E-02
2.317	1.71	1.657	5.33E-02
2.433	1.675	1.587	8.83E-02
2.55	1.638	1.518	0.1197
2.667	1.601	1.452	0.1488
2.783	1.563	1.383	0.1788
2.9	1.522	1.328	0.1938
3.017	1.483	1.27	0.2131
3.133	1.444	1.215	0.2284
3.25	1.397	1.161	0.2357
3.367	1.354	1.111	0.2434
3.483	1.311	1.063	0.246
3.6	1.263	1.016	0.2466
3.717	1.215	0.974	0.2426
3.833	1.165	0.9309	0.2341
3.95	1.116	0.8909	0.2251
4.067	1.067	0.8521	0.2161
4.183	1.013	0.8169	0.1961
4.3	0.9617	0.7824	0.1793
4.417	0.9096	0.7495	0.1601
4.533	0.8584	0.7184	0.14
4.65	0.8082	0.6884	0.1198
4.767	0.7581	0.6599	9.62E-02
4.883	0.7099	0.6329	7.30E-02
5	0.6587	0.6069	5.18E-02
5.117	0.6126	0.5821	3.05E-02
5.233	0.5684	0.5586	9.84E-03
5.35	0.5262	0.5359	-9.73E-03
5.467	0.488	0.5143	-2.63E-02
5.583	0.4499	0.4938	-4.39E-02
5.7	0.4167	0.4741	-5.74E-02
5.817	0.3845	0.4522	-7.07E-02
5.933	0.3544	0.4373	-8.29E-02
6.05	0.3262	0.42	-9.38E-02
6.167	0.3	0.4035	-0.1035
6.283	0.2779	0.3878	-0.1099
6.4	0.2567	0.3727	-0.117
6.517	0.2375	0.3582	-0.1207
6.633	0.2193	0.3444	-0.1251
6.75	0.2022	0.3311	-0.1289
6.867	0.189	0.3184	-0.1294
6.983	0.1748	0.3063	-0.1315
7.1	0.1627	0.2946	-0.1319
7.217	0.1515	0.2833	-0.1318
7.333	0.1413	0.2727	-0.1314
7.45	0.1312	0.2623	-0.1311
7.567	0.121	0.2524	-0.1314
7.683	0.1128	0.243	-0.1302
7.8	0.1036	0.2339	-0.1303
7.917	9.66E-02	0.2251	-0.1287
8.033	8.73E-02	0.2168	-0.1295
8.15	8.21E-02	0.2087	-0.1266
8.267	7.50E-02	0.201	-0.125
8.383	6.78E-02	0.1936	-0.1258
8.5	6.18E-02	0.1865	-0.1249
8.617	5.79E-02	0.1795	-0.1222
8.733	5.23E-02	0.1731	-0.1208
8.85	4.81E-02	0.1667	-0.1186
8.967	4.30E-02	0.1605	-0.1177
9.083	3.78E-02	0.1548	-0.117
9.2	3.28E-02	0.1492	-0.1166
9.317	2.94E-02	0.1438	-0.1153
9.433	2.43E-02	0.1386	-0.1143
9.55	2.01E-02	0.1336	-0.1135
9.667	1.59E-02	0.1288	-0.1128
9.783	1.38E-02	0.1242	-0.1104
9.9	1.08E-02	0.1197	-0.112
10.2	7.42E-03	0.1153	-0.1079
10.13	4.25E-03	0.1114	-0.1072
10.25	2.08E-03	0.1073	-0.1052

B1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
- 7) THE DISPERSIVITY (M) : 0.3000E-02
- 8) THE PULSE WIDTH (M) : -0.2000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1819E-05
DISPERSIVITY= 0.3808E-02
WIDTH= 0.2000E-02
RF= 1.000
CO= 25.63
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5011

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
THE CRITICAL RSS IS: 0.5439

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.82E-06	1.80E-06	1.84E-06
X(2)	3.81E-03	3.62E-03	4.00E-03
X(5)	25.63	25.11	26.14

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.137	0.163	0.1173	4.57E-02
1.433	0.209	0.1888	2.02E-02
1.65	0.255	0.2785	7.47E-03
1.667	0.395	0.3826	1.24E-02
1.783	0.531	0.4957	3.53E-02
1.9	0.6713	0.6713	5.97E-02
2.017	0.816	0.736	8.00E-02
2.133	0.943	0.8532	8.98E-02
2.25	1.054	0.9659	8.81E-02
2.367	1.144	1.071	7.32E-02
2.483	1.218	1.165	5.26E-02
2.6	1.279	1.25	2.85E-02
2.717	1.328	1.325	3.46E-03
2.833	1.367	1.387	-2.00E-02
2.95	1.42	1.439	-1.439
3.067	1.423	1.481	-5.77E-02
3.183	1.438	1.512	-7.40E-02
3.3	1.449	1.534	-8.54E-02
3.417	1.455	1.548	-9.32E-02
3.533	1.456	1.554	-9.82E-02
3.65	1.453	1.553	-9.72E-02
3.767	1.453	1.546	-9.30E-02
3.883	1.447	1.533	-8.53E-02
4	1.438	1.516	-7.81E-02
4.117	1.427	1.494	-6.68E-02
4.233	1.413	1.469	-5.56E-02
4.35	1.44	1.44	-1.02E-02
4.467	1.384	1.409	-2.50E-02
4.583	1.366	1.376	-1.02E-02
4.7	1.349	1.341	7.449E-03
4.817	1.325	1.305	1.99E-02
4.933	1.302	1.268	3.37E-02
5.05	1.278	1.23	4.58E-02
5.167	1.253	1.192	6.08E-02
5.283	1.225	1.154	7.19E-02
5.4	1.198	1.116	8.24E-02
5.517	1.17	1.077	9.27E-02
5.633	1.144	1.04	0.1004
5.75	1.107	1.002	0.1049
5.867	1.074	0.9651	0.1089
5.983	1.041	0.9291	0.1119
6.1	1.007	0.8935	0.1135
6.217	0.971	0.8587	0.1123
6.333	0.935	0.825	0.111
6.45	0.9	0.7919	0.1081
6.567	0.862	0.7597	0.1023
6.683	0.825	0.7288	9.82E-02
6.8	0.787	0.6985	8.85E-02
6.917	0.748	0.6691	7.89E-02
7.033	0.709	0.641	6.94E-02
7.15	0.674	0.6136	6.04E-02
7.267	0.637	0.5871	4.99E-02
7.383	0.601	0.5618	3.92E-02
7.5	0.565	0.5372	2.78E-02
7.617	0.53	0.5135	1.65E-02
7.733	0.495	0.4909	5.10E-03
7.85	0.464	0.469	-4.99E-03
7.967	0.432	0.4479	-1.59E-02
8.083	0.402	0.4279	-2.59E-02
8.2	0.374	0.4085	-3.45E-02
8.317	0.346	0.3899	-4.39E-02
8.433	0.32	0.3722	-5.22E-02
8.55	0.296	0.3551	-5.91E-02
8.667	0.274	0.3387	-6.47E-02
8.783	0.253	0.3232	-7.02E-02
8.9	0.233	0.3082	-7.52E-02
9.017	0.215	0.2938	-7.88E-02
9.133	0.197	0.2802	-8.32E-02
9.25	0.182	0.267	-8.50E-02
9.367	0.167	0.2545	-8.75E-02
9.483	0.154	0.2426	-8.86E-02
9.6	0.143	0.2311	-8.81E-02
9.717	0.131	0.2202	-8.92E-02
9.833	0.12	0.2098	-8.98E-02
9.95	0.11	0.1998	-8.98E-02
10.07	0.104	0.19	-8.90E-02
10.183	0.1175E-02	0.1815	-8.60E-02
10.3	8.60E-02	0.1726	-8.66E-02
10.417	7.90E-02	0.1641	-8.51E-02
10.533	7.30E-02	0.1567	-8.37E-02
10.65	7.00E-02	0.1489	-7.89E-02
10.767	6.50E-02	0.1416	-7.66E-02
10.883	6.00E-02	0.1351	-7.51E-02
11	5.50E-02	0.1284	-7.35E-02
11.12	4.80E-02	0.1221	-7.31E-02
11.233	4.50E-02	0.1165	-7.15E-02
11.35	4.00E-02	0.1107	-7.07E-02
11.47	3.60E-02	0.1052	-6.92E-02
11.58	3.30E-02	0.1004	-6.74E-02
11.7	2.90E-02	9.54E-02	-6.64E-02
11.82	2.90E-02	9.06E-02	-6.56E-02
11.93	2.20E-02	8.64E-02	-6.44E-02
12.05	1.80E-02	8.21E-02	-6.41E-02
12.17	1.80E-02	7.80E-02	-6.40E-02
12.28	1.00E-02	7.44E-02	-6.44E-02
12.4	8.00E-03	7.07E-02	-6.27E-02
12.52	4.00E-03	6.71E-02	-6.31E-02
12.63	2.00E-03	6.40E-02	-6.20E-02

May 2005
B2_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 92
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1749E-05
DISPERSIVITY= 0.2504E-02
WIDTH= 0.1000E-02
RF= 1.000
CO= 40.30
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3860

THE F STATISTIC FOR NP= 3 NOBS= 92 IS: 2.72
THE CRITICAL RSS IS: 0.4213

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.75E-06	1.73E-06	1.77E-06
X(2)	2.50E-03	2.40E-03	2.60E-03
X(5)	40.3	39.9	40.7

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.8667	1.37E-02	9.67E-02	-8.30E-02
0.95	6.12E-02	1.69E-01	-0.1074
1.033	0.1516	0.2627	-0.1111
1.117	0.2871	0.3776	-0.0905E-02
1.2	0.4595	0.506	-4.65E-02
1.283	0.6529	0.6437	9.18E-03
1.367	0.8444	0.7872	5.72E-02
1.45	1.023	0.9283	9.47E-02
1.533	1.177	1.065	0.1125
1.617	1.306	1.194	0.1117
1.7	1.411	1.312	9.89E-02
1.783	1.496	1.418	7.78E-02
1.867	1.73	1.606	-7.65E-02
1.95	1.616	1.512	5.15E-02
2.033	1.657	1.659	-2.33E-03
2.117	1.686	1.714	-2.81E-02
2.2	1.708	1.756	-4.79E-02
2.283	1.721	1.786	-6.54E-02
2.367	1.73	1.806	-7.65E-02
2.45	1.731	1.817	-8.57E-02
2.533	1.728	1.818	-9.01E-02
2.617	1.721	1.812	-9.07E-02
2.7	1.709	1.796	-8.94E-02
2.783	1.696	1.779	-8.30E-02
2.867	1.678	1.754	-7.60E-02
2.95	1.661	1.667	-6.37E-02
3.033	1.638	1.692	-5.37E-02
3.117	1.616	1.656	-3.99E-02
3.2	1.588	1.619	-2.79E-02
3.283	1.559	1.575	-1.58E-02
3.367	1.53	1.532	-1.56E-03
3.45	1.499	1.489	1.15E-02
3.533	1.467	1.443	2.44E-02
3.617	1.432	1.397	3.54E-02
3.7	1.395	1.351	4.71E-02
3.783	1.362	1.305	5.69E-02
3.867	1.324	1.259	6.50E-02
3.95	1.285	1.214	7.15E-02
4.033	1.244	1.169	7.48E-02
4.117	1.206	1.125	8.13E-02
4.2	1.168	1.084	8.24E-02
4.283	1.125	1.039	8.57E-02
4.367	1.083	0.9975	8.55E-02
4.45	1.045	0.9572	8.48E-02
4.533	1.002	0.918	8.40E-02
4.617	0.9613	0.8794	8.19E-02
4.7	0.9197	0.8425	7.73E-02
4.783	0.8772	0.8066	7.06E-02
4.867	0.8376	0.7716	6.60E-02
4.95	0.797	0.7381	5.89E-02
5.033	0.7585	0.7058	5.27E-02
5.117	0.7189	0.6743	4.46E-02
5.2	0.6783	0.6443	3.40E-02
5.283	0.6418	0.6154	2.64E-02
5.367	0.6072	0.5873	1.99E-02
5.45	0.5716	0.5607	1.09E-02
5.533	0.5391	0.535	4.08E-03
5.617	0.5065	0.5102	-3.67E-03
5.7	0.4759	0.4866	-1.07E-02
5.783	0.4484	0.464	-1.56E-02
5.867	0.4208	0.4421	-2.13E-02
5.95	0.3952	0.4214	-2.62E-02
6.033	0.3707	0.4015	-3.09E-02
6.117	0.3461	0.3824	-3.63E-02
6.2	0.3245	0.3642	-3.97E-02
6.283	0.304	0.3469	-4.29E-02
6.367	0.2834	0.3301	-4.67E-02
6.45	2.65E-01	0.3143	-4.95E-02
6.533	2.45E-01	0.2992	-5.39E-02
6.617	2.29E-01	0.2846	-5.89E-02
6.7	2.13E-01	0.2709	-5.78E-02
6.783	1.98E-01	0.2577	-6.01E-02
6.867	1.84E-01	0.2451	-6.11E-02
6.95	1.70E-01	0.2331	-6.27E-02
7.033	1.59E-01	0.2218	-6.29E-02
7.117	1.47E-01	0.2108	-6.35E-02
7.2	1.37E-01	0.2005	-6.38E-02
7.283	1.26E-01	0.1906	-6.44E-02
7.367	1.17E-01	0.1811	-6.45E-02
7.45	1.07E-01	0.1722	-6.52E-02
7.533	9.85E-02	0.1637	-6.53E-02
7.617	8.99E-02	0.1556	-6.56E-02
7.7	8.13E-02	0.1478	-6.65E-02
7.783	7.28E-02	0.1405	-6.77E-02
7.867	6.42E-02	0.1335	-7.03E-02
7.95	5.46E-02	0.1268	-7.22E-02
8.033	4.71E-02	0.1205	-7.34E-02
8.117	3.75E-02	0.1144	-7.59E-02
8.2	2.90E-02	0.1087	-7.98E-02
8.283	2.24E-02	0.1033	-8.09E-02
8.367	1.28E-02	9.81E-02	-8.53E-02
8.45	5.25E-03	9.32E-02	-8.79E-02

B2_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1611E-05
DISPERSIVITY= 0.1956E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 7.493
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2544

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
THE CRITICAL RSS IS: 0.2775

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.61E-06	1.61E-06	1.61E-06
X(2)	1.96E-03	1.88E-03	2.04E-03
X(5)	7.493	7.418	7.567

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.967	6.85E-03	5.40E-02	-4.72E-02
2.067	1.79E-02	7.95E-02	-6.16E-02
2.167	3.89E-02	0.1123	-7.34E-02
2.267	7.19E-02	0.1531	-8.12E-02
2.367	0.1189	0.2021	-8.32E-02
2.467	0.1829	0.2592	-7.63E-02
2.567	0.2209	0.3239	-6.30E-02
2.667	0.353	0.3955	-4.25E-02
2.767	0.456	0.4728	-1.68E-02
2.867	0.563	0.5546	1.14E-02
2.967	0.68	0.6393	4.07E-02
3.067	0.785	0.7255	5.95E-02
3.167	0.885	0.8117	7.33E-02
3.267	0.9751	0.8964	7.87E-02
3.367	1.056	0.9784	7.76E-02
3.467	1.129	1.057	7.25E-02
3.567	1.192	1.13	6.23E-02
3.667	1.246	1.197	4.88E-02
3.767	1.292	1.258	3.36E-02
3.867	1.331	1.313	1.82E-02
3.967	1.363	1.36	2.85E-03
4.067	1.398	1.408	1.23E-02
4.167	1.407	1.433	-8.2E-02
4.267	1.422	1.459	-3.70E-02
4.367	1.431	1.478	-4.68E-02
4.467	1.436	1.49	-4.80E-02
4.567	1.437	1.496	-5.89E-02
4.667	1.434	1.496	-6.18E-02
4.767	1.426	1.493	-6.18E-02
4.867	1.418	1.48	-6.16E-02
4.967	1.405	1.464	-5.93E-02
5.067	1.391	1.445	-5.38E-02
5.167	1.374	1.422	-4.72E-02
5.267	1.354	1.395	-4.12E-02
5.367	1.333	1.366	-3.26E-02
5.467	1.309	1.334	-2.50E-02
5.567	1.284	1.3	-1.62E-02
5.667	1.256	1.255	-6.57E-03
5.767	1.23	1.228	-2.39E-03
5.867	1.201	1.19	1.14E-02
5.967	1.172	1.151	1.22E-02
6.067	1.14	1.111	2.85E-02
6.167	1.107	1.072	3.51E-02
6.267	1.074	1.032	4.18E-02
6.367	1.04	0.9926	4.74E-02
6.467	1.006	0.9534	5.26E-02
6.567	0.9696	0.9145	5.81E-02
6.667	0.9346	0.8763	5.83E-02
6.767	0.8986	0.8387	5.99E-02
6.867	0.8616	0.8019	5.97E-02
6.967	0.8246	0.766	5.86E-02
7.067	0.7916	0.7309	6.07E-02
7.167	0.7577	0.6969	6.08E-02
7.267	0.7227	0.6639	5.88E-02
7.367	0.6867	0.6319	5.48E-02
7.467	0.6507	0.601	4.97E-02
7.567	0.6177	0.5711	4.66E-02
7.667	0.5837	0.5424	4.13E-02
7.767	0.5498	0.5148	3.50E-02
7.867	0.5178	0.4882	2.96E-02
7.967	0.4868	0.4628	2.40E-02
8.067	0.4548	0.4384	1.64E-02
8.167	0.4268	0.415	1.18E-02
8.267	0.3978	0.3927	5.07E-03
8.367	0.3708	0.3714	-6.22E-04
8.467	0.3439	0.3511	-7.19E-03
8.567	0.3169	0.3317	-1.48E-02
8.667	0.2939	0.3133	-1.94E-02
8.767	0.2719	0.2957	-2.38E-02
8.867	0.2489	0.279	-3.01E-02
8.967	0.2289	0.2631	-3.43E-02
9.067	0.209	0.2481	-3.91E-02
9.167	0.192	0.2338	-4.18E-02
9.267	0.173	0.2203	-4.73E-02
9.367	0.156	0.2074	-5.14E-02
9.467	0.14	0.1953	-5.32E-02
9.567	1.26E-01	0.1838	-5.78E-02
9.667	1.12E-01	0.1729	-6.09E-02
9.767	9.75E-02	0.1626	-6.15E-02
9.867	8.51E-02	0.1529	-6.78E-02
9.967	7.41E-02	0.1437	-6.97E-02
10.067	6.41E-02	0.1348	-7.07E-02
10.17	5.61E-02	0.1267	-7.05E-02
10.27	4.61E-02	0.119	-7.28E-02
10.37	3.82E-02	0.1117	-7.36E-02
10.47	3.22E-02	0.1049	-7.27E-02
10.57	2.42E-02	9.84E-02	-7.43E-02
10.67	1.72E-02	9.24E-02	-7.52E-02
10.77	1.32E-02	8.67E-02	-7.34E-02
10.87	9.23E-03	8.13E-02	-7.20E-02
10.97	6.24E-03	7.62E-02	-7.00E-02
11.07	1.26E-03	7.15E-02	-7.02E-02
11.17	2.75E-04	6.70E-02	-6.87E-02

May 2005
B3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 91
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.3000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2877E-05
 DISPERSIVITY= 0.1311E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.7936
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1375E-01

THE F STATISTIC FOR NP= 3 NOBS= 91 IS: 2.72
 THE CRITICAL RSS IS: 0.1503E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.88E-06	2.85E-06	2.91E-06
X(2)	1.21E-03	1.22E-03	1.42E-03
X(5)	0.7936	0.7698	0.8174

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.7667	7.86E-03	1.99E-02	-1.20E-02
0.8167	1.66E-02	2.82E-02	-1.25E-02
0.8667	3.34E-02	4.07E-02	-7.30E-03
0.9167	5.12E-02	5.45E-02	-3.32E-03
0.9667	7.04E-02	7.04E-02	1.62E-03
1.017	9.38E-02	8.80E-02	5.79E-03
1.067	0.1176	0.1067	1.09E-02
1.117	0.2511	0.2224	2.87E-02
1.167	0.1591	0.1452	1.39E-02
1.217	0.1249	0.1638	-3.89E-02
1.267	0.4497	0.4812	-3.15E-02
1.317	0.1735	0.197	-2.35E-02
1.367	0.2343	0.2108	2.35E-02
1.417	0.2511	0.2224	2.87E-02
1.467	0.1728	0.2317	-5.89E-02
1.517	0.2636	0.2386	2.50E-02
1.567	0.2614	0.2434	1.81E-02
1.617	0.2682	0.2459	2.23E-02
1.667	0.263	0.2464	1.66E-02
1.717	0.2558	0.2452	1.07E-02
1.767	0.2505	0.2425	2.797
1.817	0.2443	0.2379	6.37E-03
1.867	0.2381	0.2324	5.69E-03
1.917	0.2329	0.2259	6.91E-03
1.967	0.2267	0.2185	-1.84E-03
2.017	0.2205	0.2106	-3.08E-03
2.067	0.1953	0.2021	-5.80E-03
2.117	0.186	0.1933	-7.30E-03
2.167	0.1748	0.1843	-9.50E-03
2.217	0.1646	0.1752	-1.06E-02
2.267	0.1544	0.1661	-1.17E-02
2.317	0.1482	0.1571	-8.87E-03
2.367	0.138	0.1482	-1.02E-02
2.417	0.1287	0.1395	-1.08E-02
2.467	0.1245	0.1311	-6.59E-03
2.517	0.1153	0.1229	-7.64E-03
2.567	0.1081	0.1151	-7.00E-03
2.617	0.1019	0.1076	-5.69E-03
2.667	9.67E-02	0.1074	-3.75E-03
2.717	9.04E-02	9.36E-02	-3.15E-03
2.767	8.62E-02	8.71E-02	-8.84E-04
2.817	7.90E-02	8.10E-02	-2.98E-03
2.867	7.58E-02	7.52E-02	5.94E-04
2.917	6.86E-02	6.98E-02	-1.18E-03
2.967	6.04E-02	6.47E-02	-4.33E-03
3.017	6.82E-02	5.99E-02	8.30E-03
3.067	6.09E-02	5.54E-02	5.57E-03
3.117	6.67E-02	5.12E-02	5.58E-03
3.167	5.35E-02	4.73E-02	6.25E-03
3.217	5.23E-02	4.36E-02	8.68E-03
3.267	4.81E-02	4.02E-02	7.87E-03
3.317	4.49E-02	3.71E-02	7.80E-03
3.367	4.06E-02	3.41E-02	6.52E-03
3.7	2.62E-02	1.94E-02	6.76E-03
3.75	2.70E-02	1.78E-02	9.15E-03
3.8	2.38E-02	1.64E-02	7.42E-03
3.85	2.26E-02	1.50E-02	7.56E-03
3.9	2.03E-02	1.37E-02	6.61E-03
3.95	1.81E-02	1.26E-02	5.54E-03
4	2.99E-02	1.15E-02	1.84E-02
4.05	2.27E-02	1.05E-02	1.22E-02
4.1	1.95E-02	9.65E-03	9.82E-03
4.15	1.53E-02	8.63E-03	6.44E-03
4.2	1.40E-02	8.07E-03	5.97E-03
4.25	1.28E-02	7.38E-03	5.45E-03
4.3	1.26E-02	6.75E-03	5.87E-03
4.35	1.14E-02	6.16E-03	5.23E-03
4.4	1.02E-02	5.63E-03	4.55E-03
4.45	9.98E-03	5.14E-03	4.82E-03
4.5	1.08E-02	4.70E-03	6.05E-03
4.55	9.53E-03	4.29E-03	5.24E-03
4.6	7.32E-03	3.92E-03	3.40E-03
4.65	7.10E-03	3.57E-03	3.63E-03
4.7	3.88E-03	3.26E-03	6.23E-04
4.75	8.67E-03	2.98E-03	5.69E-03
4.8	8.45E-03	2.71E-03	5.74E-03
4.85	7.24E-03	2.48E-03	4.76E-03
4.9	7.02E-03	2.26E-03	4.76E-03
4.95	7.81E-03	2.06E-03	5.75E-03
5	7.59E-03	1.88E-03	5.71E-03
5.05	7.37E-03	1.71E-03	5.66E-03
5.1	5.16E-03	1.56E-03	3.60E-03
5.15	4.94E-03	1.42E-03	3.52E-03
5.2	4.73E-03	1.29E-03	3.43E-03
5.25	3.51E-03	1.18E-03	2.33E-03
5.3	3.30E-03	1.07E-03	2.22E-03
5.35	2.08E-03	9.78E-04	1.10E-03
5.4	1.86E-03	8.91E-04	9.74E-04
5.45	1.65E-03	8.11E-04	8.36E-04
5.5	1.43E-03	7.39E-04	6.93E-04
5.55	2.16E-04	6.72E-04	-4.57E-04

B3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.3000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1717E-05
 DISPERSIVITY= 0.2337E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.5464
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2956E-01

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.3218E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.72E-06	1.65E-06	1.80E-06
X(2)	1.42E-03	1.43E-03	2.29E-03
X(5)	5.46E-01	5.03E-01	5.90E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.7833	4.73E-03	4.13E-07	4.73E-03
0.8833	1.24E-02	2.88E-06	1.24E-02
0.9667	2.11E-02	1.05E-05	2.11E-02
1.067	2.88E-02	3.81E-05	2.88E-02
1.1433	4.23E-02	9.42E-05	4.17E-02
1.157	4.23E-02	1.49E-03	4.08E-02
1.6	4.10E-02	2.32E-03	3.87E-02
1.683	3.48E-02	3.46E-03	3.63E-02
1.767	3.85E-02	4.96E-03	3.35E-02
1.85	4.32E-02	6.86E-03	3.63E-02
1.883	3.89E-02	9.19E-03	2.97E-02
2.017	4.07E-02	1.20E-02	2.87E-02
2.1	3.84E-02	1.52E-02	2.32E-02
2.183	3.71E-02	1.89E-02	1.83E-02
2.267	2.38E-02	2.29E-02	-2.92E-02
2.35	3.86E-02	2.73E-02	1.12E-02
2.433	3.93E-02	3.20E-02	7.28E-03
2.517	4.20E-02	3.70E-02	5.05E-03
2.6	4.37E-02	4.20E-02	1.69E-03
2.683	4.55E-02	4.72E-02	-1.75E-03
2.767	5.12E-02	5.24E-02	-1.24E-03
2.85	5.39E-02	5.75E-02	-3.60E-03
2.933	5.66E-02	6.25E-02	-5.87E-03
3.017	6.34E-02	6.73E-02	-3.98E-03
3.1	6.81E-02	7.19E-02	-3.86E-03
3.183	7.28E-02	7.63E-02	-3.47E-03
3.267	7.75E-02	8.03E-02	-2.79E-03
3.417	3.50E-02	8.68E-02	-5.17E-02
3.5	4.08E-02	8.98E-02	-4.91E-02
3.583	4.65E-02	9.26E-02	-4.61E-02
3.667	9.72E-02	9.49E-02	2.29E-03
3.75	9.99E-02	9.69E-02	3.03E-03
3.833	0.1027	9.85E-02	4.12E-03
3.917	0.1054	9.98E-02	5.55E-03
4	0.1071	0.1008	6.33E-03
4.083	0.1078	0.1014	6.42E-03
4.167	0.1096	0.1096	7.82E-03
4.25	0.1103	0.1018	8.50E-03
4.333	0.11	0.1015	8.46E-03
4.417	0.1087	0.1011	7.66E-03
4.5	0.1085	0.1004	8.10E-03
4.583	9.94E-02	9.94E-02	0.00E-03
4.667	0.1079	9.83E-02	9.58E-03
4.75	0.1076	9.70E-02	1.06E-02
4.833	9.1064	9.56E-02	1.08E-02
4.917	0.1061	9.40E-02	1.21E-02
5	0.1038	9.23E-02	1.15E-02
5.083	9.1015	9.05E-02	1.06E-02
5.167	9.93E-02	8.86E-02	1.06E-02
5.25	9.80E-02	8.66E-02	1.13E-02
5.333	9.47E-02	8.46E-02	1.01E-02
5.417	9.34E-02	8.25E-02	1.09E-02
5.5	9.11E-02	8.04E-02	1.08E-02
5.583	8.89E-02	7.82E-02	1.06E-02
5.667	2.66E-02	7.61E-02	-4.95E-02
5.75	2.33E-02	7.39E-02	-5.06E-02
5.833	4.00E-02	7.17E-02	-3.16E-02
5.917	7.68E-02	6.95E-02	7.29E-03
6	7.45E-02	6.73E-02	7.19E-03
6.083	7.02E-02	6.51E-02	5.08E-03
6.167	6.69E-02	6.30E-02	1.95E-03
6.25	6.67E-02	6.09E-02	5.78E-03
6.333	6.34E-02	5.88E-02	4.59E-03
6.417	6.21E-02	5.68E-02	5.37E-03
6.5	5.88E-02	5.47E-02	4.11E-03
6.583	5.76E-02	5.26E-02	4.81E-03
6.667	5.33E-02	5.08E-02	4.47E-03
6.75	5.20E-02	4.89E-02	3.08E-03
6.833	4.97E-02	4.71E-02	2.65E-03
6.917	4.75E-02	4.53E-02	2.17E-03
7	4.62E-02	4.36E-02	2.64E-03
7.083	4.19E-02	4.19E-02	6.89E-06
7.167	4.26E-02	4.02E-02	2.46E-03
7.25	4.14E-02	3.86E-02	2.78E-03
7.333	1.57E-02	2.18E-02	-6.07E-03
7.417	1.73E-02	2.05E-02	-6.38E-03
7.5	1.42E-02	1.99E-02	-5.73E-03
7.583	1.19E-02	1.90E-02	-7.11E-03
7.667	1.82E-02	1.82E-02	0.00E-03
7.75	1.14E-02	1.73E-02	-5.99E-03
7.833	1.01E-02	1.66E-02	-6.48E-03
7.917	1.60E-03	1.58E-02	-1.70E-03
8.0	8.53E-03	1.51E-02	-6.55E-03
8.083	8.25E-03	1.44E-02	-6.13E-03
8.167	9.183	1.37E-02	-5.27E-03
8.25	9.267	1.31E-02	-5.38E-03
8.333	6.43E-03	1.25E-02	-6.05E-03
8.417	9.433	1.19E-02	-5.74E-03
8.5	4.88E-03	1.13E-02	-6.46E-03
8.583	6.60E-03	1.08E-02	-4.21E-03
8.667	4.33E-03	1.03E-02	-5.97E-03
8.75	3.05E-03	9.81E-03	-6.76E-03
8.833	1.77E-03	9.35E-03	-7.87E-03
8.917	9.933	8.90E-03	-6.40E-03
9.0	2.22E-03	8.48E-03	-6.25E-03

May 2005
B4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.3000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2905E-05
DISPERSIVITY= 0.1810E-02
WIDTH= 0.5010E-02
Rf= 1.000
CO= 2.729
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1606

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
THE CRITICAL RSS IS: 0.1764

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.91E-06	2.85E-06	2.96E-06
X(2)	1.81E-03	1.65E-03	1.92E-03
X(5)	2.729	2.647	2.838

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.67E-02	1.07E-02	3.85E-04	1.07E-02
0.1333	1.14E-02	1.14E-02	0.00E-02
0.2167	1.26E-02	4.71E-02	1.26E-02
0.2833	1.43E-02	2.97E-05	1.43E-02
0.35	1.59E-02	3.86E-04	1.59E-02
0.4167	2.28E-02	2.20E-03	2.05E-02
0.4833	3.05E-02	7.74E-03	2.27E-02
0.55	4.52E-02	1.99E-02	2.53E-02
0.6167	7.19E-02	4.17E-02	3.03E-02
0.6833	0.1066	7.50E-02	3.16E-02
0.75	0.1543	0.121	3.33E-02
0.8167	0.2051	0.1795	2.55E-02
0.8833	0.2908	0.2488	4.20E-02
0.95	0.3685	0.3254	4.01E-02
1.017	0.5764	0.444	-3.90E-02
1.083	0.4679	0.4818	-1.39E-02
1.15	0.5167	0.5228	-3.61E-02
1.217	0.6764	0.644	-3.90E-02
1.283	0.6231	0.6648	-4.17E-02
1.35	0.6998	0.7033	-4.53E-02
1.417	0.7246	0.7301	-5.87E-03
1.483	0.744	0.7457	-5.48E-03
1.55	0.744	0.7513	-7.38E-03
1.617	0.7487	0.7487	-2.49E-03
1.683	0.7194	0.7376	-1.82E-02
1.75	0.7291	0.7208	8.30E-03
1.817	0.7159	0.6992	1.67E-02
1.883	0.6966	0.6738	2.28E-02
1.95	0.6743	0.6456	2.87E-02
2.017	0.649	0.615	3.35E-02
2.083	0.6227	0.5842	3.85E-02
2.15	0.5914	0.5523	3.91E-02
2.217	0.5592	0.5204	3.88E-02
2.283	0.5259	0.4888	3.71E-02
2.35	0.4876	0.4578	2.99E-02
2.417	0.4503	0.4277	2.26E-02
2.483	0.413	0.3987	1.43E-02
2.55	0.3758	0.3709	4.83E-03
2.617	0.339E-01	0.339E-01	-5.97E-03
2.683	3.03E-01	3.19E-01	-1.62E-02
2.75	2.70E-01	2.96E-01	-2.57E-02
2.817	2.37E-01	2.73E-01	-3.66E-02
2.883	2.07E-01	2.52E-01	-4.50E-02
2.95	1.81E-01	2.33E-01	-5.16E-02
3.017	1.59E-01	2.14E-01	-5.56E-02
3.083	1.40E-01	1.97E-01	-5.78E-02
3.15	1.24E-01	1.81E-01	-5.72E-02
3.217	1.040E-02	1.67E-01	-8.28E-02
3.283	5.67E-02	1.53E-01	-9.64E-02
3.35	5.74E-02	1.40E-01	-8.30E-02
3.417	5.51E-02	1.29E-01	-7.36E-02
3.483	5.68E-02	1.18E-01	-6.12E-02
3.55	5.88E-02	1.08E-01	-4.95E-02
3.617	1.03E-01	9.89E-02	4.36E-03
3.683	1.02E-01	9.05E-02	1.15E-02
3.75	9.97E-02	8.28E-02	1.69E-02
3.817	9.74E-02	7.57E-02	2.18E-02
3.883	9.61E-02	6.92E-02	2.70E-02
3.95	9.49E-02	6.32E-02	3.17E-02
4.017	9.58E-02	5.77E-02	3.79E-02
4.083	9.73E-02	5.27E-02	4.46E-02
4.15	9.70E-02	4.81E-02	4.90E-02
4.217	9.97E-02	4.36E-02	5.59E-02
4.283	1.01E-01	3.90E-02	6.05E-02
4.35	9.82E-02	3.65E-02	6.17E-02
4.417	9.59E-02	3.33E-02	6.27E-02
4.483	9.06E-02	3.03E-02	6.03E-02
4.55	8.33E-02	2.76E-02	5.57E-02
4.617	7.61E-02	2.52E-02	5.09E-02
4.683	6.88E-02	2.30E-02	4.57E-02
4.75	6.65E-02	2.09E-02	4.56E-02
4.817	6.62E-02	1.90E-02	4.72E-02
4.883	6.79E-02	1.73E-02	5.01E-02
4.95	7.17E-02	1.58E-02	5.59E-02
5.017	7.54E-02	1.44E-02	6.10E-02
5.083	7.91E-02	1.31E-02	6.69E-02
5.15	8.38E-02	1.19E-02	7.19E-02
5.217	8.55E-02	1.08E-02	7.47E-02
5.283	8.73E-02	9.63E-03	7.77E-02
5.35	8.70E-02	8.96E-03	7.80E-02
5.417	8.37E-02	8.15E-03	7.55E-02
5.483	8.84E-02	7.41E-03	7.10E-02
5.55	4.31E-02	6.74E-03	3.64E-02
5.617	1.58E-02	6.13E-03	9.71E-03
5.683	1.26E-02	5.61E-03	6.99E-03
5.75	4.28E-03	5.07E-03	-7.90E-04

B4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.3000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1590E-05
DISPERSIVITY= 0.1534E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 1.750
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7806E-01

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
THE CRITICAL RSS IS: 0.8497E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.59E-06	1.57E-06	1.61E-06
X(2)	1.53E-03	1.40E-03	1.69E-03
X(5)	1.75E+00	1.68E+00	1.82E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1	6.87E-03	0.00E+00	6.87E-03
0.2333	6.94E-03	1.39E-39	6.04E-03
0.35	5.60E-04	9.65E-26	5.60E-04
0.45	-3.57E-03	1.37E-19	-3.57E-03
0.55	0.69E-03	1.21E-15	-6.99E-03
0.65	-4.82E-03	5.68E-13	-4.82E-03
0.75	5.63E-05	5.42E-11	5.63E-05
0.85	7.93E-03	1.76E-09	7.93E-03
1.383	3.96E-02	3.72E-05	3.96E-02
1.483	1.75E-02	1.06E-04	1.74E-02
1.583	3.53E-02	2.64E-04	3.51E-02
1.683	1.22E-02	5.87E-04	1.16E-02
1.783	3.71E-02	1.18E-03	3.59E-02
1.883	2.30E-02	2.21E-03	2.68E-02
1.983	2.58E-02	3.84E-03	2.02E-02
2.083	2.27E-02	6.31E-03	1.64E-02
2.183	2.06E-02	9.86E-03	1.07E-02
2.283	2.05E-02	1.47E-02	5.72E-03
2.383	2.33E-02	2.12E-02	2.16E-03
2.483	2.72E-02	2.94E-02	-2.16E-03
2.583	3.41E-02	3.95E-02	-3.40E-03
2.683	4.70E-02	5.16E-02	-4.62E-03
2.783	5.98E-02	6.57E-02	-5.84E-03
2.883	8.57E-02	8.17E-02	-8.37E-03
2.983	9.56E-02	9.94E-02	-3.84E-03
3.083	1.21E-01	1.19E-01	-1.78E-03
3.25	9.49E-02	1.53E-01	-5.84E-02
3.35	1.34E-01	1.75E-01	-4.13E-02
3.45	1.59E-01	1.97E-01	-3.84E-02
3.55	1.84E-01	2.19E-01	-3.55E-02
3.65	2.63E-01	2.41E-01	2.30E-02
3.75	2.85E-01	2.61E-01	2.42E-02
3.85	2.30E-02	2.81E-01	2.54E-02
3.95	0.323	2.99E-01	2.41E-02
4.05	0.3399	0.3157	2.42E-02
4.15	0.3282	0.3066	2.21E-02
4.25	0.3636	0.3438	1.99E-02
4.35	0.3715	0.365	1.65E-02
4.45	0.3974	0.3804	1.58E-02
4.55	0.3853	0.3715	1.37E-02
4.65	0.3862	0.3769	9.26E-03
4.75	3.65E-03	3.59E-01	3.59E-03
4.85	0.3899	3.82E-01	7.86E-03
4.95	0.3888	3.82E-01	6.77E-03
5.05	3.8857	3.8857	0.00E-03
5.15	0.3815	3.77E-01	4.25E-03
5.25	0.3764	3.73E-01	3.57E-03
5.35	3.3703	3.3703	0.00E-03
5.45	3.01E-01	3.60E-01	-5.93E-02
5.55	2.92E-01	3.53E-01	-6.07E-02
5.65	2.62E-01	3.44E-01	-7.33E-02
5.75	2.63E-01	3.35E-01	-7.22E-02
5.85	3.30E-01	3.25E-01	4.51E-03
5.95	3.03E-01	3.15E-01	2.66E-03
6.05	3.08E-01	3.04E-01	4.19E-03
6.15	2.97E-01	2.93E-01	3.99E-03
6.25	2.88E-01	2.82E-01	5.97E-03
6.35	2.80E-01	2.71E-01	9.05E-03
6.45	2.71E-01	2.60E-01	1.12E-02
6.55	2.62E-01	2.49E-01	1.32E-02
6.65	2.53E-01	2.37E-01	1.52E-02
6.75	2.44E-01	2.26E-01	1.71E-02
6.85	2.33E-01	2.16E-01	1.77E-02
6.95	2.24E-01	2.05E-01	1.92E-02
7.05	2.14E-01	1.95E-01	1.94E-02
7.15	2.06E-01	1.85E-01	2.13E-02
7.25	1.98E-01	1.75E-01	2.29E-02
7.35	1.90E-01	1.66E-01	2.42E-02
7.45	1.83E-01	1.57E-01	2.61E-02
7.55	1.76E-01	1.49E-01	2.77E-02
7.65	1.66E-01	1.39E-01	2.70E-02
7.75	5.93E-02	1.31E-01	-7.21E-02
7.85	5.81E-02	1.21E-01	-8.13E-02
7.95	6.90E-02	1.16E-01	-4.73E-02
8.05	7.49E-02	1.09E-01	-3.44E-02
8.15	7.78E-02	1.03E-01	-2.48E-02
8.25	1.20E-01	9.62E-02	2.34E-02
8.35	1.14E-01	9.02E-02	2.33E-02
8.45	1.07E-01	8.47E-02	2.19E-02
8.55	1.00E-01	7.91E-02	2.11E-02
8.65	9.51E-02	7.40E-02	2.11E-02
8.75	9.00E-02	6.92E-02	2.08E-02
8.85	8.29E-02	6.47E-02	1.82E-02
8.95	7.77E-02	6.04E-02	1.74E-02
9.05	6.96E-02	5.65E-02	1.73E-02
9.15	6.55E-02	5.25E-02	1.30E-02
9.25	6.24E-02	4.90E-02	1.34E-02
9.35	5.42E-02	4.52E-02	6.61E-03
9.45	4.91E-02	4.25E-02	6.62E-03
9.55	4.20E-02	3.96E-02	2.43E-03
9.65	3.49E-02	3.69E-02	-1.94E-03
9.75	2.67E-02	3.42E-02	-7.49E-03
9.85	1.66E-02	3.18E-02	-1.52E-02
9.95	-3.95E-02	2.96E-02	-6.01E-02
10.05	-1.01E-01	2.75E-02	-1.28E-01

May 2005
C1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 78
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2480E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.9000E-03
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2980E-05
DISPERSIVITY= 0.2085E-02
WIDTH= 0.9000E-03
RF= 1.000
CO= 0.5785
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1954E-03

THE F STATISTIC FOR NP= 3 NOBS= 78 IS: 2.74
THE CRITICAL RSS IS: 0.2168E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.98E-06	2.92E-06	3.04E-06
X(2)	2.09E-03	1.94E-03	2.25E-03
X(5)	0.5785	0.567	0.5959

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.45	1.18E-03	4.21E-04	7.62E-04
0.4833	1.55E-03	7.43E-04	8.05E-04
0.5167	2.11E-03	1.20E-03	1.71E-03
0.55	3.28E-03	1.82E-03	1.46E-03
0.5833	4.64E-03	2.58E-03	2.06E-03
0.6167	6.15E-03	3.51E-03	1.50E-03
0.65	6.37E-03	4.57E-03	1.81E-03
1	2.12E-02	1.86E-02	2.67E-03
1.033	2.26E-02	1.97E-02	2.93E-03
1.067	2.29E-02	2.07E-02	2.23E-03
1.1	2.23E-02	2.16E-02	6.75E-04
1.133	2.27E-02	2.25E-02	2.00E-04
1.167	2.30E-02	2.32E-02	-1.91E-04
1.2	2.24E-02	2.39E-02	-1.47E-03
1.233	2.28E-02	2.44E-02	-1.65E-03
1.267	2.31E-02	2.49E-02	-1.77E-03
1.3	2.35E-02	2.53E-02	-1.77E-03
1.333	2.39E-02	2.56E-02	-1.70E-03
1.367	2.32E-02	2.58E-02	-2.54E-03
1.4	2.36E-02	2.59E-02	-2.32E-03
1.433	2.40E-02	2.60E-02	-2.01E-03
1.467	2.43E-02	2.60E-02	-1.65E-03
1.5	2.37E-02	2.59E-02	-2.21E-03
1.533	2.41E-02	2.58E-02	-1.73E-03
1.567	2.44E-02	2.56E-02	-1.19E-03
1.6	2.48E-02	2.54E-02	-6.05E-04
1.633	2.42E-02	2.51E-02	-9.87E-04
1.667	2.45E-02	2.48E-02	-3.13E-04
1.7	2.49E-02	2.45E-02	3.77E-04
1.733	2.43E-02	2.41E-02	1.06E-04
1.767	2.46E-02	2.38E-02	8.63E-04
1.8	2.40E-02	2.33E-02	6.42E-04
1.833	2.43E-02	2.29E-02	1.43E-03
1.867	2.37E-02	2.25E-02	1.26E-03
1.9	2.41E-02	2.20E-02	2.08E-03
1.933	2.34E-02	2.15E-02	1.92E-03
1.967	2.28E-02	2.10E-02	1.77E-03
2	2.22E-02	2.05E-02	1.63E-03
2.033	2.15E-02	2.01E-02	1.48E-03
2.067	2.09E-02	1.95E-02	1.36E-03
2.1	2.13E-02	1.90E-02	2.23E-03
2.133	2.06E-02	1.85E-02	2.09E-03
2.167	2.00E-02	1.80E-02	1.97E-03
2.2	1.84E-02	1.75E-02	8.19E-04
2.233	1.87E-02	1.71E-02	1.68E-03
2.267	1.81E-02	1.66E-02	1.54E-03
2.3	1.65E-02	1.61E-02	3.88E-04
2.333	1.68E-02	1.56E-02	1.22E-03
2.367	1.62E-02	1.51E-02	1.07E-03
2.4	1.56E-02	1.47E-02	8.92E-04
2.433	1.59E-02	1.42E-02	1.71E-03
2.467	1.43E-02	1.38E-02	5.31E-04
2.5	1.37E-02	1.33E-02	3.35E-04
2.533	1.30E-02	1.29E-02	1.21E-04
2.567	1.24E-02	1.25E-02	-8.02E-05
2.6	1.17E-02	1.21E-02	-3.13E-04
2.633	1.11E-02	1.17E-02	-5.46E-04
2.667	1.15E-02	1.13E-02	2.24E-04
2.7	1.08E-02	1.09E-02	-3.82E-05
2.733	9.21E-03	1.05E-02	-1.31E-03
2.767	9.57E-03	1.01E-02	-5.70E-04
2.8	8.94E-03	9.79E-03	-8.56E-04
2.833	8.30E-03	9.45E-03	-1.15E-03
2.867	8.67E-03	9.11E-03	-1.41E-03
2.9	8.03E-03	8.78E-03	-7.62E-04
2.933	6.40E-03	8.48E-03	-2.09E-03
2.967	6.76E-03	8.17E-03	-1.41E-03
3.0	4.33E-03	8.10E-03	-7.72E-04
3.033	3.69E-03	4.90E-03	-1.21E-03
3.067	3.45E-03	4.72E-03	-6.59E-04
3.1	3.48E-03	4.54E-03	-1.12E-03
3.133	2.79E-03	4.36E-03	-1.57E-03
3.167	2.16E-03	4.20E-03	-2.04E-03
3.2	2.52E-03	4.04E-03	-1.52E-03
3.233	3.61E-03	3.88E-03	-2.99E-03
3.267	2.51E-04	3.73E-03	-3.48E-03
3.3	3.68E-03	3.58E-03	-2.97E-03
3.333	3.71E-03	3.44E-03	-3.46E-03

C1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.3000E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.9000E-03
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 7.500
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1959E-05
DISPERSIVITY= 0.1032E-01
WIDTH= 0.9000E-03
RF= 1.000
CO= 9.178
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2270E-01

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
THE CRITICAL RSS IS: 0.2464E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.96E-06	1.88E-06	2.04E-06
X(2)	1.03E-02	9.39E-03	1.15E-02
X(5)	9.178	8.511	9.545

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.2667	2.80E-02	2.97E-02	2.80E-03
0.4	4.40E-02	1.66E-03	4.23E-02
0.5333	3.10E-02	1.50E-02	4.96E-02
0.6667	8.00E-02	3.28E-02	4.72E-02
0.8	0.106	6.12E-02	4.48E-02
0.9333	0.1119	9.08E-02	2.92E-02
1.067	0.128	0.118	1.01E-02
1.2	0.138	0.1406	-2.65E-03
1.333	0.175	0.1694	5.57E-03
1.467	0.159	0.1724	-1.64E-02
1.6	0.162	0.1823	-2.03E-02
1.733	0.168	0.1889	-2.09E-02
1.867	0.171	0.193	-2.20E-02
2	0.174	0.1949	-2.09E-02
2.133	0.175	0.1952	-2.02E-02
2.267	0.176	0.1942	-1.82E-02
2.4	0.177	0.1922	-1.52E-02
2.533	0.177	0.1894	-1.24E-02
2.667	0.177	0.1861	-9.06E-03
2.8	0.175	0.1823	-7.29E-03
2.933	0.176	0.1782	-2.20E-03
3.067	0.176	0.1739	2.13E-03
3.2	0.175	0.1694	5.57E-03
3.333	0.172	0.1649	7.09E-03
3.467	0.169	0.1603	8.68E-03
3.6	0.167	0.1558	1.12E-02
3.733	0.164	0.1512	1.28E-02
3.867	0.16	0.1468	1.33E-02
4	0.157	0.1424	1.46E-02
4.133	0.152	0.138	1.40E-02
4.267	0.147	0.1338	1.32E-02
4.4	0.144	0.1297	1.43E-02
4.533	0.14	0.1257	1.43E-02
4.667	0.136	0.1218	1.43E-02
4.8	0.13	0.118	1.20E-02
4.933	0.124	0.1143	9.72E-03
5.067	0.121	0.1107	1.03E-02
5.2	0.115	0.1072	7.17E-03
5.333	0.11	0.1039	6.12E-03
5.467	0.106	0.1006	5.39E-03
5.6	0.102	9.75E-02	4.53E-03
5.733	9.90E-02	9.44E-02	4.57E-03
5.867	9.50E-02	9.15E-02	3.53E-03
6	7.40E-02	8.86E-02	5.37E-03
6.133	9.10E-02	8.59E-02	5.12E-03
6.267	8.80E-02	8.32E-02	4.80E-03
6.4	8.80E-02	8.06E-02	4.37E-03
6.533	8.60E-02	7.82E-02	7.85E-03
6.667	8.30E-02	7.57E-02	7.27E-03
6.8	8.10E-02	7.34E-02	7.59E-03
6.933	7.90E-02	7.12E-02	7.84E-03
7.067	7.70E-02	6.90E-02	8.02E-03
7.2	7.60E-02	6.69E-02	9.12E-03
7.333	7.50E-02	6.49E-02	1.02E-02
7.467	7.30E-02	6.29E-02	1.01E-02
7.6	7.00E-02	6.10E-02	9.02E-03
7.733	6.80E-02	5.91E-02	8.86E-03
7.867	6.60E-02	5.74E-02	8.66E-03
8	6.30E-02	5.56E-02	7.36E-03
8.133	6.00E-02	5.40E-02	6.02E-03
8.267	5.80E-02	5.24E-02	5.64E-03
8.4	5.60E-02	5.08E-02	5.20E-03
8.533	5.30E-02	4.93E-02	3.70E-03
8.667	5.00E-02	4.78E-02	2.17E-03
8.8	4.80E-02	4.64E-02	1.57E-03
8.933	4.50E-02	4.51E-02	-6.25E-05
9.067	4.30E-02	4.37E-02	-7.33E-04
9.2	4.00E-02	4.25E-02	-2.46E-03
9.333	3.70E-02	4.12E-02	-4.22E-03
9.467	3.50E-02	4.00E-02	-5.01E-03
9.6	3.40E-02	3.89E-02	-4.85E-03
9.733	3.20E-02	3.77E-02	-5.73E-03
9.867	3.00E-02	3.66E-02	-6.63E-03
10	2.90E-02	3.56E-02	-6.58E-03
10.13	2.70E-02	3.46E-02	-7.58E-03
10.27	2.50E-02	3.35E-02	-8.53E-03
10.4	2.40E-02	3.26E-02	-8.60E-03
10.53	2.20E-02	3.17E-02	-9.69E-03
10.67	2.10E-02	3.07E-02	-9.74E-03
10.8	2.00E-02	2.99E-02	-9.89E-03
10.93	1.80E-02	2.91E-02	-1.11E-02
11.07	1.60E-02	2.82E-02	-1.22E-02
11.2	1.40E-02	2.74E-02	-1.34E-02
11.33	1.20E-02	2.67E-02	-1.47E-02
11.47	1.00E-02	2.59E-02	-1.59E-02
11.6	1.00E-02	2.52E-02	-1.52E-02
11.73	8.00E-03	2.45E-02	-1.65E-02
11.87	7.38E-03	2.38E-02	-1.68E-02
12	7.00E-03	2.31E-02	-1.61E-02
12.13	4.00E-03	2.25E-02	-1.86E-02
12.27	4.00E-03	2.18E-02	-1.78E-02
12.4	1.00E-03	2.12E-02	-2.02E-02
12.63	2.00E-03	2.07E-02	-1.87E-02
12.87	2.00E-03	2.01E-02	-1.91E-02
12.83	2.84E-03	2.02E-02	-1.74E-02
12.77	2.58E-03	1.96E-02	-1.71E-02
12.9	1.33E-03	1.91E-02	-1.78E-02
13.03	1.07E-03	1.86E-02	-1.75E-02

May 2005
C2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.9000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 200.0
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1324E-05
 DISPERSIVITY= 0.327E-02
 WIDTH= 0.9000E-03
 RF= 1.000
 CO= 29.29
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 4.101

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
 THE CRITICAL RSS IS: 4.456

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.32E-06	1.24E-06	1.42E-06
X(2)	3.27E-03	2.58E-03	4.21E-03
X(5)	29.2	26.87	31.54

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.67E-02	9.42E-02	2.0E-36	6.42E-02
0.15	1.51E-01	7.26E-16	1.51E-01
0.2333	1.98E-01	6.96E-10	1.98E-01
0.3167	2.41E-01	6.87E-07	2.41E-01
0.4	2.82E-01	2.29E-05	2.82E-01
0.4833	3.27E-01	2.88E-04	3.19E-01
0.5667	3.68E-01	1.73E-03	3.64E-01
0.65	3.88E-01	6.50E-03	3.82E-01
0.7333	4.32E-01	1.77E-02	4.14E-01
0.8167	0.4616	3.84E-02	4.23E-01
0.9	0.4913	7.07E-02	4.21E-01
0.9833	0.517	0.1149	4.02E-01
1.067	0.5437	0.1701	3.74E-01
1.15	0.5694	0.2343	3.35E-01
1.233	0.5942	0.3052	2.89E-01
1.317	0.6189	0.3801	2.39E-01
1.4	0.6416	0.4567	1.85E-01
1.483	0.6643	0.5327	1.32E-01
1.567	0.686	0.6068	7.92E-02
1.65	0.7077	0.6772	3.05E-02
1.733	0.7284	0.7432	-1.48E-02
1.817	0.7491	0.8041	-5.50E-02
1.9	0.7699	0.8595	-8.96E-02
1.983	0.7896	0.9164	-1.20E-01
2.067	0.8093	0.9529	-1.44E-01
2.15	0.828	0.991	-1.63E-01
2.233	0.8467	1.0284	-1.78E-01
2.317	0.8644	1.051	-1.87E-01
2.4	0.8811	1.073	-1.92E-01
2.483	0.8988	1.091	-1.92E-01
2.567	0.9156	1.105	-1.89E-01
2.65	0.9313	1.114	-1.83E-01
2.733	0.9485	1.12	-1.74E-01
2.817	0.9607	1.123	-1.62E-01
2.9	0.9744	1.122	-1.48E-01
2.983	0.9881	1.119	-1.32E-01
3.067	1.003	1.113	-1.11E-01
3.15	1.015	1.106	-9.11E-02
3.233	1.030E+00	1.096E+00	-7.05E-02
3.317	1.04E+00	1.09E+00	-4.85E-02
3.4	1.05E+00	1.07E+00	-2.70E-02
3.483	1.05E+00	1.05E+00	-1.11E-03
3.567	1.06E+00	1.04E+00	1.89E-02
3.65	1.07E+00	1.03E+00	4.18E-02
3.733	1.07E+00	1.01E+00	6.35E-02
3.817	1.08E+00	9.91E-01	8.61E-02
3.9	1.08E+00	9.73E-01	1.07E-01
3.983	1.08E+00	9.54E-01	1.28E-01
4.067	1.08E+00	9.35E-01	1.47E-01
4.15	1.08E+00	9.16E-01	1.64E-01
4.233	1.08E+00	8.96E-01	1.81E-01
4.317	1.07E+00	8.76E-01	1.96E-01
4.4	1.07E+00	8.57E-01	2.10E-01
4.483	1.06E+00	8.37E-01	2.21E-01
4.567	1.05E+00	8.17E-01	2.31E-01
4.65	1.04E+00	7.97E-01	2.39E-01
4.733	1.02E+00	7.78E-01	2.44E-01
4.817	1.01E+00	7.59E-01	2.46E-01
4.9	9.86E-01	7.40E-01	2.46E-01
4.983	9.64E-01	7.21E-01	2.44E-01
5.067	9.41E-01	7.02E-01	2.39E-01
5.15	9.16E-01	6.84E-01	2.32E-01
5.233	8.88E-01	6.66E-01	2.23E-01
5.317	8.58E-01	6.48E-01	2.10E-01
5.4	8.27E-01	6.30E-01	1.97E-01
5.483	7.93E-01	6.13E-01	1.79E-01
5.567	7.56E-01	5.96E-01	1.60E-01
5.65	7.18E-01	5.80E-01	1.38E-01
5.733	6.80E-01	5.64E-01	1.16E-01
5.817	6.39E-01	5.48E-01	9.14E-02
5.9	5.98E-01	5.33E-01	6.55E-02
5.983	5.59E-01	5.18E-01	4.13E-02
6.067	5.17E-01	5.03E-01	1.38E-02
6.15	4.76E-01	4.88E-01	-1.21E-02
6.233	4.37E-01	4.74E-01	-3.74E-02
6.317	3.98E-01	4.61E-01	-6.30E-02
6.4	3.60E-01	4.47E-01	-8.69E-02
6.483	3.23E-01	4.34E-01	-1.11E-01
6.567	2.89E-01	4.22E-01	-1.33E-01
6.65	2.55E-01	4.09E-01	-1.55E-01
6.733	2.24E-01	3.97E-01	-1.77E-01
6.817	1.95E-01	3.85E-01	-1.90E-01
6.9	1.69E-01	3.74E-01	-2.05E-01
6.983	1.44E-01	3.63E-01	-2.19E-01
7.067	1.21E-01	3.52E-01	-2.31E-01
7.15	1.03E-01	3.42E-01	-2.39E-01
7.233	8.65E-02	3.31E-01	-2.45E-01
7.317	7.22E-02	3.21E-01	-2.49E-01
7.4	5.89E-02	3.12E-01	-2.53E-01
7.483	4.66E-02	3.02E-01	-2.56E-01
7.567	3.63E-02	2.95E-01	-2.57E-01
7.65	2.90E-02	2.84E-01	-2.55E-01
7.733	2.18E-02	2.72E-01	-2.52E-01
7.817	1.55E-02	0.2674	-0.2519
7.9	1.02E-02	0.2592	-0.2491
7.983	4.89E-03	0.2514	-0.2465
8.067	6.06E-04	0.2437	-0.2431

C2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 1.700
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2865E-05
 DISPERSIVITY= 0.3475E-02
 WIDTH= 0.1000
 RF= 1.000
 CO= 1.717
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 29.02

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 31.59

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.87E-06	2.72E-06	3.07E-06
X(2)	3.48E-03	0.00E+00	2.42E-02
X(5)	1.72E+00	1.53E+00	1.89E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1167	9.96E-02	6.42E-02	1.72E+00
0.25	1.10E-01	7.26E-02	-1.81E+00
0.3833	1.38E-01	8.30E-02	-3.36E+00
0.5167	1.60E-01	9.41E-02	-4.46E+00
0.65	1.80E-01	1.05E-01	-3.90E-01
0.7833	2.00E-01	1.17E-01	-8.30E-01
0.9167	2.18E-01	1.30E-01	-1.15E+00
1.05	2.35E-01	1.44E-01	-9.43E-01
1.183	2.50E-01	1.59E-01	-7.30E-01
1.317	2.63E-01	1.75E-01	-5.21E-01
1.45	2.74E-01	1.92E-01	-3.37E-01
1.583	2.83E-01	2.10E-01	-1.81E-01
1.717	2.90E-01	2.29E-01	5.42E-02
1.85	2.96E-01	2.49E-01	1.38E-01
1.983	3.00E-01	2.70E-01	2.05E-01
2.117	3.03E-01	2.92E-01	1.61E-01
2.25	3.05E-01	3.15E-01	3.07E-01
2.383	3.06E-01	3.39E-01	3.46E-01
2.517	3.06E-01	3.64E-01	3.78E-01
2.65	3.05E-01	3.90E-01	4.05E-01
2.783	3.03E-01	4.17E-01	4.28E-01
2.917	3.00E-01	4.45E-01	4.50E-01
3.05	2.96E-01	4.74E-01	4.67E-01
3.183	2.90E-01	5.04E-01	4.79E-01
3.317	2.81E-01	5.35E-01	4.91E-01
3.45	2.72E-01	5.67E-01	5.01E-01
3.583	2.60E-01	6.00E-01	5.08E-01
3.717	2.50E-01	6.34E-01	5.13E-01
3.85	2.40E-01	6.69E-01	5.16E-01
3.983	2.30E-01	7.05E-01	5.19E-01
4.117	2.20E-01	7.42E-01	5.20E-01
4.25	2.10E-01	7.80E-01	5.19E-01
4.383	2.00E-01	8.18E-01	5.17E-01
4.517	1.90E-01	8.57E-01	5.15E-01
4.65	1.80E-01	8.97E-01	5.11E-01
4.783	1.70E-01	9.37E-01	5.06E-01
4.917	1.60E-01	9.77E-01	4.98E-01
5.05	1.50E-01	1.017E+00	4.90E-01
5.183	1.40E-01	1.057E+00	4.79E-01
5.317	1.30E-01	1.097E+00	4.73E-01
5.45	1.20E-01	1.137E+00	4.61E-01
5.583	1.10E-01	1.177E+00	4.44E-01
5.717	1.00E-01	1.217E+00	4.35E-01
5.85	9.00E-02	1.257E+00	4.21E-01
5.983	8.00E-02	1.297E+00	4.05E-01
6.117	7.00E-02	1.337E+00	3.86E-01
6.25	6.00E-02	1.377E+00	3.68E-01
6.383	5.00E-02	1.417E+00	3.47E-01
6.517	4.00E-02	1.457E+00	3.24E-01
6.65	3.00E-02	1.497E+00	2.99E-01
6.783	2.00E-02	1.537E+00	2.73E-01
6.917	1.00E-02	1.577E+00	2.44E-01
7.05	0.00E-02	1.617E+00	2.13E-01
7.183	0.00E-02	1.657E+00	1.80E-01
7.317	0.00E-02	1.697E+00	1.45E-01
7.45	0.00E-02	1.737E+00	1.06E-01
7.583	0.00E-02	1.777E+00	6.46E-02
7.717	0.00E-02	1.817E+00	1.96E-02
7.85	0.00E-02	1.857E+00	-2.84E-02
7.983	0.00E-02	1.897E+00	-7.74E-02
8.117	0.00E-02	1.937E+00	-1.31E-01
8.25	0.00E-02	1.977E+00	-1.86E-01
8.383	0.00E-02	2.017E+00	-2.44E-01
8.517	0.00E-02	2.057E+00	-3.05E-01
8.65	0.00E-02	2.097E+00	-3.69E-01
8.783	0.00E-02	2.137E+00	-4.34E-01
8.917	0.00E-02	2.177E+00	-5.02E-01
9.05	0.00E-02	2.217E+00	-5.67E-01
9.183	0.00E-02	2.257E+00	-6.36E-01
9.317	0.00E-02	2.297E+00	-7.05E-01
9.45	0.00E-02	2.337E+00	-7.74E-01
9.583	0.00E-02	2.377E+00	-8.40E-01
9.717	0.00E-02	2.417E+00	-9.04E-01
9.85	0.00E-02	2.457E+00	-9.66E-01
9.983	0.00E-02	2.497E+00	-1.026E-00
10.12	0.00E-02	2.537E+00	-1.084E-00
10.25	0.00E-02	2.577E+00	-1.140E-00
10.383	0.00E-02	2.617E+00	-1.194E-00
10.52	0.00E-02	2.657E+00	-1.246E-00
10.65	0.00E-02	2.697E+00	-1.296E-00
10.783	0.00E-02	2.737E+00	-1.344E-00
10.92	0.00E-02	2.777E+00	-1.390E-00
11.05	0.00E-02	2.817E+00	-1.434E-00
11.18	0.00E-02	2.857E+00	-1.476E-00
11.32	0.00E-02	2.897E+00	-1.516E-00
11.45	0.00E-02	2.937E+00	-1.554E-00
11.58	0.00E-02	2.977E+00	-1.590E-00
11.72	0.00E-02	3.017E+00	-1.624E-

May 2005
C3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.9000E-03
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 6.000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.3218E-05
DISPERSIVITY= 0.2040E-02
WIDTH= 0.9000E-03
RF= 1.000
CO= 5.689
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1478E-01

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
THE CRITICAL RSS IS: 0.1627E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	3.22E-06	3.19E-06	3.25E-06
X(2)	2.04E-03	1.90E-03	2.18E-03
X(5)	5.689	5.518	5.859

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.83E-01	3.13E-03	2.92E-05	3.10E-03
0.3334	9.32E-03	2.44E-04	9.07E-03
0.3834	1.55E-02	1.14E-03	1.44E-02
0.4334	2.37E-02	3.57E-03	2.01E-02
0.4834	3.49E-02	8.57E-03	2.63E-02
0.5334	4.41E-02	1.69E-02	2.72E-02
0.5834	5.53E-02	2.90E-02	2.63E-02
0.6334	6.95E-02	4.45E-02	2.80E-02
0.6834	9.66E-02	6.30E-02	3.37E-02
0.7334	0.1108	8.35E-02	2.73E-02
0.7834	0.124	1.05E-01	1.89E-02
0.8334	0.1382	1.13E-02	1.13E-02
0.8834	0.1514	0.1482	3.20E-03
0.9334	0.1636	0.1682	-4.61E-03
0.9834	0.1748	0.1865	-1.17E-02
1.033	0.186	0.2026	-1.66E-02
1.083	0.1972	0.2166	-1.94E-02
1.133	0.2074	0.2282	-2.09E-02
1.183	0.2155	0.2376	-2.21E-02
1.233	0.2247	0.2446	-1.99E-02
1.283	0.2319	0.2495	-1.76E-02
1.333	0.2371	0.2524	-1.53E-02
1.383	0.2413	0.2535	-1.22E-02
1.433	0.2445	0.253	-8.50E-03
1.483	0.2467	0.2511	-4.36E-03
1.533	0.2469	0.2479	-9.60E-04
1.583	0.2471	0.2436	3.60E-03
1.633	0.2453	0.2384	4.73E-03
1.683	0.2424	0.2325	9.88E-03
1.733	0.2376	0.226	1.16E-02
1.783	0.2328	0.219	1.38E-02
1.833	0.228	0.2116	1.64E-02
1.883	0.2212	0.204	1.72E-02
1.933	0.2144	0.1962	1.82E-02
1.983	0.2066	0.1893	1.73E-02
2.033	0.1978	0.1804	1.74E-02
2.083	0.188	0.1725	1.55E-02
2.133	0.1792	0.1647	1.45E-02
2.183	1.70E-01	0.157	1.70E-02
2.233	1.62E-01	1.50E-01	1.20E-02
2.283	1.53E-01	1.42E-01	1.06E-02
2.333	1.43E-01	1.35E-01	7.93E-03
2.383	1.34E-01	1.28E-01	6.06E-03
2.433	1.25E-01	1.21E-01	3.96E-03
2.483	1.19E-01	1.15E-01	3.62E-03
2.533	1.10E-01	1.09E-01	1.04E-03
2.583	1.01E-01	1.03E-01	-1.80E-03
2.633	9.40E-02	9.70E-02	-2.96E-03
2.683	8.82E-02	9.15E-02	-3.31E-03
2.733	8.04E-02	8.63E-02	-5.91E-03
2.783	7.46E-02	8.14E-02	-6.76E-03
2.833	6.88E-02	7.66E-02	-7.84E-03
2.883	6.30E-02	7.22E-02	-9.16E-03
2.933	5.82E-02	6.79E-02	-9.71E-03
2.983	5.44E-02	6.39E-02	-9.48E-03
3.033	5.16E-02	6.00E-02	-8.46E-03
3.083	4.78E-02	5.64E-02	-8.64E-03
3.133	4.39E-02	5.30E-02	-9.03E-03
3.183	4.01E-02	4.97E-02	-9.60E-03
3.233	3.63E-02	4.67E-02	-1.04E-02
3.283	3.35E-02	4.38E-02	-1.03E-02
3.333	3.07E-02	4.11E-02	-1.04E-02
3.383	2.79E-02	3.85E-02	-1.06E-02
3.433	2.61E-02	3.61E-02	-1.00E-02
3.483	2.33E-02	3.38E-02	-1.05E-02
3.533	2.05E-02	3.17E-02	-1.12E-02
3.583	1.97E-02	2.97E-02	-1.00E-02
3.633	1.78E-02	2.78E-02	-9.94E-03
3.683	1.60E-02	2.60E-02	-9.97E-03
3.733	1.42E-02	2.43E-02	-1.01E-02
3.783	1.24E-02	2.28E-02	-9.80E-03
3.833	1.16E-02	2.13E-02	-9.71E-03
3.883	1.18E-02	1.99E-02	-8.14E-03
3.933	9.98E-03	1.86E-02	-8.66E-03
3.983	8.17E-03	1.74E-02	-9.26E-03
4.033	7.36E-03	1.63E-02	-8.93E-03
4.083	5.55E-03	1.52E-02	-9.68E-03
4.133	4.74E-03	1.42E-02	-9.50E-03
4.183	3.93E-03	1.33E-02	-9.37E-03
4.233	3.12E-03	1.24E-02	-9.31E-03
4.283	3.30E-03	1.15E-02	-8.30E-03
4.333	2.49E-03	1.08E-02	-8.35E-03
4.383	2.68E-03	1.01E-02	-7.44E-03
4.433	8.74E-04	9.46E-03	-8.58E-03

C3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 1.000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2080E-05
DISPERSIVITY= 0.1432E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 1.275
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3067E-02

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
THE CRITICAL RSS IS: 0.3369E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.08E-06	2.08E-06	2.08E-06
X(2)	1.43E-03	1.40E-03	1.48E-03
X(5)	1.26E+00	1.26E+00	1.29E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.933	2.47E-01	2.27E-01	2.05E-02
3	2.54E-01	2.39E-01	1.55E-02
3.067	2.59E-01	2.50E-01	9.50E-03
3.133	2.62E-01	2.59E-01	2.83E-03
3.2	2.67E-01	2.68E-01	-7.85E-04
3.267	2.71E-01	2.75E-01	-4.15E-03
3.333	2.74E-01	2.81E-01	-7.16E-03
3.4	2.78E-01	2.86E-01	-8.00E-03
3.467	2.80E-01	2.90E-01	-9.60E-03
3.533	2.82E-01	2.92E-01	-9.95E-03
3.6	2.89E-01	2.93E-01	-1.02E-02
3.667	2.84E-01	2.93E-01	-9.28E-03
3.733	2.84E-01	2.92E-01	-8.36E-03
3.8	2.83E-01	2.90E-01	-7.45E-03
3.867	2.82E-01	2.88E-01	-5.62E-03
3.933	2.80E-01	2.84E-01	-4.03E-03
4	2.76E-01	2.80E-01	-3.64E-03
4.067	2.73E-01	2.75E-01	-1.57E-03
4.133	2.69E-01	2.69E-01	8.18E-06
4.2	2.64E-01	2.63E-01	1.19E-03
4.267	2.59E-01	2.56E-01	2.56E-03
4.333	2.53E-01	2.49E-01	3.71E-03
4.4	2.47E-01	2.42E-01	5.02E-03
4.467	2.40E-01	2.34E-01	5.57E-03
4.533	2.34E-01	2.27E-01	7.20E-03
4.6	2.26E-01	2.19E-01	7.08E-03
4.667	2.19E-01	2.11E-01	8.04E-03
4.733	2.11E-01	2.03E-01	7.93E-03
4.8	2.01E-01	1.95E-01	5.93E-03
4.867	1.94E-01	1.87E-01	6.89E-03
4.933	1.85E-01	1.79E-01	5.66E-03
5.067	1.76E-01	1.72E-01	4.45E-03
5.133	0.16	1.57E-01	3.51E-03
5.2	0.153	0.1491	0.735E-03
5.267	0.145	0.142	3.01E-03
5.333	0.137	0.1351	1.87E-03
5.4	0.13	0.1284	1.63E-03
5.467	0.124	0.1218	2.17E-03
5.533	0.116	0.1156	3.96E-04
5.6	0.109	0.1095	-5.11E-04
5.667	0.104	0.104E-01	3.53E-04
5.733	9.70E-02	9.81E-02	-1.10E-03
5.8	9.20E-02	9.27E-02	-6.93E-04
5.867	8.70E-02	8.75E-02	-5.17E-04
5.933	8.00E-02	8.26E-02	-2.64E-03
6	7.50E-02	7.79E-02	-2.91E-03
6.067	7.10E-02	7.34E-02	-2.40E-03
6.133	6.60E-02	6.92E-02	-3.17E-03
6.2	6.30E-02	6.51E-02	-2.08E-03
6.267	5.90E-02	6.12E-02	-2.20E-03
6.333	5.40E-02	5.76E-02	-3.56E-03
6.4	5.20E-02	5.41E-02	-2.06E-03
6.467	4.70E-02	5.08E-02	-3.75E-03
6.533	4.50E-02	4.77E-02	-2.65E-03
6.6	4.10E-02	4.47E-02	-3.68E-03
6.667	3.80E-02	4.19E-02	-3.88E-03
6.733	3.60E-02	3.93E-02	-3.27E-03
6.8	3.20E-02	3.68E-02	-4.77E-03
6.867	2.90E-02	3.44E-02	-5.41E-03
6.933	2.70E-02	3.22E-02	-5.22E-03
7	2.60E-02	3.01E-02	-4.13E-03
7.067	2.30E-02	2.82E-02	-6.16E-03
7.133	2.00E-02	2.63E-02	-6.34E-03
7.2	2.10E-02	2.46E-02	-3.60E-03
7.267	1.90E-02	2.30E-02	-3.96E-03
7.333	1.80E-02	2.15E-02	-3.45E-03
7.4	1.70E-02	2.00E-02	-3.01E-03
7.467	1.50E-02	1.87E-02	-3.66E-03
7.533	1.30E-02	1.74E-02	-4.42E-03
7.6	1.10E-02	1.61E-02	-5.12E-03
7.667	1.00E-02	1.51E-02	-5.12E-03
7.733	9.00E-03	1.41E-02	-5.10E-03
7.8	8.00E-03	1.31E-02	-5.13E-03
7.867	6.00E-03	1.22E-02	-6.22E-03
7.933	5.00E-03	1.14E-02	-6.39E-03
8	4.00E-03	1.06E-02	-6.59E-03
8.067	3.00E-03	9.85E-03	-6.85E-03
8.133	2.00E-03	9.17E-03	-7.17E-03
8	2.57E-02	1.06E-02	1.51E-02
8.1	1.87E-02	9.51E-03	9.16E-03
8.2	1.07E-02	8.53E-03	2.14E-03
8.3	5.67E-03	7.64E-03	-1.98E-03
8.4	1.67E-03	6.85E-03	-5.18E-03
8.5	6.67E-04	5.49E-03	-5.47E-03
8.6	-3.33E-04	5.49E-03	-5.82E-03

May 2005
C4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 80
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.3457E-05
DISPERSIVITY= 0.3817E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 1.409
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3516E-02

THE F STATISTIC FOR NP= 3 NOBS= 80 IS: 2.73
THE CRITICAL RSS IS: 0.3891E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	3.46E-06	3.42E-06	3.49E-06
X(2)	3.82E-03	3.70E-03	3.93E-03
X(5)	1.409	1.395	1.423

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.00E-01	6.00E-03	6.42E-04	5.36E-03
0.2667	1.90E-02	4.77E-03	1.42E-02
0.3333	3.60E-02	1.61E-02	1.99E-02
0.4	5.80E-02	3.67E-02	2.14E-02
0.4667	8.50E-02	6.62E-02	1.88E-02
0.5333	1.16E-01	1.04E-01	1.25E-02
0.6	1.50E-01	1.46E-01	3.81E-03
0.6667	1.92E-01	1.90E-01	2.22E-03
0.7333	2.23E-01	2.29E-01	-5.90E-03
0.8	0.25	2.60E-01	-1.04E-02
0.8667	0.271	2.93E-01	-1.24E-02
0.9333	0.286	0.2982	-1.22E-02
1	0.297	0.3063	-9.25E-03
1.067	0.303	0.3087	-5.70E-03
1.133	0.305	0.3068	-1.82E-03
1.2	0.304	0.3016	2.36E-03
1.267	0.299	0.294	4.98E-03
1.333	0.292	0.2848	7.16E-03
1.4	0.283	0.2744	8.64E-03
1.467	0.273	0.2631	9.86E-03
1.533	0.261	0.2517	9.31E-03
1.6	0.249	0.2399	9.09E-03
1.667	0.235	0.2282	6.85E-03
1.733	0.223	0.2167	6.27E-03
1.8	0.211	0.2054	5.65E-03
1.867	0.198	0.1944	3.58E-03
1.933	0.186	0.184	2.02E-03
2	0.173	0.1738	-4.10E-03
2.067	0.164	0.1641	-5.79E-05
2.133	0.153	0.1549	-1.90E-03
2.2	0.143	0.1461	-3.05E-03
2.267	0.133	0.1376	-4.65E-03
2.333	0.125	0.1298	-4.79E-03
2.4	0.117	0.1222	-5.24E-03
2.467	0.109	0.1151	-6.10E-03
2.533	0.102	0.1084	-6.45E-03
2.6	9.50E-02	0.1021	-7.08E-03
2.667	8.90E-02	9.61E-02	-7.06E-03
2.733	8.30E-02	9.05E-02	-7.48E-03
2.8	7.90E-02	8.51E-02	-6.13E-03
2.867	7.40E-02	8.01E-02	-6.09E-03
2.933	7.00E-02	7.54E-02	-5.42E-03
3	6.70E-02	7.10E-02	-3.95E-03
3.067	6.40E-02	6.67E-02	-2.75E-03
3.133	6.00E-02	6.29E-02	-2.85E-03
3.2	5.80E-02	5.91E-02	-1.12E-03
3.267	5.50E-02	5.66E-02	-6.17E-04
3.333	5.20E-02	5.24E-02	-3.69E-04
3.4	5.00E-02	4.93E-02	7.33E-04
3.467	4.80E-02	4.64E-02	1.65E-03
3.533	4.50E-02	4.37E-02	1.35E-03
3.6	4.30E-02	4.11E-02	1.94E-03
3.667	4.10E-02	3.86E-02	2.36E-03
3.733	4.00E-02	3.64E-02	3.61E-03
3.8	3.80E-02	3.42E-02	3.76E-03
3.867	3.60E-02	3.22E-02	3.78E-03
3.933	3.40E-02	3.04E-02	3.65E-03
4	3.20E-02	2.86E-02	3.44E-03
4.067	3.00E-02	2.69E-02	3.12E-03
4.133	2.90E-02	2.53E-02	3.68E-03
4.2	2.70E-02	2.38E-02	3.17E-03
4.267	2.60E-02	2.24E-02	3.56E-03
4.333	2.50E-02	2.11E-02	3.86E-03
4.4	2.30E-02	1.99E-02	3.10E-03
4.467	2.20E-02	1.87E-02	3.27E-03
4.533	2.10E-02	1.77E-02	3.35E-03
4.6	1.90E-02	1.66E-02	2.38E-03
4.667	1.80E-02	1.57E-02	2.35E-03
4.733	1.70E-02	1.48E-02	2.25E-03
4.8	1.30E-02	1.39E-02	-8.92E-04
4.867	1.30E-02	1.31E-02	-8.24E-05
4.933	1.20E-02	1.23E-02	-3.32E-04
5	1.00E-02	1.16E-02	-1.62E-03
5.067	9.00E-03	1.09E-02	-1.94E-03
5.133	8.00E-03	1.03E-02	-2.31E-03
5.2	7.00E-03	9.72E-03	-2.72E-03
5.267	6.00E-03	9.15E-03	-3.15E-03
5.333	4.00E-03	8.63E-03	-4.63E-03
5.4	2.00E-03	8.13E-03	-6.13E-03
5.467	1.00E-03	7.66E-03	-6.66E-03

C4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2146E-05
DISPERSIVITY= 0.1590E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.7491
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3382E-03

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
THE CRITICAL RSS IS: 0.3715E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.15E-06	2.15E-06	2.15E-06
X(2)	1.59E-03	1.57E-03	1.61E-03
X(5)	7.49E-01	7.49E-01	7.49E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.767	3.44E-03	9.81E-03	-6.37E-03
1.85	7.98E-03	1.40E-02	-6.00E-03
1.933	1.35E-02	1.92E-02	-5.68E-03
2.017	2.11E-02	2.56E-02	-4.49E-03
2.1	2.96E-02	3.29E-02	-3.27E-03
2.183	3.92E-02	4.12E-02	-1.99E-03
2.267	4.97E-02	5.04E-02	-6.29E-04
2.35	5.93E-02	6.01E-02	-8.17E-04
2.433	7.08E-02	7.02E-02	5.68E-04
2.517	8.04E-02	8.08E-02	-4.03E-04
2.6	9.19E-02	9.11E-02	7.62E-04
2.683	1.03E-01	1.01E-01	1.19E-03
2.767	1.12E-01	1.11E-01	8.14E-04
2.85	1.21E-01	1.20E-01	1.43E-04
2.933	1.30E-01	1.29E-01	1.30E-03
3.017	1.40E-01	1.37E-01	3.12E-03
3.1	1.47E-01	1.43E-01	4.08E-03
3.183	1.52E-01	1.49E-01	2.93E-03
3.267	1.55E-01	1.54E-01	1.85E-03
3.35	1.59E-01	1.57E-01	1.76E-03
3.433	1.60E-01	1.60E-01	7.91E-04
3.517	1.61E-01	1.61E-01	-3.08E-04
3.6	1.62E-01	1.62E-01	-3.46E-04
3.683	1.61E-01	1.62E-01	-6.07E-04
3.767	1.60E-01	1.61E-01	-9.40E-04
3.85	1.57E-01	1.59E-01	-1.64E-03
3.933	1.55E-01	1.56E-01	-1.69E-03
4.017	1.51E-01	1.53E-01	-2.00E-03
4.1	1.48E-01	1.50E-01	-1.95E-03
4.183	1.43E-01	1.46E-01	-2.36E-03
4.267	1.39E-01	1.41E-01	-2.45E-03
4.35	1.35E-01	1.37E-01	-1.21E-03
4.433	0.1299	1.32E-01	-1.83E-03
4.517	0.1255	1.27E-01	-1.12E-03
4.6	0.122	0.125	-4.47E-04
4.683	0.1176	0.1162	1.38E-03
4.767	0.1111	0.1109	2.09E-04
4.85	0.1047	0.1056	-9.42E-04
4.933	0.1002	0.1004	-2.38E-04
5.017	9.47E-02	9.53E-02	-5.08E-04
5.1	8.93E-02	9.02E-02	-9.30E-04
5.183	8.48E-02	8.53E-02	-4.72E-04
5.267	8.04E-02	8.05E-02	-1.04E-04
5.35	7.59E-02	7.59E-02	6.49E-05
5.433	7.15E-02	7.14E-02	7.20E-05
5.517	6.70E-02	6.71E-02	-4.97E-05
5.6	6.36E-02	6.30E-02	6.11E-04
5.683	5.91E-02	5.90E-02	8.30E-05
5.767	5.57E-02	5.52E-02	4.29E-04
5.85	5.32E-02	5.17E-02	1.56E-03
5.933	4.98E-02	4.83E-02	1.48E-03
6.017	4.63E-02	4.50E-02	1.28E-03
6.1	4.29E-02	4.20E-02	8.71E-04
6.183	4.14E-02	3.91E-02	2.28E-03
6.267	3.89E-02	3.64E-02	2.57E-03
6.35	3.65E-02	3.38E-02	2.66E-03
6.433	3.30E-02	3.14E-02	1.60E-03
6.517	3.06E-02	2.92E-02	1.42E-03
6.6	2.81E-02	2.71E-02	1.07E-03
6.683	2.67E-02	2.51E-02	1.59E-03
6.767	2.42E-02	2.32E-02	1.00E-03
6.85	2.28E-02	2.15E-02	1.26E-03
6.933	2.03E-02	1.99E-02	4.20E-04
7.017	1.79E-02	1.84E-02	-5.16E-04
7.1	1.64E-02	1.70E-02	-5.83E-04
7.183	1.70E-02	1.57E-02	1.26E-03
7.267	1.65E-02	1.45E-02	2.02E-03
7.35	1.50E-02	1.34E-02	1.69E-03
7.433	1.26E-02	1.23E-02	2.78E-04
7.517	1.21E-02	1.13E-02	7.92E-04
7.6	1.07E-02	1.07E-02	1.24E-04
7.683	1.02E-02	9.62E-03	6.09E-04
7.767	8.77E-03	8.85E-03	-7.62E-05
7.85	8.32E-03	8.14E-03	1.76E-04
7.933	8.87E-03	7.49E-03	-6.24E-04
8.017	6.41E-03	6.88E-03	-4.68E-04
8.1	4.96E-03	6.32E-03	-1.37E-03
8.183	4.50E-03	5.81E-03	-1.31E-03
8.267	4.05E-03	5.33E-03	-1.28E-03
8.35	3.60E-03	4.89E-03	-1.30E-03
8.433	2.14E-03	4.49E-03	-2.35E-03
8.517	1.69E-03	4.12E-03	-2.43E-03
8.6	1.24E-03	3.78E-03	-2.54E-03
8.683	7.82E-04	3.46E-03	-2.68E-03
8.767	6.97E-04	4.19E-03	-3.22E-03
8.85	-3.33E-04	3.78E-03	-4.11E-03

May 2005
D1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 89
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.1300E-02
 8) THE PULSE WIDTH (M) : -0.6000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1786E-05
 DISPERSIVITY= 0.3075E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 8.981
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 1.151

THE F STATISTIC FOR NP= 3 NOBS= 89 IS: 2.72
 THE CRITICAL RSS IS: 1.261

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.79E-06	1.75E-06	1.82E-06
X(2)	3.86E-03	3.33E-03	4.39E-03
X(5)	8.981	8.711	9.251

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.67E-02	5.60E-02	2.15E-23	5.60E-02
0.15	6.06E-02	3.06E-10	6.06E-02
0.2333	6.20E-02	1.91E-06	6.20E-02
0.3167	7.30E-02	1.25E-04	7.28E-02
0.4	8.05E-02	1.46E-03	7.65E-02
0.4833	9.89E-02	7.36E-03	9.16E-02
0.5667	1.31E-01	2.32E-02	1.08E-01
0.65	1.49E-01	5.49E-02	1.33E-01
0.7333	2.68E-01	1.07E-01	1.61E-01
0.8167	0.3709	1.82E-01	1.89E-01
0.9	0.4959	2.81E-01	2.16E-01
0.9833	0.6329	0.4031	2.30E-01
1.067	0.7749	0.547	2.28E-01
1.15	0.9159	0.7095	2.07E-01
1.233	1.055	0.8851	1.70E-01
1.317	1.187	1.067	1.20E-01
1.4	1.312	1.246	6.61E-02
1.483	1.425	1.414	1.07E-02
1.567	1.528	1.567	-3.89E-02
1.65	1.618	1.699	-8.17E-02
1.733	1.697	1.811	-1.14E-01
1.817	1.765	1.901	-1.37E-01
1.9	1.821	1.971	-1.50E-01
1.983	1.864	2.021	-1.58E-01
2.067	1.897	2.055	-1.58E-01
2.15	1.922	2.072	-1.51E-01
2.233	1.941	2.076	-1.36E-01
2.317	1.955	2.069	-1.14E-01
2.4	1.954	2.051	-9.76E-02
2.483	1.949	2.026	-7.68E-02
2.567	1.941	1.993	-5.20E-02
2.65	1.929	1.954	-2.57E-02
2.733	1.92	1.911	-9.28E-03
2.817	1.894	1.865	-2.89E-02
2.9	1.862	1.815	-4.63E-02
2.983	1.827	1.764	-6.27E-02
3.067	1.79E+00	1.711	-7.95E-02
3.15	1.75E+00	1.66E+00	9.23E-02
3.233	1.71E+00	1.61E+00	1.13E-01
3.317	1.66E+00	1.55E+00	1.13E-01
3.4	1.62E+00	1.50E+00	1.20E-01
3.483	1.57E+00	1.44E+00	1.24E-01
3.567	1.52E+00	1.39E+00	1.27E-01
3.65	1.47E+00	1.34E+00	1.30E-01
3.733	1.42E+00	1.29E+00	1.30E-01
3.817	1.36E+00	1.24E+00	1.26E-01
3.9	1.31E+00	1.19E+00	1.24E-01
3.983	1.26E+00	1.14E+00	1.20E-01
4.067	1.21E+00	1.10E+00	1.13E-01
4.15	1.16E+00	1.05E+00	1.08E-01
4.233	1.11E+00	1.01E+00	9.92E-02
4.317	1.05E+00	9.66E-01	8.89E-02
4.4	1.02E+00	9.25E-01	9.10E-02
4.483	9.65E-01	8.87E-01	7.88E-02
4.567	9.17E-01	8.49E-01	6.82E-02
4.65	8.68E-01	8.13E-01	5.52E-02
4.733	8.22E-01	7.79E-01	4.38E-02
4.817	7.78E-01	7.45E-01	3.32E-02
4.9	7.31E-01	7.13E-01	1.82E-02
4.983	6.88E-01	6.82E-01	5.97E-03
5.067	6.47E-01	6.53E-01	-5.45E-03
5.15	6.07E-01	6.24E-01	-1.71E-02
5.233	5.68E-01	5.97E-01	-3.09E-02
5.317	5.36E-01	5.71E-01	-3.48E-02
5.4	5.00E-01	5.46E-01	-4.58E-02
5.483	4.68E-01	5.22E-01	-5.58E-02
5.567	4.36E-01	4.99E-01	-6.28E-02
5.65	4.05E-01	4.77E-01	-7.18E-02
5.733	3.98E-01	4.56E-01	-5.98E-02
5.817	3.66E-01	4.36E-01	-6.96E-02
5.9	3.39E-01	4.17E-01	-7.73E-02
5.983	3.12E-01	3.98E-01	-8.58E-02
6.067	2.87E-01	3.80E-01	-9.31E-02
6.15	2.63E-01	3.63E-01	-1.00E-01
6.233	2.39E-01	3.47E-01	-1.08E-01
6.317	2.20E-01	3.32E-01	-1.12E-01
6.4	2.00E-01	3.17E-01	-1.17E-01
6.483	1.78E-01	3.03E-01	-1.25E-01
6.567	1.61E-01	2.89E-01	-1.32E-01
6.65	1.44E-01	2.76E-01	-1.32E-01
6.733	1.26E-01	2.64E-01	-1.38E-01
6.817	1.09E-01	2.49E-01	-1.43E-01
6.9	9.31E-02	2.41E-01	-1.48E-01
6.983	7.71E-02	2.30E-01	-1.53E-01
7.067	6.31E-02	2.20E-01	-1.57E-01
7.15	4.90E-02	2.10E-01	-1.61E-01
7.233	3.40E-02	2.01E-01	-1.67E-01
7.317	2.10E-02	1.92E-01	-1.71E-01
7.4	1.20E-02	1.83E-01	-1.71E-01

D1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.7000E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1503E-05
 DISPERSIVITY= 0.1994E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 5.458
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5749E-01

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.6257E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.50E-06	1.50E-06	1.50E-06
X(2)	1.93E-03	1.93E-03	1.93E-03
X(5)	5.46E+00	5.40E+00	5.51E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1167	4.60E-02	7.02E-62	4.60E-02
0.25	4.70E-02	4.43E-28	4.70E-02
0.3833	4.60E-02	9.12E-18	4.60E-02
0.5167	4.60E-02	9.11E-13	4.60E-02
0.65	4.90E-02	8.15E-10	4.10E-02
0.7833	4.10E-02	7.04E-08	4.10E-02
0.9167	4.50E-02	1.67E-06	4.50E-02
1.05	4.78E-02	1.77E-05	4.80E-02
1.183	5.10E-02	1.07E-04	5.09E-02
1.317	6.00E-02	4.62E-04	5.95E-02
1.45	7.00E-02	1.49E-03	6.85E-02
1.583	7.40E-02	3.91E-03	7.01E-02
1.717	7.90E-02	8.84E-03	7.02E-02
1.85	8.90E-02	1.76E-02	7.14E-02
1.983	9.70E-02	3.17E-02	6.53E-02
2.117	1.09E-01	5.30E-02	5.60E-02
2.25	1.27E-01	8.25E-02	4.45E-02
2.383	1.55E-01	1.21E-01	3.38E-02
2.517	1.90E-01	1.70E-01	2.01E-02
2.65	2.32E-01	2.27E-01	4.65E-03
2.783	2.96E-01	2.93E-01	3.08E-03
2.917	3.62E-01	3.66E-01	-3.54E-03
3.05	4.35E-01	4.42E-01	-7.14E-03
3.183	5.12E-01	5.12E-01	-9.10E-03
3.317	5.91E-01	6.01E-01	-9.75E-03
3.45	6.72E-01	6.78E-01	-5.89E-03
3.583	7.48E-01	7.51E-01	-3.28E-03
3.717	8.13E-01	8.20E-01	-6.86E-03
3.85	8.78E-01	8.81E-01	-3.40E-03
3.983	9.34E-01	9.36E-01	-1.56E-03
4.117	9.77E-01	9.82E-01	-5.08E-03
4.25	1.02E+00	1.02E+00	-1.99E-03
4.383	1.047	1.05E+00	-2.64E-03
4.517	1.067	1.07E+00	-4.32E-03
4.65	1.08	1.085	-5.05E-03
4.783	1.085	1.091	-6.46E-03
4.917	1.085	1.091	-6.08E-03
5.05	1.077	1.085	-7.53E-03
5.183	1.066	1.072	-6.45E-03
5.317	1.05E+00	1.06E+00	-3.36E-03
5.45	1.03E+00	1.03E+00	-1.15E-03
5.583	1.011E+00	1.011E+00	-2.33E-03
5.717	9.84E-01	9.81E-01	2.73E-03
5.85	9.55E-01	9.51E-01	4.05E-03
5.983	9.26E-01	9.26E-01	7.31E-03
6.117	8.92E-01	8.85E-01	7.30E-03
6.25	8.61E-01	8.50E-01	1.11E-02
6.383	8.38E-01	8.25E-01	1.16E-02
6.517	7.91E-01	7.78E-01	1.26E-02
6.65	7.55E-01	7.43E-01	1.24E-02
6.783	7.22E-01	7.07E-01	1.50E-02
6.917	6.84E-01	6.72E-01	1.25E-02
7.05	6.48E-01	6.37E-01	1.10E-02
7.183	6.15E-01	6.03E-01	1.17E-02
7.317	5.77E-01	5.70E-01	6.82E-03
7.45	5.44E-01	5.38E-01	5.65E-03
7.583	5.12E-01	5.08E-01	4.40E-03
7.717	4.84E-01	4.78E-01	6.22E-03
7.85	4.52E-01	4.49E-01	2.63E-03
7.983	4.22E-01	4.22E-01	-1.67E-04
8.117	3.93E-01	3.96E-01	3.00E-03
8.25	3.69E-01	3.71E-01	-2.25E-03
8.383	3.43E-01	3.48E-01	-4.71E-03
8.517	3.17E-01	3.25E-01	-8.21E-03
8.65	2.93E-01	3.04E-01	-1.11E-02
8.783	2.71E-01	2.84E-01	-1.30E-02
8.917	2.55E-01	2.65E-01	-1.00E-02
9.05	2.37E-01	2.47E-01	-1.02E-02
9.183	2.22E-01	2.30E-01	-8.41E-03
9.317	2.08E-01	2.15E-01	-8.52E-03
9.45	1.89E-01	2.00E-01	-1.07E-02
9.583	1.74E-01	1.86E-01	-1.18E-02
9.717	1.63E-01	1.73E-01	-9.66E-03
9.85	1.50E-01	1.61E-01	-1.05E-02
9.983	1.38E-01	1.49E-01	-1.30E-02
10.12	1.21E-01	1.32E-01	-1.21E-02
10.25	1.15E-01	1.28E-01	-1.33E-02
10.38	1.09E-01	1.19E-01	-1.02E-02
10.52	1.050E-02	1.10E-01	-1.02E-02
10.65	9.40E-02	1.02E-01	-8.21E-03
10.78	8.50E-02	9.49E-02	-9.85E-03
10.92	7.89E-02	8.75E-02	-9.15E-03
11.05	7.20E-02	8.11E-02	-9.12E-03
11.18	6.90E-02	7.52E-02	-6.20E-03
11.32	6.90E-02	6.93E-02	3.28E-03
11.45	5.80E-02	6.42E-02	-6.18E-03
11.58	5.70E-02	5.94E-02	-2.44E-03
11.72	5.20E-02	5.72E-02	-2.70E-03
11.85	5.20E-02	5.06E-02	1.37E-03
11.98	4.70E-02	4.69E-02	1.46E-04
12.12	4.60E-02	4.31E-02	2.91E-03
12.25	4.40E-02	3.99E-02	4.15E-03
12.38	3.90E-02	3.69E-02	2.15E-03
12.52	3.50E-02	3.39E-02	1.14E-03
12.65	3.40E-02	3.13E-02	2.71E-03

May 2005
D2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E+00
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.7000E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1529E-05
 DISPERSIVITY= 0.6893E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 5.682
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2658

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.2893

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.53E-06	1.50E-06	1.56E-06
X(2)	6.89E-03	6.82E-03	7.37E-03
X(5)	5.682	5.512	5.853

TIME (HOURS) OBS. CONC. CALC. CONC. RESIDUALS

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.50E-01	4.60E-02	5.20E-06	4.60E-02
0.2833	5.50E-02	2.61E-03	5.24E-02
0.4167	7.90E-02	2.63E-02	5.27E-02
0.55	1.56E-01	8.91E-02	6.69E-02
0.8833	2.85E-01	1.91E-01	1.04E-01
0.8167	4.62E-01	3.24E-01	1.38E-01
0.95	6.16E-01	4.76E-01	1.40E-01
1.083	7.40E-01	6.41E-01	9.88E-02
1.217	8.37E-01	8.08E-01	2.93E-02
1.35	0.909	9.50E-01	-4.13E-02
1.483	0.951	1.05E+00	-9.05E-02
1.617	0.997	1.112	-1.15E-01
1.75	1.023	1.139	-1.17E-01
1.883	1.039	1.144	-1.05E-01
2.017	1.044	1.131	-8.73E-02
2.15	1.045	1.108	-6.32E-02
2.283	1.04	1.078	-3.81E-02
2.417	1.031	1.044	-1.37E-02
2.55	1.016	1.007	9.01E-03
2.683	1	0.9692	3.08E-02
2.817	0.979	0.9312	4.78E-02
2.95	0.957	0.8937	6.33E-02
3.083	0.931	0.857	7.40E-02
3.217	0.904	0.8213	8.27E-02
3.35	0.874	0.7869	8.71E-02
3.483	0.842	0.7538	8.82E-02
3.617	0.81	0.7221	8.79E-02
3.75	0.777	0.6917	8.53E-02
3.883	0.742	0.6627	7.93E-02
4.017	0.706	0.6349	7.11E-02
4.15	0.673	0.6085	6.45E-02
4.283	0.638	0.5833	5.47E-02
4.417	0.603	0.5593	4.37E-02
4.55	0.57	0.5364	3.36E-02
4.683	0.537	0.5145	2.25E-02
4.817	0.507	0.4937	1.33E-02
4.95	4.76E-01	0.4739	2.11E-03
5.083	4.48E-01	4.55E-01	-6.98E-03
5.217	4.21E-01	4.37E-01	-1.59E-02
5.35	3.96E-01	4.20E-01	-2.37E-02
5.483	3.73E-01	4.03E-01	-3.03E-02
5.617	3.51E-01	3.88E-01	-3.68E-02
5.75	3.31E-01	3.73E-01	-4.16E-02
5.883	3.13E-01	3.58E-01	-4.53E-02
6.017	2.96E-01	3.45E-01	-4.86E-02
6.15	2.82E-01	3.32E-01	-4.95E-02
6.283	2.68E-01	3.19E-01	-5.10E-02
6.417	2.55E-01	3.07E-01	-5.22E-02
6.55	2.43E-01	2.96E-01	-5.26E-02
6.683	2.32E-01	2.85E-01	-5.26E-02
6.817	2.23E-01	2.74E-01	-5.11E-02
6.95	2.15E-01	2.64E-01	-4.90E-02
7.083	2.07E-01	2.54E-01	-4.74E-02
7.217	2.00E-01	2.45E-01	-4.51E-02
7.35	1.94E-01	2.36E-01	-4.22E-02
7.483	1.87E-01	2.28E-01	-4.07E-02
7.617	1.83E-01	2.20E-01	-3.86E-02
7.75	1.78E-01	2.12E-01	-3.37E-02
7.883	1.73E-01	2.04E-01	-3.12E-02
8.017	1.70E-01	1.97E-01	-2.70E-02
8.15	1.66E-01	1.90E-01	-2.41E-02
8.283	1.62E-01	1.83E-01	-2.14E-02
8.417	1.58E-01	1.77E-01	-1.90E-02
8.55	1.54E-01	1.71E-01	-1.68E-02
8.683	1.50E-01	1.65E-01	-1.49E-02
8.817	1.48E-01	1.59E-01	-1.12E-02
8.95	1.44E-01	1.54E-01	-9.73E-03
9.083	1.42E-01	1.49E-01	-6.46E-03
9.217	1.40E-01	1.43E-01	-3.39E-03
9.35	1.37E-01	1.38E-01	-1.51E-03
9.483	1.36E-01	1.34E-01	2.19E-03
9.617	1.33E-01	1.29E-01	3.72E-03
9.75	1.31E-01	1.25E-01	6.07E-03
9.883	1.29E-01	1.21E-01	8.27E-03
10.02	1.27E-01	1.17E-01	1.03E-02
10.15	1.24E-01	1.13E-01	1.24E-02
10.28	1.23E-01	1.09E-01	1.40E-02
10.42	1.21E-01	1.05E-01	1.56E-02
10.55	1.21E-01	1.02E-01	1.91E-02
10.68	1.20E-01	9.86E-02	2.14E-02
10.82	1.18E-01	9.53E-02	2.27E-02
10.95	1.17E-01	9.22E-02	2.48E-02
11.08	1.16E-01	8.92E-02	2.68E-02
11.22	1.16E-01	8.63E-02	2.98E-02
11.35	1.15E-01	8.34E-02	3.16E-02
11.48	1.13E-01	8.07E-02	3.23E-02
11.62	1.11E-01	7.81E-02	3.29E-02
11.75	1.10E-01	7.55E-02	3.42E-02
11.88	1.08E-01	7.32E-02	3.49E-02
12.02	1.08E-01	7.08E-02	3.72E-02
12.15	1.078E-01	6.85E-02	3.85E-02
12.28	1.04E-01	6.63E-02	3.77E-02
12.42	1.04E-01	6.42E-02	3.98E-02
12.55	1.02E-01	6.22E-02	3.92E-02
12.68	1.01E-01	6.02E-02	4.08E-02

D2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 183
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E+00
 5) THE DISTANCE FROM SOURCE (M) : 0.301

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.7000E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1782E-05
 DISPERSIVITY= 0.2864E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 5.954
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1034

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.1126

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.78E-06	1.76E-06	1.80E-06
X(2)	2.88E-03	2.76E-03	2.98E-03
X(5)	5.95E+00	5.89E+00	6.01E+00

TIME (HOURS) OBS. CONC. CALC. CONC. RESIDUALS

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1167	3.38E-02	5.29E-37	3.38E-02
0.25	3.64E-02	7.85E-17	3.64E-02
0.3833	3.91E-02	1.16E-10	3.91E-02
0.5167	4.17E-02	1.15E-07	4.17E-02
0.65	4.30E-02	6.76E-06	4.73E-02
0.7833	5.70E-02	9.95E-05	5.69E-02
0.9167	6.96E-02	6.70E-04	6.89E-02
1.05	7.77E-02	2.77E-03	8.25E-02
1.183	9.89E-02	8.29E-03	9.06E-02
1.317	1.16E-01	1.99E-02	9.56E-02
1.45	1.33E-01	4.03E-02	9.28E-02
1.583	1.57E-01	7.22E-02	8.46E-02
1.717	1.88E-01	1.18E-01	7.06E-02
1.85	2.31E-01	1.77E-01	5.44E-02
1.983	2.85E-01	2.46E-01	3.70E-02
2.117	3.52E-01	3.29E-01	2.31E-02
2.25	4.30E-01	4.16E-01	1.37E-02
2.383	5.19E-01	5.02E-01	7.00E-03
2.517	5.95E-01	5.95E-01	6.75E-04
2.65	6.75E-01	6.79E-01	-3.73E-03
2.783	7.49E-01	7.56E-01	-7.37E-03
2.917	8.12E-01	8.25E-01	-1.32E-02
3.05	8.66E-01	8.85E-01	-1.90E-02
3.183	9.11E-01	9.34E-01	-2.37E-02
3.317	9.46E-01	9.74E-01	-2.76E-02
3.45	9.73E-01	1.00E+00	-3.03E-02
3.583	9.91E-01	1.02E+00	-3.16E-02
3.717	1.00E+00	1.03E+00	-3.12E-02
3.85	1.01E+00	1.04E+00	-2.77E-02
3.983	1.01E+00	1.03E+00	-1.03E-02
4.117	1.00E+00	1.02E+00	-2.02E-02
4.25	9.95E-01	1.01E+00	-1.37E-02
4.383	0.9931	0.9931	-6.37E-03
4.517	0.9657	9.66E-01	-2.04E-04
4.65	0.9463	0.9394	6.86E-03
4.783	0.925	0.9105	1.45E-02
4.917	0.8996	0.8795	2.01E-02
5.05	0.8732	0.8474	2.58E-02
5.183	0.8439	0.8143	2.96E-02
5.317	8.14E-01	7.80E-01	3.31E-02
5.45	7.83E-01	7.47E-01	3.65E-02
5.583	7.49E-01	7.13E-01	3.70E-02
5.717	7.16E-01	6.79E-01	3.73E-02
5.85	6.82E-01	6.46E-01	3.59E-02
5.983	6.49E-01	6.14E-01	3.49E-02
6.117	6.15E-01	5.82E-01	3.32E-02
6.25	5.82E-01	5.52E-01	3.04E-02
6.383	5.49E-01	5.22E-01	2.67E-02
6.517	5.15E-01	4.93E-01	2.21E-02
6.65	4.83E-01	4.66E-01	1.72E-02
6.783	4.52E-01	4.39E-01	1.22E-02
6.917	4.21E-01	4.14E-01	7.24E-03
7.05	3.92E-01	3.90E-01	1.94E-03
7.183	3.64E-01	3.67E-01	-2.38E-03
7.317	3.37E-01	3.45E-01	-7.74E-03
7.45	3.13E-01	3.24E-01	-1.14E-02
7.583	2.88E-01	3.04E-01	-1.59E-02
7.717	2.68E-01	2.85E-01	-1.75E-02
7.85	2.47E-01	2.68E-01	-2.12E-02
7.983	2.28E-01	2.51E-01	-2.28E-02
8.117	2.10E-01	2.35E-01	-2.53E-02
8.25	1.93E-01	2.20E-01	-2.68E-02
8.383	1.78E-01	2.06E-01	-2.81E-02
8.517	1.65E-01	1.93E-01	-2.82E-02
8.65	1.52E-01	1.80E-01	-2.81E-02
8.783	1.39E-01	1.69E-01	-2.97E-02
8.917	1.31E-01	1.68E-01	-2.71E-02
9.05	1.21E-01	1.47E-01	-2.61E-02
9.183	1.12E-01	1.38E-01	-2.58E-02
9.317	1.05E-01	1.29E-01	-2.40E-02
9.45	9.61E-02	1.20E-01	-2.39E-02
9.583	8.88E-02	1.12E-01	-2.32E-02
9.717	8.34E-02	1.05E-01	-2.11E-02
9.85	7.70E-02	9.75E-02	-2.04E-02
9.983	7.17E-02	9.09E-02	-1.93E-02
10.12	6.63E-02	8.46E-02	-1.73E-02
10.25	6.19E-02	7.90E-02	-1.71E-02
10.38	5.66E-02	7.38E-02	-1.72E-02
10.52	5.22E-02	6.86E-02	-1.73E-02
10.65	4.78E-02	6.40E-02	-1.61E-02
10.78	4.45E-02	5.97E-02	-1.52E-02
10.92	4.11E-02	5.54E-02	-1.47E-02
11.05	3.67E-02	5.17E-02	-1.50E-02
11.18	3.34E-02	4.82E-02	-1.49E-02
11.32	3.02E-02	4.48E-02	-1.47E-02
11.45	2.56E-02	4.17E-02	-1.61E-02
11.58	2.33E-02	3.89E-02	-1.66E-02
11.72	2.09E-02	3.61E-02	-1.62E-02
11.85	1.75E-02	3.37E-02	-1.61E-02

May 2005
D3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.8000E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 15.00
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1493E-05
DISPERSIVITY= 0.4176E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 10.76
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 6.374

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
THE CRITICAL RSS IS: 7.026

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.49E-06	1.42E-06	1.57E-06
X(2)	4.18E-03	3.51E-03	5.01E-03
X(5)	1.08E+01	1.01E+01	1.14E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.33E-02	1.31E-01	1.11E-16	1.31E-01
0.1833	1.87E-01	1.64E-07	1.87E-01
2.83E-01	3.01E-01	8.96E-05	3.01E-01
0.3833	4.21E-01	1.90E-03	4.19E-01
0.4833	4.20E-01	1.16E-02	4.08E-01
0.5833	5.68E-01	3.87E-02	5.29E-01
0.6833	6.58E-01	9.14E-02	5.66E-01
0.7833	7.61E-01	1.74E-01	5.88E-01
0.8833	8.03E-01	2.88E-01	5.15E-01
0.9833	9.96E-01	4.32E-01	5.66E-01
1.0833	1.09E+00	6.01E-01	4.89E-01
1.1833	1.24E+00	7.93E-01	4.48E-01
1.2833	1.30E+00	1.00E+00	2.94E-01
1.3833	1.47E+00	1.22E+00	2.48E-01
1.4833	1.42E+00	1.44E+00	-1.53E-02
1.5833	1.68E+00	1.64E+00	4.29E-02
1.6833	1.61E+00	1.81E+00	-2.00E-01
1.7833	1.75E+00	1.96E+00	-2.13E-01
1.8833	1.82E+00	2.08E+00	-2.55E-01
1.9833	1.88E+00	2.17E+00	-2.95E-01
2.0833	1.96E+00	2.29E+00	-2.76E-01
2.1833	1.97E+00	2.28E+00	-3.12E-01
2.2833	2.00E+00	2.30E+00	-3.01E-01
2.3833	2.03E+00	2.31E+00	-2.91E-01
2.4833	2.05E+00	2.30E+00	-2.53E-01
2.5833	2.06E+00	2.28E+00	-2.22E-01
2.6833	2.13E+00	2.26E+00	-1.28E-01
2.7833	2.16E+00	2.22E+00	-6.10E-02
2.8833	2.07E+00	2.18E+00	-1.06E-01
2.9833	2.16E+00	2.14E+00	2.14E-02
3.0833	2.07E+00	2.09E+00	-1.16E-02
3.1833	2.13E+00	2.03E+00	1.01E-01
3.2833	2.04E+00	1.98E+00	6.28E-02
3.3833	2.10E+00	1.93E+00	1.70E-01
3.4833	2.01E+00	1.87E+00	1.36E-01
3.5833	2.04E+00	1.81E+00	2.27E-01
3.6833	2.01E+00	1.76E+00	2.68E-01
3.7833	1.97E+00	1.70E+00	2.64E-01
3.8833	1.85E+00	1.65E+00	2.05E-01
3.9833	1.88E+00	1.60E+00	2.80E-01
4.0833	1.79E+00	1.54E+00	2.52E-01
4.1833	1.66E+00	1.49E+00	1.73E-01
4.2833	1.67E+00	1.44E+00	2.33E-01
4.3833	1.54E+00	1.39E+00	1.53E-01
4.4833	1.48E+00	1.34E+00	1.34E-01
4.5833	1.42E+00	1.30E+00	1.20E-01
4.6833	1.36E+00	1.25E+00	1.05E-01
4.7833	1.31E+00	1.21E+00	1.05E-01
4.8833	1.26E+00	1.16E+00	1.00E-01
4.9833	1.24E+00	1.12E+00	1.21E-01
5.0833	1.25E+00	1.08E+00	1.71E-01
5.1833	1.17E+00	1.04E+00	1.23E-01
5.2833	1.14E+00	1.01E+00	1.35E-01
5.3833	1.12E+00	9.70E-01	1.54E-01
5.4833	1.10E+00	9.35E-01	1.64E-01
5.5833	1.07E+00	9.02E-01	1.67E-01
5.6833	1.04E+00	8.69E-01	1.67E-01
5.7833	9.92E-01	8.38E-01	1.55E-01
5.8833	1.02E+00	8.07E-01	2.11E-01
5.9833	1.00E+00	7.78E-01	2.24E-01
6.0833	8.72E-01	7.50E-01	1.22E-01
6.1833	8.94E-01	7.23E-01	1.71E-01
6.2833	6.76E-01	6.97E-01	-2.09E-02
6.3833	7.69E-01	6.71E-01	9.82E-02
6.4833	7.05E-01	6.47E-01	5.84E-02
6.5833	6.34E-01	6.23E-01	1.08E-02
6.6833	5.65E-01	6.01E-01	-3.57E-02
6.7833	4.56E-01	5.79E-01	-1.23E-01
6.8833	4.27E-01	5.58E-01	-1.31E-01
6.9833	3.29E-01	5.38E-01	-2.09E-01
7.0833	2.97E-01	5.18E-01	-2.22E-01
7.1833	2.43E-01	5.00E-01	-2.56E-01
7.2833	1.91E-01	4.82E-01	-2.90E-01
7.3833	4.32E-02	4.64E-01	-4.21E-01
7.4833	-3.80E-02	4.47E-01	-4.85E-01
7.5833	-7.07E-03	4.31E-01	-4.38E-01
7.6833	4.38E-02	4.16E-01	-3.72E-01
7.7833	-3.73E-02	4.01E-01	-4.73E-01
7.8833	-4.85E-02	3.86E-01	-4.35E-01
7.9833	-5.86E-02	3.72E-01	-4.31E-01
8.0833	-7.37E-02	3.59E-01	-4.48E-01
8.1833	-8.15E-02	3.46E-01	-4.28E-01
8.2833	-2.70E-02	3.34E-01	-3.61E-01

D3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 92
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3000E-03
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 3.000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1331E-05
DISPERSIVITY= 0.5950E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 16.49
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 3.074

THE F STATISTIC FOR NP= 3 NOBS= 92 IS: 2.72
THE CRITICAL RSS IS: 3.355

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.33E-06	1.29E-06	1.37E-06
X(2)	5.95E-03	5.53E-03	6.43E-03
X(5)	1.65E+01	1.60E+01	1.70E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.0833	4.30E-02	3.67E-34	4.30E-02
0.1833	8.20E-02	2.26E-15	8.20E-02
0.2833	1.56E-01	8.35E-10	1.56E-01
0.3833	2.20E-01	4.00E-07	2.20E-01
0.4833	2.05E-01	1.53E-05	2.05E-01
0.5833	2.95E-01	1.70E-04	2.95E-01
0.6833	3.36E-01	9.44E-04	3.35E-01
0.7833	3.79E-01	3.40E-03	3.76E-01
0.8833	3.80E-01	9.22E-03	3.71E-01
0.9833	4.64E-01	2.05E-02	4.44E-01
1.0833	4.46E-01	3.94E-02	4.07E-01
1.1833	5.53E-01	6.80E-02	4.85E-01
1.2833	5.50E-01	1.08E-01	4.42E-01
1.3833	6.47E-01	1.61E-01	4.86E-01
1.4833	6.33E-01	2.27E-01	4.06E-01
1.5833	7.47E-01	3.07E-01	4.40E-01
1.6833	7.35E-01	4.00E-01	3.35E-01
1.7833	7.78E-01	5.06E-01	2.72E-01
1.8833	8.53E-01	6.23E-01	2.30E-01
1.9833	9.11E-01	7.48E-01	1.63E-01
2.0833	8.91E-01	8.73E-01	1.13E-01
2.1833	1.05E+00	1.01E+00	3.88E-02
2.2833	1.12E+00	1.14E+00	-1.62E-02
2.3833	1.20E+00	1.27E+00	-6.38E-02
2.4833	1.29E+00	1.39E+00	-1.03E-01
2.5833	1.37E+00	1.51E+00	-1.34E-01
2.6833	1.46E+00	1.61E+00	-1.58E-01
2.7833	1.60E+00	1.71E+00	-1.10E-01
2.8833	1.63E+00	1.81E+00	-1.71E-01
2.9833	1.76E+00	1.89E+00	-2.11E-01
3.0833	1.74E+00	1.96E+00	-2.25E-01
3.1833	1.91E+00	2.02E+00	-1.16E-01
3.2833	1.87E+00	2.08E+00	-7.11E-02
3.3833	2.031	2.13E+00	-9.73E-02
3.4833	2.029	2.17E+00	-1.40E-01
3.5833	2.131	2.20E+00	-7.11E-02
3.6833	2.172	2.23E+00	-2.58E-02
3.7833	2.207	2.25E+00	-4.25E-02
3.8833	2.198	2.26E+00	-6.84E-02
3.9833	2.26E+00	2.27E+00	-1.22E-01
4.0833	2.26E+00	2.28E+00	-1.63E-02
4.1833	2.24E+00	2.28E+00	-4.20E-02
4.2833	2.28E+00	2.28E+00	-2.87E-02
4.3833	2.26E+00	2.27E+00	-1.19E-02
4.4833	2.26E+00	2.26E+00	2.08E-03
4.5833	2.27E+00	2.25E+00	1.59E-02
4.6833	2.26E+00	2.23E+00	3.25E-02
4.7833	2.26E+00	2.21E+00	4.43E-02
4.8833	2.25E+00	2.19E+00	5.52E-02
4.9833	2.30E+00	2.17E+00	1.27E-01
5.0833	2.26E+00	2.15E+00	1.08E-01
5.1833	2.21E+00	2.12E+00	8.41E-02
5.2833	2.19E+00	2.10E+00	9.00E-02
5.3833	2.17E+00	2.07E+00	9.51E-02
5.4833	2.14E+00	2.04E+00	1.00E-01
5.5833	2.12E+00	2.01E+00	1.04E-01
5.6833	2.09E+00	1.99E+00	1.02E-01
5.7833	2.04E+00	1.96E+00	8.00E-02
5.8833	2.06E+00	1.93E+00	1.38E-01
5.9833	2.05E+00	1.89E+00	1.51E-01
6.0833	1.91E+00	1.86E+00	4.60E-02
6.1833	1.97E+00	1.83E+00	1.37E-01
6.2833	1.87E+00	1.80E+00	7.12E-02
6.3833	1.89E+00	1.77E+00	1.20E-01
6.4833	1.85E+00	1.74E+00	1.14E-01
6.5833	1.81E+00	1.71E+00	1.05E-01
6.6833	1.77E+00	1.68E+00	9.78E-02
6.7833	1.72E+00	1.65E+00	7.06E-02
6.8833	1.70E+00	1.62E+00	8.22E-02
6.9833	1.64E+00	1.58E+00	5.76E-02
7.0833	1.62E+00	1.55E+00	6.98E-02
7.1833	1.62E+00	1.52E+00	9.06E-02
7.2833	1.45E+00	1.50E+00	-4.28E-02
7.3833	1.49E+00	1.47E+00	2.14E-02
7.4833	1.46E+00	1.44E+00	2.52E-02
7.5833	1.42E+00	1.41E+00	1.07E-02
7.6833	1.40E+00	1.38E+00	1.59E-02
7.7833	1.33E+00	1.34E+00	-1.54E-02
7.8833	1.30E+00	1.33E+00	-2.91E-02
7.9833	1.25E+00	1.30E+00	-4.51E-02
8.0833	1.21E+00	1.27E+00	-3.38E-02
8.1833	1.17E+00	1.25E+00	-8.05E-02
8.2833	1.16E+00	1.22E+00	-5.99E-02
8.3833	1.14E+00	1.20E+00	-5.66E-02
8.4833	1.05E+00	1.17E+00	-1.04E-01
8.5833	1.05E+00	1.15E+00	-9.84E-02
8.6833	8.99E-01	1.12E+00	-2.22E-01
8.7833	9.57E-01	1.10E+00	-1.41E-01
8.8833	8.54E-01	1.08E+00	-2.21E-01
8.9833	8.66E-01	1.05E+00	-1.86E-01
9.0833	8.19E-01	1.03E+00	-2.11E-01
9.1833	7.82E-01	1.01E+00	-2.26E-01

May 2005
E1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.8000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1974E-05
DISPERSIVITY= 1.203E-02
WIDTH= 0.8000E-02
RF= 1.000
CO= 0.1538
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.6809E-02

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.7397E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.97E-06	1.93E-06	2.01E-06
X(2)	1.20E-03	1.01E-03	1.44E-03
X(5)	0.1538	0.1481	0.1615

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.17E-01	1.63E-03	4.1E-14	1.63E-03
0.2667	1.56E-03	7.43E-12	1.56E-03
0.3167	1.50E-03	5.41E-10	1.50E-03
0.3667	-5.60E-04	1.22E-08	-5.60E-04
0.4167	3.38E-03	1.31E-07	3.38E-03
0.4667	3.32E-03	8.34E-07	3.32E-03
0.5167	2.25E-03	3.71E-06	2.25E-03
0.5667	2.19E-03	1.26E-05	2.19E-03
0.6167	9.76E-03	1.45E-03	8.31E-03
0.6667	5.07E-03	8.31E-05	4.99E-03
0.7167	8.01E-03	1.74E-04	7.83E-03
0.7667	5.95E-03	3.30E-04	5.62E-03
0.8167	5.88E-03	5.77E-04	5.31E-03
0.8667	9.82E-03	9.42E-04	8.88E-03
0.9167	9.76E-03	1.45E-03	8.31E-03
0.9667	2.7E-02	2.43E-03	1.06E-02
1.017	1.76E-02	3.02E-03	1.46E-02
1.067	1.58E-02	4.11E-03	1.15E-02
1.117	1.95E-02	5.43E-03	1.41E-02
1.167	2.15E-02	6.99E-03	1.45E-02
1.217	2.24E-02	8.79E-03	1.38E-02
1.267	2.13E-02	1.08E-02	1.05E-02
1.317	3.03E-02	1.31E-02	1.72E-02
1.367	2.62E-02	1.72E-02	3.78E-02
1.417	3.11E-02	1.83E-02	1.29E-02
1.467	3.41E-02	2.12E-02	1.29E-02
1.517	3.40E-02	3.40E-02	9.79E-03
1.567	3.80E-02	2.75E-02	1.05E-02
1.617	3.89E-02	3.08E-02	8.09E-03
1.667	3.88E-02	3.58E-02	4.75E-03
1.717	3.88E-02	3.78E-02	9.62E-04
1.767	4.17E-02	4.14E-02	3.05E-04
1.817	4.37E-02	4.37E-02	-4.58E-03
1.867	4.26E-02	4.86E-02	-6.04E-03
1.917	4.25E-02	5.22E-02	-9.63E-03
1.967	4.56E-02	5.55E-02	-9.12E-03
2.017	4.54E-02	5.89E-02	-1.35E-02
2.067	4.73E-02	6.20E-02	-1.46E-02
2.117	4.73E-02	6.48E-02	-1.75E-02
2.167	4.82E-02	6.74E-02	-1.92E-02
2.217	5.22E-02	6.98E-02	-1.76E-02
2.267	5.71E-02	7.18E-02	-1.47E-02
2.317	6.20E-02	7.35E-02	-1.15E-02
2.367	7.10E-02	7.49E-02	-3.91E-03
2.417	7.99E-02	7.59E-02	-2.03E-03
2.467	8.08E-02	7.87E-02	4.18E-03
2.517	8.78E-02	7.71E-02	1.07E-02
2.567	9.07E-02	7.72E-02	1.35E-02
2.617	9.47E-02	7.71E-02	1.76E-02
2.667	9.36E-02	7.66E-02	1.70E-02
2.717	9.15E-02	7.59E-02	1.56E-02
2.767	8.85E-02	7.50E-02	1.34E-02
2.817	8.64E-02	7.39E-02	1.25E-02
2.867	8.34E-02	7.27E-02	1.07E-02
2.917	7.93E-02	7.12E-02	8.08E-03
2.967	7.22E-02	6.96E-02	2.61E-03
3.017	6.92E-02	6.79E-02	1.25E-03
3.067	6.61E-02	6.61E-02	5.92E-07
3.117	6.10E-02	6.42E-02	-3.17E-03
3.167	5.80E-02	6.23E-02	-4.28E-03
3.217	5.49E-02	6.03E-02	-5.35E-03
3.267	5.39E-02	5.82E-02	-4.37E-03
3.317	4.98E-02	5.62E-02	-6.37E-03
3.367	4.87E-02	5.41E-02	-5.37E-03
3.417	4.67E-02	5.20E-02	-5.36E-03
3.467	4.46E-02	5.00E-02	-5.37E-03
3.517	4.35E-02	4.80E-02	-4.41E-03
3.567	4.05E-02	4.59E-02	-5.46E-03
3.617	4.14E-02	4.40E-02	-2.55E-03
3.667	3.74E-02	4.20E-02	-4.68E-03
3.717	3.93E-02	4.01E-02	-8.45E-04
3.767	3.82E-02	3.83E-02	-7.18E-05
3.817	3.62E-02	3.65E-02	-3.40E-04
3.867	3.41E-02	3.48E-02	-6.61E-04
3.917	3.20E-02	3.31E-02	9.64E-04
3.967	3.20E-02	3.15E-02	5.32E-04
4.017	3.39E-02	2.99E-02	4.03E-03
4.067	2.99E-02	2.89E-02	1.41E-03
4.117	2.98E-02	2.89E-02	2.88E-03
4.167	2.77E-02	2.65E-02	2.22E-03
4.217	2.82E-02	2.67E-02	2.51E-03
4.267	2.46E-02	2.29E-02	1.72E-03
4.317	2.26E-02	2.17E-02	8.78E-04
4.367	2.05E-02	2.05E-02	-8.66E-06
4.417	2.04E-02	1.94E-02	1.05E-03
4.467	1.64E-02	1.83E-02	-1.94E-03
4.517	1.43E-02	1.73E-02	-2.98E-03
4.567	1.52E-02	1.63E-02	-1.09E-03
4.617	1.52E-02	1.54E-02	-2.24E-04
4.667	1.21E-02	1.45E-02	-2.41E-03
4.717	1.01E-02	1.37E-02	-3.64E-03
4.767	1.00E-02	1.29E-02	-2.91E-03
4.817	7.94E-03	1.22E-02	-4.23E-03
4.867	5.87E-03	1.15E-02	-5.58E-03
4.917	6.81E-03	1.08E-02	-3.97E-03
4.967	2.76E-03	1.02E-02	-7.40E-03
5.017	2.69E-03	9.55E-03	-6.86E-03

E1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : -0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1808E-05
DISPERSIVITY= 0.3800E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.9041
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3300E-01

THE F STATISTIC FOR NP= 2 NOBS= 94 IS: 702
THE CRITICAL RSS IS: 0.3351E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.81E-06	1.77E-06	1.85E-06
X(5)	9.04E-01	8.77E-01	9.31E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.3167	1.61E-03	1.51E-11	1.61E-03
0.3667	1.61E-03	3.36E-08	1.61E-03
0.4167	2.20E-02	2.20E-02	1.60E-02
0.4667	2.19E-02	3.20E-05	2.18E-02
0.5167	2.88E-02	1.98E-04	2.86E-02
0.5667	3.97E-02	7.92E-04	3.69E-02
0.6167	3.36E-02	2.07E-03	4.18E-02
0.6667	5.15E-02	4.59E-03	4.69E-02
0.7167	5.64E-02	8.71E-03	4.77E-02
0.7667	6.43E-02	1.48E-02	4.95E-02
0.8167	7.32E-02	2.28E-02	5.04E-02
0.8667	7.61E-02	3.26E-02	4.35E-02
0.9167	8.80E-02	4.38E-02	4.42E-02
0.9667	9.09E-02	5.57E-02	3.52E-02
1.017	9.88E-02	6.79E-02	3.09E-02
1.067	1.02E-01	7.99E-02	2.18E-02
1.117	1.10E-01	9.12E-02	1.85E-02
1.167	1.01E-01	1.01E-01	9.08E-03
1.217	1.11E-01	1.11E-01	1.81E-03
1.267	1.18E-01	1.18E-01	-9.93E-05
1.317	1.15E-01	1.25E-01	-9.69E-03
1.367	1.18E-01	1.30E-01	-1.20E-02
1.417	1.22E-01	1.34E-01	-1.22E-02
1.467	1.19E-01	1.39E-01	-1.80E-02
1.517	1.20E-01	1.39E-01	-1.89E-02
1.567	1.18E-01	1.39E-01	-2.17E-02
1.617	1.19E-01	1.39E-01	-2.07E-02
1.667	1.16E-01	1.38E-01	-2.19E-02
1.717	1.16E-01	1.37E-01	-2.05E-02
1.767	1.16E-01	1.32E-01	-1.98E-02
1.817	1.14E-01	1.29E-01	-1.53E-02
1.867	1.10E-01	1.26E-01	-1.86E-02
1.917	1.09E-01	1.23E-01	-1.28E-02
1.967	1.08E-01	1.19E-01	-1.03E-02
2.017	1.03E-01	0.1152	-2.59E-03
2.067	1.035	0.1113	-7.77E-03
2.117	0.1014	0.1073	-5.92E-03
2.167	0.1013	0.1034	-2.05E-02
2.217	9.92E-02	9.94E-02	-1.20E-04
2.267	9.71E-02	9.54E-02	1.73E-03
2.317	8.24E-02	6.97E-02	1.27E-02
2.367	9.29E-02	8.76E-02	5.29E-03
2.417	9.08E-02	8.39E-02	6.96E-03
2.467	8.87E-02	8.2E-02	6.92E-03
2.517	8.66E-02	7.66E-02	1.00E-02
2.567	8.45E-02	7.31E-02	1.14E-02
2.617	8.24E-02	6.97E-02	1.27E-02
2.667	7.83E-02	6.65E-02	1.19E-02
2.717	7.82E-02	6.33E-02	1.49E-02
2.767	7.81E-02	6.03E-02	1.79E-02
2.817	7.40E-02	5.73E-02	1.67E-02
2.867	6.99E-02	5.45E-02	1.54E-02
2.917	6.78E-02	5.18E-02	1.60E-02
2.967	6.57E-02	4.92E-02	1.65E-02
3.017	6.36E-02	4.68E-02	1.69E-02
3.067	6.15E-02	4.44E-02	1.71E-02
3.117	5.94E-02	4.21E-02	1.73E-02
3.167	5.73E-02	4.00E-02	1.74E-02
3.217	5.52E-02	3.79E-02	1.73E-02
3.267	5.21E-02	3.59E-02	1.62E-02
3.317	5.00E-02	3.40E-02	1.60E-02
3.367	4.69E-02	3.23E-02	1.47E-02
3.417	4.58E-02	3.06E-02	1.53E-02
3.467	4.37E-02	2.89E-02	1.48E-02
3.517	4.06E-02	2.74E-02	1.32E-02
3.567	4.15E-02	2.60E-02	1.56E-02
3.617	3.94E-02	2.46E-02	1.49E-02
3.667	3.93E-02	2.33E-02	1.61E-02
3.717	3.52E-02	2.20E-02	1.32E-02
3.767	3.31E-02	2.08E-02	1.23E-02
3.817	3.00E-02	1.97E-02	1.03E-02
3.867	2.79E-02	1.86E-02	9.30E-03
3.917	2.58E-02	1.76E-02	8.19E-03
3.967	2.67E-02	1.67E-02	1.00E-02
4.017	2.46E-02	1.57E-02	8.88E-03
4.067	2.35E-02	1.49E-02	8.62E-03
4.117	2.14E-02	1.41E-02	7.32E-03
4.167	2.03E-02	1.33E-02	7.03E-03
4.217	1.92E-02	1.26E-02	6.64E-03
4.267	1.71E-02	1.19E-02	5.21E-03
4.317	1.60E-02	1.12E-02	4.80E-03
4.367	1.59E-02	1.06E-02	4.30E-03
4.417	1.38E-02	1.00E-02	3.71E-03
4.467	1.37E-02	9.45E-03	4.25E-03
4.517	1.16E-02	8.94E-03	2.66E-03
4.567	9.49E-03	8.45E-03	1.04E-03
4.617	7.39E-03	7.96E-03	-5.68E-04
4.667	7.29E-03	7.53E-03	-2.37E-04
4.717	7.19E-03	7.19E-03	-1.93E-03
4.767	7.09E-03	6.71E-03	-3.86E-04
4.817	2.99E-03	6.34E-03	-3.35E-03
4.867	2.23E-04	6.23E-03	-5.71E-03
4.917	-1.21E-03	6.65E-03	-6.86E-03

May 2005
E2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1850E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.6000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 10.00
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.6212E-06
 DISPERSIVITY= 0.1310E-01
 WIDTH= 0.6000E-02
 RF= 1.000
 CO= 10.00
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 13.61

THE F STATISTIC FOR NP= 2 NOBS= 95 IS: .626
 THE CRITICAL RSS IS: 13.79

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	6.21E-07	6.03E-07	6.40E-07
X(2)	1.31E-02	1.22E-02	1.40E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1167	0.1564	3.46E-08	0.1564
2.50E-01	2.74E-01	2.74E-01	0.0000
0.3833	4.21E-01	1.07E-02	4.10E-01
0.5167	5.89E-01	4.78E-02	5.32E-01
0.65	7.43E-01	1.18E-01	6.24E-01
0.7833	8.99E-01	2.19E-01	6.81E-01
0.9167	1.05E+00	3.41E-01	7.04E-01
1.05	1.18E+00	4.78E-01	7.03E-01
1.183	1.30E+00	6.25E-01	6.80E-01
1.317	1.41E+00	7.77E-01	6.37E-01
1.45	1.51E+00	9.31E-01	5.81E-01
1.583	1.60E+00	1.09E+00	5.15E-01
1.717	1.68E+00	1.24E+00	4.40E-01
1.85	1.75E+00	1.39E+00	3.60E-01
1.983	1.81E+00	1.54E+00	2.75E-01
2.117	1.87E+00	1.68E+00	1.84E-01
2.25	1.92E+00	1.82E+00	9.37E-02
2.383	1.96E+00	1.96E+00	1.58E-03
2.517	2.00E+00	2.10E+00	-9.48E-02
2.65	2.04E+00	2.23E+00	-1.91E-01
2.783	2.07E+00	2.35E+00	-2.86E-01
2.917	2.09E+00	2.52E+00	-3.41E-01
3.05	2.11E+00	2.69E+00	-4.74E-01
3.183	2.13E+00	2.87E+00	-5.37E-01
3.317	2.16E+00	3.05E+00	-5.74E-01
3.45	2.16E+00	3.23E+00	-5.99E-01
3.583	2.17E+00	3.41E+00	-5.45E-01
3.717	2.17E+00	3.59E+00	-5.07E-01
3.85	2.18E+00	3.78E+00	-4.58E-01
3.983	2.18E+00	3.96E+00	-4.00E-01
4.117	2.18E+00	4.14E+00	-3.41E-01
4.25	2.18E+00	4.32E+00	-2.80E-01
4.383	2.18E+00	4.50E+00	-2.21E-01
4.517	2.18E+00	4.68E+00	-1.61E-01
4.65	2.17E+00	4.86E+00	-1.04E-01
4.783	2.16E+00	5.04E+00	-5.13E-02
4.917	2.14E+00	5.22E+00	6.19E-02
5.05	2.14E+00	5.40E+00	1.47E-01
5.183	2.13E+00	5.58E+00	2.61E-01
5.317	2.12E+00	5.76E+00	3.61E-01
5.45	2.10E+00	5.94E+00	4.47E-01
5.583	2.09E+00	6.12E+00	5.19E-01
5.717	2.07E+00	6.30E+00	5.77E-01
5.85	2.05E+00	6.48E+00	6.26E-01
5.983	2.03E+00	6.66E+00	6.67E-01
6.117	2.01E+00	6.84E+00	6.99E-01
6.25	1.99E+00	7.02E+00	7.23E-01
6.383	1.97E+00	7.20E+00	7.39E-01
6.517	1.95E+00	7.38E+00	7.47E-01
6.65	1.92E+00	7.56E+00	7.47E-01
6.783	1.90E+00	7.74E+00	7.39E-01
6.917	1.87E+00	7.92E+00	7.14E-01
7.05	1.84E+00	8.10E+00	6.74E-01
7.183	1.81E+00	8.28E+00	6.20E-01
7.317	1.78E+00	8.46E+00	5.54E-01
7.45	1.75E+00	8.64E+00	4.77E-01
7.583	1.72E+00	8.82E+00	3.90E-01
7.717	1.68E+00	9.00E+00	2.93E-01
7.85	1.65E+00	9.18E+00	1.87E-01
7.983	1.61E+00	9.36E+00	7.4E-02
8.117	1.57E+00	9.54E+00	-3.49E-02
8.25	1.53E+00	9.72E+00	-1.26E-01
8.383	1.49E+00	9.90E+00	-2.47E-01
8.517	1.45E+00	1.008E+00	-4.04E-01
8.65	1.41E+00	1.026E+00	-5.97E-01
8.783	1.36E+00	1.044E+00	-8.16E-01
8.917	1.32E+00	1.062E+00	-1.05E-01
9.05	1.27E+00	1.080E+00	-1.30E-01
9.183	1.23E+00	1.098E+00	-1.56E-01
9.317	1.18E+00	1.116E+00	-1.83E-01
9.45	1.13E+00	1.134E+00	-2.11E-01
9.583	1.08E+00	1.152E+00	-2.40E-01
9.717	1.04E+00	1.170E+00	-2.70E-01
9.85	9.88E-01	1.188E+00	-3.01E-01
9.983	9.38E-01	1.206E+00	-3.33E-01
10.12	8.90E-01	1.224E+00	-3.66E-01
10.25	8.38E-01	1.242E+00	-4.00E-01
10.38	7.88E-01	1.260E+00	-4.35E-01
10.52	7.39E-01	1.278E+00	-4.71E-01
10.65	6.89E-01	1.296E+00	-5.08E-01
10.78	6.39E-01	1.314E+00	-5.46E-01
10.92	5.90E-01	1.332E+00	-5.84E-01
11.05	5.41E-01	1.350E+00	-6.23E-01
11.18	4.94E-01	1.368E+00	-6.62E-01
11.32	4.44E-01	1.386E+00	-7.02E-01
11.45	3.99E-01	1.404E+00	-7.43E-01
11.58	3.53E-01	1.422E+00	-7.84E-01
11.72	3.08E-01	1.440E+00	-8.26E-01
11.85	2.63E-01	1.458E+00	-8.69E-01
11.98	2.23E-01	1.476E+00	-9.13E-01
12.12	1.81E-01	1.494E+00	-9.58E-01
12.25	1.38E-01	1.512E+00	-1.004E-01
12.38	9.88E-02	1.530E+00	-1.051E-01
12.52	6.04E-02	1.548E+00	-1.100E-01
12.65	2.20E-02	1.566E+00	-1.150E-01

E2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2900E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : -0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.6821E-06
 DISPERSIVITY= 0.3800E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 11.53
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5092E-01

