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# EVALUATION OF THE DETAILED CONTROL ROOM DESIGN REVIEW SUMMARY REPORT FOR OYSTER CREEK NUCLEAR GENERATING STATION

Technical Evaluation Report

Final

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Prepared for:

U.S. Nuclear Regulatory Commission
Washington, D.C.

Contract NRC-03-82-096

## FOREWARD

This Technical Evaluation Report (TER) was prepared by Science Applications, Inc. (SAI) under Contract NRC-03-82-096, Technical Assistance in support of NRC Licensing Actions: Program III. The evaluation was performed in support of the Division of Human Factors Safety, Human Factors Engineering Branch (HFEB). SAI previously evaluated GPU Nuclear's program plan submitted for the Detailed Control Room Design Review (DCRDR) conducted for Oyster Creek Nuclear Generating Station (Reference 1). Results of that evaluation are described in a memorandum prepared by HFEB and transmitted to the licensee (Reference 2). This report includes the SAI evaluation of the licensee's summary report (Reference 3) and considers DCRDR activity information presented in the program plan (Reference 1).

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Evaluation of the
Detailed Control Room Design Review
Summary Report
for Oyster Creek Nuclear Generating Station

This report documents the Science Applications, Inc. (SAI) evaluation of the summary report of the Detailed Control Room Design Review (DCRDR) submitted to the Nuclear Regulatory Commission (NRC) by GPU Nuclear Corporation (GPUN) for the Oyster Creek Nuclear Generating Station (Reference 3) on 30 April 1984. This evaluation also considers information fbtained from the previously submitted program plan (Reference 1).

Results of the SAI evaluation follow a brief overview of the background leading up to preparation and submission of the summary report by the licensee.

## BACKGROUND

Licensees and applicants for operating licenses are required to conduct a Detailed Control Room Design Review. The objective of the review is to "...improve the ability of nuclear power plant control room operators to prevent accidents or cope with accidents if they occur by improving the information provided to them" (NUREG-0660, Item I.D.1 (Reference 4). The need to conduct a DCRDR was confirmed in NUREG-0737 (Reference 5) and the requirements to be met in such a review were contained in Supplement 1 to NUREG-0737 (Reference 6). Guidelines for conducting a DCRDR are provided in NUREG-0700 (Reference 7) while NUREG-0801 (Reference 8) presents the assessment processes for use by the NRC.

The DCRDR requirements as stated in Supplement 1 to NUREG-0737 can be summarized in terms of nine specific issues, a list of which provides a convenient outline of the areas covered in this technical evaluation. The nine issues include:

1. Establishment of a qualified multidisciplinary review team;

2. Use of function and task analyses to identify control room operator tasks and information and control requirements during emergency operations;

3. A comparison of display and control requirements with a control room inventory;

4. A control room survey to identify deviations from accepted human factors principles;

5. Assessment of human engineering discrepancies (HEDs) to determine which HEDs are significant and should be corrected;

6. Selection of design improvements that will correct these discrepancies;

7. Verification that selected design improvements will provide the necessary correction;

8. Verification that improvements can be introduced in the control room without creating any unacceptable human engineering discrepancies; and

9. Coordination of control room improvements with changes resulting from other improvement programs such as SPDS, operator training, new instrumentation (Reg. Guide 1.97, Rev. 2) and upgraded emergency operating procedures.

A DCRDR is to be conducted according to the licensee's own program plan (which must be submitted to the NRC); according to NUREG-0700 it should address the previously stated requirements and be conducted in accordance with the following four phases: 1) planning, 2) review, 3) assessment, and 4) reporting. The product of the last phase is a summary report which must include an outline of proposed control room changes, their proposed schedules for implementation, and summary justification of human engineering discrepancies with safety significance to be left uncorrected or partially corrected. Upon receipt of the licensee's summary report and prior to implementation of proposed changes, the NRC must prepare a Safety Evaluation

Report (SER) indicating the acceptability of the DCRDR (not just the summary report). The NRC's evaluation encompasses all documentation as well as briefings, discussions, and audits if any were conducted.

The summary report submitted for evaluation by GPU Nuclear describes completed tasks and findings from a control room design review which was initiated in late 1980 at Oyster Creek prior to the issuance of the DCRDR requirements stated in Supplement 1 to NUREG-0737 and the methodology suggested in NUREG-0700 or other appropriate guidance. A control room mockup was constructed and in early 1981 guidelines and objectives were formulated to provide a framework for the control room design review. A major review of the alarm system was undertaken and other planned modifications effecting plant controls and displays were subjected to human factors evaluation. Review of the control room as a whole was conducted between 1982-1983 and included preparation of a program plan and analysis of tasks associated with executing symptom-oriented emergency operating procedures.

**PLANNING PHASE**

1. Preparation and Submission of a Program Plan

The program plan submitted for Oyster Creek showed that GPUN met many of the basic objectives for conducting a control room design review. Many of the elements of a review specified in NUREG-0737 had been addressed. However, specific areas of the work were not described in sufficient detail to provide assurance that the licensee understood the processes necessary to complete the tasks and therefore meet the requirements. The results of the evaluation of the GPU Nuclear program plan are detailed in Reference 2.

The licensee's program plan included a brief description of the staffing and management that were established to conduct the control room design review. From additional information provided by GPUN in the summary report, it appears that the structure and management of the DCRDR were flexible enough to permit a multidisciplinary effort. Overall direction of the review was provided by GPUN. More specifically, management of the DCRDR was the responsibility of GPUN's Director of Systems Engineering and Manager of Plant Analysis.

2. Structure and Qualifications of a Multidisciplinary Review Team

A competent and relevant multidisciplinary team was established to conduct the control room design review. The team included GPUN staff, personnel from MPR Associates, and human factors consultants. The resumes provided indicate that the expertise of the review team included:

- System Engineering
- Reliability and Risk Analysis
- Human Factors Engineering
- Operations Analysis
- Instrumentation and Control
- Chemical Engineering
- Electrical Engineering
- Mechanical Engineering
- Nuclear Engineering

Although GPU Nuclear has not provided actual personnel assignments and levels of effort for completed activities, it outlined the degree of involvement of MPR and consultants. It appears that participating organizations and individuals were qualified for DCRDR tasks for which they were responsible. GPUN was responsible for overall direction of the review. GPUN staff participated in almost all review activities to some extent. GPUN acted as contract manager for MPR and the human factors consultants, set the review schedule, integrated the review and corrective actions with plant activities, and scheduled correction of discrepancies. MPR developed the review's framework, coordinated review phases and drafted report findings. The human factors consultants participated in development of review guidelines, engaged in walkthroughs, and assisted in the evaluation of deficiencies. GPUN, however, has not specified if the same individuals who participated in the 1980-1981 review also were involved in the 1983 effort.

Although no details are provided, the review team, as established, appears to have had freedom to carry out the review and access records, information and facilities as needed. The team apparently also had the ability to acquire support from other administrative staff and specialists as needed. Other staff involved in the review are mentioned by name or

speciality (systems engineer/safety analysis staff, shift technical advisors, operating staff, etc.). However, as resumes for these individuals were not provided, it is impossible to evaluate their qualifications or their suitability in terms of task assignments. Additional information regarding supplemental staff needed for the review would have facilitated the evaluation of the teams capability to conduct the review.

3. Coordination of the DCRDR With Other Improvement Programs

The licensee's program plan indicated an intent to comply with the coordination requirements of the NRC and awareness of the potential disruption of the control room and complications to operator training that may result from an uncoordinated implementation plan of corrective actions. In order to ensure that the high standards established during the DCRDR are maintained, future modifications to the control room such as the Safety Parameter Display System and instrument modifications for compliance to Regulatory Guide 1.97, will be subject to procedures which integrate human factors reviews into the design process. The procedures are supported by a full time human factors staff. Such procedure have been applied to design of the Remote Shutdown Panel.

The licensee mentions in the summary report that methods used and standards established during the DCRDR will be applied to other improvement programs. However, the licensee has not described how it specifically plans to coordinate the DCRDR with other programs. Therefore, it is not possible to evaluate this aspect of the DCRDR. Note that a specific timetable would have been extremely valuable in assuring that this important coordination function was implemented.

**REVIEW PHASE**

GPU Nuclear Review Phase plans and activities included:

1. Review of operating experience;
2. Review of operator functions and responsibilities;
3. Review based on plant procedures and walkthroughs;
4. Function and task analysis;

5. Control room inventory; and
6. Control room survey.

To some extent, the above activities are those recommended by NUREG-0700 guidelines as contributing to the review phase objectives. Activities 4, 5, and 6 contribute to the accomplishment of specific DCRDR requirements contained in Supplement 1 to NUREG-0737. Activities 2 and 3 permitted a review and validation of operating procedures and provided data relevant to the assessment phase of the project. Activities 2, 3, and 4 are discussed together in the System Function and Task Analysis section to follow.

1. Review of Operating Experience

A review of operating experience is not explicitly required by Supplement 1 to NUREG-0737. However, it is an activity recommended by NUREG-0700 guidelines as contributing to the accomplishment of review phase objectives.

As described by GPU Nuclear in the program plan, its review of operating experience included: 1) a review of Licensee Event Reports and internal plant records on reactor trips and other events to ensure that problems actually encountered in Oyster Creek's operation were identified and factored into the control room review; 2) a review of Nuclear Power Experience summaries; 3) conduct of a formal opinion survey of control room operators to identify strengths and weaknesses of the control room; and 4) the acquisition of solicited and unsolicited information from operators during walkthroughs.

GPUN performed its operating experience review using methods consistent with guidelines provided by NUREG-0700. However, it is difficult to assess the adequacy of the review due to lack of detail concerning procedures employed. For example, no information has been provided on the number of operators formally surveyed (NUREG-0700 suggests surveying 50% of the control room operators). There is no description of analyses performed on data collected. Furthermore, there is no information on how and to what extent industry-wide reports were reviewed and documented. Such information and examples of checklists or questionnaires employed for data collection

would provide greater confidence in the review of operating experience performed by the licensee.

2. System Function and Task Analysis

Supplement 1 to NUREG-0737 states that the licensee is required to perform a "function and task analysis (that had been used as the basis for developing emergency operating procedures) to identify control room operator tasks and information and control requirements during emergency operations." In other words, the objective of the task analysis is to establish the input and output requirements of control room operator tasks. These information requirements are then to serve as benchmarks for examination of the adequacy of control room instrumentation, controls, and other equipment.

For licensees choosing to use the Boiling Water Reactor Owners' Group (BWROG) control room survey program, the NRC has issued Generic Letter 83-18, clarifying some task analysis requirements (Reference 11). A further memoradum issued by the NRC on May 14, 1984, has defined the requirements for performing a task analysis when the licensee uses the BWROG emergency procedure guidelines (EPGs) (Reference 12). This review has examined the summary report in light of these clarifications of the NRC requirements.

GPU Nuclear's methodology for performing the function and task analysis was described in their program plan and summary report submittals of July 1, 1983, and April 30, 1984 respectively. GPUN started their original systems function and task analysis (SF&TA) activities in 1980 using walkthroughs of 1980 off-normal and normal procedures conducted in a full scale control room mockup. GPUN has also recently completed a SF&TA based on walkthroughs using the new symptom-oriented EOPs. This review concentrates on the latter effort because Supplement 1 to NUREG-0737 specifies that the new EOPs shall be used as a basis for performing the SF&TA.

GPUN started the process of implementing the symptom-oriented EOPs in 1983. In order to comply with Generic Letter 83-18, they converted the generic guidelines to plant specific guidelines and then to "first-cut" procedures. GPUN states that these "first-cut" procedures were not tailored to the displays and controls installed in the Oyster Creek control room. Presumably this would help to establish information and control requirements

independent of the control room. The process involved defining functions and tasks required of operators during emergency conditions. In order to define tasks, GPUN performed a "desk-top" review of the procedures and also constructed logic diagrams of tasks to preclude dead end or infinite "do-loop" situations. GPUN then devoted two days to walkthroughs of the procedures on the mockup. The walkthroughs were used to analyze the ability of the operators to understand and perform the operations.

The above process was basically a verification that the controls and displays in the control room supported the tasks required by the EOPs. In order to validate the procedures, GPUN walked through mechanistic upsets on a mockup and evaluated operator responses in training exercises on the Dresden simulator. The fact that the controls and displays at the Dresden simulato are substantially different from those at Oyster Creek (Reference 3) casts doubt as to the usefulness of this step.

GPUN has not fully documented several specific areas regarding it's SF&TA, and therefore it is not possible to completely assess it. GPUN stated that they translated the BWROG generic guidelines into "first-cut" procedures. There remains the question as to whether finished procedures were ultimately developed, and if and how they differ from the "first-cut" procedures. If there are differences then Generic Letter 83-18 would require resolution.

Of the four points discussed in the NRC Memo of May 14, 1984 (Reference 12), it appears that GPUN has partially complied with the first two points and has not adequately described the second two points well enough to assess.

With regard to the first two points, the memo refers to Rev. 3 of the BWROG EPGs as providing a function analysis. GPUN did not state which revision of the EPGs they used. However it is clear from page III.4 of the summary report that they did not use Rev. 3. Thus two emergency procedures have been omitted from the SF&TA process, namely secondary containment control and radioactivity release control.

With regard to the second two points in the NRC memo, the following inadequacies were found in the GPUN submittal:

1. GPUN has not described the process used to identify plant-specific parameters and other plant-specific information and control capability needs nor has it described how the characteristics of needed instruments and controls were determined.

2. GPUN has not described nor provided an example of an auditable record which defines the necessary characteristics of each instrument and control used to implement the EOPs and basis for that determination.

The process described by GPUN emphasizes the verification that controls and displays in the control room will allow the operators to execute the tasks in the EOPs. The process described by GPUN also emphasizes the validation of the compatibility of the procedures, manning, training, and control room for emergency tasks. Although GPUN has stated, for example, that "if the operator's execution of a step was conditioned on specific values of process variables, the information on those variables was displayed to him in appropriate terms, with appropriate precision, and at a location where he would be able to see it," (Reference 3) it has not described the process used to evaluate the suitability of characteristics of the needed instruments and controls.

Even though the SF&TA as described by the Oyster Creek review team appears to fall short of satisfying the NRC requirement the GPUN team did identify many HEDs. A critical review of the findings which were presented in Sections IV.2, IV.3, IV.4, V.A, V.B, as well as Table V-1 (pp. 1-26) reveals that GPUN has discovered numerous control room inadequacies in a number of categories including: 1) missing information, controls and/or instrumentation; 2) inadequate controls and instrumentation; 3) inadequate warnings; and 4) inappropriate clusters of controls and/or instruments for plant functions. It is important to note that some of the discrepancies

were discovered during the walkthroughs of the 1980 normal and off-normal procedures and some of them were discovered when using the new EOPs. There is also evidence in Groups 2 and 3 of Table V-1, that the SF&TA may not have been performed in great enough detail to establish the information and control requirements and characteristics.

In conclusion, GPUN has performed a SF&TA which partially complies with the NRC requirement. It used an unidentified version of the BWROG EPGs to develop plant-specific EOPs. A subset of the required EOPs were used to verify and validate the tasks in the emergency procedures. The control and display requirements for the tasks were evaluated by the DCRDR team relying on its experience and knowledge rather than a systematic process which: 1) first identified plant-specific parameters and information and; 2) then described the characteristics of the needed instruments and controls and; 3) lastly verified the task performance capabilities.

