

EMGT 835 FIELD PROJECT:
10 Minute Technical Topics:
The Benefits of Continuous Job Focused Training

By

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An EMGT Field Project report submitted to the Engineering Management Program and the Faculty of the Graduate School of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Science.

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Acknowledgements

This final project is dedicated to my husband Matt. Through good times and bad, we keep learning how to work, love, and grow together. It is also dedicated to our sons, Miles and Ian. Thank you for not complaining too much about the new video game system purchased so mom could have the computer back. Now that the project is complete we will have a lot more time to play together. I love you guys.

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Executive Summary

This field project for the Master of Science in Engineering Management at the University of Kansas addresses how the utilization of ten (10) minutes per day discussing technical topics with plant maintenance workers has the potential to reap benefits in work productivity and worker confidence. The information supports the development of a quick reference technical topic based training program for electrical maintenance personnel at the MidAmerican Energy Neal Energy Center.

The paper includes a review and discussion of pertinent literature research, including quantitative research on the effectiveness of continuous training on the job and methodologies for preparing and presenting training documents. Additional research methodologies use management interviews and a survey analysis of electrical maintenance staff at the designated facility. The surveys and interviews are utilized to support the need and to determine acceptance levels for technical training.

The resultant training system developed includes a format and filing system to provide easy access to training materials for continued use by staff and management, a set of benchmark dates for implementation, and system following implementation to conduct further research on the benefits of the technical training.

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Chapter 1

Introduction

For many maintenance workers, safety is given a daily priority. It is included in pre-job briefings and required annual refresher training seminars. While technical skills and knowledge, following an initial apprenticeship or training period if available, are expected to be gained and retained strictly through on-the-job training or highly biased vendor presentations. Therefore, utilizing ten (10) minutes per day discussing technical topics with plant maintenance workers has the potential to reap benefits in work productivity and worker confidence, in addition to minimizing costly errors and potentially unsafe situations.

This field project for the University of Kansas Master of Science in Engineering Management program reviews the benefits of employee training, considers training approaches, and develops a quick reference training program for electrical maintenance workers. This resultant understanding of training benefits and formation of a best practices based technical training program can be utilized at many different types of plant facilities. However, the research and format will be directed towards the electrical maintenance staff at the MidAmerican Energy Neal Energy Center in Sioux City, IA.

MidAmerican Energy Company (MEC) provides electricity and natural gas service to 1.4 million customers in Iowa and nearby states. MEC is part of MidAmerican Energy Holdings Company, a global player in production and delivery of energy sources, is a subsidiary of Berkshire Hathaway. Neal Energy

Center is a coal-fired generation facility with four generating units on two separate sites near Sioux City, IA along the Missouri River. The North site, referred to as Neal North (NN), includes three units with a 950 megawatt (MW) capacity. The South site, also known as Neal South (NS), located 7 miles south of the North site, has the remaining single unit with a capacity of 644 MW.

Both work sites have separate electrical maintenance crews, but they are able to support each other during instances of high workloads in a particular location. NN employs eight electrical maintenance technicians and eight instrumentation and control maintenance technicians with a management supervisor for each group. The NS staff is half the size of NN with four in each group and one management level supervisor for both groups. Many of the work structures and job tasks overlap between the electrical and instrumentation groups; therefore, they are able to share functions and training materials. For the purposes of this field project they will be considered one group with the title Results or Results Technician, which is a name they have adopted internally to express their ability to get the job done.

The Results group members are all currently Journeyman technicians with background apprenticeship training or currently in the apprenticeship program working towards their Journeyman title. However, even with this background training and apprenticeship period, the needs assessment survey identified a large percentage of the staff who believe they require additional training to effectively do their jobs. Their supervisors agree that the necessary skills to support job tasks are sometimes absent, obsolete, or forgotten due to the infrequent exposure to the

large variety of diverse specialty equipment in the facility. Identifying some of these technical deficiencies and providing management staff an easy to use training format to increase their staff's knowledge base will meet both these needs.

Nevertheless, as cited repeatedly in the reference source material reviewed for this field project, companies require data on the cost effectiveness and tangible benefits of training programs. Typically, increasing staff knowledge and thereby worker confidence is not concrete enough to justify the expenditures of training programs. The Training for Quality Journal authors Hughley and Mussnug summarizes the subject well by stating, "the underlying aim of all employee training is to increase efficiency" (1997). While only addressed in the suggestions for future work sections of this field project, MidAmerican Energy has the resources in place to review job tasks. The plant currently utilizes a computerized work management system which has the ability to track increased efficiency on common job types before and after training.

Approaches to training vary widely, ranging widely from strictly on-the-job training to off-site extensive training courses with options in-between. Regardless of the approach, "the training design begins with the end first: the expected improved performance of each participant" (Beich 2005, 67). The ten minute technical topic program introduced in this field project is created with this improved performance expectation in mind. The program format is developed by review and assimilation of different training program approaches addressed in the

research material with advice from professional trainers and recommendations from the plant electrical supervisor staff at the Neal Energy Center.

The resultant goal of this field project is to use the culmination of the research on training benefits and approaches to support the development of an easy to maintain filing system and quick reference training approach program for implementation by the electrical maintenance staff at the MidAmerican Energy Neal Station facilities. The systematic approach will eventually become a self-sustaining training curriculum which benefits management, engineering, and electrical maintenance staff equally. The final program will have the potential to be developed for mechanical maintenance staff and operations staff work as well.

Chapter 2

Literature Review

A literature review of books and journals pertinent to this field project was conducted primarily utilizing the KU Library link which allows academic access to a large number of journal and book references. Research focused on two distinct areas identified as 1) the benefits of continuous training on the job for industrial workers, and 2) training techniques and approaches.

All research sources were restricted to material from the 1990's to the present. However, brief review of older materials not cited, indicates training benefits appear to be universal through the decades, while training techniques appear to have changed dramatically due to technological advances in audio visual and communications equipment.

Each article and text consulted for this project is addressed individually in the following discussion and categorized into one of the two distinct research areas.

