December 4, 1996

Mr. Nicholas J. Liparulo, Manager
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Nuclear and Advanced Technology Division
Westinghouse Electric Corporation
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SUBJECT: COMMENTS ON AP600 RELATED OPEN ITEMS ASSOCIATED WITH ELEMENT 2 OF THE HUMAN FACTORS ENGINEERING PROGRAM REVIEW MODEL (HFEPRM)

Dear Mr. Liparulo:

In a letter to Westinghouse dated August 12, 1996, the Nuclear Regulatory Commission staff provided comments on a draft version of the AP600 operating experience review report (WCAP-14645). WCAP-14645 addresses Element 2 of the HFEPRM. Westinghouse revised the report to address the staff's comments and submitted Revision 1 of WCAP-14645 in a letter dated October 17, 1996. The staff has provided an update on the current status of the human factors review of the AP600 design certification related to Element 2 of the HFEPRM based on the revised WCAP-14645 and Section 18.3 of the AP600 standard safety analysis report as an enclosure to this letter.

If you have any questions regarding this matter, you can contact me at (301) 415-1141.

Sincerely,

original signed by:

William C. Huffman, Project Manager
Standardization Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Docket No. 52-003

Enclosure: AP600 DSER Open
Item Resolution
of Element 2
Operating Experience

cc w/enclosure:
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Docket No. 52-003
AP600

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AP600 DSER Open Item Resolution
Element 2 Operating Experience

To address the Element 2 DSER open items, Westinghouse submitted draft WCAP-14645 (Revision 0), "Human Factors Engineering Operating Experience Review Report for the AP600 Nuclear Power Plant," dated May 10, 1996. Westinghouse also submitted draft WCAP-14644, "AP600 Functional Requirements Analysis and Function Allocation," dated May 1996. These documents were reviewed and the DSER open items re-evaluated based upon their contents. The results of this review were documented in a letter from NRC to Westinghouse dated August 12, 1996.

The August 12, 1996, letter was clarified during a conference call between NRC, Westinghouse and BNL on September 17, 1996. Westinghouse then responded with letter NSD-NRC-96-4845, dated October 17, 1996. Included with this letter was Revision 1 of WCAP-14645, "Human Factors Engineering Operating Experience Review Report for the AP600 Nuclear Power Plant." Also considered in this current review was Section 18.3 of the SSAR, Revision 9.

These new documents were reviewed and the DSER open items re-evaluated based upon their contents. The results are described below.

The following is an overview of the status of the results of the review for all Element 2 open items:

Open Item	#OITS	#Current Status	
18.3.3.1-1	1316	Predecessor Plant and Systems	Resolved
18.3.3.1-2	1317	Industry HFE Issues	Action W
18.3.3.1-3	1318	Related HSI Technology	Resolved
18.3.3.1-4	1319	Operator Interviews	Action W
18.3.3.2-1	1320	OER Issue Analysis	Resolved
18.3.3.2-2	1321	Documentation	Resolved
18.3.3.2-3	1322	Tracking System Incorporation	Action W

Enclosure

18.3 Operating Experience Review

Open Item 18.3.3.1-1: Predecessor Plant and Systems

1. Predecessor Plant and Systems

Criterion: The review should include information pertaining to the human factors issues related to the predecessor plant(s) or highly similar plants and plant systems.

DSER Evaluation: Section 18.9.8.1.1 of the SSAR, WCAP-14075, and the Westinghouse responses to Q440.32 and Q620.89 discuss the Westinghouse low-pressure reference plant. WCAP-14075 provides a comparison between the AP600 and the low-pressure reference plant, and documents the major functional, system, and I&C similarities with the AP600 design. This low-pressure reference plant is a composite consisting of 25 (or 26) separate systems, having generic applicability to a broad range of Westinghouse pressurized water reactor (PWR) plants. It is not clear from the documentation how to apply this concept to the OER. The documentation provided by Westinghouse to date does not clearly address whether the operating experience of a given selected plant or type of plant was reviewed (as predecessors to the AP600) for the OER or whether experience was reviewed at the systems level, considering the 25 (or 26) systems that comprise the low pressure reference plant. Tables 1 and 4 of WCAP-14075 could potentially be used for this type of process.

Particular attention should be given to operating experience at predecessor plants. If the design is considered to be completely new (without any predecessor), more emphasis must be given in the design stage to prototyping, trade studies, and validation testing. A new plant without any predecessor has implications for underlying assumptions that impact the staffing, training, and procedures.

