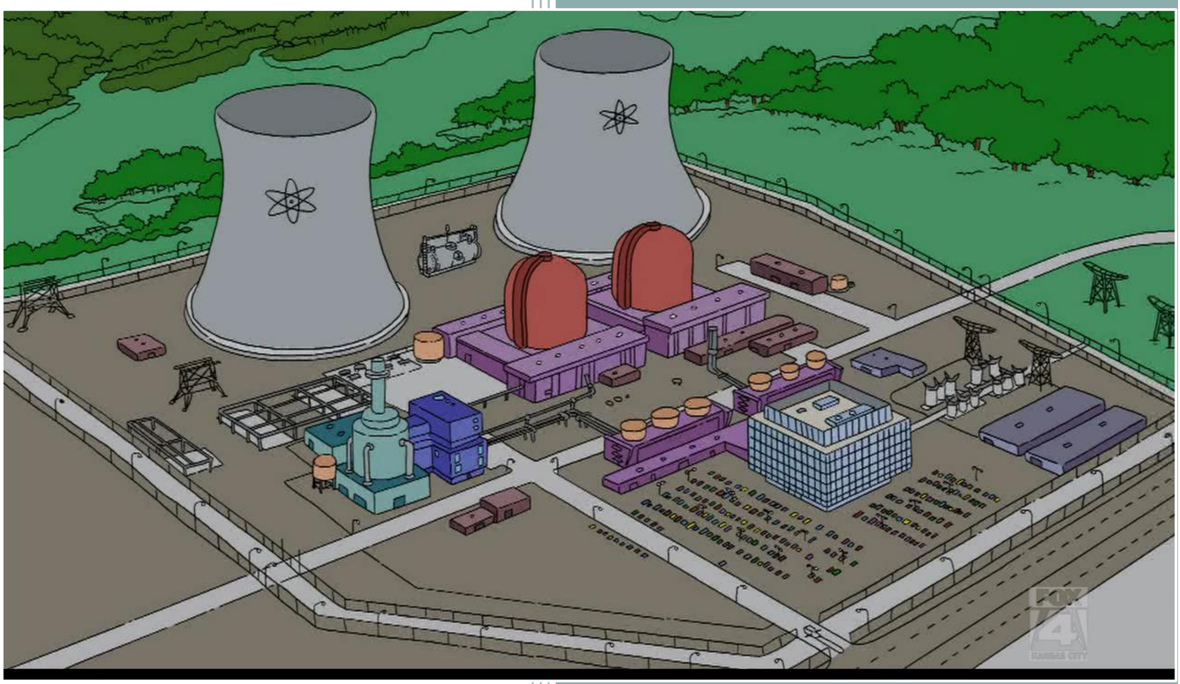
Bignuke Power Station

Troubleshooting Training Evaluation



Submitted to:
Ima Dabigboss
Supervisor, Technical Training

Submitted by:
Jim Doran, Senior Nuclear Instructor
April, 2015

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Summary

In November 2014, the visiting INPO/WANO team created ER.1-1 an Area for Improvement (AFI) for Millstone Station stating, "Complex troubleshooting team leaders do not evaluate and disposition some important potential causes of equipment failures, and sometimes do not reinforce formality and thoroughness in troubleshooting." As a result of this AFI, a Performance Analysis & Performance Improvement Instrument (PAPII) was performed by training and recommended the following:

- Initial Troubleshooting Training will be given to the entire Engineering Population as well as all new hires as part of their initial training.
- Work Group Specific Training (WGST) will be given to a specific population designated by Engineering Management as Troubleshooting Team Leads.

The completed PAPII is attached to this report as Appendix A. As a result of this PAPII, Initial Troubleshooting Training was developed and presented as Engineering Continuing Training during the first quarter of 2015. Upon completion of the training, it was expected that the learners be able to explain and implement the Simple Troubleshooting Process and use that knowledge to participate as a member of simple and complex troubleshooting teams.

The purpose of this report was to validate the effectiveness of Troubleshooting Training based on closing the performance gaps observed in station troubleshooting, such as rework and decreased equipment reliability. Major steps included:

- Direct Observation of Troubleshooting Team's effectiveness
- Analysis of troubleshooting efforts during previous 3 months versus those 2 months after completion of training
- Analysis of Red and Green Behaviors based on the newly created observation sheet.

The evaluation found that training offered in the first quarter of 2015 was very effective. Each of the parameters examined exhibited a step change in the positive direction. In addition to a vast improvement in troubleshooting methodology, there were no troubleshooting activities which required rework between the start of February to the middle of April, after the training was given. When compared to 50% rework rate which occurred in November and December, the results are obvious.

Additionally, a review of the Red/Green Behaviors based on the newly created observation checklist demonstrated that the Engineering Department is exhibiting Green Behaviors 87% of the time. While there is always room for improvement, this data point is quite striking given that the department was only introduced to the concept two months ago.

Description of Program

In the last four years, the Engineering Department at Millstone Station has experienced a ten percent turnover in its workforce due to retirements. This aging workforce issue is expected to continue for the next five years with an estimated twenty percent turnover in personnel. As a result of this turnover and fact that plant equipment is beginning to degrade, it is imperative that new engineers develop troubleshooting skills to maintain equipment reliability thereby ensuring the health and safety of the public.

Upon receipt of the PAPII, the decision was made by the Engineering Curriculum Review Committee to present a nine hour Continuing Training course on troubleshooting. Initially it was thought that three hours would be sufficient, however, given the severity of the AFI and its effect on equipment reliability, it was decided that a day long course would be more appropriate.

The course was introduced by Engineering Management and included a brief review of past troubleshooting efforts which had failed, and the need for the station to develop sound troubleshooting skills in order to maintain plant equipment and protect the core. Further, the management representative stressed that this training was designed, not to teach engineers how to be maintenance technicians, but to provide engineering personnel with the tools required to work shoulder to shoulder with the maintenance department during the troubleshooting process. Lastly, the management representative explained that although procedurally there were two phases of troubleshooting, simple and complex, very few plant issues actually rose to the level of complex troubleshooting and that the tools used in complex troubleshooting were not designed to find a simple troubleshooting problem.

Program Objectives

The objectives of the program were designed to step each learner through the troubleshooting process while at the same time reinforcing station Human Performance Standards. The objectives were as follows:

1. Given a list of plant conditions, generate a troubleshooting problem statement.
2. Given plant diagrams, identify monitoring points to be used for the system elaboration portion of the Six Step Troubleshooting process.
3. Analyze plant diagrams to develop a troubleshooting plan
4. State how the good decision making model applies to plant troubleshooting.
5. Identify Red Flag and Green Flag behaviors within the troubleshooting process.
6. State the purpose of the following plant test equipment:
    - Multimeter
    - Megger
    - Astromed

7. Analyze plant diagrams to determine the correct values of parameters at a given test point.
8. Explain the importance of failure analysis in the troubleshooting process.

Program Components

Initial Troubleshooting Training consisted of 9 hours of classroom instruction, including lecture, classroom activities and a final evaluation. The signed Lesson Plan Cover Sheet is attached to this report in Appendix B. The lecture portion of the presentation was divided into six units each consisting of a single step in the troubleshooting process. Each lecture unit was followed by a classroom activity which reinforced the previous unit of instruction. A synopsis of lecture topics and activities follows.

Symptom Recognition

The first portion of the lecture covered the Symptom Recognition step in the six step troubleshooting process. The class was introduced to the concept of the problem statement as well as the difficulties they would encounter when developing their own statements. The concept of continuity within the troubleshooting team was also stressed, addressing previously observed behaviors of non-descript troubleshooting efforts.