Benefits of Maintenance Employee Training

The article *Proving the Effectiveness of Training* in the Education + Training Journal Volume 40 by Keith Bedinham published in 1998 disputes the idea that a standard questionnaire can determine the effectiveness of training. The author challenges companies to measure the level of change associated with the training topic to prove the effectiveness of the course. He encourages identifying a baseline knowledge level before implementing training, then reviewing the

knowledge level after the course, and finally continuing the process by reassessing skill levels months later. In fact, from the text the author is quoted with the following statistics: "...70% of managers and 60% of salespeople are measured by others as significantly more effective at the remeasure stage than they were before the training took place." These ideas coupled with the statistical results are the primary basis of research used to support the development of future work addressed in Chapter 6.

The two-part article by Clifton Campbell published in the *Industrial and Commercial Training Journal* volumes 26 and 27 bolster the ideas presented by the Bedinham article, but on a concrete cost basis versus a perceived benefit. The author states, "The single greatest incentive for indicating the cost effectiveness of training is its use in justifying expenditures with documented benefits." (1994) The quoted article, titled *A Primer on Determining the Cost-Effectiveness of Training – Part 1 and Part 2*, covers the cost justification of training in three separate elements as follows:

Element Number One: covered in Part 1 and includes the need for cost justification of training and how to calculate all the associated costs, including those not immediately obvious. The author describes how the expenditures can be separated into categories, direct and indirect. The direct costs are described as expenses tied specifically to the training, such as labor wages, employee benefits, and instructor and material expenses. The indirect fees are explained as costs which are not directly attributable to the training class, but

necessary for the program to function. These include company overhead and G&A expenses.

Element Number Two: also covered in Part 1 and includes help to identify training effectiveness measurements using four distinct levels: 1) trainee's reactions, 2) knowledge and skills gained, 3) use of new job skills and knowledge, 4) business return on the training investment.

Element Number Three: covered exclusively in Part 2 published in the subsequent year from Part 1 of the article. This element outlines four different methods available to determine the cost benefits of training programs, including 1) ROI, 2) cost-benefit ratio, 3) bottom-line evaluation, and 4) payback period. The most appropriate formula for a quick evaluation of the day-to-day benefits of the ten minute training program would be a modified bottom-line evaluation; while long-term the ROI is the most valuable and concrete.

The article *The Cost of Vocational Training* by Mun Tsang published in the International Journal of Manpower in 1997 reinforces the ideas presented in Element Number One of the two part article by Campbell, but on an international setting. The author describes the methodologies to develop direct and indirect costs associated with vocational training programs used to improve efficiencies and productivity in developing countries. While the article is focused on developing countries, the detailed cost analyses are relevant to many settings.

One of the most recent articles reviewed was *Management Training: Benefits and Lost Opportunities (Part I)* published in the Industrial and Commercial Training Journal volume 37 in 2005. While the article by authors Fink and Longenecker focuses on management training strictly in rapidly changing organizations, it's information still identifies with common problems facing industrial skilled labor positions. These include placing a worker in a new position without having adequate training and support structure, similar to situations faced at the plant following installation of new equipment. The article describes in detail some of the idea and business practice benefits of training and consequences of ineffective training. Subsequently published parts of this article were not referenced for this literature review, but may provide additional value upon review.

In *Factors Associated with the Provision of Job-Related Formal Training by Employers*, the author Paul Westhead takes a different approach from cost analysis to identify the benefits of training. The article published in the 1998 Journal of Entrepreneurial Behavior & Research first reviews the market conditions that drive the need to increase workforce skill levels. He cites issues ranging from the increases in job complexity, job market conditions, and firm competitiveness in the marketplace to the extreme of meeting government standards. He also identifies the human issues such as motivation and labor mobility. The text further describes the different levels, styles, and reasons for formal job related training.

Training Techniques and Approaches

Training for Dummies by Elaine Beich was one of two books cited for this project. Even though this text is written in the conversational tone and easy to approach “for Dummies” style, it still provides valuable insight and detailed information for the training professional. The text is endorsed by the American Society for Training and Development (ASTD). It covers the basics in training subjects including defining training and trainers, designing training, delivering training, training evaluations, and professional trainers. The main sections of the book utilized for this project were Chapter 3 on the training cycle and Chapter 5 on developing the training design.

The second book cited for this project was *How to Write & Prepare Training Materials* by Nancy Stimson published in 2002. As a way of introduction, this text acknowledges that most trainers are excellent speakers and presenters, but need to be productive writers, too. The text is broken into three parts 1) writing basics, 2) what trainers write, and 3) reference material to support writing skills for trainers. The subsections on job aids, course notes, and course handouts were used to support the formation of the training course associated with this field project. The reference subsections on grammar and legalities of using copyright materials were also resourced.

The 2005 Journal of European Industrial Training article, *Continuing Vocational Training in Belgian Companies: An Upward Tendency*, addresses an overview of the evolution in formal vocational training in Belgium based on a 1999 follow-up survey to an initial 1993 survey of European companies. The

article is part of a group of research sponsored by the European Union initiative to become the most competitive and dynamic knowledge based society in the world. The authors Buyens and Wouters break the data out by industry, including an “energy and water” branch particularly applicable to this field project. According to the survey, 100% of the 1999 respondents in the electricity, power, and water industry perform job training, which is up from 50% in 1993. The preferred formats for this industry include internal courses and on-the-job training at 100% response each, with job rotation and self learning falling well behind at 25% and 4.2%, respectively.

Another article which reviews historical training approaches is the web article *A Developmental History of Training in the United States and Europe* by Deborah Alpert Sleight, published in 1993 and available on the Michigan State University; website as of March 5, 2006. The author uses historical references to identify the types of skills training utilized from the antiquity through modern day. The type of on-the-job training beneficial in antiquity is still used today. The author quotes, “...it is probably the most popular method of training.” She identifies how societal requirements shaped skilled labor training requirements to eventually establish the Job Support Aids currently in use today. By definition from the article, Job Support is defined as “a form of training that does not require the worker to learn, but simply to know where to find the changing information they need.” The ideas of job support aids developed in this article are used in the development of the training program in Chapter 4.

The quote "...innovative training takes time for individuals to accept" (1996) is taken from the Industrial and Commercial Training Journal article *Delivering Training Down the Line* by Jenni Gilleard. This statement will be important to remember as the training program developed in Chapter 4 is eventually implemented at the plants. The author uses it as a word of caution to the techniques she reviews on the benefits of e-mail technology to provide specific training needs to employees on a "just-in-time" approach. She uses the same "just-in-time" approach to quickly measure feedback to the trainer and redirect training approaches without delays.