THE F STATISTIC FOR NP= 2 NOBS= 98 IS: .396
 THE CRITICAL RSS IS: 0.5134E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	6.82E-07	6.82E-07	6.82E-07
X(5)	1.15E+01	1.15E+01	1.15E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3	1.40E-02	6.97E-02	-5.57E-02
3.1	3.90E-02	8.77E-02	-5.24E-02
3.20E+00	5.50E-02	1.03E-01	-4.83E-02
3.3	7.80E-02	1.34E-01	-4.55E-02
3.4	1.03E-01	1.46E-01	-4.31E-02
3.5	1.31E-01	1.71E-01	-4.01E-02
3.6	1.95E-01	1.95E-01	-3.36E-02
3.7	1.94E-01	2.29E-01	-3.45E-02
3.8	2.32E-01	2.61E-01	-2.90E-02
3.9	2.71E-01	2.96E-01	-2.48E-02
4	3.09E-01	3.33E-01	-2.38E-02
4.1	3.52E-01	3.72E-01	-2.01E-02
4.2	3.95E-01	4.13E-01	-1.83E-02
4.3	4.42E-01	4.56E-01	-1.44E-02
4.4	4.93E-01	5.01E-01	-8.13E-03
4.5	5.43E-01	5.47E-01	-4.26E-03
4.6	5.92E-01	5.95E-01	-2.69E-03
4.7	6.40E-01	6.43E-01	-2.89E-03
4.8	6.83E-01	6.92E-01	-4.08E-03
4.9	7.50E-01	7.42E-01	-8.52E-03
5	8.02E-01	7.91E-01	1.07E-02
5.1	8.53E-01	8.41E-01	-1.18E-02
5.2	9.02E-01	8.91E-01	-1.10E-02
5.3	9.54E-01	9.41E-01	1.35E-02
5.4	1.00E+00	9.90E-01	-1.45E-02
5.5	1.05E+00	1.04E+00	1.52E-02
5.6	1.10E+00	1.09E+00	1.57E-02
5.7	1.15E+00	1.13E+00	1.61E-02
5.8	1.19E+00	1.18E+00	1.47E-02
5.9	1.24E+00	1.22E+00	1.64E-02
6	1.27E+00	1.27E+00	1.24E-02
6.1	1.32E+00	1.31E+00	1.28E-02
6.2	1.36E+00	1.35E+00	1.06E-02
6.3	1.39E+00	1.39E+00	1.39E-02
6.4	1.429	1.42E+00	6.84E-03
6.5	1.461	1.46E+00	3.31E-03
6.6	1.492	1.49E+00	3.95E-04
6.7	1.524	1.524	1.524E-04
6.8	1.554	1.554	-5.00E-04
6.9	1.583	1.583	-1.34E-03
7	1.60E+00	1.61E+00	-7.78E-03
7.1	1.63E+00	1.64E+00	-7.45E-03
7.2	1.65E+00	1.65E+00	-8.48E-03
7.3	1.67E+00	1.68E+00	-8.90E-03
7.4	1.69E+00	1.70E+00	-1.27E-02
7.5	1.71E+00	1.72E+00	-1.40E-02
7.6	1.73E+00	1.74E+00	-1.57E-02
7.7	1.74E+00	1.76E+00	-1.69E-02
7.8	1.77E+00	1.77E+00	-1.58E-02
7.9	1.77E+00	1.79E+00	-1.59E-02
8	1.78E+00	1.80E+00	-1.48E-02
8.1	1.80E+00	1.81E+00	-1.14E-02
8.2	1.80E+00	1.82E+00	-1.26E-02
8.3	1.82E+00	1.82E+00	-9.48E-03
8.4	1.82E+00	1.83E+00	-9.17E-03
8.5	1.83E+00	1.84E+00	-7.65E-03
8.6	1.84E+00	1.84E+00	-5.97E-03
8.7	1.84E+00	1.84E+00	-6.18E-03
8.8	1.84E+00	1.85E+00	-4.31E-03
8.9	1.85E+00	1.85E+00	5.96E-04
9	1.85E+00	1.85E+00	3.49E-03
9.1	1.85E+00	1.85E+00	4.35E-03
9.2	1.85E+00	1.85E+00	4.11E-03
9.3	1.85E+00	1.84E+00	9.75E-03
9.4	1.85E+00	1.84E+00	1.12E-02
9.5	1.85E+00	1.83E+00	1.35E-02
9.6	1.84E+00	1.83E+00	1.25E-02
9.7	1.84E+00	1.82E+00	1.43E-02
9.8	1.83E+00	1.82E+00	1.68E-02
9.9	1.83E+00	1.81E+00	1.89E-02
10	1.82E+00	1.80E+00	1.96E-02
10.1	1.82E+00	1.79E+00	2.10E-02
10.2	1.81E+00	1.79E+00	2.08E-02
10.3	1.80E+00	1.78E+00	2.53E-02
10.4	1.79E+00	1.77E+00	2.32E-02
10.5	1.78E+00	1.76E+00	2.56E-02
10.6	1.77E+00	1.75E+00	2.54E-02
10.7	1.76E+00	1.73E+00	2.47E-02
10.8	1.75E+00	1.72E+00	2.53E-02
10.9	1.73E+00	1.71E+00	2.13E-02
11	1.72E+00	1.70E+00	2.17E-02
11.1	1.71E+00	1.69E+00	2.17E-02
11.2	1.69E+00	1.67E+00	2.04E-02
11.3	1.68E+00	1.66E+00	1.76E-02
11.4	1.66E+00	1.65E+00	1.61E-02
11.5	1.64E+00	1.63E+00	9.88E-03
11.6	1.62E+00	1.62E+00	6.85E-03
11.7	1.61E+00	1.61E+00	3.01E-03
11.8	1.58E+00	1.59E+00	-6.64E-03
11.9	1.56E+00	1.57E+00	-1.21E-02
12	1.54E+00	1.54E+00	-1.85E-02
12.1	1.52E+00	1.55E+00	-2.37E-02
12.2			

May 2005
E3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS
6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : -0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1142E-05
DISPERSIVITY= 0.3800E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.2000
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1386

THE F STATISTIC FOR NP= 1 NOBS= 94 IS: 3.95
THE CRITICAL RSS IS: 0.1445

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.14E-06	9.71E-07	1.38E-06

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.2833	4.90E-02	1.43E-08	4.90E-02
0.4167	5.00E-02	2.82E-06	5.00E-02
5.50E-01	5.40E-02	4.41E-05	5.40E-02
0.6833	5.60E-02	2.40E-04	5.58E-02
0.8167	5.90E-02	7.60E-04	5.82E-02
0.95	1.75E-02	1.75E-02	6.23E-02
1.083	6.50E-02	3.30E-03	6.17E-02
1.217	7.10E-02	5.45E-03	6.56E-02
1.35	7.30E-02	3.93E-02	5.27E-02
1.483	7.90E-02	1.13E-02	6.77E-02
1.617	8.10E-02	1.50E-02	6.60E-02
1.75	1.90E-02	4.31E-02	5.09E-02
1.883	8.90E-02	2.31E-02	6.59E-02
2.017	8.90E-02	2.72E-02	6.18E-02
2.15	3.09E-02	5.1E-02	5.98E-02
2.283	8.90E-02	3.42E-02	5.48E-02
2.417	9.10E-02	3.70E-02	5.40E-02
2.55	9.20E-02	3.93E-02	5.27E-02
2.683	9.30E-02	4.10E-02	5.20E-02
2.817	9.40E-02	4.23E-02	5.17E-02
2.95	9.40E-02	4.31E-02	4.89E-02
3.083	9.40E-02	4.36E-02	5.04E-02
3.217	9.40E-02	4.37E-02	5.03E-02
3.35	9.40E-02	4.36E-02	5.04E-02
3.483	9.20E-02	4.38E-02	4.89E-02
3.617	9.20E-02	4.27E-02	4.93E-02
3.75	9.20E-02	4.21E-02	5.00E-02
3.883	9.00E-02	4.13E-02	4.71E-02
4.017	8.70E-02	4.04E-02	4.66E-02
4.15	8.80E-02	3.94E-02	4.86E-02
4.283	8.60E-02	3.84E-02	4.76E-02
4.417	8.40E-02	3.73E-02	4.67E-02
4.55	8.20E-02	3.63E-02	4.57E-02
4.683	8.00E-02	3.52E-02	4.48E-02
4.817	7.90E-02	3.41E-02	4.49E-02
4.95	7.60E-02	3.30E-02	4.30E-02
5.083	7.50E-02	3.19E-02	4.31E-02
5.217	7.20E-02	3.08E-02	4.12E-02
5.35	7.00E-02	2.98E-02	4.02E-02
5.483	6.70E-02	2.87E-02	3.93E-02
5.617	6.70E-02	2.77E-02	3.93E-02
5.75	6.30E-02	2.67E-02	3.63E-02
5.883	6.20E-02	2.58E-02	3.58E-02
6.017	5.70E-02	2.48E-02	3.22E-02
6.15	5.70E-02	2.39E-02	3.31E-02
6.283	5.50E-02	2.30E-02	3.20E-02
6.417	5.10E-02	2.21E-02	2.89E-02
6.55	5.00E-02	2.13E-02	2.87E-02
6.683	4.80E-02	2.05E-02	2.75E-02
6.817	4.60E-02	1.97E-02	2.63E-02
6.95	4.20E-02	1.90E-02	2.30E-02
7.083	4.20E-02	1.82E-02	2.38E-02
7.217	3.80E-02	1.75E-02	2.05E-02
7.35	3.80E-02	1.69E-02	2.11E-02
7.483	3.40E-02	1.62E-02	1.78E-02
7.617	3.30E-02	1.56E-02	1.74E-02
7.75	3.00E-02	1.50E-02	1.50E-02
7.883	2.60E-02	1.44E-02	1.16E-02
8.017	2.70E-02	1.38E-02	1.32E-02
8.15	2.40E-02	1.33E-02	1.07E-02
8.283	2.30E-02	1.28E-02	1.02E-02
8.417	1.90E-02	1.23E-02	6.72E-03
8.55	1.80E-02	1.18E-02	6.20E-03
8.683	1.50E-02	1.13E-02	3.66E-03
8.817	1.40E-02	1.09E-02	3.10E-03
8.95	1.10E-02	1.05E-02	5.26E-04
9.083	1.20E-02	1.01E-02	1.93E-03
9.217	9.00E-03	9.67E-03	-6.70E-04
9.35	8.00E-03	9.29E-03	-1.29E-03
9.483	7.00E-03	8.93E-03	-1.93E-03
9.617	4.00E-03	8.58E-03	-4.58E-03
9.75	2.00E-03	8.25E-03	-6.25E-03
9.883	-1.00E-03	7.92E-03	-8.92E-03
10.02	-2.00E-03	7.61E-03	-9.61E-03
10.15	-4.00E-03	7.32E-03	-1.13E-02
10.28	-6.00E-03	7.04E-03	-1.30E-02
10.42	-8.00E-03	6.75E-03	-1.45E-02
10.55	-8.00E-03	6.49E-03	-1.45E-02
10.68	-1.00E-02	6.24E-03	-1.45E-02
10.82	-1.20E-02	5.99E-03	-1.45E-02
10.95	-1.30E-02	5.76E-03	-1.88E-02
11.08	-1.30E-02	5.54E-03	-1.85E-02
11.22	-1.40E-02	5.32E-03	-1.93E-02
11.35	-1.90E-02	5.11E-03	-2.41E-02
11.48	-1.80E-02	4.92E-03	-2.29E-02
11.62	-2.10E-02	4.72E-03	-2.57E-02
11.75	-2.10E-02	4.54E-03	-2.58E-02
11.88	-2.50E-02	4.37E-03	-2.94E-02
12.02	-2.50E-02	4.19E-03	-2.92E-02
12.15	-2.80E-02	4.04E-03	-3.20E-02
12.28	-2.90E-02	3.88E-03	-3.29E-02
12.42	-2.90E-02	3.72E-03	-3.27E-02
12.55	-3.10E-02	3.58E-03	-3.46E-02
12.68	-3.30E-02	3.45E-03	-3.65E-02

E3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS
6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-03
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1596E-05
DISPERSIVITY= 0.1433E-01
WIDTH= 0.8000E-03
RF= 1.000
CO= 7.999
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5082E-01

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71
THE CRITICAL RSS IS: 0.5537E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.60E-06	1.45E-06	1.77E-06
X(2)	1.43E-02	1.18E-02	1.76E-02
X(5)	8.00E+00	7.36E+00	8.64E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1167	8.40E-02	3.81E-11	8.40E-02
2.50E-01	8.40E-02	2.29E-05	8.40E-02
0.3833	8.90E-02	1.43E-03	8.76E-02
0.5167	8.80E-02	9.90E-03	7.81E-02
0.65	9.20E-02	2.78E-02	6.42E-02
0.7833	5.60E-02	5.07E-02	4.53E-02
0.9167	9.80E-02	7.38E-02	2.42E-02
1.05	1.03E-01	9.41E-02	8.89E-03
1.183	1.08E-01	1.11E-01	-2.57E-03
1.317	1.10E-01	1.24E-01	-1.36E-02
1.45	1.16E-01	1.33E-01	-1.70E-02
1.583	1.15E-01	1.43E-01	-2.27E-02
1.717	1.20E-01	1.44E-01	-2.41E-02
1.85	1.23E-01	1.47E-01	-2.37E-02
1.983	1.23E-01	1.43E-01	-2.48E-02
2.117	1.23E-01	1.48E-01	-2.49E-02
2.25	1.25E-01	1.47E-01	-2.21E-02
2.383	1.25E-01	1.46E-01	-2.07E-02
2.517	1.27E-01	1.44E-01	-1.67E-02
2.65	1.28E-01	1.41E-01	-1.34E-02
2.783	1.29E-01	1.39E-01	-9.89E-03
2.917	1.31E-01	1.36E-01	-5.14E-03
3.05	1.30E-01	1.33E-01	-3.28E-03
3.183	1.28E-01	1.30E-01	-2.34E-03
3.317	1.29E-01	1.27E-01	-1.66E-03
3.45	1.27E-01	1.24E-01	-2.65E-03
3.583	1.27E-01	1.21E-01	-8.64E-03
3.717	1.27E-01	1.18E-01	-6.62E-03
3.85	1.25E-01	1.16E-01	-9.54E-03
3.983	1.24E-01	1.13E-01	-1.14E-02
4.117	1.21E-01	1.10E-01	-1.73E-02
4.25	1.21E-01	1.07E-01	-1.40E-02
4.383	1.18E-01	1.04E-01	-1.37E-02
4.517	1.17E-01	1.02E-01	-1.63E-02
4.65	0.113	9.91E-02	-1.39E-02
4.783	0.113	9.66E-02	-1.64E-02
4.917	0.109	9.10E-02	-1.47E-02
5.05	0.109	9.18E-02	-1.72E-02
5.183	0.105	8.95E-02	-1.55E-02
5.317	0.103E-01	8.73E-02	-1.50E-02
5.45	1.02E-01	8.52E-02	-1.69E-02
5.583	9.90E-02	8.31E-02	-1.59E-02
5.717	9.80E-02	8.10E-02	-1.70E-02
5.85	9.50E-02	7.90E-02	-1.60E-02
5.983	9.40E-02	7.71E-02	-1.69E-02
6.117	9.00E-02	7.53E-02	-1.47E-02
6.25	8.90E-02	7.35E-02	-1.55E-02
6.383	8.60E-02	7.17E-02	-1.43E-02
6.517	8.50E-02	7.00E-02	-1.50E-02
6.65	8.20E-02	6.84E-02	-1.36E-02
6.783	7.90E-02	6.68E-02	-1.22E-02
6.917	7.80E-02	6.52E-02	-1.28E-02
7.05	7.40E-02	6.7E-02	-1.03E-02
7.183	7.30E-02	6.22E-02	-1.08E-02
7.317	7.00E-02	6.08E-02	-9.21E-03
7.45	6.80E-02	5.94E-02	-6.89E-03
7.583	6.60E-02	5.81E-02	-7.93E-03
7.717	6.40E-02	5.68E-02	-7.25E-03
7.85	6.10E-02	5.55E-02	-5.82E-03
7.983	6.10E-02	5.43E-02	-6.75E-03
8.117	5.80E-02	5.30E-02	-4.96E-03
8.25	5.60E-02	5.19E-02	-4.13E-03
8.383	5.30E-02	5.07E-02	-2.26E-03
8.517	5.20E-02	4.96E-02	-2.37E-03
8.65	4.90E-02	4.86E-02	-4.49E-04
8.783	4.80E-02	4.75E-02	-4.96E-04
8.917	4.60E-02	4.65E-02	-4.77E-04
9.05	4.40E-02	4.55E-02	-1.49E-03
9.183	4.40E-02	4.45E-02	-5.19E-04
9.317	4.20E-02	4.36E-02	-1.67E-03
9.45	4.00E-02	4.27E-02	-2.65E-03
9.583	3.80E-02	4.18E-02	-3.76E-03
9.717	3.60E-02	4.09E-02	-4.88E-03
9.85	3.30E-02	4.00E-02	-7.03E-03
9.983	3.10E-02	3.92E-02	-8.21E-03
10.12	3.00E-02	3.84E-02	-8.38E-03
10.25	2.75E-02	3.76E-02	-1.57E-02
10.38	2.70E-02	3.69E-02	-9.86E-03
10.52	2.60E-02	3.61E-02	-1.01E-02
10.65	2.40E-02	3.54E-02	-1.14E-02
10.78	2.20E-02	3.47E-02	-1.27E-02
10.92	2.20E-02	3.39E-02	-1.19E-02
11.05	2.10E-02	3.33E-02	-1.33E-02
11.18	2.00E-02	3.26E-02	-1.26E-02
11.32	1.70E-02	3.19E-02	-1.49E-02
11.45	1.50E-02	3.13E-02	-1.63E-02
11.58	1.50E-02	3.07E-02	-1.57E-02
11.72	1.10E-02	3.01E-02	-1.91E-02
11.85	9.00E-03	2.95E-02	-2.05E-02
11.98	8.00E-03	2.89E-02	-2.09E-02
12.12	7.00E-03	2.84E-02	-2.14E-02
12.25	6.00E-03	2.78E-02	-2.28E-02
12.38	6.00E-03	2.73E-02	-2.13E-02
12.52	1.00E-03	2.67E-02	-2.57E-02

May 2005
E4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1516E-05
 DISPERSIVITY= 0.3390E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 3.394
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1140

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.1241

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.52E-06	1.49E-06	1.55E-06
X(2)	3.19E-03	3.19E-03	3.19E-03
X(5)	3.39E+00	3.29E+00	3.50E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1167	6.80E-02	2.85E-17	6.80E-02
0.25	7.00E-02	4.07E-02	7.00E-02
3.83E-01	7.40E-02	2.71E-05	7.40E-02
0.5167	7.70E-02	6.50E-04	7.64E-02
0.65	4.29E-03	7.47E-02	4.29E-03
0.7833	8.70E-02	1.51E-02	7.20E-02
0.9167	9.70E-02	3.69E-02	6.02E-02
1.05	2.92E-01	2.58E-01	-1.59E-02
1.183	1.43E-01	1.21E-01	2.18E-02
1.317	1.85E-01	1.84E-01	9.42E-04
1.45	4.60E-01	4.33E-01	-2.75E-02
1.583	3.10E-01	3.38E-01	-2.75E-02
1.717	3.88E-01	4.18E-01	-3.23E-02
1.85	4.60E-01	4.33E-01	-2.75E-02
1.983	5.29E-01	5.58E-01	-2.93E-02
2.117	5.91E-01	6.13E-01	-2.17E-02
2.25	6.43E-01	6.55E-01	-1.18E-02
2.383	6.85E-01	6.86E-01	-4.69E-04
2.517	7.16E-01	7.06E-01	1.01E-02
2.65	7.36E-01	7.17E-01	1.89E-02
2.783	7.47E-01	7.21E-01	2.65E-02
2.917	7.51E-01	7.18E-01	3.35E-02
3.05	7.47E-01	7.09E-01	3.79E-02
3.183	7.36E-01	6.97E-01	3.94E-02
3.317	7.19E-01	6.81E-01	3.84E-02
3.45	6.98E-01	6.62E-01	3.58E-02
3.583	6.75E-01	6.42E-01	3.31E-02
3.717	6.47E-01	6.20E-01	2.69E-02
3.85	6.18E-01	5.98E-01	2.05E-02
3.983	5.86E-01	5.75E-01	1.15E-02
4.117	5.54E-01	5.51E-01	3.03E-03
4.25	5.23E-01	5.28E-01	-4.69E-03
4.383	4.91E-01	4.91E-01	-1.36E-02
4.517	4.61E-01	4.82E-01	-2.07E-02
4.65	4.34E-01	4.60E-01	-2.55E-02
4.783	4.06E-01	4.36E-01	-3.18E-02
4.917	3.81E-01	4.17E-01	-3.57E-02
5.05	3.57E-01	3.96E-01	-3.94E-02
5.183	3.35E-01	3.77E-01	-4.18E-02
5.317	3.16E-01	3.58E-01	-4.18E-02
5.45	2.98E-01	3.40E-01	-4.17E-02
5.583	2.81E-01	3.22E-01	-4.13E-02
5.717	2.65E-01	3.06E-01	-4.06E-02
5.85	2.51E-01	2.90E-01	-3.87E-02
5.983	2.39E-01	2.75E-01	-3.56E-02
6.117	2.26E-01	2.60E-01	-3.41E-02
6.25	2.16E-01	2.46E-01	-3.04E-02
6.383	2.07E-01	2.33E-01	-2.63E-02
6.517	1.98E-01	2.21E-01	-2.28E-02
6.65	1.90E-01	2.09E-01	-1.90E-02
6.783	1.83E-01	1.98E-01	-1.48E-02
6.917	1.75E-01	1.87E-01	-1.21E-02
7.05	1.70E-01	1.77E-01	-6.97E-03
7.183	1.65E-01	1.67E-01	-2.41E-03
7.317	1.59E-01	1.58E-01	7.27E-04
7.45	1.54E-01	1.50E-01	4.32E-03
7.583	1.50E-01	1.42E-01	8.45E-03
7.717	1.45E-01	1.34E-01	1.12E-02
7.85	1.40E-01	1.27E-01	1.35E-02
7.983	1.33E-01	1.20E-01	1.34E-02
8.117	1.28E-01	1.13E-01	1.50E-02
8.25	1.20E-01	1.07E-01	1.32E-02
8.383	1.14E-01	1.01E-01	1.30E-02
8.517	1.07E-01	9.64E-02	1.16E-02
8.65	1.02E-01	9.02E-02	1.18E-02
8.783	9.80E-02	8.53E-02	1.28E-02
8.917	9.30E-02	8.05E-02	1.25E-02
9.05	9.10E-02	7.61E-02	1.49E-02
9.183	8.80E-02	7.19E-02	1.61E-02
9.317	8.70E-02	6.80E-02	1.90E-02
9.45	8.50E-02	6.42E-02	2.08E-02
9.583	8.30E-02	6.07E-02	2.23E-02
9.717	8.30E-02	5.74E-02	2.57E-02
9.85	8.20E-02	5.42E-02	2.78E-02
9.983	8.00E-02	5.12E-02	2.88E-02
10.12	7.90E-02	4.90E-02	3.07E-02
10.25	7.90E-02	4.57E-02	3.33E-02
10.38	7.90E-02	4.33E-02	3.57E-02
10.52	7.90E-02	4.09E-02	3.82E-02
10.65	7.70E-02	3.86E-02	3.84E-02
10.78	7.70E-02	3.65E-02	4.05E-02
10.92	7.50E-02	3.44E-02	4.05E-02
11.05	7.50E-02	3.26E-02	4.24E-02
11.18	7.30E-02	3.08E-02	4.22E-02
11.32	7.10E-02	2.92E-02	4.20E-02
11.45	7.10E-02	2.75E-02	4.35E-02
11.58	7.00E-02	2.60E-02	4.40E-02
11.72	6.90E-02	2.45E-02	4.45E-02
11.85	6.70E-02	2.32E-02	4.48E-02
11.98	6.60E-02	2.20E-02	4.41E-02
12.12	6.60E-02	2.07E-02	4.55E-02
12.25	6.60E-02	1.96E-02	4.64E-02
12.38	6.50E-02	1.85E-02	4.65E-02
12.52	6.50E-02	1.75E-02	4.75E-02
12.65	6.40E-02	1.65E-02	4.75E-02

E4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1279E-05
 DISPERSIVITY= 0.1408E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 1.708
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7082E-01

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.7708E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.28E-06	1.27E-06	1.29E-06
X(2)	3.14E-03	3.14E-03	3.14E-03
X(5)	1.71E+00	1.64E+00	1.78E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1167	4.00E-02	0.00E+00	4.00E-02
0.25	3.80E-02	2.75E-51	3.80E-02
3.83E-01	3.80E-02	1.14E-32	3.80E-02
0.5167	3.70E-02	1.18E-23	3.70E-02
0.65	0.65	2.52E-18	3.50E-02
0.7833	3.60E-02	7.54E-15	3.60E-02
0.9167	3.70E-02	2.26E-12	3.70E-02
1.05	4.00E-02	1.57E-10	3.90E-02
1.183	4.00E-02	4.12E-09	4.00E-02
1.317	4.20E-02	5.62E-08	4.20E-02
1.45	4.30E-02	4.01E-07	4.30E-02
1.583	4.60E-02	2.65E-06	4.60E-02
1.717	4.80E-02	1.16E-05	4.80E-02
1.85	5.00E-02	4.02E-05	5.00E-02
1.983	5.20E-02	1.17E-04	5.19E-02
2.117	5.40E-02	2.98E-04	5.37E-02
2.25	5.60E-02	6.69E-04	5.53E-02
2.383	5.90E-02	1.37E-03	5.68E-02
2.517	6.10E-02	2.58E-03	5.84E-02
2.65	6.30E-02	4.52E-03	5.85E-02
2.783	6.40E-02	7.45E-03	5.68E-02
2.917	6.70E-02	1.17E-02	5.53E-02
3.05	6.90E-02	1.75E-02	5.15E-02
3.183	7.20E-02	2.52E-02	4.68E-02
3.317	7.70E-02	3.50E-02	4.20E-02
3.45	8.20E-02	4.69E-02	3.51E-02
3.583	9.00E-02	6.11E-02	2.69E-02
3.717	1.00E-01	7.76E-02	2.24E-02
3.85	1.11E-01	9.60E-02	1.50E-02
3.983	1.15E-01	1.16E-01	-1.66E-03
4.117	1.41E-01	1.38E-01	3.07E-03
4.25	1.59E-01	1.61E-01	-1.60E-03
4.383	1.79E-01	1.84E-01	-4.89E-03
4.517	0.199	2.08E-01	-8.52E-03
4.65	0.22	2.31E-01	-1.07E-02
4.783	0.241	2.52E-01	-1.21E-02
4.917	0.262	2.75E-01	-1.27E-02
5.05	0.282	2.95E-01	-1.26E-02
5.183	0.193	3.18E-01	-1.18E-02
5.317	3.18E-01	3.29E-01	-1.12E-02
5.45	3.33E-01	3.43E-01	-1.03E-02
5.583	3.46E-01	3.57E-01	-9.30E-03
5.717	3.57E-01	3.65E-01	-7.98E-03
5.85	3.65E-01	3.72E-01	-7.33E-03
5.983	3.70E-01	3.77E-01	-6.74E-03
6.117	3.75E-01	3.80E-01	-5.37E-03
6.25	3.77E-01	3.81E-01	-4.21E-03
6.383	3.77E-01	3.83E-01	-3.11E-03
6.517	3.76E-01	3.77E-01	-1.18E-03
6.65	3.73E-01	3.73E-01	3.84E-04
6.783	3.69E-01	3.67E-01	2.42E-03
6.917	3.63E-01	3.59E-01	3.83E-03
7.05	3.56E-01	3.51E-01	5.32E-03
7.183	3.47E-01	3.41E-01	5.79E-03
7.317	3.38E-01	3.31E-01	7.16E-03
7.45	3.28E-01	3.20E-01	8.12E-03
7.583	3.21E-01	3.08E-01	1.26E-02
7.717	3.10E-01	2.96E-01	1.36E-02
7.85	2.97E-01	2.84E-01	1.27E-02
7.983	2.85E-01	2.72E-01	1.30E-02
8.117	2.71E-01	2.60E-01	1.15E-02
8.25	2.59E-01	2.47E-01	1.18E-02
8.383	2.45E-01	2.35E-01	1.01E-02
8.517	2.33E-01	2.23E-01	1.02E-02
8.65	2.20E-01	2.11E-01	9.05E-03
8.783	2.08E-01	1.99E-01	8.60E-03
8.917	1.95E-01	1.88E-01	6.92E-03
9.05	1.84E-01	1.77E-01	6.79E-03
9.183	1.73E-01	1.67E-01	6.29E-03
9.317	1.61E-01	1.57E-01	4.47E-03
9.45	1.51E-01	1.47E-01	4.16E-03
9.583	1.41E-01	1.38E-01	3.42E-03
9.717	1.30E-01	1.29E-01	1.33E-03
9.85	1.21E-01	1.20E-01	7.45E-04
9.983	1.12E-01	1.12E-01	-2.63E-04
10.12	1.02E-01	1.02E-01	-4.47E-03
10.25	9.30E-02	9.75E-02	-4.47E-03
10.38	8.50E-02	9.09E-02	-5.86E-03
10.52	7.80E-02	8.62E-02	-8.15E-03
10.65	7.00E-02	7.83E-02	-8.30E-03
10.78	6.30E-02	7.28E-02	-9.79E-03
10.92	5.60E-02	6.72E-02	-1.34E-02
11.05	4.90E-02	6.24E-02	-1.34E-02
11.18	4.10E-02	5.79E-02	-1.69E-02
11.32	3.32E-02	5.33E-02	-2.73E-02
11.45	2.90E-02	4.94E-02	-2.04E-02
11.58	2.40E-02	4.57E-02	-2.17E-02
11.72	1.90E-02	4.20E-02	-2.40E-02
11.85	1.30E-02	3.88E-02	-2.58E-

May 2005
F1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.1400E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 2.000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1255E-05
DISPERSIVITY= 1.142E-01
WIDTH= 0.5000E-02
Rf= 1.000
CO= 14.53
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 10.87

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
THE CRITICAL RSS IS: 11.95

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.26E-06	1.16E-06	1.37E-06
X(2)	1.14E-02	1.38E-02	1.38E-02
X(5)	1.45E+01	1.35E+01	1.56E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.33E-02	6.95E-02	4.33E-08	6.95E-02
0.1833	1.85E-01	9.74E-04	1.85E-01
2.83E-01	2.38E-01	2.04E-02	2.18E-01
0.3833	6.63E-01	9.08E-02	5.73E-01
0.4833	9.46E-01	2.23E-01	7.23E-01
0.5833	1.26E+00	4.09E-01	8.48E-01
0.6833	1.50E+00	6.34E-01	8.66E-01
0.7833	1.69E+00	8.86E-01	8.07E-01
0.8833	1.85E+00	1.15E+00	6.92E-01
0.9833	1.97E+00	1.43E+00	5.46E-01
1.083	2.08E+00	1.71E+00	3.74E-01
1.183	2.19E+00	2.00E+00	1.72E-01
1.283	2.21E+00	2.26E+00	-4.45E-02
1.383	2.32E+00	2.51E+00	-1.97E-01
1.483	2.39E+00	2.76E+00	-4.29E-01
1.583	2.32E+00	2.84E+00	-5.15E-01
1.683	2.38E+00	2.91E+00	-5.25E-01
1.783	2.39E+00	2.93E+00	-5.34E-01
1.883	2.40E+00	2.91E+00	-5.18E-01
1.983	2.40E+00	2.88E+00	-4.78E-01
2.083	2.39E+00	2.82E+00	-4.29E-01
2.183	2.39E+00	2.79E+00	-3.79E-01
2.283	2.38E+00	2.69E+00	-3.13E-01
2.383	2.37E+00	2.62E+00	-2.51E-01
2.483	2.35E+00	2.54E+00	-1.91E-01
2.583	2.34E+00	2.47E+00	-1.32E-01
2.683	2.32E+00	2.40E+00	-7.54E-02
2.783	2.30E+00	2.33E+00	-2.35E-02
2.883	2.28E+00	2.26E+00	2.54E-02
2.983	2.26E+00	2.19E+00	7.12E-02
3.083	2.03E+00	1.71E+00	3.15E-01
3.17	1.99E+00	1.66E+00	3.30E-01
4.017	1.96E+00	1.62E+00	3.43E-01
4.117	1.93E+00	1.58E+00	3.56E-01
4.217	1.90E+00	1.53E+00	3.65E-01
4.317	1.87E+00	1.49E+00	3.72E-01
4.417	1.83E+00	1.46E+00	3.79E-01
4.517	1.80E+00	1.42E+00	3.85E-01
4.617	1.77E+00	1.38E+00	3.88E-01
4.717	1.74E+00	1.35E+00	3.92E-01
4.817	1.71E+00	1.32E+00	3.93E-01
4.917	1.68E+00	1.28E+00	3.94E-01
5.017	1.65E+00	1.25E+00	3.94E-01
5.117	1.62E+00	1.22E+00	3.93E-01
5.217	1.58E+00	1.19E+00	3.90E-01
5.317	1.49E+00	1.17E+00	3.22E-01
5.983	1.35E+00	1.00E+00	3.50E-01
6.083	1.32E+00	9.82E-01	3.40E-01
6.183	1.29E+00	9.61E-01	3.28E-01
6.283	1.26E+00	9.41E-01	3.16E-01
6.383	1.23E+00	9.21E-01	3.04E-01
6.483	1.19E+00	9.02E-01	2.90E-01
6.583	1.16E+00	8.84E-01	2.75E-01
6.683	1.13E+00	8.66E-01	2.61E-01
6.783	1.09E+00	8.48E-01	2.46E-01
6.883	1.06E+00	8.31E-01	2.31E-01
6.983	1.03E+00	8.15E-01	2.16E-01
7.083	1.00E+00	7.99E-01	2.01E-01
7.183	9.68E-01	7.83E-01	1.85E-01
7.283	9.36E-01	7.68E-01	1.68E-01
7.383	9.04E-01	7.53E-01	1.51E-01
7.483	8.72E-01	7.39E-01	1.33E-01
7.5	7.11E-01	6.96E-01	1.54E-02
7.9	6.74E-01	6.83E-01	-8.74E-03
8	6.36E-01	6.71E-01	-3.43E-02
8.1	6.18E-01	6.58E-01	-4.00E-02
8.2	6.27E-01	6.46E-01	-1.92E-02
8.3	5.90E-01	6.35E-01	-4.45E-02
8.4	5.55E-01	6.23E-01	-6.81E-02
8.5	5.20E-01	6.12E-02	-9.21E-02
8.6	4.85E-01	6.01E-01	-1.16E-01
8.7	4.50E-01	5.91E-01	-1.41E-01
8.8	4.14E-01	5.80E-01	-1.66E-01
8.9	3.79E-01	5.70E-01	-1.91E-01
9	3.45E-01	5.60E-01	-2.15E-01
9.1	3.11E-01	5.51E-01	-2.40E-01
9.2	2.77E-01	5.41E-01	-2.64E-01
9.3	2.43E-01	5.32E-01	-2.89E-01
9.4	2.10E-01	5.23E-01	-3.13E-01
9.5	1.77E-01	5.14E-01	-3.38E-01
9.6	1.44E-01	5.06E-01	-3.62E-01
9.7	1.12E-01	4.97E-01	-3.86E-01
9.8	7.86E-02	4.89E-01	-4.10E-01
9.9	-1.85E-02	4.81E-01	-4.99E-01
10	-4.85E-02	4.73E-01	-5.21E-01

F1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 92
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3000E-03
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 3.000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1375E-05
DISPERSIVITY= 0.2565E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 11.48
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.6027

THE F STATISTIC FOR NP= 3 NOBS= 92 IS: 2.72
THE CRITICAL RSS IS: 0.6579

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.38E-06	1.36E-06	1.39E-06
X(2)	2.59E-03	2.49E-03	2.69E-03
X(5)	1.15E+01	1.14E+01	1.16E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.883	1.50E-01	5.47E-06	1.50E-01
0.883	6.22E-02	3.12E-05	6.21E-02
1.083	9.17E-02	1.28E-04	9.15E-02
1.183	4.52E-02	4.16E-04	4.47E-02
1.283	1.03E-01	1.12E-03	1.02E-01
1.400	9.06E-02	2.39E-03	8.78E-02
1.500	1.62E-01	6.08E-03	1.56E-01
1.600	6.86E-02	1.13E-02	5.72E-02
1.700	4.71E-02	1.96E-02	2.75E-02
1.800	3.56E-02	3.19E-02	3.70E-03
1.900	-8.95E-03	4.91E-02	-5.81E-02
2.000	2.68E-02	7.24E-02	-4.58E-02
2.100	3.05E-03	1.03E-01	-9.96E-02
2.200	1.66E-02	1.41E-01	-1.24E-01
2.300	4.80E-02	1.87E-01	-1.39E-01
2.400	8.85E-02	2.42E-01	-1.53E-01
2.500	1.73E-01	3.05E-01	-1.32E-01
2.600	2.58E-01	3.77E-01	-1.18E-01
2.700	3.70E-01	4.56E-01	-8.56E-02
2.800	4.87E-01	5.41E-01	-5.49E-02
2.900	6.08E-01	6.33E-01	-2.46E-02
3.000	7.78E-01	7.28E-01	-1.51E-01
3.100	7.87E-01	8.27E-01	-1.36E-02
3.200	9.41E-01	9.27E-01	1.36E-02
3.300	1.07E+00	1.03E+00	1.03E-02
3.400	1.20E+00	1.13E+00	7.29E-02
3.500	1.27E+00	1.23E+00	4.83E-02
3.600	1.47E+00	1.32E+00	1.49E-01
3.700	1.54E+00	1.41E+00	1.33E-01
3.800	1.61E+00	1.50E+00	1.14E-01
3.900	1.71E+00	1.58E+00	1.158E-01
4.000	1.75E+00	1.65E+00	9.71E-02
4.100	1.79E+00	1.72E+00	7.36E-02
4.200	1.84E	1.78E+00	6.48E-02
4.300	1.878	1.84E+00	4.11E-02
4.400	1.921	1.89E+00	3.52E-02
4.500	1.934	1.93E+00	5.98E-03
4.600	1.967	1.96E+00	-1.86E-03
4.700	1.969	1.99E+00	-2.41E-02
4.800	1.98E+00	2.02E+00	-3.43E-02
4.900	1.99E+00	2.03E+00	-3.35E-02
5.000	2.00E+00	2.05E+00	-5.01E-02
5.100	1.99E+00	2.05E+00	-5.73E-02
5.200	1.92E+00	2.05E+00	-5.95E-02
5.300	1.92E+00	2.05E+00	-1.34E-01
5.400	1.90E+00	2.04E+00	-1.43E-01
5.500	1.91E+00	2.03E+00	-1.24E-01
5.600	1.89E+00	2.01E+00	-1.25E-01
5.700	1.88E+00	1.99E+00	-1.17E-01
5.800	1.93E+00	1.97E+00	-4.56E-02
5.900	1.91E+00	1.95E+00	-3.64E-02
6.000	1.89E+00	1.92E+00	-2.47E-02
6.100	1.87E+00	1.89E+00	-2.08E-02
6.200	1.84E+00	1.86E+00	-1.49E-02
6.300	1.82E+00	1.82E+00	-2.17E-03
6.400	1.80E+00	1.79E+00	8.00E-03
6.500	1.76E+00	1.75E+00	1.25E-02
6.600	1.74E+00	1.71E+00	2.10E-02
6.700	1.71E+00	1.68E+00	2.94E-02
6.800	1.68E+00	1.64E+00	3.95E-02
6.900	1.64E+00	1.60E+00	4.71E-02
7.000	1.61E+00	1.56E+00	5.41E-02
7.100	1.58E+00	1.52E+00	6.43E-02
7.200	1.54E+00	1.48E+00	6.67E-02
7.300	1.51E+00	1.44E+00	7.50E-02
7.400	1.47E+00	1.40E+00	7.82E-02
7.500	1.38E+00	1.36E+00	1.92E-02
7.600	1.34E+00	1.32E+00	2.68E-02
7.700	1.30E+00	1.28E+00	2.61E-02
7.800	1.27E+00	1.24E+00	3.07E-02
7.900	1.23E+00	1.20E+00	3.03E-02
8.000	1.19E+00	1.16E+00	2.81E-02
8.100	1.15E+00	1.13E+00	2.62E-02
8.200	1.18E+00	1.09E+00	8.77E-02
8.300	1.14E+00	1.05E+00	8.25E-02
8.400	1.10E+00	1.02E+00	7.45E-02
8.500	1.05E+00	9.83E-01	7.08E-02
8.600	1.01E+00	9.50E-01	6.14E-02
8.700	9.75E-01	9.17E-01	5.81E-02
8.800	9.28E-01	8.85E-01	4.35E-02
8.900	8.87E-01	8.54E-01	3.32E-02
9.000	8.45E-01	8.23E-01	2.20E-02
9.100	8.03E-01	7.94E-01	9.07E-03
9.200	7.63E-01	7.65E-01	-1.71E-03
9.300	7.18E-01	7.37E-01	-1.93E-02
9.400	6.70E-01	7.10E-01	-3.47E-02
9.500	6.32E-01	6.84E-01	-5.19E-02
9.600	5.88E-01	6.58E-01	-6.99E-02
9.700	5.43E-01	6.34E-01	-8.98E-02
9.800	4.60E-01	6.10E-01	-1.49E-01
9.900	3.98E-01	5.86E-01	-1.89E-01
10.000	3.51E-01	5.64E-01	-2.13E-01

August 2005
B1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1947E-05
 DISPERSIVITY= 0.2797E-02
 WIDTH= 0.5000E-02
 R= 1.00
 CO= 0.5501
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1802E-03

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72
 THE CRITICAL RSS IS: 0.1975E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.95E-06	1.95E-06	1.95E-06
X(2)	2.77E-03	2.85E-03	2.85E-03
X(5)	5.50E-01	5.50E-01	5.50E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-01	1.00E-03	1.15E-17	1.00E-03
0.2333	2.00E-03	5.52E-08	2.00E-03
3.67E-01	3.00E-03	2.62E-05	1.97E-03
0.5	3.00E-03	4.76E-04	2.52E-03
0.6333	5.00E-03	2.58E-03	2.42E-03
0.7667	1.00E-03	7.81E-03	1.20E-03
0.9	1.80E-02	1.70E-02	9.85E-04
1.033	3.20E-02	3.03E-02	1.69E-03
1.167	5.00E-02	4.71E-02	2.93E-03
1.3	6.80E-02	6.56E-02	2.39E-03
1.433	8.50E-02	8.37E-02	1.33E-03
1.567	9.90E-02	9.94E-02	-3.73E-04
1.7	1.10E-01	1.12E-01	3.170E-03
1.833	1.18E-01	1.20E-01	-2.40E-03
1.967	1.23E-01	1.26E-01	-2.72E-03
2.1	1.28E-01	1.28E-01	-3.08E-03
2.233	1.28E-01	1.28E-01	-2.04E-03
2.367	1.22E-01	1.26E-01	-1.10E-03
2.5	1.25E-01	1.23E-01	-7.30E-04
2.633	1.18E-01	1.19E-01	-6.81E-04
2.767	1.15E-01	1.13E-01	-1.81E-03
2.9	1.10E-01	1.08E-01	-2.40E-03
3.033	1.04E-01	1.04E-01	-1.02E-03
3.167	9.80E-02	9.88E-02	2.18E-03
3.3	9.20E-02	8.99E-02	-2.10E-03
3.433	8.50E-02	8.41E-02	-1.91E-03
3.567	8.00E-02	7.85E-02	-1.55E-03
3.7	7.50E-02	7.30E-02	-1.97E-03
3.833	6.90E-02	6.79E-02	-1.15E-03
4.0	6.40E-02	6.40E-02	-1.00E-03
4.1	5.90E-02	5.83E-02	-6.98E-04
4.233	5.40E-02	5.39E-02	-5.79E-05
4.367	4.90E-02	4.90E-02	-8.52E-04
4.5	4.50E-02	4.60E-02	-1.03E-03
4.633	4.20E-02	4.25E-02	-4.72E-04
4.767	3.80E-02	3.92E-02	-1.16E-03
4.9	3.50E-02	3.51E-02	-9.96E-04
5.033	3.20E-02	3.32E-02	-1.23E-03
5.167	2.90E-02	3.06E-02	-1.58E-03
5.3	2.70E-02	2.81E-02	-1.14E-03
5.433	2.40E-02	2.59E-02	-1.88E-03
5.567	2.20E-02	2.38E-02	-1.79E-03
5.7	2.00E-02	2.19E-02	-1.97E-03
5.833	1.90E-02	2.01E-02	-1.10E-03
5.967	1.70E-02	1.85E-02	-1.46E-03
6.1	1.60E-02	1.70E-02	-9.58E-04
6.233	1.40E-02	1.56E-02	-1.57E-03
6.367	1.30E-02	1.43E-02	-1.30E-03
6.5	1.20E-02	1.31E-02	-1.13E-03
6.633	1.10E-02	1.21E-02	-1.05E-03
6.767	1.00E-02	1.11E-02	-1.06E-03
6.9	1.00E-02	1.02E-02	-1.51E-04
7.033	9.00E-03	9.32E-03	-3.15E-04
7.167	8.00E-03	8.56E-03	-5.47E-04
7.3	8.00E-03	7.84E-03	1.57E-04
7.433	7.00E-03	7.20E-03	-1.96E-04
7.567	7.00E-03	6.80E-03	3.98E-04
7.7	6.00E-03	6.06E-03	-5.67E-05
7.833	6.00E-03	5.56E-03	4.44E-04
7.967	5.00E-03	5.10E-03	-9.79E-05
8.1	5.00E-03	4.68E-03	3.24E-04
8.233	5.00E-03	4.29E-03	7.11E-04
8.367	4.00E-03	3.93E-03	6.56E-05
8.5	4.00E-03	3.61E-03	3.91E-04
8.633	4.00E-03	3.31E-03	6.89E-04
8.767	4.00E-03	3.04E-03	9.63E-04
8.9	3.00E-03	2.79E-03	2.15E-04
9.033	3.00E-03	2.56E-03	4.45E-04
9.167	3.00E-03	2.34E-03	6.56E-04
9.3	3.00E-03	2.15E-03	8.50E-04
9.433	3.00E-03	1.97E-03	1.03E-03
9.567	2.00E-03	1.81E-03	1.91E-04
9.7	2.00E-03	1.66E-03	3.41E-04
9.833	2.00E-03	1.52E-03	4.78E-04
9.967	2.00E-03	1.40E-03	6.04E-04
10.1	2.00E-03	1.28E-03	7.19E-04
10.233	2.00E-03	1.18E-03	8.25E-04
10.37	2.00E-03	1.08E-03	9.22E-04
10.5	2.00E-03	9.89E-04	1.01E-03
10.633	2.00E-03	9.07E-04	1.09E-03
10.77	2.00E-03	8.32E-04	1.17E-03
10.9	2.00E-03	7.64E-04	1.24E-03
11.03	2.00E-03	7.01E-04	1.30E-03
11.17	2.00E-03	6.43E-04	1.36E-03
11.3	2.00E-03	5.90E-04	1.41E-03
11.43	3.00E-03	5.41E-04	2.46E-03
11.57	3.00E-03	4.96E-04	2.50E-03
11.7	3.00E-03	4.55E-04	2.55E-03

B1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 82
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1904E-05
 DISPERSIVITY= 0.2132E-02
 WIDTH= 0.5000E-02
 R= 1.00
 CO= 0.5351
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1833E-03

THE F STATISTIC FOR NP= 3 NOBS= 82 IS: 2.73
 THE CRITICAL RSS IS: 0.2023E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.90E-06	1.90E-06	1.90E-06
X(2)	2.13E-03	2.09E-03	2.18E-03
X(5)	5.35E-01	5.35E-01	5.35E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.167	5.78E-05	7.29E-34	5.78E-05
0.300	1.04E-04	1.31E-18	1.04E-04
0.433	1.60E-04	9.87E-13	1.50E-04
0.567	-8.03E-04	4.72E-09	-8.03E-04
0.700	2.43E-04	1.07E-07	2.43E-04
0.833	2.89E-04	2.18E-06	2.87E-04
0.967	3.35E-04	1.90E-05	3.16E-04
1.100	1.38E-03	9.73E-05	1.28E-03
1.233	2.43E-03	3.47E-04	2.08E-03
1.367	3.47E-03	9.59E-04	2.52E-03
1.500	4.52E-03	2.19E-03	2.33E-03
1.633	6.57E-03	4.34E-03	2.22E-03
1.767	1.06E-02	7.68E-03	2.93E-03
1.900	1.47E-02	1.24E-02	2.26E-03
2.033	2.07E-02	1.85E-02	2.19E-03
2.167	2.78E-02	2.59E-02	1.83E-03
2.300	3.58E-02	3.44E-02	1.44E-03
2.433	4.48E-02	4.35E-02	1.40E-03
2.567	5.39E-02	5.28E-02	1.09E-03
2.700	6.38E-02	6.19E-02	-8.69E-05
2.833	7.10E-02	7.08E-02	2.26E-04
2.967	7.80E-02	7.87E-02	-6.97E-04
3.100	8.51E-02	8.51E-02	-5.31E-04
3.233	9.01E-02	9.16E-02	-1.45E-03
3.367	9.52E-02	9.62E-02	-1.07E-03
3.500	9.92E-02	9.97E-02	-1.50E-03
3.633	1.00E-01	1.02E-01	-1.76E-03
3.767	1.01E-01	1.03E-01	-1.92E-03
3.900	1.01E-01	1.03E-01	-2.07E-03
4.033	1.01E-01	1.01E-01	-2.32E-03
4.167	1.01E-01	1.01E-01	-7.80E-04
4.300	9.85E-02	9.91E-02	-5.77E-04
4.433	9.65E-02	9.65E-02	-4.63E-04
4.567	9.36E-02	9.32E-02	4.09E-04
4.700	9.06E-02	8.97E-02	9.81E-04
4.833	8.67E-02	8.59E-02	8.17E-04
4.967	8.37E-02	8.37E-02	-9.94E-05
5.100	7.98E-02	7.78E-02	1.97E-03
5.233	7.58E-02	7.37E-02	2.16E-03
5.367	7.19E-02	6.95E-02	2.35E-03
5.500	6.79E-02	6.54E-02	2.49E-03
5.633	6.30E-02	6.14E-02	1.56E-03
5.767	5.90E-02	5.75E-02	1.53E-03
5.900	5.51E-02	5.37E-02	1.36E-03
6.033	5.11E-02	5.00E-02	1.06E-03
6.167	4.81E-02	4.66E-02	1.59E-03
6.300	4.42E-02	4.32E-02	9.62E-04
6.433	4.12E-02	4.01E-02	1.16E-03
6.567	3.73E-02	3.71E-02	1.91E-04
6.700	3.43E-02	3.43E-02	4.63E-05
6.833	3.14E-02	3.16E-02	-2.69E-04
6.967	2.84E-02	2.92E-02	-7.47E-04
7.100	2.65E-02	2.69E-02	-3.90E-04
7.233	2.38E-02	2.47E-02	-1.19E-03
7.367	2.16E-02	2.27E-02	-1.14E-03
7.500	1.96E-02	2.08E-02	-1.23E-03
7.633	1.77E-02	1.91E-02	-1.45E-03
7.767	1.57E-02	1.75E-02	-1.81E-03
7.900	1.47E-02	1.60E-02	-1.28E-03
8.033	1.37E-02	1.47E-02	-1.57E-03
8.167	1.18E-02	1.34E-02	-1.56E-03
8.300	1.09E-02	1.22E-02	-1.36E-03
8.433	8.93E-03	1.12E-02	-2.25E-03
8.567	7.97E-03	1.02E-02	-2.22E-03
8.700	8.02E-03	9.30E-03	-1.28E-03
8.833	7.06E-03	8.47E-03	-1.41E-03
8.967	6.11E-03	7.72E-03	-1.61E-03
9.100	5.16E-03	7.03E-03	-1.87E-03
9.233	4.20E-03	6.39E-03	-2.19E-03
9.367	4.25E-03	5.82E-03	-1.57E-03
9.500	3.30E-03	5.29E-03	-1.99E-03
9.633	3.34E-03	4.81E-03	-1.47E-03
9.767	2.39E-03	4.37E-03	-1.98E-03
9.900	2.43E-03	3.97E-03	-1.53E-03
10.030	2.48E-03	3.60E-03	-1.12E-03
10.170	1.53E-03	3.27E-03	-1.74E-03
10.300	1.57E-03	2.97E-03	-1.39E-03
10.430	1.62E-03	2.69E-03	-1.07E-03
10.570	6.66E-04	2.44E-03	-1.77E-03
10.700	7.12E-04	2.21E-03	-1.50E-03
10.830	7.58E-04	2.00E-03	-1.25E-03
10.970	8.04E-04	1.82E-03	-1.01E-03

August 2005
B2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1622E-05
 DISPERSIVITY= 0.3145E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.5965
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5265E-02

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
 THE CRITICAL RSS IS: 0.5721E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.62E-06	1.59E-06	1.66E-06
X(2)	3.15E-03	2.93E-03	3.40E-03
X(5)	5.97E-01	5.79E-01	6.14E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.50E-02	7.90E-05	3.05E-23	7.90E-05
0.185	1.72E-04	3.86E-11	1.72E-04
2.65E-01	2.65E-04	1.71E-07	2.65E-04
0.385	3.58E-04	1.90E-05	3.48E-04
0.485	1.45E-03	1.11E-04	1.34E-03
0.585	5.54E-04	5.48E-04	3.00E-03
0.685	7.64E-03	1.70E-03	5.93E-03
0.785	1.27E-02	3.98E-03	8.75E-03
0.885	1.68E-02	7.71E-03	1.11E-02
0.985	2.59E-02	1.31E-02	1.29E-02
1.085	3.50E-02	2.01E-02	1.49E-02
1.185	4.41E-02	2.87E-02	1.54E-02
1.285	5.42E-02	3.88E-02	1.54E-02
1.385	6.33E-02	5.01E-02	1.32E-02
1.485	7.24E-02	6.20E-02	1.04E-02
1.585	8.15E-02	4.0E-02	7.52E-03
1.685	8.86E-02	8.54E-02	3.21E-03
1.785	9.57E-02	9.58E-02	-1.38E-04
1.885	1.01E-01	1.05E-01	-4.23E-03
1.985	1.06E-01	1.13E-01	-6.90E-03
2.085	1.10E-01	1.19E-01	-9.14E-03
2.185	1.14E-01	1.24E-01	-9.98E-03
2.285	1.16E-01	1.28E-01	-1.15E-02
2.385	1.18E-01	1.30E-01	-1.11E-02
2.485	1.20E-01	1.31E-01	-1.11E-02
2.585	1.21E-01	1.32E-01	-1.04E-02
2.685	1.23E-01	1.33E-01	-4.25E-03
2.785	1.23E-01	1.30E-01	-7.73E-03
2.885	1.23E-01	1.29E-01	-5.98E-03
2.985	1.23E-01	1.23E-01	-3.74E-03
3.085	1.22E-01	1.24E-01	-2.13E-03
3.185	1.20E-01	1.21E-01	-1.20E-03
3.285	1.19E-01	1.19E-01	9.79E-04
3.385	1.17E-01	1.15E-01	2.35E-03
3.485	1.15E-01	1.11E-01	3.85E-03
3.585	1.13E-01	1.08E-01	5.45E-03
3.685	1.11E-01	1.04E-01	7.10E-03
3.785	1.09E-01	1.01E-01	7.77E-03
3.885	1.06E-01	9.72E-02	8.54E-03
3.985	1.03E-01	9.36E-02	9.11E-03
4.085	9.98E-02	9.01E-02	9.73E-03
4.185	9.69E-02	8.69E-02	1.03E-02
4.285	9.40E-02	8.32E-02	1.08E-02
4.385	9.01E-02	7.99E-02	1.02E-02
4.485	8.72E-02	7.72E-02	1.05E-02
4.585	8.33E-02	7.34E-02	9.82E-03
4.685	7.94E-02	7.04E-02	8.99E-03
4.785	7.65E-02	6.74E-02	8.06E-03
4.885	7.25E-02	6.45E-02	8.04E-03
4.985	6.86E-02	6.17E-02	6.91E-03
5.085	6.57E-02	5.90E-02	6.69E-03
5.185	6.18E-02	5.65E-02	5.38E-03
5.285	5.89E-02	5.40E-02	4.96E-03
5.385	5.60E-02	5.16E-02	4.45E-03
5.485	5.21E-02	4.93E-02	2.85E-03
5.585	4.92E-02	4.70E-02	2.16E-03
5.685	4.63E-02	4.49E-02	1.38E-03
5.785	4.34E-02	4.29E-02	5.05E-04
5.885	4.05E-02	4.09E-02	-4.50E-04
5.985	3.76E-02	3.91E-02	-1.49E-03
6.085	3.57E-02	3.73E-02	-1.60E-03
6.185	3.28E-02	3.56E-02	-2.80E-03
6.285	3.08E-02	3.39E-02	-3.07E-03
6.385	2.89E-02	3.23E-02	-3.40E-03
6.485	2.60E-02	3.08E-02	-4.81E-03
6.585	2.41E-02	2.94E-02	-5.29E-03
6.685	2.22E-02	2.80E-02	-5.83E-03
6.785	2.13E-02	2.67E-02	-5.43E-03
6.885	1.94E-02	2.55E-02	-6.08E-03
6.985	1.85E-02	2.43E-02	-5.80E-03
7.085	1.66E-02	2.32E-02	-6.57E-03
7.185	1.57E-02	2.21E-02	-6.39E-03
7.285	1.38E-02	2.10E-02	-7.26E-03
7.385	1.29E-02	2.00E-02	-7.18E-03
7.485	1.20E-02	1.91E-02	-7.14E-03
7.585	1.11E-02	1.82E-02	-7.15E-03
7.685	1.02E-02	1.73E-02	-7.20E-03
7.785	9.24E-03	1.64E-02	-7.29E-03
7.885	8.33E-03	1.58E-02	-7.41E-03
7.985	7.42E-03	1.50E-02	-7.58E-03
8.085	6.52E-03	1.43E-02	-7.79E-03
8.185	6.61E-03	1.36E-02	-7.01E-03
8.285	5.70E-03	1.30E-02	-7.27E-03
8.385	4.80E-03	1.24E-02	-7.56E-03
8.485	4.89E-03	1.18E-02	-6.89E-03
8.585	3.98E-03	1.12E-02	-7.24E-03
8.685	4.08E-03	1.07E-02	-6.61E-03
8.785	3.17E-03	1.02E-02	-7.01E-03
8.885	3.26E-03	9.70E-03	-6.44E-03
8.985	2.35E-03	9.24E-03	-6.88E-03
9.085	2.45E-03	8.80E-03	-6.35E-03
9.185	1.54E-03	8.38E-03	-6.84E-03
9.285	1.63E-03	7.99E-03	-6.35E-03
9.385	1.73E-03	7.61E-03	-5.88E-03
9.485	8.19E-04	7.25E-03	-6.43E-03
9.585	9.12E-04	6.90E-03	-5.99E-03
9.685	4.63E-06	6.58E-03	-6.57E-03

B2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 82
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1530E-05
 DISPERSIVITY= 0.324E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.5946
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9791E-03

THE F STATISTIC FOR NP= 3 NOBS= 82 IS: 2.73
 THE CRITICAL RSS IS: 0.1081E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.53E-06	1.53E-06	1.53E-06
X(2)	2.12E-03	2.04E-03	2.21E-03
X(5)	5.95E-01	5.89E-01	6.01E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.785	1.60E-03	1.56E-08	1.60E-03
0.918	1.75E-03	3.21E-07	1.75E-03
1.052	1.89E-03	3.07E-06	1.89E-03
1.185	2.04E-03	1.75E-05	2.02E-03
1.318	3.18E-03	6.97E-05	3.11E-03
1.452	3.33E-03	2.14E-04	3.12E-03
1.585	4.48E-03	5.43E-04	3.93E-03
1.718	5.62E-03	1.18E-03	4.44E-03
1.852	6.77E-03	2.29E-03	4.47E-03
1.985	6.91E-03	4.04E-03	4.87E-03
2.118	1.11E-02	6.60E-03	4.46E-03
2.252	3.06E-02	2.65E-02	4.10E-03
2.385	1.84E-02	1.45E-02	3.76E-03
2.518	2.35E-02	2.01E-02	3.40E-03
2.652	3.68E-02	3.38E-02	3.01E-03
2.785	4.49E-02	4.16E-02	3.33E-03
2.918	5.21E-02	4.98E-02	2.26E-03
3.052	6.02E-02	5.82E-02	3.06E-03
3.185	6.84E-02	6.64E-02	1.95E-03
3.318	7.55E-02	7.44E-02	1.12E-03
3.452	8.17E-02	8.19E-02	-2.37E-04
3.585	8.78E-02	8.88E-02	-9.74E-04
3.718	9.38E-02	9.30E-02	-1.98E-03
3.852	9.81E-02	1.00E-01	-2.20E-03
3.985	1.02E-01	1.05E-01	-2.66E-03
4.118	1.05E-01	1.05E-01	-3.07E-03
4.252	1.08E-01	1.11E-01	-3.72E-03
4.385	1.10E-01	1.13E-01	-3.54E-03
4.518	1.10E-01	1.11E-01	-3.57E-03
4.652	1.11E-01	1.15E-01	-3.88E-03
4.785	1.11E-01	1.15E-01	-3.49E-03
4.918	1.11E-01	1.11E-01	-3.91E-03
5.052	1.10E-01	1.12E-01	-1.96E-03
5.185	1.10E-01	1.11E-01	-9.49E-04
5.318	1.08E-01	1.08E-01	-5.10E-04
5.452	1.06E-01	1.06E-01	2.71E-04
5.585	1.03E-01	1.03E-01	3.55E-04
5.718	1.01E-01	9.95E-02	1.68E-03
5.852	9.83E-02	9.61E-02	2.18E-03
5.985	9.54E-02	9.26E-02	2.83E-03
6.118	9.26E-02	8.90E-02	3.57E-03
6.252	8.87E-02	8.53E-02	3.38E-03
6.385	8.59E-02	8.16E-02	4.22E-03
6.518	8.20E-02	7.79E-02	4.05E-03
6.652	7.81E-02	7.43E-02	3.86E-03
6.785	7.53E-02	7.07E-02	4.63E-03
6.918	7.14E-02	6.71E-02	4.33E-03
7.052	6.76E-02	6.36E-02	3.95E-03
7.185	6.37E-02	6.03E-02	3.48E-03
7.318	6.09E-02	5.70E-02	3.91E-03
7.452	5.70E-02	5.38E-02	3.22E-03
7.585	5.32E-02	5.07E-02	2.42E-03
7.718	5.03E-02	4.78E-02	2.51E-03
7.852	4.65E-02	4.50E-02	1.47E-03
7.985	4.36E-02	4.23E-02	1.31E-03
8.118	4.07E-02	3.97E-02	1.02E-03
8.252	3.79E-02	3.73E-02	6.16E-04
8.385	3.40E-02	3.50E-02	-9.13E-04
8.518	3.22E-02	3.27E-02	-5.59E-04
8.652	2.93E-02	3.07E-02	-1.32E-03
8.785	2.65E-02	2.87E-02	-2.20E-03
8.918	2.46E-02	2.68E-02	-2.18E-03
9.052	2.28E-02	2.50E-02	-2.27E-03
9.185	1.99E-02	2.34E-02	-3.47E-03
9.318	1.81E-02	2.18E-02	-3.76E-03
9.452	1.62E-02	2.03E-02	-4.14E-03
9.585	1.43E-02	1.90E-02	-4.61E-03
9.718	1.35E-02	1.77E-02	-4.17E-03
9.852	1.16E-02	1.64E-02	-4.81E-03
9.985	1.08E-02	1.53E-02	-4.52E-03
10.120	8.92E-03	1.42E-02	-5.31E-03
10.252	8.07E-03	1.32E-02	-5.16E-03
10.385	7.21E-03	1.23E-02	-5.09E-03
10.518	6.36E-03	1.14E-02	-5.07E-03
10.650	5.50E-03	1.06E-02	-5.11E-03
10.782	4.65E-03	9.85E-03	-5.21E-03
10.914	3.79E-03	9.14E-03	-5.35E-03
11.046	2.94E-03	8.48E-03	-5.55E-03
11.178	2.08E-03	7.87E-03	-5.79E-03
11.310	1.43E-03	7.35E-03	-5.07E-03
11.442	1.38E-03	6.78E-03	-5.39E-03

August 2005
B3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 79
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2300E-05
 DISPERSIVITY= 0.2434E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.5214
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7136E-03

THE F STATISTIC FOR NP= 3 NOBS= 79 IS: 2.74
 THE CRITICAL RSS IS: 0.7907E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.30E-06	2.28E-06	2.32E-06
X(2)	2.43E-03	2.34E-03	2.53E-03
X(5)	5.21E-01	5.16E-01	5.27E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.17E-01	4.56E-05	6.08E-14	4.56E-05
0.25	1.11E-03	8.19E-07	1.11E-03
3.83E-01	3.17E-03	1.28E-04	3.04E-03
0.5167	6.23E-03	1.49E-03	4.74E-03
0.65	1.33E-02	6.38E-03	6.91E-03
0.7833	2.44E-02	1.66E-02	7.76E-03
0.9167	4.04E-02	3.26E-02	7.85E-03
1.05	5.85E-02	5.32E-02	5.32E-03
1.183	7.66E-02	7.54E-02	1.19E-03
1.317	9.26E-02	9.56E-02	-2.99E-03
1.45	1.06E-01	1.12E-01	-5.80E-03
1.583	1.16E-01	1.22E-01	-4.43E-03
1.717	1.23E-01	1.28E-01	-5.15E-03
1.85	1.27E-01	1.30E-01	-2.68E-03
1.983	1.27E-01	1.28E-01	-9.44E-04
2.117	1.26E-01	1.24E-01	2.19E-03
2.25	1.22E-01	1.18E-01	3.97E-03
2.383	1.16E-01	1.11E-01	4.81E-03
2.517	1.09E-01	1.04E-01	5.25E-03
2.65	1.01E-01	9.63E-02	4.92E-03
2.783	9.33E-02	8.87E-02	4.58E-03
2.917	8.44E-02	8.13E-02	3.06E-03
3.05	7.64E-02	7.42E-02	2.22E-03
3.183	6.85E-02	6.75E-02	9.98E-04
3.317	6.06E-02	6.13E-02	-6.50E-04
3.45	5.36E-02	5.54E-02	-1.75E-03
3.583	4.77E-02	5.00E-02	-2.31E-03
3.717	4.17E-02	4.50E-02	-3.30E-03
3.85	3.68E-02	4.05E-02	-3.72E-03
3.983	3.29E-02	3.64E-02	-3.55E-03
4.117	2.89E-02	3.27E-02	-3.76E-03
4.25	2.50E-02	2.93E-02	-4.32E-03
4.383	2.31E-02	2.63E-02	-3.21E-03
4.517	2.01E-02	2.35E-02	-3.39E-03
4.65	1.82E-02	2.10E-02	-2.85E-03
4.783	1.63E-02	1.88E-02	-2.56E-03
4.917	1.45E-02	1.63E-02	-1.50E-03
5.05	1.34E-02	1.50E-02	-1.64E-03
5.183	1.24E-02	1.34E-02	-9.74E-04
5.317	1.15E-02	1.20E-02	-4.72E-04
5.45	1.06E-02	1.07E-02	-1.22E-04
5.583	9.62E-03	9.53E-03	9.30E-05
5.717	8.69E-03	8.50E-03	1.86E-04
5.85	8.75E-03	7.58E-03	1.17E-03
5.983	7.81E-03	6.76E-03	1.05E-03
6.117	6.88E-03	6.03E-03	8.50E-04
6.25	6.94E-03	5.37E-03	1.57E-03
6.383	6.00E-03	4.79E-03	1.21E-03
6.517	6.07E-03	4.27E-03	1.80E-03
6.65	6.13E-03	3.80E-03	2.33E-03
6.783	5.19E-03	3.39E-03	1.80E-03
6.917	5.25E-03	3.02E-03	2.24E-03
7.05	4.32E-03	2.69E-03	1.63E-03
7.183	4.38E-03	2.40E-03	1.98E-03
7.317	4.44E-03	2.13E-03	2.31E-03
7.45	4.51E-03	1.90E-03	2.61E-03
7.583	3.57E-03	1.69E-03	1.88E-03
7.717	3.63E-03	1.51E-03	2.12E-03
7.85	3.69E-03	1.34E-03	2.35E-03
7.983	3.76E-03	1.20E-03	2.56E-03
8.117	2.82E-03	1.07E-03	1.75E-03
8.25	2.88E-03	9.49E-04	1.93E-03
8.383	2.95E-03	8.45E-04	2.10E-03
8.517	3.01E-03	7.53E-04	2.26E-03
8.65	3.07E-03	6.70E-04	2.40E-03
8.783	2.13E-03	5.97E-04	1.54E-03
8.917	2.20E-03	5.32E-04	1.67E-03
9.05	2.26E-03	4.74E-04	1.79E-03
9.183	2.32E-03	4.22E-04	1.91E-03
9.317	2.39E-03	3.76E-04	2.01E-03
9.45	1.45E-03	3.35E-04	1.11E-03
9.583	1.51E-03	2.98E-04	1.21E-03
9.717	1.57E-03	2.65E-04	1.31E-03
9.85	1.64E-03	2.36E-04	1.40E-03
9.983	7.00E-04	2.11E-04	4.89E-04
10.12	7.63E-04	1.88E-04	5.75E-04
10.25	8.26E-04	1.67E-04	6.58E-04
10.38	8.88E-04	1.49E-04	7.40E-04
10.52	9.51E-04	1.33E-04	8.19E-04

B3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) :
 2) THE NUMBER OF PARAMETERS TO DETERMINE :
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1
 5) THE DISTANCE FROM SOURCE (M) : 0.30

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E
 7) THE DISPERSIVITY (M) : 0.1500E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.00
 10) THE INJECTION CONCENTRATION (UG/L) : 0
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1600E-05
 DISPERSIVITY= 0.1946E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.3931
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3648E-03

THE F STATISTIC FOR NP= 3 NOBS= 79 IS: 2.74
 THE CRITICAL RSS IS: 0.4042E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.60E-06	1.60E-06	1.60E-06
X(2)	1.95E-03	1.87E-03	2.02E-03
X(5)	3.93E-01	3.89E-01	3.97E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.850	1.00E-03	3.69E-08	1.00E-03
0.983	1.00E-03	5.55E-07	9.99E-04
1.117	2.00E-03	4.34E-06	2.00E-03
1.250	3.00E-03	2.16E-05	2.98E-03
1.383	4.00E-03	7.80E-05	3.92E-03
1.517	5.00E-03	2.25E-04	4.78E-03
1.650	6.00E-03	5.41E-04	5.46E-03
1.783	7.00E-03	1.13E-03	5.87E-03
1.917	8.00E-03	2.14E-03	5.87E-03
2.050	9.00E-03	3.66E-03	5.34E-03
2.183	1.10E-02	5.84E-03	5.16E-03
2.317	1.30E-02	8.77E-03	4.23E-03
2.450	1.60E-02	1.24E-02	3.57E-03
2.583	1.90E-02	1.68E-02	2.19E-03
2.717	2.30E-02	2.19E-02	1.14E-03
2.850	2.80E-02	2.74E-02	6.31E-04
2.983	3.30E-02	3.32E-02	-2.09E-04
3.117	3.90E-02	3.92E-02	-2.42E-04
3.250	4.50E-02	4.52E-02	-1.97E-04
3.383	5.00E-02	5.10E-02	-9.52E-04
3.517	5.60E-02	5.64E-02	-1.40E-03
3.650	6.00E-02	6.13E-02	-1.34E-03
3.783	6.50E-02	6.57E-02	-7.28E-04
3.917	6.80E-02	6.95E-02	-1.52E-03
4.050	7.10E-02	7.26E-02	-1.64E-03
4.183	7.40E-02	7.51E-02	-1.08E-03
4.317	7.60E-02	7.69E-02	-8.87E-04
4.450	7.70E-02	7.80E-02	-1.04E-03
4.583	7.80E-02	7.86E-02	-5.99E-04
4.717	7.80E-02	7.86E-02	-6.01E-04
4.850	7.80E-02	7.81E-02	-9.97E-05
4.983	7.70E-02	7.72E-02	-1.50E-04
5.117	7.60E-02	7.68E-02	2.03E-04
5.250	7.40E-02	7.41E-02	-1.14E-04
5.383	7.30E-02	7.22E-02	8.54E-04
5.517	7.10E-02	6.99E-02	1.07E-03
5.650	6.80E-02	6.75E-02	4.68E-04
5.783	6.60E-02	6.50E-02	1.00E-03
5.917	6.30E-02	6.23E-02	6.63E-04
6.050	6.10E-02	5.96E-02	1.38E-03
6.183	5.80E-02	5.69E-02	1.13E-03
6.317	5.60E-02	5.41E-02	1.91E-03
6.450	5.30E-02	5.13E-02	1.66E-03
6.583	5.00E-02	4.86E-02	1.37E-03
6.717	4.70E-02	4.59E-02	1.06E-03
6.850	4.40E-02	4.33E-02	6.67E-04
6.983	4.20E-02	4.08E-02	1.20E-03
7.117	3.90E-02	3.83E-02	6.62E-04
7.250	3.70E-02	3.60E-02	1.02E-03
7.383	3.40E-02	3.37E-02	2.80E-04
7.517	3.20E-02	3.15E-02	4.60E-04
7.650	3.00E-02	2.95E-02	5.22E-04
7.783	2.80E-02	2.75E-02	4.83E-04
7.917	2.60E-02	2.56E-02	3.58E-04
8.050	2.40E-02	2.39E-02	1.18E-04
8.183	2.20E-02	2.22E-02	-2.20E-04
8.317	2.00E-02	2.06E-02	-6.42E-04
8.450	1.90E-02	1.92E-02	-1.68E-04
8.583	1.70E-02	1.78E-02	-7.85E-04
8.717	1.60E-02	1.65E-02	-4.78E-04
8.850	1.40E-02	1.43E-02	-1.26E-03
8.983	1.30E-02	1.41E-02	-1.13E-03
9.117	1.20E-02	1.31E-02	-1.06E-03
9.250	1.10E-02	1.21E-02	-1.07E-03
9.383	1.00E-02	1.12E-02	-1.179E-03
9.517	9.00E-03	1.03E-02	-1.29E-03
9.650	8.00E-03	9.49E-03	-1.49E-03
9.783	7.00E-03	8.75E-03	-1.75E-03
9.917	6.00E-03	8.06E-03	-2.06E-03
10.050	5.00E-03	7.43E-03	-2.43E-03
10.180	5.00E-03	6.85E-03	-1.85E-03
10.320	4.00E-03	6.28E-03	-2.28E-03
10.450	4.00E-03	5.79E-03	-1.79E-03
10.580	3.00E-03	5.33E-03	-2.33E-03
10.720	2.00E-03	4.88E-03	-2.88E-03
10.850	2.00E-03	4.49E-03	-2.49E-03
10.980	1.00E-03	4.13E-03	-3.13E-03
11.120	1.00E-03	3.78E-03	-2.78E-03
11.250	0.00E+00	3.47E-03	-3.47E-03

August 2005
B4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 78
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.1500E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2366E-05
DISPERSIVITY= 0.2329E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.3380
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3689E-03

THE F STATISTIC FOR NP= 3 NOBS= 78 IS: 2.74
THE CRITICAL RSS IS: 0.4093E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.37E-06	2.34E-06	2.39E-06
X(2)	2.33E-03	2.24E-03	2.42E-03
X(5)	3.39E-01	3.36E-01	3.42E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.67E-02	1.00E-03	2.28E-24	1.00E-03
0.1667	1.00E-03	3.25E-10	1.00E-03
2.67E-01	2.50E-03	1.22E-03	2.00E-03
0.3667	4.00E-03	5.28E-05	3.95E-03
0.4667	6.00E-03	4.58E-04	5.54E-03
0.5667	8.00E-03	1.66E-03	6.14E-03
0.6667	1.0E-02	4.94E-03	6.06E-03
0.7667	1.60E-02	1.02E-02	5.84E-03
0.8667	2.20E-02	1.76E-02	4.36E-03
0.9667	3.00E-02	2.72E-02	2.84E-03
1.067	3.90E-02	3.81E-02	9.30E-04
1.167	4.80E-02	4.93E-02	-1.31E-03
1.267	5.70E-02	5.98E-02	-2.81E-03
1.367	6.60E-02	6.88E-02	-2.78E-03
1.467	7.50E-02	7.58E-02	-2.83E-03
1.567	7.80E-02	8.08E-02	-2.84E-03
1.667	8.20E-02	8.39E-02	-1.93E-03
1.767	8.50E-02	8.53E-02	-1.68E-03
1.867	8.60E-02	8.52E-02	7.60E-04
1.967	8.50E-02	8.40E-02	9.92E-04
2.067	8.20E-02	8.19E-02	2.98E-03
2.167	8.20E-02	7.90E-02	2.96E-03
2.267	7.90E-02	7.57E-02	3.28E-03
2.367	7.50E-02	7.28E-02	3.28E-03
2.467	7.10E-02	6.82E-02	2.78E-03
2.567	6.60E-02	6.43E-02	1.72E-03
2.667	6.00E-02	6.03E-02	3.58E-03
2.767	5.70E-02	5.64E-02	5.80E-04
2.867	5.20E-02	5.26E-02	-6.14E-04
2.967	4.80E-02	4.89E-02	-4.39E-04
3.067	4.40E-02	4.64E-02	-1.42E-03
3.167	4.00E-02	4.21E-02	-2.07E-03
3.267	3.70E-02	3.89E-02	-1.90E-03
3.367	3.30E-02	3.59E-02	-2.92E-03
3.467	3.10E-02	3.31E-02	-2.12E-03
3.567	2.80E-02	3.05E-02	-2.51E-03
3.667	2.60E-02	2.81E-02	-2.07E-03
3.767	2.30E-02	2.58E-02	-2.80E-03
3.867	2.20E-02	2.37E-02	-1.69E-03
3.967	2.00E-02	2.17E-02	-1.74E-03
4.067	1.80E-02	1.99E-02	-1.94E-03
4.167	1.70E-02	1.83E-02	-1.28E-03
4.267	1.60E-02	1.67E-02	-7.43E-04
4.367	1.50E-02	1.53E-02	-3.29E-04
4.467	1.40E-02	1.40E-02	-2.94E-05
4.567	1.30E-02	1.28E-02	1.66E-04
4.667	1.20E-02	1.17E-02	2.63E-04
4.767	1.10E-02	1.07E-02	2.70E-04
4.867	1.10E-02	9.81E-03	1.19E-03
4.967	1.00E-02	8.96E-03	1.04E-03
5.067	9.00E-03	8.18E-03	8.16E-04
5.167	9.00E-03	7.47E-03	1.53E-03
5.267	8.00E-03	6.82E-03	1.18E-03
5.367	8.00E-03	6.23E-03	1.77E-03
5.467	7.00E-03	5.69E-03	1.31E-03
5.567	7.00E-03	5.19E-03	1.81E-03
5.667	6.00E-03	4.74E-03	1.27E-03
5.767	6.00E-03	4.32E-03	1.68E-03
5.867	5.00E-03	3.94E-03	1.06E-03
5.967	5.00E-03	3.59E-03	1.41E-03
6.067	5.00E-03	3.28E-03	1.72E-03
6.167	4.00E-03	2.99E-03	1.01E-03
6.267	4.00E-03	2.73E-03	1.27E-03
6.367	4.00E-03	2.49E-03	1.52E-03
6.467	4.00E-03	2.27E-03	1.73E-03
6.567	3.00E-03	2.07E-03	9.34E-04
6.667	3.00E-03	1.88E-03	1.12E-03
6.767	3.00E-03	1.72E-03	1.28E-03
6.867	2.00E-03	1.67E-03	4.35E-04
6.967	2.00E-03	1.43E-03	5.74E-04
7.067	2.00E-03	1.30E-03	7.00E-04
7.167	2.00E-03	1.19E-03	8.15E-04
7.267	2.00E-03	1.08E-03	9.20E-04
7.367	1.00E-03	9.84E-04	1.57E-05
7.467	1.00E-03	8.97E-04	1.03E-04
7.567	1.00E-03	8.18E-04	1.82E-04
7.667	1.00E-03	7.45E-04	2.55E-04
7.767	1.00E-03	6.79E-04	3.21E-04

B4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.1500E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1614E-05
DISPERSIVITY= 0.2303E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1536
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2819E-03

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.3063E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.61E-06	1.60E-06	1.63E-06
X(2)	2.30E-03	2.14E-03	2.49E-03
X(5)	1.54E-01	1.49E-01	1.58E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.983	1.03E-03	8.98E-07	1.03E-03
1.083	1.07E-03	3.62E-06	1.06E-03
1.183	1.11E-03	1.11E-03	2.10E-03
1.283	2.15E-03	3.03E-05	2.12E-03
1.383	3.19E-03	6.95E-05	3.12E-03
1.483	3.23E-03	1.42E-04	3.09E-03
1.583	4.27E-03	2.64E-04	4.01E-03
1.683	4.31E-03	4.55E-04	3.86E-03
1.783	5.35E-03	7.35E-04	4.62E-03
1.883	5.40E-03	1.13E-03	4.17E-03
1.983	6.44E-03	1.64E-03	4.79E-03
2.083	6.48E-03	2.31E-03	4.17E-03
2.183	7.52E-03	3.12E-03	4.40E-03
2.283	7.56E-03	4.09E-03	3.47E-03
2.383	7.60E-03	5.21E-03	2.39E-03
2.483	8.64E-03	6.47E-03	2.17E-03
2.583	9.68E-03	7.85E-03	1.84E-03
2.683	1.07E-02	9.32E-03	1.40E-03
2.783	1.18E-02	1.09E-02	8.95E-04
2.883	1.28E-02	1.25E-02	3.44E-04
2.983	1.39E-02	1.41E-02	-2.25E-04
3.083	1.49E-02	1.57E-02	-7.84E-04
3.183	1.69E-02	1.72E-02	-3.08E-04
3.283	1.90E-02	1.90E-02	-7.76E-04
3.383	1.90E-02	2.02E-02	-1.17E-03
3.483	2.01E-02	2.15E-02	-1.47E-03
3.583	2.11E-02	2.28E-02	-1.68E-03
3.683	2.21E-02	2.39E-02	-1.74E-03
3.783	2.32E-02	2.49E-02	-1.70E-03
3.883	2.42E-02	2.58E-02	-1.54E-03
3.983	2.53E-02	2.65E-02	-1.25E-03
4.083	2.63E-02	2.71E-02	-8.27E-04
4.183	2.73E-02	2.76E-02	-4.11E-04
4.283	2.74E-02	2.80E-02	-6.21E-04
4.383	2.74E-02	2.83E-02	-8.41E-04
4.483	2.75E-02	2.85E-02	-9.52E-04
4.583	2.85E-02	2.85E-02	4.04E-05
4.683	2.86E-02	2.84E-02	1.29E-04
4.783	2.86E-02	2.86E-02	-3.07E-04
4.883	2.76E-02	2.81E-02	-4.34E-04
4.983	2.77E-02	2.78E-02	-1.00E-04
5.083	2.77E-02	2.74E-02	2.60E-04
5.183	2.78E-02	2.70E-02	7.60E-04
5.283	2.68E-02	2.65E-02	2.73E-04
5.383	2.68E-02	2.62E-02	6.32E-04
5.483	2.59E-02	2.55E-02	4.30E-04
5.583	2.59E-02	2.49E-02	1.06E-03
5.683	2.50E-02	2.45E-02	7.22E-04
5.783	2.50E-02	2.36E-02	1.40E-03
5.883	2.40E-02	2.29E-02	1.10E-03
5.983	2.31E-02	2.23E-02	8.18E-04
6.083	2.21E-02	2.16E-02	5.42E-04
6.183	2.22E-02	2.09E-02	1.27E-03
6.283	2.12E-02	2.02E-02	1.00E-03
6.383	2.03E-02	1.95E-02	7.35E-04
6.483	2.03E-02	1.88E-02	1.46E-03
6.583	1.93E-02	1.81E-02	1.19E-03
6.683	1.84E-02	1.75E-02	9.00E-04
6.783	1.74E-02	1.68E-02	6.05E-04
6.883	1.75E-02	1.62E-02	1.30E-03
6.983	1.65E-02	1.55E-02	9.80E-04
7.083	1.55E-02	1.49E-02	6.48E-04
7.183	1.46E-02	1.43E-02	3.02E-04
7.283	1.46E-02	1.37E-02	9.40E-04
7.383	1.37E-02	1.31E-02	5.63E-04
7.483	1.27E-02	1.25E-02	1.68E-04
7.583	1.27E-02	1.20E-02	7.57E-04
7.683	1.18E-02	1.15E-02	3.28E-04
7.783	1.08E-02	1.09E-02	-1.18E-04
7.883	1.09E-02	1.04E-02	4.19E-04
7.983	9.90E-03	9.96E-03	-6.12E-05
8.083	8.94E-03	9.50E-03	-5.59E-04
8.183	8.99E-03	9.06E-03	-7.35E-05
8.283	8.03E-03	8.63E-03	-6.05E-04
8.383	8.07E-03	8.22E-03	-1.53E-04
8.483	7.11E-03	7.83E-03	-7.17E-04
8.583	7.15E-03	7.45E-03	-2.98E-04
8.683	6.19E-03	7.09E-03	-8.94E-04
8.783	6.23E-03	6.74E-03	-5.05E-04
8.883	5.27E-03	6.40E-03	-1.13E-03
8.983	5.31E-03	6.09E-03	-7.71E-04
9.083	4.36E-03	5.78E-03	-1.43E-03
9.183	4.40E-03	5.49E-03	-1.09E-03
9.283	3.44E-03	5.21E-03	-1.77E-03
9.383	3.48E-03	4.95E-03	-1.47E-03
9.483	3.52E-03	4.69E-03	-1.17E-03
9.583	2.56E-03	4.45E-03	-1.89E-03
9.683	2.60E-03	4.22E-03	-1.62E-03
9.783	2.64E-03	4.00E-03	-1.36E-03
9.883	1.68E-03	3.79E-03	-2.11E-03
9.983	1.73E-03	3.59E-03	-1.87E-03
10.080	1.77E-03	3.41E-03	-1.64E-03
10.18	8.07E-04	3.23E-03	-2.32E-03
10.28	8.49E-04	3.06E-03	-2.21E-03
10.38	8.90E-04	2.89E-03	-2.00E-03
10.48	9.31E-04	2.74E-03	-1.81E-03
10.58	-2.83E-05	2.59E-03	-2.62E-03

August 2005
C1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 96
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1829E-05
 DISPERSIVITY= 0.2283E-02
 WIDTH= 0.1000E-02
 RF= 1.000
 CO= 2.238
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7204E-02

THE F STATISTIC FOR NP= 3 NOBS= 96 IS: 2.71
 THE CRITICAL RSS IS: 0.7833E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.83E-06	1.79E-06	1.87E-06
X(2)	2.28E-03	2.08E-03	2.51E-03
X(5)	2.24E+00	2.15E+00	2.33E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
5.03E-01	1.21E-03	7.50E-05	1.14E-03
0.57	3.63E-03	2.98E-04	3.33E-03
6.37E-01	6.04E-03	8.73E-04	5.17E-03
0.7033	9.48E-03	2.04E-03	7.42E-03
0.77	1.39E-02	4.03E-03	9.86E-03
0.8367	1.93E-02	7.00E-03	1.23E-02
0.90333	2.47E-02	1.00E-02	1.37E-02
0.97	3.11E-02	1.60E-02	1.51E-02
1.037	3.65E-02	2.19E-02	1.46E-02
1.103	4.30E-02	2.84E-02	1.46E-02
1.17	4.84E-02	3.55E-02	1.29E-02
1.237	5.38E-02	4.28E-02	1.10E-02
1.303	5.92E-02	5.02E-02	9.05E-03
1.37	6.36E-02	5.75E-02	6.15E-03
1.437	6.80E-02	6.45E-02	3.52E-03
1.503	7.15E-02	7.11E-02	3.54E-04
1.57	7.59E-02	7.73E-02	-1.43E-03
1.637	7.93E-02	8.30E-02	-3.67E-03
1.703	8.17E-02	8.80E-02	-6.25E-03
1.77	8.51E-02	9.24E-02	-7.31E-03
1.837	8.75E-02	9.63E-02	-8.76E-03
1.903	9.00E-02	9.95E-02	-9.55E-03
1.97	9.24E-02	1.02E-01	-9.81E-03
2.037	9.38E-02	1.04E-01	-1.05E-02
2.103	9.52E-02	1.06E-01	-1.06E-02
2.17	9.66E-02	1.07E-01	-1.03E-02
2.237	9.80E-02	1.08E-01	-9.52E-03
2.303	9.94E-02	1.09E-01	-8.32E-03
2.37	9.99E-02	1.08E-01	-7.52E-03
2.437	1.00E-01	1.07E-01	-6.75E-03
2.503	1.01E-01	1.01E-01	-5.52E-03
2.57	1.01E-01	1.05E-01	-4.01E-03
2.637	1.01E-01	1.04E-01	-3.25E-03
2.703	1.01E-01	1.02E-01	-1.30E-02
2.77	1.00E-01	1.00E-01	-4.85E-05
2.837	9.98E-02	9.85E-02	1.24E-03
2.903	9.92E-02	9.62E-02	2.87E-03
2.97	9.86E-02	9.44E-02	4.24E-03
3.037	9.80E-02	9.21E-02	5.91E-03
3.103	9.64E-02	8.98E-02	6.61E-03
3.17	9.49E-02	8.75E-02	7.40E-03
3.237	9.43E-02	8.50E-02	9.23E-03
3.303	9.27E-02	8.25E-02	1.00E-02
3.37	9.11E-02	8.02E-02	1.09E-02
3.437	8.85E-02	7.77E-02	1.08E-02
3.503	8.69E-02	7.53E-02	1.16E-02
3.57	8.44E-02	7.29E-02	1.11E-02
3.637	8.28E-02	7.05E-02	1.23E-02
3.703	8.02E-02	6.81E-02	1.21E-02
3.77	7.76E-02	6.58E-02	1.18E-02
3.837	7.50E-02	6.35E-02	1.15E-02
3.903	7.24E-02	6.12E-02	1.12E-02
3.97	6.98E-02	5.90E-02	1.08E-02
4.037	6.63E-02	5.69E-02	9.41E-03
4.103	6.37E-02	5.48E-02	8.92E-03
4.17	6.01E-02	5.27E-02	7.33E-03
4.237	5.75E-02	5.07E-02	6.82E-03
4.303	5.49E-02	4.88E-02	6.16E-03
4.37	5.13E-02	4.69E-02	4.43E-03
4.437	4.88E-02	4.50E-02	3.74E-03
4.503	4.52E-02	4.33E-02	1.91E-03
4.57	4.26E-02	4.15E-02	1.07E-03
4.637	4.00E-02	3.99E-02	1.50E-04
4.703	3.74E-02	3.83E-02	-8.34E-04
4.77	3.48E-02	3.67E-02	-1.86E-03
4.837	3.23E-02	3.52E-02	-2.93E-03
4.903	2.97E-02	3.37E-02	-4.07E-03
4.97	2.71E-02	3.23E-02	-5.26E-03
5.037	2.55E-02	3.10E-02	-5.48E-03
5.103	2.29E-02	2.97E-02	-6.77E-03
5.17	2.13E-02	2.84E-02	-7.11E-03
5.237	1.98E-02	2.72E-02	-7.48E-03
5.303	1.82E-02	2.61E-02	-7.92E-03
5.37	1.66E-02	2.50E-02	-8.38E-03
5.437	1.40E-02	2.39E-02	-9.88E-03
5.503	1.34E-02	2.29E-02	-9.48E-03
5.57	1.18E-02	2.18E-02	-1.00E-02
5.637	1.02E-02	2.09E-02	-1.07E-02
5.703	9.66E-03	2.00E-02	-1.04E-02
5.77	9.08E-03	1.91E-02	-1.01E-02
5.837	7.49E-03	1.83E-02	-1.08E-02
5.903	6.91E-03	1.75E-02	-1.06E-02
5.97	6.32E-03	1.67E-02	-1.04E-02
6.037	5.74E-03	1.60E-02	-1.03E-02
6.103	5.16E-03	1.53E-02	-1.01E-02
6.17	4.57E-03	1.46E-02	-1.00E-02
6.237	3.99E-03	1.40E-02	-9.97E-03
6.303	3.40E-03	1.33E-02	-9.94E-03
6.37	2.82E-03	1.27E-02	-9.92E-03
6.437	2.24E-03	1.22E-02	-9.93E-03
6.503	1.65E-03	1.16E-02	-9.98E-03
6.57	1.07E-03	1.11E-02	-1.00E-02
6.637	1.48E-03	1.06E-02	-9.12E-03
6.703	8.99E-04	1.01E-02	-9.23E-03
6.77	3.15E-04	9.67E-03	-9.35E-03
6.837	7.31E-04	9.23E-03	-8.50E-03

C1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 70
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1819E-05
 DISPERSIVITY= 0.1490E-02
 WIDTH= 0.1000E-02
 RF= 1.000
 CO= 3.258
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5434E-02

THE F STATISTIC FOR NP= 3 NOBS= 70 IS: 2.75
 THE CRITICAL RSS IS: 0.6103E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.82E-06	1.80E-06	1.84E-06
X(2)	1.49E-03	1.37E-03	1.62E-03
X(5)	3.26E+00	3.16E+00	3.36E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.103	2.55E-02	1.10E-02	1.44E-02
2.203	2.92E-02	1.57E-02	1.35E-02
2.303	3.39E-02	2.13E-02	1.26E-02
2.403	3.96E-02	2.79E-02	1.17E-02
2.503	4.63E-02	3.54E-02	1.09E-02
2.603	5.30E-02	4.37E-02	9.31E-03
2.703	6.07E-02	5.25E-02	8.19E-03
2.803	6.84E-02	6.17E-02	6.68E-03
2.903	7.61E-02	7.11E-02	4.99E-03
3.003	8.38E-02	8.05E-02	3.33E-03
3.103	9.05E-02	8.96E-02	8.82E-04
3.203	9.72E-02	9.84E-02	-1.16E-03
3.303	1.03E-01	1.07E-01	-3.64E-03
3.403	1.09E-01	1.14E-01	-5.44E-03
3.503	1.14E-01	1.21E-01	-6.45E-03
3.603	1.19E-01	1.27E-01	-7.59E-03
3.703	1.23E-01	1.32E-01	-8.81E-03
3.803	1.26E-01	1.36E-01	-9.09E-03
3.903	1.29E-01	1.39E-01	-9.43E-03
4.003	1.31E-01	1.41E-01	-9.84E-03
4.103	1.34E-01	1.42E-01	-8.35E-03
4.203	1.34E-01	1.42E-01	-8.52E-03
4.303	1.35E-01	1.42E-01	-6.89E-03
4.403	1.36E-01	1.41E-01	-5.04E-03
4.503	1.35E-01	1.39E-01	-3.52E-03
4.603	1.35E-01	1.37E-01	-1.41E-03
4.703	1.35E-01	1.34E-01	1.21E-03
4.803	1.34E-01	1.30E-01	3.29E-03
4.903	1.31E-01	1.26E-01	4.74E-03
5.003	1.29E-01	1.22E-01	6.50E-03
5.103	1.27E-01	1.18E-01	8.52E-03
5.203	1.23E-01	1.14E-01	9.72E-03
5.303	1.19E-01	1.09E-01	1.01E-02
5.403	1.16E-01	1.04E-01	1.15E-02
5.503	1.11E-01	9.94E-02	1.20E-02
5.603	1.06E-01	9.46E-02	1.15E-02
5.703	1.02E-01	8.99E-02	1.19E-02
5.803	9.65E-02	8.52E-02	1.13E-02
5.903	9.12E-02	8.06E-02	1.06E-02
6.003	8.59E-02	7.61E-02	9.83E-03
6.103	8.06E-02	7.17E-02	8.92E-03
6.203	7.43E-02	6.75E-02	6.87E-03
6.303	6.80E-02	6.34E-02	4.67E-03
6.403	6.27E-02	5.94E-02	3.31E-03
6.503	5.74E-02	5.56E-02	1.79E-03
6.603	5.21E-02	5.20E-02	1.04E-04
6.703	4.68E-02	4.86E-02	-1.75E-03
6.803	4.15E-02	4.53E-02	-3.78E-03
6.903	3.72E-02	4.22E-02	-4.97E-03
7.003	3.29E-02	3.93E-02	-6.34E-03
7.103	2.87E-02	3.65E-02	-7.86E-03
7.203	2.54E-02	3.39E-02	-8.55E-03
7.303	2.21E-02	3.14E-02	-9.39E-03
7.403	1.88E-02	2.91E-02	-1.04E-02
7.503	1.65E-02	2.70E-02	-1.05E-02
7.603	1.32E-02	2.50E-02	-1.18E-02
7.703	1.09E-02	2.31E-02	-1.22E-02
7.803	9.58E-03	2.13E-02	-1.17E-02
7.903	7.93E-03	1.97E-02	-1.24E-02
8.003	5.98E-03	1.81E-02	-1.21E-02
8.103	4.69E-03	1.67E-02	-1.20E-02
8.203	3.39E-03	1.54E-02	-1.20E-02
8.303	3.10E-03	1.41E-02	-1.11E-02
8.403	1.80E-03	1.30E-02	-1.12E-02
8.503	1.60E-03	1.20E-02	-1.05E-02
8.603	1.21E-03	1.10E-02	-9.77E-03
8.703	-8.85E-05	1.01E-02	-1.02E-02
8.803	-3.85E-04	9.24E-03	-9.63E-03
8.903	3.20E-04	8.48E-03	-8.16E-03
9.003	2.35E-05	7.77E-03	-7.75E-03

August 2005
C2_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-02
9) THE RETARDATION FACTOR (DIM) : 1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1691E-05
DISPERSIVITY= 0.1184E-02
WIDTH= 0.1000E-02
RF= 1.000
CO= 1.495
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2467E-02

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72
THE CRITICAL RSS IS: 0.2704E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.68E-06	1.67E-06	1.70E-06
X(2)	1.18E-03	1.22E-03	1.22E-03
X(5)	1.50E+00	1.45E+00	1.54E+00

TIME (HOURS)	OBS.	CONC.	CALC.	CONC.	RESIDUALS
7.82E-01	1.23E-03	2.34E-05	1.20E-03	0.84E-03	7.53E-05
0.8483	2.18E-03	2.02E-04	1.98E-03	9.15E-01	2.18E-03
0.9817	3.66E-03	4.64E-04	3.19E-03	1.048	5.41E-03
1.048	5.41E-03	9.42E-04	4.19E-03	1.115	7.61E-03
1.115	7.61E-03	1.74E-03	5.87E-03	1.182	9.09E-03
1.182	9.09E-03	2.96E-03	6.13E-03	1.248	1.16E-02
1.248	1.16E-02	4.65E-03	6.92E-03	1.315	1.50E-02
1.315	1.50E-02	6.94E-03	8.10E-03	1.382	1.85E-02
1.382	1.85E-02	9.84E-03	8.68E-03	1.448	2.20E-02
1.448	2.20E-02	1.33E-02	8.70E-03	1.515	2.55E-02
1.515	2.55E-02	1.74E-02	8.07E-03	1.582	3.00E-02
1.582	3.00E-02	2.20E-02	7.93E-03	1.648	3.44E-02
1.648	3.44E-02	2.70E-02	7.41E-03	1.715	3.89E-02
1.715	3.89E-02	3.24E-02	6.47E-03	1.782	4.34E-02
1.782	4.34E-02	3.81E-02	5.29E-03	1.848	4.69E-02
1.848	4.69E-02	4.38E-02	3.08E-03	1.915	5.13E-02
1.915	5.13E-02	4.96E-02	1.78E-03	1.982	5.58E-02
1.982	5.58E-02	5.52E-02	5.75E-04	2.048	6.03E-02
2.048	6.03E-02	6.06E-02	-3.41E-04	2.115	6.58E-02
2.115	6.58E-02	6.58E-02	-2.05E-03	2.182	6.72E-02
2.182	6.72E-02	7.07E-02	-3.42E-03	2.248	7.07E-02
2.248	7.07E-02	7.50E-02	-4.30E-03	2.315	7.42E-02
2.315	7.42E-02	7.90E-02	-4.78E-03	2.382	7.67E-02
2.382	7.67E-02	8.25E-02	-5.79E-03	2.448	7.92E-02
2.448	7.92E-02	8.54E-02	-6.23E-03	2.515	8.16E-02
2.515	8.16E-02	8.78E-02	-6.20E-03	2.582	8.41E-02
2.582	8.41E-02	8.98E-02	-5.87E-03	2.648	8.66E-02
2.648	8.66E-02	9.12E-02	-5.62E-03	2.715	8.71E-02
2.715	8.71E-02	9.22E-02	-5.10E-03	2.782	8.72E-02
2.782	8.72E-02	9.27E-02	-4.57E-03	2.848	8.90E-02
2.848	8.90E-02	9.27E-02	-3.73E-03	2.915	8.95E-02
2.915	8.95E-02	9.24E-02	-2.93E-03	2.982	9.00E-02
2.982	9.00E-02	9.17E-02	-1.78E-03	3.048	9.05E-02
3.048	9.05E-02	9.07E-02	-1.26E-03	3.115	8.89E-02
3.115	8.89E-02	8.94E-02	-4.69E-04	3.182	8.84E-02
3.182	8.84E-02	8.78E-02	6.02E-04	3.248	8.79E-02
3.248	8.79E-02	8.60E-02	1.89E-03	3.315	8.64E-02
3.315	8.64E-02	8.40E-02	2.37E-03	3.382	8.48E-02
3.382	8.48E-02	8.18E-02	3.04E-03	3.448	8.43E-02
3.448	8.43E-02	7.95E-02	4.82E-03	3.515	8.18E-02
3.515	8.18E-02	7.71E-02	4.73E-03	3.582	8.03E-02
3.582	8.03E-02	7.45E-02	5.75E-03	3.648	7.77E-02
3.648	7.77E-02	7.20E-02	5.79E-03	3.715	7.62E-02
3.715	7.62E-02	6.93E-02	6.91E-03	3.782	7.37E-02
3.782	7.37E-02	6.66E-02	7.05E-03	3.848	7.12E-02
3.848	7.12E-02	6.40E-02	7.16E-03	3.915	6.77E-02
3.915	6.77E-02	6.13E-02	6.31E-03	3.982	6.51E-02
3.982	6.51E-02	5.87E-02	6.43E-03	4.048	6.26E-02
4.048	6.26E-02	5.61E-02	6.49E-03	4.115	5.91E-02
4.115	5.91E-02	5.36E-02	5.55E-03	4.182	5.66E-02
4.182	5.66E-02	5.10E-02	5.54E-03	4.248	5.30E-02
4.248	5.30E-02	4.86E-02	4.45E-03	4.315	5.05E-02
4.315	5.05E-02	4.62E-02	4.34E-03	4.382	4.70E-02
4.382	4.70E-02	4.38E-02	3.15E-03	4.448	4.45E-02
4.448	4.45E-02	4.16E-02	2.85E-03	4.515	4.19E-02
4.515	4.19E-02	3.94E-02	2.51E-03	4.582	3.84E-02
4.582	3.84E-02	3.73E-02	1.10E-03	4.648	3.59E-02
4.648	3.59E-02	3.53E-02	5.66E-04	4.715	3.34E-02
4.715	3.34E-02	3.34E-02	-6.58E-06	4.782	3.09E-02
4.782	3.09E-02	3.15E-02	-6.60E-04	4.848	2.83E-02
4.848	2.83E-02	2.98E-02	-1.43E-03	4.915	2.58E-02
4.915	2.58E-02	2.80E-02	-2.24E-03	4.982	2.33E-02
4.982	2.33E-02	2.64E-02	-3.13E-03	5.048	2.18E-02
5.048	2.18E-02	2.49E-02	-3.12E-03	5.115	1.92E-02
5.115	1.92E-02	2.34E-02	-4.17E-03	5.182	1.77E-02
5.182	1.77E-02	2.20E-02	-4.29E-03	5.248	1.52E-02
5.248	1.52E-02	2.07E-02	-5.50E-03	5.315	1.37E-02
5.315	1.37E-02	1.94E-02	-5.76E-03	5.382	1.21E-02
5.382	1.21E-02	1.82E-02	-6.08E-03	5.448	1.06E-02
5.448	1.06E-02	1.71E-02	-6.49E-03	5.515	9.09E-03
5.515	9.09E-03	1.60E-02	-6.94E-03	5.582	8.57E-03
5.582	8.57E-03	1.50E-02	-7.45E-03	5.648	7.05E-03
5.648	7.05E-03	1.41E-02	-7.03E-03	5.715	6.53E-03
5.715	6.53E-03	1.32E-02	-6.65E-03	5.782	5.00E-03
5.782	5.00E-03	1.23E-02	-7.33E-03	5.848	4.48E-03
5.848	4.48E-03	1.15E-02	-7.06E-03	5.915	3.96E-03
5.915	3.96E-03	1.08E-02	-6.83E-03	5.982	2.43E-03
5.982	2.43E-03	1.01E-02	-7.65E-03	6.048	1.91E-03
6.048	1.91E-03	9.43E-03	-7.52E-03	6.115	1.39E-03
6.115	1.39E-03	8.80E-03	-7.41E-03	6.182	8.64E-04
6.182	8.64E-04	8.21E-03	-7.35E-03	6.248	1.34E-03
6.248	1.34E-03	7.63E-03	-7.31E-03	6.315	8.18E-04
6.315	8.18E-04	7.16E-03	-6.34E-03	6.382	2.95E-04
6.382	2.95E-04	6.67E-03	-6.38E-03	6.448	2.25E-04
6.448	2.25E-04	6.23E-03	-6.29E-03	6.515	2.49E-04
6.515	2.49E-04	5.80E-03	-5.55E-03	6.582	-2.74E-04
6.582	-2.74E-04	5.40E-03	-5.68E-03		

C2_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 91
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-02
9) THE RETARDATION FACTOR (DIM) : 1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1507E-05
DISPERSIVITY= 0.1598E-02
WIDTH= 0.1000E-02
RF= 1.000
CO= 1.975
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.8002E-02

THE F STATISTIC FOR NP= 3 NOBS= 91 IS: 2.72
THE CRITICAL RSS IS: 0.8743E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.51E-06	1.48E-06	1.54E-06
X(2)	1.10E-03	1.37E-03	1.69E-03
X(5)	1.98E+00	1.88E+00	2.07E+00

TIME (HOURS)	OBS.	CONC.	CALC.	CONC.	RESIDUALS
0.515	1.23E-03	2.01E-18	1.23E-03	0.815	4.14E-15
0.815	2.93E-03	1.00E-12	2.93E-03	0.815	4.28E-03
0.815	4.28E-03	6.26E-11	4.28E-03	0.915	5.63E-03
0.915	5.63E-03	1.67E-09	5.63E-03	1.015	5.97E-03
1.015	5.97E-03	2.07E-08	5.97E-03	1.115	7.32E-03
1.115	7.32E-03	1.69E-07	7.32E-03	1.215	8.67E-03
1.215	8.67E-03	9.66E-07	8.67E-03	1.315	1.00E-02
1.315	1.00E-02	4.18E-06	1.00E-02	1.415	1.24E-02
1.415	1.24E-02	1.44E-05	1.24E-02	1.515	1.37E-02
1.515	1.37E-02	4.15E-05	1.37E-02	1.615	1.51E-02
1.615	1.51E-02	1.03E-04	1.51E-02	1.715	1.64E-02
1.715	1.64E-02	2.27E-04	1.64E-02	1.815	1.78E-02
1.815	1.78E-02	4.52E-04	1.78E-02	1.915	1.91E-02
1.915	1.91E-02	8.26E-04	1.91E-02	2.015	2.05E-02
2.015	2.05E-02	1.41E-03	2.05E-02	2.115	2.18E-02
2.115	2.18E-02	2.24E-03	2.18E-02	2.215	2.32E-02
2.215	2.32E-02	3.40E-03	2.32E-02	2.315	2.45E-02
2.315	2.45E-02	4.92E-03	2.45E-02	2.415	2.59E-02
2.415	2.59E-02	6.84E-03	2.59E-02	2.515	2.62E-02
2.515	2.62E-02	9.17E-03	2.62E-02	2.615	2.68E-02
2.615	2.68E-02	1.19E-02	2.68E-02	2.715	2.89E-02
2.715	2.89E-02	1.51E-02	2.89E-02	2.815	3.13E-02
2.815	3.13E-02	1.86E-02	3.13E-02	2.915	2.25E-02
2.915	2.25E-02	2.25E-02	2.25E-02	3.015	3.40E-02
3.015	3.40E-02	2.67E-02	3.40E-02	3.115	3.63E-02
3.115	3.63E-02	3.11E-02	3.63E-02	3.215	3.87E-02
3.215	3.87E-02	3.56E-02	3.87E-02	3.315	4.10E-02
3.315	4.10E-02	4.02E-02	4.10E-02	3.415	4.34E-02
3.415	4.34E-02	4.48E-02	-1.47E-03	3.515	4.57E-02
3.515	4.57E-02	4.91E-02	-3.68E-03	3.615	4.91E-02
3.615	4.91E-02	5.38E-02	-4.77E-03	3.715	5.14E-02
3.715	5.14E-02	5.81E-02	-6.69E-03	3.815	5.48E-02
3.815	5.48E-02	6.21E-02	-7.37E-03	3.915	5.81E-02
3.915	5.81E-02	6.69E-02	-7.79E-03	4.015	6.05E-02
4.015	6.05E-02	6.94E-02	-8.89E-03	4.115	6.38E-02
4.115	6.38E-02	7.25E-02	-8.66E-03	4.215	6.89E-02
4.215	6.89E-02	7.52E-02	-7.62E-03	4.315	6.95E-02
4.315	6.95E-02	7.76E-02	-8.11E-03	4.415	7.19E-02
4.415	7.19E-02	7.96E-02	-7.78E-03	4.515	7.42E-02
4.515	7.42E-02	8.13E-02	-7.07E-03	4.615	7.66E-02
4.615	7.66E-02	8.25E-02	-5.99E-03	4.715	7.79E-02
4.715	7.79E-02	8.34E-02	-5.54E-03	4.815	7.80E-02
4.815	7.80E-02	8.40E-02	-3.75E-03	4.915	8.16E-02
4.915	8.16E-02	8.42E-02	-2.62E-03	5.015	8.20E-02
5.015	8.20E-02	8.41E-02	-2.18E-03	5.115	8.33E-02
5.115	8.33E-02	8.37E-02	-4.42E-04	5.215	8.37E-02
5.215	8.37E-02	8.31E-			

August 2005
C3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1652E-05
DISPERSIVITY= 0.1318E-02
WIDTH= 0.1000E-02
RF= 1.000
CO= 1.581
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2815E-02

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
THE CRITICAL RSS IS: 0.3096E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.65E-06	1.64E-06	1.67E-06
X(2)	1.32E-03	1.23E-03	1.42E-03
X(5)	1.58E+00	1.53E+00	1.63E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.85E-01	1.46E-03	1.12E-03	3.46E-03
0.9517	1.76E-04	3.36E-04	1.42E-03
1.02E+00	3.25E-03	7.03E-04	2.55E-03
1.085	4.75E-03	1.33E-03	3.42E-03
1.152	7.29E-03	2.32E-03	4.93E-03
1.218	9.74E-03	3.71E-03	6.03E-03
1.285	1.22E-02	5.63E-03	6.61E-03
1.352	1.57E-02	8.11E-03	7.64E-03
1.418	1.92E-02	1.11E-02	8.13E-03
1.485	2.27E-02	1.47E-02	8.04E-03
1.552	2.72E-02	1.88E-02	8.43E-03
1.618	3.17E-02	2.33E-02	8.43E-03
1.685	3.52E-02	2.82E-02	7.00E-03
1.752	3.97E-02	3.34E-02	6.28E-03
1.818	4.42E-02	3.88E-02	5.45E-03
1.885	4.77E-02	4.42E-02	3.47E-03
1.952	5.22E-02	4.97E-02	2.50E-03
2.018	5.57E-02	5.50E-02	7.09E-04
2.085	6.02E-02	6.02E-02	3.35E-05
2.152	6.37E-02	6.51E-02	-1.39E-03
2.218	6.72E-02	6.96E-02	-2.42E-03
2.285	6.97E-02	7.39E-02	-4.16E-03
2.352	7.32E-02	7.72E-02	-4.26E-03
2.418	7.57E-02	8.10E-02	-5.34E-03
2.485	7.82E-02	8.40E-02	-5.80E-03
2.552	7.97E-02	8.55E-02	-6.31E-03
2.618	8.22E-02	8.85E-02	-6.33E-03
2.685	8.37E-02	9.01E-02	-6.44E-03
2.752	8.52E-02	9.13E-02	-6.12E-03
2.818	8.67E-02	9.20E-02	-5.91E-03
2.885	8.72E-02	9.24E-02	-5.25E-03
2.952	8.77E-02	9.24E-02	-4.76E-03
3.018	8.82E-02	9.21E-02	-4.22E-03
3.085	8.86E-02	9.14E-02	-2.79E-03
3.152	8.91E-02	9.05E-02	-1.35E-03
3.218	8.86E-02	8.93E-02	-6.76E-04
3.285	8.81E-02	8.79E-02	-2.38E-04
3.352	8.76E-02	8.63E-02	1.37E-03
3.418	8.71E-02	8.45E-02	2.64E-03
3.485	8.66E-02	8.25E-02	3.05E-03
3.552	8.51E-02	8.04E-02	4.68E-03
3.618	8.36E-02	7.83E-02	5.34E-03
3.685	8.21E-02	7.60E-02	6.10E-03
3.752	7.96E-02	7.37E-02	5.95E-03
3.818	7.81E-02	7.13E-02	6.80E-03
3.885	7.56E-02	6.89E-02	6.72E-03
3.952	7.31E-02	6.64E-02	6.67E-03
4.018	7.16E-02	6.40E-02	7.58E-03
4.085	6.91E-02	6.16E-02	7.52E-03
4.152	6.66E-02	5.92E-02	7.44E-03
4.218	6.41E-02	5.68E-02	7.30E-03
4.285	6.06E-02	5.44E-02	6.17E-03
4.352	5.81E-02	5.21E-02	5.99E-03
4.418	5.56E-02	4.98E-02	5.73E-03
4.485	5.31E-02	4.76E-02	5.48E-03
4.552	4.96E-02	4.54E-02	4.13E-03
4.618	4.71E-02	4.34E-02	3.70E-03
4.685	4.36E-02	4.13E-02	2.25E-03
4.752	4.11E-02	3.93E-02	1.73E-03
4.818	3.86E-02	3.74E-02	1.12E-03
4.885	3.61E-02	3.56E-02	4.69E-04
4.952	3.36E-02	3.38E-02	-2.45E-04
5.018	3.10E-02	3.21E-02	-1.06E-03
5.085	2.85E-02	3.05E-02	-1.91E-03
5.152	2.60E-02	2.89E-02	-2.83E-03
5.218	2.35E-02	2.74E-02	-3.84E-03
5.285	2.20E-02	2.59E-02	-3.88E-03
5.352	1.95E-02	2.45E-02	-5.00E-03
5.418	1.80E-02	2.32E-02	-5.19E-03
5.485	1.55E-02	2.19E-02	-6.42E-03
5.552	1.40E-02	2.07E-02	-6.72E-03
5.618	1.25E-02	1.96E-02	-7.09E-03
5.685	1.10E-02	1.10E-02	-7.49E-03
5.752	9.50E-03	1.75E-02	-7.95E-03
5.818	9.00E-03	1.65E-02	-7.48E-03
5.885	7.50E-03	1.55E-02	-8.04E-03
5.952	5.99E-03	1.46E-02	-8.65E-03
6.018	5.49E-03	1.38E-02	-8.32E-03
6.085	3.99E-03	1.30E-02	-9.02E-03
6.152	3.48E-03	1.22E-02	-9.76E-03
6.218	2.98E-03	1.15E-02	-8.55E-03
6.285	2.47E-03	1.09E-02	-8.37E-03
6.352	9.71E-04	9.71E-03	-9.23E-03
6.418	4.67E-04	9.60E-03	-9.13E-03
6.485	-3.65E-05	9.03E-03	-9.06E-03

C3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 70
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1399E-05
DISPERSIVITY= 0.1258E-02
WIDTH= 0.1000E-02
RF= 1.000
CO= 1.848
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2528E-02

THE F STATISTIC FOR NP= 3 NOBS= 70 IS: 2.75
THE CRITICAL RSS IS: 0.2839E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.40E-06	1.39E-06	1.41E-06
X(2)	1.26E-03	1.14E-03	1.38E-03
X(5)	1.85E+00	1.79E+00	1.90E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.067	2.75E-02	1.21E-02	1.54E-02
3.167	2.89E-02	1.52E-02	1.37E-02
3.267	3.12E-02	1.85E-02	1.26E-02
3.367	3.25E-02	2.23E-02	1.02E-02
3.467	3.48E-02	2.63E-02	8.52E-03
3.567	3.71E-02	3.05E-02	6.57E-03
3.667	3.94E-02	3.50E-02	4.44E-03
3.767	4.27E-02	3.95E-02	3.19E-03
3.867	4.50E-02	4.41E-02	8.87E-04
3.967	4.83E-02	4.88E-02	-4.11E-04
4.067	5.17E-02	5.33E-02	-1.64E-03
4.167	5.50E-02	5.77E-02	-2.74E-03
4.267	5.83E-02	6.19E-02	-3.65E-03
4.367	6.16E-02	6.59E-02	-4.33E-03
4.467	6.49E-02	6.96E-02	-4.73E-03
4.567	6.72E-02	7.30E-02	-5.82E-03
4.667	7.05E-02	7.61E-02	-5.57E-03
4.767	7.28E-02	7.88E-02	-5.96E-03
4.867	7.51E-02	8.11E-02	-5.98E-03
4.967	7.74E-02	8.30E-02	-5.61E-03
5.067	7.97E-02	8.46E-02	-4.86E-03
5.167	8.11E-02	8.58E-02	-4.73E-03
5.267	8.24E-02	8.66E-02	-4.42E-03
5.367	8.37E-02	8.70E-02	-3.35E-03
5.467	8.50E-02	8.71E-02	-2.13E-03
5.567	8.53E-02	8.69E-02	-1.59E-03
5.667	8.56E-02	8.63E-02	-7.39E-04
5.767	8.59E-02	8.55E-02	3.95E-04
5.867	8.52E-02	8.44E-02	7.90E-04
5.967	8.45E-02	8.31E-02	1.42E-03
6.067	8.38E-02	8.16E-02	2.27E-03
6.167	8.31E-02	7.98E-02	3.30E-03
6.267	8.15E-02	7.80E-02	3.50E-03
6.367	8.08E-02	7.59E-02	4.84E-03
6.467	7.91E-02	7.38E-02	5.30E-03
6.567	7.74E-02	7.15E-02	6.85E-03
6.667	7.47E-02	6.92E-02	6.49E-03
6.767	7.30E-02	6.68E-02	6.18E-03
6.867	7.03E-02	6.44E-02	5.92E-03
6.967	6.76E-02	6.19E-02	5.68E-03
7.067	6.59E-02	5.95E-02	6.45E-03
7.167	6.32E-02	5.70E-02	6.22E-03
7.267	5.96E-02	5.46E-02	4.97E-03
7.367	5.69E-02	5.22E-02	4.70E-03
7.467	5.42E-02	4.98E-02	4.40E-03
7.567	5.15E-02	4.74E-02	4.05E-03
7.667	4.88E-02	4.51E-02	3.66E-03
7.767	4.51E-02	4.29E-02	2.21E-03
7.867	4.24E-02	4.07E-02	1.69E-03
7.967	3.97E-02	3.86E-02	1.12E-03
8.067	3.70E-02	3.66E-02	4.74E-04
8.167	3.43E-02	3.46E-02	-2.41E-04
8.267	3.16E-02	3.27E-02	-1.03E-03
8.367	2.90E-02	3.08E-02	-1.89E-03
8.467	2.63E-02	2.91E-02	-2.82E-03
8.567	2.36E-02	2.74E-02	-3.83E-03
8.667	2.19E-02	2.58E-02	-3.91E-03
8.767	1.92E-02	2.43E-02	-5.07E-03
8.867	1.75E-02	2.28E-02	-5.30E-03
8.967	1.48E-02	2.14E-02	-6.59E-03
9.067	1.31E-02	2.01E-02	-6.96E-03
9.167	1.14E-02	1.88E-02	-7.40E-03
9.267	9.73E-03	1.76E-02	-7.90E-03
9.367	8.04E-03	1.65E-02	-8.46E-03
9.467	6.35E-03	1.54E-02	-8.09E-03
9.567	5.66E-03	1.44E-02	-8.77E-03
9.667	3.97E-03	1.35E-02	-9.51E-03
9.767	2.28E-03	1.26E-02	-1.03E-02
9.867	1.59E-03	1.17E-02	-1.02E-02
9.967	8.96E-04	1.10E-02	-1.01E-02

August 2005
C4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 65
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2261E-05
 DISPERSIVITY= 0.2378E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1543
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4047E-04

THE F STATISTIC FOR NP= 3 NOBS= 65 IS: 2.76
 THE CRITICAL RSS IS: 0.4587E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.26E-06	2.26E-06	2.26E-06
X(2)	2.38E-03	2.33E-03	2.45E-03
X(5)	1.54E-01	1.53E-01	1.56E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.17E-01	8.48E-05	1.17E-03	-1.08E-03
0.6833	2.24E-03	2.13E-03	1.10E-04
7.50E-01	3.39E-03	3.49E-03	-9.28E-05
0.8167	6.55E-03	5.26E-03	1.29E-03
0.8833	8.70E-03	7.45E-03	1.25E-03
0.95	1.19E-02	1.00E-02	1.82E-03
1.017	1.50E-02	1.29E-02	2.06E-03
1.083	1.72E-02	1.81E-02	-1.07E-03
1.15	2.03E-02	1.94E-02	9.67E-04
1.217	2.35E-02	2.26E-02	8.90E-04
1.283	2.56E-02	2.57E-02	-3.09E-05
1.35	2.78E-02	2.85E-02	-7.08E-04
1.417	2.99E-02	3.10E-02	-1.07E-03
1.483	3.21E-02	3.31E-02	-1.06E-03
1.55	3.32E-02	3.49E-02	-1.69E-03
1.617	3.54E-02	3.63E-02	-9.38E-04
1.683	3.65E-02	3.74E-02	-8.29E-04
1.75	3.67E-02	3.81E-02	-1.39E-03
1.817	3.79E-02	3.79E-02	-6.97E-04
1.883	3.80E-02	3.86E-02	-6.15E-04
1.95	3.82E-02	3.85E-02	-3.51E-04
2.017	3.83E-02	3.82E-02	1.21E-04
2.083	3.75E-02	3.77E-02	-2.27E-04
2.15	3.76E-02	3.70E-02	5.76E-04
2.217	3.68E-02	3.63E-02	5.04E-04
2.283	3.59E-02	3.54E-02	5.32E-04
2.35	3.51E-02	3.44E-02	6.42E-04
2.417	3.42E-02	3.34E-02	8.16E-04
2.483	3.34E-02	3.24E-02	1.03E-03
2.55	3.25E-02	3.13E-02	1.29E-03
2.617	3.07E-02	3.01E-02	5.58E-04
2.683	2.99E-02	2.90E-02	8.39E-04
2.75	2.90E-02	2.79E-02	1.12E-03
2.817	2.72E-02	2.68E-02	4.01E-04
2.883	2.63E-02	2.56E-02	6.64E-04
2.95	2.55E-02	2.46E-02	9.13E-04
3.017	2.36E-02	2.35E-02	1.39E-04
3.083	2.28E-02	2.24E-02	3.39E-04
3.15	2.19E-02	2.14E-02	5.13E-04
3.217	2.01E-02	2.04E-02	-3.44E-04
3.283	1.92E-02	1.95E-02	-2.32E-04
3.35	1.84E-02	1.85E-02	-1.51E-04
3.417	1.75E-02	1.76E-02	-1.03E-04
3.483	1.67E-02	1.68E-02	-8.93E-05
3.55	1.58E-02	1.60E-02	-1.09E-04
3.617	1.50E-02	1.52E-02	-1.60E-04
3.683	1.42E-02	1.44E-02	-2.47E-04
3.75	1.33E-02	1.37E-02	-3.64E-04
3.817	1.25E-02	1.30E-02	-5.12E-04
3.883	1.16E-02	1.23E-02	-6.94E-04
3.95	1.08E-02	1.17E-02	-9.03E-04
4.017	9.92E-03	1.11E-02	-1.14E-03
4.083	1.01E-02	1.05E-02	-4.12E-04
4.15	9.23E-03	9.93E-03	-7.07E-04
4.217	8.38E-03	9.41E-03	-1.03E-03
4.283	8.53E-03	8.91E-03	-3.77E-04
4.35	7.69E-03	8.44E-03	-7.49E-04
4.417	7.84E-03	7.98E-03	-1.44E-04
4.483	6.99E-03	7.56E-03	-5.63E-04
4.55	7.15E-03	7.15E-03	-2.67E-06
4.617	6.30E-03	6.76E-03	-4.63E-04
4.683	6.45E-03	6.40E-03	5.62E-05
4.75	5.61E-03	6.05E-03	-4.43E-04
4.817	5.76E-03	5.72E-03	4.00E-05
4.883	5.92E-03	5.41E-03	5.05E-04

C4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 71
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1591E-05
 DISPERSIVITY= 0.8450E-03
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.7077E-01
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2283E-04

THE F STATISTIC FOR NP= 3 NOBS= 71 IS: 2.75
 THE CRITICAL RSS IS: 0.2560E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.59E-06	1.59E-06	1.59E-06
X(2)	8.45E-04	8.11E-04	8.79E-04
X(5)	7.08E-02	7.01E-02	7.15E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.000	1.25E-03	1.50E-03	-2.48E-04
3.100	1.60E-03	2.03E-03	-4.31E-04
3.200	1.95E-03	2.69E-03	-7.31E-04
3.300	3.31E-03	3.46E-03	-1.50E-04
3.400	4.66E-03	4.35E-03	3.13E-04
3.500	6.02E-03	5.35E-03	6.65E-04
3.600	7.37E-03	6.45E-03	9.18E-04
3.700	7.72E-03	7.63E-03	9.08E-05
3.800	9.08E-03	8.87E-03	2.05E-04
3.900	1.04E-02	1.02E-02	2.83E-04
4.000	1.18E-02	1.14E-02	3.55E-04
4.100	1.31E-02	1.27E-02	4.46E-04
4.200	1.45E-02	1.39E-02	5.81E-04
4.300	1.49E-02	1.51E-02	-2.12E-04
4.400	1.62E-02	1.61E-02	8.63E-05
4.500	1.66E-02	1.71E-02	-5.03E-04
4.600	1.79E-02	1.79E-02	3.31E-05
4.700	1.83E-02	1.86E-02	-2.94E-04
4.800	1.96E-02	1.91E-02	4.76E-04
4.900	1.90E-02	1.95E-02	-5.11E-04
5.000	1.93E-02	1.97E-02	-3.99E-04
5.100	1.97E-02	1.98E-02	-1.43E-04
5.200	1.90E-02	1.98E-02	-7.51E-04
5.300	1.94E-02	1.96E-02	-1.96E-04
5.400	1.87E-02	1.93E-02	-5.92E-04
5.500	1.91E-02	1.89E-02	1.52E-04
5.600	1.84E-02	1.85E-02	-9.97E-06
5.700	1.78E-02	1.79E-02	-9.27E-05
5.800	1.73E-02	1.73E-02	-1.07E-04
5.900	1.65E-02	1.66E-02	-6.80E-05
6.000	1.59E-02	1.58E-02	1.45E-05
6.100	1.52E-02	1.51E-02	1.28E-04
6.200	1.48E-02	1.43E-02	2.60E-04
6.300	1.39E-02	1.35E-02	4.04E-04
6.400	1.33E-02	1.27E-02	5.48E-04
6.500	1.26E-02	1.19E-02	6.88E-04
6.600	1.12E-02	1.12E-02	8.15E-04
6.700	1.13E-02	1.04E-02	9.22E-04
6.800	1.07E-02	9.68E-03	1.01E-03
6.900	1.00E-02	8.97E-03	1.07E-03
7.000	8.39E-03	8.30E-03	9.72E-05
7.100	7.75E-03	7.65E-03	9.54E-05
7.200	7.10E-03	7.04E-03	6.05E-05
7.300	6.45E-03	6.46E-03	-8.25E-06
7.400	5.81E-03	5.92E-03	-1.11E-04
7.500	5.16E-03	5.41E-03	-2.49E-04
7.600	4.51E-03	4.93E-03	-4.20E-04
7.700	4.87E-03	4.49E-03	3.76E-04
7.800	4.22E-03	4.08E-03	1.40E-04
7.900	3.57E-03	3.70E-03	-1.27E-04
8.000	2.93E-03	3.35E-03	-4.24E-04
8.100	2.28E-03	3.03E-03	-7.48E-04
8.200	2.64E-03	2.74E-03	-9.95E-05
8.300	1.99E-03	2.47E-03	-4.76E-04
8.400	1.34E-03	2.22E-03	-8.75E-04
8.500	1.70E-03	1.99E-03	-3.79E-04
8.600	1.05E-03	1.79E-03	-7.39E-04
8.700	4.03E-04	1.60E-03	-1.20E-03
8.800	7.57E-04	1.44E-03	-6.79E-04
8.900	1.10E-04	1.28E-03	-1.17E-03
9.000	4.64E-04	1.15E-03	-6.82E-04
9.100	-1.82E-04	1.02E-03	-1.20E-03
9.200	1.71E-04	9.11E-04	-7.39E-04
9.300	-4.75E-04	8.11E-04	-1.29E-03
9.400	-1.22E-04	7.21E-04	-8.42E-04
9.500	2.32E-04	6.40E-04	-4.08E-04
9.600	-4.14E-04	5.68E-04	-9.83E-04
9.700	-6.08E-05	5.04E-04	-5.66E-04
9.800	2.93E-04	4.46E-04	-1.54E-04
9.900	-3.54E-04	3.95E-04	-7.49E-04
10.000	0.00E+00	3.50E-04	-3.50E-04

August 2005
D1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 96
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.1700E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : 0.3000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -1.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1770E-05
 DISPERSIVITY= 0.3800E-02
 WIDTH= 0.3000E-02
 RF= 1.000
 CO= 1.000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4782E-02

THE F STATISTIC FOR NP= 3 NOBS= 96 IS: 2.71
 THE CRITICAL RSS IS: 0.5200E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.77E-06	1.73E-06	1.81E-06
X(2)	3.80E-03	3.53E-03	4.10E-03
X(3)	3.00E-03	2.91E-03	3.09E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.18E-01	1.00E-03	1.97E-07	1.00E-03
0.3183	2.00E-03	2.69E-05	1.97E-03
4.18E-01	6.00E-03	3.59E-04	5.64E-03
0.5183	1.50E-02	1.79E-03	1.12E-02
0.6183	2.20E-02	5.37E-03	1.66E-02
0.7183	3.20E-02	1.19E-02	2.01E-02
0.8183	4.30E-02	2.18E-02	2.12E-02
0.9183	5.40E-02	3.46E-02	1.94E-02
1.018	6.40E-02	4.92E-02	1.48E-02
1.118	7.30E-02	6.42E-02	8.83E-03
1.218	8.20E-02	7.84E-02	3.64E-03
1.318	9.00E-02	9.10E-02	-9.86E-04
1.418	9.60E-02	1.02E-01	-5.67E-03
1.518	1.02E-01	1.10E-01	-8.30E-03
1.618	1.07E-01	1.17E-01	-9.96E-03
1.718	1.11E-01	1.24E-01	-1.08E-02
1.818	1.14E-01	1.25E-01	-1.11E-02
1.918	1.17E-01	1.27E-01	-9.91E-03
2.018	1.18E-01	1.28E-01	-9.60E-03
2.118	1.19E-01	1.27E-01	-8.32E-03
2.218	1.20E-01	1.26E-01	-6.24E-03
2.318	1.20E-01	1.25E-01	-5.67E-03
2.418	1.19E-01	1.22E-01	-3.27E-03
2.518	1.18E-01	1.20E-01	-1.63E-03
2.618	1.17E-01	1.17E-01	3.74E-04
2.718	1.16E-01	1.14E-01	2.53E-03
2.818	1.14E-01	1.10E-01	3.88E-03
2.918	1.11E-01	1.07E-01	4.35E-03
3.018	1.09E-01	1.03E-01	5.89E-03
3.118	1.06E-01	9.95E-02	6.46E-03
3.218	1.03E-01	9.60E-02	7.03E-03
3.318	1.00E-01	9.24E-02	7.57E-03
3.418	9.70E-02	8.89E-02	8.07E-03
3.518	9.40E-02	8.55E-02	8.58E-03
3.618	9.10E-02	8.21E-02	8.89E-03
3.718	8.80E-02	7.88E-02	9.18E-03
3.818	8.50E-02	7.56E-02	9.48E-03
3.918	8.10E-02	7.25E-02	8.50E-03
4.018	7.80E-02	6.95E-02	8.51E-03
4.118	7.40E-02	6.66E-02	7.43E-03
4.218	7.10E-02	6.38E-02	7.25E-03
4.318	6.80E-02	6.10E-02	6.97E-03
4.418	6.40E-02	5.84E-02	6.59E-03
4.518	6.10E-02	5.59E-02	6.11E-03
4.618	5.80E-02	5.35E-02	5.43E-03
4.718	5.50E-02	5.11E-02	3.88E-03
4.818	4.90E-02	4.59E-02	3.11E-03
4.918	4.90E-02	4.68E-02	2.24E-03
5.018	4.70E-02	4.47E-02	2.30E-03
5.118	4.40E-02	4.27E-02	1.27E-03
5.218	4.10E-02	4.08E-02	1.65E-04
5.318	3.90E-02	3.90E-02	-2.53E-05
5.418	3.70E-02	3.73E-02	-2.92E-04
5.518	3.50E-02	3.56E-02	-6.33E-04
5.618	3.20E-02	3.41E-02	-2.05E-03
5.718	3.00E-02	3.26E-02	-2.53E-03
5.818	2.90E-02	3.11E-02	-2.08E-03
5.918	2.70E-02	2.97E-02	-2.69E-03
6.018	2.50E-02	2.84E-02	-3.36E-03
6.118	2.30E-02	2.71E-02	-4.09E-03
6.218	2.20E-02	2.59E-02	-3.88E-03
6.318	2.00E-02	2.47E-02	-4.72E-03
6.418	1.90E-02	2.36E-02	-4.61E-03
6.518	1.80E-02	2.26E-02	-4.56E-03
6.618	1.70E-02	2.16E-02	-4.66E-03
6.718	1.60E-02	2.06E-02	-4.58E-03
6.818	1.40E-02	1.97E-02	-5.66E-03
6.918	1.40E-02	1.88E-02	-4.78E-03
7.018	1.30E-02	1.79E-02	-4.94E-03
7.118	1.20E-02	1.71E-02	-5.13E-03
7.218	1.10E-02	1.64E-02	-5.36E-03
7.318	1.00E-02	1.56E-02	-5.63E-03
7.418	9.00E-03	1.49E-02	-5.93E-03
7.518	9.00E-03	1.43E-02	-5.26E-03
7.618	8.00E-03	1.36E-02	-5.63E-03
7.718	7.00E-03	1.30E-02	-6.02E-03
7.818	7.00E-03	1.24E-02	-5.43E-03
7.918	6.00E-03	1.19E-02	-5.88E-03
8.018	6.00E-03	1.14E-02	-5.35E-03
8.118	5.00E-03	1.08E-02	-5.84E-03
8.218	5.00E-03	1.04E-02	-5.36E-03
8.318	4.00E-03	9.89E-03	-5.89E-03
8.418	4.00E-03	9.45E-03	-5.45E-03
8.518	4.00E-03	9.03E-03	-5.03E-03
8.618	3.00E-03	8.63E-03	-5.63E-03
8.718	3.00E-03	8.24E-03	-5.24E-03
8.818	3.00E-03	7.88E-03	-4.88E-03
8.918	2.00E-03	7.53E-03	-5.53E-03
9.018	2.00E-03	7.19E-03	-5.19E-03
9.118	2.00E-03	6.87E-03	-4.87E-03
9.218	1.00E-03	6.57E-03	-5.57E-03
9.318	1.00E-03	6.26E-03	-5.26E-03
9.418	1.00E-03	6.00E-03	-5.00E-03
9.518	1.00E-03	5.73E-03	-4.73E-03
9.618	1.00E-03	5.46E-03	-4.46E-03
9.718	1.00E-03	5.23E-03	-4.23E-03

D1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1649E-05
 DISPERSIVITY= 0.2333E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4826
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3881E-03

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
 THE CRITICAL RSS IS: 0.4278E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.65E-06	1.65E-06	1.65E-06
X(2)	2.33E-03	2.26E-03	2.40E-03
X(5)	4.83E-01	4.78E-01	4.87E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.618	3.15E-04	7.96E-12	3.15E-04
0.618	1.36E-03	3.14E-09	1.36E-03
0.752	1.41E-03	1.49E-07	1.41E-03
0.885	1.46E-03	2.21E-06	1.46E-03
1.018	2.51E-03	1.60E-05	2.49E-03
1.152	2.56E-03	7.32E-05	2.48E-03
1.285	3.60E-03	2.43E-04	3.36E-03
1.418	3.65E-03	6.39E-04	3.01E-03
1.552	4.70E-03	1.42E-03	3.28E-03
1.685	5.75E-03	2.76E-03	2.99E-03
1.818	7.60E-03	4.84E-03	2.95E-03
1.952	1.08E-02	7.81E-03	3.03E-03
2.085	1.39E-02	1.18E-02	-1.46E-03
2.218	1.89E-02	1.67E-02	2.28E-03
2.352	2.40E-02	2.24E-02	1.55E-03
2.485	3.01E-02	2.82E-02	2.13E-03
2.618	3.71E-02	3.59E-02	1.23E-03
2.752	4.41E-02	4.31E-02	1.07E-03
2.885	5.12E-02	5.02E-02	9.38E-04
3.018	5.82E-02	5.72E-02	1.03E-03
3.152	6.43E-02	6.37E-02	5.33E-04
3.285	6.93E-02	6.97E-02	-1.92E-04
3.418	7.44E-02	7.60E-02	-6.99E-04
3.552	7.84E-02	7.96E-02	-1.14E-03
3.685	8.35E-02	8.33E-02	-1.66E-03
3.818	8.45E-02	8.63E-02	-1.78E-03
3.952	8.66E-02	8.85E-02	-1.93E-03
4.085	8.76E-02	9.00E-02	-1.34E-03
4.218	8.87E-02	9.07E-02	-2.05E-03
4.352	8.87E-02	9.08E-02	-2.12E-03
4.485	8.88E-02	9.04E-02	-1.58E-03
4.618	8.78E-02	8.94E-02	-1.61E-03
4.752	8.69E-02	8.80E-02	-1.16E-03
4.885	8.59E-02	8.62E-02	-1.32E-03
5.018	8.40E-02	8.41E-02	-1.57E-04
5.152	8.20E-02	8.17E-02	2.72E-04
5.285	8.00E-02	7.91E-02	9.11E-04
5.418	7.71E-02	7.64E-02	7.16E-04
5.552	7.51E-02	7.35E-02	1.65E-03
5.685	7.22E-02	7.05E-02	1.69E-03
5.818	7.71E-02	7.64E-02	7.16E-04
5.952	6.63E-02	6.45E-02	1.80E-03
6.085	6.33E-02	6.15E-02	1.68E-03
6.218	6.14E-02	5.85E-02	2.93E-03
6.352	5.84E-02	5.55E-02	2.94E-03
6.485	5.55E-02	5.26E-02	2.88E-03
6.618	5.25E-02	4.96E-02	2.78E-03
6.752	4.96E-02	4.70E-02	2.55E-03
6.885	4.66E-02	4.44E-02	2.25E-03
7.018	4.37E-02	4.18E-02	1.85E-03
7.152	4.07E-02	3.94E-02	1.36E-03
7.285	3.88E-02	3.70E-02	1.78E-03
7.418	3.58E-02	3.48E-02	1.06E-03
7.552	3.39E-02	3.26E-02	1.25E-03
7.685	3.09E-02	3.06E-02	3.40E-04
7.818	2.90E-02	2.86E-02	3.26E-04
7.952	2.70E-02	2.68E-02	2.12E-04
8.085	2.51E-02	2.51E-02	-1.29E-06
8.218	2.31E-02	2.34E-02	-3.11E-04
8.352	2.12E-02	2.19E-02	-7.12E-04
8.485	1.92E-02	2.04E-02	-1.20E-03
8.618	1.82E-02	1.90E-02	-7.81E-04
8.752	1.63E-02	1.77E-02	-1.44E-03
8.885	1.43E-02	1.65E-02	-2.18E-03
9.018	1.34E-02	1.54E-02	-1.99E-03
9.152	1.24E-02	1.43E-02	-1.88E-03
9.285	1.15E-02	1.33E-02	-1.83E-03
9.418	1.05E-02	1.24E-02	-2.85E-03
9.552	8.58E-03	1.15E-02	-2.92E-03
9.685	7.63E-03	1.07E-02	-3.06E-03
9.818	6.68E-03	9.92E-03	-3.25E-03
9.952	6.72E-03	9.21E-03	-2.49E-03
10.090	5.77E-03	8.55E-03	-2.78E-03
10.220	4.82E-03	7.93E-03	-3.11E-03
10.350	3.87E-03	7.35E-03	-3.49E-03
10.490	3.92E-03	6.82E-03	-2.90E-03
10.620	3.96E-03	6.32E-03	-3.36E-03
10.750	3.01E-03	5.85E-03	-2.84E-03
10.890	2.06E-03	5.42E-03	-3.37E-03
11.020	1.08E-03	5.02E-03	-3.92E-03
11.150	1.16E-03	4.65E-03	-3.50E-03
11.290	1.20E-03	4.30E-03	-3.10E-03
11.420	2.51E-04	3.98E-03	-3.76E-03

August 2005
D2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 81
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : 0.9000E-01
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1750E-05
 DISPERSIVITY= 0.3846E-02
 WIDTH= 0.1295E-01
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2291E-02