Proposed Resolution: In Section 1.4.2 of WCAP-14644 Westinghouse clarifies the predecessor plant for the AP600 as "the generic PWR design for currently licensed Westinghouse nuclear power plants." Table 1 then illustrates in detail how the Critical Safety Functions for the AP600 are the same as for current Westinghouse PWR plants. The other portions of this WCAP then illustrate the differences between the Predecessor plants and the AP600. Thus, current Westinghouse PWRs, in general, serve as the predecessor for the AP600 nuclear power plant.

In the AP600 Operating Experience Review, Westinghouse has addressed current Westinghouse PWRs. This is illustrated in WCAP-13559, as well as the additional documents listed in the Westinghouse response to RAI 620.53. Further, WCAP-14645, as noted in Section 2.0 of that WCAP, includes both Westinghouse and non-Westinghouse PWRs. It also addresses pertinent BWR issues and a pressurized heavy water reactor where applicable to the AP600 design. Thus, Westinghouse has included in their OER information pertaining to the human factors issues related to both the AP600 predecessor plant(s) and highly similar plants and plant systems.

Based on the information provided, this DSER item is resolved and the criteri-

on is satisfied.

STATUS OF OPEN ITEM: Resolved

Open Item 18.3.3.1-2: Industry HFE Issues

2. Recognized Industry HFE Issues

Criterion: Appendix B of the HFE PRM describes recognized nuclear power industry issues, organized into the following categories:

- USIs
- GSIs
- Three Mile Island (TMI) issues
- NRC generic letters and information notices
- studies by the NRC Office of Analysis and Evaluation of Operational Data (AEOD)
- low power and shutdown issues
- operating plant event reports

In addition, TMI Item I.C.5 of NUREG-0737, "Procedure for Feedback of Operating Experience to Plant Staff," was included as an HFE issue.

Evaluation: The Westinghouse documents listed in Section 18.3.2.1 of this report, as well as the additional documents listed in the Westinghouse response to Q620.53, indicate that the overall approach to an OER for review of recognized industry issues appears to be thorough. Westinghouse has performed extensive literature reviews and has maintained up-to-date knowledge of advanced systems and HSI research and experience. Further, it appears that Westinghouse has, to some extent, addressed each of the categories listed above.

The Westinghouse documents were further reviewed to determine if individual issues within these categories were adequately treated. The review was somewhat difficult to conduct because the information was distributed across several documents and was not very detailed. In particular, much of the discussion of how these industry issues are addressed in the AP600 design was presented as systems-related descriptions and did not address human factors or operator performance issues. Westinghouse has not provided a consolidated OER that discusses these issues in detail.

As examples of the above-noted lack of human factors detail for industry issues, a discussion of the review of one item from each category is provided below. These items are only examples, and Westinghouse should ensure that the

OER addresses the human factors aspects of the issues identified in Appendix B of the PRM, and those issues in Chapter 20 of this report that are related to human factors engineering.

USIs

USI A-47, "Safety Implications of Control Systems," relates to the implications of failures of non-safety-related control systems and their interaction with the control room operators. Chapter 1 of the SSAR only discusses the I&C aspects, and does not discuss how the AP600 design will help the operators in the event of a loss or failure of non-safety related control systems. Sections 7.1.3 and 7.7 of the SSAR discuss the AP600 control systems, but from an I&C perspective only. The level of automation appears to be higher than in current plants, and the type of controls differ in that they are primarily soft controls. An operator in the AP600 MCR will be more of a supervisory controller and plant monitor than in current plants. On a loss of portions (or all) of the automatic control systems, the operator will have to have an accurate understanding of the plant's status, and will then make the transition to an active controller under conditions that may be much less than optimal because of a loss of indications and a plant transient in progress. This transition was problematic in current plants, and will be different and potentially more difficult in the AP600. The human factors aspects of USI A-47 were not discussed in the Westinghouse documentation reviewed by the staff.

GSIs

GSI-57, "Effects of Fire Protection System Actuation," addresses spurious and inadvertent actuations of fire protection systems. Such actuations have often been caused by operator errors during testing or maintenance. There does not appear to be any discussion of the ways in which the AP600 HSI will help to minimize these problems.