The Training for Quality Journal article *Designing Effective Employee Training Programmes* by authors Hughey and Mussnug identifies the increase in technical training and positions for Training Managers within growing corporations. As with other articles, it makes a specific distinction between training and education, while further defining training into what it terms less effective soft-skill training and more effective skill-based training. The article can also be cross-referenced to provide data on the benefits of training as it covers how training can support company profitability.

Three specific articles from the online magazine Maintenance Technology Online archives of training articles were accessed in March 2006 for reference.

The articles are as follows:

Implementing a Successful Training Program was written by Alan Lovett and published in 2004. The article identifies the growing concern over the forthcoming technically-skilled tradesman shortage due to retirement

forecasts in the United States. It focuses on the planning and execution of successful training programs needed to transfer knowledge to the next generation of industrial workers. These include producing a classroom curriculum with on-the-job follow up. The author recommends classroom training be at least one hour in duration which is contrary to the ten minute training topics thesis being developed in this paper; however, the techniques described are applicable.

Share What You Know was written by Nancy Mercurio in 2002. This article reviews approaches to capture and retain knowledge from employees before it is lost due to retirements or job transfers. It explores reviewing a company's history to identify processes and procedures, implementing work process journals, supporting job shadowing, and effective communication techniques. In reference to company history, the author states, "many individuals refer to the company history as the "treasure map" because of the opportunity for uncovering valuable information." The ideas of using historically effective processes presented in this article support the use of the Safety 5 in 10 format for technical training.

Assessing Your Training Needs was written by Ricky Smith in 2004. The article describes using a needs assessment to identify skill deficiencies and training goals prior to implementing a training program to ensure training dollars are allocated appropriately with measurable results. It also cites valuable data collected by a joint study from the U.S. Department of

Education and the Census Bureau that recognizes training has a greater impact on productivity than increased work hours. While this article has valuable information for the Benefits of Training section of the literature review, it also discusses customized training path approaches based on assessments.

Chapter 3

Research Procedure and Methodology

The research procedures involved in this field project included literature reviews, interviews, and surveys to support the development of the ten minute topic training program for the electrical maintenance staff at the MidAmerican Energy Neal Energy Center. The research began with a review of pertinent literature on the subject of employee training. The review summary in Chapter 2 focused on past research and published studies in two separate areas. The first area involved identifying the benefits of training, particularly the correlation between productivity and technical training. The second area covered the techniques to prepare and present effective training.

The research continued with interviews and surveys conducted at the MidAmerican Energy Neal Energy Center sites with the plant staff. The individual interviews were held with an Electrical Plant Maintenance Supervisor and the Technical Trainer to identify technical knowledge shortcomings and effective communication methods. The surveys were directed towards the electrical maintenance technicians, otherwise known as the Results crew, at both work sites and focus on their specific training requests, acceptance level of training materials.

To better understand the following detailed results of the interviews and surveys, information on the Plant's Safety Tip Sheet training program is necessary. In brief, daily safety messages are provided to plant maintenance

personnel at the Neal Station through Safety Tip sheets and Safety 5 in 10s. Both Safety Tip sheets and 5 in 10s involve conveying very specific safety topics in a short amount of time. The Safety Tip sheet format is fairly standardized with an example of the format in Appendix A. Similar to the example Safety Tip Sheet, they usually contain most of the following section headings: action plan, who conducts the training, who needs to be trained, training materials, questions, purpose, introduction, recommendations with subject specific headings, and conclusions. While the Safety 5 in 10 has a similar format and objective, it uses a bullet point format versus open paragraph form in the recommendations section to convey the information. In typical dialogue within the plant facility the term 5 in 10 is often used as a catch all for both types of training methods.

Interview with Management

Formal interviews with the Neal Station Technical Trainer and the Neal South Plant Electrical Maintenance Supervisor were conducted at the plant site on February 2, 2007. The Technical Trainer discussed training approaches based on his experience as a trainer and college level instructor, while the Plant Supervisor interview focused on training needs and the effectiveness of existing training approaches. A general summary of the discussions are included in this section with specific suggestions used to support development of the training method in Chapter 4.

The current Neal Station Technical Trainer has eight years of past work experience as an instructor at a technical college. He uses his experience teaching

technical school level courses to support developing and implementing the safety training on the Neal site and other sites within MidAmerican Energy as needed. From that experience, he recommends the most effective training be hands-on with library or internet/intranet resource materials available for future reference. However, he suggests moving towards all internet/intranet based training courses to allow individuals to work at their own pace, since a typical training session is aimed at the slow learners, while the rest of the group becomes bored and disinterested. He also identified the benefits of dynamic refresher training. He noted that it is most effective annually and as data and information or programs change.

The Neal South Plant Supervisor of the electrical Results crew has many years of experience with the company as both a crew member and at the management Supervisor level. The interview initially assessed his support and the acceptance of his crew of the Safety Tips and 5 in 10 training program. He facilitates the review of the topic sheets, but has discovered that his staff is most receptive when the safety material is applicable to the current work and includes some corresponding technical information. Conversely, their attention spans are short for topics which address home safety issues or are not applicable to their job classification.

The interview with the Results Supervisor also addressed technical training requirements. These training requirements were identified broadly as a need for more exposure to specialty devices that get infrequent contact. The requirements became more specific with a request for training refresher areas, such as turbine

controls, programmable logic controllers (PLCs), and troubleshooting approaches. He indicated that he would support a technical ten minute topic program as often as every day provided the materials were readily available to support the program. He also gave the impression the staff would definitely be receptive to this type of technical training.

Survey with Electrical Maintenance Personnel

A training needs assessment survey of the MidAmerican Energy Neal Station Results Technicians was conducted at both the Neal North and Neal South Results offices on February 5, 2006. For reference, the survey text is included as Appendix B and the full survey results are included as Appendix C of this document.

At both locations the surveys were administered verbally to ensure responses due to the small pool of participants. With this approach, survey participation exceeded 80% at both locations. Figure 1 graphically depicts the number of respondents based on the available pool to support the verbal survey approach at each site.