THE F STATISTIC FOR NP= 3 NOBS= 81 IS: 2.73
 THE CRITICAL RSS IS: 0.2532E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.75E-06	1.72E-06	1.79E-06
X(2)	3.85E-03	3.46E-03	4.27E-03
X(3)	1.30E-02	1.26E-02	1.33E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-01	1.09E-03	2.28E-09	1.09E-03
0.2333	1.21E-02	6.47E-05	1.14E-03
3.67E-01	2.32E-03	1.16E-03	1.16E-03
0.5	3.44E-03	4.65E-03	-1.21E-03
0.6333	8.56E-03	1.06E-02	-1.99E-03
0.7667	1.67E-02	1.82E-02	-1.54E-03
0.9	2.78E-02	2.69E-02	8.87E-04
1.033	4.09E-02	3.61E-02	4.84E-03
1.167	5.30E-02	4.54E-02	7.62E-03
1.3	6.41E-02	5.46E-02	9.59E-03
1.433	7.33E-02	6.34E-02	9.84E-03
1.567	8.14E-02	7.20E-02	9.41E-03
1.7	8.75E-02	8.00E-02	7.47E-03
1.833	9.26E-02	8.77E-02	4.89E-03
1.967	9.67E-02	9.49E-02	1.84E-03
2.1	9.99E-02	1.02E-01	-1.78E-03
2.233	1.020	1.08E-01	-5.94E-03
2.367	1.03E-01	1.13E-01	-1.03E-02
2.5	1.04E-01	1.17E-01	-1.24E-02
2.633	1.03E-01	1.17E-01	-1.35E-02
2.767	1.02E-01	1.15E-01	-1.22E-02
2.9	1.02E-01	1.11E-01	-9.15E-03
3.033	9.97E-02	1.06E-01	-6.28E-03
3.167	9.78E-02	1.01E-01	-2.78E-03
3.3	9.49E-02	9.50E-02	-1.05E-04
3.433	9.20E-02	8.95E-02	2.57E-03
3.567	8.91E-02	8.40E-02	5.18E-03
3.7	8.53E-02	7.87E-02	6.56E-03
3.833	8.14E-02	7.37E-02	7.70E-03
3.967	7.75E-02	6.89E-02	8.60E-03
4.1	7.26E-02	6.44E-02	8.20E-03
4.233	6.87E-02	6.02E-02	8.53E-03
4.367	6.49E-02	5.62E-02	8.62E-03
4.5	6.00E-02	5.25E-02	7.42E-03
4.633	5.61E-02	4.91E-02	6.99E-03
4.767	5.22E-02	4.59E-02	6.35E-03
4.9	4.73E-02	4.28E-02	4.48E-03
5.033	4.34E-02	4.01E-02	3.38E-03
5.167	4.06E-02	3.74E-02	3.13E-03
5.3	3.67E-02	3.50E-02	1.69E-03
5.433	3.38E-02	3.27E-02	1.07E-03
5.567	2.99E-02	3.06E-02	-6.90E-04
5.7	2.70E-02	2.86E-02	-1.60E-03
5.833	2.51E-02	2.68E-02	-1.64E-03
5.967	2.23E-02	2.51E-02	-2.81E-03
6.1	2.04E-02	2.35E-02	-3.09E-03
6.233	1.85E-02	2.20E-02	-3.48E-03
6.367	1.66E-02	2.06E-02	-3.96E-03
6.5	1.47E-02	1.93E-02	-4.55E-03
6.633	1.38E-02	1.81E-02	-4.21E-03
6.767	1.20E-02	1.69E-02	-4.95E-03
6.9	1.11E-02	1.59E-02	-4.77E-03
7.033	1.02E-02	1.49E-02	-4.67E-03
7.167	9.31E-03	1.39E-02	-4.62E-03
7.3	8.43E-03	1.31E-02	-4.64E-03
7.433	7.55E-03	1.23E-02	-4.71E-03
7.567	6.66E-03	1.15E-02	-4.83E-03
7.7	6.78E-03	1.08E-02	-4.01E-03
7.833	5.90E-03	1.01E-02	-4.23E-03
7.967	5.02E-03	9.50E-03	-4.49E-03
8.1	5.13E-03	8.92E-03	-3.79E-03
8.233	4.25E-03	8.38E-03	-4.13E-03
8.367	4.37E-03	7.86E-03	-3.50E-03
8.5	4.49E-03	7.39E-03	-2.90E-03
8.633	3.60E-03	6.94E-03	-3.34E-03
8.767	3.72E-03	6.52E-03	-2.80E-03
8.9	2.84E-03	6.12E-03	-3.29E-03
9.033	2.96E-03	5.76E-03	-2.80E-03
9.167	3.07E-03	5.41E-03	-2.34E-03
9.3	2.19E-03	5.08E-03	-2.89E-03
9.433	2.31E-03	4.78E-03	-2.47E-03
9.567	2.43E-03	4.49E-03	-2.07E-03
9.7	1.54E-03	4.22E-03	-2.68E-03
9.833	1.66E-03	3.97E-03	-2.31E-03
9.967	1.78E-03	3.73E-03	-1.96E-03
10.1	8.94E-04	3.54E-03	-2.82E-03
10.23	1.01E-03	3.31E-03	-2.30E-03
10.37	1.13E-03	3.10E-03	-1.98E-03
10.5	2.46E-04	2.93E-03	-2.68E-03
10.63	3.64E-04	2.76E-03	-2.39E-03
10.77	4.81E-04	2.59E-03	-2.10E-03

D2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 79
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1707E-05
 DISPERSIVITY= 0.1992E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4985
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.6438E-03

THE F STATISTIC FOR NP= 3 NOBS= 79 IS: 2.74
 THE CRITICAL RSS IS: 0.7133E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.71E-06	1.71E-06	1.71E-06
X(2)	1.99E-03	1.91E-03	2.07E-03
X(5)	4.99E-01	4.94E-01	5.04E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.037	1.11E-03	8.92E-06	1.10E-03
1.170	2.00E-02	4.59E-05	2.16E-03
1.303	2.31E-03	1.68E-04	2.14E-03
1.437	3.41E-03	4.78E-04	2.93E-03
1.570	4.51E-03	1.13E-03	3.38E-03
1.703	5.61E-03	2.33E-03	3.29E-03
1.837	7.72E-03	4.28E-03	3.44E-03
1.970	1.08E-02	7.17E-03	3.64E-03
2.103	1.49E-02	1.12E-02	3.77E-03
2.237	2.00E-02	1.63E-02	3.75E-03
2.370	2.61E-02	2.25E-02	3.67E-03
2.503	3.32E-02	2.95E-02	3.69E-03
2.637	4.03E-02	3.73E-02	3.01E-03
2.770	4.84E-02	4.55E-02	2.86E-03
2.903	5.55E-02	5.37E-02	1.80E-03
3.037	6.26E-02	6.18E-02	8.26E-04
3.170	6.97E-02	6.94E-02	2.96E-04
3.303	7.68E-02	7.64E-02	-5.90E-04
3.437	8.09E-02	8.26E-02	-1.68E-03
3.570	8.50E-02	8.79E-02	-2.86E-03
3.703	8.91E-02	9.22E-02	-3.08E-03
3.837	9.22E-02	9.56E-02	-3.31E-03
3.970	9.43E-02	9.79E-02	-3.57E-03
4.103	9.54E-02	9.94E-02	-3.91E-03
4.237	9.65E-02	9.99E-02	-3.38E-03
4.370	9.66E-02	9.97E-02	-3.06E-03
4.503	9.67E-02	9.88E-02	-2.03E-03
4.637	9.58E-02	9.72E-02	-1.38E-03
4.770	9.49E-02	9.51E-02	-1.96E-04
4.903	9.31E-02	9.26E-02	4.34E-04
5.037	9.12E-02	8.97E-02	1.43E-03
5.170	8.83E-02	8.65E-02	1.72E-03
5.303	8.54E-02	8.31E-02	2.23E-03
5.437	8.25E-02	7.95E-02	2.91E-03
5.570	7.96E-02	7.59E-02	3.68E-03
5.703	7.57E-02	7.21E-02	3.51E-03
5.837	7.28E-02	6.84E-02	4.36E-03
5.970	6.89E-02	6.47E-02	4.18E-03
6.103	6.50E-02	6.10E-02	3.95E-03
6.237	6.11E-02	5.74E-02	3.65E-03
6.370	5.72E-02	5.39E-02	3.24E-03
6.503	5.33E-02	5.05E-02	2.73E-03
6.637	5.04E-02	4.73E-02	3.08E-03
6.770	4.65E-02	4.42E-02	2.31E-03
6.903	4.26E-02	4.12E-02	1.39E-03
7.037	3.97E-02	3.83E-02	1.33E-03
7.170	3.58E-02	3.57E-02	1.19E-04
7.303	3.29E-02	3.31E-02	-2.35E-04
7.437	3.00E-02	3.07E-02	-7.30E-04
7.570	2.71E-02	2.84E-02	-1.37E-03
7.703	2.52E-02	2.63E-02	-1.15E-03
7.837	2.23E-02	2.43E-02	-2.06E-03
7.970	2.04E-02	2.25E-02	-2.10E-03
8.103	1.75E-02	2.07E-02	-3.26E-03
8.237	1.56E-02	1.91E-02	-3.54E-03
8.370	1.47E-02	1.76E-02	-2.93E-03
8.503	1.28E-02	1.62E-02	-3.43E-03
8.637	1.19E-02	1.49E-02	-3.03E-03
8.770	9.98E-03	1.37E-02	-3.72E-03
8.903	9.08E-03	1.26E-02	-3.50E-03
9.037	8.19E-03	1.16E-02	-3.37E-03
9.170	7.29E-03	1.06E-02	-3.32E-03
9.303	6.39E-03	9.72E-03	-3.33E-03
9.437	5.49E-03	8.81E-03	-3.42E-03
9.570	4.59E-03	8.16E-03	-3.57E-03
9.703	3.69E-03	7.47E-03	-3.78E-03
9.837	3.79E-03	6.84E-03	-3.05E-03
9.970	2.89E-03	6.29E-03	-3.36E-03
10.100	3.00E-03	5.72E-03	-2.73E-03
10.240	2.10E-03	5.23E-03	-3.13E-03
10.370	2.20E-03	4.78E-03	-2.58E-03
10.500	1.30E-03	4.36E-03	-3.07E-03
10.640	1.40E-03	3.98E-03	-2.68E-03
10.770	5.02E-04	3.64E-03	-3.13E-03
10.900	6.03E-04	3.32E-03	-2.72E-03
11.040	7.04E-04	3.03E-03	-2.42E-03
11.170	-1.94E-04	2.76E-03	-2.95E-03
11.300	-9.29E-05	2.52E-03	-2.61E-03
11.440	8.44E-06	2.29E-03	-2.28E-03

August 2005
D3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : 0.6000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 3.000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1678E-05
DISPERSIVITY= 0.2705E-02
WIDTH= 0.9753E-03
R= 1.000
CO= 3.000
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5038E-02

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
THE CRITICAL RSS IS: 0.5469E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.68E-06	1.65E-06	1.71E-06
X(2)	2.71E-03	2.52E-03	2.92E-03
X(3)	9.75E-04	9.46E-04	1.01E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.67E-02	1.00E-03	1.63E-35	1.00E-03
0.1667	1.00E-03	3.52E-14	1.00E-03
2.67E-01	2.00E-03	2.00E-03	2.00E-03
0.3667	2.00E-03	2.39E-06	2.00E-03
0.4667	4.00E-03	6.16E-05	3.94E-03
0.5667	4.00E-03	7.00E-04	6.50E-03
0.6667	1.20E-02	2.09E-03	9.91E-03
0.7667	2.00E-02	5.78E-03	1.42E-02
0.8667	2.00E-02	1.21E-02	1.69E-02
0.9667	3.90E-02	2.11E-02	1.79E-02
1.067	5.00E-02	3.22E-02	1.78E-02
1.167	1.22E-01	1.24E-01	-1.17E-02
1.267	6.90E-02	5.76E-02	1.14E-02
1.367	7.80E-02	7.04E-02	7.56E-03
1.467	6.50E-02	8.25E-02	2.46E-03
1.567	9.20E-02	9.36E-02	-1.55E-03
1.667	9.80E-02	1.03E-01	-5.24E-03
1.767	1.03E-01	1.12E-01	-8.49E-03
1.867	1.08E-01	1.18E-01	-1.03E-02
1.967	1.12E-01	1.24E-01	-1.17E-02
2.067	1.16E-01	1.28E-01	-1.17E-02
2.167	1.19E-01	1.31E-01	-1.15E-02
2.267	1.22E-01	1.32E-01	-1.02E-02
2.367	1.24E-01	1.33E-01	-8.86E-03
2.467	1.25E-01	1.33E-01	-7.68E-03
2.567	1.26E-01	1.32E-01	-4.23E-03
2.667	1.26E-01	1.30E-01	-4.19E-03
2.767	1.26E-01	1.28E-01	-2.08E-03
2.867	1.26E-01	1.26E-01	4.67E-04
2.967	1.25E-01	1.23E-01	2.38E-03
3.067	1.23E-01	1.19E-01	3.58E-03
3.167	1.21E-01	1.16E-01	5.91E-03
3.267	1.19E-01	1.12E-01	6.60E-03
3.367	1.17E-01	1.09E-01	8.32E-03
3.467	1.14E-01	1.05E-01	9.76E-03
3.567	1.11E-01	1.01E-01	9.95E-03
3.667	1.07E-01	9.72E-02	9.79E-03
3.767	1.04E-01	9.34E-02	1.04E-02
3.867	1.00E-01	8.96E-02	1.04E-02
3.967	9.60E-02	8.59E-02	1.02E-02
4.067	9.20E-02	8.20E-02	9.82E-03
4.167	8.80E-02	7.86E-02	9.41E-03
4.267	8.40E-02	7.51E-02	8.91E-03
4.367	8.00E-02	7.17E-02	8.33E-03
4.467	7.50E-02	6.84E-02	6.60E-03
4.567	7.10E-02	6.52E-02	5.79E-03
4.667	6.70E-02	6.21E-02	4.87E-03
4.767	6.30E-02	5.92E-02	3.84E-03
4.867	5.90E-02	5.63E-02	2.70E-03
4.967	5.50E-02	5.36E-02	1.44E-03
5.067	5.20E-02	5.09E-02	1.08E-03
5.167	4.80E-02	4.84E-02	-4.00E-04
5.267	4.50E-02	4.60E-02	-9.82E-04
5.367	4.20E-02	4.37E-02	-1.67E-03
5.467	3.90E-02	4.15E-02	-2.46E-03
5.567	3.60E-02	3.94E-02	-3.35E-03
5.667	3.30E-02	3.73E-02	-4.33E-03
5.767	3.10E-02	3.54E-02	-4.41E-03
5.867	2.80E-02	3.36E-02	-5.58E-03
5.967	2.60E-02	3.18E-02	-5.84E-03
6.067	2.40E-02	3.02E-02	-6.18E-03
6.167	2.20E-02	2.86E-02	-6.60E-03
6.267	2.10E-02	2.71E-02	-6.10E-03
6.367	1.90E-02	2.57E-02	-6.67E-03
6.467	1.70E-02	2.43E-02	-7.31E-03
6.567	1.60E-02	2.30E-02	-7.03E-03
6.667	1.40E-02	2.06E-02	-6.64E-03
6.767	1.20E-02	1.95E-02	-7.54E-03
6.867	1.10E-02	1.75E-02	-6.50E-03
6.967	1.00E-02	1.66E-02	-6.56E-03
7.067	9.00E-03	1.57E-02	-6.67E-03
7.167	8.00E-03	1.48E-02	-6.83E-03
7.267	8.00E-03	1.40E-02	-6.03E-03
7.367	7.00E-03	1.33E-02	-6.27E-03
7.467	7.00E-03	1.26E-02	-5.55E-03
7.567	6.00E-03	1.19E-02	-5.87E-03
7.667	6.00E-03	1.12E-02	-5.52E-03
7.767	5.00E-03	1.06E-02	-5.62E-03
7.867	5.00E-03	1.00E-02	-5.04E-03
7.967	4.00E-03	8.98E-03	-4.98E-03
8.067	4.00E-03	8.49E-03	-4.49E-03
8.167	4.00E-03	8.02E-03	-4.02E-03
8.267	4.00E-03	7.58E-03	-3.58E-03
8.367	3.00E-03	7.17E-03	-4.17E-03
8.467	3.00E-03	6.78E-03	-3.78E-03
8.567	3.00E-03	6.41E-03	-3.41E-03
8.667	3.00E-03	6.06E-03	-3.06E-03
8.767	2.00E-03	5.72E-03	-3.72E-03
8.867	2.00E-03	5.41E-03	-3.41E-03
8.967	2.00E-03	5.11E-03	-3.11E-03
9.067	2.00E-03	4.83E-03	-2.83E-03
9.167	2.00E-03	4.57E-03	-2.57E-03
9.267	2.00E-03	4.32E-03	-2.32E-03
9.367	2.00E-03	4.08E-03	-2.08E-03
9.467	1.00E-03	3.86E-03	-2.86E-03

D3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : 0.6000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 3.000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1686E-05
DISPERSIVITY= 0.1944E-02
WIDTH= 0.1160E-02
R= 1.000
CO= 3.000
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1099E-02

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
THE CRITICAL RSS IS: 0.1211E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.69E-06	1.69E-06	1.69E-06
X(2)	1.94E-03	1.89E-03	2.00E-03
X(3)	1.16E-03	1.15E-03	1.17E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.737	6.79E-03	3.88E-03	2.91E-03
1.837	8.83E-03	6.19E-03	2.64E-03
1.937	1.19E-02	9.23E-03	2.59E-03
2.037	1.59E-02	1.32E-02	2.69E-03
2.137	2.09E-02	1.80E-02	2.92E-03
2.237	2.70E-02	2.40E-02	3.33E-03
2.337	3.40E-02	3.00E-02	3.97E-03
2.437	4.10E-02	3.71E-02	3.96E-03
2.537	4.91E-02	4.47E-02	4.41E-03
2.637	5.61E-02	5.26E-02	3.49E-03
2.737	6.42E-02	6.08E-02	3.34E-03
2.837	7.22E-02	6.91E-02	3.12E-03
2.937	8.02E-02	7.72E-02	2.98E-03
3.037	8.73E-02	8.52E-02	2.05E-03
3.137	9.43E-02	9.29E-02	1.46E-03
3.237	1.00E-01	1.00E-01	3.01E-04
3.337	1.05E-01	1.07E-01	-1.32E-03
3.437	1.05E-01	1.07E-01	-1.32E-03
3.537	1.10E-01	1.13E-01	-2.75E-03
3.637	1.15E-01	1.18E-01	-2.75E-03
3.737	1.16E-01	1.23E-01	-3.45E-03
3.837	1.23E-01	1.27E-01	-4.47E-03
3.937	1.26E-01	1.30E-01	-4.78E-03
4.037	1.29E-01	1.33E-01	-4.40E-03
4.137	1.31E-01	1.35E-01	-4.35E-03
4.237	1.32E-01	1.36E-01	-4.64E-03
4.337	1.33E-01	1.37E-01	-4.31E-03
4.437	1.34E-01	1.37E-01	-3.40E-03
4.537	1.34E-01	1.37E-01	-2.95E-03
4.637	1.34E-01	1.37E-01	-3.01E-03
4.737	1.33E-01	1.34E-01	-1.60E-03
4.837	1.32E-01	1.33E-01	-7.80E-04
4.937	1.30E-01	1.31E-01	-6.06E-03
5.037	1.28E-01	1.28E-01	-9.97E-05
5.137	1.26E-01	1.25E-01	6.87E-04
5.237	1.22E-01	1.22E-01	5.13E-03
5.337	1.19E-01	1.19E-01	2.93E-03
5.437	1.16E-01	1.16E-01	3.33E-03
5.537	1.13E-01	1.12E-01	3.85E-03
5.637	1.13E-01	1.09E-01	4.48E-03
5.737	1.09E-01	1.05E-01	4.18E-03
5.837	1.06E-01	1.01E-01	4.93E-03
5.937	1.02E-01	9.76E-02	4.71E-03
6.037	9.93E-02	9.38E-02	5.49E-03
6.137	9.54E-02	9.01E-02	5.25E-03
6.237	9.14E-02	8.64E-02	4.99E-03
6.337	8.74E-02	8.27E-02	4.68E-03
6.437	8.35E-02	7.91E-02	4.31E-03
6.537	7.95E-02	7.56E-02	3.88E-03
6.637	7.55E-02	7.22E-02	3.36E-03
6.737	7.26E-02	6.86E-02	3.77E-03
6.837	6.86E-02	6.55E-02	3.08E-03
6.937	6.46E-02	6.24E-02	2.29E-03
7.037	6.07E-02	5.93E-02	1.40E-03
7.137	5.77E-02	5.63E-02	1.41E-03
7.237	5.38E-02	5.34E-02	3.20E-04
7.337	5.08E-02	5.07E-02	1.19E-04
7.437	4.78E-02	4.80E-02	-1.89E-04
7.537	4.49E-02	4.55E-02	-6.02E-04
7.637	4.09E-02	4.30E-02	-2.12E-03
7.737	3.89E-02	4.07E-02	-1.75E-03
7.837	3.60E-02	3.84E-02	-2.47E-03
7.937	3.30E-02	3.63E-02	-3.30E-03
8.037	3.10E-02	3.43E-02	-3.23E-03
8.137	2.91E-02	3.23E-02	-3.25E-03
8.237	2.71E-02	3.05E-02	-3.37E-03
8.337	2.42E-02	2.87E-02	-4.58E-03
8.437	2.22E-02	2.71E-02	-4.87E-03
8.537	1.93E-02	2.40E-02	-4.72E-03
8.637	1.83E-02	2.26E-02	-4.25E-03
8.737	1.63E-02	2.12E-02	-4.87E-03
8.837	1.54E-02	1.99E-02	-4.56E-03
8.937	1.34E-02	1.87E-02	-5.32E-03
9.037	1.24E-02	1.76E-02	-5.14E-03
9.137	1.15E-02	1.65E-02	-5.03E-03
9.237	1.05E-02	1.55E-02	-4.98E-03
9.337	9.55E-03	1.45E-02	-4.98E-03
9.437	8.58E-03	1.36E-02	-5.04E-03
9.537	7.62E-03	1.25E-02	-5.16E-03
9.637	7.65E-03	1.20E-02	-4.32E-03
9.737	6.69E-03	1.12E-02	-4.53E-03
9.837	6.73E-03	1.08E-02	-4.08E-03
9.937	5.76E-03	9.84E-03	-4.08E-03

August 2005
D4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1878E-05
 DISPERSIVITY= 0.3846E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1427
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3297E-04

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
 THE CRITICAL RSS IS: 0.3621E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.88E-06	1.86E-06	1.90E-06
X(2)	3.85E-03	3.73E-03	3.96E-03
X(5)	1.43E-01	1.41E-01	1.44E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.17E-01	3.30E-04	1.15E-12	3.30E-04
0.25	3.06E-04	9.52E-07	3.05E-04
3.83E-01	1.28E-03	6.52E-05	1.22E-03
0.5167	2.26E-03	5.20E-04	1.74E-03
0.65	3.24E-03	1.80E-03	1.44E-03
0.7833	5.21E-03	4.11E-03	1.10E-03
0.9167	8.19E-03	7.42E-03	7.66E-04
1.05	1.22E-02	1.16E-02	6.02E-04
1.183	1.61E-02	1.62E-02	-1.55E-05
1.317	2.01E-02	2.06E-02	-4.67E-04
1.45	2.31E-02	2.43E-02	-1.22E-03
1.583	2.61E-02	2.71E-02	-1.05E-03
1.717	2.81E-02	2.90E-02	-9.63E-04
1.85	3.00E-02	3.01E-02	-6.55E-05
1.983	3.10E-02	3.05E-02	4.92E-04
2.117	3.10E-02	3.04E-02	5.63E-04
2.25	3.10E-02	2.99E-02	1.02E-03
2.383	2.99E-02	2.99E-02	7.55E-04
2.517	2.99E-02	2.82E-02	1.69E-03
2.65	2.79E-02	2.71E-02	7.53E-04
2.783	2.69E-02	2.60E-02	9.00E-04
2.917	2.48E-02	2.48E-02	9.17E-05
3.05	2.38E-02	2.35E-02	2.97E-04
3.183	2.18E-02	2.23E-02	-5.02E-04
3.317	2.08E-02	2.11E-02	-3.21E-04
3.45	1.88E-02	1.99E-02	-1.17E-03
3.583	1.77E-02	1.88E-02	-1.06E-03
3.717	1.67E-02	1.77E-02	-9.98E-04
3.85	1.57E-02	1.67E-02	-9.82E-04
3.983	1.47E-02	1.57E-02	-1.01E-03
4.117	1.36E-02	1.47E-02	-1.09E-03
4.25	1.36E-02	1.38E-02	-2.23E-04
4.383	1.26E-02	1.30E-02	-4.01E-04
4.517	1.16E-02	1.22E-02	-6.26E-04
4.65	1.14E-02	1.14E-02	5.08E-05
4.783	1.05E-02	1.07E-02	-2.12E-04
4.917	1.05E-02	1.01E-02	4.33E-04
5.05	9.47E-03	9.43E-03	3.62E-05
5.183	9.44E-03	8.84E-03	6.02E-04
5.317	8.42E-03	8.29E-03	1.32E-04
5.45	8.40E-03	7.77E-03	6.28E-04
5.583	7.37E-03	7.28E-03	9.21E-05
5.717	6.35E-03	6.82E-03	-5.26E-04
5.85	7.33E-03	6.40E-03	9.31E-04
5.983	6.30E-03	5.99E-03	3.09E-04
6.117	6.28E-03	5.62E-03	6.63E-04
6.25	5.26E-03	5.26E-03	-7.85E-06
6.383	5.23E-03	4.93E-03	2.99E-04
6.517	5.21E-03	4.62E-03	5.86E-04
6.65	4.19E-03	4.33E-03	-1.47E-04
6.783	4.16E-03	4.06E-03	1.01E-04
6.917	4.14E-03	3.81E-03	3.33E-04
7.05	4.12E-03	3.57E-03	5.48E-04
7.183	3.09E-03	3.35E-03	-2.52E-04
7.317	3.07E-03	3.14E-03	-6.60E-05
7.45	3.05E-03	2.94E-03	1.07E-04
7.583	3.02E-03	2.76E-03	2.67E-04
7.717	3.00E-03	2.58E-03	4.16E-04
7.85	2.98E-03	2.42E-03	5.54E-04
7.983	1.95E-03	2.27E-03	-3.19E-04
8.117	1.93E-03	2.13E-03	-2.00E-04
8.25	1.91E-03	2.00E-03	-9.12E-05
8.383	1.88E-03	1.87E-03	9.71E-06
8.517	1.86E-03	1.76E-03	1.03E-04
8.65	1.84E-03	1.65E-03	1.89E-04
8.783	1.81E-03	1.55E-03	2.67E-04
8.917	1.79E-03	1.45E-03	3.40E-04
9.05	1.77E-03	1.36E-03	4.06E-04
9.183	7.43E-04	1.28E-03	-5.33E-04
9.317	7.20E-04	1.20E-03	-4.77E-04
9.45	6.96E-04	1.12E-03	-4.27E-04
9.583	6.73E-04	1.05E-03	-3.81E-04
9.717	6.50E-04	9.89E-04	-3.39E-04
9.85	6.25E-04	9.25E-04	-3.02E-04
9.983	6.03E-04	8.71E-04	-2.68E-04
10.12	5.80E-04	8.17E-04	-2.30E-04
10.25	5.56E-04	7.67E-04	-2.11E-04
10.38	5.33E-04	7.20E-04	-1.87E-04
10.52	5.10E-04	6.76E-04	-1.66E-04
10.65	4.86E-04	6.34E-04	-1.48E-04
10.78	4.63E-04	5.93E-04	-1.33E-04
10.92	4.40E-04	5.59E-04	-1.19E-04
11.05	4.17E-04	5.25E-04	-1.08E-04
11.18	3.93E-04	4.93E-04	-9.97E-05
11.32	3.70E-04	4.63E-04	-9.28E-05
11.45	3.47E-04	4.34E-04	-8.79E-05

D4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 80
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2184E-05
 DISPERSIVITY= 0.2373E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1461
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2326E-03

THE F STATISTIC FOR NP= 3 NOBS= 80 IS: 2.73
 THE CRITICAL RSS IS: 0.2573E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.18E-06	2.14E-06	2.23E-06
X(2)	2.37E-03	2.14E-03	2.66E-03
X(5)	1.46E-01	1.40E-01	1.52E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.550	1.00E-03	1.65E-08	1.00E-03
0.683	1.00E-03	6.63E-07	9.99E-04
0.817	2.00E-03	7.90E-06	1.99E-03
0.950	3.00E-03	4.66E-05	2.95E-03
1.083	4.00E-03	1.76E-04	3.82E-03
1.217	5.00E-03	4.92E-04	4.51E-03
1.350	6.00E-03	1.11E-03	4.89E-03
1.483	7.00E-03	2.15E-03	4.85E-03
1.617	8.00E-03	3.68E-03	4.32E-03
1.750	1.00E-02	5.69E-03	4.31E-03
1.883	1.10E-02	8.10E-03	2.90E-03
2.017	1.20E-02	1.08E-02	1.21E-03
2.150	1.30E-02	1.36E-02	-5.88E-04
2.283	1.50E-02	1.64E-02	-1.35E-03
2.417	1.70E-02	1.89E-02	-1.93E-03
2.550	1.90E-02	2.12E-02	-2.22E-03
2.683	2.10E-02	2.32E-02	-2.17E-03
2.817	2.20E-02	2.47E-02	-2.72E-03
2.950	2.40E-02	2.59E-02	-1.88E-03
3.083	2.50E-02	2.66E-02	-1.64E-03
3.217	2.60E-02	2.70E-02	-1.03E-03
3.350	2.70E-02	2.71E-02	-9.93E-05
3.483	2.80E-02	2.69E-02	1.12E-03
3.617	2.80E-02	2.64E-02	1.60E-03
3.750	2.70E-02	2.57E-02	2.17E-03
3.883	2.70E-02	2.49E-02	2.11E-03
4.017	2.60E-02	2.39E-02	2.08E-03
4.150	2.50E-02	2.29E-02	2.14E-03
4.283	2.40E-02	2.17E-02	2.26E-03
4.417	2.20E-02	2.06E-02	1.42E-03
4.550	2.10E-02	1.94E-02	1.60E-03
4.683	2.23E-02	1.90E-02	1.85E-04
4.817	1.80E-02	1.71E-02	9.52E-04
4.950	1.60E-02	1.59E-02	9.16E-05
5.083	1.50E-02	1.45E-02	1.96E-04
5.217	1.30E-02	1.37E-02	-7.41E-04
5.350	1.20E-02	1.27E-02	-7.25E-04
5.483	1.10E-02	1.18E-02	-7.60E-04
5.617	9.00E-03	1.09E-02	-1.85E-03
5.750	9.00E-03	9.99E-03	-9.87E-04
5.883	8.00E-03	9.18E-03	-1.18E-03
6.017	7.00E-03	8.43E-03	-1.43E-03
6.150	6.00E-03	7.72E-03	-1.72E-03
6.283	6.00E-03	7.07E-03	-1.07E-03
6.417	5.00E-03	6.46E-03	-1.46E-03
6.550	5.00E-03	5.90E-03	-9.03E-04
6.683	4.00E-03	5.39E-03	-1.39E-03
6.817	4.00E-03	4.91E-03	-9.09E-04
6.950	4.00E-03	4.47E-03	-4.70E-04
7.083	3.00E-03	4.07E-03	-1.07E-03
7.217	3.00E-03	3.70E-03	-6.98E-04
7.350	3.00E-03	3.36E-03	-3.60E-04
7.483	3.00E-03	3.05E-03	-5.04E-05
7.617	3.00E-03	2.77E-03	2.33E-04
7.750	2.00E-03	2.51E-03	-5.10E-04
7.883	2.00E-03	2.27E-03	-2.74E-04
8.017	2.00E-03	2.06E-03	-6.00E-05
8.150	2.00E-03	1.87E-03	1.35E-04
8.283	2.00E-03	1.69E-03	3.12E-04
8.417	2.00E-03	1.53E-03	4.74E-04
8.550	2.00E-03	1.38E-03	6.20E-04
8.683	2.00E-03	1.25E-03	7.53E-04
8.817	1.00E-03	1.13E-03	-1.27E-04
8.950	1.00E-03	1.02E-03	-1.76E-05
9.083	1.00E-03	9.19E-04	8.13E-05
9.217	1.00E-03	8.29E-04	1.71E-04
9.350	1.00E-03	7.48E-04	2.62E-04
9.483	1.00E-03	6.75E-04	3.25E-04
9.617	1.00E-03	6.08E-04	3.92E-04
9.750	1.00E-03	5.49E-04	4.52E-04
9.883	1.00E-03	4.94E-04	5.16E-04
10.020	1.00E-03	4.45E-04	5.55E-04
10.150	1.00E-03	4.01E-04	5.99E-04
10.283	1.00E-03	3.28E-04	6.33E-04
10.420	1.00E-03	3.25E-04	6.75E-04
10.550	1.00E-03	2.93E-04	7.07E-04
10.680	1.00E-03	2.64E-04	7.36E-04
10.820	1.00E-03	2.37E-04	7.63E-04
10.950	1.00E-03	2.14E-04	7.86E-04
11.080	1.00E-03	1.92E-04	8.08E-04

August 2005
E1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1007E-05
 DISPERSIVITY= 0.3623E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.3744
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4920E-03

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.5398E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.01E-06	9.97E-07	1.02E-06
X(2)	3.62E-03	3.73E-03	3.78E-03
X(5)	3.74E-01	3.71E-01	3.78E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
5.50E-01	0.00E+00	1.07E-05	-1.07E-05
0.6833	0.00E+00	8.78E-05	-8.78E-05
8.17E-01	0.00E+00	3.66E-04	-3.66E-04
0.95	0.00E+00	1.03E-03	-1.03E-03
1.083	0.00E+00	2.26E-03	-2.26E-03
1.217	1.00E-03	4.19E-03	-3.19E-03
1.35	2.00E-03	6.89E-03	-4.89E-03
1.483	4.00E-03	1.04E-02	-6.37E-03
1.617	8.00E-03	1.46E-02	-6.62E-03
1.75	1.40E-02	1.96E-02	-5.58E-03
1.883	2.20E-02	2.52E-02	-3.17E-03
2.017	3.00E-02	3.13E-02	-1.28E-03
2.15	3.90E-02	3.77E-02	1.29E-03
2.283	4.70E-02	4.42E-02	2.79E-03
2.417	5.40E-02	5.05E-02	3.48E-03
2.55	6.00E-02	5.64E-02	3.58E-03
2.683	6.60E-02	6.17E-02	4.25E-03
2.817	7.00E-02	6.64E-02	3.59E-03
2.95	7.30E-02	7.04E-02	2.63E-03
3.083	7.50E-02	7.36E-02	2.37E-03
3.217	7.70E-02	7.62E-02	7.77E-04
3.35	7.90E-02	7.82E-02	8.08E-04
3.483	7.90E-02	7.96E-02	-5.93E-04
3.617	7.90E-02	8.06E-02	-1.49E-03
3.75	7.90E-02	8.09E-02	-1.93E-03
3.883	7.90E-02	8.10E-02	-1.98E-03
4.017	7.80E-02	8.07E-02	-1.69E-03
4.15	7.80E-02	8.01E-02	-2.11E-03
4.283	7.70E-02	7.93E-02	-2.28E-03
4.417	7.50E-02	7.82E-02	-2.24E-03
4.55	7.40E-02	7.70E-02	-3.03E-03
4.683	7.30E-02	7.57E-02	-2.68E-03
4.817	7.20E-02	7.42E-02	-2.21E-03
4.95	7.00E-02	7.26E-02	-2.31E-03
5.083	6.90E-02	7.10E-02	-2.01E-03
5.217	6.80E-02	6.93E-02	-1.32E-03
5.35	6.60E-02	6.69E-02	-1.59E-03
5.483	6.50E-02	6.58E-02	-8.39E-04
5.617	6.40E-02	6.41E-02	-7.02E-05
5.75	6.20E-02	6.23E-02	-2.98E-04
5.883	6.10E-02	6.10E-02	4.71E-04
6.017	6.00E-02	5.88E-02	1.23E-03
6.15	5.80E-02	5.70E-02	9.73E-04
6.283	5.70E-02	5.63E-02	1.69E-03
6.417	5.50E-02	5.36E-02	1.39E-03
6.55	5.40E-02	5.19E-02	2.06E-03
6.683	5.20E-02	5.03E-02	1.69E-03
6.817	5.10E-02	4.87E-02	2.30E-03
6.95	4.90E-02	4.71E-02	1.87E-03
7.083	4.80E-02	4.56E-02	2.40E-03
7.217	4.60E-02	4.41E-02	1.89E-03
7.35	4.50E-02	4.27E-02	2.35E-03
7.483	4.30E-02	4.12E-02	1.76E-03
7.617	4.20E-02	3.99E-02	2.14E-03
7.75	4.00E-02	3.85E-02	1.48E-03
7.883	3.90E-02	3.72E-02	1.78E-03
8.017	3.80E-02	3.60E-02	2.05E-03
8.15	3.60E-02	3.47E-02	1.27E-03
8.283	3.50E-02	3.35E-02	1.46E-03
8.417	3.40E-02	3.24E-02	1.61E-03
8.55	3.30E-02	3.13E-02	1.73E-03
8.683	3.20E-02	3.02E-02	1.81E-03
8.817	3.10E-02	2.92E-02	1.85E-03
8.95	3.00E-02	2.81E-02	1.86E-03
9.083	2.80E-02	2.72E-02	8.40E-04
9.217	2.70E-02	2.62E-02	7.86E-04
9.35	2.60E-02	2.53E-02	7.01E-04
9.483	2.50E-02	2.44E-02	5.85E-04
9.617	2.40E-02	2.36E-02	4.40E-04
9.75	2.30E-02	2.27E-02	2.65E-04
9.883	2.20E-02	2.19E-02	6.23E-05
10.02	2.10E-02	2.12E-02	-1.65E-04
10.15	2.00E-02	2.04E-02	-4.23E-04
10.28	1.90E-02	1.97E-02	-7.06E-04
10.42	1.80E-02	1.90E-02	-1.01E-03
10.55	1.70E-02	1.83E-02	-1.34E-03
10.68	1.60E-02	1.77E-02	-1.70E-03
10.82	1.50E-02	1.71E-02	-2.07E-03
10.95	1.50E-02	1.60E-02	-1.47E-03
11.08	1.40E-02	1.59E-02	-1.89E-03
11.22	1.30E-02	1.53E-02	-2.33E-03
11.35	1.20E-02	1.48E-02	-2.79E-03
11.48	1.10E-02	1.43E-02	-3.27E-03
11.62	1.00E-02	1.38E-02	-3.76E-03
11.75	1.00E-02	1.33E-02	-3.27E-03
11.88	9.00E-03	1.28E-02	-3.81E-03
12.02	8.00E-03	1.24E-02	-4.35E-03

E1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 76
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1164E-05
 DISPERSIVITY= 0.2728E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4925
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1087E-02

THE F STATISTIC FOR NP= 3 NOBS= 76 IS: 2.74
 THE CRITICAL RSS IS: 0.1210E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.16E-06	1.15E-06	1.18E-06
X(2)	2.73E-03	2.62E-03	2.86E-03
X(5)	4.93E-01	4.83E-01	5.02E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.917	1.00E-03	7.32E-04	2.69E-04
2.050	1.00E-03	1.29E-03	-2.89E-04
2.183	1.00E-03	2.12E-03	-1.12E-03
2.317	1.00E-03	3.28E-03	-2.28E-03
2.450	2.00E-03	4.82E-03	-2.82E-03
2.583	3.00E-03	6.80E-03	-3.80E-03
2.717	4.00E-03	9.24E-03	-5.24E-03
2.850	6.00E-03	1.22E-02	-6.15E-03
2.983	8.00E-03	1.55E-02	-7.50E-03
3.117	1.10E-02	1.93E-02	-8.27E-03
3.250	1.50E-02	2.34E-02	-8.38E-03
3.383	2.00E-02	2.78E-02	-7.78E-03
3.517	2.60E-02	3.24E-02	-6.39E-03
3.650	3.20E-02	3.71E-02	-5.12E-03
3.783	3.90E-02	4.19E-02	-2.89E-03
3.917	4.60E-02	4.66E-02	-6.26E-04
4.050	5.20E-02	5.13E-02	7.45E-04
4.183	5.80E-02	5.57E-02	2.28E-03
4.317	6.40E-02	6.00E-02	4.04E-03
4.450	6.90E-02	6.39E-02	5.06E-03
4.583	7.40E-02	6.76E-02	6.37E-03
4.717	7.70E-02	7.10E-02	6.01E-03
4.850	8.00E-02	7.40E-02	5.98E-03
4.983	8.30E-02	7.67E-02	6.31E-03
5.117	8.50E-02	7.90E-02	5.98E-03
5.250	8.60E-02	8.10E-02	5.00E-03
5.383	8.70E-02	8.29E-02	4.37E-03
5.517	8.70E-02	8.39E-02	3.07E-03
5.650	8.80E-02	8.49E-02	3.08E-03
5.783	8.70E-02	8.40E-02	3.40E-03
5.917	8.70E-02	8.60E-02	1.01E-03
6.050	8.60E-02	8.61E-02	-1.20E-04
6.183	8.50E-02	8.60E-02	-9.98E-04
6.317	8.40E-02	8.57E-02	-3.48E-03
6.450	8.30E-02	8.51E-02	-2.33E-03
6.583	8.20E-02	8.43E-02	-2.30E-03
6.717	8.00E-02	8.34E-02	-3.40E-03
6.850	7.90E-02	8.23E-02	-3.32E-03
6.983	7.70E-02	8.11E-02	-4.10E-03
7.117	7.60E-02	7.98E-02	-3.76E-03
7.250	7.40E-02	7.83E-02	-4.31E-03
7.383	7.30E-02	7.68E-02	-3.78E-03
7.517	7.10E-02	7.52E-02	-4.16E-03
7.650	7.00E-02	7.35E-02	-3.48E-03
7.783	6.80E-02	7.17E-02	-3.74E-03
7.917	6.70E-02	7.00E-02	-2.97E-03
8.050	6.50E-02	6.82E-02	-3.16E-03
8.183	6.30E-02	6.63E-02	-3.33E-03
8.317	6.20E-02	6.45E-02	-2.48E-03
8.450	6.00E-02	6.26E-02	-2.62E-03
8.583	5.90E-02	6.08E-02	-1.77E-03
8.717	5.70E-02	5.89E-02	-1.92E-03
8.850	5.60E-02	5.71E-02	-1.08E-03
8.983	5.40E-02	5.53E-02	-1.25E-03
9.117	5.30E-02	5.35E-02	-4.80E-04
9.250	5.10E-02	5.17E-02	-6.70E-04
9.383	5.00E-02	4.99E-02	8.19E-05
9.517	4.80E-02	4.82E-02	-1.95E-04
9.650	4.70E-02	4.65E-02	4.96E-04
9.783	4.60E-02	4.49E-02	1.15E-03
9.917	4.40E-02	4.32E-02	7.72E-04
10.050	4.30E-02	4.17E-02	1.35E-03
10.180	4.20E-02	4.01E-02	1.89E-03
10.320	4.10E-02	3.86E-02	2.40E-03
10.450	3.90E-02	3.71E-02	1.86E-03
10.580	3.80E-02	3.57E-02	2.28E-03
10.720	3.70E-02	3.43E-02	2.67E-03
10.850	3.60E-02	3.30E-02	3.01E-03
10.980	3.40E-02	3.17E-02	3.11E-03
11.120	3.30E-02	3.04E-02	3.57E-03
11.250	3.30E-02	2.92E-02	3.79E-03
11.380	3.20E-02	2.80E-02	3.95E-03
11.520	3.10E-02	2.69E-02	4.11E-03
11.650	3.00E-02	2.58E-02	4.21E-03
11.780	2.90E-02	2.47E-02	4.27E-03
11.920	2.80E-02	2.37E-02	4.30E-03

August 2005
E2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 89
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1850E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1002E-05
 DISPERSIVITY= 0.3477E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.4951
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7133E-02

THE F STATISTIC FOR NP= 3 NOBS= 89 IS: 2.72
 THE CRITICAL RSS IS: 0.7810E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.00E-06	9.72E-07	1.03E-06
X(2)	3.48E-03	3.13E-03	3.89E-03
X(5)	4.95E-01	4.75E-01	5.15E-01

TIME (HOURS) OBS. CONC. CALC. CONC. RESIDUALS

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.00E+00	2.91E-03	1.62E-10	2.91E-03
0.2333	3.86E-03	4.54E-07	3.86E-03
3.67E-01	0.5	1.92E-05	4.79E-03
0.6333	7.75E-03	1.72E-04	7.58E-03
0.7667	1.07E-02	7.26E-04	9.97E-03
0.9	1.46E-02	2.02E-03	1.26E-02
1.033	1.96E-02	4.33E-03	1.53E-02
1.167	2.55E-02	7.84E-03	1.77E-02
1.3	3.15E-02	1.26E-02	1.89E-02
1.433	3.74E-02	1.89E-02	1.89E-02
1.567	4.44E-02	2.57E-02	1.87E-02
1.7	5.13E-02	3.36E-02	1.76E-02
1.833	5.73E-02	4.27E-02	1.46E-02
1.967	6.42E-02	5.23E-02	1.20E-02
2.1	6.92E-02	6.21E-02	7.06E-03
2.233	7.51E-02	7.18E-02	3.33E-03
2.367	8.00E-02	8.08E-02	-7.93E-04
2.5	8.40E-02	8.90E-02	-4.99E-03
2.633	8.89E-02	9.60E-02	-7.07E-03
2.767	9.19E-02	1.02E-01	-9.37E-03
2.9	9.48E-02	1.07E-01	-1.17E-02
3.033	9.78E-02	1.10E-01	-1.23E-02
3.167	1.01E-01	1.13E-01	-1.15E-02
3.3	1.03E-01	1.14E-01	-1.16E-02
3.433	1.04E-01	1.15E-01	-1.15E-02
3.567	1.06E-01	1.16E-01	-9.73E-03
3.7	1.07E-01	1.15E-01	-8.36E-03
3.833	1.06E-01	1.14E-01	-7.51E-03
3.967	1.07E-01	1.13E-01	-5.23E-03
4.1	1.07E-01	1.11E-01	-3.63E-03
4.233	1.06E-01	1.09E-01	-2.75E-03
4.367	1.06E-01	1.07E-01	-6.37E-04
4.5	1.05E-01	1.05E-01	5.33E-04
4.633	1.04E-01	1.02E-01	2.05E-03
4.767	1.03E-01	9.95E-02	3.55E-03
4.9	1.02E-01	9.69E-02	5.15E-03
5.033	1.00E-01	9.42E-02	5.76E-03
5.167	9.89E-02	9.15E-02	7.41E-03
5.3	9.69E-02	8.88E-02	8.06E-03
5.433	9.48E-02	8.59E-02	8.71E-03
5.567	9.27E-02	8.34E-02	9.34E-03
5.7	9.07E-02	8.08E-02	9.93E-03
5.833	8.76E-02	7.81E-02	9.49E-03
5.967	8.56E-02	7.56E-02	1.00E-02
6.1	8.35E-02	7.30E-02	1.05E-02
6.233	8.05E-02	7.06E-02	9.88E-03
6.367	7.74E-02	6.82E-02	9.24E-03
6.5	7.54E-02	6.58E-02	9.53E-03
6.633	7.23E-02	6.35E-02	8.76E-03
6.767	6.93E-02	6.13E-02	7.93E-03
6.9	6.72E-02	5.92E-02	8.04E-03
7.033	6.41E-02	5.71E-02	7.08E-03
7.167	6.11E-02	5.50E-02	6.06E-03
7.3	5.90E-02	5.31E-02	5.98E-03
7.433	5.60E-02	5.11E-02	4.83E-03
7.567	5.39E-02	4.93E-02	4.62E-03
7.7	5.09E-02	4.75E-02	3.36E-03
7.833	4.88E-02	4.58E-02	3.03E-03
7.967	4.68E-02	4.41E-02	2.64E-03
8.1	4.37E-02	4.23E-02	1.20E-03
8.233	4.17E-02	4.10E-02	6.99E-04
8.367	3.96E-02	3.95E-02	1.47E-04
8.5	3.75E-02	3.80E-02	-4.59E-04
8.633	3.55E-02	3.66E-02	-1.12E-03
8.767	3.34E-02	3.53E-02	-1.82E-03
8.9	3.14E-02	3.40E-02	-2.58E-03
9.033	2.93E-02	3.27E-02	-3.38E-03
9.167	2.73E-02	3.15E-02	-4.22E-03
9.3	2.52E-02	3.03E-02	-5.11E-03
9.433	2.42E-02	2.92E-02	-5.05E-03
9.567	2.21E-02	2.81E-02	-6.02E-03
9.7	2.11E-02	2.71E-02	-6.03E-03
9.833	1.90E-02	2.61E-02	-7.08E-03
9.967	1.79E-02	2.51E-02	-7.17E-03
10.1	1.69E-02	2.42E-02	-7.30E-03
10.233	1.58E-02	2.32E-02	-7.46E-03
10.37	1.38E-02	2.24E-02	-8.47E-03
10.5	1.27E-02	2.16E-02	-8.87E-03
10.63	1.17E-02	2.08E-02	-9.12E-03
10.77	1.06E-02	2.00E-02	-9.40E-03
10.9	9.56E-03	1.93E-02	-9.72E-03
11.03	7.51E-03	1.86E-02	-1.11E-02
11.17	6.45E-03	1.79E-02	-1.40E-02
11.3	5.40E-03	1.72E-02	-1.18E-02
11.43	4.34E-03	1.66E-02	-1.22E-02
11.57	3.29E-03	1.60E-02	-1.27E-02
11.7	2.23E-03	1.54E-02	-1.31E-02
11.83	1.18E-03	1.48E-02	-1.36E-02

E2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 89
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.291

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9893E-06
 DISPERSIVITY= 0.2262E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.4972
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9371E-03

THE F STATISTIC FOR NP= 3 NOBS= 89 IS: 2.72
 THE CRITICAL RSS IS: 0.1026E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.89E-07	9.89E-07	9.89E-07
X(2)	2.26E-03	2.17E-03	2.35E-03
X(5)	4.97E-01	4.92E-01	5.02E-01

TIME (HOURS) OBS. CONC. CALC. CONC. RESIDUALS

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.00E+00	1.00E-03	1.00E-03	0.00E+00
1.337	1.00E-03	1.14E-06	9.99E-04
1.470	1.00E-03	4.75E-06	9.95E-04
1.603	1.00E-03	1.56E-05	1.98E-03
1.737	2.00E-03	4.27E-05	1.96E-03
1.870	3.00E-03	1.01E-04	2.90E-03
2.003	3.00E-03	2.12E-04	2.79E-03
2.137	4.00E-03	4.06E-04	3.59E-03
2.270	4.00E-03	7.18E-04	3.28E-03
2.403	5.00E-03	1.19E-03	3.81E-03
2.537	6.00E-03	1.87E-03	3.87E-03
2.670	8.00E-03	2.80E-03	5.20E-03
2.803	9.00E-03	4.02E-03	4.98E-03
2.937	1.10E-02	5.59E-03	5.41E-03
3.070	1.30E-02	7.52E-03	5.48E-03
3.203	1.50E-02	9.84E-03	5.16E-03
3.337	1.80E-02	1.26E-02	5.44E-03
3.470	2.10E-02	1.57E-02	5.32E-03
3.603	2.40E-02	1.92E-02	4.83E-03
3.737	2.70E-02	2.30E-02	4.00E-03
3.870	3.10E-02	2.71E-02	3.87E-03
4.003	3.50E-02	3.15E-02	3.50E-03
4.137	3.80E-02	3.61E-02	1.94E-03
4.270	4.20E-02	4.07E-02	2.27E-03
4.403	4.70E-02	4.55E-02	1.53E-03
4.537	5.10E-02	5.02E-02	7.94E-04
4.670	5.49E-02	5.49E-02	1.30E-04
4.803	5.80E-02	5.94E-02	-1.44E-03
4.937	6.20E-02	6.38E-02	-1.84E-03
5.070	6.60E-02	6.80E-02	-2.04E-03
5.203	7.03E-02	7.20E-02	-2.00E-03
5.337	7.30E-02	7.57E-02	-2.70E-03
5.470	7.60E-02	7.91E-02	-3.11E-03
5.603	7.90E-02	8.22E-02	-3.50E-03
5.737	8.10E-02	8.50E-02	-4.00E-03
5.870	8.40E-02	8.75E-02	-3.47E-03
6.003	8.13E-02	8.96E-02	-3.01E-03
6.137	8.80E-02	9.14E-02	-3.44E-03
6.270	9.00E-02	9.30E-02	-2.95E-03
6.403	9.10E-02	9.42E-02	-3.15E-03
6.537	8.71E-02	9.51E-02	-3.06E-03
6.670	9.40E-02	9.57E-02	-1.69E-03
6.803	9.40E-02	9.60E-02	-2.04E-03
6.937	9.50E-02	9.51E-02	-1.14E-03
7.070	9.50E-02	9.60E-02	-1.01E-03
7.203	9.05E-02	9.57E-02	3.54E-04
7.337	9.60E-02	9.51E-02	9.20E-04
7.470	9.50E-02	9.43E-02	6.75E-04
7.603	9.50E-02	9.34E-02	1.60E-03
7.737	9.40E-02	9.23E-02	1.69E-03
7.870	9.00E-02	9.11E-02	2.92E-03
8.003	9.30E-02	8.97E-02	3.28E-03
8.137	9.20E-02	8.83E-02	3.75E-03
8.270	9.00E-02	8.67E-02	3.32E-03
8.403	8.90E-02	8.50E-02	3.97E-03
8.537	8.70E-02	8.33E-02	3.70E-03
8.670	8.60E-02	8.15E-02	4.50E-03
8.803	8.40E-02	7.97E-02	4.34E-03
8.937	8.20E-02	7.78E-02	4.23E-03
9.070	8.00E-02	7.59E-02	4.16E-03
9.203	7.80E-02	7.39E-02	4.10E-03
9.337	7.60E-02	7.19E-02	4.07E-03
9.470	7.40E-02	7.00E-02	4.04E-03
9.603	7.10E-02	6.80E-02	3.01E-03
9.737	6.90E-02	6.60E-02	2.99E-03
9.870	6.70E-02	6.41E-02	2.95E-03
10.000	6.40E-02	6.21E-02	1.90E-03
10.140	6.20E-02	6.02E-02	1.84E-03
10.270	5.90E-02	5.83E-02	7.45E-04
10.400	5.70E-02	5.64E-02	6.26E-04
10.540	5.40E-02	5.45E-02	-5.07E-04
10.670	5.20E-02	5.27E-02	-6.85E-04
10.800	4.90E-02	5.09E-02	-1.90E-03
10.940	4.70E-02	4.91E-02	-2.13E-03
11.070	4.40E-02	4.74E-02	-3.41E-03
11.200	4.20E-02	4.57E-02	-3.73E-03
11.340	4.00E-02	4.41E-02	-4.08E-03
11.470	3.80E-02	4.25E-02	-4.48E-03
11.600	3.50E-02	4.09E-02	-5.92E-03
10.640	5.20E-02	5.31E-02	-1.13E-03
10.770	5.40E-02	5.13E-02	-1.34E-03
10.900	4.80E-02	4.96E-02	-1.57E-03
11.040	4.50E-02	4.78E-02	-2.83E-03
11.170	4.30E-02	4.62E-02	-3.15E-03
11.300	4.00E-02	4.45E-02	-4.50E-03
11.440	3.80E-02	4.29E-02	-4.87E-03
11.570	3.60E-02	4.13E-02	-5.30E-03
11.720	3.80E-02	3.96E-02	-1.61E-03
11.850	3.50E-02	3.81E-02	-3.11E-03

August 2005
E3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 89
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1005E-05
 DISPERSIVITY= 0.2666E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4139
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1065E-01

THE F STATISTIC FOR NP= 3 NOBS= 89 IS: 2.72
 THE CRITICAL RSS IS: 0.1166E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.01E-06	9.75E-07	1.05E-06
X(2)	2.67E-03	2.29E-03	3.09E-03
X(5)	4.14E-01	3.93E-01	4.39E-01

TIME (HOURS) OBS. CONC. CALC. CONC. RESIDUALS

1.10E+00	8.89E-04	1.13E-03	-2.37E-04
1.232	2.74E-03	2.38E-03	3.56E-04
1.37E+00	5.59E-03	4.34E-03	1.25E-03
1.493	9.44E-03	7.11E-03	2.32E-03
1.632	1.43E-02	1.08E-02	3.50E-03
1.765	2.01E-02	1.53E-02	4.83E-03
1.898	2.60E-02	2.07E-02	5.29E-03
2.032	3.28E-02	2.69E-02	5.92E-03
2.165	3.97E-02	3.38E-02	5.92E-03
2.298	4.65E-02	4.11E-02	5.42E-03
2.432	5.24E-02	4.88E-02	3.63E-03
2.565	5.82E-02	5.63E-02	1.92E-03
2.698	6.41E-02	6.36E-02	4.98E-04
2.832	6.99E-02	7.04E-02	-4.95E-04
2.965	7.48E-02	7.66E-02	-1.80E-03
3.098	8.02E-02	8.20E-02	-5.45E-03
3.232	8.25E-02	8.67E-02	-4.21E-03
3.365	8.53E-02	9.06E-02	-5.22E-03
3.498	8.82E-02	9.36E-02	-5.45E-03
3.632	9.10E-02	9.60E-02	-4.98E-03
3.765	9.29E-02	9.77E-02	-4.80E-03
3.898	9.37E-02	9.87E-02	-4.49E-03
4.032	9.56E-02	9.92E-02	-3.95E-03
4.165	9.64E-02	9.92E-02	-2.79E-03
4.298	9.63E-02	9.88E-02	-2.50E-03
4.432	9.61E-02	9.79E-02	-2.02E-03
4.565	9.60E-02	9.68E-02	-8.02E-04
4.698	9.58E-02	9.53E-02	4.87E-04
4.832	9.57E-02	9.37E-02	1.98E-03
4.965	9.45E-02	9.18E-02	2.73E-03
5.098	9.34E-02	8.98E-02	3.61E-03
5.232	9.23E-02	8.76E-02	3.64E-03
5.365	9.01E-02	8.53E-02	4.74E-03
5.498	8.79E-02	8.30E-02	4.92E-03
5.632	8.58E-02	8.06E-02	5.18E-03
5.765	8.36E-02	7.82E-02	5.44E-03
5.898	8.15E-02	7.57E-02	5.73E-03
6.032	7.93E-02	7.33E-02	6.09E-03
6.165	7.72E-02	7.09E-02	6.32E-03
6.298	7.40E-02	6.84E-02	5.58E-03
6.432	7.09E-02	6.59E-02	4.79E-03
6.565	6.87E-02	6.37E-02	5.02E-03
6.698	6.56E-02	6.14E-02	4.18E-03
6.832	6.34E-02	5.91E-02	4.31E-03
6.965	6.03E-02	5.69E-02	3.37E-03
7.098	5.71E-02	5.47E-02	2.38E-03
7.232	5.50E-02	5.26E-02	2.34E-03
7.365	5.18E-02	5.06E-02	1.24E-03
7.498	4.87E-02	4.86E-02	6.16E-05
7.632	4.65E-02	4.67E-02	-1.49E-04
7.765	4.34E-02	4.48E-02	-1.43E-03
7.898	4.02E-02	4.30E-02	-2.78E-03
8.032	3.81E-02	4.12E-02	-3.17E-03
8.165	3.59E-02	3.96E-02	-3.64E-03
8.298	3.28E-02	3.79E-02	-5.16E-03
8.432	3.06E-02	3.63E-02	-5.73E-03
8.565	2.85E-02	3.48E-02	-6.37E-03
8.698	2.63E-02	3.34E-02	-7.06E-03
8.832	2.42E-02	3.20E-02	-7.80E-03
8.965	2.20E-02	3.06E-02	-8.60E-03
9.098	2.09E-02	2.93E-02	-8.46E-03
9.232	1.87E-02	2.81E-02	-9.35E-03
9.365	1.76E-02	2.69E-02	-9.30E-03
9.498	1.54E-02	2.57E-02	-1.03E-02
9.632	1.43E-02	2.46E-02	-1.03E-02
9.765	1.31E-02	2.35E-02	-1.04E-02
9.898	1.10E-02	2.25E-02	-1.16E-02
10.03	9.80E-03	2.16E-02	-1.18E-02
10.16	8.65E-03	2.06E-02	-1.20E-02
10.3	7.50E-03	1.97E-02	-1.22E-02
10.43	6.35E-03	1.89E-02	-1.25E-02
10.57	5.20E-03	1.80E-02	-1.28E-02
10.7	5.05E-03	1.72E-02	-1.22E-02
10.83	3.90E-03	1.65E-02	-1.26E-02
10.97	2.75E-03	1.57E-02	-1.30E-02
11.1	2.60E-03	1.51E-02	-1.25E-02
11.23	1.45E-03	1.44E-02	-1.30E-02
11.37	1.30E-03	1.37E-02	-1.24E-02
11.5	1.49E-04	1.32E-02	-1.30E-02
11.63	-1.88E-06	1.26E-02	-1.26E-02
10.77	5.00E-02	1.68E-02	3.32E-02
10.9	4.80E-02	1.61E-02	3.19E-02
11.04	4.50E-02	1.54E-02	2.96E-02
11.17	4.30E-02	1.47E-02	2.83E-02
11.3	4.00E-02	1.41E-02	2.59E-02
11.44	3.80E-02	1.34E-02	2.46E-02
11.57	3.60E-02	1.28E-02	2.32E-02
11.72	3.20E-02	1.22E-02	2.58E-02
11.85	3.0E-02	1.17E-02	2.33E-02

E3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9111E-06
 DISPERSIVITY= 0.1549E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4021
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2753E-04

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
 THE CRITICAL RSS IS: 0.3002E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.11E-07	9.11E-07	9.11E-07
X(2)	1.55E-03	1.55E-03	1.55E-03
X(5)	4.02E-01	4.02E-01	4.02E-01

TIME (HOURS) OBS. CONC. CALC. CONC. RESIDUALS

2.398	1.00E-03	1.08E-05	9.89E-04
2.498	1.00E-03	1.98E-05	9.80E-04
2.598	1.00E-03	3.45E-05	9.66E-04
2.698	1.00E-03	5.77E-05	9.43E-04
2.798	1.00E-03	9.29E-05	9.07E-04
2.898	1.00E-03	1.44E-04	8.56E-04
2.998	1.00E-03	2.18E-04	7.82E-04
3.098	1.00E-03	3.19E-04	6.81E-04
3.198	1.00E-03	4.55E-04	5.45E-04
3.298	2.00E-03	6.35E-04	1.37E-03
3.398	2.00E-03	8.68E-04	1.13E-03
3.498	2.00E-03	1.16E-03	8.38E-04
3.598	3.00E-03	1.53E-03	1.47E-03
3.698	3.00E-03	1.98E-03	1.02E-03
3.798	3.00E-03	2.52E-03	4.79E-04
3.898	4.00E-03	3.17E-03	3.27E-04
3.998	5.00E-03	3.94E-03	1.07E-03
4.098	5.00E-03	4.82E-03	1.79E-04
4.198	6.00E-03	5.84E-03	1.61E-04
4.298	7.00E-03	7.00E-03	5.46E-06
4.398	9.00E-03	8.29E-03	7.06E-04
4.498	1.00E-02	9.74E-03	2.60E-04
4.598	1.10E-02	1.13E-02	-3.34E-04
4.698	1.30E-02	1.31E-02	-7.66E-05
4.798	1.50E-02	1.50E-02	3.58E-06
4.898	1.70E-02	1.70E-02	1.79E-06
4.998	1.90E-02	1.92E-02	-1.55E-04
5.098	2.10E-02	2.14E-02	-4.43E-04
5.198	2.30E-02	2.39E-02	1.53E-04
5.298	2.60E-02	2.64E-02	-3.56E-04
5.398	2.90E-02	2.90E-02	4.40E-05
5.498	3.20E-02	3.16E-02	1.66E-04
5.598	3.40E-02	3.44E-02	-3.74E-04
5.698	3.70E-02	3.72E-02	-1.63E-04
5.798	4.00E-02	4.00E-02	4.66E-05
5.898	4.30E-02	4.28E-02	1.80E-04
5.998	4.60E-02	4.57E-02	3.42E-04
6.098	4.90E-02	4.85E-02	5.8E-04
6.198	5.10E-02	5.13E-02	-2.76E-04
6.298	5.40E-02	5.40E-02	-2.66E-05
6.398	5.70E-02	5.70E-02	2.50E-04
6.498	5.90E-02	5.93E-02	-3.43E-04
6.598	6.20E-02	6.19E-02	1.15E-04
6.698	6.40E-02	6.34E-02	6.81E-04
6.798	6.70E-02	6.67E-02	3.20E-04
6.898	6.90E-02	6.89E-02	8.46E-05
6.998	7.10E-02	7.10E-02	-3.22E-05
7.098	7.30E-02	7.30E-02	-2.37E-05
7.198	7.50E-02	7.49E-02	1.15E-04
7.298	7.60E-02	7.66E-02	-6.10E-04
7.398	7.80E-02	7.82E-02	1.98E-04
7.498	7.90E-02	7.96E-02	-6.44E-04
7.598	8.10E-02	8.10E-02	5.25E-05
7.698	8.20E-02	8.21E-02	-1.08E-04
7.798	8.30E-02	8.31E-02	-1.26E-04
7.898	8.40E-02	8.40E-02	-1.27E-06
7.998	8.40E-02	8.47E-02	7.36E-04
8.098	8.50E-02	8.53E-02	-3.33E-04
8.198	8.60E-02	8.58E-02	2.06E-04
8.298	8.60E-02	8.61E-02	-1.23E-04
8.398	8.60E-02	8.63E-02	-3.23E-04
8.498	8.60E-02	8.64E-02	-3.99E-04
8.598	8.60E-02	8.64E-02	-3.55E-04
8.698	8.60E-02	8.62E-02	-1.95E-04
8.798	8.60E-02	8.59E-02	7.46E-05
8.898	8.60E-02	8.56E-02	4.50E-04
8.998	8.50E-02	8.51E-02	-7.50E-05
9.098	8.50E-02	8.45E-02	4.95E-04
9.198	8.40E-02	8.39E-02	1.54E-04
9.298	8.30E-02	8.31E-02	-1.03E-04
9.398	8.30E-02	8.23E-02	7.18E-04
9.498	8.20E-02	8.14E-02	6.13E-04
9.598	8.10E-02	8.04E-02	5.76E-04
9.698	8.00E-02	7.94E-02	5.99E-04
9.798	7.90E-02	7.83E-02	6.81E-04
9.898	7.80E-02	7.72E-02	8.15E-04
9.998	7.60E-02	7.60E-02	-3.96E-06
10.100	7.50E-02	7.48E-02	2.16E-04
10.200	7.40E-02	7.40E-02	4.78E-04
10.300	7.30E-02	7.22E-02	7.73E-04
10.400	7.10E-02	7.09E-02	9.77E-05
10.500	6.90E-02	6.90E-02	4.47E-04
10.600	6.80E-02	6.82E-02	-1.82E-04
10.700	6.70E-02	6.68E-02	2.07E-04
10.800	6.60E-02	6.58E-02	3.90E-04
10.900	6.40E-02	6.40E-02	2.29E-05
11.000	6.20E-02	6.26E-02	-5.56E-04
11.100	6.10E-02	6.10E-02	-1.31E-04
11.200	5.90E-02	5.97E-02	7.04E-04
11.300	5.80E-02	5.83E-02	-2.78E-04
11.400	5.60E-02	5.69E-02	-8.56E-04
11.500	5.50E-02	5.54E-02	-4.39E-04

August 2005
E4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1427E-05
DISPERSIVITY= 0.3309E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1333
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5706E-04

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
THE CRITICAL RSS IS: 0.6268E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.43E-06	1.41E-06	1.44E-06
X(2)	3.31E-03	3.18E-03	3.44E-03
X(5)	1.33E-01	1.32E-01	1.35E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.18E-01	1.00E-03	7.25E-20	1.00E-03
0.2517	1.00E-03	3.91E-10	1.00E-03
3.85E-01	1.00E-03	4.16E-07	1.00E-03
0.5193	1.00E-03	1.26E-05	9.87E-04
0.6517	2.00E-03	9.66E-05	1.90E-03
0.785	2.00E-03	3.73E-04	1.63E-03
0.9193	3.00E-03	9.78E-04	2.02E-03
1.052	4.00E-03	2.02E-03	1.98E-03
1.185	5.00E-03	3.54E-03	1.47E-03
1.318	7.00E-03	5.54E-03	1.46E-03
1.452	9.00E-03	7.99E-03	1.01E-03
1.585	1.10E-02	1.08E-02	2.09E-04
1.718	1.40E-02	1.38E-02	2.25E-04
1.852	1.60E-02	1.67E-02	-7.39E-04
1.985	1.90E-02	1.95E-02	-4.99E-04
2.118	2.10E-02	2.19E-02	-9.34E-04
2.252	2.30E-02	2.40E-02	-9.78E-04
2.385	2.40E-02	2.49E-02	-2.13E-04
2.518	2.60E-02	2.68E-02	-8.35E-04
2.652	2.70E-02	2.77E-02	-6.90E-04
2.785	2.80E-02	2.78E-02	-4.25E-02
2.918	2.90E-02	2.85E-02	5.53E-04
3.052	2.90E-02	2.84E-02	5.64E-04
3.185	2.90E-02	2.82E-02	7.81E-04
3.318	2.90E-02	2.78E-02	1.17E-03
3.452	2.80E-02	2.73E-02	6.88E-04
3.585	2.80E-02	2.67E-02	1.32E-03
3.718	2.70E-02	2.60E-02	1.03E-03
3.852	2.60E-02	2.52E-02	8.03E-04
3.985	2.50E-02	2.44E-02	6.22E-04
4.118	2.40E-02	2.35E-02	4.72E-04
4.252	2.30E-02	2.27E-02	3.44E-04
4.385	2.20E-02	2.18E-02	2.16E-04
4.518	2.10E-02	2.09E-02	9.13E-05
4.652	2.00E-02	2.00E-02	-3.92E-05
4.785	1.90E-02	1.92E-02	-1.65E-04
4.918	1.80E-02	1.83E-02	-3.42E-04
5.052	1.70E-02	1.75E-02	-5.20E-04
5.185	1.60E-02	1.67E-02	-7.21E-04
5.318	1.50E-02	1.60E-02	-9.47E-04
5.452	1.40E-02	1.52E-02	-1.20E-03
5.585	1.40E-02	1.48E-02	-4.73E-04
5.718	1.30E-02	1.38E-02	-7.77E-04
5.852	1.20E-02	1.31E-02	-1.11E-03
5.985	1.10E-02	1.25E-02	-1.46E-03
6.118	1.10E-02	1.19E-02	-8.48E-04
6.252	1.00E-02	1.13E-02	-1.26E-03
6.385	1.00E-02	1.07E-02	-6.94E-04
6.518	1.00E-02	1.02E-02	-1.55E-04
6.652	9.00E-03	9.64E-03	-6.41E-04
6.785	9.00E-03	9.15E-03	-1.51E-04
6.918	9.00E-03	8.68E-03	3.17E-04
7.052	8.00E-03	8.24E-03	-2.38E-04
7.185	8.00E-03	7.81E-03	1.86E-04
7.318	8.00E-03	7.41E-03	5.89E-04
7.452	7.00E-03	7.03E-03	-2.78E-05
7.585	7.00E-03	6.66E-03	3.37E-04
7.718	7.00E-03	6.32E-03	6.83E-04
7.852	6.00E-03	5.99E-03	1.19E-05
7.985	6.00E-03	5.68E-03	3.24E-04
8.118	6.00E-03	5.38E-03	6.21E-04
8.252	6.00E-03	5.10E-03	9.02E-04
8.385	5.00E-03	4.83E-03	1.69E-04
8.518	5.00E-03	4.58E-03	4.23E-04
8.652	5.00E-03	4.34E-03	6.63E-04
8.785	5.00E-03	4.11E-03	8.91E-04
8.918	4.00E-03	3.89E-03	1.07E-04
9.052	4.00E-03	3.69E-03	3.12E-04
9.185	4.00E-03	3.49E-03	5.07E-04
9.318	4.00E-03	3.31E-03	6.91E-04
9.452	4.00E-03	3.14E-03	8.64E-04
9.585	4.00E-03	2.97E-03	1.03E-03
9.718	3.00E-03	2.81E-03	1.87E-04
9.852	3.00E-03	2.66E-03	3.36E-04
9.985	3.00E-03	2.52E-03	4.77E-04
10.12	3.00E-03	2.39E-03	6.10E-04
10.25	2.00E-03	2.26E-03	-2.63E-04
10.39	2.00E-03	2.14E-03	-1.44E-04
10.52	2.00E-03	2.03E-03	-3.10E-05
10.65	2.00E-03	1.92E-03	7.69E-05
10.79	2.00E-03	1.82E-03	1.76E-04
10.92	1.00E-03	1.73E-03	-7.26E-04
11.05	1.00E-03	1.63E-03	-6.34E-04
11.19	1.00E-03	1.55E-03	-5.48E-04
11.32	1.00E-03	1.47E-03	-4.66E-04
11.45	1.00E-03	1.39E-03	-3.88E-04

E4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 78
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1295E-05
DISPERSIVITY= 0.1817E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.9961E-01
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1652E-03

THE F STATISTIC FOR NP= 3 NOBS= 78 IS: 2.74
THE CRITICAL RSS IS: 0.1832E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.30E-06	1.28E-06	1.31E-06
X(2)	1.82E-03	1.64E-03	2.02E-03
X(5)	9.96E-02	9.56E-02	1.04E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.585	9.73E-04	2.21E-06	9.70E-04
1.718	9.34E-04	6.94E-06	9.27E-04
1.852	8.95E-04	1.84E-05	8.77E-04
1.985	1.86E-03	4.26E-05	1.81E-03
2.118	1.82E-03	8.83E-05	1.73E-03
2.252	2.78E-03	1.67E-04	2.61E-03
2.385	2.74E-03	2.93E-04	2.45E-03
2.518	2.70E-03	4.82E-04	2.22E-03
2.652	3.66E-03	7.49E-04	2.91E-03
2.785	3.63E-03	1.11E-03	2.51E-03
2.918	4.59E-03	1.58E-03	3.01E-03
3.052	4.55E-03	2.16E-03	2.38E-03
3.185	5.51E-03	2.87E-03	2.64E-03
3.318	5.47E-03	3.69E-03	1.78E-03
3.452	6.43E-03	4.62E-03	1.82E-03
3.585	7.39E-03	5.64E-03	1.75E-03
3.718	8.36E-03	6.75E-03	1.61E-03
3.852	8.32E-03	7.91E-03	4.08E-04
3.985	9.28E-03	9.11E-03	1.72E-04
4.118	1.02E-02	1.03E-02	-7.73E-05
4.252	1.12E-02	1.15E-02	-3.19E-04
4.385	1.22E-02	1.27E-02	-5.28E-04
4.518	1.31E-02	1.38E-02	-6.88E-04
4.652	1.41E-02	1.49E-02	-7.83E-04
4.785	1.51E-02	1.58E-02	-1.07E-03
4.918	1.50E-02	1.67E-02	-1.72E-03
5.052	1.60E-02	1.75E-02	-1.54E-03
5.185	1.69E-02	1.82E-02	-1.26E-03
5.318	1.79E-02	1.88E-02	-8.71E-04
5.452	1.79E-02	1.92E-02	-1.37E-03
5.585	1.88E-02	1.96E-02	-7.67E-04
5.718	1.88E-02	1.98E-02	-1.06E-03
5.852	1.87E-02	2.00E-02	-1.24E-03
5.985	1.97E-02	2.00E-02	-3.38E-04
6.118	2.07E-02	2.00E-02	-7.83E-04
6.252	1.99E-02	1.99E-02	-2.65E-04
6.385	1.95E-02	1.97E-02	-1.11E-04
6.518	1.95E-02	1.94E-02	1.10E-04
6.652	1.95E-02	1.91E-02	3.91E-04
6.785	1.95E-02	1.87E-02	7.27E-04
6.918	1.94E-02	1.83E-02	1.11E-03
7.052	1.84E-02	1.79E-02	5.30E-04
7.185	1.84E-02	1.74E-02	9.83E-04
7.318	1.83E-02	1.69E-02	1.46E-03
7.452	1.73E-02	1.63E-02	9.68E-04
7.585	1.72E-02	1.58E-02	1.49E-03
7.718	1.62E-02	1.52E-02	1.02E-03
7.852	1.62E-02	1.46E-02	1.55E-03
7.985	1.51E-02	1.40E-02	1.09E-03
8.118	1.41E-02	1.35E-02	6.38E-04
8.252	1.40E-02	1.29E-02	1.17E-03
8.385	1.30E-02	1.23E-02	7.03E-04
8.518	1.30E-02	1.17E-02	1.23E-03
8.652	1.19E-02	1.12E-02	7.38E-04
8.785	1.19E-02	1.07E-02	1.24E-03
8.918	1.09E-02	1.01E-02	7.25E-04
9.052	9.81E-03	9.61E-03	1.97E-04
9.185	9.77E-03	9.12E-03	6.53E-04
9.318	8.73E-03	8.64E-03	9.24E-05
9.452	8.70E-03	8.18E-03	5.15E-04
9.585	7.66E-03	7.74E-03	-7.91E-05
9.718	7.62E-03	7.31E-03	3.09E-04
9.852	6.58E-03	6.90E-03	-3.20E-04
9.985	5.54E-03	6.51E-03	-9.66E-04
10.120	5.50E-03	6.13E-03	-6.33E-04
10.250	5.46E-03	5.78E-03	-3.12E-04
10.390	4.42E-03	5.44E-03	-1.01E-03
10.520	4.39E-03	5.11E-03	-7.27E-04
10.650	3.35E-03	4.80E-03	-1.46E-03
10.790	3.31E-03	4.51E-03	-1.20E-03
10.920	2.23E-03	4.27E-03	-2.34E-03
11.050	2.23E-03	3.97E-03	-1.74E-03
11.190	1.19E-03	3.73E-03	-2.53E-03
11.320	1.19E-03	3.45E-03	-2.34E-03
11.450	1.12E-03	3.27E-03	-2.15E-03
11.590	7.68E-05	3.06E-03	-2.98E-03
11.720	3.82E-05	2.87E-03	-2.83E-03
11.850	-4.20E-07	2.68E-03	-2.68E-03

August 2005
F1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : 1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1201E-05
 DISPERSIVITY= 0.2877E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.2253
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1175E-03

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72
 THE CRITICAL RSS IS: 0.1288E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.20E-06	1.20E-06	1.20E-06
X(2)	2.88E-03	2.99E-03	2.77E-03
X(5)	2.25E-01	2.23E-01	2.28E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-01	5.10E-05	1.62E-27	5.10E-05
0.2333	1.19E-04	1.69E-12	1.19E-04
3.67E-01	1.87E-04	2.30E-08	1.87E-04
0.5	2.55E-04	2.04E-06	2.53E-04
0.5333	3.23E-04	2.77E-05	2.95E-04
0.667	1.39E-03	1.54E-04	1.24E-03
0.9	1.46E-03	5.15E-04	9.44E-04
1.033	2.53E-03	1.27E-03	1.26E-03
1.167	3.60E-03	1.02E-02	6.32E-04
1.3	5.66E-03	4.44E-03	1.22E-03
1.433	7.73E-03	6.98E-03	7.47E-04
1.567	1.08E-02	1.39E-02	9.24E-04
1.7	1.49E-02	1.82E-02	7.18E-04
1.833	3.72E-02	3.64E-02	8.40E-04
1.967	2.91E-02	2.75E-02	1.55E-03
2.1	3.31E-02	3.21E-02	1.04E-03
2.233	4.03E-02	4.02E-02	1.02E-04
2.367	4.33E-02	4.34E-02	-1.02E-04
2.5	4.54E-02	4.62E-02	-7.41E-04
2.633	4.76E-02	4.86E-02	-8.14E-04
2.767	4.86E-02	4.99E-02	-1.35E-03
2.9	4.96E-02	5.10E-02	-1.39E-03
3.033	5.07E-02	5.17E-02	-9.81E-04
3.167	5.08E-02	5.19E-02	-1.18E-03
3.3	5.08E-02	5.19E-02	-1.03E-03
3.433	4.99E-02	5.15E-02	-1.59E-03
3.567	5.00E-02	5.09E-02	-9.03E-04
3.7	4.90E-02	5.00E-02	-1.01E-03
3.833	4.91E-02	4.91E-02	-5.79E-04
3.967	4.72E-02	4.79E-02	-7.45E-04
4.1	4.62E-02	4.67E-02	-4.38E-04
4.233	4.53E-02	4.53E-02	-4.98E-05
4.367	4.44E-02	4.40E-02	-3.93E-04
4.5	4.24E-02	4.25E-02	-1.10E-04
4.633	4.15E-02	4.11E-02	4.06E-04
4.767	3.96E-02	3.96E-02	9.33E-04
4.9	3.77E-02	3.67E-02	9.87E-04
5.033	3.68E-02	3.63E-02	1.43E-03
5.167	3.58E-02	3.39E-02	1.98E-03
5.3	3.39E-02	3.25E-02	1.44E-03
5.433	3.30E-02	3.11E-02	1.88E-03
5.567	3.10E-02	2.98E-02	1.25E-03
5.7	2.91E-02	2.85E-02	6.06E-04
5.833	2.82E-02	2.73E-02	9.21E-04
5.967	2.73E-02	2.61E-02	1.20E-03
6.1	2.53E-02	2.49E-02	4.32E-04
6.233	2.44E-02	2.38E-02	6.26E-04
6.367	2.35E-02	2.27E-02	7.78E-04
6.5	2.25E-02	2.16E-02	8.90E-04
6.633	2.06E-02	2.06E-02	-4.01E-05
6.767	2.07E-02	1.97E-02	9.91E-04
6.9	1.97E-02	1.87E-02	9.82E-04
7.033	1.88E-02	1.79E-02	9.35E-04
7.167	1.79E-02	1.70E-02	8.51E-04
7.3	1.69E-02	1.62E-02	7.30E-04
7.433	1.60E-02	1.54E-02	5.73E-04
7.567	1.51E-02	1.47E-02	3.83E-04
7.7	1.41E-02	1.40E-02	1.59E-04
7.833	1.32E-02	1.33E-02	-9.65E-05
7.967	1.23E-02	1.27E-02	-3.83E-04
8.1	1.14E-02	1.15E-02	-4.32E-05
8.233	1.05E-02	1.09E-02	-4.15E-04
8.367	9.54E-03	1.04E-02	-8.13E-04
8.5	9.61E-03	9.84E-03	-2.36E-04
8.633	8.68E-03	9.36E-03	-6.83E-04
8.767	7.74E-03	8.46E-03	-1.15E-03
8.9	7.81E-03	8.46E-03	-6.46E-04
9.033	6.88E-03	8.04E-03	-1.16E-03
9.167	6.02E-03	7.26E-03	-1.25E-03
9.3	6.08E-03	6.90E-03	-8.18E-04
9.433	5.15E-03	6.56E-03	-1.41E-03
9.567	5.22E-03	6.22E-03	-1.00E-03
9.7	4.29E-03	5.92E-03	-1.63E-03
9.833	4.36E-03	5.63E-03	-1.27E-03
9.967	3.42E-03	5.35E-03	-1.92E-03
10.1	3.49E-03	5.08E-03	-1.59E-03
10.233	2.56E-03	4.83E-03	-2.27E-03
10.367	2.63E-03	4.58E-03	-1.96E-03
10.5	1.70E-03	4.35E-03	-2.66E-03
10.633	1.76E-03	4.14E-03	-2.37E-03
10.767	3.33E-03	2.21E-03	1.12E-03
10.9	8.99E-04	3.73E-03	-2.83E-03
11.033	9.67E-04	3.55E-03	-2.58E-03
11.167			
11.3			
11.433			
11.57			
11.7			

F1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 91
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : 1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1179E-05
 DISPERSIVITY= 0.1232E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1493
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2446E-03

THE F STATISTIC FOR NP= 3 NOBS= 91 IS: 2.72
 THE CRITICAL RSS IS: 0.2673E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.18E-06	1.18E-06	1.18E-06
X(2)	2.93E-03	1.17E-03	5.13E-03
X(5)	1.49E-01	1.46E-01	1.52E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.797	9.67E-04	2.93E-04	6.74E-04
2.897	4.32E-04	4.32E-04	4.91E-04
2.997	8.79E-04	6.19E-04	2.60E-04
3.097	1.83E-03	8.63E-04	9.72E-04
3.197	3.17E-03	1.18E-03	6.16E-04
3.297	1.75E-03	1.56E-03	1.82E-04
3.397	2.70E-03	2.04E-03	6.62E-04
3.497	3.66E-03	2.61E-03	1.05E-03
3.597	4.81E-03	3.25E-03	1.53E-03
3.697	5.57E-03	4.06E-03	1.51E-03
3.797	6.53E-03	4.95E-03	1.58E-03
3.897	7.48E-03	5.95E-03	1.53E-03
3.997	8.44E-03	7.05E-03	1.39E-03
4.097	9.39E-03	8.26E-03	1.14E-03
4.197	1.52E-02	1.39E-02	1.79E-03
4.297	1.23E-02	1.09E-02	1.37E-03
4.397	1.33E-02	1.24E-02	8.68E-04
4.497	1.52E-02	1.39E-02	1.31E-03
4.597	1.62E-02	1.55E-02	7.07E-04
4.697	1.81E-02	1.71E-02	1.08E-03
4.797	1.91E-02	1.87E-02	4.34E-04
4.897	2.10E-02	2.03E-02	1.744E-04
4.997	2.20E-02	2.18E-02	1.73E-04
5.097	2.40E-02	2.34E-02	5.88E-04
5.197	2.49E-02	2.49E-02	5.27E-05
5.297	2.59E-02	2.63E-02	-4.21E-04
5.397	2.68E-02	2.76E-02	-8.20E-04
5.497	2.89E-02	2.89E-02	-1.34E-04
5.597	2.97E-02	3.01E-02	-3.54E-04
5.697	2.97E-02	3.12E-02	-1.47E-03
5.797	3.06E-02	3.21E-02	-1.62E-03
5.897	3.16E-02	3.30E-02	-1.39E-03
5.997	3.26E-02	3.37E-02	-1.17E-03
6.097	3.25E-02	3.44E-02	-1.84E-03
6.197	3.35E-02	3.49E-02	-1.47E-03
6.297	3.34E-02	3.53E-02	-1.84E-03
6.397	3.44E-02	3.55E-02	-1.16E-03
6.497	3.43E-02	3.57E-02	-1.38E-03
6.597	3.43E-02	3.58E-02	-1.49E-03
6.697	3.53E-02	3.57E-02	-4.97E-04
6.797	3.52E-02	3.57E-02	-4.09E-04
6.897	3.52E-02	3.54E-02	-2.30E-04
6.997	3.41E-02	3.51E-02	-9.66E-04
7.097	3.41E-02	3.47E-02	-6.23E-04
7.197	3.40E-02	3.42E-02	-2.08E-04
7.297	3.40E-02	3.37E-02	2.74E-04
7.397	3.29E-02	3.31E-02	-1.84E-04
7.497	3.29E-02	3.25E-02	4.12E-04
7.597	3.29E-02	3.18E-02	1.06E-03
7.697	3.18E-02	3.11E-02	7.39E-04
7.797	3.18E-02	3.03E-02	1.46E-03
7.897	3.07E-02	2.95E-02	1.21E-03
7.997	2.97E-02	2.87E-02	9.81E-04
8.097	2.96E-02	2.79E-02	1.78E-03
8.197	2.86E-02	2.70E-02	1.58E-03
8.297	2.75E-02	2.61E-02	1.40E-03
8.397	2.65E-02	2.53E-02	1.23E-03
8.497	2.65E-02	2.44E-02	2.06E-03
8.597	2.54E-02	2.35E-02	1.89E-03
8.697	2.44E-02	2.27E-02	1.71E-03
8.797	2.33E-02	2.18E-02	1.53E-03
8.897	2.23E-02	2.10E-02	1.33E-03
8.997	2.12E-02	2.01E-02	1.13E-03
9.097	2.12E-02	1.93E-02	1.91E-03
9.197	2.01E-02	1.85E-02	1.67E-03
9.297	1.91E-02	1.77E-02	1.42E-03
9.397	1.81E-02	1.69E-02	1.15E-03
9.497	1.70E-02	1.62E-02	8.64E-04
9.597	1.70E-02	1.54E-02	1.56E-03
9.697	1.59E-02	1.47E-02	1.22E-03
9.797	1.49E-02	1.40E-02	8.72E-04
9.897	1.38E-02	1.33E-02	4.97E-04
9.997	1.28E-02	1.23E-02	9.89E-05
10.100	1.18E-02	1.21E-02	-3.19E-04
10.200	1.17E-02	1.15E-02	2.39E-04
10.300	1.07E-02	1.09E-02	-2.26E-04
10.400	9.62E-03	1.03E-02	-7.14E-04
10.500	8.57E-03	9.80E-03	-1.22E-03
10.600	7.53E-03	9.28E-03	-1.76E-03
10.700	7.48E-03	8.79E-03	-1.31E-03
10.800	6.44E-03	8.32E-03	-1.88E-03
10.900	5.40E-03	7.87E-03	-2.48E-03
11.000	4.36E-03	7.00E-03	-2.64E-03
11.100	4.31E-03	7.03E-03	-2.73E-03
11.200	3.26E-03	6.64E-03	-3.38E-03
11.300	2.22E-03	6.20E-03	-3.95E-03
11.400	2.17E-03	5.92E-03	-3.75E-03
11.500	1.13E-03	5.58E-03	-4.45E-03
11.600	1.09E-03	5.26E-03	-4.18E-03
11.700	4.96E-05	4.96E-03	-4.92E-03
11.800	-2.33E-06	4.67E-03	-4.67E-03

August 2005
F3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 78
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1008E-05
 DISPERSIVITY= 0.1908E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.3058
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2736E-03

THE F STATISTIC FOR NP= 3 NOBS= 78 IS: 2.74
 THE CRITICAL RSS IS: 0.3036E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.01E-06	1.01E-06	1.01E-06
X(2)	1.91E-03	1.85E-03	1.97E-03
X(5)	3.06E-01	3.03E-01	3.09E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.47E+00	2.48E-03	1.29E-03	1.19E-03
1.6	3.16E-03	2.36E-03	8.02E-04
1.73E+00	4.84E-03	3.93E-03	9.14E-04
1.867	7.53E-03	6.07E-03	1.45E-03
2	9.20E-03	8.83E-03	3.72E-04
2.133	1.29E-02	1.22E-02	6.49E-04
2.267	4.96E-02	1.63E-02	2.88E-02
2.4	2.12E-02	2.09E-02	3.38E-04
2.533	2.59E-02	2.60E-02	-1.14E-04
2.667	3.16E-02	3.15E-02	5.60E-05
2.8	3.83E-02	3.73E-02	1.01E-03
2.933	4.40E-02	4.30E-02	9.18E-04
3.067	4.96E-02	4.87E-02	9.33E-04
3.2	5.53E-02	5.41E-02	1.21E-03
3.333	6.00E-02	5.91E-02	8.65E-04
3.467	6.57E-02	6.47E-02	9.84E-04
3.6	6.94E-02	6.77E-02	6.38E-04
3.733	7.10E-02	7.12E-02	-1.42E-04
3.867	7.37E-02	7.41E-02	-3.41E-04
4	7.54E-02	7.64E-02	-9.61E-04
4.133	7.71E-02	7.81E-02	-1.02E-03
4.267	7.78E-02	7.93E-02	-1.45E-03
4.4	7.84E-02	8.00E-02	-1.58E-03
4.533	7.91E-02	8.03E-02	-1.15E-03
4.667	7.98E-02	8.01E-02	-1.32E-03
4.8	7.85E-02	7.96E-02	-1.11E-03
4.933	7.72E-02	7.87E-02	-1.58E-03
5.067	7.68E-02	7.76E-02	-7.58E-04
5.2	7.55E-02	7.62E-02	-6.96E-04
5.333	7.42E-02	7.46E-02	-4.27E-04
5.467	7.29E-02	7.29E-02	0.00E-04
5.6	7.06E-02	7.10E-02	-4.00E-04
5.733	6.82E-02	6.89E-02	-7.05E-04
5.867	6.69E-02	6.68E-02	7.98E-05
6	6.46E-02	6.47E-02	-7.43E-05
6.133	6.33E-02	6.25E-02	8.15E-04
6.267	6.10E-02	6.02E-02	7.31E-04
6.4	5.86E-02	5.80E-02	6.54E-04
6.533	5.63E-02	5.58E-02	5.73E-04
6.667	5.50E-02	5.35E-02	1.48E-03
6.8	5.27E-02	5.13E-02	1.35E-03
6.933	5.04E-02	4.92E-02	1.20E-03
7.067	4.80E-02	4.70E-02	9.98E-04
7.2	4.67E-02	4.50E-02	1.75E-03
7.333	4.44E-02	4.30E-02	1.45E-03
7.467	4.31E-02	4.10E-02	2.10E-03
7.6	4.08E-02	3.91E-02	1.68E-03
7.733	3.84E-02	3.72E-02	1.21E-03
7.867	3.71E-02	3.55E-02	1.67E-03
8	3.58E-02	3.37E-02	2.07E-03
8.133	3.35E-02	3.21E-02	1.40E-03
8.267	3.22E-02	3.05E-02	1.67E-03
8.4	3.08E-02	2.90E-02	1.88E-03
8.533	2.95E-02	2.75E-02	2.02E-03
8.667	2.72E-02	2.61E-02	1.11E-03
8.8	2.59E-02	2.48E-02	1.13E-03
8.933	2.46E-02	2.35E-02	1.09E-03
9.067	2.32E-02	2.22E-02	9.95E-04
9.2	2.19E-02	2.11E-02	8.44E-04
9.333	2.06E-02	2.00E-02	6.39E-04
9.467	1.93E-02	1.89E-02	3.81E-04
9.6	1.80E-02	1.79E-02	7.24E-05
9.733	1.66E-02	1.69E-02	-2.86E-04
9.867	1.53E-02	1.60E-02	-6.90E-04
10	1.40E-02	1.51E-02	-1.14E-03
10.13	1.37E-02	1.43E-02	-6.37E-04
10.27	1.24E-02	1.38E-02	-1.17E-03
10.4	1.10E-02	1.28E-02	-1.76E-03
10.53	9.72E-03	1.21E-02	-2.36E-03
10.67	8.40E-03	1.14E-02	-3.01E-03
10.8	8.08E-03	1.08E-02	-2.70E-03
10.93	6.76E-03	1.02E-02	-3.42E-03
11.07	5.44E-03	9.61E-03	-4.17E-03
11.2	5.12E-03	9.07E-03	-3.95E-03
11.33	3.80E-03	8.56E-03	-4.76E-03
11.47	2.48E-03	8.08E-03	-5.60E-03
11.6	2.16E-03	7.62E-03	-5.46E-03
11.73	8.40E-04	7.19E-03	-6.35E-03

F3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 96
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1157E-05
 DISPERSIVITY= 0.1030E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.2358
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2895E-03

THE F STATISTIC FOR NP= 3 NOBS= 96 IS: 2.71
 THE CRITICAL RSS IS: 0.3148E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.16E-06	1.16E-06	1.16E-06
X(2)	1.03E-03	9.99E-04	1.06E-03
X(5)	2.36E-01	2.34E-01	2.38E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.237	1.55E-03	4.91E-06	1.54E-03
2.337	1.17E-03	1.04E-05	1.16E-03
2.437	7.93E-04	2.07E-05	7.73E-04
2.537	4.17E-04	3.89E-05	3.78E-04
2.637	4.09E-05	6.91E-05	-2.82E-05
2.737	6.65E-04	1.17E-04	5.47E-04
2.837	2.89E-04	1.91E-04	9.76E-05
2.937	-8.77E-05	2.99E-04	-3.87E-04
3.037	5.36E-04	4.54E-04	8.22E-05
3.137	1.60E-04	6.68E-04	-5.08E-04
3.237	7.84E-04	9.55E-04	-1.71E-04
3.337	4.08E-04	1.33E-03	-9.24E-04
3.437	1.03E-03	1.81E-03	-7.83E-04
3.537	1.66E-03	2.42E-03	-7.65E-04
3.637	2.28E-03	3.16E-03	-8.85E-04
3.737	2.90E-03	4.06E-03	-1.16E-03
3.837	4.53E-03	5.13E-03	-5.99E-04
3.937	6.15E-03	6.37E-03	-2.16E-04
4.037	6.77E-03	7.79E-03	-1.02E-03
4.137	9.40E-03	9.40E-03	0.00E-03
4.237	1.10E-02	1.12E-02	-1.73E-04
4.337	1.27E-02	1.32E-02	-5.24E-04
4.437	1.43E-02	1.53E-02	-4.37E-05
4.537	1.79E-02	1.76E-02	2.82E-04
4.637	2.05E-02	2.01E-02	4.70E-04
4.737	2.31E-02	2.25E-02	5.49E-04
4.837	2.58E-02	2.52E-02	5.22E-04
4.937	2.94E-02	2.80E-02	1.44E-03
5.037	3.20E-02	3.07E-02	1.32E-03
5.137	3.46E-02	3.35E-02	1.18E-03
5.237	3.73E-02	3.62E-02	9.37E-04
5.337	3.99E-02	3.89E-02	1.00E-03
5.437	4.25E-02	4.15E-02	1.01E-03
5.537	4.51E-02	4.40E-02	1.12E-03
5.637	4.78E-02	4.64E-02	1.34E-03
5.737	4.94E-02	4.87E-02	7.15E-04
5.837	5.10E-02	5.08E-02	2.48E-04
5.937	5.26E-02	5.27E-02	5.46E-05
6.037	5.43E-02	5.44E-02	-1.46E-04
6.137	5.60E-02	5.59E-02	-4.94E-05
6.237	5.65E-02	5.72E-02	7.47E-04
6.337	5.71E-02	5.84E-02	-1.24E-03
6.437	5.88E-02	6.00E-02	-5.12E-04
6.537	5.84E-02	6.00E-02	-1.68E-03
6.637	5.90E-02	6.04E-02	-1.44E-03
6.737	5.96E-02	6.07E-02	-1.09E-03
6.837	5.92E-02	6.05E-02	-1.55E-03
6.937	5.89E-02	6.07E-02	-1.82E-03
7.037	5.85E-02	6.04E-02	-1.92E-03
7.137	5.81E-02	6.00E-02	-1.84E-03
7.237	5.77E-02	5.93E-02	-1.61E-03
7.337	5.74E-02	5.86E-02	-1.23E-03
7.437	5.70E-02	5.77E-02	-7.21E-04
7.537	5.66E-02	5.67E-02	-8.97E-05
7.637	5.52E-02	5.56E-02	-3.50E-04
7.737	5.39E-02	5.44E-02	-5.14E-04
7.837	5.35E-02	5.31E-02	4.06E-04
7.937	5.21E-02	5.17E-02	3.98E-04
8.037	5.07E-02	5.03E-02	4.52E-04
8.137	4.94E-02	4.88E-02	5.57E-04
8.237	4.80E-02	4.73E-02	7.01E-04
8.337	4.66E-02	4.57E-02	8.75E-04
8.437	4.52E-02	4.42E-02	1.07E-03
8.537	4.39E-02	4.26E-02	1.28E-03
8.637	4.25E-02	4.10E-02	1.50E-03
8.737	4.11E-02	3.94E-02	1.71E-03
8.837	3.97E-02	3.78E-02	1.91E-03
8.937	3.83E-02	3.62E-02	2.10E-03
9.037	3.70E-02	3.47E-02	2.27E-03
9.137	3.56E-02	3.32E-02	2.42E-03
9.237	3.42E-02	3.17E-02	2.53E-03
9.337	3.18E-02	3.02E-02	1.62E-03
9.437	3.05E-02	2.88E-02	1.67E-03
9.537	2.91E-02	2.74E-02	1.68E-03
9.637	2.77E-02	2.61E-02	1.66E-03
9.737	2.63E-02	2.47E-02	1.59E-03
9.837	2.50E-02	2.35E-02	1.48E-03
9.937	2.36E-02	2.23E-02	1.32E-03
10.040	2.22E-02	2.11E-02	1.13E-03
10.140	2.08E-02	1.99E-02	8.65E-04
10.240	1.95E-02	1.89E-02	5.98E-04
10.340	1.81E-02	1.78E-02	2.65E-04
10.440	1.67E-02	1.67E-02	-1.11E-04
10.540	1.53E-02	1.59E-02	-5.31E-04
10.640	1.40E-02	1.49E-02	-9.94E-04
10.740	1.26E-02	1.41E-02	-1.60E-03
10.840	1.12E-02	1.32E-02	-2.05E-03
10.940	1.08E-02	1.25E-02	-1.63E-03
11.040	1.04E-02	1.17E-02	-2.26E-03
11.140	8.06E-03	1.10E-02	-2.92E-03
11.240	6.69E-03	1.03E-02	-3.62E-03
11.340	5.31E-03	9.67E-03	-4.36E-03
11.44	3.94E-03	9.07E-03	-5.13E-03
11.54	3.56E-03	8.49E-03	-4.94E-03
11.64	2.18E-03	7.95E-03	-5.77E-03
11.74	8.07E-04	7.44E-03	-6.64E-03

August 2005
F4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 78
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1900E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1211E-05
 DISPERSIVITY= 0.2006E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.7015E-01
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4340E-04

THE F STATISTIC FOR NP= 3 NOBS= 78 IS: 2.74
 THE CRITICAL RSS IS: 0.4815E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.21E-06	1.20E-06	1.22E-06
X(2)	2.01E-03	1.91E-03	2.13E-03
X(5)	7.02E-02	6.87E-02	7.16E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.40E+00	1.80E-05	1.38E-03	-1.37E-03
1.533	1.80E-05	9.27E-04	-9.27E-04
1.67E+00	1.92E-03	3.28E-03	-1.37E-03
1.8	2.86E-03	4.58E-03	-1.71E-03
1.933	4.81E-03	6.07E-03	-1.25E-03
2.067	6.76E-03	7.70E-03	-9.42E-04
2.2	8.71E-03	9.41E-03	-6.99E-04
2.333	1.07E-02	1.11E-02	-4.46E-04
2.467	1.26E-02	1.27E-02	-1.11E-04
2.6	1.46E-02	1.42E-02	3.69E-04
2.733	1.65E-02	1.55E-02	1.04E-03
2.867	1.75E-02	1.65E-02	9.08E-04
3	1.84E-02	1.74E-02	1.00E-03
3.133	1.94E-02	1.80E-02	1.31E-03
3.267	1.93E-02	1.85E-02	8.21E-04
3.4	2.03E-02	1.87E-02	1.52E-03
3.533	1.92E-02	1.88E-02	3.92E-04
3.667	1.91E-02	1.87E-02	4.09E-04
3.8	1.91E-02	1.86E-02	5.65E-04
3.933	1.80E-02	1.82E-02	-1.90E-04
4.067	1.80E-02	1.78E-02	1.53E-04
4.2	1.69E-02	1.74E-02	-4.31E-04
4.333	1.59E-02	1.69E-02	-9.58E-04
4.467	1.58E-02	1.63E-02	-4.42E-04
4.6	1.48E-02	1.57E-02	-8.94E-04
4.733	1.37E-02	1.37E-02	-1.32E-03
4.867	1.37E-02	1.44E-02	-7.42E-04
5	1.26E-02	1.38E-02	-1.15E-03
5.133	1.26E-02	1.26E-02	-5.87E-04
5.267	1.15E-02	1.25E-02	-9.87E-04
5.4	1.15E-02	1.19E-02	-4.16E-04
5.533	1.04E-02	1.13E-02	-8.90E-04
5.667	1.04E-02	1.07E-02	-3.17E-04
5.8	9.32E-03	1.01E-02	-7.94E-04
5.933	9.27E-03	9.56E-03	-2.90E-04
6.067	8.22E-03	9.03E-03	-8.08E-04
6.2	8.17E-03	8.52E-03	-3.46E-04
6.333	8.12E-03	8.03E-03	9.27E-05
6.467	8.07E-03	7.56E-03	5.10E-04
6.6	7.02E-03	7.11E-03	-9.46E-05
6.733	6.97E-03	6.69E-03	2.79E-04
6.867	6.91E-03	6.28E-03	6.31E-04
7	5.86E-03	5.90E-03	-3.74E-05
7.133	5.81E-03	5.54E-03	2.74E-04
7.267	5.76E-03	5.19E-03	5.65E-04
7.4	5.71E-03	4.87E-03	8.38E-04
7.533	5.66E-03	4.56E-03	1.09E-03
7.667	4.61E-03	4.28E-03	3.29E-04
7.8	4.55E-03	4.00E-03	5.50E-04
7.933	4.50E-03	3.75E-03	7.54E-04
8.067	4.45E-03	3.51E-03	9.43E-04
8.2	4.40E-03	3.28E-03	1.12E-03
8.333	3.35E-03	3.07E-03	2.79E-04
8.467	3.30E-03	2.87E-03	4.27E-04
8.6	3.25E-03	2.68E-03	5.63E-04
8.733	3.20E-03	2.51E-03	6.87E-04
8.867	3.14E-03	2.34E-03	8.01E-04
9	3.09E-03	2.19E-03	9.04E-04
9.133	3.04E-03	2.04E-03	9.97E-04
9.267	2.99E-03	1.91E-03	1.08E-03
9.4	1.94E-03	1.78E-03	1.56E-04
9.533	1.89E-03	1.66E-03	2.23E-04
9.667	1.84E-03	1.55E-03	2.83E-04
9.8	1.78E-03	1.45E-03	3.35E-04
9.933	1.73E-03	1.35E-03	3.81E-04
10.07	1.68E-03	1.26E-03	4.20E-04
10.2	1.63E-03	1.18E-03	4.53E-04
10.33	5.79E-04	1.10E-03	-5.19E-04
10.47	5.27E-04	1.02E-03	-4.96E-04
10.6	4.76E-04	9.55E-04	-4.79E-04
10.73	4.25E-04	8.90E-04	-4.66E-04
10.87	3.73E-04	8.30E-04	-4.57E-04
11	3.22E-04	7.74E-04	-4.52E-04
11.13	2.71E-04	7.22E-04	-4.51E-04
11.27	2.19E-04	6.72E-04	-4.53E-04
11.4	1.68E-04	6.27E-04	-4.59E-04
11.53	1.17E-04	5.84E-04	-4.68E-04
11.67	6.53E-05	5.44E-04	-4.79E-04

F4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1288E-05
 DISPERSIVITY= 0.1537E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.5908E-01
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1867E-03

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72
 THE CRITICAL RSS IS: 0.2046E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.29E-06	1.26E-06	1.31E-06
X(2)	1.54E-03	1.28E-03	1.86E-03
X(5)	5.91E-02	5.55E-02	6.26E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.097	-2.48E-05	0.00E+00	-2.48E-05
0.230	9.87E-05	0.00E+00	-9.87E-05
0.363	9.07E-04	3.31E-33	9.07E-04
0.497	8.73E-04	3.69E-24	8.73E-04
0.630	8.39E-04	6.06E-19	8.39E-04
0.763	8.04E-04	1.49E-15	8.04E-04
0.897	7.70E-04	3.56E-13	7.70E-04
1.030	7.35E-04	2.04E-11	7.35E-04
1.163	1.70E-03	4.57E-10	1.70E-03
1.297	1.67E-03	5.36E-09	1.67E-03
1.430	1.63E-03	3.94E-08	1.63E-03
1.563	1.60E-03	2.05E-07	1.60E-03
1.697	2.57E-03	8.15E-07	2.56E-03
1.830	2.53E-03	2.63E-06	2.53E-03
1.963	2.50E-03	7.18E-06	2.49E-03
2.097	2.46E-03	1.72E-05	2.45E-03
2.230	3.43E-03	3.67E-05	3.39E-03
2.363	3.39E-03	7.16E-05	3.32E-03
2.497	3.36E-03	1.29E-04	3.23E-03
2.630	3.33E-03	2.82E-04	3.11E-03
2.763	4.29E-03	3.50E-04	3.94E-03
2.897	4.26E-03	5.32E-04	5.32E-03
3.030	4.22E-03	7.75E-04	3.45E-03
3.163	4.19E-03	1.09E-03	3.10E-03
3.297	4.16E-03	1.47E-03	2.58E-03
3.430	4.12E-03	1.93E-03	2.19E-03
3.563	4.09E-03	2.47E-03	1.62E-03
3.697	4.05E-03	3.07E-03	9.83E-04
3.830	5.02E-03	3.73E-03	3.73E-03
3.963	4.98E-03	4.45E-03	5.37E-04
4.097	4.95E-03	5.20E-03	-2.48E-04
4.230	4.92E-03	5.97E-03	-5.43E-05
4.363	5.88E-03	6.75E-03	-8.68E-04
4.497	6.85E-03	7.52E-03	-6.76E-04
4.630	6.81E-03	8.27E-03	-1.46E-03
4.763	7.78E-03	8.99E-03	-2.21E-03
4.897	8.75E-03	9.66E-03	-9.19E-04
5.030	8.71E-03	1.03E-02	-1.57E-03
5.163	9.68E-03	1.10E-02	-1.15E-03
5.297	1.06E-02	1.13E-02	-6.79E-04
5.430	1.06E-02	1.17E-02	-1.13E-03
5.563	1.15E-02	1.21E-02	-5.04E-04
5.697	1.15E-02	1.23E-02	-8.06E-04
5.830	1.25E-02	1.25E-02	-3.41E-05
5.963	1.25E-02	1.27E-02	-1.91E-04
6.097	1.24E-02	1.27E-02	-2.81E-04
6.230	1.34E-02	1.27E-02	6.94E-04
6.363	1.34E-02	1.26E-02	7.27E-04
6.497	1.33E-02	1.25E-02	8.16E-04
6.630	1.33E-02	1.24E-02	9.54E-04
6.763	1.23E-02	1.21E-02	1.36E-04
6.897	1.22E-02	1.19E-02	3.58E-04
7.030	1.22E-02	1.16E-02	6.12E-04
7.163	1.22E-02	1.13E-02	8.94E-04
7.297	1.21E-02	1.09E-02	1.20E-03
7.430	1.11E-02	1.06E-02	5.27E-04
7.563	1.11E-02	1.02E-02	8.68E-04
7.697	1.00E-02	9.81E-03	2.20E-04
7.830	9.99E-03	9.41E-03	5.79E-04
7.963	9.96E-03	9.02E-03	9.42E-04
8.097	8.92E-03	8.62E-03	3.07E-04
8.230	8.89E-03	8.22E-03	6.69E-04
8.363	7.86E-03	7.83E-03	2.84E-05
8.497	7.82E-03	7.44E-03	3.82E-04
8.630	6.79E-03	7.06E-03	-2.72E-04
8.763	6.75E-03	6.69E-03	6.56E-05
8.897	6.72E-03	6.33E-03	3.93E-04
9.030	5.69E-03	5.98E-03	-2.91E-04
9.163	5.65E-03	5.64E-03	1.41E-05
9.297	5.62E-03	5.31E-03	3.07E-04
9.430	4.58E-03	5.00E-03	-4.14E-04
9.563	4.55E-03	4.70E-03	-1.47E-04
9.697	4.51E-03	4.41E-03	-1.07E-04
9.830	3.48E-03	4.13E-03	-6.53E-04
9.963	3.45E-03	3.87E-03	-4.26E-04
10.100	3.41E-03	3.61E-03	-2.11E-04
10.230	2.38E-03	3.39E-03	-1.01E-03
10.360	2.34E-03	3.17E-03	-8.22E-04
10.500	2.31E-03	2.95E-03	-6.44E-04
10.630	2.28E-03	2.75E-03	-4.79E-04
10.760	1.24E-03	2.57E-03	-1.33E-03
10.900	1.21E-03	2.39E-03	-1.18E-03
11.030	1.17E-03	2.22E-03	-1.05E-03
11.160	1.14E-03	2.07E-03	-9.30E-04
11.300	1.10E-03	1.92E-03	-8.17E-04
11.430	1.07E-03	1.78E-03	-7.14E-04
11.560	1.03E-03	1.66E-03	-6.12E-04
11.700	9.75E-07	1.53E-03	-1.53E-03

October 2005
B1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2014E-05
 DISPERSIVITY= 0.6140E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.6042
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2694E-02

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.2957E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.01E-06	1.97E-06	2.08E-06
X(2)	6.14E-03	5.71E-03	6.63E-03
X(5)	6.04E-01	5.86E-01	6.22E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.83E-01	3.60E-05	2.03E-05	1.58E-05
0.3167	1.08E-03	1.31E-03	-2.32E-04
4.60E-01	7.13E-02	7.58E-02	-4.51E-04
0.5833	2.22E-02	2.01E-02	2.03E-03
0.7167	4.52E-02	3.78E-02	7.45E-03
0.85	6.73E-02	5.87E-02	8.58E-03
0.9833	8.63E-02	8.07E-02	5.67E-03
1.117	9.94E-02	9.90E-02	3.82E-04
1.25	1.07E-01	1.11E-01	-3.65E-03
1.383	1.13E-01	1.17E-01	-4.94E-03
1.517	1.14E-01	1.20E-01	-5.96E-03
1.65	1.13E-01	1.19E-01	-6.08E-03
1.783	1.11E-01	1.16E-01	-5.36E-03
1.917	1.07E-01	1.12E-01	-5.48E-03
2.05	1.04E-01	1.08E-01	-3.96E-03
2.183	9.87E-02	1.03E-01	-4.11E-03
2.317	9.48E-02	9.79E-02	-3.13E-03
2.45	9.08E-02	9.30E-02	-2.16E-03
2.583	8.79E-02	8.82E-02	-3.04E-04
2.717	8.39E-02	8.35E-02	4.02E-04
2.85	8.10E-02	7.91E-02	1.92E-03
2.983	7.80E-02	7.48E-02	3.23E-03
3.117	7.51E-02	7.07E-02	4.32E-03
3.25	7.21E-02	6.92E-02	6.21E-03
3.383	6.92E-02	6.33E-02	5.88E-03
3.517	6.62E-02	5.98E-02	6.36E-03
3.65	6.43E-02	6.43E-02	7.92E-04
3.783	6.13E-02	5.36E-02	7.72E-03
3.917	5.83E-02	5.07E-02	7.64E-03
4.05	5.64E-02	4.80E-02	7.33E-03
4.183	5.34E-02	4.54E-02	7.99E-03
4.317	5.05E-02	4.30E-02	7.44E-03
4.45	4.75E-02	4.08E-02	6.74E-03
4.583	4.46E-02	3.87E-02	5.93E-03
4.717	4.16E-02	3.66E-02	4.98E-03
4.85	3.97E-02	3.47E-02	4.92E-03
4.983	3.67E-02	3.27E-02	3.76E-03
5.117	3.48E-02	3.13E-02	3.49E-03
5.25	3.18E-02	2.97E-02	2.13E-03
5.383	2.99E-02	2.82E-02	1.69E-03
5.517	2.79E-02	2.67E-02	1.19E-03
5.65	2.59E-02	2.54E-02	5.44E-04
5.783	2.30E-02	2.41E-02	-1.14E-03
5.917	2.10E-02	2.20E-02	-1.89E-03
6.05	1.91E-02	2.18E-02	-2.71E-03
6.183	1.81E-02	2.07E-02	-2.59E-03
6.317	1.62E-02	1.97E-02	-3.52E-03
6.45	1.52E-02	1.87E-02	-3.51E-03
6.583	1.33E-02	1.78E-02	-4.55E-03
6.717	1.23E-02	1.70E-02	-4.64E-03
6.85	1.14E-02	1.61E-02	-4.77E-03
6.983	1.04E-02	1.54E-02	-4.95E-03
7.117	9.45E-03	1.46E-02	-5.17E-03
7.25	8.50E-03	1.39E-02	-5.42E-03
7.383	7.55E-03	1.33E-02	-5.71E-03
7.517	6.59E-03	1.26E-02	-6.03E-03
7.65	5.64E-03	1.20E-02	-6.39E-03
7.783	5.69E-03	1.15E-02	-5.77E-03
7.917	4.73E-03	1.09E-02	-6.19E-03
8.05	4.78E-03	1.04E-02	-5.63E-03
8.183	3.83E-03	9.92E-03	-6.09E-03
8.317	3.87E-03	9.46E-03	-5.58E-03
8.45	2.92E-03	9.02E-03	-6.10E-03
8.583	2.97E-03	8.60E-03	-5.63E-03
8.717	2.01E-03	8.20E-03	-6.19E-03
8.85	2.06E-03	7.82E-03	-5.76E-03
8.983	2.11E-03	7.46E-03	-5.36E-03
9.117	1.15E-03	7.12E-03	-5.97E-03
9.25	1.20E-03	6.79E-03	-5.69E-03
9.383	1.25E-03	6.48E-03	-5.24E-03
9.517	2.91E-04	6.19E-03	-5.89E-03
9.65	3.38E-04	5.93E-03	-5.57E-03
9.783	3.84E-04	5.64E-03	-5.25E-03
9.917	4.31E-04	5.38E-03	-4.95E-03
10.05	5.14E-04	4.77E-03	-4.66E-03
10.18	5.24E-04	4.91E-03	-4.38E-03
10.32	5.70E-04	4.68E-03	-4.11E-03
10.82	1.50E-02	3.94E-03	1.11E-02
10.95	1.60E-02	3.77E-03	1.12E-02
11.08	1.40E-02	3.60E-03	1.04E-02
11.22	1.30E-02	3.44E-03	9.56E-03
11.35	1.20E-02	3.29E-03	8.71E-03
11.48	1.10E-02	3.14E-03	7.86E-03
11.62	1.00E-02	3.00E-03	7.00E-03
11.75	1.00E-02	2.87E-03	7.13E-03
11.88	9.00E-03	2.74E-03	6.29E-03
12.02	8.00E-03	2.62E-03	5.38E-03

B1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1860E-05
 DISPERSIVITY= 0.2652E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.5195
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5344E-03

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.5864E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.86E-06	1.86E-06	1.86E-06
X(2)	2.65E-03	2.57E-03	2.73E-03
X(5)	5.20E-01	5.14E-01	5.25E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.617	6.00E-03	6.43E-03	-4.29E-04
1.717	8.00E-03	9.37E-03	-1.37E-03
1.817	1.10E-02	1.30E-02	-2.02E-03
1.917	1.50E-02	1.74E-02	-2.35E-03
2.017	2.00E-02	2.23E-02	-2.30E-03
2.117	2.60E-02	2.77E-02	-1.74E-03
2.217	3.20E-02	3.36E-02	-1.56E-03
2.317	3.90E-02	3.96E-02	-5.93E-04
2.417	4.60E-02	4.57E-02	2.97E-04
2.517	5.30E-02	5.18E-02	1.25E-03
2.617	6.00E-02	5.78E-02	2.40E-03
2.717	6.60E-02	6.32E-02	2.85E-03
2.817	7.10E-02	6.83E-02	2.68E-03
2.917	7.60E-02	7.30E-02	2.96E-03
3.017	8.00E-02	7.73E-02	2.74E-03
3.117	8.30E-02	8.10E-02	2.05E-03
3.217	8.50E-02	8.41E-02	9.03E-04
3.317	8.70E-02	8.67E-02	2.95E-04
3.417	8.90E-02	8.88E-02	2.19E-04
3.517	9.00E-02	9.03E-02	-3.43E-04
3.617	9.00E-02	9.14E-02	-1.42E-03
3.717	9.10E-02	9.20E-02	-1.03E-03
3.817	9.00E-02	9.22E-02	-2.22E-03
3.917	9.00E-02	9.03E-02	-2.60E-03
4.017	8.90E-02	8.95E-02	-2.47E-03
4.117	8.80E-02	9.06E-02	-2.59E-03
4.217	8.70E-02	9.24E-02	-2.44E-03
4.317	8.50E-02	8.80E-02	-3.03E-03
4.417	8.40E-02	8.64E-02	-2.41E-03
4.517	8.20E-02	8.26E-02	-4.6E-03
4.617	8.00E-02	8.26E-02	-2.64E-03
4.717	7.90E-02	8.05E-02	-1.54E-03
4.817	7.70E-02	7.83E-02	-1.34E-03
4.917	7.50E-02	7.59E-02	-9.06E-03
5.017	7.30E-02	7.37E-02	-7.15E-04
5.117	7.10E-02	7.13E-02	-3.27E-04
5.217	6.90E-02	6.89E-02	6.81E-05
5.317	6.70E-02	6.65E-02	5.16E-04
5.417	6.50E-02	6.41E-02	9.42E-04
5.517	6.30E-02	6.16E-02	1.36E-03
5.617	6.10E-02	5.93E-02	1.75E-03
5.717	5.90E-02	5.69E-02	2.11E-03
5.817	5.70E-02	5.46E-02	2.43E-03
5.917	5.50E-02	5.23E-02	2.71E-03
6.017	5.30E-02	5.01E-02	2.94E-03
6.117	5.10E-02	4.79E-02	3.12E-03
6.217	4.90E-02	4.58E-02	3.23E-03
6.317	4.70E-02	4.37E-02	3.29E-03
6.417	4.50E-02	4.17E-02	3.28E-03
6.517	4.30E-02	3.98E-02	3.21E-03
6.617	4.10E-02	3.79E-02	3.08E-03
6.717	3.90E-02	3.61E-02	2.88E-03
6.817	3.70E-02	3.44E-02	2.61E-03
6.917	3.50E-02	3.27E-02	2.28E-03
7.017	3.40E-02	3.11E-02	2.88E-03
7.117	3.20E-02	2.96E-02	2.42E-03
7.217	3.00E-02	2.81E-02	1.90E-03
7.317	2.80E-02	2.67E-02	1.32E-03
7.417	2.70E-02	2.53E-02	1.67E-03
7.517	2.50E-02	2.40E-02	9.65E-04
7.617	2.30E-02	2.28E-02	2.02E-04
7.717	2.20E-02	2.16E-02	3.84E-04
7.817	2.00E-02	2.05E-02	-4.88E-04
7.917	1.90E-02	1.94E-02	-4.12E-04
8.017	1.80E-02	1.84E-02	-3.98E-04
8.117	1.60E-02	1.74E-02	-1.41E-03
8.217	1.50E-02	1.65E-02	-1.48E-03
8.317	1.40E-02	1.56E-02	-1.60E-03
8.417	1.30E-02	1.48E-02	-1.76E-03
8.517	1.20E-02	1.40E-02	-1.96E-03
8.617	1.10E-02	1.32E-02	-2.20E-03
8.717	1.00E-02	1.25E-02	-2.48E-03
8.817	9.00E-03	1.18E-02	-2.80E-03
8.917	8.00E-03	1.12E-02	-3.15E-03
9.017	7.00E-03	1.05E-02	-3.53E-03
9.117	7.00E-03	9.95E-03	-2.95E-03
9.217	6.00E-03	9.40E-03	-3.40E-03
9.317	5.00E-03	8.87E-03	-3.87E-03
9.417	4.00E-03	8.39E-03	-4.38E-03
9.517	4.00E-03	7.91E-03	-3.91E-03
9.617	3.00E-03	7.46E-03	-4.46E-03
9.717	3.00E-03	7.04E-03	-4.04E-03
9.817	2.00E-03	6.65E-03	-4.65E-03
9.917	2.00E-03	6.27E-03	-4.27E-03
10.020	1.00E-03	5.90E-03	-4.90E-03
10.120	1.00E-03	5.47E-03	-4.57E-03
10.220	1.00E-03	5.25E-03	-4.25E-03

October 2005
B2_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1466E-05
 DISPERSIVITY= 0.5152E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.7741
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4188E-02

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.4595E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.47E-06	1.44E-06	1.50E-06
X(2)	5.15E-03	4.79E-03	5.56E-03
X(5)	7.74E-01	7.51E-01	7.97E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.30E-01	1.95E-03	9.38E-07	1.95E-03
0.3967	4.87E-03	2.59E-04	4.61E-03
5.63E-01	1.08E-02	2.71E-03	8.07E-03
0.73	2.17E-02	9.96E-03	1.17E-02
0.8967	3.86E-02	2.29E-02	1.57E-02
1.063	5.85E-02	4.09E-02	1.76E-02
1.23	7.95E-02	6.28E-02	1.67E-02
1.397	9.74E-02	8.68E-02	1.06E-02
1.563	1.11E-01	1.09E-01	2.02E-03
1.73	1.23E-01	1.27E-01	-4.16E-03
1.897	1.31E-01	1.40E-01	-9.02E-03
2.063	1.36E-01	1.48E-01	-1.20E-02
2.23	1.40E-01	1.52E-01	-1.20E-02
2.397	1.41E-01	1.53E-01	-1.19E-02
2.563	1.41E-01	1.51E-01	-1.06E-02
2.73	1.40E-01	1.49E-01	-8.76E-03
2.897	1.38E-01	1.44E-01	-6.80E-03
3.063	1.36E-01	1.40E-01	-4.12E-03
3.23	1.33E-01	1.35E-01	-1.99E-03
3.397	1.28E-01	1.29E-01	-6.11E-04
3.563	1.23E-01	1.23E-01	1.88E-03
3.73	1.21E-01	1.18E-01	3.35E-03
3.897	1.17E-01	1.12E-01	4.77E-03
4.063	1.13E-01	1.07E-01	6.07E-03
4.23	1.09E-01	1.02E-01	7.20E-03
4.397	1.05E-01	9.68E-02	8.16E-03
4.563	1.01E-01	9.19E-02	8.92E-03
4.73	9.67E-02	8.73E-02	9.47E-03
4.897	9.27E-02	8.29E-02	9.81E-03
5.063	8.86E-02	7.86E-02	9.95E-03
5.23	8.45E-02	7.46E-02	9.89E-03
5.397	8.04E-02	7.04E-02	9.64E-03
5.563	7.63E-02	6.72E-02	9.19E-03
5.73	7.23E-02	6.37E-02	8.55E-03
5.897	6.82E-02	6.03E-02	7.74E-03
6.063	6.41E-02	5.73E-02	6.76E-03
6.23	6.10E-02	5.44E-02	6.62E-03
6.397	5.69E-02	5.16E-02	5.32E-03
6.563	5.39E-02	4.90E-02	4.88E-03
6.73	4.98E-02	4.65E-02	3.30E-03
6.897	4.67E-02	4.41E-02	2.58E-03
7.063	4.38E-02	4.19E-02	1.74E-03
7.23	4.05E-02	3.97E-02	7.85E-04
7.397	3.74E-02	3.77E-02	-2.85E-04
7.563	3.54E-02	3.58E-02	-4.60E-04
7.73	3.23E-02	3.40E-02	-1.74E-03
7.897	3.02E-02	3.23E-02	-2.11E-03
8.063	2.81E-02	3.07E-02	-2.57E-03
8.23	2.60E-02	2.91E-02	-3.11E-03
8.397	2.40E-02	2.77E-02	-3.74E-03
8.563	2.19E-02	2.63E-02	-4.44E-03
8.73	2.08E-02	2.50E-02	-4.21E-03
8.897	1.87E-02	2.38E-02	-5.05E-03
9.063	1.76E-02	2.26E-02	-4.96E-03
9.23	1.65E-02	2.15E-02	-4.92E-03
9.397	1.55E-02	2.04E-02	-4.95E-03
9.563	1.34E-02	1.94E-02	-6.02E-03
9.73	1.23E-02	1.85E-02	-6.15E-03
9.897	1.12E-02	1.76E-02	-6.33E-03
10.06	1.11E-02	1.67E-02	-5.56E-03
10.23	1.01E-02	1.59E-02	-5.82E-03
10.4	8.97E-03	1.51E-02	-6.13E-03
10.56	8.89E-03	1.44E-02	-5.48E-03
10.73	7.81E-03	1.37E-02	-5.86E-03
10.9	7.73E-03	1.30E-02	-5.28E-03
11.06	6.64E-03	1.24E-02	-5.74E-03
11.23	6.56E-03	1.18E-02	-5.22E-03
11.4	5.48E-03	1.12E-02	-5.73E-03
11.56	5.40E-03	1.07E-02	-5.28E-03
11.73	4.32E-03	1.02E-02	-5.85E-03
11.9	4.24E-03	9.68E-03	-5.44E-03
12.06	4.15E-03	9.21E-03	-5.06E-03
12.23	3.07E-03	8.77E-03	-5.70E-03
12.4	2.99E-03	8.35E-03	-5.35E-03
12.56	1.91E-03	7.96E-03	-6.05E-03
12.73	1.83E-03	7.58E-03	-5.75E-03
12.9	1.75E-03	7.22E-03	-5.47E-03
13.06	1.68E-03	6.88E-03	-5.21E-03
13.23	1.58E-03	6.55E-03	-4.97E-03
13.4	5.01E-04	6.24E-03	-5.74E-03
13.56	4.20E-04	5.95E-03	-5.53E-03
13.73	3.38E-04	5.67E-03	-5.33E-03
13.9	2.56E-04	5.40E-03	-5.15E-03
14.06	1.75E-04	5.15E-03	-4.97E-03
14.23	9.32E-05	4.91E-03	-4.81E-03
14.4	1.16E-05	4.68E-03	-4.66E-03

B2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1325E-05
 DISPERSIVITY= 0.3024E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.6827
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7950E-03

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
 THE CRITICAL RSS IS: 0.8754E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.33E-06	1.33E-06	1.33E-06
X(2)	3.02E-03	2.93E-03	3.12E-03
X(5)	6.83E-01	6.76E-01	6.90E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.563	8.72E-04	1.90E-10	8.72E-04
0.730	7.11E-04	4.46E-08	7.11E-04
0.897	1.55E-03	1.39E-06	1.55E-03
1.063	2.39E-03	1.48E-05	2.38E-03
1.230	3.23E-03	8.27E-05	3.15E-03
1.397	4.07E-03	3.07E-04	3.76E-03
1.563	4.91E-03	8.58E-04	4.05E-03
1.730	5.75E-03	1.97E-03	3.78E-03
1.897	7.59E-03	3.88E-03	3.71E-03
2.063	9.43E-03	6.84E-03	2.58E-03
2.230	1.33E-02	1.10E-02	2.23E-03
2.397	1.81E-02	1.65E-02	1.59E-03
2.563	2.40E-02	2.32E-02	7.08E-04
2.730	3.18E-02	3.10E-02	7.74E-04
2.897	4.06E-02	3.96E-02	1.07E-03
3.063	5.05E-02	4.86E-02	1.91E-03
3.230	5.93E-02	5.77E-02	1.62E-03
3.397	6.91E-02	6.66E-02	2.50E-03
3.563	7.70E-02	7.52E-02	1.82E-03
3.730	8.48E-02	8.31E-02	1.77E-03
3.897	9.17E-02	9.02E-02	1.49E-03
4.063	9.65E-02	9.64E-02	8.73E-05
4.230	1.01E-01	1.02E-01	-3.94E-04
4.397	1.05E-01	1.06E-01	-9.33E-04
4.563	1.07E-01	1.07E-01	-2.55E-03
4.730	1.10E-01	1.12E-01	-1.12E-01
4.897	1.11E-01	1.14E-01	-3.17E-03
5.063	1.12E-01	1.15E-01	-1.52E-03
5.230	1.11E-01	1.15E-01	-3.70E-03
5.397	1.11E-01	1.15E-01	-3.48E-03
5.563	1.10E-01	1.14E-01	-3.71E-03
5.730	1.10E-01	1.14E-01	-2.44E-03
5.897	1.08E-01	1.11E-01	-2.75E-03
6.063	1.07E-01	1.08E-01	-1.70E-03
6.230	1.04E-01	1.04E-01	-1.36E-03
6.397	1.02E-01	1.03E-01	-7.73E-04
6.563	1.00E-01	1.00E-01	1.56E-05
6.730	9.79E-02	9.70E-02	9.63E-04
6.897	9.48E-02	9.38E-02	1.02E-03
7.063	9.26E-02	9.05E-02	2.15E-03
7.230	8.95E-02	8.71E-02	2.34E-03
7.397	8.63E-02	8.38E-02	2.54E-03
7.563	8.41E-02	8.04E-02	3.74E-03
7.730	8.10E-02	7.71E-02	3.92E-03
7.897	7.78E-02	7.38E-02	4.06E-03
8.063	7.47E-02	7.05E-02	4.15E-03
8.230	7.15E-02	6.73E-02	4.17E-03
8.397	6.83E-02	6.42E-02	4.12E-03
8.563	6.52E-02	6.12E-02	3.99E-03
8.730	6.20E-02	5.82E-02	3.77E-03
8.897	5.89E-02	5.54E-02	3.45E-03
9.063	5.57E-02	5.27E-02	3.04E-03
9.230	5.25E-02	5.00E-02	2.53E-03
9.397	4.94E-02	4.74E-02	1.92E-03
9.563	4.72E-02	4.50E-02	2.21E-03
9.730	4.41E-02	4.26E-02	1.41E-03
9.897	4.09E-02	4.04E-02	4.97E-04
10.060	3.87E-02	3.82E-02	4.85E-04
10.230	3.66E-02	3.62E-02	3.87E-04
10.400	3.34E-02	3.42E-02	-8.06E-04
10.560	3.12E-02	3.23E-02	-1.10E-03
10.730	2.91E-02	3.06E-02	-1.48E-03
10.900	2.69E-02	2.89E-02	-1.94E-03
11.060	2.48E-02	2.73E-02	-2.48E-03
11.230	2.26E-02	2.57E-02	-3.12E-03
11.400	2.14E-02	2.43E-02	-2.82E-03
11.560	1.93E-02	2.29E-02	-3.51E-03
11.730	1.66E-02	1.76E-02	-1.04E-03
11.900	1.54E-02	1.66E-02	-1.17E-03
12.060	1.43E-02	1.56E-02	-1.37E-03
12.230	1.49E-02	1.47E-02	-4.71E-03
12.400	1.09E-02	1.38E-02	-2.90E-03
12.570	9.77E-03	1.30E-02	-3.25E-03
12.740	8.41E-03	1.22E-02	-3.56E-03
12.910	7.45E-03	1.15E-02	-4.07E-03
13.080	6.29E-03	1.08E-02	-4.55E-03
13.250	5.13E-03	1.02E-02	-5.06E-03
13.420	3.97E-03	9.57E-03	-4.51E-03
13.590	3.81E-03	9.00E-03	-5.20E-03
13.760	2.65E-03	8.46E-03	-5.81E-03
13.930	1.49E-03	7.95E-03	-6.46E-03
14.100	1.32E-03	7.47E-03	-6.15E-03
14.270	1.64E-04	7.02E-03	-6.85E-03
14.440	3.23E-06	6.59E-03	-6.59E-03

**October 2005
B3_1**

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2041E-05
DISPERSIVITY= 0.2968E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.6078
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1392E-02

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
THE CRITICAL RSS IS: 0.1529E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.04E-06	2.02E-06	2.06E-06
X(2)	2.97E-03	3.15E-03	2.83E-03
X(5)	6.98E-01	5.96E-01	6.20E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.15E-01	1.00E-03	2.57E-13	1.00E-03
0.2483	2.00E-03	1.46E-06	2.00E-03
3.82E-01	3.00E-03	1.70E-04	2.83E-03
0.515	6.00E-03	1.73E-03	4.27E-03
0.6483	1.30E-02	6.84E-03	6.16E-03
0.7817	2.60E-02	1.70E-02	9.01E-03
0.915	4.40E-02	3.24E-02	1.16E-02
1.048	6.30E-02	5.24E-02	1.06E-02
1.182	8.10E-02	7.47E-02	6.27E-03
1.315	9.70E-02	9.62E-02	7.72E-04
1.448	1.11E-01	1.14E-01	-3.27E-03
1.582	1.21E-01	1.28E-01	-6.68E-03
1.715	1.28E-01	1.36E-01	-8.38E-03
1.848	1.32E-01	1.41E-01	-8.91E-03
1.982	1.35E-01	1.42E-01	-7.01E-03
2.115	1.35E-01	1.41E-01	-5.46E-03
2.248	1.34E-01	1.37E-01	-2.93E-03
2.382	1.32E-01	1.32E-01	-5.97E-06
2.515	1.28E-01	1.26E-01	1.86E-03
2.648	1.24E-01	1.20E-01	4.33E-03
2.782	1.19E-01	1.13E-01	6.08E-03
2.915	1.13E-01	1.06E-01	6.95E-03
3.048	1.07E-01	9.92E-02	7.78E-03
3.182	1.00E-01	9.22E-02	7.46E-03
3.315	9.30E-02	8.61E-02	6.90E-03
3.448	8.70E-02	7.99E-02	7.08E-03
3.582	8.00E-02	7.41E-02	5.71E-03
3.715	7.30E-02	6.85E-02	4.48E-03
3.848	6.70E-02	6.33E-02	3.69E-03
3.982	6.00E-02	5.84E-02	1.57E-03
4.115	6.40E-02	5.39E-02	1.17E-04
4.248	4.90E-02	4.97E-02	-6.47E-04
4.382	4.40E-02	4.57E-02	-1.71E-03
4.515	3.90E-02	4.21E-02	-3.06E-03
4.648	3.50E-02	3.87E-02	-3.69E-03
4.782	3.20E-02	3.56E-02	-3.56E-03
4.915	2.90E-02	3.27E-02	-4.69E-03
5.048	2.60E-02	3.00E-02	-4.03E-03
5.182	2.30E-02	2.76E-02	-4.57E-03
5.315	2.10E-02	2.53E-02	-4.32E-03
5.448	1.90E-02	2.32E-02	-4.24E-03
5.582	1.70E-02	2.13E-02	-4.33E-03
5.715	1.60E-02	1.96E-02	-3.58E-03
5.848	1.40E-02	1.80E-02	-3.96E-03
5.982	1.30E-02	1.65E-02	-3.48E-03
6.115	1.20E-02	1.51E-02	-3.12E-03
6.248	1.10E-02	1.39E-02	-2.87E-03
6.382	1.00E-02	1.27E-02	-2.72E-03
6.515	9.00E-03	1.17E-02	-2.67E-03
6.648	8.00E-03	1.07E-02	-2.70E-03
6.782	7.00E-03	9.81E-03	-2.81E-03
6.915	7.00E-03	9.00E-03	-2.00E-03
7.048	6.00E-03	8.25E-03	-2.25E-03
7.182	6.00E-03	7.57E-03	-1.57E-03
7.315	5.00E-03	6.94E-03	-1.94E-03
7.448	5.00E-03	6.37E-03	-1.37E-03
7.582	5.00E-03	5.84E-03	-8.38E-04
7.715	4.00E-03	5.35E-03	-1.35E-03
7.848	4.00E-03	4.91E-03	-9.11E-04
7.982	4.00E-03	4.50E-03	-5.03E-04
8.115	3.00E-03	4.13E-03	-1.13E-03
8.248	3.00E-03	3.79E-03	-7.88E-04
8.382	3.00E-03	3.47E-03	-4.74E-04
8.515	3.00E-03	3.19E-03	-1.86E-04
8.648	2.00E-03	2.92E-03	-9.23E-04
8.782	2.00E-03	2.68E-03	-6.81E-04
8.915	2.00E-03	2.46E-03	-4.59E-04
9.048	2.00E-03	2.26E-03	-2.56E-04
9.182	1.00E-03	2.07E-03	-1.07E-03
9.315	1.00E-03	1.90E-03	-8.98E-04
9.448	1.00E-03	1.74E-03	-7.41E-04
9.582	1.00E-03	1.60E-03	-6.97E-04
9.715	1.00E-03	1.47E-03	-4.65E-04
9.848	1.00E-03	1.34E-03	-3.44E-04
9.982	1.00E-03	1.23E-03	-2.72E-04
10.12	1.00E-03	1.13E-03	-1.32E-04
10.25	1.00E-03	1.04E-03	-3.86E-05
10.38	1.00E-03	9.53E-04	4.74E-05
10.52	1.00E-03	8.74E-04	1.29E-04
10.65	1.00E-03	8.02E-04	1.98E-04
10.78	1.00E-03	7.36E-04	2.64E-04
10.92	1.00E-03	6.76E-04	3.24E-04
13.9	2.56E-04	9.98E-05	1.57E-04
14.06	1.75E-04	8.98E-05	8.51E-05
14.23	9.32E-05	8.07E-05	1.26E-05
14.4	1.16E-05	7.25E-05	-6.09E-05

B3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1388E-05
DISPERSIVITY= 0.2282E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.4694
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3869E-03

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
THE CRITICAL RSS IS: 0.4246E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.39E-06	1.39E-06	1.39E-06
X(2)	2.21E-03	2.21E-03	2.21E-03
X(5)	4.69E-01	4.65E-01	4.74E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.382	9.14E-04	7.29E-19	9.14E-04
0.548	1.81E-03	4.73E-13	1.81E-03
0.715	1.70E-03	6.05E-10	1.70E-03
0.882	2.59E-03	5.17E-08	2.59E-03
1.048	3.48E-03	1.07E-06	3.48E-03
1.215	4.37E-03	9.62E-06	4.36E-03
1.382	5.26E-03	5.07E-05	5.21E-03
1.548	6.15E-03	1.84E-04	5.97E-03
1.715	7.04E-03	5.21E-04	6.52E-03
1.882	7.93E-03	1.22E-03	6.72E-03
2.048	8.83E-03	2.46E-03	6.37E-03
2.215	9.72E-03	4.45E-03	5.27E-03
2.382	1.16E-02	7.35E-03	4.27E-03
2.548	1.45E-02	1.12E-02	3.28E-03
2.715	1.84E-02	1.61E-02	2.27E-03
2.882	2.33E-02	2.19E-02	1.36E-03
3.048	2.92E-02	2.84E-02	7.69E-04
3.215	3.51E-02	3.54E-02	-3.66E-04
3.382	4.20E-02	4.27E-02	-7.16E-04
3.548	4.98E-02	4.98E-02	-6.28E-06
3.715	5.67E-02	5.68E-02	-3.07E-05
3.882	6.26E-02	6.32E-02	-6.14E-04
4.048	6.85E-02	6.91E-02	-5.43E-04
4.215	7.44E-02	7.44E-02	-1.28E-03
4.382	7.73E-02	7.85E-02	-1.22E-03
4.548	8.12E-02	8.20E-02	-8.03E-04
4.715	8.31E-02	8.47E-02	-1.59E-03
4.882	8.50E-02	8.65E-02	-1.56E-03
5.048	8.69E-02	8.76E-02	-7.77E-04
5.215	8.68E-02	8.80E-02	-1.28E-03
5.382	8.67E-02	8.78E-02	-1.16E-03
5.548	8.65E-02	8.70E-02	-4.76E-04
5.715	8.54E-02	8.57E-02	-2.89E-04
5.882	8.43E-02	8.43E-02	-4.93E-04
6.048	8.22E-02	8.19E-02	2.89E-04
6.215	8.01E-02	7.95E-02	5.59E-04
6.382	7.50E-02	7.50E-02	1.07E-03
6.548	7.49E-02	7.41E-02	7.40E-04
6.715	7.28E-02	7.12E-02	1.58E-03
6.882	6.97E-02	6.82E-02	1.49E-03
7.048	6.66E-02	6.51E-02	1.44E-03
7.215	6.35E-02	6.20E-02	1.43E-03
7.382	6.03E-02	5.89E-02	1.41E-03
7.548	5.72E-02	5.59E-02	1.35E-03
7.715	5.41E-02	5.29E-02	1.25E-03
7.882	5.10E-02	4.99E-02	1.08E-03
8.048	4.79E-02	4.71E-02	8.08E-04
8.215	4.48E-02	4.43E-02	4.66E-04
8.382	4.27E-02	4.17E-02	1.03E-03
8.548	3.96E-02	3.91E-02	4.71E-04
8.715	3.75E-02	3.67E-02	8.14E-04
8.882	3.44E-02	3.43E-02	4.59E-05
9.048	3.23E-02	3.21E-02	1.52E-04
9.215	3.01E-02	3.00E-02	1.58E-04
9.382	2.80E-02	2.80E-02	5.39E-05
9.548	2.59E-02	2.61E-02	-1.71E-04
9.715	2.38E-02	2.43E-02	-4.91E-04
9.882	2.17E-02	2.26E-02	-9.06E-04
10.050	2.06E-02	2.10E-02	-4.21E-04
10.220	1.85E-02	1.95E-02	-1.02E-03
10.380	1.74E-02	1.82E-02	-7.89E-04
10.550	1.63E-02	1.68E-02	-5.67E-04
10.720	1.52E-02	1.56E-02	-4.33E-04
10.880	1.31E-02	1.45E-02	-1.45E-03
11.050	1.19E-02	1.34E-02	-1.47E-03
11.220	1.18E-02	1.24E-02	-5.68E-04
11.380	1.07E-02	1.15E-02	-7.90E-04
11.550	9.62E-03	1.06E-02	-1.02E-03
11.720	8.51E-03	9.81E-03	-1.23E-03
11.880	7.40E-03	9.10E-03	-1.70E-03
12.050	7.29E-03	8.39E-03	-1.10E-03
12.220	6.18E-03	7.18E-03	-1.56E-03
12.380	6.07E-03	7.17E-03	-1.10E-03
12.550	4.96E-03	6.60E-03	-1.64E-03
12.720	4.85E-03	6.85E-03	-1.23E-03
12.880	3.74E-03	5.63E-03	-1.88E-03
13.050	3.64E-03	5.18E-03	-1.54E-03
13.220	2.53E-03	4.77E-03	-2.24E-03
13.380	2.42E-03	4.41E-03	-1.99E-03
13.550	2.31E-03	4.05E-03	-1.74E-03
13.720	1.20E-03	3.22E-03	-2.53E-03
13.880	1.09E-03	3.24E-03	-2.35E-03
14.050	1.10E-02	1.10E-02	1.51E-05
14.220	1.00E-02	1.03E-02	-2.87E-04
14.390	1.00E-02	9.68E-03	3.24E-04
14.560	1.188E-03	9.10E-03	-9.88E-05
14.730	8.00E-03	8.51E-03	-5.13E-04