Student Exercise 1

Students were presented with a site specific Plant Condition Report which identified an equipment problem. The problem was presented including editorialized, extraneous information. In the exercise, students were instructed to create a problem statement for the given Condition Report. Those statements were then analyzed with the class to determine which information should and should not be included.

Symptom Elaboration

This portion of the lecture dealt with elaborating the symptoms during the troubleshooting process. The EPRI specified parameter classification system was reviewed, including mechanical, electrical, plant and system parameters and how to identify them. The lecture stressed that they Symptom Elaboration portion of troubleshooting was a non-intrusive process.

Student Exercise 2

Students were introduced to a new system to search and identify plant prints. Students then used their laptops to search for plant drawings to identify non-intrusive components which could be used for symptom elaboration.

Probably Faulty Functions

Students were introduced to the concept of identifying all probable faulty functions for an equipment failure. The students discussed an EPRI statement that faulty equipment forces those tasked with fixing the equipment to think outside normal parameters. Lastly, students were introduced to the EPRI model which illustrates Engineering and Maintenance working together to solve problems.

Student Exercise 3

Students were given a Plant Condition Report which identified an equipment problem. The students were then tasked to work in groups and developing a troubleshooting plan to identify the probably faulty functions for that piece of equipment. Students were encouraged to think outside the troubleshooting process presented by MA-AA-103, the plant troubleshooting procedure.

Localize Faulty Function

This portion of the lecture dealt with narrowing down the possible faulty functions and the importance of validating assumptions when doing so. In accordance with the long term strategy laid out for Engineering Continuing Training, Red Flag and Green Flag behaviors were discussed based on the approved decision making model.

Student Exercise 4

Students were lead through a Red Flag/Green Flag PROS exercise. The exercise was similar to a Bingo game, but used the acronym of PROS. (Protect the Safety of the Public, Reliable Equipment, Operational Focus, Standards Driven) During the exercise, appropriate behaviors were reviewed and students were challenged to hold each other accountable for their own, and others, behaviors.

Identify Faulty Component

Students were taken through the next to last phase of the troubleshooting process. During this lecture, they were lead through the process of identify the single faulty component within plant equipment. The test equipment and its limitations that the technicians use was explained including the safety concerns with utilizing this equipment. Actual plant operating experience was covered.

Student Exercise 5

Students were given the computer code from the previous exercise. Using the Six Step Troubleshooting process, they were lead through the exercise such that they identified a single error in over 500 lines of computer code.

Failure Analysis

This portion of the lecture summarized the previous 5 sections and stressed the importance of Failure Analysis in the troubleshooting process. Students were taught to utilize post job critiques and provide sufficient documentation such that the results were clearly communicated to the next generation of the Engineering Department.

Final Evaluation

Students were given a Plant Condition Report which identified an equipment problem. They then used MA-AA-103 to develop a complete troubleshooting plan. They then were tasked with presenting this plan to a fully qualified Plant Shift Manager. The Shift Managers provided direct feedback as they would in the plant. This forced the students to role play accordingly. A passing result for this final evaluation was the Shift Manager's acceptance of their plan. A copy of a blank troubleshooting plan can be found in Appendix C.

Evaluation Method

Participants

The Engineering Department consists of System Engineering, Component Engineering and Design Engineering. Each of these groups is made up of electrical and mechanical engineers who have never received troubleshooting training as part of their qualification. These groups received the training as a mixed population during the months of January and February aware of the INPO AFI and its ramifications for the station. Each group is responsible for supplying personnel to troubleshooting teams. The remainder of the team consists of maintenance technicians who are responsible obtaining data from the field. The Maintenance Department did not attend this training; however maintenance personnel did receive similar training in 2014.

The Operations Department, while not directly involved in the team, plays a vital role in the troubleshooting process. In accordance with the MA-AA-103, Operations works in parallel with the team to resolve plant issues. Specifically, the Operations Department is responsible for ensuring plant safety and have the right of final refusal for any troubleshooting plan. It is for this reason that a qualified shift manager acted as the evaluator for the final class exercise.

Procedures

It is important to remember that the purpose of the troubleshooting training was to teach the methodology of troubleshooting. Hence, the majority of the evaluation will focus on whether or not engineers have improved their methods when conducting troubleshooting on plant equipment. This report looks at specific steps in the process, such as the generation of a problem statement or the organization of collected data and other indicators of methodology, to determine the effectiveness of the training. Specific grading scales have been created for the following troubleshooting attributes:

- Problem Statements
- Symptom Elaboration Monitoring Points
- Plant Intrusiveness and Redundant Readings
- Data Gathering
- Post Job Critiques

The specific grading criteria are outlined in Appendix D.

Beyond methodology, Objective 5 of the training addresses Red and Green Flag Behaviors. The INPO AFI as stated in the PAPII specifically addresses the inability of team leaders to reinforce formality in troubleshooting. This formality is a matter of behavior and cannot be measured retroactively, but instead must be directly observed.

Lastly, although it is not specifically addressed in the training objectives, the true measure of successful troubleshooting training is results. The best methodology and behaviors will not matter in the least should re-work be required. Therefore this evaluation will also look at the results of troubleshooting efforts based on rework and whether the equipment continues to work after it has been returned to service.

Data Sources

In order to gage the effectiveness of the troubleshooting training, this evaluation will examine station troubleshooting efforts occurring from November 1, 2014 to January 15, 2015, and compare them to troubleshooting that occurred from February 16, 2015 to April 17, 2015. Using these periods provides eight discrete troubleshooting events to examine before the training took place and 6 events after the training took place. The specific plant components that were repaired are listed in Appendix D.

The data from the fourteen troubleshooting events will be gathered using the Work Orders that were generated to address the equipment malfunctions, specifically the troubleshooting plans generated as part of MA-AA-103, the troubleshooting procedure. In addition to reviewing the troubleshooting plans, the verbiage of the Work Order will be reviewed to ensure that the appropriate post job critique was conducted.

To assess the behaviors denoted in Objective 5, two observation forms were used. The first is taken from the Work Observation System Data Base and included as Appendix E. The second was developed by the Engineering Department in February 2015 and is specifically designed to observe Red and Green Behaviors and is included as Appendix F. This second survey was not created until 2015, however, it does evaluate whether the significance of Red and Green Behaviors has been taken on board.

Lastly, to assess the results of troubleshooting, this evaluation will examine the amount of rework required following completion of the troubleshooting. Regardless of the method, the true performance indicator on the successfulness of a troubleshooting activity is whether the equipment in question stays running.