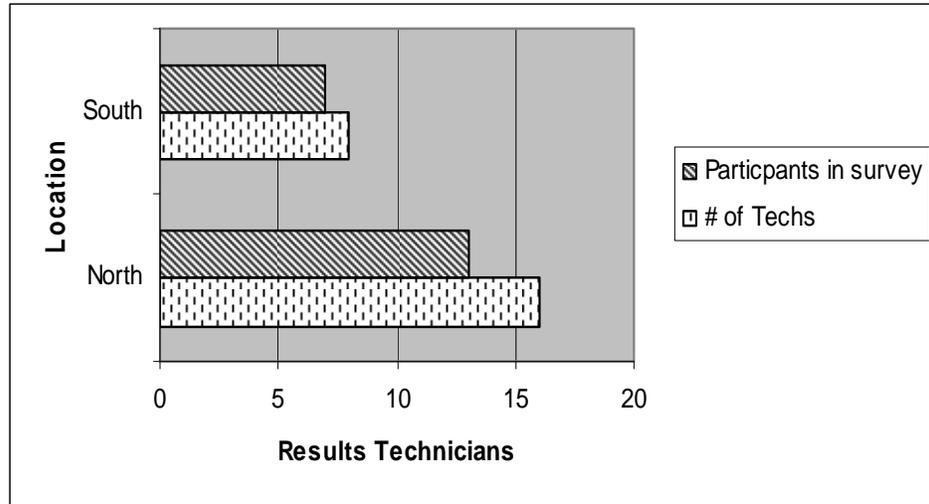


Figure 1: Training Needs Assessment Survey of MidAmerican Energy Neal Station Results Technicians Participation Report

The first question on the survey was left open for discussion among the Results technicians. The Results technicians were asked to identify technical areas where they would want more training. The most common response was PLCs and other plant controls systems. Following closely behind was the request for training on new and specialty equipment. These responses matched closely to training needs identified in the interview with the Plant Electrical Supervisor.

The remainders of the survey questions were multiple choice to specifically allow for the calculation of simple statistical results. In order to obtain a larger sample to create usable statistics, the survey data collected at each site was combined for overall assessment. The statistical results were used to support the ten minute topic training approach and program implementation based on acceptance level of the technicians.

The second survey question assessed the preferred method training materials are presented. As presented in Figure 2, close to 90% of the respondents prefer

the training to include a combination of lecture, hands-on application, and written hand-outs for future reference. Applying all three techniques to a ten minute training period may be challenging, but will be considered in Chapter 4 with the implementation of the program.

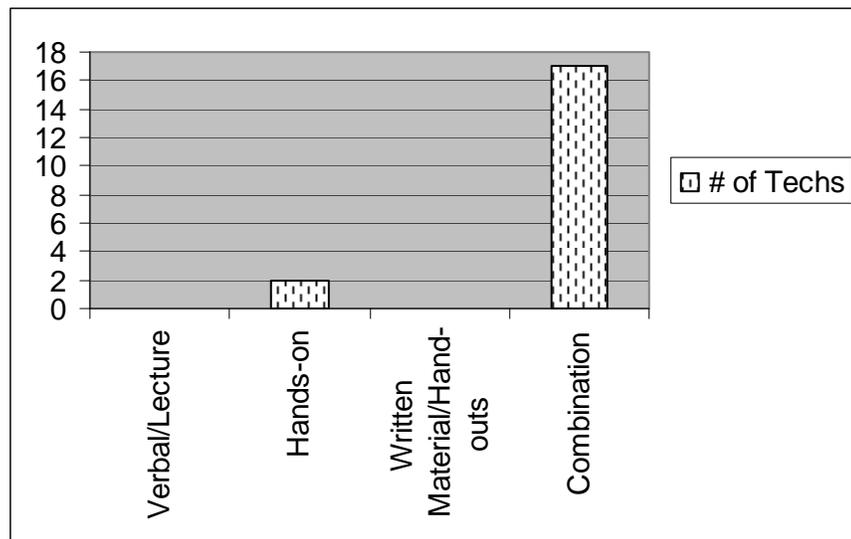


Figure 2: Preferred Methods of Training

The next three survey questions evaluated the perceived value of the Safety 5 in 10 and Safety Tip Topic program already employed with the maintenance staff at the Neal Energy Center. The first indicated 100% of the Results staff believe safety 5in 10s are beneficial. However, they stressed their responses were strictly based on the use of the adjectives “timely” and “relevant” included in the phrasing of the question. Random comments revealed dissatisfaction with safety training not relevant to the job. Responses on the frequency and length of Safety 5 in 10 was a little more divided among the job as shown in figures 3 and 4, respectively. However, the overall results still support this style of training.

