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|  | <h2 style="margin: 0;">NEEDS ANALYSIS WORKSHEET</h2> |
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**Training Request # and description:** TWR #02-297 AFW Mini-Recirc Issue

1. What are the reasons for performing Needs Analysis?

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| <input type="checkbox"/> Performance deficiency<br><input type="checkbox"/> Regulation change<br><br><input type="checkbox"/> Procedure change<br><input checked="" type="checkbox"/> System/equipment operating characteristic change (flows, pressure, temperatures, etc.)<br><input type="checkbox"/> New or changed job position description | <input type="checkbox"/> Management request for training<br><input type="checkbox"/> Operating Experience (LER, SOER, SER, etc.)<br><input type="checkbox"/> System/equipment hardware change<br><input type="checkbox"/> Feedback (student, instructor, management, assessment, or inspection results)<br><br><input type="checkbox"/> Other: |
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**Describe reasons:**  
 Engineering analysis indicates that particulate can clog the modified orifices in the mini-recirc lines for the AFW pumps. Temporary information tags have been placed on the control boards to require that AFW pumps NOT be run with less than 50 gpm MDAFP (75 gpm TDAFP) flow. Procedure changes are being processed to ensure that guidance is in place to prevent pump operation without adequate forward flow.

2. Investigate what prevents or may prevent personnel from performing this task satisfactorily. •

- Lack of knowledge or skills. These situations would most likely be resolved through training.  
 Situations that may affect knowledge or skills include:
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|---|---|
| <input type="checkbox"/> New/revise procedure or equipment<br><input type="checkbox"/> New/revise regulatory requirement<br><input type="checkbox"/> Inadequate training on tasks<br><input checked="" type="checkbox"/> Change in task skill or knowledge requirements | <input checked="" type="checkbox"/> Plant modification<br><input type="checkbox"/> Industry event<br><input type="checkbox"/> Change in job scope<br><input type="checkbox"/> Unsatisfactory work control |
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**Describe knowledge or skill weakness:**  
 The control of AFW has fundamentally changed such that it is now imperative that the pumps not be operated below a minimum indicated flowrate. The pumps are to be cycled on and off as needed (within starting duties) for SG level control with a low steaming rate.

Previous practice in normal operations has been to reduce flow below the point where the mini-recirc valve opens (75 gpm / 110 gpm), then secure the pump. There was no lower flow limit. Normal operations are covered by OI 62B / 62A.

In abnormal and emergency situations, we have operated the pumps as needed, making sure that the recirc valve operates properly. If the recirc valve fails shut (e.g., loss of IA) then we secure the pump before lowering flow below the minimum acceptable flowrate of 50 (75) gpm.

The key knowledge change: the operator needs to apply the same guidance that he now uses for failed recirc valve to all AFW pump operations.

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- Improper attitude. Affective behavior can be resolved by management initiatives, which might include training. Factors impacting affective behavior include:
  - Confusing work assignments
  - Poor supervision observation/follow-up on work in progress
  - Work assignments that are not challenging
  - Poor interpersonal relationships on job
  - Lack of acknowledgment of the worth of the work
  - Misconception of one's own abilities
  - "Rewarding" satisfactory performance by increasing the work

Describe factors below:

The feeling that pump damage due to a plugged recirc line orifice is such a remote possibility might lessen the emotional learning impact of the briefing that has been provided. This would limit retention of the new requirements. Management reinforcement of the serious nuclear safety consequences is needed. The use of the Information Tags, followed by appropriate procedure changes, should also negate this effect due to our strong emphasis on operating according to procedures.

- Environmental obstacles. Environmental obstacles can usually be resolved by management initiatives other than training. Environmental obstacles include:
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|---|---|
| <input checked="" type="checkbox"/> Distractions on the job | <input type="checkbox"/> Poor lighting                          |
| <input type="checkbox"/> Lack of resources                  | <input type="checkbox"/> Poor equipment                         |
| <input checked="" type="checkbox"/> Inadequate procedures   | <input type="checkbox"/> Poor work planning by the organization |
| <input type="checkbox"/> Poorly defined work goals          | <input type="checkbox"/> Unsatisfactory work control            |

Describe obstacles. (If ONLY environmental obstacles exist, proceed to 8)

Control of AFW for S/G level in AOP/EOP space is typically of a "Continuous Action" nature. This lends itself to potential adverse consequences if distractions cause improper control of AFW flowrate.