October 2005
B4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8895E-06
 DISPERSIVITY= 0.1411E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.3018
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3520E-03

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.3862E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.90E-07	8.90E-07	8.90E-07
X(2)	1.45E-03	1.41E-03	1.49E-03
X(5)	3.02E-01	2.99E-01	3.05E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.82E-01	9.14E-04	1.05E-16	9.14E-04
0.5483	1.81E-03	1.16E-11	1.81E-03
7.15E-01	1.70E-03	5.77E-05	1.70E-03
0.8817	2.59E-03	2.75E-07	2.59E-03
1.048	3.48E-03	3.83E-06	3.47E-03
1.215	4.37E-03	2.57E-05	4.34E-03
1.382	5.26E-03	1.09E-04	5.19E-03
1.548	6.15E-03	3.35E-04	5.82E-03
1.715	7.04E-03	8.26E-04	6.22E-03
1.882	7.93E-03	1.73E-03	6.21E-03
2.048	8.83E-03	3.19E-03	5.64E-03
2.215	9.72E-03	5.34E-03	4.38E-03
2.382	1.16E-02	8.28E-03	3.33E-03
2.548	1.45E-02	1.21E-02	2.42E-03
2.715	1.84E-02	1.67E-02	1.65E-03
2.882	2.33E-02	2.22E-02	1.05E-03
3.048	2.92E-02	2.84E-02	7.40E-04
3.215	3.51E-02	3.52E-02	-1.07E-04
3.382	4.20E-02	4.22E-02	-2.65E-04
3.548	4.98E-02	4.98E-02	-2.26E-04
3.715	5.67E-02	5.63E-02	4.80E-04
3.882	6.26E-02	6.28E-02	-1.62E-04
4.048	6.85E-02	6.85E-02	-2.26E-04
4.215	7.34E-02	7.40E-02	-5.85E-04
4.382	7.73E-02	7.85E-02	-1.15E-03
4.548	8.21E-02	8.21E-02	-8.72E-04
4.715	8.31E-02	8.48E-02	-1.75E-03
4.882	8.50E-02	8.68E-02	-1.80E-03
5.048	8.69E-02	8.79E-02	-1.07E-03
5.215	8.68E-02	8.94E-02	-1.81E-03
5.382	8.67E-02	8.81E-02	-1.49E-03
5.548	8.65E-02	8.73E-02	-7.86E-04
5.715	8.64E-02	8.60E-02	-8.07E-04
5.882	8.43E-02	8.42E-02	7.98E-05
6.048	8.22E-02	8.21E-02	9.49E-05
6.215	8.01E-02	7.97E-02	4.10E-04
6.382	7.80E-02	7.70E-02	9.61E-04
6.548	7.49E-02	7.42E-02	6.92E-04
6.715	7.28E-02	7.42E-02	1.56E-03
6.882	6.97E-02	6.97E-02	-2.43E-03
7.048	6.66E-02	6.51E-02	1.50E-03
7.215	6.35E-02	6.19E-02	1.52E-03
7.382	6.03E-02	5.88E-02	1.52E-03
7.548	5.72E-02	5.58E-02	1.48E-03
7.715	5.41E-02	5.27E-02	1.39E-03
7.882	5.10E-02	4.98E-02	1.22E-03
8.048	4.79E-02	4.69E-02	9.65E-04
8.215	4.48E-02	4.42E-02	6.18E-04
8.382	4.27E-02	4.15E-02	1.17E-03
8.548	3.96E-02	3.90E-02	6.09E-04
8.715	3.75E-02	3.65E-02	9.40E-04
8.882	3.44E-02	3.42E-02	1.57E-04
9.048	3.23E-02	3.20E-02	2.60E-04
9.215	3.01E-02	2.99E-02	2.52E-04
9.382	2.80E-02	2.79E-02	1.32E-04
9.548	2.59E-02	2.60E-02	-9.93E-05
9.715	2.38E-02	2.43E-02	-4.36E-04
9.882	2.17E-02	2.26E-02	-8.75E-04
10.05	2.06E-02	2.10E-02	-4.18E-04
10.22	1.85E-02	1.95E-02	-1.05E-03
10.38	1.74E-02	1.82E-02	-7.75E-04
10.55	1.63E-02	1.69E-02	-5.94E-04
10.72	1.62E-02	1.67E-02	-4.90E-04
10.88	1.31E-02	1.45E-02	-1.47E-03
11.05	1.19E-02	1.35E-02	-1.52E-03
11.22	1.18E-02	1.25E-02	-6.42E-04
11.38	1.07E-02	1.16E-02	-8.30E-04
11.55	9.62E-03	1.07E-02	-1.09E-03
11.72	8.51E-03	9.90E-03	-1.40E-03
11.88	7.40E-03	9.16E-03	-1.76E-03
12.05	7.29E-03	8.48E-03	-1.19E-03
12.22	6.18E-03	7.84E-03	-1.66E-03
12.38	6.07E-03	7.24E-03	-1.17E-03
12.55	4.96E-03	6.69E-03	-1.73E-03
12.72	4.85E-03	6.18E-03	-1.33E-03
12.88	3.74E-03	5.71E-03	-1.96E-03
13.05	3.64E-03	5.27E-03	-1.63E-03
13.22	2.53E-03	4.86E-03	-2.34E-03
13.38	2.42E-03	4.49E-03	-2.07E-03
13.55	2.31E-03	4.14E-03	-1.83E-03
13.72	1.20E-03	3.82E-03	-2.62E-03
13.88	1.09E-03	3.52E-03	-2.43E-03
14.05	1.10E-02	1.10E-02	-2.84E-05
14.22	1.00E-02	1.04E-02	-3.65E-04
14.38	1.00E-02	9.74E-03	2.56E-04
14.55	9.00E-03	9.16E-03	-1.57E-04
14.72	8.00E-03	8.60E-03	-6.00E-04

B4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1278E-05
 DISPERSIVITY= 0.1910E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1661
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2961E-04

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
 THE CRITICAL RSS IS: 0.3239E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.28E-06	1.28E-06	1.28E-06
X(2)	1.91E-03	1.87E-03	1.95E-03
X(5)	1.66E-01	1.66E-01	1.66E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.948	1.00E-03	8.85E-05	9.12E-04
2.082	1.00E-03	1.80E-04	8.20E-04
2.215	2.00E-03	3.34E-04	1.67E-03
2.348	2.00E-03	2.59E-04	1.43E-03
2.482	2.00E-03	9.33E-04	1.07E-03
2.615	3.00E-03	1.43E-03	1.57E-03
2.748	3.00E-03	2.05E-03	9.09E-04
2.882	4.00E-03	2.94E-03	1.06E-03
3.015	5.00E-03	3.98E-03	1.02E-03
3.148	6.00E-03	5.22E-03	7.85E-04
3.282	7.00E-03	6.65E-03	3.51E-04
3.415	8.00E-03	8.24E-03	-2.44E-04
3.548	1.00E-02	9.99E-03	-1.48E-05
3.682	1.20E-02	1.19E-02	1.45E-04
3.815	1.30E-02	1.38E-02	-7.92E-04
3.948	1.50E-02	1.58E-02	-7.70E-04
4.082	1.70E-02	1.78E-02	-7.69E-04
4.215	1.90E-02	1.97E-02	-7.22E-04
4.348	2.10E-02	2.16E-02	-6.12E-04
4.482	2.30E-02	2.34E-02	-2.34E-04
4.615	2.50E-02	2.51E-02	-1.00E-04
4.748	2.70E-02	2.66E-02	3.59E-04
4.882	2.80E-02	2.80E-02	-2.83E-05
5.015	2.90E-02	2.93E-02	-2.60E-04
5.148	3.10E-02	3.03E-02	6.89E-04
5.282	3.10E-02	3.12E-02	-1.94E-04
5.415	3.20E-02	3.19E-02	1.05E-04
5.548	3.30E-02	3.24E-02	5.74E-04
5.682	3.30E-02	3.28E-02	2.06E-04
5.815	3.30E-02	3.30E-02	-1.06E-05
5.948	3.30E-02	3.31E-02	-5.95E-05
6.082	3.30E-02	3.30E-02	2.17E-05
6.215	3.30E-02	3.29E-02	2.30E-04
6.348	3.30E-02	3.24E-02	5.55E-04
6.482	3.20E-02	3.20E-02	-1.15E-05
6.615	4.10E-02	4.10E-02	6.12E-04
6.748	3.10E-02	3.09E-02	1.18E-04
6.882	3.00E-02	3.02E-02	-1.99E-04
7.015	3.00E-02	2.95E-02	5.59E-04
7.148	2.90E-02	2.87E-02	3.29E-04
7.282	2.80E-02	2.78E-02	1.66E-04
7.415	2.70E-02	2.70E-02	3.03E-05
7.548	2.60E-02	2.61E-02	-8.03E-05
7.682	2.50E-02	2.52E-02	-1.66E-04
7.815	2.40E-02	2.43E-02	-2.47E-04
7.948	2.30E-02	2.33E-02	-3.23E-04
8.082	2.20E-02	2.24E-02	-3.92E-04
8.215	2.10E-02	2.15E-02	-4.73E-04
8.348	2.00E-02	2.06E-02	-5.63E-04
8.482	2.00E-02	1.97E-02	3.42E-04
8.615	1.90E-02	1.88E-02	2.24E-04
8.748	1.80E-02	1.79E-02	8.86E-05
8.882	1.70E-02	1.71E-02	-6.15E-05
9.015	1.60E-02	1.62E-02	-2.40E-04
9.148	1.50E-02	1.54E-02	-4.43E-04
9.282	1.40E-02	1.47E-02	-6.84E-04
9.415	1.40E-02	1.39E-02	8.24E-05
9.548	1.30E-02	1.32E-02	-1.97E-04
9.682	1.20E-02	1.25E-02	-4.99E-04
9.815	1.20E-02	1.18E-02	1.68E-04
9.948	1.10E-02	1.12E-02	-1.93E-04
10.080	1.10E-02	1.06E-02	4.15E-04
10.215	3.00E-02	9.97E-03	3.18E-05
10.350	9.00E-03	9.42E-03	-4.22E-04
10.480	9.00E-03	8.90E-03	9.97E-05
10.620	8.00E-03	8.37E-03	-3.65E-04
10.750	8.00E-03	7.89E-03	1.08E-04
10.880	7.00E-03	7.44E-03	-4.43E-04
11.020	6.00E-03	6.98E-03	-1.73E-05
11.150	6.00E-03	6.58E-03	-5.78E-04
11.280	6.00E-03	6.19E-03	-1.93E-04
11.420	6.00E-03	5.80E-03	1.98E-04
11.550	5.00E-03	5.46E-03	-4.58E-04
12.270	5.00E-03	3.86E-03	1.14E-03
12.400	5.00E-03	3.62E-03	1.38E-03
12.530	4.00E-03	3.43E-03	5.69E-04
12.670	4.00E-03	3.17E-03	8.27E-04
12.800	4.00E-03	2.97E-03	1.03E-03
12.930	3.00E-03	2.79E-03	2.13E-04
13.070	3.00E-03	2.60E-03	4.01E-04
13.200	3.00E-03	2.43E-03	5.66E-04
13.330	2.00E-03	2.23E-03	7.21E-04
13.470	2.00E-03	2.12E-03	1.23E-04
13.600	2.00E-03	1.99E-03	1.31E-05
13.730	2.00E-03	1.86E-03	1.41E-04
13.870	1.00E-03	1.73E-03	-7.70E-04
14.000	1.00E-03	1.62E-03	-6.18E-04
14.130	1.00E-03	1.51E-03	-5.13E-04
14.270	1.00E-03	1.41E-03	-4.07E-04
14.400	1.00E-03	1.32E-03	-3.15E-04

October 2005
C1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2116E-05
DISPERSIVITY= 0.2086E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.4342
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.8401E-03

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
THE CRITICAL RSS IS: 0.9229E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.12E-06	2.10E-06	2.14E-06
X(2)	2.09E-03	2.00E-03	4.39E-03
X(5)	4.34E-01	4.26E-01	4.39E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
5.83E-01	1.00E-03	8.53E-04	1.47E-04
0.6833	4.00E-03	2.68E-03	1.32E-03
7.83E-01	8.00E-03	6.25E-03	1.75E-03
0.8833	1.60E-02	1.20E-02	4.01E-03
0.9833	2.60E-02	2.01E-02	5.91E-03
1.083	3.70E-02	3.04E-02	6.56E-03
1.183	4.90E-02	4.26E-02	6.42E-03
1.283	6.10E-02	5.57E-02	5.30E-03
1.383	7.20E-02	6.88E-02	3.23E-03
1.483	8.10E-02	8.09E-02	1.06E-04
1.583	8.90E-02	9.14E-02	-2.39E-03
1.683	9.50E-02	9.99E-02	-4.88E-03
1.783	1.01E-01	1.06E-01	-5.23E-03
1.883	1.04E-01	1.11E-01	-6.49E-03
1.983	1.07E-01	1.13E-01	-5.83E-03
2.083	1.08E-01	1.14E-01	-5.48E-03
2.183	1.09E-01	1.13E-01	-3.69E-03
2.283	1.08E-01	1.11E-01	-2.72E-03
2.383	1.07E-01	1.08E-01	-8.09E-04
2.483	1.05E-01	1.04E-01	8.23E-04
2.583	1.03E-01	1.00E-01	2.99E-03
2.683	9.90E-02	9.55E-02	3.53E-03
2.783	9.60E-02	9.07E-02	5.30E-03
2.883	9.10E-02	8.58E-02	5.19E-03
2.983	8.70E-02	8.09E-02	6.12E-03
3.083	8.20E-02	7.60E-02	6.01E-03
3.183	7.70E-02	7.12E-02	5.81E-03
3.283	7.10E-02	6.65E-02	4.47E-03
3.383	6.60E-02	6.20E-02	3.96E-03
3.483	6.10E-02	5.77E-02	3.27E-03
3.583	5.60E-02	5.36E-02	2.36E-03
3.683	5.10E-02	4.95E-02	1.22E-03
3.783	4.70E-02	4.61E-02	9.21E-04
3.883	4.20E-02	4.26E-02	-6.26E-04
3.983	3.90E-02	3.94E-02	-3.39E-04
4.083	3.50E-02	3.64E-02	-1.36E-03
4.183	3.10E-02	3.35E-02	-2.53E-03
4.283	2.80E-02	3.09E-02	-2.89E-03
4.383	2.50E-02	2.84E-02	-3.44E-03
4.483	2.30E-02	2.62E-02	-3.17E-03
4.583	2.00E-02	2.41E-02	-4.06E-03
4.683	1.80E-02	2.21E-02	-4.11E-03
4.783	1.70E-02	2.03E-02	-3.30E-03
4.883	1.50E-02	1.86E-02	-3.64E-03
4.983	1.40E-02	1.71E-02	-3.10E-03
5.083	1.30E-02	1.57E-02	-2.68E-03
5.183	1.10E-02	1.44E-02	-3.38E-03
5.283	1.00E-02	1.32E-02	-3.18E-03
5.383	1.00E-02	1.21E-02	-2.07E-03
5.483	9.00E-03	1.11E-02	-2.06E-03
5.583	8.00E-03	1.01E-02	-2.13E-03
5.683	7.00E-03	9.27E-03	-2.27E-03
5.783	7.00E-03	8.48E-03	-1.48E-03
5.883	6.00E-03	7.76E-03	-1.76E-03
5.983	6.00E-03	7.10E-03	-1.10E-03
6.083	5.00E-03	6.50E-03	-1.50E-03
6.183	4.00E-03	5.94E-03	-1.94E-03
6.283	4.00E-03	5.43E-03	-1.43E-03
6.383	4.00E-03	4.97E-03	-9.65E-04
6.483	3.00E-03	4.54E-03	-1.54E-03
6.583	3.00E-03	4.15E-03	-1.15E-03
6.683	3.00E-03	3.79E-03	-7.90E-04
6.783	2.00E-03	3.46E-03	-1.46E-03
6.883	2.00E-03	3.16E-03	-1.16E-03
6.983	2.00E-03	2.89E-03	-8.90E-04
7.083	2.00E-03	2.64E-03	-6.40E-04
7.183	1.00E-03	2.41E-03	-1.41E-03
7.283	1.00E-03	2.20E-03	-1.20E-03
7.383	1.00E-03	2.01E-03	-1.01E-03
7.483	1.00E-03	1.84E-03	-8.37E-04
7.583	0.00E+00	1.68E-03	-1.68E-03
12.06	4.15E-03	2.78E-05	4.13E-03
12.23	3.07E-03	2.39E-05	3.05E-03
12.4	2.00E-03	2.09E-05	2.09E-03
12.56	1.91E-03	1.76E-05	1.89E-03
12.73	1.83E-03	1.51E-05	1.81E-03
12.9	1.75E-03	1.30E-05	1.73E-03
13.06	1.66E-03	1.11E-05	1.65E-03
13.23	1.58E-03	9.54E-06	1.57E-03
13.4	5.01E-04	8.19E-06	4.93E-04
13.56	4.20E-04	7.04E-06	4.13E-04
13.73	3.38E-04	6.04E-06	3.32E-04
13.9	2.56E-04	5.18E-06	2.51E-04
14.06	1.75E-04	4.45E-06	1.70E-04
14.23	9.32E-05	3.82E-06	8.99E-05
14.4	1.16E-05	3.28E-06	8.36E-06

C1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 80
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1769E-05
DISPERSIVITY= 0.1471E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.5122
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1014E-02

THE F STATISTIC FOR NP= 3 NOBS= 80 IS: 2.73
THE CRITICAL RSS IS: 0.1122E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.77E-06	1.75E-06	1.77E-06
X(2)	1.47E-03	1.40E-03	1.56E-03
X(5)	5.12E-01	5.02E-01	5.22E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.183	1.00E-03	2.19E-46	1.00E-03
0.350	1.00E-03	1.38E-23	1.00E-03
0.517	1.00E-03	1.69E-15	1.00E-03
0.683	1.00E-03	2.25E-11	1.00E-03
0.850	2.00E-03	7.17E-09	2.00E-03
1.017	3.00E-03	3.33E-07	3.00E-03
1.183	4.00E-03	5.14E-06	4.00E-03
1.350	5.00E-03	3.94E-05	4.96E-03
1.517	6.00E-03	1.89E-04	5.81E-03
1.683	7.00E-03	6.50E-04	6.35E-03
1.850	8.00E-03	1.76E-03	6.24E-03
2.017	9.00E-03	3.98E-03	5.02E-03
2.183	1.10E-02	7.78E-03	3.23E-03
2.350	1.50E-02	1.36E-02	1.45E-03
2.517	2.10E-02	2.14E-02	-4.44E-04
2.683	2.90E-02	3.13E-02	-2.32E-02
2.850	4.00E-02	4.28E-02	-2.75E-03
3.017	5.20E-02	5.51E-02	-3.08E-03
3.183	6.50E-02	6.78E-02	-2.68E-02
3.350	7.90E-02	7.95E-02	-5.12E-04
3.517	9.00E-02	9.03E-02	-2.53E-04
3.683	1.00E-01	9.93E-02	6.85E-04
3.850	1.07E-01	1.06E-01	5.95E-04
4.017	1.12E-01	1.11E-01	6.22E-04
4.183	1.16E-01	1.14E-01	1.76E-03
4.350	1.17E-01	1.15E-01	1.90E-03
4.517	1.16E-01	1.14E-01	1.83E-03
4.683	1.13E-01	1.12E-01	4.32E-03
4.850	1.10E-01	1.08E-01	2.09E-03
5.017	1.05E-01	1.03E-01	1.86E-03
5.183	9.90E-02	9.76E-02	1.39E-03
5.350	9.20E-02	9.03E-02	4.28E-04
5.517	8.50E-02	8.52E-02	-2.28E-04
5.683	7.80E-02	7.88E-02	-7.63E-04
5.850	7.10E-02	7.23E-02	-1.32E-03
6.017	6.40E-02	6.60E-02	-2.01E-03
6.183	5.70E-02	5.99E-02	-2.93E-03
6.350	5.10E-02	5.42E-02	-3.15E-03
6.517	4.50E-02	4.87E-02	-3.70E-03
6.683	4.00E-02	4.36E-02	-3.63E-03
6.850	3.50E-02	3.89E-02	-3.94E-03
7.017	3.10E-02	3.46E-02	-3.63E-03
7.183	2.80E-02	3.07E-02	-2.70E-03
7.350	2.50E-02	2.71E-02	-2.14E-03
7.517	2.30E-02	2.39E-02	-9.20E-04
7.683	2.10E-02	2.10E-02	-3.31E-05
7.850	1.90E-02	1.85E-02	5.50E-04
8.017	1.70E-02	1.62E-02	8.52E-04
8.183	1.60E-02	1.41E-02	1.89E-03
8.350	1.50E-02	1.23E-02	2.70E-03
8.517	1.40E-02	1.07E-02	3.30E-03
8.683	1.30E-02	9.30E-03	3.70E-03
8.850	1.20E-02	8.07E-03	3.93E-03
9.017	1.20E-02	6.99E-03	5.01E-03
9.183	1.10E-02	6.05E-03	4.96E-03
9.350	1.00E-02	5.22E-03	4.78E-03
9.517	1.00E-02	4.51E-03	5.49E-03
9.683	9.00E-03	3.88E-03	5.12E-03
9.850	9.00E-03	3.34E-03	5.66E-03
10.020	8.00E-03	2.88E-03	5.13E-03
10.180	8.00E-03	2.47E-03	5.53E-03
10.350	8.00E-03	2.12E-03	5.88E-03
10.520	7.00E-03	1.82E-03	5.18E-03
10.680	7.00E-03	1.56E-03	6.44E-03
10.850	7.00E-03	1.34E-03	5.67E-03
11.020	7.00E-03	1.14E-03	5.86E-03
11.180	6.00E-03	9.77E-04	5.02E-03
11.350	6.00E-03	8.35E-04	5.17E-03
11.520	6.00E-03	7.13E-04	5.29E-03
11.930	5.00E-03	4.80E-04	4.52E-03
12.080	4.00E-03	2.69E-04	4.09E-03
12.270	5.00E-03	3.48E-04	4.65E-03
12.430	4.00E-03	2.97E-04	3.70E-03
12.590	4.00E-03	2.52E-04	3.75E-03
12.770	4.00E-03	2.15E-04	3.79E-03
12.930	4.00E-03	1.83E-04	3.82E-03
13.100	3.00E-03	1.55E-04	2.85E-03
13.270	3.00E-03	1.32E-04	2.87E-03
13.430	3.00E-03	1.12E-04	2.89E-03
13.600	3.00E-03	9.51E-05	2.91E-03

October 2005
C2_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.1100E-05
 7) THE DISPERSIVITY (M) : 0.1000E-03
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1514E-05
 DISPERSIVITY= 0.2391E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4897
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1900E-02

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71
 THE CRITICAL RSS IS: 0.2070E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.51E-06	1.50E-06	1.53E-06
X(2)	2.39E-03	2.25E-03	2.54E-03
X(5)	4.90E-01	4.50E-01	5.00E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.67E-01	9.69E-04	6.38E-15	9.69E-04
0.3	1.93E-03	1.44E-08	1.93E-03
4.93E-01	2.88E-03	4.23E-06	2.88E-03
0.5667	4.84E-03	8.69E-05	4.76E-03
0.7	6.80E-03	5.68E-04	6.23E-03
0.8333	9.76E-03	2.04E-03	7.71E-03
0.9667	1.47E-02	5.17E-03	9.54E-03
1.1	2.17E-02	1.04E-02	1.13E-02
1.233	2.96E-02	1.80E-02	1.16E-02
1.367	3.96E-02	2.80E-02	1.16E-02
1.5	4.96E-02	4.00E-02	9.59E-03
1.633	6.33E-02	5.33E-02	7.20E-03
1.767	7.05E-02	6.72E-02	3.29E-03
1.9	8.04E-02	8.04E-02	6.31E-05
2.033	9.34E-02	9.34E-02	-3.90E-03
2.167	9.63E-02	1.02E-01	-5.87E-03
2.3	1.02E-01	1.10E-01	-7.75E-03
2.433	1.07E-01	1.16E-01	-8.49E-03
2.567	1.11E-01	1.20E-01	-8.37E-03
2.7	1.14E-01	1.22E-01	-7.34E-03
2.833	1.16E-01	1.22E-01	-5.86E-03
2.967	1.17E-01	1.21E-01	-3.97E-03
3.1	1.18E-01	1.19E-01	-1.12E-03
3.233	1.17E-01	1.16E-01	6.74E-04
3.367	1.16E-01	1.15E-01	3.15E-03
3.5	1.13E-01	1.09E-01	4.01E-03
3.633	1.11E-01	1.05E-01	6.31E-03
3.767	1.07E-01	1.00E-01	6.78E-03
3.9	1.03E-01	9.53E-02	7.46E-03
4.033	9.87E-02	9.06E-02	8.13E-03
4.167	9.37E-02	8.37E-02	7.84E-03
4.3	8.87E-02	8.12E-02	7.47E-03
4.433	8.26E-02	7.66E-02	6.00E-03
4.567	7.56E-02	7.21E-02	5.44E-03
4.7	7.25E-02	6.78E-02	4.70E-03
4.833	6.65E-02	6.37E-02	2.78E-03
4.967	6.14E-02	5.94E-02	1.73E-03
5.1	5.64E-02	5.60E-02	4.55E-04
5.233	5.14E-02	5.24E-02	-9.97E-04
5.367	4.73E-02	4.79E-02	-1.62E-03
5.5	4.33E-02	4.57E-02	-2.44E-03
5.633	3.92E-02	4.27E-02	-3.44E-03
5.767	3.52E-02	3.92E-02	-4.62E-03
5.9	3.21E-02	3.71E-02	-4.96E-03
6.033	3.01E-02	3.46E-02	-4.47E-03
6.167	2.71E-02	3.22E-02	-5.12E-03
6.3	2.50E-02	3.00E-02	-4.93E-03
6.433	2.30E-02	2.79E-02	-4.90E-03
6.567	2.09E-02	2.59E-02	-4.98E-03
6.7	1.99E-02	2.41E-02	-4.20E-03
6.833	1.79E-02	2.24E-02	-4.54E-03
6.967	1.68E-02	2.08E-02	-4.00E-03
7.1	1.58E-02	1.93E-02	-3.56E-03
7.233	1.47E-02	1.80E-02	-3.23E-03
7.367	1.37E-02	1.67E-02	-2.98E-03
7.5	1.26E-02	1.56E-02	-2.83E-03
7.633	1.16E-02	1.44E-02	-2.76E-03
7.767	1.06E-02	1.33E-02	-2.76E-03
7.9	1.05E-02	1.24E-02	-1.84E-03
8.033	9.46E-03	1.15E-02	-2.00E-03
8.167	9.42E-03	1.06E-02	-1.20E-03
8.3	8.38E-03	9.85E-03	-1.48E-03
8.433	8.34E-03	9.14E-03	-8.02E-04
8.567	7.29E-03	8.47E-03	-1.18E-03
8.7	7.25E-03	7.65E-03	-6.01E-04
8.833	7.21E-03	7.28E-03	-7.17E-05
8.967	6.17E-03	6.75E-03	-5.79E-04
9.1	6.12E-03	6.25E-03	-1.29E-04
9.233	6.08E-03	5.80E-03	2.86E-04
9.367	6.04E-03	5.37E-03	6.70E-04
9.5	5.00E-03	4.98E-03	2.10E-05
9.633	4.95E-03	4.61E-03	3.43E-04
9.767	4.91E-03	4.27E-03	6.41E-04
9.9	4.87E-03	3.96E-03	9.11E-04
10.03	3.83E-03	3.67E-03	1.53E-04
10.17	3.79E-03	3.39E-03	3.95E-04
10.3	3.74E-03	3.15E-03	5.95E-04
10.43	3.70E-03	2.92E-03	7.80E-04
10.57	3.66E-03	2.70E-03	9.62E-04
10.7	2.62E-03	1.11E-03	1.51E-03
10.83	2.57E-03	2.32E-03	2.51E-04
10.97	2.53E-03	2.14E-03	3.89E-04
11.1	2.49E-03	1.99E-03	5.00E-04
11.23	2.45E-03	1.84E-03	6.01E-04
11.37	2.40E-03	1.70E-03	7.01E-04
11.5	2.36E-03	1.58E-03	7.91E-04
11.63	2.32E-03	1.47E-03	8.52E-04
11.77	2.28E-03	1.35E-03	9.23E-04
11.9	1.23E-03	1.25E-03	-2.13E-05
12.03	1.19E-03	1.16E-03	2.61E-05
12.17	1.15E-03	1.07E-03	7.42E-05
12.3	1.11E-03	9.96E-04	1.09E-04
12.43	1.06E-03	9.25E-04	1.33E-04
12.57	1.02E-03	8.53E-04	1.67E-04

C2_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 81
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1350E-05
 DISPERSIVITY= 0.1560E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4787
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4953E-03

THE F STATISTIC FOR NP= 3 NOBS= 81 IS: 2.73
 THE CRITICAL RSS IS: 0.5474E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.35E-06	1.35E-06	1.35E-06
X(2)	1.56E-03	1.51E-03	1.61E-03
X(5)	4.79E-01	4.74E-01	4.84E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.467	9.19E-04	4.44E-21	9.19E-04
0.633	8.20E-04	3.20E-15	8.20E-04
0.800	1.72E-03	8.25E-12	1.72E-03
0.967	1.62E-03	1.40E-09	1.62E-03
1.133	2.52E-03	5.15E-08	2.52E-03
1.300	3.42E-03	7.46E-07	3.42E-03
1.467	3.33E-03	5.79E-06	3.32E-03
1.633	4.23E-03	2.92E-05	4.20E-03
1.800	5.13E-03	1.08E-04	5.02E-03
1.967	6.03E-03	3.16E-04	5.71E-03
2.133	6.93E-03	7.75E-04	6.15E-03
2.300	7.82E-03	1.65E-03	7.41E-03
2.467	8.73E-03	3.15E-03	5.58E-03
2.633	1.16E-02	5.47E-03	6.16E-03
2.800	1.45E-02	8.20E-03	6.30E-03
2.967	1.74E-02	1.33E-02	4.16E-03
3.133	2.23E-02	1.89E-02	3.44E-03
3.300	2.82E-02	2.56E-02	2.61E-03
3.467	3.51E-02	3.33E-02	1.86E-03
3.633	4.30E-02	4.16E-02	1.43E-03
3.800	5.09E-02	5.03E-02	5.99E-04
3.967	5.88E-02	5.92E-02	-3.06E-04
4.133	6.77E-02	6.77E-02	-6.77E-05
4.300	7.46E-02	7.58E-02	-1.15E-03
4.467	8.15E-02	8.31E-02	-1.71E-03
4.633	8.74E-02	8.96E-02	-2.11E-03
4.800	9.24E-02	9.49E-02	-2.60E-03
4.967	9.67E-02	9.93E-02	-2.98E-03
5.133	1.00E-01	1.02E-01	-2.24E-03
5.300	1.02E-01	1.04E-01	-2.39E-03
5.467	1.04E-01	1.04E-01	-2.47E-03
5.633	1.04E-01	1.05E-01	-1.60E-03
5.800	1.04E-01	1.05E-01	-8.17E-04
5.967	1.04E-01	1.04E-01	-2.47E-03
6.133	1.02E-01	1.01E-01	1.00E-03
6.300	9.95E-02	9.76E-02	1.83E-03
6.467	9.64E-02	9.42E-02	2.12E-03
6.633	9.33E-02	9.05E-02	2.78E-03
6.800	8.92E-02	8.64E-02	2.72E-03
6.967	8.51E-02	8.22E-02	2.85E-03
7.133	8.10E-02	7.79E-02	3.10E-03
7.300	7.69E-02	7.35E-02	3.40E-03
7.467	7.18E-02	6.91E-02	2.71E-03
7.633	6.67E-02	6.47E-02	1.96E-03
7.800	6.26E-02	6.04E-02	2.12E-03
7.967	5.75E-02	5.63E-02	1.17E-03
8.133	5.34E-02	5.23E-02	1.07E-03
8.300	4.83E-02	4.85E-02	-1.98E-04
8.467	4.42E-02	4.48E-02	-6.39E-04
8.633	4.01E-02	4.13E-02	-1.27E-03
8.800	3.70E-02	3.81E-02	-1.09E-03
8.967	3.29E-02	3.50E-02	-2.10E-03
9.133	2.98E-02	3.21E-02	-2.31E-03
9.300	2.77E-02	2.94E-02	-1.70E-03
9.467	2.46E-02	2.69E-02	-2.28E-03
9.633	2.25E-02	2.45E-02	-2.05E-03
9.800	2.04E-02	2.24E-02	-1.98E-03
9.967	1.83E-02	2.04E-02	-2.08E-03
10.133	1.62E-02	1.85E-02	-2.33E-03
10.300	1.51E-02	1.68E-02	-1.73E-03
10.470	1.40E-02	1.53E-02	-1.27E-03
10.633	1.19E-02	1.38E-02	-1.94E-03
10.800	1.08E-02	1.25E-02	-1.73E-03
10.970	9.68E-03	1.13E-02	-1.64E-03
11.133	9.58E-03	1.02E-02	-6.48E-04
11.300	8.49E-03	9.24E-03	-7.52E-04
11.470	7.39E-03	8.33E-03	-9.46E-04
11.633	6.29E-03	7.51E-03	-1.23E-03
11.800	6.19E-03	6.77E-03	-5.80E-04
11.970	5.09E-03	6.09E-03	-1.00E-03
12.133	4.99E-03	5.48E-03	-4.92E-04
12.300	3.89E-03	4.93E-03	-1.04E-03
12.470	3.79E-03	4.43E-03	-6.34E-04
12.633	3.69E-03	3.98E-03	-2.83E-04
12.800	2.59E-03	3.57E-03	-9.74E-04
12.970	2.50E-03	3.20E-03	-7.05E-04
13.133	2.40E-03	2.93E-03	-4.74E-04
13.300	1.30E-03	2.57E-03	-1.27E-03
13.470	1.20E-03	2.30E-03	-1.10E-03
13.633	1.11E-03	2.03E-03	-9.63E-04
13.800	2.80E-13	1.85E-03	-1.85E-03

October 2005
C3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 91
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1520E-05
 DISPERSIVITY= 0.2139E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.452
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9420E-03

THE F STATISTIC FOR NP= 3 NOBS= 91 IS: 2.72
 THE CRITICAL RSS IS: 0.1029E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.52E-06	1.50E-06	1.54E-06
X(2)	2.14E-03	2.23E-03	2.05E-03
X(5)	4.55E-01	4.51E-01	4.60E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-01	9.53E-04	2.25E-28	9.53E-04
0.2333	1.83E-12	1.89E-03	1.83E-12
3.67E-01	2.83E-03	4.30E-08	2.83E-03
0.5	3.77E-03	4.85E-06	3.76E-03
0.6333	3.73E-03	7.51E-05	3.63E-03
0.7667	5.64E-03	4.50E-04	5.19E-03
0.9	7.58E-03	1.58E-03	5.99E-03
1.033	1.05E-02	4.02E-03	6.49E-03
1.167	1.65E-02	3.32E-02	7.04E-03
1.3	2.24E-02	1.45E-02	7.91E-03
1.433	3.03E-02	2.29E-02	7.46E-03
1.567	4.03E-02	3.52E-02	7.04E-03
1.7	5.02E-02	4.51E-02	5.14E-03
1.833	6.01E-02	5.76E-02	2.50E-03
1.967	7.01E-02	7.01E-02	-2.29E-05
2.1	7.90E-02	8.17E-02	-2.66E-03
2.233	8.80E-02	9.18E-02	-3.86E-03
2.367	9.49E-02	1.00E-01	-5.31E-03
2.5	1.01E-01	1.07E-01	-5.86E-03
2.633	1.06E-01	1.11E-01	-5.55E-03
2.767	1.10E-01	1.14E-01	-4.47E-03
2.9	1.12E-01	1.16E-01	-3.50E-03
3.033	1.14E-01	1.15E-01	-1.78E-03
3.167	1.14E-01	1.14E-01	-5.86E-04
3.3	1.14E-01	1.12E-01	-1.56E-03
3.433	1.11E-01	1.09E-01	2.47E-03
3.567	1.09E-01	1.05E-01	3.96E-03
3.7	1.06E-01	1.01E-01	4.90E-03
3.833	1.02E-01	9.71E-02	5.15E-03
3.967	9.81E-02	9.25E-02	5.61E-03
4.1	9.31E-02	8.79E-02	5.7E-03
4.233	8.80E-02	8.33E-02	4.76E-03
4.367	8.30E-02	7.86E-02	4.34E-03
4.5	7.79E-02	7.40E-02	3.84E-03
4.633	7.18E-02	6.96E-02	2.23E-03
4.767	6.68E-02	6.53E-02	1.49E-03
4.9	6.17E-02	6.11E-02	5.86E-04
5.033	5.66E-02	5.71E-02	-4.92E-04
5.167	5.16E-02	5.33E-02	-1.75E-03
5.3	4.75E-02	4.97E-02	-2.20E-03
5.433	4.33E-02	4.63E-02	-2.84E-03
5.567	3.94E-02	4.31E-02	-3.66E-03
5.7	3.63E-02	4.00E-02	-3.68E-03
5.833	3.34E-02	3.71E-02	-3.58E-03
5.967	3.02E-02	3.45E-02	-4.25E-03
6.1	2.81E-02	3.19E-02	-3.80E-03
6.233	2.61E-02	2.96E-02	-3.51E-03
6.367	2.40E-02	2.74E-02	-3.38E-03
6.5	2.20E-02	2.53E-02	-3.39E-03
6.633	1.99E-02	2.34E-02	-3.55E-03
6.767	1.88E-02	2.17E-02	-2.84E-03
6.9	1.78E-02	2.00E-02	-2.25E-03
7.033	1.67E-02	1.85E-02	-1.79E-03
7.167	1.56E-02	1.71E-02	-1.43E-03
7.3	1.46E-02	1.58E-02	-1.18E-03
7.433	1.35E-02	1.45E-02	-1.02E-03
7.567	1.25E-02	1.34E-02	-9.53E-04
7.7	1.24E-02	1.24E-02	2.80E-05
7.833	1.13E-02	1.14E-02	-6.82E-05
7.967	1.03E-02	1.05E-02	-2.38E-04
8.1	1.02E-02	9.67E-03	5.24E-04
8.233	9.13E-03	8.91E-03	2.24E-04
8.367	9.07E-03	8.20E-03	8.65E-04
8.5	8.01E-03	7.56E-03	4.52E-04
8.633	7.94E-03	6.96E-03	9.88E-04
8.767	7.88E-03	6.40E-03	1.48E-03
8.9	6.82E-03	5.89E-03	9.25E-04
9.033	6.76E-03	5.42E-03	1.33E-03
9.167	6.69E-03	4.99E-03	1.70E-03
9.3	5.63E-03	4.59E-03	1.04E-03
9.433	5.57E-03	4.22E-03	1.34E-03
9.567	5.51E-03	3.89E-03	1.62E-03
9.7	4.45E-03	3.57E-03	8.89E-04
9.833	4.38E-03	3.29E-03	1.09E-03
9.967	4.32E-03	3.02E-03	1.30E-03
10.1	4.26E-03	2.78E-03	1.48E-03
10.233	4.19E-03	2.56E-03	1.66E-03
10.37	3.13E-03	2.35E-03	7.80E-04
10.5	3.07E-03	2.16E-03	9.07E-04
10.633	3.00E-03	1.99E-03	1.03E-03
10.77	2.94E-03	1.83E-03	1.12E-03
10.9	2.88E-03	1.68E-03	1.20E-03
11.033	2.82E-03	1.54E-03	1.27E-03
11.17	2.75E-03	1.42E-03	1.34E-03
11.3	1.69E-03	1.30E-03	3.88E-04
11.433	1.63E-03	1.20E-03	4.31E-04
11.57	1.57E-03	1.10E-03	4.66E-04
12.3	1.22E-03	6.91E-04	5.30E-04
12.433	1.16E-03	6.35E-04	5.23E-04
12.57	1.10E-03	5.83E-04	5.13E-04
12.7	1.03E-03	5.36E-04	4.97E-04

C3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1380E-05
 DISPERSIVITY= 0.1640E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4549
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5441E-03

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
 THE CRITICAL RSS IS: 0.5998E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.38E-06	1.38E-06	1.38E-06
X(2)	1.64E-03	1.58E-03	1.71E-03
X(5)	4.55E-01	4.50E-01	4.59E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.300	9.19E-04	2.57E-31	9.19E-04
0.467	9.05E-20	9.05E-20	1.82E-03
0.633	1.71E-03	2.67E-14	1.71E-03
0.800	2.61E-03	4.09E-11	2.61E-03
0.967	2.50E-03	4.93E-09	2.50E-03
1.133	3.40E-03	1.43E-07	3.40E-03
1.300	3.30E-03	1.74E-06	3.29E-03
1.467	4.19E-03	1.18E-05	4.18E-03
1.633	5.09E-03	1.14E-04	6.42E-03
1.800	5.98E-03	1.81E-04	5.80E-03
1.967	6.88E-03	4.94E-04	6.39E-03
2.133	7.78E-03	1.14E-03	6.64E-03
2.300	8.67E-03	2.31E-03	6.36E-03
2.467	1.06E-02	4.21E-03	6.36E-03
2.633	1.25E-02	2.21E-02	6.42E-03
2.800	1.64E-02	1.09E-02	5.42E-03
2.967	2.03E-02	1.60E-02	4.28E-03
3.133	2.52E-02	2.21E-02	3.06E-03
3.300	3.11E-02	2.92E-02	1.89E-03
3.467	3.79E-02	3.69E-02	1.01E-03
3.633	4.58E-02	4.52E-02	6.94E-04
3.800	5.37E-02	5.35E-02	7.53E-04
3.967	6.06E-02	6.17E-02	-1.03E-03
4.133	6.75E-02	6.94E-02	-1.84E-03
4.300	7.44E-02	7.64E-02	-1.59E-03
4.467	8.03E-02	8.26E-02	-2.28E-03
4.633	8.52E-02	8.78E-02	-2.60E-03
4.800	8.91E-02	9.20E-02	-2.67E-03
4.967	9.30E-02	9.51E-02	-2.07E-03
5.133	9.49E-02	9.71E-02	-2.21E-03
5.300	9.30E-02	9.58E-02	-1.35E-03
5.467	9.77E-02	9.83E-02	-5.53E-04
5.633	9.76E-02	9.75E-02	8.81E-05
5.800	9.65E-02	9.60E-02	4.77E-04
5.967	9.54E-02	9.39E-02	1.51E-03
6.133	9.33E-02	9.12E-02	2.09E-03
6.300	9.02E-02	8.81E-02	2.11E-03
6.467	8.71E-02	8.45E-02	2.48E-03
6.633	8.40E-02	8.09E-02	3.11E-03
6.800	7.99E-02	7.69E-02	2.92E-03
6.967	7.58E-02	7.29E-02	2.85E-03
7.133	7.17E-02	6.88E-02	2.83E-03
7.300	6.66E-02	6.47E-02	1.82E-03
7.467	6.25E-02	6.07E-02	1.76E-03
7.633	5.74E-02	5.67E-02	6.12E-04
7.800	5.32E-02	5.29E-02	3.61E-04
7.967	4.91E-02	4.92E-02	-2.31E-05
8.133	4.50E-02	4.56E-02	-5.60E-04
8.300	4.09E-02	4.22E-02	-1.26E-03
8.467	3.78E-02	3.90E-02	-1.13E-03
8.633	3.37E-02	3.59E-02	-2.18E-03
8.800	3.16E-02	3.30E-02	-1.40E-03
8.967	2.85E-02	3.03E-02	-1.80E-03
9.133	2.54E-02	2.78E-02	-2.38E-03
9.300	2.33E-02	2.54E-02	-2.13E-03
9.467	2.12E-02	2.33E-02	-2.05E-03
9.633	1.91E-02	2.12E-02	-2.13E-03
9.800	1.70E-02	1.94E-02	-2.35E-03
9.967	1.59E-02	1.76E-02	-1.73E-03
10.133	1.48E-02	1.60E-02	-1.24E-03
10.300	1.27E-02	1.46E-02	-1.87E-03
10.470	1.16E-02	1.32E-02	-1.63E-03
10.633	1.05E-02	1.20E-02	-1.51E-03
10.800	1.04E-02	1.09E-02	4.79E-04
10.970	9.27E-03	9.82E-03	-5.52E-04
11.133	8.16E-03	8.88E-03	-7.20E-04
11.300	8.06E-03	8.03E-03	3.36E-05
11.470	6.95E-03	7.24E-03	-2.90E-04
11.633	6.85E-03	6.54E-03	3.11E-04
11.800	5.75E-03	5.90E-03	-1.49E-04
11.970	5.64E-03	5.31E-03	3.31E-04
12.133	4.54E-03	4.79E-03	-2.47E-04
12.300	4.40E-03	4.29E-03	1.13E-03
13.070	3.96E-03	2.64E-03	1.32E-03
13.233	2.85E-03	2.37E-03	4.86E-04
13.400	2.65E-03	2.12E-03	6.26E-04
13.570	2.65E-03	1.90E-03	7.42E-04
13.733	2.54E-03	1.71E-03	8.34E-04
13.900	1.44E-03	1.53E-03	-9.24E-05
14.070	1.07E-03	1.07E-03	-2.67E-05
14.233	1.23E-03	1.23E-03	2.01E-06
14.400	1.13E-03	1.10E-03	2.69E-05
14.570	1.02E-03	9.82E-04	3.86E-05

October 2005
C4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS
 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1746E-05
 DISPERSIVITY= 0.6389E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1647
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1107E-03

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
 THE CRITICAL RSS IS: 0.1208E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.75E-06	1.73E-06	1.76E-06
X(2)	6.39E-03	6.13E-03	6.64E-03
X(5)	1.65E-01	1.63E-01	1.68E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.85E-01	1.00E-03	3.55E-06	9.97E-04
0.285	1.00E-03	1.28E-04	8.72E-04
3.85E-01	2.00E-03	7.45E-04	1.26E-03
0.485	4.00E-03	2.15E-03	1.85E-03
0.585	6.00E-03	4.36E-03	1.64E-03
0.685	9.00E-03	7.28E-03	1.72E-03
0.785	1.00E-02	1.07E-02	1.27E-03
0.885	1.60E-02	1.46E-02	1.44E-03
0.985	1.90E-02	1.86E-02	3.62E-04
1.085	2.30E-02	2.27E-02	2.77E-04
1.185	2.60E-02	2.64E-02	-3.65E-04
1.285	2.80E-02	2.92E-02	-1.23E-03
1.385	3.00E-02	3.12E-02	-1.24E-03
1.485	3.10E-02	3.25E-02	-1.49E-03
1.585	3.20E-02	3.31E-02	-1.14E-03
1.685	3.30E-02	3.33E-02	-3.06E-04
1.785	3.30E-02	3.31E-02	-1.25E-04
1.885	3.30E-02	3.27E-02	3.13E-04
1.985	3.20E-02	3.21E-02	-6.66E-05
2.085	3.20E-02	3.13E-02	6.81E-04
2.185	3.10E-02	3.05E-02	5.13E-04
2.285	3.00E-02	2.96E-02	3.99E-04
2.385	2.90E-02	2.87E-02	3.15E-04
2.485	2.80E-02	2.78E-02	2.45E-04
2.585	2.70E-02	2.68E-02	1.75E-04
2.685	2.60E-02	2.59E-02	9.59E-05
2.785	2.50E-02	2.50E-02	1.52E-06
2.885	2.40E-02	2.41E-02	-1.13E-04
2.985	2.30E-02	2.30E-02	-9.95E-05
3.085	2.20E-02	2.24E-02	-4.13E-04
3.185	2.10E-02	2.16E-02	-6.03E-04
3.285	2.00E-02	2.08E-02	-8.35E-04
3.385	1.90E-02	2.01E-02	-1.07E-03
3.485	1.90E-02	1.93E-02	-3.37E-04
3.585	1.80E-02	1.86E-02	-4.75E-04
3.685	1.70E-02	1.80E-02	-9.63E-04
3.785	1.70E-02	1.73E-02	-3.15E-04
3.885	1.70E-02	1.67E-02	3.08E-04
3.985	1.60E-02	1.61E-02	-9.34E-05
4.085	1.60E-02	1.55E-02	4.82E-04
4.185	1.50E-02	1.50E-02	3.38E-05
4.285	1.50E-02	1.44E-02	5.64E-04
4.385	1.40E-02	1.39E-02	7.39E-05
4.485	1.40E-02	1.34E-02	5.63E-04
4.585	1.40E-02	1.30E-02	1.03E-03
4.685	1.30E-02	1.25E-02	4.86E-04
4.785	1.30E-02	1.21E-02	9.20E-04
4.885	1.30E-02	1.17E-02	1.34E-03
4.985	1.20E-02	1.13E-02	7.38E-04
5.085	1.20E-02	1.09E-02	1.12E-03
5.185	1.20E-02	1.05E-02	1.50E-03
5.285	1.10E-02	1.02E-02	8.51E-04
5.385	1.10E-02	9.81E-03	1.19E-03
5.485	1.10E-02	9.48E-03	1.52E-03
5.585	1.00E-02	9.16E-03	8.42E-04
5.685	1.00E-02	8.85E-03	1.15E-03
5.785	1.00E-02	8.56E-03	1.44E-03
5.885	1.00E-02	8.27E-03	1.73E-03
5.985	9.00E-03	8.00E-03	9.99E-04
6.085	9.00E-03	7.74E-03	1.26E-03
6.185	9.00E-03	7.49E-03	1.52E-03
6.285	8.00E-03	7.24E-03	7.59E-04
6.385	8.00E-03	7.01E-03	9.94E-04
6.485	8.00E-03	6.78E-03	1.22E-03
6.585	7.00E-03	6.56E-03	4.40E-04
6.685	7.00E-03	6.35E-03	6.51E-04
6.785	7.00E-03	6.15E-03	8.65E-04
6.885	6.00E-03	5.95E-03	5.08E-05
6.985	6.00E-03	5.76E-03	2.40E-04
7.085	6.00E-03	5.58E-03	4.23E-04
7.185	5.00E-03	5.40E-03	-4.01E-04
7.285	5.00E-03	5.23E-03	-2.30E-04
7.385	5.00E-03	5.07E-03	-6.59E-05
7.485	4.00E-03	4.91E-03	-9.07E-04
7.585	4.00E-03	4.75E-03	-7.54E-04
7.685	4.00E-03	4.61E-03	-6.06E-04
7.785	4.00E-03	4.46E-03	-4.63E-04
7.885	3.00E-03	4.32E-03	-1.32E-03
7.985	3.00E-03	4.19E-03	-1.19E-03
8.085	3.00E-03	4.06E-03	-1.06E-03
8.185	3.00E-03	3.94E-03	-9.37E-04
8.285	2.00E-03	3.82E-03	-1.82E-03
8.385	2.00E-03	3.70E-03	-1.70E-03
8.485	2.00E-03	3.59E-03	-1.59E-03
8.585	2.00E-03	3.48E-03	-1.48E-03
8.685	2.00E-03	3.37E-03	-1.37E-03
8.785	1.00E-03	3.27E-03	-2.27E-03
8.885	1.00E-03	3.17E-03	-2.17E-03
8.985	1.00E-03	3.08E-03	-2.08E-03
9.085	1.00E-03	2.98E-03	-1.98E-03
9.185	1.00E-03	2.89E-03	-1.89E-03
9.285	1.00E-03	2.81E-03	-1.81E-03
9.385	0.00E+00	2.72E-03	-2.72E-03

C4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS
 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1719E-05
 DISPERSIVITY= 0.2883E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1095
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3043E-03

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.3339E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.72E-06	1.67E-06	1.77E-06
X(2)	2.88E-03	2.48E-03	3.37E-03
X(5)	1.10E-01	1.04E-01	1.16E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.218	1.03E-03	3.22E-23	1.03E-03
0.352	1.08E-03	1.02E-14	1.08E-03
0.485	1.12E-03	7.01E-11	1.12E-03
0.618	2.16E-03	1.05E-08	2.16E-03
0.752	2.21E-03	2.80E-07	2.21E-03
0.885	3.25E-03	2.72E-06	3.25E-03
1.018	3.29E-03	1.45E-05	3.28E-03
1.152	4.34E-03	5.26E-05	4.29E-03
1.285	5.38E-03	1.45E-04	5.24E-03
1.418	5.43E-03	3.31E-04	5.10E-03
1.552	5.47E-03	6.51E-04	4.82E-03
1.685	6.51E-03	1.15E-03	5.37E-03
1.818	6.51E-03	1.85E-03	4.71E-03
1.952	7.60E-03	2.76E-03	4.84E-03
2.085	7.64E-03	3.88E-03	3.77E-03
2.218	7.69E-03	5.16E-03	2.52E-03
2.352	7.73E-03	6.68E-03	1.16E-03
2.485	8.78E-03	8.06E-03	7.17E-04
2.618	9.82E-03	9.56E-03	2.61E-04
2.752	9.86E-03	1.10E-02	-1.16E-03
2.885	1.09E-02	1.24E-02	-1.51E-03
3.018	1.20E-02	1.37E-02	-1.75E-03
3.152	1.31E-02	1.48E-02	-1.85E-03
3.285	1.40E-02	1.58E-02	-1.81E-03
3.418	1.51E-02	1.67E-02	-1.60E-03
3.552	1.61E-02	1.74E-02	-1.24E-03
3.685	1.62E-02	1.79E-02	-1.72E-03
3.818	1.72E-02	1.83E-02	-1.06E-03
3.952	1.73E-02	1.85E-02	-1.25E-03
4.085	1.83E-02	1.86E-02	-3.13E-04
4.218	1.83E-02	1.86E-02	-2.59E-04
4.352	1.84E-02	1.84E-02	-1.02E-04
4.485	1.84E-02	1.83E-02	1.47E-04
4.618	1.85E-02	1.80E-02	4.79E-04
4.752	1.85E-02	1.76E-02	9.37E-04
4.885	1.86E-02	1.72E-02	1.33E-03
5.018	1.76E-02	1.68E-02	8.27E-04
5.152	1.77E-02	1.67E-02	3.57E-03
5.285	1.77E-02	1.58E-02	1.93E-03
5.418	1.67E-02	1.52E-02	1.52E-03
5.552	1.39E-02	1.37E-02	-1.13E-03
5.685	1.58E-02	1.41E-02	1.74E-03
5.818	1.49E-02	1.35E-02	1.36E-03
5.952	1.39E-02	1.29E-02	9.75E-04
6.085	1.40E-02	1.24E-02	1.69E-03
6.218	1.30E-02	1.18E-02	1.20E-03
6.352	1.20E-02	1.13E-02	7.93E-04
6.485	1.11E-02	1.07E-02	3.79E-04
6.618	1.11E-02	1.02E-02	9.51E-04
6.752	1.02E-02	9.67E-03	5.08E-04
6.885	9.22E-03	9.17E-03	4.60E-05
7.018	9.26E-03	8.69E-03	5.71E-04
7.152	8.30E-03	8.23E-03	7.77E-05
7.285	7.35E-03	7.78E-03	-4.34E-04
7.418	7.39E-03	7.36E-03	3.56E-05
7.552	6.44E-03	6.95E-03	-5.12E-04
7.685	6.48E-03	6.50E-03	-7.35E-05
7.818	5.52E-03	6.19E-03	-6.63E-04
7.952	5.57E-03	5.83E-03	-2.64E-04
8.085	4.61E-03	5.49E-03	-8.93E-04
8.218	4.65E-03	5.17E-03	-5.18E-04
8.352	3.70E-03	4.87E-03	-1.17E-03
8.485	3.74E-03	4.58E-03	-8.37E-04
8.618	2.78E-03	4.30E-03	-1.52E-03
8.752	2.83E-03	4.04E-03	-1.22E-03
8.885	2.87E-03	3.80E-03	-9.28E-04
9.018	2.92E-03	3.57E-03	-6.52E-04
9.152	1.96E-03	3.35E-03	-1.39E-03
9.285	2.00E-03	3.14E-03	-1.14E-03
9.418	2.05E-03	2.95E-03	-9.01E-04
9.552	2.09E-03	2.76E-03	-6.74E-04
9.685	1.13E-03	2.59E-03	-1.46E-03
9.818	1.18E-03	2.43E-03	-1.25E-03
9.952	1.22E-03	2.28E-03	-1.05E-03
10.090	1.27E-03	2.13E-03	-8.67E-04
10.223	4.30E-03	2.21E-03	-2.09E-03
10.355	1.35E-03	1.87E-03	-5.16E-04
10.490	3.96E-04	1.75E-03	-1.35E-03
10.623	4.19E-04	1.62E-03	-1.43E-03
10.755	4.83E-04	1.53E-03	-1.05E-03
10.890	5.27E-04	1.43E-03	-9.06E-04
11.023	1.02E-04	1.30E-03	-7.70E-04
11.155	6.14E-04	1.25E-03	-6.39E-04
11.290	6.58E-04	1.17E-03	-5.14E-04
11.423	7.01E-04	1.12E-03	-3.94E-04
11.555	7.45E-04	1.02E-03	-2.79E-04
12.300	9.90E-04	6.99E-04	2.91E-04

October 2005
D1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 89
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : -0.3800E-02
8) THE PULSE WIDTH (M) : 0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1142E-05
DISPERSIVITY= 0.3800E-02
WIDTH= 0.1217E-01
Rf= 1.000
CO= 0.2000
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3699E-02

THE F STATISTIC FOR NP= 2 NOBS= 89 IS: 1.08
THE CRITICAL RSS IS: 0.3788E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.14E-06	1.13E-06	1.15E-06
X(3)	1.22E-02	1.21E-02	1.23E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.7333	2.17E-03	1.06E-03	-1.06E-03
8.67E-01	5.26E-03	6.12E-03	-8.65E-04
1	9.40E-03	9.98E-03	-5.80E-04
1.13E+00	1.26E-02	1.46E-02	-9.87E-04
1.267	2.17E-02	1.97E-02	1.98E-03
1.4	2.88E-02	2.52E-02	3.62E-03
1.533	3.70E-02	3.10E-02	6.03E-03
1.667	4.41E-02	3.69E-02	7.26E-03
1.8	5.03E-02	4.28E-02	7.50E-03
1.933	5.74E-02	4.87E-02	8.75E-03
2.067	6.38E-02	5.45E-02	9.05E-03
2.2	6.87E-02	6.02E-02	8.49E-03
2.333	7.39E-02	6.58E-02	8.07E-03
2.467	7.89E-02	7.13E-02	6.76E-03
2.6	8.22E-02	7.65E-02	5.66E-03
2.733	8.53E-02	8.16E-02	3.73E-03
2.867	8.84E-02	8.65E-02	1.95E-03
3	9.16E-02	9.12E-02	3.83E-04
3.133	9.27E-02	9.57E-02	-3.00E-03
3.267	9.49E-02	1.00E-01	-5.24E-03
3.4	9.60E-02	1.04E-01	-8.08E-03
3.533	9.72E-02	1.07E-01	-1.02E-02
3.667	9.73E-02	1.10E-01	-1.22E-02
3.8	9.85E-02	1.10E-01	-1.20E-02
3.933	9.86E-02	1.10E-01	-1.17E-02
4.067	9.78E-02	1.09E-01	-1.14E-02
4.2	9.79E-02	1.07E-01	-8.49E-03
4.333	9.71E-02	1.05E-01	-8.01E-03
4.467	9.62E-02	1.02E-01	-6.11E-03
4.6	9.43E-02	9.93E-02	-4.95E-03
4.733	9.35E-02	9.64E-02	-3.73E-03
4.867	9.16E-02	9.28E-02	-1.14E-03
5	9.08E-02	8.94E-02	1.34E-03
5.133	8.89E-02	8.61E-02	2.83E-03
5.267	8.61E-02	8.27E-02	3.34E-03
5.4	8.42E-02	7.95E-02	4.75E-03
5.533	8.24E-02	7.63E-02	6.03E-03
5.667	8.05E-02	7.31E-02	7.37E-03
5.8	7.77E-02	7.01E-02	7.54E-03
5.933	7.48E-02	6.72E-02	7.60E-03
6.067	7.29E-02	6.44E-02	8.50E-03
6.2	7.01E-02	6.16E-02	8.45E-03
6.333	6.72E-02	5.90E-02	8.21E-03
6.467	6.46E-02	5.64E-02	8.89E-03
6.6	6.25E-02	5.41E-02	8.44E-03
6.733	5.97E-02	5.18E-02	7.90E-03
6.867	5.68E-02	4.95E-02	7.27E-03
7	5.40E-02	4.74E-02	6.54E-03
7.133	5.21E-02	4.54E-02	6.71E-03
7.267	4.93E-02	4.34E-02	5.81E-03
7.4	4.64E-02	4.16E-02	4.82E-03
7.533	4.45E-02	3.98E-02	4.74E-03
7.667	4.17E-02	3.81E-02	3.60E-03
7.8	3.98E-02	3.65E-02	3.36E-03
7.933	3.70E-02	3.49E-02	2.06E-03
8.067	3.51E-02	3.34E-02	1.70E-03
8.2	3.23E-02	3.20E-02	2.69E-04
8.333	3.04E-02	3.07E-02	-2.25E-04
8.467	2.86E-02	2.93E-02	-7.79E-04
8.6	2.67E-02	2.81E-02	-1.39E-03
8.733	2.49E-02	2.69E-02	-2.07E-03
8.867	2.30E-02	2.58E-02	-2.77E-03
9	2.11E-02	2.47E-02	-3.55E-03
9.133	2.03E-02	2.37E-02	-3.37E-03
9.267	1.84E-02	2.27E-02	-4.22E-03
9.4	1.66E-02	2.17E-02	-5.13E-03
9.533	1.57E-02	2.08E-02	-5.08E-03
9.667	1.39E-02	1.99E-02	-6.06E-03
9.8	1.30E-02	1.91E-02	-6.08E-03
9.933	1.22E-02	1.83E-02	-6.15E-03
10.07	1.13E-02	1.75E-02	-6.22E-03
10.2	1.05E-02	1.68E-02	-6.36E-03
10.33	9.60E-03	1.61E-02	-6.54E-03
10.47	8.75E-03	1.54E-02	-6.70E-03
10.6	7.89E-03	1.48E-02	-6.93E-03
10.73	7.04E-03	1.42E-02	-7.19E-03
10.87	6.18E-03	1.36E-02	-7.43E-03
11	5.33E-03	1.31E-02	-7.74E-03
11.13	5.47E-03	1.26E-02	-7.08E-03
11.27	4.62E-03	1.20E-02	-7.39E-03
11.4	3.77E-03	1.15E-02	-7.77E-03
11.53	3.91E-03	1.11E-02	-7.16E-03
11.67	3.06E-03	1.06E-02	-7.55E-03
11.8	2.20E-03	1.02E-02	-7.99E-03
11.93	2.35E-03	9.78E-03	-7.43E-03
12.07	1.49E-03	9.37E-03	-7.87E-03
12.2	1.64E-03	9.00E-03	-7.36E-03
12.33	7.85E-04	8.64E-03	-7.86E-03
12.47	9.31E-04	8.28E-03	-7.35E-03

D1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 76
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : 0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1156E-05
DISPERSIVITY= 0.1652E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.3435
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7496E-03

THE F STATISTIC FOR NP= 3 NOBS= 76 IS: 2.74
THE CRITICAL RSS IS: 0.8340E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.16E-06	1.14E-06	1.17E-06
X(2)	1.65E-03	1.57E-03	1.75E-03
X(5)	3.44E-01	3.37E-01	3.50E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.200	1.14E-03	1.77E-03	-6.30E-04
2.867	2.33E-03	2.68E-03	-3.53E-04
3.000	4.51E-03	3.88E-03	6.34E-04
3.133	5.69E-03	5.40E-03	2.89E-04
3.267	7.88E-03	7.31E-03	5.64E-04
3.400	1.11E-02	9.59E-03	1.48E-03
3.533	1.42E-02	1.22E-02	2.00E-03
3.667	1.74E-02	1.53E-02	2.15E-03
3.800	2.16E-02	1.86E-02	2.98E-03
3.933	2.48E-02	2.23E-02	2.52E-03
4.067	2.90E-02	2.62E-02	2.81E-03
4.200	3.32E-02	3.02E-02	2.94E-03
4.333	3.74E-02	3.44E-02	2.99E-03
4.467	4.05E-02	3.86E-02	1.95E-03
4.600	4.47E-02	4.27E-02	1.99E-03
4.733	4.79E-02	4.68E-02	1.13E-03
4.867	5.11E-02	5.07E-02	3.96E-04
5.000	5.43E-02	5.44E-02	-9.96E-05
5.133	5.75E-02	5.78E-02	-3.30E-04
5.267	5.96E-02	6.09E-02	-1.30E-03
5.400	6.18E-02	6.37E-02	-1.93E-03
5.533	6.40E-02	6.62E-02	-2.21E-03
5.667	6.62E-02	6.84E-02	-2.17E-03
5.800	6.74E-02	7.01E-02	-2.75E-03
5.933	6.86E-02	7.15E-02	-2.96E-03
6.067	6.97E-02	7.26E-02	-2.84E-03
6.200	6.99E-02	7.35E-02	-3.38E-03
6.333	7.11E-02	7.37E-02	-2.57E-03
6.467	7.13E-02	7.38E-02	-2.47E-03
6.600	7.15E-02	7.35E-02	-2.07E-03
6.733	7.07E-02	7.31E-02	-2.42E-03
6.867	7.08E-02	7.23E-02	-1.51E-03
7.000	7.00E-02	7.14E-02	-1.38E-03
7.133	6.92E-02	7.03E-02	-1.05E-03
7.267	6.84E-02	6.89E-02	-5.44E-04
7.400	6.76E-02	6.75E-02	1.20E-04
7.533	6.68E-02	6.58E-02	6.07E-04
7.667	6.49E-02	6.41E-02	8.20E-04
7.800	6.41E-02	6.23E-02	1.82E-03
7.933	6.23E-02	6.04E-02	1.89E-03
8.067	6.15E-02	5.85E-02	3.03E-03
8.200	5.97E-02	5.65E-02	3.21E-03
8.333	5.79E-02	5.44E-02	3.41E-03
8.467	5.60E-02	5.24E-02	3.65E-03
8.600	5.42E-02	5.04E-02	3.86E-03
8.733	5.24E-02	4.83E-02	4.07E-03
8.867	4.96E-02	4.63E-02	3.29E-03
9.000	4.78E-02	4.43E-02	3.46E-03
9.133	4.60E-02	4.24E-02	3.60E-03
9.267	4.41E-02	4.04E-02	3.73E-03
9.400	4.13E-02	3.85E-02	2.79E-03
9.533	3.95E-02	3.67E-02	2.80E-03
9.667	3.77E-02	3.49E-02	2.79E-03
9.800	3.59E-02	3.32E-02	2.69E-03
9.933	3.31E-02	3.15E-02	1.55E-03
10.070	3.12E-02	2.98E-02	1.40E-03
10.200	2.94E-02	2.83E-02	1.10E-03
10.330	2.76E-02	2.69E-02	7.51E-04
10.470	2.58E-02	2.53E-02	4.57E-04
10.600	2.40E-02	2.40E-02	-1.38E-05
10.730	2.22E-02	2.27E-02	-5.30E-04
10.870	2.03E-02	2.14E-02	-1.02E-03
11.000	1.85E-02	2.02E-02	-1.66E-03
11.130	1.67E-02	1.91E-02	-2.34E-03
11.270	1.49E-02	1.79E-02	-3.01E-03
11.400	1.31E-02	1.69E-02	-3.81E-03
11.530	1.23E-02	1.59E-02	-3.65E-03
11.670	1.04E-02	1.49E-02	-4.48E-03
11.800	8.62E-03	1.40E-02	-5.42E-03
11.930	7.81E-03	1.32E-02	-5.41E-03
12.070	5.99E-03	1.24E-02	-6.38E-03
12.200	5.17E-03	1.16E-02	-6.46E-03
12.330	4.36E-03	1.09E-02	-6.57E-03
12.470	3.54E-03	1.01E-02	-7.08E-03
12.600	1.73E-03	9.59E-03	-7.87E-03
12.730	9.08E-04	9.00E-03	-8.10E-03

October 2005
D2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-01
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1193E-05
 DISPERSIVITY= 0.2251E-02
 WIDTH= 0.1000E-01
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1700E-02

THE F STATISTIC FOR NP= 2 NOBS= 87 IS: 1.24
 THE CRITICAL RSS IS: 0.1749E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.19E-06	1.19E-06	1.19E-06
X(2)	2.25E-03	2.16E-03	2.34E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.118	1.12E-03	4.05E-03	-2.93E-03
1.252	4.28E-03	6.86E-03	-2.58E-03
1.39E+00	7.44E-03	1.03E-02	-3.02E-03
1.518	1.36E-02	1.48E-02	-1.20E-03
1.65E+00	1.98E-02	1.98E-02	-5.92E-05
1.785	2.59E-02	2.53E-02	5.91E-04
1.918	3.41E-02	3.13E-02	2.83E-03
2.052	4.13E-02	3.75E-02	3.73E-03
2.185	4.84E-02	4.40E-02	4.46E-03
2.318	5.56E-02	5.05E-02	5.08E-03
2.452	6.17E-02	5.71E-02	4.61E-03
2.585	6.79E-02	6.37E-02	4.21E-03
2.718	7.31E-02	7.02E-02	2.89E-03
2.852	7.72E-02	7.66E-02	6.54E-04
2.985	8.14E-02	8.27E-02	-1.29E-03
3.118	8.45E-02	8.83E-02	-3.77E-03
3.252	8.67E-02	9.33E-02	-6.58E-03
3.385	8.99E-02	9.73E-02	-7.45E-03
3.518	9.10E-02	1.00E-01	-9.29E-03
3.652	9.22E-02	1.02E-01	-1.01E-02
3.785	9.33E-02	1.03E-01	-9.91E-03
3.918	9.45E-02	1.03E-01	-8.79E-03
4.052	9.47E-02	1.03E-01	-7.86E-03
4.185	9.48E-02	1.01E-01	-7.24E-03
4.318	9.40E-02	9.90E-02	-5.06E-03
4.452	9.21E-02	9.66E-02	-4.41E-03
4.585	9.13E-02	9.37E-02	-3.91E-03
4.718	8.95E-02	9.06E-02	-1.15E-03
4.852	8.76E-02	8.73E-02	3.33E-04
4.985	8.58E-02	8.39E-02	1.93E-03
5.118	8.40E-02	8.04E-02	3.59E-03
5.252	8.11E-02	7.68E-02	4.30E-03
5.385	7.83E-02	7.33E-02	4.98E-03
5.518	7.54E-02	6.98E-02	5.65E-03
5.652	7.16E-02	6.64E-02	5.22E-03
5.785	6.88E-02	6.30E-02	5.72E-03
5.918	6.59E-02	5.95E-02	6.22E-03
6.052	6.21E-02	5.66E-02	5.44E-03
6.185	5.82E-02	5.36E-02	4.63E-03
6.318	5.54E-02	5.07E-02	4.71E-03
6.452	5.16E-02	4.79E-02	3.68E-03
6.585	4.87E-02	4.52E-02	3.51E-03
6.718	4.59E-02	4.27E-02	3.21E-03
6.852	4.20E-02	4.02E-02	1.82E-03
6.985	3.92E-02	3.79E-02	1.28E-03
7.118	3.64E-02	3.57E-02	6.33E-04
7.252	3.35E-02	3.36E-02	-1.13E-04
7.385	3.07E-02	3.17E-02	-9.84E-04
7.518	2.88E-02	2.98E-02	-9.59E-04
7.652	2.60E-02	2.80E-02	-2.02E-03
7.785	2.42E-02	2.64E-02	-2.19E-03
7.918	2.13E-02	2.48E-02	-3.45E-03
8.052	1.95E-02	2.33E-02	-3.80E-03
8.185	1.87E-02	2.19E-02	-3.23E-03
8.318	1.68E-02	2.06E-02	-3.75E-03
8.452	1.50E-02	1.93E-02	-4.34E-03
8.585	1.41E-02	1.81E-02	-4.01E-03
8.718	1.23E-02	1.70E-02	-4.74E-03
8.852	1.15E-02	1.60E-02	-4.54E-03
8.985	9.61E-03	1.50E-02	-5.40E-03
9.118	8.77E-03	1.41E-02	-5.32E-03
9.252	7.94E-03	1.32E-02	-5.29E-03
9.385	7.10E-03	1.24E-02	-5.32E-03
9.518	6.26E-03	1.17E-02	-5.39E-03
9.652	5.42E-03	1.09E-02	-5.51E-03
9.785	5.58E-03	1.03E-02	-4.67E-03
9.918	4.74E-03	9.62E-03	-4.88E-03
10.05	3.90E-03	9.03E-03	-5.13E-03
10.19	3.15E-03	8.44E-03	-4.78E-03
10.32	3.22E-03	7.93E-03	-4.71E-03
10.45	3.38E-03	7.45E-03	-4.07E-03
10.59	2.54E-03	6.97E-03	-4.42E-03
10.72	2.71E-03	6.54E-03	-3.84E-03
10.85	1.87E-03	6.15E-03	-4.28E-03
10.99	2.03E-03	5.75E-03	-3.75E-03
11.12	1.19E-03	5.40E-03	-4.21E-03
11.25	1.35E-03	5.07E-03	-3.72E-03
11.39	1.51E-03	4.74E-03	-3.23E-03
11.52	1.67E-03	4.45E-03	-2.78E-03
11.65	8.31E-04	4.18E-03	-3.35E-03
11.79	9.92E-04	3.91E-03	-2.92E-03
11.92	1.15E-03	3.67E-03	-2.50E-03
12.05	1.31E-03	3.45E-03	-2.13E-03
12.19	4.75E-04	3.22E-03	-2.75E-03
12.32	6.36E-04	3.03E-03	-2.39E-03
12.45	7.97E-04	2.84E-03	-2.04E-03
12.59	9.58E-04	2.66E-03	-1.70E-03

D2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 101
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.301

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1255E-05
 DISPERSIVITY= 0.1349E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.3495
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4547E-03

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.4989E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.26E-06	1.26E-06	1.26E-06
X(2)	1.30E-03	1.30E-03	1.40E-03
X(5)	3.50E-01	3.46E-01	3.53E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.452	1.13E-03	6.12E-04	5.15E-04
2.585	1.30E-03	1.08E-03	2.19E-04
2.718	1.46E-03	1.78E-03	6.84E-04
2.852	3.63E-03	2.79E-03	8.43E-04
2.985	4.80E-03	4.17E-03	6.31E-04
3.118	6.96E-03	5.98E-03	9.88E-04
3.252	9.13E-03	8.26E-03	8.68E-04
3.385	1.23E-02	1.11E-02	1.25E-03
3.518	1.55E-02	1.44E-02	1.12E-03
3.652	1.96E-02	1.81E-02	1.50E-03
3.785	2.38E-02	2.24E-02	1.45E-03
3.918	2.90E-02	2.69E-02	2.02E-03
4.052	3.41E-02	3.18E-02	2.30E-03
4.185	3.93E-02	3.69E-02	2.39E-03
4.318	4.35E-02	4.21E-02	1.40E-03
4.452	4.86E-02	4.72E-02	1.41E-03
4.585	5.28E-02	5.23E-02	5.46E-04
4.718	5.80E-02	5.71E-02	8.95E-04
4.852	6.11E-02	6.16E-02	-4.63E-04
4.985	6.53E-02	6.58E-02	-4.49E-04
5.118	6.85E-02	6.95E-02	-1.01E-03
5.252	7.06E-02	7.27E-02	-2.10E-03
5.385	7.38E-02	7.55E-02	-1.69E-03
5.518	7.70E-02	7.77E-02	-2.77E-03
5.652	7.71E-02	7.95E-02	-2.33E-03
5.785	7.83E-02	8.07E-02	-2.37E-03
5.918	7.95E-02	8.14E-02	-1.92E-03
6.052	7.96E-02	8.16E-02	-1.99E-03
6.185	7.98E-02	8.14E-02	-1.62E-03
6.318	7.90E-02	8.08E-02	-1.93E-03
6.452	7.91E-02	7.98E-02	-6.74E-04
6.585	7.83E-02	7.85E-02	-1.79E-04
6.718	7.65E-02	7.69E-02	-3.87E-04
6.852	7.53E-02	7.50E-02	6.84E-04
6.985	7.38E-02	7.29E-02	9.34E-04
7.118	7.20E-02	7.06E-02	1.39E-03
7.252	7.02E-02	6.82E-02	1.99E-03
7.385	6.73E-02	6.56E-02	1.70E-03
7.518	6.55E-02	6.30E-02	2.49E-03
7.652	6.27E-02	6.03E-02	2.35E-03
7.785	5.98E-02	5.76E-02	2.23E-03
7.918	5.80E-02	5.49E-02	3.12E-03
8.052	5.52E-02	5.21E-02	3.00E-03
8.185	5.23E-02	4.95E-02	2.86E-03
8.318	4.95E-02	4.68E-02	2.66E-03
8.452	4.67E-02	4.42E-02	2.42E-03
8.585	4.38E-02	4.17E-02	2.10E-03
8.718	4.10E-02	3.93E-02	1.71E-03
8.852	3.82E-02	3.69E-02	1.24E-03
8.985	3.53E-02	3.47E-02	6.72E-04
9.118	3.25E-02	3.25E-02	1.77E-05
9.252	3.07E-02	3.04E-02	2.71E-04
9.385	2.78E-02	2.84E-02	-5.74E-04
9.518	2.60E-02	2.65E-02	-5.15E-04
9.652	2.32E-02	2.47E-02	-1.56E-03
9.785	2.13E-02	2.30E-02	-1.68E-03
9.918	1.95E-02	2.14E-02	-1.91E-03
10.050	1.77E-02	1.99E-02	-2.22E-03
10.190	1.58E-02	1.85E-02	-2.63E-03
10.320	1.50E-02	1.71E-02	-2.12E-03
10.450	1.32E-02	1.59E-02	-2.69E-03
10.590	1.13E-02	1.47E-02	-3.36E-03
10.720	1.05E-02	1.36E-02	-3.08E-03
10.850	9.66E-03	1.25E-02	-2.88E-03
10.990	7.83E-03	1.16E-02	-3.75E-03
11.120	6.99E-03	1.07E-02	-3.69E-03
11.250	6.16E-03	9.84E-03	-3.68E-03
11.390	5.33E-03	9.07E-03	-3.74E-03
11.520	4.50E-03	8.36E-03	-3.36E-03
11.650	4.66E-03	7.68E-03	-3.02E-03
11.790	3.83E-03	7.07E-03	-3.24E-03
11.920	3.42E-03	6.49E-03	-3.50E-03
12.050	2.16E-03	5.96E-03	-3.80E-03
12.190	2.33E-03	5.47E-03	-3.15E-03
12.320	1.72E-03	5.02E-03	-3.53E-03
12.450	6.64E-04	4.60E-03	-3.94E-03
12.590	8.31E-04	4.22E-03	-3.39E-03
12.720	-2.09E-06	3.87E-03	-3.87E-03
12.850	1.78E-02	1.18E-02	3.18E-03
11.080	1.40E-02	1.09E-02	3.09E-03
11.220	1.30E-02	1.01E-02	2.94E-03
11.350	1.25E-02	9.27E-03	2.73E-03
11.480	1.10E-02	8.54E-03	2.46E-03
11.620	1.00E-02	7.85E-03	2.15E-03
11.750	1.00E-02	7.22E-03	2.78E-03
11.880	9.04E-03	6.64E-03	2.36E-03
12.020	8.00E-03	6.10E-03	1.90E-03

October 2005
D3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1137E-05
 DISPERSIVITY= 0.2038E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4130
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2282E-02

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.2504E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.14E-06	1.13E-06	1.15E-06
X(2)	2.04E-03	1.90E-03	2.18E-03
X(5)	4.13E-01	4.05E-01	4.21E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.97	1.05E-03	3.14E-04	7.36E-04
1.103	2.12E-03	9.06E-04	1.21E-03
1.24E+00	4.30E-03	2.10E-03	2.10E-03
1.37	8.25E-03	4.06E-03	4.19E-03
1.50E+00	1.33E-02	7.02E-03	6.31E-03
1.637	1.86E-02	1.11E-02	8.30E-03
1.77	2.65E-02	1.83E-02	9.16E-03
1.903	3.25E-02	2.26E-02	9.89E-03
2.037	4.08E-02	3.01E-02	1.05E-02
2.17	4.77E-02	3.83E-02	9.36E-03
2.303	5.47E-02	4.71E-02	7.64E-03
2.437	6.18E-02	5.62E-02	5.63E-03
2.57	6.79E-02	6.50E-02	2.83E-03
2.703	7.39E-02	7.34E-02	4.77E-04
2.837	7.90E-02	8.12E-02	-2.22E-03
2.97	8.41E-02	8.80E-02	-3.96E-03
3.103	8.81E-02	9.39E-02	-5.73E-03
3.237	9.12E-02	9.87E-02	-7.47E-03
3.37	9.43E-02	1.02E-01	-8.14E-03
3.503	9.73E-02	1.05E-01	-7.82E-03
3.637	9.94E-02	1.07E-01	-7.55E-03
3.77	1.01E-01	1.08E-01	-7.37E-03
3.903	1.02E-01	1.08E-01	-6.53E-03
4.037	1.03E-01	1.08E-01	-4.89E-04
4.17	1.03E-01	1.06E-01	-3.67E-03
4.303	1.03E-01	1.05E-01	-2.03E-03
4.437	1.02E-01	1.02E-01	-5.70E-03
4.57	1.01E-01	1.00E-01	6.61E-04
4.703	9.99E-02	9.75E-02	2.39E-03
4.837	9.80E-02	9.40E-02	3.41E-03
4.97	9.61E-02	9.15E-02	4.56E-03
5.103	9.41E-02	8.83E-02	5.85E-03
5.237	9.12E-02	8.20E-02	6.20E-03
5.37	8.83E-02	8.16E-02	6.65E-03
5.503	8.53E-02	7.83E-02	7.08E-03
5.637	8.24E-02	7.49E-02	7.49E-03
5.77	7.95E-02	7.16E-02	7.90E-03
5.903	7.55E-02	6.83E-02	7.24E-03
6.037	7.16E-02	6.51E-02	6.50E-03
6.17	6.87E-02	6.19E-02	6.74E-03
6.303	6.47E-02	5.89E-02	5.84E-03
6.437	6.08E-02	5.59E-02	4.88E-03
6.57	5.79E-02	5.31E-02	4.79E-03
6.703	5.39E-02	5.03E-02	3.60E-03
6.837	5.10E-02	4.77E-02	3.33E-03
6.97	4.71E-02	4.51E-02	1.94E-03
7.103	4.41E-02	4.27E-02	1.44E-03
7.237	4.12E-02	4.04E-02	8.40E-04
7.37	3.83E-02	3.81E-02	1.29E-04
7.503	3.53E-02	3.60E-02	-6.84E-04
7.637	3.24E-02	3.40E-02	-1.59E-03
7.77	2.95E-02	3.21E-02	-2.60E-03
7.903	2.75E-02	3.03E-02	-2.71E-03
8.037	2.56E-02	2.85E-02	-2.91E-03
8.17	2.37E-02	2.69E-02	-3.20E-03
8.303	2.17E-02	2.53E-02	-3.57E-03
8.437	1.98E-02	2.38E-02	-4.01E-03
8.57	1.79E-02	2.24E-02	-4.56E-03
8.703	1.69E-02	2.11E-02	-4.17E-03
8.837	1.50E-02	1.96E-02	-4.84E-03
8.97	1.41E-02	1.87E-02	-4.60E-03
9.103	1.21E-02	1.76E-02	-5.42E-03
9.237	1.12E-02	1.65E-02	-5.29E-03
9.37	1.03E-02	1.55E-02	-5.23E-03
9.503	9.34E-03	1.46E-02	-5.24E-03
9.637	8.41E-03	1.37E-02	-5.28E-03
9.77	7.48E-03	1.29E-02	-5.39E-03
9.903	6.54E-03	1.21E-02	-5.54E-03
10.04	6.61E-03	1.13E-02	-4.72E-03
10.17	5.68E-03	1.07E-02	-4.97E-03
10.3	4.74E-03	1.00E-02	-5.27E-03
10.44	4.81E-03	9.37E-03	-4.56E-03
10.57	3.88E-03	8.81E-03	-4.93E-03
10.7	3.95E-03	8.28E-03	-4.33E-03
10.84	3.01E-03	7.74E-03	-4.73E-03
10.97	3.08E-03	7.27E-03	-4.19E-03
11.1	3.15E-03	6.83E-03	-3.69E-03
11.24	2.21E-03	6.31E-03	-4.18E-03
11.37	2.28E-03	6.00E-03	-3.72E-03
11.5	2.35E-03	5.64E-03	-3.29E-03
11.64	1.42E-03	5.27E-03	-3.73E-03
11.77	1.48E-03	4.95E-03	-3.47E-03
11.9	1.55E-03	4.65E-03	-3.10E-03
12.04	6.16E-04	4.34E-03	-3.40E-03
12.17	6.83E-04	4.08E-03	-3.39E-03
12.3	7.50E-04	3.83E-03	-3.08E-03
12.44	8.17E-04	3.56E-03	-2.76E-03

D3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1179E-05
 DISPERSIVITY= 0.1226E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4042
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.8209E-03

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
 THE CRITICAL RSS IS: 0.8919E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.18E-06	1.18E-06	1.18E-06
X(2)	1.23E-03	1.19E-03	1.26E-03
X(5)	4.04E-01	4.00E-01	4.08E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.103	1.09E-03	2.98E-03	-1.89E-03
3.203	2.24E-03	4.01E-03	-1.77E-03
3.303	4.30E-03	5.27E-03	-1.89E-03
3.403	8.25E-03	6.80E-03	-1.28E-03
3.503	1.33E-02	8.61E-03	-9.42E-04
3.603	1.86E-02	1.07E-02	-9.08E-04
3.703	2.65E-02	1.30E-02	-1.37E-04
3.803	3.25E-02	1.59E-02	2.45E-04
3.903	4.08E-02	1.89E-02	1.37E-03
4.003	4.77E-02	2.34E-02	2.22E-02
4.103	5.47E-02	2.58E-02	1.76E-03
4.203	6.18E-02	3.27E-02	2.96E-02
4.303	6.79E-02	3.68E-02	3.39E-02
4.403	7.39E-02	4.10E-02	3.78E-02
4.503	7.90E-02	4.51E-02	4.21E-02
4.603	8.41E-02	4.93E-02	4.65E-02
4.703	8.81E-02	5.44E-02	5.10E-02
4.803	9.12E-02	5.85E-02	5.54E-02
4.903	9.43E-02	6.17E-02	5.98E-02
5.003	9.73E-02	6.58E-02	6.41E-02
5.103	9.94E-02	6.90E-02	6.82E-02
5.203	1.01E-01	7.31E-02	7.22E-02
5.303	1.02E-01	7.63E-02	7.59E-02
5.403	1.03E-01	7.94E-02	7.94E-02
5.503	1.03E-01	8.15E-02	8.27E-02
5.603	1.03E-01	8.37E-02	8.56E-02
5.703	1.02E-01	8.58E-02	8.82E-02
5.803	1.00E-01	8.80E-02	9.06E-02
5.903	9.99E-02	9.01E-02	9.27E-02
6.003	9.80E-02	9.13E-02	9.43E-02
6.103	9.61E-02	9.24E-02	9.57E-02
6.203	9.41E-02	9.36E-02	9.68E-02
6.303	9.12E-02	9.37E-02	9.75E-02
6.403	8.83E-02	9.48E-02	9.79E-02
6.503	8.53E-02	9.50E-02	9.80E-02
6.603	8.24E-02	9.51E-02	9.79E-02
6.703	7.95E-02	9.53E-02	9.74E-02
6.803	7.55E-02	9.44E-02	9.68E-02
6.903	7.16E-02	9.46E-02	9.54E-02
7.003	6.87E-02	9.37E-02	9.47E-02
7.103	6.47E-02	9.29E-02	9.34E-02
7.203	6.08E-02	9.10E-02	9.10E-02
7.303	5.79E-02	9.01E-02	9.02E-02
7.403	5.39E-02	8.93E-02	8.84E-02
7.503	5.10E-02	8.74E-02	8.64E-02
7.603	4.71E-02	8.56E-02	8.44E-02
7.703	4.41E-02	8.37E-02	8.22E-02
7.803	4.12E-02	8.19E-02	8.19E-02
7.903	3.83E-02	8.00E-02	7.77E-02
8.003	3.53E-02	7.81E-02	7.54E-02
8.103	3.24E-02	7.63E-02	7.30E-02
8.203	2.95E-02	7.44E-02	7.06E-02
8.303	2.75E-02	7.16E-02	6.82E-02
8.403	2.56E-02	6.97E-02	6.58E-02
8.503	2.37E-02	6.69E-02	6.34E-02
8.603	2.17E-02	6.50E-02	6.10E-02
8.703	1.98E-02	6.22E-02	5.86E-02
8.803	1.79E-02	6.03E-02	5.63E-02
8.903	1.69E-02	5.74E-02	5.40E-02
9.003	1.50E-02	5.46E-02	5.17E-02
9.103	1.41E-02	5.27E-02	4.95E-02
9.203	1.21E-02	4.99E-02	4.73E-02
9.303	1.12E-02	4.80E-02	4.52E-02
9.403	1.03E-02	4.52E-02	4.31E-02
9.503	9.34E-03	4.33E-02	4.11E-02
9.603	8.41E-03	4.04E-02	3.92E-02
9.703	7.48E-03	3.86E-02	3.73E-02
9.803	6.54E-03	3.67E-02	3.55E-02
9.903	6.61E-03	3.39E-02	3.38E-02
10.000	5.68E-03	3.20E-02	3.21E-02
10.100	4.74E-03	3.02E-02	3.04E-02
10.200	4.81E-03	2.83E-02	2.89E-02
10.300	3.88E-03	2.65E-02	2.74E-02
10.400	3.95E-03	2.46E-02	2.59E-02
10.500	3.08E-03	2.27E-02	2.46E-02
10.600	3.08E-03	2.19E-02	2.32E-02
10.700	3.15E-03	2.00E-02	2.20E-02
10.800	2.21E-03	1.82E-02	2.08E-02
10.900	2.28E-03	1.73E-02	1.96E-02
11.000	2.35E-03	1.55E-02	1.85E-02
11.100	1.42E-03	1.37E-02	1.75E-02
11.200	1.48E-03	1.28E-02	1.65E-02
11.300	1.55E-03	1.19E-02	1.56E-02
11.400	6.16E-04	1.10E-02	1.47E-02
11.500	6.83E-04	9.18E-03	1.38E-02
11.600	7.50E-04	8.32E-03	1.30E-02
11.700	8.17E-04	7.47E-03	1.22E-02
11.800	8.81E-04	6.61E-03	1.15E-02
11.900	9.41E-04	5.75E-03	1.08E-02
12.000	9.94E-04	4.90E-03	1.02E-02
12.100	1.03E-03	4.04E-03	9.56E-03
12.200	1.03E-03	4.19E-03	8.98E-03
12.3	1.03E-03	3.33E-03	8.43E-03
12.4	1.03E-03	2.47E-03	7.91E-03
12.5	1.03		

October 2005
D4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1739E-05
DISPERSIVITY= 0.2228E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1298
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2695E-04

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
THE CRITICAL RSS IS: 0.2971E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.74E-06	1.74E-06	1.74E-06
X(2)	2.23E-03	2.18E-03	2.27E-03
X(5)	1.30E-01	1.29E-01	1.31E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.77	9.75E-04	4.46E-04	5.29E-04
0.87	9.38E-04	1.01E-03	-7.51E-05
0.70E-01	1.90E-03	1.90E-03	-4.05E-05
1.07	3.87E-03	3.29E-03	5.75E-04
1.17E+00	5.83E-03	5.08E-03	7.46E-04
1.27	7.73E-03	7.31E-03	4.80E-04
1.37	1.08E-02	9.93E-03	8.26E-04
1.47	1.37E-02	1.28E-02	8.86E-04
1.57	1.67E-02	1.59E-02	7.99E-04
1.67	1.97E-02	1.89E-02	7.23E-04
1.77	2.16E-02	2.18E-02	-2.00E-04
1.87	2.46E-02	2.44E-02	1.41E-04
1.97	2.65E-02	2.67E-02	-1.80E-04
2.07	2.75E-02	2.86E-02	-1.12E-03
2.17	2.95E-02	3.01E-02	-6.61E-04
2.27	3.04E-02	3.13E-02	-8.17E-04
2.37	3.14E-02	3.20E-02	-6.07E-04
2.47	3.13E-02	3.20E-02	-2.97E-04
2.57	3.13E-02	3.25E-02	-1.22E-03
2.67	3.23E-02	3.24E-02	-1.19E-04
2.77	3.12E-02	3.12E-02	3.27E-04
2.87	3.12E-02	3.15E-02	-2.83E-04
2.97	3.12E-02	3.08E-02	3.81E-04
3.07	3.01E-02	3.01E-02	1.62E-04
3.17	3.01E-02	2.91E-02	1.05E-03
3.27	2.91E-02	2.91E-02	1.01E-03
3.37	2.80E-02	2.80E-02	1.02E-03
3.47	2.70E-02	2.59E-02	1.06E-03
3.57	2.60E-02	2.48E-02	1.13E-03
3.67	2.49E-02	2.49E-02	1.20E-03
3.77	2.29E-02	2.26E-02	2.66E-04
3.87	2.19E-02	2.15E-02	3.23E-04
3.97	2.08E-02	2.08E-02	3.61E-04
4.07	1.98E-02	1.94E-02	3.74E-04
4.17	1.87E-02	1.84E-02	3.57E-04
4.27	1.77E-02	1.74E-02	3.10E-04
4.37	1.67E-02	1.64E-02	2.27E-04
4.47	1.56E-02	1.55E-02	1.08E-04
4.57	1.46E-02	1.46E-02	-4.84E-05
4.67	1.36E-02	1.38E-02	-2.42E-04
4.77	1.25E-02	1.30E-02	-4.75E-04
4.87	1.15E-02	1.22E-02	-7.46E-04
4.97	1.05E-02	1.15E-02	-1.05E-03
5.07	1.04E-02	1.08E-02	-3.98E-04
5.17	9.38E-03	1.02E-02	-7.78E-04
5.27	8.34E-03	9.54E-03	-1.19E-03
5.37	8.31E-03	8.95E-03	-6.42E-04
5.47	8.27E-03	8.39E-03	-1.24E-04
5.57	7.23E-03	7.87E-03	-6.36E-04
5.67	7.20E-03	7.38E-03	-1.78E-04
5.77	6.18E-03	6.91E-03	-7.49E-04
5.87	6.13E-03	6.47E-03	-3.47E-04
5.97	6.09E-03	6.06E-03	2.92E-05
6.07	5.05E-03	5.67E-03	-6.19E-04
6.17	5.02E-03	5.31E-03	-2.91E-04
6.27	4.98E-03	4.97E-03	1.46E-05
6.37	4.94E-03	4.64E-03	3.00E-04
6.47	3.91E-03	4.34E-03	-4.35E-04
6.57	3.87E-03	4.06E-03	-1.89E-04
6.67	3.83E-03	3.79E-03	3.98E-05
6.77	3.80E-03	3.55E-03	2.52E-04
6.87	3.76E-03	3.31E-03	4.48E-04
6.97	3.73E-03	3.10E-03	6.30E-04
7.07	2.69E-03	2.89E-03	-2.02E-04
7.17	2.65E-03	2.70E-03	-4.76E-05
7.27	2.62E-03	2.62E-03	9.47E-05
7.37	2.58E-03	2.36E-03	2.26E-04
7.47	2.54E-03	2.20E-03	3.46E-04
7.57	2.51E-03	2.05E-03	4.58E-04
7.67	2.47E-03	1.92E-03	5.56E-04
7.77	1.44E-03	1.79E-03	-3.53E-04
7.87	1.40E-03	1.67E-03	-2.70E-04
7.97	1.36E-03	1.56E-03	-1.94E-04
8.07	1.33E-03	1.45E-03	-1.27E-04
8.17	1.29E-03	1.36E-03	-6.66E-05
8.27	1.25E-03	1.27E-03	-1.09E-05
8.37	1.22E-03	1.18E-03	3.78E-05
8.47	1.18E-03	1.18E-03	8.97E-05
8.57	1.15E-03	1.03E-03	1.18E-04
8.67	1.11E-03	9.58E-04	1.51E-04
8.77	1.07E-03	8.93E-04	1.73E-04
8.87	1.04E-03	8.33E-04	2.03E-04
8.97	3.84E-13	7.77E-04	-7.77E-04

D4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1799E-05
DISPERSIVITY= 0.1642E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1219
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7449E-04

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.8093E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.80E-06	1.80E-06	1.80E-06
X(2)	1.64E-03	1.58E-03	1.72E-03
X(5)	1.22E-01	1.21E-01	1.23E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.270	9.93E-04	1.11E-05	9.82E-04
1.370	9.83E-04	3.00E-05	9.53E-04
1.470	1.97E-03	1.97E-03	7.03E-05
1.570	1.96E-03	1.47E-04	1.82E-03
1.670	1.95E-03	2.79E-04	1.67E-03
1.770	1.77E-03	4.84E-03	2.45E-03
1.870	2.93E-03	8.05E-04	2.13E-03
1.970	3.92E-03	1.25E-03	2.67E-03
2.070	3.91E-03	1.85E-03	2.06E-03
2.170	4.90E-03	2.61E-03	2.29E-03
2.270	5.89E-03	3.56E-03	2.33E-03
2.370	5.88E-03	4.68E-03	1.20E-03
2.470	6.87E-03	5.97E-03	8.97E-04
2.570	7.86E-03	7.41E-03	4.47E-04
2.670	8.85E-03	8.97E-03	8.75E-04
2.770	1.08E-02	1.06E-02	2.15E-04
2.870	1.18E-02	1.23E-02	-4.97E-04
2.970	1.38E-02	1.40E-02	-2.24E-04
3.070	1.48E-02	1.57E-02	-9.27E-04
3.170	1.68E-02	1.74E-02	-5.73E-04
3.270	1.78E-02	1.89E-02	-1.13E-03
3.370	1.98E-02	2.04E-02	-5.74E-04
3.470	2.08E-02	2.17E-02	-8.81E-04
3.570	2.18E-02	2.27E-02	-2.04E-03
3.670	2.28E-02	2.38E-02	-1.03E-03
3.770	2.37E-02	2.46E-02	-8.51E-04
3.870	2.47E-02	2.47E-02	-5.03E-04
3.970	2.57E-02	2.57E-02	-1.48E-05
4.070	2.67E-02	2.60E-02	-3.04E-04
4.170	2.67E-02	2.67E-02	-4.66E-04
4.270	2.67E-02	2.62E-02	5.20E-04
4.370	2.67E-02	2.60E-02	6.42E-04
4.470	2.57E-02	2.57E-02	1.12E-04
4.570	2.57E-02	2.54E-02	2.46E-04
4.670	2.56E-02	2.49E-02	7.03E-04
4.770	2.56E-02	2.47E-02	1.25E-03
4.870	2.46E-02	2.38E-02	8.62E-04
4.970	2.36E-02	2.31E-02	5.40E-04
5.070	2.36E-02	2.37E-02	-2.47E-05
5.170	2.26E-02	2.16E-02	1.04E-03
5.270	2.16E-02	2.08E-02	8.37E-04
5.370	2.06E-02	1.99E-02	6.57E-04
5.470	1.96E-02	1.91E-02	4.90E-04
5.570	1.86E-02	1.82E-02	3.28E-04
5.670	1.75E-02	1.74E-02	1.87E-04
5.770	1.65E-02	1.65E-02	-1.14E-07
5.870	1.55E-02	1.57E-02	-1.78E-04
5.970	1.45E-02	1.45E-02	-4.73E-04
6.070	1.35E-02	1.41E-02	-5.85E-04
6.170	1.35E-02	1.33E-02	1.82E-04
6.270	1.25E-02	1.26E-02	-7.58E-05
6.370	1.15E-02	1.18E-02	-3.58E-04
6.470	1.05E-02	1.11E-02	-6.68E-04
6.570	9.45E-03	1.05E-02	-1.01E-03
6.670	9.44E-03	9.81E-03	-3.72E-04
6.770	8.43E-03	9.20E-03	-7.67E-04
6.870	8.42E-03	8.61E-03	-1.91E-04
6.970	7.41E-03	8.05E-03	-6.45E-04
7.070	7.40E-03	7.52E-03	-1.26E-04
7.170	6.39E-03	7.02E-03	-6.36E-04
7.270	5.38E-03	6.55E-03	-1.17E-03
7.370	5.37E-03	6.10E-03	-7.36E-04
7.470	5.36E-03	5.68E-03	-3.25E-04
7.570	4.35E-03	5.29E-03	-9.39E-04
7.670	4.34E-03	4.91E-03	-5.77E-04
7.770	4.33E-03	4.58E-03	-2.38E-04
7.870	4.32E-03	4.24E-03	7.93E-05
7.970	3.31E-03	3.93E-03	-6.24E-04
8.070	3.30E-03	3.64E-03	-3.48E-04
8.170	3.28E-03	3.38E-03	-9.02E-05
8.270	3.27E-03	3.13E-03	1.50E-04
8.370	2.25E-03	2.89E-03	-3.73E-04
8.470	2.25E-03	2.67E-03	-4.21E-04
8.570	2.24E-03	2.47E-03	-2.29E-04
8.670	2.23E-03	2.23E-03	5.10E-05
8.770	2.22E-03	2.11E-03	1.14E-04
8.870	2.21E-03	1.95E-03	2.65E-04
8.970	2.20E-03	1.80E-03	4.06E-04
9.070	2.19E-03	1.66E-03	5.35E-04
9.170	2.18E-03	1.53E-03	6.54E-04
9.270	1.17E-03	1.41E-03	-2.36E-04
9.370	1.16E-03	1.30E-03	-1.35E-04
9.470	1.15E-03	1.19E-03	-4.30E-05
9.570	1.147E-03	1.10E-03	7.58E-05
9.670	1.13E-03	1.01E-03	1.19E-04
9.770	1.12E-03	9.30E-04	1.90E-04
9.870	1.114E-03	8.56E-04	2.84E-04
9.970	1.10E-03	7.86E-04	3.13E-04
10.070	1.09E-03	7.23E-04	3.67E-04
10.170	1.08E-03	6.64E-04	4.25E-04
10.270	1.07E-03	6.10E-04	4.59E-04
10.370	1.06E-03	5.60E-04	4.98E-04
10.47	1.05E-03	5.14E-04	5.35E-04
10.57	1.04E-03	4.72E-04	5.66E-04
10.67	1.03E-03	4.33E-04	5.95E-04
10.77	1.02E-03	3.97E-04	6.20E-04
10.87	1.01E-03	3.64E-04	6.43E-04

October 2005
E1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : 0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (1/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9226E-06
 DISPERSIVITY= 0.2839E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4586
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2359E-02

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71
 THE CRITICAL RSS IS: 0.2570E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.23E-07	9.13E-07	9.32E-07
X(2)	2.84E-03	2.70E-03	3.01E-03
X(5)	4.59E-01	4.49E-01	4.68E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.233	8.86E-04	1.46E-03	-5.77E-04
1.367	7.39E-04	2.81E-03	-2.07E-03
1.50E+00	4.79E-03	2.59E-03	2.19E-03
1.633	4.45E-03	7.51E-03	-3.06E-03
1.77E+00	8.30E-03	1.10E-02	-2.70E-03
1.9	1.53E-02	-2.12E-03	2.03E-03
2.033	2.00E-02	2.03E-02	-2.96E-04
2.167	2.89E-02	2.61E-02	2.80E-03
2.3	3.77E-02	3.25E-02	5.25E-03
2.433	4.56E-02	3.94E-02	6.19E-03
2.567	5.44E-02	4.66E-02	7.79E-03
2.7	5.40E-02	5.40E-02	0.00E-03
2.833	6.81E-02	6.13E-02	6.86E-03
2.967	7.40E-02	6.83E-02	5.72E-03
3.1	7.88E-02	7.48E-02	4.04E-03
3.233	8.37E-02	8.08E-02	2.90E-03
3.367	8.65E-02	8.61E-02	4.01E-04
3.5	9.04E-02	9.06E-02	-4.25E-04
3.633	9.22E-02	9.48E-02	-2.57E-03
3.767	9.41E-02	9.81E-02	-4.03E-03
3.9	9.60E-02	1.01E-01	-4.85E-03
4.033	9.68E-02	1.03E-01	-6.05E-03
4.167	9.77E-02	1.04E-01	-6.68E-03
4.3	9.85E-02	1.05E-01	-6.79E-03
4.433	9.94E-02	1.06E-01	-6.42E-03
4.567	9.92E-02	1.06E-01	-6.62E-03
4.7	9.91E-02	1.06E-01	-6.44E-03
4.833	9.89E-02	1.05E-01	-5.93E-03
4.967	9.88E-02	1.04E-01	-5.12E-03
5.1	9.86E-02	1.03E-01	-4.05E-03
5.233	9.79E-02	1.01E-01	-3.17E-03
5.367	9.73E-02	9.96E-02	-2.29E-03
5.5	9.62E-02	9.78E-02	-1.66E-03
5.633	9.50E-02	9.50E-02	0.00E-03
5.767	9.39E-02	9.39E-02	-1.75E-05
5.9	9.27E-02	9.18E-02	9.42E-04
6.033	9.16E-02	8.96E-02	1.97E-03
6.167	8.95E-02	8.74E-02	2.05E-03
6.3	8.83E-02	8.51E-02	3.16E-03
6.433	8.62E-02	8.29E-02	3.29E-03
6.567	8.50E-02	8.06E-02	4.44E-03
6.7	8.29E-02	7.83E-02	4.59E-03
6.833	8.07E-02	7.47E-02	6.96E-03
6.967	7.86E-02	7.37E-02	4.85E-03
7.1	7.64E-02	7.15E-02	4.95E-03
7.233	7.53E-02	6.93E-02	7.36E-03
7.367	7.31E-02	6.71E-02	6.07E-03
7.5	7.10E-02	6.49E-02	6.07E-03
7.633	6.88E-02	6.28E-02	6.04E-03
7.767	6.67E-02	6.07E-02	5.96E-03
7.9	6.45E-02	5.87E-02	5.84E-03
8.033	6.24E-02	5.67E-02	5.67E-03
8.167	6.02E-02	5.48E-02	5.46E-03
8.3	5.81E-02	5.29E-02	5.19E-03
8.433	5.60E-02	5.11E-02	4.88E-03
8.567	5.38E-02	4.93E-02	4.52E-03
8.7	5.17E-02	4.76E-02	4.11E-03
8.833	5.05E-02	4.59E-02	4.64E-03
8.967	4.84E-02	4.42E-02	4.13E-03
9.1	4.62E-02	4.26E-02	3.57E-03
9.233	4.41E-02	4.11E-02	2.99E-03
9.367	4.19E-02	3.96E-02	2.30E-03
9.5	4.08E-02	3.82E-02	2.60E-03
9.633	3.86E-02	3.68E-02	1.85E-03
9.767	3.65E-02	3.54E-02	1.05E-03
9.9	3.53E-02	3.41E-02	1.21E-03
10.03	3.32E-02	3.29E-02	3.20E-04
10.17	3.20E-02	3.16E-02	3.98E-04
10.3	2.99E-02	3.05E-02	-5.74E-04
10.43	2.87E-02	2.93E-02	-5.87E-04
10.57	2.66E-02	2.82E-02	-1.63E-03
10.7	2.55E-02	2.72E-02	-1.72E-03
10.83	2.43E-02	2.62E-02	-1.85E-03
10.97	2.22E-02	2.52E-02	-3.00E-03
11.1	2.10E-02	2.42E-02	-3.20E-03
11.23	1.99E-02	2.33E-02	-3.44E-03
11.37	1.87E-02	2.24E-02	-3.70E-03
11.5	1.76E-02	2.16E-02	-3.99E-03
11.63	1.54E-02	2.07E-02	-5.32E-03
11.97	1.41E-02	1.98E-02	-4.76E-03
12.1	1.29E-02	1.81E-02	-5.19E-03
12.23	1.18E-02	1.74E-02	-5.65E-03
12.37	1.06E-02	1.67E-02	-6.12E-03
12.5	9.47E-03	1.61E-02	-6.63E-03
12.63	8.32E-03	1.55E-02	-7.16E-03
12.77	7.17E-03	1.49E-02	-7.71E-03
12.9	6.03E-03	1.43E-02	-8.28E-03
13.03	5.88E-03	1.38E-02	-7.88E-03
13.17	4.73E-03	1.32E-02	-8.49E-03
13.3	3.58E-03	1.27E-02	-9.13E-03
13.43	2.44E-03	1.22E-02	-9.79E-03
13.57	2.29E-03	1.18E-02	-9.46E-03
13.7	1.14E-03	1.13E-02	-1.02E-02
13.83	-3.68E-06	1.09E-02	-1.09E-02

E1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : 0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (1/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1061E-05
 DISPERSIVITY= 0.2400E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.6325
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3583E-03

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
 THE CRITICAL RSS IS: 0.3907E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.06E-06	1.06E-06	1.06E-06
X(2)	2.40E-03	2.38E-03	2.45E-03
X(5)	6.33E-01	6.33E-01	6.33E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.367	1.00E-03	1.61E-06	9.98E-04
1.500	1.00E-03	6.48E-06	9.94E-04
1.633	1.00E-03	2.08E-05	9.79E-04
1.767	1.00E-03	5.62E-05	9.44E-04
1.900	2.00E-03	1.31E-04	1.87E-03
2.033	2.00E-03	2.03E-04	1.73E-03
2.167	3.00E-03	5.21E-04	2.48E-03
2.300	3.00E-03	9.17E-04	2.08E-03
2.433	2.43E-03	1.51E-03	1.49E-03
2.567	4.00E-03	2.38E-03	1.63E-03
2.700	5.00E-03	3.55E-03	1.45E-03
2.833	5.00E-03	5.09E-03	1.52E-03
2.967	7.00E-03	7.06E-03	-6.06E-05
3.100	8.00E-03	9.48E-03	-1.48E-03
3.233	8.00E-03	1.24E-02	-2.37E-03
3.367	1.20E-02	1.58E-02	-3.77E-03
3.500	1.60E-02	1.96E-02	-3.62E-03
3.633	1.90E-02	2.39E-02	-4.91E-03
3.767	2.40E-02	2.86E-02	-4.63E-03
3.900	2.90E-02	3.37E-02	-4.65E-03
4.033	3.50E-02	3.90E-02	-3.95E-03
4.167	4.10E-02	4.45E-02	-3.48E-03
4.300	4.80E-02	5.01E-02	-2.10E-03
4.433	5.40E-02	5.58E-02	-1.77E-03
4.567	6.10E-02	6.15E-02	-4.54E-04
4.700	6.80E-02	6.70E-02	9.93E-04
4.833	7.40E-02	7.24E-02	1.59E-03
4.967	8.00E-02	7.78E-02	2.42E-03
5.100	8.50E-02	8.26E-02	2.43E-03
5.233	9.00E-02	8.72E-02	2.78E-03
5.367	9.50E-02	9.17E-02	3.14E-03
5.500	9.90E-02	9.55E-02	3.47E-03
5.633	1.02E-01	9.91E-02	2.88E-03
5.767	1.05E-01	1.02E-01	2.88E-03
5.900	1.08E-01	1.05E-01	2.80E-03
6.033	1.10E-01	1.08E-01	2.36E-03
6.167	1.12E-01	1.10E-01	2.19E-03
6.300	1.13E-01	1.11E-01	1.59E-03
6.433	1.14E-01	1.13E-01	1.26E-03
6.567	1.15E-01	1.14E-01	1.27E-03
6.700	1.15E-01	1.14E-01	6.32E-04
6.833	1.15E-01	1.15E-01	3.05E-04
6.967	1.14E-01	1.14E-01	-7.22E-04
7.100	1.14E-01	1.15E-01	-4.68E-04
7.233	1.13E-01	1.14E-01	-9.54E-04
7.367	1.12E-01	1.13E-01	-1.19E-03
7.500	1.10E-01	1.12E-01	-2.22E-03
7.633	1.09E-01	1.11E-01	-2.04E-03
7.767	1.08E-01	1.10E-01	-1.67E-03
7.900	1.08E-01	1.08E-01	-2.14E-03
8.033	1.04E-01	1.07E-01	-2.47E-03
8.167	1.02E-01	1.05E-01	-2.65E-03
8.300	1.00E-01	1.03E-01	-2.73E-03
8.433	9.80E-02	1.01E-01	-2.71E-03
8.567	9.70E-02	9.86E-02	-1.59E-03
8.700	9.40E-02	9.64E-02	-2.42E-03
8.833	9.20E-02	9.42E-02	-2.18E-03
8.967	9.00E-02	9.19E-02	-1.89E-03
9.100	8.80E-02	8.96E-02	-1.57E-03
9.233	8.60E-02	8.72E-02	-1.23E-03
9.367	8.40E-02	8.49E-02	-8.52E-04
9.500	8.20E-02	8.25E-02	-4.85E-04
9.633	8.00E-02	8.01E-02	-1.17E-04
9.767	7.70E-02	7.77E-02	-7.38E-04
9.900	7.50E-02	7.54E-02	-3.89E-04
10.030	7.30E-02	7.31E-02	-1.12E-04
10.170	7.10E-02	7.07E-02	3.17E-04
10.300	6.90E-02	6.85E-02	5.44E-04
10.430	6.70E-02	6.63E-02	7.40E-04
10.570	6.50E-02	6.39E-02	1.07E-03
10.700	6.30E-02	6.18E-02	1.19E-03
10.830	6.10E-02	5.97E-02	1.28E-03
10.970	5.90E-02	5.75E-02	1.47E-03
11.100	5.70E-02	5.55E-02	1.47E-03
11.230	5.50E-02	5.36E-02	1.42E-03
11.370	5.30E-02	5.15E-02	1.47E-03
11.500	5.10E-02	4.97E-02	1.33E-03
11.630	4.90E-02	4.79E-02	1.14E-03
11.770	4.70E-02	4.60E-02	1.03E-03
11.900	4.60E-02	4.43E-02	1.74E-03
12.030	4.40E-02	4.26E-02	1.40E-03
12.170	4.20E-02	4.09E-02	1.13E-03
12.300	4.00E-02	3.93E-02	6.95E-04
12.430	3.80E-02	3.74E-02	1.33E-03
12.570	3.90E-02	3.78E-02	1.21E-03
12.700	3.70E-02	3.62E-02	7.85E-04
12.830	3.60E-02	3.48E-02	1.20E-03
12.970	3.40E-02	3.34E-02	6.19E-04
13.100	3.30E-02	3.20E-02	9.98E-04
13.230	3		

October 2005
E2_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1850E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8075E-06
 DISPERSIVITY= 0.2600E-02
 WIDTH= 0.1000E-02
 Rf= 1.000
 CO= 3.465
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1208E-01

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
 THE CRITICAL RSS IS: 0.1327E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.08E-07	7.91E-07	8.24E-07
X(2)	2.50E-03	2.37E-03	2.61E-03
X(5)	3.47E+00	3.36E+00	3.57E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.4667	1.00E-03	1.60E-09	1.00E-03
0.6333	2.00E-03	5.50E-05	1.85E-03
8.00E-01	3.00E-03	1.85E-05	2.98E-03
0.9667	6.00E-03	1.79E-04	5.82E-03
1.13E+00	1.31E-02	2.83E-03	1.42E-02
1.3	1.70E-02	2.83E-03	1.42E-02
1.467	2.60E-02	6.76E-03	1.92E-02
1.633	6.90E-02	4.53E-02	2.07E-02
1.8	4.50E-02	2.19E-02	2.31E-02
1.967	5.60E-02	3.29E-02	2.31E-02
2.133	6.90E-02	4.53E-02	2.07E-02
2.3	7.60E-02	5.88E-02	1.72E-02
2.467	8.60E-02	7.25E-02	1.35E-02
2.633	9.50E-02	8.60E-02	9.03E-03
2.8	1.03E-01	8.99E-02	4.13E-03
2.967	1.11E-01	1.11E-01	1.70E-04
3.133	1.34E-01	1.22E-01	-3.59E-03
3.3	1.24E-01	1.31E-01	-7.15E-03
3.467	1.29E-01	1.39E-01	-1.04E-02
3.633	1.34E-01	1.46E-01	-1.23E-02
3.8	1.39E-01	1.52E-01	-1.30E-02
3.967	1.42E-01	1.57E-01	-1.45E-02
4.133	1.45E-01	1.60E-01	-1.48E-02
4.3	1.48E-01	1.64E-01	-1.51E-02
4.467	1.50E-01	1.64E-01	-1.35E-02
4.633	1.52E-01	1.64E-01	-1.20E-02
4.8	1.53E-01	1.64E-01	-1.08E-02
4.967	1.54E-01	1.63E-01	-8.93E-03
5.133	1.54E-01	1.62E-01	-7.49E-03
5.3	1.54E-01	1.60E-01	-5.84E-03
5.467	1.54E-01	1.57E-01	-3.16E-03
5.633	1.54E-01	1.54E-01	-4.43E-04
5.8	1.53E-01	1.51E-01	-1.60E-03
5.967	1.52E-01	1.48E-01	3.89E-03
6.133	1.50E-01	1.45E-01	5.35E-03
6.3	1.48E-01	1.41E-01	7.00E-03
6.467	1.46E-01	1.37E-01	8.77E-03
6.633	1.44E-01	1.33E-01	1.06E-02
6.8	1.38E-01	1.28E-01	1.15E-02
6.967	1.39E-01	1.26E-01	1.35E-02
7.133	1.35E-01	1.22E-01	1.34E-02
7.3	1.32E-01	1.18E-01	1.44E-02
7.467	1.29E-01	1.14E-01	1.53E-02
7.633	1.25E-01	1.10E-01	1.52E-02
7.8	1.21E-01	1.06E-01	1.50E-02
7.967	1.17E-01	1.02E-01	1.48E-02
8.133	1.13E-01	9.85E-02	1.45E-02
8.3	1.08E-01	9.49E-02	1.31E-02
8.467	1.04E-01	9.14E-02	1.26E-02
8.633	1.00E-01	8.79E-02	1.21E-02
8.8	9.50E-02	8.46E-02	1.05E-02
8.967	9.10E-02	8.13E-02	9.74E-03
9.133	8.60E-02	7.81E-02	7.90E-03
9.3	8.20E-02	7.50E-02	7.00E-03
9.467	7.70E-02	7.20E-02	4.99E-03
9.633	7.30E-02	6.91E-02	3.87E-03
9.8	6.90E-02	6.63E-02	2.68E-03
9.967	6.50E-02	6.36E-02	1.39E-03
10.13	6.10E-02	6.11E-02	-5.58E-05
10.3	5.70E-02	5.95E-02	-1.49E-03
10.47	5.30E-02	5.60E-02	-3.01E-03
10.63	5.00E-02	5.38E-02	-3.76E-03
10.8	4.60E-02	5.15E-02	-5.46E-03
10.97	4.30E-02	4.93E-02	-6.25E-03
11.13	4.00E-02	4.72E-02	-7.24E-03
11.3	3.70E-02	4.52E-02	-8.20E-03
11.47	3.50E-02	4.32E-02	-8.23E-03
11.63	3.20E-02	4.15E-02	-9.45E-03
11.8	3.00E-02	3.96E-02	-9.63E-03
11.97	2.80E-02	3.79E-02	-9.89E-03
12.13	2.60E-02	3.63E-02	-1.03E-02
12.3	2.40E-02	3.47E-02	-1.07E-02
12.47	2.20E-02	3.32E-02	-1.12E-02
12.63	2.10E-02	3.18E-02	-1.08E-02
12.8	1.90E-02	3.04E-02	-1.14E-02
12.97	1.80E-02	2.90E-02	-1.10E-02
13.13	1.70E-02	2.78E-02	-1.08E-02
13.3	1.60E-02	2.66E-02	-1.06E-02
13.47	1.50E-02	2.54E-02	-1.04E-02
13.63	1.40E-02	2.43E-02	-1.03E-02
13.8	1.30E-02	2.32E-02	-1.02E-02
13.97	1.20E-02	2.20E-02	-1.00E-02
14.13	1.10E-02	2.09E-02	-9.89E-03
14.23	1.00E-02	1.98E-02	-9.79E-03
14.4	1.15E-05	1.97E-02	-1.97E-02

E2_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2900E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8054E-06
 DISPERSIVITY= 0.2874E-02
 WIDTH= 0.5000E-02
 Rf= 1.000
 CO= 0.7706
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2088E-02

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.2273E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.05E-07	7.97E-07	8.14E-07
X(2)	2.67E-03	2.59E-03	2.76E-03
X(5)	7.71E-01	7.63E-01	7.78E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.052	1.00E-03	5.32E-09	1.00E-03
1.218	1.00E-03	1.55E-08	1.00E-03
1.318	2.00E-03	3.61E-07	2.00E-03
1.452	3.00E-03	1.69E-06	3.00E-03
1.585	4.00E-03	6.89E-06	2.99E-03
1.718	4.00E-03	1.77E-05	3.98E-03
1.852	4.00E-03	4.47E-05	3.96E-03
1.985	9.91E-03	9.91E-05	4.90E-03
2.118	6.00E-03	1.99E-04	5.80E-03
2.252	6.00E-03	3.68E-04	5.63E-03
2.385	7.00E-03	6.33E-04	6.37E-03
2.518	8.00E-03	1.03E-03	6.97E-03
2.652	9.00E-03	1.60E-03	7.41E-03
2.785	1.00E-02	2.39E-03	7.64E-03
2.918	1.0E-02	3.37E-03	7.63E-03
3.052	1.20E-02	4.68E-03	7.32E-03
3.185	1.40E-02	6.29E-03	7.71E-03
3.318	1.60E-02	8.25E-03	7.75E-03
3.452	1.80E-02	1.06E-02	7.39E-03
3.585	2.10E-02	1.33E-02	6.87E-03
3.718	2.30E-02	1.65E-02	6.64E-03
3.852	2.60E-02	2.00E-02	5.98E-03
3.985	3.00E-02	2.39E-02	6.07E-03
4.118	3.30E-02	2.82E-02	5.11E-03
4.252	3.70E-02	3.29E-02	4.15E-03
4.385	4.20E-02	3.78E-02	4.25E-03
4.518	4.60E-02	4.29E-02	3.11E-03
4.652	5.10E-02	4.83E-02	2.73E-03
4.785	5.60E-02	5.38E-02	2.24E-03
4.918	6.10E-02	5.94E-02	1.66E-03
5.052	6.60E-02	6.50E-02	9.88E-04
5.185	7.10E-02	7.06E-02	3.71E-04
5.318	7.60E-02	7.62E-02	-1.92E-04
5.452	8.10E-02	8.17E-02	-6.98E-04
5.585	8.60E-02	8.70E-02	-1.03E-03
5.718	9.00E-02	9.22E-02	-2.18E-03
5.852	9.50E-02	9.72E-02	-2.18E-03
5.985	9.90E-02	1.02E-01	-2.91E-03
6.118	1.03E-01	1.03E-01	-3.39E-03
6.252	1.07E-01	1.11E-01	-3.63E-03
6.385	1.11E-01	1.15E-01	-3.56E-03
6.518	1.15E-01	1.14E-01	-4.20E-03
6.652	1.18E-01	1.22E-01	-3.58E-03
6.785	1.21E-01	1.25E-01	-3.62E-03
6.918	1.25E-01	1.27E-01	-3.37E-03
7.052	1.28E-01	1.30E-01	-3.84E-03
7.185	1.28E-01	1.32E-01	-3.99E-03
7.318	1.30E-01	1.30E-01	-3.86E-03
7.452	1.32E-01	1.35E-01	-3.45E-03
7.585	1.34E-01	1.37E-01	-2.76E-03
7.718	1.35E-01	1.38E-01	-2.80E-03
7.852	1.36E-01	1.39E-01	-2.60E-03
7.985	1.37E-01	1.39E-01	-2.14E-03
8.118	1.38E-01	1.40E-01	-1.46E-03
8.252	1.39E-01	1.40E-01	-5.52E-04
8.385	1.39E-01	1.39E-01	-4.37E-04
8.518	1.39E-01	1.39E-01	-1.26E-04
8.652	1.39E-01	1.39E-01	3.74E-04
8.785	1.39E-01	1.38E-01	1.04E-03
8.918	1.39E-01	1.37E-01	1.87E-03
9.052	1.39E-01	1.36E-01	2.86E-03
9.185	1.38E-01	1.35E-01	2.98E-03
9.318	1.37E-01	1.34E-01	3.22E-03
9.452	1.36E-01	1.32E-01	3.60E-03
9.585	1.35E-01	1.31E-01	4.07E-03
9.718	1.34E-01	1.29E-01	4.63E-03
9.852	1.33E-01	1.28E-01	5.30E-03
9.985	1.31E-01	1.26E-01	5.03E-03
10.120	1.29E-01	1.24E-01	4.87E-03
10.250	1.28E-01	1.22E-01	5.69E-03
10.390	1.26E-01	1.20E-01	5.72E-03
10.520	1.23E-01	1.18E-01	4.64E-03
10.650	1.21E-01	1.16E-01	4.61E-03
10.790	1.19E-01	1.14E-01	4.76E-03
10.920	1.17E-01	1.12E-01	4.79E-03
11.050	1.15E-01	1.10E-01	4.84E-03
11.190	1.11E-01	1.08E-01	3.07E-03
11.320	1.09E-01	1.06E-01	3.15E-03
11.450	1.07E-01	1.04E-01	3.22E-03
11.590	1.03E-01	1.02E-01	1.49E-03
11.930	1.00E-01	9.61E-02	3.95E-03
12.270	9.38E-02	9.38E-02	1.19E-03
12.200	9.40E-02	9.18E-02	2.25E-03
12.330	9.10E-02	8.97E-02	1.30E-03
12.470	8.70E-02	8.70E-02	-5.05E-04
12.600	8.40E-02	8.55E-02	-1.49E-03
12.730	8.10E-02	8.35E-02	-2.50E-03
12.870	7.80E-02	8.14E-02	-3.37E-03
13.000	7.40E-02	7.94E-02	-5.43E-03
13.130	7.10E-02	7.75E-02	-6.50E-03
13.270	6.80E-02	7.55E-02	-7.46E-03
13.400	6.50E-02	7.36E-02	-8.59E-03
13.530	6.20E-02	7.18E-02	-9.76E-03
13.670	5.90E-02	6.99E-02	-1.08E-02
13.8	5.50E-02	6.80E-02	-1.30E-02

October 2005
E3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 99
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9232E-06
 DISPERSIVITY= 0.2093E-02
 WIDTH= 0.5000E-02
 RF= 1.00
 CO= 0.4092
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2609E-02

THE F STATISTIC FOR NP= 3 NOBS= 99 IS: 2.71
 THE CRITICAL RSS IS: 0.2829E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.23E-07	9.14E-07	9.32E-07
X(3)	1.97E-03	1.93E-03	2.02E-03
X(5)	4.09E-01	4.01E-01	4.17E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.6667	9.27E-04	4.52E-07	9.26E-04
0.8	8.26E-04	5.07E-06	8.20E-04
9.33E-01	1.73E-03	3.47E-05	1.69E-03
1.067	1.62E-03	1.35E-04	1.49E-03
1.20E+00	1.20E-03	2.52E-03	2.30E-03
1.333	4.42E-03	9.07E-04	3.51E-03
1.467	5.32E-03	1.81E-03	3.51E-03
1.6	9.22E-03	3.23E-03	4.99E-03
1.733	1.11E-02	5.25E-03	5.87E-03
1.867	1.40E-02	7.95E-03	6.07E-03
2	1.89E-02	1.14E-02	7.63E-03
2.133	2.38E-02	1.56E-02	8.24E-03
2.267	2.97E-02	2.05E-02	9.21E-03
2.4	3.56E-02	3.56E-02	9.48E-03
2.533	4.15E-02	3.24E-02	9.13E-03
2.667	4.74E-02	3.91E-02	8.28E-03
2.8	5.33E-02	4.62E-02	7.11E-03
2.933	5.92E-02	5.34E-02	5.81E-03
3.067	6.41E-02	6.06E-02	3.55E-03
3.2	6.90E-02	6.75E-02	1.53E-03
3.333	7.39E-02	7.40E-02	-1.02E-04
3.467	7.78E-02	8.01E-02	-2.24E-03
3.6	8.17E-02	8.55E-02	-3.79E-03
3.733	8.56E-02	9.03E-02	-4.69E-03
3.867	8.95E-02	9.44E-02	-4.97E-03
4	9.14E-02	9.79E-02	-6.48E-03
4.133	9.33E-02	1.01E-01	-7.36E-03
4.267	9.52E-02	1.03E-01	-7.61E-03
4.4	9.71E-02	1.04E-01	-7.24E-03
4.533	9.80E-02	1.05E-01	-7.30E-03
4.667	9.89E-02	1.05E-01	-6.85E-03
4.8	9.98E-02	1.06E-01	-5.92E-03
4.933	1.01E-01	1.05E-01	-4.56E-03
5.067	1.01E-01	1.04E-01	-3.83E-03
5.2	1.01E-01	1.03E-01	-2.76E-03
5.333	1.00E-01	1.02E-01	-1.39E-03
5.467	9.93E-02	1.01E-01	-7.78E-04
5.6	9.92E-02	9.81E-02	1.05E-03
5.733	9.81E-02	9.60E-02	2.05E-03
5.867	9.60E-02	9.30E-02	2.21E-03
6	9.49E-02	9.14E-02	3.48E-03
6.133	9.38E-02	8.89E-02	4.84E-03
6.267	9.17E-02	8.64E-02	6.27E-03
6.4	8.96E-02	8.38E-02	7.57E-03
6.533	8.75E-02	8.12E-02	8.29E-03
6.667	8.54E-02	7.81E-02	8.77E-03
6.8	8.23E-02	7.59E-02	6.35E-03
6.933	8.02E-02	7.33E-02	6.87E-03
7.067	7.81E-02	7.07E-02	8.17E-03
7.2	7.50E-02	6.81E-02	6.84E-03
7.333	7.19E-02	6.58E-02	6.28E-03
7.467	6.98E-02	6.31E-02	6.67E-03
7.6	6.67E-02	6.07E-02	6.00E-03
7.733	6.36E-02	5.83E-02	5.29E-03
7.867	6.15E-02	5.60E-02	5.52E-03
8	5.84E-02	5.37E-02	4.68E-03
8.133	5.53E-02	5.15E-02	3.78E-03
8.267	5.32E-02	4.94E-02	3.82E-03
8.4	5.01E-02	4.73E-02	2.79E-03
8.533	4.80E-02	4.53E-02	2.70E-03
8.667	4.49E-02	4.33E-02	1.54E-03
8.8	4.28E-02	4.15E-02	1.31E-03
8.933	4.07E-02	3.96E-02	1.02E-03
9.067	3.76E-02	3.79E-02	-3.38E-04
9.2	3.55E-02	3.62E-02	-7.60E-04
9.333	3.34E-02	3.46E-02	-1.25E-03
9.467	3.13E-02	3.31E-02	-1.79E-03
9.6	3.02E-02	3.16E-02	-1.40E-03
9.733	2.81E-02	3.01E-02	-2.07E-03
9.867	2.60E-02	2.88E-02	-2.80E-03
10	2.49E-02	2.74E-02	-2.58E-03
10.13	2.28E-02	2.62E-02	-3.42E-03
10.27	2.17E-02	2.50E-02	-3.30E-03
10.4	1.96E-02	2.38E-02	-4.24E-03
10.53	1.85E-02	2.27E-02	-4.24E-03
10.67	1.74E-02	2.16E-02	-4.27E-03
10.8	1.63E-02	2.06E-02	-4.35E-03
10.93	1.52E-02	1.96E-02	-4.49E-03
11.07	1.41E-02	1.87E-02	-4.65E-03
11.2	1.30E-02	1.78E-02	-4.30E-03
11.33	1.19E-02	1.70E-02	-5.12E-03
11.47	1.08E-02	1.62E-02	-5.41E-03
11.6	9.64E-03	1.54E-02	-5.74E-03
11.73	9.54E-03	1.47E-02	-5.10E-03
11.87	8.44E-03	1.39E-02	-5.50E-03
12	7.34E-03	1.31E-02	-5.15E-03
12.13	7.24E-03	1.26E-02	-5.39E-03
12.27	6.14E-03	1.20E-02	-5.88E-03
12.4	6.04E-03	1.14E-02	-5.40E-03
12.53	4.94E-03	1.09E-02	-5.94E-03
12.67	4.84E-03	1.04E-02	-5.51E-03
12.8	3.74E-03	9.84E-03	-5.11E-03
12.93	3.63E-03	9.36E-03	-5.73E-03
13.07	2.53E-03	8.90E-03	-6.37E-03
13.2	2.43E-03	8.47E-03	-6.04E-03
13.33	1.33E-03	8.06E-03	-6.72E-03
13.47	1.23E-03	7.66E-03	-6.43E-03
13.6	1.13E-03	7.26E-03	-6.15E-03
13.73	1.03E-03	6.93E-03	-5.90E-03

E3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8663E-06
 DISPERSIVITY= 0.1577E-02
 WIDTH= 0.5000E-02
 RF= 1.00
 CO= 0.3577
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5522E-03

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
 THE CRITICAL RSS IS: 0.6040E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.63E-07	8.63E-07	8.63E-07
X(3)	1.97E-03	1.58E-03	1.71E-03
X(5)	3.58E-01	3.54E-01	3.61E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.770	1.00E-03	1.76E-08	1.00E-03
1.903	1.00E-03	8.03E-08	1.00E-03
2.037	1.00E-03	3.01E-07	1.00E-03
2.170	2.00E-03	9.49E-07	2.00E-03
2.303	2.00E-03	2.61E-06	2.00E-03
2.437	2.00E-03	6.42E-06	1.99E-03
2.570	3.00E-03	1.43E-05	2.99E-03
2.703	2.70E-03	2.94E-05	2.97E-03
2.837	3.00E-03	5.64E-05	2.94E-03
2.970	4.00E-03	1.02E-04	3.90E-03
3.103	3.10E-03	1.73E-04	3.83E-03
3.237	4.00E-03	2.83E-04	3.72E-03
3.370	5.00E-03	4.42E-04	4.56E-03
3.503	6.00E-03	6.67E-04	4.93E-03
3.637	6.00E-03	9.73E-04	5.03E-03
3.770	6.00E-03	1.38E-03	4.62E-03
3.903	7.00E-03	1.90E-03	4.10E-03
4.037	7.00E-03	2.57E-03	4.43E-03
4.170	8.00E-03	3.38E-03	4.62E-03
4.303	9.00E-03	4.37E-03	4.63E-03
4.437	1.00E-02	5.55E-03	4.45E-03
4.570	1.10E-02	6.93E-03	4.08E-03
4.703	1.20E-02	8.50E-03	3.50E-03
4.837	1.40E-02	1.03E-02	3.71E-03
4.970	1.50E-02	1.21E-02	3.71E-03
5.103	1.70E-02	1.45E-02	2.52E-03
5.237	1.90E-02	1.69E-02	2.13E-03
5.370	2.10E-02	1.94E-02	1.57E-03
5.503	2.40E-02	2.22E-02	1.85E-03
5.637	2.60E-02	2.50E-02	9.89E-04
5.770	2.90E-02	2.80E-02	1.82E-03
5.903	3.10E-02	3.10E-02	-3.95E-05
6.037	3.40E-02	3.42E-02	-1.58E-04
6.170	3.83E-02	3.79E-02	-4.58E-04
6.303	4.00E-02	4.05E-02	-4.58E-04
6.437	4.20E-02	4.36E-02	-1.59E-03
6.570	4.78E-02	4.57E-02	-7.78E-04
6.703	4.80E-02	4.97E-02	-1.68E-03
6.837	5.10E-02	5.26E-02	-1.59E-03
6.970	5.22E-02	5.62E-02	-1.39E-03
7.103	5.60E-02	5.81E-02	-2.05E-03
7.237	6.90E-02	6.06E-02	-1.56E-03
7.370	6.10E-02	6.25E-02	-1.90E-03
7.503	6.30E-02	6.51E-02	-2.07E-03
7.637	6.50E-02	6.71E-02	-2.05E-03
7.770	6.70E-02	6.88E-02	-1.84E-03
7.903	6.90E-02	7.04E-02	-1.44E-03
8.037	7.00E-02	7.18E-02	-1.84E-03
8.170	7.30E-02	7.30E-02	-1.03E-03
8.303	7.30E-02	7.40E-02	-1.03E-03
8.437	7.40E-02	7.48E-02	-6.35E-04
8.570	7.50E-02	7.55E-02	-4.47E-04
8.703	7.50E-02	7.59E-02	-8.73E-04
8.837	7.60E-02	7.61E-02	-1.19E-04
8.970	7.60E-02	7.62E-02	-1.92E-04
9.103	7.60E-02	7.61E-02	-1.00E-04
9.237	7.60E-02	7.59E-02	1.49E-04
9.370	7.60E-02	7.55E-02	5.45E-04
9.503	7.60E-02	7.49E-02	1.08E-03
9.637	7.60E-02	7.43E-02	1.74E-03
9.770	7.50E-02	7.35E-02	1.53E-03
9.903	7.40E-02	7.26E-02	1.42E-03
10.040	7.40E-02	7.16E-02	2.42E-03
10.170	7.30E-02	7.05E-02	2.50E-03
10.300	7.20E-02	6.93E-02	2.67E-03
10.440	7.00E-02	6.81E-02	1.92E-03
10.570	6.90E-02	6.68E-02	2.23E-03
10.700	6.80E-02	6.54E-02	2.59E-03
10.840	6.60E-02	6.40E-02	2.01E-03
10.970	6.50E-02	6.25E-02	2.46E-03
11.100	6.30E-02	6.11E-02	1.95E-03
11.240	6.10E-02	5.95E-02	1.48E-03
11.370	6.00E-02	5.80E-02	2.01E-03
11.500	5.80E-02	5.64E-02	1.58E-03
11.640	5.60E-02	5.49E-02	1.14E-03
11.770	5.40E-02	5.33E-02	7.06E-04
11.900	5.20E-02	5.17E-02	2.74E-04
12.040	5.00E-02	5.02E-02	-1.51E-04
12.170	4.90E-02	4.86E-02	4.05E-04
12.300	4.70E-02	4.70E-02	-5.71E-05
12.440	4.40E-02	4.55E-02	-1.51E-03
12.570	4.30E-02	4.40E-02	-9.99E-04
12.700	4.20E-02	4.20E-02	-1.51E-03
12.840	3.90E-02	4.10E-02	-2.03E-03
12.970	3.70E		

October 2005
E4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1212E-05
 DISPERSIVITY= 0.1939E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1399
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4826E-03