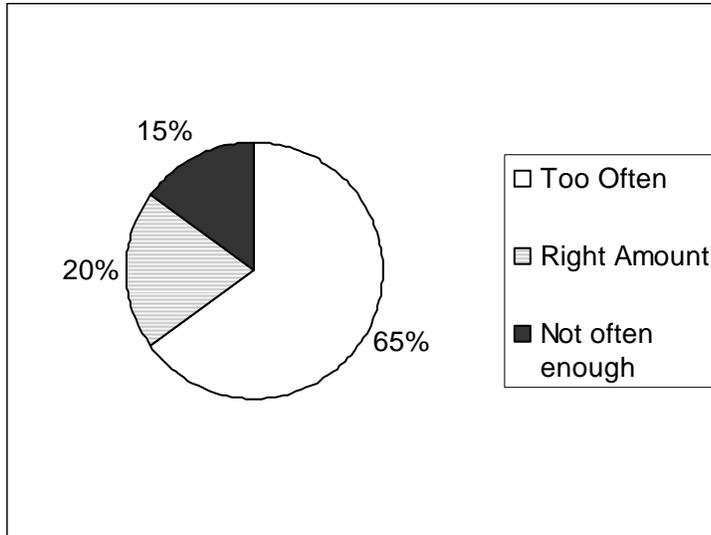


Figure 3: Frequency of 5 in 10 Safety Training

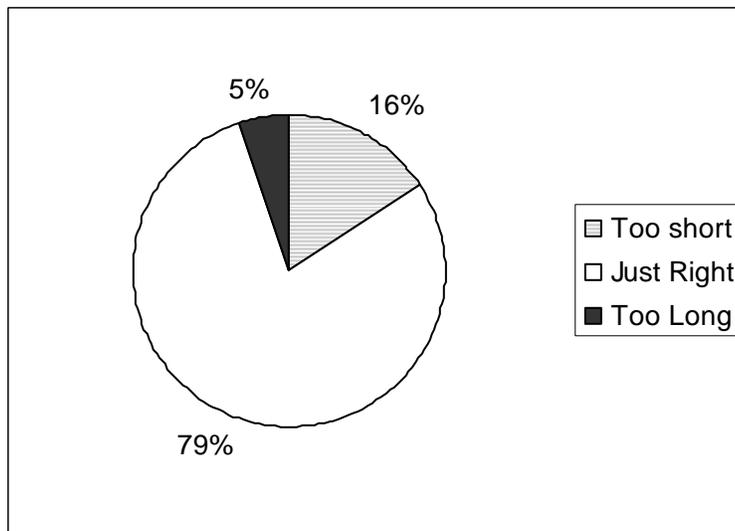


Figure 4: Length of 5 in 10 Safety Training

The final three questions of the survey focused on the perceived value and acceptance level for a technical 5 in 10 type training program. As with the Safety 5 in 10 program, 100% of the Results staff believes the program would be beneficial, but did not provide stipulations to their response. The staff was also

100% receptive to this style of technical training. Nevertheless, as shown in Figure 5, the technicians were clearly divided on the frequency of training.

Chapter 4 addresses how this conflicting opinion will be handled.

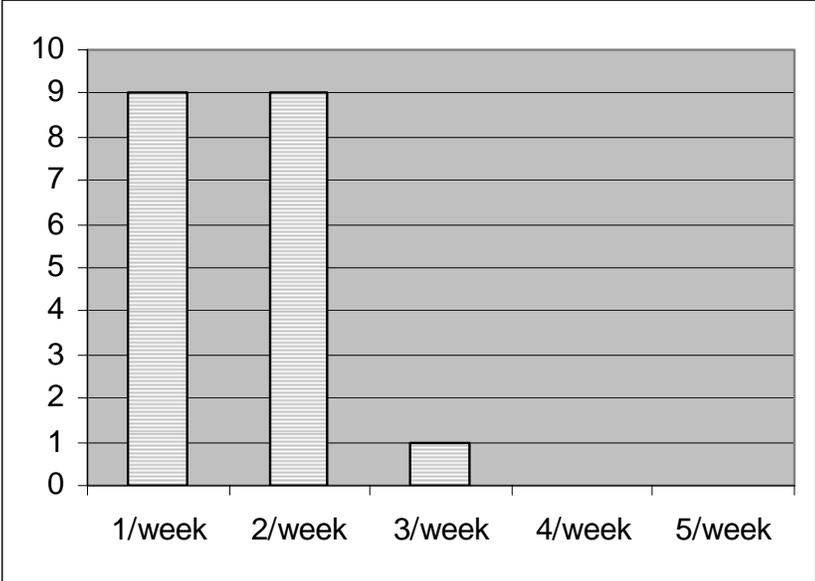


Figure 5: Suggested Frequency of 5 in 10 Technical Training Program

Chapter 4

Training Program

The Neal Energy Center Maintenance Supervisors, including the Electrical Maintenance Supervisor interviewed, are required to perform the Safety Tips or 5 in 10s described in Chapter 3 on a daily basis as part of their positions. The requirement is outlined in the maintenance leadership alignment goals for the plant staff. These goals describe the details of the daily safety talk to include an open line of communication, location void of distractions, and common courtesy to the presenter. The proposed 10 minute technical topic training course shall use the same goals and formats, with modifications where appropriate for the technical training application.

Format

The design of the format for the technical training was selected based on suggestions from the literary research, the existing Safety Tip training format, the interviews, and the technician surveys. As a basis, the recommended format design uses a condensed Safety Tip approach, eliminating the need for the fields defining training instructor and student population. The eliminated fields are defined by default with the scope limited to the Neal Energy Center Results Technicians. The format approach then meets the hands-outs and lecture materials requested by the interviews and surveys. The hand-outs also use the

ideas of quick reference job support aids presented in the paper by Sleight.

Finally, the author of the individual technical tip sheet has the license to include the final requested hands-on element as applicable and/or available for the specific topic.

A sample of the recommended format for the Technical 10 Minute Topic training program is included as Appendix E. The description of each section of the format is described in detail as follows:

Title: The Title should be descriptive enough to support topic identification at first glance. It should also reinforce the selection of the File Section.

File Section: The File Section shall be selected to fit a section and subsection, as appropriate, of the Technical 10 Minute Tips Table of Contents shown in Appendix D. Some topics may have information that can be cross referenced to additional sections of the table of contents. However, the information sheet will be filed with the most appropriate section as determined by the author, identified in the created by section, or the authors of subsequent revisions, identified in the modified by section.

Date Created: The date created shall reflect the date the material is included in the file for use in the training curriculum rotation.

Created By: The Created By section defines the main author of the technical tip. The author should be the technical resource for additional information and review of possible revisions. An administrative assistant (AA) may be used to create electronic files, compile information, and file the tip sheets, but

should not be identified in the author section. The AA and additional contributors may be noted in subsequent sections.

Date Last Modified: Similar to the Date Created, the Date Last Modified shall reflect the date the modified material is included in the files for use in the training curriculum rotation.

Modified By: Similar to the Created By section, the Modified Section defines the main author of the latest revision of the technical tip. The author of the revision should be the technical resource for additional information and review of any additional revisions. An administrative assistant (AA) may be used to update electronic files, compile the new information, and file the updated sheets, but should not be identified in this section.

Technical Contacts: The Technical Contact is separated into three individual areas: Technician, Engineer/Supervisor, and Vendor. At least one of the three areas must be completed to allow the Results staff future reference contacts. In the case of a Vendor, adequate information must be included to support contact, such as telephone, email, web address, etc. Special care is required to verify the identified individuals are willing to support queries on the specific technical area. The technical contact information can duplicate the information in the Created By field author.

Description: The Description field in the technical tip sheet format is the field that includes the technical data for the presentation. It is the author's responsibility to limit the amount and scope of the information to meet a ten minute training session. Specific format of the information is open to the

author's discretion, though a valuable suggestion from the book by Biech indicates "a design that includes bullets can help guide learners" (2005). An attachment can be used in lieu of formal written material.

Attachments, if applicable: The Attachments field describes any attached documentation for the purpose of supporting the technical topic training. An attachment should only be included if the information is used in lieu of the description field or the additional information is not available from another source of material.