Specific procedure steps for isolation of AFW to a SG or securing an AFP should be clearly written to address the plugged mini-recirc concern. In these situations, when the operator is manipulating the equipment in response to the procedure being read to him, he is less likely to use "background knowledge" or foldout page information that isn't explicitly stated in the procedure. This is especially true if that knowledge has been relatively recently acquired, but not fully assimilated as habit or normal practice.

Over a hundred procedure changes are currently being processed in support of this concern. These changes primarily consist of two basic types.

- For the EOP/CSP set and AOPs with foldout pages, the existing step to maintain minimum flow if the recirc valve fails or Instrument Air is lost has been modified to simply require maintaining that same amount of minimum flow at all times.
- For normal operating procedures (e.g., OI 62A&B) a dedicated operator will be stationed to continuously monitor recirculation flow when planning to feed at less than the minimum flowrate.

These procedure changes, and an elaboration of the need to take no credit for AFW recirc flow were clearly described in the Operation Notebook entry on 10/31/02. Although they address the immediate need, it is important that the specific step guidance also be promptly placed.

Previous AFW recirc line actions need to be reviewed for their effectiveness since very similar issues exist. Following the changes made for the initial failed-shut recirc line concern, Training noted some instances of AFW pump operation without obvious monitoring of the recirc valve operation during Annual Operating Exams. This is a continuing area for re-enforcement and the current LOR cycle includes a specific performance-mode challenge in this area. The bottom line is, we have demonstrated that, although generally effective, we cannot guarantee that the recirc flow will always be checked. With similar methods employed in this concern (foldout page procedure change and training), we should expect similar results. Clearly, something additional must be done to ensure we are always operating the AFPs with forward flow.

3. Will training accomplish any of the following:

- a. Raise level of personnel performance to the desired level; or
- b. Enhance the safety and reliability of plant operations; or
- c. Help prevent errors based on lessons learned from operating experience?

**YES / MAYBE** Explain and proceed to 4

**NO** Explain and proceed to 8

**Explanation:**

The combination of the briefings, the Operations Notebook entry and the procedure changes put in place is adequate to ensure that all operators are aware of the issue at this time. With the knowledge issues globally addressed, and crew peer checking fully evolved as a normal Human Performance error reduction practice, we can reasonably expect to safely operate the AFW system at this time.

Until modifications are in place which eliminate or mitigate this concern, this should be a frequent topic of review in Continuing License, STA and Auxiliary Operator training. Aspects of that training should include pump starting duty cycles and minimizing those cycles by taking advantage of the wide level control band. In addition, examples of situations that might require operator action to address this concern should be discussed and/or practiced. Examples of such situations would include ECA 2.1 double faulted feeding requirements, sharing AFW between units on dual-unit trips, Steam Generator isolation actions for a ruptured or faulted S/G, and actions on a failed shut MDAFP discharge pressure control valve.

To further ensure safe operation, more explicit guidance must be placed in individual AFW flowrate control steps in the AOP/EOP set. It is unreasonable to expect that the CO and DOS will **ALWAYS** remember to apply a foldout page general requirement when implementing a specific AFW control step. Our operators are good, but why place that challenge in the procedures?

The briefings held with the operators on the recirc plugging concern did not address potential pump damage (referring instead to "AFPs to be considered operable"). However, the message that the minimum flow **MUST** always be maintained or the pump stopped, and that we can take no credit for recirc flow was clear in the 10/31 OPS Notebook entry.

Besides the current actions, OPS management delivery of this message would provide better assimilation and address any potential Affective domain concerns noted above. The message that the pumps must be operated as though the orifices are plugged needs to be **emphasized**.

Additional procedure changes that are currently being processed should be reviewed in light of the above concerns for any additional training needs.

4. Are the consequences of performance deficiencies important?

- YES: Threat to health and safety of plant personnel or general public. Personnel injury, fuel damage or radioactive release may result (proceed to 5).
- YES: Plant availability affected by loss of system operability or equipment down time. Regulatory violations or major equipment damage may result (proceed to 5).
- YES: Additional compensating actions are required to complete a task, prevent minor regulatory infractions, or non-essential equipment failures. Inefficient use of materials or manpower may result (proceed to 5).
- NO: No significant impact on plant operations. Performance does not impact plant, personnel or public (proceed to 8).

Describe Consequences: Potential for destruction of an AFW pump.

5. Which personnel and how many are impacted by this training need? (Check all applicable boxes and inform other groups as necessary.)

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|--|--|
| <input checked="" type="checkbox"/> Engineering: Need child action for evaluation of potential longer term training or use as OE | <input type="checkbox"/> Construction Craft:                     |
| <input type="checkbox"/> Chemistry technician:   | <input checked="" type="checkbox"/> Non-Licensed Operator:       |
| <input type="checkbox"/> Radwaste Operator:  | <input checked="" type="checkbox"/> Licensed Operator (RO, SRO): |
| <input type="checkbox"/> Radiation/Health Physics technician:  | <input checked="" type="checkbox"/> Shift Technical Advisor:     |
| <input type="checkbox"/> Electrical Maint. technician:   | <input checked="" type="checkbox"/> Shift Supervisor/Manager:    |
| <input type="checkbox"/> Mechanical Maint. technician:   | <input type="checkbox"/> Line Supervisor:                        |
| <input type="checkbox"/> Instrument & Control technician:  | <input checked="" type="checkbox"/> Other: OPS Training          |

6. Supervisor completes the cost analysis as necessary. What is the estimated cost / benefit?

**NOTE: THE COST / BENEFIT ALONE SHOULD NOT BE THE SOLE METHOD FOR DETERMINING WHETHER TRAINING IS BENEFICIAL.**

To determine the cost / benefit:

1. Estimate the cost of continuing to operate with the performance deficiency uncorrected or the cost of shutdown.
2. Estimate the cost of implementing training to correct the performance deficiency.

Refer to QF-1010-01b, Cost Analysis Worksheet, to complete a cost analysis.

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| Estimated cost of performance deficiency: Not completing cost analysis due to importance of the issue. |
| Estimated cost of training:  |

**7. TRAINING RECOMMENDATION:** (check all applicable boxes and proceed to 8)

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| <input checked="" type="checkbox"/> <b>Train immediately</b><br>(immediately contact training supervision)                         | <input checked="" type="checkbox"/> <b>Just-In-Time training</b>                   |
|  | <input type="checkbox"/> <b>Classroom</b>  |
|  | <input type="checkbox"/> <b>Simulator / Dynamic Learning Activity</b>              |
|  | <input type="checkbox"/> <b>Lab</b>  |
|  | <input type="checkbox"/> <b>Other:</b>   |
| <input checked="" type="checkbox"/> <b>Include in existing training program</b><br>(proceed with job and task analysis, if needed) | <input checked="" type="checkbox"/> <b>Next continuing training/requal session</b> |
|  | <input type="checkbox"/> <b>Future continuing training/requal session</b>          |
|  | <input type="checkbox"/> <b>Next initial training class</b>                        |
| <input type="checkbox"/> <b>Do NOT Train</b>   |  |
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- Credit the Briefings given, OPS Notebook entries and procedure changes as providing adequate immediate compensation (issue awareness, and trained personnel with a high visibility issue and recent re-enforcement)
- Provide briefings to the crews which emphasize the following points
  - Absolute necessity to prevent operation of an AFP below the minimum flow. For operational purposes, we must operate the pumps as though the recirc is failed shut at all times. Emphasize the consequences if a lapse of attention causes this to be missed.
  - Note the foldout page changes have been made to AOPs and EOPs. Specific step guidance has not been changed yet. There are several situations that you may find conflicting guidance in an AOP/EOP situation
    - EOP-2
    - EOP-3
    - ECA-2.1
    - AOP-10A
    - Others?
  - For normal operation of the AFPs per OI 62 A/B or testing procedures, the use of the level 3 dedicated operators must be approached with the highest level of briefing and preparation. The CO and AO have to be in communication **whenever flow adjustments are to be made**. The communications to be expected when recirc flow is below minimum must be immediate, concise, clear and evoke an immediate pre-planned response to protect the pump if the low recirc flow is not expected as a result of intentionally raising AFW flowrate. There is no room for error.
  - MDAFP starting duties should be reviewed so that everyone knows them. They are not in OI 62 A/B but can be found in ORT 3C.

**Briefings should be conducted as soon as possible.**

- Provide simulator training to licensed operators and STAs on the specific AFW control issues that might be encountered in AOP/EOP space. Similar situations can be handled with one scenario. Specific known procedurally challenging situations should also be practiced.
  - A situation of throttling flow per continuous action guidance
  - A situation of flow isolation per EOP-2.0 / EOP 3.0
  - A situation of ECA 2.1 conflicting guidance
  - A situation of normal OI 62 flow control on recirc.The situations should ensure that the operators actually have to make the adjustments to flow / secure the pumps for protection. The simulator training could be accomplished in the window of the upcoming mini-cycle if PSA impact of this issue is low enough. Otherwise, if PSA-significant to complete this training, it should be conducted as soon as possible.
- Ensure that adequate briefings are provided to any individual used as a level 3 dedicated operator. Auxiliary Operators used in that capacity need an understanding of the overall concerns expressed in the above licensed / STA briefings. This is in addition to thorough briefing on the expected specific actions to be taken during their level 3 dedicated operator assignment.
- Pending equipment modifications to address adequate operator awareness of recirc flow (annunciators, etc.) ensure that each LOR training cycle includes at least one opportunity to challenge the AFP flow control restrictions. Also review AO level 3 dedicated operator actions. This will maintain this issue at a high level of awareness.

8. Non-Training Actions to consider (check the applicable boxes):

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| <input checked="" type="checkbox"/> Change the procedure                      | <input type="checkbox"/> Change work design or conditions  |
| <input type="checkbox"/> Provide a job aid                                    | <input type="checkbox"/> Improve incentives / consequences |
| <input checked="" type="checkbox"/> Modify the equipment                      | <input type="checkbox"/> Improve tools                     |
| <input type="checkbox"/> Change job assignments                               | <input type="checkbox"/> Conduct crew briefings            |
| <input type="checkbox"/> Improve feedback, coaching, or supervisory oversight | <input type="checkbox"/> Provide information sharing       |
|   | <input type="checkbox"/> Other:                            |

Identify corrective action paperwork initiated:

- *Paint the AFW flow meters red below 50 gpm (MDAFP) and 75 gpm (TAFP)*
- *Consider painting the MDAFP discharge MOV control switches red.*
- *Specifically address this orifice plugging concern in all procedure steps that direct flow adjustments or isolation of flow to a Steam Generator.*
- *Annunciate low discharge flow at or near the minimum allowed.*

Specific implementation paperwork to be determined later.

*Randall E. Anderson 11/2/02*

### Reasons for Needs Analysis

Engineering analysis indicates that particulate can clog the modified orifices in the mini-recirc lines for the AFW pumps. Temporary information tags have been placed on the control boards to require that AFW pumps NOT be run with less than 50 gpm MDAFP (75 gpm TDAFP) flow. Without forward flow, AFW Pumps can be destroyed in a very short period of time (seconds). Crew Briefings have been given and an Operations Notebook entry made to inform the operators of the compensatory actions. Procedure changes are being processed to ensure that guidance is in place to prevent pump operation without adequate forward flow.

### The Performance Issue

Operation of the AFW Pumps below the minimum allowed flow (50 gpm MDAFPs / 75 gpm TAFP) can result in pump destruction because of an assumed blockage in the recirc line.

### Knowledge / Skill Issues

This is a change in task skill or knowledge requirements. Previous problems with the AFW mini-flow recirc valves resulted in foldout page instructions to ensure minimum flow requirements are met **when** the recirc valve has failed. This new requirement is to assume recirc line blocked **regardless** of mini-recirc valve operation.

*The major change is that operators must now apply the same mitigation strategies they learned for a failed recirc valve to any low-flow situation.*

Revised normal operating procedures and tests will have an Auxiliary Operator stationed as a level 3 dedicated operator to monitor flow and report when locally indicated recirc flowrate is less than minimum.

Previous training on the AFW mini-flow recirc issue emphasized the need for the MDAFPs to be operated within their starting duties when stopping and stopping the pumps in non-emergency situations to control S/G level after a reactor trip. Those starting duties are not in the normal operating instructions available to operators and need to be remembered to implement post-trip S/G level control with the current orifice blocking concern.

*With the need for these starting duties to be implemented as a part of post-event S/G level control strategies, they should be reviewed with the control room operators. This should be considered a short-term fix. Normal operating instructions that direct AFP operations (at a minimum, OI 62 A/B) should be revised to indicate the starting duties. (Note, ORT-3C currently lists the starting duties).*

### **Affective Domain Issues**

Operators who hear these concerns and see the foldout page changes but do not feel that the failure is likely, will have less retention of the issue in a future stressful situation. It is important that, at this time, all operators fully understand that indicated flow below the minimum is UNACCEPTABLE and WILL introduce considerable nuclear safety concerns.

*OPS Management re-enforcement of this specific message is needed.*

### **Environmental Obstacles**

Much of the control of AFW in AOP/EOP space is of a "Continuous Action" nature. If distracted, an operator may not remember the foldout page minimum flowrate when making adjustments. This is because under stress we tend to revert to habit, and previous experience has the operator checking the minimum recirc valve opening at low flows. *To mitigate this concern, the meter face should be painted red in the unacceptable flowrate region for the AFPs. Operators always watch the flowmeter when making flow adjustments and a red band would ensure that they do not intentionally lower flow below minimum.*

In situations when the operator is manipulating the equipment in response to the procedure being read to him, he is less likely to use "background knowledge" or foldout page information that isn't explicitly stated in the procedure. This is especially true if that knowledge has been relatively recently acquired, but not fully assimilated as habit or normal practice. *Specific procedure steps for isolation of AFW to a SG or securing an AFP should be clearly written to address the plugged mini-recirc concern.*

Over a hundred procedure changes are currently being processed in support of this concern. These changes primarily consist of two basic types.

- For the EOP/CSP set and AOPs with foldout pages, the existing step to maintain minimum flow if the recirc valve fails or Instrument Air is lost has been modified to simply require maintaining that same amount of minimum flow at all times.
- For normal operating procedures (e.g., OI 62A&B) a level 3 dedicated operator will be stationed to continuously monitor recirculation flow when planning to feed at less than the minimum flowrate. *With the time-critical nature of this function, the briefing for this evolution must be precise, with CO/AO communications and specific actions agreed to before beginning the evolution. In addition, communications with the AO should be made for every planned flow adjustment, to ensure both operators are aware of expected indications.* The OI language is such that if the flow drops below minimum, he will tell the control room and then the CO will assess if he has adjusted the flow above the recirc closing flowrate. In practice, the CO should not have adjusted the flow without notifying the AO. In addition, the short period of time between loss of recirc flow and pump destruction does not allow much time for this assessment.

These procedure changes, and an elaboration of the need to take no credit for AFW recirc flow were clearly described in the Operation Notebook entry on 10/31/02.

## TWR #02-297 AFW Mini-Recirc Issue OPS Training Needs Analysis Summary

The results from previous AFW recirc line change management actions need to be reviewed for their effectiveness since very similar issues exist with the orifice plugging issue. Following the changes made for the initial failed-shut recirc line concern, Training noted some instances of AFW pump operation without obvious monitoring of the recirc valve operation during Annual Operating Exams. This is a continuing area for re-enforcement and the current LOR cycle includes a specific performance-mode challenge in this area.

*The bottom line is, we have demonstrated that, although generally effective, we cannot guarantee that the recirc valve operation will always be checked. With similar methods employed in this concern (foldout page procedure change and training), we should expect similar results. Clearly, something additional must be done to ensure we are always operating the AFPs with forward flow. Potential solutions might include:*

- *Paint the AFW flow meters red below 50 gpm (MDAFP) and 75 gpm (TAFP)*
- *Consider painting the MDAFP discharge MOV control switches red.*
- *Specifically address this concern in all procedure steps that direct flow adjustments or isolation of flow to a Steam Generator.*
- *Annunciate low discharge flow at or near the minimum allowed.*

## Recommendations

- Credit the Briefings given, OPS Notebook entries and procedure changes as providing immediate compensation (issue awareness, and trained personnel with a high visibility issue and recent re-enforcement).
- Provide briefings to the crews which emphasize the following points
  - Absolute necessity to prevent operation of an AFP below the minimum flow. For operational purposes, we must operate the pumps as though the recirc is failed shut at all times. A nuclear safety concern arises if a lapse of attention causes this to be missed.
  - Note the foldout page changes have been made to AOPs and EOPs. Specific step guidance has not been changed yet. There are several situations that you may find conflicting guidance in an AOP/EOP situation
    - EOP-2 ✓
    - EOP-3 ✓
    - ECA-2.1 ✓
    - AOP-10A ✓
    - Others?
  - For normal operation of the AFPs per OI 62 A/B or testing procedures, the use of the level 3 dedicated operators must be approached with the highest level of briefing and preparation. The CO and AO have to be in communication **whenever flow adjustments are to be made**. The communications to be expected when recirc flow is below minimum must be immediate, concise, clear and evoke an immediate pre-planned response to protect the pump if the low recirc flow is not expected as a result of intentionally raising AFW flowrate. There is no room for error.
  - MDAFP starting duties should be reviewed so that everyone knows them. They are not in OI 62 A/B but can be found in ORT 3C.

**Briefings should be conducted as soon as possible.**

## TWR #02-297 AFW Mini-Recirc Issue OPS Training Needs Analysis Summary

- Provide simulator training to licensed operators and STAs on the specific AFW control issues that might be encountered in AOP/EOP space. Similar situations can be handled with one scenario. Specific known procedurally challenging situations should also be practiced.
  - A situation of throttling flow per continuous action guidance
  - A situation of flow isolation per EOP-2.0 / EOP 3.0
  - A situation of ECA 2.1 conflicting guidance
  - A situation of normal OI 62 flow control on recirc.

*used Goldent page and background documents!*

The situations should ensure that the operators actually have to make the adjustments to flow / secure the pumps for protection. The simulator training could be accomplished in the window of the upcoming mini-cycle if PSA impact of this issue is low enough. Otherwise, if PSA indicates it is significant to complete this training, it should be conducted as soon as possible.

- Ensure that adequate briefings are provided to any individual used as a level 3 dedicated operator. Auxiliary Operators used in that capacity need an understanding of the overall concerns expressed in the above licensed / STA briefings. This is in addition to thorough briefing on the expected specific actions to be taken during their level 3 dedicated operator assignment.
- Pending equipment modifications to address adequate operator awareness of recirc flow (annunciators, etc.) ensure that each LOR training cycle includes at least one opportunity to challenge the AFP flow control restrictions. This will maintain this issue at a high level of awareness.

### Procedure / Process / Equipment Changes recommended

- *Paint the AFW flow meters red below 50 gpm (MDAFP) and 75 gpm (TAFP)*
- *Consider painting the MDAFP discharge MOV control switches red.*
- *Specifically address this orifice plugging concern in all procedure steps that direct flow adjustments or isolation of flow to a Steam Generator.*
- *Annunciate low discharge flow at or near the minimum allowed.*
- *Place MDAFP starting duties in OI-62A and OI-62B.*

*Randall E. Anderson 11/2/02*