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.5295E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.21E-06	1.19E-06	1.24E-06
X(2)	1.94E-03	1.77E-03	2.13E-03
X(5)	1.40E-01	1.36E-01	1.46E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.382	9.63E-04	8.05E-04	1.57E-04
1.615	2.86E-03	1.50E-03	4.15E-04
1.65E+00	2.86E-03	2.51E-03	3.51E-04
1.782	4.82E-03	3.89E-03	9.24E-04
1.92E+00	2.86E-03	5.05E-03	1.16E-04
2.048	8.72E-03	7.78E-03	9.36E-04
2.182	1.07E-02	1.02E-02	4.22E-04
2.315	1.36E-02	1.30E-02	6.53E-04
2.448	1.56E-02	1.58E-02	-2.74E-04
2.582	1.85E-02	1.88E-02	-2.50E-04
2.715	2.15E-02	2.16E-02	-1.65E-04
2.848	2.34E-02	2.43E-02	-9.24E-04
2.982	2.64E-02	2.68E-02	-4.54E-04
3.115	2.83E-02	2.90E-02	-6.98E-04
3.248	3.03E-02	3.09E-02	-6.24E-04
3.382	3.22E-02	3.24E-02	-2.17E-04
3.515	3.32E-02	3.37E-02	-4.73E-04
3.648	3.41E-02	3.45E-02	-4.02E-04
3.782	3.51E-02	3.51E-02	-2.97E-05
3.915	3.50E-02	3.54E-02	-3.63E-04
4.048	3.60E-02	3.54E-02	5.56E-04
4.182	3.59E-02	3.59E-02	3.88E-04
4.315	3.59E-02	3.48E-02	1.05E-03
4.448	3.48E-02	3.43E-02	5.72E-04
4.582	3.48E-02	3.46E-02	1.24E-04
4.715	3.37E-02	3.27E-02	1.02E-03
4.848	3.27E-02	3.18E-02	9.02E-04
4.982	3.16E-02	3.08E-02	8.61E-04
5.115	3.06E-02	3.07E-02	-9.77E-05
5.248	2.95E-02	2.86E-02	9.35E-04
5.382	2.75E-02	2.75E-02	1.93E-05
5.515	2.64E-02	2.61E-02	1.19E-04
5.648	2.54E-02	2.52E-02	2.23E-04
5.782	2.43E-02	2.40E-02	3.22E-04
5.915	2.23E-02	2.29E-02	-5.92E-04
6.048	2.12E-02	2.18E-02	-6.29E-04
6.182	2.02E-02	2.07E-02	-4.83E-04
6.315	1.91E-02	1.96E-02	-4.68E-04
6.448	1.81E-02	1.86E-02	-4.85E-04
6.582	1.70E-02	1.76E-02	-5.36E-04
6.715	1.60E-02	1.66E-02	-6.24E-04
6.848	1.50E-02	1.57E-02	-6.54E-04
6.982	1.39E-02	1.46E-02	-9.10E-04
7.115	1.29E-02	1.40E-02	-1.11E-03
7.248	1.18E-02	1.32E-02	-1.35E-03
7.382	1.18E-02	1.24E-02	-6.25E-04
7.515	1.07E-02	1.16E-02	-9.39E-04
7.648	9.65E-03	1.09E-02	-1.29E-03
7.782	9.60E-03	1.03E-02	-6.76E-04
7.915	8.55E-03	9.65E-03	-1.10E-03
8.048	8.50E-03	9.05E-03	-5.52E-04
8.182	7.45E-03	8.49E-03	-1.04E-03
8.315	7.40E-03	7.96E-03	-5.67E-04
8.448	6.36E-03	7.46E-03	-1.11E-03
8.582	6.31E-03	6.99E-03	-6.81E-04
8.715	6.26E-03	6.84E-03	-2.86E-04
8.848	5.21E-03	6.12E-03	-9.16E-04
8.982	5.16E-03	5.73E-03	-5.71E-04
9.115	5.11E-03	5.36E-03	-2.50E-04
9.248	4.06E-03	5.01E-03	-9.51E-04
9.382	4.01E-03	4.68E-03	-6.74E-04
9.515	3.96E-03	4.38E-03	-4.16E-04
9.648	3.91E-03	4.09E-03	-1.78E-04
9.782	3.86E-03	3.82E-03	4.30E-05
9.915	2.81E-03	3.57E-03	-7.54E-04
10.05	2.77E-03	3.33E-03	-5.67E-04
10.18	2.72E-03	3.11E-03	-3.93E-04
10.32	2.67E-03	2.90E-03	-2.35E-04
10.45	2.62E-03	2.71E-03	-9.07E-05
10.59	2.57E-03	2.57E-03	4.2E-05
10.72	2.52E-03	2.36E-03	1.63E-04
10.86	1.47E-03	2.20E-03	-7.28E-04
10.99	1.42E-03	2.05E-03	-6.28E-04
11.12	1.37E-03	1.91E-03	-5.39E-04
11.25	1.32E-03	1.78E-03	-4.59E-04
11.39	1.27E-03	1.65E-03	-3.87E-04
11.52	1.22E-03	1.55E-03	-3.23E-04
11.65	1.17E-03	1.44E-03	-2.67E-04
11.78	1.13E-03	1.34E-03	-2.18E-04
11.92	1.08E-03	1.25E-03	-1.75E-04
12.05	1.03E-03	1.17E-03	-1.39E-04
11.35	1.20E-02	1.69E-02	1.03E-02
11.48	1.19E-02	1.25E-02	9.43E-03
11.62	1.00E-02	1.47E-03	8.54E-03
11.75	1.00E-02	1.37E-03	8.64E-03
11.88	9.00E-03	1.27E-03	7.73E-03
12.02	8.00E-03	1.19E-03	6.82E-03

E4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1131E-05
 DISPERSIVITY= 0.1508E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.8966E-01
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2492E-03

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72
 THE CRITICAL RSS IS: 0.2731E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.13E-06	1.11E-06	1.15E-06
X(2)	1.51E-03	1.33E-03	1.72E-03
X(5)	8.97E-02	8.61E-02	9.33E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.082	9.57E-04	2.44E-12	9.57E-04
1.215	9.00E-04	6.05E-11	9.00E-04
1.348	8.43E-04	8.81E-10	8.43E-04
1.482	7.86E-04	7.49E-09	7.86E-04
1.615	7.29E-04	4.43E-08	7.29E-04
1.748	1.67E-03	2.00E-07	1.67E-03
1.882	1.62E-03	7.20E-07	1.61E-03
2.015	1.58E-03	2.18E-06	1.56E-03
2.148	2.50E-03	5.71E-06	2.50E-03
2.282	2.44E-03	1.33E-05	2.43E-03
2.415	2.39E-03	2.81E-05	2.36E-03
2.548	3.32E-03	5.43E-05	3.28E-03
2.682	3.27E-03	9.87E-05	3.17E-03
2.815	3.22E-03	1.68E-04	3.05E-03
2.948	4.16E-03	2.72E-04	3.89E-03
3.082	4.10E-03	4.19E-04	3.68E-03
3.215	4.05E-03	6.21E-04	3.42E-03
3.348	3.99E-03	8.87E-04	3.10E-03
3.482	3.89E-03	1.23E-03	3.70E-03
3.615	4.87E-03	1.65E-03	3.23E-03
3.748	4.82E-03	2.16E-03	2.66E-03
3.882	5.76E-03	2.75E-03	3.01E-03
4.015	5.70E-03	3.44E-03	2.27E-03
4.148	6.65E-03	4.20E-03	2.44E-03
4.282	6.59E-03	5.05E-03	1.54E-03
4.415	6.53E-03	5.96E-03	5.71E-04
4.548	7.48E-03	6.93E-03	5.47E-04
4.682	8.42E-03	7.94E-03	4.80E-04
4.815	8.37E-03	8.97E-03	5.68E-04
4.948	9.30E-03	1.00E-02	-7.15E-04
5.082	1.03E-02	1.11E-02	-8.14E-04
5.215	1.12E-02	1.22E-02	-9.13E-04
5.348	1.21E-02	1.31E-02	-9.98E-04
5.482	1.31E-02	1.40E-02	-9.39E-04
5.615	1.40E-02	1.49E-02	-8.82E-04
5.748	1.49E-02	1.57E-02	-8.25E-04
5.882	1.49E-02	1.65E-02	-1.56E-03
6.015	1.59E-02	1.71E-02	-1.28E-03
6.148	1.68E-02	1.77E-02	-9.23E-04
6.282	1.67E-02	1.82E-02	-1.48E-03
6.415	1.77E-02	1.86E-02	-9.39E-04
6.548	1.87E-02	1.92E-02	-1.32E-03
6.682	1.86E-02	1.92E-02	-6.08E-04
6.815	1.85E-02	1.93E-02	-8.15E-04
6.948	1.95E-02	1.94E-02	5.71E-05
7.082	1.94E-02	1.94E-02	5.35E-06
7.215	1.93E-02	1.93E-02	2.49E-05
7.348	1.93E-02	1.92E-02	1.11E-04
7.482	1.92E-02	1.90E-02	2.59E-04
7.615	1.92E-02	1.87E-02	4.61E-04
7.748	1.91E-02	1.84E-02	7.13E-04
7.882	1.91E-02	1.80E-02	1.01E-03
8.015	1.90E-02	1.77E-02	1.35E-03
8.148	1.79E-02	1.72E-02	7.15E-04
8.282	1.79E-02	1.68E-02	1.11E-03
8.415	1.78E-02	1.63E-02	1.54E-03
8.548	1.68E-02	1.58E-02	9.76E-04
8.682	1.67E-02	1.53E-02	1.43E-03
8.815	1.57E-02	1.48E-02	8.99E-04
8.948	1.56E-02	1.42E-02	1.37E-03
9.082	1.45E-02	1.37E-02	8.53E-04
9.215	1.45E-02	1.32E-02	1.33E-03
9.348	1.34E-02	1.26E-02	8.11E-04
9.482	1.34E-02	1.21E-02	1.29E-03
9.615	1.23E-02	1.16E-02	7.53E-04
9.748	1.13E-02	1.10E-02	2.13E-04
9.882	1.12E-02	1.05E-02	6.63E-04
10.020	1.01E-02	1.00E-02	1.03E-04
10.150	1.01E-02	9.55E-03	5.29E-04
10.280	9.03E-03	9.05E-03	-5.54E-05
10.420	8.97E-03	8.63E-03	3.43E-04
10.550	7.91E-03	8.18E-03	-2.73E-04
10.680	7.85E-03	7.75E-03	9.59E-05
10.820	6.80E-03	7.34E-03	-5.46E-04
10.950	6.74E-03	6.95E-03	-2.08E-04
11.080	5.69E-03	6.57E-03	-8.63E-04
11.220	5.63E-03	6.20E-03	-5.76E-04
11.350	4.57E-03	5.85E-03	-1.28E-03
11.480	4.51E-03	5.52E-03	-1.01E-03
11.620	3.46E-03	5.20E-03	-1.75E-03
11.750	3.40E-03	4.90E-03	-1.50E-03
11.880	3.34E-03	4.61E-03	-1.27E-03
12.020	2.28E-03	4.33E-03	-2.05E-03
12.150	2.23E-03	4.07E-03	-1.85E-03
12.280	1.17E-03	3.82E-03	-2.65E-03
12.420	1.11E-03	3.59E-03	-2.48E-03
12.550	1.06E-03	3.37E-03	-2.31E-03
12.680	-7.12E-07	3.16E-03	-3.16E-03

October 2005
F1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 99
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5500E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8533E-06
DISPERSIVITY= 0.7960E-02
WIDTH= 0.5500E-02
Rf= 1.00
CO= 0.9187
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1000

THE F STATISTIC FOR NP= 3 NOBS= 99 IS: 2.71
THE CRITICAL RSS IS: 0.1085

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.53E-07	7.85E-07	9.30E-07
X(2)	7.96E-03	6.37E-03	9.91E-03
X(5)	9.19E-01	8.54E-01	9.92E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
9.67E-02	6.00E-03	4.55E-15	6.00E-03
0.23	2.00E-02	4.45E-07	2.00E-02
3.63E-01	3.60E-02	6.65E-05	3.59E-02
0.4967	5.20E-02	7.07E-04	5.13E-02
6.30E-01	2.93E-03	6.32E-02	1.36E-03
0.7633	7.90E-02	7.09E-03	7.19E-02
0.8967	8.90E-02	1.37E-02	7.53E-02
1.03	9.80E-02	2.24E-02	7.56E-02
1.163	1.06E-01	3.30E-02	7.30E-02
1.297	1.13E-01	4.51E-02	6.79E-02
1.43	1.19E-01	1.02E-01	3.19E-02
1.563	1.25E-01	7.24E-02	5.27E-02
1.697	1.30E-01	8.71E-02	4.29E-02
2.23	1.58E-01	1.02E-01	2.56E-03
1.963	1.38E-01	1.17E-01	2.06E-02
2.097	1.41E-01	1.33E-01	8.10E-03
2.23	1.50E-01	1.74E-01	-2.39E-02
2.363	1.47E-01	1.62E-01	-1.49E-02
2.497	1.51E-01	1.84E-01	2.86E-03
2.63	1.52E-01	1.83E-01	-3.13E-02
2.763	1.54E-01	1.90E-01	-3.63E-02
2.897	1.58E-01	1.95E-01	-3.90E-02
3.03	1.58E-01	1.98E-01	-3.98E-02
3.163	1.60E-01	1.99E-01	-3.91E-02
3.297	1.61E-01	1.98E-01	-4.03E-02
3.43	1.62E-01	1.98E-01	-3.60E-02
3.563	1.63E-01	1.96E-01	-3.33E-02
3.697	1.64E-01	1.94E-01	-2.99E-02
3.83	1.65E-01	1.91E-01	-2.60E-02
3.963	1.65E-01	1.88E-01	-2.29E-02
4.097	1.66E-01	1.86E-01	-1.84E-02
4.23	1.66E-01	1.81E-01	-1.49E-02
4.363	1.67E-01	1.77E-01	-1.02E-02
4.497	1.67E-01	1.67E-01	6.30E-03
4.63	1.67E-01	1.70E-01	-2.59E-03
4.763	1.67E-01	1.66E-01	1.21E-03
4.897	1.67E-01	1.67E-01	5.15E-02
5.03	1.67E-01	1.58E-01	8.74E-03
5.163	1.66E-01	1.55E-01	1.14E-02
5.297	1.66E-01	1.51E-01	1.51E-02
5.43	1.65E-01	1.47E-01	1.76E-02
5.563	1.64E-01	1.44E-01	2.01E-02
5.697	1.63E-01	1.40E-01	2.32E-02
5.83	1.62E-01	1.37E-01	2.49E-02
5.963	1.61E-01	1.34E-01	2.71E-02
6.097	1.59E-01	1.31E-01	2.83E-02
6.23	1.58E-01	1.28E-01	3.04E-02
6.363	1.56E-01	1.25E-01	3.14E-02
6.497	1.54E-01	1.21E-01	3.23E-02
6.63	1.52E-01	1.19E-01	3.32E-02
6.763	1.48E-01	1.18E-01	3.39E-02
6.897	1.47E-01	1.13E-01	3.37E-02
7.03	1.45E-01	1.11E-01	3.43E-02
7.163	1.42E-01	1.08E-01	3.38E-02
7.297	1.39E-01	1.06E-01	3.33E-02
7.43	1.36E-01	1.03E-01	3.27E-02
7.563	1.33E-01	1.01E-01	3.20E-02
7.697	1.30E-01	9.87E-02	3.13E-02
7.83	1.27E-01	9.65E-02	3.05E-02
7.963	1.24E-01	9.43E-02	2.97E-02
8.097	1.20E-01	9.22E-02	2.78E-02
8.23	1.17E-01	9.02E-02	2.68E-02
8.363	1.13E-01	8.82E-02	2.48E-02
8.497	1.10E-01	8.63E-02	2.37E-02
8.63	1.06E-01	8.44E-02	2.16E-02
8.763	1.02E-01	8.26E-02	1.94E-02
8.897	9.80E-02	8.08E-02	1.72E-02
9.03	9.40E-02	7.91E-02	1.49E-02
9.163	9.10E-02	7.74E-02	1.38E-02
9.297	8.70E-02	7.58E-02	1.13E-02
9.43	8.30E-02	7.42E-02	8.84E-03
9.563	7.90E-02	7.26E-02	6.33E-03
9.697	7.50E-02	7.11E-02	3.92E-03
9.83	7.10E-02	6.96E-02	1.39E-03
9.963	6.80E-02	6.82E-02	-1.77E-04
10.1	6.40E-02	6.67E-02	-2.74E-03
10.23	6.00E-02	6.54E-02	-5.40E-03
10.36	5.60E-02	6.41E-02	-8.10E-03
10.5	5.30E-02	6.27E-02	-9.74E-03
10.63	4.90E-02	6.15E-02	-1.38E-02
10.76	4.60E-02	6.03E-02	-1.43E-02
10.9	4.30E-02	5.90E-02	-1.60E-02
11.03	4.00E-02	5.79E-02	-1.79E-02
11.16	3.60E-02	5.68E-02	-2.08E-02
11.3	3.30E-02	5.56E-02	-2.28E-02
11.43	3.00E-02	5.45E-02	-2.43E-02
11.56	2.80E-02	5.35E-02	-2.55E-02
11.7	2.50E-02	5.24E-02	-2.74E-02
11.83	2.20E-02	5.14E-02	-2.93E-02
11.96	2.00E-02	5.04E-02	-3.04E-02
12.1	1.80E-02	4.94E-02	-3.14E-02
12.23	1.60E-02	4.85E-02	-3.25E-02
12.36	1.30E-02	4.76E-02	-3.46E-02
12.5	1.10E-02	4.66E-02	-3.66E-02
12.63	9.00E-03	4.56E-02	-3.86E-02
12.76	7.00E-03	4.46E-02	-3.79E-02
12.9	5.00E-03	4.40E-02	-3.90E-02
13.03	3.00E-03	4.32E-02	-4.02E-02
13.16	2.00E-03	4.24E-02	-4.04E-02

F1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5500E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9198E-06
DISPERSIVITY= 0.5128E-02
WIDTH= 0.5500E-02
Rf= 1.000
CO= 1.118
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1014E-01

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.1101E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.20E-07	9.02E-07	9.38E-07
X(2)	5.13E-03	4.87E-03	5.44E-03
X(5)	1.12E+00	1.10E+00	1.14E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.830	1.00E-03	1.77E-06	9.98E-04
0.963	2.00E-03	1.20E-05	1.99E-03
1.097	2.00E-03	5.16E-05	1.95E-03
1.230	4.00E-03	1.62E-04	3.84E-03
1.363	3.00E-03	4.06E-04	4.59E-03
1.497	6.00E-03	8.72E-04	5.13E-03
1.630	7.00E-03	1.65E-03	5.35E-03
1.763	9.00E-03	2.84E-03	6.16E-03
1.897	1.20E-02	4.54E-03	7.46E-03
2.030	1.60E-02	6.83E-03	9.18E-03
2.163	2.00E-02	9.75E-03	1.02E-02
2.297	2.50E-02	1.34E-02	1.16E-02
2.430	3.10E-02	1.78E-02	1.32E-02
2.563	3.70E-02	2.29E-02	1.41E-02
2.697	4.40E-02	2.89E-02	1.51E-02
2.830	5.10E-02	3.54E-02	1.56E-02
2.963	5.80E-02	4.27E-02	1.53E-02
3.097	6.50E-02	5.05E-02	1.45E-02
3.230	7.30E-02	5.86E-02	1.44E-02
3.363	8.00E-02	6.71E-02	1.29E-02
3.497	8.60E-02	7.57E-02	1.03E-02
3.630	9.30E-02	8.43E-02	6.73E-03
3.763	9.90E-02	9.27E-02	6.27E-03
3.897	1.05E-01	1.01E-01	3.97E-03
4.030	1.10E-01	1.10E-01	1.03E-03
4.163	1.16E-01	1.17E-01	-5.46E-04
4.297	1.21E-01	1.24E-01	-2.75E-03
4.430	1.26E-01	1.30E-01	-4.43E-03
4.563	1.30E-01	1.37E-01	-6.62E-03
4.697	1.34E-01	1.42E-01	-8.35E-03
4.830	1.39E-01	1.47E-01	-8.54E-03
4.963	1.42E-01	1.52E-01	-1.02E-02
5.097	1.46E-01	1.56E-01	-1.04E-02
5.230	1.50E-01	1.60E-01	-1.15E-02
5.363	1.52E-01	1.63E-01	-1.13E-02
5.497	1.54E-01	1.66E-01	-1.21E-02
5.630	1.56E-01	1.67E-01	-1.15E-02
5.763	1.59E-01	1.70E-01	-1.14E-02
5.897	1.61E-01	1.72E-01	-1.10E-02
6.030	1.63E-01	1.73E-01	-1.02E-02
6.163	1.64E-01	1.74E-01	-1.01E-02
6.297	1.66E-01	1.75E-01	-8.65E-03
6.430	1.67E-01	1.77E-01	-8.92E-03
6.563	1.68E-01	1.75E-01	-6.92E-03
6.697	1.69E-01	1.75E-01	-5.67E-03
6.830	1.69E-01	1.74E-01	-5.19E-03
6.963	1.70E-01	1.74E-01	-3.50E-03
7.097	1.71E-01	1.73E-01	-1.62E-03
7.230	1.71E-01	1.72E-01	1.54E-04
7.363	1.71E-01	1.70E-01	6.49E-04
7.497	1.71E-01	1.69E-01	2.02E-03
7.630	1.70E-01	1.68E-01	2.50E-03
7.763	1.70E-01	1.66E-01	4.10E-03
7.897	1.69E-01	1.64E-01	4.82E-03
8.030	1.69E-01	1.62E-01	6.62E-03
8.163	1.68E-01	1.61E-01	7.51E-03
8.297	1.67E-01	1.59E-01	8.48E-03
8.430	1.66E-01	1.57E-01	9.50E-03
8.563	1.65E-01	1.54E-01	1.09E-02
8.697	1.63E-01	1.52E-01	1.07E-02
8.830	1.62E-01	1.50E-01	1.19E-02
8.963	1.60E-01	1.48E-01	1.21E-02
9.097	1.58E-01	1.46E-01	1.23E-02
9.230	1.56E-01	1.43E-01	1.26E-02
9.363	1.54E-01	1.41E-01	1.28E-02
9.497	1.52E-01	1.39E-01	1.31E-02
9.630	1.50E-01	1.37E-01	1.34E-02
9.763	1.47E-01	1.34E-01	1.27E-02
9.897	1.45E-01	1.32E-01	1.30E-02
10.030	1.42E-01	1.30E-01	1.23E-02
10.160	1.39E-01	1.28E-01	1.15E-02
10.300	1.36E-01	1.25E-01	1.09E-02
10.430	1.33E-01	1.23E-01	1.01E-02
10.560	1.30E-01	1.21E-01	9.24E-03
10.700	1.27E-01	1.18E-01	8.68E-03
10.830	1.23E-01	1.16E-01	6.74E-03
10.960	1.20E-01	1.14E-01	5.67E-03
11.100	1.18E-01	1.12E-01	4.15E-03
11.230	1.13E-01	1.10E-01	3.24E-03
11.360	1.10E-01	1.08E-01	1.35E-03
11.500	1.05E-01	1.06E-01	-4.95E-04
11.600	1.02E-01	9.94E-02	2.63E-03
11.700	9.90E-02	9.74E-02	5.70E-04
11.800	9.40E-02	9.54E-02	-1.37E-03
11.900	9.00E-02	9.35E-02	-3.49E-03
12.000	8.50E-02	9.16E-02	-5.70E-04
12.100	8.00E-02	8.97E-02	-6.67E-03
12.200	7.90E-02	8.79E-02	-8.88E-03
12.300	7.80E-02	8.61E-02	-8.11E-02
12.400	7.20E-02	8.42E-02	-1.22

October 2005
F3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.6334E-06
 DISPERSIVITY= 0.2277E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.2797
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3246E-02

THE F STATISTIC FOR NP= 3 NOBS= 86 IS: 2.73
 THE CRITICAL RSS IS: 0.3566E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	6.33E-07	6.21E-07	6.52E-07
X(2)	2.28E-03	2.05E-03	2.55E-03
X(5)	2.90E-01	2.69E-01	2.91E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
4.67E-01	1.00E-03	7.28E-14	1.00E-03
0.6333	1.00E-03	1.97E-10	1.00E-03
8.00E-01	1.00E-03	2.02E-08	1.00E-03
0.9667	1.00E-03	4.25E-07	1.00E-03
1.13E+00	1.00E-03	3.66E-06	9.96E-04
1.3	1.83E-05	1.98E-03	1.98E-03
1.467	2.00E-03	6.33E-05	1.94E-03
1.633	3.00E-03	1.70E-04	2.83E-03
1.8	3.00E-03	3.82E-04	2.62E-03
1.967	4.00E-03	7.49E-04	3.25E-03
2.133	4.00E-03	1.32E-03	2.68E-03
2.3	2.14E-03	2.14E-03	2.86E-03
2.467	6.00E-03	3.26E-03	2.75E-03
2.633	7.00E-03	4.69E-03	2.31E-03
2.8	9.00E-03	6.47E-03	2.54E-03
2.967	1.10E-02	8.59E-03	2.41E-03
3.133	1.30E-02	1.11E-02	1.93E-03
3.3	1.60E-02	1.39E-02	2.10E-03
3.467	1.90E-02	1.71E-02	1.95E-03
3.633	2.30E-02	2.05E-02	2.51E-03
3.8	2.60E-02	2.42E-02	1.84E-03
3.967	3.00E-02	2.80E-02	1.99E-03
4.133	3.40E-02	3.20E-02	2.05E-03
4.3	3.80E-02	3.59E-02	2.09E-03
4.467	4.20E-02	4.00E-02	2.18E-03
4.633	4.50E-02	4.36E-02	1.40E-03
4.8	4.90E-02	4.72E-02	1.79E-03
4.967	5.10E-02	5.00E-02	4.19E-04
5.133	5.40E-02	5.37E-02	3.09E-04
5.3	5.60E-02	5.65E-02	-5.15E-04
5.467	5.80E-02	5.90E-02	-1.04E-03
5.633	6.00E-02	6.12E-02	-1.24E-03
5.8	6.10E-02	6.31E-02	-2.14E-03
5.967	6.20E-02	6.47E-02	-2.74E-03
6.133	6.30E-02	6.60E-02	-3.04E-03
6.3	6.40E-02	6.71E-02	-3.05E-03
6.467	6.50E-02	6.78E-02	-2.91E-03
6.633	6.50E-02	6.83E-02	-3.31E-03
6.8	6.60E-02	6.86E-02	-2.58E-03
6.967	6.60E-02	6.86E-02	-2.63E-03
7.133	6.60E-02	6.85E-02	-2.49E-03
7.3	6.50E-02	6.82E-02	-3.18E-03
7.467	6.50E-02	6.77E-02	-2.70E-03
7.633	6.50E-02	6.71E-02	-2.08E-03
7.8	6.40E-02	6.63E-02	-2.33E-03
7.967	6.40E-02	6.55E-02	-1.47E-03
8.133	6.30E-02	6.45E-02	-1.51E-03
8.3	6.30E-02	6.35E-02	-4.64E-04
8.467	6.20E-02	6.23E-02	-3.45E-04
8.633	6.10E-02	6.12E-02	-1.64E-04
8.8	6.00E-02	5.99E-02	6.97E-05
8.967	6.00E-02	5.87E-02	1.35E-03
9.133	5.90E-02	5.73E-02	6.57E-04
9.3	5.80E-02	5.60E-02	1.99E-03
9.467	5.70E-02	5.47E-02	2.35E-03
9.633	5.60E-02	5.33E-02	4.72E-03
9.8	5.50E-02	5.19E-02	3.10E-03
9.967	5.40E-02	5.05E-02	3.48E-03
10.13	5.30E-02	4.91E-02	3.86E-03
10.3	5.20E-02	4.78E-02	4.23E-03
10.47	5.10E-02	4.64E-02	4.60E-03
10.63	4.90E-02	4.51E-02	3.94E-03
10.8	4.80E-02	4.37E-02	4.28E-03
10.97	4.70E-02	4.24E-02	4.60E-03
11.13	4.60E-02	4.11E-02	4.89E-03
11.3	4.50E-02	3.98E-02	5.17E-03
11.47	4.40E-02	3.86E-02	5.43E-03
11.63	4.30E-02	3.74E-02	5.68E-03
11.8	4.20E-02	3.61E-02	5.86E-03
11.97	4.10E-02	3.50E-02	6.04E-03
12.13	3.90E-02	3.38E-02	5.18E-03
12.3	3.80E-02	3.27E-02	5.31E-03
12.47	3.70E-02	3.16E-02	5.41E-03
12.63	3.50E-02	3.05E-02	4.47E-03
12.8	3.40E-02	2.95E-02	4.51E-03
12.97	3.30E-02	2.85E-02	4.53E-03
13.13	3.20E-02	2.75E-02	3.50E-03
13.3	3.00E-02	2.65E-02	3.46E-03
13.47	2.80E-02	2.56E-02	2.39E-03
13.63	2.70E-02	2.47E-02	2.29E-03
13.8	2.50E-02	2.38E-02	1.17E-03
13.73	3.38E-04	2.42E-02	-2.39E-02
13.9	2.58E-04	2.33E-02	-2.31E-02
14.06	1.75E-04	2.25E-02	-2.23E-02
14.23	9.32E-05	2.17E-02	-2.16E-02
14.4	1.16E-05	2.09E-02	-2.09E-02

F3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7471E-06
 DISPERSIVITY= 0.2568E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.3092
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3375E-03

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71
 THE CRITICAL RSS IS: 0.3677E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.47E-07	7.40E-07	7.55E-07
X(2)	2.56E-03	2.48E-03	2.63E-03
X(5)	3.09E-01	3.06E-01	3.12E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.115	1.00E-03	7.54E-11	1.00E-03
1.248	1.00E-03	1.04E-09	1.00E-03
1.382	1.00E-03	8.71E-09	1.00E-03
1.515	2.00E-03	5.00E-08	2.00E-03
1.648	2.00E-03	2.16E-07	2.00E-03
1.782	2.00E-03	7.55E-07	2.00E-03
1.915	2.00E-03	2.21E-06	2.00E-03
2.048	3.00E-03	5.61E-06	2.99E-03
2.182	3.00E-03	1.27E-05	2.99E-03
2.315	3.00E-03	2.62E-05	2.97E-03
2.448	3.00E-03	4.98E-05	2.95E-03
2.582	3.00E-03	8.86E-05	2.90E-03
2.715	4.00E-03	1.49E-04	3.85E-03
2.848	4.00E-03	2.38E-04	3.79E-03
2.982	4.00E-03	3.65E-04	3.64E-03
3.115	5.00E-03	5.38E-04	4.46E-03
3.248	5.00E-03	7.68E-04	4.23E-03
3.382	6.00E-03	1.07E-03	4.93E-03
3.515	6.00E-03	1.44E-03	4.56E-03
3.648	6.00E-03	1.91E-03	4.10E-03
3.782	7.00E-03	2.47E-03	4.53E-03
3.915	7.00E-03	3.3E-03	3.87E-03
4.048	8.00E-03	3.91E-03	4.09E-03
4.182	8.00E-03	4.81E-03	3.19E-03
4.315	9.00E-03	5.83E-03	3.17E-03
4.448	9.00E-03	6.97E-03	2.03E-03
4.582	1.00E-02	8.23E-03	1.77E-03
4.715	1.10E-02	9.61E-03	1.39E-03
4.848	1.20E-02	1.11E-02	9.08E-04
4.982	1.30E-02	1.27E-02	3.23E-04
5.115	1.40E-02	1.44E-02	-1.43E-04
5.248	1.60E-02	1.61E-02	-1.06E-04
5.382	1.70E-02	1.79E-02	-9.28E-04
5.515	1.80E-02	1.98E-02	-7.40E-04
5.648	2.10E-02	2.17E-02	-7.14E-04
5.782	2.20E-02	2.37E-02	-1.65E-03
5.915	2.20E-02	2.56E-02	-1.61E-03
6.048	2.60E-02	2.76E-02	-1.56E-03
6.182	2.80E-02	2.95E-02	-1.49E-03
6.315	3.00E-02	3.14E-02	-1.41E-03
6.448	3.20E-02	3.33E-02	-1.28E-03
6.582	3.40E-02	3.51E-02	-1.12E-03
6.715	3.60E-02	3.69E-02	-8.91E-04
6.848	3.80E-02	3.86E-02	-6.04E-04
6.982	4.00E-02	4.03E-02	-2.49E-04
7.115	4.10E-02	4.18E-02	-4.16E-04
7.248	4.30E-02	4.33E-02	-3.03E-04
7.382	4.40E-02	4.47E-02	-7.06E-04
7.515	4.60E-02	4.60E-02	-1.99E-05
7.648	4.70E-02	4.72E-02	-2.44E-04
7.782	4.80E-02	4.84E-02	-3.76E-04
7.915	5.00E-02	4.94E-02	5.85E-04
8.048	5.10E-02	5.04E-02	6.40E-04
8.182	5.10E-02	5.12E-02	-2.14E-04
8.315	5.20E-02	5.20E-02	2.55E-05
8.448	5.30E-02	5.26E-02	3.56E-04
8.582	5.40E-02	5.32E-02	7.74E-04
8.715	5.40E-02	5.37E-02	2.80E-04
8.848	5.50E-02	5.41E-02	8.71E-04
8.982	5.50E-02	5.45E-02	5.44E-04
9.115	5.60E-02	5.47E-02	2.96E-04
9.248	5.60E-02	5.49E-02	1.25E-04
9.382	5.60E-02	5.50E-02	1.03E-03
9.515	5.60E-02	5.50E-02	9.99E-04
9.648	5.60E-02	5.50E-02	3.86E-05
9.782	5.50E-02	5.49E-02	1.41E-04
9.915	5.50E-02	5.47E-02	3.04E-04
10.050	5.50E-02	5.45E-02	5.24E-04
10.180	5.50E-02	5.42E-02	7.99E-04
10.320	5.40E-02	5.39E-02	1.22E-04
10.450	5.30E-02	5.21E-02	4.93E-04
10.580	5.40E-02	5.31E-02	9.10E-04
10.720	5.30E-02	5.26E-02	3.65E-04
10.850	5.30E-02	5.21E-02	8.59E-04
10.980	5.20E-02	5.16E-02	3.91E-04
11.120	5.10E-02	5.11E-02	-4.89E-05
11.250	5.10E-02	5.05E-02	5.41E-04
11.380	5.00E-02	4.98E-02	1.62E-04
11.520	4.90E-02	4.92E-02	-1.97E-04
11.650	4.80E-02	4.85E-02	4.87E-04
11.780	4.80E-02	4.79E-02	1.54E-04
11.920	4.70E-02	4.72E-02	-1.45E-04
12.050	4.60E-02	4.64E-02	-4.30E-04
12.180	4.60E-02	4.57E-02	3.05E-04
12.320	4.50E-02	4.50E-02	4.51E-05
12.450	4.40E-02	4.42E-02	-2.05E-04
12.580	4.40E-02	4.34E-02	-4.11E-04
12.720	4.20E-02	4.27E-02	-6.76E-04
12.850	4.10E-02	4.19E-02	-9.07E-04
12.980	4.00E-02	4.11E-02	-1.13E-03
13.120	3.90E-02	4.04E-02	-1.35E-03
13.250	3.90E-02	3.96E-02	-5.77E-04
13.380	3.80E-02	3.88E-02	3.79E-04
13.52	3.70E-02	3.80E-02	-1.02E-03

October 2005
F4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.1900E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9717E-06
DISPERSIVITY= 0.3494E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.8602E-01
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5544E-04

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
THE CRITICAL RSS IS: 0.6035E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.72E-07	9.62E-07	9.81E-07
X(2)	3.59E-03	3.54E-03	3.70E-03
X(5)	8.60E-02	8.43E-02	8.77E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
9.82E-01	9.60E-04	3.69E-04	5.92E-04
1.15	9.08E-04	7.48E-04	1.61E-04
1.25E+00	1.86E-03	1.31E-03	5.48E-04
1.382	1.80E-03	2.06E-03	-2.56E-04
1.52E+00	3.00E-03	3.00E-03	-2.46E-04
1.648	3.70E-03	4.11E-03	-4.13E-04
1.782	4.65E-03	5.39E-03	-7.38E-04
1.915	5.91E-03	6.80E-03	-8.72E-04
2.048	7.54E-03	8.31E-03	-7.71E-04
2.182	8.49E-03	9.89E-03	-1.40E-03
2.315	1.04E-02	1.15E-02	-1.02E-03
2.448	1.24E-02	1.30E-02	-5.79E-04
2.582	1.43E-02	1.44E-02	-1.40E-03
2.715	1.53E-02	1.66E-02	-2.93E-04
2.848	1.72E-02	1.86E-02	6.02E-04
2.982	1.82E-02	1.75E-02	6.72E-04
3.115	1.91E-02	1.82E-02	9.17E-04
3.248	2.01E-02	1.88E-02	1.32E-03
3.382	2.00E-02	1.91E-02	8.81E-04
3.515	2.00E-02	1.94E-02	5.70E-04
3.648	2.09E-02	1.96E-02	1.38E-03
3.782	2.09E-02	1.96E-02	1.29E-03
3.915	2.08E-02	1.95E-02	1.29E-03
4.048	1.98E-02	1.94E-02	3.70E-04
4.182	1.97E-02	1.92E-02	5.12E-04
4.315	1.97E-02	1.89E-02	7.08E-04
4.448	1.86E-02	1.87E-02	-5.10E-05
4.582	1.86E-02	1.83E-02	2.27E-04
4.715	1.75E-02	1.80E-02	-4.66E-04
4.848	1.74E-02	1.74E-02	1.35E-04
4.982	1.64E-02	1.72E-02	-7.85E-04
5.115	1.63E-02	1.68E-02	-4.23E-04
5.248	1.63E-02	1.63E-02	-1.05E-03
5.382	1.52E-02	1.59E-02	-6.72E-04
5.515	1.42E-02	1.55E-02	-1.29E-03
5.648	1.41E-02	1.50E-02	-9.07E-04
5.782	1.31E-02	1.46E-02	-1.53E-03
5.915	1.30E-02	1.42E-02	-1.15E-03
6.048	1.30E-02	1.37E-02	-7.72E-04
6.182	1.19E-02	1.33E-02	-1.40E-03
6.315	1.19E-02	1.29E-02	-1.04E-03
6.448	1.18E-02	1.18E-02	-6.40E-04
6.582	1.08E-02	1.21E-02	-1.34E-03
6.715	1.07E-02	1.17E-02	-9.99E-04
6.848	1.07E-02	1.13E-02	-6.69E-04
6.982	1.06E-02	1.10E-02	-3.47E-04
7.115	1.06E-02	1.06E-02	-3.68E-05
7.248	1.05E-02	1.05E-02	2.65E-04
7.382	9.45E-03	9.89E-03	-4.43E-04
7.515	9.40E-03	9.56E-03	-1.60E-04
7.648	9.34E-03	9.23E-03	1.12E-04
7.782	9.29E-03	8.92E-03	3.76E-04
7.915	9.24E-03	8.61E-03	6.29E-04
8.048	9.19E-03	8.31E-03	8.73E-04
8.182	8.14E-03	8.03E-03	1.09E-04
8.315	8.08E-03	7.75E-03	3.35E-04
8.448	8.03E-03	7.48E-03	5.52E-04
8.582	7.98E-03	7.22E-03	7.60E-04
8.715	7.93E-03	6.97E-03	9.60E-04
8.848	7.87E-03	6.72E-03	1.15E-03
8.982	6.82E-03	6.49E-03	3.35E-04
9.115	6.77E-03	6.26E-03	5.11E-04
9.248	6.72E-03	6.04E-03	6.78E-04
9.382	6.66E-03	5.83E-03	8.39E-04
9.515	6.61E-03	5.62E-03	9.92E-04
9.648	6.56E-03	5.42E-03	1.14E-03
9.782	5.51E-03	5.23E-03	-2.77E-04
9.915	5.45E-03	5.04E-03	4.10E-04
10.05	5.40E-03	4.87E-03	6.36E-04
10.18	5.36E-03	4.69E-03	6.67E-04
10.32	5.30E-03	4.53E-03	7.70E-04
10.45	5.25E-03	4.37E-03	8.78E-04
10.58	5.19E-03	4.21E-03	9.82E-04
10.72	5.14E-03	4.06E-03	1.08E-03
10.85	4.09E-03	3.92E-03	1.70E-04
10.98	4.04E-03	3.78E-03	2.57E-04
11.12	3.98E-03	3.65E-03	3.39E-04
11.25	3.93E-03	3.52E-03	4.15E-04
11.38	3.88E-03	3.40E-03	4.89E-04
11.52	3.83E-03	3.27E-03	5.56E-04
11.65	2.77E-03	3.15E-03	-3.80E-04
11.78	2.72E-03	3.04E-03	-5.29E-04
11.92	2.67E-03	2.93E-03	-2.65E-04
12.05	2.62E-03	2.83E-03	-2.13E-04
12.18	2.57E-03	2.73E-03	-1.64E-04
12.32	2.51E-03	2.63E-03	-1.20E-04
12.45	2.46E-03	2.54E-03	-7.92E-05
12.58	1.41E-03	2.45E-03	-1.04E-03
12.72	1.36E-03	2.36E-03	-1.01E-03
12.85	1.30E-03	2.28E-03	-9.76E-04
12.98	1.25E-03	2.20E-03	-9.47E-04
13.12	1.20E-03	2.12E-03	-9.21E-04
13.25	1.15E-03	2.05E-03	-8.99E-04
13.38	1.09E-03	1.97E-03	-8.79E-04
13.52	1.04E-03	1.90E-03	-8.61E-04

F4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9238E-06
DISPERSIVITY= 0.5637E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.1127
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2946E-03

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
THE CRITICAL RSS IS: 0.3222E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.24E-07	8.87E-07	9.61E-07
X(2)	5.64E-03	5.59E-03	5.47E-03
X(5)	1.13E-01	1.08E-01	1.18E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.933	1.00E-03	8.18E-07	9.99E-04
1.067	1.06E-03	3.78E-06	9.96E-04
1.200	1.00E-03	1.25E-05	9.88E-04
1.333	2.00E-03	3.26E-05	1.97E-03
1.467	6.00E-03	7.59E-05	1.93E-03
1.600	3.00E-03	4.139E-04	2.86E-03
1.733	3.00E-03	2.43E-04	2.76E-03
1.867	1.86E-03	3.93E-04	3.61E-03
2.000	4.00E-03	5.96E-04	3.40E-03
2.133	5.00E-03	8.60E-04	4.14E-03
2.267	5.00E-03	1.19E-03	3.81E-03
2.400	6.00E-03	1.59E-03	3.41E-03
2.533	6.00E-03	2.06E-03	3.94E-03
2.667	6.00E-03	2.59E-03	3.41E-03
2.800	9.00E-03	3.19E-03	2.81E-03
2.933	7.00E-03	3.84E-03	3.16E-03
3.067	7.00E-03	4.53E-03	2.47E-03
3.200	7.00E-03	5.25E-03	1.75E-03
3.333	8.00E-03	5.99E-03	2.01E-03
3.467	8.00E-03	6.74E-03	1.26E-03
3.600	8.00E-03	7.48E-03	5.19E-04
3.733	8.00E-03	8.21E-03	-2.08E-04
3.867	9.00E-03	8.91E-03	8.68E-05
4.000	9.00E-03	9.62E-03	9.59E-04
4.133	9.00E-03	1.02E-02	-1.23E-03
4.267	9.00E-03	1.08E-02	-1.84E-03
4.400	9.00E-03	1.14E-02	-2.40E-03
4.533	1.00E-02	1.19E-02	-2.40E-03
4.667	1.00E-02	1.24E-02	-2.40E-03
4.800	1.00E-02	1.29E-02	-2.38E-03
4.933	1.10E-02	1.32E-02	-2.23E-03
5.067	1.10E-02	1.36E-02	-2.58E-03
5.200	1.10E-02	1.39E-02	-2.89E-03
5.333	1.20E-02	1.42E-02	-2.16E-03
5.467	1.20E-02	1.44E-02	-2.40E-03
5.600	1.20E-02	1.46E-02	-1.60E-03
5.733	1.30E-02	1.48E-02	-1.77E-03
5.867	1.40E-02	1.49E-02	-9.03E-04
6.000	1.40E-02	1.50E-02	-2.07E-03
6.133	1.50E-02	1.51E-02	-8.74E-05
6.267	1.50E-02	1.51E-02	-1.40E-04
6.400	1.50E-02	1.52E-02	-3.70E-04
6.533	1.60E-02	1.52E-02	8.24E-04
6.667	1.60E-02	1.52E-02	8.37E-04
6.800	1.60E-02	1.52E-02	8.70E-04
6.933	1.70E-02	1.51E-02	1.92E-03
7.067	1.70E-02	1.50E-02	1.99E-03
7.200	1.70E-02	1.49E-02	2.07E-03
7.333	1.70E-02	1.48E-02	2.16E-03
7.467	1.70E-02	1.47E-02	2.26E-03
7.600	1.70E-02	1.46E-02	2.38E-03
7.733	1.60E-02	1.45E-02	1.51E-03
7.867	1.60E-02	1.44E-02	1.64E-03
8.000	1.60E-02	1.42E-02	1.79E-03
8.133	1.60E-02	1.41E-02	1.94E-03
8.267	1.60E-02	1.39E-02	2.09E-03
8.400	1.50E-02	1.37E-02	1.26E-03
8.533	1.50E-02	1.36E-02	1.42E-03
8.667	1.50E-02	1.34E-02	1.59E-03
8.800	1.40E-02	1.32E-02	7.69E-04
8.933	1.40E-02	1.31E-02	9.47E-04
9.067	1.40E-02	1.29E-02	1.13E-03
9.200	1.30E-02	1.27E-02	3.11E-04
9.333	1.30E-02	1.25E-02	4.95E-04
9.467	1.30E-02	1.23E-02	6.81E-04
9.600	1.20E-02	1.21E-02	-1.32E-04
9.733	1.20E-02	1.19E-02	5.56E-05
9.867	1.20E-02	1.18E-02	2.44E-04
10.000	1.20E-02	1.16E-02	4.31E-04
10.133	1.10E-02	1.14E-02	-3.81E-04
10.270	1.10E-02	1.12E-02	-1.93E-04
10.400	1.10E-02	1.10E-02	-7.15E-06
10.533	1.00E-02	1.08E-02	-8.22E-04
10.670	1.00E-02	1.06E-02	-6.36E-04
10.800	1.00E-02	1.05E-02	-4.53E-04
10.933	1.00E-02	1.03E-02	-2.72E-04
11.070	9.00E-03	1.01E-02	-1.09E-03
11.200	9.00E-03	9.91E-03	-9.12E-04
11.333	9.00E-03	9.73E-03	-7.36E-04
11.470	9.00E-03	9.56E-03	-5.59E-04
11.600	8.00E-03	9.39E-03	-1.39E-03
11.733	8.00E-03	9.21E-03	-1.51E-03
11.870	8.00E-03	9.04E-03	-1.04E-03
12.000	8.00E-03	8.88E-03	-8.77E-04
12.133	7.00E-03	8.	

May 2006
B1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : 0.5000E-02
9) THE RETARDATION FACTOR (DIM) : 0.0000E+00
10) THE INJECTION CONCENTRATION (UG/L) : -1.000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2251E-05
DISPERSIVITY= 0.3899E-02
WIDTH= 0.3417E-02
RF= 1.000
CO= 1.000
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2347E-02

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
THE CRITICAL RSS IS: 0.2588E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.25E-06	2.23E-06	2.27E-06
X(2)	3.90E-03	4.13E-03	4.13E-03
X(3)	3.42E-03	3.35E-03	3.49E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.67E-02	0.00E+00	4.02E-18	-4.02E-18
1.667	1.05E-04	1.05E-07	8.79E-04
2.67E-01	2.81E-03	4.68E-05	2.76E-03
0.3667	8.73E-03	7.77E-04	7.96E-03
4.67E-01	1.57E-02	3.95E-03	1.17E-02
0.5667	2.76E-02	1.14E-02	1.62E-02
0.6667	4.15E-02	2.42E-02	1.74E-02
0.7667	5.64E-02	4.18E-02	1.47E-02
0.8667	7.14E-02	6.21E-02	9.23E-03
0.9667	8.63E-02	8.23E-02	3.96E-03
1.067	9.92E-02	1.00E-01	-1.22E-03
1.167	1.19E-01	1.15E-01	-6.04E-03
1.267	1.19E-01	1.27E-01	-7.40E-03
1.367	1.26E-01	1.34E-01	-8.42E-03
1.467	1.31E-01	1.39E-01	-8.52E-03
1.567	1.34E-01	1.42E-01	-8.07E-03
1.667	1.36E-01	1.43E-01	-6.73E-03
1.767	1.36E-01	1.39E-01	-3.58E-03
1.867	1.36E-01	1.39E-01	-3.58E-03
1.967	1.35E-01	1.36E-01	-1.52E-03
2.067	1.33E-01	1.32E-01	2.15E-04
2.167	1.29E-01	1.28E-01	1.43E-03
2.267	1.26E-01	1.23E-01	3.08E-03
2.367	1.22E-01	1.19E-01	3.83E-03
2.467	1.18E-01	1.14E-01	4.69E-03
2.567	1.14E-01	1.09E-01	5.57E-03
2.667	1.10E-01	1.04E-01	6.53E-03
2.767	1.05E-01	9.87E-02	6.31E-03
2.867	9.99E-02	9.39E-02	6.01E-03
2.967	9.59E-02	8.93E-02	6.58E-03
3.067	9.08E-02	8.48E-02	6.96E-03
3.167	8.67E-02	8.04E-02	6.26E-03
3.267	8.16E-02	7.63E-02	5.36E-03
3.367	7.76E-02	7.23E-02	5.28E-03
3.467	7.25E-02	6.82E-02	4.02E-03
3.567	6.84E-02	6.48E-02	3.60E-03
3.667	6.43E-02	6.13E-02	3.01E-03
3.767	6.03E-02	5.80E-02	2.22E-03
3.867	5.72E-02	5.49E-02	2.32E-03
3.967	5.31E-02	5.19E-02	1.23E-03
4.067	5.01E-02	4.91E-02	9.98E-04
4.167	4.70E-02	4.64E-02	6.15E-04
4.267	4.39E-02	4.38E-02	8.29E-05
4.367	4.08E-02	4.14E-02	-5.74E-04
4.467	3.88E-02	3.91E-02	-3.59E-04
4.567	3.57E-02	3.70E-02	-1.27E-03
4.667	3.36E-02	3.49E-02	-1.30E-03
4.767	3.15E-02	3.30E-02	-1.44E-03
4.867	2.95E-02	3.12E-02	-1.68E-03
4.967	2.74E-02	2.94E-02	-2.02E-03
5.067	2.53E-02	2.78E-02	-2.47E-03
5.167	2.43E-02	2.63E-02	-2.00E-03
5.267	2.22E-02	2.48E-02	-2.61E-03
5.367	2.11E-02	2.34E-02	-2.30E-03
5.467	1.90E-02	2.21E-02	-3.08E-03
5.567	1.80E-02	2.09E-02	-2.93E-03
5.667	1.69E-02	1.97E-02	-2.84E-03
5.767	1.48E-02	1.86E-02	-3.81E-03
5.867	1.37E-02	1.76E-02	-3.86E-03
5.967	1.27E-02	1.66E-02	-3.95E-03
6.067	1.16E-02	1.57E-02	-4.10E-03
6.167	1.05E-02	1.48E-02	-4.30E-03
6.267	9.45E-03	1.40E-02	-4.55E-03
6.367	9.38E-03	1.32E-02	-3.85E-03
6.467	8.31E-03	1.25E-02	-4.19E-03
6.567	8.24E-03	1.18E-02	-3.57E-03
6.667	7.16E-03	1.12E-02	-3.99E-03
6.767	7.09E-03	1.05E-02	-3.45E-03
6.867	6.02E-03	9.96E-03	-3.94E-03
6.967	5.95E-03	9.41E-03	-3.46E-03
7.067	4.87E-03	8.89E-03	-4.02E-03
7.167	4.80E-03	8.40E-03	-3.60E-03
7.267	3.73E-03	7.94E-03	-4.21E-03
7.367	3.66E-03	7.50E-03	-3.84E-03
7.467	3.58E-03	7.09E-03	-3.50E-03
7.567	2.51E-03	6.70E-03	-4.19E-03
7.667	2.44E-03	6.33E-03	-3.89E-03
7.767	2.37E-03	5.98E-03	-3.62E-03
7.867	2.29E-03	5.65E-03	-3.36E-03
7.967	1.22E-03	5.34E-03	-4.12E-03
8.067	1.15E-03	5.05E-03	-3.90E-03
8.167	1.08E-03	4.77E-03	-3.70E-03
8.267	2.42E-06	4.51E-03	-4.51E-03

B1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 91
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : 0.5000E-02
9) THE RETARDATION FACTOR (DIM) : 0.0000E+00
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1722E-05
DISPERSIVITY= 0.1832E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.5494
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5322E-03

THE F STATISTIC FOR NP= 3 NOBS= 91 IS: 2.72
THE CRITICAL RSS IS: 0.5815E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.72E-06	1.72E-06	1.72E-06
X(2)	1.83E-03	1.80E-03	1.87E-03
X(5)	5.49E-01	5.44E-01	5.55E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.967	1.00E-03	1.04E-06	9.99E-04
1.067	1.05E-03	5.23E-06	9.95E-04
1.167	2.00E-03	1.97E-05	1.98E-03
1.267	2.00E-03	6.01E-05	1.94E-03
1.367	3.00E-03	1.15E-04	2.85E-03
1.467	3.00E-03	3.47E-04	2.65E-03
1.567	4.00E-03	7.01E-04	3.30E-03
1.667	5.00E-03	1.30E-03	3.71E-03
1.767	6.00E-03	2.22E-03	3.78E-03
1.867	7.00E-03	3.58E-03	3.42E-03
1.967	9.00E-03	5.46E-03	3.54E-03
2.067	1.10E-02	7.95E-03	3.05E-03
2.167	1.40E-02	1.11E-02	2.89E-03
2.267	1.70E-02	1.50E-02	2.02E-03
2.367	2.10E-02	1.96E-02	1.45E-03
2.467	2.60E-02	2.48E-02	1.21E-03
2.567	3.20E-02	3.06E-02	1.39E-03
2.667	3.80E-02	3.69E-02	1.09E-03
2.767	4.40E-02	4.38E-02	4.12E-04
2.867	5.10E-02	5.05E-02	5.08E-04
2.967	5.80E-02	5.75E-02	5.13E-04
3.067	6.50E-02	6.44E-02	5.68E-04
3.167	7.20E-02	7.12E-02	7.93E-04
3.267	7.80E-02	7.77E-02	3.13E-04
3.367	8.40E-02	8.38E-02	2.28E-04
3.467	9.00E-02	8.94E-02	6.20E-04
3.567	9.40E-02	9.45E-02	-4.45E-04
3.667	9.30E-02	9.89E-02	-9.19E-04
3.767	1.02E-01	1.03E-01	-7.70E-04
3.867	1.05E-01	1.06E-01	-9.82E-04
3.967	1.07E-01	1.09E-01	-1.56E-03
4.067	1.09E-01	1.11E-01	-1.50E-03
4.167	1.10E-01	1.12E-01	-1.83E-03
4.267	1.10E-01	1.13E-01	-2.57E-03
4.367	1.11E-01	1.13E-01	-1.77E-03
4.467	1.10E-01	1.13E-01	-2.45E-03
4.567	1.10E-01	1.12E-01	-1.67E-03
4.667	1.09E-01	1.11E-01	-1.45E-03
4.767	1.07E-01	1.09E-01	-1.85E-03
4.867	1.06E-01	1.07E-01	-9.14E-04
4.967	1.04E-01	1.04E-01	-6.80E-04
5.067	1.02E-01	1.02E-01	-1.90E-04
5.167	1.00E-01	9.95E-02	5.15E-04
5.267	9.70E-02	9.66E-02	3.99E-04
5.367	9.50E-02	9.36E-02	1.43E-03
5.467	9.20E-02	9.04E-02	1.56E-03
5.567	8.90E-02	8.72E-02	1.78E-03
5.667	8.60E-02	8.40E-02	2.05E-03
5.767	8.30E-02	8.07E-02	2.35E-03
5.867	7.90E-02	7.73E-02	1.66E-03
5.967	7.60E-02	7.40E-02	1.96E-03
6.067	7.30E-02	7.08E-02	2.23E-03
6.167	7.00E-02	6.76E-02	2.45E-03
6.267	6.70E-02	6.44E-02	2.62E-03
6.367	6.40E-02	6.13E-02	2.73E-03
6.467	6.10E-02	5.82E-02	2.76E-03
6.567	5.80E-02	5.53E-02	2.70E-03
6.667	5.50E-02	5.24E-02	2.56E-03
6.767	5.20E-02	4.97E-02	2.32E-03
6.867	4.90E-02	4.70E-02	1.98E-03
6.967	4.60E-02	4.45E-02	1.55E-03
7.067	4.30E-02	4.20E-02	1.01E-03
7.167	4.10E-02	3.96E-02	1.38E-03
7.267	3.80E-02	3.74E-02	6.40E-04
7.367	3.60E-02	3.52E-02	8.01E-04
7.467	3.40E-02	3.31E-02	8.63E-04
7.567	3.10E-02	3.12E-02	-1.73E-04
7.667	2.90E-02	2.93E-02	-3.04E-04
7.767	2.70E-02	2.75E-02	-5.30E-04
7.867	2.50E-02	2.59E-02	-8.46E-04
7.967	2.30E-02	2.43E-02	-1.25E-03
8.067	2.10E-02	2.27E-02	-1.74E-03
8.167	1.90E-02	2.10E-02	-2.13E-03
8.267	1.80E-02	2.00E-02	-1.96E-03
8.367	1.70E-02	1.87E-02	-1.69E-03
8.467	1.50E-02	1.75E-02	-2.49E-03
8.567	1.40E-02	1.64E-02	-2.36E-03
8.667	1.20E-02	1.53E-02	-3.29E-03
8.767	1.10E-02	1.43E-02	-3.28E-03
8.867	1.00E-02	1.33E-02	-3.24E-03
8.967	9.00E-03	1.25E-02	-3.46E-03
9.067	8.00E-03	1.16E-02	-3.63E-03
9.167	7.00E-03	1.09E-02	-3.85E-03
9.267	6.00E-03	1.01E-02	-4.11E-03
9.367	5.00E-03	9.43E-03	-4.43E-03
9.467	4.00E-03	8.79E-03	-4.79E-03
9.567	3.00E-03	8.19E-03	-5.19E-03
9.667	3.00E-03	7.62E-03	-4.62E-03
9.767	2.00E-03	7.10E-03	-5.10E-03
9.867	1.00E-03	6.61E-03	-5.71E-03
9.967	1.00E-03	6.15E-03	-5.15E-03

May 2006
B2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 76
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1873E-05
DISPERSIVITY= 1.21E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.6718
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.6445E-03

THE F STATISTIC FOR NP= 3 NOBS= 76 IS: 2.74
THE CRITICAL RSS IS: 0.7171E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.87E-06	1.87E-06	1.87E-06
X(2)	3.12E-03	3.03E-03	3.22E-03
X(5)	6.72E-01	6.65E-01	6.78E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-01	1.00E-03	1.88E-17	1.00E-03
0.2333	1.00E-03	6.77E-08	1.00E-03
3.67E-01	2.00E-03	1.97E-03	1.467
0.5	5.00E-03	5.27E-04	4.47E-03
6.33E-01	9.00E-03	2.81E-03	6.19E-03
0.7667	1.60E-02	8.44E-03	7.56E-03
0.9	2.60E-02	1.53E-02	7.69E-03
1.033	4.00E-02	3.26E-02	7.36E-03
1.167	5.70E-02	5.08E-02	6.19E-03
1.3	7.50E-02	7.13E-02	3.72E-03
1.433	9.30E-02	9.17E-02	1.29E-03
1.567	1.09E-01	1.10E-01	-9.98E-04
1.7	1.21E-01	1.25E-01	-3.88E-03
1.833	1.31E-01	1.36E-01	-4.95E-03
1.967	1.38E-01	1.43E-01	-5.34E-03
2.1	1.42E-01	1.48E-01	-5.46E-03
2.233	1.44E-01	1.49E-01	-4.83E-03
2.367	1.45E-01	1.48E-01	-2.99E-03
2.5	1.44E-01	1.45E-01	-1.43E-03
2.633	1.42E-01	1.42E-01	4.33E-04
2.767	1.38E-01	1.37E-01	1.26E-03
2.9	1.34E-01	1.31E-01	2.73E-03
3.033	1.29E-01	1.29E-01	3.64E-03
3.167	1.24E-01	1.19E-01	4.79E-03
3.3	1.17E-01	1.13E-01	4.04E-03
3.433	1.07E-01	1.07E-01	4.28E-03
3.567	1.05E-01	1.01E-01	4.43E-03
3.7	9.80E-02	9.46E-02	3.43E-03
3.833	9.20E-02	8.88E-02	3.24E-03
3.967	8.90E-02	8.30E-02	5.067
4.1	7.90E-02	7.78E-02	1.16E-03
4.233	7.40E-02	7.28E-02	1.24E-03
4.367	6.80E-02	6.79E-02	5.72E-05
4.5	6.30E-02	6.34E-02	-3.90E-04
4.633	5.80E-02	5.91E-02	-1.10E-03
4.767	5.40E-02	5.51E-02	-1.05E-03
4.9	5.00E-02	5.13E-02	-1.26E-03
5.033	4.60E-02	4.77E-02	-1.70E-03
5.167	4.30E-02	4.44E-02	-1.37E-03
5.3	4.00E-02	4.13E-02	-1.26E-03
5.433	3.70E-02	3.84E-02	-1.35E-03
5.567	3.40E-02	3.56E-02	-1.63E-03
5.7	3.10E-02	3.31E-02	-2.10E-03
5.833	2.90E-02	3.07E-02	-1.74E-03
5.967	2.70E-02	2.86E-02	-1.55E-03
6.1	2.50E-02	2.65E-02	-1.50E-03
6.233	2.30E-02	2.46E-02	-1.60E-03
6.367	2.20E-02	2.28E-02	-8.29E-04
6.5	2.00E-02	2.12E-02	-1.19E-03
6.633	1.90E-02	1.97E-02	-6.57E-04
6.767	1.82E-02	1.82E-02	-1.24E-03
6.9	1.60E-02	1.69E-02	-9.18E-04
7.033	1.50E-02	1.57E-02	-6.94E-04
7.167	1.40E-02	1.46E-02	-5.57E-04
7.3	1.30E-02	1.35E-02	-5.02E-04
7.433	1.20E-02	1.25E-02	-5.24E-04
7.567	1.10E-02	1.16E-02	-6.15E-04
7.7	1.00E-02	1.08E-02	-7.72E-04
7.833	9.00E-03	9.99E-03	-9.90E-04
7.967	8.00E-03	9.26E-03	-1.26E-03
8.1	7.00E-03	8.59E-03	-1.59E-03
8.233	7.00E-03	7.97E-03	-9.67E-04
8.367	6.00E-03	7.39E-03	-1.39E-03
8.5	5.00E-03	6.85E-03	-1.85E-03
8.633	5.00E-03	6.35E-03	-1.35E-03
8.767	4.00E-03	5.89E-03	-1.89E-03
8.9	4.00E-03	5.46E-03	-1.46E-03
9.033	3.00E-03	5.07E-03	-2.07E-03
9.167	3.00E-03	4.70E-03	-1.70E-03
9.3	2.00E-03	4.36E-03	-2.36E-03
9.433	2.00E-03	4.04E-03	-2.04E-03
9.667	2.00E-03	3.54E-03	-1.54E-03
9.8	1.00E-03	3.29E-03	-2.29E-03
9.933	1.00E-03	3.05E-03	-2.05E-03
10.07	1.00E-03	2.83E-03	-1.83E-03
10.2	1.00E-03	2.62E-03	-1.62E-03

B2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1597E-05
DISPERSIVITY= 0.2295E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.7044
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1309E-03

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
THE CRITICAL RSS IS: 0.1432E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.60E-06	1.60E-06	1.60E-06
X(2)	2.30E-03	2.27E-03	2.32E-03
X(5)	7.04E-01	7.04E-01	7.04E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.200	9.75E-04	7.61E-05	8.99E-04
1.333	1.94E-03	2.53E-04	1.69E-03
1.467	2.91E-03	6.75E-04	2.23E-03
1.600	4.88E-03	1.52E-03	3.36E-03
1.733	6.84E-03	3.00E-03	3.84E-03
1.867	8.81E-03	5.35E-03	3.46E-03
2.000	1.18E-02	8.73E-03	3.00E-03
2.133	1.57E-02	1.34E-02	2.31E-03
2.267	2.07E-02	1.94E-02	1.32E-03
2.400	2.67E-02	2.68E-02	1.05E-04
2.533	3.46E-02	3.49E-02	-2.04E-04
2.667	4.26E-02	4.40E-02	-1.38E-03
2.800	5.26E-02	5.37E-02	-1.13E-03
2.933	6.25E-02	6.37E-02	-1.14E-03
3.067	7.25E-02	7.36E-02	-1.12E-03
3.200	8.25E-02	8.33E-02	-7.89E-04
3.333	9.25E-02	9.24E-02	9.31E-05
3.467	1.01E-01	1.01E-01	7.08E-04
3.600	1.08E-01	1.08E-01	2.20E-04
3.733	1.15E-01	1.15E-01	1.12E-04
3.867	1.20E-01	1.20E-01	2.26E-04
4.000	1.25E-01	1.25E-01	8.09E-04
4.133	1.28E-01	1.28E-01	4.34E-04
4.267	1.30E-01	1.30E-01	5.31E-05
4.400	1.31E-01	1.32E-01	-3.65E-04
4.533	1.31E-01	1.32E-01	1.01E-04
4.667	1.31E-01	1.32E-01	-6.37E-04
4.800	1.30E-01	1.31E-01	-6.38E-04
4.933	1.29E-01	1.29E-01	3.43E-06
5.067	1.27E-01	1.27E-01	-8.03E-04
5.200	1.24E-01	1.24E-01	-1.20E-04
5.333	1.21E-01	1.21E-01	-3.18E-05
5.467	1.17E-01	1.18E-01	-3.18E-05
5.600	1.14E-01	1.14E-01	7.13E-05
5.733	1.10E-01	1.10E-01	-3.22E-05
5.867	1.06E-01	1.06E-01	2.04E-05
6.000	1.02E-01	1.02E-01	1.64E-04
6.133	9.78E-02	9.74E-02	3.78E-04
6.267	9.37E-02	9.31E-02	6.17E-04
6.400	8.97E-02	8.88E-02	9.57E-04
6.533	8.47E-02	8.46E-02	3.15E-05
6.667	8.06E-02	8.05E-02	1.61E-04
6.800	7.66E-02	7.64E-02	2.06E-04
6.933	7.26E-02	7.24E-02	1.54E-04
7.067	6.85E-02	6.85E-02	-6.28E-06
7.200	6.45E-02	6.48E-02	-2.91E-04
7.333	6.15E-02	6.12E-02	2.94E-04
7.467	5.84E-02	5.77E-02	7.46E-04
7.600	5.44E-02	5.43E-02	5.57E-05
7.733	5.14E-02	5.11E-02	2.24E-04
7.867	4.83E-02	4.81E-02	2.53E-04
8.000	4.53E-02	4.52E-02	1.36E-04
8.133	4.23E-02	4.24E-02	-1.21E-04
8.267	4.02E-02	3.97E-02	4.85E-04
8.400	3.72E-02	3.72E-02	-4.66E-05
8.533	3.52E-02	3.49E-02	2.88E-04
8.667	3.31E-02	3.26E-02	4.97E-04
8.800	3.11E-02	3.05E-02	5.80E-04
8.933	2.91E-02	2.85E-02	5.43E-04
9.067	2.70E-02	2.66E-02	3.92E-04
9.200	2.50E-02	2.49E-02	1.29E-04
9.333	2.40E-02	2.32E-02	7.60E-04
9.467	2.19E-02	2.16E-02	2.91E-04
9.600	2.09E-02	2.02E-02	7.26E-04
9.733	1.89E-02	1.88E-02	6.96E-05
9.867	1.78E-02	1.75E-02	3.28E-04
10.000	1.68E-02	1.63E-02	5.03E-04
10.130	1.48E-02	1.52E-02	-4.02E-04
10.370	1.37E-02	1.34E-02	3.50E-04
10.500	1.27E-02	1.24E-02	2.53E-04
10.630	1.16E-02	1.15E-02	9.39E-05
10.770	1.06E-02	1.07E-02	-1.17E-04
10.900	9.66E-03	9.60E-03	-3.99E-04
11.030	8.53E-03	9.24E-03	-7.12E-04
11.170	8.50E-03	8.58E-03	-7.91E-05
11.300	7.47E-03	7.96E-03	-1.47E-04
11.430	6.43E-03	7.39E-03	-9.56E-04
11.570	6.40E-03	6.85E-03	-4.52E-04
11.700	5.37E-03	6.35E-03	-9.88E-04
11.830	4.33E-03	5.89E-03	-1.56E-03
11.970	4.30E-03	5.46E-03	-1.16E-03
12.100	3.27E-03	5.06E-03	-1.80E-03
12.230	3.23E-03	4.69E-03	-1.46E-03
12.370	2.20E-03	4.34E-03	-2.14E-03
12.500	2.17E-03	4.02E-03	-1.86E-03
12.630	1.13E-03	3.73E-03	-2.59E-03
12.770	1.10E-03	3.45E-03	-2.35E-03
12.900	1.07E-03	3.19E-03	-2.13E-03
13.030	3.40E-05	2.96E-03	-2.92E-03
13.170	8.29E-07	2.74E-03	-2.74E-03

May 2006
B3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.2162E-05
DISPERSIVITY= 0.2593E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.6419
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5069E-02

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
THE CRITICAL RSS IS: 0.5528E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	2.16E-06	2.14E-06	2.18E-06
X(2)	2.44E-03	2.44E-03	2.44E-03
X(5)	6.42E-01	6.29E-01	6.55E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.52E-01	9.29E-04	9.34E-07	9.28E-04
0.3183	7.78E-04	1.90E-05	7.59E-04
3.85E-01	1.63E-03	1.38E-04	1.49E-03
0.4517	3.48E-03	5.61E-04	2.92E-03
5.18E-01	5.18E-03	1.58E-03	3.73E-03
0.585	9.18E-03	3.57E-03	5.60E-03
0.6517	1.50E-02	6.80E-03	8.23E-03
0.7183	2.94E-02	1.15E-02	9.41E-03
0.785	2.97E-02	1.77E-02	1.20E-02
0.8517	3.86E-02	2.56E-02	1.30E-02
0.9183	4.94E-02	3.49E-02	1.45E-02
0.985	5.93E-02	4.57E-02	1.36E-02
1.052	7.01E-02	5.76E-02	1.25E-02
1.118	8.10E-02	7.01E-02	1.09E-02
1.185	9.08E-02	8.29E-02	7.91E-03
1.252	9.97E-02	9.55E-02	4.19E-03
1.318	1.08E-01	1.07E-01	1.34E-03
1.385	1.16E-01	1.18E-01	-1.06E-03
1.452	1.22E-01	1.28E-01	-5.27E-03
1.518	1.28E-01	1.36E-01	-7.37E-03
1.585	1.33E-01	1.42E-01	-9.27E-03
1.652	1.38E-01	1.48E-01	-9.67E-03
1.718	1.41E-01	1.51E-01	-1.08E-02
1.785	1.44E-01	1.42E-01	-1.06E-02
1.852	1.45E-01	1.56E-01	-1.04E-02
1.918	1.47E-01	1.56E-01	-9.06E-03
1.985	1.48E-01	1.58E-01	-7.96E-03
2.052	1.48E-01	1.55E-01	-6.99E-03
2.118	1.48E-01	1.53E-01	-5.47E-03
2.185	1.47E-01	1.47E-01	-4.27E-03
2.252	1.45E-01	1.48E-01	-2.69E-03
2.318	1.44E-01	1.45E-01	-6.71E-04
2.385	1.42E-01	1.42E-01	-4.30E-04
2.452	1.40E-01	1.38E-01	2.24E-03
2.518	1.38E-01	1.34E-01	3.90E-03
2.585	1.35E-01	1.30E-01	4.96E-03
2.652	1.32E-01	1.26E-01	5.81E-03
2.718	1.28E-01	1.22E-01	6.86E-03
2.785	1.25E-01	1.17E-01	7.90E-03
2.852	1.22E-01	1.13E-01	9.04E-03
2.918	1.18E-01	1.09E-01	9.98E-03
2.985	1.15E-01	1.05E-01	1.08E-02
3.052	1.11E-01	1.01E-01	9.95E-03
3.118	1.07E-01	9.67E-02	9.82E-03
3.185	1.02E-01	9.27E-02	9.57E-03
3.252	9.82E-02	8.89E-02	9.27E-03
3.318	9.40E-02	8.52E-02	8.81E-03
3.385	8.99E-02	8.16E-02	8.30E-03
3.452	8.57E-02	7.80E-02	7.68E-03
3.518	8.16E-02	7.47E-02	6.90E-03
3.585	7.74E-02	7.14E-02	6.05E-03
3.652	7.43E-02	6.82E-02	6.09E-03
3.718	7.01E-02	6.51E-02	4.97E-03
3.785	6.60E-02	6.22E-02	3.78E-03
3.852	6.28E-02	5.93E-02	3.48E-03
3.918	5.87E-02	5.66E-02	2.02E-03
3.985	5.55E-02	5.40E-02	1.50E-03
4.052	5.24E-02	5.15E-02	8.69E-04
4.118	4.92E-02	4.91E-02	9.95E-05
4.185	4.61E-02	4.68E-02	-7.35E-04
4.252	4.29E-02	4.46E-02	-1.67E-03
4.318	3.98E-02	4.25E-02	-2.73E-03
4.385	3.66E-02	4.05E-02	-3.85E-03
4.452	3.45E-02	3.85E-02	-4.06E-03
4.518	3.23E-02	3.67E-02	-4.40E-03
4.585	3.01E-02	3.49E-02	-4.78E-03
4.652	2.79E-02	3.32E-02	-6.24E-03
4.718	2.58E-02	3.16E-02	-5.80E-03
4.785	2.37E-02	3.01E-02	-6.41E-03
4.852	2.15E-02	2.86E-02	-7.09E-03
4.918	2.04E-02	2.73E-02	-6.86E-03
4.985	1.82E-02	2.59E-02	-7.68E-03
5.052	1.71E-02	2.46E-02	-7.55E-03
5.118	1.59E-02	2.35E-02	-7.51E-03
5.185	1.48E-02	2.23E-02	-7.50E-03
5.252	1.36E-02	2.11E-02	-7.36E-03
5.318	1.25E-02	2.02E-02	-7.67E-03
5.385	1.13E-02	1.92E-02	-7.82E-03
5.452	1.02E-02	1.82E-02	-8.03E-03
5.518	9.04E-03	1.73E-02	-8.29E-03
5.585	7.89E-03	1.66E-02	-8.58E-03
5.652	7.74E-03	1.57E-02	-8.70E-03
5.718	6.58E-03	1.49E-02	-8.29E-03
5.785	5.43E-03	1.41E-02	-8.70E-03
5.852	4.28E-03	1.32E-02	-8.70E-03
5.918	4.13E-03	1.28E-02	-8.64E-03
5.985	3.98E-03	1.21E-02	-8.15E-03
6.052	2.83E-03	1.18E-02	-8.70E-03
6.118	2.68E-03	1.10E-02	-8.28E-03
6.185	2.53E-03	1.04E-02	-7.88E-03
6.252	1.38E-03	9.89E-03	-8.51E-03
6.318	1.23E-03	9.40E-03	-8.17E-03
6.385	1.08E-03	8.93E-03	-7.85E-03

B3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1315E-05
DISPERSIVITY= 0.1533E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.3728
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2968E-03

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
THE CRITICAL RSS IS: 0.3231E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.32E-06	1.32E-06	1.32E-06
X(2)	2.77E-03	2.50E-03	2.80E-03
X(5)	3.73E-01	3.69E-01	3.77E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.785	1.00E-03	4.26E-03	-3.26E-03
2.885	3.00E-03	6.65E-03	-2.65E-03
2.985	5.00E-03	7.32E-03	-2.32E-03
3.085	7.00E-03	9.29E-03	-2.29E-03
3.185	1.18E-02	1.16E-02	-1.56E-03
3.285	1.30E-02	1.41E-02	-1.13E-03
3.385	1.60E-02	1.70E-02	-9.82E-04
3.485	2.01E-02	2.01E-02	-1.06E-04
3.585	2.30E-02	2.35E-02	-4.69E-04
3.685	2.70E-02	2.70E-02	-3.71E-05
3.785	3.20E-02	3.08E-02	1.23E-03
3.885	3.60E-02	3.46E-02	1.38E-03
3.985	4.00E-02	3.86E-02	1.45E-03
4.085	4.40E-02	4.25E-02	1.49E-03
4.185	4.80E-02	4.64E-02	1.56E-03
4.285	5.20E-02	5.03E-02	1.68E-03
4.385	5.60E-02	5.41E-02	1.92E-03
4.485	5.90E-02	5.77E-02	-1.30E-03
4.585	6.30E-02	6.11E-02	1.86E-03
4.685	6.60E-02	6.44E-02	1.63E-03
4.785	6.80E-02	6.74E-02	6.31E-04
4.885	7.10E-02	7.01E-02	8.94E-04
4.985	7.30E-02	7.26E-02	4.29E-04
5.085	7.50E-02	7.48E-02	-2.47E-04
5.185	7.60E-02	7.66E-02	-6.43E-04
5.285	7.70E-02	7.82E-02	-1.24E-03
5.385	7.80E-02	7.95E-02	-1.54E-03
5.485	7.90E-02	8.06E-02	-1.55E-03
5.585	8.00E-02	8.13E-02	-1.28E-03
5.685	8.00E-02	8.17E-02	-1.74E-03
5.785	8.00E-02	8.19E-02	-1.93E-03
5.885	8.00E-02	8.19E-02	-1.87E-03
5.985	8.00E-02	8.16E-02	-1.57E-03
6.085	7.90E-02	8.11E-02	-2.06E-03
6.185	7.90E-02	8.03E-02	-1.34E-03
6.285	7.80E-02	7.94E-02	-1.43E-03
6.385	7.70E-02	7.84E-02	-1.35E-03
6.485	7.60E-02	7.71E-02	-1.11E-03
6.585	7.50E-02	7.57E-02	-7.33E-04
6.685	7.40E-02	7.42E-02	-2.40E-04
6.785	7.20E-02	7.26E-02	-6.33E-04
6.885	7.10E-02	7.16E-02	-7.69E-05
6.985	6.90E-02	6.92E-02	-1.54E-04
7.085	6.80E-02	6.73E-02	6.91E-04
7.185	6.60E-02	6.54E-02	1.48E-03
7.285	6.40E-02	6.35E-02	5.27E-04
7.385	6.30E-02	6.15E-02	1.50E-03
7.485	6.10E-02	5.92E-02	1.43E-03
7.585	5.90E-02	5.75E-02	1.48E-03
7.685	5.70E-02	5.55E-02	1.48E-03
7.785	5.50E-02	5.35E-02	1.48E-03
7.885	5.30E-02	5.15E-02	1.46E-03
7.985	5.10E-02	4.96E-02	1.42E-03
8.085	4.90E-02	4.76E-02	1.36E-03
8.185	4.70E-02	4.57E-02	1.27E-03
8.285	4.50E-02	4.39E-02	1.14E-03
8.385	4.40E-02	4.20E-02	1.98E-03
8.485	4.20E-02	4.02E-02	1.77E-03
8.585	4.00E-02	3.85E-02	1.52E-03
8.685	3.80E-02	3.68E-02	1.22E-03
8.785	3.60E-02	3.51E-02	8.81E-04
8.885	3.50E-02	3.35E-02	1.49E-03
8.985	3.30E-02	3.20E-02	1.05E-03
9.085	3.20E-02	3.05E-02	1.55E-03
9.200	3.00E-02	2.88E-02	1.22E-03
9.300	2.80E-02	2.74E-02	6.16E-04
9.400	2.70E-02	2.60E-02	9.60E-04
9.500	2.60E-02	2.48E-02	1.25E-03
9.600	2.40E-02	2.35E-02	4.96E-04
9.700	2.30E-02	2.23E-02	6.89E-04
9.800	2.20E-02	2.12E-02	8.33E-04
9.900	2.00E-02	2.01E-02	-7.18E-05
10.000	1.90E-02	1.90E-02	-2.32E-05
10.100	1.80E-02	1.80E-02	-2.06E-05
10.200	1.70E-02	1.71E-02	-6.27E-05
10.300	1.60E-02	1.60E-02	-1.48E-04
10.400	1.50E-02	1.53E-02	-2.76E-04
10.500	1.40E-02	1.44E-02	-4.45E-04
10.600	1.30E-02	1.37E-02	-6.65E-04
10.700	1.20E-02	1.29E-02	-9.00E-04
10.800	1.10E-02	1.22E-02	-1.18E-03
10.900	1.00E-02	1.15E-02	-1.51E-03
11.000	9.00E-03	1.09E-02	-1.86E-03
11.100	8.00E-03	1.02E-02	-2.24E-03
11.200	7.00E-03	9.66E-03	-2.66E-03
11.300	6.00E-03	9.11E-03	-3.11E-03
11.400	5.00E-03	8.58E-03	-2.58E-03
11.500	4.00E-03	8.09E-03	-3.09E-03
11.600	4.00E-03	7.62E-03	-3.62E-03
11.700	4.00E-03	7.17E-03	-3.17E-03
11.800	3.00E-03	6.75E-03	-3.75E-03
11.900	2.00E-03	6.35E-03	-4.35E-03
12	2.00E-03	5.98E-03	-3.98E-03
12.1	1.00E-03	5.62E-03	-4.62E-03
12.2	1.00E-03	5.29E-03	-4.29E-03

May 2006
B4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 68
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.3375E-05
DISPERSIVITY= 0.3023E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.4806
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1930E-02

THE F STATISTIC FOR NP= 3 NOBS= 68 IS: 2.75
THE CRITICAL RSS IS: 0.2176E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	3.38E-06	3.31E-06	3.44E-06
X(3)	2.78E-03	3.34E-03	3.34E-03
X(5)	4.81E-01	4.66E-01	4.95E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.50E-02	8.92E-04	8.82E-11	8.92E-04
0.1517	6.86E-04	1.49E-06	6.84E-04
2.18E-01	2.48E-03	8.74E-05	2.39E-03
0.285	6.27E-03	7.78E-04	5.50E-03
3.52E-01	1.21E-02	1.21E-02	0.00E-02
0.4183	1.99E-02	7.79E-03	1.21E-02
0.485	2.87E-02	1.54E-02	1.33E-02
0.5517	3.95E-02	2.56E-02	1.39E-02
0.6183	5.02E-02	3.87E-02	1.16E-02
0.685	6.10E-02	5.31E-02	7.91E-03
0.7517	6.98E-02	6.77E-02	2.15E-03
0.8183	7.86E-02	8.10E-02	-2.32E-03
0.885	8.64E-02	9.20E-02	-5.61E-03
0.9517	9.52E-02	9.01E-02	8.32E-03
1.018	9.80E-02	1.07E-01	-8.48E-03
1.085	1.02E-01	1.10E-01	-8.31E-03
1.152	1.06E-01	1.12E-01	-7.15E-03
1.218	1.06E-01	1.12E-01	-5.35E-03
1.285	1.08E-01	1.10E-01	-4.24E-03
1.352	1.06E-01	1.08E-01	-2.10E-03
1.418	1.06E-01	1.05E-01	7.84E-04
1.485	1.04E-01	1.01E-01	2.24E-03
1.552	1.01E-01	9.73E-02	4.06E-03
1.618	9.82E-02	9.30E-02	5.13E-03
1.685	9.40E-02	8.86E-02	5.34E-03
1.752	9.07E-02	8.42E-02	6.59E-03
1.818	8.65E-02	7.97E-02	6.82E-03
1.885	8.13E-02	7.53E-02	5.99E-03
1.952	7.71E-02	7.11E-02	6.05E-03
2.018	7.29E-02	6.69E-02	5.99E-03
2.085	6.87E-02	6.30E-02	5.76E-03
2.152	6.35E-02	5.91E-02	4.37E-03
2.218	5.93E-02	5.55E-02	3.80E-03
2.285	5.51E-02	5.20E-02	3.08E-03
2.352	5.09E-02	4.87E-02	2.15E-03
2.418	4.77E-02	4.56E-02	2.05E-03
2.485	4.35E-02	4.27E-02	7.85E-04
2.552	4.03E-02	3.99E-02	3.52E-04
2.618	3.71E-02	3.73E-02	-2.48E-04
2.685	3.39E-02	3.49E-02	-9.99E-04
2.752	3.17E-02	3.26E-02	-9.01E-04
2.818	2.84E-02	3.04E-02	-1.95E-03
2.885	2.62E-02	2.84E-02	-2.13E-03
2.952	2.40E-02	2.65E-02	-2.43E-03
3.018	2.18E-02	2.47E-02	-2.87E-03
3.085	1.96E-02	2.30E-02	-3.41E-03
3.152	1.84E-02	2.15E-02	-3.06E-03
3.218	1.72E-02	2.00E-02	-2.82E-03
3.285	1.50E-02	1.87E-02	-3.67E-03
3.352	1.38E-02	1.74E-02	-3.61E-03
3.418	1.26E-02	1.62E-02	-3.63E-03
3.485	1.14E-02	1.51E-02	-3.73E-03
3.552	1.02E-02	1.41E-02	-3.91E-03
3.618	9.97E-03	1.31E-02	-4.16E-03
3.685	7.77E-03	1.22E-02	-4.47E-03
3.752	6.56E-03	1.14E-02	-4.84E-03
3.818	6.35E-03	1.06E-02	-4.27E-03
3.885	5.15E-03	9.89E-03	-4.75E-03
3.952	4.94E-03	9.22E-03	-4.28E-03
4.018	4.74E-03	8.59E-03	-3.85E-03
4.085	3.53E-03	8.00E-03	-4.47E-03
4.152	3.32E-03	7.45E-03	-4.13E-03
4.218	3.12E-03	6.94E-03	-3.83E-03
4.285	1.91E-03	6.47E-03	-4.56E-03
4.352	1.71E-03	6.03E-03	-4.32E-03
4.418	1.50E-03	5.61E-03	-4.11E-03
4.485	1.29E-03	5.23E-03	-3.94E-03
4.552	1.09E-03	4.87E-03	-3.78E-03

B4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 99
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1337E-05
DISPERSIVITY= 0.1940E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1776
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2291E-03

THE F STATISTIC FOR NP= 3 NOBS= 99 IS: 2.71
THE CRITICAL RSS IS: 0.2485E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.34E-06	1.32E-06	1.35E-06
X(3)	1.84E-03	1.84E-03	2.04E-03
X(5)	1.78E-01	1.74E-01	1.81E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.318	6.00E-03	8.61E-04	5.14E-03
2.418	6.00E-03	1.23E-03	4.78E-03
2.518	6.00E-03	1.69E-03	4.31E-03
2.618	6.00E-03	2.27E-03	3.73E-03
2.718	6.00E-03	2.97E-03	3.04E-03
2.818	7.00E-03	3.79E-03	3.21E-03
2.918	7.00E-03	4.75E-03	2.25E-03
3.018	8.00E-03	5.83E-03	2.17E-03
3.118	9.00E-03	7.03E-03	1.97E-03
3.218	1.00E-02	8.35E-03	1.65E-03
3.318	1.10E-02	9.77E-03	1.23E-03
3.418	1.30E-02	1.13E-02	1.73E-03
3.518	1.40E-02	1.28E-02	1.16E-03
3.618	1.60E-02	1.45E-02	1.49E-04
3.718	1.60E-02	1.61E-02	-1.10E-04
3.818	1.80E-02	1.78E-02	2.30E-04
3.918	1.90E-02	1.94E-02	-4.22E-04
4.018	2.00E-02	2.11E-02	-1.05E-03
4.118	2.20E-02	2.26E-02	-6.31E-04
4.218	2.30E-02	2.42E-02	-1.16E-03
4.318	2.50E-02	2.56E-02	-6.10E-04
4.418	2.60E-02	2.70E-02	-9.61E-04
4.518	2.70E-02	2.83E-02	-1.26E-03
4.618	2.80E-02	2.94E-02	-1.44E-03
4.718	2.90E-02	3.05E-02	-1.51E-03
4.818	3.00E-02	3.15E-02	-1.47E-03
4.918	3.10E-02	3.23E-02	-1.32E-03
5.018	3.20E-02	3.31E-02	-1.05E-03
5.118	3.30E-02	3.37E-02	-6.74E-04
5.218	3.30E-02	3.42E-02	-1.18E-03
5.318	3.40E-02	3.46E-02	-5.79E-04
5.418	3.40E-02	3.49E-02	-8.70E-04
5.518	3.50E-02	3.51E-02	-5.73E-05
5.618	3.50E-02	3.52E-02	-1.47E-04
5.718	3.50E-02	3.51E-02	-1.43E-04
5.818	3.50E-02	3.51E-02	-5.06E-05
5.918	3.50E-02	3.46E-02	4.18E-04
6.033	3.40E-02	3.43E-02	-2.50E-04
6.133	3.30E-02	3.39E-02	-3.96E-04
6.233	3.40E-02	3.34E-02	5.99E-04
6.333	3.30E-02	3.29E-02	1.05E-04
6.433	3.20E-02	3.23E-02	3.19E-04
6.533	3.20E-02	3.18E-02	2.52E-04
6.633	3.20E-02	3.11E-02	8.83E-04
6.733	3.10E-02	3.05E-02	3.44E-04
6.833	3.10E-02	2.98E-02	1.23E-03
6.933	3.00E-02	2.91E-02	9.45E-04
7.033	2.90E-02	2.87E-02	1.95E-04
7.133	2.80E-02	2.76E-02	4.19E-04
7.233	2.70E-02	2.68E-02	1.17E-03
7.333	2.70E-02	2.61E-02	9.36E-04
7.433	2.60E-02	2.53E-02	7.02E-04
7.533	2.60E-02	2.45E-02	1.47E-03
7.633	2.50E-02	2.38E-02	1.24E-03
7.733	2.40E-02	2.30E-02	1.00E-03
7.833	2.30E-02	2.22E-02	7.60E-04
7.933	2.20E-02	2.15E-02	5.12E-04
8.033	2.20E-02	2.08E-02	1.25E-03
8.133	2.10E-02	2.00E-02	8.86E-04
8.233	2.00E-02	1.93E-02	7.06E-04
8.333	1.90E-02	1.86E-02	4.13E-04
8.433	1.90E-02	1.79E-02	1.11E-03
8.533	1.80E-02	1.72E-02	7.85E-04
8.633	1.70E-02	1.66E-02	4.48E-04
8.733	1.60E-02	1.59E-02	9.46E-05
8.833	1.60E-02	1.53E-02	7.25E-04
8.933	1.50E-02	1.47E-02	3.38E-04
9.033	1.40E-02	1.41E-02	-6.55E-05
9.133	1.40E-02	1.35E-02	5.13E-04
9.233	1.30E-02	1.29E-02	7.47E-05
9.333	1.20E-02	1.24E-02	-3.82E-04
9.433	1.20E-02	1.19E-02	1.45E-04
9.533	1.10E-02	1.14E-02	-3.46E-04
9.633	1.10E-02	1.09E-02	1.46E-04
9.733	1.00E-02	1.04E-02	-3.80E-04
9.833	1.00E-02	9.92E-03	7.82E-05
9.933	9.00E-03	9.48E-03	-4.82E-04
10.030	9.00E-03	9.06E-03	-5.68E-05
10.130	8.00E-03	8.65E-03	-6.48E-04
10.230	7.00E-03	8.25E-03	-1.25E-03
10.330	7.00E-03	7.88E-03	-8.76E-04
10.430	6.00E-03	7.51E-03	-5.13E-04
10.530	6.00E-03	7.15E-03	-1.16E-03
10.630	6.00E-03	6.83E-03	-8.29E-04
10.730	5.00E-03	6.51E-03	-1.51E-03
10.830	5.00E-03	6.20E-03	-1.20E-03
10.930	4.00E-03	5.91E-03	-1.91E-03
11.030	4.00E-03	5.62E-03	-1.62E-03
11.130	4.00E-03	5.35E-03	-1.35E-03
11.230	3.00E-03	5.10E-03	-2.10E-03
11.330	3.00E-03	4.85E-03	-1.85E-03
11.430	3.00E-03	4.61E-03	-1.61E-03
11.53	2.00E-03	4.39E-03	-2.39E-03
11.73	2.00E-03	4.17E-03	-2.17E-03
11.83	1.00E-03	3.97E-03	-2.97E-03
11.93	1.00E-03	3.77E-03	-2.77E-03
12.03	1.00E-03	3.58E-03	-2.58E-03
12.13	1.00E-03	3.40E-03	-2.40E-03

May 2006
C1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1561E-05
DISPERSIVITY= 0.2400E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.5727
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2187E-02

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.2376E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.56E-06	1.55E-06	1.58E-06
X(3)	2.30E-03	2.25E-03	2.35E-03
X(6)	5.73E-01	5.61E-01	5.79E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-01	2.00E-03	1.48E-23	2.00E-03
0.2	2.00E-03	4.34E-12	2.00E-03
3.00E-01	3.00E-03	3.07E-08	3.00E-03
0.4	3.00E-03	2.67E-06	3.00E-03
5.00E-01	3.92E-05	3.92E-05	0.00E+00
0.6	4.00E-03	2.37E-04	3.76E-03
0.7	5.00E-03	8.58E-04	4.14E-03
0.8	7.00E-03	2.26E-03	4.74E-03
0.9	1.00E-02	4.79E-03	5.21E-03
1	1.50E-02	8.75E-03	6.25E-03
1.1	2.10E-02	1.43E-02	6.70E-03
1.2	2.90E-02	2.15E-02	7.48E-03
1.3	3.90E-02	3.04E-02	8.63E-03
1.4	4.07E-02	4.07E-02	8.29E-03
1.5	6.10E-02	5.23E-02	8.74E-03
1.6	7.20E-02	6.48E-02	7.45E-03
1.7	8.20E-02	7.70E-02	4.95E-03
1.8	9.20E-02	8.92E-02	2.82E-03
1.9	1.01E-01	1.01E-01	5.04E-04
2	1.09E-01	1.11E-01	-1.16E-03
2.1	1.16E-01	1.20E-01	-3.46E-03
2.2	1.21E-01	1.42E-01	-6.24E-03
2.3	1.26E-01	1.33E-01	-6.61E-03
2.4	1.30E-01	1.37E-01	-6.99E-03
2.5	1.34E-01	1.37E-01	-8.03E-03
2.6	1.34E-01	1.42E-01	-7.83E-03
2.7	1.35E-01	1.43E-01	-7.52E-03
2.8	1.36E-01	1.42E-01	-6.24E-03
2.9	1.36E-01	1.41E-01	-5.12E-03
3	1.35E-01	1.39E-01	-4.29E-03
3.1	1.34E-01	1.34E-01	-2.86E-03
3.2	1.32E-01	1.34E-01	-1.93E-03
3.3	1.31E-01	1.31E-01	3.94E-04
3.4	1.28E-01	1.27E-01	1.03E-03
3.5	1.26E-01	1.23E-01	2.92E-03
3.6	1.23E-01	1.19E-01	3.97E-03
3.7	1.20E-01	1.15E-01	5.15E-03
3.8	1.17E-01	1.11E-01	6.40E-03
3.9	1.14E-01	1.06E-01	7.68E-03
4	1.02E-01	1.02E-01	7.99E-03
4.1	1.06E-01	9.78E-02	8.22E-03
4.2	1.02E-01	9.36E-02	8.41E-03
4.3	9.60E-02	8.60E-02	8.57E-03
4.4	9.40E-02	8.54E-02	8.57E-03
4.5	8.90E-02	8.15E-02	7.50E-03
4.6	8.60E-02	7.77E-02	6.33E-03
4.7	8.00E-02	7.40E-02	6.03E-03
4.8	7.50E-02	7.04E-02	4.61E-03
4.9	7.10E-02	6.60E-02	3.63E-03
5	6.60E-02	6.36E-02	2.39E-03
5.1	6.20E-02	6.04E-02	1.58E-03
5.2	5.80E-02	5.74E-02	6.45E-04
5.3	5.40E-02	5.44E-02	-4.18E-04
5.4	5.00E-02	5.16E-02	-1.61E-03
5.5	4.70E-02	4.89E-02	-1.92E-03
5.6	4.30E-02	4.64E-02	-3.36E-03
5.7	4.00E-02	4.39E-02	-3.91E-03
5.8	3.80E-02	4.16E-02	-3.58E-03
5.9	3.50E-02	3.94E-02	-4.36E-03
6	3.30E-02	3.73E-02	-4.25E-03
6.1	3.10E-02	3.52E-02	-4.25E-03
6.2	2.90E-02	3.33E-02	-4.34E-03
6.3	2.70E-02	3.15E-02	-4.53E-03
6.4	2.50E-02	2.98E-02	-4.81E-03
6.5	2.40E-02	2.82E-02	-4.17E-03
6.6	2.30E-02	2.66E-02	-3.63E-03
6.7	2.10E-02	2.52E-02	-4.16E-03
6.8	2.00E-02	2.38E-02	-3.77E-03
6.9	1.90E-02	2.25E-02	-3.45E-03
7	1.80E-02	2.12E-02	-3.20E-03
7.1	1.70E-02	2.00E-02	-3.02E-03
7.2	1.60E-02	1.89E-02	-2.91E-03
7.3	1.50E-02	1.79E-02	-2.85E-03
7.4	1.40E-02	1.69E-02	-2.85E-03
7.5	1.30E-02	1.59E-02	-2.90E-03
7.6	1.20E-02	1.50E-02	-3.01E-03
7.7	1.10E-02	1.42E-02	-3.17E-03
7.8	1.10E-02	1.34E-02	-2.37E-03
7.9	1.00E-02	1.26E-02	-2.61E-03
8	9.00E-03	1.19E-02	-2.67E-03
8.1	8.00E-03	1.12E-02	-3.23E-03
8.2	8.00E-03	1.06E-02	-2.59E-03
8.3	7.00E-03	9.99E-03	-2.93E-03
8.4	6.00E-03	9.42E-03	-3.42E-03
8.5	6.00E-03	8.89E-03	-2.89E-03
8.6	5.00E-03	8.38E-03	-3.47E-03
8.7	5.00E-03	7.91E-03	-2.91E-03
8.8	4.00E-03	7.46E-03	-3.46E-03
8.9	4.00E-03	7.03E-03	-3.03E-03
9	3.00E-03	6.63E-03	-3.63E-03
9.1	3.00E-03	6.25E-03	-3.25E-03
9.2	2.00E-03	5.89E-03	-2.89E-03
9.3	2.00E-03	5.56E-03	-3.56E-03
9.4	2.00E-03	5.24E-03	-3.24E-03
9.5	1.00E-03	4.94E-03	-3.94E-03
9.6	1.00E-03	4.66E-03	-3.66E-03
9.7	1.00E-03	4.39E-03	-3.39E-03

C1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 99
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1554E-05
DISPERSIVITY= 0.1355E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.6733
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1433E-02

THE F STATISTIC FOR NP= 3 NOBS= 99 IS: 2.71
THE CRITICAL RSS IS: 0.1554E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.55E-06	1.55E-06	1.55E-06
X(3)	1.36E-03	1.32E-03	1.41E-03
X(5)	6.73E-01	6.67E-01	6.80E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.133	1.00E-03	9.77E-79	1.00E-03
0.267	1.00E-03	1.96E-38	1.00E-03
0.400	1.00E-03	5.38E-25	1.00E-03
0.533	1.00E-03	2.79E-18	1.00E-03
0.667	3.00E-03	2.94E-14	1.00E-03
0.800	1.00E-03	1.39E-11	1.00E-03
0.933	2.00E-03	1.11E-09	2.00E-03
1.067	3.00E-03	2.91E-08	3.00E-03
1.200	4.00E-03	3.63E-07	4.00E-03
1.333	5.00E-03	2.71E-06	5.00E-03
1.467	6.00E-03	1.33E-05	5.99E-03
1.600	7.00E-03	5.30E-05	6.95E-03
1.733	8.00E-03	1.64E-04	7.84E-03
1.867	1.00E-02	4.25E-04	8.48E-03
2.000	1.10E-02	9.61E-04	1.00E-02
2.133	1.20E-02	1.94E-03	1.01E-02
2.267	1.30E-02	3.59E-03	9.41E-03
2.400	1.50E-02	6.12E-03	8.88E-03
2.533	1.60E-02	9.77E-03	6.23E-03
2.667	2.00E-02	1.47E-02	5.95E-03
2.800	2.60E-02	2.11E-02	4.90E-03
2.933	2.93E-02	2.89E-02	4.08E-03
3.067	4.10E-02	3.81E-02	2.89E-03
3.200	5.00E-02	4.85E-02	1.53E-03
3.333	6.10E-02	5.93E-02	1.48E-03
3.467	7.30E-02	7.16E-02	1.37E-03
3.600	8.50E-02	8.37E-02	1.28E-03
3.733	9.60E-02	9.57E-02	3.23E-04
3.867	1.07E-01	1.07E-01	-1.57E-04
4.000	1.17E-01	1.18E-01	-8.36E-04
4.133	1.28E-01	1.28E-01	-1.48E-03
4.267	1.33E-01	1.36E-01	-2.85E-03
4.400	1.39E-01	1.43E-01	-3.84E-03
4.533	1.44E-01	1.44E-01	-4.19E-03
4.667	1.48E-01	1.52E-01	-4.40E-03
4.800	1.51E-01	1.56E-01	-3.96E-03
4.933	1.52E-01	1.52E-01	-1.10E-03
5.067	1.55E-01	1.56E-01	-2.93E-03
5.200	1.53E-01	1.55E-01	-1.65E-03
5.333	1.51E-01	1.51E-01	1.09E-03
5.467	1.49E-01	1.49E-01	3.13E-04
5.600	1.46E-01	1.45E-01	1.52E-03
5.733	1.42E-01	1.40E-01	4.59E-03
5.867	1.38E-01	1.34E-01	3.80E-03
6.000	1.33E-01	1.28E-01	4.62E-03
6.133	1.27E-01	1.27E-01	1.27E-03
6.267	1.22E-01	1.16E-01	6.04E-03
6.400	1.15E-01	1.10E-01	5.44E-03
6.533	1.09E-01	1.03E-01	6.06E-03
6.667	1.02E-01	9.68E-02	5.24E-03
6.800	9.50E-02	9.05E-02	4.50E-03
6.933	8.80E-02	8.44E-02	3.61E-03
7.067	8.10E-02	7.85E-02	2.52E-03
7.200	7.40E-02	7.28E-02	1.21E-03
7.333	6.80E-02	6.74E-02	6.50E-04
7.467	6.10E-02	6.22E-02	-1.17E-03
7.600	5.50E-02	5.73E-02	-2.27E-03
7.733	5.00E-02	5.27E-02	-2.65E-03
7.867	4.50E-02	4.83E-02	-3.30E-03
8.000	4.10E-02	4.42E-02	-3.24E-03
8.133	3.60E-02	4.05E-02	-4.45E-03
8.267	3.30E-02	3.69E-02	-3.92E-03
8.400	2.90E-02	3.37E-02	-4.65E-03
8.533	2.60E-02	3.06E-02	-4.62E-03
8.667	2.30E-02	2.78E-02	-4.83E-03
8.800	2.10E-02	2.53E-02	-4.26E-03
8.933	1.90E-02	2.29E-02	-3.90E-03
9.067	1.70E-02	2.07E-02	-3.73E-03
9.200	1.60E-02	1.86E-02	-2.75E-03
9.333	1.40E-02	1.69E-02	-2.94E-03
9.467	1.30E-02	1.53E-02	-2.28E-03
9.600	1.20E-02	1.38E-02	-1.78E-03
9.733	1.00E-02	1.24E-02	-2.41E-03
9.867	1.00E-02	1.12E-02	-1.17E-03
10.000	8.00E-03	1.00E-02	-1.05E-03
10.133	8.00E-03	9.03E-03	-1.03E-03
10.267	7.00E-03	8.10E-03	-1.10E-03
10.400	6.00E-03	7.27E-03	-1.27E-03
10.533	5.00E-03	6.52E-03	-1.52E-03
10.667	5.00E-03	5.84E-03	-6.35E-04
10.800	4.00E-03	5.23E-03	-1.27E-03
10.933	3.00E-03	4.68E-03	-1.68E-03
11.067	2.00E-03	4.18E-03	-2.18E-03
11.200	2.00E-03	3.74E-03	-1.74E-03
11.333	2.00E-03	3.34E-03	-1.34E-03
11.467	1.00E-03	3.19E-03	-2.19E-03
11.600	1.00E-03	2.66E-03	-1.66E-03
11.733	1.00E-03	4.30E-03	-3.00E-04
11.867	1.00E-03	3.99E-03	-4.99E-05
12.000	4.00E-03	3.63E-03	3.67E-04
12.133	3.00E-03	3.34E-03	-3.37E-04
12.267	2.00E-03	2.99E-03	-6.50E-05
12.400	3.00E-03	2.81E-03	1.86E-04
12.533	2.00E-03	2.59E-03	-5.83E-04
12.667	1.00E-03	2.37E-03	-3.70E-04

May 2006
C2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1396E-05
DISPERSIVITY= 0.1879E-02
WIDTH= 0.5000E-02
RF= 1.00
CO= 0.4734
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9396E-03

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72
THE CRITICAL RSS IS: 0.1030E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.40E-06	1.40E-06	1.40E-06
X(2)	1.80E-03	1.90E-03	1.90E-03
X(5)	4.73E-01	4.69E-01	4.78E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.52E-01	0.00E+00	1.09E-21	-1.09E-21
0.285	1.00E-03	1.06E-11	1.00E-03
4.18E-01	1.00E-03	4.62E-08	1.00E-03
0.5517	2.00E-03	3.58E-06	2.00E-03
6.85E-01	3.00E-03	5.10E-05	2.95E-03
0.8183	4.00E-03	3.05E-04	3.70E-03
0.9517	6.00E-03	1.11E-03	4.90E-03
1.085	8.00E-03	2.90E-03	6.10E-03
1.218	1.30E-02	6.15E-03	6.85E-03
1.352	1.80E-02	1.12E-02	6.80E-03
1.485	2.60E-02	1.82E-02	7.78E-03
1.618	3.40E-02	2.73E-02	6.72E-03
1.752	4.40E-02	3.81E-02	5.86E-03
1.885	5.04E-02	5.04E-02	4.63E-03
2.018	6.70E-02	6.33E-02	3.71E-03
2.152	7.70E-02	7.62E-02	8.23E-04
2.285	8.70E-02	8.93E-02	-1.32E-03
2.418	9.60E-02	9.92E-02	-3.18E-03
2.552	1.04E-01	1.08E-01	-4.42E-03
2.685	1.10E-01	1.16E-01	-5.82E-03
2.818	1.16E-01	1.21E-01	-5.36E-03
2.952	1.20E-01	1.28E-01	-5.31E-03
3.085	1.22E-01	1.27E-01	-5.17E-03
3.218	1.24E-01	1.28E-01	-3.74E-03
3.352	1.25E-01	1.27E-01	-2.90E-03
3.485	1.24E-01	1.25E-01	-1.17E-03
3.618	1.23E-01	1.22E-01	5.73E-04
3.752	1.21E-01	1.19E-01	2.05E-03
3.885	1.19E-01	1.15E-01	4.09E-03
4.018	1.15E-01	1.11E-01	4.55E-03
4.152	1.11E-01	1.07E-01	5.31E-03
4.285	1.07E-01	1.01E-01	6.27E-03
4.418	1.02E-01	9.57E-02	6.33E-03
4.552	9.60E-02	8.90E-02	5.42E-03
4.685	9.10E-02	8.55E-02	5.47E-03
4.818	8.50E-02	8.06E-02	4.44E-03
4.952	7.90E-02	7.50E-02	3.29E-03
5.085	7.30E-02	7.10E-02	2.00E-03
5.218	6.80E-02	6.65E-02	1.53E-03
5.352	6.20E-02	6.21E-02	-1.19E-04
5.485	5.70E-02	5.80E-02	-9.71E-04
5.618	5.20E-02	5.40E-02	-2.03E-03
5.752	4.70E-02	5.03E-02	-3.29E-03
5.885	4.30E-02	4.68E-02	-3.75E-03
6.018	4.00E-02	4.34E-02	-3.42E-03
6.152	3.60E-02	4.03E-02	-4.29E-03
6.285	3.30E-02	3.74E-02	-4.35E-03
6.418	3.10E-02	3.46E-02	-3.60E-03
6.552	2.80E-02	3.20E-02	-4.03E-03
6.685	2.60E-02	2.96E-02	-3.63E-03
6.818	2.40E-02	2.74E-02	-3.39E-03
6.952	2.20E-02	2.53E-02	-3.30E-03
7.085	2.10E-02	2.34E-02	-2.37E-03
7.218	1.90E-02	2.16E-02	-2.57E-03
7.352	1.80E-02	1.99E-02	-1.89E-03
7.485	1.70E-02	1.83E-02	-1.34E-03
7.618	1.60E-02	1.69E-02	-9.09E-04
7.752	1.50E-02	1.56E-02	-5.79E-04
7.885	1.40E-02	1.44E-02	-3.49E-04
8.018	1.30E-02	1.32E-02	-2.13E-04
8.152	1.20E-02	1.22E-02	-1.62E-04
8.285	1.10E-02	1.12E-02	-1.92E-04
8.418	1.00E-02	1.03E-02	-2.96E-04
8.552	1.00E-02	9.47E-03	5.31E-04
8.685	9.00E-03	8.71E-03	2.93E-04
8.818	8.00E-03	8.01E-03	-5.17E-06
8.952	8.00E-03	7.36E-03	6.43E-04
9.085	7.00E-03	6.76E-03	2.39E-04
9.218	7.00E-03	6.21E-03	7.88E-04
9.352	6.00E-03	5.71E-03	2.93E-04
9.485	6.00E-03	5.24E-03	7.58E-04
9.618	5.00E-03	4.81E-03	1.88E-04
9.752	5.00E-03	4.42E-03	5.80E-04
9.885	4.00E-03	4.06E-03	-5.78E-05
10.02	4.00E-03	3.73E-03	2.74E-04
10.15	3.00E-03	3.42E-03	-4.18E-04
10.29	3.00E-03	3.14E-03	-1.38E-04
10.42	3.00E-03	2.86E-03	1.20E-04
10.55	2.00E-03	2.64E-03	-6.42E-04
10.69	2.00E-03	2.42E-03	-8.24E-04
10.82	2.00E-03	2.22E-03	-2.24E-04
10.95	2.00E-03	2.04E-03	-3.95E-05
11.09	1.00E-03	1.67E-03	-8.71E-04
11.22	1.00E-03	1.72E-03	-7.17E-04
11.35	1.00E-03	1.57E-03	-5.74E-04
11.49	1.00E-03	1.44E-03	-4.49E-04
11.62	1.00E-03	1.32E-03	-3.24E-04
11.77	0.00E+00	1.20E-03	-1.20E-03

C2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 99
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1177E-05
DISPERSIVITY= 0.9896E-03
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.4122
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2402E-02

THE F STATISTIC FOR NP= 3 NOBS= 99 IS: 2.71
THE CRITICAL RSS IS: 0.2605E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.18E-06	1.18E-06	1.18E-06
X(2)	9.30E-04	9.30E-04	9.30E-04
X(5)	4.12E-01	4.04E-01	4.21E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.452	1.00E-03	8.80E-10	1.00E-03
1.585	1.00E-03	9.14E-09	1.00E-03
1.718	1.00E-03	6.52E-08	1.00E-03
1.852	2.00E-03	3.48E-07	2.00E-03
1.985	3.00E-03	1.46E-06	2.00E-03
2.118	2.00E-03	5.06E-06	2.00E-03
2.252	3.00E-03	1.50E-05	2.99E-03
2.385	3.00E-03	3.89E-05	2.96E-03
2.518	4.00E-03	9.05E-05	3.91E-03
2.652	4.00E-03	1.92E-04	3.81E-03
2.785	5.00E-03	3.75E-04	4.63E-03
2.918	5.00E-03	6.83E-04	4.32E-03
3.052	6.00E-03	1.17E-03	4.83E-03
3.185	7.00E-03	1.91E-03	5.09E-03
3.318	8.00E-03	2.97E-03	5.03E-03
3.452	9.00E-03	4.43E-03	4.57E-03
3.585	1.10E-02	6.37E-03	4.70E-03
3.718	1.30E-02	8.85E-03	4.15E-03
3.852	1.60E-02	1.19E-02	4.07E-03
3.985	2.00E-02	1.68E-02	3.46E-03
4.118	2.40E-02	2.00E-02	4.02E-03
4.252	2.80E-02	2.49E-02	3.06E-03
4.385	3.40E-02	3.05E-02	3.53E-03
4.518	3.90E-02	3.65E-02	2.52E-03
4.652	4.65E-02	4.35E-02	2.11E-03
4.785	5.20E-02	4.96E-02	2.43E-03
4.918	5.80E-02	5.64E-02	1.61E-03
5.052	6.40E-02	6.32E-02	7.70E-04
5.185	7.10E-02	6.99E-02	1.06E-03
5.318	7.60E-02	7.64E-02	-3.94E-04
5.452	8.20E-02	8.25E-02	-4.81E-04
5.585	8.70E-02	8.81E-02	-1.09E-03
5.718	9.10E-02	9.31E-02	-2.13E-03
5.852	9.50E-02	9.75E-02	-3.75E-02
5.985	9.80E-02	1.01E-01	-3.25E-03
6.118	1.01E-01	1.04E-01	-3.26E-03
6.252	1.03E-01	1.07E-01	-3.03E-03
6.385	1.04E-01	1.08E-01	-4.08E-03
6.518	1.05E-01	1.09E-01	-3.91E-03
6.652	1.05E-01	1.09E-01	-3.91E-03
6.785	1.06E-01	1.09E-01	-2.57E-03
6.918	1.05E-01	1.08E-01	-2.48E-03
7.052	1.04E-01	1.04E-01	-1.85E-03
7.185	1.03E-01	1.04E-01	-7.40E-04
7.318	1.01E-01	1.01E-01	-2.00E-04
7.452	9.90E-02	9.82E-02	7.70E-04
7.585	9.60E-02	9.51E-02	9.25E-04
7.718	9.30E-02	9.16E-02	1.39E-03
7.852	9.00E-02	8.79E-02	2.00E-03
7.985	8.70E-02	8.41E-02	2.87E-03
8.118	8.30E-02	8.03E-02	3.78E-03
8.252	8.00E-02	7.63E-02	3.74E-03
8.385	7.60E-02	7.23E-02	3.72E-03
8.518	7.20E-02	6.83E-02	3.69E-03
8.652	6.90E-02	6.44E-02	4.61E-03
8.785	6.50E-02	6.05E-02	4.49E-03
8.918	6.10E-02	5.68E-02	4.22E-03
9.052	5.80E-02	5.31E-02	4.86E-03
9.185	5.40E-02	4.96E-02	4.39E-03
9.318	5.10E-02	4.62E-02	4.77E-03
9.452	4.70E-02	4.30E-02	4.00E-03
9.585	4.40E-02	3.99E-02	4.09E-03
9.718	4.10E-02	3.70E-02	4.02E-03
9.852	3.80E-02	3.42E-02	3.80E-03
9.985	3.50E-02	3.16E-02	3.42E-03
10.120	3.30E-02	2.91E-02	3.88E-03
10.250	3.00E-02	2.68E-02	3.20E-03
10.390	2.80E-02	2.46E-02	3.36E-03
10.520	2.60E-02	2.26E-02	2.38E-03
10.650	2.30E-02	2.07E-02	2.27E-03
10.790	2.10E-02	1.90E-02	2.02E-03
10.920	1.90E-02	1.74E-02	1.64E-03
11.050	1.70E-02	1.59E-02	1.15E-03
11.190	1.60E-02	1.45E-02	1.54E-03
11.320	1.40E-02	1.32E-02	5.18E-04
11.450	1.30E-02	1.20E-02	1.01E-03
11.590	1.20E-02	1.09E-02	1.09E-03
11.720	1.00E-02	9.92E-03	5.50E-05
11.850	9.00E-03	9.00E-03	4.54E-04
11.990	8.00E-03	8.10E-03	-1.60E-04
12.120	7.00E-03	7.40E-03	-3.9E-04
12.250	6.00E-03	6.69E-03	-6.92E-04
12.390	5.00E-03	5.15E-03	-1.45E-02
12.520	4.00E-03	4.41E-03	-1.31E-02
12.650	3.00E-03	3.29E-03	-1.19E-02
12.790	2.00E-03	2.17E-03	-1.17E-02
12.920	1.00E-03	1.07E-02	-9.66E-03
13.050	0.00E+00	9.57E-03	-9.57E-03
13.190	4.13E-02	1.150E-02	-1.10E-02
13.320	4.00E-03	1.40E-02	-9.99E-03
13.450	3.00E-03	1.30E-02	-1.00E-02
13.590	3.00E-03	1.22E-02	-9.16E-03
13.720	3.00E-03	1.13E-02	-8.32E-03
13.850	2.00E-03	1.05E-02	-8.54E-03
13.990	2.00E-03	9.81E-03	-7.81E-03
14.120	1.00E-03	9.12E-03	-8.12E-03
14.250	1.00E-03	8.48E-03	-7.48E-03
14.390	1.00E-03	7.88E-03	-6.88E-03
14.520	1.00E-03	7.31E-03	-6.31E-03

May 2006
C3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.7600E-02
 9) THE RETARDATION FACTOR (DIM) : 1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7880E-06
 DISPERSIVITY= 0.2483E-02
 WIDTH= 0.7600E-02
 RF= 0.5855
 CO= 0.3799
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1827E-01

THE F STATISTIC FOR NP= 4 NOBS= 87 IS: 2.49
 THE CRITICAL RSS IS: 0.2047E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.88E-07	7.72E-07	8.04E-07
X(2)	2.48E-03	2.21E-03	2.96E-03
X(4)	5.86E-01	5.68E-01	5.97E-01
X(5)	3.80E-01	3.61E-01	3.91E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.2183	1.00E-03	2.20E-08	1.00E-03
3.52E-01	2.00E-03	1.43E-05	1.99E-03
0.485	4.00E-03	2.73E-04	3.73E-03
6.19E-01	6.00E-03	1.49E-03	4.51E-03
0.7517	1.00E-02	4.49E-03	5.51E-03
0.885	1.60E-02	9.74E-03	6.27E-03
1.018	2.40E-02	1.73E-02	6.73E-03
1.152	3.60E-02	2.69E-02	9.06E-03
1.285	5.00E-02	3.82E-02	1.18E-02
1.418	6.60E-02	5.08E-02	1.52E-02
1.552	8.20E-02	6.44E-02	1.76E-02
1.685	9.90E-02	7.84E-02	2.06E-02
1.818	1.15E-01	9.27E-02	2.23E-02
1.952	1.29E-01	1.07E-01	2.19E-02
2.085	1.43E-01	1.21E-01	2.17E-02
2.218	1.55E-01	1.35E-01	1.97E-02
2.352	1.65E-01	1.49E-01	1.61E-02
2.485	1.74E-01	1.61E-01	1.20E-02
2.618	1.82E-01	1.75E-01	7.41E-03
2.752	1.88E-01	1.87E-01	1.26E-03
2.885	1.94E-01	1.98E-01	-4.24E-03
3.018	1.98E-01	2.09E-01	-1.12E-02
3.152	2.02E-01	2.19E-01	-1.74E-02
3.285	2.05E-01	2.28E-01	-2.32E-02
3.418	2.07E-01	2.35E-01	-2.77E-02
3.552	2.09E-01	2.39E-01	-2.95E-02
3.685	2.10E-01	2.39E-01	-2.94E-02
3.818	2.10E-01	2.39E-01	-2.79E-02
3.952	2.10E-01	2.34E-01	-2.39E-02
4.085	2.10E-01	2.28E-01	-1.84E-02
4.218	2.08E-01	2.21E-01	-1.23E-02
4.352	2.06E-01	2.14E-01	-7.45E-03
4.485	2.03E-01	2.05E-01	-1.88E-03
4.618	2.00E-01	1.96E-01	4.12E-03
4.752	1.96E-01	1.87E-01	9.85E-03
4.885	1.91E-01	1.77E-01	1.36E-02
5.018	1.86E-01	1.68E-01	1.78E-02
5.152	1.80E-01	1.59E-01	2.20E-02
5.285	1.73E-01	1.50E-01	2.62E-02
5.418	1.65E-01	1.42E-01	2.32E-02
5.552	1.57E-01	1.34E-01	2.34E-02
5.685	1.49E-01	1.26E-01	2.33E-02
5.818	1.40E-01	1.18E-01	2.17E-02
5.952	1.30E-01	1.11E-01	1.89E-02
6.085	1.21E-01	1.04E-01	1.67E-02
6.218	1.12E-01	9.79E-02	1.41E-02
6.352	1.02E-01	9.18E-02	1.02E-02
6.485	9.30E-02	8.61E-02	6.88E-03
6.618	8.50E-02	8.07E-02	4.27E-03
6.752	7.70E-02	7.56E-02	1.38E-03
6.885	6.90E-02	7.08E-02	-1.84E-03
7.018	6.10E-02	6.64E-02	-5.36E-03
7.152	5.50E-02	6.21E-02	-7.10E-03
7.285	4.90E-02	5.81E-02	-9.14E-03
7.418	4.30E-02	5.44E-02	-1.14E-02
7.552	3.80E-02	5.09E-02	-1.29E-02
7.685	3.40E-02	4.77E-02	-1.37E-02
7.818	3.00E-02	4.46E-02	-1.46E-02
7.952	2.70E-02	4.17E-02	-1.47E-02
8.085	2.40E-02	3.90E-02	-1.50E-02
8.218	2.10E-02	3.65E-02	-1.55E-02
8.352	1.90E-02	3.41E-02	-1.51E-02
8.485	1.70E-02	3.19E-02	-1.49E-02
8.618	1.50E-02	2.99E-02	-1.49E-02
8.752	1.40E-02	2.79E-02	-1.39E-02
8.885	1.20E-02	2.61E-02	-1.41E-02
9.018	1.10E-02	2.44E-02	-1.34E-02
9.152	1.00E-02	2.28E-02	-1.28E-02
9.285	9.00E-03	2.14E-02	-1.24E-02
9.418	8.00E-03	2.00E-02	-1.20E-02
9.552	7.00E-03	1.87E-02	-1.17E-02
9.685	6.00E-03	1.75E-02	-1.15E-02
9.818	6.00E-03	1.64E-02	-1.10E-02
9.952	5.00E-03	1.53E-02	-1.03E-02
10.09	4.00E-03	1.43E-02	-1.03E-02
10.22	4.00E-03	1.34E-02	-9.36E-03
10.35	3.00E-03	1.25E-02	-9.52E-03
10.49	3.00E-03	1.17E-02	-8.67E-03
10.62	2.00E-03	1.09E-02	-8.93E-03
10.75	2.00E-03	1.02E-02	-8.24E-03
10.89	2.00E-03	9.55E-03	-7.55E-03
11.02	1.00E-03	8.96E-03	-7.95E-03
11.15	1.00E-03	8.30E-03	-7.30E-03
11.3	1.00E-03	7.78E-03	-6.78E-03
11.43	1.00E-03	7.29E-03	-6.29E-03
11.57	1.00E-03	6.80E-03	-5.80E-03
11.7	0.00E+00	6.37E-03	-6.37E-03

C3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 86
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.7600E-02
 9) THE RETARDATION FACTOR (DIM) : 1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.6551E-06
 DISPERSIVITY= 0.1847E-02
 WIDTH= 0.7601E-02
 RF= 0.5888
 CO= 0.3730
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1669E-02

THE F STATISTIC FOR NP= 4 NOBS= 86 IS: 2.49
 THE CRITICAL RSS IS: 0.1871E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	6.55E-07	6.55E-07	6.55E-07
X(2)	1.85E-03	1.77E-03	1.92E-03
X(4)	5.89E-01	5.89E-01	5.89E-01
X(5)	3.73E-01	3.69E-01	3.77E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.952	1.00E-03	8.02E-08	1.00E-03
1.085	1.00E-03	7.67E-07	9.99E-04
1.218	2.00E-03	4.45E-06	2.00E-03
1.352	2.00E-03	1.82E-05	1.98E-03
1.485	3.00E-03	5.75E-05	2.94E-03
1.618	3.00E-03	1.50E-04	2.85E-03
1.752	4.00E-03	3.37E-04	3.66E-03
1.885	5.00E-03	6.72E-04	4.33E-03
2.018	6.00E-03	1.22E-03	4.78E-03
2.152	7.00E-03	2.05E-03	4.95E-03
2.285	7.00E-03	3.24E-03	3.77E-03
2.418	8.00E-03	4.84E-03	3.16E-03
2.552	1.00E-02	6.92E-03	3.08E-03
2.685	1.10E-02	9.53E-03	1.47E-03
2.818	1.30E-02	1.27E-02	3.03E-04
2.952	1.50E-02	1.65E-02	-1.45E-03
3.085	1.80E-02	2.08E-02	-2.78E-03
3.218	2.20E-02	2.57E-02	-3.59E-03
3.352	2.70E-02	3.12E-02	-4.17E-03
3.485	3.30E-02	3.72E-02	-4.19E-03
3.618	3.90E-02	4.37E-02	-4.37E-03
3.752	4.70E-02	5.07E-02	-3.68E-03
3.885	5.50E-02	5.81E-02	-3.07E-03
4.018	6.50E-02	6.58E-02	-8.58E-04
4.152	7.40E-02	7.39E-02	9.77E-05
4.285	8.40E-02	8.22E-02	1.76E-03
4.418	9.40E-02	9.08E-02	3.21E-03
4.552	1.04E-01	9.95E-02	4.79E-03
4.685	1.14E-01	1.08E-01	5.70E-03
4.818	1.24E-01	1.17E-01	6.88E-03
4.952	1.28E-01	1.26E-01	7.09E-03
5.085	1.41E-01	1.35E-01	6.47E-03
5.218	1.48E-01	1.43E-01	5.08E-03
5.352	1.55E-01	1.51E-01	4.03E-03
5.485	1.62E-01	1.59E-01	2.43E-03
5.618	1.67E-01	1.66E-01	1.37E-03
5.752	1.72E-01	1.72E-01	-7.66E-05
5.885	1.77E-01	1.77E-01	-1.78E-02
6.018	1.81E-01	1.83E-01	-1.85E-03
6.152	1.83E-01	1.87E-01	-4.09E-03
6.285	1.86E-01	1.91E-01	-4.53E-03
6.418	1.88E-01	1.93E-01	-5.16E-03
6.552	1.89E-01	1.95E-01	-6.01E-03
6.685	1.90E-01	1.96E-01	-6.07E-03
6.818	1.90E-01	1.96E-01	-6.40E-03
6.952	1.90E-01	1.96E-01	-6.01E-03
7.085	1.89E-01	1.95E-01	-5.97E-03
7.218	1.88E-01	1.93E-01	-5.31E-03
7.352	1.87E-01	1.91E-01	-4.09E-03
7.485	1.85E-01	1.88E-01	-3.36E-03
7.618	1.83E-01	1.85E-01	-2.18E-03
7.752	1.81E-01	1.82E-01	5.36E-04
7.885	1.78E-01	1.78E-01	3.33E-04
8.018	1.75E-01	1.73E-01	1.56E-03
8.152	1.71E-01	1.69E-01	2.04E-03
8.285	1.67E-01	1.64E-01	1.72E-03
8.418	1.63E-01	1.59E-01	3.57E-03
8.552	1.59E-01	1.55E-01	4.54E-03
8.685	1.55E-01	1.49E-01	5.60E-03
8.818	1.50E-01	1.44E-01	5.72E-03
8.952	1.45E-01	1.39E-01	5.86E-03
9.085	1.40E-01	1.34E-01	6.00E-03
9.218	1.35E-01	1.29E-01	6.12E-03
9.352	1.30E-01	1.24E-01	6.19E-03
9.485	1.25E-01	1.19E-01	6.20E-03
9.618	1.19E-01	1.14E-01	5.13E-03
9.752	1.14E-01	1.09E-01	4.98E-03
9.885	1.09E-01	1.04E-01	4.71E-03
10.020	1.04E-01	9.97E-02	4.32E-03
10.150	9.80E-02	9.52E-02	2.85E-03
10.290	9.30E-02	9.08E-02	2.21E-03
10.420	8.80E-02	8.62E-02	1.54E-03
10.550	8.30E-02	8.24E-02	5.65E-04
10.690	7.80E-02	7.85E-02	-4.79E-04
10.820	7.30E-02	7.32E-02	-1.66E-02
10.950	6.90E-02	7.10E-02	-1.96E-03
11.090	6.40E-02	6.74E-02	-3.42E-03
11.220	6.00E-02	6.40E-02	-4.02E-03
11.350	5.60E-02	6.07E-02	-4.74E-03
11.490	5.20E-02	5.76E-02	-5.61E-03
11.620	4.80E-02	5.46E-02	-6.62E-03
11.750	4.50E-02	5.14E-02	-6.43E-03
11.890	4.10E-02	4.90E-02	-8.01E-03
12.020	3.80E-02	4.64E-02	-8.38E-03
12.150	3.60E-02	4.39E-02	-7.89E-03
12.290	3.30E-02	4.19E-02	-8.52E-03

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : 1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1241E-05
 DISPERSIVITY= 0.4403E-02
 WIDTH= 0.5000E-02
 RF= 0.7250
 CO= 0.1717
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1844E-03

THE F STATISTIC FOR NP= 4 NOBS= 97 IS: 2.47
 THE CRITICAL RSS IS: 0.2041E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.24E-06	1.23E-06	1.25E-06
X(2)	4.40E-03	4.23E-03	4.59E-03
X(4)	7.25E-01	7.18E-01	7.32E-01
X(5)	1.72E-01	1.70E-01	1.73E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.4	9.42E-04	3.31E-04	6.11E-04
5.00E-01	8.59E-04	1.17E-03	-3.09E-04
0.6	1.78E-03	2.74E-03	-9.64E-04
7.00E-01	3.69E-03	5.08E-03	-1.38E-03
0.8	6.81E-03	6.11E-03	-2.49E-03
0.9	9.53E-03	1.17E-02	-2.18E-03
1	1.45E-02	1.58E-02	-1.31E-03
1.1	1.94E-02	2.01E-02	-7.97E-04
1.2	2.53E-02	2.47E-02	-5.69E-04
1.3	3.02E-02	2.94E-02	-7.61E-04
1.4	3.51E-02	3.42E-02	-9.08E-04
1.5	3.90E-02	3.88E-02	-2.37E-04
1.6	4.30E-02	4.29E-02	-9.09E-05
1.7	4.69E-02	4.62E-02	-2.79E-04
1.8	4.78E-02	4.86E-02	-7.95E-04
1.9	4.97E-02	5.02E-02	-4.95E-04
2	5.06E-02	5.11E-02	-4.80E-04
2.1	5.15E-02	5.14E-02	1.31E-04
2.2	5.25E-02	5.12E-02	1.22E-03
2.3	5.14E-02	5.07E-02	6.86E-04
2.4	5.13E-02	4.99E-02	1.44E-03
2.5	5.02E-02	4.88E-02	1.42E-03
2.6	4.91E-02	4.76E-02	1.55E-03
2.7	4.80E-02	4.63E-02	1.79E-03
2.8	4.49E-02	4.39E-02	7.11E-03
2.9	4.49E-02	4.34E-02	1.48E-03
3	4.28E-02	4.19E-02	8.67E-04
3.1	4.07E-02	4.05E-02	2.63E-04
3.2	3.96E-02	3.90E-02	6.53E-04
3.3	3.75E-02	3.75E-02	2.33E-05
3.4	3.55E-02	3.61E-02	-6.33E-04
3.5	3.34E-02	3.47E-02	-1.32E-03
3.6	3.23E-02	3.33E-02	-1.04E-03
3.7	3.02E-02	3.02E-02	-1.80E-03
3.8	2.91E-02	3.07E-02	-1.61E-03
3.9	2.71E-02	2.95E-02	-2.45E-03
4	2.60E-02	2.83E-02	-2.34E-03
4.1	2.49E-02	2.72E-02	-2.27E-03
4.2	2.38E-02	2.60E-02	-2.24E-03
4.3	2.27E-02	2.50E-02	-2.26E-03
4.4	2.16E-02	2.40E-02	-2.31E-03
4.5	2.16E-02	2.30E-02	-1.41E-03
4.6	2.05E-02	2.20E-02	-1.55E-03
4.7	1.94E-02	2.11E-02	-1.72E-03
4.8	1.93E-02	2.02E-02	-9.56E-04
4.9	1.82E-02	1.94E-02	-1.191E-03
5	1.81E-02	1.86E-02	-4.67E-04
5.1	1.71E-02	1.78E-02	-7.83E-04
5.2	1.70E-02	1.71E-02	-1.311E-04
5.3	1.59E-02	1.64E-02	-5.10E-04
5.4	1.58E-02	1.57E-02	8.22E-05
5.5	1.47E-02	1.51E-02	-3.55E-04
5.6	1.46E-02	1.45E-02	1.81E-04
5.7	1.48E-02	1.39E-02	6.91E-04
5.8	1.35E-02	1.33E-02	1.78E-04
5.9	1.34E-02	1.28E-02	6.37E-04
6	1.33E-02	1.22E-02	1.08E-03
6.1	1.32E-02	1.17E-02	1.43E-03
6.2	1.31E-02	1.13E-02	1.89E-03
6.3	1.21E-02	1.08E-02	1.26E-03
6.4	1.20E-02	1.04E-02	1.62E-03
6.5	1.19E-02	9.94E-03	1.95E-03
6.6	1.18E-02	9.54E-03	2.27E-03
6.7	1.07E-02	9.16E-03	1.68E-03
6.8	1.07E-02	8.79E-03	1.86E-03
6.9	1.06E-02	8.43E-03	2.13E-03
7	9.48E-03	8.09E-03	1.39E-03
7.1	9.40E-03	7.77E-03	1.63E-03
7.2	9.32E-03	7.48E-03	1.88E-03
7.3	9.23E-03	7.16E-03	2.08E-03
7.4	9.15E-03	6.87E-03	2.28E-03
7.5	9.07E-03	6.60E-03	1.47E-03
7.6	7.99E-03	6.33E-03	1.65E-03
7.7	7.90E-03	6.08E-03	1.82E-03
7.8	6.82E-03	5.84E-03	9.80E-04
7.9	6.74E-03	5.61E-03	1.13E-03
8	6.66E-03	5.39E-03	1.27E-03
8.1	6.57E-03	5.17E-03	1.40E-03
8.2	5.49E-03	4.97E-03	5.20E-04
8.3	5.41E-03	4.77E-03	6.33E-04
8.4	5.32E-03	4.59E-03	7.39E-04
8.5	4.24E-03	4.41E-03	-1.64E-04
8.6	4.16E-03	4.23E-03	-7.35E-05
8.7	4.08E-03	4.08E-03	-9.37E-05
8.8	3.99E-03	3.91E-03	8.64E-05
8.9	2.91E-03	3.75E-03	-8.44E-04
9	2.83E-03	3.61E-03	-7.90E-04
9.1	2.75E-03	3.47E-03	-7.21E-04
9.2	2.66E-03	3.33E-03	-6.69E-04
9.3	1.58E-03	3.20E-03	-1.62E-03
9.4	1.50E-03	3.08E-03	-1.58E-03
9.5	1.41E-03	2.96E-03	-1.54E-03
9.6	1.33E-03	2.84E-03	-1.51E-03
9.7	1.25E-03	2.73E-03	-1.48E-03
9.8	1.66E-04	2.63E-03	-2.46E-03
9.9	8.27E-05	2.53E-03	-2.44E-03
10	1.00E-13	2.43E-03	-2.43E-03

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : 1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1825E-05
 DISPERSIVITY= 0.1857E-02
 WIDTH= 0.5000E-02
 RF= 1.330
 CO= 0.2365
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1429E-03

THE F STATISTIC FOR NP= 4 NOBS= 93 IS: 2.48
 THE CRITICAL RSS IS: 0.1589E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.83E-06	1.83E-06	1.83E-06
X(2)	1.86E-03	1.78E-03	1.93E-03
X(4)	7.33E+00	7.33E+00	7.33E+00
X(5)	2.37E-01	2.34E-01	2.39E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.067	1.30E-02	6.98E-03	6.02E-03
3.167	3.16E-02	8.36E-03	4.64E-03
3.267	1.40E-02	9.84E-03	4.16E-03
3.367	1.40E-02	1.14E-02	2.58E-03
3.467	1.70E-02	1.31E-02	1.93E-03
3.567	1.60E-02	1.48E-02	1.24E-03
3.667	1.70E-02	1.65E-02	5.07E-04
3.767	1.80E-02	1.82E-02	-2.30E-04
3.867	1.90E-02	2.00E-02	-9.55E-04
3.967	2.00E-02	2.17E-02	-1.65E-03
4.067	2.20E-02	2.33E-02	-1.29E-03
4.167	2.30E-02	2.49E-02	-1.87E-03
4.267	2.50E-02	2.64E-02	-1.37E-03
4.367	2.60E-02	2.79E-02	-1.78E-03
4.467	2.70E-02	2.91E-02	-2.09E-03
4.567	2.90E-02	3.03E-02	-1.29E-03
4.667	3.00E-02	3.14E-02	-1.37E-03
4.767	3.10E-02	3.23E-02	-1.33E-03
4.867	3.20E-02	3.32E-02	-1.17E-03
4.967	3.30E-02	3.39E-02	-8.81E-04
5.067	3.40E-02	3.45E-02	-4.74E-04
5.167	3.40E-02	3.50E-02	-9.46E-04
5.267	3.50E-02	3.55E-02	-3.02E-04
5.367	3.50E-02	3.55E-02	-5.43E-04
5.467	3.60E-02	3.60E-02	-3.24E-04
5.567	3.60E-02	3.57E-02	2.95E-04
5.667	3.60E-02	3.56E-02	3.63E-04
5.767	3.60E-02	3.55E-02	5.23E-04
5.867	3.60E-02	3.52E-02	7.68E-04
5.967	3.60E-02	3.49E-02	1.09E-03
6.067	3.60E-02	3.46E-02	1.46E-03
6.167	3.50E-02	3.41E-02	9.50E-04
6.267	3.40E-02	3.35E-02	4.72E-04
6.367	3.40E-02	3.30E-02	1.005E-03
6.467	3.30E-02	3.23E-02	6.67E-04
6.567	3.30E-02	3.17E-02	1.33E-03
6.667	3.20E-02	3.10E-02	1.243E-03
6.767	3.10E-02	3.02E-02	7.55E-04
6.867	3.00E-02	2.95E-02	5.08E-04
6.967	2.90E-02	2.87E-02	2.82E-04
7.067	2.80E-02	2.79E-02	1.07E-03
7.167	2.80E-02	2.71E-02	8.73E-04
7.267	2.70E-02	2.63E-02	4.65E-04
7.367	2.60E-02	2.55E-02	4.98E-04
7.467	2.50E-02	2.47E-02	3.13E-04
7.567	2.40E-02	2.39E-02	1.68E-04
7.667	2.30E-02	2.31E-02	-6.19E-05
7.767	2.20E-02	2.23E-02	-2.59E-04
7.867	2.20E-02	2.15E-02	6.37E-04
7.967	2.10E-02	2.07E-02	3.22E-04
8.067	2.00E-02	1.99E-02	9.45E-05
8.167	1.90E-02	1.92E-02	-1.47E-04
8.267	1.80E-02	1.84E-02	-4.02E-04
8.367	1.80E-02	1.77E-02	3.26E-04
8.467	1.70E-02	1.70E-02	3.71E-05
8.567	1.60E-02	1.63E-02	-2.69E-04
8.667	1.50E-02	1.56E-02	-5.94E-04
8.767	1.50E-02	1.49E-02	6.32E-05
8.867	1.40E-02	1.43E-02	-2.99E-04
8.967	1.30E-02	1.37E-02	-6.81E-04
9.067	1.30E-02	1.31E-02	-8.14E-05
9.167	1.20E-02	1.25E-02	-5.02E-04
9.267	1.20E-02	1.19E-02	5.83E-05
9.367	1.10E-02	1.14E-02	-4.01E-04
9.467	1.10E-02	1.09E-02	1.21E-04
9.567	1.00E-02	1.04E-02	-3.77E-04
9.667	1.00E-02	9.89E-03	1.07E-04
9.767	9.00E-03	9.43E-03	-4.28E-04
9.867	8.00E-03	8.98E-03	1.91E-05
9.967	8.00E-03	8.55E-03	-5.52E-04
10.070	8.00E-03	8.14E-03	-1.38E-04
10.170	7.00E-03	7.74E-03	-7.43E-04
10.270	7.00E-03	7.37E-03	-3.65E-04
10.370	7.00E-03	7.00E-03	-1.92E-06
10.470	6.00E-03	6.66E-03	-6.55E-04
10.570	6.00E-03	6.32E-03	-3.29E-04
10.670	6.00E-03	6.01E-03	-5.66E-06
10.770	5.00E-03	5.77E-03	-7.73E-04
10.870	5.00E-03	5.41E-03	-4.13E-04
10.970	5.00E-03	5.14E-03	-1.37E-04
11.070	4.00E-03	4.873E-03	-8.73E-04
11.170	4.00E-03	4.62E-03	-6.22E-04
11.270	4.00E-03	4.38E-03	-3.82E-04
11.370	3.00E-03	4.13E-03	-1.15E-03
11.470	3.00E-03	3.94E-03	-9.37E-04
11.570	3.00E-03	3.73E-03	-7.30E-04
11.670	2.00E-03	3.67E-03	-5.33E

May 2006
D1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : 1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.6594E-06
DISPERSIVITY= 0.3186E-02
WIDTH= 0.5000E-02
RF= 0.5904
CO= 0.3840
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5110E-02