Other Resources: The Other Resources field is available, if necessary, to identify reference material, such as equipment manuals, textbooks, additional training references, and websites.

Procedures

The procedures for the technical tip sheets are restricted to file creation and filing methods. The methodologies developed for the Technical 10 Minute topic files will be loosely set to encourage participation by a wide pool of authors and contributors, which might otherwise be deterred by strict development rules and an overly structured process. Final training program implementation procedures are defined in the following subheading.

Creating the pool of technical training files will be a continuous process with authorship open to engineering staff, supervisory staff, vendor representatives, and Results technicians. While it is anticipated most of the training tip sheets will be generated by the engineering and supervisory staff, each group has the option

to support the other in training suggestions and background materials. Allowing the Results technicians themselves to author technical training tips and share their own specific knowledge will, hopefully, lead to quicker acceptance and sustain growth of the program.

The filing system of the technical training tips sheets consists of a standard filing index, electronic storage parameters, and hardcopy files at both the North and South Plant sites. The filing index system is defined in Appendix D: Technical 10 Minute Tips Table of Contents and supports the *File Section* field defined on the standard training tip sheet format. The model table of contents file is specific to the types of material and equipment an electrical maintenance technician in an electrical generating facility may encounter. Within that design premise, the table of contents is open for review and reasonable modification with the understanding that changes may require modification of a large number of training tip sheets files. Additional subheadings within a specific category would be the most beneficial change to support organization of the training material. Any reorganization would be at an individual author's discretion and their responsibility to account for all necessary filing changes.

Since more and more reference material, such as web address links, email vendor contacts, and electronic equipment manuals, is available electronically, so too should the quick reference training material. In order to support electronic storage of all of the technical tip sheets documents, the author will be required to create their files electronically, obtain documentation in an electronic format, or scan the material as necessary. All files associated with a specific tip are to

include the tip sheet name in the title with a page number following. File software requirements will not be specified in this document beyond the request for commonly available software programs, such as MSWord .doc, Adobe Acrobat .PDF, and picture files .JPG, etc.

The electronic files shall be stored in a file structure that mimics the table of contents in both the Neal North Results group and the Neal South Results group secure network file directories. The definition of a secure directory allows limited access, in this case to electrical engineers, electrical maintenance supervisors, and Results technicians only, and unlimited backup protection on the corporate network. While this requires maintenance of two (2) separate file locations, it also allows for subtle training differences, including equipment and plant arrangement distinctions, between the two facilities. Two additional electronic file folders, In Progress and Superseded, are also necessary to store uncompleted technical tip sheets and outdated tip sheets, respectively. Individual authors may choose to create subdirectories in the In Progress file folder to identify their working files from another author's work.

Finally, hardcopies of the technical tip sheets will be made available at both the North and South Plant sites. The training books will be stored in the reference book shelves in a three-ring binder in the Results department shop areas. Upon completion of a new tip sheet the author will be responsible to update the book or send the material to the appropriate Electrical Maintenance Supervisor to update the reference book. Hardcopy files of in progress and outdated materials will not be stored.

Implementation Approach

The next step in developing a training program is implementation with the appropriate student populations, in this case the Neal Energy Center Results Technicians. Before this can occur, initial program implementation issues include development of the procedures cited in the previous subheading, establishment of execution dates, determination of the frequency of training, and most importantly obtain management buy-in of the program in its entirety.

The execution dates for implementation of the Technical 10 Minute Topic Training Program for Electrical Maintenance Technicians at the MidAmerican Energy Neal Energy Center will hinge on two main factors: creation of an adequate pool of training tip sheets and management buy-in for the program. It is recommended an initial batch of tip sheets be developed prior to presenting the program to management. The process of creating the tip sheets first may seem like a ‘cart before the horse’ approach, but will provide a more tangible asset for management review and even if the actual training program is not implemented, the material will be available for future reference. The course of action to obtain management buy-in would include presenting the interview and survey findings, example tip sheets and the filing format, the future ability to expand the program, and possibly provide a demonstration using one of the actual training tip sheets.

From the survey of the Results technicians, a clear division exists on the desired frequency of technical training. This information, coupled with the Supervisor’s preference for daily technical training pending information

availability, makes a decision that meets the needs of all involved difficult.

However, time will be required to build a large library of technical tip training files and widespread program acceptance and active participation with the author pool and students. It is recommended that at the inception of the program training be conducted once a week. As additional training material is developed, the program refined, and acceptance levels increased, the frequency of training should be reassessed to meet the needs of the participating population. The reassessment is defined in Chapter 6 designated to future work.

Formal implementation dates would commence following completion of this Master's field project work. Anticipated dates include presentation to tip sheet author pool by June 2007, initial organization of electronic and hardcopy of materials by November 2007, and presentation to management shortly thereafter. The end goal is to deploy the complete program by January 2008.

Chapter 5

Summary & Conclusions

In conclusion, implementing a 10 Minute Technical Topic training program for Electrical Maintenance Technicians at the MidAmerican Energy Neal Energy Center can help to assign a priority status, similar to that held by safety training, to technical knowledge. With the program in place, technical training will move beyond the apprenticeship and on-the-job pressure situation training to a minimum of once per week direct focus. The direct focus will place a value on education within the MidAmerican Energy Neal Station Maintenance organization. The expectation is that an educated workforce will be easier to manage, increase performance on existing tasks, and more readily welcome new techniques, equipment, and materials. Furthermore, management may anticipate less wasted materials, less wasted time, and less absenteeism. These benefits of the educated workforce can be directly assessed through an ROI assessment identified in Chapter 6.

The expected benefits align with those from those identified in the published literature review. From the review, the ultimate corporate side expectations of training are to increase worker efficiencies. Most sources agreed this information is derived by assessing the direct and indirect costs of training programs for analysis against benchmarked productivity numbers. However, a few articles cite the intangible benefits of training programs, including worker motivation and lower rates of attrition from increasing staff knowledge. Both are valid

approaches of determining the benefits of training programs and can be utilized for justification following implementation of the 10 Minute Technical Topic training courses at the Neal Energy Center.