In order to complete the requirements of Supplement 1 to NUREG-0737 and the NRC Memo of May 14, 1984, GPUN should:

1. Write EOPs for the two remaining emergency procedures namely: secondary containment control and radioactivity release control. After the plant-specific EOPs are written GPUN can then carry out a SF&TA for these procedures.

2. State whether their "first-cut" procedures are differenct from their finalized EOPs and if any differences would affect the SF&TA.

3. Describe the process used to identify plant-specific parameters and other plant-specific information and control capability needs. Describe how the characteristics of needed instruments and controls were determined.

4. Describe and provide an example of an auditable record which defines the necessary characteristics and bases for that determination of each instrument and control used to implement the EOPs.

3. Control Room Inventory

The licensee's stated objective for this task was to identify all instrumentation, controls, and equipment within the control room. GPUN's inventory is based on photographs used for a mockup which include all components with which the operator interfaces. This includes all main control panels and visual annunciators for alarms. The actual inventory is included in a set of reproducible drawings. The compilation of the inventory appears to be complete.

Other than this information, there is little discussion in either of Oyster Creek's submittals as to how the capabilities represented by the inventory were compared to the requirements identified through the analysis of operator tasks. Although a comparison was conducted to identify discrepancies, there is little information as to whether the inventory provided an indication of component use and characteristics (i.e., parameters, unit of measure, range of display, etc.) for comparison to requirements identified in the task analysis. There is no discussion of data management for cataloguing existing controls and displays and their characteristics to ensure that verification of control and display availability and suitability were addressed. Further discussion of these issues and a description of the method used to identify missing and/or inappropriate controls and displays would have permitted a full evaluation of GPUN's understanding of the requirement.

4. The Control Room Survey

GPUN conducted a survey of control room components to identify any characteristics of instruments, equipment, layout and ambient conditions that did not conform to good human engineering practice. The survey included: 1) a panel review (controls, displays, panel layout, process computer displays); 2) survey of alarm systems; 3) survey of control room environment (ambient conditions, lighting, sound, workspace, communications, etc.).

Survey results were obtained by reviewing photographs of panel components from the inventory. Although never mentioned, it is assumed that measurements and observations were made in the control room itself, as

necessary. These results were then compared to detailed human engineering guidelines prepared for the Oyster Creek control room. These guidelines, shown in Appendix A of the program plan, were developed from guidelines contained in MIL-STD-1472B (Reference 10) and human engineering references such as VanCott and Kinkade (Reference 13) and Woodson and Conover (Reference 14). The development of such guidelines was necessary as GPUN conducted its survey of Oyster Creek prior to the issurance of the NRC DCRDR guidelines (NUREG-0700).

Both the objectives of this effort and areas of survey consideration are consistent with the requirements described in Supplement 1 to NUREG-0737. Whether the requirement has been met completely is difficult to assess, however, because information necessary for a valid assessment has not been provided by the licensee. For example, although the survey did include panel layout, it is unclear as to whether all primary control panels were included. It appears that the Remote Shutdown Panel was not surveyed as it is currently under construction and evaluation. A drawing of the control room layout, including all panels surveyed, would be valuable to the review. Furthermore, there is no indication that a thorough set of items and indicators was included in the survey. GPUN has described neither the methodology nor the procedure used to conduct the survey task and has provided no examples of checklists or other data gathering instruments used to complete the task. The licensee's report could be enhanced by inclusion of such documentation and information and would have facilitated our evaluation.

The fact that there may be differences between the specific guidelines used by the licensee to conduct its survey and NUREG-0700 guidelines is of particular concern. There are, in fact, differences between MIL-STD-1472B and NUREG-0700 guidelines in scope and breath. Thus, although it is clear that a control room survey was conducted basically in accordance with the requirements of Supplement 1 to NUREG-0737, the completeness of the effort cannot be assessed until the licensee provides documentation to show a comparison between guidelines it developed and used and those in NUREG-0700.

## ASSESSMENT AND IMPLEMENTATION PHASE

GPUN's assessment and implementation phase is addressed in Section V of the program plan. Section IV of the summary report provides a summary of conclusions and Section V describes the corrective action plan to resolve discrepancies uncovered by the review. A summary of review findings is included in Tables V-I and V-II of the summary report.

### 1. HED Assessment Methodology

Overall, GPUN's control room review resulted in the identification of roughly 1000 HEDs. Some 20 deficiencies related to the control room environmentally. One hundred sixty eight deficiencies were generated by the review of operator tasks. Over 800 deficiencies were uncovered by the detailed review of the control room hardware.

HEDs identified during the review were assessed to determine whether corrective action needed to be taken. The fundamental criteria were 1) the likelihood that a deficiency would lead to an operator error and 2) the impact that such error on the plant would be significant. These criteria are appropriate and imply consideration of operation safety. The licensee also included plant availability and potential for equipment damage as secondary criteria.

HEDs were prioritized individually or generically by review team consensus into one of three categories based on likelihood of operator error and impact of such error on the plant. Categories were defined as follows:

Importance Category A - a deficiency that may impair an operator's performance under off-normal conditions;

Importance Category B - a deficiency that is unlikely to lead to an irreversible operator error in an off-normal situation or can lead to operator error under normal conditions and/or generic deficiencies that individually are not likely to degrade performance seriously, but taken together can be significant; and

Importance Category 3 - deficiency which is unlikely to affect operator performance under any condition or a deficiency for which solutions are not readily apparent.

Scheduling of the corrective action for each deficiency was accomplished by placing each deficiency into one of five categories. Scheduling ranged from corrective actions to be taken at the earliest opportunity (Category 1) to accomplishing the correction as convenient as possible or after the 1987 refueling outage (Category 4). HEDs for which no corrective action was considered necessary were placed in Category 4 as well. HEDs corrected during the course of the review process were placed in Category 5, "already corrected."

Overall, GPUN'S HED assessment activity somewhat satisfies the requirements of NUREG-0737, Supplement 1 to determine which HEDs are significant and should be corrected. HEDs were assessed individually and in aggregate for their potential plant safety consequences. The output of this evaluation was safety-significant HEDs to be analyzed for design improvements. Consistent with NUREG-0700 guidelines, several groups of HEDs, including HEDs considered to warrant no corrective action were subjected to a detailed evaluation. The licensee, however, has failed to describe this assessment process or its purpose. Importance categories are poorly defined and do not appear mutually exclusive. Category 3 places HEDs "for which solutions are not clear cut" in a low importance position. The apparent ease of correction is not an appropriate criteria for assessing the significance of the HED. In addition, GPUN has not documented whether or not known operator errors that had occurred were placed in scheduling Category 1 and importance Category A consistent with NUREG-0801 guidance. In fact, a few examples are provided in the results which indicate placement of such errors in Category B.

2. Selection of Design Improvements

A brief description of the process to select design improvements was provided in the licensee's program plan. Although additional information provided in the summary report was limited, it appears that a number of factors were considered by the review team in selecting design improvements. Examples of those factors include: 1) relative effectiveness of the action

to correct the problems; and 2) relative practicality of implementing the action promptly. Possible alternative design improvements examined by the licensee were changes or additions to control room hardware and administrative actions such as procedural changes or training. As a result of the selection process, the licensee states that the vast majority of identified HEDs were considered correctible through hardware change. About 15% of the deficiencies warranted procedural change while about 7% required further study or no action at all.

A review of the proposed corrective actions indicates that the licensee has not corrected the vast majority of HEDs through hardware changes, rather, reliance has already been placed on corrections through enhancements and the addition of a computer. Therefore it is difficult to determine whether the process to select design improvements was conducted with full consideration of alternative solutions that would provide the optimum human factors design.

Although it appears that the selection of design improvements was an integral part of the DCRDR performed at Oyster Creek, the licensee's submittals provide limited information describing the actual processes that were used to select improvements for identified HEDs. Little information is provided on the processes that were used to examine various alternative solutions, their integrated effects on operator performance, and the arrival at a final solution. Therefore, this task within GPUN's Assessment and Implementation phase is found incomplete until such information is made available.

3 and 4. Verification that Selected Design Improvements will Provide the Necessary Correction and Verification that Improvements can be Introduced in the Control Room Without Creating Any Unacceptable Human Engineering Discrepancies

Although described briefly, it appears that the licensee did implement a process to verify that design improvements would provide the necessary correction without introducing new problems. As indicated in the summary report indicates that all corrective actions were subjected to a human factors review and normal plant approval requirements for any changes to the existing configuration, documentation, and training. It is

noteworthy that the licensee has developed a program that requires human factors review for both the conceptual and final designs of all control room modifications.

All corrective actions which involved changes in configuration were incorporated on the full scale mockup. Often, some abbreviated walkthroughs were conducted with operating staff to confirm that the operator's response had been improved and that no new problems had been introduced. Apparently not all of the suggested improvements were walked-through. Furthermore, there is no justification or rationale provided for the conduct of "abbreviated" evaluations.

Although the licensee appears to have implemented a verification process, (conduct of walk-throughs), it is unclear from the summary report if the process adequately satisfies the requirement. For example, the licensee has provided no indication that design improvements were properly integrated with all other functions and systems in the control room. The process by which effects on task performance were examined has not been elaborated. Therefore, it is impossible to assess whether GPUN's method is a sufficient substitute for the rigorous verification process suggested in NUREG-0700 Sections 4.2.2.1 and 4.2.2.2.

Also, the licensee has indicated awareness of the need to insure that modifications to the control room would not introduce new HEDs. However, no analytical procedure has been provided to demonstrate how this was accomplished. Without this information, the effectiveness of the verification process cannot be evaluated.

## ANALYSIS OF PROPOSED DESIGN CHANGES AND JUSTIFICATION FOR HEDs TO BE LEFT UNCORRECTED FROM THE RESULTS OF OYSTER CREEK NUCLEAR GENERATING STATION

Licensees are required by Supplement 1 to NUREG-0737 to submit an outline of proposed design changes, including their proposed schedules for implementation and a summary justification for HEDs with safety significance to be left uncorrected or partially corrected.

The Oyster Creek submittal for the DCRDR has a summary of review findings organized into seven groups. This review will retain that organi-

zation, numbering each discrepancy sequentially within each group. Thus group 1 has discrepancies numbered 1 through 16, and group 2 has discrepancies numbered 1 through 75, etc..

The following are the results of a SAI evaluation of proposed corrections and justifications for no correction.

Group 1: Further Evaluation Required

HED Nos. 1-15

All of the items in this group require futher evaluation. In many cases no proposed solution is given. Supplement 1 to NUREG-0737 requires that evaluation of the HED and a proposed solution be submitted in the summary report. GPUN has not done this, thus all of these items will require additional effort before final NRC assessment can be made.

In addition to the above general comments on this category, the following is a listing of the HED number with reasons for concluding that a specific portion of the summary is inadequate.

- The description of the proposed problem, recommendation and/or implementation is too brief, general or ambiguous to allow a valid assessment.

  HED Nos. 4, 5, 13, 14, 15, 16

- The description indicates that the SF&TA portion of the DCRDR may not have been carried out in great enough detail to determine the information and control requirements. For this reason it is not possible to evaluate the partial solution proposed.

  HED Nos. 6, 10

Group 2: Relabeling, Demarcating and Other Improvements

In general we concur with the surface enhancement techniques chosen by the licensee to correct or improve the stated design deficiencies. However, some of the proposed relabeling solutions could not be completely assessed due to general or vague description of the problem and/or the solution.

Of the 75 HEDs in group 2, we concur with the proposed solutions for the following HEDs.

HED Nos. 1, 6, 8, 9, 10. 11, 12, 13, 14, 15, 16, 17, 18, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 38, 39, 40, 41, 43, 44, 45, 46, 47, 48, 50, 51, 52, 53, 54, 57, 58, 59, 62

The following is a listing of the HED number and reason for concluding that the descriptions for the solutions are inadequate.

- There are many groups of two or more HEDs which appear to be related to each other. NUREG-0700 states that if two or more HEDs have a potential effect on the same system, then the cumulative effects could be great enough to justify changing the importance category from a medium to high level. The following are groups which GPUN does not appear to have considered in this light.

  HED Nos. 2, 3, 4, 5, 7;
  25 and 26;
  27 and 28;
  61, 63, 64 and 65;
  60 and 66

- The importance category appears to be too low.

  HED Nos. 2 and 3 are important because if the operator were to be confused about the rod display and the rod selector, possible power shape imbalances could arise.

HED No. 20 - this is a safety-system.

HED No. 32 - NUREG-0801 requires that HEDs which have caused operator errors in the past shall be corrected as soon as possible.

- The solution does not appear to correct the HED, or only partially corrects the HED, or is in contradiction to NUREG-0700 guidelines.

  HED Nos. 19, 21, 49, 56, 68, 69, 72

- The description of the problem and/or solution is too brief, general or ambiguous to permit a valid assessment.

  HED Nos. 21, 22, 35, 36, 42, 55, 60, 66, 67, 70, 71, 74, 75

- The description indicates that the SF&TA portion of the DCRDR may not have been carried out in great enough detail to determine the information and control requirements. For this reason it is not possible to evaluate the incomplete solution proposed.

  HED Nos. 37, 42

- The justification for not correcting the HED is inadequate.

  HED No. 73

Group 3: Administrative

Of the 27 HEDs in group 3, we concur with the proposed solutions for the following HEDs.

HED Nos. 3, 5, 10, 13, 14, 16, 17, 18, 19, 20, 22, 24, 25, 26, 27

The following is a listing of the HED numbers and reason for concluding that the descriptions for the solutions are inadequate.

- The description indicates that the SF&TA portion of the DCRDR may not have been carried out in great enough detail to determine the information and control requirements. For this reason it is not possible to evaluate the incomplete solution proposed.

  HED Nos. 1, 2, 4, 6, 9, 15, 21, 23
  (Note on 21 - This should be category A, safety significant, because any reading of water in dry well could indicate a pipe break.)

- The description indicates that the validation and verification of the new EOPs is not complete on the following HEDs.

  HED Nos. 6, 7, 8, 11

- The description of the problem and/or solution is too brief, general or ambiguous to permit a valid assessment.

  HED No. 12

Group 4: Hardware

The licensee has identified a proportionally large number of HEDs related to information that is needed by the operators and is either not provided on the panels or is not suitably presented. The corrective actions in this group of findings include removal of unnecessary components, rearrangements, replacement and modifications of existing hardware, and the addition of components.

- The evaluation of the proposed corrective actions in this group has resulted in a major concern with the use of the "Integrated Consolidated Display" to provide the information displays identified as missing in the control room. Because this display has not been described in enough detail we are unable to fully assess its adequacy to correct the HED. This concern effects the following HEDs.

  HED Nos. 8, 9, 10, 16, 18, 41, 42, 44, 48, 56, 66

- In general most of the proposed hardware changes outlined in this section appear appropriate and reasonable. The following is a listing of those HEDs and the proposed solutions which appear to correct the HED. Note that the limited description of both the HED and corrective action limits the capabilities of our assessment. In some instances the corrective action was not found acceptable due to its scheduling/importance category. (A discussion of those instances where the corrective action was found to be inadequate will follow below.)

  HED Nos. 1, 2, 3, 5, 6, 7, 13, 14, 15, 20, 22, 25, 26, 27, 28, 30, 32, 33, 36, 47, 49, 50, 52, 53, 54, 55

- The following is a listing of the HED and corrective action number and either a generic or specific reason for concluding that the corrective action descriptions are inadequate.

  - The description of the deficiency and/or corrective action is too brief, general or ambiguous to allow a valid assessment. Also the descriptions for corrective actions sometimes call for further evaluation to determine the solution and therefore we are unable to fully assess them.

    HED Nos. 17, 21, 29, 31, 35, 37, 39, 40, 43, 46, 48, 50, 51, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66

  - The description of the corrective action only partially corrects the discrepancy.

    HED 34: The need to protect controls has not been addressed by the corrective action.

HED 45: The identification of burned out indicator light bulbs has not been addressed by the corrective action.

HED 56: The need for containment purge and vent controls on front panels has not been addressed by the corrective action.

- Due to the safety significance of these findings they were found to warrant higher importance and schedule categories than those proposed.

HEDs 19 and 20. The isolation of the recirculation pump during an accident such as a LOCA is important and those HEDs associated with its control therefore warrants a more immediate correction than that indicated in the summary report.

HED 23 and 24. The emergency diesel generators are extremely important in case of a loss of AC power. Therefore the correction of the arrangement and design of the controls and displays for this operation should be considered of high importance and implemented in the earliest possible time-frame.

HED 43. The water level in the torus is an important safety related parameter for operators and because a failure of the common standpipe would result in a loss of all indication for this parameter this deficiency is considered important enough to warrant a more immediate corrective action schedule.

- General Comment

HED 48. Removal of this indicator should be postponed until full consideration has been given to the operators needs during any affected tasks.

Group 5: Computer System Addition

The discrepancies listed in this group primarily address the absence and poor location/arrangement of information or feedback required by the operator to conduct operations. The corrective action described for these deficiencies requires the providing of needed parameter information on the plant computer CRT display which apparently is planned for implementation in 1987. Several concerns have surfaced as a result of the evaluation of these deficiencies and the suitability of the corrective action. They are discussed below. Because of the number of concerns raised with regard to this action we are not able to find the corrective actions fully adequate at this time.

- The extraordinary amount of information that appears to be missing from the display panels is to be corrected by software rather than hardware additions. It appears that there is an extensive reliance on the computer CRT display for correction of seemingly important information needs. A concern with the use of software additions is the failure to provide more basic hardware changes to the control boards with which the operators are considerably more accustomed to using.

- The provision of needed information on the computer system will clearly require some delay before implementation. The schedule category for this is 3, the refueling outage of 1987. This appears to be a long delay before providing these information needs to the operator. In addition, considering the operators' prior habits (use of hardware: e.g., meters, recorders) some further time will be required to familiarize and train the operators to use the computer as a source of information.

- A related concern with the use of the CRT display to provide missing or poorly arranged information is whether it would indeed correct the deficiency and not create any additional problems. An obvious concern may be that the operator who has relied on a poor display arrangement to monitor a system

for many years may continue to do so if the arrangement itself is not corrected. See HED No. 1.

- Additionally, it is not clear if consideration has been given to the reduction of the computer capability for displaying other operator information needs for which it was initially required.

- The following is a listing of the HED and corrective action number with either a generic or specific reason for concluding that the corrective action descriptions are inadequate.

  - The description of the deficiency and/or corrective action is too brief, general or indefinite to allow a valid assessment.

    HED Nos. 2, 7, 8, 19, 20

  - The description of the corrective action only partially corrects the deficiency.

    HED Nos. 2, 3, 4, 13, 19
    Recorders that are unreadable should be removed when replaced with an improved display.

- Due to the safety significance of this finding it is found to warrant higher importance and schedule categories than those proposed.

  - HED 1. The states of the torus and drywell variables are safety related parameters necessary to monitor important operations. The HED associated with the layout of these controls and displays should be addressed in a closer time frame than that proposed.

Group 6: Control Room Environment

The discrepancies listed in this group contain findings relative to the operators working environment. The corrective actions for these discrepancies have been evaluated to the extent possible. However, given our unfamiliarity with the control room and limited information in the report, several corrective actions can not be fully assessed.

- The following descriptions of corrective actions for identified discrepancies were found to be adequate.

  HED Nos. 5, 6, 8

- The following HEDs and corrective actions could not be assessed with any validity due to our unfamiliarity with the control room and the limited information submitted by the licensee.

  HED Nos. 1, 2, 7, 8, 9, 12, 13

- The following HEDs all relate to a poor HVAC system which appears to need extensive modification or maintenance. The proposed corrections fall considerably short of full maintenance or lack a definite planned correction.

  HED Nos. 3, 4, 10, 11

- The HED description (No. 9) states that "some controls can be jarred by walking by." It is unclear how the rearrangement of the traffic pattern will fully correct this HED. The licensee should evaluate the need for a guard-rail to protect vulnerable controls from inadvertent actuation.

Group 7: No Action Required or Deficiency Corrected

This group contains both HEDs that have been corrected and those HEDs that were assessed as requiring no action. Although the corrective

actions already completed were found to be adequate, the justifications for not correcting HEDs were sometimes found inadequate as described below.

- The adequacy of the following justifications for not requiring corrective action cannot be fully evaluated due to the limited description of the deficiency.

  HED Nos. 10, 13, 15, 16, 18, 19, 20, 24

- The following justifications for not requiring corrective action is inadequate for specific reasons as described.

  HED 11. Inconsistent color codes used for the position displays and positions of air operated scram valves for each rod. This display is considered of high importance as the operation of the air operated scram is crucial for correct operation and shutdown of the reactor. Additionally, a justification for not correcting a discrepancy should not rest upon the fact that the operator has adapted to a poor design feature (as the licensee has indicated). A design discrepancy may prove to be hard (to adapt to) for an operator under duress (during an accident).

  HED 13. The isolation condenser control switch is on 5F/6F instead of 1F/2F. The licensee states that this is not a serious problem: no corrective action recommended. Two concerns related to this finding lead us to conclude that the justification is inadequate. Firstly, it is unclear as to why this discrepancy was initially flagged as a problem. Secondly, the isolation condenser control switch is considered to be of safety importance and it does not appear to have received the appropriate importance category.

  HED 14 and 16. The licensee indicates there are controls on the board that are never used but does not propose to remove them.

HED 15. A surplus of electrical displays could confuse operations. Licensee states that there is no evidence of operator confusion. The need for these displays should have been confirmed by a task analysis and verification, and a justification then provided.

HED 22. The justification that operators have adapted to a deficiency is inadequate for an HED that may cause significant problems for an operator during emergency operations (under stress).

The following justifications were found to be adequate.

HED Nos. 12, 17, 21, 23

## CONCLUSION AND RECOMMENDATIONS

GPU Nuclear's Summary Report for the DCRDR demonstrates a commitment towards meeting many of the requirements of Supplement 1 to NUREG-0737. The summary report submitted provides documentation and discussion relevant to the Review Team Organization and Structure, the Functions and Task Analysis, a Summary of Conclusions and the Corrective Action Program or the manner in which deficiencies are to be resolved. A table attached to the report contains a summary of the review findings classified according to the nature of corrective action. GPU Nuclear has made reference to their program plan for the DCRDR for those areas of the review not discussed in the summary report.

Based upon the documentation both in the summary report and the program plan, the licensee has attempted to meet the requirements that a DCRDR entails. However, sparse discussion of most requirements has prevented a valid assessment of the licensee's efforts. Those include the following requirements: 1) to conduct a functions and task analysis, 2) to conduct a control room survey, 3) assessment of HEDs', 4) the verification of improvements, and 5) the coordination of the DCRDR with other improvement programs. Due to the brevity of discussion in the summary report and inadequacies in the proposed corrective actions, and justifications for HEDs left uncorrected we conclude that a more definitive presentation is

necessary to establish the degree to which the requirements of Supplement 1 to NUREG-0737 have been met. Therefore, we recommend that a pre-implementation audit be conducted to clarify the points raised in this evaluation report and to provide GPU Nuclear with additional feedback. The concerns raised as a result of this evaluation are summarized below and should be addressed by the licensee during the audit.

- Identification of task assignments and levels of effort for DCRDR team members and supplemental staff.

- A description of the scope and procedures used for performing the operating experience review.

- A description of the purpose and content of the control room inventory.

- Control room survey guidelines, procedures, sample checklist and data collection forms used.

- Identification of the scope of the function and task analysis; clarification of differences between the "first-cut" procedures and finalized EOPs. A description of the process used to identify plant-specific information and control needs and to establish the characteristics required of needed instruments and controls. A description of the auditable record that contains the data generated from the functions and task analysis.

- A description of the HED assessment process; the manner in which HEDs were assigned to categories; definition of importance categories to assess HED significance; and the rationale used for including safety significant HEDs in relatively low importance and scheduling categories.

- A description of the process used to select design improvements and to ensure the integration of design modifications/changes.

- A description of the process used to verify that design improvements will provide the necessary corrections without introducing new HEDs.

- A description of the system or the methodology used for coordinating the DCRDR with other improvement programs.

- A description of the analysis used to develop proposed design changes and the justification for HEDs to be left uncorrected. (Various inadequacies with respect to proposed corrective actions, importance and scheduling categories for certain HEDs, and justifications for HEDs left uncorrected have been described above.)

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Oyster Creek
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ENCLOSURE 2

# HFEB SALP INPUT

# FOR

# OYSTER CREEK

The DHFS/HFEB Salp Input for the Oyster Creek Nuclear Generating Station is provided for your use. This evaluation is based on our review of the licensee's Program Plan and Summary Report Submittals.

Our SALP ratings to date for Oyster Creek are as follows:

1. Management Involvement and Control in Assuring Quality - The licensee exhibited evidence of prior planning.

   Rating: Category 2

2. Approach to Resolution of Technical Issues from a Safety Standpoint - The licensee has demonstrated viable approaches, but lacks thoroughness and depth.

   Rating: Category 3

3. Responsiveness to NRC Initiatives - The licensee provides generally timely responses.

   Rating: Category 2