THE F STATISTIC FOR NP= 4 NOBS= 98 IS: 2.47
THE CRITICAL RSS IS: 0.5647E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	6.59E-07	6.46E-07	6.73E-07
X(2)	2.96E-03	3.51E-03	3.42E-03
X(4)	5.90E-01	5.79E-01	6.02E-01
X(5)	3.84E-01	3.73E-01	3.92E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1	2.81E-03	2.24E-02	2.51E-03
2.33E-01	3.55E-03	1.98E-09	3.55E-03
0.3667	5.30E-03	2.12E-06	5.30E-03
5.00E-01	6.04E-03	6.04E-03	0.567
0.6333	7.79E-03	3.91E-04	7.40E-03
0.7667	9.53E-03	1.39E-03	8.14E-03
0.9	1.23E-02	6.98E-02	1.20E-02
1.033	1.50E-02	6.69E-03	8.33E-03
1.167	1.98E-02	1.13E-02	8.47E-03
1.3	2.65E-02	1.71E-02	9.37E-03
1.433	3.43E-02	2.41E-02	1.02E-02
1.567	4.30E-02	3.20E-02	1.10E-02
1.7	5.28E-02	4.07E-02	1.20E-02
1.833	6.25E-02	5.00E-02	1.25E-02
1.967	7.22E-02	5.98E-02	1.25E-02
2.1	8.20E-02	6.98E-02	1.26E-02
2.233	9.07E-02	8.00E-02	1.07E-02
2.367	9.95E-02	9.04E-02	9.07E-03
2.5	1.06E-01	1.01E-01	5.50E-03
2.633	1.13E-01	1.11E-01	2.14E-03
2.767	1.19E-01	1.21E-01	-1.92E-03
2.9	1.25E-01	1.29E-01	-4.90E-03
3.033	1.28E-01	1.37E-01	-8.69E-03
3.167	1.30E-01	1.43E-01	-3.23E-03
3.3	1.35E-01	1.47E-01	-1.27E-02
3.433	1.37E-01	1.50E-01	-1.29E-02
3.567	1.39E-01	1.59E-01	-2.77E-02
3.7	1.40E-01	1.62E-01	-1.24E-02
3.833	1.41E-01	1.62E-01	-1.10E-02
3.967	1.40E-01	1.60E-01	-4.03E-03
4.1	1.40E-01	1.48E-01	-7.80E-03
4.233	1.39E-01	1.45E-01	-6.35E-03
4.367	1.39E-01	1.42E-01	-4.43E-03
4.5	1.36E-01	1.39E-01	-2.11E-03
4.633	1.35E-01	1.35E-01	3.71E-04
4.767	1.33E-01	1.31E-01	2.17E-03
4.9	1.31E-01	1.27E-01	3.95E-03
5.033	1.27E-01	1.23E-01	4.91E-03
5.167	1.25E-01	1.18E-01	6.83E-03
5.3	1.22E-01	1.14E-01	7.82E-03
5.433	1.19E-01	1.10E-01	8.67E-03
5.567	1.15E-01	1.06E-01	9.63E-03
5.7	1.11E-01	1.02E-01	9.33E-03
5.833	1.08E-01	9.78E-02	9.99E-03
5.967	1.04E-01	9.30E-02	1.032E-02
6.1	1.00E-01	9.02E-02	1.01E-02
6.233	9.61E-02	8.65E-02	9.54E-03
6.367	9.18E-02	8.18E-02	8.83E-03
6.5	8.76E-02	7.96E-02	8.00E-03
6.633	8.33E-02	7.63E-02	7.05E-03
6.767	8.01E-02	7.31E-02	7.01E-03
6.9	7.68E-02	7.00E-02	6.82E-03
7.033	7.26E-02	6.70E-02	5.52E-03
7.167	6.93E-02	6.42E-02	5.13E-03
7.3	6.50E-02	6.14E-02	3.62E-03
7.433	6.18E-02	5.88E-02	2.99E-03
7.567	5.85E-02	5.63E-02	2.28E-03
7.7	5.53E-02	5.38E-02	1.44E-03
7.833	5.20E-02	5.15E-02	5.12E-04
7.967	4.98E-02	4.93E-02	4.96E-04
8.1	4.65E-02	4.71E-02	-6.20E-04
8.233	4.43E-02	4.51E-02	-8.35E-04
8.367	4.20E-02	4.31E-02	-1.11E-03
8.5	3.87E-02	4.12E-02	-2.50E-03
8.633	3.65E-02	3.94E-02	-2.95E-03
8.767	3.52E-02	3.77E-02	-2.48E-03
8.9	3.30E-02	3.61E-02	-3.08E-03
9.033	3.07E-02	3.45E-02	-3.77E-03
9.167	2.95E-02	3.30E-02	-3.50E-03
9.3	2.72E-02	3.15E-02	-4.32E-03
9.433	2.60E-02	3.02E-02	-4.19E-03
9.567	2.37E-02	2.88E-02	-5.13E-03
9.7	2.25E-02	2.76E-02	-5.12E-03
9.833	2.12E-02	2.64E-02	-5.17E-03
9.967	1.99E-02	2.52E-02	-5.26E-03
10.1	1.87E-02	2.41E-02	-5.42E-03
10.23	1.74E-02	2.31E-02	-5.64E-03
10.37	1.62E-02	2.20E-02	-5.84E-03
10.5	1.50E-02	2.11E-02	-5.15E-03
10.63	1.47E-02	2.02E-02	-5.51E-03
10.77	1.34E-02	1.92E-02	-5.83E-03
10.9	1.24E-02	1.84E-02	-6.27E-03
11.03	1.19E-02	1.76E-02	-6.74E-03
11.17	1.06E-02	1.68E-02	-6.19E-03
11.3	1.04E-02	1.61E-02	-6.47E-03
11.43	9.13E-03	1.54E-02	-6.29E-03
11.57	8.88E-03	1.47E-02	-5.84E-03
11.7	7.62E-03	1.41E-02	-6.27E-03
11.83	7.37E-03	1.35E-02	-6.12E-03
11.97	6.11E-03	1.29E-02	-6.79E-03
12.1	5.86E-03	1.23E-02	-6.47E-03
12.23	4.60E-03	1.18E-02	-7.20E-03
12.37	4.35E-03	1.13E-02	-6.92E-03
12.5	4.09E-03	1.08E-02	-6.70E-03
12.63	2.84E-03	1.03E-02	-7.49E-03
12.77	2.58E-03	9.86E-03	-7.28E-03
12.9	1.33E-03	9.44E-03	-8.11E-03
13.03	1.07E-03	9.04E-03	-7.97E-03

D1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : 1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1084E-05
DISPERSIVITY= 0.2231E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.6659
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9534E-03

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
THE CRITICAL RSS IS: 0.1035E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.08E-06	1.08E-06	1.08E-06
X(2)	2.23E-03	2.16E-03	2.30E-03
X(5)	6.66E-01	6.59E-01	6.73E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.1	1.00E-03	2.60E-04	1.00E-03
0.3000	2.00E-03	1.09E-20	2.00E-03
0.5667	3.00E-03	9.98E-16	2.00E-03
0.7000	3.00E-03	1.18E-12	3.00E-03
0.8333	3.00E-03	1.46E-10	3.00E-03
0.9667	3.00E-03	4.77E-09	3.00E-03
1.1000	4.00E-03	6.69E-08	4.00E-03
1.2333	4.00E-03	5.31E-07	4.00E-03
1.3667	5.00E-03	2.81E-06	5.00E-03
1.5000	5.00E-03	1.10E-05	4.99E-03
1.6333	6.00E-03	3.43E-05	5.97E-03
1.7667	7.00E-03	9.01E-05	6.91E-03
1.9000	7.00E-03	2.06E-04	6.79E-03
2.0333	8.00E-03	4.22E-04	7.58E-03
2.1667	9.00E-03	7.89E-04	8.77E-03
2.3000	1.00E-02	1.37E-03	8.63E-03
2.4333	1.10E-02	2.23E-03	8.77E-03
2.5667	1.20E-02	3.45E-03	8.56E-03
2.7000	1.30E-02	5.09E-03	7.91E-03
2.8333	1.50E-02	7.22E-03	7.78E-03
2.9667	1.60E-02	9.89E-03	6.11E-03
3.1000	1.90E-02	1.31E-02	5.86E-03
3.2333	2.20E-02	1.70E-02	5.32E-03
3.3667	2.50E-02	2.14E-02	3.60E-03
3.5000	2.90E-02	2.64E-02	2.64E-03
3.6333	3.30E-02	3.18E-02	1.19E-03
3.7667	3.80E-02	3.77E-02	3.12E-04
3.9000	4.40E-02	4.39E-02	1.08E-04
4.0333	5.00E-02	5.03E-02	-3.36E-04
4.1667	5.60E-02	5.69E-02	-9.27E-04
4.3000	6.20E-02	6.36E-02	-1.56E-03
4.4333	6.90E-02	7.03E-02	-1.19E-03
4.5667	7.50E-02	7.66E-02	-1.59E-03
4.7000	8.10E-02	8.28E-02	-1.83E-03
4.8333	8.70E-02	8.83E-02	-1.78E-03
4.9667	9.30E-02	9.44E-02	-1.40E-03
5.1000	9.80E-02	9.99E-02	-1.62E-03
5.2333	1.03E-01	1.03E-01	-1.43E-03
5.3667	1.07E-01	1.09E-01	-1.78E-03
5.5000	1.11E-01	1.13E-01	-1.66E-03
5.6333	1.06E-01	1.16E-01	-1.05E-03
5.7667	1.18E-01	1.19E-01	-9.71E-04
5.9000	1.20E-01	1.21E-01	-1.41E-03
6.0333	1.23E-01	1.23E-01	-2.37E-03
6.1667	1.24E-01	1.25E-01	-8.86E-04
6.3000	1.25E-01	1.26E-01	-9.60E-04
6.4333	1.27E-01	1.27E-01	-6.16E-04
6.5667	1.27E-01	1.27E-01	1.23E-04
6.7000	1.27E-01	1.27E-01	2.32E-04
6.8333	1.27E-01	1.26E-01	6.85E-04
6.9667	1.26E-01	1.26E-01	4.58E-04
7.1000	1.26E-01	1.25E-01	1.52E-03
7.2333	1.24E-01	1.23E-01	8.52E-04
7.3667	1.23E-01	1.22E-01	1.42E-03
7.5000	1.21E-01	1.20E-01	1.21E-03
7.6333	1.20E-01	1.18E-01	2.19E-03
7.7667	1.18E-01	1.16E-01	2.34E-03
7.9000	1.15E-01	1.13E-01	1.63E-03
8.0333	1.13E-01	1.11E-01	2.05E-03
8.1667	1.10E-01	1.08E-01	1.58E-03
8.3000	1.08E-01	1.06E-01	2.19E-03
8.4333	1.05E-01	1.03E-01	1.88E-03
8.5667	1.02E-01	1.00E-01	1.62E-03
8.7000	9.90E-02	9.79E-02	1.40E-03
8.8333	9.60E-02	9.48E-02	1.21E-03
8.9667	9.30E-02	9.20E-02	1.04E-03
9.1000	9.00E-02	8.91E-02	8.63E-04
9.2333	8.70E-02	8.63E-02	6.87E-04
9.3667	8.40E-02	8.35E-02	4.97E-04
9.5000	8.10E-02	8.07E-02	2.84E-04
9.6333	7.80E-02	7.80E-02	4.02E-05
9.7667	7.50E-02	7.52E-02	-2.37E-04
9.9000	7.20E-02	7.26E-02	-5.58E-04
10.0333	6.90E-02	6.99E-02	-9.31E-04
10.1667	6.70E-02	6.73E-02	-3.35E-04
10.3000	6.40E-02	6.48E-02	-8.12E-04
10.4333	6.10E-02	6.24E-02	-1.35E-03
10.5667	5.80E-02	5.99E-02	-9.20E-04
10.7000	5.60E-02	5.76E-02	-1.57E-03
10.8333	5.40E-02	5.53E-02	-1.29E-03
10.9667	5.20E-02	5.31E-02	-2.05E-03
11.1000	4.90E-02	5.09E-02	-1.90E-03
11.2333	4.70E-02	4.88E-02	-1.81E-03
11.3667	4.50E-02	4.67E-02	-1.77E-03
11.5000	4.30E-02	4.48E-02	-1.80E-03
11.6333	4.20E-02	4.29E-02	-9.08E-04
11.7667	4.10E-02	4.17E-02	-1.06E-03
11.9000	3.80E-02	3.93E-02	-1.29E-03
12.0333	3.60E-02	3.76E-02	-1.59E-03
12.1667	3.40E-02	3.50E-02	-1.70E-03
12.3000			

May 2006
D2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1052E-05
DISPERSIVITY= 0.1820E-02
WIDTH= 0.5000E-02
R= 1.000
CO= 0.4583
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3010E-02

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
THE CRITICAL RSS IS: 0.3267E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.05E-06	1.04E-06	1.06E-06
X(2)	1.82E-03	1.71E-03	1.93E-03
X(5)	4.58E-01	4.49E-01	4.68E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.83E-01	9.12E-04	3.43E-24	9.12E-04
0.3167	7.97E-04	3.78E-14	7.97E-04
4.60E-01	6.83E-04	6.83E-04	1.65E-03
0.5833	1.57E-03	8.33E-08	1.57E-03
7.17E-01	1.46E-03	2.14E-06	1.45E-03
0.85	2.34E-03	1.58E-05	2.32E-03
0.9833	2.23E-03	1.00E-04	2.13E-03
1.117	3.11E-03	3.44E-04	2.77E-03
1.25	4.00E-03	9.06E-04	3.02E-03
1.383	5.88E-03	1.98E-03	3.91E-03
1.517	7.77E-03	3.75E-03	4.02E-03
1.65	1.07E-02	6.40E-03	4.29E-03
1.783	1.45E-02	1.01E-02	4.49E-03
1.917	2.04E-02	1.48E-02	5.84E-03
2.05	2.79E-02	2.07E-02	6.66E-03
2.183	3.42E-02	2.76E-02	6.60E-03
2.317	4.21E-02	3.56E-02	6.54E-03
2.45	5.10E-02	4.43E-02	6.68E-03
2.583	5.99E-02	5.36E-02	6.28E-03
2.717	6.77E-02	6.31E-02	4.63E-03
2.85	7.66E-02	7.26E-02	4.05E-03
2.983	8.35E-02	8.17E-02	1.84E-03
3.117	9.04E-02	9.02E-02	2.20E-04
3.25	9.63E-02	9.79E-02	-1.60E-03
3.383	1.01E-01	1.05E-01	-3.49E-03
3.517	1.05E-01	1.10E-01	-5.38E-03
3.65	1.09E-01	1.15E-01	-6.25E-03
3.783	1.12E-01	1.19E-01	-7.08E-03
3.917	1.15E-01	1.22E-01	-7.91E-03
4.05	1.17E-01	1.23E-01	-6.81E-03
4.183	1.18E-01	1.24E-01	-6.85E-03
4.317	1.19E-01	1.24E-01	-5.98E-03
4.45	1.19E-01	1.24E-01	-4.61E-03
4.583	1.19E-01	1.23E-01	-3.52E-03
4.717	1.19E-01	1.21E-01	-1.88E-03
4.85	1.18E-01	1.19E-01	-7.85E-04
4.983	1.16E-01	1.16E-01	-2.91E-04
5.117	1.13E-01	1.13E-01	1.31E-03
5.25	1.13E-01	1.10E-01	2.59E-03
5.383	1.11E-01	1.07E-01	3.87E-03
5.517	1.08E-01	1.03E-01	5.30E-03
5.65	1.05E-01	9.94E-02	6.85E-03
5.783	1.02E-01	9.57E-02	8.45E-03
5.917	9.90E-02	9.19E-02	9.10E-03
6.05	9.49E-02	8.81E-02	6.76E-03
6.183	9.18E-02	8.44E-02	7.39E-03
6.317	8.77E-02	8.07E-02	6.99E-03
6.45	8.35E-02	7.70E-02	6.52E-03
6.583	7.94E-02	7.34E-02	5.99E-03
6.717	7.53E-02	6.93E-02	5.37E-03
6.85	7.12E-02	6.52E-02	4.66E-03
6.983	6.71E-02	6.33E-02	3.84E-03
7.117	6.40E-02	6.01E-02	3.92E-03
7.25	5.99E-02	5.70E-02	2.88E-03
7.383	5.57E-02	5.40E-02	1.73E-03
7.517	5.26E-02	5.12E-02	1.47E-03
7.65	4.85E-02	4.84E-02	9.00E-05
7.783	4.54E-02	4.58E-02	-4.07E-04
7.917	4.23E-02	4.33E-02	-1.02E-03
8.05	3.92E-02	4.09E-02	-1.74E-03
8.183	3.61E-02	3.86E-02	-2.58E-03
8.317	3.39E-02	3.65E-02	-2.52E-03
8.45	3.08E-02	3.44E-02	-3.57E-03
8.583	2.87E-02	3.24E-02	-3.73E-03
8.717	2.66E-02	3.06E-02	-3.98E-03
8.85	2.45E-02	2.88E-02	-4.32E-03
8.983	2.24E-02	2.71E-02	-4.76E-03
9.117	2.13E-02	2.56E-02	-4.29E-03
9.25	1.91E-02	2.40E-02	-4.90E-03
9.383	1.80E-02	2.26E-02	-4.59E-03
9.517	1.59E-02	2.13E-02	-5.36E-03
9.65	1.48E-02	2.00E-02	-5.21E-03
9.783	1.37E-02	1.88E-02	-5.13E-03
9.917	1.26E-02	1.77E-02	-5.11E-03
10.05	1.15E-02	1.66E-02	-5.15E-03
10.18	1.03E-02	1.56E-02	-5.27E-03
10.32	9.23E-03	1.47E-02	-5.43E-03
10.45	9.12E-03	1.38E-02	-4.65E-03
10.58	8.29E-03	1.29E-02	-4.92E-03
10.72	7.89E-03	1.21E-02	-4.24E-03
10.85	6.77E-03	1.14E-02	-4.61E-03
10.98	5.66E-03	1.07E-02	-4.50E-03
11.12	5.55E-03	1.00E-02	-4.48E-03
11.25	5.43E-03	9.40E-03	-3.97E-03
11.38	4.32E-03	8.82E-03	-4.58E-03
11.52	4.20E-03	8.27E-03	-4.07E-03
11.65	4.09E-03	7.76E-03	-3.67E-03
11.78	2.97E-03	7.27E-03	-4.30E-03
11.92	2.86E-03	6.82E-03	-3.96E-03
12.05	2.75E-03	6.39E-03	-3.64E-03
12.18	2.63E-03	5.93E-03	-3.36E-03
12.32	2.52E-03	5.61E-03	-3.09E-03
12.45	1.40E-03	5.26E-03	-3.86E-03
12.58	1.29E-03	4.93E-03	-3.64E-03
12.72	1.17E-03	4.62E-03	-3.44E-03
12.85	1.06E-03	4.32E-03	-3.26E-03
12.97	2.80E-02	4.08E-02	2.39E-02
13.1	2.70E-02	3.83E-03	2.32E-02

D2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 89
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1165E-05
DISPERSIVITY= 0.1217E-02
WIDTH= 0.5000E-02
R= 1.000
CO= 0.4364
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7306E-03

THE F STATISTIC FOR NP= 3 NOBS= 89 IS: 2.72
THE CRITICAL RSS IS: 0.7999E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.17E-06	1.17E-06	1.17E-06
X(2)	1.22E-03	1.18E-03	1.27E-03
X(5)	4.36E-01	4.32E-01	4.41E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.383	8.96E-04	5.22E-09	8.96E-04
1.517	7.61E-04	4.52E-08	7.61E-04
1.65	1.63E-03	2.73E-07	1.63E-03
1.783	1.49E-03	1.26E-06	1.49E-03
1.917	2.36E-03	4.62E-06	2.35E-03
2.05	3.22E-03	1.42E-05	3.17E-03
2.183	3.09E-03	3.78E-05	3.05E-03
2.317	3.95E-03	8.92E-05	3.86E-03
2.45	3.82E-03	1.90E-04	3.63E-03
2.583	4.68E-03	3.73E-04	4.31E-03
2.717	4.55E-03	6.81E-04	3.87E-03
2.85	5.41E-03	1.17E-03	4.25E-03
2.983	6.28E-03	1.89E-03	4.39E-03
3.117	7.14E-03	2.93E-03	4.22E-03
3.25	8.01E-03	4.34E-03	3.67E-03
3.383	9.87E-03	6.20E-03	3.67E-03
3.517	1.17E-02	8.57E-03	3.17E-03
3.65	1.46E-02	1.15E-02	3.11E-03
3.783	1.75E-02	1.50E-02	2.48E-03
3.917	2.13E-02	1.91E-02	2.27E-03
4.05	2.52E-02	2.37E-02	1.52E-03
4.183	3.01E-02	2.88E-02	1.25E-03
4.317	3.59E-02	3.44E-02	1.54E-03
4.45	4.18E-02	4.03E-02	1.48E-03
4.583	4.77E-02	4.65E-02	1.18E-03
4.717	5.35E-02	5.28E-02	7.25E-04
4.85	6.04E-02	5.91E-02	1.25E-03
4.983	6.63E-02	6.54E-02	8.68E-04
5.117	7.21E-02	7.15E-02	6.75E-04
5.25	7.70E-02	7.72E-02	-2.18E-04
5.383	8.19E-02	8.26E-02	-7.28E-04
5.517	8.68E-02	8.75E-02	-7.84E-04
5.65	9.06E-02	9.19E-02	-1.32E-03
5.783	9.45E-02	9.57E-02	-1.29E-03
5.917	9.73E-02	9.92E-02	-1.67E-03
6.05	9.92E-02	1.02E-01	-2.43E-03
6.183	1.01E-01	1.04E-01	-2.59E-03
6.317	1.153E-01	1.153E-01	1.52E-03
6.45	1.03E-01	1.06E-01	-3.08E-03
6.583	1.04E-01	1.06E-01	-2.46E-03
6.717	1.04E-01	1.04E-01	1.32E-03
6.85	1.03E-01	1.05E-01	-1.67E-03
6.983	1.02E-01	1.04E-01	-1.57E-03
7.117	9.57E-02	9.52E-02	4.94E-04
7.25	1.00E-01	1.00E-01	-1.80E-04
7.383	9.78E-02	9.78E-02	1.74E-05
7.517	8.83E-02	8.61E-02	2.15E-03
7.65	9.14E-02	8.93E-02	2.10E-03
7.783	9.28E-02	8.91E-02	3.50E-03
7.917	8.52E-02	8.28E-02	2.37E-03
8.05	8.20E-02	7.95E-02	2.57E-03
8.183	7.89E-02	7.60E-02	2.87E-03
8.317	7.89E-02	7.60E-02	2.87E-03
8.45	7.58E-02	7.26E-02	3.19E-03
8.583	7.28E-02	6.91E-02	3.50E-03
8.717	6.85E-02	6.57E-02	2.80E-03
8.85	6.54E-02	6.23E-02	3.04E-03
8.983	6.22E-02	5.90E-02	3.23E-03
9.117	5.91E-02	5.57E-02	3.34E-03
9.25	5.49E-02	5.26E-02	2.36E-03
9.383	5.18E-02	4.95E-02	2.29E-03
9.517	4.87E-02	4.66E-02	2.11E-03
9.65	4.55E-02	4.37E-02	1.82E-03
9.783	4.24E-02	4.10E-02	1.41E-03
9.917	3.93E-02	3.84E-02	9.91E-04
10.05	3.61E-02	3.59E-02	2.48E-04
10.18	3.40E-02	3.35E-02	4.60E-04
10.32	3.09E-02	3.13E-02	-3.90E-04
10.45	2.87E-02	2.91E-02	-3.94E-04
10.58	2.56E-02	2.71E-02	-1.52E-03
10.72	2.35E-02	2.52E-02	-1.73E-03
10.85	2.13E-02	2.34E-02	-2.08E-03
10.98	1.92E-02	2.17E-02	-2.53E-03
11.12	1.71E-02	2.01E-02	-3.07E-03
11.25	1.59E-02	1.86E-02	-2.72E-03
11.38	1.38E-02	1.73E-02	-3.47E-03
11.52	1.27E-02	1.60E-02	-3.30E-03
11.65	1.15E-02	1.47E-02	-3.22E-03
11.78	1.04E-02	1.34E-02	-3.44E-03
11.92	8.25E-03	1.26E-02	-4.30E-03
12.05	7.11E-03	1.16E-02	-4.46E-03
12.18	6.03E-03	1.05E-02	-4.68E-03
12.32	4.84E-03	9.81E-03	-4.96E-03
12.45	3.71E-03	9.02E-03	-5.32E-03
12.58	2.57E-03	8.57E-03	-5.70E-03
12.72	2.44E-03	7.62E-03	-5.18E-03
12.85	1.30E-03	7.00E-03	-5.70E-03
12.97	1.17E-03	6.98E-03	-5.26E-03
13.1	3.37E-05	5.89E-03	-5.86E-03

May 2006
D3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-01
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1128E-05
DISPERSIVITY= 0.1950E-02
WIDTH= 0.1000E-01
RF= 1.000
CO= 0.2321
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1313E-02

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
THE CRITICAL RSS IS: 0.1432E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.13E-06	1.12E-06	1.14E-06
X(2)	1.95E-03	1.85E-03	2.05E-03
X(5)	2.32E-01	2.30E-01	2.35E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.83E-01	9.42E-04	3.19E-08	9.42E-04
0.5167	8.67E-04	2.58E-06	8.65E-04
6.50E-01	1.79E-03	3.47E-05	1.76E-03
0.7833	1.72E-03	1.94E-04	1.63E-03
9.17E-01	2.64E-03	6.56E-04	1.99E-03
1.05	3.57E-03	1.63E-03	1.94E-03
1.183	5.49E-03	3.30E-03	2.20E-03
1.317	7.42E-03	5.80E-03	1.62E-03
1.45	1.03E-02	9.14E-03	1.21E-03
1.583	1.48E-02	1.33E-02	9.54E-04
1.717	2.02E-02	1.83E-02	1.87E-03
1.85	2.61E-02	2.40E-02	2.15E-03
1.983	3.25E-02	3.02E-02	2.83E-03
2.117	4.10E-02	3.70E-02	4.01E-03
2.25	4.89E-02	4.40E-02	4.87E-03
2.383	5.88E-02	5.13E-02	5.49E-03
2.517	6.47E-02	5.89E-02	5.88E-03
2.65	7.27E-02	6.64E-02	6.27E-03
2.783	7.96E-02	7.40E-02	5.65E-03
2.917	8.65E-02	8.15E-02	5.03E-03
3.05	9.25E-02	8.89E-02	3.59E-03
3.183	9.84E-02	9.60E-02	2.37E-03
3.317	1.02E-01	1.02E-01	-5.03E-04
3.45	1.06E-01	1.09E-01	-2.73E-03
3.583	1.10E-01	1.14E-01	-4.01E-03
3.717	1.13E-01	1.19E-01	-5.19E-03
3.85	1.15E-01	1.22E-01	-6.70E-03
3.983	1.16E-01	1.24E-01	-7.86E-03
4.117	1.17E-01	1.25E-01	-8.94E-03
4.25	1.18E-01	1.25E-01	-6.14E-03
4.383	1.18E-01	1.24E-01	-6.14E-03
4.517	1.18E-01	1.14E-01	-2.04E-04
4.65	1.17E-01	1.20E-01	-3.21E-03
4.783	1.15E-01	1.17E-01	-2.44E-03
4.917	1.14E-01	1.14E-01	-2.04E-04
5.05	1.11E-01	1.10E-01	-1.34E-03
5.183	1.08E-01	1.06E-01	2.24E-03
5.317	1.05E-01	1.02E-01	3.24E-03
5.45	1.02E-01	9.78E-02	4.32E-03
5.583	9.90E-02	9.35E-02	5.48E-03
5.717	9.50E-02	8.93E-02	5.69E-03
5.85	9.09E-02	8.50E-02	5.83E-03
5.983	8.68E-02	8.09E-02	5.92E-03
6.117	8.27E-02	7.68E-02	5.95E-03
6.25	7.87E-02	7.28E-02	5.88E-03
6.383	7.46E-02	6.89E-02	5.64E-03
6.517	7.05E-02	6.52E-02	5.32E-03
6.65	6.64E-02	6.16E-02	4.83E-03
6.783	6.24E-02	5.81E-02	4.21E-03
6.917	5.83E-02	5.48E-02	3.46E-03
7.05	5.42E-02	5.17E-02	2.54E-03
7.183	5.01E-02	4.87E-02	1.47E-03
7.317	4.71E-02	4.58E-02	1.28E-03
7.45	4.30E-02	4.31E-02	-7.47E-05
7.583	3.99E-02	4.05E-02	-5.75E-04
7.717	3.68E-02	3.80E-02	-1.19E-03
7.85	3.38E-02	3.57E-02	-1.95E-03
7.983	3.17E-02	3.35E-02	-1.84E-03
8.117	2.86E-02	3.14E-02	-2.84E-03
8.25	2.65E-02	2.95E-02	-2.96E-03
8.383	2.45E-02	2.77E-02	-3.20E-03
8.517	2.24E-02	2.59E-02	-3.53E-03
8.65	2.13E-02	2.43E-02	-2.98E-03
8.783	1.92E-02	2.28E-02	-3.52E-03
8.917	1.72E-02	2.13E-02	-4.15E-03
9.05	1.61E-02	2.00E-02	-3.87E-03
9.183	1.50E-02	1.87E-02	-3.68E-03
9.317	1.39E-02	1.75E-02	-3.55E-03
9.45	1.29E-02	1.64E-02	-3.51E-03
9.583	1.18E-02	1.53E-02	-3.53E-03
9.717	1.07E-02	1.43E-02	-3.62E-03
9.85	9.63E-03	1.34E-02	-3.76E-03
9.983	8.55E-03	1.25E-02	-3.97E-03
10.12	8.48E-03	1.17E-02	-3.21E-03
10.25	7.40E-03	1.10E-02	-3.55E-03
10.38	7.03E-03	1.03E-02	-2.93E-03
10.52	6.25E-03	9.55E-03	-3.30E-03
10.65	6.18E-03	8.94E-03	-2.77E-03
10.78	5.10E-03	8.28E-03	-1.87E-03
10.92	5.03E-03	7.80E-03	-2.77E-03
11.05	3.95E-03	7.30E-03	-3.35E-03
11.18	3.88E-03	6.88E-03	-2.88E-03
11.32	3.81E-03	6.36E-03	-2.56E-03
11.45	3.73E-03	5.95E-03	-2.22E-03
11.58	5.56E-03	5.56E-03	-2.39E-03
11.72	2.58E-03	5.19E-03	-2.61E-03
11.85	2.51E-03	4.85E-03	-2.35E-03
11.98	2.43E-03	4.54E-03	-2.11E-03
12.12	2.36E-03	4.23E-03	-1.87E-03
12.25	1.28E-03	3.96E-03	-2.67E-03
12.38	1.21E-03	3.70E-03	-2.49E-03
12.52	1.13E-03	3.44E-03	-2.31E-03
12.65	1.06E-03	3.22E-03	-2.17E-03

D3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-01
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1121E-05
DISPERSIVITY= 0.1539E-02
WIDTH= 0.1000E-01
RF= 1.000
CO= 0.2918
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3179E-03

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
THE CRITICAL RSS IS: 0.3476E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.12E-06	1.12E-06	1.12E-06
X(2)	1.54E-03	1.51E-03	1.57E-03
X(5)	2.92E-01	2.92E-01	2.92E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.183	1.00E-03	4.23E-08	1.00E-03
1.317	1.00E-03	3.23E-07	1.00E-03
1.450	2.00E-03	1.68E-06	2.00E-03
1.583	2.00E-03	6.56E-06	1.99E-03
1.717	3.00E-03	2.07E-05	2.98E-03
1.850	4.00E-03	5.48E-05	3.95E-03
1.983	3.15E-03	1.78E-04	3.87E-03
2.117	5.00E-03	2.63E-04	4.74E-03
2.250	5.00E-03	4.98E-04	4.50E-03
2.383	6.00E-03	8.72E-04	5.13E-03
2.517	7.00E-03	1.44E-03	5.57E-03
2.650	7.00E-03	2.24E-03	4.79E-03
2.783	2.78E-03	3.33E-03	4.57E-03
2.917	9.00E-03	4.75E-03	4.25E-03
3.050	1.00E-02	6.56E-03	3.44E-03
3.183	3.15E-03	8.78E-03	3.22E-03
3.317	1.30E-02	1.14E-02	1.56E-03
3.450	1.50E-02	1.46E-02	4.32E-04
3.583	1.80E-02	1.82E-02	-1.59E-04
3.717	2.10E-02	2.22E-02	-1.28E-03
3.850	2.50E-02	2.67E-02	-1.73E-03
3.983	3.00E-02	3.17E-02	-1.68E-03
4.117	3.50E-02	3.70E-02	-4.71E-04
4.250	4.10E-02	4.28E-02	-1.77E-03
4.383	4.70E-02	4.88E-02	-1.82E-03
4.517	5.40E-02	5.51E-02	-1.31E-03
4.650	6.10E-02	6.16E-02	-6.35E-04
4.783	6.80E-02	6.83E-02	-2.48E-04
4.917	7.85E-02	7.49E-02	-1.09E-04
5.050	8.20E-02	8.15E-02	5.39E-04
5.183	8.90E-02	8.79E-02	1.12E-03
5.317	9.50E-02	9.41E-02	4.91E-04
5.450	1.01E-01	9.99E-02	1.11E-03
5.583	1.06E-01	1.05E-01	6.73E-04
5.717	5.71E-01	1.11E-01	-4.51E-04
5.850	1.15E-01	1.15E-01	2.48E-04
5.983	1.19E-01	1.19E-01	3.56E-04
6.117	1.22E-01	1.22E-01	4.75E-05
6.250	1.24E-01	1.25E-01	-6.57E-04
6.383	1.26E-01	1.27E-01	-7.56E-04
6.517	1.28E-01	1.28E-01	-2.59E-04
6.650	1.28E-01	1.29E-01	-1.17E-03
6.783	1.29E-01	1.30E-01	-5.21E-04
6.917	1.29E-01	1.29E-01	-3.39E-04
7.050	1.29E-01	1.29E-01	-6.56E-04
7.183	1.27E-01	1.28E-01	-5.09E-04
7.317	1.26E-01	1.26E-01	6.25E-05
7.450	1.24E-01	1.24E-01	1.66E-05
7.583	1.22E-01	1.22E-01	3.13E-04
7.717	1.19E-01	1.19E-01	-8.88E-05
7.850	1.17E-01	1.16E-01	7.68E-04
7.983	1.14E-01	1.13E-01	8.47E-04
8.117	1.11E-01	1.10E-01	1.11E-03
8.250	1.07E-01	1.07E-01	5.23E-04
8.383	1.04E-01	1.03E-01	1.05E-03
8.517	1.00E-01	9.93E-02	6.67E-04
8.650	9.70E-02	9.57E-02	1.34E-03
8.783	9.30E-02	9.20E-02	1.04E-03
8.917	8.90E-02	8.82E-02	7.56E-04
9.050	8.50E-02	8.45E-02	4.57E-04
9.183	8.10E-02	8.09E-02	1.28E-04
9.317	7.70E-02	7.72E-02	-2.44E-04
9.450	7.00E-02	7.02E-02	-1.83E-04
9.583	6.60E-02	6.68E-02	-7.68E-04
9.717	6.30E-02	6.34E-02	-4.44E-04
9.850	5.90E-02	6.02E-02	-1.22E-03
9.983	5.60E-02	5.71E-02	-1.08E-03
10.120	5.30E-02	5.41E-02	-1.07E-03
10.250	5.00E-02	5.12E-02	-1.17E-03
10.380	4.70E-02	4.84E-02	-1.35E-03
10.520	4.40E-02	4.57E-02	-1.67E-03
10.650	4.20E-02	4.31E-02	-1.10E-03
10.780	3.90E-02	4.06E-02	-1.63E-03
10.920	3.70E-02	3.83E-02	-1.28E-03
11.050	2.93E-02	3.18E-02	-1.04E-03
11.200	3.30E-02	3.39E-02	-8.95E-04
11.450	3.10E-02	3.19E-02	-8.68E-04
11.680	2.58E-02	2.59E-02	5.57E-05
11.720	2.80E-02	2.81E-02	-1.02E-04
11.850	2.60E-02	2.64E-02	-3.71E-04
11.980	2.50E-02	2.50E-02	2.587E-04
12.120	2.40E-02	2.32E-02	8.28E-04
12.250	2.30E-02	2.17E-02	1.29E-03
12.380	2.20E-02	2.03E-02	6.73E-04
12.530	2.00E-02	1.89E-02	1.14E-03
12.670	1.90E-02	1.76E-02	1.37E-03
12.800	1.90E-02	1.65E-02	2.51E-03
12.930	1.89E-02	1.54E-02	2.59E-03
13.070	1.70E-02	1.44E-02	2.61E-03

May 2006
D4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 79
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1953E-05
DISPERSIVITY= 0.2172E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1774
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.8241E-04

THE F STATISTIC FOR NP= 3 NOBS= 79 IS: 2.74

THE CRITICAL RSS IS: 0.9131E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.95E-06	1.95E-06	1.95E-06
X(2)	2.17E-03	2.11E-03	2.24E-03
X(5)	1.77E-01	1.76E-01	1.79E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.33E-01	6.87E-04	2.98E-04	3.89E-04
0.7333	1.62E-03	8.81E-04	7.34E-04
8.93E-01	1.64E-03	2.00E-03	-4.58E-04
0.9333	3.47E-03	3.80E-03	-3.31E-04
1.03E+00	5.40E-03	6.36E-03	-9.62E-04
1.133	0.53E-02	0.68E-02	-3.59E-04
1.233	1.33E-02	1.37E-02	-4.41E-04
1.333	1.82E-02	1.82E-02	-1.91E-05
1.433	2.31E-02	2.29E-02	1.81E-04
1.533	2.80E-02	2.76E-02	4.58E-04
1.633	3.20E-02	3.19E-02	7.12E-05
1.733	3.59E-02	4.28E-02	-4.90E-04
1.833	3.88E-02	3.88E-02	-1.70E-05
1.933	4.08E-02	4.13E-02	-5.59E-04
2.033	4.37E-02	4.31E-02	-7.97E-04
2.133	4.36E-02	4.43E-02	-6.45E-04
2.233	4.45E-02	4.48E-02	-2.89E-04
2.333	4.45E-02	4.49E-02	-4.24E-04
2.433	4.44E-02	4.45E-02	-1.25E-04
2.533	4.43E-02	4.38E-02	5.35E-04
2.633	4.32E-02	4.28E-02	4.90E-04
2.733	4.22E-02	4.15E-02	6.76E-04
2.833	4.11E-02	4.01E-02	1.04E-03
2.933	4.00E-02	3.85E-02	1.53E-03
3.033	3.89E-02	3.69E-02	1.11E-03
3.133	3.59E-02	3.51E-02	7.51E-04
3.233	3.38E-02	3.34E-02	4.14E-04
3.333	3.27E-02	3.17E-02	1.08E-03
3.433	3.07E-02	2.99E-02	7.30E-04
3.533	2.86E-02	2.82E-02	3.48E-04
3.633	2.65E-02	2.60E-02	7.58E-05
3.733	2.45E-02	2.50E-02	-5.51E-04
3.833	2.24E-02	2.35E-02	-1.09E-03
3.933	2.03E-02	2.20E-02	-1.68E-03
4.033	1.92E-02	2.06E-02	-1.35E-03
4.133	1.72E-02	1.92E-02	-2.08E-03
4.233	1.61E-02	1.80E-02	-1.88E-03
4.333	1.50E-02	1.68E-02	-1.74E-03
4.433	1.39E-02	1.56E-02	-1.68E-03
4.533	1.29E-02	1.45E-02	-1.68E-03
4.633	1.18E-02	1.35E-02	-1.74E-03
4.733	1.17E-02	1.26E-02	-8.64E-04
4.833	1.07E-02	1.17E-02	-1.05E-03
4.933	9.58E-03	1.09E-02	-1.29E-03
5.033	9.51E-03	1.01E-02	-5.83E-04
5.133	9.43E-03	9.36E-03	7.21E-05
5.233	8.36E-03	8.68E-03	-3.22E-04
5.333	8.29E-03	8.05E-03	2.39E-04
5.433	8.22E-03	7.46E-03	7.56E-04
5.533	7.15E-03	6.91E-03	2.32E-04
5.633	7.07E-03	6.40E-03	6.71E-04
5.733	7.00E-03	5.93E-03	1.07E-03
5.833	6.93E-03	5.49E-03	1.44E-03
5.933	5.86E-03	5.08E-03	7.79E-04
6.033	5.78E-03	4.70E-03	1.09E-03
6.133	5.71E-03	4.34E-03	1.37E-03
6.233	5.64E-03	4.02E-03	1.62E-03
6.333	5.57E-03	3.71E-03	1.85E-03
6.433	5.49E-03	3.43E-03	2.06E-03
6.533	4.42E-03	3.17E-03	1.25E-03
6.633	4.35E-03	2.93E-03	1.42E-03
6.733	4.28E-03	2.71E-03	1.57E-03
6.833	4.21E-03	2.50E-03	1.70E-03
6.933	4.13E-03	2.31E-03	1.82E-03
7.033	3.06E-03	2.14E-03	9.25E-04
7.133	2.99E-03	1.97E-03	1.02E-03
7.233	2.92E-03	1.82E-03	1.10E-03
7.333	2.84E-03	1.68E-03	1.18E-03
7.433	2.77E-03	1.55E-03	1.22E-03
7.533	2.70E-03	1.43E-03	1.27E-03
7.633	2.63E-03	1.32E-03	1.30E-03
7.733	1.55E-03	1.22E-03	3.34E-04
7.833	1.48E-03	1.13E-03	3.56E-04
7.933	1.41E-03	1.04E-03	3.70E-04
8.033	1.34E-03	9.59E-04	3.78E-04
8.133	1.27E-03	8.85E-04	3.80E-04
8.233	1.19E-03	8.16E-04	3.75E-04
8.333	1.12E-03	7.53E-04	3.67E-04
8.433	1.05E-03	6.95E-04	3.53E-04

D4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : 0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1946E-05
DISPERSIVITY= 0.1359E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1639
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1879E-03

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71

THE CRITICAL RSS IS: 0.2047E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.95E-06	1.95E-06	1.95E-06
X(2)	1.38E-03	1.29E-03	1.44E-03
X(5)	1.64E-01	1.61E-01	1.67E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.397	1.00E-03	4.30E-05	9.57E-04
1.497	1.00E-03	1.05E-04	8.95E-04
1.597	2.00E-03	2.26E-04	1.77E-03
1.697	2.00E-03	4.41E-04	1.56E-03
1.797	3.00E-03	7.92E-04	2.21E-03
1.897	3.00E-03	1.33E-03	1.67E-03
1.997	4.00E-03	2.09E-03	1.91E-03
2.097	5.00E-03	3.12E-03	1.88E-03
2.197	2.19E-02	4.46E-03	5.42E-04
2.297	6.00E-03	6.10E-03	-1.04E-04
2.397	8.00E-03	8.06E-03	-5.55E-05
2.497	9.00E-03	9.00E-03	1.29E-03
2.597	1.20E-02	1.28E-02	-7.50E-04
2.697	1.40E-02	1.54E-02	-1.39E-03
2.797	1.70E-02	1.81E-02	-1.14E-03
2.897	1.90E-02	2.09E-02	-1.91E-03
2.997	2.30E-02	2.37E-02	-6.50E-04
3.097	2.50E-02	2.63E-02	-1.27E-03
3.197	2.80E-02	2.87E-02	-7.26E-04
3.297	3.10E-02	3.10E-02	4.94E-05
3.397	3.30E-02	3.29E-02	9.15E-05
3.497	3.50E-02	3.46E-02	4.30E-04
3.597	3.70E-02	3.59E-02	1.08E-03
3.697	3.80E-02	3.69E-02	1.06E-03
3.797	3.90E-02	3.79E-02	1.36E-03
3.897	3.90E-02	3.80E-02	9.65E-04
3.997	3.90E-02	3.81E-02	8.68E-04
4.097	3.90E-02	3.80E-02	1.05E-03
4.197	3.90E-02	3.75E-02	1.47E-03
4.297	3.80E-02	3.69E-02	1.12E-03
4.397	3.70E-02	3.60E-02	9.73E-04
4.497	3.60E-02	3.50E-02	9.72E-04
4.597	3.40E-02	3.39E-02	1.19E-04
4.697	3.20E-02	3.26E-02	-4.71E-04
4.797	3.10E-02	3.13E-02	-2.78E-04
4.897	3.00E-02	2.99E-02	1.29E-04
4.997	2.80E-02	2.80E-02	-1.21E-04
5.097	2.60E-02	2.70E-02	-9.49E-04
5.197	2.40E-02	2.55E-02	-1.47E-03
5.297	2.20E-02	2.40E-02	-9.93E-04
5.397	2.10E-02	2.26E-02	-1.55E-03
5.497	1.90E-02	2.11E-02	-2.13E-03
5.597	1.70E-02	1.99E-02	-1.75E-03
5.697	1.70E-02	1.84E-02	-1.42E-03
5.797	1.50E-02	1.71E-02	-2.14E-03
5.897	1.40E-02	1.59E-02	-1.91E-03
5.997	1.30E-02	1.47E-02	-1.74E-03
6.097	1.20E-02	1.36E-02	-1.64E-03
6.197	1.10E-02	1.26E-02	-1.59E-03
6.297	1.10E-02	1.16E-02	-6.02E-04
6.397	1.00E-02	1.07E-02	-6.79E-04
6.497	1.00E-02	9.81E-03	1.92E-04
6.597	1.00E-02	9.00E-03	1.11E-06
6.697	8.00E-03	8.25E-03	-2.45E-04
6.797	8.00E-03	7.54E-03	4.56E-04
6.897	8.00E-03	6.89E-03	1.11E-03
6.997	7.00E-03	6.29E-03	7.07E-04
7.097	7.00E-03	5.74E-03	1.26E-03
7.197	7.00E-03	5.23E-03	1.77E-03
7.297	6.00E-03	4.76E-03	1.25E-03
7.397	6.00E-03	4.32E-03	1.68E-03
7.497	6.00E-03	3.93E-03	2.08E-03
7.597	5.00E-03	3.56E-03	1.44E-03
7.697	5.00E-03	3.23E-03	1.77E-03
7.797	5.00E-03	2.92E-03	2.08E-03
7.897	5.00E-03	2.65E-03	2.35E-03
7.997	5.00E-03	2.39E-03	2.61E-03
8.097	4.00E-03	2.16E-03	1.84E-03
8.197	4.00E-03	1.95E-03	2.05E-03
8.297	4.00E-03	1.76E-03	2.24E-03
8.397	4.00E-03	1.59E-03	2.41E-03
8.497	4.00E-03	1.43E-03	2.57E-03
8.597	3.00E-03	1.29E-03	1.71E-03
8.697	3.00E-03	1.16E-03	1.94E-03
8.797	3.00E-03	1.05E-03	1.95E-03
8.897	3.00E-03	9.41E-04	2.06E-03
8.997	3.00E-03	8.27E-04	2.15E-03
9.097	3.00E-03	7.60E-04	2.24E-03
9.197	2.00E-03	6.83E-04	1.32E-03
9.297	2.00E-03	6.13E-04	2.39E-03
9.397	2.00E-03	5.50E-04	1.45E-03
9.497	2.00E-03	4.93E-04	1.51E-03
9.597	2.00E-03	4.42E-04	1.56E-03
9.697	2.00E-03	3.96E-04	1.60E-03
9.797	2.00E-03	3.55E-04	1.65E-03
9.897	1.00E-03	3.18E-04	6.82E-04
9.997	1.00E-03	2.85E-04	7.18E-04
10.100	1.00E-03	2.55E-04	7.46E-04
10.200	1.00E-03	2.28E-04	7.72E-04
10.300	1.00E-03	2.04E-04	7.96E-04
10.400	1.00E-03	1.82E-04	8.18E-04
10.500	1.00E-03	1.63E-04	8.37E-04
10.600	1.00E-03	1.45E-04	8.55E-04
10.7	1.00E-03	1.30E-04	8.70E-04

May 2006
E2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.1850E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.1000E-01
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8698E-06
DISPERSIVITY= 0.1695E-02
WIDTH= 0.1000E-01
RF= 1.000
CO= 0.1459
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7830E-03

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.8507E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.70E-07	8.61E-07	8.78E-07
X(2)	1.70E-03	1.61E-03	1.80E-03
X(5)	1.46E-01	1.44E-01	1.47E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.33E-01	6.96E-04	1.36E-27	6.96E-04
0.2667	1.30E-03	2.35E-14	1.30E-03
4.00E-01	9.10E-04	9.10E-04	0.00E+00
0.5333	1.52E-03	1.08E-07	1.52E-03
6.67E-01	2.13E-03	2.40E-06	2.12E-03
0.8	1.90E-03	1.90E-03	0.00E+00
0.9333	2.34E-03	8.34E-05	2.26E-03
1.067	2.95E-03	2.54E-04	2.69E-03
1.2	3.56E-03	6.01E-04	2.95E-03
1.333	4.16E-03	1.20E-03	2.96E-03
1.467	4.77E-03	2.11E-03	2.66E-03
1.6	6.38E-03	3.37E-03	3.01E-03
1.733	7.98E-03	4.99E-03	2.99E-03
1.867	9.59E-03	7.01E-03	2.58E-03
2	1.22E-02	9.36E-03	2.84E-03
2.133	1.48E-02	1.21E-02	2.75E-03
2.267	1.74E-02	1.51E-02	2.35E-03
2.4	2.10E-02	1.83E-02	2.71E-03
2.533	2.46E-02	2.18E-02	2.86E-03
2.667	2.82E-02	2.54E-02	2.79E-03
2.8	3.18E-02	2.92E-02	2.62E-03
2.933	3.55E-02	3.31E-02	2.35E-03
3.067	4.01E-02	3.71E-02	2.98E-03
3.2	4.37E-02	4.11E-02	2.59E-03
3.333	4.83E-02	4.51E-02	3.20E-03
3.467	5.19E-02	4.91E-02	2.89E-03
3.6	5.55E-02	5.30E-02	2.46E-03
3.733	5.91E-02	5.69E-02	2.17E-03
3.867	6.27E-02	6.08E-02	9.33E-04
4	6.53E-02	6.45E-02	8.17E-04
4.133	6.79E-02	6.81E-02	-1.68E-04
4.267	7.05E-02	7.15E-02	-9.62E-04
4.4	7.31E-02	7.46E-02	-1.44E-03
4.533	7.47E-02	7.73E-02	-2.58E-03
4.667	7.63E-02	7.96E-02	-3.29E-03
4.8	7.80E-02	8.15E-02	-3.52E-03
4.933	7.86E-02	8.28E-02	-4.26E-03
5.067	7.92E-02	8.37E-02	-4.26E-03
5.2	7.98E-02	8.41E-02	-4.30E-03
5.333	8.04E-02	8.40E-02	-3.64E-03
5.467	8.00E-02	8.36E-02	-3.56E-03
5.6	7.96E-02	8.27E-02	-3.13E-03
5.733	7.92E-02	8.16E-02	-2.36E-03
5.867	7.88E-02	8.01E-02	-1.30E-03
6	7.74E-02	7.84E-02	-1.02E-03
6.133	7.60E-02	7.66E-02	-5.31E-04
6.267	7.46E-02	7.46E-02	1.36E-04
6.4	7.32E-02	7.23E-02	9.15E-04
6.533	7.18E-02	7.01E-02	1.78E-03
6.667	7.05E-02	6.77E-02	2.71E-03
6.8	6.81E-02	6.53E-02	2.74E-03
6.933	6.57E-02	6.29E-02	2.76E-03
7.067	6.43E-02	6.05E-02	3.79E-03
7.2	6.19E-02	5.81E-02	3.80E-03
7.333	5.95E-02	5.57E-02	3.80E-03
7.467	5.71E-02	5.33E-02	3.78E-03
7.6	5.47E-02	5.10E-02	3.68E-03
7.733	5.23E-02	4.88E-02	3.55E-03
7.867	4.99E-02	4.66E-02	3.38E-03
8	4.75E-02	4.44E-02	3.12E-03
8.133	4.51E-02	4.23E-02	2.80E-03
8.267	4.27E-02	4.03E-02	2.43E-03
8.4	4.03E-02	3.84E-02	1.97E-03
8.533	3.90E-02	3.65E-02	2.45E-03
8.667	3.66E-02	3.47E-02	1.67E-03
8.8	3.42E-02	3.30E-02	1.21E-03
8.933	3.28E-02	3.13E-02	1.47E-03
9.067	3.04E-02	2.97E-02	6.75E-04
9.2	2.90E-02	2.82E-02	8.04E-04
9.333	2.66E-02	2.67E-02	-1.34E-04
9.467	2.52E-02	2.53E-02	-1.37E-04
9.6	2.38E-02	2.40E-02	-2.04E-04
9.733	2.24E-02	2.28E-02	-3.32E-04
9.867	2.10E-02	2.15E-02	-5.22E-04
10	1.86E-02	2.04E-02	-1.77E-03
10.13	1.72E-02	1.93E-02	-2.09E-03
10.27	1.69E-02	1.82E-02	-1.39E-03
10.4	1.55E-02	1.73E-02	-1.83E-03
10.53	1.41E-02	1.64E-02	-2.31E-03
10.67	1.27E-02	1.54E-02	-2.77E-03
10.8	1.23E-02	1.46E-02	-2.34E-03
10.93	1.09E-02	1.38E-02	-2.13E-03
11.07	1.05E-02	1.30E-02	-2.55E-03
11.2	9.10E-03	1.23E-02	-3.24E-03
11.33	8.70E-03	1.17E-02	-2.53E-03
11.47	7.31E-03	1.10E-02	-3.68E-03
11.6	6.92E-03	1.04E-02	-3.48E-03
11.73	5.53E-03	9.53E-03	-4.13E-03
11.87	5.13E-03	9.26E-03	-4.13E-03
12	4.74E-03	8.76E-03	-4.02E-03
12.13	4.35E-03	8.26E-03	-3.93E-03
12.27	2.95E-03	7.79E-03	-4.84E-03
12.4	2.56E-03	7.36E-03	-4.80E-03
12.53	2.17E-03	6.96E-03	-4.79E-03
12.67	1.78E-03	6.55E-03	-4.77E-03
12.8	1.38E-03	6.19E-03	-4.81E-03
12.93	0.00E+00	5.66E-03	-5.65E-03

E2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.2900E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.1000E-01
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8121E-06
DISPERSIVITY= 0.1469E-02
WIDTH= 0.1000E-01
RF= 1.000
CO= 0.1588
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1754E-03

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
THE CRITICAL RSS IS: 0.1904E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.12E-07	8.12E-07	8.12E-07
X(2)	1.47E-03	1.44E-03	1.50E-03
X(5)	1.59E-01	1.59E-01	1.59E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.333	1.00E-03	9.13E-10	1.00E-03
1.467	1.00E-03	7.55E-09	1.00E-03
1.6	1.00E-03	4.37E-08	1.00E-03
1.733	1.00E-03	1.93E-07	1.00E-03
1.867	1.00E-03	6.86E-07	9.99E-04
2.0	2.00E-03	6.79E-04	2.00E-03
2.133	2.00E-03	5.32E-06	2.00E-03
2.267	2.00E-03	1.23E-05	1.99E-03
2.4	2.00E-03	2.65E-05	1.97E-03
2.533	3.00E-03	5.02E-05	2.95E-03
2.667	3.00E-03	9.08E-05	2.91E-03
2.8	3.00E-03	1.55E-04	2.85E-03
2.933	3.00E-03	2.51E-04	2.75E-03
3.067	3.00E-03	3.88E-04	2.61E-03
3.2	3.00E-03	5.79E-04	2.44E-03
3.333	4.00E-03	7.78E-04	3.17E-03
3.467	4.00E-03	1.16E-03	2.84E-03
3.6	5.00E-03	1.68E-03	3.42E-03
3.733	5.00E-03	2.10E-03	2.90E-03
3.867	5.00E-03	2.73E-03	2.28E-03
4.0	6.00E-03	3.47E-03	2.53E-03
4.133	6.00E-03	4.34E-03	1.66E-03
4.267	7.00E-03	5.35E-03	1.65E-03
4.4	8.00E-03	6.50E-03	1.50E-03
4.533	9.00E-03	7.78E-03	1.22E-03
4.667	1.00E-02	9.22E-03	7.84E-04
4.8	1.10E-02	1.08E-02	2.09E-04
4.933	1.20E-02	1.25E-02	-5.09E-04
5.067	1.40E-02	1.40E-02	-3.67E-04
5.2	1.60E-02	1.64E-02	-3.58E-04
5.333	1.80E-02	1.85E-02	-4.78E-04
5.467	2.00E-02	2.07E-02	-2.07E-04
5.6	2.20E-02	2.31E-02	-1.07E-03
5.733	2.40E-02	2.55E-02	-1.53E-03
5.867	2.70E-02	2.81E-02	-2.08E-03
6.0	2.90E-02	3.07E-02	-1.70E-03
6.133	3.20E-02	3.34E-02	-1.38E-03
6.267	3.50E-02	3.60E-02	-1.11E-03
6.4	3.80E-02	3.89E-02	-8.64E-04
6.533	4.10E-02	4.16E-02	-6.20E-04
6.667	4.40E-02	4.40E-02	-4.62E-04
6.8	4.60E-02	4.71E-02	-1.07E-03
6.933	4.90E-02	4.97E-02	-7.12E-04
7.067	5.20E-02	5.25E-02	-2.82E-04
7.2	5.50E-02	5.48E-02	2.48E-04
7.333	5.70E-02	5.71E-02	-1.09E-04
7.467	6.00E-02	6.03E-02	3.67E-04
7.6	6.20E-02	6.14E-02	5.89E-04
7.733	6.40E-02	6.33E-02	6.70E-04
7.867	6.60E-02	6.47E-02	7.91E-04
8.0	6.70E-02	6.67E-02	3.46E-04
8.133	6.90E-02	6.80E-02	9.56E-04
8.267	7.00E-02	6.93E-02	7.52E-04
8.4	7.10E-02	7.03E-02	7.38E-04
8.533	7.20E-02	7.11E-02	9.13E-04
8.667	7.20E-02	7.17E-02	2.74E-04
8.8	7.30E-02	7.22E-02	8.20E-04
8.933	7.30E-02	7.25E-02	5.45E-04
9.067	7.30E-02	7.26E-02	4.43E-04
9.2	7.30E-02	7.25E-02	5.07E-04
9.333	7.30E-02	7.23E-02	7.30E-04
9.467	7.20E-02	7.19E-02	1.04E-04
9.6	7.20E-02	7.14E-02	6.18E-04
9.733	7.10E-02	7.07E-02	2.65E-04
9.867	7.00E-02	7.00E-02	3.46E-05
10.0	6.90E-02	6.91E-02	-8.35E-05
10.13	6.80E-02	6.81E-02	-1.01E-04
10.27	6.70E-02	6.70E-02	-1.68E-05
10.4	6.60E-02	6.59E-02	1.43E-04
10.53	6.30E-02	6.33E-02	-3.13E-04
10.67	6.10E-02	6.20E-02	-9.56E-04
10.8	6.00E-02	6.06E-02	-5.51E-04
10.93	5.80E-02	5.91E-02	-1.09E-03
11.07	5.70E-02	5.76E-02	-6.14E-04
11.2	5.40E-02	5.46E-02	-5.70E-04
11.33	5.20E-02	5.30E-02	-1.03E-03
11.47	4.90E-02	4.99E-02	-9.22E-04
11.6	4.80E-02	4.84E-02	-3.74E-04
11.73	4.60E-02	4.65E-02	-2.95E-04
11.87	4.50E-02	4.53E-02	-2.91E-04
12.0	4.30E-02	4.38E-02	-7.76E-04
12.13	4.20E-02	4.27E-02	-2.77E-04
12.27	4.00E-02	4.08E-02	-7.88E-04
12.4	3.90E-02	3.93E-02	-3.34E-04
12.53	3.70E-02	3.75E-02	-9.52E-05
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May 2006
E3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-01
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1077E-05
DISPERSIVITY= 0.2132E-02
WIDTH= 0.1000E-01
Rf= 1.000
CO= 0.1704
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2131E-03

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
THE CRITICAL RSS IS: 0.2346E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.08E-06	1.08E-06	1.08E-06
X(2)	2.13E-03	2.07E-03	2.20E-03
X(5)	1.70E-01	1.69E-01	1.72E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.33E-01	9.43E-04	2.49E-21	9.43E-04
0.3	8.71E-04	3.85E-10	8.71E-04
4.67E-01	6.55E-04	6.00E-04	7.90E-04
0.6333	1.73E-03	2.28E-05	1.71E-03
8.00E-01	1.66E-03	1.83E-04	1.47E-03
0.9667	1.467E-03	7.19E-04	8.66E-04
1.133	2.51E-03	1.89E-03	6.19E-04
1.3	3.44E-03	3.89E-03	-4.50E-04
1.467	6.37E-03	6.78E-03	-4.13E-04
1.633	8.30E-03	1.05E-02	-2.24E-03
1.8	1.32E-02	1.51E-02	-1.84E-03
1.967	1.82E-02	2.02E-02	-2.09E-03
2.133	2.51E-02	2.59E-02	-8.29E-04
2.3	3.20E-02	3.20E-02	5.84E-05
2.467	3.99E-02	3.92E-02	1.71E-03
2.633	4.79E-02	4.46E-02	3.23E-03
2.8	5.48E-02	5.11E-02	3.72E-03
2.967	6.07E-02	5.75E-02	3.25E-03
3.133	6.67E-02	6.38E-02	2.89E-03
3.3	7.28E-02	6.98E-02	2.75E-03
3.467	7.65E-02	7.05E-02	1.05E-03
3.633	7.94E-02	8.04E-02	-9.21E-04
3.8	8.24E-02	8.43E-02	-1.91E-03
3.967	8.43E-02	8.71E-02	-2.78E-03
4.133	8.52E-02	8.87E-02	-3.50E-03
4.3	8.52E-02	8.92E-02	-3.15E-03
4.467	8.61E-02	8.89E-02	-2.83E-03
4.633	8.50E-02	8.77E-02	-2.70E-03
4.8	8.59E-02	8.58E-02	-1.89E-03
4.967	8.19E-02	8.34E-02	-1.54E-03
5.133	7.98E-02	8.06E-02	-7.92E-04
5.3	7.77E-02	7.75E-02	-6.90E-04
5.467	7.47E-02	7.42E-02	-5.07E-04
5.633	7.26E-02	7.07E-02	-1.89E-03
5.8	6.95E-02	6.72E-02	-2.31E-03
5.967	6.54E-02	6.37E-02	-1.75E-03
6.133	6.24E-02	6.02E-02	-2.15E-03
6.3	5.93E-02	5.68E-02	-2.48E-03
6.467	5.62E-02	5.35E-02	-2.72E-03
6.633	5.22E-02	5.03E-02	-1.85E-03
6.8	4.91E-02	4.72E-02	-1.88E-03
6.967	4.60E-02	4.43E-02	-1.74E-03
7.133	4.29E-02	4.15E-02	-1.48E-03
7.3	3.99E-02	3.88E-02	-1.08E-03
7.467	3.68E-02	3.63E-02	-5.42E-04
7.633	3.47E-02	3.39E-02	-8.65E-04
7.8	3.17E-02	3.16E-02	-5.41E-05
7.967	2.96E-02	2.95E-02	-1.11E-04
8.133	2.75E-02	2.75E-02	4.04E-05
8.3	2.54E-02	2.56E-02	-1.62E-04
8.467	2.34E-02	2.38E-02	-4.62E-04
8.633	2.13E-02	2.22E-02	-8.84E-04
8.8	2.02E-02	2.06E-02	-4.12E-04
8.967	1.82E-02	1.92E-02	-1.04E-03
9.133	1.71E-02	1.78E-02	-7.65E-04
9.3	1.60E-02	1.66E-02	-5.78E-04
9.467	1.49E-02	1.54E-02	-4.77E-04
9.633	1.29E-02	1.43E-02	-1.45E-03
9.8	1.28E-02	1.33E-02	-5.07E-04
9.967	1.07E-02	1.24E-02	-1.63E-03
10.13	1.07E-02	1.15E-02	-8.20E-04
10.3	9.58E-03	1.06E-02	-1.07E-03
10.47	8.51E-03	9.88E-03	-1.37E-03
10.63	8.43E-03	9.17E-03	-7.38E-04
10.8	7.36E-03	8.51E-03	-1.15E-03
10.97	7.29E-03	7.89E-03	-6.04E-04
11.13	6.22E-03	7.33E-03	-1.11E-03
11.3	6.15E-03	6.80E-03	-6.48E-04
11.47	5.08E-03	6.30E-03	-1.23E-03
11.63	5.00E-03	5.85E-03	-8.44E-04
11.8	4.93E-03	5.42E-03	-4.90E-04
11.97	3.86E-03	5.03E-03	-1.17E-03
12.13	3.79E-03	4.66E-03	-8.75E-04
12.3	3.72E-03	4.32E-03	-6.07E-04
12.47	3.65E-03	4.01E-03	-3.63E-04
12.63	2.57E-03	3.72E-03	-1.14E-03
12.8	2.50E-03	3.45E-03	-9.44E-04
12.97	2.43E-03	3.20E-03	-7.64E-04
13.13	2.36E-03	2.96E-03	-6.04E-04
13.3	1.29E-03	2.75E-03	-1.46E-03
13.47	1.22E-03	2.55E-03	-1.33E-03
13.63	1.15E-03	2.36E-03	-1.22E-03
13.8	1.07E-03	2.19E-03	-1.12E-03
13.97	1.43E-06	2.03E-03	-2.03E-03

E3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.1000E-01
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8664E-06
DISPERSIVITY= 0.1656E-02
WIDTH= 0.1000E-01
Rf= 1.000
CO= 0.1407
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.6415E-03

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
THE CRITICAL RSS IS: 0.6964E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.66E-07	8.66E-07	8.66E-07
X(2)	1.66E-03	1.57E-03	1.74E-03
X(5)	1.41E-01	1.39E-01	1.42E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.787	1.00E-03	1.18E-04	8.82E-04
2.900	1.00E-03	1.93E-04	8.07E-04
3.013	1.00E-03	3.01E-04	6.99E-04
3.127	1.00E-03	4.52E-04	5.49E-04
3.300	2.00E-03	6.54E-04	1.35E-03
3.433	3.00E-03	8.83E-04	1.08E-03
3.567	2.00E-03	1.25E-03	7.47E-04
3.700	3.00E-03	1.67E-03	1.33E-03
3.833	4.00E-03	2.15E-03	8.24E-04
3.967	4.00E-03	2.78E-03	1.22E-03
4.100	4.00E-03	3.49E-03	5.07E-04
4.233	5.00E-03	4.33E-03	6.84E-04
4.367	6.00E-03	5.26E-03	7.44E-04
4.500	6.00E-03	6.32E-03	-3.15E-04
4.633	7.00E-03	7.50E-03	-4.95E-04
4.767	8.00E-03	8.80E-03	-7.98E-04
4.900	1.00E-02	1.02E-02	-2.21E-04
5.033	1.10E-02	1.19E-02	-7.64E-04
5.167	1.20E-02	1.34E-02	-1.42E-03
5.300	1.40E-02	1.52E-02	-1.19E-03
5.433	1.60E-02	1.71E-02	-1.06E-03
5.567	1.80E-02	1.90E-02	-1.03E-03
5.700	2.00E-02	2.11E-02	-1.09E-03
5.833	2.20E-02	2.32E-02	-1.22E-03
5.967	2.40E-02	2.54E-02	-1.41E-03
6.100	2.60E-02	2.77E-02	-1.65E-03
6.233	2.90E-02	2.99E-02	-9.19E-04
6.367	3.10E-02	3.22E-02	-1.21E-03
6.500	3.40E-02	3.40E-02	-4.86E-04
6.633	3.60E-02	3.68E-02	-7.46E-04
6.767	3.90E-02	3.90E-02	3.09E-05
6.900	4.10E-02	4.10E-02	-1.34E-04
7.033	4.30E-02	4.32E-02	-2.27E-04
7.167	4.60E-02	4.52E-02	7.66E-04
7.300	4.80E-02	4.71E-02	6.63E-04
7.433	5.00E-02	4.89E-02	1.07E-03
7.567	5.10E-02	5.06E-02	4.07E-04
7.700	5.00E-02	5.19E-02	-7.76E-04
7.833	5.40E-02	5.35E-02	4.86E-04
7.967	5.60E-02	5.48E-02	1.24E-03
8.100	5.70E-02	5.70E-02	-1.15E-03
8.233	5.80E-02	5.68E-02	1.21E-03
8.367	5.90E-02	5.76E-02	1.42E-03
8.500	5.90E-02	5.82E-02	-4.99E-04
8.633	6.00E-02	5.87E-02	1.29E-03
8.767	6.00E-02	5.91E-02	9.49E-04
8.900	6.00E-02	6.03E-02	-7.49E-04
9.033	6.00E-02	5.93E-02	6.86E-04
9.167	6.00E-02	5.93E-02	7.55E-04
9.300	6.00E-02	6.09E-02	-4.91E-04
9.433	5.90E-02	5.87E-02	2.58E-04
9.567	5.90E-02	5.83E-02	6.80E-04
9.700	5.80E-02	5.78E-02	2.04E-04
9.833	5.70E-02	5.72E-02	-1.76E-04
9.967	5.70E-02	5.65E-02	5.33E-04
10.100	5.60E-02	5.57E-02	3.21E-04
10.233	5.50E-02	5.48E-02	1.80E-04
10.370	5.30E-02	5.39E-02	-8.88E-04
10.500	5.20E-02	5.29E-02	-9.05E-04
10.630	5.10E-02	5.19E-02	-8.71E-04
10.770	5.00E-02	5.08E-02	-7.84E-04
10.900	4.90E-02	4.97E-02	-6.57E-04
11.030	4.70E-02	4.85E-02	-1.52E-03
11.170	4.60E-02	4.73E-02	-1.33E-03
11.300	4.50E-02	4.61E-02	-1.14E-03
11.430	4.30E-02	4.49E-02	-1.92E-03
11.570	4.20E-02	4.37E-02	-1.69E-03
11.700	4.00E-02	4.25E-02	-2.46E-03
11.830	3.90E-02	4.12E-02	-2.23E-03
11.970	3.80E-02	4.00E-02	-1.98E-03
12.100	3.60E-02	3.88E-02	-2.76E-03
12.230	3.50E-02	3.75E-02	-2.53E-03
12.370	3.40E-02	3.63E-02	-2.31E-03
12.500	3.20E-02	3.51E-02	-3.12E-03
12.630	3.10E-02	3.39E-02	-2.93E-03
12.770	3.00E-02	3.28E-02	-2.76E-03
12.900	2.80E-02	3.16E-02	-3.61E-03
13.030	2.70E-02	3.05E-02	-3.49E-03
13.160	2.60E-02	2.94E-02	-3.38E-03
13.300	2.50E-02	2.83E-02	-3.30E-03
13.430	2.40E-02	2.72E-02	-3.24E-03
13.570	2.30E-02	2.62E-02	-3.17E-03
13.700	2.20E-02	2.52E-02	-3.20E-03
13.830	2.10E-02	2.42E-02	-3.22E-03
13.970	2.00E-02	2.33E-02	-3.26E-03
14.100	1.90E-02	2.23E-02	-3.33E-03
14.230	1.80E-02	2.14E-02	-3.43E-03
14.370	1.70E-02	2.05E-02	-3.51E-03
14.500	1.60E-02	1.96E-02	-3.58E-03
14.630	1.50E-02	1.87E-02	-3.65E-03
14.770	1.40E-02	1.78E-02	-3.72E-03
14.900	1.30E-02	1.69E-02	-3.79E-03
15.030	1.20E-02	1.60E-02	-3.86E-03
15.170	1.10E-02	1.51E-02	-3.93E-03
15.300	1.00E-02	1.42E-02	-4.00E-03
15.430	9.00E-03	1.33E-02	-4.07E-03
15.570	8.00E-03	1.24E-02	-4.14E-03
15.700	7.00E-03	1.15E-02	-4.21E-03
15.830	6.00E-03	1.06E-02	-4.28E-03
15.970	5.00E-03	9.70E-03	-4.35E-03

May 2006
E4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 88
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1614E-05
 DISPERSIVITY= 0.1998E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1755
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2805E-04

THE F STATISTIC FOR NP= 3 NOBS= 88 IS: 2.72

THE CRITICAL RSS IS: 0.3075E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.61E-06	1.61E-06	1.61E-06
X(2)	2.00E-03	1.98E-03	2.02E-03
X(5)	1.76E-01	1.76E-01	1.76E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.00E-01	8.96E-04	6.53E-06	8.90E-04
0.7	7.48E-04	3.70E-05	7.11E-04
8.00E-01	6.00E-04	1.36E-04	4.64E-04
0.9	4.52E-04	3.73E-04	7.89E-05
1.00E+00	1.30E-03	8.33E-04	4.70E-04
1.1	1.16E-03	1.60E-03	-4.49E-04
1.2	2.01E-03	2.76E-03	-7.56E-04
1.3	3.86E-03	4.36E-03	-5.04E-04
1.4	5.71E-03	6.44E-03	-7.25E-04
1.5	8.56E-03	8.98E-03	-4.17E-04
1.6	1.14E-02	1.20E-02	-5.41E-04
1.7	4.19E-02	4.16E-02	1.20E-05
1.8	1.91E-02	1.88E-02	2.86E-04
1.9	2.20E-02	2.25E-02	-5.08E-04
2.0	2.61E-02	2.61E-02	-2.58E-04
2.1	2.97E-02	2.95E-02	1.60E-04
2.2	3.25E-02	3.27E-02	-1.57E-04
2.3	3.54E-02	3.55E-02	-1.31E-04
2.4	3.82E-02	3.80E-02	2.82E-04
2.5	4.01E-02	4.00E-02	1.09E-04
2.6	4.19E-02	4.16E-02	3.52E-04
2.7	4.28E-02	4.28E-02	5.22E-06
2.8	4.36E-02	4.36E-02	4.61E-05
2.9	4.45E-02	4.40E-02	4.47E-04
3	4.43E-02	4.42E-02	1.74E-04
3.1	4.42E-02	4.40E-02	1.92E-04
3.2	4.40E-02	4.36E-02	4.68E-04
3.3	4.29E-02	4.29E-02	-3.87E-05
3.4	4.28E-02	4.21E-02	6.49E-04
3.5	4.18E-02	4.11E-02	4.88E-04
3.6	4.05E-02	4.05E-02	4.58E-04
3.7	3.93E-02	3.88E-02	5.25E-04
3.8	3.72E-02	3.75E-02	-3.28E-04
3.9	3.60E-02	3.60E-02	-1.25E-04
4	3.49E-02	3.47E-02	1.17E-04
4.1	3.27E-02	3.33E-02	-6.17E-04
4.2	3.16E-02	3.16E-02	-2.33E-04
4.3	3.04E-02	3.05E-02	-7.22E-05
4.4	2.83E-02	2.91E-02	-8.13E-04
4.5	2.71E-02	2.77E-02	-5.74E-04
4.6	2.60E-02	2.63E-02	-3.63E-04
4.7	2.48E-02	2.50E-02	-1.84E-04
4.8	2.37E-02	2.37E-02	-4.42E-05
4.9	2.15E-02	2.25E-02	-9.44E-04
5	2.04E-02	2.13E-02	-8.86E-04
5.1	1.92E-02	2.01E-02	-8.73E-04
5.2	1.81E-02	1.90E-02	-9.08E-04
5.3	1.79E-02	1.79E-02	1.27E-05
5.4	1.68E-02	1.69E-02	-1.14E-04
5.5	1.56E-02	1.59E-02	-2.87E-04
5.6	1.45E-02	1.50E-02	-5.07E-04
5.7	1.33E-02	1.41E-02	-7.71E-04
5.8	1.32E-02	1.33E-02	-7.94E-05
5.9	1.20E-02	1.25E-02	-4.31E-04
6	1.19E-02	1.17E-02	1.75E-04
6.1	1.07E-02	1.10E-02	-2.58E-04
6.2	1.06E-02	1.03E-02	2.70E-04
6.3	9.45E-03	9.69E-03	-2.40E-04
6.4	9.30E-03	9.08E-03	2.15E-04
6.5	9.15E-03	8.52E-03	6.35E-04
6.6	8.00E-03	7.98E-03	2.29E-05
6.7	7.65E-03	7.47E-03	3.79E-04
6.8	7.71E-03	7.00E-03	7.06E-04
6.9	7.56E-03	6.55E-03	1.01E-03
7	7.41E-03	6.13E-03	1.28E-03
7.1	6.26E-03	5.74E-03	5.23E-04
7.2	6.11E-03	5.37E-03	7.45E-04
7.3	5.96E-03	5.02E-03	9.45E-04
7.4	5.82E-03	4.69E-03	1.12E-03
7.5	5.67E-03	4.39E-03	1.28E-03
7.6	5.52E-03	4.10E-03	1.42E-03
7.7	4.37E-03	3.83E-03	5.41E-04
7.8	4.22E-03	3.58E-03	6.45E-04
7.9	4.08E-03	3.34E-03	7.32E-04
8	3.93E-03	3.12E-03	8.05E-04
8.1	3.78E-03	2.92E-03	8.64E-04
8.2	3.63E-03	2.72E-03	9.09E-04
8.3	2.48E-03	2.54E-03	-5.83E-05
8.4	2.33E-03	2.37E-03	-3.72E-05
8.5	2.19E-03	2.19E-03	-2.37E-05
8.6	2.04E-03	2.07E-03	-2.73E-05
8.7	1.89E-03	1.93E-03	-3.72E-05
8.8	1.74E-03	1.80E-03	-5.61E-05
8.9	1.59E-03	1.68E-03	-8.36E-05
9	1.44E-03	1.56E-03	-1.19E-04
9.1	1.30E-03	1.48E-03	-1.62E-04
9.2	1.15E-03	1.36E-03	-2.12E-04
9.3	0.00E+00	1.27E-03	-1.27E-03

E4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1187E-05
 DISPERSIVITY= 0.1395E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1375
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4020E-04

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71

THE CRITICAL RSS IS: 0.4379E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.19E-06	1.19E-06	1.19E-06
X(2)	1.40E-03	1.37E-03	1.44E-03
X(5)	1.38E-01	1.36E-01	1.39E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.833	9.34E-04	7.60E-07	9.34E-04
1.967	8.49E-04	2.50E-06	8.47E-04
2.100	7.65E-04	7.01E-06	7.58E-04
2.233	1.68E-03	1.73E-05	1.66E-03
2.367	1.60E-03	3.83E-05	1.56E-03
2.500	2.60E-03	7.73E-05	2.52E-03
2.633	1.43E-03	1.45E-04	1.28E-03
2.767	1.34E-03	2.54E-04	1.09E-03
2.900	2.26E-03	4.20E-04	1.84E-03
3.033	2.17E-03	6.60E-04	1.51E-03
3.167	2.09E-03	9.96E-04	1.09E-03
3.300	3.30E-03	2.00E-03	1.43E-03
3.433	2.92E-03	2.02E-03	8.96E-04
3.567	3.83E-03	2.74E-03	1.09E-03
3.700	3.70E-03	3.75E-03	-3.32E-04
3.833	4.66E-03	4.64E-03	1.71E-05
3.967	5.58E-03	5.83E-03	-2.53E-04
4.100	7.49E-03	7.16E-03	3.32E-04
4.233	8.41E-03	8.62E-03	-2.15E-04
4.367	1.03E-02	1.02E-02	1.25E-04
4.500	1.12E-02	1.19E-02	-5.22E-04
4.633	1.32E-02	1.36E-02	-4.29E-04
4.767	1.51E-02	1.53E-02	-2.71E-04
4.900	1.70E-02	1.71E-02	-1.14E-04
5.033	1.87E-02	1.85E-02	6.84E-05
5.167	2.08E-02	2.05E-02	3.02E-04
5.300	2.17E-02	2.21E-02	-3.86E-04
5.433	2.35E-02	2.36E-02	-5.91E-05
5.567	2.46E-02	2.50E-02	-4.45E-04
5.700	2.65E-02	2.63E-02	2.19E-04
5.833	2.74E-02	2.74E-02	-9.91E-05
5.967	2.83E-02	2.83E-02	-9.28E-06
6.100	2.92E-02	2.91E-02	1.11E-04
6.233	3.01E-02	3.01E-02	-1.42E-04
6.367	3.01E-02	3.02E-02	-1.69E-04
6.500	3.10E-02	3.05E-02	4.26E-04
6.633	3.09E-02	3.04E-02	4.43E-04
6.767	3.08E-02	3.07E-02	5.89E-05
6.900	3.07E-02	3.06E-02	8.07E-05
7.033	3.06E-02	3.04E-02	5.27E-04
7.167	2.95E-02	3.01E-02	-5.12E-04
7.300	2.95E-02	2.96E-02	-1.48E-04
7.433	2.84E-02	2.84E-02	-3.09E-04
7.567	2.83E-02	2.84E-02	-1.51E-04
7.700	2.72E-02	2.77E-02	-5.42E-04
7.833	2.71E-02	2.71E-02	-2.39E-04
7.967	2.60E-02	2.62E-02	-1.50E-04
8.100	2.50E-02	2.53E-02	-3.88E-04
8.233	2.39E-02	2.45E-02	-5.95E-04
8.367	2.38E-02	2.36E-02	2.23E-04
8.500	2.27E-02	2.26E-02	5.58E-05
8.633	2.16E-02	2.17E-02	-1.02E-04
8.767	2.05E-02	2.08E-02	-2.55E-04
8.900	1.94E-02	1.99E-02	-4.13E-04
9.033	1.94E-02	1.89E-02	4.21E-04
9.167	1.83E-02	1.80E-02	2.44E-04
9.300	1.72E-02	1.71E-02	5.08E-05
9.433	1.61E-02	1.63E-02	-1.62E-04
9.567	1.60E-02	1.54E-02	6.04E-04
9.700	1.49E-02	1.46E-02	3.46E-04
9.833	1.38E-02	1.38E-02	6.16E-05
9.967	1.28E-02	1.30E-02	-2.50E-04
10.100	1.27E-02	1.23E-02	4.10E-04
10.233	1.16E-02	1.16E-02	3.85E-05
10.370	1.15E-02	1.09E-02	6.43E-04
10.500	1.04E-02	1.02E-02	2.12E-04
10.633	1.03E-02	9.58E-03	7.53E-04
10.770	9.25E-03	8.98E-03	2.67E-04
10.900	9.16E-03	8.42E-03	7.49E-04
11.033	8.08E-03	7.88E-03	2.01E-04
11.170	7.99E-03	7.37E-03	6.29E-04
11.300	6.91E-03	6.88E-03	2.65E-05
11.433	6.83E-03	6.43E-03	3.97E-04
11.570	5.74E-03	5.99E-03	-2.54E-04
11.700	5.66E-03	5.59E-03	6.60E-05
11.833	5.57E-03	5.21E-03	3.63E-04
11.967	4.49E-03	4.42E-03	-3.61E-04
12.100	4.40E-03	4.51E-03	-1.09E-04
12.233	4.32E-03	4.19E-03	1.22E-04
12.370	3.23E-03	3.23E-03	3.36E-06
12.500	3.15E-03	3.62E-03	-4.71E-04
12.633	3.06E-03	3.36E-03	-2.97E-04
12.770	2.97E-03	3.11E-03	-1.37E-04
12.900	2.89E-03	2.89E-03	4.54E-06
13.033	1.81E-03	2.68E-03	-8.69E-04
13.170	1.72E-03	2.48E-03	-7.55E-04
13.300	1.64E-03	2.30E-03	-6.91E-04
13.433	1.55E-03	2.12E-03	-5.70E-04
13.570	1.47E-03	1.96E-03	-4.95E-04
13.700	1.37E-03	1.81E-03	-1.43E-03
13.833	2.97E-04	1.68E-03	-1.38E-03
13.970	2.12E-04	1.55E-03	-1.34E-03
14.100	1.27E-04	1.43E-03	-1.30E-03
14.233	4.25E-05	1.32E-03	-1.28E-03

May 2006
F1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 99
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9795E-06
DISPERSIVITY= 0.2613E-02
WIDTH= 0.5000E-02
RF= 1.00
CO= 0.2857
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.8136E-03

THE F STATISTIC FOR NP= 3 NOBS= 99 IS: 2.71
THE CRITICAL RSS IS: 0.8624E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.80E-07	9.70E-07	9.89E-07
X(3)	2.51E-03	2.41E-03	2.74E-03
X(5)	2.86E-01	2.80E-01	2.91E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.17E+00	1.10E-03	6.60E-04	4.35E-04
1.3	2.23E-03	1.38E-03	8.51E-04
1.43E+00	4.36E-03	2.50E-03	1.86E-03
1.567	7.49E-03	4.11E-03	3.38E-03
1.70E+00	1.06E-02	6.25E-03	4.37E-03
1.833	1.38E-02	8.93E-03	4.82E-03
1.967	1.79E-02	1.22E-02	5.72E-03
2.1	2.20E-02	1.59E-02	6.11E-03
2.233	2.62E-02	2.01E-02	6.03E-03
2.367	3.03E-02	2.47E-02	5.57E-03
2.5	3.44E-02	2.96E-02	4.87E-03
2.633	3.75E-02	3.45E-02	3.09E-03
2.767	4.17E-02	3.93E-02	2.36E-03
2.9	4.48E-02	4.40E-02	8.37E-04
3.033	4.79E-02	4.83E-02	-3.74E-04
3.167	5.01E-02	5.23E-02	-2.20E-03
3.3	5.32E-02	5.64E-02	-3.07E-03
3.433	5.53E-02	5.88E-02	-3.47E-03
3.567	5.75E-02	6.14E-02	-3.90E-03
3.7	5.96E-02	6.34E-02	-4.85E-03
3.833	6.07E-02	6.51E-02	-4.34E-03
3.967	6.19E-02	6.63E-02	-4.33E-03
4.1	6.30E-02	6.71E-02	-4.09E-03
4.233	6.41E-02	6.75E-02	-3.41E-03
4.367	6.43E-02	6.73E-02	-4.83E-03
4.5	6.44E-02	6.75E-02	-3.12E-03
4.633	6.45E-02	6.71E-02	-2.57E-03
4.767	6.46E-02	6.64E-02	-1.80E-03
4.9	6.48E-02	6.56E-02	-8.31E-04
5.033	6.39E-02	6.46E-02	-7.01E-04
5.167	6.40E-02	6.40E-02	5.77E-04
5.3	6.32E-02	6.22E-02	9.57E-04
5.433	6.23E-02	6.09E-02	1.44E-03
5.567	6.14E-02	5.94E-02	2.13E-03
5.7	5.96E-02	5.79E-02	1.62E-03
5.833	5.87E-02	5.64E-02	2.29E-03
5.967	5.78E-02	5.47E-02	3.01E-03
6.1	5.60E-02	5.32E-02	2.72E-03
6.233	5.51E-02	5.16E-02	3.46E-03
6.367	5.02E-02	5.02E-02	7.33E-04
6.5	5.14E-02	4.84E-02	2.93E-03
6.633	5.05E-02	4.68E-02	3.66E-03
6.767	4.86E-02	4.53E-02	4.83E-03
6.9	4.67E-02	4.37E-02	3.05E-03
7.033	4.59E-02	4.22E-02	3.72E-03
7.167	4.40E-02	4.07E-02	3.32E-03
7.3	4.21E-02	3.92E-02	2.96E-03
7.433	4.03E-02	3.77E-02	2.53E-03
7.567	3.94E-02	3.61E-02	3.83E-03
7.7	3.75E-02	3.50E-02	2.57E-03
7.833	3.57E-02	3.37E-02	2.03E-03
7.967	3.48E-02	3.23E-02	2.45E-03
8.1	3.29E-02	3.11E-02	1.84E-03
8.233	3.11E-02	2.99E-02	1.19E-03
8.367	3.02E-02	2.87E-02	1.50E-03
8.5	2.83E-02	2.75E-02	7.75E-04
8.633	2.75E-02	2.64E-02	1.01E-03
8.767	2.56E-02	2.54E-02	2.08E-04
8.9	2.47E-02	2.43E-02	3.68E-04
9.033	2.38E-02	2.34E-02	4.92E-04
9.167	2.20E-02	2.24E-02	-4.19E-04
9.3	2.11E-02	2.15E-02	-3.66E-04
9.433	2.02E-02	2.06E-02	-3.46E-04
9.567	1.94E-02	1.97E-02	-3.59E-04
9.7	1.75E-02	1.89E-02	-1.41E-03
9.833	1.66E-02	1.81E-02	-3.48E-03
9.967	1.58E-02	1.74E-02	-1.59E-03
10.1	1.49E-02	1.66E-02	-1.73E-03
10.23	1.40E-02	1.59E-02	-1.90E-03
10.37	1.32E-02	1.52E-02	-2.09E-03
10.5	1.33E-02	1.46E-02	-1.31E-03
10.63	1.24E-02	1.40E-02	-1.56E-03
10.77	1.16E-02	1.34E-02	-1.83E-03
10.9	1.07E-02	1.28E-02	-2.12E-03
11.03	1.08E-02	1.23E-02	-1.44E-03
11.17	9.94E-03	1.17E-02	-1.78E-03
11.3	9.08E-03	1.12E-02	-2.15E-03
11.43	9.21E-03	1.07E-02	-1.53E-03
11.57	8.34E-03	1.03E-02	-1.94E-03
11.7	7.47E-03	9.63E-03	-2.38E-03
11.83	6.60E-03	9.41E-03	-2.81E-03
11.97	6.73E-03	9.00E-03	-2.26E-03
12.1	5.86E-03	8.61E-03	-2.74E-03
12.23	4.99E-03	8.23E-03	-3.24E-03
12.37	5.13E-03	7.87E-03	-2.75E-03
12.5	4.26E-03	7.53E-03	-3.27E-03
12.67	4.42E-03	7.12E-03	-2.70E-03
12.8	3.55E-03	6.81E-03	-3.26E-03
12.93	3.68E-03	6.51E-03	-2.83E-03
13.07	2.82E-03	6.23E-03	-3.41E-03
13.2	2.95E-03	5.95E-03	-3.01E-03
13.33	2.08E-03	5.67E-03	-3.52E-03
13.47	2.21E-03	5.44E-03	-3.23E-03
13.6	2.34E-03	5.20E-03	-2.86E-03
13.73	1.47E-03	4.96E-03	-3.51E-03
13.87	1.60E-03	4.76E-03	-3.15E-03
14	7.34E-04	4.55E-03	-3.81E-03
14.13	8.65E-04	4.35E-03	-3.48E-03
14.27	0.00E+00	4.16E-03	-4.16E-03

F1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 81
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9986E-06
DISPERSIVITY= 0.1883E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.3279
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4823E-03

THE F STATISTIC FOR NP= 3 NOBS= 81 IS: 2.73
THE CRITICAL RSS IS: 0.5330E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.99E-07	9.89E-07	1.01E-06
X(3)	1.88E-03	1.79E-03	1.79E-03
X(5)	3.28E-01	3.21E-01	3.35E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.837	1.00E-03	7.58E-04	1.00E-03
1.003	1.00E-03	1.84E-11	1.00E-03
1.170	2.00E-03	9.31E-10	2.00E-03
1.337	2.00E-03	1.76E-08	2.00E-03
1.503	1.50E-03	1.73E-07	3.00E-03
1.670	3.00E-03	1.07E-06	3.00E-03
1.837	3.00E-03	4.76E-06	3.00E-03
2.003	2.00E-03	1.63E-05	3.98E-03
2.170	4.00E-03	4.62E-05	3.95E-03
2.337	5.00E-03	1.12E-04	4.89E-03
2.503	5.00E-03	2.41E-04	4.76E-03
2.670	6.00E-03	4.69E-04	5.53E-03
2.837	6.00E-03	8.40E-04	5.16E-03
3.003	3.00E-03	1.40E-03	6.60E-03
3.170	8.00E-03	2.21E-03	5.79E-03
3.337	9.00E-03	3.32E-03	6.68E-03
3.503	1.00E-02	4.77E-03	7.14E-03
3.670	1.10E-02	6.59E-03	4.42E-03
3.837	1.30E-02	8.79E-03	4.21E-03
4.003	1.50E-02	1.14E-02	3.63E-03
4.170	1.70E-02	1.43E-02	2.68E-03
4.337	2.00E-02	1.76E-02	2.41E-03
4.503	2.20E-02	2.11E-02	8.70E-04
4.670	2.60E-02	2.49E-02	1.13E-03
4.837	2.90E-02	2.89E-02	2.49E-04
5.003	3.20E-02	3.27E-02	-6.86E-04
5.170	3.60E-02	3.66E-02	-6.11E-04
5.337	3.90E-02	4.05E-02	-1.46E-03
5.503	4.30E-02	4.42E-02	-1.16E-03
5.670	4.60E-02	4.77E-02	-1.66E-03
5.837	5.70E-02	5.09E-02	-1.90E-03
6.003	5.20E-02	5.39E-02	-1.90E-03
6.170	5.40E-02	5.66E-02	-2.57E-03
6.337	6.10E-02	6.26E-02	-1.58E-03
6.503	5.90E-02	6.09E-02	-1.91E-03
6.670	6.10E-02	6.26E-02	-1.58E-03
6.837	6.40E-02	6.49E-02	-8.81E-04
7.003	6.50E-02	6.56E-02	-5.46E-04
7.170	6.50E-02	6.59E-02	9.05E-04
7.337	6.80E-02	6.60E-02	2.53E-03
7.503	6.60E-02	6.58E-02	2.23E-04
7.670	6.60E-02	6.53E-02	6.68E-04
7.837	6.50E-02	6.47E-02	3.38E-04
8.003	6.50E-02	6.36E-02	1.21E-03
8.170	6.40E-02	6.27E-02	2.66E-03
8.337	6.30E-02	6.15E-02	1.47E-03
8.503	6.20E-02	6.02E-02	1.82E-03
8.670	6.00E-02	5.87E-02	1.29E-03
8.837	5.90E-02	5.72E-02	1.85E-03
9.003	5.70E-02	5.55E-02	1.49E-03
9.170	5.50E-02	5.38E-02	1.20E-03
9.337	5.40E-02	5.20E-02	1.96E-03
9.503	5.20E-02	5.03E-02	1.75E-03
9.670	5.00E-02	4.84E-02	1.56E-03
9.837	4.80E-02	4.66E-02	1.38E-03
10.000	4.60E-02	4.48E-02	1.21E-03
10.170	4.40E-02	4.30E-02	1.03E-03
10.340	4.20E-02	4.12E-02	8.18E-04
10.500	4.00E-02	3.94E-02	5.95E-04
10.670	3.80E-02	3.77E-02	3.42E-04
10.840	3.60E-02	3.60E-02	4.29E-05
11.000	3.50E-02	3.43E-02	7.15E-04
11.170	3.30E-02	3.27E-02	3.44E-04
11.340	3.10E-02	3.11E-02	-8.27E-05
11.500	2.90E-02	2.96E-02	-5.48E-04
11.670	2.80E-02	2.81E-02	-6.39E-05
11.840	2.60E-02	2.66E-02	-6.40E-04
12.000	2.40E-02	2.53E-02	-1.26E-03
12.170	2.30E-02	2.39E-02	-9.31E-04
12.340	2.10E-02	2.27E-02	-1.66E-03
12.500	2.00E-02	2.14E-02	-1.44E-03
12.670	1.90E-02	2.03E-02	-1.27E-03
12.840	1.70E-02	1.92E-02	-2.16E-03
13.000	1.60E-02	1.81E-02	-2.09E-03
13.170	1.50E-02	1.71E-02	-2.07E-03
13.340	1.40E-02	1.61E-02	-2.10E-03
13.500	1.30E-02	1.52E-02	-2.18E-03
13.670	1.20E-02	1.43E-02	-2.30E-03
13.840	1.20E-02	1.35E-02	-2.47E-03
14.000	1.00E-02	1.27E-02	-2.67E-03

May 2006
F3_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9556E-06
DISPERSIVITY= 9.2723E-02
WIDTH= 0.5000E-02
RF= 1.000
C0= 0.2723
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3392E-03

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
THE CRITICAL RSS IS: 0.3730E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.56E-07	9.46E-07	9.65E-07
X(2)	2.72E-03	2.62E-03	2.83E-03
X(5)	2.72E-01	2.70E-01	2.75E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.33E-01	9.91E-04	6.07E-07	9.91E-04
0.3	1.98E-03	1.27E-12	1.98E-03
4.67E-01	1.97E-03	1.81E-08	1.97E-03
0.6333	1.96E-03	1.74E-06	1.96E-03
8.00E-01	2.94E-03	2.53E-05	2.92E-03
0.9667	2.93E-03	1.47E-04	2.79E-03
1.133	3.92E-03	5.14E-04	3.41E-03
1.3	3.91E-03	1.31E-03	2.60E-03
1.467	4.90E-03	2.69E-03	2.21E-03
1.633	6.89E-03	4.78E-03	2.11E-03
1.8	8.87E-03	7.63E-03	1.24E-03
1.967	1.29E-02	1.13E-02	1.60E-03
2.133	1.69E-02	1.56E-02	1.23E-03
2.3	2.28E-02	2.06E-02	2.21E-03
2.467	2.78E-02	2.61E-02	1.73E-03
2.633	3.38E-02	3.18E-02	3.05E-03
2.8	3.88E-02	3.74E-02	1.42E-03
2.967	4.38E-02	4.27E-02	1.09E-03
3.133	4.78E-02	4.75E-02	2.65E-04
3.3	5.18E-02	5.18E-02	1.67E-05
3.467	5.48E-02	5.53E-02	-5.55E-04
3.633	5.68E-02	5.68E-02	-1.45E-03
3.8	5.87E-02	6.04E-02	-1.68E-03
3.967	5.97E-02	6.20E-02	-2.29E-03
4.133	6.07E-02	6.31E-02	-2.43E-03
4.3	6.17E-02	6.36E-02	-1.87E-03
4.467	6.17E-02	6.37E-02	-1.96E-03
4.633	6.17E-02	6.17E-02	-8.00E-04
4.8	6.07E-02	6.27E-02	-2.04E-03
4.967	6.07E-02	6.18E-02	-1.14E-03
5.133	5.98E-02	6.07E-02	-9.20E-04
5.3	5.88E-02	5.93E-02	-6.95E-04
5.467	5.78E-02	5.79E-02	-2.28E-04
5.633	5.68E-02	5.68E-02	-6.00E-05
5.8	5.48E-02	5.46E-02	2.05E-05
5.967	5.38E-02	5.28E-02	7.53E-04
6.133	5.18E-02	5.11E-02	5.90E-04
6.3	5.08E-02	4.92E-02	1.32E-03
6.467	4.88E-02	4.74E-02	1.13E-03
6.633	4.78E-02	4.56E-02	1.92E-03
6.8	4.55E-02	4.38E-02	1.71E-03
6.967	4.35E-02	4.20E-02	1.47E-03
7.133	4.25E-02	4.03E-02	2.20E-03
7.3	4.05E-02	3.86E-02	1.89E-03
7.467	3.95E-02	3.69E-02	2.54E-03
7.633	3.75E-02	3.53E-02	2.14E-03
7.8	3.55E-02	3.38E-02	1.70E-03
7.967	3.44E-02	3.22E-02	2.21E-03
8.133	3.24E-02	3.08E-02	1.67E-03
8.3	3.14E-02	2.94E-02	2.07E-03
8.467	2.94E-02	2.80E-02	1.43E-03
8.633	2.84E-02	2.67E-02	1.73E-03
8.8	2.74E-02	2.54E-02	1.98E-03
8.967	2.64E-02	2.42E-02	2.18E-03
9.133	2.44E-02	2.30E-02	1.33E-03
9.3	2.34E-02	2.19E-02	1.43E-03
9.467	2.23E-02	2.09E-02	1.48E-03
9.633	2.03E-02	1.98E-02	4.86E-04
9.8	1.93E-02	1.89E-02	4.48E-04
9.967	1.83E-02	1.79E-02	3.66E-04
10.13	1.73E-02	1.71E-02	2.39E-04
10.3	1.63E-02	1.62E-02	7.67E-05
10.47	1.43E-02	1.54E-02	-1.13E-03
10.63	1.43E-02	1.46E-02	-3.72E-04
10.8	1.33E-02	1.39E-02	-6.48E-04
11.13	1.12E-02	1.25E-02	-1.31E-03
11.3	1.02E-02	1.19E-02	-1.69E-03
11.47	9.20E-03	1.13E-02	-2.10E-03
11.63	9.19E-03	1.07E-02	-1.54E-03
11.8	8.18E-03	1.02E-02	-2.00E-03
11.97	7.16E-03	9.66E-03	-2.50E-03
12.13	7.15E-03	9.17E-03	-2.02E-03
12.3	6.14E-03	8.70E-03	-2.56E-03
12.47	6.13E-03	8.25E-03	-2.13E-03
12.63	5.12E-03	7.83E-03	-2.72E-03
12.8	4.11E-03	7.43E-03	-3.33E-03
12.97	4.09E-03	7.09E-03	-2.95E-03
13.13	3.08E-03	6.69E-03	-3.61E-03
13.3	3.07E-03	6.34E-03	-3.27E-03
13.47	2.06E-03	6.02E-03	-3.96E-03
13.67	2.04E-03	5.65E-03	-3.60E-03
13.83	2.03E-03	5.36E-03	-3.32E-03
14	1.02E-03	5.08E-03	-4.06E-03
14.17	1.01E-03	4.82E-03	-3.81E-03

F3_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9516E-06
DISPERSIVITY= 0.2562E-02
WIDTH= 0.5000E-02
RF= 1.000
C0= 0.3637
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2523E-03

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.2741E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.52E-07	9.52E-07	9.52E-07
X(2)	2.56E-03	2.51E-03	2.61E-03
X(5)	3.64E-01	3.60E-01	3.67E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-02	1.00E-03	6.11E-08	1.00E-03
1.333	1.00E-03	3.75E-07	1.00E-03
1.467	1.00E-03	1.65E-06	9.98E-04
1.600	2.00E-03	5.67E-06	1.99E-03
1.733	2.00E-03	1.61E-05	1.98E-03
1.867	3.00E-03	3.93E-05	2.96E-03
2.000	3.00E-03	8.52E-05	2.92E-03
2.133	4.00E-03	1.67E-04	3.83E-03
2.267	4.00E-03	3.03E-04	3.70E-03
2.400	5.00E-03	5.13E-04	4.49E-03
2.533	6.00E-03	8.21E-04	5.18E-03
2.667	6.00E-03	1.25E-03	4.75E-03
2.800	7.00E-03	1.83E-03	5.17E-03
2.933	7.00E-03	2.58E-03	4.42E-03
3.067	8.00E-03	3.53E-03	4.47E-03
3.200	8.00E-03	4.69E-03	3.17E-03
3.333	9.00E-03	6.07E-03	2.93E-03
3.467	1.00E-02	7.69E-03	2.31E-03
3.600	1.10E-02	9.54E-03	1.46E-03
3.733	1.30E-02	1.16E-02	1.39E-03
3.867	1.40E-02	1.39E-02	1.19E-04
4.000	1.60E-02	1.63E-02	-1.63E-04
4.133	1.80E-02	1.90E-02	-9.55E-04
4.267	2.10E-02	2.17E-02	-7.00E-04
4.400	2.40E-02	2.45E-02	-1.54E-03
4.533	2.60E-02	2.74E-02	-1.44E-03
4.667	2.90E-02	3.04E-02	-1.38E-03
4.800	3.20E-02	3.33E-02	-1.17E-03
4.933	3.50E-02	3.62E-02	-1.20E-03
5.067	3.80E-02	3.90E-02	-1.04E-03
5.200	4.10E-02	4.19E-02	-6.19E-04
5.333	4.40E-02	4.44E-02	-4.33E-04
5.467	4.70E-02	4.70E-02	4.67E-05
5.600	5.00E-02	4.93E-02	6.79E-04
5.733	5.20E-02	5.16E-02	4.48E-04
5.867	5.40E-02	5.36E-02	3.88E-04
6.000	5.60E-02	5.55E-02	3.01E-04
6.133	5.80E-02	5.72E-02	7.90E-04
6.267	5.90E-02	5.87E-02	2.56E-04
6.400	6.00E-02	6.01E-02	-9.98E-05
6.533	6.10E-02	6.13E-02	-2.76E-04
6.667	6.20E-02	6.23E-02	-2.80E-04
6.800	6.30E-02	6.35E-02	-1.12E-04
6.933	6.40E-02	6.38E-02	2.21E-04
7.067	6.40E-02	6.43E-02	-2.86E-04
7.200	6.40E-02	6.46E-02	-6.43E-04
7.333	6.50E-02	6.49E-02	1.46E-04
7.467	6.50E-02	6.47E-02	7.37E-05
7.600	6.50E-02	6.49E-02	1.31E-04
7.733	6.40E-02	6.47E-02	-6.91E-04
7.867	6.40E-02	6.44E-02	-3.98E-04
8.000	6.40E-02	6.40E-02	-1.93E-07
8.133	6.30E-02	6.35E-02	-5.05E-04
8.267	6.30E-02	6.29E-02	6.03E-05
8.400	6.20E-02	6.23E-02	-2.53E-04
8.533	6.10E-02	6.15E-02	-5.12E-04
8.667	6.10E-02	6.07E-02	2.98E-04
8.800	6.00E-02	5.98E-02	1.67E-04
8.933	5.90E-02	5.89E-02	9.02E-05
9.067	5.80E-02	5.79E-02	6.18E-05
9.200	5.70E-02	5.69E-02	7.44E-05
9.333	5.60E-02	5.59E-02	1.23E-04
9.467	5.50E-02	5.48E-02	2.04E-04
9.600	5.40E-02	5.37E-02	3.09E-04
9.733	5.30E-02	5.26E-02	4.36E-04
9.867	5.20E-02	5.14E-02	5.81E-04
10.000	5.10E-02	5.03E-02	7.38E-04
10.133	5.00E-02	4.91E-02	9.01E-04
10.270	4.90E-02	4.79E-02	1.08E-03
10.400	4.70E-02	4.68E-02	2.51E-04
10.533	4.60E-02	4.56E-02	4.23E-04
10.670	4.50E-02	4.44E-02	6.00E-04
10.800	4.40E-02	4.32E-02	7.64E-04
10.933	4.30E-02	4.21E-02	9.19E-04
11.070	4.10E-02	4.09E-02	7.42E-05
11.200	4.00E-02	3.98E-02	2.09E-04
11.333	3.90E-02	3.87E-02	3.31E-04
11.470	3.80E-02	3.76E-02	4.94E-04
11.600	3.70E-02	3.65E-02	5.38E-04
11.733	3.60E-02	3.54E-02	6.13E-04
11.870	3.50E-02	3.46E-02	7.82E-04
12.000	3.30E-02	3.33E-02	-2.83E-04
12.133	3.20E-02	3.23E-02	-2.64E-04
12.270	3.10E-02	3.13E-02	-2.16E-04
12.400	3.00E-02	3.03E-02	-2.79E-04
12.533	2.90E-02	2.93E-02	-3.21E-04
12.670	2.80E-02	2.87E-02	-4.77E-04
12.800	2.70E-02	2.75E-02	-4.62E-04
12.933	2.60E-02	2.66E-02	-5.69E-04
13.070	2.50E-02	2.57E-02	-6.91E-04
13.200	2.40E-02	2.48E-02	-8.41E-04
13.333	2.30E-02	2.40E-02	-1.01E-03
13.470	2.20E-02	2.32E-02	-1.20E-03
13.63	2.10E-02	2.22E-02	-1.22E-03
13.77	2.10E-02	2.15E-02	-4.60E-04
13.9	2.00E-02	2.07E-02	-7.23E-04
14.03	1.90E-02	2.00E-02	-1.01E-03

May 2006
F4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 82
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1900E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1298E-05
DISPERSIVITY= 0.1992E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1632
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9536E-04

THE F STATISTIC FOR NP= 3 NOBS= 82 IS: 2.73
THE CRITICAL RSS IS: 0.1052E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.30E-06	1.29E-06	1.31E-06
X(2)	2.47E-03	2.37E-03	2.57E-03
X(5)	1.63E-01	1.62E-01	1.65E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.97E-01	9.56E-04	6.29E-04	3.26E-04
1.03	2.90E-03	1.49E-03	1.40E-03
1.16E+00	4.83E-03	2.90E-03	1.93E-03
1.297	6.77E-03	4.92E-03	1.86E-03
1.43E+00	9.71E-03	7.55E-03	2.16E-03
1.563	1.37E-02	1.08E-02	2.90E-03
1.697	1.66E-02	1.45E-02	2.14E-03
1.83	2.05E-02	1.85E-02	2.06E-03
1.963	2.35E-02	2.26E-02	8.97E-04
2.097	2.64E-02	2.65E-02	-1.20E-04
2.23	2.93E-02	3.01E-02	-7.90E-04
2.363	3.23E-02	3.33E-02	-9.84E-04
2.497	3.42E-02	3.59E-02	-1.63E-03
2.63	3.62E-02	3.79E-02	-1.72E-03
2.763	3.71E-02	3.94E-02	-2.26E-03
2.897	3.80E-02	4.03E-02	-2.29E-03
3.03	3.90E-02	4.08E-02	-1.87E-03
3.163	3.99E-02	4.10E-02	-1.05E-03
3.297	3.99E-02	4.07E-02	-8.89E-04
3.43	4.08E-02	4.02E-02	-4.47E-04
3.563	3.97E-02	3.95E-02	2.26E-04
3.697	3.97E-02	3.86E-02	1.09E-03
3.83	3.86E-02	3.75E-02	1.10E-03
3.963	3.76E-02	3.63E-02	1.21E-03
4.097	3.65E-02	3.51E-02	1.42E-03
4.23	3.54E-02	3.38E-02	1.67E-03
4.363	3.44E-02	3.24E-02	1.96E-03
4.497	3.23E-02	3.10E-02	1.27E-03
4.63	3.12E-02	2.97E-02	1.58E-03
4.763	3.02E-02	2.82E-02	1.60E-03
4.897	2.81E-02	2.70E-02	1.16E-03
5.03	2.71E-02	2.57E-02	1.41E-03
5.163	2.50E-02	2.44E-02	6.34E-04
5.297	2.39E-02	2.31E-02	8.17E-04
5.43	2.19E-02	2.19E-02	-4.11E-05
5.563	2.08E-02	2.08E-02	5.72E-05
5.697	1.98E-02	1.96E-02	1.11E-04
5.83	1.77E-02	1.86E-02	-8.81E-04
5.963	1.66E-02	1.76E-02	-9.21E-04
6.097	1.56E-02	1.66E-02	-1.01E-03
6.23	1.45E-02	1.56E-02	-1.14E-03
6.363	1.35E-02	1.48E-02	-1.31E-03
6.497	1.34E-02	1.39E-02	-5.28E-04
6.63	1.23E-02	1.31E-02	-7.89E-04
6.763	1.13E-02	1.24E-02	-1.09E-03
6.897	1.12E-02	1.16E-02	-4.33E-04
7.03	1.01E-02	1.10E-02	-8.13E-04
7.163	1.01E-02	1.03E-02	-2.30E-04
7.297	9.02E-03	9.70E-03	-6.82E-04
7.43	8.96E-03	9.13E-03	-1.68E-04
7.563	7.90E-03	8.58E-03	-6.86E-04
7.697	7.84E-03	8.07E-03	-2.34E-04
7.83	6.78E-03	7.59E-03	-8.12E-04
7.963	6.71E-03	7.13E-03	-4.17E-04
8.097	6.65E-03	6.70E-03	-4.87E-05
8.23	6.59E-03	6.30E-03	2.95E-04
8.363	5.53E-03	5.92E-03	-3.85E-04
8.497	5.47E-03	5.56E-03	-8.76E-05
8.63	5.41E-03	5.22E-03	1.89E-04
8.763	5.35E-03	4.90E-03	4.45E-04
8.897	4.29E-03	4.60E-03	-3.17E-04
9.03	4.23E-03	4.32E-03	-9.71E-05
9.163	4.16E-03	4.06E-03	1.05E-04
9.297	4.10E-03	3.81E-03	2.93E-04
9.43	3.04E-03	3.58E-03	-5.35E-04
9.563	2.98E-03	3.36E-03	-3.76E-04
9.697	2.92E-03	3.15E-03	-2.31E-04
9.83	2.86E-03	2.96E-03	-9.88E-05
9.963	2.80E-03	2.78E-03	2.19E-05
10.1	2.74E-03	2.60E-03	1.32E-04
10.23	1.67E-03	2.44E-03	-7.69E-04
10.36	1.61E-03	2.29E-03	-6.80E-04
10.5	1.56E-03	2.15E-03	-5.99E-04
10.63	1.49E-03	2.02E-03	-5.28E-04
10.76	1.43E-03	1.89E-03	-4.65E-04
10.9	1.37E-03	1.78E-03	-4.08E-04
11.03	1.31E-03	1.67E-03	-3.60E-04
11.16	1.25E-03	1.56E-03	-3.18E-04
11.3	1.19E-03	1.47E-03	-2.82E-04
11.43	1.12E-03	1.38E-03	-2.53E-04
11.56	1.06E-03	1.29E-03	-2.29E-04
11.7	1.53E-06	1.21E-03	-1.21E-03

F4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : -0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1191E-05
DISPERSIVITY= 0.1992E-02
WIDTH= 0.5000E-02
RF= 1.000
CO= 0.1743
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3701E-03

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
THE CRITICAL RSS IS: 0.4048E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.19E-06	1.18E-06	1.20E-06
X(2)	1.98E-03	1.84E-03	2.14E-03
X(5)	1.74E-01	1.69E-01	1.80E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.333	1.00E-03	1.44E-07	1.00E-03
1.467	1.00E-03	7.28E-07	9.99E-04
1.600	2.00E-03	2.79E-06	2.00E-03
1.733	2.00E-03	8.64E-06	1.99E-03
1.867	3.00E-03	2.27E-05	2.98E-03
2.000	3.00E-03	5.23E-05	2.95E-03
2.133	7.00E-03	1.08E-04	3.89E-03
2.267	4.00E-03	2.04E-04	3.80E-03
2.400	5.00E-03	3.58E-04	4.64E-03
2.533	5.00E-03	5.90E-04	4.41E-03
2.667	6.00E-03	9.22E-04	5.08E-03
2.800	6.00E-03	1.37E-03	4.63E-03
2.933	7.00E-03	1.97E-03	5.03E-03
3.067	7.00E-03	2.72E-03	4.28E-03
3.200	8.00E-03	3.63E-03	4.37E-03
3.333	8.00E-03	4.72E-03	3.28E-03
3.467	9.00E-03	5.97E-03	3.03E-03
3.600	1.00E-02	7.38E-03	2.62E-03
3.733	1.10E-02	8.93E-03	2.07E-03
3.867	1.06E-02	1.06E-02	1.40E-03
4.000	1.30E-02	1.24E-02	6.42E-04
4.133	1.40E-02	1.42E-02	-1.83E-04
4.267	1.70E-02	1.54E-02	-1.04E-03
4.400	1.70E-02	1.79E-02	-9.06E-04
4.533	1.80E-02	1.98E-02	-1.75E-03
4.667	1.90E-02	2.15E-02	-2.54E-03
4.800	2.10E-02	2.33E-02	-2.25E-03
4.933	2.30E-02	2.49E-02	-1.88E-03
5.067	2.40E-02	2.64E-02	-2.39E-03
5.200	2.80E-02	2.79E-02	-2.78E-03
5.333	2.70E-02	2.90E-02	-2.03E-03
5.467	2.80E-02	3.01E-02	-2.14E-03
5.600	3.00E-02	3.11E-02	-1.10E-03
5.733	3.10E-02	3.19E-02	-9.06E-04
5.867	3.20E-02	3.26E-02	-5.69E-04
6.000	5.72E-02	3.80E-02	1.58E-05
6.133	3.40E-02	3.35E-02	5.40E-04
6.267	3.40E-02	3.37E-02	3.01E-04
6.400	3.50E-02	3.38E-02	1.19E-03
6.533	3.50E-02	3.38E-02	1.30E-03
6.667	3.50E-02	3.37E-02	1.33E-03
6.800	3.50E-02	3.34E-02	1.56E-03
6.933	3.50E-02	3.31E-02	1.89E-03
7.067	3.40E-02	3.27E-02	1.30E-03
7.200	3.40E-02	3.22E-02	1.79E-03
7.333	3.30E-02	3.16E-02	1.36E-03
7.467	3.30E-02	3.10E-02	1.98E-03
7.600	3.20E-02	3.04E-02	1.65E-03
7.733	3.10E-02	2.96E-02	1.37E-03
7.867	3.00E-02	2.89E-02	1.13E-03
8.000	2.90E-02	2.81E-02	9.22E-04
8.133	2.80E-02	2.73E-02	7.36E-04
8.267	2.70E-02	2.64E-02	5.69E-04
8.400	2.60E-02	2.56E-02	4.15E-04
8.533	2.50E-02	2.47E-02	2.70E-04
8.667	2.40E-02	2.39E-02	1.29E-04
8.800	2.30E-02	2.30E-02	-1.28E-05
8.933	2.10E-02	2.22E-02	-1.16E-03
9.067	2.00E-02	2.13E-02	-1.31E-03
9.200	2.00E-02	2.05E-02	-4.72E-04
9.333	1.90E-02	1.97E-02	-6.46E-04
9.467	1.80E-02	1.88E-02	-8.34E-04
9.600	1.70E-02	1.80E-02	-1.04E-03
9.733	1.60E-02	1.73E-02	-1.26E-03
9.867	1.50E-02	1.65E-02	-1.50E-03
10.000	1.40E-02	1.58E-02	-1.77E-03
10.133	1.40E-02	1.51E-02	-1.05E-03
10.270	1.30E-02	1.44E-02	-1.35E-03
10.400	1.20E-02	1.37E-02	-1.68E-03
10.530	1.20E-02	1.30E-02	-1.03E-03
10.670	1.10E-02	1.24E-02	-1.40E-03
10.800	1.10E-02	1.18E-02	-7.98E-04
10.930	1.00E-02	1.12E-02	-1.29E-03
11.070	1.00E-02	1.07E-02	-6.54E-04
11.200	1.00E-02	1.01E-02	-1.18E-04
11.330	9.00E-03	9.60E-03	-6.04E-04
11.470	9.00E-03	9.11E-03	-1.08E-04
11.600	9.00E-03	8.64E-03	3.64E-04
11.730	8.00E-03	8.00E-03	-1.85E-04
11.870	8.00E-03	7.75E-03	2.49E-04
12.000	8.00E-03	7.34E-03	6.61E-04
12.130	8.00E-03	6.95E-03	1.05E-03
12.270	7.00E-03	6.57E-03	4.30E-04
12.400	7.00E-03	6.21E-03	7.86E-04
12.530	7.00E-03	5.87E-03	1.13E-03
12.670	7.00E-03	5.55E-03	1.48E-03
12.800	7.00E-03	5.24E-03	1.76E-03
12.930	7.00E-03	4.95E-03	2.05E-03
13.070	6.00E-03	4.67E-03	1.33E-03
13.170	8.29E-07	4.47E-03	-4.47E-03

October 2006
B1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 92
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.8000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1282E-05
 DISPERSIVITY= 0.185E-02
 WIDTH= 0.8000E-03
 RF= 1.000
 CO= 2.762
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.8714E-03

THE F STATISTIC FOR NP= 3 NOBS= 92 IS: 2.72
 THE CRITICAL RSS IS: 0.9512E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.28E-06	1.27E-06	1.30E-06
X(2)	3.19E-03	3.06E-03	3.31E-03
X(5)	2.76E+00	2.74E+00	2.79E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.7333	4.68E-03	7.25E-04	3.95E-03
8.67E-01	9.50E-03	2.66E-03	6.83E-03
1	1.65E-02	1.53E-02	1.20E-03
1.13E+00	2.11E-02	1.26E-02	8.53E-03
1.267	2.89E-02	2.04E-02	8.57E-03
1.4	3.29E-02	2.93E-02	6.43E-03
1.533	4.36E-02	3.86E-02	4.94E-03
1.667	5.04E-02	4.79E-02	2.47E-03
1.8	5.72E-02	5.67E-02	5.34E-04
1.933	6.40E-02	6.46E-02	-6.03E-04
2.067	6.88E-02	7.18E-02	-2.77E-03
2.2	7.37E-02	7.75E-02	-3.89E-03
2.333	7.85E-02	8.24E-02	-3.95E-03
2.467	8.13E-02	8.63E-02	-5.00E-03
2.6	8.51E-02	8.92E-02	-4.11E-03
2.733	8.69E-02	9.13E-02	-4.35E-03
2.867	8.96E-02	9.27E-02	-2.47E-03
3	8.96E-02	9.32E-02	-3.60E-03
3.133	9.04E-02	9.32E-02	-2.79E-03
3.267	9.27E-02	9.27E-02	-2.47E-03
3.4	9.00E-02	9.17E-02	-1.71E-03
3.533	8.98E-02	9.04E-02	-5.91E-04
3.667	8.86E-02	8.86E-02	-1.68E-04
3.8	8.75E-02	8.70E-02	5.01E-04
3.933	8.63E-02	8.49E-02	1.37E-03
4.067	8.41E-02	8.11E-02	3.00E-03
4.2	8.29E-02	8.04E-02	2.53E-03
4.333	8.07E-02	7.80E-02	2.76E-03
4.467	7.85E-02	7.55E-02	3.04E-03
4.6	7.64E-02	7.30E-02	3.36E-03
4.733	7.42E-02	7.05E-02	3.70E-03
4.867	7.20E-02	6.79E-02	4.03E-03
5	6.88E-02	6.54E-02	3.35E-03
5.133	6.66E-02	6.30E-02	3.64E-03
5.267	6.44E-02	6.05E-02	3.93E-03
5.4	6.12E-02	5.81E-02	3.10E-03
5.533	5.91E-02	5.58E-02	3.26E-03
5.667	5.69E-02	5.30E-02	3.39E-03
5.8	5.37E-02	5.13E-02	2.39E-03
5.933	5.15E-02	4.91E-02	2.37E-03
6.067	4.93E-02	4.71E-02	2.22E-03
6.2	4.71E-02	4.60E-02	1.12E-03
6.333	4.50E-02	4.31E-02	1.89E-03
6.467	4.28E-02	4.12E-02	1.60E-03
6.6	4.06E-02	3.94E-02	1.23E-03
6.733	3.84E-02	3.76E-02	8.01E-04
6.867	3.62E-02	3.59E-02	3.04E-04
7	3.40E-02	3.43E-02	-2.59E-04
7.133	3.19E-02	3.27E-02	-8.57E-04
7.267	3.07E-02	3.13E-02	-5.76E-04
7.4	2.95E-02	2.98E-02	-3.27E-04
7.533	2.73E-02	2.84E-02	-1.14E-03
7.667	2.61E-02	2.71E-02	-1.01E-03
7.8	2.49E-02	2.59E-02	-9.32E-04
7.933	2.38E-02	2.47E-02	-9.11E-04
8.067	2.16E-02	2.26E-02	-1.94E-03
8.2	2.04E-02	2.24E-02	-2.02E-03
8.333	1.92E-02	2.14E-02	-2.15E-03
8.467	1.90E-02	2.04E-02	-1.33E-03
8.6	1.78E-02	1.94E-02	-1.56E-03
8.733	1.67E-02	1.85E-02	-1.62E-03
8.867	1.55E-02	1.76E-02	-2.13E-03
9	1.53E-02	1.68E-02	-1.48E-03
9.133	1.41E-02	1.60E-02	-1.88E-03
9.267	1.29E-02	1.52E-02	-2.29E-03
9.4	1.27E-02	1.45E-02	-1.74E-03
9.533	1.16E-02	1.38E-02	-2.24E-03
9.667	1.14E-02	1.31E-02	-1.76E-03
9.8	1.02E-02	1.25E-02	-2.31E-03
9.933	9.99E-03	1.19E-02	-1.90E-03
10.07	9.81E-03	1.13E-02	-1.51E-03
10.2	8.63E-03	1.08E-02	-2.15E-03
10.33	8.44E-03	1.03E-02	-1.82E-03
10.47	8.26E-03	9.76E-03	-1.50E-03
10.6	7.08E-03	9.29E-03	-2.22E-03
10.73	6.89E-03	8.85E-03	-1.95E-03
10.87	6.71E-03	8.42E-03	-1.71E-03
11	5.52E-03	8.01E-03	-2.49E-03
11.13	5.34E-03	7.58E-03	-2.24E-03
11.27	5.16E-03	7.25E-03	-2.10E-03
11.4	3.97E-03	6.90E-03	-2.93E-03
11.53	3.79E-03	6.57E-03	-2.78E-03
11.67	3.60E-03	6.25E-03	-2.65E-03
11.8	3.42E-03	5.95E-03	-2.53E-03
11.93	3.24E-03	5.66E-03	-2.43E-03
12.07	2.05E-03	5.39E-03	-3.33E-03
12.2	1.87E-03	5.13E-03	-3.26E-03
12.33	1.69E-03	4.88E-03	-3.19E-03
12.47	1.50E-03	4.64E-03	-3.14E-03
12.6	1.32E-03	4.42E-03	-3.10E-03
12.73	1.13E-03	4.20E-03	-3.07E-03

B1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.8000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1190E-05
 DISPERSIVITY= 0.1839E-02
 WIDTH= 0.8000E-03
 RF= 1.000
 CO= 2.54
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5708E-03

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
 THE CRITICAL RSS IS: 0.6196E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.19E-06	1.19E-06	1.19E-06
X(2)	1.84E-03	1.78E-03	1.90E-03
X(5)	2.54E+00	2.52E+00	2.57E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.433	6.26E-04	9.76E-07	6.24E-04
1.567	5.91E-04	4.77E-06	5.87E-04
1.700	1.36E-03	1.77E-05	1.34E-03
1.833	1.21E-03	5.33E-05	1.20E-03
1.967	2.89E-03	1.36E-04	2.76E-03
2.100	3.66E-03	3.02E-04	3.36E-03
2.233	3.42E-03	6.00E-04	2.82E-03
2.367	5.19E-03	1.09E-03	4.10E-03
2.500	5.96E-03	1.83E-03	4.13E-03
2.633	6.72E-03	2.89E-03	3.84E-03
2.767	8.49E-03	4.31E-03	4.19E-03
2.900	1.03E-02	6.13E-03	4.13E-03
3.033	1.20E-02	8.37E-03	3.65E-03
3.167	1.48E-02	1.11E-02	3.74E-03
3.300	1.76E-02	1.41E-02	3.42E-03
3.433	2.13E-02	1.76E-02	-3.72E-03
3.567	2.41E-02	2.14E-02	2.69E-03
3.700	2.79E-02	2.55E-02	2.38E-03
3.833	3.16E-02	2.98E-02	1.87E-03
3.967	3.54E-02	3.42E-02	1.22E-03
4.100	4.02E-02	3.87E-02	1.51E-03
4.233	4.39E-02	4.31E-02	7.97E-04
4.367	4.77E-02	4.75E-02	1.57E-04
4.500	5.15E-02	5.15E-02	-3.47E-04
4.633	5.52E-02	5.59E-02	-6.62E-04
4.767	5.80E-02	5.97E-02	-1.75E-03
4.900	6.18E-02	6.31E-02	-1.55E-03
5.033	6.45E-02	6.66E-02	-2.05E-03
5.167	6.73E-02	6.95E-02	-2.23E-03
5.300	7.01E-02	7.24E-02	-2.06E-03
5.433	7.18E-02	7.44E-02	-2.53E-03
5.567	7.36E-02	7.62E-02	-2.64E-03
5.700	7.50E-02	7.74E-02	-2.48E-03
5.833	7.71E-02	7.89E-02	-1.80E-03
5.967	7.79E-02	7.98E-02	-1.87E-03
6.100	7.87E-02	8.07E-02	-1.61E-03
6.233	7.84E-02	8.05E-02	-2.04E-03
6.367	7.92E-02	8.04E-02	-1.18E-03
6.500	7.90E-02	8.00E-02	-1.07E-03
6.633	7.87E-02	7.94E-02	-6.68E-04
6.767	7.85E-02	7.85E-02	-5.70E-05
6.900	7.73E-02	7.75E-02	-2.40E-04
7.033	7.60E-02	7.63E-02	-2.37E-04
7.167	7.58E-02	7.49E-02	9.32E-04
7.300	7.46E-02	7.33E-02	1.24E-03
7.433	7.33E-02	7.16E-02	1.68E-03
7.567	7.11E-02	6.99E-02	1.23E-03
7.700	6.99E-02	6.89E-02	9.96E-04
7.833	6.76E-02	6.61E-02	1.56E-03
7.967	6.64E-02	6.41E-02	2.33E-03
8.100	6.42E-02	6.19E-02	2.47E-03
8.233	6.29E-02	6.00E-02	2.96E-03
8.367	6.07E-02	5.79E-02	2.81E-03
8.500	5.85E-02	5.58E-02	2.67E-03
8.633	5.62E-02	5.37E-02	2.52E-03
8.767	5.40E-02	5.16E-02	2.36E-03
8.900	5.18E-02	4.96E-02	2.19E-03
9.033	4.95E-02	4.75E-02	1.98E-03
9.167	4.83E-02	4.55E-02	2.74E-03
9.300	4.61E-02	4.36E-02	2.47E-03
9.433	4.38E-02	4.17E-02	2.15E-03
9.567	4.16E-02	3.96E-02	1.79E-03
9.700	3.94E-02	3.80E-02	1.37E-03
9.833	3.71E-02	3.62E-02	9.09E-04
9.967	3.59E-02	3.45E-02	1.39E-03
10.100	3.37E-02	3.28E-02	8.19E-04
10.233	3.14E-02	3.12E-02	1.87E-04
10.370	3.02E-02	2.97E-02	5.09E-04
10.500	2.80E-02	2.82E-02	-2.36E-04
10.630	2.67E-02	2.68E-02	-3.84E-05
10.770	2.45E-02	2.54E-02	-8.86E-04
10.900	2.33E-02	2.41E-02	-8.01E-04
11.030	2.20E-02	2.28E-02	-7.70E-04
11.170	2.08E-02	2.16E-02	-7.85E-04
11.300	1.96E-02	2.04E-02	-8.61E-04
11.430	1.73E-02	1.93E-02	-1.99E-03
11.570	1.61E-02	1.81E-02	-2.09E-03
11.700	1.49E-02	1.72E-02	-2.39E-03
11.830	1.46E-02	1.63E-02	-1.67E-03
11.970	1.34E-02	1.54E-02	-2.08E-03
12.100	1.22E-02	1.45E-02	-2.35E-03
12.230	1.09E-02	1.37E-02	-2.76E-03
12.370	1.07E-02	1.27E-02	-2.20E-03
12.500	1.22E-02	1.21E-02	-2.56E-03
12.630	1.09E-02	1.14E-02	-3.23E-03
12.770	1.08E-02	1.06E-02	-2.79E-03
12.900	6.74E-03	1.01E-02	-3.39E-03
13.030	6.51E-03	9.54E-03	-3.03E-03
13.170	6.28E-03	8.77E-03	-2.49E-03
13.300	5.04E-03	8.43E-03	-3.39E-03
13.430	4.81E-03	7.93E-03	-3.12E-03
13.570	3.57E-03	7.58E-03	-3.68E-03
13.700			

October 2006
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SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1239E-05
 DISPERSIVITY= 0.2399E-02
 WIDTH= 0.5000E-02
 RF= 1.00
 CO= 0.5025
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2023E-03

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
 THE CRITICAL RSS IS: 0.2206E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.24E-06	1.24E-06	1.24E-06
X(3)	2.35E-03	2.44E-03	2.44E-03
X(6)	5.03E-01	5.03E-01	5.03E-01
TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.167	1.00E-03	1.28E-03	-2.78E-04
1.30E+00	6.00E-03	5.74E-03	2.57E-04
1.433	1.00E-02	9.86E-03	1.44E-04
1.57E+00	1.54E-02	1.59E-02	-2.03E-03
1.7	2.40E-02	2.24E-02	1.57E-03
1.833	3.40E-02	3.08E-02	3.18E-03
1.967	4.30E-02	4.04E-02	2.63E-03
2.1	5.40E-02	5.07E-02	3.32E-03
2.233	6.40E-02	6.13E-02	2.69E-03
2.367	7.40E-02	7.18E-02	2.23E-03
2.5	8.20E-02	8.16E-02	3.57E-04
2.633	9.10E-02	9.06E-02	3.83E-04
2.767	9.70E-02	9.70E-02	-1.49E-03
2.9	1.03E-01	1.05E-01	-2.12E-03
3.033	1.08E-01	1.11E-01	-2.49E-03
3.167	1.12E-01	1.16E-01	-2.82E-03
3.3	1.15E-01	1.18E-01	-2.57E-03
3.433	1.17E-01	1.19E-01	-2.43E-03
3.567	1.18E-01	1.20E-01	-2.31E-03
3.7	1.18E-01	1.20E-01	-2.32E-03
3.833	1.18E-01	1.20E-01	-1.37E-03
3.967	1.17E-01	1.18E-01	-1.17E-03
4.1	1.16E-01	1.16E-01	-2.26E-04
4.233	1.14E-01	1.14E-01	1.77E-04
4.367	1.11E-01	1.11E-01	-4.93E-05
4.5	1.09E-01	1.08E-01	1.02E-03
4.633	1.06E-01	1.05E-01	1.31E-03
4.767	1.03E-01	1.01E-01	1.78E-03
4.9	9.90E-02	9.76E-02	1.36E-03
5.033	9.60E-02	9.60E-02	2.01E-03
5.167	9.20E-02	9.03E-02	1.71E-03
5.3	8.90E-02	8.66E-02	2.41E-03
5.433	8.50E-02	8.50E-02	0.00E-03
5.567	8.10E-02	7.93E-02	1.72E-03
5.7	7.80E-02	7.57E-02	2.29E-03
5.833	7.40E-02	7.40E-02	1.73E-03
5.967	7.00E-02	6.88E-02	1.20E-03
6.1	6.70E-02	6.55E-02	1.51E-03
6.233	6.40E-02	6.40E-02	0.00E-03
6.367	6.00E-02	5.92E-02	8.18E-04
6.5	5.70E-02	5.62E-02	8.06E-04
6.633	5.40E-02	5.40E-02	0.00E-04
6.767	5.10E-02	5.06E-02	4.42E-04
6.9	4.80E-02	4.79E-02	8.73E-05
7.033	4.60E-02	4.54E-02	6.19E-04
7.167	4.30E-02	4.30E-02	4.05E-05
7.3	4.10E-02	4.07E-02	3.50E-04
7.433	3.90E-02	3.86E-02	-4.48E-04
7.567	3.60E-02	3.64E-02	-3.49E-04
7.7	3.40E-02	3.44E-02	-3.53E-04
7.833	3.20E-02	3.25E-02	-4.55E-04
7.967	3.00E-02	3.07E-02	-6.51E-04
8.1	2.80E-02	2.89E-02	-9.40E-04
8.233	2.70E-02	2.73E-02	-3.17E-04
8.367	2.50E-02	2.58E-02	-7.79E-04
8.5	2.30E-02	2.43E-02	-1.32E-03
8.633	2.20E-02	2.29E-02	-9.37E-04
8.767	2.10E-02	2.16E-02	-6.29E-04
8.9	1.90E-02	2.04E-02	-1.39E-03
9.033	1.80E-02	1.92E-02	-1.22E-03
9.167	1.70E-02	1.81E-02	-1.12E-03
9.3	1.60E-02	1.71E-02	-1.07E-03
9.433	1.50E-02	1.61E-02	-1.08E-03
9.567	1.40E-02	1.52E-02	-1.15E-03
9.7	1.30E-02	1.43E-02	-1.27E-03
9.833	1.20E-02	1.34E-02	-1.44E-03
9.967	1.20E-02	1.27E-02	-6.55E-04
10.1	1.10E-02	1.19E-02	-9.15E-04
10.23	1.00E-02	1.12E-02	-1.22E-03
10.37	1.00E-02	1.06E-02	-6.58E-04
10.5	9.00E-03	9.94E-03	-9.40E-04
10.63	8.00E-03	9.36E-03	-1.36E-03
10.77	8.00E-03	8.80E-03	-8.03E-04
10.9	7.00E-03	8.29E-03	-1.29E-03
11.03	7.00E-03	7.80E-03	-7.97E-04
11.17	6.00E-03	7.33E-03	-1.33E-03
11.3	6.00E-03	6.90E-03	-9.01E-04
11.43	6.00E-03	6.49E-03	-4.93E-04
11.57	6.00E-03	6.11E-03	-2.03E-03
11.7	5.00E-03	5.75E-03	-7.45E-04
11.83	4.00E-03	5.40E-03	-1.40E-03
11.97	4.00E-03	5.08E-03	-2.43E-03
12.1	4.00E-03	4.78E-03	-7.80E-04
12.23	3.00E-03	4.50E-03	-1.50E-03
12.37	3.00E-03	4.23E-03	-2.83E-03
12.5	2.00E-03	3.98E-03	-1.98E-03
12.63	2.00E-03	3.74E-03	-1.74E-03
12.77	2.00E-03	3.52E-03	-1.52E-03
12.9	1.00E-03	3.31E-03	-2.31E-03
13.03	1.00E-03	3.11E-03	-2.11E-03
13.17	1.00E-03	2.92E-03	-1.92E-03
13.3	1.00E-03	2.75E-03	-1.75E-03

B2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 99
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.8000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1170E-05
 DISPERSIVITY= 0.1728E-02
 WIDTH= 0.8000E-03
 RF= 1.00
 CO= 3.049
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5656E-03

THE F STATISTIC FOR NP= 3 NOBS= 99 IS: 2.71
 THE CRITICAL RSS IS: 0.6134E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.17E-06	1.17E-06	1.17E-06
X(3)	2.73E-03	1.73E-03	1.78E-03
X(6)	3.05E+00	3.02E+00	3.08E+00
TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.500	9.09E-04	9.68E-07	9.08E-04
1.633	7.88E-04	4.62E-06	7.84E-04
1.767	1.67E-03	1.70E-05	1.65E-03
1.900	2.55E-03	5.12E-05	2.50E-03
2.033	3.43E-03	1.31E-04	3.30E-03
2.167	4.31E-03	2.94E-04	4.01E-03
2.300	5.18E-03	5.90E-04	4.59E-03
2.433	6.06E-03	1.08E-03	4.98E-03
2.567	7.94E-03	1.85E-03	6.10E-03
2.700	8.82E-03	2.95E-03	5.88E-03
2.833	9.70E-03	4.45E-03	5.25E-03
2.967	1.16E-02	6.41E-03	5.17E-03
3.100	1.35E-02	8.87E-03	4.59E-03
3.233	1.63E-02	1.15E-02	4.69E-03
3.367	1.82E-02	1.53E-02	2.91E-03
3.500	2.21E-02	1.93E-02	2.84E-03
3.633	2.60E-02	2.36E-02	2.34E-03
3.767	2.99E-02	2.84E-02	1.46E-03
3.900	3.37E-02	3.35E-02	2.81E-04
4.033	3.66E-02	3.87E-02	-1.20E-04
4.167	4.35E-02	4.42E-02	-6.63E-04
4.300	4.94E-02	4.96E-02	-2.54E-04
4.433	5.43E-02	5.51E-02	-8.15E-04
4.567	5.91E-02	6.04E-02	-1.27E-03
4.700	6.70E-02	6.65E-02	4.97E-04
4.833	6.99E-02	7.05E-02	-5.70E-04
4.967	7.48E-02	7.51E-02	-3.02E-04
5.100	7.87E-02	7.93E-02	-6.85E-04
5.233	8.25E-02	8.32E-02	-6.89E-04
5.367	8.64E-02	8.67E-02	-1.29E-03
5.500	8.83E-02	8.97E-02	-1.48E-03
5.633	9.12E-02	9.24E-02	-1.19E-03
5.767	9.30E-02	9.45E-02	-1.48E-03
5.900	9.49E-02	9.64E-02	-1.46E-03
6.033	9.68E-02	9.78E-02	-7.62E-04
6.167	9.77E-02	9.85E-02	-7.73E-04
6.300	9.70E-02	9.79E-02	-8.94E-04
6.433	9.84E-02	9.91E-02	-6.26E-04
6.567	9.83E-02	9.88E-02	-5.11E-04
6.700	9.72E-02	9.72E-02	0.00E-04
6.833	9.71E-02	9.74E-02	-3.18E-04
6.967	9.60E-02	9.62E-02	-2.93E-04
7.100	9.48E-02	9.48E-02	0.00E-05
7.233	9.27E-02	9.32E-02	-5.20E-04
7.367	9.16E-02	9.14E-02	1.78E-04
7.500	8.95E-02	8.94E-02	5.68E-05
7.633	8.84E-02	8.73E-02	1.07E-03
7.767	8.62E-02	8.50E-02	1.21E-03
7.900	8.31E-02	8.29E-02	1.85E-04
8.033	8.10E-02	8.02E-02	7.85E-04
8.167	7.89E-02	7.77E-02	1.18E-03
8.300	7.67E-02	7.51E-02	1.62E-03
8.433	7.36E-02	7.25E-02	1.09E-03
8.567	7.15E-02	6.99E-02	1.58E-03
8.700	6.94E-02	6.73E-02	2.07E-03
8.833	6.63E-02	6.47E-02	1.56E-03
8.967	6.41E-02	6.21E-02	2.02E-03
9.100	6.10E-02	5.96E-02	1.45E-03
9.233	5.89E-02	5.71E-02	1.85E-03
9.367	5.68E-02	5.46E-02	2.20E-03
9.500	5.37E-02	5.22E-02	1.50E-03
9.633	5.15E-02	4.98E-02	1.74E-03
9.767	4.94E-02	4.75E-02	1.93E-03
9.900	4.73E-02	4.52E-02	2.05E-03
10.030	4.42E-02	4.31E-02	1.10E-03
10.170	4.21E-02	4.10E-02	1.09E-03
10.300	3.99E-02	3.89E-02	9.99E-04
10.430	3.78E-02	3.70E-02	8.37E-04
10.570	3.57E-02	3.51E-02	6.16E-04
10.700	3.36E-02	3.33E-02	3.09E-04
10.830	3.15E-02	3.15E-02	-7.02E-05
10.970	3.03E-02	2.98E-02	4.92E-04
11.100	2.82E-02	2.82E-02	-2.91E-05
11.230	2.61E-02	2.67E-02</	

October 2006
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SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 95
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1648E-05
 DISPERSIVITY= 0.2598E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.5486
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2099E-02

THE F STATISTIC FOR NP= 3 NOBS= 95 IS: 2.71
 THE CRITICAL RSS IS: 0.2285E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.65E-06	1.63E-06	1.67E-06
X(2)	2.60E-03	2.47E-03	2.73E-03
X(5)	5.50E-01	5.39E-01	5.61E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
4.17E-01	1.00E-03	1.00E-03	0.00E-03
0.5167	2.00E-03	1.53E-04	1.85E-03
6.17E-01	4.00E-03	6.84E-04	3.32E-03
0.7167	7.00E-03	2.02E-03	4.98E-03
8.17E-01	1.20E-02	4.57E-03	7.43E-03
0.9167	2.50E-02	8.68E-03	9.33E-03
1.017	2.50E-02	1.45E-02	1.05E-02
1.117	3.40E-02	2.21E-02	1.19E-02
1.217	4.30E-02	1.24E-01	-7.78E-03
1.317	5.30E-02	4.23E-02	1.07E-02
1.417	6.30E-02	5.42E-02	8.78E-03
1.517	7.30E-02	6.67E-02	6.30E-03
1.617	8.20E-02	7.91E-02	2.94E-03
1.717	9.00E-02	9.07E-02	-7.18E-04
1.817	9.80E-02	1.01E-01	-3.23E-03
1.917	1.05E-01	1.10E-01	-9.32E-03
2.017	1.11E-01	1.18E-01	-6.84E-03
2.117	1.18E-01	1.24E-01	-1.15E-02
2.217	1.20E-01	1.28E-01	-8.19E-03
2.317	1.23E-01	1.31E-01	-8.18E-03
2.417	1.26E-01	1.34E-01	-8.18E-03
2.517	1.27E-01	1.34E-01	-6.48E-03
2.617	1.28E-01	1.33E-01	-5.08E-03
2.717	1.28E-01	1.30E-01	-1.93E-03
2.817	1.28E-01	1.30E-01	-1.93E-03
2.917	1.27E-01	1.27E-01	-4.30E-04
3.017	1.25E-01	1.25E-01	0.00E-03
3.117	1.23E-01	1.23E-01	1.86E-03
3.217	1.21E-01	1.18E-01	3.47E-03
3.317	1.18E-01	1.14E-01	4.29E-03
3.417	1.15E-01	1.10E-01	5.25E-03
3.517	1.11E-01	1.06E-01	5.30E-03
3.617	1.08E-01	1.02E-01	6.45E-03
3.717	1.04E-01	9.75E-02	6.51E-03
3.817	1.00E-01	9.34E-02	6.59E-03
3.917	9.60E-02	8.90E-02	6.61E-03
4.017	9.10E-02	8.54E-02	5.59E-03
4.117	8.70E-02	8.15E-02	5.48E-03
4.217	8.30E-02	7.77E-02	5.29E-03
4.317	7.90E-02	7.41E-02	4.94E-03
4.417	7.50E-02	7.05E-02	4.50E-03
4.517	7.10E-02	6.71E-02	3.99E-03
4.617	6.70E-02	6.38E-02	3.25E-03
4.717	6.30E-02	6.06E-02	2.44E-03
4.817	5.90E-02	5.75E-02	1.55E-03
4.917	5.60E-02	5.46E-02	1.44E-03
5.017	5.30E-02	5.18E-02	1.25E-03
5.117	4.90E-02	4.91E-02	-6.37E-05
5.217	4.60E-02	4.65E-02	-4.98E-04
5.317	4.40E-02	4.41E-02	-5.00E-05
5.417	4.10E-02	4.17E-02	-7.17E-04
5.517	3.80E-02	3.95E-02	-1.50E-03
5.617	3.60E-02	3.74E-02	-1.38E-03
5.717	3.30E-02	3.54E-02	-2.37E-03
5.817	3.10E-02	3.35E-02	-2.46E-03
5.917	2.90E-02	3.17E-02	-2.65E-03
6.017	2.70E-02	2.98E-02	-2.93E-03
6.117	2.50E-02	2.83E-02	-3.29E-03
6.217	2.40E-02	2.67E-02	-2.74E-03
6.317	2.20E-02	2.53E-02	-3.27E-03
6.417	2.10E-02	2.39E-02	-2.88E-03
6.517	1.90E-02	2.26E-02	-3.56E-03
6.617	1.80E-02	2.13E-02	-3.32E-03
6.717	1.70E-02	2.01E-02	-3.13E-03
6.817	1.50E-02	1.90E-02	-4.02E-03
6.917	1.40E-02	1.80E-02	-3.96E-03
7.017	1.30E-02	1.70E-02	-3.96E-03
7.117	1.20E-02	1.60E-02	-4.01E-03
7.217	1.10E-02	1.51E-02	-4.12E-03
7.317	1.10E-02	1.43E-02	-3.27E-03
7.417	1.00E-02	1.35E-02	-3.47E-03
7.517	9.00E-03	1.27E-02	-3.71E-03
7.617	8.00E-03	1.20E-02	-4.00E-03
7.717	8.00E-03	1.13E-02	-3.33E-03
7.817	7.00E-03	1.07E-02	-3.69E-03
7.917	7.00E-03	1.01E-02	-3.09E-03
8.017	6.00E-03	9.52E-03	-3.52E-03
8.117	6.00E-03	8.98E-03	-3.52E-03
8.217	5.00E-03	8.48E-03	-3.48E-03
8.317	5.00E-03	8.00E-03	-3.00E-03
8.417	5.00E-03	7.55E-03	-2.55E-03
8.517	4.00E-03	7.12E-03	-3.12E-03
8.617	4.00E-03	6.72E-03	-2.72E-03
8.717	3.00E-03	6.34E-03	-3.34E-03
8.817	3.00E-03	5.98E-03	-2.98E-03
8.917	3.00E-03	5.64E-03	-2.64E-03
9.017	2.00E-03	5.32E-03	-3.32E-03
9.117	2.00E-03	5.02E-03	-3.02E-03
9.217	2.00E-03	4.73E-03	-2.73E-03
9.317	1.00E-03	4.47E-03	-3.47E-03
9.417	1.00E-03	4.21E-03	-3.21E-03
9.517	1.00E-03	3.97E-03	-2.97E-03
9.617	1.00E-03	3.75E-03	-2.75E-03
9.717	1.00E-03	3.54E-03	-2.54E-03
9.817	0.00E+00	3.34E-03	-3.34E-03

B3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.8000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1103E-05
 DISPERSIVITY= 0.658E-02
 WIDTH= 0.8000E-03
 RF= 1.000
 CO= 1.913
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.6501E-03

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
 THE CRITICAL RSS IS: 0.7063E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.10E-06	1.10E-06	1.10E-06
X(2)	1.59E-03	1.51E-03	1.67E-03
X(5)	1.91E+00	1.88E+00	1.95E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.450	0.09E-04	2.88E-08	9.09E-04
1.583	7.87E-04	1.99E-07	7.87E-04
1.717	1.67E-03	1.07E-03	1.66E-03
1.850	2.54E-03	2.93E-06	2.54E-03
1.983	2.42E-03	1.26E-05	2.41E-03
2.117	3.42E-03	3.42E-05	3.27E-03
2.250	4.18E-03	8.14E-05	4.10E-03
2.383	4.06E-03	1.73E-04	3.88E-03
2.517	4.94E-03	3.35E-04	4.60E-03
2.650	5.81E-03	6.00E-04	5.21E-03
2.783	5.69E-03	1.00E-03	4.69E-03
2.917	6.57E-03	1.59E-03	4.98E-03
3.050	7.45E-03	2.38E-03	5.07E-03
3.183	8.33E-03	3.43E-03	4.90E-03
3.317	9.20E-03	4.75E-03	4.48E-03
3.450	1.01E-02	6.35E-03	3.73E-03
3.583	1.20E-02	8.25E-03	3.71E-03
3.717	1.38E-02	1.05E-02	3.39E-03
3.850	1.57E-02	1.29E-02	2.80E-03
3.983	1.76E-02	1.56E-02	1.96E-03
4.117	1.94E-02	1.86E-02	1.90E-03
4.250	2.34E-02	2.17E-02	1.66E-03
4.383	2.62E-02	2.50E-02	1.28E-03
4.517	2.91E-02	2.84E-02	6.99E-04
4.650	3.20E-02	3.17E-02	3.17E-04
4.783	3.49E-02	3.51E-02	-1.81E-04
4.917	3.77E-02	3.87E-02	-1.30E-04
5.050	4.06E-02	4.16E-02	-9.83E-04
5.183	4.35E-02	4.47E-02	-1.21E-03
5.317	4.64E-02	4.76E-02	-1.27E-03
5.450	4.93E-02	5.04E-02	-1.13E-03
5.583	5.11E-02	5.29E-02	-1.78E-03
5.717	5.40E-02	5.52E-02	-1.19E-03
5.850	5.59E-02	5.73E-02	-1.86E-03
5.983	5.68E-02	5.90E-02	-2.26E-03
6.117	5.87E-02	6.07E-02	-1.90E-03
6.250	6.05E-02	6.18E-02	-1.28E-03
6.383	6.14E-02	6.28E-02	-1.39E-03
6.517	6.23E-02	6.37E-02	-1.25E-03
6.650	6.22E-02	6.40E-02	-1.85E-03
6.783	6.30E-02	6.43E-02	-1.22E-03
6.917	6.39E-02	6.49E-02	-3.36E-03
7.050	6.28E-02	6.41E-02	-1.29E-03
7.183	6.27E-02	6.37E-02	-1.02E-03
7.317	6.31E-02	6.35E-02	-5.60E-04
7.450	6.24E-02	6.24E-02	6.58E-05
7.583	6.13E-02	6.15E-02	-1.67E-04
7.717	6.12E-02	6.04E-02	7.59E-04
7.850	6.01E-02	5.93E-02	7.96E-04
7.983	5.89E-02	5.80E-02	9.41E-04
8.117	5.78E-02	5.66E-02	1.18E-03
8.250	5.67E-02	5.52E-02	1.50E-03
8.383	5.56E-02	5.37E-02	1.88E-03
8.517	5.35E-02	5.21E-02	1.31E-03
8.650	5.23E-02	5.05E-02	1.79E-03
8.783	5.12E-02	4.89E-02	2.30E-03
8.917	4.91E-02	4.73E-02	1.83E-03
9.050	4.80E-02	4.56E-02	2.37E-03
9.183	4.59E-02	4.39E-02	1.92E-03
9.317	4.47E-02	4.23E-02	2.46E-03
9.450	4.26E-02	4.06E-02	1.99E-03
9.583	4.15E-02	3.90E-02	2.50E-03
9.717	3.94E-02	3.74E-02	2.00E-03
9.850	3.82E-02	3.58E-02	2.47E-03
9.983	3.61E-02	3.42E-02	1.90E-03
10.120	3.40E-02	3.27E-02	1.31E-03
10.250	3.29E-02	3.12E-02	1.67E-03
10.380	3.08E-02	2.98E-02	9.93E-04
10.520	2.96E-02	2.83E-02	1.29E-03
10.650	2.85E-02	2.70E-02	1.52E-03
10.780	2.64E-02	2.57E-02	7.19E-04
10.920	2.53E-02	2.44E-02	8.79E-04
11.050	2.41E-02	2.32E-02	9.84E-04
11.180	2.20E-02	2.20E-02	4.32E-05
11.320	2.09E-02	2.08E-02	6.68E-05
11.450	1.98E-02	1.97E-02	3.56E-05
11.580	1.87E-02	1.87E-02	-4.02E-05
11.720	1.75E-02	1.75E-02	-1.15E-05
11.850	1.54E-02	1.67E-02	-1.32E-03
11.980	1.43E-02	1.56E-02	-1.52E-03
12.120	1.32E-02	1.45E-02	-1.76E-03
12.250	1.21E-02	1.41E-02	-2.05E-03
12.380	1.09E-02	1.33E-02	-2.38E-03
12.520	9.84E-03	1.24E-02	-2.74E-03
12.650	9.68E-03	1.18E-02	-2.14E-03
12.780	8.56E-03	1.11E-02	

October 2006
B4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1801E-05
 DISPERSIVITY= 0.5000E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4268
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.6021E-03

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
 THE CRITICAL RSS IS: 0.6586E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.80E-06	1.78E-06	1.82E-06
X(2)	3.11E-03	3.02E-03	3.24E-03
X(5)	4.27E-01	4.23E-01	4.31E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.50E-01	7.00E-03	2.84E-03	4.16E-03
0.75	1.10E-02	6.13E-03	4.87E-03
6.50E-01	1.70E-02	1.11E-02	5.95E-03
0.95	2.40E-02	1.76E-02	6.37E-03
1.05E+00	3.10E-02	2.57E-02	5.27E-03
1.15	4.00E-02	3.51E-02	4.87E-03
1.25	4.80E-02	4.54E-02	2.63E-03
1.35	5.60E-02	5.58E-02	2.19E-04
1.45	6.40E-02	6.57E-02	-1.66E-03
1.55	7.10E-02	7.45E-02	-3.49E-03
1.65	7.80E-02	8.19E-02	-3.91E-03
1.75	8.40E-02	8.79E-02	-3.91E-03
1.85	8.80E-02	9.24E-02	-4.41E-03
1.95	9.20E-02	9.55E-02	-3.54E-03
2.05	9.50E-02	9.74E-02	-2.44E-03
2.15	9.60E-02	9.83E-02	-2.29E-03
2.25	9.70E-02	9.82E-02	-1.24E-03
2.35	9.80E-02	9.75E-02	5.50E-04
2.45	9.70E-02	9.61E-02	9.51E-04
2.55	9.60E-02	9.42E-02	1.81E-03
2.65	9.50E-02	9.19E-02	3.11E-03
2.75	9.30E-02	8.93E-02	3.66E-03
2.85	9.00E-02	8.66E-02	3.44E-03
2.95	8.70E-02	8.36E-02	3.36E-03
3.05	8.40E-02	8.06E-02	3.38E-03
3.15	8.10E-02	7.75E-02	3.46E-03
3.25	7.80E-02	7.44E-02	3.56E-03
3.35	7.40E-02	7.14E-02	2.65E-03
3.45	7.10E-02	6.83E-02	2.71E-03
3.55	6.70E-02	6.52E-02	1.72E-03
3.65	6.40E-02	6.23E-02	1.66E-03
3.75	6.00E-02	5.95E-02	1.52E-04
3.85	5.60E-02	5.67E-02	3.14E-04
3.95	5.40E-02	5.40E-02	9.35E-06
4.05	5.00E-02	5.14E-02	-1.39E-03
4.15	4.70E-02	4.92E-02	-1.81E-03
4.25	4.40E-02	4.65E-02	-2.47E-03
4.35	4.20E-02	4.42E-02	-2.16E-03
4.45	4.00E-02	4.20E-02	-1.95E-03
4.55	3.70E-02	3.98E-02	-2.83E-03
4.65	3.50E-02	3.78E-02	-2.80E-03
4.75	3.30E-02	3.59E-02	-2.87E-03
4.85	3.10E-02	3.40E-02	-3.03E-03
4.95	2.90E-02	3.23E-02	-3.27E-03
5.05	2.80E-02	3.06E-02	-2.59E-03
5.15	2.60E-02	2.90E-02	-3.00E-03
5.25	2.50E-02	2.75E-02	-2.49E-03
5.35	2.40E-02	2.61E-02	-2.05E-03
5.45	2.20E-02	2.47E-02	-2.68E-03
5.55	2.10E-02	2.34E-02	-2.38E-03
5.65	2.00E-02	2.22E-02	-2.15E-03
5.75	1.90E-02	2.10E-02	-1.98E-03
5.85	1.90E-02	1.98E-02	-8.64E-04
5.95	1.80E-02	1.88E-02	-8.11E-04
6.05	1.70E-02	1.78E-02	-8.12E-04
6.15	1.60E-02	1.69E-02	-8.55E-04
6.25	1.60E-02	1.60E-02	3.34E-05
6.35	1.50E-02	1.51E-02	-1.16E-04
6.45	1.40E-02	1.43E-02	-3.10E-04
6.55	1.40E-02	1.36E-02	4.54E-04
6.65	1.30E-02	1.28E-02	1.78E-04
6.75	1.30E-02	1.21E-02	8.63E-04
6.85	1.20E-02	1.16E-02	5.12E-04
6.95	1.20E-02	1.09E-02	1.13E-03
7.05	1.10E-02	1.03E-02	7.08E-04
7.15	1.10E-02	9.74E-03	1.25E-03
7.25	1.00E-02	9.22E-03	7.81E-04
7.35	1.00E-02	8.73E-03	1.28E-03
7.45	1.00E-02	8.26E-03	1.74E-03
7.55	9.00E-03	7.82E-03	1.18E-03
7.65	9.00E-03	7.40E-03	1.60E-03
7.75	9.00E-03	7.00E-03	2.00E-03
7.85	8.00E-03	6.60E-03	1.37E-03
7.95	8.00E-03	6.27E-03	1.73E-03
8.05	8.00E-03	5.94E-03	2.07E-03
8.15	7.00E-03	5.62E-03	1.38E-03
8.25	7.00E-03	5.32E-03	1.68E-03
8.35	7.00E-03	5.03E-03	1.97E-03
8.45	6.00E-03	4.76E-03	2.24E-03
8.55	6.00E-03	4.51E-03	1.49E-03
8.65	6.00E-03	4.27E-03	1.74E-03
8.75	6.00E-03	4.04E-03	1.98E-03
8.85	6.00E-03	3.82E-03	2.18E-03
8.95	5.00E-03	3.62E-03	1.38E-03
9.05	5.00E-03	3.42E-03	1.58E-03
9.15	5.00E-03	3.24E-03	1.77E-03
9.25	5.00E-03	3.07E-03	1.93E-03
9.35	5.00E-03	2.90E-03	2.10E-03
9.45	4.00E-03	2.75E-03	1.25E-03
12.8	7.00E-03	4.41E-04	6.56E-03

B4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 81
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9855E-06
 DISPERSIVITY= 0.2401E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.2340
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2718E-03

THE F STATISTIC FOR NP= 3 NOBS= 81 IS: 2.73
 THE CRITICAL RSS IS: 0.3003E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.86E-07	9.76E-07	9.95E-07
X(2)	2.40E-03	2.28E-03	2.55E-03
X(5)	2.34E-01	2.29E-01	2.39E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.317	1.00E-03	9.67E-08	1.00E-03
1.483	1.00E-03	6.97E-07	9.99E-04
1.650	2.00E-03	3.35E-06	2.00E-03
1.817	3.00E-03	1.21E-05	2.99E-03
1.983	4.00E-03	3.49E-05	3.97E-03
2.150	4.00E-03	8.54E-05	3.92E-03
2.317	5.00E-03	1.83E-04	4.82E-03
2.483	5.00E-03	3.54E-04	4.65E-03
2.650	6.00E-03	6.28E-04	5.37E-03
2.817	6.00E-03	1.04E-03	4.96E-03
2.983	7.00E-03	1.62E-03	5.38E-03
3.150	7.00E-03	2.40E-03	4.60E-03
3.317	8.00E-03	3.40E-03	4.60E-03
3.483	8.00E-03	4.64E-03	3.36E-03
3.650	9.00E-03	6.12E-03	2.88E-03
3.817	1.00E-02	7.83E-03	2.17E-03
3.983	1.10E-02	9.76E-03	1.24E-03
4.150	1.30E-02	1.19E-02	1.13E-03
4.317	1.40E-02	1.41E-02	-1.23E-04
4.483	1.60E-02	1.65E-02	-4.81E-04
4.650	1.80E-02	1.89E-02	-9.02E-04
4.817	2.00E-02	2.13E-02	-1.34E-03
4.983	2.20E-02	2.38E-02	-1.75E-03
5.150	2.50E-02	2.61E-02	-1.11E-03
5.317	2.70E-02	2.84E-02	-1.36E-03
5.483	3.00E-02	3.30E-02	-1.50E-02
5.650	3.10E-02	3.25E-02	-1.48E-03
5.817	3.30E-02	3.43E-02	-1.31E-03
5.983	3.50E-02	3.60E-02	-9.48E-04
6.150	3.70E-02	3.77E-02	-6.70E-04
6.317	3.80E-02	3.87E-02	-6.70E-04
6.483	3.90E-02	3.97E-02	-7.42E-04
6.650	4.10E-02	4.06E-02	-3.76E-04
6.817	4.10E-02	4.13E-02	-3.20E-04
6.983	4.20E-02	4.18E-02	1.64E-04
7.150	4.20E-02	4.22E-02	-1.91E-04
7.317	4.30E-02	4.24E-02	6.36E-04
7.483	4.30E-02	4.24E-02	6.03E-04
7.650	4.30E-02	4.23E-02	7.12E-04
7.817	4.30E-02	4.21E-02	3.49E-04
7.983	4.20E-02	4.17E-02	3.05E-04
8.150	4.20E-02	4.12E-02	7.67E-04
8.317	4.20E-02	4.07E-02	1.32E-03
8.483	4.10E-02	4.00E-02	9.66E-04
8.650	4.00E-02	3.93E-02	6.83E-04
8.817	3.90E-02	3.85E-02	4.64E-04
8.983	3.80E-02	3.77E-02	3.01E-04
9.150	3.70E-02	3.68E-02	1.84E-04
9.317	3.60E-02	3.59E-02	1.07E-04
9.483	3.50E-02	3.49E-02	6.00E-05
9.650	3.40E-02	3.40E-02	3.39E-05
9.817	3.30E-02	3.30E-02	3.78E-05
9.983	3.20E-02	3.20E-02	4.14E-05
10.150	3.10E-02	3.09E-02	5.64E-05
10.320	3.00E-02	2.99E-02	7.56E-05
10.480	2.90E-02	2.89E-02	8.67E-05
10.650	2.80E-02	2.79E-02	9.82E-05
10.820	2.70E-02	2.69E-02	1.01E-04
10.980	2.60E-02	2.59E-02	8.52E-05
11.150	2.50E-02	2.49E-02	6.11E-05
11.320	2.40E-02	2.40E-02	2.02E-05
11.480	2.30E-02	2.30E-02	-4.49E-05
11.650	2.20E-02	2.21E-02	-1.26E-04
11.820	2.10E-02	2.12E-02	-2.26E-04
11.980	2.00E-02	2.04E-02	-3.55E-04
12.150	1.90E-02	1.95E-02	-5.02E-04
12.320	1.80E-02	1.87E-02	-6.74E-04
12.480	1.80E-02	1.79E-02	1.25E-04
12.650	1.70E-02	1.71E-02	-9.61E-05
12.820	1.60E-02	1.63E-02	-3.42E-04
12.980	1.50E-02	1.56E-02	-6.18E-04
13.150	1.50E-02	1.49E-02	8.51E-05
13.320	1.40E-02	1.42E-02	-2.37E-04
13.480	1.30E-02	1.36E-02	-5.87E-04
13.650	1.20E-02	1.30E-02	-9.58E-04
13.820	1.20E-02	1.32E-02	-1.39E-03
13.980	1.10E-02	1.18E-02	-7.75E-04
14.150	1.10E-02	1.12E-02	-2.16E-04
14.320	1.00E-02	1.07E-02	-6.80E-04
14.480	1.00E-02	1.02E-02	-1.70E-04
14.650	9.00E-03	9.68E-03	-6.77E-04

October 2006
C1_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.2000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 2.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1072E-05
 DISPERSIVITY= 0.2885E-02
 WIDTH= 0.2000E-03
 RF= 1.000
 CO= 14.73
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1152E-02

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
 THE CRITICAL RSS IS: 0.1267E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.07E-06	1.06E-06	1.08E-06
X(2)	2.29E-03	2.22E-03	2.35E-03
X(5)	1.47E+01	1.46E+01	1.49E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.67E-01	7.78E-04	2.24E-04	5.53E-04
1.033	3.51E-03	1.23E-03	2.28E-03
1.20E+00	8.24E-03	3.96E-03	4.28E-03
1.367	1.50E-02	9.21E-03	5.75E-03
1.53E+00	2.37E-02	1.73E-02	6.44E-03
1.7	3.54E-02	2.78E-02	7.62E-03
1.867	4.77E-02	4.02E-02	6.94E-03
2.033	5.99E-02	5.37E-02	6.21E-03
2.2	7.26E-02	6.74E-02	5.20E-03
2.367	8.43E-02	8.07E-02	3.61E-03
2.533	9.41E-02	9.31E-02	9.57E-04
2.7	1.03E-01	1.04E-01	-1.42E-03
2.867	1.11E-01	1.14E-01	-3.30E-03
3.033	1.17E-01	1.22E-01	-4.56E-03
3.2	1.23E-01	1.28E-01	-5.22E-03
3.367	1.27E-01	1.33E-01	-6.31E-03
3.533	1.30E-01	1.36E-01	-6.94E-03
3.7	1.32E-01	1.38E-01	-6.24E-03
3.867	1.34E-01	1.39E-01	-5.34E-03
4.033	1.35E-01	1.39E-01	-4.38E-03
4.2	1.34E-01	1.38E-01	-3.52E-03
4.367	1.34E-01	1.36E-01	-1.87E-03
4.533	1.33E-01	1.33E-01	-5.69E-04
4.7	1.31E-01	1.30E-01	-2.71E-04
4.867	1.29E-01	1.27E-01	2.54E-03
5.033	1.26E-01	1.23E-01	3.15E-03
5.2	1.23E-01	1.19E-01	4.02E-03
5.367	1.20E-01	1.14E-01	5.07E-03
5.533	1.15E-01	1.10E-01	5.24E-03
5.7	1.11E-01	1.05E-01	5.26E-03
5.867	1.07E-01	1.01E-01	5.74E-03
6.033	1.02E-01	9.64E-02	5.99E-03
6.2	9.71E-02	9.19E-02	5.20E-03
6.367	9.28E-02	8.75E-02	5.33E-03
6.533	8.76E-02	8.32E-02	4.37E-03
6.7	8.30E-02	7.93E-02	4.30E-03
6.867	7.80E-02	7.49E-02	3.11E-03
7.033	7.38E-02	7.10E-02	2.78E-03
7.2	6.95E-02	6.72E-02	2.31E-03
7.367	6.52E-02	6.38E-02	1.70E-03
7.533	6.09E-02	6.00E-02	9.33E-04
7.7	5.67E-02	5.66E-02	2.32E-05
7.867	5.34E-02	5.34E-02	-3.65E-05
8.033	5.01E-02	5.04E-02	-2.46E-04
8.2	4.69E-02	4.75E-02	-6.01E-04
8.367	4.36E-02	4.47E-02	-1.10E-03
8.533	4.03E-02	4.20E-02	-1.74E-03
8.7	3.70E-02	3.95E-02	-2.51E-03
8.867	3.48E-02	3.72E-02	-2.41E-03
9.033	3.25E-02	3.49E-02	-2.44E-03
9.2	3.02E-02	3.28E-02	-2.59E-03
9.367	2.80E-02	3.08E-02	-2.86E-03
9.533	2.57E-02	2.89E-02	-3.24E-03
9.7	2.44E-02	2.71E-02	-2.73E-03
9.867	2.21E-02	2.55E-02	-3.32E-03
10.033	2.09E-02	2.39E-02	-3.01E-03
10.2	1.96E-02	2.24E-02	-2.79E-03
10.37	1.83E-02	2.10E-02	-2.65E-03
10.533	1.71E-02	1.97E-02	-2.61E-03
10.7	1.58E-02	1.84E-02	-2.63E-03
10.87	1.45E-02	1.72E-02	-2.74E-03
11.033	1.32E-02	1.62E-02	-2.91E-03
11.2	1.20E-02	1.51E-02	-3.18E-03
11.37	1.17E-02	1.42E-02	-2.46E-03
11.533	1.04E-02	1.33E-02	-2.83E-03
11.7	1.02E-02	1.24E-02	-2.24E-03
11.87	8.88E-03	1.16E-02	-2.72E-03
12.033	8.61E-03	1.09E-02	-2.24E-03
12.2	7.34E-03	1.02E-02	-2.81E-03
12.37	7.07E-03	9.49E-03	-2.42E-03
12.533	5.80E-03	8.88E-03	-3.08E-03
12.7	5.53E-03	8.30E-03	-2.77E-03
12.87	5.28E-03	7.76E-03	-2.60E-03
13.033	3.98E-03	7.25E-03	-3.27E-03
13.2	3.71E-03	6.78E-03	-3.07E-03
13.37	3.44E-03	6.34E-03	-2.90E-03
13.533	3.17E-03	5.92E-03	-2.75E-03
13.7	2.90E-03	5.53E-03	-2.64E-03
13.87	1.63E-03	5.17E-03	-3.54E-03
14.033	1.36E-03	4.83E-03	-3.48E-03
14.2	1.09E-03	4.51E-03	-3.43E-03
14.37	8.14E-04	4.22E-03	-3.40E-03
14.533	5.42E-04	3.94E-03	-3.40E-03
14.7	2.71E-04	3.68E-03	-3.41E-03
14.87	-4.27E-05	3.44E-03	-3.44E-03

C1_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1140E-05
 DISPERSIVITY= 0.1352E-02
 WIDTH= 0.1000E-02
 RF= 1.000
 CO= 3.437
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4758E-02

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
 THE CRITICAL RSS IS: 0.5204E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.14E-06	1.13E-06	1.15E-06
X(2)	1.35E-03	1.27E-03	1.45E-03
X(5)	3.44E+00	3.37E+00	3.51E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.433	8.01E-04	7.83E-04	8.01E-04
1.600	5.52E-04	1.19E-07	5.52E-04
1.767	1.30E-03	1.06E-06	1.30E-03
1.933	1.06E-03	6.26E-06	1.05E-03
2.100	1.81E-03	2.73E-05	1.78E-03
2.267	2.56E-03	9.37E-05	2.48E-03
2.433	3.31E-03	2.63E-04	3.05E-03
2.600	4.06E-03	6.37E-04	3.42E-03
2.767	4.81E-03	1.36E-03	3.45E-03
2.933	6.56E-03	2.59E-03	3.97E-03
3.100	9.31E-03	4.55E-03	4.76E-03
3.267	1.21E-02	7.43E-03	4.64E-03
3.433	1.58E-02	1.13E-02	4.48E-03
3.600	2.06E-02	1.65E-02	4.11E-03
3.767	2.73E-02	2.28E-02	4.52E-03
3.933	3.51E-02	3.03E-02	4.80E-03
4.100	4.28E-02	3.89E-02	3.95E-03
4.267	5.26E-02	4.84E-02	4.19E-03
4.433	6.23E-02	5.85E-02	3.79E-03
4.600	7.31E-02	6.92E-02	3.38E-03
4.767	8.38E-02	8.00E-02	3.80E-03
4.933	9.36E-02	9.07E-02	2.85E-03
5.100	1.03E-01	1.01E-01	2.13E-03
5.267	1.12E-01	1.11E-01	1.04E-03
5.433	1.20E-01	1.20E-01	-3.42E-04
5.600	1.27E-01	1.28E-01	-1.78E-03
5.767	1.32E-01	1.36E-01	-3.28E-03
5.933	1.37E-01	1.42E-01	-4.54E-03
6.100	1.42E-01	1.47E-01	-4.78E-03
6.267	1.47E-01	1.50E-01	-5.75E-03
6.433	1.47E-01	1.53E-01	-5.63E-03
6.600	1.48E-01	1.54E-01	-6.32E-03
6.767	1.49E-01	1.55E-01	-6.03E-03
6.933	1.49E-01	1.54E-01	-5.66E-03
7.100	1.48E-01	1.53E-01	-4.48E-03
7.267	1.47E-01	1.51E-01	-3.37E-03
7.433	1.45E-01	1.48E-01	-2.56E-03
7.600	1.43E-01	1.44E-01	-1.21E-03
7.767	1.39E-01	1.40E-01	-2.18E-04
7.933	1.35E-01	1.35E-01	7.08E-03
8.100	1.33E-01	1.30E-01	2.86E-03
8.267	1.29E-01	1.25E-01	3.82E-03
8.433	1.24E-01	1.19E-01	5.04E-03
8.600	1.20E-01	1.14E-01	6.31E-03
8.767	1.15E-01	1.08E-01	6.79E-03
8.933	1.10E-01	1.03E-01	7.08E-03
9.100	1.04E-01	9.69E-02	7.50E-03
9.267	9.91E-02	9.14E-02	7.75E-03
9.433	9.49E-02	8.60E-02	8.90E-03
9.600	8.96E-02	8.07E-02	8.94E-03
9.767	8.44E-02	7.56E-02	8.81E-03
9.933	7.91E-02	7.06E-02	8.48E-03
10.100	7.39E-02	6.59E-02	7.98E-03
10.270	6.86E-02	6.13E-02	7.35E-03
10.430	6.44E-02	5.71E-02	7.24E-03
10.600	5.91E-02	5.29E-02	6.18E-03
10.770	5.49E-02	4.90E-02	5.88E-03
10.930	5.06E-02	4.55E-02	5.15E-03
11.100	4.64E-02	4.20E-02	4.42E-03
11.270	4.21E-02	3.87E-02	3.47E-03
11.430	3.89E-02	3.57E-02	3.14E-03
11.600	3.56E-02	3.28E-02	2.79E-03
11.770	3.24E-02	3.02E-02	2.29E-03
11.930	2.91E-02	2.78E-02	1.35E-03
12.100	2.59E-02	2.54E-02	4.35E-04
12.270	2.36E-02	2.33E-02	3.50E-04
12.430	2.14E-02	2.14E-02	-1.07E-05
12.600	1.91E-02	1.95E-02	-4.03E-04
12.770	1.69E-02	1.78E-02	-9.30E-04
12.930	1.46E-02	1.63E-02	-1.69E-03
13.100	1.24E-02	1.49E-02	-2.49E-03
13.270	1.11E-02	1.35E-02	-2.40E-03
13.430	9.89E-03	1.24E-02	-3.24E-03
13.600	7.64E-03	1.13E-02	-3.61E-03
13.770	6.39E-03	1.02E-02	-3.82E-03
13.930	5.14E-03	9.32E-03	-4.18E-03
14.100	3.90E-03	8.45E-03	-4.55E-03
14.270	2.65E-03	7.66E-03	-5.01E-03
14.430	2.40E-03	6.93E-03	-4.58E-03
14.600	1.15E-03	6.31E-03	-5.17E-03
14.770	8.00E-03	3.28E-02	-2.48E-02
14.930	8.00E-03	3.28E-02	-2.48E-02
15.100	8.00E-03	2.87E-02	-2.07E-02
15.270	8.00E-03	2.68E-02	-1.88E-02
15.430	8.00E-03	2.51E-02	-1.71E-02
15.600	7.00E-03	2.33E-02	-1.63E-02
15.770	7.00E-03	2.17E-02	-1.47E-02
15.930	7.00E-03	2.03E-02	-1.33E-02
16.100	7.00E-03	1.88E-02	-1.18E-02
16.270	7.00E-03	1.75E-02	-1.05E-02

October 2006
C2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : 0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -2.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1074E-05
 DISPERSIVITY= 0.2820E-02
 WIDTH= 0.2092E-02
 Rf= 1.000
 CO= 2.000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1716E-01

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
 THE CRITICAL RSS IS: 0.1890E-01

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.07E-06	1.04E-06	1.11E-06
X(2)	2.82E-03	2.54E-03	3.16E-03
X(3)	2.09E-03	2.01E-03	2.18E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.17E-01	9.62E-04	1.11E-10	9.62E-04
0.4933	2.92E-03	4.98E-07	2.92E-03
6.50E-01	6.87E-03	3.10E-05	6.84E-03
0.8167	1.28E-02	3.62E-04	1.25E-02
9.83E-01	2.18E-02	1.85E-03	1.99E-02
1.15	3.37E-02	5.91E-03	2.78E-02
1.317	4.67E-02	1.40E-02	3.27E-02
1.483	6.06E-02	2.65E-02	3.42E-02
1.65	7.56E-02	4.31E-02	3.25E-02
1.817	8.95E-02	6.24E-02	2.72E-02
1.983	1.03E-01	8.27E-02	1.98E-02
2.15	1.14E-01	1.03E-01	1.15E-02
2.317	1.25E-01	1.22E-01	3.62E-03
2.483	1.34E-01	1.39E-01	-4.24E-03
2.65	1.43E-01	1.53E-01	-9.69E-03
2.817	1.50E-01	1.65E-01	-1.46E-02
2.983	1.56E-01	1.74E-01	-1.80E-02
3.15	1.61E-01	1.81E-01	-2.01E-02
3.317	1.65E-01	1.86E-01	-2.09E-02
3.483	1.69E-01	1.89E-01	-1.99E-02
3.65	1.72E-01	1.90E-01	-1.80E-02
3.817	1.74E-01	1.90E-01	-1.57E-02
3.983	1.75E-01	1.88E-01	-1.33E-02
4.15	1.76E-01	1.86E-01	-8.66E-03
4.317	1.77E-01	1.82E-01	-5.32E-03
4.483	1.77E-01	1.78E-01	-1.21E-03
4.65	1.76E-01	1.73E-01	2.37E-03
4.817	1.74E-01	1.68E-01	6.44E-03
4.983	1.73E-01	1.63E-01	9.73E-03
5.15	1.70E-01	1.57E-01	1.24E-02
5.317	1.67E-01	1.52E-01	1.50E-02
5.483	1.64E-01	1.46E-01	1.78E-02
5.65	1.59E-01	1.40E-01	1.96E-02
5.817	1.54E-01	1.34E-01	2.04E-02
5.983	1.49E-01	1.28E-01	2.11E-02
6.15	1.43E-01	1.23E-01	2.07E-02
6.317	1.37E-01	1.17E-01	2.02E-02
6.483	1.31E-01	1.12E-01	1.95E-02
6.65	1.24E-01	1.07E-01	1.78E-02
6.817	1.18E-01	1.01E-01	1.67E-02
6.983	1.11E-01	9.65E-02	1.46E-02
7.15	1.04E-01	9.17E-02	1.23E-02
7.317	9.70E-02	8.72E-02	9.82E-03
7.483	9.09E-02	8.28E-02	8.13E-03
7.65	8.39E-02	7.86E-02	5.29E-03
7.817	7.78E-02	7.46E-02	3.27E-03
7.983	7.18E-02	7.07E-02	1.06E-03
8.15	6.57E-02	6.70E-02	-1.31E-03
8.317	6.07E-02	6.35E-02	-2.85E-03
8.483	5.48E-02	6.02E-02	-6.67E-03
8.65	5.06E-02	5.70E-02	-6.42E-03
8.817	4.55E-02	5.40E-02	-8.43E-03
8.983	4.15E-02	5.11E-02	-9.61E-03
9.15	3.74E-02	4.84E-02	-1.09E-02
9.317	3.44E-02	4.57E-02	-1.13E-02
9.483	3.14E-02	4.33E-02	-1.19E-02
9.65	2.83E-02	4.09E-02	-1.26E-02
9.817	2.63E-02	3.87E-02	-1.25E-02
9.983	2.32E-02	3.66E-02	-1.34E-02
10.15	2.12E-02	3.46E-02	-1.34E-02
10.32	1.91E-02	3.27E-02	-1.35E-02
10.48	1.81E-02	3.09E-02	-1.29E-02
10.65	1.60E-02	2.92E-02	-1.32E-02
10.82	1.50E-02	2.76E-02	-1.26E-02
10.98	1.39E-02	2.61E-02	-1.22E-02
11.15	1.29E-02	2.46E-02	-1.18E-02
11.32	1.18E-02	2.32E-02	-1.14E-02
11.48	1.08E-02	2.20E-02	-1.12E-02
11.65	9.73E-03	2.07E-02	-1.10E-02
11.82	8.68E-03	1.96E-02	-1.09E-02
11.98	7.64E-03	1.84E-02	-1.09E-02
12.15	6.59E-03	1.75E-02	-1.09E-02
12.32	6.54E-03	1.65E-02	-9.93E-03
12.48	5.49E-03	1.56E-02	-1.01E-02
12.65	4.45E-03	1.47E-02	-1.03E-02
12.82	4.40E-03	1.39E-02	-9.46E-03
12.98	3.35E-03	1.31E-02	-9.76E-03
13.15	3.30E-03	1.24E-02	-9.06E-03
13.32	2.26E-03	1.17E-02	-9.49E-03
13.48	2.21E-03	1.10E-02	-8.82E-03
13.65	2.16E-03	1.04E-02	-8.24E-03
13.82	1.11E-03	9.80E-03	-8.69E-03
13.98	1.07E-03	9.27E-03	-8.21E-03
14.15	1.02E-03	8.74E-03	-7.72E-03

C2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 82
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : 0.4000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 1.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1012E-05
 DISPERSIVITY= 0.1668E-02
 WIDTH= 0.4000E-03
 Rf= 1.000
 CO= 9.674
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4640E-02

THE F STATISTIC FOR NP= 3 NOBS= 82 IS: 2.73
 THE CRITICAL RSS IS: 0.5122E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.01E-06	1.00E-06	1.02E-06
X(2)	1.66E-03	1.56E-03	1.76E-03
X(5)	9.67E+00	9.48E+00	9.87E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.217	6.69E-04	2.58E-10	6.69E-04
1.383	2.80E-04	8.33E-09	2.66E-04
1.550	8.62E-04	1.25E-07	8.62E-04
1.717	4.59E-04	1.07E-06	4.58E-04
1.883	1.06E-03	6.02E-06	1.05E-03
2.050	3.44E-03	2.51E-05	1.63E-03
2.217	2.25E-03	8.23E-05	2.17E-03
2.383	2.85E-03	2.23E-04	2.62E-03
2.550	3.44E-03	5.22E-04	2.92E-03
2.717	4.04E-03	1.08E-03	2.95E-03
2.883	5.64E-03	2.03E-03	3.61E-03
3.050	8.23E-03	3.51E-03	4.72E-03
3.217	9.82E-03	5.66E-03	4.17E-03
3.383	1.34E-02	8.59E-03	4.83E-03
3.550	1.80E-02	1.24E-02	5.60E-03
3.717	2.26E-02	1.72E-02	5.44E-03
3.883	2.92E-02	2.29E-02	3.35E-03
4.050	3.58E-02	2.95E-02	6.33E-03
4.217	4.34E-02	3.69E-02	6.47E-03
4.383	5.20E-02	4.51E-02	9.94E-03
4.550	6.06E-02	5.38E-02	6.79E-03
4.717	6.92E-02	6.30E-02	6.22E-03
4.883	7.78E-02	7.23E-02	5.45E-03
5.050	8.64E-02	8.18E-02	4.65E-03
5.217	9.50E-02	9.12E-02	3.75E-03
5.383	1.03E-01	1.00E-01	2.26E-03
5.550	1.10E-01	1.09E-01	1.08E-03
5.717	1.17E-01	1.17E-01	-5.80E-04
5.883	1.22E-01	1.25E-01	-2.59E-03
6.050	1.28E-01	1.32E-01	-3.94E-03
6.217	1.50E-01	1.53E-01	-5.54E-03
6.383	1.37E-01	1.44E-01	-6.31E-03
6.550	1.41E-01	1.48E-01	-7.29E-03
6.717	1.44E-01	1.52E-01	-7.43E-03
6.883	2.17E-01	1.95E-01	-7.73E-03
7.050	1.50E-01	1.57E-01	-7.34E-03
7.217	1.51E-01	1.58E-01	-7.07E-03
7.383	1.52E-01	1.59E-01	-7.05E-03
7.550	1.69E-01	1.69E-01	-6.34E-03
7.717	1.53E-01	1.58E-01	-4.97E-03
7.883	1.53E-01	1.57E-01	-4.02E-03
8.050	1.52E-01	1.55E-01	-2.51E-03
8.217	1.51E-01	1.52E-01	-1.52E-03
8.383	1.49E-01	1.49E-01	-1.07E-04
8.550	1.48E-01	1.46E-01	1.70E-03
8.717	1.46E-01	1.43E-01	2.84E-03
8.883	1.43E-01	1.39E-01	4.23E-03
9.050	1.41E-01	1.35E-01	5.88E-03
9.217	1.37E-01	1.31E-01	6.71E-03
9.383	1.34E-01	1.26E-01	7.66E-03
9.550	1.31E-01	1.22E-01	8.74E-03
9.717	1.26E-01	1.17E-01	8.89E-03
9.883	1.23E-01	1.13E-01	1.01E-02
10.050	1.18E-01	1.08E-01	1.03E-02
10.220	1.14E-01	1.03E-01	1.05E-02
10.380	1.09E-01	9.90E-02	9.48E-03
10.550	1.04E-01	9.45E-02	9.65E-03
10.720	9.87E-02	9.00E-02	8.72E-03
10.880	9.43E-02	8.58E-02	8.46E-03
11.050	8.99E-02	8.15E-02	7.36E-03
11.220	8.45E-02	7.73E-02	7.14E-03
11.380	7.91E-02	7.35E-02	5.56E-03
11.550	7.37E-02	6.96E-02	4.10E-03
11.720	6.93E-02	6.58E-02	3.48E-03
11.880	6.39E-02	6.23E-02	1.53E-03
12.050	5.95E-02	5.88E-02	6.47E-04
12.220	5.40E-02	5.54E-02	-1.39E-03
12.380	5.26E-02	5.27E-02	-2.25E-03
12.550	4.52E-02	4.93E-02	-4.06E-03
12.720	4.08E-02	4.63E-02	-5.51E-03
12.880	3.64E-02	4.37E-02	-7.26E-03
13.050	3.30E-02	4.10E-02	-7.99E-03
13.220	2.86E-02	3.85E-02	-9.85E-03
13.380	2.52E-02	3.62E-02	-1.10E-02
13.550	2.18E-02	3.39E-02	-1.21E-02
13.720	1.84E-02	3.17E-02	-1.33E-02
13.880	1.50E-02	2.98E-02	-1.48E-02
14.050	1.16E-02	2.79E-02	-1.63E-02
14.220	8.20E-03	2.60E-02	-1.68E-02
14.380	6.80E-03	2.44E-02	-1.76E-02
14.550	4.39E-03	2.28E-02	-1.84E-02
14.720	1.99E-03	2.13E-02	-1.93E-02

October 2006
C3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
 2) THE NUMBER OF VARIABLES TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 2.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1088E-05
 DISPERSIVITY= 0.1811E-02
 WIDTH= 0.1000E-03
 RF= 1.000
 CO= 25.86
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9852E-03

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
 THE CRITICAL RSS IS: 0.1083E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.09E-06	1.09E-06	1.10E-06
X(2)	1.81E-03	1.76E-03	1.88E-03
X(5)	2.59E+01	2.56E+01	2.61E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.33E-01	9.16E-04	4.27E-02	9.16E-04
0.3	1.81E-03	8.69E-18	1.81E-03
4.67E-01	1.70E-03	6.79E-11	1.70E-03
0.6333	1.60E-03	9.97E-08	1.60E-03
8.00E-01	2.49E-03	6.16E-06	2.49E-03
0.9667	3.44E-02	6.09E-02	3.44E-02
1.133	4.28E-03	4.98E-04	3.78E-03
1.3	7.18E-03	1.79E-03	5.39E-03
1.467	1.11E-02	4.60E-03	6.47E-03
1.633	1.70E-02	9.44E-03	7.53E-03
1.8	2.39E-02	1.65E-02	7.32E-03
1.967	3.28E-02	2.67E-02	7.01E-03
2.133	4.27E-02	3.65E-02	6.11E-03
2.3	5.35E-02	4.65E-02	5.05E-03
2.467	6.44E-02	5.62E-02	3.66E-03
2.633	7.53E-02	7.31E-02	2.23E-03
2.8	8.52E-02	8.48E-02	4.62E-04
2.967	9.31E-02	9.54E-02	-2.31E-03
3.133	1.01E-01	1.05E-01	-3.77E-03
3.3	1.08E-01	1.13E-01	-4.84E-03
3.467	1.14E-01	1.19E-01	-5.41E-03
3.633	1.19E-01	1.24E-01	-5.45E-03
3.8	1.23E-01	1.28E-01	-5.08E-03
3.967	1.26E-01	1.30E-01	-4.34E-03
4.133	1.26E-01	1.31E-01	-4.37E-03
4.3	1.27E-01	1.31E-01	-3.29E-03
4.467	1.28E-01	1.29E-01	-1.24E-03
4.633	1.27E-01	1.28E-01	-3.60E-04
4.8	1.25E-01	1.25E-01	1.23E-03
4.967	1.24E-01	1.22E-01	3.41E-03
5.133	1.21E-01	1.18E-01	2.03E-03
5.3	1.14E-01	1.14E-01	1.18E-03
5.467	1.15E-01	1.09E-01	5.22E-03
5.633	1.10E-01	1.05E-01	5.67E-03
5.8	1.05E-01	1.00E-01	5.23E-03
5.967	1.01E-01	9.53E-02	5.91E-03
6.133	9.61E-02	9.06E-02	5.56E-03
6.3	9.10E-02	8.58E-02	5.18E-02
6.467	8.59E-02	8.12E-02	4.72E-03
6.633	7.98E-02	7.67E-02	3.15E-03
6.8	7.47E-02	7.22E-02	2.47E-03
6.967	6.96E-02	6.79E-02	1.65E-03
7.133	6.45E-02	6.38E-02	6.53E-04
7.3	5.94E-02	5.99E-02	5.10E-04
7.467	5.53E-02	5.61E-02	-7.96E-04
7.633	5.12E-02	5.25E-02	-1.31E-03
7.8	4.71E-02	4.90E-02	-1.97E-03
7.967	4.30E-02	4.58E-02	-2.82E-03
8.133	3.99E-02	4.27E-02	-2.85E-03
8.3	3.67E-02	3.98E-02	-3.04E-03
8.467	3.36E-02	3.70E-02	-3.40E-03
8.633	3.05E-02	3.45E-02	-3.93E-03
8.8	2.84E-02	3.20E-02	-3.61E-03
8.967	2.53E-02	2.97E-02	-4.42E-03
9.133	2.42E-02	2.76E-02	-3.41E-03
9.3	2.21E-02	2.56E-02	-3.51E-03
9.467	2.00E-02	2.38E-02	-3.75E-03
9.633	1.89E-02	2.20E-02	-3.13E-03
9.8	1.78E-02	2.04E-02	-2.60E-03
9.967	1.57E-02	1.89E-02	-3.20E-03
10.13	1.46E-02	1.75E-02	-2.92E-03
10.3	1.35E-02	1.62E-02	-2.69E-03
10.47	1.34E-02	1.49E-02	-1.55E-03
10.63	1.23E-02	1.38E-02	-1.57E-03
10.8	1.12E-02	1.28E-02	-1.60E-03
10.97	1.11E-02	1.18E-02	-7.14E-04
11.13	9.94E-03	1.09E-02	-9.52E-04
11.3	8.84E-03	1.00E-02	-1.20E-03
11.47	8.73E-03	9.25E-03	-5.19E-04
11.63	7.63E-03	8.56E-03	-9.34E-04
11.8	7.52E-03	7.88E-03	-3.62E-04
11.97	6.42E-03	7.26E-03	-8.40E-04
12.13	6.31E-03	6.71E-03	-4.00E-04
12.3	5.20E-03	6.17E-03	-9.70E-04
12.47	5.10E-03	5.68E-03	-5.80E-04
12.63	4.99E-03	5.25E-03	-2.56E-04
12.8	3.89E-03	4.83E-03	-9.39E-04
12.97	3.78E-03	4.44E-03	-6.55E-04
13.13	2.68E-03	4.10E-03	-1.42E-03
13.3	2.57E-03	3.77E-03	-1.20E-03
13.47	2.47E-03	3.46E-03	-9.96E-04
13.63	1.36E-03	3.26E-03	-1.84E-03
13.8	1.25E-03	2.94E-03	-1.68E-04
13.97	1.15E-03	2.70E-03	-1.55E-03
14.13	1.04E-03	2.49E-03	-1.45E-03

C3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
 2) THE NUMBER OF VARIABLES TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 2.500
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1053E-05
 DISPERSIVITY= 0.1335E-02
 WIDTH= 0.1000E-03
 RF= 1.000
 CO= 23.76
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1322E-02

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
 THE CRITICAL RSS IS: 0.1435E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.05E-06	1.05E-06	1.05E-06
X(2)	1.34E-03	1.28E-03	1.39E-03
X(5)	2.36E+01	2.35E+01	2.40E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.700	8.62E-04	8.53E-08	8.62E-04
1.833	6.78E-04	4.50E-07	6.77E-04
1.967	1.84E-04	1.88E-06	1.84E-04
2.100	1.31E-03	6.40E-06	1.30E-03
2.233	2.13E-03	1.85E-05	2.11E-03
2.367	1.03E-02	6.80E-03	4.39E-03
2.500	2.76E-03	1.06E-04	2.65E-03
2.633	2.57E-03	2.18E-04	2.36E-03
2.767	3.79E-03	4.14E-04	2.98E-03
2.900	4.21E-03	7.31E-04	3.47E-03
3.033	5.02E-03	1.22E-03	3.80E-03
3.167	6.84E-03	1.93E-03	4.91E-03
3.300	7.65E-03	2.91E-03	4.75E-03
3.433	9.47E-03	4.21E-03	5.26E-03
3.567	1.03E-02	5.80E-03	4.59E-03
3.700	1.31E-02	7.97E-03	5.13E-03
3.833	1.49E-02	1.05E-02	4.44E-03
3.967	1.77E-02	1.35E-02	4.26E-03
4.100	2.16E-02	1.69E-02	4.68E-03
4.233	2.44E-02	2.07E-02	3.66E-03
4.367	2.82E-02	2.50E-02	3.22E-03
4.500	3.30E-02	2.96E-02	3.44E-03
4.633	3.78E-02	3.44E-02	3.37E-03
4.767	4.26E-02	3.96E-02	3.02E-03
4.900	4.74E-02	4.49E-02	2.52E-03
5.033	5.23E-02	5.03E-02	1.93E-03
5.167	5.71E-02	5.58E-02	1.25E-03
5.300	6.19E-02	6.12E-02	6.62E-04
5.433	6.67E-02	6.65E-02	1.76E-04
5.567	7.15E-02	7.17E-02	-1.91E-04
5.700	7.63E-02	7.66E-02	-1.28E-03
5.833	8.02E-02	8.13E-02	-1.11E-03
5.967	8.40E-02	8.56E-02	-1.64E-03
6.100	8.68E-02	8.96E-02	-2.78E-03
6.233	9.06E-02	9.31E-02	-2.54E-03
6.367	9.34E-02	9.63E-02	-2.91E-03
6.500	9.52E-02	9.91E-02	-3.84E-03
6.633	9.81E-02	1.01E-01	-1.33E-03
6.767	9.99E-02	1.03E-01	-3.41E-03
6.900	1.01E-01	1.05E-01	-4.02E-03
7.033	1.03E-01	1.07E-01	-1.24E-03
7.167	1.03E-01	1.06E-01	-3.06E-03
7.300	1.04E-01	1.07E-01	-2.49E-03
7.433	1.04E-01	1.06E-01	-1.54E-03
7.567	1.04E-01	1.06E-01	-2.14E-03
7.700	1.04E-01	1.05E-01	-1.52E-03
7.833	1.03E-01	1.04E-01	-5.30E-04
7.967	1.02E-01	1.03E-01	-3.76E-04
8.100	1.01E-01	1.01E-01	7.77E-05
8.233	9.99E-02	9.90E-02	9.95E-04
8.367	9.87E-02	9.70E-02	1.71E-03
8.500	9.65E-02	9.47E-02	1.77E-03
8.633	9.43E-02	9.23E-02	1.99E-03
8.767	9.31E-02	8.98E-02	3.34E-03
8.900	9.09E-02	8.71E-02	3.79E-03
9.033	8.77E-02	8.44E-02	3.31E-03
9.167	8.56E-02	8.16E-02	3.92E-03
9.300	8.34E-02	7.88E-02	4.56E-03
9.433	8.02E-02	7.60E-02	4.21E-03
9.567	7.80E-02	7.31E-02	4.91E-03
9.700	7.48E-02	7.02E-02	4.57E-03
9.833	7.16E-02	6.74E-02	4.24E-03
9.967	6.85E-02	6.46E-02	3.89E-03
10.100	6.63E-02	6.18E-02	4.48E-03
10.233	6.31E-02	5.91E-02	3.97E-03
10.370	5.99E-02	5.63E-02	3.61E-03
10.500	5.67E-02	5.37E-02	2.99E-03
10.630	5.36E-02	5.12E-02	2.30E-03
10.770	5.13E-02	4.86E-02	2.74E-03
10.900	4.82E-02	4.62E-02	1.92E-03
11.030	4.60E-02	4.40E-02	1.01E-03
11.170	4.28E-02	4.16E-02	1.21E-03
11.300	3.96E-02	3.95E-02	1.54E-04
11.430	3.74E-02	3.74E-02	2.66E-05
11.570	3.52E-02	3.53E-02	-2.95E-05
11.700	3.21E-02	3.34E-02	-1.33E-03
11.830	2.99E-02	3.16E-02	-1.69E-03
11.970	2.77E-02	2.97E-02	-2.02E-03
12.100	2.55E-02	2.80E-02	-2.54E-03
12.230	2.33E-02	2.65E-02	-3.14E-03
12.370	2.21E-02	2.48E-02	-2.71E-03
12.500	2.00E-02	2.30E-02	-3.45E-03
12.630	1.78E-02	2.20E-02	-4.28E-03
12.770	1.66E-02	2.06E-02	-4.06E-03
12.900	1.44E-02	1.94E-02	-5.03E-03
13.030	1.32E-02	1.83E-02	-5.04E-03
13.170	1.20E-02	1.71E-02	-5.04E-03
13.300	1.160E-02	1.60E-02	-5.19E-03
13.430	9.66E-03	1.50E-02	-5.38E-03
13.570	8.47E-03	1.40E-02	-5.57E-03
13.700	7.37E-03	1.32E-02	-5.76E-03
13.830	6.11E-03	1.23E-02	-6.23E-03
13.970	4.92E-03	1.15E-02	-6.57E-03
14.1	3.74E-03	1.08E-02	-7.03E-03
14.23	2.55E-03	1.01E-02	-7.52E-03
14.37	2.37E-03	9.37E-03	-7.01E-03
14.5	1.16E-03		

October 2006
C4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 93
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1131E-05
 DISPERSIVITY= 0.3791E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1113
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3417E-04

THE F STATISTIC FOR NP= 3 NOBS= 93 IS: 2.72
 THE CRITICAL RSS IS: 0.3726E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.13E-06	1.12E-06	1.14E-06
X(2)	3.79E-03	3.68E-03	3.91E-03
X(5)	1.11E-01	1.10E-01	1.13E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.07E+00	1.00E-03	1.93E-03	-6.31E-04
1.2	3.00E-03	2.74E-03	2.63E-04
1.33E+00	4.00E-03	4.15E-03	-1.53E-04
1.467	6.00E-03	6.87E-03	-1.34E-04
1.60E+00	8.00E-03	7.81E-03	1.86E-04
1.733	1.10E-02	9.96E-03	1.04E-03
1.867	1.30E-02	1.22E-02	7.62E-04
2	1.50E-02	1.45E-02	5.09E-04
2.133	1.70E-02	1.66E-02	3.86E-04
2.267	2.00E-02	2.42E-02	-1.78E-04
2.4	2.00E-02	2.02E-02	-1.59E-04
2.533	2.10E-02	2.15E-02	-4.95E-04
2.667	2.30E-02	2.26E-02	-5.51E-04
2.8	2.30E-02	2.33E-02	-3.31E-04
2.933	2.40E-02	2.39E-02	1.31E-04
3.067	2.40E-02	2.42E-02	-1.96E-04
3.2	2.40E-02	2.43E-02	-3.37E-04
3.333	2.40E-02	2.43E-02	-3.23E-04
3.467	2.40E-02	2.42E-02	-1.78E-04
3.6	2.40E-02	2.39E-02	7.45E-05
3.733	2.40E-02	2.36E-02	4.15E-04
3.867	2.30E-02	2.32E-02	-1.71E-04
4	2.30E-02	2.27E-02	2.97E-04
4.133	2.20E-02	2.22E-02	-1.92E-04
4.267	2.20E-02	2.16E-02	3.57E-04
4.4	2.10E-02	2.11E-02	-7.39E-05
4.533	2.00E-02	2.05E-02	-4.88E-04
4.667	2.00E-02	1.99E-02	1.13E-04
4.8	1.90E-02	1.90E-02	-2.85E-04
4.933	1.80E-02	1.87E-02	-6.82E-04
5.067	1.80E-02	1.81E-02	-7.65E-05
5.2	1.70E-02	1.75E-02	-4.69E-04
5.333	1.60E-02	1.69E-02	-8.94E-04
5.467	1.60E-02	1.63E-02	-3.11E-04
5.6	1.50E-02	1.57E-02	-2.56E-04
5.733	1.50E-02	1.52E-02	-1.90E-04
5.867	1.50E-02	1.46E-02	3.55E-04
6	1.40E-02	1.41E-02	-1.17E-04
6.133	1.40E-02	1.36E-02	3.96E-04
6.267	1.30E-02	1.31E-02	-1.02E-04
6.4	1.20E-02	1.26E-02	-3.81E-04
6.533	1.20E-02	1.22E-02	-1.51E-04
6.667	1.20E-02	1.17E-02	3.06E-04
6.8	1.20E-02	1.13E-02	7.45E-04
6.933	1.10E-02	1.08E-02	1.69E-04
7.067	1.10E-02	1.04E-02	5.81E-04
7.2	1.10E-02	1.00E-02	9.77E-04
7.333	1.00E-02	0.64E-03	3.58E-04
7.467	1.00E-02	9.27E-03	7.29E-04
7.6	1.00E-02	8.92E-03	1.08E-03
7.733	9.00E-03	8.86E-03	4.25E-04
7.867	9.00E-03	8.24E-03	7.56E-04
8	9.00E-03	7.93E-03	1.07E-03
8.133	8.00E-03	7.62E-03	3.78E-04
8.267	8.00E-03	7.33E-03	6.74E-04
8.4	8.00E-03	7.04E-03	9.56E-04
8.533	7.00E-03	6.77E-03	2.28E-04
8.667	7.00E-03	6.51E-03	4.92E-04
8.8	7.00E-03	6.26E-03	7.43E-04
8.933	7.00E-03	6.02E-03	9.85E-04
9.067	6.00E-03	5.78E-03	2.20E-04
9.2	6.00E-03	5.56E-03	4.43E-04
9.333	6.00E-03	5.34E-03	6.58E-04
9.467	6.00E-03	5.13E-03	-1.34E-04
9.6	5.00E-03	4.94E-03	6.50E-05
9.733	5.00E-03	4.74E-03	2.56E-04
9.867	5.00E-03	4.56E-03	4.41E-04
10	4.00E-03	4.38E-03	-3.83E-04
10.13	4.00E-03	4.22E-03	-2.17E-04
10.27	4.00E-03	4.05E-03	-4.57E-05
10.4	4.00E-03	3.89E-03	1.07E-04
10.53	3.00E-03	3.75E-03	-7.46E-04
10.67	3.00E-03	3.59E-03	-5.94E-04
10.8	3.00E-03	3.46E-03	-4.58E-04
10.93	3.00E-03	3.33E-03	-3.27E-04
11.07	2.00E-03	3.19E-03	-1.92E-04
11.2	2.00E-03	3.07E-03	-1.07E-03
11.33	2.00E-03	2.96E-03	-9.56E-04
11.47	2.00E-03	2.84E-03	-9.17E-04
11.6	2.00E-03	2.73E-03	-7.30E-04
11.73	2.00E-03	2.63E-03	-6.27E-04
11.87	2.00E-03	2.52E-03	-5.21E-04
12	1.00E-03	2.43E-03	-1.43E-03
12.13	1.00E-03	2.34E-03	-1.34E-03
12.27	1.00E-03	2.24E-03	-1.24E-03
12.4	1.00E-03	2.16E-03	-1.16E-03
12.53	1.00E-03	2.08E-03	-1.08E-03
12.67	1.00E-03	1.99E-03	-9.92E-04
12.8	1.00E-03	1.92E-03	-9.17E-04
12.93	1.00E-03	1.85E-03	-8.45E-04
13.07	1.00E-03	1.77E-03	-7.71E-04
13.2	1.00E-03	1.71E-03	-7.05E-04
13.33	1.00E-03	1.64E-03	-6.41E-04

C4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 90
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1212E-05
 DISPERSIVITY= 0.3077E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.8911E-01
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3226E-03

THE F STATISTIC FOR NP= 3 NOBS= 90 IS: 2.72
 THE CRITICAL RSS IS: 0.3528E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.21E-06	1.18E-06	1.26E-06
X(2)	3.08E-03	2.58E-03	3.66E-03
X(5)	8.91E-02	8.38E-02	9.45E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.533	1.00E-03	3.53E-05	9.65E-04
1.667	1.00E-03	2.74E-05	9.23E-04
1.800	2.00E-03	1.50E-04	1.85E-03
1.933	3.00E-03	2.66E-04	2.73E-03
2.067	3.00E-03	4.38E-04	2.56E-03
2.200	4.00E-03	6.77E-04	3.32E-03
2.333	4.00E-03	9.93E-04	3.01E-03
2.467	5.00E-03	1.39E-03	3.61E-03
2.600	5.00E-03	1.88E-03	3.12E-03
2.733	6.00E-03	2.45E-03	3.55E-03
2.867	6.00E-03	3.10E-03	2.90E-03
3.000	6.00E-03	3.82E-03	2.18E-03
3.133	7.00E-03	4.59E-03	2.41E-03
3.267	7.00E-03	5.41E-03	1.59E-03
3.400	7.00E-03	6.24E-03	7.59E-04
3.533	8.00E-03	7.09E-03	1.16E-04
3.667	8.00E-03	7.92E-03	7.84E-05
3.800	8.00E-03	8.74E-03	-7.38E-04
3.933	9.00E-03	9.52E-03	-5.23E-04
4.067	9.00E-03	1.03E-02	-1.27E-03
4.200	9.00E-03	1.10E-02	-1.96E-03
4.333	1.00E-02	1.16E-02	-1.61E-03
4.467	1.00E-02	1.22E-02	-2.19E-03
4.600	1.10E-02	1.27E-02	-1.71E-03
4.733	1.10E-02	1.32E-02	-2.17E-03
4.867	1.20E-02	1.36E-02	-1.57E-03
5.000	1.20E-02	1.39E-02	-1.19E-03
5.133	1.30E-02	1.42E-02	-1.18E-03
5.267	1.30E-02	1.44E-02	-1.44E-02
5.400	1.30E-02	1.46E-02	-1.75E-04
5.533	1.40E-02	1.47E-02	-6.75E-04
5.667	1.40E-02	1.47E-02	-1.61E-03
5.800	1.40E-02	1.48E-02	-7.55E-04
5.933	1.50E-02	1.47E-02	2.70E-04
6.067	1.50E-02	1.50E-02	1.34E-04
6.200	1.50E-02	1.46E-02	4.32E-04
6.333	1.50E-02	1.44E-02	5.63E-04
6.467	1.50E-02	1.42E-02	7.25E-04
6.600	1.50E-02	1.41E-02	9.07E-04
6.733	1.50E-02	1.39E-02	1.11E-03
6.867	1.50E-02	1.37E-02	1.44E-03
7.000	1.50E-02	1.34E-02	1.59E-03
7.133	1.50E-02	1.32E-02	1.85E-03
7.267	1.50E-02	1.29E-02	2.12E-03
7.400	1.40E-02	1.26E-02	1.40E-03
7.533	1.40E-02	1.23E-02	1.69E-03
7.667	1.40E-02	1.20E-02	1.99E-03
7.800	1.30E-02	1.17E-02	1.29E-03
7.933	1.30E-02	1.14E-02	1.60E-03
8.067	1.30E-02	1.11E-02	1.91E-03
8.200	1.20E-02	1.08E-02	1.22E-03
8.333	1.20E-02	1.05E-02	1.53E-03
8.467	1.10E-02	1.02E-02	8.36E-04
8.600	1.10E-02	9.86E-03	1.14E-03
8.733	1.00E-02	9.55E-03	4.48E-04
8.867	1.00E-02	9.25E-03	7.49E-04
9.000	9.00E-03	8.95E-03	4.65E-05
9.133	9.00E-03	8.66E-03	3.39E-04
9.267	8.00E-03	8.37E-03	-3.73E-04
9.400	8.00E-03	8.09E-03	-9.00E-05
9.533	8.00E-03	7.81E-03	1.87E-04
9.667	7.00E-03	7.54E-03	-5.42E-04
9.800	7.00E-03	7.28E-03	-2.77E-04
9.933	6.00E-03	7.02E-03	-1.02E-03
10.070	6.00E-03	6.77E-03	-7.65E-04
10.200	6.00E-03	6.52E-03	-5.20E-04
10.330	5.00E-03	6.28E-03	-1.28E-03
10.470	5.00E-03	6.05E-03	-1.05E-03
10.600	4.00E-03	5.82E-03	-1.82E-03
10.730	4.00E-03	5.60E-03	-1.80E-03
10.870	4.00E-03	5.39E-03	-1.39E-03
11.000	3.00E-03	5.18E-03	-2.18E-03
11.130	3.00E-03	4.98E-03	-1.98E-03
11.270	3.00E-03	4.79E-03	-1.79E-03
11.400	3.00E-03	4.60E-03	-1.60E-03
11.530	2.00E-03	4.42E-03	-2.42E-03
11.670	2.00E-03	4.25E-03	-2.25E-03
11.800	2.00E-03	4.08E-03	-2.08E-03
11.930	2.00E-03	3.92E-03	-1.92E-03
12.070	1.00E-03	3.76E-03	-2.76E-03
12.200	1.00E-03	3.61E-03	-2.61E-03
12.330	1.00E-03	3.46E-03	-2.46E-03
12.470	1.00E-03	3.32E-03	-2.32E-03
12.600	1.00E-03	3.18E-03	-2.18E-03
12.730	1.00E-03	3.05E-03	-2.05E-03
12.870	7.00E-03	3.53E-03	3.47E-03
13.000	7.00E-03	3.39E-03	3.61E-03
13.130	7.00E-03	3.25E-03	3.75E-03
13.270	7.00E-03	3.12E-03	3.88E-03
13.400	7.00E-03	2.99E-03	4.01E-03

October 2006
D1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2500E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : 0.5000E-02
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : -2.500
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7552E-06
DISPERSIVITY= 0.2431E-02
WIDTH= 0.1148E-02
RT= 1.0000
CO= 2.500
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.7188E-02

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
THE CRITICAL RSS IS: 0.7924E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.55E-07	7.40E-07	7.70E-07
X(2)	2.43E-03	2.24E-03	2.65E-03
X(3)	1.15E-03	1.11E-03	1.18E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.17E-01	9.66E-04	9.15E-07	6.65E-04
0.9833	1.26E-03	1.41E-05	1.24E-03
1.15E+00	1.69E-03	1.95E-05	1.75E-03
1.317	4.44E-03	4.23E-04	4.02E-03
1.48E+00	7.04E-03	1.28E-03	5.76E-03
1.65	1.62E-02	3.05E-03	8.58E-03
1.817	1.62E-02	0.06E-03	1.02E-02
1.983	2.28E-02	1.05E-02	1.23E-02
2.15	2.94E-02	1.64E-02	1.30E-02
2.317	3.70E-02	2.37E-02	1.33E-02
2.483	4.56E-02	3.20E-02	1.36E-02
2.65	5.32E-02	4.11E-02	1.21E-02
2.817	6.18E-02	5.06E-02	1.12E-02
2.983	6.94E-02	6.03E-02	9.09E-03
3.15	7.60E-02	6.99E-02	6.99E-03
3.317	8.26E-02	7.91E-02	3.3E-03
3.483	8.92E-02	8.78E-02	1.37E-03
3.65	9.47E-02	9.59E-02	-1.11E-03
3.817	1.00E-01	1.03E-01	-2.87E-03
3.983	1.05E-01	1.10E-01	-4.76E-03
4.15	1.09E-01	1.15E-01	-6.86E-03
4.317	1.12E-01	1.20E-01	-8.15E-03
4.483	1.16E-01	1.24E-01	-8.60E-03
4.65	1.19E-01	1.28E-01	-9.21E-03
4.817	1.20E-01	1.30E-01	-1.03E-02
4.983	1.23E-01	1.32E-01	-9.56E-03
5.15	1.24E-01	1.34E-01	-9.21E-03
5.317	1.25E-01	1.34E-01	-9.28E-03
5.483	1.26E-01	1.34E-01	-7.81E-03
5.65	1.27E-01	1.34E-01	-6.87E-03
5.817	1.27E-01	1.33E-01	-5.60E-03
5.983	1.27E-01	1.32E-01	-4.85E-03
6.15	1.27E-01	1.32E-01	-4.09E-03
6.317	1.26E-01	1.29E-01	-2.38E-03
6.483	1.26E-01	1.27E-01	-7.58E-04
6.65	1.26E-01	1.24E-01	-1.09E-03
6.817	1.24E-01	1.22E-01	2.13E-03
6.983	1.23E-01	1.19E-01	3.30E-03
7.15	1.21E-01	1.17E-01	4.62E-03
7.317	1.20E-01	1.14E-01	6.03E-03
7.483	1.18E-01	1.11E-01	7.51E-03
7.65	1.16E-01	1.08E-01	8.06E-03
7.817	1.14E-01	1.05E-01	8.65E-03
7.983	1.11E-01	1.02E-01	9.14E-03
8.15	1.09E-01	9.89E-02	9.76E-03
8.317	1.06E-01	9.59E-02	1.04E-02
8.483	1.04E-01	9.29E-02	1.10E-02
8.65	1.02E-01	9.00E-02	1.16E-02
8.817	9.81E-02	8.70E-02	1.11E-02
8.983	9.47E-02	8.41E-02	1.06E-02
9.15	9.23E-02	8.13E-02	1.10E-02
9.317	8.89E-02	7.84E-02	1.04E-02
9.483	8.55E-02	7.57E-02	9.77E-03
9.65	8.21E-02	7.30E-02	9.06E-03
9.817	7.87E-02	7.04E-02	8.29E-03
9.983	7.63E-02	6.78E-02	8.44E-03
10.15	7.28E-02	6.53E-02	7.53E-03
10.32	6.94E-02	6.28E-02	6.61E-03
10.48	6.60E-02	6.06E-02	5.49E-03
10.65	6.26E-02	5.82E-02	4.41E-03
10.82	5.92E-02	5.59E-02	3.28E-03
10.98	5.58E-02	5.39E-02	1.94E-03
11.15	5.24E-02	5.17E-02	6.78E-04
11.32	4.90E-02	4.97E-02	-6.66E-04
11.48	4.66E-02	4.78E-02	-1.19E-03
11.65	4.32E-02	4.58E-02	-2.67E-03
11.82	3.98E-02	4.40E-02	-4.21E-03
11.98	3.74E-02	4.23E-02	-4.92E-03
12.15	3.40E-02	4.05E-02	-6.59E-03
12.32	3.15E-02	3.89E-02	-7.33E-03
12.48	2.91E-02	3.73E-02	-8.21E-03
12.65	2.67E-02	3.58E-02	-9.06E-03
12.82	2.33E-02	3.43E-02	-1.10E-02
12.98	2.09E-02	3.29E-02	-1.20E-02
13.15	1.85E-02	3.15E-02	-1.30E-02
13.32	1.61E-02	3.02E-02	-1.41E-02
13.48	1.37E-02	2.90E-02	-1.53E-02
13.65	1.13E-02	2.78E-02	-1.65E-02
13.82	9.88E-03	2.66E-02	-1.67E-02
13.98	7.47E-03	2.55E-02	-1.80E-02
14.15	5.06E-03	2.44E-02	-1.93E-02
14.32	3.65E-03	2.34E-02	-1.97E-02
14.48	1.25E-03	2.24E-02	-2.12E-02

D1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
7) THE DISPERSIVITY (M) : 0.3800E-02
8) THE PULSE WIDTH (M) : 0.2000E-03
9) THE RETARDATION FACTOR (DIM) : -1.000
10) THE INJECTION CONCENTRATION (UG/L) : 1.000
11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9294E-06
DISPERSIVITY= 0.166E-02
WIDTH= 0.2000E-03
RT= 1.000
CO= 9.491
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1651E-02

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
THE CRITICAL RSS IS: 0.1794E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.29E-07	9.20E-07	9.39E-07
X(2)	1.37E-03	1.29E-03	1.45E-03
X(5)	9.49E+00	9.30E+00	9.68E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.683	5.87E-04	3.78E-09	5.87E-04
1.817	5.36E-05	2.61E-08	5.36E-05
1.983	-4.80E-04	1.36E-07	-4.80E-04
2.083	-1.01E-03	5.46E-07	-1.01E-03
2.217	-5.46E-04	1.87E-06	-5.46E-04
2.350	-1.06E-03	5.50E-06	-1.06E-03
2.483	-1.61E-03	1.41E-05	-1.61E-03
2.617	-1.15E-03	3.28E-05	-1.15E-03
2.750	-1.68E-03	6.89E-05	-1.68E-03
2.883	-1.21E-03	1.34E-04	-1.35E-03
3.017	-1.75E-03	2.44E-04	-1.99E-03
3.150	-1.28E-03	4.18E-04	-1.70E-03
3.283	-8.12E-04	6.79E-04	-1.49E-03
3.417	-3.45E-04	1.06E-03	-1.40E-03
3.550	1.22E-04	1.58E-03	-1.45E-03
3.683	1.59E-03	2.27E-03	-6.76E-04
3.817	2.06E-03	3.16E-03	-1.10E-03
3.950	3.52E-03	4.27E-03	-7.52E-04
4.083	5.99E-03	5.63E-03	3.56E-04
4.217	7.46E-03	7.27E-03	1.90E-04
4.350	9.92E-03	9.16E-03	7.65E-04
4.483	1.24E-02	1.13E-02	1.07E-03
4.617	1.59E-02	1.38E-02	2.08E-03
4.750	1.93E-02	1.85E-02	1.85E-03
4.883	2.18E-02	1.94E-02	2.38E-03
5.017	2.53E-02	2.26E-02	2.67E-03
5.150	2.87E-02	2.79E-02	2.79E-03
5.283	3.22E-02	2.94E-02	2.76E-03
5.417	3.67E-02	3.31E-02	3.57E-03
5.550	4.01E-02	3.68E-02	3.68E-02
5.683	4.36E-02	4.06E-02	3.03E-03
5.817	4.71E-02	4.44E-02	2.70E-03
5.950	5.15E-02	4.81E-02	4.42E-03
6.083	5.40E-02	5.18E-02	2.21E-03
6.217	5.65E-02	5.54E-02	1.07E-03
6.350	5.89E-02	5.92E-02	3.09E-03
6.483	6.24E-02	6.21E-02	2.53E-04
6.617	6.49E-02	6.53E-02	-4.14E-04
6.750	6.73E-02	6.82E-02	-8.54E-04
6.883	6.98E-02	7.09E-02	-1.08E-03
7.017	7.13E-02	7.33E-02	-2.08E-03
7.150	7.27E-02	7.56E-02	-2.82E-03
7.283	7.42E-02	7.75E-02	-3.31E-03
7.417	7.57E-02	7.92E-02	-3.55E-03
7.550	7.71E-02	8.06E-02	-3.51E-03
7.683	7.86E-02	8.18E-02	-3.22E-03
7.817	7.91E-02	8.27E-02	-3.66E-03
7.950	7.96E-02	8.34E-02	-3.85E-03
8.083	8.00E-02	8.38E-02	-3.81E-03
8.217	8.05E-02	8.40E-02	-3.52E-03
8.350	8.09E-02	8.39E-02	-3.01E-03
8.483	8.04E-02	8.37E-02	-3.29E-03
8.617	8.09E-02	8.32E-02	-2.36E-03
8.750	8.03E-02	8.26E-02	-2.24E-03
8.883	8.08E-02	8.17E-02	-9.51E-04
9.017	8.03E-02	8.08E-02	-4.86E-04
9.150	7.97E-02	7.98E-02	-8.81E-04
9.283	7.82E-02	7.83E-02	-1.42E-04
9.417	7.77E-02	7.69E-02	7.20E-04
9.550	7.71E-02	7.54E-02	1.69E-03
9.683	7.56E-02	7.39E-02	1.75E-03
9.817	7.41E-02	7.22E-02	1.90E-03
9.950	7.35E-02	7.04E-02	3.12E-03
10.083	7.20E-02	6.87E-02	3.35E-03
10.220	7.05E-02	6.67E-02	3.76E-03
10.350	6.89E-02	6.49E-02	4.08E-03
10.480	6.74E-02	6.30E-02	4.43E-03
10.620	6.59E-02	6.09E-02	4.93E-03
10.750	6.43E-02	5.90E-02	5.31E-03
10.880	6.18E-02	5.71E-02	4.69E-03
11.020	6.03E-02	5.51E-02	5.20E-03
11.150	5.87E-02	5.32E-02	5.67E-03
11.280	5.62E-02	5.13E-02	4.92E-03
11.420	5.47E-02	4.93E-02	5.39E-03
11.550	5.21E-02	4.74E-02	4.70E-03
11.680	5.06E-02	4.56E-02	4.97E-03
11.820	4.81E-02	4.37E-02	4.35E-03
11.950	4.65E-02	4.20E-02	4.56E-03
12.080	4.40E-02	4.03E-02	3.73E-03
12.220	4.15E-02	3.86E-02	2.98E-03
12.350	3.99E-02	3.69E-02	2.07E-03
12.480	3.74E-02	3.53E-02	2.11E-03
12.620	3.49E-02	3.36E-02	1.23E-03
12.750	3.23E-02	3.27E-02	-3.74E-04
12.880	2.98E-02	3.07E-02	-9.18E-04
13.020	2.73E-02	2.92E-02	-1.95E-03
13.150	2.47E-02	2.70E-02	-3.15E-03
13.280	2.22E-02	2.66E-02	-4.38E-03
13.420	2.07E-02	2.52E-02	-4.57E-03
13.550	1.81E-02	2.40E-02	-4.51E-03
13.680	1.56E-02	2.29E-02	-7.28E-03
13.820	1.31E-02	2.17E-02	-8.61E-03
13.950	1.05E-02	2.06E-02	-1.01E-02
14.08	9.00E-03	1.96E-02	-1.06E-02
14.22	6.47E-03	1.86E-02	-1.21E-02
14.35	4.36E-03	1.76E-02	-1.37E-02
14.48	1.40E-03	1.67E-02	-1.53E-02

October 2006
D2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.2000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 1.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8981E-06
 DISPERSIVITY= 0.2337E-02
 WIDTH= 0.2000E-03
 RF= 1.000
 CO= 15.57
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.5700E-02

THE F STATISTIC FOR NP= 3 NOBS= 87 IS: 2.72
 THE CRITICAL RSS IS: 0.6255E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.98E-07	8.80E-07	9.16E-07
X(2)	2.34E-03	2.17E-03	2.51E-03
X(5)	1.56E+01	1.51E+01	1.60E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.33E-01	9.27E-04	4.53E-38	9.27E-04
0.3	8.35E-04	2.13E-16	8.35E-04
4.67E-01	7.91E-04	3.53E-10	7.44E-04
0.6333	6.52E-04	2.88E-07	6.52E-04
8.00E-01	1.56E-03	1.29E-05	1.55E-03
0.9667	2.47E-03	1.43E-04	2.33E-03
1.133	4.38E-03	7.32E-04	3.65E-03
1.3	8.29E-03	2.36E-03	5.93E-03
1.467	1.32E-02	5.61E-03	7.58E-03
1.633	2.11E-02	1.09E-02	1.02E-02
1.8	3.00E-02	1.83E-02	1.18E-02
1.967	3.99E-02	2.75E-02	1.24E-02
2.133	5.08E-02	3.82E-02	1.27E-02
2.3	6.17E-02	4.98E-02	1.19E-02
2.467	7.27E-02	6.19E-02	1.08E-02
2.633	8.16E-02	7.39E-02	7.63E-03
2.8	9.05E-02	8.56E-02	4.91E-03
2.967	9.84E-02	9.64E-02	1.93E-03
3.133	1.05E-01	1.06E-01	-1.11E-03
3.3	1.12E-01	1.15E-01	-3.06E-03
3.467	1.17E-01	1.23E-01	-5.84E-03
3.633	1.22E-01	1.29E-01	-7.44E-03
3.8	1.26E-01	1.35E-01	-8.84E-03
3.967	1.29E-01	1.39E-01	-1.01E-02
4.133	1.32E-01	1.42E-01	-1.03E-02
4.3	1.34E-01	1.44E-01	-1.05E-02
4.467	1.36E-01	1.46E-01	-9.79E-03
4.633	1.37E-01	1.46E-01	-9.25E-03
4.8	1.37E-01	1.45E-01	-7.99E-03
4.967	1.37E-01	1.44E-01	-7.06E-03
5.133	1.37E-01	1.43E-01	-5.57E-03
5.3	1.37E-01	1.41E-01	-3.58E-03
5.467	1.36E-01	1.38E-01	-2.18E-03
5.633	1.35E-01	1.35E-01	-4.25E-04
5.8	1.34E-01	1.32E-01	1.61E-03
5.967	1.32E-01	1.29E-01	2.89E-03
6.133	1.30E-01	1.25E-01	4.36E-03
6.3	1.28E-01	1.22E-01	5.97E-03
6.467	1.26E-01	1.18E-01	7.68E-03
6.633	1.22E-01	1.14E-01	8.46E-03
6.8	1.19E-01	1.09E-01	9.36E-03
6.967	1.16E-01	1.06E-01	1.01E-02
7.133	1.13E-01	1.02E-01	1.09E-02
7.3	1.09E-01	9.83E-02	1.07E-02
7.467	1.06E-01	9.44E-02	1.15E-02
7.633	1.02E-01	9.06E-02	1.12E-02
7.8	9.77E-02	8.69E-02	1.08E-02
7.967	9.36E-02	8.33E-02	1.03E-02
8.133	8.95E-02	7.97E-02	9.79E-03
8.3	8.54E-02	7.63E-02	9.15E-03
8.467	8.14E-02	7.29E-02	8.41E-03
8.633	7.73E-02	6.97E-02	7.57E-03
8.8	7.32E-02	6.65E-02	6.63E-03
8.967	6.91E-02	6.35E-02	5.58E-03
9.133	6.50E-02	6.06E-02	4.42E-03
9.3	6.09E-02	5.77E-02	3.15E-03
9.467	5.78E-02	5.50E-02	2.78E-03
9.633	5.37E-02	5.24E-02	1.30E-03
9.8	4.96E-02	4.99E-02	-2.79E-04
9.967	4.65E-02	4.75E-02	-9.62E-04
10.13	4.34E-02	4.52E-02	-1.75E-03
10.3	4.03E-02	4.30E-02	-2.63E-03
10.47	3.73E-02	4.09E-02	-3.60E-03
10.63	3.42E-02	3.88E-02	-4.67E-03
10.8	3.11E-02	3.69E-02	-5.83E-03
10.97	2.90E-02	3.51E-02	-6.07E-03
11.13	2.69E-02	3.33E-02	-6.40E-03
11.3	2.38E-02	3.16E-02	-7.81E-03
11.47	2.17E-02	2.97E-02	-8.30E-03
11.63	1.96E-02	2.85E-02	-8.87E-03
11.8	1.85E-02	2.70E-02	-8.50E-03
11.97	1.64E-02	2.64E-02	-9.29E-03
12.13	1.43E-02	2.43E-02	-9.98E-03
12.3	1.33E-02	2.31E-02	-9.81E-03
12.47	1.22E-02	2.20E-02	-9.71E-03
12.63	1.01E-02	2.07E-02	-1.07E-02
12.8	8.97E-03	1.97E-02	-1.07E-02
12.97	7.88E-03	1.86E-02	-1.07E-02
13.13	6.79E-03	1.77E-02	-1.09E-02
13.3	5.70E-03	1.67E-02	-1.10E-02
13.47	4.60E-03	1.58E-02	-1.12E-02
13.63	3.51E-03	1.50E-02	-1.15E-02
13.8	2.42E-03	1.42E-02	-1.18E-02
13.97	2.33E-03	1.35E-02	-1.11E-02
14.13	1.24E-03	1.28E-02	-1.15E-02
14.3	1.47E-04	1.21E-02	-1.19E-02
14.47	5.49E-05	1.14E-02	-1.14E-02

D2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 81
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.2000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 2.500
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1054E-05
 DISPERSIVITY= 0.1473E-02
 WIDTH= 0.2000E-03
 RF= 1.000
 CO= 13.38
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2033E-02

THE F STATISTIC FOR NP= 3 NOBS= 81 IS: 2.73
 THE CRITICAL RSS IS: 0.2247E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.05E-06	1.04E-06	1.07E-06
X(2)	1.47E-02	1.40E-03	1.65E-03
X(5)	1.34E+01	1.31E+01	1.37E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.033	8.09E-04	2.12E-03	-1.32E-03
3.167	2.56E-03	3.22E-03	-6.52E-04
3.300	4.32E-03	4.67E-03	-3.48E-04
3.433	6.07E-03	6.52E-03	-4.52E-04
3.567	8.83E-03	8.83E-03	-3.48E-06
3.700	1.16E-02	1.16E-02	-2.37E-05
3.833	1.53E-02	1.49E-02	4.76E-04
3.967	2.01E-02	1.86E-02	1.50E-03
4.100	2.48E-02	2.28E-02	2.07E-03
4.233	2.96E-02	2.74E-02	2.22E-03
4.367	3.54E-02	3.23E-02	3.01E-03
4.500	4.11E-02	3.76E-02	3.48E-03
4.633	4.69E-02	4.32E-02	3.71E-03
4.767	5.26E-02	4.89E-02	3.76E-03
4.900	5.84E-02	5.47E-02	3.71E-03
5.033	6.41E-02	6.05E-02	3.64E-03
5.167	6.99E-02	6.63E-02	3.62E-03
5.300	7.46E-02	7.19E-02	2.72E-03
5.433	7.94E-02	7.74E-02	2.00E-03
5.567	8.41E-02	8.26E-02	1.51E-03
5.700	8.79E-02	8.78E-02	3.25E-04
5.833	9.16E-02	9.22E-02	-5.28E-04
5.967	9.54E-02	9.64E-02	-1.01E-03
6.100	9.92E-02	1.00E-01	-1.44E-03
6.233	1.01E-01	1.04E-01	-2.75E-03
6.367	1.04E-01	1.07E-01	-2.97E-03
6.500	1.07E-01	1.09E-01	-3.75E-03
6.633	1.07E-01	1.11E-01	-4.07E-03
6.767	1.08E-01	1.13E-01	-4.97E-03
6.900	1.09E-01	1.14E-01	-5.42E-03
7.033	1.10E-01	1.15E-01	-4.45E-03
7.167	1.11E-01	1.15E-01	-4.09E-03
7.300	1.11E-01	1.15E-01	-4.33E-03
7.433	1.11E-01	1.15E-01	-4.21E-03
7.567	1.10E-01	1.14E-01	-3.75E-03
7.700	1.10E-01	1.13E-01	-2.97E-03
7.833	1.10E-01	1.13E-01	-1.91E-03
7.967	1.09E-01	1.10E-01	-1.55E-03
8.100	1.08E-01	1.09E-01	-1.00E-03
8.233	1.06E-01	1.06E-01	-2.23E-04
8.367	1.05E-01	1.04E-01	7.56E-04
8.500	1.04E-01	1.02E-01	1.89E-03
8.633	1.02E-01	9.93E-02	2.16E-03
8.767	9.92E-02	9.67E-02	2.56E-03
8.900	9.70E-02	9.39E-02	3.05E-03
9.033	9.57E-02	9.11E-02	4.62E-03
9.167	9.25E-02	8.82E-02	4.26E-03
9.300	9.02E-02	8.53E-02	4.93E-03
9.433	8.80E-02	8.24E-02	5.62E-03
9.567	8.48E-02	7.94E-02	5.33E-03
9.700	8.25E-02	7.65E-02	6.03E-03
9.833	7.93E-02	7.35E-02	5.72E-03
9.967	7.70E-02	7.06E-02	6.39E-03
10.100	7.38E-02	6.77E-02	6.02E-03
10.233	7.05E-02	6.49E-02	5.60E-03
10.370	6.83E-02	6.21E-02	6.16E-03
10.500	6.50E-02	5.94E-02	5.63E-03
10.633	6.18E-02	5.67E-02	5.04E-03
10.770	5.85E-02	5.41E-02	4.41E-03
10.900	5.53E-02	5.16E-02	3.68E-03
11.033	5.21E-02	4.92E-02	2.88E-03
11.170	4.98E-02	4.68E-02	3.03E-03
11.300	4.66E-02	4.45E-02	2.07E-03
11.433	4.33E-02	4.23E-02	1.04E-03
11.570	4.01E-02	4.01E-02	-5.25E-05
11.700	3.78E-02	3.81E-02	-2.43E-04
11.833	3.46E-02	3.61E-02	-1.51E-03
11.970	3.23E-02	3.42E-02	-1.85E-03
12.100	2.99E-02	3.07E-02	-2.48E-03
12.233	2.68E-02	3.06E-02	-3.78E-03
12.370	2.36E-02	2.89E-02	-5.35E-03
12.500	2.13E-02	2.80E-02	-3.01E-03
12.633	1.91E-02	2.58E-02	-6.74E-03
12.770	1.69E-02	2.44E-02	-7.52E-03
12.900	1.36E-02	2.30E-02	-9.39E-03
13.033	1.14E-02	2.17E-02	-1.03E-02
13.170	9.11E-03	2.04E-02	-1.13E-02
13.300	6.86E-03	1.92E-02	-1.24E-02
13.433	5.62E-03	1.81E-02	-1.25E-02
13.570	3.37E-03	1.70E-02	-1.37E-02
13.700	1.12E-03	1.60E-02	-1.49E-02

October 2006
D3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : 0.1000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -2.500
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9086E-06
 DISPERSIVITY= 0.1525E-02
 WIDTH= 0.9355E-03
 RT= 1.000
 CO= 2.500
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2385E-02

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
 THE CRITICAL RSS IS: 0.2626E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.09E-07	9.00E-07	9.18E-07
X(2)	1.93E-03	1.81E-03	2.04E-03
X(3)	9.36E-04	9.17E-04	9.54E-04

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
6.83E-01	9.81E-04	3.18E-08	9.81E-04
0.85	9.57E-04	1.68E-06	9.55E-04
1.02E+00	2.45E-03	2.31E-03	1.91E-03
1.183	2.91E-03	1.62E-04	2.75E-03
1.35E+00	4.89E-03	6.61E-04	4.23E-03
5.17	7.63E-03	1.91E-03	5.95E-03
1.683	1.18E-02	4.33E-03	7.51E-03
1.85	1.68E-02	8.26E-03	8.55E-03
2.017	2.38E-02	1.38E-02	9.97E-03
2.183	3.08E-02	2.09E-02	9.91E-03
2.35	3.87E-02	2.92E-02	9.52E-03
2.517	4.87E-02	3.85E-02	8.25E-04
2.683	5.47E-02	4.82E-02	6.49E-03
2.85	6.27E-02	5.81E-02	4.56E-03
3.017	7.07E-02	6.78E-02	2.86E-03
3.183	7.69E-02	7.69E-02	7.01E-04
3.35	8.46E-02	8.54E-02	-7.77E-04
3.517	9.36E-02	9.30E-02	-3.38E-03
3.683	9.46E-02	9.95E-02	-4.98E-03
3.85	9.95E-02	1.05E-01	-5.59E-03
4.017	1.04E-01	1.10E-01	-6.18E-03
4.183	1.07E-01	1.13E-01	-6.71E-03
4.35	1.09E-01	1.16E-01	-7.31E-03
4.517	1.10E-01	1.18E-01	-7.12E-03
4.683	1.12E-01	1.18E-01	-5.99E-03
4.85	1.13E-01	1.19E-01	-5.12E-03
5.017	1.14E-01	1.18E-01	-4.58E-03
5.183	1.13E-01	1.17E-01	-3.56E-03
5.35	1.13E-01	1.15E-01	-1.93E-03
5.517	1.13E-01	1.13E-01	-6.55E-04
5.683	1.11E-01	1.11E-01	5.74E-04
5.85	1.10E-01	1.08E-01	2.22E-03
6.017	1.08E-01	1.05E-01	3.28E-03
6.183	1.06E-01	1.02E-01	4.40E-03
6.35	1.03E-01	9.85E-02	4.74E-03
6.517	1.00E-01	9.00E-02	5.19E-03
6.683	9.81E-02	9.15E-02	6.61E-03
6.85	9.41E-02	8.80E-02	6.15E-03
7.017	9.11E-02	8.44E-02	6.70E-03
7.183	8.81E-02	8.09E-02	7.20E-03
7.35	8.40E-02	7.73E-02	6.71E-03
7.517	8.10E-02	7.39E-02	7.15E-03
7.683	7.70E-02	7.05E-02	6.52E-03
7.85	7.30E-02	6.71E-02	5.83E-03
8.017	6.89E-02	6.39E-02	5.04E-03
8.183	6.59E-02	6.08E-02	5.15E-03
8.35	6.19E-02	5.77E-02	4.19E-03
8.517	5.89E-02	5.48E-02	4.10E-03
8.683	5.48E-02	5.19E-02	2.91E-03
8.85	5.18E-02	4.92E-02	2.61E-03
9.017	4.78E-02	4.66E-02	1.21E-03
9.183	4.48E-02	4.41E-02	6.86E-04
9.35	4.17E-02	4.17E-02	5.99E-05
9.517	3.87E-02	3.94E-02	-6.63E-04
9.683	3.57E-02	3.72E-02	-1.52E-03
9.85	3.37E-02	3.51E-02	-1.45E-03
10.02	3.07E-02	3.31E-02	-2.44E-03
10.18	2.86E-02	3.13E-02	-2.66E-03
10.35	2.66E-02	2.95E-02	-2.85E-03
10.52	2.36E-02	2.77E-02	-4.14E-03
10.68	2.16E-02	2.62E-02	-4.62E-03
10.85	2.05E-02	2.46E-02	-4.08E-03
11.02	1.85E-02	2.31E-02	-4.62E-03
11.18	1.65E-02	2.18E-02	-5.34E-03
11.35	1.55E-02	2.05E-02	-5.04E-03
11.52	1.34E-02	1.93E-02	-5.82E-03
11.68	1.24E-02	1.81E-02	-5.73E-03
11.85	1.14E-02	1.70E-02	-5.63E-03
12.02	1.04E-02	1.60E-02	-5.61E-03
12.18	9.34E-03	1.50E-02	-5.70E-03
12.35	8.31E-03	1.41E-02	-5.79E-03
12.52	7.29E-03	1.32E-02	-5.94E-03
12.68	6.27E-03	1.25E-02	-6.18E-03
12.85	5.24E-03	1.17E-02	-6.42E-03
13.02	4.22E-03	1.09E-02	-6.71E-03
13.18	4.20E-03	1.03E-02	-6.09E-03
13.35	3.17E-03	9.63E-03	-6.46E-03
13.52	3.15E-03	9.05E-03	-6.87E-03
13.68	2.12E-03	8.48E-03	-6.36E-03
13.85	1.10E-03	7.94E-03	-6.84E-03
14.02	1.08E-03	7.43E-03	-6.33E-03
14.18	1.05E-03	6.99E-03	-5.93E-03
14.35	2.86E-06	6.54E-03	-6.51E-03
14.52	4.76E-06	6.12E-03	-6.11E-03

D3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : 0.1000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 2.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9851E-06
 DISPERSIVITY= 0.1226E-02
 WIDTH= 0.1000E-03
 RT= 1.000
 CO= 22.00
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1221E-02

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
 THE CRITICAL RSS IS: 0.1327E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.85E-07	9.85E-07	9.85E-07
X(2)	1.23E-03	1.18E-03	1.28E-03
X(5)	2.20E+01	2.18E+01	2.22E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.650	6.89E-04	1.90E-09	6.89E-04
1.783	6.95E-04	1.51E-08	6.95E-04
1.917	5.21E-04	8.92E-08	5.20E-04
2.050	3.46E-04	4.01E-07	3.46E-04
2.183	1.72E-04	1.49E-06	1.70E-04
2.317	2.43E-03	1.91E-06	-7.37E-06
2.450	8.23E-04	4.72E-04	4.80E-04
2.583	6.49E-04	3.16E-05	6.17E-04
2.717	4.74E-04	6.99E-05	4.05E-04
2.850	3.00E-04	1.42E-04	1.58E-04
2.983	1.13E-03	2.67E-04	8.59E-04
3.117	9.51E-04	4.72E-04	4.80E-04
3.250	1.78E-03	7.88E-04	8.99E-04
3.383	1.60E-03	1.25E-03	3.50E-04
3.517	6.91E-03	5.42E-03	1.49E-03
3.650	3.25E-03	2.79E-03	4.61E-04
3.783	5.08E-03	3.95E-03	1.13E-03
3.917	1.34E-02	1.20E-02	1.43E-03
4.050	8.73E-03	7.23E-03	1.50E-03
4.183	1.06E-02	9.40E-03	1.15E-03
4.317	1.34E-02	1.20E-02	1.43E-03
4.450	1.72E-02	1.49E-02	2.32E-03
4.583	2.00E-02	1.82E-02	1.84E-03
4.717	2.39E-02	2.19E-02	2.69E-03
4.850	2.87E-02	2.59E-02	2.83E-03
4.983	3.25E-02	3.01E-02	2.37E-03
5.117	3.73E-02	3.47E-02	3.26E-03
5.250	4.22E-02	3.94E-02	2.77E-03
5.383	4.70E-02	4.43E-02	2.73E-03
5.517	5.17E-02	4.92E-02	2.51E-03
5.650	5.66E-02	5.42E-02	2.47E-03
5.783	6.15E-02	5.91E-02	2.36E-03
5.917	6.63E-02	6.40E-02	2.34E-03
6.050	6.91E-02	6.87E-02	4.66E-04
6.183	7.39E-02	7.32E-02	7.85E-04
6.317	7.87E-02	7.74E-02	-7.63E-04
6.450	8.06E-02	8.14E-02	-8.35E-04
6.583	8.34E-02	8.51E-02	-1.70E-03
6.717	8.52E-02	8.88E-02	-2.24E-03
6.850	8.91E-02	9.15E-02	-2.41E-03
6.983	9.19E-02	9.41E-02	-2.22E-03
7.117	9.47E-02	9.64E-02	-2.66E-03
7.250	9.46E-02	9.83E-02	-3.71E-03
7.383	9.64E-02	9.99E-02	-3.38E-03
7.517	9.72E-02	1.01E-01	-3.67E-03
7.650	9.80E-02	1.02E-01	-3.59E-03
7.783	9.89E-02	1.02E-01	-3.16E-03
7.917	9.87E-02	1.02E-01	-3.38E-03
8.050	9.95E-02	1.02E-01	-2.28E-03
8.183	9.93E-02	1.01E-01	-1.88E-03
8.317	9.82E-02	1.00E-01	-2.18E-03
8.450	9.80E-02	9.92E-02	-1.23E-03
8.583	9.68E-02	9.78E-02	-1.03E-03
8.717	9.56E-02	9.62E-02	-6.09E-04
8.850	9.45E-02	9.45E-02	7.27E-06
8.983	9.33E-02	9.25E-02	7.98E-04
9.117	9.21E-02	9.04E-02	1.75E-03
9.250	8.99E-02	8.81E-02	1.83E-03
9.383	8.78E-02	8.57E-02	2.02E-03
9.517	8.56E-02	8.33E-02	2.30E-03
9.650	8.34E-02	8.08E-02	2.66E-03
9.783	8.22E-02	7.82E-02	4.08E-03
9.917	7.91E-02	7.55E-02	3.54E-03
10.050	7.69E-02	7.29E-02	4.02E-03
10.180	7.47E-02	7.02E-02	4.52E-03
10.320	7.15E-02	6.75E-02	4.03E-03
10.450	6.94E-02	6.49E-02	4.51E-03
10.580	6.72E-02	6.22E-02	4.97E-03
10.720	6.40E-02	5.95E-02	4.42E-03
10.850	6.18E-02	5.70E-02	4.81E-03
10.980	5.87E-02	5.45E-02	4.16E-03
11.120	5.65E-02	5.20E-02	3.47E-03
11.250	5.33E-02	4.96E-02	3.71E-03
11.380	5.01E-02	4.73E-02	2.88E-03
11.520	4.80E-02	4.50E-02	3.01E-03
11.650	4.48E-02	4.27E-02	2.05E-03
11.780	4.26E-02	4.06E-02	2.02E-03
11.920	3.94E-02	3.84E-02	9.37E-04
12.050	3.73E-02	3.65E-02	7.61E-04
12.180	3.51E-02	3.46E-02	5.12E-04
12.320	3.19E-02	3.27E-02	-7.98E-04
12.450	2.98E-02	3.09E-02	-1.20E-03
12.580	2.76E-02	2.92E-02	-1.67E-03
12.720	2.74E-02	2.74E-02	-2.20E-03
12.850	2.32E-02	2.60E-02	-2.82E-03
12.980	2.11E-02	2.46E-02	-3.51E-03
13.120	1.89E-02	2.31E-02	-4.26E-03
13.250	1.67E-02	2.18E-02	-5.08E-03
13.380	1.45E-02	2.05E-02	-5.97E-03
13.520	1.24E-02	1.93E-02	-6.78E-03
13.650	1.12E-02	1.81E-02	-6.93E-03
13.780	9.00E-03	1.70E-02	-8.01E-03
13.920	7.80E-03	1.60E-02	-8.14E-03
14.05	5.65E-03	1.50E-02	-9.33E-03
14.18	4.48E-03	1.41E-02	-9.57E-03
14.32	2.31E-03	1.32E-02	-1.01E-02
14.45	1.13E-03	1.23E-02	-1.12E-02

October 2006
D4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 97
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 2.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1349E-05
 DISPERSIVITY= 0.2632E-02
 WIDTH= 0.1000E-03
 RF= 1.000
 CO= 5.428
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9205E-04

THE F STATISTIC FOR NP= 3 NOBS= 97 IS: 2.71
 THE CRITICAL RSS IS: 0.1000E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.35E-06	1.34E-06	1.36E-06
X(2)	2.83E-03	2.69E-03	2.97E-03
X(5)	5.43E+00	5.32E+00	5.54E+00

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
8.83E-01	9.84E-04	8.31E-04	1.53E-04
1.017	1.96E-03	1.90E-03	6.19E-05
1.15E+00	2.84E-03	3.98E-03	-5.32E-04
1.283	4.92E-03	6.46E-03	-5.34E-04
1.42E+00	6.90E-03	7.70E-03	-8.01E-04
1.55	9.60E-03	1.01E-02	-1.73E-04
1.683	1.19E-02	1.24E-02	-5.18E-04
1.817	1.38E-02	1.46E-02	-7.35E-04
1.95	1.58E-02	1.65E-02	-7.47E-04
2.083	1.78E-02	1.83E-02	-5.14E-04
2.217	1.98E-02	1.98E-02	-1.55E-05
2.35	2.08E-02	2.10E-02	-2.45E-04
2.483	1.7E-02	2.20E-02	-2.14E-04
2.617	2.27E-02	2.27E-02	6.27E-05
2.75	2.37E-02	2.31E-02	5.66E-04
2.883	2.37E-02	2.34E-02	2.71E-04
3.017	2.47E-02	2.35E-02	1.16E-03
3.15	2.46E-02	2.34E-02	1.20E-03
3.283	2.46E-02	2.32E-02	1.37E-03
3.417	2.36E-02	2.29E-02	6.57E-04
3.55	2.36E-02	2.25E-02	1.04E-03
3.683	2.36E-02	2.21E-02	1.50E-03
3.817	2.25E-02	2.15E-02	1.02E-03
3.95	6.01E-03	7.03E-03	-5.92E-04
4.083	2.05E-02	2.03E-02	2.01E-04
4.217	2.05E-02	1.96E-02	8.38E-04
4.35	1.85E-02	1.89E-02	-4.85E-04
4.483	1.84E-02	1.83E-02	1.61E-04
4.617	1.74E-02	1.76E-02	-1.67E-04
4.75	1.64E-02	1.69E-02	-4.64E-04
4.883	1.54E-02	1.62E-02	-8.27E-04
5.017	1.43E-02	1.55E-02	-1.17E-03
5.15	1.33E-02	1.48E-02	-1.52E-03
5.283	1.33E-02	1.42E-02	-8.87E-04
5.417	1.23E-02	1.36E-02	-1.27E-03
5.55	1.23E-02	1.39E-02	-1.67E-03
5.683	1.02E-02	1.23E-02	-2.09E-03
5.817	1.02E-02	1.17E-02	-1.53E-03
5.95	9.20E-03	1.12E-02	-2.04E-03
6.083	9.18E-03	1.06E-02	-1.46E-03
6.217	9.16E-03	1.01E-02	-9.59E-04
6.35	8.14E-03	9.62E-03	-1.48E-03
6.483	8.12E-03	9.14E-03	-1.02E-03
6.617	7.10E-03	8.67E-03	-1.58E-03
6.75	7.08E-03	8.23E-03	-1.16E-03
6.883	7.05E-03	7.81E-03	-7.58E-04
7.017	7.03E-03	7.41E-03	-3.76E-04
7.15	6.01E-03	7.03E-03	-1.01E-03
7.283	5.99E-03	6.66E-03	-6.67E-04
7.417	5.97E-03	6.31E-03	-3.38E-04
7.55	5.95E-03	5.98E-03	-2.69E-05
7.683	5.93E-03	5.66E-03	2.69E-04
7.817	5.91E-03	5.36E-03	5.49E-04
7.95	5.89E-03	5.08E-03	8.14E-04
8.083	5.87E-03	4.80E-03	1.06E-03
8.217	4.85E-03	4.55E-03	3.02E-04
8.35	4.83E-03	4.30E-03	5.26E-04
8.483	4.81E-03	4.07E-03	7.37E-04
8.617	4.79E-03	3.85E-03	9.37E-04
8.75	4.77E-03	3.64E-03	1.13E-03
8.883	4.74E-03	3.44E-03	1.30E-03
9.017	4.72E-03	3.25E-03	1.47E-03
9.15	4.70E-03	3.08E-03	1.63E-03
9.283	3.68E-03	2.91E-03	7.74E-04
9.417	3.66E-03	2.75E-03	9.13E-04
9.55	3.64E-03	2.60E-03	1.04E-03
9.683	3.62E-03	2.46E-03	1.17E-03
9.817	3.60E-03	2.32E-03	1.28E-03
9.95	3.58E-03	2.19E-03	1.39E-03
10.08	3.56E-03	2.07E-03	1.49E-03
10.22	3.54E-03	1.96E-03	1.58E-03
10.35	3.52E-03	1.85E-03	1.67E-03
10.48	3.50E-03	1.75E-03	1.75E-03
10.62	2.48E-03	1.65E-03	8.27E-04
10.75	2.46E-03	1.56E-03	8.98E-04
10.88	2.43E-03	1.47E-03	9.64E-04
11.02	2.41E-03	1.39E-03	1.03E-03
11.15	2.39E-03	1.31E-03	1.09E-03
11.28	2.37E-03	1.24E-03	1.13E-03
11.42	2.35E-03	1.17E-03	1.18E-03
11.55	2.33E-03	1.10E-03	1.23E-03
11.68	2.31E-03	1.04E-03	1.27E-03
11.82	2.29E-03	9.84E-04	1.31E-03
11.95	2.27E-03	9.29E-04	1.34E-03
12.08	1.25E-03	8.77E-04	3.71E-04
12.22	1.23E-03	8.28E-04	4.00E-04
12.35	1.21E-03	7.82E-04	4.25E-04
12.48	1.19E-03	7.38E-04	4.48E-04
12.62	1.17E-03	6.96E-04	4.69E-04
12.75	1.15E-03	6.58E-04	4.87E-04
12.88	1.12E-03	6.21E-04	5.03E-04
13.02	1.10E-03	5.86E-04	5.18E-04
13.15	1.08E-03	5.53E-04	5.30E-04
13.28	1.06E-03	5.22E-04	5.40E-04
13.42	1.04E-03	4.93E-04	5.49E-04
13.55	1.02E-03	4.65E-04	5.56E-04
13.68	5.95E-13	4.39E-04	-4.39E-04

D4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60): 87
 2) THE NUMBER OF PARAMETERS TO DETERMINE: 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...): 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC): 1.00E-10
 5) THE DISTANCE FROM SOURCE (M): 3.05E-02

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC): 2.45E-06
 7) THE DISPERSIVITY (M): 3.80E-03
 8) THE PULSEWIDTH (M): -8.00E-03
 9) THE RETARDATION FACTOR (DIM): -1
 10) THE INJECTION CONCENTRATION (UG/L): 2
 11) FIRST ORDER DECAY CONSTANT (/SEC): 0.00E+00
 12) TYPE OF WEIGHTING: N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 1.53E-06
 DISPERSIVITY= 2.24E-03
 WIDTH= 8.00E-03
 RF= 1
 CO= 6.89E-02
 LAMBDA= 1

RESIDUAL SUM OF SQUARES = 3.17E-05

THE F STATIS1 FOR NP= 3 N87 IS: 2.72
 THE CRITICAL RSS IS: 3.48E-05

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.53E-06	1.53E-06	1.53E-06
X(2)	2.24E-03	2.15E-03	2.33E-03
X(5)	6.89E-02	6.82E-02	6.96E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.383	9.82E-04	4.92E-05	9.33E-04
1.517	9.59E-04	1.18E-04	8.41E-04
1.65	9.36E-04	2.44E-04	6.92E-04
1.783	1.91E-03	4.51E-04	1.46E-03
1.917	1.89E-03	7.63E-04	1.13E-03
2.05	2.87E-03	1.20E-03	1.67E-03
2.183	2.85E-03	1.78E-03	1.07E-03
2.317	3.82E-03	2.51E-03	1.31E-03
2.45	4.80E-03	3.40E-03	1.40E-03
2.583	5.78E-03	4.44E-03	1.33E-03
2.717	5.75E-03	5.64E-03	1.18E-04
2.85	6.73E-03	6.95E-03	-2.21E-04
2.983	8.71E-03	8.36E-03	3.44E-04
3.117	9.68E-03	9.84E-03	-1.53E-04
3.25	1.07E-02	1.13E-02	-6.71E-04
3.383	1.07E-02	1.26E-02	-1.70E-04
3.517	1.36E-02	1.42E-02	-6.14E-04
3.65	1.48E-02	1.58E-02	-9.69E-04
3.783	1.56E-02	1.68E-02	-1.21E-03
3.917	1.76E-02	1.79E-02	-3.15E-04
4.05	1.85E-02	1.88E-02	-2.71E-04
4.183	1.95E-02	1.95E-02	-6.95E-05
4.317	1.95E-02	2.02E-02	-7.09E-04
4.45	2.05E-02	2.07E-02	-1.67E-04
4.583	2.14E-02	2.10E-02	4.78E-04
4.717	2.14E-02	2.11E-02	2.91E-04
4.85	2.14E-02	2.11E-02	2.37E-04
4.983	2.14E-02	2.11E-02	3.06E-04
5.117	2.13E-02	2.09E-02	4.82E-04
5.25	2.13E-02	2.15E-02	-1.55E-04
5.383	2.03E-02	2.02E-02	1.12E-04
5.517	2.03E-02	1.97E-02	5.41E-04
5.65	2.03E-02	1.92E-02	1.02E-03
5.783	1.92E-02	1.87E-02	5.67E-04
5.917	1.82E-02	1.81E-02	1.45E-04
6.05	1.82E-02	1.74E-02	7.57E-04
6.183	1.72E-02	1.68E-02	3.82E-04
6.317	1.61E-02	1.61E-02	2.67E-05
6.45	1.61E-02	1.54E-02	7.21E-04
6.583	1.51E-02	1.48E-02	3.34E-04
6.717	1.41E-02	1.41E-02	-1.36E-05
6.85	1.30E-02	1.34E-02	-3.69E-04
6.983	1.20E-02	1.28E-02	-7.34E-04
7.117	1.20E-02	1.21E-02	-1.13E-04
7.25	1.10E-02	1.15E-02	-5.07E-04
7.383	9.95E-03	1.09E-02	-9.20E-04
7.517	9.93E-03	1.03E-02	-3.52E-04
7.65	8.91E-03	9.71E-03	-8.04E-04
7.783	8.88E-03	9.16E-03	-2.78E-04
7.917	7.86E-03	8.63E-03	-7.74E-04
8.05	7.84E-03	8.13E-03	-2.92E-04
8.183	6.81E-03	7.65E-03	-8.33E-04
8.317	6.79E-03	7.19E-03	-3.96E-04
8.45	6.77E-03	6.75E-03	1.86E-05
8.583	5.75E-03	6.33E-03	-5.89E-04
8.717	5.72E-03	5.94E-03	-2.17E-04
8.85	5.70E-03	5.57E-03	1.34E-04
8.983	4.68E-03	5.21E-03	-5.35E-04
9.117	4.65E-03	4.88E-03	-2.24E-04
9.25	4.63E-03	4.58E-03	6.90E-05
9.383	4.61E-03	4.46E-03	3.44E-04
9.517	4.58E-03	3.98E-03	6.01E-04
9.65	3.56E-03	3.72E-03	-1.59E-04
9.783	3.54E-03	3.47E-03	6.62E-05
9.917	3.52E-03	3.24E-03	2.76E-04
10.05	3.49E-03	3.02E-03	4.72E-04
10.183	3.47E-03	2.82E-03	6.53E-04
10.32	3.45E-03	2.62E-03	8.23E-04
10.45	2.42E-03	2.44E-03	-2.06E-05
10.58	2.40E-03	2.28E-03	1.24E-04
10.72	2.38E-03	2.12E-03	2.60E-04
10.85	2.36E-03	1.97E-03	3.84E-04
10.98	2.33E-03	1.83E-03	4.98E-04
11.12	2.31E-03	1.71E-03	6.04E-04
11.25	2.29E-03	1.59E-03	7.01E-04
11.38	1.26E-03	1.47E-03	-2.11E-04
11.52	1.24E-03	1.37E-03	-1.29E-04
11.65	1.22E-03	1.27E-03	-5.48E-05
11.78	1.20E-03	1.18E-03	1.27E-05
11.92	1.17E-03	1.10E-03	7.46E-05
12.05	1.15E-03	1.05E-03	2.68E-04
12.18	1.13E-03	9.46E-04	1.80E-04
12.32	1.10E-03	8.78E-04	2.26E-04
12.45	1.08E-03	8.14E-04	2.68E-04
12.58	1.06E-03	7.56E-04	3.02E-04
12.72	1.03E-03	7.01E-04	3.34E-04
12.85	1.01E-03	6.50E-04	3.62E-04

October 2006
E1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.6000E-02
 8) THE PULSE WIDTH (M) : 0.9000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7682E-06
 DISPERSIVITY= 0.3559E-02
 WIDTH= 0.1488E-01
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.3289E-02

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
 THE CRITICAL RSS IS: 0.3617E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.68E-07	7.61E-07	7.76E-07
X(2)	3.56E-03	3.27E-03	3.88E-03
X(3)	1.49E-02	1.46E-02	1.52E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
5.67E-01	1.00E-03	1.23E-04	8.77E-04
0.7333	1.00E-03	6.47E-04	3.53E-04
9.00E-01	2.00E-03	1.88E-03	1.23E-04
1.067	3.00E-03	3.95E-03	-9.45E-04
1.23E+00	5.00E-03	6.81E-03	-1.81E-03
1.4	1.04E-02	1.04E-02	-3.40E-03
1.567	1.00E-02	1.46E-02	-4.57E-03
1.733	1.50E-02	1.92E-02	-4.15E-03
1.9	2.00E-02	2.41E-02	-4.07E-03
2.067	2.50E-02	2.92E-02	-4.20E-03
2.233	3.20E-02	3.44E-02	-2.42E-03
2.4	3.80E-02	3.97E-02	-1.73E-03
2.567	4.50E-02	4.51E-02	-5.03E-05
2.733	5.20E-02	5.03E-02	1.70E-03
2.9	5.90E-02	5.55E-02	3.50E-03
3.067	6.50E-02	6.06E-02	4.38E-03
3.233	7.20E-02	6.56E-02	6.41E-03
3.4	7.80E-02	7.05E-02	7.54E-03
3.567	8.30E-02	7.52E-02	7.80E-03
3.733	8.80E-02	7.98E-02	8.23E-03
3.9	9.30E-02	8.42E-02	8.77E-03
4.067	9.70E-02	8.85E-02	8.46E-03
4.233	1.01E-01	9.27E-02	8.32E-03
4.4	1.04E-01	9.67E-02	7.30E-03
4.567	1.07E-01	1.01E-01	6.03E-03
4.733	1.10E-01	1.04E-01	5.71E-03
4.9	1.12E-01	1.08E-01	4.11E-03
5.067	1.14E-01	1.11E-01	2.64E-03
5.233	1.16E-01	1.15E-01	1.32E-03
5.4	1.17E-01	1.18E-01	-8.88E-04
5.567	1.18E-01	1.21E-01	-2.93E-03
5.733	1.19E-01	1.24E-01	-4.93E-03
5.9	1.19E-01	1.27E-01	-7.73E-03
6.067	1.19E-01	1.29E-01	-1.01E-02
6.233	1.20E-01	1.31E-01	-1.07E-02
6.4	1.19E-01	1.31E-01	-1.24E-02
6.567	1.19E-01	1.31E-01	-1.22E-02
6.733	1.18E-01	1.30E-01	-1.22E-02
6.9	1.18E-01	1.28E-01	-1.04E-02
7.067	1.07E-01	1.06E-01	5.73E-04
7.233	1.16E-01	1.23E-01	-7.34E-03
7.4	1.14E-01	1.20E-01	-6.27E-03
7.567	1.13E-01	1.17E-01	-3.97E-03
7.733	1.11E-01	1.14E-01	-2.54E-03
7.9	1.09E-01	1.10E-01	-1.01E-03
8.067	1.05E-01	1.03E-01	2.13E-03
8.233	1.03E-01	9.93E-02	3.69E-03
8.4	9.80E-02	9.58E-02	5.20E-03
8.567	9.80E-02	9.24E-02	5.62E-03
8.733	9.80E-02	8.90E-02	6.99E-03
8.9	9.60E-02	8.57E-02	7.27E-03
9.067	9.00E-02	8.26E-02	7.44E-03
9.233	8.70E-02	7.95E-02	7.53E-03
9.4	8.40E-02	7.65E-02	7.53E-03
9.567	8.10E-02	7.36E-02	7.41E-03
9.733	7.90E-02	7.08E-02	8.21E-03
9.9	7.60E-02	6.81E-02	7.95E-03
10.07	7.30E-02	6.56E-02	7.45E-03
10.23	7.00E-02	6.30E-02	7.00E-03
10.4	6.70E-02	6.06E-02	6.45E-03
10.57	6.40E-02	5.83E-02	5.68E-03
10.73	6.10E-02	5.61E-02	4.95E-03
10.9	5.80E-02	5.39E-02	4.14E-03
11.07	5.60E-02	5.19E-02	3.12E-03
11.23	5.20E-02	4.99E-02	2.14E-03
11.4	5.00E-02	4.79E-02	2.08E-03
11.57	4.70E-02	4.62E-02	8.34E-04
11.73	4.50E-02	4.44E-02	6.27E-04
12.07	4.20E-02	4.27E-02	-6.52E-04
12.23	4.00E-02	4.11E-02	-1.10E-03
12.4	3.70E-02	3.95E-02	-2.51E-03
12.57	3.50E-02	3.80E-02	-2.98E-03
12.73	3.30E-02	3.66E-02	-3.60E-03
12.9	3.10E-02	3.52E-02	-4.19E-03
13.07	2.90E-02	3.38E-02	-4.84E-03
13.23	2.70E-02	3.25E-02	-5.62E-03
13.4	2.50E-02	3.14E-02	-6.37E-03
13.57	2.30E-02	3.02E-02	-7.17E-03
13.73	2.09E-02	2.91E-02	-8.08E-03
13.9	1.90E-02	2.80E-02	-8.97E-03
14.07	1.80E-02	2.69E-02	-8.91E-03
14.23	1.60E-02	2.59E-02	-9.04E-03
14.4	1.50E-02	2.50E-02	-9.96E-03
14.57	1.40E-02	2.40E-02	-1.00E-02

E1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : 0.9000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8850E-06
 DISPERSIVITY= 0.2106E-02
 WIDTH= 0.1630E-01
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1986E-02

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71
 THE CRITICAL RSS IS: 0.2164E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.85E-07	8.85E-07	8.85E-07
X(2)	2.11E-03	2.00E-03	2.21E-03
X(3)	1.93E-02	1.81E-02	1.85E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.00E-03	8.05E-04	1.13E-04	1.95E-04
1.00E-03	1.26E-03	-2.60E-04	-2.60E-04
1.00E-03	1.87E-03	-8.57E-04	-8.57E-04
2.00E-03	2.65E-03	-6.51E-04	-6.51E-04
2.00E-03	3.64E-03	-1.64E-03	-1.64E-03
2.80E-03	2.53E-02	-1.83E-03	-1.83E-03
4.00E-03	6.23E-03	-2.23E-03	-2.23E-03
5.00E-03	7.88E-03	-2.88E-03	-2.88E-03
6.00E-03	9.73E-03	-3.73E-03	-3.73E-03
7.00E-03	1.18E-02	-4.81E-03	-4.81E-03
8.00E-03	1.41E-02	-6.12E-03	-6.12E-03
9.00E-03	1.66E-02	-7.28E-03	-7.28E-03
1.20E-02	1.93E-02	-7.32E-03	-7.32E-03
1.50E-02	2.22E-02	-7.22E-03	-7.22E-03
2.00E-02	2.53E-02	-8.26E-03	-8.26E-03
2.00E-02	2.85E-02	-8.46E-03	-8.46E-03
2.40E-02	3.18E-02	-7.82E-03	-7.82E-03
2.80E-02	3.53E-02	-7.28E-03	-7.28E-03
3.20E-02	3.88E-02	-6.84E-03	-6.84E-03
3.60E-02	4.25E-02	-6.52E-03	-6.52E-03
4.00E-02	4.62E-02	-5.24E-03	-5.24E-03
4.60E-02	5.00E-02	-4.02E-03	-4.02E-03
5.10E-02	5.39E-02	-2.87E-03	-2.87E-03
5.60E-02	5.77E-02	-1.72E-03	-1.72E-03
6.10E-02	6.16E-02	-5.30E-04	-5.30E-04
6.70E-02	6.55E-02	1.51E-03	1.51E-03
7.20E-02	6.94E-02	2.64E-03	2.64E-03
7.70E-02	7.33E-02	3.79E-03	3.79E-03
8.20E-02	7.71E-02	4.93E-03	4.93E-03
8.70E-02	8.09E-02	6.14E-03	6.14E-03
9.20E-02	8.48E-02	7.39E-03	7.39E-03
9.60E-02	8.83E-02	7.66E-03	7.66E-03
1.00E-01	9.20E-02	8.01E-03	8.01E-03
1.00E-01	9.42E-02	9.58E-02	9.58E-02
1.08E-01	9.91E-02	8.87E-03	8.87E-03
1.11E-01	1.03E-01	8.42E-03	8.42E-03
1.13E-01	1.05E-01	1.29E-03	1.29E-03
1.17E-01	1.09E-01	7.70E-03	7.70E-03
1.20E-01	1.13E-01	7.48E-03	7.48E-03
1.22E-01	1.16E-01	8.40E-04	8.40E-04
1.25E-01	1.19E-01	6.34E-03	6.34E-03
1.26E-01	1.22E-01	4.47E-03	4.47E-03
1.27E-01	1.24E-01	-4.77E-03	-4.77E-03
1.29E-01	1.27E-01	2.22E-03	2.22E-03
1.31E-01	1.29E-01	1.91E-03	1.91E-03
1.31E-01	1.31E-01	8.40E-04	8.40E-04
1.32E-01	1.33E-01	-9.91E-04	-9.91E-04
1.33E-01	1.35E-01	-1.53E-03	-1.53E-03
1.33E-01	1.36E-01	-2.79E-03	-2.79E-03
1.33E-01	1.37E-01	-3.75E-03	-3.75E-03
1.33E-01	1.37E-01	-4.41E-03	-4.41E-03
1.33E-01	1.38E-01	-4.77E-03	-4.77E-03
1.33E-01	1.38E-01	-4.83E-03	-4.83E-03
1.32E-01	1.38E-01	-5.59E-03	-5.59E-03
1.32E-01	1.37E-01	-5.08E-03	-5.08E-03
1.27E-01	1.33E-01	-5.30E-03	-5.30E-03
1.29E-01	1.34E-01	-5.00E-03	-5.00E-03
1.27E-01	1.33E-01	-5.85E-03	-5.85E-03
1.26E-01	1.31E-01	-4.82E-03	-4.82E-03
1.25E-01	1.29E-01	-3.99E-03	-3.99E-03
1.23E-01	1.27E-01	-3.85E-03	-3.85E-03
1.21E-01	1.25E-01	-3.71E-03	-3.71E-03
1.20E-01	1.22E-01	-2.45E-03	-2.45E-03
1.18E-01	1.20E-01	-1.89E-03	-1.89E-03
1.14E-01	1.15E-01	-8.74E-04	-8.74E-04
1.12E-01	1.12E-01	5.83E-05	5.83E-05
1.10E-01	1.09E-01	6.09E-04	6.09E-04
1.07E-01	1.07E-01	3.16E-04	3.16E-04
1.05E-01	1.04E-01	1.26E-03	1.26E-03
1.03E-01	1.01E-01	2.02E-03	2.02E-03
1.00E-01	9.82E-02	1.78E-03	1.78E-03
9.80E-02	9.53E-02	2.75E-03	2.75E-03
9.52E-02	9.25E-02	2.50E-03	2.50E-03
9.30E-02	8.98E-02	3.24E-03	3.24E-03
8.98E-02	8.69E-02	3.16E-03	3.16E-03
8.80E-02	8.42E-02	3.84E-03	3.84E-03
8.50E-02	8.15E-02	3.49E-03	3.49E-03
8.27E-02	7.87E-02	4.30E-03	4.30E-03
8.00E-02	7.61E-02	3.87E-03	3.87E-03
7.70E-02	7.36E-02	3.40E-03	3.40E-03
7.50E-02	7.09E-02	4.06E-03	4.06E-03
7.20E-02	6.85E-02	3.48E-03	3.48E-03
7.00E-02	6.62E-02	3.85E-03	3.85E-03
6.70E-02	6.37E-02	3.34E-03	3.34E-03
6.40E-02	6.14E-02	2.59E-03	2.59E-03
6.20E-02	5.92E-02	2.79E-03	2.79E-03
5.90E-02	5.69E-02	2.10E-03	2.10E-03
5.70E-02	5.48E-02	2.18E-03	2.18E-03
5.40E-02	5.28E-02	1.20E-03	1.20E-03
5.20E-02	5.07E-02	1.31E-03	1.31E-03
4.80E-02	4.88E-02	1.22E-03	1.22E-03
4.80E-02	4.69E-02	1.06E-03	1.06E-03

October 2006
E2_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 94
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1850E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : 0.9000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.5367E-06
 DISPERSIVITY= 0.1160E-02
 WIDTH= 0.1110E-01
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1986E-02

THE F STATISTIC FOR NP= 3 NOBS= 94 IS: 2.71

THE CRITICAL RSS IS: 0.2163E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	5.37E-07	5.37E-07	5.37E-07
X(2)	1.16E-03	1.09E-03	1.23E-03
X(3)	1.11E-02	1.10E-02	1.12E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.13E+00	1.00E-03	8.04E-04	1.96E-04
2.267	1.00E-03	1.26E-03	-2.55E-04
2.40E+00	1.00E-03	1.86E-03	-8.62E-04
2.533	2.00E-03	2.65E-03	-6.47E-04
2.67E+00	2.00E-03	3.63E-03	-1.63E-03
2.8	4.00E-03	4.82E-03	-1.82E-03
2.933	4.00E-03	6.22E-03	-2.22E-03
3.067	5.00E-03	7.86E-03	-2.86E-03
3.2	6.00E-03	9.71E-03	-3.71E-03
3.333	7.00E-03	1.18E-02	-4.79E-03
3.467	8.00E-03	1.41E-02	-6.09E-03
3.6	1.00E-02	1.66E-02	-6.59E-03
3.733	1.20E-02	1.93E-02	-7.29E-03
3.867	1.50E-02	2.22E-02	-7.18E-03
4	2.00E-02	2.52E-02	-8.43E-03
4.133	2.00E-02	2.84E-02	-8.43E-03
4.267	2.40E-02	3.18E-02	-7.78E-03
4.4	2.80E-02	3.52E-02	-7.24E-03
4.533	3.20E-02	3.88E-02	-6.81E-03
4.667	3.60E-02	4.25E-02	-6.46E-03
4.8	4.10E-02	4.62E-02	-5.19E-03
4.933	4.60E-02	5.00E-02	-3.98E-03
5.067	5.10E-02	5.38E-02	-2.81E-03
5.2	5.60E-02	5.77E-02	-1.67E-03
5.333	6.10E-02	6.16E-02	-5.47E-04
5.467	6.70E-02	6.54E-02	1.57E-03
5.6	7.20E-02	6.93E-02	2.69E-03
5.733	7.70E-02	7.32E-02	3.83E-03
5.867	8.20E-02	7.70E-02	5.00E-03
6	8.70E-02	8.08E-02	6.20E-03
6.133	9.20E-02	8.46E-02	7.44E-03
6.267	9.60E-02	8.83E-02	7.72E-03
6.4	1.00E-01	9.19E-02	8.07E-03
6.533	1.04E-01	9.57E-02	8.47E-03
6.667	1.08E-01	9.91E-02	8.93E-03
6.8	1.11E-01	1.03E-01	8.47E-03
6.933	1.15E-01	1.05E-01	9.05E-03
7.067	1.17E-01	1.09E-01	7.76E-03
7.2	1.20E-01	1.13E-01	7.54E-03
7.333	1.23E-01	1.16E-01	6.23E-03
7.467	1.25E-01	1.19E-01	6.40E-03
7.6	1.26E-01	1.22E-01	4.52E-03
7.733	1.24E-01	1.24E-01	3.31E-03
7.867	1.29E-01	1.27E-01	2.28E-03
8	1.31E-01	1.29E-01	1.96E-03
8.133	1.32E-01	1.31E-01	8.82E-04
8.267	1.32E-01	1.33E-01	-9.42E-04
8.4	1.33E-01	1.35E-01	-1.49E-03
8.533	1.33E-01	1.36E-01	-2.75E-03
8.667	1.33E-01	1.37E-01	-3.71E-03
8.8	1.33E-01	1.37E-01	-4.37E-03
8.933	1.33E-01	1.38E-01	-4.73E-03
9.067	1.33E-01	1.38E-01	-4.79E-03
9.2	1.32E-01	1.38E-01	-5.56E-03
9.333	1.32E-01	1.37E-01	-5.05E-03
9.467	1.31E-01	1.36E-01	-5.28E-03
9.6	1.30E-01	1.35E-01	-5.24E-03
9.733	1.29E-01	1.34E-01	-4.98E-03
9.867	1.27E-01	1.33E-01	-5.49E-03
10	1.26E-01	1.31E-01	-4.80E-03
10.13	1.25E-01	1.29E-01	-3.93E-03
10.27	1.23E-01	1.27E-01	-3.88E-03
10.4	1.21E-01	1.25E-01	-3.70E-03
10.53	1.20E-01	1.22E-01	-2.39E-03
10.67	1.18E-01	1.20E-01	-1.94E-03
10.8	1.16E-01	1.17E-01	-1.42E-03
10.93	1.14E-01	1.15E-01	-8.13E-04
11.07	1.12E-01	1.12E-01	-1.20E-04
11.2	1.10E-01	1.09E-01	6.07E-04
11.33	1.07E-01	1.07E-01	3.75E-04
11.47	1.05E-01	1.04E-01	1.19E-03
11.6	1.03E-01	1.01E-01	2.01E-03
11.73	1.00E-01	9.82E-02	1.83E-03
11.87	9.80E-02	9.53E-02	2.68E-03
12	9.50E-02	9.25E-02	2.49E-03
12.13	9.30E-02	8.97E-02	3.29E-03
12.27	9.00E-02	8.69E-02	3.98E-03
12.4	8.80E-02	8.42E-02	3.83E-03
12.53	8.50E-02	8.15E-02	3.54E-03
12.67	8.30E-02	7.88E-02	4.23E-03
12.8	8.00E-02	7.61E-02	3.86E-03
12.93	7.70E-02	7.36E-02	3.44E-03
13.07	7.50E-02	7.10E-02	3.99E-03
13.2	7.20E-02	6.85E-02	3.46E-03
13.33	7.00E-02	6.61E-02	3.88E-03
13.47	6.70E-02	6.37E-02	3.27E-03
13.6	6.40E-02	6.14E-02	2.56E-03
13.73	6.20E-02	5.92E-02	2.83E-03
13.87	5.90E-02	5.70E-02	2.03E-03
14	5.70E-02	5.48E-02	2.16E-03
14.13	5.40E-02	5.28E-02	1.23E-03
14.27	5.20E-02	5.08E-02	1.25E-03
14.4	5.00E-02	4.88E-02	1.20E-03
14.53	4.80E-02	4.69E-02	1.09E-03

E2_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 76
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2900E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : 0.9000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8546E-06
 DISPERSIVITY= 0.1827E-02
 WIDTH= 0.1704E-01
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1587E-02

THE F STATISTIC FOR NP= 3 NOBS= 76 IS: 2.74

THE CRITICAL RSS IS: 0.1766E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.55E-07	8.46E-07	8.63E-07
X(2)	1.83E-03	1.74E-03	1.94E-03
X(3)	1.70E-02	1.69E-02	1.72E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.133	1.00E-03	5.86E-04	4.14E-04
2.267	1.00E-03	9.50E-04	4.98E-05
2.40E+00	1.00E-03	1.45E-03	-4.52E-04
2.533	2.00E-03	2.12E-03	-1.18E-04
2.67E+00	2.00E-03	2.98E-03	-9.77E-04
2.8	4.00E-03	4.37E-03	-1.03E-03
2.933	4.00E-03	5.31E-03	-1.31E-03
3.067	5.00E-03	6.83E-03	-1.83E-03
3.2	6.00E-03	8.58E-03	-2.58E-03
3.333	7.00E-03	1.05E-02	-3.54E-03
3.467	8.00E-03	1.28E-02	-4.76E-03
3.6	1.00E-02	1.52E-02	-5.19E-03
3.733	1.20E-02	1.78E-02	-5.83E-03
3.867	1.50E-02	2.07E-02	-5.70E-03
4	2.00E-02	2.37E-02	-1.74E-03
4.133	2.00E-02	2.70E-02	-6.95E-03
4.267	2.40E-02	3.04E-02	-6.35E-03
4.4	2.80E-02	3.39E-02	-5.86E-03
4.533	3.20E-02	3.75E-02	-5.50E-03
4.667	3.60E-02	4.13E-02	-5.27E-03
4.8	4.10E-02	4.51E-02	-4.10E-03
4.933	4.60E-02	4.90E-02	-3.00E-03
5.067	5.10E-02	5.30E-02	-1.99E-03
5.2	5.60E-02	5.70E-02	-9.94E-04
5.333	6.10E-02	6.10E-02	-4.52E-04
5.467	6.70E-02	6.51E-02	1.91E-03
5.6	7.20E-02	6.91E-02	2.87E-03
5.733	7.70E-02	7.30E-02	3.84E-03
5.867	8.20E-02	7.72E-02	4.81E-03
6	8.70E-02	8.12E-02	6.84E-03
6.133	9.20E-02	8.51E-02	6.91E-03
6.267	9.60E-02	8.90E-02	7.00E-03
6.4	1.00E-01	9.28E-02	7.18E-03
6.533	1.04E-01	9.66E-02	7.42E-03
6.667	1.08E-01	1.00E-01	7.71E-03
6.8	1.11E-01	1.04E-01	7.09E-03
6.933	1.15E-01	1.07E-01	7.56E-03
7.067	1.17E-01	1.11E-01	6.09E-03
7.2	1.20E-01	1.14E-01	5.75E-03
7.333	1.22E-01	1.18E-01	4.53E-03
7.467	1.25E-01	1.21E-01	4.43E-03
7.6	1.26E-01	1.24E-01	2.51E-03
7.733	1.28E-01	1.26E-01	1.78E-03
7.867	1.29E-01	1.29E-01	2.54E-04
8	1.31E-01	1.31E-01	-1.49E-05
8.133	1.32E-01	1.33E-01	-1.02E-03
8.267	1.32E-01	1.35E-01	-2.75E-03
8.4	1.33E-01	1.36E-01	-3.17E-03
8.533	1.33E-01	1.37E-01	-4.26E-03
8.667	1.33E-01	1.38E-01	-5.08E-03
8.8	1.33E-01	1.39E-01	-5.55E-03
8.933	1.33E-01	1.39E-01	-5.71E-03
9.067	1.33E-01	1.39E-01	-5.55E-03
9.2	1.32E-01	1.38E-01	-6.09E-03
9.333	1.32E-01	1.37E-01	-5.35E-03
9.467	1.31E-01	1.36E-01	-5.32E-03
9.6	1.30E-01	1.35E-01	-5.04E-03
9.733	1.29E-01	1.34E-01	-4.52E-03
9.867	1.27E-01	1.32E-01	-4.77E-03
10	1.26E-01	1.30E-01	-3.83E-03
10.13	1.25E-01	1.28E-01	-2.76E-03
10.27	1.23E-01	1.25E-01	-2.36E-03
10.4	1.21E-01	1.23E-01	-1.98E-03
10.53	1.20E-01	1.21E-01	-4.89E-04
10.67	1.18E-01	1.18E-01	3.10E-04
10.8	1.16E-01	1.15E-01	9.99E-04
10.93	1.14E-01	1.12E-01	1.76E-03
11.07	1.12E-01	1.09E-01	2.79E-03
11.2	1.10E-01	1.06E-01	3.65E-03
11.33	1.07E-01	1.04E-01	3.54E-03
11.47	1.05E-01	1.00E-01	4.67E-03
11.6	1.03E-01	9.74E-02	5.59E-03
11.73	1.00E-01	9.45E-02	5.50E-03
11.87	9.80E-02	9.14E-02	6.63E-03
12	9.50E-02	8.85E-02	6.51E-03
12.13	9.30E-02	8.56E-02	7.37E-03

October 2006
E3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1950E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2450E-05
 7) THE DISPERSIVITY (M) : 0.3800E-02
 8) THE PULSE WIDTH (M) : -0.1000E-03
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 2.000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8963E-06
 DISPERSIVITY= 0.2142E-02
 WIDTH= 0.1000E-03
 RF= 1.000
 CO= 24.26
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2256E-02

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
 THE CRITICAL RSS IS: 0.2481E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.98E-07	8.87E-07	9.05E-07
X(2)	2.14E-03	2.04E-03	2.27E-03
X(5)	2.43E+01	2.38E+01	2.48E+01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.50E-01	-9.80E-05	1.16E-06	-9.80E-05
0.3167	-2.24E-04	1.06E-16	-2.24E-04
4.83E-01	-3.49E-04	1.53E-10	-3.49E-04
0.65	5.25E-04	1.28E-04	5.25E-04
0.17E-01	4.00E-04	6.08E-06	3.94E-04
0.9833	1.27E-03	7.22E-05	1.20E-03
1.15	3.44E-02	3.94E-04	1.75E-03
1.317	5.02E-03	1.34E-03	3.68E-03
1.483	7.90E-03	3.36E-03	4.54E-03
1.65	1.28E-02	6.79E-03	5.99E-03
1.817	1.97E-02	1.18E-02	7.85E-03
1.983	2.65E-02	1.83E-02	8.20E-03
2.15	3.44E-02	2.61E-02	5.26E-03
2.317	4.33E-02	3.49E-02	8.37E-03
2.483	5.11E-02	4.42E-02	6.92E-03
2.65	6.59E-02	5.27E-02	6.26E-03
2.817	6.99E-02	6.32E-02	3.73E-03
2.983	7.48E-02	7.22E-02	2.61E-03
3.15	8.06E-02	8.05E-02	1.12E-04
3.317	8.65E-02	8.91E-02	-1.61E-03
3.483	9.14E-02	9.49E-02	-3.46E-03
3.65	9.63E-02	1.01E-01	-6.22E-03
3.817	1.00E-01	1.09E-01	-5.37E-03
3.983	1.03E-01	1.09E-01	-6.42E-03
4.15	1.06E-01	1.13E-01	-6.08E-03
4.317	1.08E-01	1.15E-01	-6.89E-03
4.483	1.10E-01	1.16E-01	-6.41E-03
4.65	1.11E-01	1.17E-01	-6.22E-03
4.817	1.11E-01	1.17E-01	-5.37E-03
4.983	1.12E-01	1.16E-01	-3.96E-03
5.15	1.15E-01	1.15E-01	-2.03E-03
5.317	1.11E-01	1.14E-01	-2.65E-03
5.483	1.11E-01	1.12E-01	-9.00E-04
5.65	1.10E-01	1.10E-01	1.86E-04
5.817	1.08E-01	1.07E-01	5.34E-04
5.983	1.07E-01	1.04E-01	2.11E-03
6.15	1.04E-01	1.04E-01	2.86E-03
6.317	1.02E-01	9.85E-02	3.75E-03
6.483	1.00E-01	9.54E-02	4.75E-03
6.65	9.70E-02	9.22E-02	4.82E-03
6.817	9.49E-02	8.90E-02	5.93E-03
6.983	9.18E-02	8.57E-02	6.06E-03
7.15	8.96E-02	8.24E-02	7.19E-03
7.317	8.65E-02	7.92E-02	7.31E-03
7.483	8.24E-02	7.60E-02	6.39E-03
7.65	7.93E-02	7.28E-02	6.42E-03
7.817	7.61E-02	6.97E-02	6.40E-03
7.983	7.30E-02	6.67E-02	6.31E-03
8.15	6.99E-02	6.37E-02	6.15E-03
8.317	6.68E-02	6.09E-02	5.90E-03
8.483	6.26E-02	5.81E-02	4.57E-03
8.65	5.95E-02	5.53E-02	4.16E-03
8.817	5.64E-02	5.27E-02	3.65E-03
8.983	5.33E-02	5.02E-02	3.06E-03
9.15	5.01E-02	4.78E-02	2.37E-03
9.317	4.70E-02	4.54E-02	1.59E-03
9.483	4.39E-02	4.32E-02	7.11E-04
9.65	4.07E-02	4.10E-02	-2.53E-04
9.817	3.86E-02	3.89E-02	-3.07E-04
9.983	3.55E-02	3.69E-02	-1.45E-03
10.15	3.34E-02	3.51E-02	-1.68E-03
10.32	3.12E-02	3.32E-02	-1.99E-03
10.48	2.81E-02	3.15E-02	-3.39E-03
10.65	2.60E-02	2.99E-02	-3.86E-03
10.82	2.39E-02	2.83E-02	-4.41E-03
10.98	2.27E-02	2.68E-02	-4.04E-03
11.15	2.06E-02	2.54E-02	-4.74E-03
11.32	1.85E-02	2.40E-02	-5.60E-03
11.48	1.74E-02	2.27E-02	-5.34E-03
11.65	1.62E-02	2.15E-02	-5.24E-03
11.82	1.41E-02	2.03E-02	-6.20E-03
11.98	1.30E-02	1.92E-02	-6.22E-03
12.15	1.19E-02	1.82E-02	-6.29E-03
12.32	1.07E-02	1.72E-02	-6.42E-03
12.48	9.61E-03	1.62E-02	-6.61E-03
12.65	8.48E-03	1.53E-02	-6.83E-03
12.82	7.36E-03	1.45E-02	-7.11E-03
12.98	6.23E-03	1.37E-02	-7.43E-03
13.15	6.11E-03	1.29E-02	-6.80E-03
13.32	4.98E-03	1.22E-02	-7.29E-03
13.48	3.85E-03	1.15E-02	-7.64E-03
13.65	3.73E-03	1.09E-02	-7.12E-03
13.82	2.60E-03	1.02E-02	-7.64E-03
13.98	1.48E-03	9.66E-03	-8.19E-03
14.15	1.35E-03	9.12E-03	-7.77E-03

E3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 96
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : 0.9000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.8326E-06
 DISPERSIVITY= 0.2026E-02
 WIDTH= 0.1425E-01
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1

RESIDUAL SUM OF SQUARES = 0.2142E-03

THE F STATIS FOR NP= 3 N87 IS: 2.72
 THE CRITICAL RSS IS: 0.2329E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	8.33E-07	8.33E-07	8.33E-07
X(2)	2.06E-03	2.04E-03	2.08E-03
X(3)	1.43E-02	1.43E-02	1.43E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.017	1.00E-03	5.16E-05	9.48E-04
2.150	2.00E-03	1.01E-04	1.90E-03
2.283	2.00E-03	1.83E-04	1.83E-04
2.417	2.00E-03	3.09E-04	1.69E-03
2.550	3.00E-03	4.94E-04	2.51E-03
2.683	7.52E-04	7.52E-04	0.00E+00
2.817	3.00E-03	1.10E-03	1.90E-03
2.950	4.00E-03	1.55E-03	2.45E-03
3.083	4.00E-03	2.12E-03	1.88E-03
3.217	5.00E-03	2.82E-03	2.18E-03
3.350	5.00E-03	3.66E-03	1.34E-03
3.483	6.00E-03	4.65E-03	1.35E-03
3.617	7.00E-03	5.80E-03	1.20E-03
3.750	8.00E-03	7.11E-03	8.87E-04
3.883	9.00E-03	8.59E-03	4.08E-04
4.017	1.00E-02	1.02E-02	-2.39E-04
4.150	1.10E-02	1.21E-02	-1.05E-03
4.283	1.30E-02	1.40E-02	-1.02E-03
4.417	1.40E-02	1.62E-02	-2.15E-03
4.550	1.60E-02	1.84E-02	-2.44E-03
4.683	1.80E-02	2.09E-02	-2.86E-03
4.817	2.10E-02	2.34E-02	-2.43E-03
4.950	2.30E-02	2.61E-02	-3.11E-03
5.083	2.50E-02	2.89E-02	-2.92E-03
5.217	2.80E-02	3.18E-02	-1.84E-03
5.350	3.30E-02	3.49E-02	-1.85E-03
5.483	3.60E-02	3.80E-02	-1.95E-03
5.617	4.00E-02	4.11E-02	-1.12E-03
5.750	4.40E-02	4.44E-02	-3.63E-04
5.883	4.70E-02	4.77E-02	-6.58E-04
6.017	5.10E-02	5.10E-02	-3.1E-06
6.150	5.50E-02	5.44E-02	6.20E-04
6.283	5.90E-02	5.78E-02	1.22E-03
6.417	6.30E-02	6.13E-02	1.79E-03
6.550	6.70E-02	6.46E-02	2.37E-03
6.683	6.80E-02	6.80E-02	0.00E+00
6.817	7.40E-02	7.15E-02	2.55E-03
6.950	7.70E-02	7.48E-02	2.20E-03
7.083	7.70E-02	7.81E-02	1.11E-03
7.217	8.40E-02	8.13E-02	2.66E-03
7.350	8.70E-02	8.45E-02	2.52E-03
7.483	8.70E-02	8.75E-02	1.50E-03
7.617	9.20E-02	9.04E-02	1.61E-03
7.750	9.40E-02	9.31E-02	8.74E-04
7.883	9.70E-02	9.57E-02	1.31E-03
8.017	9.90E-02	9.97E-02	0.23E-04
8.150	1.00E-01	1.00E-01	-2.60E-04
8.283	1.02E-01	1.02E-01	-2.33E-04
8.417	1.03E-01	1.04E-01	-9.90E-04
8.550	1.05E-01	1.06E-01	-5.22E-04
8.683	1.06E-01	1.07E-01	-8.25E-04
8.817	1.07E-01	1.08E-01	-9.01E-04
8.950	1.07E-01	1.09E-01	-1.75E-03
9.083	1.08E-01	1.09E-01	-1.37E-03
9.217	1.08E-01	1.10E-01	-1.77E-03
9.350	1.08E-01	1.10E-01	-1.96E-03
9.483	1.08E-01	1.10E-01	-1.94E-03
9.617	1.08E-01	1.10E-01	-1.72E-03
9.750	1.08E-01	1.09E-01	-1.32E-03
9.883	1.08E-01	1.09E-01	-7.32E-04
10.017	1.07E-01	1.08E-01	-9.77E-04
10.150	1.06E-01	1.07E-01	-1.07E-03
10.283	1.05E-01	1.06E-01	-1.02E-03
10.417	1.04E-01	1.05E-01	-8.19E-04
10.550	1.03E-01	1.04E-01	-5.08E-04
10.683	1.02E-01	1.02E-01	-8.44E-05
10.817	1.01E-01	1.01E-01	4.52E-04
10.950	9.90E-02	9.89E-02	6.77E-05
11.083	9.80E-02	9.72E-02	7.64E-04
11.217	9.60E-02	9.55E-02	5.45E-04
11.350	9.40E-02	9.36E-02	3.74E-04
11.483	9.30E-02	9.17E-02	1.26E-03
11.617	9.10E-02	8.98E-02	1.20E-03
11.750	8.90E-02	8.78E-02	1.16E-03
11.883	8.70E-02	8.59E-02	1.15E-03
12.017	8.50E-02	8.35E-02	1.18E-03
12.150	8.30E-02	8.18E-02	1.21E-03
12.283	8.10E-02	7.98E-02	1.25E-03
12.417	7.90E-02	7.77E-02	1.30E-03
12.550	7.70E-02	7.57E-02	1.34E-03
12.683	7.50E-02	7.36E-02	1.38E-03
12.817	7.30E-02	7.16E-02	1.42E-03
12.950	7.00E-02	6.96E-02	4.26E-04
13.083	6.80E-02	6.76E-02	4.17E-04
13.217	6.60E-02	6.56E-02	4.02E-04
13.350	6.40E-02	6.37E-02	3.47E-04
13.483	6.20E-02	6.17E-02	2.66E-04
13.617	6.00E-02	5.98E-02	1.69E-04
13.750	5.80E-02	5.80E-02	2.76E-05
13.883	5.60E-02	5.62E-02	-1.47E-04
14.017	5.40E-02	5.43E-02	-1.34E-03
14.150	5.20E-02	5.26E-02	-5.87E-04
14.283	5.00E-02	5.09E-02	-8.66E-04
14.417	4.80E-02	4.92E-02	-1.17E-03
14.550	4.60E-02	4.75E-02	-1.53E-03

October 2006
E4_1

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
 2) THE NUMBER OF VARIABLES TO DETERMINE : 6
 3) THE NUMBER OF PARAMETERS (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2100E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : 0.9000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1035E-05
 DISPERSIVITY= 0.3535E-02
 WIDTH= 0.5158E-02
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2007E-03

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
 THE CRITICAL RSS IS: 0.2178E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.04E-06	1.03E-06	1.05E-06
X(2)	3.54E-03	3.39E-03	3.68E-03
X(3)	5.16E-03	5.11E-03	5.21E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.53E+00	7.00E-03	4.85E-03	2.15E-03
1.667	9.00E-03	6.91E-03	2.09E-03
1.80E+00	1.10E-02	9.33E-03	1.75E-03
1.933	1.40E-02	1.21E-02	1.90E-03
2.07E+00	1.70E-02	1.52E-02	1.85E-03
2.2	2.00E-02	1.84E-02	1.58E-03
2.333	2.20E-02	2.18E-02	2.33E-04
2.467	2.50E-02	2.51E-02	-8.17E-05
2.6	2.80E-02	2.82E-02	-2.43E-04
2.733	3.00E-02	3.12E-02	-1.17E-03
2.867	3.20E-02	3.38E-02	-1.79E-03
3	3.40E-02	3.61E-02	-2.08E-03
3.133	3.60E-02	3.80E-02	-2.03E-03
3.267	3.80E-02	3.96E-02	-1.63E-03
3.4	3.90E-02	4.09E-02	-1.91E-03
3.533	4.00E-02	4.19E-02	-1.89E-03
3.667	4.20E-02	4.28E-02	-5.84E-04
3.8	4.20E-02	4.30E-02	-1.03E-03
3.933	4.30E-02	4.33E-02	-2.48E-04
4.067	4.30E-02	4.33E-02	-2.71E-04
4.2	4.40E-02	4.31E-02	8.80E-04
4.333	4.40E-02	4.28E-02	1.18E-03
4.467	4.40E-02	4.24E-02	1.61E-03
4.6	4.30E-02	4.19E-02	1.15E-03
4.733	4.30E-02	4.12E-02	1.78E-03
4.867	4.20E-02	4.05E-02	1.45E-03
5	4.20E-02	3.97E-02	2.26E-03
5.133	4.10E-02	3.89E-02	2.08E-03
5.267	4.00E-02	3.81E-02	1.94E-03
5.4	3.90E-02	3.72E-02	1.83E-03
5.533	3.80E-02	3.63E-02	1.75E-03
5.667	3.70E-02	3.53E-02	1.68E-03
5.8	3.60E-02	3.44E-02	1.62E-03
5.933	3.50E-02	3.34E-02	1.57E-03
6.067	3.40E-02	3.20E-02	5.19E-03
6.2	3.20E-02	3.16E-02	4.55E-04
6.333	3.10E-02	3.06E-02	3.89E-04
6.467	3.00E-02	2.97E-02	3.15E-04
6.6	2.90E-02	2.88E-02	2.28E-04
6.733	2.70E-02	2.79E-02	-8.74E-04
6.867	2.50E-02	2.70E-02	-9.90E-04
7	2.50E-02	2.61E-02	-1.13E-03
7.133	2.40E-02	2.53E-02	-1.28E-03
7.267	2.30E-02	2.45E-02	-1.45E-03
7.4	2.20E-02	2.36E-02	-1.64E-03
7.533	2.10E-02	2.29E-02	-1.85E-03
7.667	2.00E-02	2.21E-02	-2.08E-03
7.8	2.00E-02	2.13E-02	-1.33E-03
7.933	1.90E-02	2.06E-02	-1.61E-03
8.067	1.80E-02	1.99E-02	-1.90E-03
8.2	1.70E-02	1.92E-02	-2.21E-03
8.333	1.70E-02	1.86E-02	-1.55E-03
8.467	1.60E-02	1.79E-02	-1.90E-03
8.6	1.60E-02	1.73E-02	-1.28E-03
8.733	1.50E-02	1.67E-02	-1.67E-03
8.867	1.40E-02	1.61E-02	-2.08E-03
9	1.40E-02	1.55E-02	-1.51E-03
9.133	1.40E-02	1.50E-02	-9.63E-04
9.267	1.30E-02	1.44E-02	-1.43E-03
9.4	1.30E-02	1.39E-02	-9.17E-04
9.533	1.20E-02	1.34E-02	-1.42E-03
9.667	1.20E-02	1.29E-02	-9.59E-04
9.8	1.20E-02	1.25E-02	-4.75E-04
9.933	1.10E-02	1.20E-02	-1.03E-03
10.07	1.10E-02	1.16E-02	-5.93E-04
10.2	1.10E-02	1.12E-02	-1.77E-04
10.33	1.00E-02	1.08E-02	-7.74E-04
10.47	1.00E-02	1.04E-02	-3.83E-04
10.6	1.00E-02	1.00E-02	-8.16E-06
10.73	9.00E-03	9.65E-03	3.53E-04
10.87	9.00E-03	9.30E-03	-2.95E-04
11	9.00E-03	8.96E-03	4.14E-05
11.13	9.00E-03	8.63E-03	3.66E-04
11.27	9.00E-03	8.32E-03	6.81E-04
11.4	8.00E-03	8.02E-03	-1.70E-05
11.53	8.00E-03	7.73E-03	2.74E-04
11.67	8.00E-03	7.44E-03	5.57E-04
11.8	8.00E-03	7.17E-03	8.27E-04
11.93	8.00E-03	6.91E-03	1.10E-03
12.07	8.00E-03	6.66E-03	1.34E-03
12.2	8.00E-03	6.42E-03	1.59E-03
12.33	7.00E-03	6.18E-03	8.17E-03
12.47	7.00E-03	5.96E-03	1.04E-03
12.6	7.00E-03	5.74E-03	1.26E-03
12.73	7.00E-03	5.53E-03	1.47E-03
12.87	7.00E-03	5.33E-03	1.67E-03
13	7.00E-03	5.13E-03	1.87E-03
13.13	7.00E-03	4.95E-03	2.05E-03
13.27	6.00E-03	4.77E-03	1.24E-03
13.4	6.00E-03	4.59E-03	1.41E-03
13.53	6.00E-03	4.42E-03	1.58E-03
13.67	6.00E-03	4.26E-03	1.74E-03
13.8	6.00E-03	4.11E-03	1.89E-03
13.93	6.00E-03	3.96E-03	2.04E-03
14.07	6.00E-03	3.81E-03	2.19E-03
14.2	6.00E-03	3.67E-03	2.33E-03
14.33	5.00E-03	3.54E-03	2.46E-03
14.47	5.00E-03	3.41E-03	1.59E-03

E4_2

SIMPLEX OPTIMIZATION
PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
 2) THE NUMBER OF VARIABLES TO DETERMINE : 6
 3) THE NUMBER OF PARAMETERS (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : 0.9000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : -0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9189E-06
 DISPERSIVITY= 0.2807E-02
 WIDTH= 0.4977E-02
 RF= 1.000
 CO= 0.2000
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2228E-03

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
 THE CRITICAL RSS IS: 0.2419E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.19E-07	9.10E-07	9.28E-07
X(2)	2.81E-03	2.70E-03	2.95E-03
X(3)	4.96E-03	4.93E-03	5.03E-03

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.483	1.00E-03	6.61E-07	9.99E-04
1.617	1.00E-03	2.27E-06	9.98E-04
1.750	1.00E-03	6.43E-06	9.94E-04
1.883	2.00E-03	1.57E-05	1.98E-03
2.017	2.00E-03	3.42E-05	1.97E-03
2.150	2.00E-03	6.73E-05	2.93E-03
2.283	3.00E-03	1.23E-04	2.88E-03
2.417	3.00E-03	2.09E-04	2.79E-03
2.550	3.00E-03	3.35E-04	2.67E-03
2.683	4.00E-03	5.14E-04	3.49E-03
2.817	4.00E-03	7.55E-04	3.25E-03
2.950	5.00E-03	1.07E-03	3.93E-03
3.083	5.00E-03	1.47E-03	3.53E-03
3.217	6.00E-03	1.97E-03	4.03E-03
3.350	6.00E-03	2.56E-03	3.44E-03
3.483	7.00E-03	3.26E-03	3.74E-03
3.617	7.00E-03	4.07E-03	2.93E-03
3.750	8.00E-03	4.99E-03	3.01E-03
3.883	8.00E-03	6.00E-03	2.00E-03
4.017	9.00E-03	7.11E-03	1.89E-03
4.150	1.00E-02	8.31E-03	1.49E-03
4.283	1.10E-02	9.57E-03	1.63E-03
4.417	1.20E-02	1.09E-02	1.10E-03
4.550	1.30E-02	1.23E-02	7.26E-04
4.683	1.40E-02	1.37E-02	3.22E-04
4.817	1.50E-02	1.50E-02	-1.00E-04
4.950	1.60E-02	1.65E-02	-5.24E-04
5.083	1.70E-02	1.79E-02	-9.38E-04
5.217	1.80E-02	1.93E-02	-1.33E-03
5.350	1.90E-02	2.07E-02	-1.69E-03
5.483	2.10E-02	2.20E-02	-1.00E-03
5.617	2.30E-02	2.33E-02	-4.27E-03
5.750	2.50E-02	2.45E-02	-1.47E-03
5.883	2.40E-02	2.56E-02	-1.81E-03
6.017	2.60E-02	2.69E-02	-1.57E-03
6.150	2.60E-02	2.77E-02	-1.67E-03
6.283	2.70E-02	2.86E-02	-1.59E-03
6.417	2.80E-02	2.95E-02	-1.43E-03
6.550	2.90E-02	3.02E-02	-1.15E-03
6.683	3.00E-02	3.09E-02	-8.62E-04
6.817	3.10E-02	3.15E-02	-3.15E-04
6.950	3.10E-02	3.20E-02	-9.82E-04
7.083	3.20E-02	3.24E-02	-4.27E-04
7.217	3.20E-02	3.28E-02	-7.95E-04
7.350	3.30E-02	3.31E-02	-9.39E-05
7.483	3.30E-02	3.33E-02	-3.22E-04
7.617	3.40E-02	3.35E-02	3.16E-04
7.750	3.40E-02	3.36E-02	4.18E-04
7.883	3.40E-02	3.36E-02	3.81E-04
8.017	3.40E-02	3.36E-02	4.90E-04
8.150	3.40E-02	3.35E-02	4.73E-04
8.283	3.40E-02	3.34E-02	5.96E-04
8.417	3.40E-02	3.32E-02	7.67E-04
8.550	3.40E-02	3.30E-02	9.81E-04
8.683	3.40E-02	3.28E-02	1.24E-03
8.817	3.40E-02	3.25E-02	1.53E-03
8.950	3.30E-02	3.22E-02	8.53E-04
9.083	3.30E-02	3.18E-02	1.21E-03
9.217	3.30E-02	3.14E-02	1.60E-03
9.350	3.20E-02	3.10E-02	1.01E-03
9.483	3.20E-02	3.06E-02	1.44E-03
9.617	3.10E-02	3.01E-02	8.98E-04
9.750	3.10E-02	2.96E-02	1.37E-03
9.883	3.00E-02	2.91E-02	8.61E-04
10.020	2.90E-02	2.86E-02	3.66E-04
10.150	2.90E-02	2.81E-02	8.80E-04
10.280	2.80E-02	2.76E-02	4.04E-04
10.420	2.80E-02	2.71E-02	9.41E-04
10.550	2.70E-02	2.65E-02	4.80E-04
10.680	2.60E-02	2.60E-02	2.34E-05
10.820	2.60E-02	2.54E-02	5.75E-04
10.950	2.50E-02	2.49E-02	1.25E-04
11.080	2.40E-02	2.43E-02	-3.25E-04
11.220	2.40E-02	2.38E-02	2.30E-04
11.350	2.30E-02	2.32E-02	-2.20E-04
11.480	2.30E-02	2.27E-02	3.27E-04
11.620	2.20E-02	2.21E-02	-1.24E-04
11.750	2.10E-02	2.16E-02	-5.84E-04
11.880	2.10E-02	2.11E-02	-4.77E-05
12.020	2.00E-02	2.05E-02	-5.13E-04
12.150	2.00E-02	2.00E-02	1.23E-05
12.280	1.90E-02	1.95E-02	-4.69E-04
12.420	1.90E-02	1.90E-02	4.69E-05
12.550	1.80E-02	1.85E-02	-4.48E-04
12.680	1.70E-02	1.75E-02	-9.51E-04
12.820			

October 2006
F1_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 98
 2) THE NUMBER OF VARIABLES TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.5840E-06
 DISPERSIVITY= 0.1772E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.1271
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1961E-03

THE F STATISTIC FOR NP= 3 NOBS= 98 IS: 2.71
 THE CRITICAL RSS IS: 0.2129E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	5.84E-07	5.78E-07	5.90E-07
X(2)	1.77E-03	1.70E-03	1.86E-03
X(5)	1.27E-01	1.26E-01	1.28E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.48E+00	1.00E-03	2.28E-06	9.98E-04
1.617	1.00E-03	6.64E-06	9.93E-04
1.76E+00	1.00E-03	1.63E-03	9.84E-04
1.883	2.00E-03	3.52E-05	1.97E-03
2.02E+00	2.00E-03	6.91E-05	1.93E-03
2.15	3.00E-03	1.24E-04	1.88E-03
2.283	3.00E-03	2.08E-04	2.79E-03
2.417	3.00E-03	3.30E-04	2.67E-03
2.55	3.00E-03	4.57E-04	2.50E-03
2.683	4.00E-03	7.18E-04	3.28E-03
2.817	4.00E-03	1.00E-03	3.00E-03
2.95	5.00E-03	1.36E-03	3.64E-03
3.083	5.00E-03	1.79E-03	3.21E-03
3.217	6.00E-03	2.30E-03	3.70E-03
3.35	6.00E-03	2.90E-03	3.10E-03
3.483	7.00E-03	3.58E-03	3.42E-03
3.617	7.00E-03	4.58E-03	2.64E-03
3.75	8.00E-03	6.23E-03	2.77E-03
3.883	8.00E-03	6.18E-03	1.82E-03
4.017	9.00E-03	7.23E-03	1.77E-03
4.15	1.00E-02	8.35E-03	1.65E-03
4.283	1.10E-02	9.55E-03	1.45E-03
4.417	1.20E-02	1.08E-02	1.18E-03
4.55	1.30E-02	1.21E-02	8.70E-04
4.683	1.40E-02	1.35E-02	5.14E-04
4.817	1.49E-02	1.49E-02	1.19E-03
4.95	1.60E-02	1.63E-02	-2.81E-04
5.083	1.70E-02	1.77E-02	-6.82E-04
5.217	1.80E-02	1.91E-02	-1.08E-03
5.35	1.90E-02	2.05E-02	-1.45E-03
5.483	2.10E-02	2.18E-02	-7.77E-04
5.617	2.20E-02	2.31E-02	-1.07E-03
5.75	2.30E-02	2.43E-02	-1.30E-03
5.883	2.40E-02	2.55E-02	-1.47E-03
6.017	2.50E-02	2.66E-02	-1.57E-03
6.15	2.60E-02	2.76E-02	-1.60E-03
6.283	2.70E-02	2.85E-02	-1.54E-03
6.417	2.80E-02	2.94E-02	-1.41E-03
6.55	2.90E-02	3.02E-02	-1.20E-03
6.683	3.00E-02	3.09E-02	-9.02E-04
6.817	3.10E-02	3.15E-02	-5.27E-04
6.95	3.10E-02	3.21E-02	-1.07E-03
7.083	3.20E-02	3.25E-02	-5.25E-04
7.217	3.20E-02	3.29E-02	-9.19E-04
7.35	3.30E-02	3.32E-02	-2.17E-04
7.483	3.30E-02	3.35E-02	-4.52E-04
7.617	3.40E-02	3.36E-02	3.81E-04
7.75	3.40E-02	3.37E-02	2.81E-04
7.883	3.40E-02	3.38E-02	2.44E-04
8.017	3.40E-02	3.37E-02	2.69E-04
8.15	3.40E-02	3.37E-02	3.43E-04
8.283	3.40E-02	3.35E-02	4.71E-04
8.417	3.40E-02	3.34E-02	6.49E-04
8.55	3.40E-02	3.31E-02	8.70E-04
8.683	3.40E-02	3.29E-02	1.13E-03
8.817	3.40E-02	3.26E-02	1.44E-03
8.95	3.30E-02	3.22E-02	1.70E-03
9.083	3.30E-02	3.19E-02	1.14E-03
9.217	3.30E-02	3.15E-02	1.53E-03
9.35	3.20E-02	3.11E-02	9.54E-04
9.483	3.20E-02	3.06E-02	1.40E-03
9.617	3.10E-02	3.01E-02	8.64E-04
9.75	3.10E-02	2.97E-02	1.35E-03
9.883	3.00E-02	2.92E-02	8.42E-04
10.02	2.90E-02	2.86E-02	3.68E-04
10.15	2.90E-02	2.81E-02	8.78E-04
10.28	2.80E-02	2.76E-02	3.97E-04
10.42	2.80E-02	2.70E-02	9.64E-04
10.55	2.70E-02	2.65E-02	4.96E-04
10.68	2.60E-02	2.60E-02	3.21E-05
10.82	2.60E-02	2.54E-02	6.13E-04
10.95	2.50E-02	2.49E-02	1.54E-04
11.08	2.40E-02	2.43E-02	-3.05E-04
11.22	2.40E-02	2.37E-02	2.77E-04
11.35	2.30E-02	2.32E-02	-1.84E-04
11.48	2.30E-02	2.27E-02	3.53E-04
11.62	2.20E-02	2.21E-02	-7.33E-05
11.75	2.10E-02	2.15E-02	-5.45E-04
11.88	2.10E-02	2.10E-02	-2.06E-05
12.02	2.00E-02	2.05E-02	-4.62E-04
12.15	2.00E-02	2.00E-02	4.99E-05
12.28	1.90E-02	1.94E-02	-4.44E-04
12.42	1.90E-02	1.89E-02	9.29E-05
12.55	1.80E-02	1.84E-02	-4.16E-04
12.68	1.70E-02	1.79E-02	-9.32E-04
12.82	1.70E-02	1.74E-02	-4.20E-04
12.95	1.60E-02	1.70E-02	-9.52E-04
13.08	1.60E-02	1.65E-02	-4.93E-04
13.22	1.50E-02	1.60E-02	-1.01E-03
13.35	1.50E-02	1.56E-02	-5.67E-04
13.48	1.40E-02	1.51E-02	-1.13E-03
13.62	1.40E-02	1.47E-02	-6.77E-04
13.75	1.30E-02	1.43E-02	-1.26E-03
13.88	1.30E-02	1.39E-02	-6.57E-04
14.02	1.30E-02	1.34E-02	-4.30E-04
14.15	1.20E-02	1.30E-02	-1.04E-03
14.28	1.20E-02	1.27E-02	-6.64E-04
14.42	1.10E-02	1.23E-02	-1.27E-03

F1_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
 2) THE NUMBER OF VARIABLES TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,...) : 2
 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.5553E-06
 DISPERSIVITY= 0.3240E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.3578
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.4731E-03

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
 THE CRITICAL RSS IS: 0.5209E-03

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	5.55E-07	5.50E-07	5.60E-07
X(2)	3.24E-03	3.11E-03	3.40E-03
X(5)	3.56E-01	3.51E-01	3.65E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
0.233	1.00E-03	2.30E-54	1.00E-03
0.400	1.00E-03	5.16E-32	1.00E-03
0.567	2.00E-03	8.65E-23	2.00E-03
0.733	2.00E-03	9.50E-18	2.00E-03
0.900	2.00E-03	1.45E-14	2.00E-03
1.067	3.00E-03	2.27E-12	3.00E-03
1.233	3.00E-03	8.94E-11	3.00E-03
1.400	3.00E-03	1.50E-09	3.00E-03
1.567	4.00E-03	7.55E-05	3.00E-03
1.733	3.00E-03	8.28E-08	3.00E-03
1.900	4.00E-03	3.67E-07	4.00E-03
2.067	4.00E-03	1.23E-06	4.00E-03
2.233	4.00E-03	3.67E-06	4.00E-03
2.400	4.00E-03	9.15E-06	3.99E-03
2.567	4.00E-03	2.03E-05	3.98E-03
2.733	4.00E-03	4.07E-05	3.96E-03
2.900	4.00E-03	7.55E-05	3.92E-03
3.067	5.00E-03	1.31E-04	4.87E-03
3.233	5.00E-03	2.14E-04	4.79E-03
3.400	5.00E-03	3.35E-04	4.67E-03
3.567	5.00E-03	5.02E-04	4.50E-03
3.733	5.00E-03	7.24E-04	4.28E-03
3.900	5.00E-03	1.01E-03	3.99E-03
4.067	6.00E-03	1.38E-03	4.62E-03
4.233	6.00E-03	1.83E-03	4.17E-03
4.400	6.00E-03	2.38E-03	3.92E-03
4.567	7.00E-03	3.03E-03	3.97E-03
4.733	7.00E-03	3.79E-03	3.21E-03
4.900	4.900E-03	4.67E-03	4.33E-03
5.067	8.00E-03	5.67E-03	2.33E-03
5.233	9.00E-03	6.78E-03	2.22E-03
5.400	5.400E-03	8.02E-03	1.009E-03
5.567	1.10E-02	9.38E-03	1.62E-03
5.733	1.20E-02	1.08E-02	1.17E-03
5.900	1.20E-02	1.24E-02	1.24E-03
6.067	1.50E-02	1.41E-02	9.39E-04
6.233	1.60E-02	1.58E-02	2.08E-04
6.400	1.70E-02	1.76E-02	-6.03E-04
6.567	1.90E-02	1.95E-02	-4.70E-04
6.733	2.00E-02	2.14E-02	-1.37E-03
6.900	2.20E-02	2.33E-02	-1.31E-03
7.067	2.40E-02	2.53E-02	-1.27E-03
7.233	2.60E-02	2.72E-02	-1.22E-03
7.400	2.80E-02	2.92E-02	-1.17E-03
7.567	2.90E-02	3.11E-02	-2.11E-03
7.733	3.10E-02	3.30E-02	-2.01E-03
7.900	3.30E-02	3.49E-02	-1.88E-03
8.067	3.50E-02	3.67E-02	-1.70E-03
8.233	3.70E-02	3.85E-02	-1.46E-03
8.400	3.90E-02	4.02E-02	-1.17E-03
8.567	4.10E-02	4.18E-02	-8.07E-04
8.733	4.20E-02	4.34E-02	-1.37E-03
8.900	4.40E-02	4.49E-02	-8.63E-04
9.067	4.60E-02	4.63E-02	-2.80E-04
9.233	4.70E-02	4.76E-02	-6.08E-04
9.400	4.90E-02	4.89E-02	1.37E-04
9.567	5.00E-02	5.00E-02	-3.41E-05
9.733	5.20E-02	5.11E-02	8.85E-04
9.900	5.30E-02	5.21E-02	8.81E-04
10.070	5.40E-02	5.31E-02	9.44E-04
10.230	5.50E-02	5.39E-02	1.14E-03
10.400	5.60E-02	5.46E-02	1.37E-03
10.570	5.70E-02	5.53E-02	1.68E-03
10.730	5.80E-02	5.59E-02	1.11E-03
10.900	5.80E-02	5.64E-02	1.57E-03
11.070	5.80E-02	5.69E-02	1.11E-03
11.230	5.90E-02	5.73E-02	1.75E-03
11.400	5.90E-02	5.76E-02	1.44E-03
11.570	5.90E-02	5.78E-02	1.19E-03
11.730	5.90E-02	5.80E-02	1.02E-03
11.900	5.90E-02	5.81E-02	8.96E-04
12.070	5.90E-02	5.82E-02	8.36E-04
12.230	5.90E-02	5.82E-02	8.32E-04
12.400	5.90E-02	5.81E-02	8.82E-04
12.570	5.80E-02	5.80E-02	-1.56E-05
12.730	5.80E-02	5.79E-02	1.26E-04
12.900	5.80E-02	5.77E-02	3.23E-04
13.070	5.70E-02	5.74E-02	-4.37E-04
13.230	5.60E-02	5.72E-02	-3.17E-03
13.400	5.60E-02	5.69E-02	-8.52E-04
13.570	5.50E-02	5.65E-02	-1.50E-03
13.730	5.40E-02	5.61E-02	-2.15E-03
13.900	5.40E-02	5.57E-02	-1.71E-03

October 2006
F3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7933E-06
DISPERSIVITY= 0.2290E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.2871
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1577E-02

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
THE CRITICAL RSS IS: 0.1736E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.93E-07	7.77E-07	8.09E-07
X(2)	2.29E-03	2.11E-03	2.50E-03
X(5)	2.87E-01	2.79E-01	2.96E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.83E-01	7.14E-04	1.95E-27	7.14E-04
0.35	8.65E-15	2.36E-03	8.65E-15
5.17E-01	3.00E-03	2.82E-10	3.00E-03
0.6833	3.64E-03	5.90E-08	3.64E-03
8.50E-01	3.29E-03	1.55E-06	3.28E-03
1.017	3.93E-03	1.41E-05	3.92E-03
1.183	4.57E-03	6.81E-05	4.50E-03
1.35	5.21E-03	2.26E-04	4.99E-03
1.517	5.86E-03	3.41E-02	5.28E-03
1.683	6.50E-03	1.21E-03	5.57E-03
1.85	8.14E-03	2.24E-03	5.90E-03
2.017	9.79E-03	3.74E-03	6.04E-03
2.183	1.24E-02	5.76E-03	6.67E-03
2.35	1.51E-02	8.35E-03	6.72E-03
2.517	1.77E-02	1.15E-02	6.20E-03
2.683	2.14E-02	1.52E-02	6.15E-03
2.85	2.59E-02	1.94E-02	5.93E-03
3.017	2.86E-02	2.41E-02	4.56E-03
3.183	3.33E-02	2.90E-02	4.30E-03
3.35	3.69E-02	3.41E-02	2.84E-03
3.517	4.16E-02	3.92E-02	2.39E-03
3.683	4.52E-02	4.41E-02	1.12E-03
3.85	4.89E-02	4.88E-02	1.00E-04
4.017	5.31E-02	5.31E-02	-1.56E-03
4.183	5.51E-02	5.69E-02	-1.75E-03
4.35	5.68E-02	6.03E-02	-3.48E-03
4.517	5.94E-02	6.32E-02	-3.73E-03
4.683	6.11E-02	6.55E-02	-4.45E-03
4.85	6.27E-02	6.74E-02	-4.70E-03
5.017	6.44E-02	6.88E-02	-4.48E-03
5.183	6.59E-02	6.98E-02	-3.82E-03
5.35	6.66E-02	7.04E-02	-3.77E-03
5.517	6.73E-02	7.06E-02	-3.34E-03
5.683	6.69E-02	7.05E-02	-3.60E-03
5.85	6.69E-02	7.01E-02	-2.56E-03
6.017	6.72E-02	6.95E-02	-2.26E-03
6.183	6.69E-02	6.86E-02	-1.73E-03
6.35	6.65E-02	6.75E-02	-1.02E-03
6.517	6.61E-02	6.63E-02	-1.39E-04
6.683	6.48E-02	6.49E-02	-1.20E-04
6.85	6.44E-02	6.34E-02	1.01E-03
7.017	6.31E-02	6.18E-02	1.23E-03
7.183	6.27E-02	6.02E-02	2.51E-03
7.35	6.14E-02	5.85E-02	2.87E-03
7.517	6.00E-02	5.67E-02	3.26E-03
7.683	5.86E-02	5.50E-02	3.66E-03
7.85	5.73E-02	5.32E-02	4.09E-03
8.017	5.59E-02	5.14E-02	4.52E-03
8.183	5.36E-02	4.96E-02	3.94E-03
8.35	5.22E-02	4.79E-02	4.35E-03
8.517	5.09E-02	4.61E-02	4.75E-03
8.683	4.85E-02	4.44E-02	4.10E-03
8.85	4.71E-02	4.27E-02	4.43E-03
9.017	4.58E-02	4.11E-02	4.74E-03
9.183	4.44E-02	3.94E-02	5.00E-03
9.35	4.21E-02	3.79E-02	4.22E-03
9.517	4.07E-02	3.63E-02	4.40E-03
9.683	3.84E-02	3.48E-02	3.54E-03
9.85	3.70E-02	3.34E-02	3.63E-03
10.02	3.46E-02	3.19E-02	2.70E-03
10.18	3.33E-02	3.06E-02	2.66E-03
10.35	3.09E-02	2.93E-02	1.64E-03
10.52	2.96E-02	2.80E-02	1.57E-03
10.68	2.82E-02	2.68E-02	1.39E-03
10.85	2.59E-02	2.56E-02	2.39E-04
11.02	2.45E-02	2.45E-02	3.62E-05
11.18	2.31E-02	2.34E-02	-2.76E-04
11.35	2.08E-02	2.08E-02	-1.65E-03
11.52	1.94E-02	2.13E-02	-1.89E-03
11.68	1.81E-02	2.04E-02	-2.32E-03
11.85	1.67E-02	1.94E-02	-2.73E-03
12.02	1.54E-02	1.85E-02	-3.17E-03
12.18	1.40E-02	1.77E-02	-3.71E-03
12.35	1.26E-02	1.69E-02	-4.24E-03
12.52	1.13E-02	1.61E-02	-4.79E-03
12.68	9.93E-03	1.54E-02	-5.43E-03
12.85	8.57E-03	1.46E-02	-6.06E-03
13.02	7.21E-03	1.39E-02	-6.72E-03
13.18	5.86E-03	1.33E-02	-7.45E-03
13.35	4.50E-03	1.27E-02	-8.16E-03
13.52	4.14E-03	1.21E-02	-7.91E-03
13.68	2.79E-03	1.15E-02	-6.72E-03
13.85	1.43E-03	1.10E-02	-9.52E-03
14.02	1.07E-03	1.04E-02	-9.34E-03

F3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 80
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.5000E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7507E-06
DISPERSIVITY= 0.2014E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.2877
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9670E-05

THE F STATISTIC FOR NP= 3 NOBS= 80 IS: 2.73
THE CRITICAL RSS IS: 0.1070E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.51E-07	7.51E-07	7.51E-07
X(2)	2.01E-03	2.01E-03	2.01E-03
X(5)	2.88E-01	2.88E-01	2.88E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.550	1.00E-03	5.95E-04	4.05E-04
3.633	8.31E-04	8.31E-04	1.69E-04
3.817	1.00E-03	1.13E-03	-1.34E-04
3.950	2.00E-03	1.51E-03	4.90E-04
4.083	2.00E-03	1.97E-03	2.89E-05
4.217	5.15E-03	9.57E-03	-5.66E-04
4.350	3.00E-03	3.19E-03	-1.88E-04
4.483	4.00E-03	3.96E-03	4.46E-05
4.617	5.00E-03	4.94E-03	1.56E-04
4.750	6.00E-03	5.84E-03	1.56E-04
4.883	7.00E-03	6.96E-03	3.67E-05
5.017	8.00E-03	8.21E-03	-2.11E-04
5.150	9.10E-03	9.57E-03	-5.66E-04
5.283	1.10E-02	1.10E-02	-3.08E-05
5.417	1.20E-02	1.26E-02	-6.12E-04
5.550	1.40E-02	1.43E-02	-2.77E-04
5.683	1.60E-02	1.60E-02	-2.72E-05
5.817	1.80E-02	1.79E-02	1.79E-04
5.950	2.00E-02	1.98E-02	2.50E-04
6.083	2.17E-02	2.17E-02	-6.84E-04
6.217	2.40E-02	2.37E-02	3.32E-04
6.350	2.60E-02	2.57E-02	3.42E-04
6.483	2.80E-02	2.77E-02	3.44E-04
6.617	3.00E-02	2.97E-02	4.56E-04
6.750	3.20E-02	3.16E-02	3.61E-04
6.883	3.40E-02	3.36E-02	4.15E-04
7.017	3.60E-02	3.55E-02	4.96E-04
7.150	3.70E-02	3.74E-02	-3.57E-04
7.283	3.90E-02	3.92E-02	-1.50E-04
7.417	4.10E-02	4.09E-02	1.13E-04
7.550	4.30E-02	4.30E-02	4.86E-04
7.683	4.40E-02	4.41E-02	-9.94E-05
7.817	4.60E-02	4.56E-02	4.13E-04
7.950	4.70E-02	4.70E-02	2.88E-05
8.083	4.80E-02	4.83E-02	-2.59E-04
8.217	4.90E-02	4.95E-02	-4.58E-04
8.350	5.00E-02	5.06E-02	-5.46E-04
8.483	5.10E-02	5.15E-02	-5.33E-04
8.617	5.20E-02	5.24E-02	-4.26E-04
8.750	5.30E-02	5.32E-02	-2.08E-04
8.883	5.40E-02	5.39E-02	1.09E-04
9.017	5.40E-02	5.45E-02	-4.79E-04
9.150	5.50E-02	5.50E-02	3.53E-05
9.283	5.50E-02	5.54E-02	-3.56E-04
9.417	5.60E-02	5.57E-02	3.44E-04
9.550	5.60E-02	5.59E-02	1.35E-04
9.683	5.60E-02	5.60E-02	1.27E-05
9.817	5.60E-02	5.60E-02	-2.71E-05
9.950	5.60E-02	5.60E-02	1.29E-05
10.083	5.60E-02	5.59E-02	1.28E-04
10.220	5.60E-02	5.67E-02	3.22E-04
10.350	5.50E-02	5.54E-02	-4.28E-04
10.480	5.50E-02	5.51E-02	-1.16E-04
10.620	5.50E-02	5.47E-02	2.84E-04
10.750	5.40E-02	5.43E-02	-2.90E-04
10.880	5.40E-02	5.38E-02	1.87E-04
11.020	5.30E-02	5.33E-02	-2.47E-04
11.150	5.30E-02	5.27E-02	3.23E-04
11.280	5.20E-02	5.21E-02	-6.83E-05
11.420	5.20E-02	5.14E-02	6.28E-04
11.550	5.10E-02	5.07E-02	3.09E-04
11.680	5.00E-02	5.00E-02	1.98E-05
11.820	4.90E-02	4.92E-02	-1.85E-04
11.950	4.90E-02	4.84E-02	5.78E-04
12.080	4.80E-02	4.76E-02	3.62E-04
12.220	4.70E-02	4.68E-02	2.28E-04
12.350	4.60E-02	4.60E-02	4.73E-05
12.480	4.50E-02	4.50E-02	-1.19E-04
12.620	4.40E-02	4.42E-02	-2.10E-04
12.750	4.30E-02	4.34E-02	-3.55E-04
12.880	4.20E-02	4.25E-02	5.06E-04
13.020	4.20E-02	4.16E-02	4.39E-04
13.150	4.10E-02	4.07E-02	3.09E-04
13.280	4.00E-02	3.98E-02	1.80E-04
13.420	3.90E-02	3.89E-02	1.19E-04
13.550	3.80E-02	3.80E-02	-1.13E-05
13.680	3.70E-02	3.71E-02	-1.44E-04
13.820	3.60E-02	3.62E-02	-1.22E-03
13.950	3.50E-02	3.48E-02	3.58E-04
14.080	3.40E-02	3.45E-02	-5.06E-04

October 2006
F3_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 84
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.2000E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.3800E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.1000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7933E-06
DISPERSIVITY= 0.2290E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.2871
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.1577E-02

THE F STATISTIC FOR NP= 3 NOBS= 84 IS: 2.73
THE CRITICAL RSS IS: 0.1736E-02

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.93E-07	7.77E-07	8.09E-07
X(2)	2.29E-03	2.11E-03	2.50E-03
X(5)	2.87E-01	2.79E-01	2.96E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.83E-01	7.14E-04	1.95E-27	7.14E-04
0.35	8.65E-15	2.36E-03	8.65E-15
5.17E-01	3.00E-03	2.82E-10	3.00E-03
0.6833	3.64E-03	5.90E-08	3.64E-03
8.50E-01	3.29E-03	1.55E-06	3.28E-03
1.017	3.93E-03	1.41E-05	3.92E-03
1.183	4.57E-03	6.81E-05	4.50E-03
1.35	5.21E-03	2.26E-04	4.99E-03
1.517	5.86E-03	3.41E-02	5.28E-03
1.683	6.50E-03	1.21E-03	5.57E-03
1.85	8.14E-03	2.24E-03	5.90E-03
2.017	9.79E-03	3.74E-03	6.04E-03
2.183	1.24E-02	5.76E-03	6.67E-03
2.35	1.51E-02	8.35E-03	6.72E-03
2.517	1.77E-02	1.15E-02	6.20E-03
2.683	2.14E-02	1.52E-02	6.15E-03
2.85	2.59E-02	1.94E-02	5.93E-03
3.017	2.86E-02	2.41E-02	4.56E-03
3.183	3.33E-02	2.90E-02	4.30E-03
3.35	3.69E-02	3.41E-02	2.84E-03
3.517	4.16E-02	3.92E-02	2.39E-03
3.683	4.52E-02	4.41E-02	1.12E-03
3.85	4.89E-02	4.88E-02	1.00E-04
4.017	5.31E-02	5.31E-02	-1.56E-03
4.183	5.51E-02	5.69E-02	-1.75E-03
4.35	5.68E-02	6.03E-02	-3.48E-03
4.517	5.94E-02	6.32E-02	-3.73E-03
4.683	6.11E-02	6.55E-02	-4.45E-03
4.85	6.27E-02	6.74E-02	-4.70E-03
5.017	6.44E-02	6.88E-02	-4.48E-03
5.183	6.59E-02	6.98E-02	-3.82E-03
5.35	6.66E-02	7.04E-02	-3.37E-03
5.517	6.73E-02	7.06E-02	-3.34E-03
5.683	6.69E-02	7.05E-02	-3.60E-03
5.85	6.69E-02	7.01E-02	-2.56E-03
6.017	6.72E-02	6.95E-02	-2.26E-03
6.183	6.69E-02	6.86E-02	-1.73E-03
6.35	6.65E-02	6.75E-02	-1.02E-03
6.517	6.61E-02	6.63E-02	-1.39E-04
6.683	6.48E-02	6.49E-02	-1.20E-04
6.85	6.44E-02	6.34E-02	1.01E-03
7.017	6.31E-02	6.18E-02	1.23E-03
7.183	6.27E-02	6.02E-02	2.51E-03
7.35	6.14E-02	5.85E-02	2.87E-03
7.517	6.00E-02	5.67E-02	3.26E-03
7.683	5.86E-02	5.50E-02	3.66E-03
7.85	5.73E-02	5.32E-02	4.09E-03
8.017	5.59E-02	5.14E-02	4.52E-03
8.183	5.36E-02	4.96E-02	3.94E-03
8.35	5.22E-02	4.79E-02	4.35E-03
8.517	5.09E-02	4.61E-02	4.75E-03
8.683	4.85E-02	4.44E-02	4.10E-03
8.85	4.71E-02	4.27E-02	4.43E-03
9.017	4.58E-02	4.11E-02	4.74E-03
9.183	4.44E-02	3.94E-02	5.00E-03
9.35	4.21E-02	3.79E-02	4.22E-03
9.517	4.07E-02	3.63E-02	4.40E-03
9.683	3.84E-02	3.48E-02	3.54E-03
9.85	3.70E-02	3.34E-02	3.63E-03
10.02	3.46E-02	3.19E-02	2.70E-03
10.18	3.33E-02	3.06E-02	2.66E-03
10.35	3.09E-02	2.93E-02	1.64E-03
10.52	2.96E-02	2.80E-02	1.57E-03
10.68	2.82E-02	2.68E-02	1.39E-03
10.85	2.59E-02	2.56E-02	2.39E-04
11.02	2.45E-02	2.45E-02	3.62E-05
11.18	2.31E-02	2.34E-02	-2.76E-04
11.35	2.08E-02	2.08E-02	-1.65E-03
11.52	1.94E-02	2.13E-02	-1.89E-03
11.68	1.81E-02	2.04E-02	-2.32E-03
11.85	1.67E-02	1.94E-02	-2.73E-03
12.02	1.54E-02	1.85E-02	-3.17E-03
12.18	1.40E-02	1.77E-02	-3.71E-03
12.35	1.26E-02	1.69E-02	-4.24E-03
12.52	1.13E-02	1.61E-02	-4.79E-03
12.68	9.93E-03	1.54E-02	-5.43E-03
12.85	8.57E-03	1.46E-02	-6.06E-03
13.02	7.21E-03	1.39E-02	-6.72E-03
13.18	5.86E-03	1.33E-02	-7.45E-03
13.35	4.50E-03	1.27E-02	-8.16E-03
13.52	4.14E-03	1.21E-02	-7.91E-03
13.68	2.79E-03	1.15E-02	-6.72E-03
13.85	1.43E-03	1.10E-02	-9.52E-03
14.02	1.07E-03	1.04E-02	-9.34E-03

F3_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

- 1) THE NUMBER OF OBSERVATIONS (MAX 60) : 80
- 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
- 3) THE NUMBER OF VARIABLES (X,Y,Z, ...) : 2
- 4) THE DIFFUSION COEFFICIENT (M²/SEC) : 0.1000E-09
- 5) THE DISTANCE FROM SOURCE (M) : 0.3050E-01

INITIAL GUESSES OF PARAMETERS

- 6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
- 7) THE DISPERSIVITY (M) : 0.5000E-02
- 8) THE PULSE WIDTH (M) : -0.5000E-02
- 9) THE RETARDATION FACTOR (DIM) : -1.000
- 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
- 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
- 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.7507E-06
DISPERSIVITY= 0.2014E-02
WIDTH= 0.5000E-02
Rf= 1.000
CO= 0.2877
LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.9670E-05

THE F STATISTIC FOR NP= 3 NOBS= 80 IS: 2.73
THE CRITICAL RSS IS: 0.1070E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	7.51E-07	7.51E-07	7.51E-07
X(2)	2.01E-03	2.01E-03	2.01E-03
X(5)	2.88E-01	2.88E-01	2.88E-01

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
3.550	1.00E-03	5.95E-04	4.05E-04
3.633	8.31E-04	8.31E-04	1.69E-04
3.817	1.00E-03	1.13E-03	-1.34E-04
3.950	2.00E-03	1.51E-03	4.90E-04
4.083	2.00E-03	1.97E-03	2.89E-05
4.217	5.15E-03	9.57E-03	-5.66E-04
4.350	3.00E-03	3.19E-03	-1.88E-04
4.483	4.00E-03	3.96E-03	4.46E-05
4.617	5.00E-03	4.94E-03	1.56E-04
4.750	6.00E-03	5.84E-03	1.56E-04
4.883	7.00E-03	6.96E-03	3.67E-05
5.017	8.00E-03	8.21E-03	-2.11E-04
5.150	9.10E-03	9.57E-03	-5.66E-04
5.283	1.10E-02	1.10E-02	-3.08E-05
5.417	1.20E-02	1.26E-02	-6.12E-04
5.550	1.40E-02	1.43E-02	-2.77E-04
5.683	1.60E-02	1.60E-02	-2.72E-05
5.817	1.80E-02	1.79E-02	1.79E-04
5.950	2.00E-02	1.98E-02	2.50E-04
6.083	2.17E-02	2.17E-02	-6.84E-04
6.217	2.40E-02	2.37E-02	3.32E-04
6.350	2.60E-02	2.57E-02	3.42E-04
6.483	2.80E-02	2.77E-02	3.44E-04
6.617	3.00E-02	2.97E-02	4.56E-04
6.750	3.20E-02	3.16E-02	3.61E-04
6.883	3.40E-02	3.36E-02	4.15E-04
7.017	3.60E-02	3.55E-02	4.96E-04
7.150	3.70E-02	3.74E-02	-3.57E-04
7.283	3.90E-02	3.92E-02	-1.50E-04
7.417	4.10E-02	4.09E-02	1.13E-04
7.550	4.30E-02	4.30E-02	4.26E-04
7.683	4.40E-02	4.41E-02	-9.94E-05
7.817	4.60E-02	4.56E-02	4.13E-04
7.950	4.70E-02	4.70E-02	2.88E-05
8.083	4.80E-02	4.83E-02	-2.59E-04
8.217	4.90E-02	4.95E-02	-4.58E-04
8.350	5.00E-02	5.06E-02	-5.46E-04
8.483	5.10E-02	5.15E-02	-5.33E-04
8.617	5.20E-02	5.24E-02	-4.26E-04
8.750	5.30E-02	5.32E-02	-2.08E-04
8.883	5.40E-02	5.39E-02	1.09E-04
9.017	5.40E-02	5.45E-02	-4.79E-04
9.150	5.50E-02	5.50E-02	3.53E-05
9.283	5.50E-02	5.54E-02	-3.56E-04
9.417	5.60E-02	5.57E-02	3.44E-04
9.550	5.60E-02	5.59E-02	1.35E-04
9.683	5.60E-02	5.60E-02	1.27E-05
9.817	5.60E-02	5.60E-02	-2.71E-05
9.950	5.60E-02	5.60E-02	1.29E-05
10.083	5.60E-02	5.59E-02	1.28E-04
10.220	5.60E-02	5.67E-02	3.22E-04
10.350	5.50E-02	5.54E-02	-4.28E-04
10.480	5.50E-02	5.51E-02	-1.16E-04
10.620	5.50E-02	5.47E-02	2.84E-04
10.750	5.40E-02	5.43E-02	-2.90E-04
10.880	5.40E-02	5.38E-02	1.87E-04
11.020	5.30E-02	5.33E-02	-2.47E-04
11.150	5.30E-02	5.27E-02	3.23E-04
11.280	5.20E-02	5.21E-02	-6.83E-05
11.420	5.20E-02	5.14E-02	6.28E-04
11.550	5.10E-02	5.07E-02	3.09E-04
11.680	5.00E-02	5.00E-02	1.98E-05
11.820	4.90E-02	4.92E-02	-1.85E-04
11.950	4.90E-02	4.84E-02	5.78E-04
12.080	4.80E-02	4.76E-02	3.62E-04
12.220	4.70E-02	4.68E-02	2.28E-04
12.350	4.60E-02	4.60E-02	4.73E-05
12.480	4.50E-02	4.50E-02	-1.19E-04
12.620	4.40E-02	4.42E-02	-2.10E-04
12.750	4.30E-02	4.34E-02	-3.55E-04
12.880	4.20E-02	4.25E-02	-5.06E-04
13.020	4.20E-02	4.16E-02	4.39E-04
13.150	4.10E-02	4.07E-02	3.09E-04
13.280	4.00E-02	3.98E-02	1.80E-04
13.420	3.90E-02	3.89E-02	1.19E-04
13.550	3.80E-02	3.80E-02	-1.13E-05
13.680	3.70E-02	3.71E-02	-1.44E-04
13.820	3.60E-02	3.62E-02	-1.22E-03
13.950	3.50E-02	3.48E-02	3.58E-04
14.080	3.40E-02	3.45E-02	-5.06E-04

October 2006
F4_1

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 85
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.1900E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.9496E-06
 DISPERSIVITY= 0.2603E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.5054E-01
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2311E-04

THE F STATISTIC FOR NP= 3 NOBS= 85 IS: 2.73
 THE CRITICAL RSS IS: 0.2541E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	9.50E-07	9.40E-07	9.59E-07
X(2)	2.60E-03	2.47E-03	2.76E-03
X(5)	5.05E-02	4.95E-02	5.16E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
1.72E+00	3.00E-03	1.50E-03	1.50E-03
1.85	3.00E-03	2.07E-03	9.26E-04
1.98E+00	4.00E-03	2.75E-03	1.25E-03
2.117	5.00E-03	3.51E-03	1.49E-03
2.25E+00	6.00E-03	4.35E-03	1.65E-03
2.383	6.00E-03	5.24E-03	7.59E-04
2.517	7.00E-03	6.16E-03	8.38E-04
2.65	7.00E-03	7.08E-03	-7.93E-05
2.783	8.00E-03	7.96E-03	3.56E-05
2.917	8.00E-03	8.79E-03	-7.94E-04
3.05	9.00E-03	9.55E-03	-5.49E-04
3.183	1.00E-02	1.02E-02	-2.19E-04
3.317	1.00E-02	1.08E-02	-7.97E-04
3.45	1.10E-02	1.13E-02	-2.81E-04
3.583	1.10E-02	1.17E-02	-6.73E-04
3.717	1.10E-02	1.20E-02	-9.78E-04
3.85	1.20E-02	1.22E-02	-2.00E-04
3.983	1.20E-02	1.24E-02	-3.46E-04
4.117	1.20E-02	1.24E-02	-4.25E-04
4.25	1.20E-02	1.24E-02	-4.41E-04
4.383	1.20E-02	1.24E-02	-4.03E-04
4.517	1.20E-02	1.23E-02	-3.18E-04
4.65	1.20E-02	1.20E-02	-1.91E-04
4.783	1.20E-02	1.20E-02	-2.87E-05
4.917	1.20E-02	1.18E-02	1.64E-04
5.05	1.20E-02	1.16E-02	3.91E-04
5.183	1.20E-02	1.14E-02	6.20E-04
5.317	1.20E-02	1.11E-02	8.76E-04
5.45	1.10E-02	1.09E-02	1.45E-04
5.583	1.10E-02	1.06E-02	4.24E-04
5.717	1.10E-02	1.03E-02	7.11E-04
5.85	1.00E-02	1.00E-02	3.49E-06
5.983	9.00E-03	9.70E-03	-2.99E-04
6.117	1.00E-02	9.40E-03	5.97E-04
6.25	9.00E-03	9.11E-03	-1.06E-04
6.383	9.00E-03	8.81E-03	1.89E-04
6.517	9.00E-03	8.52E-03	4.83E-04
6.65	9.00E-03	8.23E-03	7.72E-04
6.783	8.00E-03	7.94E-03	5.75E-05
6.917	8.00E-03	7.65E-03	3.38E-04
7.05	8.00E-03	7.39E-03	6.13E-04
7.183	7.00E-03	7.12E-03	-1.18E-04
7.317	7.00E-03	6.86E-03	1.44E-04
7.45	7.00E-03	6.60E-03	4.00E-04
7.583	6.00E-03	6.35E-03	-3.51E-04
7.717	6.00E-03	6.11E-03	-1.09E-04
7.85	6.00E-03	5.87E-03	1.27E-04
7.983	6.00E-03	5.66E-03	3.54E-04
8.117	5.00E-03	5.43E-03	-4.25E-04
8.25	5.00E-03	5.21E-03	-2.11E-04
8.383	5.00E-03	5.00E-03	-4.41E-06
8.517	5.00E-03	4.81E-03	1.95E-04
8.65	5.00E-03	4.61E-03	3.88E-04
8.783	4.00E-03	4.43E-03	-4.26E-04
8.917	4.00E-03	4.25E-03	-2.46E-04
9.05	4.00E-03	4.07E-03	-7.33E-05
9.183	4.00E-03	3.91E-03	9.33E-05
9.317	4.00E-03	3.75E-03	2.54E-04
9.45	4.00E-03	3.59E-03	4.08E-04
9.583	3.00E-03	3.44E-03	-4.43E-04
9.717	3.00E-03	3.30E-03	-3.00E-04
9.85	3.00E-03	3.16E-03	-1.63E-04
9.983	3.00E-03	3.03E-03	-3.10E-05
10.12	3.00E-03	2.90E-03	9.62E-05
10.25	3.00E-03	2.78E-03	2.18E-04
10.38	3.00E-03	2.67E-03	3.34E-04
10.52	2.00E-03	2.55E-03	-5.53E-04
10.65	2.00E-03	2.45E-03	-4.45E-04
10.78	2.00E-03	2.34E-03	-3.42E-04
10.92	2.00E-03	2.24E-03	-2.42E-04
11.05	2.00E-03	2.15E-03	-1.47E-04
11.18	2.00E-03	2.06E-03	-5.64E-05
11.32	2.00E-03	1.97E-03	3.16E-05
11.45	2.00E-03	1.89E-03	1.15E-04
11.58	1.00E-03	1.80E-03	-8.05E-04
11.72	1.00E-03	1.73E-03	-7.27E-04
11.85	1.00E-03	1.65E-03	-6.53E-04
11.98	1.00E-03	1.58E-03	-5.83E-04
12.12	1.00E-03	1.52E-03	-5.15E-04
12.25	1.00E-03	1.45E-03	-4.50E-04
12.38	1.00E-03	1.39E-03	-3.88E-04
12.52	1.00E-03	1.33E-03	-3.28E-04
12.65	1.00E-03	1.27E-03	-2.71E-04
12.78	1.00E-03	1.22E-03	-2.16E-04
12.92	0.00E+00	1.16E-03	-1.16E-03

F4_2

SIMPLEX OPTIMIZATION

PULSEPE

INPUT SETTINGS

1) THE NUMBER OF OBSERVATIONS (MAX 60) : 83
 2) THE NUMBER OF PARAMETERS TO DETERMINE : 6
 3) THE NUMBER OF VARIABLES (X,Y,Z,) : 2
 4) THE DIFFUSION COEFFICIENT (M^2/SEC) : 0.1000E-09
 5) THE DISTANCE FROM SOURCE (M) : 0.3150E-01

INITIAL GUESSES OF PARAMETERS

6) THE FLOW VELOCITY (M/SEC) : 0.2400E-05
 7) THE DISPERSIVITY (M) : 0.5000E-02
 8) THE PULSE WIDTH (M) : -0.5000E-02
 9) THE RETARDATION FACTOR (DIM) : -1.000
 10) THE INJECTION CONCENTRATION (UG/L) : 0.2000
 11) FIRST ORDER DECAY CONSTANT (/SEC) : 0.0000E+00
 12) TYPE OF WEIGHTING : N

OPTIMIZED PARAMETER ESTIMATES:

VEL= 0.1066E-05
 DISPERSIVITY= 0.1696E-02
 WIDTH= 0.5000E-02
 RF= 1.000
 CO= 0.4211E-01
 LAMBDA= 1.000

RESIDUAL SUM OF SQUARES = 0.2834E-04

THE F STATISTIC FOR NP= 3 NOBS= 83 IS: 2.73
 THE CRITICAL RSS IS: 0.3124E-04

THE 95% CONFIDENCE INTERVALS ARE:

PARAMETER	BEST FIT	FROM	TO
X(1)	1.07E-06	1.06E-06	1.08E-06
X(2)	1.70E-03	1.56E-03	1.85E-03
X(5)	4.21E-02	4.09E-02	4.34E-02

TIME (HOURS)	OBS. CONC.	CALC. CONC.	RESIDUALS
2.783	1.00E-03	5.64E-05	9.44E-04
3.017	1.00E-03	1.43E-04	8.57E-04
3.150	1.00E-03	2.13E-04	7.87E-04
3.283	1.00E-03	3.08E-04	6.94E-04
3.417	1.00E-03	4.26E-04	5.74E-04
3.550	2.00E-03	5.76E-04	1.42E-03
3.683	2.00E-03	7.59E-04	1.24E-03
3.817	2.00E-03	9.76E-04	1.02E-03
3.950	2.00E-03	1.23E-03	7.72E-04
4.083	2.00E-03	1.52E-03	4.85E-04
4.217	3.00E-03	1.83E-03	1.17E-03
4.350	3.00E-03	2.18E-03	8.16E-04
4.483	3.00E-03	2.56E-03	4.40E-04
4.617	3.00E-03	2.96E-03	4.12E-05
4.750	4.00E-03	3.37E-03	6.26E-04
4.883	4.00E-03	3.80E-03	1.99E-04
5.017	4.00E-03	4.24E-03	-2.35E-04
5.150	5.00E-03	4.67E-03	3.32E-04
5.283	5.00E-03	5.10E-03	-9.73E-05
5.417	5.00E-03	5.52E-03	-5.17E-04
5.550	6.00E-03	5.92E-03	7.91E-05
5.683	6.00E-03	6.31E-03	-3.06E-04
5.817	6.00E-03	6.67E-03	-6.69E-04
5.950	6.00E-03	7.01E-03	-1.01E-03
6.083	6.00E-03	7.32E-03	-3.18E-04
6.217	7.00E-03	7.60E-03	-5.95E-04
6.350	7.00E-03	7.84E-03	-8.42E-04
6.483	8.00E-03	8.06E-03	-5.71E-05
6.617	8.00E-03	8.24E-03	8.24E-05
6.750	8.00E-03	8.39E-03	-3.89E-04
6.883	8.00E-03	8.51E-03	-5.06E-04
7.017	8.00E-03	8.59E-03	-5.92E-04
7.150	8.00E-03	8.65E-03	-6.48E-04
7.283	8.00E-03	8.67E-03	-6.74E-04
7.417	9.00E-03	8.67E-03	3.28E-04
7.550	9.00E-03	8.65E-03	3.55E-04
7.683	9.00E-03	8.59E-03	4.07E-04
7.817	9.00E-03	8.52E-03	4.82E-04
7.950	9.00E-03	8.35E-03	6.77E-04
8.083	9.00E-03	8.31E-03	6.91E-04
8.217	8.00E-03	8.18E-03	-1.78E-04
8.350	8.00E-03	8.03E-03	-3.21E-05
8.483	8.00E-03	7.87E-03	1.27E-04
8.617	8.00E-03	7.70E-03	2.99E-04
8.750	8.00E-03	7.52E-03	4.80E-04
8.883	8.00E-03	7.33E-03	6.69E-04
9.017	8.00E-03	7.13E-03	8.66E-04
9.150	7.00E-03	6.93E-03	6.82E-05
9.283	7.00E-03	6.73E-03	2.75E-04
9.417	7.00E-03	6.52E-03	4.85E-04
9.550	7.00E-03	6.30E-03	6.96E-04
9.683	6.00E-03	6.09E-03	-9.12E-05
9.817	6.00E-03	5.88E-03	1.22E-04
9.950	6.00E-03	5.67E-03	3.34E-04
10.083	6.00E-03	5.46E-03	5.44E-04
10.220	6.00E-03	5.25E-03	7.53E-04
10.350	5.00E-03	5.04E-03	-4.19E-05
10.483	5.00E-03	4.84E-03	1.60E-04
10.620	5.00E-03	4.64E-03	3.60E-04
10.750	5.00E-03	4.45E-03	5.54E-04
10.883	4.00E-03	4.26E-03	-2.57E-04
11.020	4.00E-03	4.07E-03	-7.08E-05
11.150	4.00E-03	3.89E-03	1.09E-04
11.280	4.00E-03	3.72E-03	2.84E-04
11.420	3.00E-03	3.65E-03	-5.48E-04
11.550	3.00E-03	3.38E-03	-3.81E-04
11.680	3.00E-03	3.22E-03	-2.23E-04
11.820	3.00E-03	3.07E-03	-6.82E-05
11.950	3.00E-03	2.92E-03	7.95E-05
12.080	2.00E-03	2.78E-03	-7.78E-04
12.220	2.00E-03	2.64E-03	-6.40E-04
12.360	2.00E-03	2.50E-03	-5.09E-04
12.480	2.00E-03	2.38E-03	-3.82E-04
12.620	2.00E-03	2.26E-03	-2.60E-04
12.750	2.00E-03	2.15E-03	-1.44E-04
12.880	1.00E-03	2.03E-03	-1.03E-03
13.020	1.00E-03	1.93E-03	-9.27E-04
13.150	1.00E-03	1.83E-03	-8.25E-04
13.280	1.00E-03	1.73E-03	-7.28E-04
13.420	1.00E-03	1.64E-03	-6.35E-04
13.550	1.00E-03	1.55E-03	-5.47E-04
13.680	1.00E-03	1.46E-03	-4.63E-04

Appendix D Campbell Scientific Datalogger Program

Program written in Cr Basic to operate PVPs by measuring electrical resistivity on a series of half-bridges.

```
'CR1000
'Created by SCWIN (2.3)

'Declare Variables and Units
Public Batt_Volt
Public HalfBR(16)

Units Batt_Volt=Volts
Units HalfBR=mV

'Define Data Tables
DataTable(Oct12,True,-1)
    DataInterval(0,2,min,10)
    Minimum(1,Batt_Volt,FP2,False,False)
    Sample(1,HalfBR(1),FP2)
    Sample(1,HalfBR(2),FP2)
    Sample(1,HalfBR(3),FP2)
    Sample(1,HalfBR(4),FP2)
    Sample(1,HalfBR(5),FP2)
    Sample(1,HalfBR(6),FP2)
    Sample(1,HalfBR(7),FP2)
    Sample(1,HalfBR(8),FP2)
    Sample(1,HalfBR(9),FP2)
    Sample(1,HalfBR(10),FP2)
    Sample(1,HalfBR(11),FP2)
    Sample(1,HalfBR(12),FP2)
    Sample(1,HalfBR(13),FP2)
    Sample(1,HalfBR(14),FP2)
    Sample(1,HalfBR(15),FP2)
    Sample(1,HalfBR(16),FP2)
EndTable

'Main Program
BeginProg
    Scan(10,Sec,25,0)
        'Default Datalogger Battery Voltage measurement
Batt_Volt:
    Battery(Batt_Volt)
    'Generic Half Bridge measurements HalfBR(1):

    BrHalf(HalfBR(1),1,mV2500,1,1,1,2500,True,0,_60Hz,1.0,0.0)

    BrHalf(HalfBR(2),1,mV2500,2,1,1,2500,True,0,_60Hz,1.0,0.0)

    BrHalf(HalfBR(3),1,mV2500,3,1,1,2500,True,0,_60Hz,1.0,0.0)

    BrHalf(HalfBR(4),1,mV2500,4,1,1,2500,True,0,_60Hz,1.0,0.0)

    BrHalf(HalfBR(5),1,mV2500,5,1,1,2500,True,0,_60Hz,1.0,0.0)

    BrHalf(HalfBR(6),1,mV2500,6,1,1,2500,True,0,_60Hz,1.0,0.0)
```

```
BrHalf(HalfBR(7),1,mV2500,7,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(8),1,mV2500,8,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(9),1,mV2500,9,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(10),1,mV2500,10,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(11),1,mV2500,11,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(12),1,mV2500,12,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(13),1,mV2500,13,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(14),1,mV2500,14,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(15),1,mV2500,15,1,1,2500,True,0,_60Hz,1.0,0.0)
BrHalf(HalfBR(16),1,mV2500,16,1,1,2500,True,0,_60Hz,1.0,0.0)
    CallTable(Oct12)
NextScan
```

EndProg

Appendix E: Lipid Phosphate Biomass Procedures

Reagents:

Reagents should be pesticide grade.

1. **50 mM Phosphate Buffer** (pH 7.0-7.4): to a 1 liter volumetric flask add 20 mLs 1M K_2HPO_4 stock, sterile, 30 mL 1M KH_2PO_4 stock, fill to 1 liter.
2. **Chloroform (CLF)**
3. **Methanol (MeOH)**
4. **Saturated Acid Persulfate:** Add 5 g K-persulfate to 100 mLs 0.36N H_2SO_4 (1% H_2SO_4 v/v, 1ml/100 mLs). Store in dark at 4°C. Make fresh weekly.
5. **Ammonium molybdate:** 2.5 g $(NH_4)Mo_7O_{24} \cdot 4H_2O$ in 16% (v/v) H_2SO_4
6. **Malachite green solution:** Mix 1.11 g polyvinyl alcohol (PVA) in 800 mL DI- H_2O and heat to 80°C; stir until dissolved. Cool, dilute to 1000 mLs, add 0.11 g malachite green. Store in dark at 4°C. Heat gently and stir before using.
7. **Glycerophosphate** as QA standards from 0.1 mM stock solution as follows: duplicates of each concentration 0, 1.5 nM, 3nM, 6 nM, 10 nM, and 15 nM (or 15 uL, 30 uL, 60 uL, 100 uL, 150 uL of stock solution delivered).

Glassware and equipment

Glassware should be washed in non-phosphate detergent (micro) only, acid-washed, rinsed with DI- H_2O , and then baked at 500°C for ~4 hours.

1. 50 mL glass or Teflon Oak Ridge centrifuge tubes
2. 60 mL serum bottles
3. Serum bottle liners and aluminum seals, either
 - a. 20 mm Teflon/silicone liners (Alltech #95313) or
 - b. Straight sided Teflon/butyl stoppers (Fisher #03-340-302)
4. Crimpers
5. 3 x 5-10 mL pipettors with clean pipette tips
6. 500 uL glass syringe with Teflon plunger and Luer fitting, 24 g SS needle.
7. 13 mm PTFE or glass fiber (GF) syringe filters or Na_2SO_4 /glass wool filters (made from Pasteur pipettes with small amount of glass wool, then filled with Na_2SO_4 -S421-500)
8. Vacuum aspirator with Pasteur pipette tip
9. Gas manifold for dry down.

Sample Preservation and Preparation

1. Sample can be soil, mat, or filters. Samples should be frozen as quickly as possible after collection
2. Take 10 g of sediment, 1 g mat, or one 47 mm filter frozen at -80°C and freeze dry for 48 hours. Store under nitrogen at -80°C until extracted.

Wet samples can be extracted directly but the water can split the solution into phases.

Extraction Procedure

1. Add 1-5 g of freeze dried sediment or 0.01 g dried mat to a clean 50 ml Oak Ridge tube.
2. Add 5 mLs of phosphate buffer, 7.5 mLs CLF, 15 mLs MeOH IN THAT ORDER (0.8:2.1, total volume 27.5 mLs).
 - a. Smaller volumes can be used in same ratios. Use at least 2 ml CLF for each g freeze-dried soil or mg cell material.
 - b. Add additional methanol to assure a single phase as needed.
3. Shake by hand with venting until equilibrated. Allow to stand for 24 hours at 4°C. Centrifuge 30 m at 2000 rpm (centrifuging optional).
4. Add 7.5 mLs CLF and 7.5 mls DI-H₂O to the solution to create two phases (Final ratio 0.9:1:1), resuspend the mixture using vortex, vent and then let stand overnight at 4°C. The phases should be clearly separated, but the tubes can be centrifuged (2000 rpm x 10 minutes),
5. Draw off the methanol aqueous phase by suction aspirator and discard (optional)
6. Volumetrically transfer 10 mL of the CLF phase (at bottom) with Pasteur pipette, and filter through a Na₂SO₄ filter.
7. Remove the solvent by evaporating with a gentle stream of nitrogen gas over a water bath at 37°C. Add 1 mL of CLF, cap and store frozen until the digestion procedure.
8. Duplicate extractions should be done for all samples.

Digestion Procedure

1. Transfer 100-500 uL of sample to a clean 60 mL serum bottle using a gastight syringe (clean syringe between samples with 1x acetone then 2x CLF).
2. Remove the solvent by evaporating with a gentle stream of nitrogen gas over a water bath at 37°C.
3. Prepare standards from 0.1 mM stock solution of glycerophosphate as follows: duplicates of each concentration 0, 1.5 nM, 3 nM, 6 nM, 10 nM, and 15 nM (or 15 uL, 30 uL, 60 uL, 100 uL, 150 uL of stock solution delivered to clean serum bottles).
4. To each prepared serum bottle add 2 mLs of 5%(w/v) acid potassium persulfate solution, cap with Teflon-coated septa and crimp immediately.
5. Incubate at 95°C for 12-24 hours.

Analytical Procedure

1. After the digested sample has cooled remove the cap and add 0.5 mLs ammonium molybdate solution, let stand 10 minutes.
2. Add 2 mLs malachite green solution and let stand 30 minutes.
3. Decant sample into a 1 cm square cuvette, read absorbance on a spectrometer at 610 nm using glycerophosphate standards.

Biomass Calculation

1. Use the conversions factor of Findlay (1989) of 4×10^9 cells per 100 nmol lipid bound phosphate
2. nmol Lipid bound phosphate/gram material =
ppb Pi / 95 * mLs persulfate / mLs CHCl₃ digested * mLs CHCl₃/g soil extract.
 - a. For the suggested sediment protocol, cells = ppb/127 * 10^7 .

References

1. Findlay, R.H., G.M. King, and L. Watling, 1989. Efficacy of phospholipid analysis in determining microbial biomass in sediments. *Applied and Environmental Microbiology*, 55: 2888-2893.

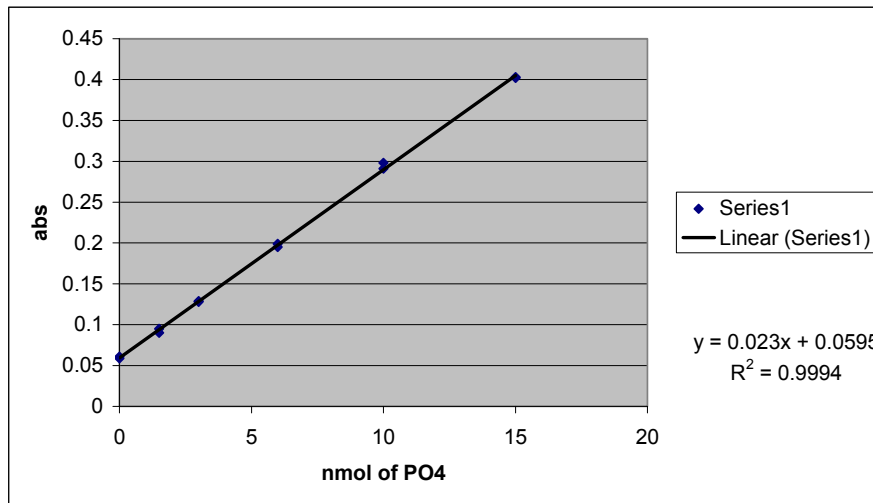
Appendix F: Field Core Description and Biomass Data

Core	Depth (cm bgs)	Field Observations (deviations from normal)	Sample Label	Duplicate Label
1-1	61-86		1-1 A	1-1 AD
	86-111		1-1 B	1-1 BD
	111-136		1-1 C	1-1 CD
	136-156		1-1 D	1-1 DD
	156-176		1-1 E	1-1 ED
1-2	176-201		1-2 A	1-2 AD
	201-226		1-2 B	1-2 BD
	226-251		1-2 C	1-2 CD
	251-276		1-2 D	1-2 DD
	276-301		1-2 E	1-2 ED
	301-328		1-2 F	1-2 FD
1-3	328-353		1-3 A	1-3 AD
	353-378		1-3 B	1-3 BD
	378-403		1-3 C	1-3 CD
	403-428		1-3 D	1-3 DD
	428-467	not enough for 2 shorts	1-3 E	1-3 ED
2-1	61-86		2-1 A	2-1 AD
	86-111		2-1 B	2-1 BD
	111-136		2-1 C	2-1 CD
	136-175	not enough for 2 shorts	2-1 E	2-1 DD
2-2	175-200	gas smell-blk pcpt	2-2 A	2-2 AD
	200-225	gas smell	2-2 B	2-2 BD
	225-250	little gas smell- blk pcpt	2-2 C	2-2 CD
	250-275		2-2 D	2-2 DD
	275-300	very gassy-drk gry-blk pcpt	2-2 E	2-2 ED
	300-325	very gassy	2-2 F	2-2 FD
2-3	325-350	gas smell	2-3 A	2-3 AD
	350-375	gas smell-gry/brwn	2-3 B	2-3 BD
	375-400		2-3 C	2-3 CD
	400-425	gas smell-coarse brwn upper to fine gry lower	2-3 D	2-3 DD
	425-466	gas smell-silty at lower-gry color	2-3 E	2-3 ED
3-1	61-86		3-1 A	3-1 AD
	86-111		3-1 B	3-1 BD
	111-136		3-1 C	3-1 CD
	136-169		3-1 D	3-1 DD
3-2	169-194	gas smell	3-2 A	3-2 AD
	194-219	gas smell	3-2 B	3-2 BD
	219-244	gas smell	3-2 C	3-2 CD
	244-269	gas smell	3-2 D	3-2 DD
	269-294	gas smell	3-2 E	3-2 ED
	294-319	gas smell	3-2 F	3-2 FD
3-3	319-344	lots of pebbles	3-3 A	3-3 AD
	344-369	little gas smell	3-3 B	3-3 BD
	369-394	gas smell	3-3 C	3-3 CD
	394-419	gas smell-gry color	3-3 D	3-3 DD
	419-444	gas smell-gry color-coarse	3-3 E	3-3 ED
	444-462	gas smell-gry color	3-3 F	3-3 FD

Location: Background
 Date of Core Extraction 12/5/2006
 Date of PLFA Extraction 5/14/2007
 Date of PLFA Absorbance 5/17/2007

Standards	Conc	Abs	Conc	Abs
	0	0.061	0	0.059
	1.5	0.09	1.5	0.095
	3	0.128	3	0.129
	6	0.199	6	0.195
	10	0.298	10	0.291
	15	0.403	15	0.402

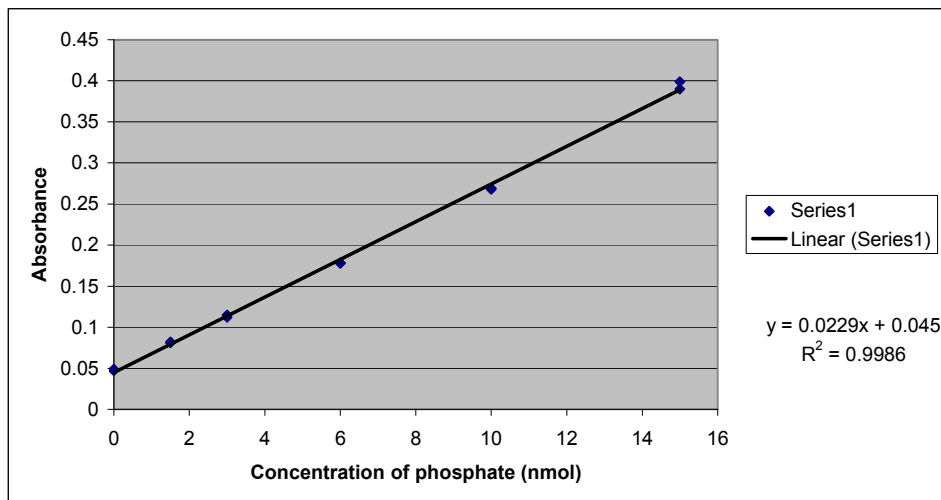
Sample	Mass weighed (g dry sediment)	Lab notes	Absorbance	Amount of Phosphate nmol	Biomass (Dobbs&Findlay 1993) (cells/gdw sed)	High Value (cells/gdw sed)	Average (cells/gdw sed)
1-1 A	10.001	+ 4 ml DCM	0.072	0.54347826	1.85E+06	1.09E+08	5.53E+07
1-1 B							
1-1 C	10.003	+ 5 ml DCM	0.06	0.02173913	7.39E+04	4.35E+06	2.21E+06
1-1 D							
1-1 E							
1-1 AD	10.001	+ 6 ml DCM	0.066	0.2826087	9.61E+05	5.65E+07	2.87E+07
1-1 BD							
1-1 CD	10.007	+ 4 ml DCM	0.072	0.54347826	1.85E+06	1.09E+08	5.53E+07
1-1 DD							
1-1 ED							
1-2 A	10.007	+ 5 ml DCM	0.071	0.5	1.70E+06	1.00E+08	5.09E+07
1-2 B							
1-2 C							
1-2 D	10.003	+ 3 ml DCM	0.074	0.63043478	2.14E+06	1.26E+08	6.41E+07
1-2 E							
1-2 F							
1-2 AD	10.008	+ 6 ml DCM	0.105	1.97826087	6.73E+06	3.96E+08	2.01E+08
1-2 BD							
1-2 CD							
1-2 DD	10.001	+ 5 ml DCM	0.064	0.19565217	6.65E+05	3.91E+07	1.99E+07
1-2 ED							
1-2 FD							
1-3 A	10.007	+ 4 ml DCM	0.063	0.15217391	5.17E+05	3.04E+07	1.55E+07
1-3 B							
1-3 C	10.003	+ 1 ml DCM	0.093	1.45652174	4.95E+06	2.91E+08	1.48E+08
1-3 D							
1-3 E							
1-3 AD	10.008	+ 4 ml DCM	0.07	0.45652174	1.55E+06	9.13E+07	4.64E+07
1-3 BD							
1-3 CD	10.003	+ 6 ml DCM	0.115	2.41304348	8.20E+06	4.83E+08	2.45E+08
1-3 DD							
1-3 ED							



Location: 0.3 m down-gradient of ORC wells between D & E PVPs
 Date of Core Extraction 12/5/2006
 Date of PLFA Extraction 2/13/2007 for 2-2; 2/28/2007 for 2-1; 3/7/2007 for 2-3;
 Date of PLFA Absorbance 2/24/07 for 2-2; 3/07/07 for 2-1; 3/10/07 for 2-3

Standards Conc	Abs	Conc	Abs
0	0.049	0	0.047
1.5	0.082	1.5	0.081
3	0.112	3	0.115
6	0.178	6	0.178
10	0.268	10	0.269
15	0.39	15	0.399

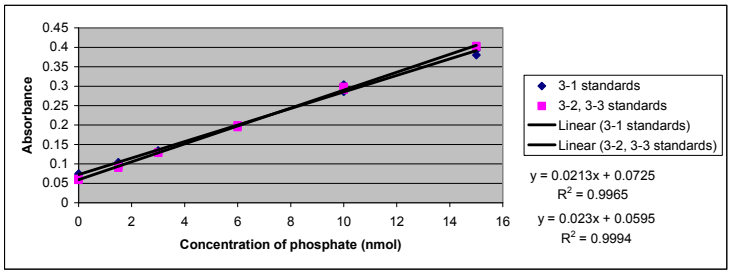
Sample	Mass weighed (g dry sediment)	Lab notes	Absorbance	Amount of Phosphate nmol	Biomass (cells/g dry weight sed) (Dobbs&Findlay 1993)	High Value (cells/g dry weight sed)	Average (cells/g dry weight sed)
2-1 A	1.001	+ 1ml DCM	0.07	1.09170306	3.71E+07	2.18E+09	1.11E+09
2-1 B	1.003	+ 1ml DCM	0.064	0.82969432	2.82E+07	1.66E+09	8.44E+08
2-1 C	1.009	+ 1ml DCM	0.06	0.65502183	2.23E+07	1.31E+09	6.66E+08
2-1 D	1.006	+ 1ml DCM	0.062	0.74235808	2.52E+07	1.48E+09	7.55E+08
2-1 AD	1.001	+ 1ml DCM	0.065	0.87336245	2.97E+07	1.75E+09	8.88E+08
2-1 BD	1.002	+ 1ml DCM	0.059	0.61135371	2.08E+07	1.22E+09	6.22E+08
2-1 CD	1.009	+ 1ml DCM	0.061	0.69868996	2.38E+07	1.40E+09	7.11E+08
2-1 DD	1.001	+ 1ml DCM	0.065	0.87336245	2.97E+07	1.75E+09	8.88E+08
2-2 A	1.003		0.167	5.32751092	1.81E+08	1.07E+10	5.42E+09
2-2 B	1.002		0.078	1.44104803	4.90E+07	2.88E+09	1.47E+09
2-2 C	1.003		0.086	1.79039301	6.09E+07	3.58E+09	1.82E+09
2-2 D	1.000		0.087	1.83406114	6.24E+07	3.67E+09	1.87E+09
2-2 E	1.004		0.082	1.61572052	5.49E+07	3.23E+09	1.64E+09
2-2 F	1.009		0.085	1.74672489	5.94E+07	3.49E+09	1.78E+09
2-2 AD	1.002		0.085	1.74672489	5.94E+07	3.49E+09	1.78E+09
2-2 BD	1.003	+ 1ml DCM	0.08	1.52838428	5.20E+07	3.06E+09	1.55E+09
2-2 CD	1.002		0.08	1.52838428	5.20E+07	3.06E+09	1.55E+09
2-2 DD	1.001	+ 1ml DCM	0.093	2.09606987	7.13E+07	4.19E+09	2.13E+09
2-2 ED	1.001		0.081	1.5720524	5.34E+07	3.14E+09	1.60E+09
2-2 FD	1.005		0.084	1.70305677	5.79E+07	3.41E+09	1.73E+09
2-3 A	1.003	+ 1ml DCM	0.076	1.35371179	4.60E+07	2.71E+09	1.38E+09
2-3 B	1.003	+ 1ml DCM	0.074	1.26637555	4.31E+07	2.53E+09	1.29E+09
2-3 C	1.002	+ 1ml DCM	0.078	1.44104803	4.90E+07	2.88E+09	1.47E+09
2-3 D	1.003	+ 1ml DCM	0.08	1.52838428	5.20E+07	3.06E+09	1.55E+09
2-3 E	1.005	+ 1ml DCM	0.076	1.35371179	4.60E+07	2.71E+09	1.38E+09
2-3 AD	1.002	+ 1ml DCM	0.073	1.22270742	4.16E+07	2.45E+09	1.24E+09
2-3 BD	1.007	+ 1ml DCM	0.081	1.5720524	5.34E+07	3.14E+09	1.60E+09
2-3 CD	1.001	+ 1ml DCM	0.075	1.31004367	4.45E+07	2.62E+09	1.33E+09
2-3 DD	1.002	+ 1ml DCM	0.078	1.44104803	4.90E+07	2.88E+09	1.47E+09
2-3 ED	1.002	+ 1ml DCM	0.074	1.26637555	4.31E+07	2.53E+09	1.29E+09



Location: Near B PVP at plume edge
 Date of Core Extraction 12/5/2006
 Date of PLFA Extraction 3/15/07 for 3-1; 3/27/07 for 3-2 and 3-3; 3-3 A, AD, B, BD, E, ED, F, & FD redone on 5/17
 Date of PLFA Absorbance 3/20/07 for 3-1; 5/7/07 for 3-2 and 3-3; 3-2 D,DD,F,&FD and 3-3C & CD on 5/14; 3-3 A, AD, B, BD, E, ED, F, & FD redone on 5/17

Standards	Conc	Abs	Conc	Abs	Conc	abs	Conc	abs
	0	0.072	0	0.075	0	0.061	0	0.059
	1.5	0.104	1.5	0.102	1.5	0.09	1.5	0.095
	3	0.134	3	0.134	3	0.128	3	0.129
	6	0.198	6	0.199	6	0.199	6	0.195
	10	0.304	10	0.286	10	0.298	10	0.291
	15	0.393	15	0.38	15	0.403	15	0.402

Sample	Mass weighed (g dry sediment)	Lab notes	Absorbance	Amount of Phosphate nmol	Biomass (cells/g dry weight sed) (Dobbs&Findlay 1993)	High Value (cells/g dry weight sed)	Average (cells/g dry weight sed)
3-1 A	3.002	+1 ml DCM	0.098	1.1971831	1.36E+07	7.98E+08	4.06E+08
3-1 B	3.003	+1 ml DCM	0.172	4.6713615	5.29E+07	3.11E+09	1.58E+09
3-1 C	3.003	+1 ml DCM	0.105	1.5258216	1.73E+07	1.02E+09	5.17E+08
3-1 D	3.002	+1 ml DCM	0.093	0.96244131	1.09E+07	6.42E+08	3.26E+08
3-1 AD	3.001	+1 ml DCM	0.125	2.46478873	2.79E+07	1.64E+09	8.36E+08
3-1 BD	3.005	+1 ml DCM	0.092	0.91549296	1.04E+07	6.10E+08	3.10E+08
3-1 CD	3.004	+1 ml DCM	0.093	0.96244131	1.09E+07	6.42E+08	3.26E+08
3-1 DD	3	+2 ml DCM	0.199	5.93896714	6.73E+07	3.96E+09	2.01E+09
3-2 A	3.006	+3 ml DCM	0.06	0.02173913	2.46E+05	1.45E+07	7.37E+06
3-2 B	3	+3 ml DCM	0.074	0.63043478	7.14E+06	4.20E+08	2.14E+08
3-2 C	3.006	+3 ml DCM	0.066	0.2826087	3.20E+06	1.88E+08	9.58E+07
3-2 D	3.001	+1 ml DCM	0.06	0.02173913	2.46E+05	1.45E+07	7.37E+06
3-2 E	3.003	+1 ml DCM	0.06	0.02173913	2.46E+05	1.45E+07	7.37E+06
3-2 F	3.005	+2 ml DCM	0.07	0.45652174	5.17E+06	3.04E+08	1.55E+08
3-2 AD	3.01	+2 ml DCM	0.06	0.02173913	2.46E+05	1.45E+07	7.37E+06
3-2 BD	3.007	+1 ml DCM	0.064	0.19565217	2.22E+06	1.30E+08	6.63E+07
3-2 CD	3.008	+1 ml DCM	0.062	0.10869565	1.23E+06	7.25E+07	3.68E+07
3-2 DD	3.007	+1 ml DCM	0.065	0.23913043	2.71E+06	1.59E+08	8.11E+07
3-2 ED	3.009	+2 ml DCM	0.06	0.02173913	2.46E+05	1.45E+07	7.37E+06
3-2 FD	3.003	+1 ml DCM	0.06	0.02173913	2.46E+05	1.45E+07	7.37E+06
3-3 A	6.008	+1 ml DCM	0.065	0.23913043	1.36E+06	7.97E+07	4.05E+07
3-3 B	6.006	+6 ml DCM	0.066	0.2826087	1.60E+06	9.42E+07	4.79E+07
3-3 C	3.007	+4 ml DCM	0.078	0.80434783	9.12E+06	5.36E+08	2.73E+08
3-3 D	3.004	+3 ml DCM	0.079	0.84782609	9.61E+06	5.65E+08	2.87E+08
3-3 E	6.002	+5 ml DCM	0.083	1.02173913	5.79E+06	3.41E+08	1.73E+08
3-3 F	6.003	+6 ml DCM	0.061	0.06521739	3.70E+05	2.17E+07	1.11E+07
3-3 AD	6.008	+3 ml DCM	0.061	0.06521739	3.70E+05	4.35E+07	2.19E+07
3-3 BD	6.007	+6 ml DCM	0.063	0.15217391	1.72E+06	1.01E+08	5.16E+07
3-3 CD	3.003	+1 ml DCM	0.079	0.84782609	9.61E+06	5.65E+08	2.87E+08
3-3 DD	3.007	+1 ml DCM	0.061	0.06521739	7.39E+05	4.35E+07	2.21E+07
3-3 ED	6.009	+6 ml DCM	0.074	0.63043478	3.57E+06	2.10E+08	1.07E+08
3-3 FD	6.008	+6 ml DCM	0.092	1.41304348	8.01E+06	4.71E+08	2.40E+08



PLFA for October 2005

Sample	Absorbance
0	0.061
0	0.063
0	0.066
0	0.061
1.5	0.144
1.5	0.105
3	0.136
3	0.141
6	0.205
6	0.201
10	0.291
10	0.283
15	0.391
15	0.4

2/24/2006

Standards recorded as nmol of PO4

filtered 2000 ml of water per sample

Equation $y = 0.0217x + 0.0722$
 R2 = 0.9889

Location	Absorbance	Amount of Phosphate (nmol)	Biomass (Dobbs&Findlay 1993)	High Value	Average of replicates, D&F and high values
1-2_3	0.094	1.00460829	1.708E+04	1.005E+06	5.577E+05
1-2_3	0.098	1.18894009	2.021E+04	1.189E+06	
1-2_7	0.08	0.359447	6.111E+03	3.594E+05	1.711E+05
1-2_7	0.079	0.31336406	5.327E+03	3.134E+05	
1-2_11*	0.05	-1.0230415	-1.739E+04	-1.023E+06	Below detection
4-2_3	0.072	-0.0092166	-1.567E+02	-9.217E+03	5.366E+05
4-2_3	0.118	2.11059908	3.588E+04	2.111E+06	
4-2_7	0.077	0.22119816	3.760E+03	2.212E+05	2.414E+05
4-2_7**	0.088	0.7281106	1.238E+04	7.281E+05	
4-2_11	0.059	-0.6082949	-1.034E+04	-6.083E+05	6.796E+04
4-2_11***	0.078	0.26728111	4.544E+03	2.673E+05	
4-3_3*	0.084	0.5437788	9.244E+03	5.438E+05	2.765E+05
4-3_7	0.059	-0.6082949	-1.034E+04	-6.083E+05	Below detection
4-3_7	0.056	-0.7465438	-1.269E+04	-7.465E+05	
4-3_11	0.075	0.12903226	2.194E+03	1.290E+05	1.242E+05
4-3_11	0.08	0.359447	6.111E+03	3.594E+05	
4-4_3	0.077	0.22119816	3.760E+03	2.212E+05	1.125E+05
4-4_3	0.077	0.22119816	3.760E+03	2.212E+05	
4-4_7*	0.12	2.20276498	3.745E+04	2.203E+06	1.120E+06
4-4_11*	0.074	0.08294931	1.410E+03	8.295E+04	4.218E+04
OW2	0.165	4.2764977	7.270E+04	4.276E+06	2.362E+06
OW2	0.181	5.01382488	8.524E+04	5.014E+06	
PRB	0.081	0.40552995	6.894E+03	4.055E+05	2.414E+05
PRB	0.084	0.5437788	9.244E+03	5.438E+05	
W1E	0.06	-0.562212	-9.558E+03	-5.622E+05	Below detection
W1E	0.066	-0.2857143	-4.857E+03	-2.857E+05	
PMP	0.076	0.17511521	2.977E+03	1.751E+05	1.008E+05
PMP	0.077	0.22119816	3.760E+03	2.212E+05	
W1W	0.147	3.44700461	5.860E+04	3.447E+06	1.694E+06
W1W	0.142	3.21658986	5.468E+04	3.217E+06	

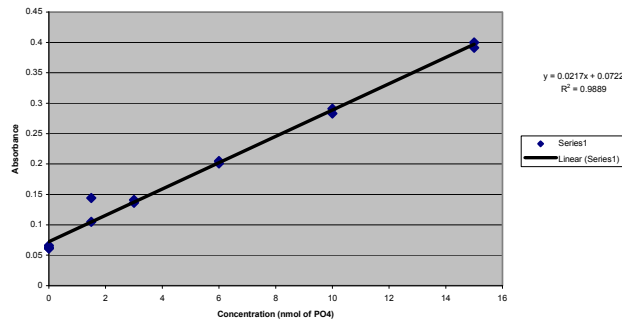
* due to limited amount of sample from Nov. 2005 analysis, not all locations could be done in replicate

** 180 µl used

*** 100 µl used

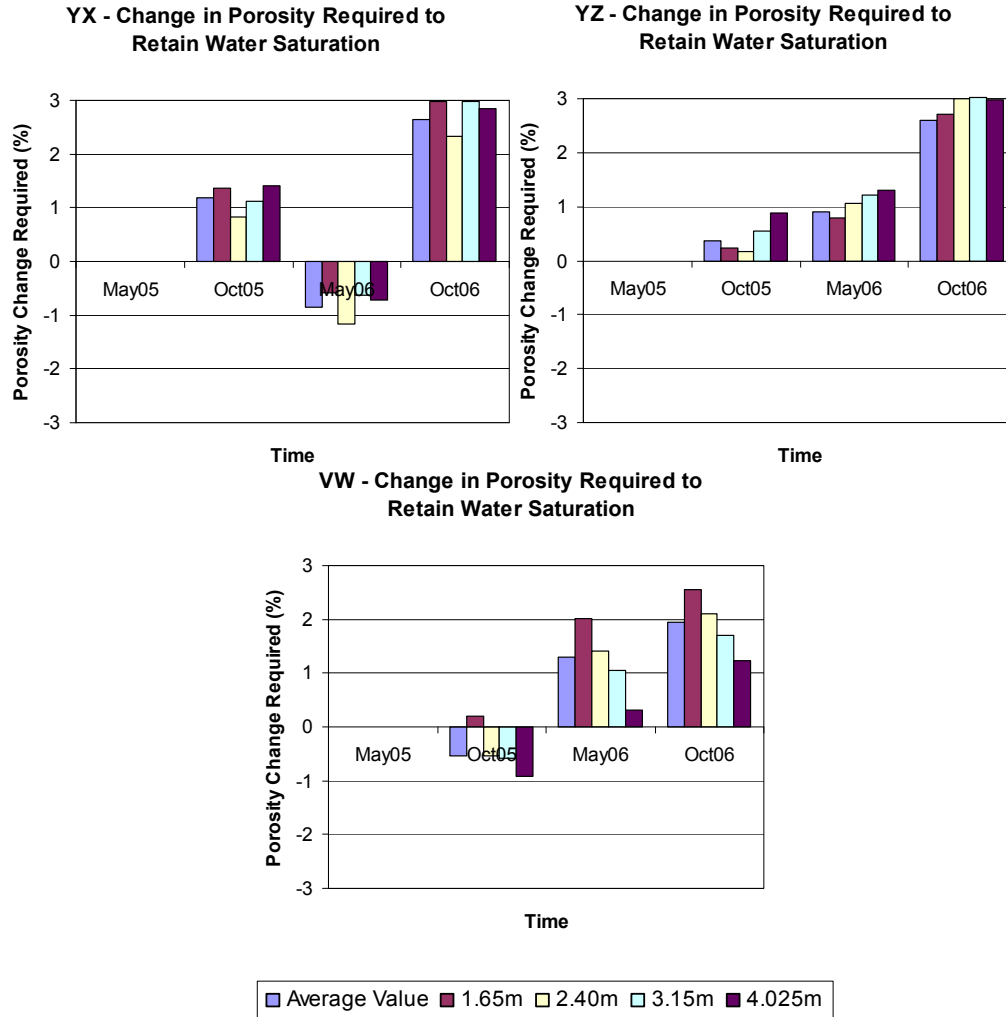
all other samples used 200 µl

Standards Curve for PFLA

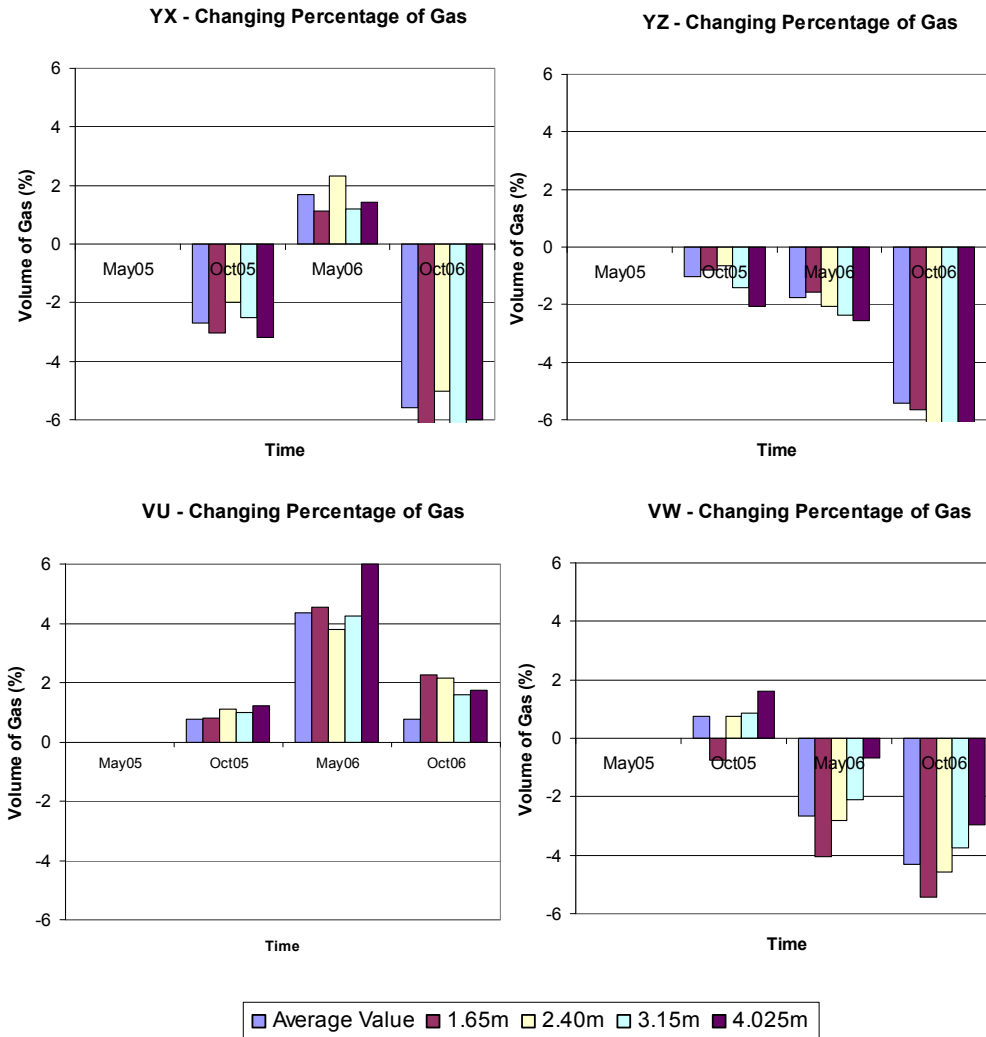


Appendix G: McGlashan (2007) Petrophysical Analysis with CRIM

The following graphs are results from a petrophysical analysis to explain the changes observed in GPR EM wave velocities for borehole-pairs used in this study.



Percentages of Porosity Change due to Mineral Dissolution from McGlashan, 2007. Profile orientation is east-west. Upper two profiles are located 0.5 m down-gradient of oxygen release wells; lower profile is 2.5 m down-gradient of oxygen wells on the western side of the monitoring area. All borehole-pairs show an overall increase in porosity over time. The negative values in Y-X for May 06 and V-W for Oct05 are probably not explained by porosity changes, but another mechanism such as gas production.



Percentages of Gas Formation from McGlashan 2007. Profile orientation is east-west. Upper two profiles are located 0.5 m down-gradient of oxygen release wells; lower profiles are 2.5 m down-gradient of oxygen wells. Only V-U shows an overall increase in gas accumulation over time, while borehole-pairs Y-X, Y-Z, and V-W all show the opposite trend of increasing S_w with time overall.

Appendix H: Geochemical Calculations to Determine Saturation Indices at Borden with Respect to Calcite

The subsequent pages are a calculation to investigate saturation indices calculated from log ion activity product of calcite in the following locations in the aquifer: background, in the plume at the KURL wells (biostimulated), at the ORC wells with pH = 9.4 (biostimulated), at the ORC wells with pH = 8.2 (biostimulated), and within the plume with no ORC influence. Input parameters were taken from field measurements of CO₂ and Ca²⁺ values in **Table 2.1**.

Assuming concentrations are representative of activities over the concentration ranges of interest. Constants were taken from Drever, J.I. 1997 for 10⁰C.



Using Equation 3, solve for $[\text{HCO}_3^-]$, insert into Equation 2, and solve for $[\text{H}_2\text{CO}_3]$

$$5) [\text{HCO}_3^-] = \frac{[\text{CO}_3^{2-}][\text{H}^+]}{K_2}$$

$$6) [\text{H}_2\text{CO}_3] = \frac{\left(\frac{[\text{CO}_3^{2-}][\text{H}^+]}{K_2} \right) [\text{H}^+]}{K_1}$$

Insert Equation 5 into Equation 1 and solve for $[\text{CO}_3^{2-}]$

$$7) [\text{CO}_3^{2-}] = \frac{[\rho\text{CO}_2] (K_{\text{CO}_2}) (K_1) (K_2)}{[\text{H}^+]^2}$$

where K_{CO_2} , K_1 , and K_2 are found in tables for conditions at 10⁰C. Using Henry's Law, $[\rho\text{CO}_2]$ was determined from measured $[\text{CO}_2]_{\text{aq}}$ with the following equation:

$$8) [\rho\text{CO}_2] = \frac{[\text{CO}_2]}{K_H}$$

where $K_H = 10^{-1.5}$ (mol/L atm), and $[\text{CO}_2]$ is expressed as molar concentration.

$$9) IAP = [\text{Ca}^{2+}][\text{CO}_3^{2-}]$$

$$10) SI = \log\left(\frac{IAP}{K_{\text{sp Calcite}}}\right)$$

Location	Low [CO2] values favoring CaCO3 remaining dissolved						High [CO2] values favoring CaCO3 precipitation							
	pH	[CO2] (M)	(atm)	[Ca2+] (M)	[CO3=] (M)	SI	pH	[CO2] (M)	(atm)	[Ca2+] (M)	[CO3=] (M)	IAP	SI	
R4-4	7.64	1.19E-03	2.21E-02	0.0013	2.53E-05	3.29E-08	0.93	7.43	3.86E-03	7.19E-02	0.0028	3.14E-05	8.79E-08	1.35
R4-5	7.43	1.85E-03	3.45E-02	0.0013	1.50E-05	1.96E-08	0.70	7.64	2.12E-03	3.95E-02	0.0028	4.54E-05	1.27E-07	1.51
KUML A	7.4	1.45E-03	2.70E-02	0.0013	1.03E-05	1.33E-08	0.54	6.76	4.01E-02	7.47E-01	0.0028	1.49E-05	4.17E-08	1.03
KUML B	7.58	2.62E-03	4.87E-02	0.0013	4.24E-05	5.51E-08	1.15	6.74	3.55E-02	6.62E-01	0.0028	1.20E-05	3.37E-08	0.94
ORC Wells	8.2	1.45E-03	2.70E-02	0.0013	4.08E-04	5.31E-07	2.14	9.4	4.01E-02	7.47E-01	0.0028	2.84E+00	7.95E-03	6.31
	measured quantities													
	assumed quantities from nearby locations or literature													
	calculated quantities													

**Appendix I: Tabulation of Aqueous Concentrations of CO₂, H₂S, and CH₄ for
May and October 2006.**

Spreadsheet formulations provided by Roberts, J.A. (2006) personal communication.

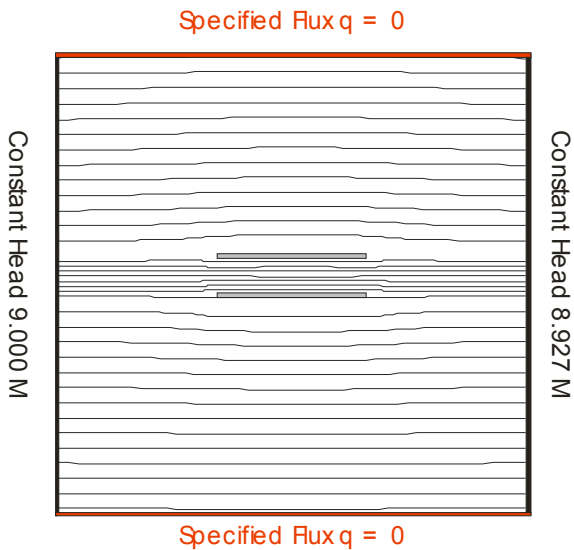
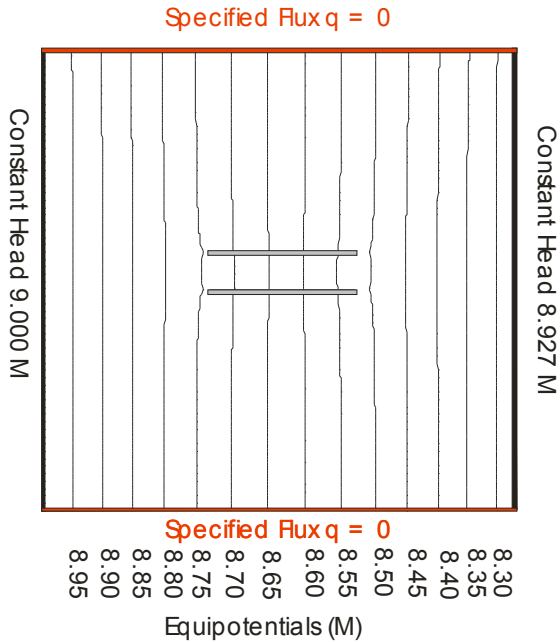
Standards

CH4(ppm)	CO2(ppm)	CH4(area)	CO2(area)
1020		41.5	
10200	9900	424.8	599.9
20400	19800	893.2	1261.3
40800	39600	1721	2551.3

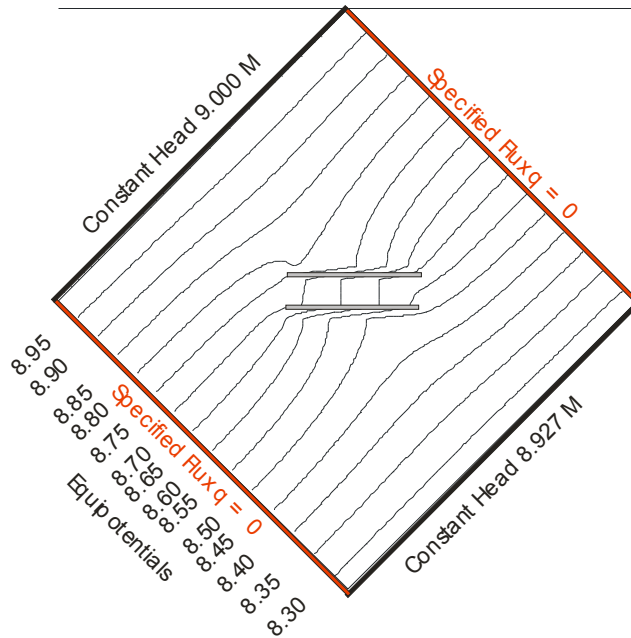
Sample	CH4	CO2	H2S	[CH4] ppm	CH4 ppm sol	[CO2]ppm	CO2 ppm sol	H2S ppm (from May 2006 STDs)	H2S ppm sol
R4-1-3	0	452.9	196.7	0	0	7589.40	248.6113	18.66003	1.882367
-1-3	0	177.1	176.2	0	0	3386.76	110.9425	16.71529	1.686188
-1-7	0	132.3	178.8	0	0	2704.10	88.58	16.96194	1.711069
-1-11	0	256.7	196.1	0	0	4599.70	150.6757	18.60311	1.876625
R4-2-1	0	242.2	189.5	0	0	4378.75	143.4379	17.977	1.813465
-2-3	0	280.9	181.9	0	0	4968.46	162.7554	17.25602	1.740735
-2-5	0	178.5	184.5	0	0	3408.09	111.6413	17.50267	1.765616
-2-5repeat	0	168.1	171.5	0	0	3249.62	106.45	16.26942	1.64121
-2-7	0	131	179.7	0	0	2684.29	87.93109	17.04731	1.719682
-2-9	0	163.8	171.8	0	0	3184.09	104.3036	16.29788	1.644081
-2-11	0	283.8	189.5	0	0	5012.65	164.203	17.977	1.813465
-2-13	0	227	180	0	0	4147.14	135.8506	17.07577	1.722553
R-4-3-1	0	383	181.7	0	0	6524.26	213.7199	17.23704	1.738821
-3-3	0	222.6	232.7	0	0	4080.09	133.6543	22.07518	2.226878
-3-5	0	104.6	211	0	0	2282.00	74.75322	20.0166	2.019214
-3-7	0	145.4	187.3	0	0	2903.72	95.11902	17.76829	1.792412
-3-9	0	180.8	175.6	0	0	3443.14	112.7894	16.65837	1.680446
-3-11	0	324.4	167.2	0	0	5631.32	184.469	15.8615	1.60006
-3-13	0	141.1	163.9	0	0	2838.19	92.97263	15.54844	1.56848
R4-4-1	0	205	166	0	0	3811.90	124.8691	15.74766	1.588576
-4-3	0	170.4	216.1	0	0	3284.67	107.5981	20.50042	2.06802
-4-5	0	145.9	135.8	0	0	2911.33	95.3686	12.88272	1.29957
-4-7	0	75.3	147.8	0	0	1835.53	60.12778	14.02111	1.414407
-4-9	0	59.3	168	0	0	1591.72	52.14119	15.93739	1.607716
-4-11	0	295.2	153.7	0	0	5186.37	169.8935	14.58081	1.470868
-4-13	0	132.9	321	0	0	2713.24	88.8795	30.4518	3.071885
R4-5-3	0	118	303	0	0	2486.19	81.44199	28.74422	2.89963
-5-7	0	141.9	284.6	0	0	2850.38	93.37196	26.9987	2.723547
-5-11	0	125.3	303.8	0	0	2597.43	85.08587	28.82011	2.907286
KUML 1-1	0	96	262.3	0	0	2150.96	70.46043	24.8832	2.510142
1-2	0	188	236.2	0	0	3552.85	116.3833	22.40721	2.260372
1-3	0	82.6	203.1	0	0	1946.77	63.77166	19.26716	1.943613
1-4	0	3489.6	204.1	0	0	53862.63	1764.416	19.36203	1.953183
KUML 2-1	0	185.4	198	0	0	3513.24	115.0855	18.78335	1.894808
2-2	0	355.2	164.6	0	0	6100.65	199.8432	15.61485	1.575179
2-3	0	514.8	206.3	0	0	8532.63	279.5094	19.57073	1.974237
2-4new	42.5	3087.9	177.2	932.2135	0.40709	47741.53	1563.903	16.81015	1.695757
2-4old	27.1	2952.2	190	568.7581	0.248372	45673.73	1496.166	18.02443	1.81825
2-5	55.3	3977.1	208	1234.306	0.539012	61291.16	2007.757	19.73201	1.990505

Appendix J: Groundwater Flow Models to Simulate Seasonality

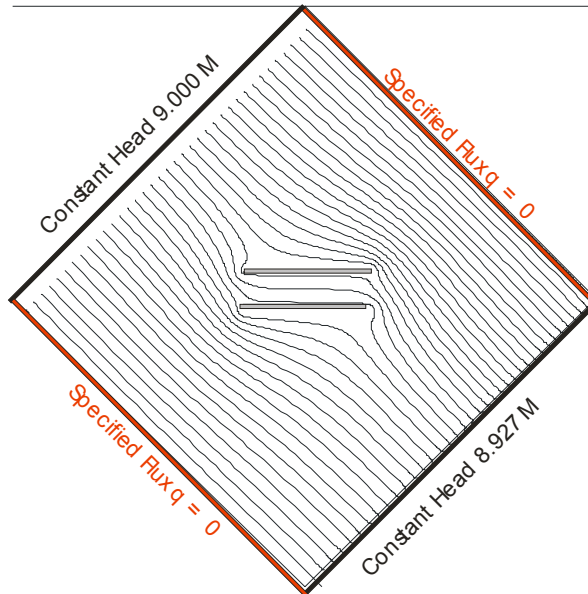
Flow modeling was done to evaluate the impact of seasonal variations in the hydraulic gradient on the groundwater velocity magnitude and direction. The sheet-pile gate restricted the overall average direction of flow. However, the magnitude could still vary since a change in hydraulic gradient entering the gate occurs from seasonal variations. These changes in gradient were represented by changing the orientation of the constant head boundary with respect to the gate. Model simulations were also run to verify the seasonal changes in groundwater velocity within the gate with a heterogeneous hydraulic conductivity distribution. In these simulations, seasonal variations in the gradient were caused by changing the constant head boundary magnitudes at the influent and effluent locations of the gate.

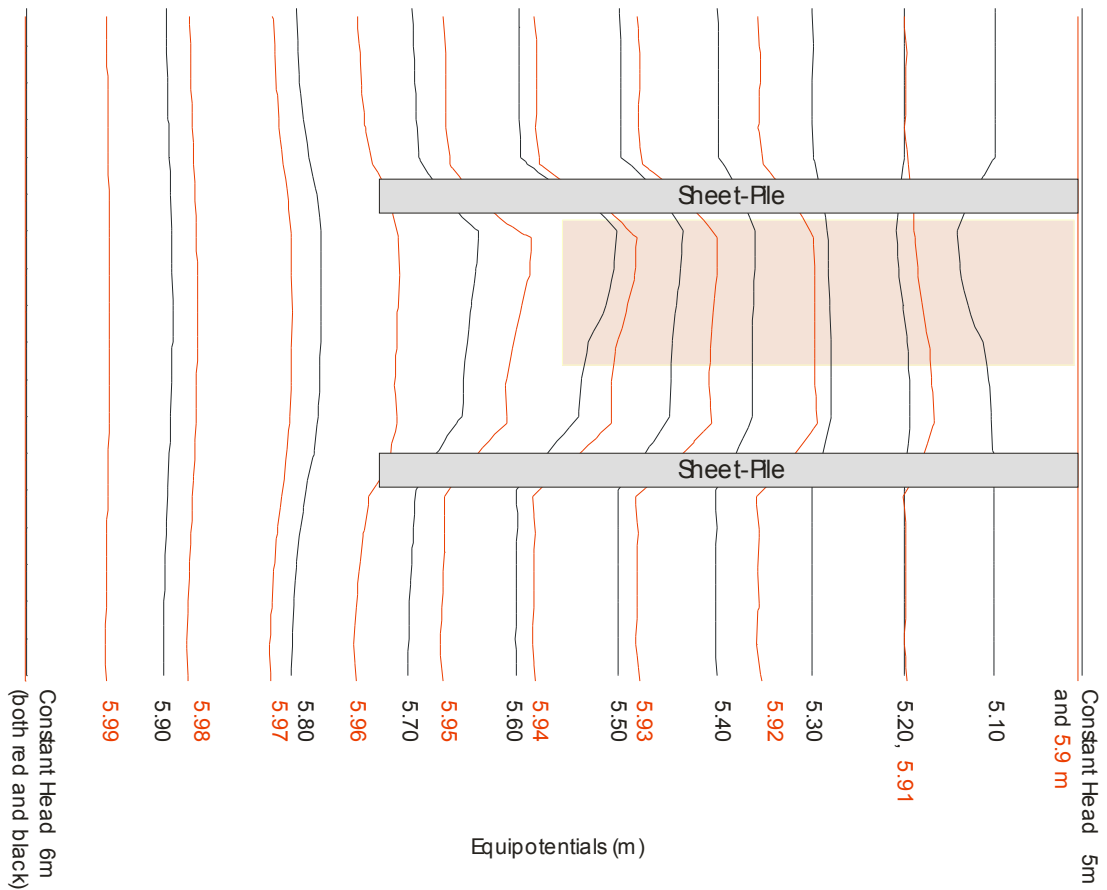


A series of simulations were run to identify the expected influence seasonality has on the direction and magnitude of groundwater velocity. Seasonal variations in groundwater velocity were assumed to be derived from changes in the gradient direction. To simulate this a modeling domain analogous to the Borden aquifer was created with a homogenous hydraulic conductivity field in both the x and y directions ($k_{xx} = k_{yy} = 6.048 \text{ m/d}$). Sheet piling represented by parallel grey rectangles, was simulated by assigning nodes with a k_{xx} and k_{yy} of $1\text{E-}5 \text{ m/d}$. Porosity was held constant through the domain at 0.33. Shown, are equipotentials (upper left) and flow paths (lower left) for an ambient flow field oriented directly into the flow gate. Constant head boundaries (thick black lines) at both lateral ends of the domain produce the gradient. Thick red lines represent a constant Darcy flux of 0. Changes in the flow gradient are illustrated on the next page.

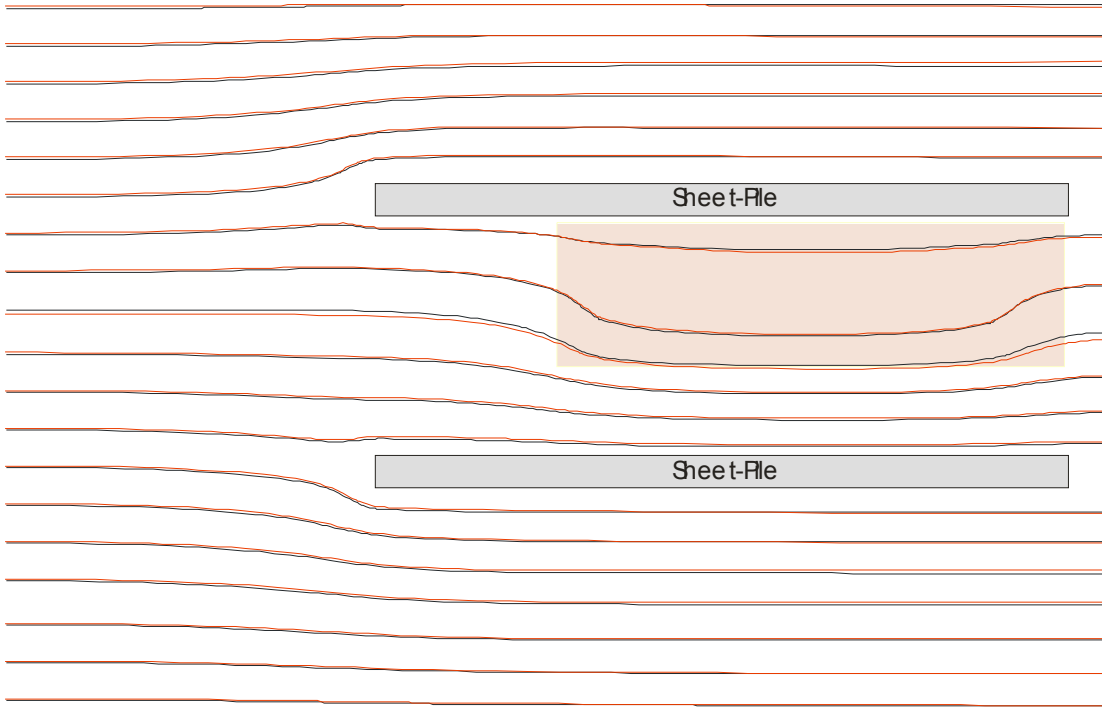


To simulate velocity changes within the gate as a result of seasonal groundwater gradient changes, the aquifer domain used on the previous page is rotated by 45°. Shown, are equipotentials (upper left) and flow paths (lower left) for an ambient flow field oriented 45° to the flow gate. Constant head boundaries (thick black lines) at both lateral ends of the domain produce the gradient. Thick red lines represent a constant Darcy flux of 0. Changes in the flow gradient and flow paths are evident compared to the previous case where the flow field was oriented parallel to the gate. Average velocity in the gate was shown to decrease by nearly 30% as a result of orienting the flow field by 45°.





A series of simulations were run to identify the expected influence seasonality has on the direction and magnitude of groundwater velocity in a heterogeneous aquifer. Seasonal variations in groundwater velocity were assumed to be derived from changes in the gradient direction. To simulate this, a modeling domain analogous to the Borden site was constructed with a heterogeneous aquifer and sheet piling. The aquifer was given an initial k_{xx} and k_{yy} (hydraulic conductivity in x and y directions) of 6.048 m/d. Sheet piling represented by parallel grey rectangles, was simulated by assigning nodes with a k_{xx} and k_{yy} of $1E-5$ m/d. A slower velocity zone was placed inside the gate (shaded area) with k_{xx} and k_{yy} equivalent to 1.2 m/d. Porosity was held constant through the domain at 0.33. Shown above, are equipotentials for two different gradient directions. The red equipotentials represent a gradient that directs flow parallel to the sheet piling. The black equipotentials represent a gradient that is adjusted in direction as a function of cosine to the original gradient. Constant head boundaries at both lateral ends of the domain produce the change in gradient. From the above figure, it is evident that seasonal changes in gradient will produce changes in groundwater velocity magnitude in a heterogeneous aquifer. Changes in groundwater direction are evaluated by examining the flow paths on the next page.



Flow paths are shown above for the same heterogeneous aquifer described on the previous page. Note that little difference is seen in groundwater velocity direction from seasonal gradient changes.

Appendix K: Biomass Calculation from Holmes 2000 and Vandevivere and Baveye (1992a and 1992b)

Reported reduction in K = 90%

Initial Biomass = 1 mg wet weight/cm³ porous medium

Measured Biomass at 90% K reduction = 10 mg wet weight/cm³ porous medium

Dry Bulk Density of Medium = 1.6 g/cm³

Cell Density = 1.1 mg biomass/mm³

Cell volume = 2.4 μm³/cell

$$\left(\frac{2.4 \times 10^9 \text{ mm}^3}{\text{cell}} \right) \left(\frac{1.1 \text{ mg biomass}}{\text{mm}^3} \right) = \frac{2.64 \times 10^{-9} \text{ mg biomass}}{\text{cell}}$$

$$\left(\frac{\text{Cells}}{2.64 \times 10^9 \text{ mg biomass}} \right) \left(\frac{1 \text{ mg wet biomass}}{\text{cm}^3 \text{ aquifer}} \right) \left(\frac{\text{cm}^3}{1.6 \text{ g dry sed}} \right) = \frac{2.3 \times 10^8 \text{ cells}}{\text{g dry weight}}$$

$$\left(\frac{\text{Cells}}{2.64 \times 10^9 \text{ mg biomass}} \right) \left(\frac{10 \text{ mg wet biomass}}{\text{cm}^3 \text{ aquifer}} \right) \left(\frac{\text{cm}^3}{1.6 \text{ g dry sed}} \right) = \frac{2.3 \times 10^9 \text{ cells}}{\text{g dry weight}}$$

Appendix L: Non Parametric Statistical Analysis of PVP and GPR Data

Date	GPR Velocity (m/ns)	Corresponding PVP	PVP Velocity (cm/d)	GPR Difference	PVP Difference	GPR Percent Change From May 2005	PVP Percent Change From Aug 2005	Product	Sort Product	Rank	Rank with sign	Lowry, 2008	Finkelstein and Levin, 2001
May-05	0.0536	B1	8.77285								n	55	55
Aug-05	0.0532	B2	7.169436								W	716	412
	0.054	B3	13.81658								EW	1540	770
	0.0527	B4	14.60343								VarW	56980	14245
	0.0537	C1	8.369289								z	2.997426	-2.9995203
	0.0531	C2	7.462551										
	0.0535	C3	7.642369										
	0.0533	C4	13.36593										
	0.0532	D1	7.806194										
	0.0535	D2	7.869618										
	0.0532	D3	7.765603										
	0.0532	D4	11.45922										
	0.0532	E1	6.058215										
	0.0534	E2	4.552361										
	0.0531	E3	4.444129										
	0.0533	E4	6.308453										
	0.0531	F1	5.428656										
	0.0531	F3	5.966536										
	0.0538	F4	6.109439										
											Pos	Neg	
Oct-05	0.05246	B1	8.880605	-0.00114	0.10775417	-103.636	0.529248	-54.8493	10000	1	1	1	0
	0.05226	B2	6.489148	-0.00094	-0.6802885	-85.4545	-3.34132	285.5309	6566.088	2	2	2	0
	0.05346	B3	12.65908	-0.00054	-1.1574956	-49.0909	-5.68518	279.0906	2866.157	3	3	3	0
	0.05206	B4	8.982853	-0.00064	-5.6205736	-58.1818	-27.6061	1606.175	2145.543	4	4	4	0
	0.05256	C1	9.922021	-0.00114	1.55273281	-103.636	7.626434	-790.376	1772.644	5	5	5	0
	0.05266	C2	6.738254	-0.00044	-0.7242963	-40	-3.55747	142.2988	1719.56	6	6	6	0
	0.05266	C3	6.71938	-0.00084	-0.9229896	-76.3636	-4.53337	346.185	1606.175	7	7	7	0
	0.05266	C4	7.912154	-0.00064	-5.453773	-58.1818	-26.7869	1558.508	1569.646	8	8	8	0
	0.05246	D1	5.333175	-0.00074	-2.4730186	-67.2727	-12.1465	817.1301	1558.508	9	9	9	0
	0.05296	D2	5.902669	-0.00054	-1.9669486	-49.0909	-9.66091	474.2626	1390.009	10	10	10	0
	0.05266	D3	5.49443	-0.00054	-2.2711728	-49.0909	-11.1551	547.6159	1358.77	11	11	11	0
	0.05206	D4	8.375575	-0.00114	-3.0836475	-103.636	-15.1457	1569.646	1031.102	12	12	12	0
	0.05246	E1	5.484846	-0.00074	-0.5733689	-67.2727	-2.81617	189.4515	1011.917	13	13	13	0
	0.05296	E2	3.706237	-0.00044	-0.8461248	-40	-4.15584	166.2338	951.4531	14	14	14	0
	0.05266	E3	4.073555	-0.00044	-0.3705735	-40	-1.82012	72.80467	948.4533	15	15	15	0
	0.05216	E4	5.346439	-0.00114	-0.9620137	-103.636	-4.72505	489.6866	917.3757	16	16	16	0
	0.05276	F1	4.414578	-0.00034	-1.0140784	-30.9091	-4.98077	153.951	860.51	17	17	17	0
	0.05256	F3	3.995939	-0.00054	-1.9705967	-49.0909	-9.67882	475.1422	817.1301	18	18	18	0
	0.05316	F4	4.306176	-0.00064	-1.8032632	-58.1818	-8.85694	515.3131	776.2753	19	19	19	0
										20	20	20	0
May-06	0.0543	B1	11.81694	0.0007	3.04408801	63.63636	14.95141	951.4531	684.8991	21	21	21	0
	0.054	B2	8.608333	0.0008	1.43889639	72.72727	7.067313	513.9864	618.083	22	22	22	0
	0.0547	B3	15.45995	0.0007	1.64336711	63.63636	8.071596	513.647	567.7353	23	23	23	0
	0.0538	B4	34.96331	0.0011	20.3598787	100	100	10000	559.0386	24	24	24	0
	0.0544	C1	7.150301	0.0007	-1.2189874	63.63636	-5.9872	-381.004	547.6159	25	25	25	0
	0.054	C2	6.486698	0.0009	-0.9758525	81.81818	-4.79302	-392.156	515.3131	26	26	26	0
	0.0542	C3	3.720324	0.0007	-3.9220457	63.63636	-19.2636	-1225.87	513.9864	27	27	27	0
	0.0543	C4	13.56641	0.001	0.20048162	90.90909	0.98469	89.51724	513.647	28	28	28	0
	0.0529	D2	5.750464	-0.0006	-2.119154	-54.5455	-10.4085	567.7353	489.6866	29	29	29	0
	0.0526	D3	5.157654	-0.0006	-2.6079494	-54.5455	-12.8093	698.6868	475.1422	30	30	30	0
	0.0528	D4	8.954416	-0.0004	-2.5048065	-36.3636	-12.3027	447.3694	474.2626	31	31	31	0
	0.0528	E2	3.836171	-0.0006	-0.7161906	-54.5455	-3.51766	191.8722	447.3694	32	32	32	0
	0.0526	E3	5.282289	-0.0005	0.8381607	-45.4545	4.116727	-187.124	354.5177	33	33	33	0
	0.0529	E4	8.960813	-0.0004	2.65236013	-36.3636	13.02739	-473.723	346.185	34	34	34	0
	0.0527	F1	4.61745	-0.0004	-0.8112066	-36.3636	-3.98434	144.8851	285.5309	35	35	35	0
	0.0526	F3	4.378589	-0.0005	-1.5879464	-45.4545	-7.79939	354.5177	279.0906	36	36	36	0
	0.0535	F4	5.725909	-0.0003	-0.3835294	-27.2727	-1.88375	51.37503	191.8722	37	37	37	0
										38	38	38	0
Oct-06	0.05206	B1	5.652637	-0.00154	-3.1202134	-140	-15.3253	2145.543	166.2338	39	39	39	0
	0.05186	B2	5.478185	-0.00134	-1.6912508	-121.818	-8.30678	1011.917	153.951	40	40	40	0
	0.05286	B3	10.43842	-0.00114	-3.378161	-103.636	-16.5922	1719.56	144.8851	41	41	41	0
	0.05156	B4	14.46032	-0.00114	-0.1431088	-103.636	-0.7029	72.84561	142.2988	42	42	42	0
	0.05236	C1	5.40661	-0.00134	-2.9626786	-121.818	-14.5516	1772.644	118.5744	43	43	43	0
	0.05246	C2	4.748088	-0.00064	-2.7164623	-58.1818	-13.3422	776.2753	89.51724	44	44	44	0
	0.05276	C3	4.865961	-0.00074	-2.7764085	-67.2727	-13.6367	917.3757	72.84561	45	45	45	0
	0.05136	C4	5.785864	-0.00194	-7.5800632	-176.364	-37.2304	6566.088	72.80467	46	46	46	0
	0.05236	D1	5.277452	-0.00084	-2.528742	-76.3636	-12.4202	948.4533	51.37503	47	47	47	0
	0.05216	D2	5.59866	-0.00134	-2.2709574	-121.818	-11.1541	1358.77	-54.8493	48	-48	0	48
	0.05256	D3	4.754374	-0.00064	-3.0112293	-58.1818	-14.79	860.51	-187.124	49	-49	0	49
	0.05146	D4	7.770138	-0.00174	-3.689084	-158.182	-18.1194	2866.157	-381.004	50	-50	0	50
	0.05226	E1	4.585608	-0.00094	-1.472607	-85.4545	-7.23289	618.083	-392.156	51	-51	0	51
	0.05216	E2	6.786346	-0.00124	2.2339851	-112.727	10.97249	-1236.9	-473.723	52	-52	0	52
	0.05256	E3	3.952355	-0.00054	-0.4917734	-49.0909	-2.4154	118.5744	-790.376	53	-53	0	53
	0.05146	E4	4.61658	-0.00184	-1.691873	-167.273	-8.30984	1390.009	-1225.87	54	-54	0	54
	0.05256	F1	2.588118	-0.00054	-2.8405389	-49.0909	-13.9516	684.8991	-1236.9	55	-55	0	55
	0.05216	F3	3.509896	-0.00094	-2.4566399	-85.4545	-12.0661	1031.102				1128	412 Sums
	0.05216	F4	5.346015	-0.00164	-0.763424	-149.091	-3.74965	559.0386					
			maximum	0.0011	20.3598787					W	716		
			minimum	-0.00194	-7.5800632								
			absolute	0.00194									

Appendix M: Total Discharge Calculations for the Entire Gate Determined with PVP Velocities

Date	Days	Discharge	Expected
1-Aug-05	30	144.0452	123
1-Oct-05	91	119.6745	123
1-May-06	303	169.8059	123
1-Oct-06	456	103.1917	123

2005 Aug									
5.42	6.05	7.8	8.36	8.77					
5.69	4.55	7.86	7.46	7.16					
5.96	4.44	7.76	7.64	13.81	Vtot	160.54			
6.1	6.3	11.45	13.36	14.6					
2005 Oct									
4.41	5.48	5.33	9.92	8.88					
4.2	3.7	5.9	6.73	6.49					
3.99	4.07	5.49	6.71	12.65	Vtot	131.28	Vaverage	144.3925	
6.73	5.34	8.37	7.91	8.98			Vsd	26.03104	22
							error%	18.02797	84.51449
2006 May									
4.61	5.765	6.565	7.15	11.81					
4.49	3.83	5.75	6.48	8.6					
4.37	5.23	5.15	3.72	15.45	Vtot	171.12	Borden pumping rate	600 mL/min	5.18E+07 cm ³ /d
5.72	8.96	8.95	13.56	34.96			total transect area	4.20E+05 cm ²	
							flux	1.23E+02	
2006 Oct									
2.58	4.59	5.28	5.41	5.65					
3.04	6.79	5.6	4.75	5.47					
3.5	3.95	4.75	4.87	10.43	Vtot	114.63			
5.34	4.61	7.77	5.79	14.46					
Area grid									
48.99	34.08	25.56	74.55	94.43					
0.728584	0.506841	0.380131	1.108715	1.404372					
2005 Aug									
3.948926	3.066389	2.965021	9.268858	12.31635					
4.145644	2.306127	2.987829	8.271014	10.05531	Vavg	7.20226	Qtot	144.0452	
4.342362	2.250375	2.949816	8.470583	19.39438					
4.444363	3.193099	4.352499	14.81243	20.50384					
2005 Oct									
3.213056	2.77749	2.026098	10.99845	12.47083					
3.060054	1.875312	2.242772	7.461652	9.114377	Vavg	5.983725	Qtot	119.6745	Vaverage
2.907051	2.062844	2.086919	7.439478	17.76531					134.1793
4.903372	2.706532	3.181695	8.769936	12.61126					Qsd
									29.08158
									error%
									21.67366
									16.39597
2006 May									
3.358773	2.921939	2.495559	7.927313	16.58564					
3.271343	1.941202	2.185753	7.184474	12.0776	Vavg	8.490297	Qtot	169.8059	Theoretical flux
3.183913	2.650779	1.957674	4.12442	21.69755					123
4.167501	4.541297	3.402171	15.03418	49.09686					error
									9.08889
2006 Oct									
1.879747	2.326401	2.007091	5.998148	7.934704					
2.214896	3.441452	2.128733	5.266396	7.681917	Vavg	5.159585	Qtot	103.1917	
2.550045	2.002023	1.805622	5.399442	14.6476					
3.89064	2.336538	2.953617	6.41946	20.30722	Vstd	1.454079			