The literature review also identified a variety of approaches to training course methods, including ideas for the selected format. The “just-in-time” training ideas developed in the Gilleard along with the job support aids presented in the Sleight article provided a research support basis for an innovative style of technical training. However, Sleight’s warning about acceptance for innovative training taking time is a strong deterrent to unreasonable expectations. While her subsequent text, “generating change often requires vision, sometimes courage to believe in oneself, and probably tactical initiative as well” (1996) helps to encourage moving forward with the program despite possible impedances.

The 10 Minute Technical Topic program format was an innovative solution to technical training developed from the MidAmerican Safety Tip training. The program design started with the short intense focus training format already utilized by the safety tips. The design then adapted ideas from different training program approaches addressed in the research material along with advice from a professional trainer and recommendations from the plant electrical supervisor staff at the Neal Energy Center. The final format is flexible enough to support multiple authors and equipment differences between locations, yet structured enough to provide the necessary access for instructors and students to continue to utilize the program following implementation.

Chapter 6

Suggestions for Additional Work

Many additional areas of study were inherent from the start of this field project due to narrowing the topic scope to 10 Minute Technical Topics for electrical maintenance workers at a specific Midwest power plant facility. Other areas of study evolved from the research materials and information gathered to support development of the training program. As a whole, the acknowledged continuation of work on the subject can be separated into three categories: development of effectiveness measurements, further work on the designed training program, and expanded the use of the designed training program.

A complete Master's field project could be dedicated to the process of performing the calculations and assessments to determine the effectiveness of this or similar training curriculums. When writing about training in the Education + Training Journal, Bedinham states "the whole process of measuring change increases commitment levels and creates an environment that sustains reform" (1998). This statement supports the need for future study work in this subject area to prove the effectiveness of the ten minute training program. At the Neal Energy Center this would involve tracking the duration of similar work tasks to identify increased productivity levels. The work management software used within the MidAmerican Energy system would support review over several years following implementation of the program. This data would also be available to support a future ROI cost analysis.

The subject area of further work on the designed training program can be divided into additional work required to implement the program and review of the program following implementation. Both subject areas are covered in Chapter 4, but pertain to future required work. The additional work required to implement the program included a timetable of events in Chapter 4 which consist of communication with the author pool to start creating the technical tip sheets and training materials, setting up the electronic file directories, and the management presentation. Review of the program following implementation could include an assessment of the training materials and filing format, as well as a possible resurvey of the electrical maintenance workers concerning their emotional acceptance of the program. Ongoing throughout the program lifespan would be the continuous need for new and updated technical tip sheets.

Finally, if the program is successful with the Results crews at the Neal Station, the next step would be to expand the program to the mechanical maintenance groups. This expansion would require inclusion of the mechanical engineering and mechanical maintenance supervisory staff. An informal poll indicates their interest, but also a completely different level of acceptance for the current safety training tip program used as a basis for the technical training program, which may be due to larger staff. Therefore, the program may have to be modified beyond the table of contents section to support the mechanical maintenance staff. Future work would include the appropriate assessments for the desired target student population. With this flexible approach, the program could

eventually be implemented in the entire MidAmerican power generation maintenance fleet.

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Appendix A: Example Safety Tip Sheet: Are You Drinking Enough? Water, That Is!



Subject: Safety Tip – Are You Drinking Enough? Water, That Is!
To: MEC Supervisors
From: Safety Audit and Compliance

Action Plan

1. Review the training materials provided in this tip document.
 2. Provide necessary training on the topic.
 3. Route the attached sign-up sheet.
 4. Retain a copy of the sign-up sheet.
 5. We encourage you to post tips on the bulletin board for future reference after training.
-

Who will conduct the training?

Supervisors are responsible for providing this training to all of their employees at weekly 5 & 10 safety meetings.

Who needs to be trained?

Please review the attached tip information with all of your employees.

Training Materials

Attached training materials include:

- Tip document

Questions

Contact your local safety supervisor if you have any questions.

The information provided in this document is limited and does not meet compliance training requirements.

Safety Tip – Are You Drinking Enough? Water, That Is!

Purpose of tip document

The purpose of this safety tip is to provide you with safety information and basic guidelines to follow for proper body hydration.

Hydration and dehydration

Hydration and dehydration:

- Hydration status refers to the amount of water being retained or thought of as being retained; a combination of water in a definite ratio.
- Dehydration refers to just the opposite; the removal of water from a substance or compound; to eliminate water from or loss of water or moisture.

Next to air, water is the single most important nutrient needed to keep the body functioning!

Water makes up about 60% of our bodies and 70% of our muscles. It helps to carry nutrients to our tissues and helps us rid our bodies of waste products. According to information published by *LeRoy R. Perry Jr. and Condensed from PARADE*, without water, the human body could poison itself to death.

- The kidney removes uric acid and urea; without proper hydration, kidney stones may develop because waste is not removed effectively.
- The digestive system relies on water to continue vital chemical reactive functions and determines our metabolic rate.
- The body is cooled through perspiration fueled by water. It carries nutrients and oxygen to the cells through the blood stream which allows us to sweat.
- Joints are lubricated by water; without it, we experience pain and weakness.
- Respiratory functions rely on water to keep our lungs moist which allows us to take in oxygen and excrete carbon dioxide.
- Skin conditions are attributed to the amount of water people drink; without plenty of water, the toxins cannot be flushed from the system and eliminated allowing for clear, healthy-looking skin.
- Proper water intake is a key to weight loss or maintenance. Without adequate water intake, the body can't metabolize the fat adequately. Retaining toxic fluids keeps weight up.

What happens if I don't get enough water?

Body performance will begin to lag quickly. A loss of body water equaling only 1 to 3 percent of the body's weight will have adverse effects including weak knees or leg strength, it causes poor muscle tone and size, it can decrease digestive efficiencies and organ function, it will increase toxicity in the body, making you feel ill frequently, it will add to muscle or joint soreness and increases water retention.

Worse yet, it can attribute to heat exhaustion and heat stroke; a condition that occurs when the body's sweating shuts down in an attempt to conserve water and the body temperature rises quickly to a dangerous and life-threatening level. Most people associate this with the summer's heat, but people can experience heat stroke or stress in other environmental conditions or during workouts.

**Why water?
Can't I drink
any fluid to stay
hydrated?**

While other fluids such as soda pop, coffee and alcoholic containing beverages do contain water, they are actually dehydrating fluids. Not only do they eliminate the water contained in them, they also cause the body to lose further amounts of water that the body stores in reserve. The body fights back by attempting to hold water in but is only successful in holding in toxins and bad fluids that need to be expelled.