TMI Issues

10 CFR 50.34(f)(2)(vi), "Venting of Noncondensible Gases (II.B.1)," addresses the capability to vent gases from the reactor coolant system. Plant operators should be capable of monitoring the status of noncondensible gases in the reactor coolant system, and should have clear, unambiguous indication of the conditions under which gas release must be initiated. They should then be able to easily control any necessary venting. The discussion of human factors or HSI issues associated with this operation in Chapter 1 and Section 5.4.12 of the SSAR is very limited, and should be expanded to address these issues.

NRC Generic Letters

In Generic Letter 91-06, "Resolution of Generic Issue A-30, 'Adequacy of Safety-Related dc Power Supplies,' Pursuant to 10 CFR 50.54(f)," the NRC outlines certain monitoring, surveillance, and maintenance provisions for safety-related direct current (dc) systems. Westinghouse addresses this item in Chapter 1 and Section 8.3.2 of the SSAR; however, not all of the items identified in Enclosure 1 to the generic letter were addressed. The control

room design does not appear to contain all of the listed, separately and independently annunciated, alarms and indications. Also, the presence of bypassed and inoperable status indication for circuit breakers and other devices could not readily be verified. There are many recommendations for maintenance, surveillance, and test procedures. Some means for tracking these recommendations needs to be established, because these procedures are not yet written for the AP600. One method is the HFE issues tracking system.

NRC Information Notices

Information Notices 93-47, "Unrecognized Loss of Control Room Annunciators," and 93-81, "Implications of Engineering Expertise on Shift," have not been addressed in the documentation reviewed to date.

AEOD Studies

Westinghouse has reviewed a number of AEOD reports as listed in WCAP-13559. These reports were judged by Westinghouse either to be not applicable to the AP600 design, or to pertain to a section of the SSAR other than Chapter 18 (except one 1989 report that did pertain to Chapter 18). NUREG-1275 summarizes a number of earlier AEOD studies in the human performance area. This report should be carefully reviewed by Westinghouse and applied to the AP600 design.

Low Power and Shutdown Issues

A current area of active NRC work is that of the risk associated with operation during low power and shutdown. The NRC has identified the operator-centered and human factors issues as particularly important in this area. The current status of these issues is contained in NUREG-1449. The applicant has referred to a Westinghouse low power and shutdown report, but that report was unavailable to the staff in time to support this stage of the review.

Industry-Based Operating Experience Documents

In its response to Q620.04, Westinghouse indicates that it has reviewed some Institute for Nuclear Power Operations (INPO) documents that provide an important insight into operating experience as they apply to advanced reactors. However, the results of the Westinghouse review of these documents were not submitted to the staff in time to support this stage of the review.

Proposed Resolution: As noted in the DSER evaluation Westinghouse had performed a fairly thorough review of various industry issues that would have pertinent operating experience to the AP600. They have performed extensive literature reviews and have continued to maintain an up-to-date knowledge of advanced systems and HSI research and experience, as illustrated by their reference lists contained in WCAP-14645 (Rev 1). However, the original documentation submitted was lacking with respect to how the human factors and operator performance aspects were reviewed and addressed. As a result Westinghouse developed WCAP-14645, to address this concern. Table 1 of the WCAP provides a detailed summary of the results of the Westinghouse OER relative to the industry operating experience issues identified in the HFE PRM

(NUREG-0711), Appendix B. Specifically, Table 1 of WCAP-14645 addresses Appendix B, Sections B.1-USIs/GSIs, B.2-TMI Issues, B.3-NRC Generic Letters and Information Notices, and B.4-AEOD Studies. Table 1 also covers B.5-Low-Power and Shutdown Issues and B.6-Operating Plant Event Reports by addressing the BNL Technical Report E2090-T4-3-1/95, HFE Insights for Advanced Reactors Based Upon Operating Experience.

In Table 1, Westinghouse discusses how the human factors/human performance issue is addressed by the AP600 design. The Table also identifies that the item is: Not Applicable to AP600, input into the Design Issues Tracking System, or the responsibility of the COL.

Section 3.0 and Table 1 of the draft WCAP-14645 were reviewed to determine if Westinghouse had satisfactorily addressed each of the issues listed in Appendix B of the HFE PRM. The below Table lists the results of this review.