Results

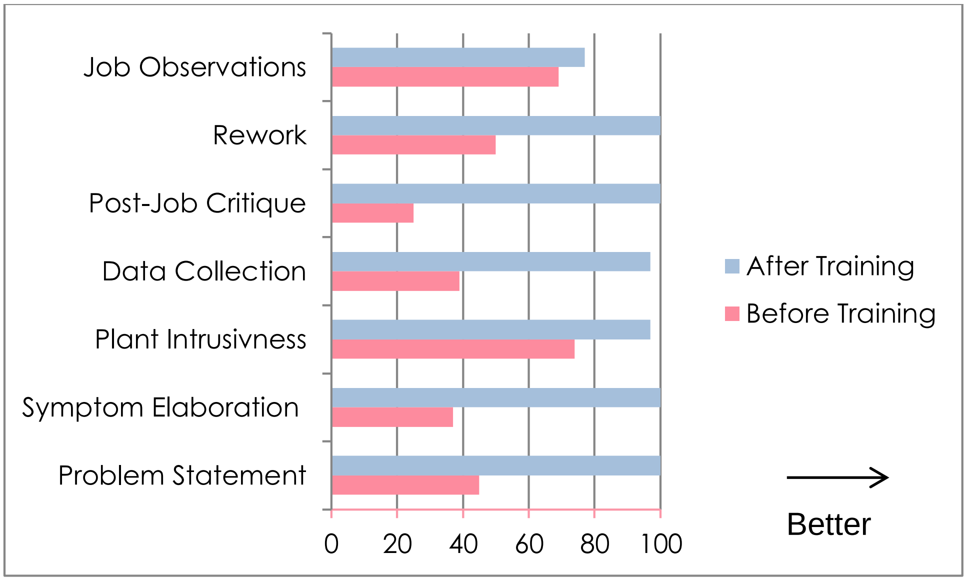

Figure 1
Troubleshooting Metrics Results

While the specifics of the data analysis can be found in Appendix D, the above figure clearly illustrates that there has been a step change in Millstone Station's troubleshooting performance since the conduct of troubleshooting training. It should be noted that the Job Observation category is formatted such that a 75% rating is equivalent to all standards being met. Every other category examined scored greater than 95%, indicating that the troubleshooting is now proceeding in accordance with the procedure and that those members who are part of troubleshooting teams are applying the procedure correctly.

More important than just methodology, however, is the fact that Figure 1 shows that when the proper methodology is applied, successful troubleshooting occurs and rework is not required. In fact, since the completion of the training, there has not been a single instance of rework on a component that has been repaired.

Further, the data collected indicates that those who attended training have retained and can apply the objectives from the training. Specifically, the quality of the troubleshooting plan problem statements has been perfect, incorporating all three areas required. Engineers have learned to look at non-intrusive indications first and then, when digging deeper, they have gained an appreciation for minimizing the disturbances to the plant. Their data, now, is recorded in accordance with plant standards, which will yield benefits in the future when similar issues arise. Lastly Figure 1 illustrates that unlike with pre-training troubleshooting teams, the troubleshooting teams post training are taking the time to conduct Post-Job Critiques which will also yield benefits in the future.

Lastly, an examination of the Red and Green Behaviors discussed in the class has resulted in a Green Behavior percentage of 87 percent. This indicates that not only have the engineers absorbed what Red and Green Behaviors are, but they are conscious of their behavior and are mindful of applying the proper model as they go about their day to day work.

Discussion

While it is obvious that the first quarter troubleshooting training was effective, it is important to remember that this was the first time that the Engineering Department was exposed to the troubleshooting process. Because of this, they may not have known, as a group, what the 4.0 model of troubleshooting looked like. The data from the evaluation does, however, affirm that Millstone workers have a strong desire to adhere to standards and will do so once those standards are presented in a formal learning environment.

As discussed, the lack of prior knowledge of the troubleshooting knowledge may have been the cause of poor results previously. Because of this, it is imperative that this training be required as part of initial engineering training. As previously stated, the Engineering Department will experience a huge turnover in its workforce in the next five years. In order to keep the knowledge level high, all new hires should attend this course.

Finally, this class should not be a onetime occurrence. In order for standards to be effective, they should be reinforced on a periodic basis. Unfortunately troubleshooting is not something which can be practiced in the plant, and when troubleshooting teams are assembled, they will always be subjected to time pressure to return equipment to service. Therefore, time should be allotted to allow those who have received the training to practice what they have learned. Realistic scenarios should be developed using the equipment in the training labs to put various engineering groups through their troubleshooting paces. Doing this will eliminate complacency, enforce standards and increase the overall effectiveness of the workforce.

Dominion

Performance Analysis & Performance Improvement Instrument

TR-AA-100 - Attachment 2 Page 1 of 5

Section I – General Information		
Topic or Task #: **Troubleshooting**	Description: **Troubleshooting Team Leads ineffective**	Date: **01/05/2015**
Program: **ES**	Site: ☐ ITC ☐ NAPS ☐ SPS ☒ MPS	CRS Tracking Number: CA292987

Section II – Performance Analysis		
1. What is the performance **issue**? Defined as the observed difference between actual and desired performance.	What is actually happening? **Complex troubleshooting team leaders do not evaluate and disposition some important potential causes of equipment failures, and sometimes do not reinforce formality and thoroughness in troubleshooting. A contributor is that team leaders occasionally do not enforce thorough and documented reviews to validate assumptions and conclusions reached during complex troubleshooting are valid.**	
	What should be happening (desired performance)? **Troubleshooting Team Leaders should be responsible for managing the execution of the complex troubleshooting process properly so that the true cause for equipment malfunction gets correctly identified and resolved. They are also responsible for overall condition of the troubleshooting activities and communication to the management team. (From MA-AA-103)**	
	What is the performance gap? **There is a lack of formality and a consistent approach when implementing the systematic approach to troubleshooting. Data is often communicated unclearly from the field resulting in lost time and less than thorough review and analysis of this data.**	
	Who is affected by the performance gap? ☐ Individual Only ☐ Department ☒ Multiple Departments or Site	
2. How was the issue identified?	☐ DSEM ☐ CRS ☐ Cognitive Trending ☐ Self Assessment ☐ Benchmarking ☒ Other (describe) **2014 WANO Peer Review Area for Improvement (AFI): ER.1-1**	
3. Is the problem worth solving?	Does the problem affect plant strategies and goals? ☒ Yes ☐ No Is there a cost or consequence of doing nothing? ☒ Yes ☐ No Is there some other driver that makes the problem worth solving? ☒ Yes ☐ No If yes, explain: **The station's inability to effectively troubleshoot has already resulted in unplanned shutdowns, downpowers and equipment unavailability.**	If <u>Yes</u>, continue. If <u>No</u>, exit this form and document the determination in CRS.

Section III – Cause Analysis/Intervention Selection		
1. Expectations and Feedback	Have the expectations and goals been communicated to the performers, including their roles and responsibilities?	☒ Yes ☐ No
	If no, explain:	
	Have the risks and importance of the task been communicated to the performers?	☒ Yes ☐ No
	If no, explain:	

	Have the expectations and standards for the conduct of work been communicated to the performers?	☐ Yes ☒ No
	If no, explain: **While the expectations and standards have been provided, there is no clear picture of what a 4.0 model of a troubleshooting team looks like leading to dissimilar models depending upon who is appointed as the Troubleshooting Team Lead.**	
	Are the performers given relevant feedback on previous job or task performance, including opportunities for development?	☐ Yes ☒ No
	If no, explain: **Troubleshooting teams often disband before a thorough post job critique is performed. This has contributed to the lack of a 4.0 model. Additionally, the crispness and formality of turnovers are not often enforced.**	
2. Tools, Resources, and Environment	Do the appropriate tools, material, clothing, furniture, facilities, systems, and equipment accommodate human limitations, and are they available and accessible?	☒ Yes ☐ No
	If no, explain	
	Do the usability, accuracy, and availability of procedures support error-free performance?	☒ Yes ☐ No
	If no, explain:	
	Are other individuals or organizations available if needed?	☒ Yes ☐ No
	If no, explain:	
	Is the activity free of other obstacles such as supervisory or direction conflicts, distractions, interactions with others, or peer pressure?	☒ Yes ☐ No
	If no, explain:	
	Do the values, attitudes, and beliefs of the performers' immediate workgroup about hazards in the workplace support safe work practices?	☒ Yes ☐ No
	If no, explain:	
3. Incentives and Disincentives	Are financial and non-financial rewards contingent on performance?	☒ Yes ☐ No
	If no, explain:	
	Are competing incentives for poor performance eliminated?	☒ Yes ☐ No
	If no, explain:	
	Are the performers treated with honesty, fairness, and respect, regardless of position in the organization?	☒ Yes ☐ No
	If no, explain:	
4. Capacity and Readiness	Do the performers possess the intelligence, sociability, aptitude, size, strength, and dexterity to perform the task successfully?	☒ Yes ☐ No
	If no, explain:	
	Are the performers available for work, undistracted, and fit for duty?	☒ Yes ☐ No
	If no, explain:	
5. Personal Motives	Do the performers care about performing the task well?	☒ Yes ☐ No