**What are my
daily water
requirements?**

You need to drink water regularly throughout the day and increase your intake if you plan to engage in physical activities. Don't wait until you are tired and sweaty to begin drinking water. To properly hydrate the body, you must begin BEFORE the activities occur and continue throughout the day. The minimum for a healthy person is eight to ten eight-ounce glasses per day. If you exercise or engage in physical activities, increase your intake at least 3-4 ounces every 15 minutes. If you are overweight, you should take in an extra glass for every 25 pounds you exceed according to your ideal weight.

**How do I know
if I am
dehydrated?**

According to Dr. Thomas Stearns Lee *NaturoDocLLC.*, the most common signs of dehydration are:

- Heartburn, stomachache
 - No-infectious recurring or chronic pain
 - Low back pain
 - Headache
 - Mental irritation and depression
 - Water retention (toxic body fluid)
-

**Don't wait to
hydrate!**

Don't wait until you are thirsty to drink water. You know that red "check engine" light in your car? Although it is considered a warning, it usually only comes on when the engine is ready to shut down. Your body is the same way. It gives little signs that we tend to ignore. Don't ignore what your body tries to tell you!

- Thirst most likely will not occur until your body has lost more than 1% of its body weight (equivalent to 3 cups of fluid).
 - Drink plain cool water; cold water tends to shock the system and takes longer to absorb.
 - A dry or pasty mouth is one of the LAST signs of dehydration. Hydration should be taking place long before these signs are present.
-

Conclusion

Spread your water consumption out throughout the day. Guzzled water will go straight to the bladder. Drink cool or room temperature water for proper absorption. Don't drink during a meal, this dilutes the digestive juices and makes it harder for the body to digest food properly. And remember, soda pop, coffee or other types of drinks do not take the place of water!

Questions

Contact your local safety supervisor if you have any questions.

**Appendix B: Training Needs Assessment Survey of MidAmerican
Energy Neal Station Results Technicians**

1. What subjects would you like to see covered in technical training?

2. Number of technicians/ Number Participating in Survey:

a. North _____ / _____

b. South _____ / _____

3. Training approach preference:

North South

a. Verbal/ Lecture _____ / _____

b. Hands-on _____ / _____

c. Written Material/ Hand-outs _____ / _____

d. Combination _____ / _____

4. Timely/ work related 5 in 10s

North South

a. Beneficial _____ / _____

b. Not beneficial _____ / _____

5. Frequency of Safety 5 in 10s

North South

a. Not often enough _____ / _____

b. Just right _____ / _____

	c. Too often	_____ / _____
6.	Length of Safety 5 in 10s	
		North South
	a. Too long	_____ / _____
	b. Just right	_____ / _____
	c. Too short	_____ / _____
7.	Would a technical 5 in 10 be effective?	
		North South
	a. Beneficial	_____ / _____
	b. Not beneficial	_____ / _____
8.	Suggested frequency of technical 5 in 10s:	
		North South
	a. 1/week	_____ / _____
	b. 2/week	_____ / _____
	c. 3/week	_____ / _____
	d. 4/week	_____ / _____
	e. 5/week	_____ / _____
9.	Would you be receptive	
		North South
	a. Yes	_____ / _____
	b. No	_____ / _____

Appendix C: Training Needs Assessment Survey of MidAmerican Energy

Neal Station Results Technicians Raw Data Results

1. What subjects would you like to see covered in technical training?

Responses included in Chapter text.

2. Number of technicians/ Number Participating in Survey:

a. North 16 / 13

b. South 8 / 7

3. Training approach preference:

	North	South
a. Verbal/ Lecture	<u>0 / 0</u>	
b. Hands-on	<u>2 / 0</u>	
c. Written Material/ Hand-outs	<u>0 / 0</u>	
d. Combination	<u>10 / 7</u>	

4. Timely/ work related 5 in 10s

	North	South
a. Beneficial	<u>13 / 7</u>	
b. Not beneficial	<u>0 / 0</u>	

5. Frequency of Safety 5 in 10s

	North	South
a. Not often enough	<u>3 / 0</u>	
b. Just right	<u>4 / 0</u>	
c. Too often	<u>6 / 7</u>	

6. Length of Safety 5 in 10s

	North		South
a. Too long	<u>1</u>	/	<u>0</u>
b. Just right	<u>11</u>	/	<u>4</u>
c. Too short	<u>0</u>	/	<u>3</u>

7. Would a technical 5 in 10 be effective?

	North		South
a. Beneficial	<u>13</u>	/	<u>7</u>
b. Not beneficial	<u>0</u>	/	<u>0</u>

8. Suggested frequency of technical 5 in 10s:

	North		South
a. 1/week	<u>9</u>	/	<u>0</u>
b. 2/week	<u>2</u>	/	<u>7</u>
c. 3/week	<u>1</u>	/	<u>0</u>
d. 4/week	<u>0</u>	/	<u>0</u>
e. 5/week	<u>0</u>	/	<u>0</u>

9. Would you be receptive

	North		South
a. Yes	<u>13</u>	/	<u>7</u>
b. No	<u>0</u>	/	<u>0</u>

Appendix D: Technical 10 Minute Tips Table of Contents

- A. Breakers
 - a. 4160V Switchgear
 - b. 480V Switchgear
 - c. Molded Case Circuit Breakers
- B. Conduit And Tray
- C. Control Systems
 - a. DCS – Distributed Controls Systems
 - b. PLC – Programmable Logic Controllers
 - c. Specialty Controls
 - i. Turbine Controls
 - ii. Feeders
- D. Instrumentation
 - a. Switches
 - b. Transmitters
 - c. Gauges
 - d. Temperature Devices
- E. Motors
- F. Tools & Equipment
- G. Transformers
- H. Troubleshooting

- a. Schematics
- b. Manuals
- I. Relays
- J. Wire and Cable
- K. Miscellaneous

Appendix E: Sample Training File Format

Title: _____

File Section: _____

Date Created: _____ By: _____

Date Last Modified: _____ By: _____

Technical Contacts:

Technician: _____

Engineer/Supervisor: _____

Vendor: _____

Description:

Attachments, if applicable:

Other Resources:

