APPENDIX B

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No.: 50-336/88-10 Operating License: DPR-65

Docket: 50-336

Licensee: Northeast Nuclear Energy Company
P.O. Box 270
Hartford, CT 06101-0270

Inspection At: Millstone Unit 2

Inspection Conducted: May 10-17, 1988

Inspector: _____ 9/4/88
for Perry Stewart, Reactor Inspector, Operational Programs Section, Division of Reactor Safety, Region IV — Date

Team Members: J. O'Brien, Senior Reactor Inspector, Region V
L. Defferding, Licensing Examiner
C. Tolbert, Human Factors Specialist
S. Sun, Reactor Systems Engineer
P. Bibb, Resident Inspector, St. Lucie
P. Habighorst, Resident Inspector, Millstone 2

Approved By: _____ 9/4/88
J. E. Gagliardo, Chief, Operational Programs Branch, Division of Reactor Safety, Region IV — Date

Inspection Summary

Inspection Conducted May 10-17, 1988 (Report 50-336/88-10)

Scope: This special announced inspection was conducted in the area of Emergency Operating Procedures, including the implementation of vendor Generic Technical Guidelines (GTG), validation and verification program, and the performance of adequate training on the EOPs.

Results: No unsafe operational conditions were identified. One apparent deviation (missing procedural steps, paragraph 3) was identified. Other discrepancies requiring followup were noted in specified EOP technical review items and human factor element review items.

DETAILS

1. Persons Contacted

*S. Scace, Millstone Station Superintendent
*J. Keenan, Unit 2 Superintendent
*J. Smith, Unit 2 Operations Supervisor
*M. Wilson, Unit 2 Operator Training Supervisor
*S. Brinkman, Unit 2 Operations Engineer
*J. Becker, Unit 2 Assistant Engineering Supervisor

*Denotes those present at the exit meeting on May 17, 1988.

The NRC inspectors also contacted other members of the Operations and Training Departments.

Also in attendance at the exit meeting on May 17, 1988, were the following NRC and NRC contracted staff personnel:

L. Bettenhausen, Chief, Projects Branch 1, Region I
J. Persensky, NRR Section Chief, EOP Program Manager
J. Gagliardo, Section Chief, CE EOP Manager, Region IV
J. Stewart, CE EOP Team Leader, Region IV
D. Jaffe, NRR Millstone Project Manager
J. O'Brien, Reactor Inspector, Region V
H. Bibb, St. Lucie Resident Inspector, Region II
C. Tolbert, SAIC, Human Factors Engineer
W. Raymond, Millstone Senior Resident Inspector
P. Habighorst, Millstone 2 Resident Inspector
G. Barber, Millstone 3 Resident Inspector

2. EOP/Generic Technical Guidelines (GTG) Comparison (25592)

A comparison of the plant's EOPs and the Combustion Engineering Owners Group (CEOG) GTGs contained in CEN-152 was conducted to ensure that the licensee had generated procedures in accordance with the CEN-152 recommendations. The EOPs reviewed are listed in Appendix I of this report. The comparison included a review of licensee letters issued to document changes made from the CEN-152 recommendations and interviews with personnel to determine the bases for the changes.

The inspectors reviewed the contents of CEN-152 Revision 2 and Millstone 2 EOPs. The licensee had incorporated all emergency events with the exception of "Loss of Forced Circulation." The inspectors reviewed the guidelines in CEN-152 concerning the Loss of Forced Circulation event and concluded that the licensee had incorporated the guidelines into plant specific EOPs with few exceptions.

The inspectors noted that the licensee had exceeded the CEN-152, Revision 2, guidelines by implementation of EOP 2528 "Electrical Emergency." The team reviewed this procedure and had no outstanding observations. EOP 2528 addresses operator actions on in-plant electrical distribution degradation. The operator considers the use of EOP 2528, in the standard post trip actions of EOP 2525.

The inspectors reviewed the licensee's Procedure Generation Package (PGP), Revision 1, to review the incorporation of the CEOG Emergency Procedure Guidelines EPGs into the plant specific EOPs. This effort was accomplished in four principle steps.

The first step of the review consisted of the verification of the licensee's incorporation of a writer's guide, and the deviations from the CEOG emergency procedure guidelines into the Millstone 2 EOPs. The writer's guide for EOPs is a plant specific document that provides instruction on writing EOPs. The writer's guide was based on industry development of Emergency Operating Procedure Writing Guideline (INPO 82-017). The licensee had incorporated this guide into ACP-QA-3.02, Revision 1, "Writers Guide for Millstone Procedures," Attachment A.

The second step of the inspector's review consisted of EOP verification. The inspectors determined that the licensee reviewed the draft EOPs to ensure applicable generic and plant specific technical information was incorporated. The verification process consisted of the following: an operations review, use of an EOP verification checklist, a tabletop review, control room walk-throughs, and a safety evaluation conducted by the licensee's Safety Analysis Branch, and a Plant Operations Review Committee (PORC) review.

The third step examined was the development of the licensee's EOP validation program, which assessed the control room operator's ability to manage emergency conditions using EOPs. The licensee's review consisted of observing operating crews exercise the EOPs on the CE simulator at Windsor, Connecticut. At the end of each EOP exercise, licensee comments on performance of the procedure were incorporated into the draft EOP procedure.

The fourth area examined was the development of the EOP training program. The inspectors determined that the licensee required the operators to have a significant knowledge level to implement a specific EOP. The training program had four major objectives. The four objectives were to enable the operator to understand the structure and format of all EOPs, to enable the operator to understand the technical basis of all EOPs, to ensure all safety functions for EOPs have been satisfied, and to provide operator experience in using all EOPs under simulated control room conditions.

The inspector had no additional comments in regard to the methods the licensee had implemented to incorporate generic guidelines into specific EOPs.

No violations or deviations were identified.

3. Independent Technical Adequacy Review of the EOPs (25592)

The Millstone 2 EOPs listed in Part I, Appendix I, were reviewed to ensure that the procedures were technically adequate and accurately incorporated the guidelines of the CEOG CEN-152. This review verified that the vendor step sequence was followed, the exit/entry points were correct, transfer between procedures was well defined and appropriate for procedures performed concurrently, that minimum staffing was met, and that notes and cautions were used correctly. Each deviation from the CEN-152 was reviewed to ensure that safety significant deviations were reported to the NRC as required, safety evaluations were performed per 10 CFR 50.59, all deviations warranted by the specific plant design were incorporated, and prioritization of accident mitigation strategies were correct. Adverse containment values were also verified to be present in the procedures.

The team determined that, in general, the EOPs accurately incorporated the procedure guidelines of CEN-152 and were technically adequate. This determination was based on the following findings observed during the review of the Millstone 2 procedures:

- The EOPs generally followed the CEN-152 (Revision 2) step sequence with detailed instructions for the operator actions required to cool down the plant or place the plant in a stable condition.

- Entry/exit points in the EOPs were clearly stated and could be followed by trained reactor operators.

- Notes and Cautions within the EOPs were generally clear and were appropriately located in the EOPs.

- The plant specific values were consistent with the plant design.

- The CEN-152 prioritization of the accident safety function hierarchy was maintained in the EOPs.

During the course of the EOP review, however, the team identified a number of technical concerns in the Millstone 2 EOPs and they are listed along with the licensee's responses in Appendix II of this report. The concerns mainly focus on two areas: (a) additions or omissions of major steps specified in the CEN-152 guideline without providing documentation for the technical basis to justify the additions or the omissions; (b) deviations from the suggested procedural steps listed in CEN-152 without providing technical basis or justification for the alternative steps contained within the plant-specific EOPs. In response, the licensee either provided clarification of the deviations from CEN-152, or acknowledged the

technical deficiencies identified by the inspection team, and agreed to correct the EOPs as required to be consistent with CEN-152 in the next revision of the Millstone 2 EOPs. The team determined that the resolutions presented by the licensee were acceptable. The team determined that the following deficiencies as discussed in Appendix II of this report may impair the effectiveness of the safety function controls and require correction in the next revision of the EOPs.

- The EOPs, except for RCP operation in the functional recovery EOPs, contain a deficiency in the identification of RCP NPSH requirements. CEN-152 specifies a NPSH curve in the figure titled, "typical post-accident pressure-temperatures limits," which is included in many sections of the CEN-152 guidelines. Instead, the licensee used a 30°F subcooled margin pressure-temperature curve as acceptance criteria for operation of two RCPs. The team compared the required minimum NPSH curve with the 30°F subcooled margin curve, and determined that use of the 30°F subcooled margin curve to operate the two RCPs is only adequate for RCS temperatures greater than approximately 480°F, where the RCS pressure is greater than the RCP NPSH pressure requirements. For RCS coolant temperatures less than 480°F, the pressure for the 30°F subcooling margin is less than pressure required to satisfy the RCP NPSH requirements. Thus, use of the 30°F subcooled margin pressure-temperature curve to operate the two RCPs may result in damage to the RCPs below 480°F, and in turn, degrade the post-accident RCS heat removal capability of the plant. The licensee agreed to evaluate the use of a caution or otherwise clarify the proper temperature band for utilizing the 30°F thumb rule for the NPSH requirements of the RCP. Resolution of this deficiency will be followed up in a subsequent inspection. (50-336/88-10-01).

- EOP 2532 does not include a procedural step to eliminate the RCS voiding in the SG tubes, while step 41.d of the LOCA procedure in section 5.0 of CEN-152 specifically includes guidelines to eliminate voiding in the RCS SG tube side. Omission of this step may impair the effectiveness of the plant safety functions to cooldown the plant or bring the plant into stable conditions. The same deficiency was also noted in the Steam Generator Tube Rupture (SGTR) procedure, EOP 2534. CEN-152, Section 6.0, Steps 34 and 35.d identify the CEOG guidance for the SGTR event which will eliminate the voiding.

  The above noted deficiency is a deviation (50-336/88-10-02) from the licensee's commitments to CEN-152.

4. Review of Validation Program and Independent Verification of the EOPs (25592)

As a result of the TMI-2 Accident, NUREG-0899 was issued in August 1982 to establish the guidelines for the development and implementation of EOPs which would provide the operators with directions to mitigate the consequences of a broad range of accidents and equipment failures.

Paragraph 3.3.5 of this NUREG stated that, after development, the EOPs were to undergo a process of verification/validation to determine that the procedures are technically adequate, address both technical and human factors issues, and can be accurately and efficiently carried out.

The licensee provided documentation to show that their verification program met the following purposes: to confirm the correctness of the procedures; to ensure that EPG and plant specific technical guidance was properly incorporated into the EOPs; and to verify that application of human factors aspects had been addressed.

The licensee's verification program contained the following elements:

- Old EOP to new EOP comparison.
- EPG to new EOP comparison.
- New EOP compliance with the Writer's Guide.
- Operations review.
- Table top review.
- Control Room Walk-through.
- PORC review and approval.
- NUSCO Safety Analysis Branch review.

The licensee also provided documentation to demonstrate that the validation program assured that the actions specified in the new EOPs could be used by the operators to manage emergency conditions effectively. The two elements of the validation program were:

- Three 2-day sessions at the CE simulator in Windsor Locks in mid-1983. The EOP project team observed accident scenarios for each draft EOP, provided comments, and the proposed changes where appropriate.

- Eleven 1-week sessions were held in late 1983 to accomplish final simulator validation and operator training. Each licensed operator performed some role in each EOP to assure that they could effectively manage emergency conditions. Comments from these scenarios were incorporated in the final version of the new EOPs.

The inspection team conducted its own control room, simulator, and plant walkdowns of the EOPs listed in Part A of Appendix I of this report to ensure that the procedures were validated and verified by the licensee.

During the walkdown, instruments and controls were verified to be correctly labeled (except for those deficiencies indicated in Appendices III and IV). The team also verified that indications referenced in the procedures were available to the operator and values were not too specific for the indicators available. Administrative procedures were reviewed to ensure that adequate controls existed to incorporate changes to the EOPs, that the latest revision was available to

the operators, and that they were easily accessible. Documentation of the licensee's validation and verification program was reviewed to ensure discrepancies noted were adequately addressed and corrected, comprehensive reviews were conducted, table top reviews were adequate, walkdowns were completed and documented, and that human factors analyses were incorporated in the program.

During the performance of one of the simulator scenarios, the team identified several deficiencies with the use of the SPDS by a reactor operator during the performance of EOP 2540. The inspectors noted that in five instances the SPDS, which is used in place of Form 2540-1 "Functional Recovery Safety Function Status Check (list)," was in disagreement with Form 2540-1 (Form 2540-1 is used only when the SPDS is not available). The five technical deficiencies, which were identified by the NRC were: (1) Sump Recirculation Actuation Signal (SRAS), which was used as one of the elements to satisfy the acceptance criteria in the Pressure and Heat Removal safety functions in the SPDS, was not included in Form 2540-1 for these safety functions; (2) the containment pressure parameter listed in Condition 1 of the Containment Integrity safety function of the SPDS was listed as 5 PSIG, which is in disagreement with the value of 2 PSIG contained in Form 2540-1; (3) the containment hydrogen concentration parameter listed in Conditions 1 and 2 of the Containment Integrity safety function was listed as 3%, which was in disagreement with the value of 2% contained in Form 2540-1; (4) the feedwater parameter listed in Condition 1 of the Heat Removal safety function lists both main and auxiliary feedwater flow, and also provides a minimum acceptable value of 300 GPM for auxiliary feedwater flow, this was in disagreement with the description contained in Form 2540-1, which provided no guidance on the amount or type of feedwater flow for the acceptable condition; (5) the RWST liquid level parameter when listed as an element for evaluation of acceptable conditions in the safety functions, was listed in a different logic format (with a different numerical value in some cases) in the SPDS, than that in Form 2540-1. The licensee agreed to evaluate each of these five concerns and to revise either the SPDS, or the Form 2540-1 as appropriate, to have the two systems in agreement with one another. This item will be followed up during a future inspection (50-336/88-10-03).

The inspection team determined, based on the observations of the use of the SPDS that the SPDS would be an excellent tool in assisting the reactor operators in mitigating the consequences of a design base accident. The reactor operators were able to monitor the status of the six safety functions on a continuous basis, rather than at ten minute intervals, as recommended in the generic guidance of CEN-152. The SPDS provided a visual alarm indication on the visual computer display, and also provided a continuous status of plant parameters and safety equipment, which were the elements used to determine if a safety function was currently in a satisfactory condition for the mitigation of an accident.

Based on interviews with the SPDS cognizant engineers, and the above noted observations, the team indicated to the licensee that the Millstone plant

staff had exceeded the NRC requirements in this area and that it was recognized that considerable effort was expended in developing the SPDS to its current capability.

In addition, the inspectors, during the control room, simulator, and in-plant walkdowns, identified other deficiencies as listed in Appendix IV. The licensee committed to make the appropriate procedure revisions as noted in Appendix IV. The licensee's revision of the EOPs and associated documentation for the correction of the noted procedural deficiencies will be followed up in a later inspection (50-336/88-10-04).

No violations or deviations were identified in this area.

5. EOP Training (25592)

The inspectors assessed the adequacy of the EOP training by reviewing three areas. The first dealt with observing two unrehearsed operating crews performing the EOPs on the site-specific simulator with scenarios designed to exercise each of the EOPs. The second effort was to review the lesson plans and training records for the hot licensed and requalification operator training programs as it pertained to EOP training. Finally, interviews were conducted of a selected sample of the operations staff.

a. Simulator Scenarios

The team's license operator examiner and reactor inspector developed scenarios similar to those used for licensed operator exams and the facility's EOP training. During the performance of these scenarios with the unrehearsed operating crew, the entire NRC EOP inspection team had the opportunity to: observe operator performance to validate or dismiss any concerns that may have been raised during the NRC table-top reviews of the EOPs; assess the licensee's operating philosophy (possibly as it differs from CEOG guidance in CEN 152); assess the human factors elements (place keeping, assignment of duties, physical interference, etc.) associated with the performance of the procedures in a "real time" atmosphere, and observe how the operators diagnose accident conditions and transition from one EOP to another. The team made the following observations:

- the operators exhibited adequate knowledge of the EOPs and the CEN-152 guidance.

- the operators used the SPDS to verify the safety functions status check in lieu of the approved OPS Form 2540-1 contained in the EOPs. See section 4 of this report for additional information concerning the SPDS.

- Other Human Factors observations are addressed in Section 7 and Appendix III of this report.

b. Formal Training Programs

Lesson plans and simulator scenarios used for EOP training were reviewed to determine whether the training covered the technical basis for the procedure as well as the structure and format. The lesson plans, procedures and material reviewed are listed in Part III of Appendix II. This review included a review of attendance sheets for selected lesson plans, and a review of how the licensee handled makeup training for those who miss the normally scheduled training.

The training program met, or in some areas exceeded, the requirements as committed to by the licensee.

c. Operator Interviews

Operators were interviewed to determine their understanding of the EOPs and their responsibilities and required actions, both individually and as a team. Additionally, operators were interviewed to determine if they felt that actions were duplicated by other operators, that they were knowledgeable of the requirements for transitioning from one procedure to another, and that training was conducted on revised EOPs before they were implemented.

Four training issues were expressed by operators during the interviews. One operator commented that the simulator training did not include the realism that accompanies a reactor trip. The reactor trips in the simulator were relatively straightforward, without major interruptions. In contrast, reactor trips in the control room are marked by increased noise and stress levels due to the presence of additional personnel and phone calls.

A similar concern voiced during an interview was that STAs are not included in the simulator training of the shift supervisor (SS). Since these two operators would work closely together following a trip, especially if an emergency was evolved, it would seem beneficial to include both in simulator training.

Consistent with the foregoing, plant equipment operators (PEOs) should also be required to simulate their EOP-related actions out in the plant. Stress levels, time limitations, and other environmental conditions (e.g., noise) should be simulated to the extent possible. Those conditions that could not be simulated would be incorporated into the PEO's role-playing of the scenario.

Also identified in operator interviews was the need to require trainees to use placekeeping techniques of checkoff spaces provided in documents. This is especially critical when using EOPs, since the operators must monitor many parameters simultaneously. If operators

were required to use checkoff spaces during training, the behavior would become a matter of habit. Other placekeeping methods should also be exercised during simulator training.

No violations or deviations were identified in this area.

6. On-going Evaluation of EOPs

Administrative procedures (listed in Part D of Appendix I) were reviewed to ensure that the licensee had an effective program in place to maintain the EOPs up to date and provide feedback from operator experience, simulator exercises, control room/plant walkthroughs, and plant design changes. These administrative procedures contained forms for the user to fill out describing the proposed change, identifying the change by a specific number, and providing justification for the change. Several of these completed forms were reviewed by the inspector and found to be satisfactory.

No violations or deviations were identified in this area.

7. Human Factors Analysis of EOPs (25592)

An integral part of the EOP inspection effort was to identify human factors considerations in the implementation of Millstone 2 EOPs. The human factors review covered a number of domains including analysis of the procedures, observations of instruments in the control room required for EOPs, observations of instruments outside the control room required for EOPs, and environmental factors. The data were obtained via several methods:

- Table-top review of the EOPs.
- Table-top review of the Writer' Guide.
- Walkthroughs of the Unit 2 control room.
- Walkthroughs of the Unit 2 plant.
- Observation of simulator scenarios.
- Interviews with operators.

The findings are categorized below by area of concern. Examples are provided in Appendix III.

a. Writer's Guide

A number of human factors concerns pertaining to the Writer's Guide were raised. Some concerns were noted in the lack of guidance provided by the Writer's Guide, others pertained to inconsistencies between the Writer's Guide and the EOPs. The concerns included:

1. Lack of guidance in the Writer's Guide on the location of EOP identification information, e.g., procedure number, revision, page number.

2. The Writer's Guide does not include guidance on the provision of checkoff spaces for substeps.

3. Definitions for the verbs, such as "verify," "refer," and "consider" were not clearly defined in the Writer's Guide.

4. Vague terminology, such as "excessive" is used, rather than a numerical limit, as stated in the Writer's Guide (page 5).

5. Wording and structure of steps is unclear and awkward.

6. Inconsistencies in format were noted. These inconsistencies included spacing between steps, use of emphasis, and punctuation.

7. Notes were not highlighted by a border or additional space between the Note and the steps. In addition, the different functions of Cautions and Notes were not always clear.

8. Steps for which the sequence of performance was not mandatory were not identified as such.

b. Control Room

The following concerns were identified in the control room:

1. The absence of grouping for acceptance criteria in Safety Function Status check sheets, and of logic statements in the Safety Parameter Display System check sheets, made the appropriate interpretation more difficult.

2. Many inconsistencies were noted between the written Safety Function Status Check sheets and the SPDS.

3. Several labeling concerns were identified, many of which had been identified by the licensee during the Detailed Control Room Design Review (DCRDR) and were already scheduled to be corrected. The concerns are as follows:

   a. Labeling of panels and components was difficult to read.

   b. Three out of four steam generator gauges had scales which were difficult to read.

c. Extraneous labels, for example, manufacturer names, and markings were noted on panels and instrumentation.

4. The following concerns were noted with procedure revisions:

a. EOP 2540, Revision 4 was in the C-10 Equipment Locker; the current revision in the control room is Revision 5. The licensee agreed to investigate and correct this problem.

b. Handwritten changes were noted in EOPs and OPs.

c. Changes documented on the "Change Form" were not also documented within the procedure. Thus, if the operator did not remember to look at the form at the appropriate step, revisions would be overlooked.

c. Simulator Scenarios

The inspection team observed two different shifts (Shift 1 and Shift 2) perform various scenarios on the simulator. The following concerns were identified:

1. Training

a. The communication within Shift 1 was infrequent and as a result the Supervising Control Operator did not always have the information he needed.

b. Although the EOPs have checkoff spaces for major steps, operators were not accustomed to using them. The team observed placekeeping difficulties during the scenarios.

2. Lack of table space to lay down procedures which resulted in several documents piling up on top of each other.

3. Figures are difficult to use because the gridmarks are too salient.

4. Mental calculation of coolant delta-T and shutdown margin are required.

d. Local Control Stations

The following concerns are identified during the execution of local EOP actions:

1. Unavailability of support equipment.

2. Unavailability of an additional set of procedures needed to complete local actions. The Plant Equipment Operator (PEO) had to either take the control room operator's copy with him, or make a copy of it in the control room.

3. Atmospheric steam dump valves are difficult to locate and access because they are 15 to 20 feet above the ground. If both valves need to be operated simultaneously, two PEOs would be required. In addition, communication is difficult due to noise produced by the steam.

4. The hydrogen analyzer is difficult to access due to the out-of-service gauges located underneath it. In addition, the labeling was handwritten and faded.

5. Potential for operator exposure to high radiation levels in the safeguards room, auxiliary building and enclosure building.

6. Extension cords used with headphones interfere with the PEO carrying out his task. They may get tangled in ladders or operators may trip over them.

7. Component location information is needed for local actions in the OPs.

8. Local in-plant and control room actions were not identified as such.

Additional human factors items are addressed in Appendix III of this report. The licensee agreed to review and evaluate these items for possible improvements. The above items will be reviewed in a future inspection. (50-336/88-10-05)

8. Exit Interview

The inspection scope and findings were summarized on May 17, 1988 with those persons indicated in paragraph 1 at the conclusion of the inspection. The inspector summarized the purpose and scope of the inspection and the findings. At no time during this inspection was written material provided by the inspectors to the licensee.

The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during this inspection.

APPENDIX I

LIST OF PROCEDURES REVIEWED

A. EOP REVIEWED ON TABLE TOP, ON SIMULATOR, AND DURING PLANT WALKDOWN

1. EOP-2525 (Revision 2): Standard Post-Trip Actions
2. EOP-2526 (Revision 1): Reactor Trip Recovery
3. EOP-2529 (Revision 1): Electrical Emergency
4. EOP-2532 (Revision 3): Loss of Coolant Accident
5. EOP-2534 (Revision 4): Steam Generator Tube Rupture
6. EOP-2536 (Revision 3): Excess Steam Demand
7. EOP-2537 (Revision 3): Loss of Feed
8. EOP-2540 (Revision 5): Functional Recovery
9. EOP-2540A(Revision 1): Functional Recovery of Reactivity Control
10. EOP-2540B(Revision 1): Functional Recovery of Maintenance of Vital Auxiliaries (AC and DC Power)
11. EOP-2540C(Revision 2): Functional Recovery of RCS Inventory and Pressure
12. EOP-2540D(Revision 2): Functional Recovery of Heat Removal
13. EOP-2540E(Revision 2): Functional Recovery of Containment Integrity

B. PROCEDURES REVIEWED WHICH WERE REFERENCED IN EOPS

1. MS-2-AOP 2553 (Revision 2): Plant Cooldown Using Natural Circulation

2. MS-2-OP 2207 (Revision 8): Plant Cooldown
3. MS-2-OP 2301C(Revision 8): RCP Operation
4. MS-2-OP 2309 (Revision 4): Containment Spray System
5. MS-2-OP 2310 (Revision 9): Shutdown Cooling System
6. MS-2-OP 2313A(Revision 5): Air Recirculation and Cooling System
7. MS-2-OP 2313C(Revision 8): Containment Post-Trip Incident Hydrogen Control
8. MS-2-OP 2319B(Revision 7): Condensate Storage/Surge System
9. MS-2-OP 2322 (Revision 8): Auxiliary Feedwater System
10. MS-2-OP 2398 (Revision 8): RC Vent Procedure

C. EOP TRAINING MATERIAL AND LESSON PLANS REVIEWED

1. NUCLEAR TRAINING MANUALS

   a. NTM-3.054 Licensed Operator Requalification Training
   b. NTM-3.051 Licensed Operator Initial Training
   c. ACP-QA-8.08 Millstone Reactor Operator Training Program
   d. ACP-8.09 Millstone Licensed Operator Requalification Program

2. CLASSROOM PRESENTATIONS

   a. M2-OP-RO-TA-2026 Mitigating Core Damage
   b. M2-OP-RO-TA-2525/6 Introduction to Emergency Operating Procedures

c. M2-OP-REQ-EOP-2500 Trip 2/Leave 2 Basis

3. SIMULATOR BRIEFING ROOM SESSIONS

a.	RO2-28(B)	Electrical Emergency
b.	RO2-29A(B)	Loss of Primary Coolant
c.	RO2-29B(B)	Steam Generator Tube Rupture
d.	RO2-29C(B)	Excess Steam Demand
e.	RO2-29D(B)	Review LOCA, SGTR, ESD
f.	RO2-31(B)	Loss of Feedwater/Functional Recovery
g.	RO2-34(B)	Key Parameters and Trends
h.	RO2-35(B)	Diagnostic Skills & Thought Processes
i.	RO2-39(B)	General Operating Skills
j.	RO2-40(B)	Thermo/Accident Assessment/E-Plan
k.	SR2-11(B)	SPTA & TR

4. SIMULATOR LESSON PLANS

a.	RO2-28(S)	Electrical Emergencies
b.	RO2-29(S)	LOCA, SGTR, ESD Demo.
c.	RO2-30(S)	LOCA, SGTR, ESD
d.	RO2-31(S)	LOAF/Functional Recovery
e.	RO2-32(S)	Emergency Exercises
f.	RO2-36(S)	Operational Exercise
g.	RO2-38(S)	Operational Exercise
h.	RQ2-500-1	Trip Two/Leave Two Strategy
i.	RQ2-525-1(S)	Failure of Auto Trip
j.	RQ2-525-2	EOP 2525 Review
k.	RQ2-532-1(S)	Loss of Reactor Coolant Saturated Conditions
l.	RQ2-536-1(S)	Steam Line Break
m.	RO2-536-2(S)	Steam Leak in Turbine Building
n.	RQ2-537-1(S)	Feed Water Leak Inside Containment
o.	RQ2-537-1(S)	Loss of All Feedwater
p.	RQ2-537-2(S)	Loss of All Feedwater
q.	RQ2-537-3(S)	Loss of All Feedwater
r.	RQ2-569-1(S)	Steam Generator Tube Leak
s.	RQ2-800-5	In House Electrical

D. <u>PGP ADMINISTRATIVE VALIDATION AND VERIFICATION PROCEDURES REVIEWED</u>

OTBI-6, Revision 1	Operator Training Branch Instruction Operating Plant Procedure Change
ACP-QA-3.02A	Writer's Guide for Millstone Procedure
ACP-QA-3.02	Station Procedures and Forms
ACP-QA-3.10	Preparation, Review and Disposition of Plant Design Change Records (NEO 3.03)

OP-2253	Biannual Procedure Review Rules
2-OPS-3.08	Emergency Operating Procedures Writer's Guide
Letter from Counsil NE to Miller NRR date 1/30/85 Millstone II, Supplement 1 to NUREG-0737, Attachment 1	EOP Procedures Generation Package

APPENDIX II

TECHNICAL REVIEW COMMENTS

The following are inspector comments as a result of the technical reviews of the Millstone 2 EOPs. The licensee either clarified the concerns to the inspector's satisfaction or committed to correct the deficiencies in the revised EOPs. Section 3 of this report provides further discussions regarding these issues.

1. MS-2-EOP-2525 (Revision 2): STANDARD POST-ACTION TRIPS

   a. A note prior to step 3.1 specified boration time: for each CEA not fully inserted, the boration time was 12, 18, and 36 minutes for boration with 3, 2 and 1 charging pumps, respectively. In response to the concern regarding lack of technical basis, the licensee stated that, the criteria to determine the boration time was to satisfy the shut down margins in the Technical Specifications. The calculational results were documented in 2-ENG-012, dated 8/18/77. The inspector determined the technical basis was adequate.

   b. Step 3.3.d, contingency action used the 30-degree F subcooled pressure-temperature curve to trip the last two RCPs. CEN-152 specified NPSH requirements for the RCP operation. A NPSH curve in the figure titled "typical post-accident pressure temperature limits" was included in many sections of the guidelines. The inspector found that the use of 30°F subcooled margin curve to trip the last two RCPs is adequate only for the temperatures greater than or equal to 480°F since in this temperature range, the 30°F subcooled pressure is greater than the NPSH requirements. Use of 30°F subcooled pressure to trip the last two RCPs for temperature less than 480°F may damage the RCP and, in turn, degrade the safety function of removing the RCS heat. The licensee committed to correct this deficiency to be consistent with the CEN-152 NPSH requirements in the next revision.

   c. Contingency action of step 3.3(b) specified a preference to trip B and D RCPs instead of A and C. This is a plant specific operator action. However, no technical basis was provided. In response, the licensee stated that based on the start-up testing data, certain combinations were found to provide a greater spray flow. The startup test data showed that for operation with one pump operational in each loop, B and D RCPs provided the largest spray flow. Therefore, RCPs B and D were tripped if the spray flow was excessive. The inspector determined the technical basis was adequate.

   d. A note prior to step 3.1.6 specifies a delay time of 3 minutes 25 seconds for Automatic initiation of Auxiliary feedwater. The licensee was requested to provide the technical basis for the specific delay time. In response, the licensee stated that the technical basis, per PDCR 2-182-79, is to ensure that (1) the peak containment pressure and temperature do not exceed design values and, (2) the core performance satisfies the safety criteria. The inspector found that the technical basis for the specific delay time was adequate.

2. EOP 2532: LOCA

a. Entry condition. CEN-152 (Revision 2) listed high quench tank level temperature and pressure as entry conditions for LOCA events. EOP 2532 did not include these entry conditions. The licensee was requested to provide the justification for the deviation from CEN-152. They responded that the quench tank parameters were not unique enough to conclude that a LOCA had occurred. For example, any high pressure trip events will lift PORVs and elevate quench tank parameters. The inspector found the omission of entry conditions for the quench tank for LOCA events was adequate.

b. Steps 3.6 and 3.7 addressed containment integrity items, while step 3.8 addressed RCS inventory. This deviated from the safety function hierarchy in CEN-152, which addressed RCS inventory prior to containment integrity. The licensee responded that step 3.6 and 3.7 were action steps to verify the proper response of containment spray and Enclosed Building Filtration Actuation System (EBFAS) systems. Safety functions were being continuously monitored by the SPDS in parallel with these steps which were part of the safety function status check. The inspector found that even though the safety function hierarchy in EOP-2532 deviated from CEN-152, continuous check of the safety function status will appropriately direct the operator to mitigate the consequences of LOCA events.

c. Step 3.21 did not address the voiding in the SG tube while step 41.d of CEN-152 addressed elimination of the voiding on the SG tube side. Omission of removing steam voids from the SG tubes may impair the effectiveness of the safety functions to cool down the plant. The licensee committed to add appropriate steps to be consistent with CEN-152 in order to address the concern for voiding on the SG tube side of the RCS.

3. EOP 2523 ESD

a. The note between steps 3.11 and 3.12 should be a step. The licensee responded that the note did not contain an action, therefore, cannot be a step. However, the note should be moved to precede step 3.11. The licensee agreed to incorporate this correction into the next revision. The inspector found the response and corrective action adequate.

APPENDIX III

HUMAN FACTORS REVIEW COMMENTS

The following coments resulted from the human factors review of the EOPs. The licensee committed to review and correct these concerns where appropriate. Several of the following items are identified in Section 7 of this report, however additional examples and details of noted concerns have been provided.

I. Writer's Guide

A. Guidance Needed

1. The Writer's Guide recommends that each page of an EOP be identified by procedure number, revision number, and page number. However, no detail was provided on where such information should be positioned on each page. As a result, page identification is positioned at the bottom of each page, and is not emphasized in any way. Furthermore, the title of the EOP is not provided. During simulator scenarios, the team observed the SCO turning to the EOP folder label for EOP identification. Consistent emphasis and formatting is needed.

2. The rule requiring space for operator checkoff prior to each instruction step did not state that substeps should also have checkoff spaces. As a result, checkoff spaces were not provided in the EOPs.

3. The meaning of "verify" is unclear. It could mean "to visually check" or "to perform." In EOP 2534, Step 3.2C.a, it is not clear what actions are required by the term "verify." "Verify" is not defined in the Writer's Guide.

4. The verbs "ensure" and "monitor" are not clearly defined in the Writer's Guide. Two definitions may be implied by the verb "ensure": -"to make certain," and "to take action." The verb "monitor" is defined in the Writer's Guide in three separate ways: "Keep track of," "regulate," and "control." Consequently, the use and interpretation of these verbs in the EOPs may be inconsistent or incorrect.

B. EOP Inconsistencies with Writer's Guide

1. Numerical Limits

a. EOP 2525, Contingency Action (C.A.) 3.3.b. "If main spray flow is excessive..." The term "excessive" is not numerically defined.

b. EOP 2532, Step 3.3.1. Step 3.18 should be referenced in Step 3.3.1 so that the operator has an easy method of determining safety injection termination criteria.

c. EOP 2540, Step 3.6.b. "Steam generator level is 10-80% or there is adequate flow". The term "adequate flow" is not numerically defined.

d. EOP 2540, Safety Function Status Check, Heat Removal, Condition 1, Acceptance Criterion 4.b.iii. "Adequate feed flow is not numerically defined.

2. Clarify Concerns

a. EOP 2525, Contingency Action 3.3.c.iii. was too long and required either a comma or rewording.

b. EOP 2525, Instruction 3.3.c should be reworded to eliminate the negative.

c. EOP 2525, Instruction 3.9 contains two actions and is very long.

d. EOP 2525, Step 3.14.g. The verb "closed" is at the end of the phrase and the operator must read the entire phrase before understanding it.

e. EOP 2525, C.A. 3.25.a. This entire substep is confusing because it begins with "diagnose" and then directs the operator to the Break Identification Chart (i). A colon or "by:" at the end of "Diagnose event and go to the appropriate EOP" may clarify this redundancy.

f. EOP 2525, Step 3.17.c.i. & ii. It is not clear whether "return" and "control" are action verbs, requiring the operator to do something, or passive verbs requiring the operator to check to ensure something actuated.

g. EOP 2525, Step 3.14. The initial statement, "Establish...", is incomplete; the instruction is unclear regarding what action is to be taken, and whether or not all substeps must be performed.

h. EOP 2525, C.A.3.17.d. The word "all" is needed to clarify to the operator that all subsequent substeps must be performed. An action verb should also be included (e.g.," ...by doing all the following:").

i. EOP 2536, Step 3.24. The step does not clearly state whether all four criteria must be met, nor is it clear whether the substeps are criteria or actions. Modifying the initial phrase to include "all" and "criteria" would help resolve this issue.

j. EOP 2525, C.A.3.17. Grouping a. (i. and ii) separately from b. would facilitate the interpretation of "and" and "or". Boxes, brackets, or some other technique could be used for this purpose.

k. EOP 2540, SFSC, Page 6 of 13, Acceptance Criteria 4.b.i-iii. Subitems i and ii should be combined into a single substep; and the "and" between ii and iii should be replaced by "or". The corresponding parameter column should be changed to reflect this. The licensee has agreed to evaluate the need for this change.

l. Only two typographical errors were found, however, one was extremely critical EOP 2534, SFSC, page 2 of 10, Condition 2, Acceptance Criterion 1.b.i, "level creasing...." The significance is that the omitted letters ("in" or "de") completely change the criterion. The licensee has agreed to correct this in the next revision of the EOPs.

4. <u>Format</u>

a. EOP 2525, Step 3.17. The large amount of blank space following step b could mislead the operator into believing that he had completed this step, when in fact, it is continued with step c on the next page. Also, the word "all" should appear in the initial phrase, "...by all the following:."

b. EOP 2534, Page 8. All text is positioned in the upper third of the page, followed by a large blank space. Since the procedure continues on page 9, a "(cont.)" or other indication is necessary. In addition, extra space between the headings and instruction steps would provide better visual balance.

c. EOP 2525, Page 15. Additional space should be added between the headings and the instruction steps. This modification helps separate and emphasize the headings.

d. EOP 2525, Step 3.14. Some indication that substep g. exists on the subsequent page is needed.

e. EOP 2525, Page 10. Following the contingency actions, a "cont." or similar indication is needed to inform the operator that the procedure continues on the subsequent page. This example is especially critical because the last substep directs the SCO to consider using another EOP. In many cases, operators are referred to other EOPs only at the end of the procedure which they are currently using.

f. EOP 2534, Page 6. C.A.3.9 on this page is too close to "page 6". Page identification should be clearly separated from the surrounding text.

g. EOP 2536, Safety Function Status Check sheet (SFSC), Page 2 of 11. Acceptance criteria column is hard to follow because insufficient space (or other demarcation method) exists between subitems. E.g., between ii and b., Condition 1 and between b.i and c., Condition 2.

i. EOP 2540B,C,A,3.4 When the word "or" is surrounded by lengthy text, it is not immediately apparent. In this step, for example, "or" supersedes the other logic terms because it defines the relationship between i. and ii. In cases such as these, additional space might be added above and below "or."

j. EOP 2540, SFSC, Page 8 of 13, Acceptance Criteria 5.a.i-5.c. These criteria are not easily distinguishable form one another due to insufficient space (or grouping) between subitems.

k. EOP 2525, Step 3.3.c The "not" should be underlined, or "not open" should be replaced with "closed."

l. EOP 2525, Caution, and EOP 2528, Caution. "Slowly" should be emphasized with underlining, capitalization, or both.

m. EOP 2525, C.A. 3.16.b.iii. The second "override" should be underlined for clarity.

n. EOP 2525, Pages 3, 8 and 15. The "primary plant operator", "secondary plant operator" and "SS/SCO" headings should be further emphasized.

o. Colons to introduce actions would provide increased precision. This applies to virtually all EOPs.

p. EOP 2525, C.A.3.3c.iii. This step needs punctuation as it is very long.

5. <u>Notes and Cautions</u>

a. EOP 2528, Page 12, Note. This note is an example that illustrates the need to further distinguish all notes. They should be further separated from surrounding text by adding more space and either boxes or lines.

II. Control Room

A. Safety Parameter Display System (SPDS)

The following discrepancies were found between written EOP Safety Function Status Check sheets and the corresponding SPDS acceptance.

1. EOP 2532, Containment Integrity. Written SFSC, Condition 2.b.ii indicates "less than 2%" vs. SPDS which indicates "less than 3%."

2. EOP 2532, Containment Integrity. Written SFSC, Condition 1.a. indicated "less than 2 psig", vs. SPDS which indicates "less than 5 psig."

3. EOP 2532, Vital Auxiliaries. Written SFSC, 6.a indicates "greater than 90 psig" vs. SPDS which indicates "normal."

4. EOP 2540, Reactivity Control. Written SFSC, Condition 3.4.d.i and ii, indicate "i. greater than 9.5% or ii. If less than 6-9.5% then SRAS" vs. SPDS which indicated only "greater than 6%."

5. EOP 2540, Heat Removal. Written SFSC, Condition 1.b.iii, indicated only "feed flow" vs. SPDS which indicates a minimum value of 300 gpm for Auxiliary Feed.

B. Procedure Revisions

1. EOP 2528, Step and Contingency Action 3.19. "Change 1" was handwritten on an otherwise blank page that followed the Change Form. The handwritten changes were almost illegible.

2. EOP 2540C had a Change Form, followed by three handwritten changes that were very difficult to read. Furthermore, the steps to which they refered did not reference the Change Form. The operator would not be aware of the changes unless he remembered to look back at the form.

III. Simulator Scenarios

1. In the LOCA scenario, the SPDS operator knew that the HPSI flow curve was being violated and mentioned this to the SCO. The SCO correctly increased HPSI flow, however the increase was insufficient and the SPDS operator did not relate this information to the SCO.

In contrast, Shift 2 operators spontaneously provided relevant information to the SCO, and the SS requested information as well. The differences between shifts suggests that the importance of communication may need to be stressed more in training.

2. The team observed placekeeping difficulties during the scenarios. Operators used their fingers or lost their place. Two operators were heard talking about how to record which steps had and had not been completed.

3. Mental calculations are required for RCS delta-T and shutdown margin. To calculate RCS delta-T operators had to either obtain two temperature (T) values on C04, and subtract them, or obtain wide-range T from the RPS panel which was some distance from C04. In either case, the operators had to subtract the Ts mentally or on paper. Both the location of the temperature gauges and the need for hand calculations increase the potential for operator error.

   To calculate the shutdown margin, the SPDS operator had to locate a series of numerical values and transfer them to computation sheets, which then guided the operator's calculation. The entire calculation took about 10 minutes, and required the operator's full attention as he was required to remember how to perform the calculation. The operator was unable to perform other tasks until he completed the shutdown margin calculation. The complexity of the calculation makes it highly prone to error, and the time taken to complete it is excessive.

IV. Local Control Stations

A. Component Location and Labeling

In many EOPs, the locations (panel identification or "local") of cited components were omitted. This was inconsistent with the prevailing format, which was to always identify components locations. Below are examples:

1. EOP 2534, C.A.3.9. This step does not identify whether it is a local or control room action.

2. EOP 2540A, Step 3.3.a. "CO2" should be added after "10%."

3. EOP 2540A, Step 3.3.b Add "CO2" after "2-CH-514."

4. EOP 2540A, Step 3.3.e.ii. "CO1" should be added after "open."

5. EOP 2540D, Step 3.2.b.viii. No location information is provided.

6. EOP 2540D, Step 3.4.d. i-iv, and corresponding contingency actions. No location for cited components are provided.

7. EOP 2540D, Step 3.6.j i-iii, and corresponding contingency action. Location of cited components is not identified.

8. Several labels in local control stations were difficult to read due to small or handwritten labels. In addition, some labels lacked needed information. For example, the "emergency button" in the diesel room has no label indicating whether the button starts or stops the diesel. The licensee stated that new labels for plant components had been ordered to replace the old ones.

APPENDIX IV

VERIFICATION/VALIDATION REVIEW COMMENTS

Specific comments on the control room walkdowns and the review of the verification and validation programs are provided below. The licensee committed to correct these weaknesses or review specific steps for potential changes. Section 6 of this report provides further discussions regarding verification and validation.

1. GENERAL LABELING

   a. SGFP reset push buttons are difficult to read.
   b. HPSI to charging pump cross tie valve 2-SI-440 does not have a label.
   c. RCP pump designation is hard to read on the label.
   d. LPSI valves 2S1 635 & 2S1-645 breakers are labeled HPSI

   The licensee states that the DCRDR modifications will include improved (and corrected) labels.

2. EOP 2525 SPTA

   Sixteen of the scales on control room instruments (C05) that are used to read SG pressure and level are faded and must be read at close range. The licensee stated that this will be corrected as part of the DCRDR work.

3. EOP 2532 LOCA

   a. Control Board Locations.

      (1) Step 3.9.6 indicated the acoustic monitor alarm location on panel C02, and should also specify panel RC 05E.

      (2) Step 3.15d notes that T Hot indication is located on panel C03; and it should also state that T Hot can be read on panel C101.

      The licensee agreed to include these changes in the next revisions of the EOP.

   (b) Safety Function Status Check. Several discrepancies exist between the safety function status check sheets and the SPDS. (Discussed in Section 4 of this report and Section 7.)

4. EOP 2534 SGTR

   a. Step 3.20 should include the statement "RCS cooldown to cold shutdown using forced circulation" The licensee will evaluate and consider changing this during the next revision.

   b. Step 3.20a These action substeps should be done for both the primary step or the contingency step. The licensee will evaluate and consider changes during the next revision.

c. Step 3.24 The caution before this step should contain a statement to check the main steam line radiation monitors before sending the Plant Equipment Operator (PEO) to complete the local operation.

d. Step 3.24.a.ii and iii Sub step iii should be completed before substep ii in order to reduce the potential exposure to the PEO when he adjusts the blowdown flow. The licensee indicated that they would rework Step 3.24 to include the needed changes.

5. EOP 2540E Functional Recovery-Containment

a. Step 3.1.a.iii Place Hydrogen monitor in service per OP 2313C. During the walkdown of OP 2313C the following deficiencies were identified.

(1) The operator could not find the temperature indication for the cabinet (which is to be verified to be 100°F).

(2) Gauges and valves were not marked very clearly and the operator had to crawl in the cabinet to identify valves and gauges.

(3) Only the zero hydrogen gas was hookup up with a regulator and tubing to the analyzer. The calibration gas bottle with hydrogen was in the bottle rack, but there was no regulator or tubing connecting it to the analyzer.

b. Step 3.3 This step needs to include actions to help the operator recover the containment temperature when it is out of specifications. The licensee will evaluate and consider changes upon incorporation of CEN 152, Revision 3.