	If no, explain:	
	Do the performers possess a healthy work ethic and are they willing to do what is right regardless of what others would do?	☒ Yes ☐ No
	If no, explain:	
	Do the performers feel that the task is meaningful and attainable, progress is recognizable, and the task generates a personal sense of accomplishment?	☒ Yes ☐ No
	If no, explain:	
6. Knowledge and Skills	Have the performers satisfactorily completed the task in the past, e.g., for initial qualification?	☐ Yes ☒ No
	If no, explain: **There has been no formal initial training for Troubleshooting Team Leads.**	
	Has the task ever been successfully done by others?	☒ Yes ☐ No
	If no, explain:	
	Do the performers understand the task objective(s), critical steps, performance standards and expectations, and potential consequences if performed improperly?	☒ Yes ☐ No
	If no, explain:	
	Has refresher training been provided at an appropriate frequency or is the task done with enough frequency to maintain proficiency?	☐ Yes ☒ No
	If no, explain: **Refresher training has not been conducted for Troubleshooting Team Leads nor has generic troubleshooting training been given to the Engineering population as a whole.**	

Section IV – Recommended Actions

7. Recommended non-training actions (address all ‘No’ responses from Sections III.1 through III.5):

Tracking Number*	Non-Training Assignment Details	Responsible Person
	An Engineering Management briefing will be held prior to WGST for Troubleshooting Leads reinforcing the expectations for crisp turnovers, failure analysis and post job critiques for all troubleshooting activities.	**Rigatti**

8. Recommended training actions (Complete this section if any 'No' responses were identified in Section III.6):

   a. Ensure the training addresses the gap identified in Section II.
   ☐ Provide knowledge-based training ☒ Provide skill-based training

   b. Is the recommended training supported by an existing training program task? ☒ Yes ☐ No
   If no, conduct a job and task analysis.
   Task number and description: **ACAD 3.3.4.7 -** Prepare, provide technical support for, and document special tests as may be required to evaluate system performance or to determine the cause of system malfunctions.

   c. Identify the knowledge and skills to be covered in training to address the performance gap.
   Initial and Continuing Troubleshooting Lead Training for designated Troubleshooting Leads. / Initial General Troubleshooting training for ES Population

   d. Identify the target population.
   Troubleshooting Leads as appointed from CA295690. / ES Population

   e. Identify the proposed training setting.
   Initial Training for Troubleshooting Leads will be conducted as WGST. Initial General Troubleshooting training to be given during Continuing Training for all current ES Population and will be offered to new hires as part of the IPO portion of initial training.

Tracking Number*	Training Assignment Details	Due Date
CA296143	Conduct training.	**2/15/15**
N/A	Update initial training material, if required.	
N/A	Review the affected task and DIF ratings and update, if required.	
	Conduct PAPII interim effectiveness review, if required.	**4/15/15, 9/15/15**
	Conduct final PAPII effectiveness review.	**12/15/15**

Section V– Performance Improvement Instrument (Training Actions only)

1. Identify the specific methods to be used to determine the effectiveness of the training. Methods should be quantitative, measurable, and capable of reflecting the desired performance defined in Section II.1, when feasible and practicable, e.g., lower dose by X% or reduce rework rate from X to Y. Be sure to include the initial value from which the change in performance will be measured. The effectiveness methods should not be based upon cognitive evaluations unless other performance measures cannot be applied due to the nature of the task. *[This section is not applicable if no training actions are identified in Section IV.8.]*

   A review of all troubleshooting activities will be conducted between the dates of 01November15 and 15April15. Work Orders will be reviewed for completeness of the Problem Statement, use of Symptom Elaboration Monitoring Points, Plant Intrusiveness, thoroughness of recorded data and documentation of a Post-Job Critique. Additionally, a search will be conducted for rework on the component, post troubleshooting.

   A review of Management Observations will also be conducted on these activities to assess Red / Green Flag Behaviors and Troubleshooting Lead effectiveness.

   A similar review will take place for all troubleshooting activities conducted between 15April15 and 15September15 with a final review occurring on 15December15.

   The final acceptance criteria is an average of greater than 95% for all measured activities.

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Performance Analysis & Performance Improvement Instrument

Section VI – Approval of Performance Analysis and Training Effectiveness Methods

Performed by:

[signature] Training Instructor — 3/17/15 Date

[signature] PER TELCON ETHAN TREPTOW Line Department SME — 3/19/15 Date

Approved by:

[signature] Training Supervisor — 3/17/15 Date

[signature] PER TELCON JOE RIGATTI Training Program Owner/ CRC Chairperson — 3/19/15 Date

Section VII – Training Effectiveness

1. Evaluator:	2. Evaluation Date:

3. Was training effective in achieving goal as measured by methods identified in V.1?

☐ Yes – provide specific details and cite sources:

☐ No – Initiate a CR and identify actions planned or taken:

4. Comments:

Section VIII – Approval of Training Effectiveness Review

Training Supervision (signature):	Date:
Training Program Owner/ CRC Chairperson (signature):	Date:

*Tracking numbers may be follow-on assignments to the CRS assignment listed in Section I.

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Lesson Plan Coversheet

TR-AA-300 – Attachment 1 Page 1 of 4

Lesson Plan Title: Troubleshooting		Revision Number: 0
Check all that are appropriate: ☒ Classroom ☐ Laboratory ☐ Activity ☐ Self-Study		Site: **MPS**
Program: **ES**		
Course: Troubleshooting 1Q15 ESCT		Course Number: N/A
Total (Presentation and Evaluation) Time: **10.0**	Related PA/PII: **Approved 01/13/15 ESCRC**	ORA Needed? **No**

Preparer's Printed Name: Doran	Signature: [signature]	Date: 2/5/15
Instructional Reviewer's Printed Name (Optional): Chriss Miller	Signature: [signature]	Date: 2/24/15
SME Technical Reviewer's Printed Name: Mihalko	Signature: [signature]	Date: 2/5/15
Training Supervisor Approver's Printed Name: Maclean Ellen Maclean	Signature: [signature]	Date: 2/5/15

Tracking Number	Description of Revision
CA292987	2014 WANO Peer Review Area for Improvement (AFI): ER.1-1

Lesson Plan Requirements

Goal of Training

To introduce simple troubleshooting tools and techniques to the general ES Training population

Learning Objectives

EO1 Given a list of plant conditions, generate a troubleshooting problem statement.

EO2 Given plant diagrams, identify monitoring points to be used for the system elaboration portion of the Six Step troubleshooting process.

EO3 Analyze plant diagrams to develop a troubleshooting plan

EO4 State how the good decision making model applies to plant troubleshooting.

EO5 Identify Red Flag and Green Flag behaviors within the troubleshooting process.

EO6 State the purpose of the following plant test equipment:

- Multimeter
- Megger
- Astromed
- Clamp On Ammeter

EO7 Analyze plant diagrams to determine the correct values of parameters at a given test point.

EO8 Explain the importance of failure analysis in the troubleshooting process.

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Lesson Plan Coversheet

Standards

Condition, action, and standard statements are accurate and reflect the technical knowledge and skills required for class completion. (IR TR)
Cognitive levels of objectives are appropriate for the goal of the lesson. (IR)
Higher order objectives are included when appropriate. (IR)
Objectives are sequenced appropriately (i.e., simple to complex, etc.). (IR TR)
Operator/Discipline specific fundamentals objectives are included. (IR TR)

Prerequisites

None

Standards

Prerequisites accurately identify the knowledge and/or skills that the trainee must possess or courses that must be completed prior to attending the training. (IR TR)

Training Resources

Computer/Projector/Internet Connection

Standards

Special equipment and other required instruments are identified and technically accurate to support lesson content. Examples include AV equipment, stands, flipcharts, props, models, etc. (IR TR)
The time allotted for the training session is appropriate for the technical presentation of content and activities. (TR)

References

MA-AA-103 "Conduct of Troubleshooting"
25212-32001 SH. 6EQ, 6AKQ, 7BR, 7BT
S&W DWG NO 12179-EM-106C

Standards

References are current and relate to the learning objectives and content. (TR)

Commitments

None

Standards

Commitments relate to the learning objectives. (IR TR)

Evaluation Methods

Team Troubleshooting Plan Development Exercise. Students will be evaluated on: developing a problem statement given plant conditions (EO1), using plant drawings to determine which indications can be used for symptom elaboration(EO2) Lastly, they will develop a complete troubleshooting plan and discuss test points and expected results (EO3/EO7)

Standards

Evaluation methods are consistent with the learning objectives. (IR TR)

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Lesson Plan Coversheet

Fundamentals

Engineers model critical thinking, maintain technical independence and have a questioning attitude.

Standards

Fundamentals are applicable to the content. (TR)
Fundamentals cover either knowledge, behavior, and/or skill. (TR)

HU Tools

Discuss the fact that Troubleshooting operates in the knowledge based space of Human Performance.
Stress that not only Self-Checking, but Peer-Checking is required.

Standards

Management expectations and Standard Work Practices are incorporated (STAR, communications, safety, etc.). (IR TR)
Applicable HU Tools and error likely situations are appropriately referenced throughout the lesson plan. (IR TR)

Operating Experience

CR382225/CR482783: SBO Diesel found running
CR564252: Wrong Breaker installed in 32T

Standards

Lessons learned from applicable industry/plant events are included in the lesson plan. (IR TR)

Handouts

Identifying Number	Description
HO1	**Power Point presentation with notes attached**
MA-AA-103	**Conduct of Troubleshooting**
HO2	**PROS Card**

Standards

Handouts and other instructional aids are current and support the learning objectives. (IR TR)

Activities

Develop Problem Statement	**Develop Troubleshooting Plan for 3CN C-P1A**
List Parameters in Symptom Elaboration	**Red Flag/Green Flag PROS! Activity**
Class Use of the Operations Document App	**Class troubleshoot computer program**

Standards

Instructional methods and planned activities are appropriate for mastery of the learning objectives. (IR)
The instructor note box is used to identify the use of instructional aids, questions, exercises, reviews, etc. (IR)

Multimedia

PPT	
PROS Website	

Key: SME-Subject Matter Expert; IR-Instructional Review; TR-Technical Review

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Lesson Plan Coversheet

Standards
Multimedia are technically accurate and support the lesson content. (IR TR)
Multimedia are designed to enhance learning. (IR TR)

Tasks Associated with the Lesson Plan

DQR –SYS-ENG-AA Prepare, provide technical support for, and document special tests as may be required to evaluate system performance or to determine the cause of system malfunctions.

Content

Select the appropriate lesson plan template to attach to this document. Your lesson should include at a minimum—an introduction that provides a WIIFM, a body organized by each learning objective, and a summary with review questions and answers tied to the objectives. You should include appropriate instructor notes that guide the instructor in conducting activities including formative assessments, handing out materials, etc.

Standards
The content is technically accurate and supports the learning objectives. (IR TR)
Sufficient detail is provided such that training is delivered consistently. (IR TR)
Notes to the instructor help reinforce lesson material to the trainee(s). (IR)
Operator/Discipline specific fundamentals are incorporated with sufficient level of detail. (IR TR)

Dominion®

Troubleshooting Sheet

MA-AA-103 – Attachment 2 **Page 1 of 4**

CR Number	Risk ☐ I-High ☐ II-Medium ☐ III-Low ☐ IV-No	Rigor Category ☐ A ☐ B ☐ C ☐ D
Work Authorization (CR/WO)	System	Is a Complex Troubleshooting Plan required? ☐ Yes ☐ No
Component ID		
Operating Conditions		
Initial Problem Statement		

Name of Personnel Having Knowledge of the Problem	Department	Phone Number

Troubleshooting Team Members [Identify personnel with failure modes/cause analysis training with an asterisk (*).]

☐ Engineering ____________________

☐ Operations ____________________

☐ Maintenance ____________________

☐ Vendor ____________________

☐ Corporate ____________________

☐ O&P ____________________

☐ Project Manager ____________________

☐ Other ____________________

Operations to determine the following: a. Troubleshooting will cause TS Equipment to become inoperable? ☐ Yes ☐ No b. **IF** Yes, **THEN VERIFY** opposite train equipment and associated EDG are operable.	Operations (Initials)

Troubleshooting Sheet

MA-AA-103 – Attachment 2 **Page 2 of 4**

Describe the troubleshooting actions or steps for which approval is being requested. Include any initial observations and response completed by the Operating crew.

Troubleshooting Limits or Boundaries

Describe the equipment configuration during the troubleshooting (extent of equipment isolated, removed from service, made operable, in bypass, controller in manual, etc.) to bound the effects of the troubleshooting and prevent creating an undesirable or unanalyzed equipment configuration. (Refer to MA-AA-103 Attachment 1 for additional risk and rigor consideration.)

Troubleshooting Sheet

MA-AA-103 – Attachment 2 **Page 3 of 4**

Identify the Impact of the Troubleshooting on Plant Equipment (Alarms, Lost Indication, Lost Function, system flow changes, affects on adjacent equipment/systems, potential to affect reactivity by isolation of feedwater heating/control rod movement/boron dilution change or other means, etc. (Refer to MA-AA-103 Attachment 1 for additional risk and rigor consideration.)
Describe the expected results.
Identify any decision or stop points to evaluate progress or subsequent actions.

FSRC review required? ☐ Yes ☐ No	PRA Risk evaluated by Operations or O&P? ☐ Yes	
Troubleshooting Team Lead (TTL) Approval, if required (Print Name)	Troubleshooting Team Lead (TTL) Approval, if required (Signature)	Date
Maintenance Manager/Designee Review/Approval (Mark N/A if Rigor Category C or D) (Print Name)	Maintenance Manager/Designee Review/Approval (Mark N/A if Rigor Category C or D) (Signature)	Date
Troubleshooting Team Manager (TTM) Approval, if required (Print Name)	Troubleshooting Team Manager (TTM) Approval, if required (Signature)	Date
Plant Manager (Nuclear) Approval, if required (Print Name)	Plant Manager (Nuclear) Approval, if required (Signature)	Date
FSRC Chair Approval, if required (Print Name)	FSRC Chair Approval, if required (Signature)	Date
Shift Manager Approval (Print Name)	Shift Manager Approval (Signature)	Date

Troubleshooting Sheet

MA-AA-103 – Attachment 2 **Page 4 of 4**

Results Attained		
Follow-up Action Required		
Additional sheets attached? ☐ Yes ☐ No		
Worker (Print Name)	Worker (Signature)	Date

Management Challenge Board results from Step 3.11.6:

Appendix D: Raw Data Results - Problem Statement Results

Table 1: Problem Statement Grading

Issue	CR Number	Work Order Number	Problem Statement	Grade
Before Troubleshooting Training (November 1, 2014 to January 15, 2015)				
A' HVK Chiller Failed to Start	CR564078	53102787309	3HVK*CHL1A failed to start when taken to run.	66
Unit 3 Turbine Driven Aux Feed Pump Oversped	CR565317	53102788330	3FWA*P2 tripped on overspeed.	33
Breaker 32T4-2 Tripped During Battery Restoration	CR566414	53102790102	While restoring Battery 3, 32T4-2, Supply to 32-2T MCC tripped	66
Low Flow During Service Water Op Test	CR567107	53102790990	ISI Service Water Pump Op Test failed due to low flow.	33
Stack Wide Range Rad Monitor Tripped	CR568303	53102792225	Stack Wide Range Rad Monitor Tripped	33
Unit 3 PORV Indication Failure	CR568502	53102792817	Unit 3 PORV does not change indication when valve is stroked.	33
3DAS-P1A Failed to Start	CR569514	53102793504	3DAS-P1A failed to start	33
B' Diesel Generator Field Flash Failure	CR570619	53102794103	B' EDG Field Flash failed during retest run.	66
After Troubleshooting Training (February 1, 2014 to April 15, 2015)				
D' Variable Frequency Drive Tripped	CR573407	53102796506	On 2/17/15 at 1700 while restoring 3CWS-P1D, the variable frequency drive for 3CWS-P1D tripped, giving the Control Room an alarm	100
C' S/G Feed Reg Valve Operated Sluggishly	CR575317	53102798813	On 2/27/15 at 09:30 while lowering power from 100% to 95%, 3FWS-AOV40C operated sluggishly resulting in oscillating S/G levels.	100
A' Diesel Generator Sequencer Trouble Alarm	CR577204	53102799207	On 3/7/15 at 10:00, while conducting slave relay testing, the Control Room received a Trouble Alarm on the 'A' EDG sequencer.	100
3CWS-P1F Circuit Breaker Failed to Close	CR577863	53102800063	On 3/20/15 at 1700, while attempting to restore 3CWS-P1F, circuit breaker 34B15-2 failed to close.	100
3CHS*MOV45B Failed to Stroke	CR578761	53102801452	On 4/2/15 at 1300, while conducting ISI stroke testing on 3CHS*MOV45B, the valve failed to stroke in either the open or closed direction.	100
Breaker B0402 Failed to Close	CR579202	53102802509	On 4/13/15 at 0400, while attempting to cross tie load centers 22B and 22D, breaker B0402 failed to close.	100

Average Grade Before Training: 45%

Average Grade After Training: 100%

Grading Methodology

EPRI specifies, in their troubleshooting guide, that a correctly written problem statement is composed of three distinct parts. The first part of the problem statement must be the date and time that the incident occurred. Without this knowledge, plant parameters at the time the incident occurred would be unknown. The second portion of the problem statement highlights the plant activity in process when the problem was discovered. Including this second portion will allow the troubleshooting team to recreate plant configurations should that be necessary. The last portion of the problem statement should state exactly what the issue is without editorializing. Extraneous information can often lead a troubleshooting team in the wrong direction. The grade scale for this table allotted 33% for each portion of the problem statement. The individual grades were then totaled and divided by the number of troubleshooting activities that occurred.

Appendix D: Raw Data Results - Symptom Elaboration Monitoring

Table 2: Symptom Elaboration Monitoring Grading

Issue	Work Order Number	Drawing Numbers	Monitoring Points Available	Monitoring Points Used	Grade
Before Troubleshooting Training (November 1, 2014 to January 15, 2015)					
A' HVK Chiller Failed to Start	53102787309	EM-151D, ESK-5DZ, EE-3QV,	10	4	40
Unit 3 Turbine Driven Aux Feed Pump Oversped	53102788330	EM-130B, EE-55B, EP-17K	7	3	43
Breaker 32T4-2 Tripped During Battery Restoration	53102790102	EE-9AA, ESK-6ZT, ESK-6AFF	4	0	0
Low Flow During Service Water Op Test	53102790990	EM-133A, ESK-5CJ, EE-8BF	8	4	50
Stack Wide Range Rad Monitor Tripped	53102792225	EM-123G. ESK-6KA, EE-9BB	3	1	33
Unit 3 PORV Indication Failure	53102792817	EM-112C, ESK-7DB, EE-9AF	3	1	33
3DAS-P1A Failed to Start	53102793504	EM-121A, ESK-6AAR, EE-9CF	4	2	50
B' Diesel Generator Field Flash Failure	53102794103	ESK-7AH, ESK7-AJ, EE-8RS	4	2	50
After Troubleshooting Training (February 1, 2014 to April 15, 2015)					
D' Variable Frequency Drive Tripped	53102796506	ESK-5CC, LSK-02-01.1A, EE-8AC	5	5	100
C' S/G Feed Reg Valve Operated Sluggishly	53102798813	EM-145C, LSK-03-04.1A , EE7G	6	6	100
A' Diesel Generator Sequencer Trouble Alarm	53102799207	ESK-7AF, ESK7-AG, EE-8RQ	2	2	100
3CWS-P1F Circuit Breaker Failed to Close	53102800063	ESK-5CG, EE-8AE	3	3	100
3CHS*MOV45B Failed to Stroke	53102801452	EM-142K, ESK-6AAN, EE-9DB	4	4	100
Breaker B0402 Failed to Close	53102802509	25203-30099-16, 25203-30051-7	2	2	100

Average Grade Before Training: 37%

Average Grade After Training: 100%

Grading Methodology

The troubleshooting process specifies that all non-intrusive plant parameters be observed during the Symptom Elaboration step. Checking these parameters often yields a great deal of information without introducing the possibility of a human performance error. The drawings listed for each Work Order were independently reviewed by two parties for the availability of non-intrusive monitoring points. These parties then compared notes and the Monitoring Points Available was created based on these discussions. The Work Orders listed were then reviewed to determine how many of the Available Monitoring Points were used during the Symptom Elaboration step. The grade is the percentage of available points that were used.

Appendix D: Raw Data Results – Plant Intrusiveness Monitoring

Table 3: Plant Intrusiveness Monitoring Grading

Issue	Work Order Number	Drawing Numbers	Monitoring Points Required	Monitoring Points Used	Grade
Before Troubleshooting Training (November 1, 2014 to January 15, 2015)					
A' HVK Chiller Failed to Start	53102787309	EM-151D, ESK-5DZ, EE-3QV	12	12	100
Unit 3 Turbine Driven Aux Feed Pump Oversped	53102788330	EM-130B, EE-55B, EP-17K	7	15	20
Breaker 32T4-2 Tripped During Battery Restoration	53102790102	EE-9AA, ESK-6ZT, ESK-6AFF	2	7	50
Low Flow During Service Water Op Test	53102790990	EM-133A, ESK-5CJ, EE-8BF	5	6	90
Stack Wide Range Rad Monitor Tripped	53102792225	EM-123G. ESK-6KA, EE-9BB	6	9	70
Unit 3 PORV Indication Failure	53102792817	EM-112C, ESK-7DB, EE-9AF	5	6	90
3DAS-P1A Failed to Start	53102793504	EM-121A, ESK-6AAR, EE-9CF	4	7	70
B' Diesel Generator Field Flash Failure	53102794103	ESK-7AH, ESK7-AJ, EE-8RS	12	12	100
After Troubleshooting Training (February 1, 2014 to April 15, 2015)					
D' Variable Frequency Drive Tripped	53102796506	ESK-5CC, LSK-02-01.1A, EE-8AC	14	15	90
C' S/G Feed Reg Valve Operated Sluggishly	53102798813	EM-145C, LSK-03-04.1A , EE7G	10	10	100
A' Diesel Generator Sequencer Trouble Alarm	53102799207	ESK-7AF, ESK7-AG, EE-8RQ	8	8	100
3CWS-P1F Circuit Breaker Failed to Close	53102800063	ESK-5CG, EE-8AE	9	9	100
3CHS*MOV45B Failed to Stroke	53102801452	EM-142K, ESK-6AAN, EE-9DB	8	9	90
Breaker B0402 Failed to Close	53102802509	25203-30099-16, 25203-30051-7	7	7	100