Summary of Review of AP600 Applicable Issues from Westinghouse draft OER Report (WCAP-14645)

	Total Items Reviewed	Acceptably Addressed	Not acceptably Addressed
USI/GI	20	15	5
HF Gen Issues	7	7	
TMI Items	27	22	4
GL/IN	5	5	
BNL OER Report	43	40	3
HSI Tech	38	30	9
Operator Interviews	8 References	8	
AEOD Items	13	13	
Totals	161	140	21

notes:

1. All items of the draft WCAP-14645 were reviewed with the exception of the items in the BNL OER Report. In this category about 50 percent of the items were reviewed.
2. The "Acceptably Addressed" column includes items classified as N/A by Westinghouse, excluded by NRC and Westinghouse in conference call, placed in the tracking system by Westinghouse, and those with adequately described activities to address the HFE concern associated with the item. There were 18 items that were either N/A by Westinghouse or excluded per

the NRC/Westinghouse call; three items entered into the tracking system; and 119 with adequately described activities.

3. The one item added to the criterion for this element beyond those listed in Appendix was the TMI item I.C.5. WCAP-14645 states that this is a COL responsibility.

Based on this review, the staff considered it necessary for Westinghouse to do additional work on the 21 items in the last column. Westinghouse performed additional analysis and documented it in WCAP-14645 (Revision 1), the Westinghouse OER Report. Discussed below were the staff's concerns with the draft WCAP-1645 and the current status of this open item based on the staff's review of WCAP-1645 (Revision 1).

For ten of these 21 items the draft WCAP-14645 referred only to the general HSI design process and did not tie the process to the specific issue being described or provide tracking to later ensure that the process had in fact addressed the issue. These ten items are: Table 1, Item 43 (TMI item 2xxi); Table 2, ref. 2.1, items 4,6,7, and ref. 2.2, items 1 through 4; and Table 3, ref. 3.3, items 1 and 2. For two of these items (Table 1 - Item 43, and Table 2 - ref. 2.1, Item 6) WCAP-14645 (Revision 1) provides additional satisfactory information; for the other eight items, Westinghouse has incorporated each issue into the Design Issues Tracking System. This is approach is acceptable.

The additional 11 items in the "Not acceptably Addressed" Column were:

USI/GIs:	1 (A44), 2 (A47), 4 (B-32), 7 (GI-51), 20 (GI-130)
TMI Items:	35 (2v), 37 (2xi), 46 (2xxvii)
BNL OER Rpt:	78, 157, 165

Of these 11 items, nine have now been acceptably addressed by WCAP-14645 (Revision 1). Two items, 7(GI-51) and 165, still are open. Each of the eleven items is discussed below.

Item 1 (A44): WCAP-14645 (Revision 1) provides a significant amount of detail on the AP600 design to address station blackout (SBO). The passive systems provide the main defense against SBO, with a one-time realignment of valves. Regarding monitoring instrumentation, the QDPS is powered from a Class 1E dc UPS with sufficient battery capacity for 72 hours. More detail on the DC power system is given in SSAR section 8. This item is acceptably addressed.

Item 2 (A47): Specific issues were noted in the DSER open item 18.3.3.1-2, A-47. The draft WCAP-14645 discusses the reliability and diversity of the plant control system, which is also described in the SSAR. WCAP-14645 (Revision 1) discusses analyses performed in WCAP-14477, "Adverse Systems Interactions Report", related to plant control system failures, and the ERGs, which provide contingency actions for system failures, including control systems. This item is acceptably addressed.

Item 4 (B-32): The draft WCAP-14645 stated that this item was NA since service water in AP600 is nonsafety-related. WCAP-14645 (Revision 1) states

that the Service Water System temperature is monitored and alarmed in the control room on low temperature. This provides a warning of potential icing conditions. This item is acceptably addressed.

Item 7 (GI-51): The draft WCAP-14645 did not address the instrumentation to be used by operators for monitoring for the buildup of clams, mussels, and corrosion products. GI-51 also references Generic Letter 89-13 which has more detail about the testing and instrumentation needed to ensure continued operability of open cycle service water systems. This item has not been adequately addressed by WCAP-14645 (Revision 1) or for Chapter 18, SSAR (Revision 9).

Item 20 (GI-130): A potential applicability to single unit sites was noted in Appendix B of the PRM, but was not addressed by the draft WCAP-14645. WCAP-14645 (Revision 1) addresses internal cross ties for a single unit AP600. This item is acceptably addressed.

Item 35 (2v): This item deals with automatic indication of bypassed and inoperable systems, which is an important aspect of the operators' situation awareness. The draft WCAP-14645 only addressed protection systems, which was too narrow of an interpretation, since the item relates more generally to safety systems. WCAP-14645 (Revision 1) discusses generally the manner in which the AP600 provides for situation awareness, including the wall panel information system and bypassed and inoperable systems information. SSAR Revision 9, in Sections 1.9.3 (2v) and 1A, states that the AP600 meets all the recommendations of Regulatory Guide 1.47 for bypassed and inoperable indication of plant safety systems. This item is acceptably addressed.

Item 37 (2xi): WCAP-14645 (Revision 1) clarified that the indication provided for SRVs is "direct." This, together with the added discussion for this item in WCAP-14645 (Revision 1) acceptably addresses this item.

Item 46 (xxvii): WCAP-14645 (Revision 1) discusses the broad range of routine and accident conditions that are addressed by the radiation monitoring system (RMS). It also discusses how the RMS is integrated into the CR displays. This item is acceptably addressed.

Item 78: This item addresses change in control modes during transient situations. WCAP-14645 (Revision 1) discusses an example new system and new automation that will help in this area. The WCAP also discusses the use of the function based task analyses to assist in the design in this area. Further, the AP600 design has an operator alert when a control system switches from automatic to manual. In this case, the computerized alarm response procedure will provide the operator with prompt access to the associated soft control. This item is acceptably addressed.

Item 157: WCAP-14645 (Revision 1) adequately addresses this item for all noted systems' heat exchangers with the exception of the open cycle service water system. The service water system is covered by Item 7 above. This item is acceptably addressed.

Item 165: This item relates to local valve position indication (VPI).

NUREG/CR-6146 found that many manual valves, even those found to be the most risk significant manual valves, lacked local position indication. Without such explicit indication, the position of the valve is inferred from stem position (for rising stem valves) or determined by checking the valve in the closed direction. Both methods have potential problems, as discussed in the NUREG/CR. Operating experience review (OER) also identified incidents that were caused by poor or missing local VPI. Valve manufacturers reported that the cost of providing a position indicator on a new valve was relatively small, whereas the costs of backfitting such indication on in-place valves would vary considerably and could be prohibitive. Thus, while adding position indication in an existing plant might only be feasible for a selected set of valves, it could be specified for many (or all) valves in the design of a new plant for relatively low cost. It should be noted that the nature of the position indication should be appropriate to the use of the valve. WCAP-14645 (Revision 1) only commits to local VPI for valves "where appropriate" and states that "most valves" will show their position by their mechanical properties. This item has not been acceptably addressed.

Westinghouse should provide additional information addressing the staff's concerns for the items 7 and 165 above.

During the review of draft WCAP-14645 the staff reviewed only 50 percent of the items from the BNL OER Report and, three were found not to be adequately addressed. As a result, in the August 12, 1996, letter from the NRC, Westinghouse was asked to review the remaining items in WCAP-14645 that responded to this report and correct any with deficiencies similar to those noted for items 78, 157, and 165 above. Revision 1 of the WCAP does not appear to have addressed this item.

The staff also noted that Westinghouse should explain how they will assure that all of the items noted as COL responsibility will be effectively and specifically transferred over to the COL. In Section 3.0 of Revision 1 to WCAP-14645, Westinghouse has summarized the 17 items from Table 1 that are totally or partially the responsibility of the COL. The exact transfer mechanism has not yet been specified.

Still open on this item are: Items 7 and 165, re-review by Westinghouse of 50 percent or BNL report items, and describing the COL transfer mechanism.

STATUS OF OPEN ITEM: Action W

Open Item 18.3.3.1-3: Related HSI Technology

3. <u>Related HSI Technology</u>

Criterion: The OER should address related HSI technology. For example, if touch screen interfaces are planned, HFE issues associated with their use should be reviewed.

Evaluation: Westinghouse will use some HSI technologies that are not typically used in currently operating nuclear plants (e.g., large screen displays and touch screens). A comprehensive list is needed of the new HSI technologies planned for use in the AP600 design. Then pertinent HFE issues may be reviewed and addressed, as appropriate. The staff recognizes that Westinghouse is aware of research in this area and activities associated with HSI technology in other industries (see Westinghouse's response to Q620.53). Further, Westinghouse has proposed V&V evaluations (in Section 18.5 and Table 18.8.2-1 of the SSAR) that would help to address these issues. However, the materials received from Westinghouse before preparing this report do not directly address this aspect of the OER.

Proposed Resolution: Draft WCAP-14645 addresses this criterion in Section 4.0, "Related Human System Interface (HSI) Technologies Where Little or No Nuclear Plant Experience Exists," and in Table 2. The WCAP identifies three such HSI technologies for use in the AP600: soft controls, computerized procedures, and large screen (wall panel) displays. Westinghouse has reviewed the operating experience of soft controls and large overview type displays to identify human factors issues. There are 38 identified issues from these two areas listed in Table 2 of the WCAP. However, in the draft OER there was no information related to operating experience in the area of computerized procedures. A review of Table 1 and the information provided for procedure-related items indicated that Westinghouse has in fact performed some such reviews. In WCAP-14645 (Revision 1), Westinghouse clarified this by adding a discussion in Section 4.0 about the AP600 computerized procedure system (CPS). This states that the AP600 CPS is dynamic and interactive with the remaining AP600 HSI. No comparable system with relevant operating experience was found in other industries. If any such experience is published, Westinghouse has committed to reviewing it and identifying any human factors issues to be addressed.

Additionally, there were nine issues in Table 2 of the draft WCAP that required further information from Westinghouse. These items were satisfactorily addressed in WCAP-14645 (Revision 1), as discussed in the above item.

Also in section 4.0 of WCAP-14645 (Revision 1), Westinghouse summarized the seven items from Table 2 that are the responsibility of the COL applicant.

Based on the information provided, this DSER item is resolved and the criterion is satisfied.

STATUS OF OPEN ITEM: Resolved

Open Item 18.3.3.1-4: Operator Interviews

4. Operator Interviews

Criterion: Operator interviews should be conducted to determine operating experience related to predecessor plants or systems. The following topics should be included in the operator interviews:

- Plant Operations
  - Normal plant evolutions (e.g., start-up, full power, and shutdown),
  - Instrument failures (e.g., safety-related system logic & control (SSLC) unit, fault tolerant controller (NSSS), local "field unit" for multiplexer (MUX) system, MUX controller (BOP), break in MUX line),
  - HSI equipment and processing failure (e.g., loss of video display units (VDUs), loss of data processing, loss of large overview display),
  - Transients (e.g., turbine trip, loss of offsite power, station blackout, loss of all feed water, loss of service water, loss of power to selected buses/CR power supplies, and safety relief valve (SRV) transients),
  - Accidents (e.g., main steam line break, positive reactivity addition, control rod insertion at power, control rod ejection, anticipated transient without scram (ATWS), and various-sized loss of coolant accidents (LOCAs)), and
  - Reactor shutdown and cooldown using remote shutdown system.
- HFE/HSI Design Topics
  - Alarm/annunciation
  - Display
  - Control and automation
  - Information processing and job aids
  - Real-time communications with plant personnel and other organizations
  - Procedures, training, staffing, and job design

Evaluation: Westinghouse's responses to Q620.12 and Q620.52 discuss some of the interviews that have been conducted by Westinghouse to date. Complete documentation of the content and results of the interviews have not yet been

made available to the staff. The references contained in the response to Q620.52 contain some advanced and potentially applicable material in this area; however, Westinghouse should relate the work discussed in these papers and reports to the AP600 design. Further, the appropriateness of the subjects and the content of the interviews must still be determined after the information discussed for Criterion 1 ("Predecessor Plant and Systems") and Criterion 3 ("Related HSI Technology") of this section is provided.

Proposed Resolution: WCAP-14645 addresses operator interviews in Section 5.0 and Table 3. They state that interviews have been conducted during plant operations and after events. Eight specific reports are cited that document the operator interviews. These reports are: two NUREG/CRs, two Westinghouse proprietary reports, one Westinghouse non-proprietary WCAP, one EPRI report, one utility (PG&E) letter, and one Canadian report. These reports were reviewed by the staff to determine the scope of the operator interviews. All of the topics above were addressed to some extent in the eight reports with the exception of remote shutdown and staffing. A number of issues were identified based on the interviews, as documented in Table 3. The issues cover many areas including: emergency situations, cognitively demanding situations, procedures, soft controls, alarms and alarm systems, SPDS, plant startup, and feedwater control. The Westinghouse treatment of the issues is primarily based on references to earlier information in the OER report. Westinghouse should discuss how the issues identified in column 2, Table 3, were selected (and the criteria used to determine their applicability to the AP600 design) from the numerous issues covered by the eight reports.

This item remains open pending Westinghouse's response to the two topics not addressed in the scope of the interviews (remote shutdown and staffing) and a discussion of how issues were selected from the eight reports for inclusion in column 2, Table 3 of WCAP-14645.

STATUS OF OPEN ITEM: Action W

Open Item 18.3.3.2-1: OER Issue Analysis

1. Analysis Content

Criterion: The issues should be analyzed with regard to the identification of:

- Human performance issues, problems and sources of human error should be identified.
- Design elements which support and enhance human performance should be identified.

Evaluation: The review process discussed in Section 18.3 of the SSAR and the Westinghouse response to Q620.41 appears thorough and generally addresses the criterion. However, from the review of a number of items, summarized in Section 18.3.3.1, "Criterion 2: Recognized Industry HFE Issues," of this report, it appears that the OER performed to date did not sufficiently analyze the experience with regard to these criteria. As the OER is completed,

Westinghouse should ensure that these aspects are addressed and documented in the OER review.

Proposed Resolution: In WCAP-14645 Westinghouse identified human performance issues and problems, and sources of human error. They also identified the various aspects of the AP600 design and design process that will address these problems by supporting and enhancing human performance. During review of the draft OER a small percentage of the responses to the issues were identified by the staff for further follow up by Westinghouse; however those appeared to be the exception to a well-thought out and thorough analysis. Furthermore, Westinghouse reanalyzed those identified by NRC as needing follow up and documented the results in WCAP-14645 (Revision 1). All but two of the issues were satisfactorily resolved with the submission of WCAP-14645 (Revision 1). These two items (7, 165) needing further follow up are being tracked by another open item (OITS #1317).

Additionally, in Section 1 of WCAP-14645, Westinghouse states that they will continue to review current plant operating experience and as new HFE issues are identified they will address and track to resolution those issues applicable to AP600.

Based on the information provided, this DSER item is resolved and the criterion is satisfied.

STATUS OF OPEN ITEM: Resolved

Open Item 18.3.3.2-2: Documentation

2. Documentation

Criterion: The analysis of operating experience should be documented in an evaluation report.

Evaluation: From the review performed on the documentation received before preparing this report, it appears that the OER has not yet been fully completed or documented into one integrated report. As an example, WCAP-13559 discusses many industry documents that were reviewed, but little detail is provided and it is not clear how or if Westinghouse used the results of this review for the AP600 HFE design.

Proposed Resolution: As described in the above sections Westinghouse has consolidated their operating experience review work into a single document, WCAP-14645 titled, "Human Factors Engineering Operating Experience Review Report for the AP600 Nuclear Power Plant," Revision 1. This report addresses all of the areas and issues identified in the HFE PRM, Appendix B as well as the additional related industry issues in BNL Technical Report E2090-T4-3-1/95, HFE Insights for Advanced Reactors Based Upon Operating Experience. Based on the information provided, this DSER item is resolved and the criterion is satisfied.

STATUS OF OPEN ITEM: Resolved

Open Item 18.3.3.2-3: Tracking System Incorporation

3. Incorporation into the Tracking System

Criterion: Each operating experience issue determined to be appropriate for incorporation into the design (but not already addressed in the design) should be documented in the HFE issue tracking system.

Evaluation: As discussed in Section 18.2.3.4 of this report, Westinghouse has not yet described an acceptable HFE issues tracking system (Open Item 18.2.3.4-1). Additionally, this tracking system should already have items pertinent to the AP600 design entered into it. For example, the tracking system should include human factors items or issues that were identified during the development of the OER, but for which design (or procedural) resolutions have yet to be determined. The maintenance and testing issues noted in Generic Letter 91-06 and discussed in Section 18.3.3.1 of this report are examples of this type of issue. Therefore, any identified items that have not been incorporated into the design documentation in some fashion should be entered into the HFE issues tracking system when the OER is completed.

Proposed Resolution: Westinghouse should provide the staff with evidence that the tracking system has been successfully implemented for HFE issues. At a minimum, database entries that have been made by Westinghouse to date, for those HFE issues that require tracking, should be provided for staff review. Related design file documents which support the database entries should be provided for a sample of the HFE entries that have been made to date in the database.

STATUS OF OPEN ITEM: Action W