Average Grade Before Training: 74%

Average Grade After Training: 97%

Grading Methodology

While it is important to collect the appropriate data during the troubleshooting process, intruding too much into the plant increases the opportunity for a human performance error to lead to equipment damage. Troubleshooting teams should limit their readings to those that will narrow down the problem, without taking duplicate readings. The drawings listed for each Work Order were independently reviewed by two parties for the number of points required to discern the appropriate information. These parties then compared notes and the Monitoring Points Required column was created based on these discussions. The Work Orders listed were then reviewed to determine how many of the Required Points were used during the troubleshooting. An insufficient number of points would result in a zero any number of points over the number required resulted in 10 points being subtracted from 100 for each infraction.

Appendix D: Raw Data Results – Data Collection

Table 4: Data Collection Grading

Issue	Work Order Number	Data Points Taken	Time/Date	Point Title	M & TE Specified	Scale Specified	Result with Units	Grade
Before Troubleshooting Training (November 1, 2014 to January 15, 2015)								
A' HVK Chiller Failed to Start	53102787309	12	0	12	0	0	12	20
Unit 3 Turbine Driven Aux Feed Pump Oversped	53102788330	15	0	12	0	0	10	14.6
Breaker 32T4-2 Tripped During Battery Restoration	53102790102	7	0	0	0	0	0	0
Low Flow During Service Water Op Test	53102790990	6	6	6	0	0	6	60
Stack Wide Range Rad Monitor Tripped	53102792225	9	9	9	9	9	9	100
Unit 3 PORV Indication Failure	53102792817	6	0	3	0	0	6	30
3DAS-P1A Failed to Start	53102793504	7	0	3	0	0	7	28.5
B' Diesel Generator Field Flash Failure	53102794103	12	12	12	0	0	12	60
After Troubleshooting Training (February 1, 2014 to April 15, 2015)								
D' Variable Frequency Drive Tripped	53102796506	15	15	15	15	12	12	92
C' S/G Feed Reg Valve Operated Sluggishly	53102798813	10	10	10	10	7	7	88
A' Diesel Generator Sequencer Trouble Alarm	53102799207	8	8	8	8	8	8	100
3CWS-P1F Circuit Breaker Failed to Close	53102800063	9	9	9	9	9	9	100
3CHS*MOV45B Failed to Stroke	53102801452	9	9	9	9	9	9	100
Breaker B0402 Failed to Close	53102802509	7	7	7	7	7	7	100

Average Grade Before Training: 39%

Average Grade After Training: 97%

Grading Methodology

Data Collection was specifically called out as a weakness in the INPO AFI. The Troubleshooting Plans for each Work Order were reviewed for the data collected. Each entry was appraised as to whether time and date was called out, the specific measuring point was specified, the test equipment used and its scale was listed and lastly whether the resulting readings included the appropriate units. Each attribute was worth 20% of the whole. For example, if there were 12 readings taken and each of the 12 readings listed both value and the appropriate units, 20 points would be added to the final grade of that particular work order. If only 6 of the 12 were correctly documented, a total of 10 points would be added to the final grade.

Appendix D: Raw Data Results – Post-Job Critique, Rework, Observations

Table 5: Post-Job Critique, Rework, Observations Grading

Issue	Work Order Number	Post-Job Critique Held	Rework Required	Observations				
				ES	MS	OI	UN	Grade
Before Troubleshooting Training (November 1, 2014 to January 15, 2015)								
A' HVK Chiller Failed to Start	53102787309	NO	YES	0	12	4	2	64
Unit 3 Turbine Driven Aux Feed Pump Oversped	53102788330	NO	YES	0	14	3	1	68
Breaker 32T4-2 Tripped During Battery Restoration	53102790102	NO	YES	0	11	4	3	61
Low Flow During Service Water Op Test	53102790990	NO	NO	0	18	0	0	75
Stack Wide Range Rad Monitor Tripped	53102792225	YES	NO	0	18	0	0	75
Unit 3 PORV Indication Failure	53102792817	NO	YES	0	13	3	2	65
3DAS-P1A Failed to Start	53102793504	NO	NO	0	16	2	0	72
B' Diesel Generator Field Flash Failure	53102794103	YES	NO	0	18	0	0	75
Final Averages		25%	50%			**Average**		**69**
After Troubleshooting Training (February 1, 2014 to April 15, 2015)								
D' Variable Frequency Drive Tripped	53102796506	YES	NO	1	16	1	0	75
C' S/G Feed Reg Valve Operated Sluggishly	53102798813	YES	NO	2	16	0	0	78
A' Diesel Generator Sequencer Trouble Alarm	53102799207	YES	NO	3	15	0	0	79
3CWS-P1F Circuit Breaker Failed to Close	53102800063	YES	NO	2	15	1	0	76
3CHS*MOV45B Failed to Stroke	53102801452	YES	NO	4	14	0	0	81
Breaker B0402 Failed to Close	53102802509	YES	NO	1	14	3	0	72
Final Averages		100%	100%			**Average**		**77**

Grading Methodology

Data Analysis for the Post-Job Critique was performed by dividing the total number of Post-Job Critiques performed by the total number of troubleshooting activities and then multiplying by 100. The same method was used for the rework score except that the total was based on no rework required. For the Observation score, the total number of Exceeds Standards, Meets Standards, Opportunities for Improvement and Un-Sats were totaled. In the case of more than one observation being performed, these totals were averaged. The results were then tabulated as follows: an Exceeds Standards was given a point value of 4, Meets Standards a value of 3, Opportunities for Improvement a value of 2 and an Un-Sat a value of one. The total was then divided by 72, which is equivalent to all 18 categories being rated as Exceeds Standards. Therefore, when viewing this metric, it must be remembered that a grade of 75 is the equivalent to meeting all station standards.

Appendix D: Raw Data Results – Red / Green Behavioral Observations

Thus far, a total of 20 Red / Green Behavioral Observations have been entered into the data base. This is not surprising as the form was introduced as a tool in the middle of March 2015. A review of those observations submitted has yielded the following results:

Green Behaviors Observed: 420

Red Behaviors Observed: 60

Green Behavioral Average: 87.5

WORK OBSERVATION CARD

Site: MILL **Card: ENG COMPLEX TROUBLESHOOTING**

Functional Area	Category	Attribute					
1. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Problem statement accurately defines the gap	ES	MS	OI	UN	NO
2. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Facts are presented and used vice opinions	ES	MS	OI	UN	NO
3. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Information gathered from diverse sources. (SOER 10-2)	ES	MS	OI	UN	NO
4. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Process for vetting (discarding vs. using) information is robust. (SOER 10-2)	ES	MS	OI	UN	NO
5. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Structured, objective, repeatable methods are used for analysis	ES	MS	OI	UN	NO
6. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Causes are summarized and consistent with facts and analysis	ES	MS	OI	UN	NO
7. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	The reasons for refuting other credible causes are included	ES	MS	OI	UN	NO
8. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Actions are suggested for causes commensurate with risk, benefit, and cost	ES	MS	OI	UN	NO
9. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Potential risk and consequences for uncertainty are addressed	ES	MS	OI	UN	NO
10. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	If risks / consequences high, then additional SME reviews and/or challenge boards are performed. (SOER 10-2)	ES	MS	OI	UN	NO
11. Engineering	Engineering Troubleshooting & Problem Solving (MA-AA-103)	Operation Risk evaluated in accordance with WM-AA-301.	ES	MS	OI	UN	NO
12. Engineering	Generic Observations for Engineering work	Operating Experience is incorporated	ES	MS	OI	UN	NO
13. Engineering	Technical Conscience #3 Engineers identify, communicate, & advocate resolution of technical concerns	Engineers thoroughly evaluate and promptly communicate potential consequences and solutions for identified technical issues. Failure modes and effects analyses are used to ensure full understanding of probabilities and the potential consequences of technical problems.	ES	MS	OI	UN	NO
14. Engineering	Technical Conscience #3 Engineers identify, communicate, & advocate resolution of technical concerns	Engineers advocate solutions to plant conditions that support reliable equipment operation and operational excellence.	ES	MS	OI	UN	NO
15. Engineering	Technical Conscience #4 Engineers adhere to sound engineering principles.	Engineers use factual information from diverse sources to develop technical products, recommendations, and decisions. This information is independently verified as part of the engineering review process.	ES	MS	OI	UN	NO
16. Engineering	Technical Conscience #4 Engineers adhere to sound engineering principles.	Tech Conscience #4 Engineers adhere to sound engineering principles	ES	MS	OI	UN	NO
17. Leadership Behaviors	Generates Alignment to Vision & Goals	Actively solicits input from others, listens to them, and considers alternate perspectives.	ES	MS	OI	UN	NO
18. Leadership Behaviors	Promotes Productive Teamwork	Aligns priorities and collaboratively works with other leaders and personnel within his/her department and across the station to implement Excellence and Business Plan initiatives.	ES	MS	OI	UN	NO

Engineering Behaviors

Date(s) ____________________________ Observer__________________________

	RED FLAGS	GREEN FLAGS	
1	Supervisors/managers **accept excuses** for not obtaining results without identifying and correcting the cause of the failure and taking action to prevent recurrence.	Supervisor/managers are intrusive enough to help **engineers identify hard spots early and drive for resolutions** to be obtained so that commitments can be met.	
2	Engineers deviate from **standards or procedures**.	Engineers adhere to procedures and standards and escalate issues if there is difficulty encountered in doing so.	
3	Engineers accept a **degraded or low margin** condition without knowing the cause or potential consequences of an inaccurate assessment.	Engineers produce well documented and reviewed basis for accepting a degraded or low margin condition commensurate with the risk posed by the condition.	
4	Engineers refer problems to supervisor or manager without well defined problem statement, without well thought out options for solving the problem, without recognizing risks and potential consequences, and/or without the recommended option identified. Engineer displays a victim mentality - i.e., has no influence over improving the situation.	**Problem are escalated** to supervisor or manager using the **decision making model** - well defined problem statement, well thought out options for solving the problem, risk assessment of the options (what if we're wrong) and the recommended option identified. Engineers display a problem solver mentality.	
5	Engineers do not engage with appropriate stakeholder – exhibiting a silo mentality.	Engineers **engage the appropriate stakeholders** to resolve problems and develop optimal solutions - exhibiting a teamwork mentality.	
6	Engineer takes **on new work or rearranges priorities** without involving supervision.	Engineer engages with supervision when new work activities are identified or if priorities need to change. Affected stakeholders are notified and consulted if commitment dates need to shift due to change in priorities.	
7	Engineer makes a material change to the plan to resolve an issue without approval of management.	Engineers **work to the established plan** and if improvement opportunities or issues are found then supervision, management and other stakeholder alignment is obtained on prudent changes to the work plan.	
8	Necessary actions are missing a "**who", "when" or a "how** tracked" part of the accountability model.	Action items are in accordance with NBU accountability model. They describe who will do what by when with the appropriate tracking mechanism. The due dates are considered as commitments and extensions are rare.	
9	A problem or issue exists with **no owner** and there is no action to determine the owner.	There is a defined owner for new and existing issues and problems. The owner has been briefed on and understands his or her responsibilities.	
10	Supervisor or manager **works down a level** and loses his or her oversight and leadership role.	Supervisor or manager ensures that the right resources are assigned to a problem or issue and remains in the role of oversight, prioritization, facilitation, and direction.	
11	System monitoring and trending is not up to date, adverse trends or significant vulnerabilities are not being addressed.	System **monitoring and trending** is in accordance with the standard. Vulnerabilities are included in SHR, PHIL, and MM as appropriate with action plans that meet the accountability model.	
12	System **health report presentations** are not IAW standards	System health report presentations IAW standards identifying all significant vulnerabilities, their point deductions, plans and schedules for resolution/point recovery, and interim compensatory or bridging strategies when prudent.	
13	Late system or component **health report.**	System health report is issued with challenge review comments incorporated on time.	

Engineering Behaviors

Date(s) ____________________________ Observer__________________________

	RED FLAGS	GREEN FLAGS	
14	Engineer describes actions to resolve an issue as limited to sending an e-mail or initiating a process (e.g., submitted a CR) without active involvement and follow-up.	Engineers **follow up**, early and often, and **in person** when possible or on the phone to ensure their issues are on track for resolution (i.e., they display ownership).	
15	Engineers work through inefficient or antiquated means when better methods would save time and resources.	Engineers identify and implement improvements to make their jobs more effective and efficient.	
16	A **developmental opportunity** for an engineer, supervisor, or manager is missed or avoided based on the additional burden it would entail.	Beneficial developmental opportunities are sought and pursued. Adjustments and compensatory measures are taken to address the additional short term burden created by taking advantage of developmental opportunities.	
17	**CAP extension** < 8 days prior to due date or late CA response.	Engineer recognizes challenges to meeting commitment dates early and escalates to supervision (then to manager, director if necessary) if challenge can't be resolved. Escalation occurs with enough time to overcome challenge and meet commitment.	
18	Supervisors/managers **do not escalate the consequences** for recurring behaviors that do not meet expectations and have been previously coached.	Supervisors/managers employ an increasing level of intervention and consequences for recurring behaviors that do not meet expectations.	
19	No engineering log entry (LE) made for an issue or event that warrants one or a LE that is not in accordance with the standard - Open ended - CR needed but not identified in the LE - Accountability model lacking - who (by name – not just dept), is doing what, by when - Review not described if LE review was required	Complete and concise **log entries** are made when appropriate IAW the standard.	
20	Supervisors or managers do not reflect recurring performance issues in the performance appraisal system by downgrading the item.	Supervisors and managers **use the performance appraisal** system to highlight areas for improvement and increase their visibility and importance to the employee.	
21	Engineer does not seek OE especially from Surry and North Anna for solving problems.	Engineers **confer with Surry and NAPS** personnel on problem issues to determine if they have OE on the problem or perhaps have already solved it. They are able to answer the question "What do Surry and North Anna do?" when discussing an engineering issue.	
22	Engineer is unaware of **industry OE** in an area of responsibility and problem solving.	Engineers search industry OE to identify and resolve problems.	
23	Engineers/supervisors use effort/activity vs. results based language.	Supervisors and engineers **measure performance based on our behaviors AND result**s.	
24	Personnel use language that is not consistent with **ownership and teamwork**: "They" vs. "We" "Hopefully ..." vs. "We will …" or "We expect … " "Waiting on …" vs. "Working with …"		