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September 6, 2005
L-05-140

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Beaver Valley Power Station, Unit Nos. 1 and 2
BV-1 Docket No. 50-334, License No. DPR-66
BV-2 Docket No. 50-412, License No. NPF-73
Response to a Request for Additional Information (RAI dated August 2, 2005) in Support of License Amendment Request Nos. 302 and 173, Extended Power Uprate

By letter dated August 2, 2005, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) pertaining to FirstEnergy Nuclear Operating Company (FENOC) License Amendment Request (LAR) Nos. 302 and 173 (Reference 1). These LARs propose an Extended Power Uprate (EPU) for Beaver Valley Power Station (BVPS) Unit Nos. 1 and 2. The EPU LAR proposes increasing the licensed power level approximately 8 percent above the current licensed power level.

Enclosure 1 contains the non-proprietary FENOC responses to all of the August 2, 2005 RAI questions except question number 4. The response to question number 4 is not included in this enclosure because it contains proprietary information.

Enclosure 2 contains the proprietary FENOC response to question number 4 of the August 2, 2005 RAI. The proprietary information in Enclosure 2 has been identified with brackets.

Enclosure 3 contains the non-proprietary FENOC response to question number 4 of the August 2, 2005 RAI. The proprietary information in Enclosure 3 has been identified with brackets and deleted.

As the response to RAI question number 4 in Enclosure 2 contains information proprietary to Westinghouse Electric Company LLC, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission

APO1

and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390 of the Commission's regulations.

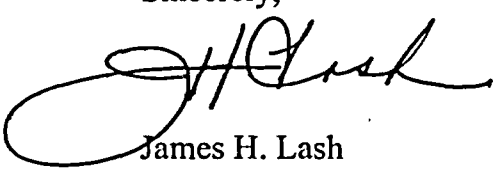
Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR 2.390 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference Westinghouse letter CAW-05-2046 and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

No new regulatory commitments are contained in this submittal. If you have questions or require additional information, please contact Mr. Henry L. Hegrat, Supervisor - Licensing, at 330-315-6944.

I declare under penalty of perjury that the foregoing is true and correct. Executed on September 6, 2005.

Sincerely,



James H. Lash

Enclosures:
1. Non-Proprietary responses to all RAI questions except number 4
2. Proprietary response to RAI question number 4
3. Non-Proprietary response to RAI question number 4
4. Affidavit

References:
1. FENOC Letter L-04-125, License Amendment Request 302 and 173, dated October 4, 2004.

c: Mr. T. G. Colburn, NRR Senior Project Manager
Mr. P. C. Cataldo, NRC Senior Resident Inspector
Mr. S. J. Collins, NRC Region I Administrator
Mr. D. A. Allard, Director BRP/DEP
Mr. L. E. Ryan (BRP/DEP)

L-05-140 Enclosure 1

REQUEST FOR ADDITIONAL INFORMATION RELATED TO

FIRSTENERGY NUCLEAR OPERATING COMPANY (FENOC)

BEAVER VALLEY POWER STATION, UNIT NOS. 1 AND 2 (BVPS-1 AND 2)

EXTENDED POWER UPRATE (EPU)

DOCKET NOS. 50-334 AND 50-412

By letter dated October 4, 2004, as supplemented February 28, May 26, June 14, and July 8, 2005, Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML042920300, ML051530376, ML051670270, and ML051940575, FENOC (the licensee) proposed changes to the BVPS-1 and 2 operating licenses to increase the maximum authorized power level from 2689 to 2900 megawatts thermal rated thermal power or approximately 8 percent. The Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's application against the guidelines in the EPU review standard (RS-001) and determined that it will need the additional information identified below to complete its review.

Question

1. **Section 10.16.1.2 of the risk assessment (Reference 2), states: "A review of the engineering change packages associated with the EPU including containment conversion was performed to determine their effect on systems and associated equipment that are important to plant risk."**

   a. **Are the BVPS-1 auxiliary feedwater cavitating venturis and main feedwater (MFW) fast-acting isolation valves related to EPU?**

   Response:

   The BVPS-1 auxiliary feedwater cavitating venturis and main feedwater fast-acting isolation valves were installed to support the BVPS-1 containment conversion design modification License Amendment Requests (LAR 317 & 190), and these components are related to the extended power uprate (EPU).

   As noted on page 1-4 of Enclosure 2 of LAR 302 & 173 (L-04-125), the containment conversion from a sub-atmospheric to an atmospheric containment design, including related modifications such as the addition of feedwater isolation valves and auxiliary feedwater flow limiting venturis for BVPS-1 are required to support the implementation of the EPU analyses.

Question

b. For EPU-related change packages, please provide the details of these reviews for BVPS-1 and 2, including the effect of each modification on the probability risk assessment (PRA) model.

Response:

An evaluation was performed as a two-step screening process. The end result determined whether there is a significant impact on risk due to a plant modification. The two steps are outlined below and shown on Figure 1-1. In each step, if the criterion can be answered in the negative for a given component, that component can be eliminated from further consideration, as it is considered to have no impact or a negligible impact on risk.

Step 1: Is the modified system or component currently modeled in the PRA, or not modeled and considered potentially important to plant risk? – Modifications to components that are currently included in the PRA model will be evaluated for risk impact.

In the event a component is not included in the PRA model, yet the component is determined to be potentially important to plant risk, and therefore should be included in the PRA model, the component will be evaluated for risk impact. Potential risk impact for components not included in the PRA model are determined by engineering judgment.

Step 2: Modification meets guidelines in Standard Review Plan 19.0:

- Does the change impact the system performance in a potentially negative or non-conservative manner?
- Does the change impact the system design in such a way as to alter system reliability models?
- Does the change impact the support function of the system in such a way as to alter the dependencies in the model?

If the answer to all of these criteria is no, then there is no expected impact on system function or component reliability due to the plant modification.

The process resulted in the majority of the plant modifications being screened as not modeled in the PRA, or not important to risk. Only seven plant modifications passed the first screen. Those modifications are:

- BVPS-1 Installation of Main Feedwater (MFW) Fast Acting Feedwater Valves
- BVPS-1 Installation of Auxiliary Feedwater (AFW) Cavitating Venturis
- Extended Power Uprate Charging System Rethrottling (BVPS-1 and BVPS-2)
- Charging Pump Rotating Assembly Replacement (BVPS-1 and BVPS-2)
- Replacement Steam Generator Level Transmitters (BVPS-1)
- Feedwater Valve Replacement (BVPS-2)
- Replacement Steam Generators (BVPS-1)

A review of the above seven modifications was performed. It was determined that these modifications were to be made in order to maintain or improve the performance of equipment under EPU conditions. This will ensure that the plant systems and equipment will continue to be operated within their design constraints. Therefore, it was concluded that the failure rates of the affected components would not change with the implementation of EPU. A brief description of the evaluations performed for each of the seven modifications is provided below.

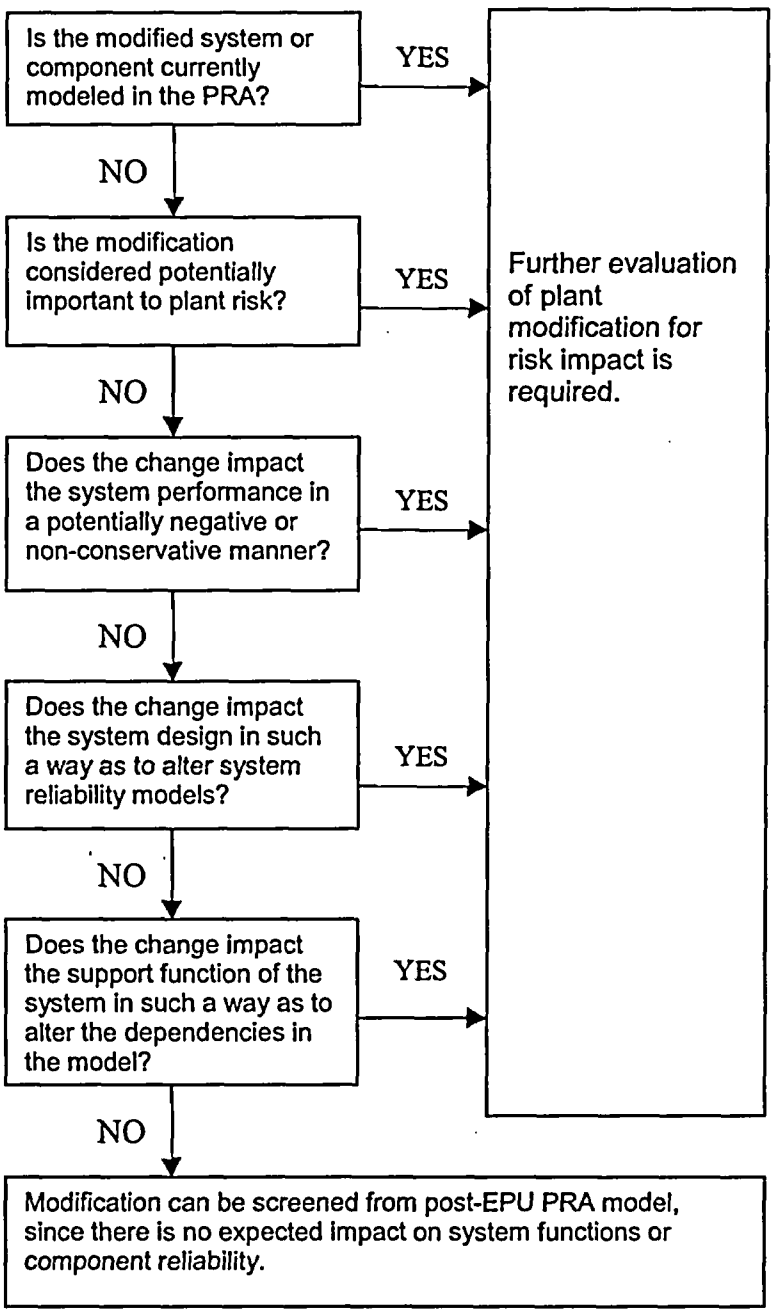
The MFW fast-acting feedwater valves and AFW cavitating venturis were considered to be potentially important to risk, as they were new components that were not modeled in the current PRA and may impact the function of the MFW and AFW systems, respectively. Thus, these components were added to the BVPS-1 PRA model. Since similar components were modeled in the BVPS-2 PRA model, their failure rates were assumed to be applicable to BVPS-1 also. Results from the re-evaluation, as addressed in response to RAI question 3, indicate that these components are not significant contributors to risk. The fast-acting feedwater valves have a Fussell-Vesely of 1.05E-07 each, and the cavitating venturis have a Fussell-Vesely of 1.90E-09 each.

The charging system modifications (rethrottling and rotating assembly replacement) were included in the thermal-hydraulic Modular Accident Analysis Program (MAAP) to evaluate their impact on the PRA model success criteria at EPU conditions. It was concluded that these modifications have no impact on the success criteria due to the EPU, as all the pre-EPU modeling success criteria remained valid for the post-EPU conditions (one auxiliary feedwater pump delivering flow to one steam generator provided enough heat removal capability at BVPS-1, even with the AFW cavitating venturis installed, to prevent core damage).

The replacement steam generator (RSG) level transmitters at BVPS-1 are not explicitly modeled in the PRA, and will not impact any modeled component or success criteria. The feedwater valve replacements at BVPS-2 are considered to be a one-for-one replacement for PRA modeling purposes, and also will not impact any modeled component or success criteria. Therefore, these modifications were not considered further.

The RSG was addressed by a re-calculation of the steam generator tube rupture (SGTR) initiating event frequency to account for the improved Alloy 690 material used for the replacement steam generator U-tubes. The methodology for this re-calculation is provided in the response to RAI question 4. The RSG SGTR initiating event frequency was calculated to be 6.96E-04 /year per steam generator versus 1.48E-03 per steam generator in the original steam generator model. The contribution to core damage frequency (CDF) due to SGTRs is 1.71E-07 /year per steam generator for the replacement steam generator EPU model. This contribution is based on the re-evaluation as addressed in RAI question 3. The contribution to CDF from SGTRs for the original steam generator EPU model is 3.93E-07 /year per steam generator. Thus, it can be seen that both the SGTR initiating frequency and the contribution to CDF decrease with the replacement steam generator.

Figure 1-1


Is the modified system or component currently modeled in the PRA?
YES
NO
Is the modification considered potentially important to plant risk?
YES
NO
Does the change impact the system performance in a potentially negative or non-conservative manner?
YES
NO
Does the change impact the system design in such a way as to alter system reliability models?
YES
NO
Does the change impact the support function of the system in such a way as to alter the dependencies in the model?
YES
NO
Further evaluation of plant modification for risk impact is required.
Modification can be screened from post-EPU PRA model, since there is no expected impact on system functions or component reliability.

Question

2. **Section 10.16.1.4 of Reference 2, discusses the impact of EPU conversion on the human reliability analysis (HRA). The major impact is that the time available to perform some operator actions had decreased. In some cases, the base PRA model used a conservative estimate of the time available, which is taken in the analysis to bound the post-EPU time. The NRC staff notes that use of bounding times can mask the actual change in risk, although such practice should result in a bounding estimate of risk. The following clarifications and additional information are needed to facilitate determining the overall impact of EPU on the HRA.**

Question

a. **For both units, please provide the detailed HRA for all human interactions ("operator actions") that (1) have a Fussell-Vesely importance measure greater than 0.005 or a risk-achievement worth greater than 2, or (2) were modified to represent the post-EPU plant. Include whether the time available is considered "bounding" or is best estimate for pre- and post-EPU conditions.**

Response:

The following tables provide the Fussell-Vesely importance measures, risk achievement worth, and basis for the time available to perform the operator action used in the HRA for all BVPS-1 and BVPS-2 human interactions that:

(1) have a Fussell-Vesely importance measure greater than 0.005 or a risk achievement worth greater than 2.0 for the pre-EPU and post-EPU conditions, or

(2) were modified to represent the post-EPU plant.

It should be noted that the post-EPU importance measures are based on the realistic human error probability (HEP) values that were reassessed using MAAP results to determine a best estimate of the time available, and the requantified PRA model used to address RAI question 3.

Table 2-1 identifies the BVPS-1 pre-EPU operator actions that have either a Fussell-Vesely importance greater than 0.005, or a risk achievement worth of greater than 2.0. All of these pre-EPU human actions were evaluated using best estimate hand calculations to determine the time available to perform the action.

Table 2-1. BVPS-1 Pre-EPU Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPRBV3	Operators setup portable fans & open doors to cool Emergency Switchgear.	1.38E-01	2.62E+00	Best Estimate
OPRCD3	Operator cools down & depressurizes the RCS using atmospheric steam dumps or RHR valve during a SGTR.	7.88E-03	2.54E+00	Best Estimate
OPRCD6	Operator depressurizes RCS to LHSI entry conditions by using pressurizer PORVs; given a Small Break LOCA and failure of HHSI.	5.02E-02	1.96E+00	Best Estimate
OPRCD7	Operator depressurizes RCS to LHSI entry conditions by using pressurizer PORVs; given a Small Break LOCA and failure of HHSI and AC Orange power.	4.76E-02	1.31E+00	Best Estimate
OPROB2	Operator initiates Bleed & Feed when AFW fails, given that DAFW and MFW restoration was not attempted.	1.55E-02	2.13E+00	Best Estimate
OPROC1	Operator trips the RCPs during a loss of all CCR.	8.16E-03	2.70E+00	Best Estimate
OPROD1	Operator depressurizes RCS to RHR and LHSI entry conditions by using pressurizer PORVs or sprays; cooldown is successful.	2.44E-03	2.53E+00	Best Estimate
OPROS6	Operator manually initiates safety injection given failure of SSPS.	2.44E-03	3.99E+00	Best Estimate
OPRSL1	Operator identifies ruptured S/G and initiates isolation.	5.30E-03	2.54E+00	Best Estimate
OPRSL3	Operator locally gags a stuck open S/G safety relief valve.	2.35E-02	1.10E+00	Best Estimate
OPRWA1	Operator manually aligns Auxiliary River Water pump when main RW pumps fail given that Offsite Power is available.	5.17E-03	1.66E+00	Best Estimate
OPRWM1	Operator aligns makeup to the RWST, given a SGTR with secondary leakage.	4.70E-02	6.75E+00	Best Estimate

Table 2-2 identifies the BVPS-2 pre-EPU operator actions that have either a Fussell-Vesely importance greater than 0.005, or a risk achievement worth of greater than 2.0. All of these pre-EPU human actions were evaluated using a hand calculation best estimate time available to perform the action.

Table 2-2. BVPS-2 Pre-EPU Risk Significant Operator Action Importance Measures

Basic Event	Description	Fussell-Vesely Importance	Risk Achievement Worth	Time Available Basis
OPRCD3	Operator depressurizes RCS using atmospheric steam dumps - SGTR	1.50E-03	2.03E+00	Best Estimate
OPRCD6	Operator depressurizes RCS to LHSI entry conditions by using pressurizer PORVs given a Small Break LOCA and failure of HHSI.	2.48E-02	1.31E+00	Best Estimate
OPROB1	Operator initiates Bleed & Feed, after attempting to realign MFW	6.46E-02	1.66E+01	Best Estimate
OPROB2	Operator initiates Bleed & Feed, MFW restoration not attempted	3.28E-02	1.89E+00	Best Estimate
OPROD1	Operator depressurizes RCS to LHSI/RHS entry conditions	1.23E-03	2.03E+00	Best Estimate
OPROF2	Operator realigns main feedwater - no SI	1.38E-03	5.06E+00	Best Estimate
OPROS6	Operator manually actuates AFW following transient	4.24E-03	5.23E+00	Best Estimate
OPROT1	Operator manually trips reactor within 1 minute	2.36E-03	2.88E+00	Best Estimate
OPRSL1	Operator identifies ruptured S/G and initiates isolation	5.69E-03	2.03E+00	Best Estimate
OPRWM1	Operator aligns makeup to RWST - SGTR with secondary leakage	2.19E-02	4.61E+00	Best Estimate

Table 2-3 identifies the BVPS-1 post-EPU operator actions that have either a Fussell-Vesely importance greater than 0.005, or a risk achievement worth of greater than 2.0. These importance measures are based on the reassessment of the HEP values and requantification of the post-EPU PRA model used to address the issues raised in RAI question 3. All of these post-EPU human actions were reassessed using the MAAP results for the time available to perform the action, and are considered best estimates.

Table 2-3. BVPS-1 Post-EPU Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPRCD3	Operator depressurizes the RCS to 400 psig by dumping steam through the intact steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR).	1.05E-02	3.48E+00	Best Estimate
OPRCD5	Operator depressurizes the RCS to 400 psig by locally manipulating the steam generator atmospheric steam dumps to relieve steam during a SBO.	5.90E-03	1.22E+00	Best Estimate
OPRCD6	Operator depressurizes the RCS to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR with HHSI has failed).	1.43E-01	4.09E+00	Best Estimate
OPRCD7	Operator depressurizes the RCS to 400 psig by locally manipulating the steam generator atmospheric steam dumps to relief steam, given HHSI failure and loss of emergency AC orange.	1.55E-01	2.14E+00	Best Estimate
OPRMU5	Operators provide borated makeup water to the RWST initially from the spent fuel pool, and, in the long term, from blending operations following an ISLOCA.	1.02E-02	2.63E+00	Best Estimate
OPROA1	Operator starts charging/HHSI pumps and aligns an appropriate flow path for boron injection after an ATWS event.	4.11E-04	2.06E+00	Best Estimate
OPROC1	Operator trips RCP during loss of CCP.	2.12E-02	5.40E+00	Best Estimate
OPROC2	Operator trips RCP during loss of all seal cooling.	5.30E-03	2.10E+00	Best Estimate
OPROD1	Operator depressurizes RCS to RHS entry conditions using pressurizer spray/PORVs.	3.53E-03	3.48E+00	Best Estimate

Table 2-3. BVPS-1 Post-EPU Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPROF6	Operator starts diesel driven AFW pump and manually controls MFW bypass valve.	9.66E-03	1.49E+00	Best Estimate
OPROP1	Operators protect RSS pumps by stopping them (QS failure) restarting when there is sufficient water in the sump.	1.27E-02	1.22E+00	Best Estimate
OPROS1	Operator manually actuates safety injection and verifies operation of certain safety equipment on loss of SSPS due to actuation relay failure given a transient initiating event that leads to SI conditions. On failure of manual safety injection actuation, the operator manually aligns the safety equipment.	8.78E-03	2.14E+00	Best Estimate
OPROS6	Operator starts AFW given failure of SSPS for sequences in which there is no safety injection; e.g., turbine trip sequences.	1.21E-02	1.18E+01	Best Estimate
OPRSL1	Operator identifies the ruptured steam generator, and isolates or verifies closed all flow paths to and from that steam generator, following an SGTR event.	8.58E-03	3.49E+00	Best Estimate
OPRSL3	Operators locally gag the stuck-open steam relief valves during the SGTR event.	3.80E-02	1.17E+00	Best Estimate
OPRWA1	Operator manually starts and aligns auxiliary river water pumps to the required river water header given no LOSP.	3.03E-02	4.85E+00	Best Estimate
OPRWM1	Operator supplies borated makeup water to the RWST initially from the spent fuel pool, and, in the long term, from blending operations during an SGTR event.	7.17E-02	1.03E+01	Best Estimate

Table 2-4 identifies the BVPS-2 post-EPU operator actions that have either a Fussell-Vesely importance greater than 0.005, or a risk achievement worth of greater than 2.0. These importance measures are based on the reassessment of the HEP values and requantification of the post-EPU PRA model used to address the issues raised in RAI question 3. All of these post-EPU human actions were reassessed using the MAAP results for the time available to perform the action, and are considered best estimates.

Table 2-4. BVPS-2 Post-EPU Risk Significant Operator Action Importance Measures

Basic Event	Description	Fussell-Vesely Importance	Risk Achievement Worth	Time Available Basis
OPRCD3	Operator depressurizes the Reactor Coolant System (RCS) to 400 psig by dumping steam through the intact steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR).	1.22E-03	2.01E+00	Best Estimate
OPRCD6	Operator depressurizes the Reactor Coolant System (RCS) to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (small LOCA with HHSI failed). Not impacted by EPU.	2.51E-02	1.30E+00	Best Estimate
OPRIC1	Operator cross-ties station instrument air to containment instrument air. Not impacted by EPU.	1.04E-02	1.20E+00	Best Estimate
OPROB1	Operators initiate bleed-and-feed operation by initiating safety injection, opening the PORVs, reopening the PORV block valves, and verifying HHSI pump operation. Not impacted by EPU.	6.94E-02	1.69E+01	Best Estimate
OPROB2	Operators initiate bleed-and-feed operation by initiating safety injection, opening the PORVs, reopening the PORV block valves, and verifying HHSI pump operation. Actions take place after the operators fail to attempt to restore MFW. Not impacted by EPU.	3.49E-02	1.88E+00	Best Estimate

Table 2-4. BVPS-2 Post-EPU Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPROD1	Operator depressurizes RCS to Residual Heat Removal System (RHS) entry conditions after dumping steam via the atmospheric steam dumps to cool down the RCS, and to depressurize the RCS by using pressurizer spray/PORVs following a steam generator tube rupture (SGTR) event.	1.05E-03	2.00E+00	Best Estimate
OPROF2	Operator opens main feed bypass valves following a partial feedwater isolation event after a plant trip.	1.91E-03	5.29E+00	Best Estimate
OPROS6	Operator starts AFW given failure of SSPS for sequences in which there is no safety injection; for example, turbine trip sequences. Not impacted by EPU.	4.23E-03	5.23E+00	Best Estimate
OPROT1	Operator pushes the manual reactor trip buttons after the Solid State Protection System (SSPS) fails to automatically actuate reactor trip in response to a plant trip condition. Not impacted by EPU.	2.53E-03	2.87E+00	Best Estimate
OPRSL1	Operator identifies the ruptured steam generator, and isolates or verifies closed all flow paths to and from that steam generator, following an SGTR event.	3.73E-03	2.01E+00	Best Estimate
OPRSL3	Operators locally gag the stuck-open steam relief valves during an SGTR event.	1.48E-02	1.00E+00	Best Estimate
OPRWM1	Operator supplies borated makeup water to the RWST initially from the spent fuel pool, and in the long term, with makeup from service water during an SGTR event. Not impacted by EPU.	1.91E-02	4.19E+00	Best Estimate

Table 2-5 identifies the remaining BVPS-1 post-EPU operator actions that were modified using realistic HEPs to represent the post-EPU plant, but did not have a Fussell-Vesely importance greater than 0.005, or a risk achievement worth of greater than 2.0. These importance measures are based on the reassessment of the HEP values and requantification of the post-EPU PRA model used to address the issues raised in RAI question 3. All of these post-EPU human actions were reassessed using the MAAP results for the time available to perform the action, and are considered best estimates.

Table 2-5. BVPS-1 Post-EPU Non-Risk Significant Operator Action Importance Measures

Basic Event	Description	Fussell-Vesely Importance	Risk Achievement Worth	Time Available Basis
OPRCD4	Operator depressurizes the RCS to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR given AC orange power has failed, and operators have to locally manipulate the steam generator atmospheric steam dumps to cooldown.)	1.36E-04	1.00E+00	Best Estimate
OPRHH1	Operator manually aligns power supply for the standby HHSI pump, starts and aligns the pump to provide the necessary flow after a small LOCA event.	1.52E-03	1.48E+00	Best Estimate
OPRHH2	Operators fail to properly monitor plant parameters and prematurely secure the safety injection system.	N/A	1.00E+00	Best Estimate
OPROF1	Operators align main feedwater or the dedicated auxiliary feed pump given the auxiliary feedwater was successful, but makeup to the PPDWST failed.	8.75E-05	1.66E+00	Best Estimate
OPROR1	Operators manually initiate recirculation mode of operation by starting the RSS pumps, aligning power supplies to appropriate RSS equipment, resetting safety injection system and verifying RW flow to RSS headers, following a small LOCA event.	1.92E-06	1.00E+00	Best Estimate
OPROR2	Operators align outside recirculation spray trains A or B to the LHSI flow path for high pressure recirculation, given that both LHSI supply trains fail.	5.49E-05	1.02E+00	Best Estimate

Table 2-5. BVPS-1 Post-EPU Non-Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPROS2	Operator manually actuates safety injection and verifies operation of certain safety equipment on small LOCA or steam line break. On failure of manual safety injection actuation, the operator manually aligns the safety equipment.	2.65E-03	1.34E+00	Best Estimate
OPROS3	Operator manually actuates safety injection and verifies operation of certain safety equipment on medium LOCA. On failure of manual safety injection actuation, the operator manually aligns the safety equipment.	2.17E-04	1.01E+00	Best Estimate
OPRSL2	Operators locally close the steam generator steam valves given that these valves cannot be closed remotely during an SGTR accident.	1.55E-04	1.03E+00	Best Estimate

Table 2-6 identifies the remaining BVPS-2 post-EPU operator actions that were modified using realistic HEPs to represent the post-EPU plant, but did not have a Fussell-Vesely importance greater than 0.005, or a risk achievement worth of greater than 2.0. These importance measures are based on the reassessment of the HEP values and requantification of the post-EPU PRA model used to address the issues raised in RAI question 3. All of these post-EPU human actions were reassessed using the MAAP results for the time available to perform the action, and are considered best estimates.

Table 2-6. BVPS-2 Post-EPU Non-Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPRCD1	Operator depressurizes the Reactor Coolant System (RCS) to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (small LOCA).	2.77E-05	1.03E+00	Best Estimate
OPRCD2	This is the same as CD1 except that AC Orange power has failed and operators have to locally manipulate the steam generator atmospheric steam dumps to cool down.	0.00E+00	1.00E+00	Best Estimate

Table 2-6. BVPS-2 Post-EPU Non-Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPRCD4	Operator depressurizes the Reactor Coolant System (RCS) to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR, AC Orange power has failed, and operators have to locally manipulate the steam generator atmospheric steam dumps to cool down).	5.27E-06	1.00E+00	Best Estimate
OPRHH1	Operator manually aligns power supply for the standby HHSI pump, and starts and aligns the pump to provide the necessary flow after a small LOCA event.	1.76E-04	1.07E+00	Best Estimate
OPRHH2	Operators fail to properly monitor plant parameters and prematurely secure the safety injection system.	1.12E-04	1.25E+00	Best Estimate
OPRMU1	Operators provide borated makeup water to the RWST initially from the spent fuel pool, and in the long term, with makeup from service water following a transient-initiated small LOCA or SGTR.	0.00E+00	1.00E+00	Best Estimate
OPRMU2	This is the same as MU1 except that the actions follow a small LOCA event.	1.14E-03	1.21E+00	Best Estimate
OPRMU3	This is the same as MU1 except that the actions follow a medium LOCA event.	1.37E-05	1.00E+00	Best Estimate
OPROR1	Operators manually initiate recirculation mode of operation by starting the Recirculation Spray System (RSS) pumps, aligning power supplies to appropriate RSS equipment, resetting safety injection system, and verifying service water flow to RSS headers, following a small LOCA event.	1.39E-04	1.13E+00	Best Estimate

Table 2-6. BVPS-2 Post-EPU Non-Risk Significant Operator Action Importance Measures				
Basic Event	**Description**	**Fussell-Vesely Importance**	**Risk Achievement Worth**	**Time Available Basis**
OPROS1	Operator manually actuates safety injection and verifies operation of certain safety equipment on loss of both trains of SSPS due to actuation relay failure. On failure of manual safety injection actuation, the operator manually aligns the safety equipment. Though there is no LOCA present, a valid safety injection condition has occurred; for example, steamline break.	3.40E-03	1.25E+00	Best Estimate
OPROS2	Operator manually actuates safety injection and verifies operation of certain safety equipment on loss of both trains of SSPS due to actuation relay failure. On failure of manual safety injection actuation, the operator manually aligns the safety equipment. Following a small LOCA	9.46E-04	1.07E+00	Best Estimate
OPROS3	Operator manually actuates safety injection and verifies operation of certain safety equipment on loss of both trains of SSPS due to actuation relay failure. On failure of manual safety injection actuation, the operator manually aligns the safety equipment. Following a medium LOCA	4.17E-05	1.00E+00	Best Estimate
OPRPR1	Operator secures safety injection before PORVs are challenged.	1.71E-03	1.00E+00	Best Estimate
OPRSL2	Operators locally close the steam generator steam valves given that these valves cannot be closed remotely during an SGTR accident.	1.97E-04	1.06E+00	Best Estimate

All of the operator actions identified in the Tables 2-1 through 2-6 meet the criteria of either having a Fussell-Vesely importance measure greater than 0.005 or a risk achievement worth greater than 2, or were modified to represent the post-EPU plant using best estimate times to develop realistic HEPs (see response to RAI question 3). The human reliability analysis for all of these operator actions used the success likelihood index methodology (SLIM). As such, the SLIM process evaluates groups of human actions. Therefore, all human actions contained in the SLIM grouping are included in with the details of the operator actions identified in Tables 2-1 through 2-6.

The details of the HRA for the operator actions are provided in the attached SLIM worksheets (included as Attachments 1 – 4 to Enclosure 1), which provide the rankings, weightings, and HEP mean values for each human interaction within the group. For BVPS-1, all pre-EPU human action SLIM worksheets are provided in Attachment 1, while Attachment 2 provides the BVPS-1 post-EPU human action SLIM worksheets which were reassessed in response to RAI question 3. Attachments 3 and 4 provide the SLIM worksheets for the pre-EPU and post-EPU reassessed human actions for BVPS-2, respectively.

Question

b. Table 10.16-5 provides post-EPU importance measures for selected operator actions. (1) Which unit PRA model was used to generate these importance measures? (2) Are the operator actions in this table, which are of the form "OPR*," the same as the corresponding actions in Table 10.16-2, which are designated "ZHE*" (where "*" represents an alphanumeric string).

Response:

The first two sheets of Table 10.16-5 (L-05-104 Enclosure 1, pages 21 and 22 of 32) were generated using the BVPS-1 EPU PRA model. The second two sheets of Table 10.16-5 (L-05-104 Enclosure 1, pages 23 and 24 of 32) were generated using the BVPS-2 EPU PRA model.

The operator actions listed in Table 10.16-5 ("OPR*" designators) are the basic event identifiers used in the top event fault tree models. The operator actions listed in Table 10.16-2 ("ZHE*" designators) are the RISKMAN database HEP distribution identifiers used to quantify the basic events. Typically, these correspond directly to each other (OPRAF1 and ZHEAF1 are the same action). However, there are some cases where they do not correspond directly to each other. The following list includes the exceptions to the rule.

BVPS-1:

OPRCC3 is quantified using ZHECC1

OPRDF1 is quantified using ZHEOF1

OPRHH3 is quantified using ZHEHH1

OPRHH4 is quantified using 1.0

OPRNA1 is quantified using 1.00E-02

BVPS-2:

OPRCC3 is quantified using ZHECC1

OPRHH3 is quantified using ZHEHH1

OPRPR2 is quantified using ZHEPI1

OPRMU4 is quantified using 1.0

OPROS4 is quantified using 1.0

OPRPR1 is quantified using 1.0

OPRRI2 is quantified using 1.0

OPRSL3 is quantified using 1.0

OPRXT3 is quantified using 1.0

Question

c. Table 10.16-1 gives pre- and post-EPU times to core damage for station blackout scenarios. Why does this time increase on BVPS-1 and decrease on BVPS-2 for the "182 gpm, successful cooldown/depressurization, primary plant demineralized water storage tank make-up available" case?

Response:

The increase in time to core damage for the BVPS-1, 182 gpm reactor coolant pump (RCP) seal LOCA with successful cooldown/depressurization and primary plant demineralized water storage tank (PPDWST) make-up available case is primarily due to changes in the primary system water mass used in the MAAP parameter file for the pre- to post-EPU/ replacement steam generators (RSG) conditions.

This key difference in the BVPS-1 MAAP inputs is that the initial primary system water mass (excluding the pressurizer) for the EPU model is 388,127 lbs. vs. 382,073 lbs. for the pre-EPU model MAAP analysis. Thus, the EPU model has about 1.5% more water mass in the primary system. This initial mass difference is due to a slightly larger primary side volume for the RSG's as compared to the original steam generators (OSG). The total primary side volume of one steam generator is 1136 ft^3 for the RSG and 1087 ft^3 for the OSG.

The impact of this change is subtle and does not appear to have a significant impact on thermal-hydraulic (T/H) behavior. Both the pre- and post- EPU cases behave similarly for the first 10 hours except for a time shift due to differences in time of seal binding failure (30 minutes for the pre-EPU case and 13 minutes for the post-EPU case). Around 10 hours, the two cases have different pressurizer behavior and the T/H results begin to diverge. Thus, there appears to be some beneficial impact from the RSGs due to an increased primary side initial inventory.

Moreover, the effects of the increased inventory are more pronounced for the 182 gpm with successful cooldown/depressurization and PPDWST make-up available case, where the RCS inventory loss out the RCP seal LOCA is the governing circumstance to core uncovery, as opposed to the 21 gpm break sizes and PPDWST depletion cases where decay heat removal capability governs the time to core uncovery.

As expected, since the BVPS-2 RCS volume remained essentially the same for the pre- to post-EPU MAAP analysis, all BVPS-2 EPU cases provided in Table 10.16-1 resulted in a decrease in the time to core damage, due to the increase in decay heat associated with the power uprate.

Question

d. Under the discussion of "general transients," it states: "Thus, with the RSG [replacement steam generators] there is less margin for successful completion of the plant-specific feed and bleed procedure ... initiated at 0.495 hours ...." Does the time available for this action change under EPU conditions? What is the human error probability (HEP) for this action, both pre- and post-EPU? Why was this action not included in Table 10.16-2 or 10.16-5?

Response:

The general transient success criteria discussion presented in LAR 302 & 173 (L-05-104) was based on a loss of all feedwater (both main and auxiliary), with credit for operators to initiate feed and bleed at 13% wide range SG level per the plant procedures. This stemmed from a Westinghouse Owner's Group issue regarding the required component success criteria for feed and bleed implementation (number of power operated relief valves (PORVs) and high head safety injection (HHSI) pumps). To address this concern for EPU conditions, a MAAP analysis was performed assuming that one HHSI pump injects and one PORV was opened once the replacement steam generator reached the 13% wide range level, which occurred at 0.495 hours. The results of this analysis showed that even at EPU conditions the feed and bleed component success criteria did not change from the current plant model (one HHSI pump and one PORV).

The timing used for the operator action to initiate feed and bleed developed for the human reliability analysis (HRA) was based on the maximum time that operators have available in order to successfully implement feed and bleed. In the thermal-hydraulic hand calculations developed for the Individual Plant Examination (IPE) human action accident scenarios, the time for feed and bleed implementation was based on the time for the PORVs to lift prior to steam generator dryout. This was estimated to occur 5 minutes prior to dryout, or at about 58 minutes following a reactor trip.

Since this time was shorter than the corresponding time of 63 minutes in a similar EPU MAAP analysis (a station blackout scenario with a 21 gpm RCP seal LOCA and loss of all feedwater), the IPE time value was bounding. Therefore, the HEPs used in the current PRA models (BVPS-1: 1.22E-03 for OPROB1, and 1.39E-02 for OPROB2; BVPS-2: 4.34E-03 for OB1, and 3.79E-02 for OB2) were bounding so the values were not changed for the EPU. As such, Tables 10.16-2 and 10.16-5, which listed operators actions that have changed for the EPU analyses, did not include these actions.

Question

e. Note 2 of Table 10.16-2 explains that the reduction in time available for a number of the operator actions is due to adopting a new reactor coolant pump seal loss-of-coolant accident model. Is this considered an EPU change?

Response:

The RCP seal LOCA expected time of occurrence, due to seal popping or binding failures, was assumed to occur at 13 minutes in the post-EPU PRA models. This assumption was not a result of the EPU, but was made in order to have the PRA models reflect the most recent RCP seal LOCA issues that were approved by the NRC in their acceptance of WCAP-15603-A, Revision 1.

Question

f. Note 3 of Table 10.16-2 refers to changes in HRA because the pre-EPU model did not credit resetting containment isolation phase B. Is this considered an EPU change?

Response:

As noted in Note 3 of Table 10.16-2, the current (pre-EPU) HEP analyses takes credit for the operators resetting the containment isolation phase "B" (CIB) signal and stopping the quench spray pumps, whereas the post-EPU HEP analyses does not.

The assumption of not resetting the CIB signal is not considered part of the EPU change but was done in order to maximize the impact of the EPU on the HEP by minimizing the time to transfer to safety injection recirculation mode. This timing was of interest for operator actions ZHECD1 and ZHECD2, where the operators are trying to depressurize the RCS below 400 psig. If core damage occurs due to additional equipment failures during the recirculation phase, the RCS would be at low pressure at the time of vessel melt-through. It is also of interest for operator actions ZHEMU1 and ZHEMU2, where the time to deplete the refueling water storage tank (RWST) is of relevance.

The operators actions to reset the CIB signal and stop quench spray flow are in the current plant procedures and will continue to be in the respective post-EPU emergency operating procedures.

Question

g. Note 4 of Table 10.16-2 says that ZHEIA1 is considered a "guaranteed success since the diesel air compressor will auto-start." Is this change due to a change to the plant equipment? Is it related to the EPU?

Response:

The change in the diesel air compressor starting signal from manual to automatic was due to a physical plant modification that was implemented by ECP-02-0541. This modification installed a backup train of instrument air, comprised of a 1500 scfm diesel powered, oil free, rotary screw air compressor, which auto-starts upon a low system air pressure signal.

This backup train of instrument air was not related to the EPU modifications, but rather was performed to increase the reliability of the station air supply.

Question

h. Table 10.16-5 shows the Fussell-Vesely importance of operator action OPRIA1, "Given LOSP [loss of offsite power], operators locally start the diesel air compressor," as 6.13E-04. Is this the same operator action as ZHEIA1 in Table 10.16-2? (It has the same description.) If "yes", how was the Fussell-Vesely determined, given that the HEP for ZHEIA1 is given as 0.0?

Response:

Operator action ZHEIA1 is the same operator action as OPRIA1. ZHEIA1 is the RISKMAN database variable for the HEP and OPRIA1 is the PRA basic event for the operator action. ZHEIA1 is the operator action to manually start the diesel air compressor, and was evaluated using the time of the first RCP seal damage, given a loss of all seal cooling. As discussed in the response to RAI question 2.e, and shown in Table 10.16-2, this timing was changed from 60 minutes to 13 minutes for the post-EPU HRA. As such, it resulted in an increase in the HEP from 5.87E-03 to 1.18E-02.

However, as noted in the response to RAI question 2.g, there was a currently installed non-EPU change to auto-start the diesel air compressor. To represent this change in the post-EPU PRA model, the database variable ZHEIA1 was to be set to "guaranteed success" to accurately reflect the current plant conditions that would also be present following the EPU. This was considered necessary, since the post-EPU condition would have resulted in an increase in the HEP for the operator action to manually start the diesel air compressor, had it not already been changed to an auto-start feature.

It was later discovered (post-submittal) that the change to make ZHEIA1 a "guaranteed success" was not incorporated into the post-EPU PRA model, and that the post-EPU adjusted value without the auto-start feature was used (1.18E-02). As such, a Fussell-Vesely importance value was calculated in the RISKMAN quantification and reported in Section 10.16 of Reference 2. However, as noted in the response to RAI question 2.g this change to the diesel air compressor starting circuit is not EPU related, so the HEP was set back to its pre-EPU normal value of 5.87E-03 used in the re-quantification to respond to RAI question 3.b.

It was also noted during this subsequent review that some of the other numbers listed in Table 10.6-2 of L-05-104 Enclosure 1 were not correctly identified. These include the following:

- For BVPS-1, the true value of operator action ZHEIC2 that was used to quantify the pre-EPU (current) PRA model is 2.99E-03, not 2.73E-03.
- For BVPS-2, the correct time available to complete the operator action used in the evaluation of ZHECD1 was 5.95 hours, not 12.3 hours.
- For BVPS-2, the correct time available to complete the operator action used in the evaluation of ZHECD2 was 5.9 hours, not 12.3 hours.

Question

i. **Section 10.15 of Reference 1 states: "A review of operating procedures/ emergency operating procedures/training potentially impacted by EPU will be completed ...." How was the full impact of the EPU on the human reliability analysis determined if operating procedure changes have not yet been identified?**

Response:

The full impact of the EPU on the human reliability analysis will be addressed during the PRA model update process following the EPU implementation. However, in order to address the impact of the EPU on the operator actions analyzed in the LAR, it was assumed that only the timings and stress levels could be significantly impacted by the EPU, and that the indications, proceduralized steps and operator actions would essentially remain unaffected. The basis for this assumption is provided below.

Application of the success likelihood index methodology (SLIM) to quantify the event-level dynamic operator actions in the plant response model of a PRA has been adopted at BVPS. It is based on the assumption that the HEP in a particular situation depends on the combined effects of a relatively small set of performance-shaping factors (PSF) that influence the operators' ability to perform the action successfully. The PSFs were selected to describe the range of problems that the operators face. They were chosen to relate the impact of the following:

- The scenario in which the action must be accomplished. These include plant/operator interface and indications from instrumentation; adequacy of time to accomplish the action; preceding and concurrent actions; and the complexity of the task.

- The psychological and cognitive condition of the operators during the scenario. This includes stress; training and experience relative to the action; and procedures or other operational aids available to the operators, and their performance up to the current point in the scenario.

Based on these PSFs, it was assumed that the scenario based plant/operator interface and indications, preceding and concurrent actions, and task complexity would not be significantly impacted enough by the EPU to warrant a change in their ranking. Additionally, for the psychological and cognitive condition of the operators during the scenario, it was assumed that only the stress rankings of the operator actions that had significantly less time to complete due to the EPU conditions would be impacted.

Question

j. Are there any additional operator actions that are considered in the model for estimating large early release frequency (LERF)? Please provide a listing of any operator actions unique to LERF and an assessment of the impact of the EPU on the corresponding HEPs.

Response:

All of the operator actions developed for the BVPS PRA models are contained in the plant model (Level 1) event trees used to calculate the core damage frequency, including actions for containment isolation and other actions important for estimating release frequencies. This approach, used in the BVPS PRA models, was selected for the following reasons:

- All active systems, including the containment engineered safeguards, are included in the plant model event tree because their dependencies on support systems, such as electrical power and service water, can be determined more easily in the plant model event trees. This avoids the dependency tracking problems associated with placing certain active containment systems into the Level 2 containment event trees (CETs).

- The prescribed boundary separates the phenomenological CET from the plant model event trees that deal only with active systems and operator actions with a well-defined interface.

- The prescribed boundary facilitates a clean separation between analyses of likelihood (as measured by frequency) and uncertainty (as measured by probability).

This clean separation between plant model and CETs allows an optimization of both the plant analysis and the containment analysis, while at the same time providing needed flexibility in the modeling process. However, in doing so, all of the plant model information on the operability status of active systems important to the timing and magnitude of the release of radioactive materials must be passed into the CET when linked to the Level 1 event trees. This required that, in addition to representing the systems and functions that are important to keeping the core cooled, the plant model event trees had to also address active systems and functions important to containment isolation, containment heat removal, and removal of radioactivity from the containment atmosphere.

As such, there are no additional operator actions considered in the PRA models for estimating large early release frequency (LERF), and the Level 2 analyses are strictly based on containment phenomenology or events that have occurred during the core damage process. However, the operator actions that are modeled would have different importance measures based on their contribution to either CDF or LERF.

Question

3. **Please provide an assessment of the increase in risk if only the EPU is considered. For example, the impact of containment conversion, BVPS-1 replacement steam generators, BVPS-1 AFW cavitating venturis and MFW fast-acting isolation valves should not be included unless they are required for the EPU. Note that this can be done either by having non-EPU changes in both the base model and the post-EPU model or in neither.**

   The NRC staff would prefer that this assessment use realistic HEPs for both the pre-EPU and post-EPU analysis (where these would change) to avoid masking of the actual change in risk; refer to question 2, above. However, if bounding HEP numbers are employed, justify that the final risk metric is bounding with respect to those HEPs.

   The following risk metrics should be provided for both BVPS-1 and 2:

   a. Internal events core damage frequency (CDF) and LERF.

   b. CDF and LERF from internal fires.

   Response:

   As noted in Section 1.1.2 of Enclosure 2 of LAR 302 & 173, L-04-125, the principal modifications planned to support implementation of the EPU LAR analyses include:

   - Containment conversion from a sub-atmospheric to an atmospheric design basis including related modifications such as the addition of (fast-acting) feedwater isolation valves and auxiliary feedwater flow limiting (cavitating) venturis for BVPS-1
   - Replacement charging/safety injection pump rotating assemblies
   - Replacement steam generators for BVPS-1

   Since the above modifications are required to support the EPU, they were considered necessary and either explicitly or implicitly included in the EPU risk analysis (as addressed in the response to RAI question 1.b) in order to accurately determine the risk impact associated with the EPU.

   Consequently, the only changes that were made to the post-EPU PRA models that were not associated with the EPU, were changes to the HEPs resulting from:

   - The change in timing of the RCP seal binding failure (see response to RAI question 2.e.)
   - Using conservative times to SI recirculation phase or RWST depletion by not crediting the resetting the CIB signal and stopping quench spray flow (see response to RAI question 2.f.)
   - Crediting the auto-start of the diesel air compressor by setting the HEP to zero (see response to RAI question 2.g.)

Since the first two bulleted items above are not associated with the EPU, the impacted HEPs were reanalyzed excluding these changes, and instead used the pre-EPU PRA model assumptions. That is, the start of the increased RCP seal LOCA was assumed to occur at 60 minutes (based on NUREG-1150) instead of the 13 minutes suggested in WCAP-15603-A, Revision 1, and credit was given for resetting the CIB signal and stopping quench spray flow.

As noted in the response to RAI question 2.h, the third bulleted item was not included in the post-EPU PRA model, so the operator action to manually start the diesel air compressor was evaluated in the LAR 302 and 173 submittal using the post-EPU HEP, which reflected the change in timing of the RCP seal binding failure. In response to this RAI, the HEP for this operator action was set back to the pre-EPU value, since it removed the effects of non-EPU changes, as addressed below.

All of the operator actions impacted by excluding these non-EPU changes and using realistic HEPs developed from the MAAP result best estimate timings, when considering only the EPU related modifications, are presented in Table 3-1. This table complements Table 10.16-2 of Reference 2 to complete the full post-EPU HRA. This re-evaluation resulted in several changes, as outlined below:

- In response to RAI question 2.e, since the new RCP seal LOCA model is not related to the EPU, all operator action times available were changed back to the pre-EPU model times available.
- In response to RAI question 2.f, the HRA for the post-EPU model will use the operator action times available while taking credit for resetting the CIB signal and securing the quench spray system, as was done in the pre-EPU model.
- In response to RAI question 2.g, the operator action OPRIA1 is no longer set to "guaranteed success," since the change to the diesel air compressor is not related to the EPU.
- The HRA no longer uses the "bounding" operator action time available. Realistic timings are used, which resulted in decreasing many of the human error rates.

Table 3-1: Operator Action Human Error Probabilities

Human Action Description	Time Available pre-EPU	PSF - pre-EPU	HEP - pre-EPU	Time Available post-EPU	PSF - post- EPU	HEP - post-EPU
BVPS-1						
OPROS2 – Operator manually actuates safety injection and verifies operation of certain safety equipment on small LOCA or steam line break. On failure of manual safety injection actuation, the operator manually aligns the safety equipment.	0.67 hours	Time - 5	9.19E-03	0.94 hours	Time - 3	7.68E-03
OPROS3 – Operator manually actuates safety injection and verifies operation of certain safety equipment on medium LOCA. On failure of manual safety injection actuation, the operator manually aligns the safety equipment.	0.15 hours	Time - 6	2.77E-02	0.35 hours	Time - 4	1.90E-02

Table 3-1: Operator Action Human Error Probabilities						
Human Action Description	**Time Available pre-EPU**	**PSF - pre-EPU**	**HEP - pre-EPU**	**Time Available post-EPU**	**PSF - post- EPU**	**HEP - post-EPU**
OPRHH1 – Operator manually aligns power supply for the standby HHSI pump, starts and aligns the pump to provide the necessary flow after a small LOCA event.	0.67 hours	Time - 4	3.87E-03	0.94 hours	Time - 2	3.13E-03
OPRHH2 – Operators fail to properly monitor plant parameters and prematurely secure the safety injection system.	2.21 hours	Time - 3	7.15E-04	13.91 hours	Time - 1	5.77E-04
OPROF1 – Operators align main feedwater or the dedicated auxiliary feed pump given the auxiliary feedwater was successful, but makeup to the PPDWST failed.	6 hours	Time - 1	1.58E-04	10.34 hours	Time - 0	1.32E-04
OPROR1 - Operators manually initiate recirculation mode of operation by starting the RSS pumps, aligning power supplies to appropriate RSS equipment, resetting safety injection system and verifying RW flow to RSS headers, following a small LOCA event.	1.5 hours	Time - 2	2.01E-03	2.82 hours	Time - 1	1.88E-03
OPROR2 - Operators align outside recirculation spray trains A or B to the LHSI flow path for high pressure recirculation, given that both LHSI supply trains fail.	1.5 hours	Time - 2	2.85E-03	2.82 hours	Time - 1	2.60E-03
OPROD1 – Operator depressurizes RCS to RHS entry conditions using pressurizer spray/PORVs.	10 hours	Time - 1	1.58E-03	>24 hours	Time - 0	1.42E-03
OPRSL2 - Operators locally close the steam generator steam valves given that these valves cannot be closed remotely during an SGTR accident.	9.5 hours	Time - 2	5.52E-03	17.99 hours	Time - 1	4.96E-03
OPRCD3 - Operator depressurizes the RCS to 400 psig by dumping steam through the intact steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR)	11 hours	Time - 5	5.12E-03	> 24 hours	Time - 2	4.19E-03
OPRCD4 - Operator depressurizes the RCS to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR given AC orange power has failed, and operators have to locally manipulate the steam generator atmospheric steam dumps to cooldown.)	11 hours	Time - 5	8.29E-02	> 24 hours	Time - 1	5.10E-02

Table 3-1: Operator Action Human Error Probabilities						
Human Action Description	*Time Available pre-EPU*	*PSF - pre-EPU*	*HEP - pre-EPU*	*Time Available post-EPU*	*PSF - post- EPU*	*HEP - post-EPU*
OPRCD6 - Operator depressurizes the RCS to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR with HHSI has failed).	0.83 hours	Time - 3	4.99E-02	1.02 hours	Time - 2	4.40E-02
OPRCD7 - Operator depressurizes the RCS to 400 psig by locally manipulating the steam generator atmospheric steam dumps to relief steam, given HHSI failure and loss of emergency AC orange.	0.83 hours	Time - 5	1.35E-01	1.02 hours	Time - 4	1.20E-01
OPRWM1 - Operator supplies borated makeup water to the RWST initially from the spent fuel pool, and, in the long term, from blending operations during an SGTR event.	21 hours	Time - 1	8.40E-03	30.46 hours	Time - 0	7.68E-03
OPRWA1 - Operator manually starts and aligns auxiliary river water pumps to the required river water header given no LOSP.	1 hour	Time - 5	7.80E-03	1 hour (was 13 minutes due to RCP seal leakage)	Time - 5	7.80E-03
OPRIA1 - Given LOSP, operators locally start the diesel air compressor	1 hour	Time - 1	5.84E-03	1 hour	Time - 1	5.84E-03
OPRIC2 - Operators cross-tie station instrument air to containment instrument air by locally opening manual valve IA-90.	1 hour	Time - 5	2.99E-03	1 hour (was 13 minutes due to RCP seal leakage)	Time - 5	2.99E-03
OPRCD1 - Operator depressurizes the RCS to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (small LOCA).	5.95 hours	Time - 2	1.71E-03	6.63 hours (was 1.23 hours due to CIB setpoint)	Time - 2	1.71E-03 (time difference did not justify a change in PSF)
OPRCD2 - Same as OPRCD1 except that AC orange power has failed and operators have to locally manipulate the steam generator atmospheric steam dumps to cooldown.	5.9 hours	Time - 2	2.58E-03	11.6 hours (was 2.02 hours due to CIB setpoint)	Time - 2	2.58E-03 (time difference did not justify a change in PSF)
OPRMU1 - Operators provide borated makeup water to the RWST initially from the spent fuel pool, and, in the long term, from blending operations following a steam generator tube rupture event.	4.03 hours	Time - 1	8.40E-03	4.03 hours (was 0.46 hours due to CIB setpoint)	Time - 1	8.40E-03

Table 3-1: Operator Action Human Error Probabilities						
Human Action Description	**Time Available pre-EPU**	**PSF - pre-EPU**	**HEP - pre-EPU**	**Time Available post-EPU**	**PSF - post- EPU**	**HEP - post-EPU**
OPRMU2 - Same as OPRMU1 except that the actions follow a small LOCA event.	1.9 hours	Time - 3	1.01E-02	1.9 hours (was 0.46 hours due to CIB setpoint)	Time - 3	1.01E-02
BVPS-2						
OPROS2 – Operator manually actuates safety injection and verifies operation of certain safety equipment on loss of both trains of SSPS due to actuation relay failure. On failure of manual safety injection actuation, the operator manually aligns the safety equipment. Following a small LOCA	0.67 hours	Time - 4	1.71E-02	0.94 hours	Time - 2	1.33E-02
OPROS3 – Operator manually actuates safety injection and verifies operation of certain safety equipment on loss of both trains of SSPS due to actuation relay failure. On failure of manual safety injection actuation, the operator manually aligns the safety equipment. Following a medium LOCA	0.15 hours	Time - 5	2.20E-02	0.28 hours	Time - 3	1.71E-02
OPRHH1 – Operator manually aligns power supply for the standby HHSI pump, and starts and aligns the pump to provide the necessary flow after a small LOCA event.	0.67 hours	Time - 4	3.29E-03	0.94 hours	Time - 2	2.49E-03
OPRHH2 – Operators fail to properly monitor plant parameters and prematurely secure the safety injection system.	5.56 hours	Time - 3	5.87E-04	19.62 hours	Time - 1	4.44E-04
OPROR1 – Operators manually initiate recirculation mode of operation by starting the Recirculation Spray System (RSS) pumps, aligning power supplies to appropriate RSS equipment, resetting safety injection system, and verifying service water flow to RSS headers, following a small LOCA event.	0.95 hours	Time - 2	1.38E-03	9.5 hours	Time - 0	1.05E-03
OPROD1 – Operator depressurizes RCS to Residual Heat Removal System (RHS) entry conditions after dumping steam via the atmospheric steam dumps to cool down the RCS, and to depressurize the RCS by using pressurizer spray/PORVs following a steam generator tube rupture (SGTR) event.	14 hours	Time - 1	1.20E-03	> 24 hours	Time - 0	1.04E-03
OPRSL1 – Operator identifies the ruptured steam generator, and isolates or verifies closed all flow paths to and from that steam generator, following an SGTR event.	0.93 hours	Time - 7	5.25E-03	1.6 hours	Time - 5	3.63E-03

Table 3-1: Operator Action Human Error Probabilities						
Human Action Description	**Time Available pre-EPU**	**PSF - pre-EPU**	**HEP - pre-EPU**	**Time Available post-EPU**	**PSF - post- EPU**	**HEP - post-EPU**
OPRSL2– Operators locally close the steam generator steam valves given that these valves cannot be closed remotely during an SGTR accident.	11.2 hours	Time - 2	4.33E-03	> 24 hours	Time - 0	3.28E-03
OPRSL3 - Operators locally gag the stuck-open steam relief valves during an SGTR event.	11.2 hours	Time - 1	1.35E-01 (Assigned 1.0)	> 24 hours	Time - 0	1.18E-01 (Assigned 1.0)
OPRSL4– Operator isolates ruptured steam generator given HHSI failed. (Not used in PRA models)	0.83 hours	Time - 7	3.41E-02	1.22 hours	Time - 5	2.66E-02
OPRSL5 - Operator isolates ruptured steam generator given one train of emergency AC power and HHSI failed. (Not used in PRA models)	0.83 hours	Time - 8	1.09E-02	1.22 hours	Time - 6	7.53E-03
OPRCD3– Operator depressurizes the Reactor Coolant System (RCS) to 400 psig by dumping steam through the intact steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR).	14 hours	Time - 1	1.46E-03	> 24 hours	Time - 0	1.21E-03
OPRCD4 - Operator depressurizes the Reactor Coolant System (RCS) to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (SGTR, AC Orange power has failed, and operators have to locally manipulate the steam generator atmospheric steam dumps to cool down).	14 hours	Time - 4	1.04E-02	> 24 hours	Time - 0	4.99E-03
OPRMU1 - Operators provide borated makeup water to the RWST initially from the spent fuel pool, and in the long term, with makeup from service water following a transient-initiated small LOCA or SGTR.	1.14 hours	Time - 3	5.97E-03	2.58 hours	Time - 2	5.45E-03
OPRMU2 - This is the same as OPRMU1 except that the actions follow a small LOCA event.	1.01 hours	Time - 3	5.97E-03	2.58 hours	Time - 2	5.45E-03
OPRMU3 - This is the same as OPRMU1 except that the actions follow a medium LOCA event.	1.3 hours	Time - 7	8.60E-03	2.67 hours	Time - 5	7.17E-03
OPRMU4 - This is the same as OPRMU1 except that the actions follow a large LOCA event.	0.54 hours	Time - 9	1.03E-02 (Assigned 1.0)	1.11 hours	Time - 7	8.60E-03 (Assigned 1.0)

Table 3-1: Operator Action Human Error Probabilities						
Human Action Description	**Time Available pre-EPU**	**PSF - pre-EPU**	**HEP - pre-EPU**	**Time Available post-EPU**	**PSF - post- EPU**	**HEP - post-EPU**
OPRPR1 – Operator secures safety injection before PORVs are challenged.	15 minutes	Time - 9	3.44E-02 (Assigned 1.0)	33 minutes	Time - 8	2.65E-02 (Assigned 1.0)
OPRCD1 - Operator depressurizes the Reactor Coolant System (RCS) to 400 psig by dumping steam through the steam generator atmospheric steam dumps to depressurize and cool down the secondary side (small LOCA).	5.95 hours	Time - 3	9.10E-04	6.63 hours (was 1.04 hours due to CIB setpoint)	Time - 1	6.88E-04
OPRCD2 - This is the same as OPRCD1 except that AC Orange power has failed and operators have to locally manipulate the steam generator atmospheric steam dumps to cool down.	5.9 hours	Time - 3	4.93E-03	11.6 hours (was 3.62 due to CIB setpoint)	Time - 1	3.73E-03
OPRWA1 - Operator manually stops the EDG and racks the spare service water (SWS) pump onto the bus prior to restarting the EDG during a loss of offsite power.	1 hour	Time - 6	7.93E-02	1 hour (was 13 minutes due to RCP seal leakage)	Time - 6	7.93E-02
OPRCC1 - Operator starts the manual standby component cooling pump (CCP) on loss of the operating and the automatic standby CCPs, to restore component cooling water (CCW) flow to the RCP thermal barriers.	1 hour	Time - 2	3.31E-03	1 hour (was 13 minutes due to RCP seal leakage)	Time - 2	3.31E-03
OPRTB1 - Operator cross-ties station instrument air to containment instrument air.	1 hour	Time - 1	7.92E-04	1 hour (was 13 minutes due to RCP seal leakage)	Time - 1	7.92E-04
OPRTB2 - Operator resets containment isolation Phase A (CIA) and restores containment instrument air.	1 hour	Time - 1	1.12E-02	1 hour (was 13 minutes due to RCP seal leakage)	Time - 1	1.12E-02

The BVPS-1 and BVPS-2 post-EPU models were requantified using the above realistic operator action HEPs and removing the non-EPU associated modifications. The results from the requantification of the BVPS-1 and BVPS-2 post-EPU PRA models are presented in Tables 3-2 and 3-3, respectively.

Table 3-2. BVPS-1 Pre-EPU and Post-EPU Core Damage Frequency			
	Pre-EPU CDF (/year)	Post-EPU CDF (/year)	Delta CDF (/year)
Internal Events	7.45E-06	6.53E-06	-9.15E-07
Fire	4.60E-06	4.59E-06	-1.44E-08
External Events	1.63E-05	1.63E-05	-1.50E-08
Total	2.37E-05	2.28E-05	-9.31E-07

Table 3-3. BVPS-2 Pre-EPU and Post-EPU Core Damage Frequency			
	Pre-EPU CDF (/year)	Post-EPU CDF (/year)	Delta CDF (/year)
Internal Events	2.01E-05	2.01E-05	-6.00E-09
Fire	5.29E-06	5.29E-06	-1.20E-09
External Events	1.48E-05	1.48E-05	-2.00E-09
Total	3.49E-05	3.49E-05	-8.00E-09

In many instances, the best-estimate HEPs improved (the HEP decreased) as a result of the new analyses using MAAP results versus hand calculations. As a result, the BVPS-1 and BVPS-2 post-EPU PRA models indicate a decrease or no change in CDF, as shown above in Tables 3-2 and 3-3. The HEPs did not impact the BVPS-1 and BVPS-2 LERF values. Therefore, LERF remains as reported in Section 10.16 of Reference 2.

In addition to the change in timing of the RCP seal binding failure affecting some of the above reanalyzed HEPs, the post-EPU station blackout (SBO) MAAP analyses also assumed that the start of the increased RCP seal leakage started at 13 minutes, as opposed to the 30 minutes used in the pre-EPU MAAP analyses (based on WCAP-15603, Revision 0). The time to core damage from these pre- and post-EPU SBO MAAP analyses were used in the electric power recovery models.

For the pre-EPU SBO MAAP analyses, the impact of the change in the onset of the increased seal LOCA from 30 minutes to 13 minutes on the time to core damage was evaluated to assess the NRC concerns in approving WCAP-15603, Revision 1A. The results of this sensitivity assessment did not lead to any significant changes in the time to core damage. Thus, it was concluded that the time to core damage provided in the current, pre-EPU seal LOCA sequences, using the 30-minute timing, was sufficient to access the electric power recovery models.

The impact of this change on the post-EPU PRA model was also assessed by performing sensitivity analyses. For the post-EPU SBO MAAP sensitivity analyses, the onset of the increased seal LOCA changed from 13 minutes back to 30 minutes. The results of this sensitivity assessment did not lead to any significant changes in the time to core damage. Thus, it was concluded, over the spectrum of seal binding failure sizes, that the core damage timing difference between the pre-EPU and EPU models is due largely to the EPU design changes and not the start of the increased RCP seal leakage.

Moreover, there is an insignificant impact on CDF from the non-electric power recovery split fractions developed using the electric power recovery model whose time to core damage decreased by more than one minute from the change in timing of the RCP seal binding failure. All of these split fractions had Fussell-Vesely importance values less than 2E-04 and risk achievement worths less than 1.01. This shows that the impact of the time change in the RCP seal binding failure from 13 minutes to 30 minutes, or vice versa, on CDF is insignificant. Additionally, since over 99% of the LERF contribution is attributed to interfacing system LOCAs and SGTRs, the impact of this timing change on LERF is also expected to be insignificant.

Question

5. **What is the expected impact of EPU on the probability of consequential loss of offsite power (LOOP)? For each unit, provide the contribution to the total CDF from consequential LOOP events in the current model. Provide the same information for operation at EPU conditions, or provide a sensitivity analysis showing how CDF would change assuming the probability of consequential LOOP increases after EPU.**

Response:

The probability of a consequential LOOP is 2.66E-04 at both BVPS-1 and BVPS-2, and is not expected to be impacted by the EPU.

Studies were performed to evaluate the impact of BVPS EPU operation on the transmission system grid stability. The results of these studies yield generally comparable results to that obtained from the previous pre-EPU study. In addition, the 345 kV and 138 kV switchyards were also evaluated. This evaluation concluded equipment and components associated with the 345 kV and 138 kV overhead lines between the station and the switchyards are adequate under EPU conditions. The equipment and components in the 345 kV and 138 kV switchyards are also adequate under EPU conditions. As such, the plant response following a unit trip will be essentially the same following the EPU as it currently is modeled.

The contribution to the total CDF from consequential LOOP events for the current PRA models and EPU PRA models for both BVPS-1 and BVPS-2 are provided below:

BVPS-1:

Current PRA model = 2.62E-03 (0.26%)

EPU PRA model = 1.95E-03 (0.20%)

BVPS-2:

Current PRA model = 1.22E-02 (1.22%)

EPU PRA model = 1.25E-02 (1.25%)

The slight decrease in the consequential LOOP contribution to the total CDF at BVPS-1 is attributed to the reduction in CDF due to the steam generator replacement, since there were several SGTR sequences involving consequential LOOPs. The consequential LOOP contributions to the total CDF at BVPS-2 remains essentially the same for both the current pre-EPU and post-EPU conditions.

Question

6. **The PRA results in the EPU risk assessment (Reference 2) were compared with those provided in a response to the NRC staff's questions on a recent license amendment request for extending the emergency diesel generator (EDG) allowed outage time (AOT) (Reference 3). The table below compares the information.**

	EDG AOT (Ref. 3)	EPU (Ref. 2)
Beaver Valley Unit 1		
PRA Model Designator	BV1 REV3	BV1 REV3
Date Updated	9/2003	9/2003
CDF (per year)	2.34E-5	7.45E-6
LERF (per year)	1.03E-6	1.03E-6
Beaver Valley Unit 2		
PRA Model Designator	BV2 REV3B	BV2 REV3D
Date Updated	5/2003	5/2003
CDF (per year)	3.27E-5	2.01E-5
LERF (per year)	1.12E-6	1.12E-6

Question

a. **What has changed in the BVPS-1 and BVPS-2 PRA models since the Reference 3 letter?**

Response:

The BVPS-1 and BVPS-2 baseline PRA models used in the EDG AOT analyses are the same as the BVPS-1 and BVPS-2 baseline PRA models used in the EPU analyses. There were some changes associated with the EDG AOT PRA models for Case 1, which were noted in LAR 306 and 176, L-04-072 (dated May 26, 2004), Section 4.3.2, Page 15. These consisted of the following:

"Case 1 modeled the current EDG unavailability. This sensitivity case was run by changing the EDG unavailability from 2.5%, which is the current value used in the BVPS-1 and BVPS-2 baseline PRA models, to the present mean unavailability of the EDG under the current AOT or 0.77% (Unit 1) and 0.348% (Unit 2)."

The EPU baseline PRA models used the 2.5% EDG unavailability value. Additionally, the EPU PRA model include all of the modifications identified in Section 10.16.1.6 of L-05-104 Enclosure 1 (page 17 of 32). It should also be noted that BV2REV3B is the current model revision of record at BVPS-2; however, BV2REV3D was used in both the EDG AOT and EPU analyses, which removed common cause failures from the 4KV transformers.

Question

b. Explain why BVPS-1 CDF has dropped significantly and BVPS-2 CDF has dropped somewhat compared to the Reference 3 values.

Response:

The EPU CDF values in the comparison table provided with this RAI question are incorrect.

As stated in Section 10.16.1.6 of L-05-104 Enclosure 1 (page 18 of 32), "...the effect of the BVPS-1 EPU was to decrease the internal events CDF from 7.45E-06 per year to 6.85E-06 per year. This section also states that "...the effect of the BVPS-2 EPU was to increase the internal events CDF from 2.01E-05 per year to 2.02E-05 per year..."

Moreover, the EPU CDF values provided in the comparison table are based on point estimate values and only include the core damage frequency associated with internal initiating events. The EDG AOT CDF values provided in the comparison table represents the total core damage frequency, including both internal and external initiating events.

Using the PRA baseline models and the information provided in Reference 3 for Case 1 (Tables 5 and 9 for BVPS-1 and BVPS-2, respectively), a better breakdown comparison between the Baseline PRA CDF, EDG AOT CDF, and EPU CDF are provided in Tables 6-1 and 6-2:

Table 6-1. BVPS-1

	BASELINE PRA MODELS	EDG AOT (Ref. 3)	EPU (Ref. 2)
Internal Events CDF	7.45E-06	7.13E-06	6.85E-06
Fire CDF	4.60E-06	4.69E-06	4.61E-06
Seismic CDF	1.17E-05	1.17E-05	1.17E-05
Total CDF	2.37E-05	2.35E-05	2.31E-05

Table 6-2. BVPS-2			
	BASELINE PRA MODELS	EDG AOT (Ref. 3)	EPU (Ref. 2)
Internal Events CDF	2.01E-05	1.86E-05	2.02E-05
Fire CDF	5.29E-06	4.71E-06	5.30E-06
Seismic CDF	9.54E-06	9.58E-06	9.54E-06
Total CDF	3.49E-05	3.29E-05	3.51E-05

Based on the above tables, the reduction in BVPS-1 total EPU CDF is insignificant when compared to the total AOT CDF, and is mostly attributed to the reduction in the SGTR initiating event frequency.

It should also be mentioned that Reference 3, Case 1 modeled the current EDG unavailability, as opposed to the baseline PRA model unavailability of 2.5%. This sensitivity case was run by changing the EDG unavailability from 2.5%, to the present mean unavailability of the EDG under the current AOT or 0.77% (BVPS-1) and 0.348% (BVPS-2). These changes in EDG unavailability account for the differences in the internal events CDF as stated in Section 10.16.1.6 of L-05-104 Enclosure 1 (7.13E-06 vs. 7.45E-06 for BVPS-1, and 1.86E-05 vs. 2.01E-05 for BVPS-2).

REFERENCES:

1. **Letter from L. William Pearce, FirstEnergy Nuclear Operating Company, to U.S. Nuclear Regulatory Commission, "Beaver Valley Power Station, Unit No. 1 and No. 2 BV-1 Docket No. 50-334, License No. DPR-66 BV-2 Docket No. 50-412. License No. NPF-73 License Amendment Request Nos. 302 and 173," L-04-125, October 4, 2004. (ADAMS Accession No. ML042920300)**

2. **Letter from L. William Pearce, FirstEnergy Nuclear Operating Company, to U.S. Nuclear Regulatory Commission, "Beaver Valley Power Station, Unit Nos. 1 and 2 BV-1 Docket No. 50-334, License No. DPR-66 BV-2 Docket No. 50-412, License No. NPF-73 Probabilistic Safety Review for License Amendment Request Nos. 302 and 173," L-05-104, June 14, 2005. (ADAMS Accession No. ML051670270)**

3. **Letter from L. William Pearce, FirstEnergy Nuclear Operating Company, to U.S. Nuclear Regulatory Commission, "Beaver Valley Power Station, Unit No. 1 and No. 2 BV-1 Docket No. 50-334, License No. DPR-66 BV-2 Docket No. 50-412, License No. NPF-73 Response to Request for Additional Information in Support of LAR Nos. 306 and 176 Emergency Diesel Generator Allowed Outage Time Extension," L-04-141, October 29, 2004. (ADAMS Accession No. ML043070444)**

Attachment 1 to RAI 2.a.

BVPS-1 Pre-EPU SLIM Worksheets

BEAVER VALLEY UNIT 1 - GROUP 1 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.13	0.13	0.13	0.31	0.13	0.06	0.13	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.98E-01	-0.0008
ZHEOR1	5	5	5	3	5	2	5	4.188	2.01E-03	-2.6970
ZHECD3	8	2	9	2	8	5	6	5.063	5.12E-03	-2.2911
ZHEMU5	8	4	6	5	6	1	5	5.25	6.25E-03	-2.2042
MINHER	0	0	0	0	0	0	0	0	2.29E-05	-4.6394

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
DCZHERF1(1)	5	5	5	3	5	2	5	4.188	2.00E-03	-2.6990
MINHER	0	0	0	0	0	0	0	0	2.30E-05	-4.6383

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BVI (ZHEOR1)

Regression Output:

Constant	-4.63941
Std Err of YEst	0.002418
R Squared	0.999999
No. of Observations	3
Degrees of Freedom	1
X Coefficient (s)	0.4638592
Std Err of Coef.	0.0003404

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEOR1	0	0	0	5	0	0	0	5
ZHECD3	5	5	5	10	5	5	5	40
ZHEMU5	5	5	5	10	5	0	5	35
NORMALIZED PSF WEIGHTS	0.13	0.13	0.13	0.31	0.13	0.06	0.13	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

OPERATOR ACTIONS	RANGE FACTOR	MEDIAN
ZHEOR1	7.5	9.49E-04
ZHECD3	7.5	2.42E-03
ZHEMU5	7.5	2.95E-03

Figure 1: BVPS-1 Pre-EPU SLIM Worksheet Group 1

BEAVER VALLEY UNIT 1 - GROUP 2 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE QUALITY	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.08	0.00	0.33	0.33	0.08	0.08	0.08	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	.999E-01	-0.0003
ZHEMU1	8	5	8	5	2	1	4	5.583	8.40E-03	-2.0757
ZHEMU2	8	6	8	5	2	3	4	5.75	1.01E-02	-1.9974
ZHEOR2	7	7	6	3	5	2	5	4.583	2.85E-03	-2.5456
ZHEWM1	8	5	8	5	2	1	4	5.583	8.40E-03	-2.0757
ZHEOS1	7	1	7	5	3	3	3	5.333	6.41E-03	-2.1932
ZHEOS2	7	1	7	5	3	5	5	5.667	9.19E-03	-2.0365
MINHER	0	0	0	0	0	0	0	0	2.00E-05	-4.6993

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
PLANT-XCFBPO1(1)	7	1	7	5	3	3	3	5.333	6.40E-03	-2.1938
MINHER	0	0	0	0	0	0	0	0	2.00E-05	-4.6990

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV1(ZHEOS1)

Regression Output:

Constant	-4.69927
Std Err of YEst	0.000789
R Squared	1
No of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.4698927
Std Err of Coef.	0.0001115

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE QUALITY	TRAINING	TIME	STRESS	SUM

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEMU1	0	0	5	5	0	0	0	10
ZHEMU2	0	0	5	5	0	0	0	10
ZHEOR2	0	0	5	5	0	0	0	10
ZHEWM1	0	0	5	5	0	0	0	10
ZHEOS1	5	0	10	10	5	5	5	40
ZHEOS2	5	0	10	10	5	5	5	40
NORMALIZED PSF WEIGHTS	0.08	0.00	0.33	0.33	0.08	0.08	0.08	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	3.97E-03
5	6.23E-03
7.5	1.34E-03
7.5	3.97E-03
7.5	3.03E-03
7.5	4.34E-03

Figure 2: BVPS-1 Pre-EPU SLIM Worksheet Group 2

BEAVER VALLEY UNIT 1 - GROUP 3 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.12	0.12	0.10	0.10	0.07	0.24	0.24	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.36E-01	-0.0285
ZHECD2	2	6	8	5	7	2	4	4.241	2.58E-03	-2.5886
ZHEHM1	2	1	2	2	4	6	6	3.948	1.91E-03	-2.7190
ZHERE6	1	2	6	9	9	7	7	6.121	1.77E-02	-1.7531
ZHEFL1	7	7	9	9	6	6	8	7.345	6.18E-02	-1.2069
ZHEFL2	7	7	9	9	6	5	8	7.103	4.83E-02	-1.3162
ZHEFL3	7	7	9	9	6	5	8	7.103	4.83E-02	-1.3162
ZHEIC3	6	9	8	2	9	6	8	6.845	3.70E-02	-1.4312
MINHER	0	0	0	0	0	0	0	0	3.36E-05	-4.4743

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STPHEOS01	4	3	6	10	10	6	3	5.362	1.80E-02	-1.7447
FERMIRE7	6	7	6	8	6	5	6	6.569	1.32E-02	-1.8794
MINHER	0	0	0	0	0	0	0	0	3.00E-05	-4.5229

Regression Output:

Constant	-4.47426
Std Err of Y Est	0.338135
R Squared	0.978095
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.444575
Std Err of Coef.	0.0470447

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PREDIDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHECD2	5	5	5	5	5	10	10	45
ZHEHM1	5	5	5	5	5	10	10	45
ZHERE6	5	5	5	5	5	10	10	45
ZHEFL1	5	5	5	5	0	10	10	40
ZHEFL2	5	5	5	5	0	10	10	40
ZHEFL3	5	5	5	5	0	10	10	40
ZHEIC3	5	5	0	0	5	10	10	35
NORMALIZED PSF WEIGHTS	0.12	0.12	0.10	0.10	0.07	0.24	0.24	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

OPERATOR ACTIONS	RANGE FACTOR	MEDIAN
ZHECD2	7.5	1.22E-03
ZHEHM1	7.5	9.02E-04
ZHERE6	5	1.09E-02
ZHEFL1	5	3.83E-02
ZHEFL2	5	2.99E-02
ZHEFL3	5	2.99E-02
ZHEIC3	5	2.30E-02

Figure 3: BVPS-1 Pre-EPU SLIM Worksheet Group 3

BEAVER VALLEY UNIT 1 - GROUP 4 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.13	0.11	0.13	0.11	0.13	0.11	0.30	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.15E-01	-0.0387
ZHEHC1	2	1	2	2	4	0	5	2.83	2.58E-04	-3.5885
ZHEPR1	2	2	2	2	3	0	6	3.106	3.53E-04	-3.4518
ZHECD4	9	2	9	8	8	5	10	7.894	8.29E-02	-1.0815
ZHEMU3	8	6	8	5	8	5	6	6.553	1.80E-02	-1.7451
ZHEMU4	8	6	8	5	8	7	8	7.362	4.52E-02	-1.3449
ZHECB1	2	6	3	2	4	1	7	4.191	1.22E-03	-2.9144
ZHEOA1	2	0	2	0	3	2	7	3.191	3.90E-04	-3.4095
ZHEOT1	0	10	1	2	3	1	6	3.681	6.60E-04	-3.1872
MINHER	0	0	0	0	0	0	0	0	1.02E-05	-4.9895

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HERC4	2	6	3	5	6	1	6	4.681	9.82E-04	-3.0079
FERMI HECT3	4	6	3	3	3	3	3	3.447	1.15E-03	-2.9393
MINHER	0	0	0	0	0	0	0	0	9.20E-06	-5.0362

Regression Output:

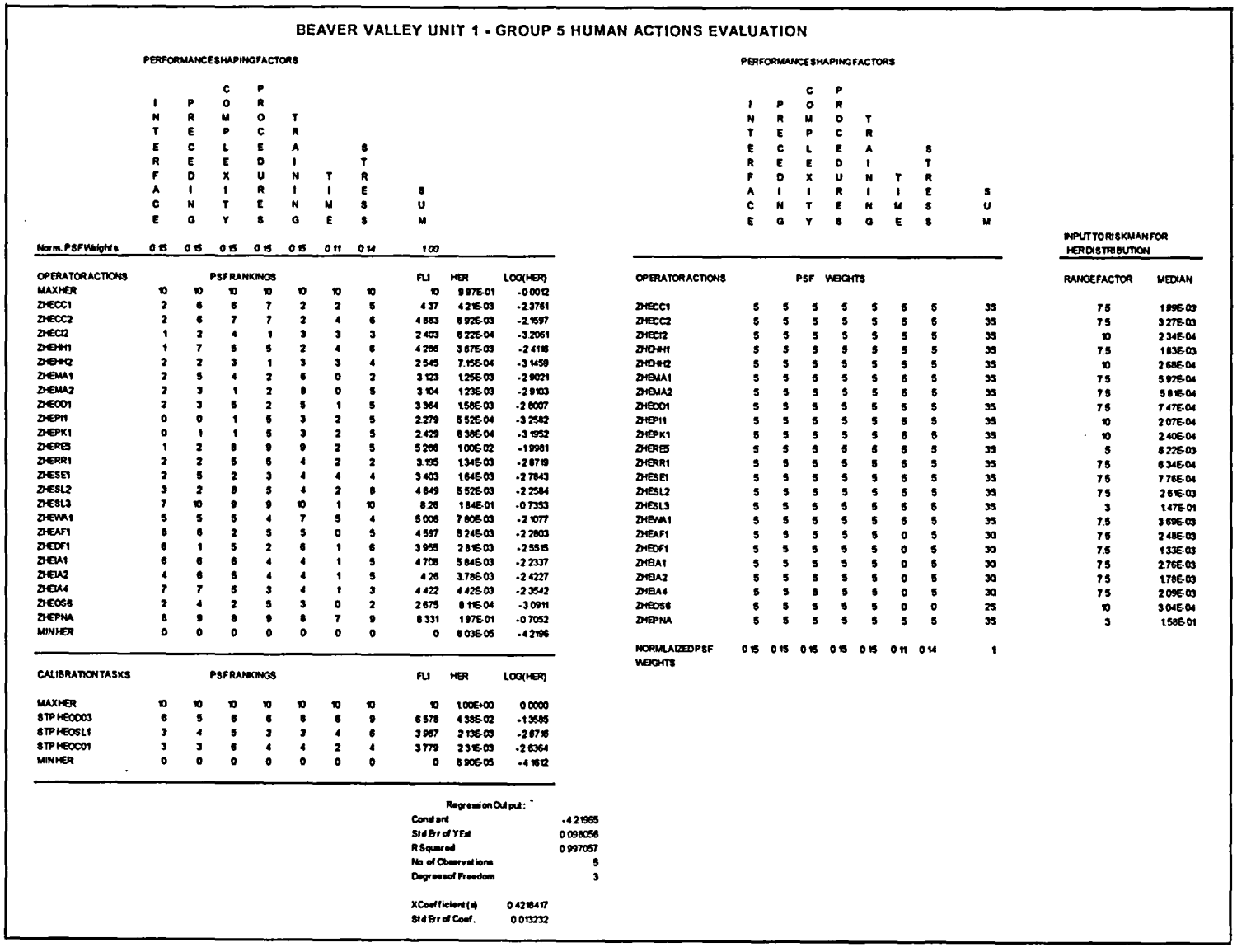
Constant	-4.98954
Std Err of Y Est	0.342488
R Squared	0.981802
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.4950857
Std Err of Coef.	0.0476608

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM

OPERATOR ACTIONS	PSF WEIGHTS								INPUT TO RISKMAN FOR HER DISTRIBUTION	
									RANGE FACTOR	MEDIAN
ZHEHC1	0	0	0	0	0	0	5	5	10	9.68E-05
ZHEPR1	0	0	0	0	0	0	5	5	10	1.33E-04
ZHECD4	5	5	5	5	5	5	10	40	5	5.14E-02
ZHEMU3	5	5	5	5	5	5	10	40	5	1.11E-02
ZHEMU4	5	5	5	5	5	5	10	40	5	2.80E-02
ZHECB1	5	5	5	5	5	5	10	40	7.5	5.75E-04
ZHEOA1	5	5	5	5	5	0	10	35	10	1.46E-04
ZHEOT1	5	0	5	0	5	5	10	30	10	2.55E-04
NORMALIZED PSF WEIGHTS	0.13	0.11	0.13	0.11	0.13	0.11	0.30	1		

Figure 4: BVPS-1 Pre-EPU SLIM Worksheet Group 4



BEAVER VALLEY UNIT 1 - GROUP 5 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.15	0.15	0.15	0.15	0.15	0.11	0.14	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.97E-01	-0.0012
ZHECC1	2	6	6	7	2	2	5	4.37	4.21E-03	-2.3761
ZHECC2	2	6	7	7	2	4	6	4.883	6.92E-03	-2.1597
ZHEC2	1	2	4	1	3	3	3	2.403	6.22E-04	-3.2061
ZHEHH1	1	7	5	5	2	4	6	4.266	3.87E-03	-2.4118
ZHEHH2	2	2	3	1	3	3	4	2.545	7.15E-04	-3.1459
ZHEMA1	2	5	4	2	6	0	2	3.123	1.25E-03	-2.9021
ZHEMA2	2	3	1	2	8	0	5	3.104	1.23E-03	-2.9103
ZHEOO1	2	3	5	2	5	1	5	3.364	1.58E-03	-2.8007
ZHEPI1	0	0	1	5	3	2	5	2.279	5.52E-04	-3.2582
ZHEPK1	0	1	1	5	3	2	5	2.429	6.38E-04	-3.1952
ZHERE5	1	2	8	9	9	2	5	5.266	1.00E-02	-1.9981
ZHERR1	2	2	5	5	4	2	2	3.195	1.34E-03	-2.8719
ZHESE1	2	5	2	3	4	4	4	3.403	1.64E-03	-2.7843
ZHESL2	3	2	8	5	4	2	8	4.649	5.52E-03	-2.2584
ZHESL3	7	10	9	9	10	1	10	8.26	1.84E-01	-0.7353
ZHEWA1	5	5	5	4	7	5	4	5.006	7.80E-03	-2.1077
ZHEAF1	8	6	2	5	5	0	5	4.597	5.24E-03	-2.2803
ZHEDF1	6	1	5	2	6	1	6	3.955	2.81E-03	-2.5515
ZHEIA1	6	6	6	4	4	1	5	4.708	5.84E-03	-2.2337
ZHEIA2	4	6	5	4	4	1	5	4.26	3.78E-03	-2.4227
ZHEIA4	7	7	6	3	4	1	3	4.422	4.42E-03	-2.3542
ZHEOS6	2	4	2	5	3	0	2	2.675	8.11E-04	-3.0911
ZHEPNA	8	9	8	9	8	7	9	8.331	1.97E-01	-0.7052
MINHER	0	0	0	0	0	0	0	0	6.03E-05	-4.2196

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STPHEOD03	6	5	6	6	6	6	9	6.578	4.38E-02	-1.3585
STPHEOS11	3	4	5	3	3	4	6	3.987	2.13E-03	-2.6718
STPHEOC01	3	3	6	4	4	2	4	3.779	2.31E-03	-2.6364
MINHER	0	0	0	0	0	0	0	0	6.90E-05	-4.1612

Regression Output:

Constant	-4.21965
Std Err of YEst	0.098056
R Squared	0.997057
No of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.421841
Std Err of Coef.	0.013232

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHECC1	5	5	5	5	5	5	5	35
ZHECC2	5	5	5	5	5	5	5	35
ZHEC2	5	5	5	5	5	5	5	35
ZHEHH1	5	5	5	5	5	5	5	35
ZHEHH2	5	5	5	5	5	5	5	35
ZHEMA1	5	5	5	5	5	5	5	35
ZHEMA2	5	5	5	5	5	5	5	35
ZHEOO1	5	5	5	5	5	5	5	35
ZHEPI1	5	5	5	5	5	5	5	35
ZHEPK1	5	5	5	5	5	5	5	35
ZHERE5	5	5	5	5	5	5	5	35
ZHERR1	5	5	5	5	5	5	5	35
ZHESE1	5	5	5	5	5	5	5	35
ZHESL2	5	5	5	5	5	5	5	35
ZHESL3	5	5	5	5	5	5	5	35
ZHEWA1	5	5	5	5	5	5	5	35
ZHEAF1	5	5	5	5	5	0	5	30
ZHEDF1	5	5	5	5	5	0	5	30
ZHEIA1	5	5	5	5	5	0	5	30
ZHEIA2	5	5	5	5	5	0	5	30
ZHEIA4	5	5	5	5	5	0	5	30
ZHEOS6	5	5	5	5	5	0	0	25
ZHEPNA	5	5	5	5	5	5	5	35
NORMLAIZED PSF WEIGHTS	0.15	0.15	0.15	0.15	0.15	0.11	0.14	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	1.89E-03
7.5	3.27E-03
10	2.34E-04
7.5	1.83E-03
10	2.68E-04
7.5	5.92E-04
7.5	5.81E-04
7.5	7.47E-04
10	2.07E-04
10	2.40E-04
5	6.22E-03
7.5	6.34E-04
7.5	7.76E-04
7.5	2.61E-03
3	1.47E-01
7.5	3.69E-03
7.5	2.48E-03
7.5	1.33E-03
7.5	2.76E-03
7.5	1.78E-03
7.5	2.09E-03
10	3.04E-04
3	1.58E-01

Figure 5: BVPS-1 Pre-EPU SLIM Worksheet Group 5

BEAVER VALLEY UNIT 1 - GROUP 6 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE INDEX	TRAINING INDEX	TIME	STRESS	SUM
Norm. PSF Weights	0.00	0.50	0.00	0.00	0.00	0.50	0.00	1.00

OPERATOR ACTIONS	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE INDEX	TRAINING INDEX	TIME	STRESS	SUM	FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10		9.98E-01	-0.0007
ZHESL1	6	6	6	5	3	3	5	4.5		3.38E-03	-2.4715
ZHETT1	4	5	2	3	3	7	5	6		1.59E-02	-1.7976
MINHER	0	0	0	0	0	0	0	0		3.21E-05	-4.4930

CALIBRATION TASKS	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE INDEX	TRAINING INDEX	TIME	STRESS	SUM	FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10		1.00E+00	0.0000
STP HEOSL1	3	4	5	3	3	4	6	4		2.13E-03	-2.6716
DC ZHEOX1(1)	6	6	6	5	3	3	5	4.5		3.20E-03	-2.4949
MINHER	0	0	0	0	0	0	0	0		3.20E-05	-4.4949

NOTE

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV1(ZHESL1)

Regression Output:

Constant	-4.49301
Std Err of Y Est	0.023969
R Squared	0.999888
No of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.4492291
Std Err of Coef.	0.0033667

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE INDEX	TRAINING INDEX	TIME	STRESS	SUM
NORMALIZED PSF WEIGHTS	0.00	0.50	0.00	0.00	0.00	0.50	0.00	1

OPERATOR ACTIONS	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE INDEX	TRAINING INDEX	TIME	STRESS	SUM
ZHESL1	0	5	0	0	0	5	0	10
ZHETT1	0	5	0	0	0	5	0	10

INPUT TO RISKMAN FOR HER DISTRUBITION

RANGE FACTOR	MEDIAN
7.5	1.59E-03
5	9.87E-03

Figure 6: BVPS-1 Pre-EPU SLIM Worksheet Group 6

BEAVER VALLEY UNIT 1 - GROUP 7 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.10	0.25	0.10	0.10	0.10	0.10	0.25	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.99E-01	-0.0005
ZHECI1	2	5	3	3	5	2	3	3.5	2.23E-03	-2.6512
ZHECD5	1	6	8	5	7	2	8	5.8	1.94E-02	-1.7133
ZHEOB2	2	9	3	2	4	1	8	5.45	1.39E-02	-1.8560
MIN HER	0	0	0	0	0	0	0	0	8.35E-05	-4.0785

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HEOB02	4	3	6	4	7	2	8	5.05	8.80E-03	-2.0555
OPRA-8 (1)	2	9	3	2	4	1	8	5.45	1.00E-02	-2.0000
DC ZHEOB1	5	7	7	6	6	4	8	6.55	5.49E-02	-1.2604
MIN HER	0	0	0	0	0	0	0	0	9.00E-05	-4.0458

NOTE

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV1 (ZHEOB2)

Regression Output:

Constant	-4.07855
Std Err of Y Est	0.122121
R Squared	0.99483
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.4078012
Std Err of Coef.	0.0159732

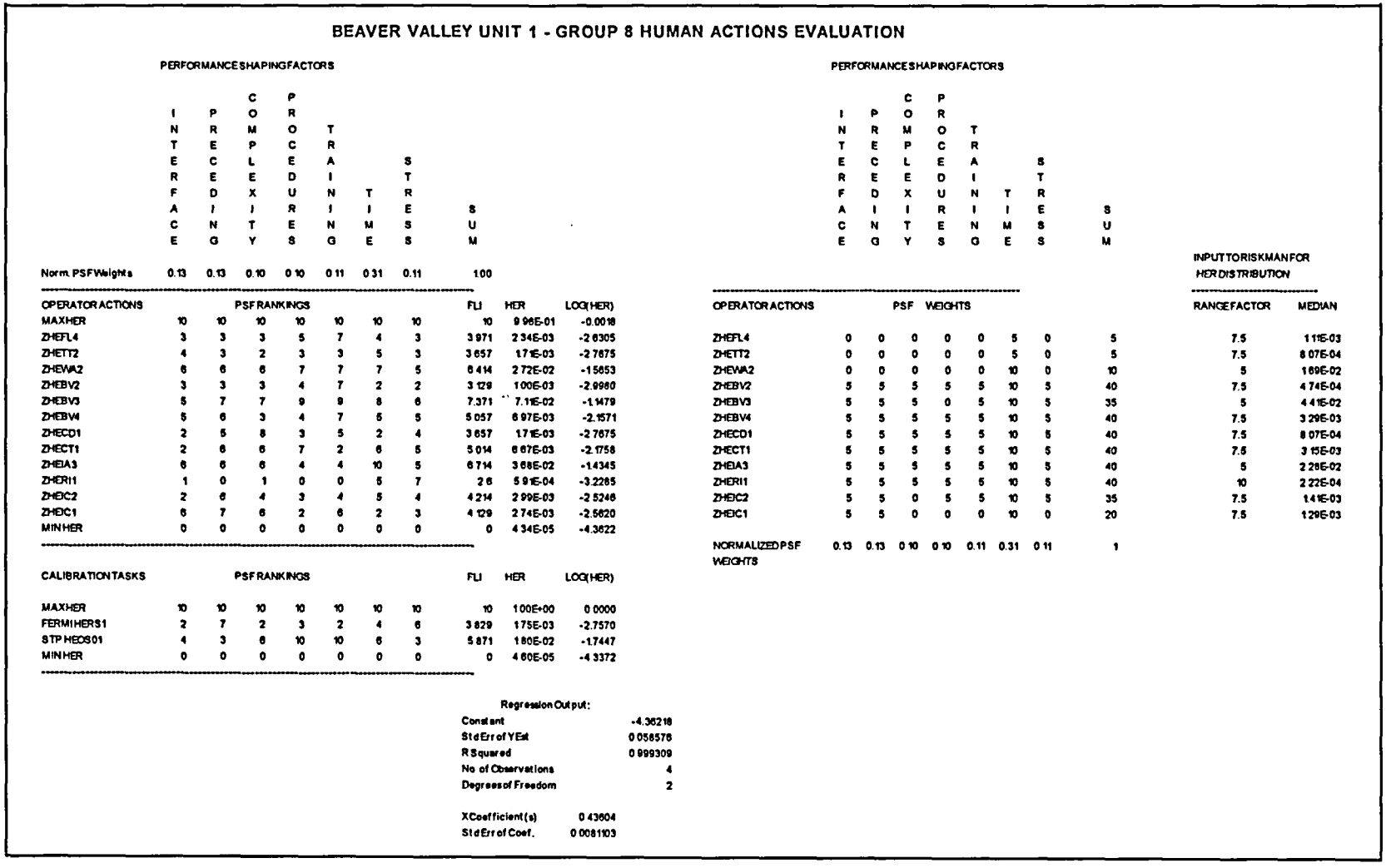
PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHECI1	0	5	0	0	0	0	5	10
ZHECD5	5	10	5	5	5	5	10	45
ZHEOB2	5	10	5	5	5	5	10	45
NORMALIZED PSF WEIGHTS	0.10	0.25	0.10	0.10	0.10	0.10	0.25	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	1.05E-03
5	1.20E-02
5	8.63E-03

Figure 7: BVPS-1 Pre-EPU SLIM Worksheet Group 7



BEAVER VALLEY UNIT 1 - GROUP 8 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDISPOSING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.13	0.13	0.10	0.10	0.11	0.31	0.11	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HEP	LOG(HEP)
MAXHEP	10	10	10	10	10	10	10	10	9.96E-01	-0.0018
ZHEFL4	3	3	3	5	7	4	3	3.971	2.34E-03	-2.6305
ZHETT2	4	3	2	3	3	5	3	3.657	1.71E-03	-2.7675
ZHEWA2	6	6	6	7	7	7	5	6.414	2.72E-02	-1.5653
ZHEBV2	3	3	3	4	7	2	2	3.129	1.00E-03	-2.9980
ZHEBV3	5	7	7	9	9	8	6	7.371	7.11E-02	-1.1479
ZHEBV4	5	6	3	4	7	5	5	5.057	6.97E-03	-2.1571
ZHECD1	2	5	8	3	5	2	4	3.657	1.71E-03	-2.7675
ZHECT1	2	6	6	7	2	6	5	5.014	6.67E-03	-2.1758
ZHEIA3	6	6	6	4	4	10	5	6.714	3.68E-02	-1.4345
ZHERI1	1	0	1	0	0	5	7	2.6	5.91E-04	-3.2285
ZHEIC2	2	6	4	3	4	5	4	4.214	2.99E-03	-2.5246
ZHEIC1	6	7	6	2	6	2	3	4.129	2.74E-03	-2.5620
MINHEP	0	0	0	0	0	0	0	0	4.34E-05	-4.3622

CALIBRATION TASKS	PSF RANKINGS							FLI	HEP	LOG(HEP)
MAXHEP	10	10	10	10	10	10	10	10	1.00E+00	0.0000
FERMIHERS1	2	7	2	3	2	4	6	3.829	1.75E-03	-2.7570
STPHEOS01	4	3	6	10	10	6	3	5.871	1.80E-02	-1.7447
MINHEP	0	0	0	0	0	0	0	0	4.60E-05	-4.3372

Regression Output:

Constant	-4.36218
Std Err of YEst	0.058576
R Squared	0.999309
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.43604
Std Err of Coef.	0.0081103

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEFL4	0	0	0	0	0	5	0	5
ZHETT2	0	0	0	0	0	5	0	5
ZHEWA2	0	0	0	0	0	10	0	10
ZHEBV2	5	5	5	5	5	10	5	40
ZHEBV3	5	5	5	0	5	10	5	35
ZHEBV4	5	5	5	5	5	10	5	40
ZHECD1	5	5	5	5	5	10	5	40
ZHECT1	5	5	5	5	5	10	5	40
ZHEIA3	5	5	5	5	5	10	5	40
ZHERI1	5	5	5	5	5	10	5	40
ZHEIC2	5	5	0	5	5	10	5	35
ZHEIC1	5	5	0	0	0	10	0	20
NORMALIZED PSF WEIGHTS	0.13	0.13	0.10	0.10	0.11	0.31	0.11	1

INPUT TO RISKMAN FOR *HEP DISTRIBUTION*

RANGE FACTOR	MEDIAN
7.5	1.11E-03
7.5	8.07E-04
5	1.69E-02
7.5	4.74E-04
5	4.41E-02
7.5	3.29E-03
7.5	8.07E-04
7.5	3.15E-03
5	2.28E-02
10	2.22E-04
7.5	1.41E-03
7.5	1.29E-03

Figure 8: BVPS-1 Pre-EPU SLIM Worksheet Group 8

BEAVER VALLEY UNIT 1 - GROUP 9 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.00	0.17	0.17	0.17	0.17	0.17	0.17	1.00
OPERATOR ACTIONS	**PSF RANKINGS**							**FLI / HER / LOG(HER)**
MAXHER	10	10	10	10	10	10	10	10 / 9.98E-01 / -0.0008
ZHECD6	2	9	5	3	7	3	9	6 / 4.99E-02 / -1.3022
ZHECD7	2	9	8	5	8	5	9	7.333 / 1.35E-01 / -0.8684
MINHER	0	0	0	0	0	0	0	0 / 5.57E-04 / -3.2542
CALIBRATION TASKS	**PSF RANKINGS**							**FLI / HER / LOG(HER)**
MAXHER	10	10	10	10	10	10	10	10 / 1.00E+00 / 0.0000
STP HECD03	6	5	6	6	8	6	9	6.667 / 4.36E-02 / -1.3585
EPRISH1(1)	2	9	5	3	7	3	9	6 / 1.00E-01 / -1.0000
MINHER	0	0	0	0	0	0	0	0 / 5.20E-04 / -3.2840

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV1(ZHECD6)

Regression Output:

Constant	-3.2542
Std Err of Y Est	0.288842
R Squared	0.970575
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.3253357
Std Err of Coef.	0.0400552

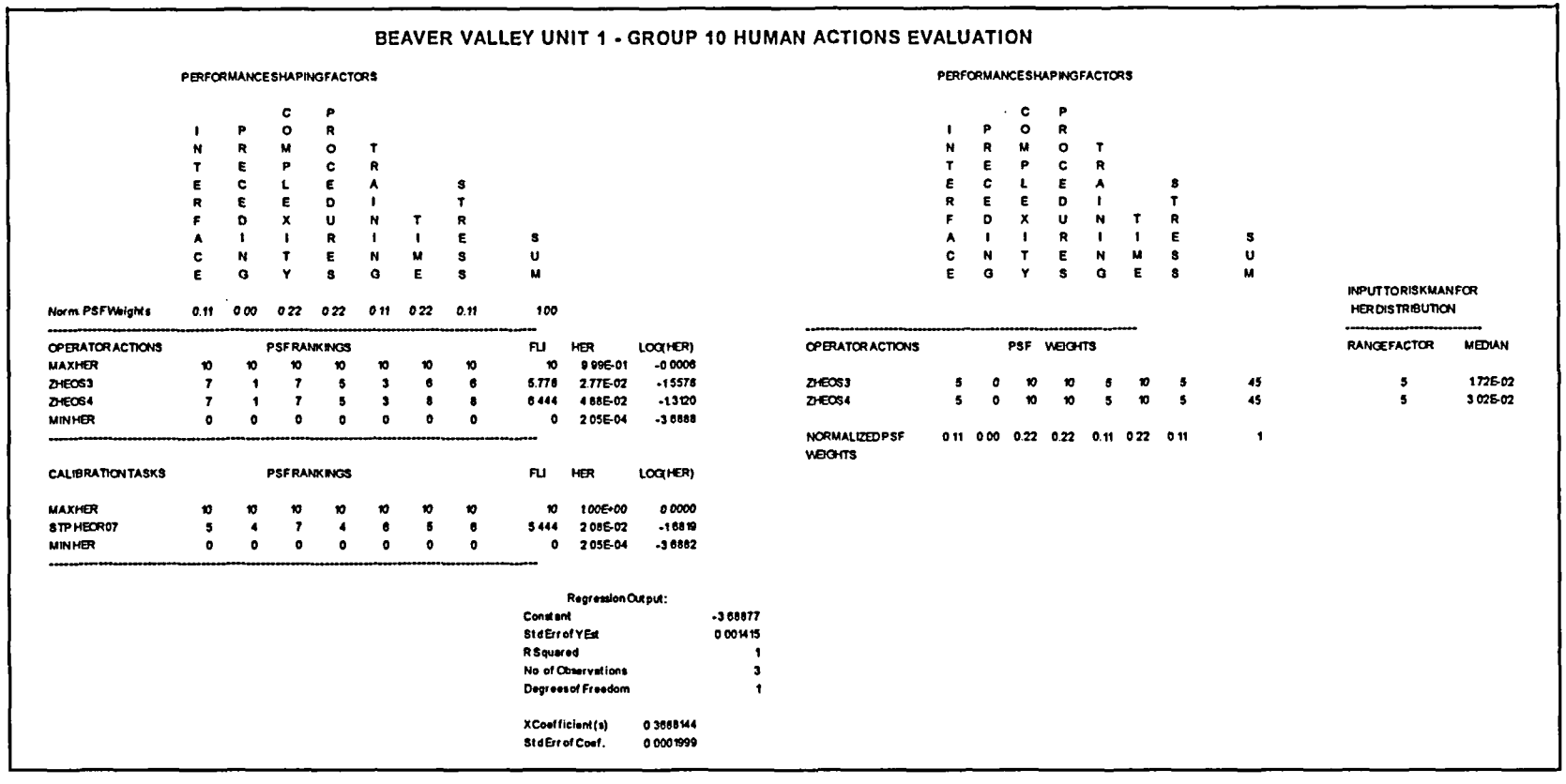
PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
OPERATOR ACTIONS	**PSF WEIGHTS**							
ZHECD6	0	5	5	5	5	5	5	30
ZHECD7	0	5	5	5	5	5	5	30
NORMALIZED PSF WEIGHTS	0.00	0.17	0.17	0.17	0.17	0.17	0.17	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

OPERATOR ACTIONS	RANGE FACTOR	MEDIAN
ZHECD6	5	3.09E-02
ZHECD7	3	1.08E-01

Figure 9: BVPS-1 Pre-EPU SLIM Worksheet Group 9



BEAVER VALLEY UNIT 1 - GROUP 10 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURES	TRAINING	STRESS	SUM
Norm PSF Weights	0.11	0.00	0.22	0.22	0.11	0.22	0.11	1.00

OPERATOR ACTIONS	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURES	TRAINING	STRESS	SUM	FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.99E-01	-0.0006
ZHEOS3	7	1	7	5	3	6	6	5.778	2.77E-02	-1.5578
ZHEOS4	7	1	7	5	3	8	8	6.444	4.68E-02	-1.3120
MINHER	0	0	0	0	0	0	0	0	2.05E-04	-3.6888

CALIBRATION TASKS	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURES	TRAINING	STRESS	SUM	FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STPHEOR07	5	4	7	4	6	5	6	5.444	2.08E-02	-1.6819
MINHER	0	0	0	0	0	0	0	0	2.05E-04	-3.6882

Regression Output:

Constant	-3.68877
Std Err of Y Est	0.001415
R Squared	1
No. of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.368144
Std Err of Coef.	0.0001999

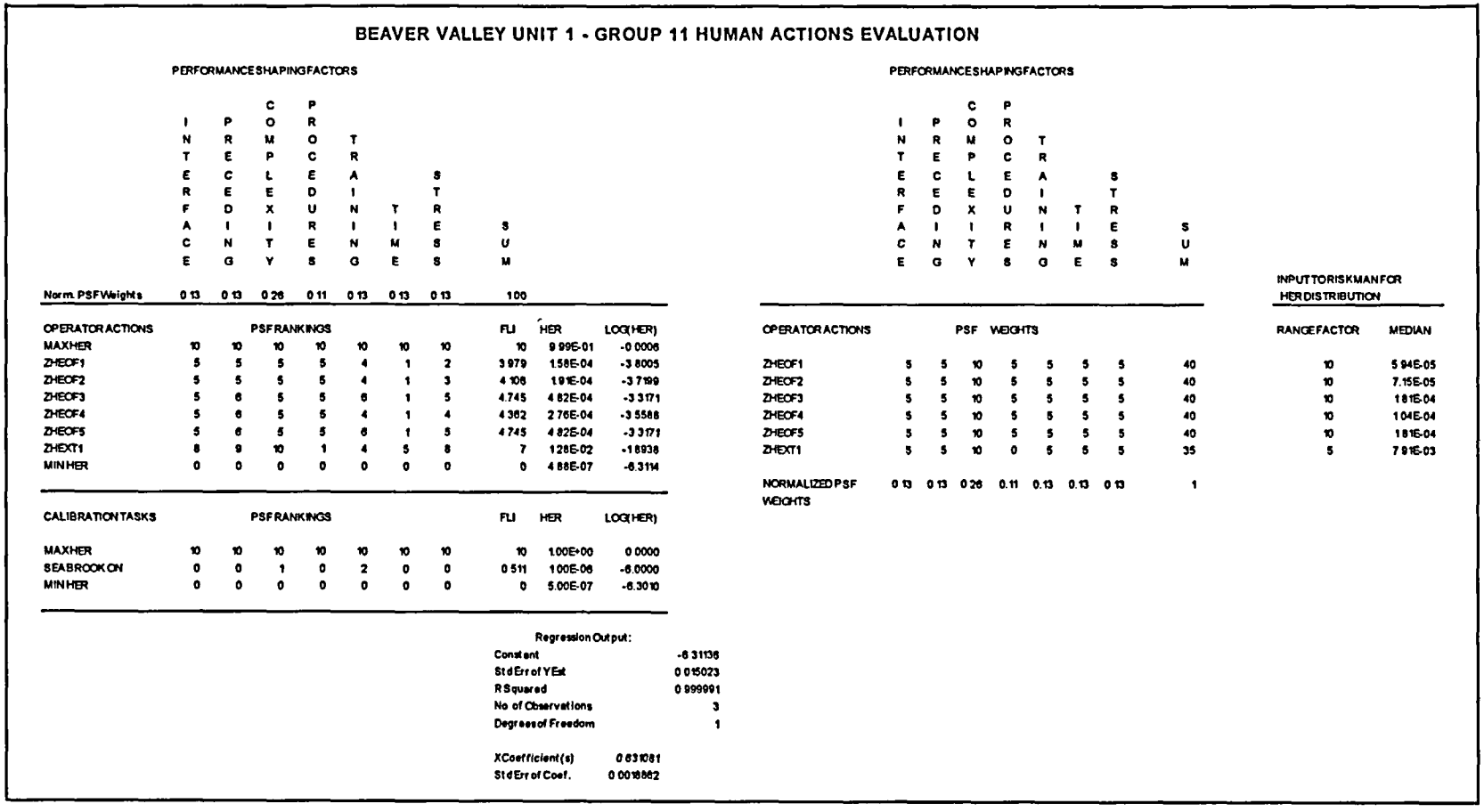
PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURES	TRAINING	STRESS	SUM	SUM
ZHEOS3	5	0	10	10	5	10	5	45
ZHEOS4	5	0	10	10	5	10	5	45
NORMALIZED PSF WEIGHTS	0.11	0.00	0.22	0.22	0.11	0.22	0.11	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	1.72E-02
5	3.02E-02

Figure 10: BVPS-1 Pre-EPU SLIM Worksheet Group 10



BEAVER VALLEY UNIT 1 - GROUP 11 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDENCE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.13	0.13	0.26	0.11	0.13	0.13	0.13	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.99E-01	-0.0006
ZHEOF1	5	5	5	5	4	1	2	3.979	1.58E-04	-3.8005
ZHEOF2	5	5	5	5	4	1	3	4.106	1.91E-04	-3.7199
ZHEOF3	5	6	5	5	6	1	5	4.745	4.82E-04	-3.3171
ZHEOF4	5	6	5	5	4	1	4	4.362	2.76E-04	-3.5588
ZHEOF5	5	6	5	5	6	1	5	4.745	4.82E-04	-3.3171
ZHEXT1	8	9	10	1	4	5	8	7	1.28E-02	-1.8938
MINHER	0	0	0	0	0	0	0	0	4.88E-07	-6.3114

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
SEABROOK ON	0	0	1	0	2	0	0	0.511	1.00E-06	-6.0000
MINHER	0	0	0	0	0	0	0	0	5.00E-07	-6.3010

Regression Output:

Constant	-6.31136
Std Err of YEst	0.015023
R Squared	0.999991
No of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.631081
Std Err of Coef.	0.0018862

PERFORMANCE SHAPING FACTORS

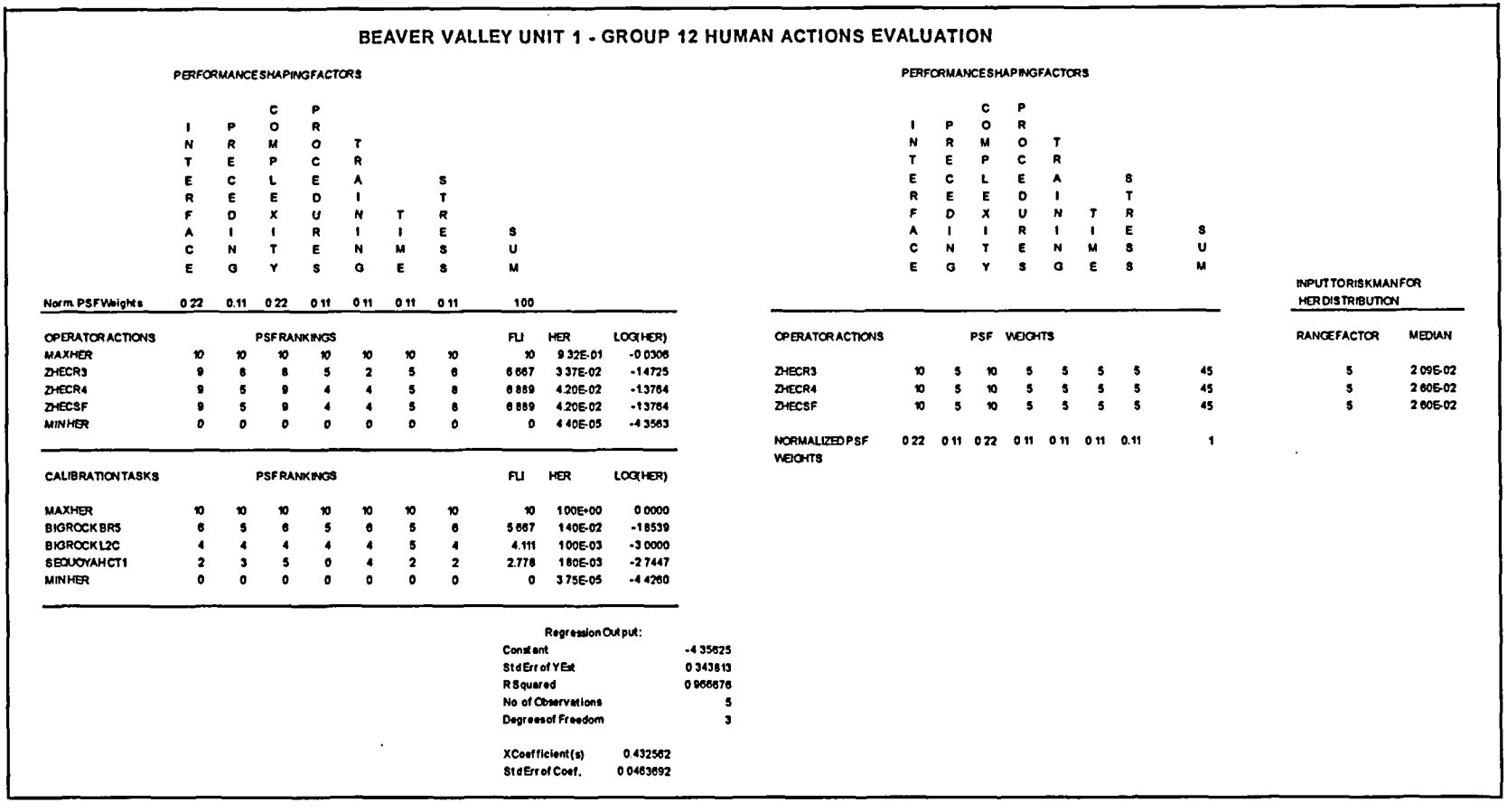
	INTERFACE	PRECEDENCE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEOF1	5	5	10	5	5	5	5	40
ZHEOF2	5	5	10	5	5	5	5	40
ZHEOF3	5	5	10	5	5	5	5	40
ZHEOF4	5	5	10	5	5	5	5	40
ZHEOF5	5	5	10	5	5	5	5	40
ZHEXT1	5	5	10	0	5	5	5	35
NORMALIZED PSF WEIGHTS	0.13	0.13	0.26	0.11	0.13	0.13	0.13	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
10	5.94E-05
10	7.15E-05
10	1.81E-04
10	1.04E-04
10	1.81E-04
5	7.91E-03

Figure 11: BVPS-1 Pre-EPU SLIM Worksheet Group 11



BEAVER VALLEY UNIT 1 - GROUP 12 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.22	0.11	0.22	0.11	0.11	0.11	0.11	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.32E-01	-0.0306
ZHECR3	9	6	8	5	2	5	6	6.667	3.37E-02	-1.4725
ZHECR4	9	5	9	4	4	5	8	6.889	4.20E-02	-1.3764
ZHECSF	9	5	9	4	4	5	8	6.889	4.20E-02	-1.3764
MINHER	0	0	0	0	0	0	0	0	4.40E-05	-4.3563

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
BIGROCK BR5	6	5	6	5	6	5	6	5.667	1.40E-02	-1.8539
BIGROCK L2C	4	4	4	4	4	5	4	4.111	1.00E-03	-3.0000
SEQUOYAH CT1	2	3	5	0	4	2	2	2.778	1.60E-03	-2.7447
MINHER	0	0	0	0	0	0	0	0	3.75E-05	-4.4260

Regression Output:

Constant	-4.35625
Std Err of Y Est	0.343813
R Squared	0.966676
No of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.432562
Std Err of Coef.	0.0463692

PERFORMANCE SHAPING FACTORS

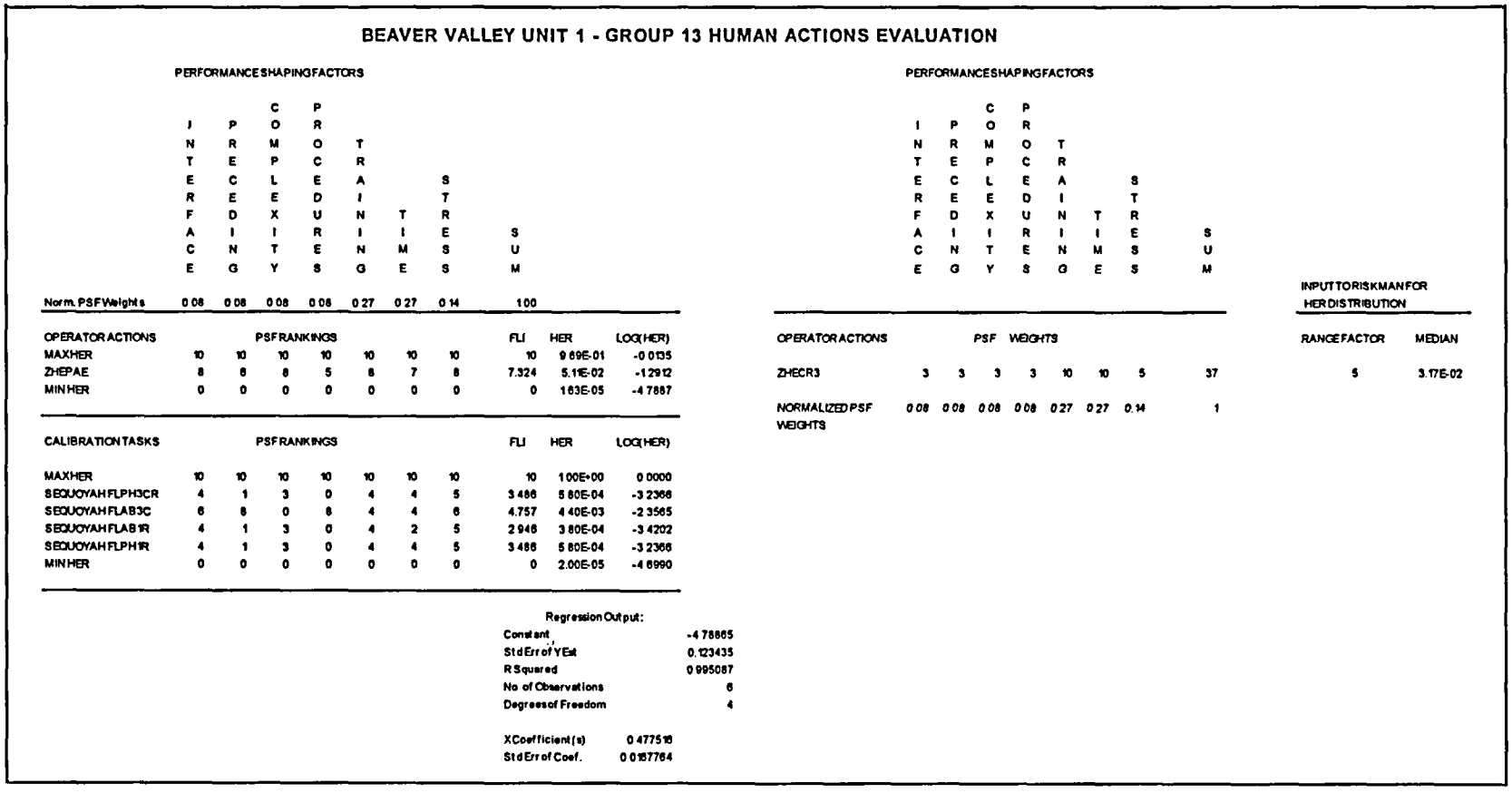
	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM

OPERATOR ACTIONS	PSF WEIGHTS							
ZHECR3	10	5	10	5	5	5	5	45
ZHECR4	10	5	10	5	5	5	5	45
ZHECSF	10	5	10	5	5	5	5	45
NORMALIZED PSF WEIGHTS	0.22	0.11	0.22	0.11	0.11	0.11	0.11	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	2.09E-02
5	2.60E-02
5	2.60E-02

Figure 12: BVPS-1 Pre-EPU SLIM Worksheet Group 12



BEAVER VALLEY UNIT 1 - GROUP 13 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING		STRESS	
Norm. PSF Weights	0.08	0.08	0.08	0.08	0.27	0.27	0.14	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.69E-01	-0.0135
ZHEPAE	8	8	8	5	8	7	8	7.324	5.11E-02	-1.2912
MINHER	0	0	0	0	0	0	0	0	1.63E-05	-4.7887

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
SEQUOYAH FLPH3CR	4	1	3	0	4	4	5	3.486	5.80E-04	-3.2366
SEQUOYAH FLAB3C	6	8	0	8	4	4	6	4.757	4.40E-03	-2.3565
SEQUOYAH FLAB1R	4	1	3	0	4	2	5	2.946	3.80E-04	-3.4202
SEQUOYAH FLPH1R	4	1	3	0	4	4	5	3.486	5.80E-04	-3.2366
MINHER	0	0	0	0	0	0	0	0	2.00E-05	-4.6990

Regression Output:

Constant	-4.78865
Std Err of Y Est	0.123435
R Squared	0.995087
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.477516
Std Err of Coef.	0.0187764

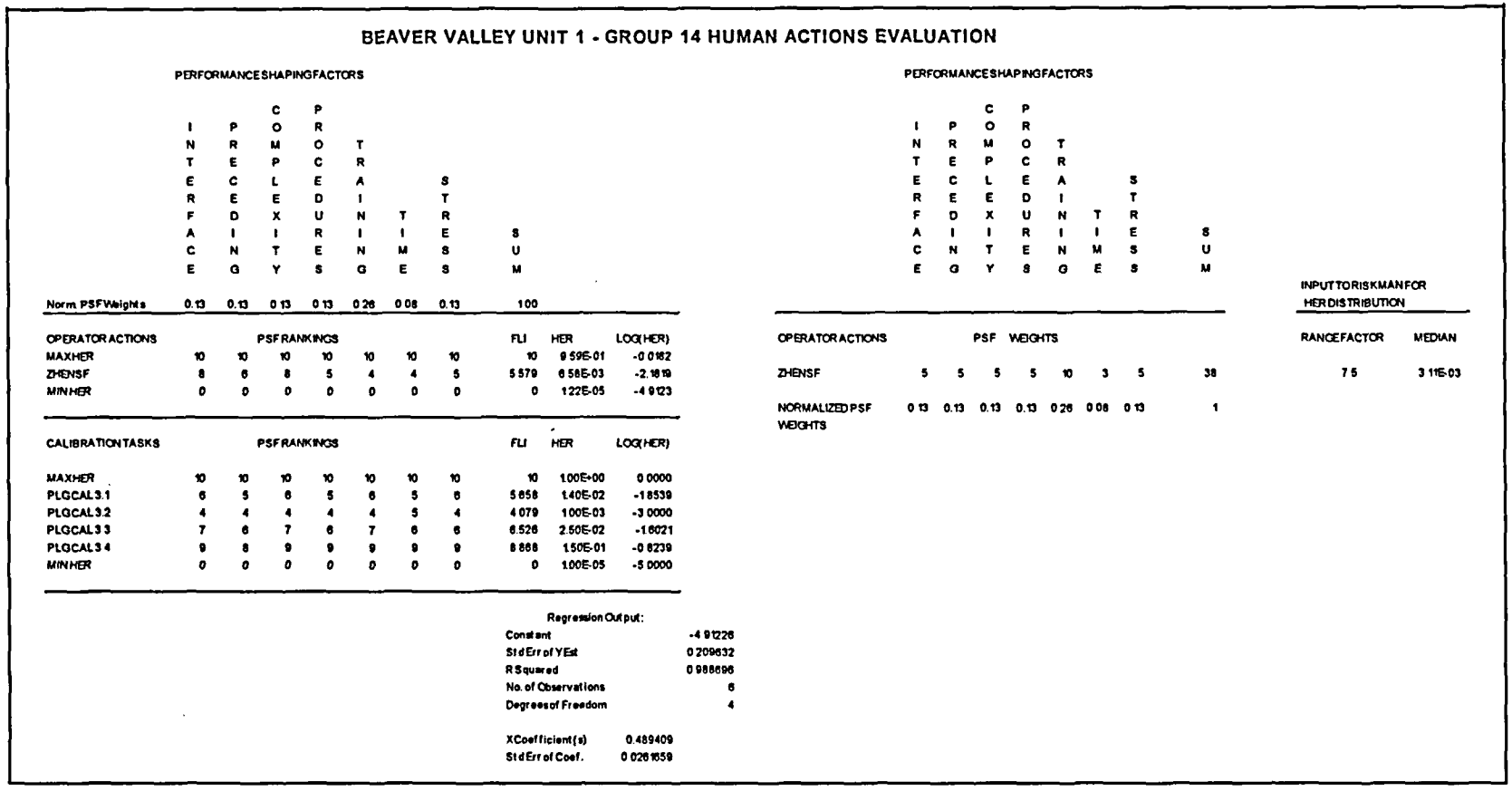
PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE	TRAINING		STRESS	
OPERATOR ACTIONS	PSF WEIGHTS							
ZHECR3	3	3	3	3	10	10	5	37
NORMALIZED PSF WEIGHTS	0.08	0.08	0.08	0.08	0.27	0.27	0.14	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	3.17E-02

Figure 13: BVPS-1 Pre-EPU SLIM Worksheet Group 13



BEAVER VALLEY UNIT 1 - GROUP 14 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.13	0.13	0.13	0.13	0.26	0.08	0.13	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.59E-01	-0.0182
ZHENSF	8	6	8	5	4	4	5	5.579	6.58E-03	-2.1819
MINHER	0	0	0	0	0	0	0	0	1.22E-05	-4.9123

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
PLGCAL3.1	6	5	6	5	6	5	6	5.658	1.40E-02	-1.8539
PLGCAL3.2	4	4	4	4	4	5	4	4.079	1.00E-03	-3.0000
PLGCAL3.3	7	6	7	6	7	6	6	6.526	2.50E-02	-1.6021
PLGCAL3.4	9	8	9	9	9	9	9	8.868	1.50E-01	-0.8239
MINHER	0	0	0	0	0	0	0	0	1.00E-05	-5.0000

Regression Output:

Constant	-4.91226
Std Err of YEst	0.209632
R Squared	0.988696
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.489409
Std Err of Coef.	0.026159

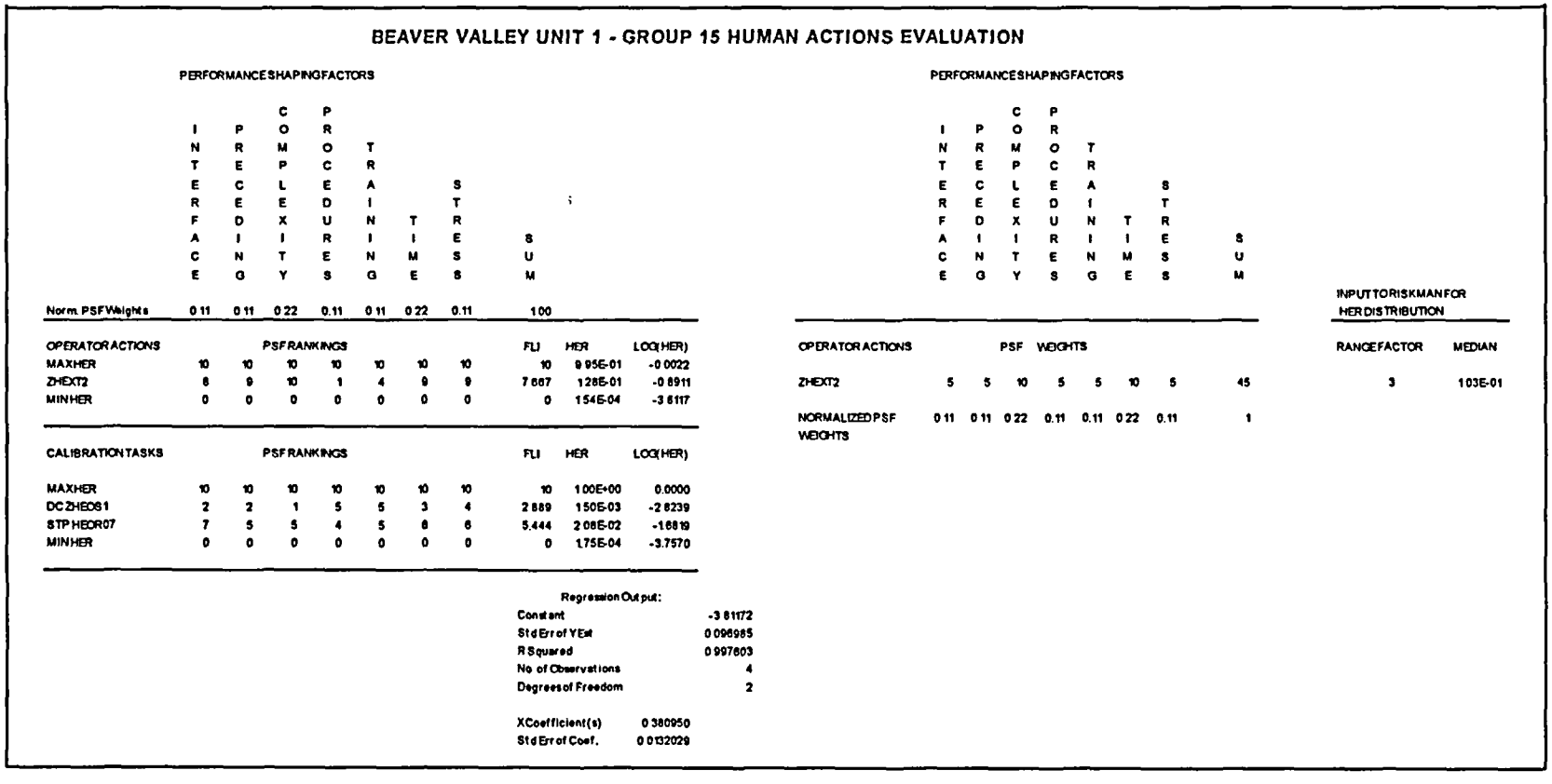
PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
PSF WEIGHTS								
ZHENSF	5	5	5	5	10	3	5	38
NORMALIZED PSF WEIGHTS	0.13	0.13	0.13	0.13	0.26	0.08	0.13	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	3.11E-03

Figure 14: BVPS-1 Pre-EPU SLIM Worksheet Group 14



BEAVER VALLEY UNIT 1 - GROUP 15 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICE	COMPLEXI	PROCEDUR	TRAININ	TIMES	STRESS	SUM
Norm PSF Weights	0.11	0.11	0.22	0.11	0.11	0.22	0.11	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HEP	LOG(HEP)
MAXHEP	10	10	10	10	10	10	10	10	9.95E-01	-0.0022
ZHEXT2	6	9	10	1	4	9	9	7.667	1.28E-01	-0.8911
MINHEP	0	0	0	0	0	0	0	0	1.54E-04	-3.8117

CALIBRATION TASKS	PSF RANKINGS							FLI	HEP	LOG(HEP)
MAXHEP	10	10	10	10	10	10	10	10	1.00E+00	0.0000
DCZHEOS1	2	2	1	5	5	3	4	2.889	1.50E-03	-2.8239
STPHEOR07	7	5	5	4	5	8	6	5.444	2.08E-02	-1.6819
MINHEP	0	0	0	0	0	0	0	0	1.75E-04	-3.7570

Regression Output:

Constant	-3.81172
Std Err of YEst	0.096985
R Squared	0.997603
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.380950
Std Err of Coef.	0.0132029

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICE	COMPLEXI	PROCEDUR	TRAININ	TIMES	STRESS	SUM
OPERATOR ACTIONS PSF WEIGHTS	5	5	10	5	5	10	5	45
NORMALIZED PSF WEIGHTS	0.11	0.11	0.22	0.11	0.11	0.22	0.11	1

INPUT TO RISKMAN FOR HEP DISTRIBUTION

RANGE FACTOR	MEDIAN
3	1.03E-01

Figure 15: BVPS-1 Pre-EPU SLIM Worksheet Group 15

Attachment 2 to RAI 2.a.

BVPS-1 Post-EPU SLIM Worksheets

BEAVER VALLEY UNIT 1 - GROUP 1 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICT	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.13	0.13	0.13	0.31	0.13	0.05	0.13	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.99E-01	-0.0009
ZHEOR1	5	5	5	3	5	1	5	4.125	1.86E-03	-2.7280
ZHEOD3	8	2	9	2	8	2	6	4.875	4.19E-03	-2.3781
ZHEMU5	8	4	6	5	6	1	5	5.25	6.25E-03	-2.2042
MIN HER	0	0	0	0	0	0	0	0	2.29E-05	-4.6394

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
DC ZHERF1 (1)	5	5	5	3	5	2	5	4.188	2.00E-03	-2.6990
MIN HER	0	0	0	0	0	0	0	0	2.30E-05	-4.6383

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV1 (ZHEOR1)

Regression Output:

Constant	-4.63941
Std Err of Y Est	0.002418
R Squared	0.999999
No. of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.4639592
Std Err of Coef.	0.0003404

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEOR1	0	0	0	5	0	0	0	5
ZHEOD3	5	5	5	10	5	5	5	40
ZHEMU5	5	5	5	10	5	0	5	35
NORMALIZED PSF WEIGHTS	0.13	0.13	0.13	0.31	0.13	0.05	0.13	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	8.88E-04
7.5	1.99E-03
7.5	2.95E-03

Figure 16: BVPS-1 Post-EPU SLIM Worksheet Group 1

BEAVER VALLEY UNIT 1 - GROUP 2 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIGING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.08	0.00	0.33	0.33	0.08	0.08	0.08	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.99E-01	-0.0003
ZHEMU1	8	5	8	5	2	1	4	5.583	8.40E-03	-2.0757
ZHEMU2	8	6	8	5	2	3	4	5.75	1.01E-02	-1.9974
ZHEOR2	7	7	6	3	5	1	5	4.5	2.60E-03	-2.5848
ZHEWM1	8	5	8	5	2	0	4	5.5	7.68E-03	-2.1149
ZHEOS1	7	1	7	5	3	5	3	5.5	7.68E-03	-2.1149
ZHEOS2	7	1	7	5	3	3	5	5.5	7.68E-03	-2.1149
MIN HER	0	0	0	0	0	0	0	0	2.00E-05	-4.6990

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
PLANT-X OFBPO1 (1)	7	1	7	5	3	3	3	5.333	6.40E-03	-2.1938
MIN HER	0	0	0	0	0	0	0	0	2.00E-05	-4.6990

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV1 (ZHEOS1)

Regression Output:

Constant	-4.60927
Std Err of Y Est	0.000789
R Squared	1
No. of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.4999927
Std Err of Coef.	0.0001115

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS								INPUT TO RISKMAN FOR HER DISTRIBUTION	
									RANGE FACTOR	MEDIAN
ZHEMU1	0	0	5	5	0	0	0	10	7.5	3.97E-03
ZHEMU2	0	0	5	5	0	0	0	10	5	6.23E-03
ZHEOR2	0	0	5	5	0	0	0	10	7.5	1.23E-03
ZHEWM1	0	0	5	5	0	0	0	10	7.5	3.62E-03
ZHEOS1	5	0	10	10	5	5	5	40	7.5	3.62E-03
ZHEOS2	5	0	10	10	5	5	5	40	7.5	3.62E-03
NORMALIZED PSF WEIGHTS	0.08	0.00	0.33	0.33	0.08	0.08	0.08	1		

Figure 17: BVPS-1 Post-EPU SLIM Worksheet Group 2

BEAVER VALLEY UNIT 1 - GROUP 3 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIAGNG	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.12	0.12	0.10	0.10	0.07	0.24	0.24	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.36E-01	-0.0285
ZHECO2	2	6	8	5	7	2	4	4.241	2.58E-03	-2.5886
ZHEHM1	2	1	2	2	4	4	6	3.466	1.17E-03	-2.9336
ZHEREB	1	2	8	9	9	8	7	6.362	2.26E-02	-1.6458
ZHEFL1	7	7	9	9	6	6	8	7.345	6.18E-02	-1.2089
ZHEFL2	7	7	9	9	6	5	8	7.103	4.83E-02	-1.3162
ZHEFL3	7	7	9	9	6	5	8	7.103	4.83E-02	-1.3162
ZHEIC3	6	9	8	2	9	6	8	6.845	3.70E-02	-1.4312
MIN HER	0	0	0	0	0	0	0	0	3.36E-05	-4.4743

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HEOS01	4	3	6	10	10	6	3	5.362	1.80E-02	-1.7447
FERMI RE7	6	7	6	8	6	5	8	6.569	1.32E-02	-1.8794
MIN HER	0	0	0	0	0	0	0	0	3.00E-05	-4.5229

Regression Output:

Constant	-4.47426
Std Err of Y Est	0.338135
R Squared	0.978095
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.444575
Std Err of Coef.	0.0470447

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHECO2	5	5	5	5	5	10	10	45
ZHEHM1	5	5	5	5	5	10	10	45
ZHEREB	5	5	5	5	5	10	10	45
ZHEFL1	5	5	5	5	0	10	10	40
ZHEFL2	5	5	5	5	0	10	10	40
ZHEFL3	5	5	5	5	0	10	10	40
ZHEIC3	5	5	0	0	5	10	10	35
NORMALIZED PSF WEIGHTS	0.12	0.12	0.10	0.10	0.07	0.24	0.24	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	1.22E-03
7.5	5.50E-04
5	1.40E-02
5	3.83E-02
5	2.99E-02
5	2.99E-02
5	2.30E-02

Figure 18: BVPS-1 Post-EPU SLIM Worksheet Group 3

BEAVER VALLEY UNIT 1 - GROUP 4 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIND	COMPLEXITY	PROCEDURES	TRAINING	TIMES	STRESS	SUM
Norm. PSF Weights	0.13	0.11	0.13	0.11	0.13	0.11	0.30	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.15E-01	-0.0387
ZHEHC1	2	1	2	2	4	0	5	2.83	2.58E-04	-3.5885
ZHEPR1	2	2	2	2	3	0	6	3.106	3.53E-04	-3.4516
ZHECD4	9	2	9	8	8	1	10	7.468	5.10E-02	-1.2922
ZHEMU3	8	6	8	5	8	5	6	6.553	1.80E-02	-1.7451
ZHEMU4	8	6	8	5	8	7	8	7.362	4.52E-02	-1.3449
ZHEOB1	2	6	3	2	4	1	7	4.191	1.22E-03	-2.9144
ZHEOA1	2	0	2	0	3	2	7	3.191	3.90E-04	-3.4095
ZHEOT1	0	10	1	2	3	1	6	3.681	6.80E-04	-3.1672
MIN HER	0	0	0	0	0	0	0	0	1.02E-05	-4.9895

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HERC4	2	8	3	5	6	1	6	4.681	9.62E-04	-3.0079
FERMI HECT3	4	6	3	3	3	3	3	3.447	1.15E-03	-2.9393
MIN HER	0	0	0	0	0	0	0	0	9.20E-06	-5.0362

Regression Output:

Constant	-4.98954
Std Err of Y Est	0.342488
R Squared	0.981802
No. of Observations	4
Degrees of Freedom	2

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIND	COMPLEXITY	PROCEDURES	TRAINING	TIMES	STRESS	SUM

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEHC1	0	0	0	0	0	0	5	5
ZHEPR1	0	0	0	0	0	0	5	5
ZHECD4	5	5	5	5	5	5	10	40
ZHEMU3	5	5	5	5	5	5	10	40
ZHEMU4	5	5	5	5	5	5	10	40
ZHEOB1	5	5	5	5	5	5	10	40
ZHEOA1	5	5	5	5	5	0	10	35
ZHEOT1	5	0	5	0	5	5	10	30
NORMALIZED PSF WEIGHTS	0.13	0.11	0.13	0.11	0.13	0.11	0.30	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
10	9.68E-05
10	1.33E-04
5	3.16E-02
5	1.11E-02
5	2.80E-02
7.5	5.75E-04
10	1.46E-04
10	2.55E-04

Figure 19: BVPS-1 Post-EPU SLIM Worksheet Group 4

BEAVER VALLEY UNIT 1 - GROUP 5 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIMES	STRESS	SUM
Norm. PSF Weights	0.15	0.15	0.15	0.15	0.15	0.11	0.14	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.97E-01	-0.0012
ZHECC1	2	6	6	7	2	2	5	4.37	4.21E-03	-2.3761
ZHECC2	2	6	7	7	2	4	6	4.883	6.92E-03	-2.1597
ZHECI2	1	2	4	1	3	3	3	2.403	6.22E-04	-3.2061
ZHEHH1	1	7	5	5	2	2	6	4.095	3.13E-03	-2.5049
ZHEHH2	2	2	3	1	3	1	4	2.325	5.77E-04	-3.2390
ZHEMA1	2	5	4	2	6	2	2	3.344	1.55E-03	-2.8089
ZHEMA2	2	3	1	2	8	2	5	3.325	1.52E-03	-2.8172
ZHECO1	2	3	5	2	5	0	5	3.253	1.42E-03	-2.8473
ZHEPI1	0	0	1	5	3	3	5	2.39	6.14E-04	-3.2116
ZHEPK1	0	1	1	5	3	3	5	2.539	7.10E-04	-3.1486
ZHERE5	1	2	8	9	9	4	5	5.487	1.24E-02	-1.9060
ZHERR1	2	2	5	5	4	2	2	3.195	1.34E-03	-2.8719
ZHESE1	2	5	2	3	4	3	4	3.292	1.48E-03	-2.8309
ZHESL2	3	2	8	5	4	1	8	4.539	4.96E-03	-2.3049
ZHESL3	7	10	9	9	10	1	10	8.26	1.84E-01	-0.7353
ZHEVA1	5	5	5	4	7	5	4	5.008	7.80E-03	-2.1077
ZHEAF1	8	6	2	5	5	3	5	4.929	7.23E-03	-2.1408
ZHEDF1	6	1	5	2	6	1	6	3.955	2.81E-03	-2.5515
ZHEIA1	6	6	6	4	4	1	5	4.708	5.84E-03	-2.2337
ZHEIA2	4	6	5	4	4	1	5	4.26	3.78E-03	-2.4227
ZHEIA4	7	7	5	3	4	1	3	4.422	4.42E-03	-2.3542
ZHECO8	2	4	2	5	3	3	2	3.008	1.12E-03	-2.9514
ZHEPNA	8	9	8	9	8	7	9	8.331	1.97E-01	-0.7052
MIN HER	0	0	0	0	0	0	0	0	6.03E-05	-4.2196

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHECC1	5	5	5	5	5	5	5	35
ZHECC2	5	5	5	5	5	5	5	35
ZHECI2	5	5	5	5	5	5	5	35
ZHEHH1	5	5	5	5	5	5	5	35
ZHEHH2	5	5	5	5	5	5	5	35
ZHEMA1	5	5	5	5	5	5	5	35
ZHEMA2	5	5	5	5	5	5	5	35
ZHECO1	5	5	5	5	5	5	5	35
ZHEPI1	5	5	5	5	5	5	5	35
ZHEPK1	5	5	5	5	5	5	5	35
ZHERE5	5	5	5	5	5	5	5	35
ZHERR1	5	5	5	5	5	5	5	35
ZHESE1	5	5	5	5	5	5	5	35
ZHESL2	5	5	5	5	5	5	5	35
ZHESL3	5	5	5	5	5	5	5	35
ZHEVA1	5	5	5	5	5	5	5	35
ZHEAF1	5	5	5	5	5	0	5	30
ZHEDF1	5	5	5	5	5	0	5	30
ZHEIA1	5	5	5	5	5	0	5	30
ZHEIA2	5	5	5	5	5	0	5	30
ZHEIA4	5	5	5	5	5	0	5	30
ZHECO8	5	5	5	5	5	0	0	25
ZHEPNA	5	5	5	5	5	5	5	35
NORMLAIZED PSF WEIGHTS	0.15	0.15	0.15	0.15	0.15	0.11	0.14	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

OPERATOR ACTIONS	RANGE FACTOR	MEDIAN
ZHECC1	7.5	1.99E-03
ZHECC2	7.5	3.27E-03
ZHECI2	10	2.34E-04
ZHEHH1	7.5	1.49E-03
ZHEHH2	10	2.17E-04
ZHEMA1	7.5	7.33E-04
ZHEMA2	7.5	7.19E-04
ZHECO1	7.5	6.71E-04
ZHEPI1	10	2.31E-04
ZHEPK1	10	2.67E-04
ZHERE5	5	7.71E-03
ZHERR1	7.5	6.34E-04
ZHESE1	7.5	6.97E-04
ZHESL2	7.5	2.34E-03
ZHESL3	3	1.47E-01
ZHEVA1	7.5	3.69E-03
ZHEAF1	7.5	3.42E-03
ZHEDF1	7.5	1.33E-03
ZHEIA1	7.5	2.76E-03
ZHEIA2	7.5	1.78E-03
ZHEIA4	7.5	2.09E-03
ZHECO8	7.5	5.28E-04
ZHEPNA	3	1.58E-01

Figure 20: BVPS-1 Post-EPU SLIM Worksheet Group 5

CALIBRATION TASKS	PSF RANKINGS							FU	HEP	LOG(HEP)
MAX HEP	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HEC003	6	5	6	6	8	6	9	6.578	4.38E-02	-1.3585
STP HEC9L1	3	4	5	3	3	4	6	3.997	2.13E-03	-2.6716
STP HEC001	3	3	6	4	4	2	4	3.779	2.31E-03	-2.6364
MIN HEP	0	0	0	0	0	0	0	0	6.90E-05	-4.1612

Regression Output:

Constant	-4.21955
Std Err of Y Est	0.099056
R Squared	0.997057
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.4218417
Std Err of Coef.	0.013232

Figure 20: BVPS-1 Post-EPU SLIM Worksheet Group 5 (continued)

BEAVER VALLEY UNIT 1 - GROUP 6 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIGNITY	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.00	0.50	0.00	0.00	0.00	0.50	0.00	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.98E-01	-0.0007
ZHESL1	6	6	6	5	3	3	5	4.5	3.38E-03	-2.4715
ZHETT1	4	5	2	3	3	7	5	6	1.59E-02	-1.7976
MIN HER	0	0	0	0	0	0	0	0	3.21E-05	-4.4900

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HEOSL1	3	4	5	3	3	4	6	4	2.13E-03	-2.6716
DC ZHEOX1 (1)	6	6	6	5	3	3	5	4.5	3.20E-03	-2.4949
MIN HER	0	0	0	0	0	0	0	0	3.20E-05	-4.4949

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN EVT (ZHESL1)

Regression Output:

Constant	-4.49001
Std Err of Y Est	0.023009
R Squared	0.999998
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.4492291
Std Err of Coef.	0.0003667

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS								INPUT TO RISKMAN FOR HER DISTRIBUTION	
									RANGE FACTOR	MEDIAN
ZHESL1	0	5	0	0	0	5	0	10	7.5	1.59E-03
ZHETT1	0	5	0	0	0	5	0	10	5	9.87E-03
NORMALIZED PSF WEIGHTS	0.00	0.50	0.00	0.00	0.00	0.50	0.00	1		

Figure 21: BVPS-1 Post-EPU SLIM Worksheet Group 6

BEAVER VALLEY UNIT 1 - GROUP 7 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTENTIONAL FAILURE	PROCEDURE INDEXING	COMPLEXITY	PROCEDURE TRAINING	STRESS	TIMING	SUM
Norm PSF Weights	0.10	0.25	0.10	0.10	0.10	0.10	0.25	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.99E-01	-0.0005
ZHEO1	2	5	3	3	5	3	3	3.6	2.45E-03	-2.6105
ZHEO5	1	6	8	5	7	5	8	6.1	2.56E-02	-1.5910
ZHEO32	2	9	3	2	4	1	8	5.45	1.39E-02	-1.8560
MIN HER	0	0	0	0	0	0	0	0	8.35E-05	-4.0785

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HEO302	4	3	6	4	7	2	8	5.05	8.80E-03	-2.0555
OPRA-8 (1)	2	9	3	2	4	1	8	5.45	1.00E-02	-2.0000
DC ZHEO81	5	7	7	6	6	4	8	6.55	5.40E-02	-1.2804
MIN HER	0	0	0	0	0	0	0	0	9.00E-05	-4.0458

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV1 (ZHEO32)

Regression Output:

Constant	-4.07855
Std Err of Y Est	0.122121
R Squared	0.99483
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.4078012
Std Err of Coef.	0.0109732

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTENTIONAL FAILURE	PROCEDURE INDEXING	COMPLEXITY	PROCEDURE TRAINING	STRESS	TIMING	SUM
ZHEO1	0	5	0	0	0	0	5	10
ZHEO5	5	10	5	5	5	5	10	45
ZHEO32	5	10	5	5	5	5	10	45
NORMALIZED PSF WEIGHTS	0.10	0.25	0.10	0.10	0.10	0.10	0.25	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

	RANGE FACTOR	MEDIAN
ZHEO1	7.5	1.16E-03
ZHEO5	5	1.59E-02
ZHEO32	5	8.63E-03

Figure 22: BVPS-1 Post-EPU SLIM Worksheet Group 7

BEAVER VALLEY UNIT 1 - GROUP 8 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIDING	COMPLEXITY	PROCEDURES	TRAINING	TIMES	STRESS	SUM
Norm. PSF Weights	0.13	0.13	0.10	0.10	0.11	0.31	0.11	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.96E-01	-0.0018
ZHEFL4	3	3	3	5	7	4	3	3.971	2.34E-03	-2.6305
ZHETT2	4	3	2	3	3	5	3	3.657	1.71E-03	-2.7675
ZHEWA2	6	6	6	7	7	7	5	6.414	2.72E-02	-1.5653
ZHEBV2	3	3	3	4	7	2	2	3.129	1.00E-03	-2.9980
ZHEBV3	5	7	7	9	9	8	6	7.371	7.11E-02	-1.1479
ZHEBV4	5	6	3	4	7	5	5	5.057	6.97E-03	-2.1571
ZHECD1	2	5	8	3	5	2	4	3.657	1.71E-03	-2.7675
ZHECT1	2	6	6	7	2	6	5	5.014	6.67E-03	-2.1758
ZHEIA3	6	6	6	4	4	10	5	6.714	3.68E-02	-1.4345
ZHERI1	1	0	1	0	0	5	7	2.6	5.91E-04	-3.2285
ZHEIC2	2	6	4	3	4	5	4	4.214	2.99E-03	-2.5246
ZHEIC1	6	7	6	2	6	2	3	4.129	2.74E-03	-2.5620
MIN HER	0	0	0	0	0	0	0	0	4.34E-05	-4.3622

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
FERMI HERS1	2	7	2	3	2	4	6	3.829	1.75E-03	-2.7570
STP HEOS01	4	3	6	10	10	6	3	5.871	1.80E-02	-1.7447
MIN HER	0	0	0	0	0	0	0	0	4.60E-05	-4.3372

Regression Output:

Constant	-4.36218
Std Err of Y Est	0.058576
R Squared	0.999309
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.43604
Std Err of Coef.	0.0081103

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEFL4	0	0	0	0	0	5	0	5
ZHETT2	0	0	0	0	0	5	0	5
ZHEWA2	0	0	0	0	0	10	0	10
ZHEBV2	5	5	5	5	5	10	5	40
ZHEBV3	5	5	5	0	5	10	5	35
ZHEBV4	5	5	5	5	5	10	5	40
ZHECD1	5	5	5	5	5	10	5	40
ZHECT1	5	5	5	5	5	10	5	40
ZHEIA3	5	5	5	5	5	10	5	40
ZHERI1	5	5	5	5	5	10	5	40
ZHEIC2	5	5	0	5	5	10	5	35
ZHEIC1	5	5	0	0	0	10	0	20
NORMALIZED PSF WEIGHTS	0.13	0.13	0.10	0.10	0.11	0.31	0.11	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	1.11E-03
7.5	8.07E-04
5	1.69E-02
7.5	4.74E-04
5	4.41E-02
7.5	3.29E-03
7.5	8.07E-04
7.5	3.15E-03
5	2.28E-02
10	2.22E-04
7.5	1.41E-03
7.5	1.29E-03

Figure 23: BVPS-1 Post-EPU SLIM Worksheet Group 8

BEAVER VALLEY UNIT 1 - GROUP 9 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDEX	COMPLEXITY	PROCEDURE	TRAINING	TIMES	STRESS	SUM
Norm PSF Weights	0.00	0.17	0.17	0.17	0.17	0.17	0.17	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.99E-01	-0.0003
ZHEOD6	2	9	5	3	7	2	9	5.833	4.40E-02	-1.3564
ZHEOD7	2	9	8	5	8	4	9	7.167	1.20E-01	-0.9226
MIN HER	0	0	0	0	0	0	0	0	5.57E-04	-3.2542

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HEOD03	6	5	6	6	8	6	9	6.667	4.39E-02	-1.3585
EPRI SH1 (1)	2	9	5	3	7	3	9	6	1.00E-01	-1.0000
MIN HER	0	0	0	0	0	0	0	0	5.20E-04	-3.2840

NOTE

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BVI (ZHEOD6)

Regression Output:

Constant	-3.2542
Std Err of Y Est	0.286842
R Squared	0.970575
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.3253357
Std Err of Coef.	0.0100552

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDEX	COMPLEXITY	PROCEDURE	TRAINING	TIMES	STRESS	SUM
OPERATOR ACTIONS	PSF WEIGHTS							
ZHEOD6	0	5	5	5	5	5	5	30
ZHEOD7	0	5	5	5	5	5	5	30
NORMALIZED PSF WEIGHTS	0.00	0.17	0.17	0.17	0.17	0.17	0.17	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

	RANGE FACTOR	MEDIAN
	5	2.73E-02
	3	9.55E-02

Figure 24: BVPS-1 Post-EPU SLIM Worksheet Group 9

BEAVER VALLEY UNIT 1 - GROUP 10 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTEGRATED FAILURE	PROCEDURE EXIT	COMPLEXITY	PROCEDURE READING	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.11	0.00	0.22	0.22	0.11	0.22	0.11	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.90E-01	-0.0008
ZHEOS3	7	1	7	5	3	4	6	5.333	1.90E-02	-1.7218
ZHEOS4	7	1	7	5	3	8	8	6.444	4.89E-02	-1.3120
MIN HER	0	0	0	0	0	0	0	0	2.00E-04	-3.6998

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
STP HEOR07	5	4	7	4	6	5	6	5.444	2.09E-02	-1.6819
MIN HER	0	0	0	0	0	0	0	0	2.00E-04	-3.6992

Regression Output:

Constant	-3.69877
Std Err of Y Est	0.001415
R Squared	1
No. of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.3999144
Std Err of Coef.	0.0001999

PERFORMANCE SHAPING FACTORS

	INTEGRATED FAILURE	PROCEDURE EXIT	COMPLEXITY	PROCEDURE READING	TRAINING	TIME	STRESS	SUM
NORMALIZED PSF WEIGHTS	0.11	0.00	0.22	0.22	0.11	0.22	0.11	1

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEOS3	5	0	10	10	5	10	5	45
ZHEOS4	5	0	10	10	5	10	5	45

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	1.18E-02
5	3.02E-02

Figure 25: BVPS-1 Post-EPU SLIM Worksheet Group 10

BEAVER VALLEY UNIT 1 - GROUP 11 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDINGE	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm PSF Wights	0.13	0.13	0.25	0.11	0.13	0.13	0.13	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.99E-01	-0.0005
ZHEOF1	5	5	5	5	4	0	2	3.851	1.32E-04	-3.8810
ZHEOF2	5	5	5	5	4	2	3	4.234	2.23E-04	-3.6393
ZHEOF3	5	6	5	5	6	2	5	4.872	5.80E-04	-3.2365
ZHEOF4	5	6	5	5	4	2	4	4.489	3.32E-04	-3.4782
ZHEOF5	5	6	5	5	6	2	5	4.872	5.80E-04	-3.2365
ZHEXT1	8	9	10	1	4	5	8	7	1.26E-02	-1.8998
MIN HER	0	0	0	0	0	0	0	0	4.66E-07	-6.3114

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
SEABROOK ON	0	0	1	0	2	0	0	0.511	1.00E-06	-6.0000
MIN HER	0	0	0	0	0	0	0	0	5.00E-07	-6.3010

Regression Output:

Constant	-6.31136
Std Err of Y Est	0.015023
R Squared	0.999991
No. of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.631081
Std Err of Coef.	0.0018862

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEOF1	5	5	10	5	5	5	5	40
ZHEOF2	5	5	10	5	5	5	5	40
ZHEOF3	5	5	10	5	5	5	5	40
ZHEOF4	5	5	10	5	5	5	5	40
ZHEOF5	5	5	10	5	5	5	5	40
ZHEXT1	5	5	10	0	5	5	5	35
NORMALIZED PSF WEIGHTS	0.13	0.13	0.26	0.11	0.13	0.13	0.13	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
10	4.94E-05
10	8.61E-05
10	2.18E-04
10	1.25E-04
10	2.18E-04
5	7.91E-03

Figure 26: BVPS-1 Post-EPU SLIM Worksheet Group 11

BEAVER VALLEY UNIT 1 - GROUP 12 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE INDEX	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.22	0.11	0.22	0.11	0.11	0.11	0.11	1.00

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.32E-01	-0.0308
ZHECR3	9	8	8	5	2	5	6	6.667	3.37E-02	-1.4725
ZHECR4	9	5	9	4	4	5	8	6.889	4.20E-02	-1.3764
ZHECSF	9	5	9	4	4	5	8	6.889	4.20E-02	-1.3764
MIN HER	0	0	0	0	0	0	0	0	4.40E-05	-4.3553

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
BIG ROCK BR5	6	5	6	5	6	5	6	5.667	1.40E-02	-1.8539
BIG ROCK L2C	4	4	4	4	4	5	4	4.111	1.00E-03	-3.0000
SEQUOYAH CT1	2	3	5	0	4	2	2	2.778	1.80E-03	-2.7447
MIN HER	0	0	0	0	0	0	0	0	3.75E-05	-4.4260

Regression Output:

Constant	-4.35925
Std Err of Y Est	0.343813
R Squared	0.966576
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.432552
Std Err of Coef.	0.0463692

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE INDEX	TRAINING	TIME	STRESS	SUM
	PSF WEIGHTS							
ZHECR3	10	5	10	5	5	5	5	45
ZHECR4	10	5	10	5	5	5	5	45
ZHECSF	10	5	10	5	5	5	5	45
NORMALIZED PSF WEIGHTS	0.22	0.11	0.22	0.11	0.11	0.11	0.11	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	2.00E-02
5	2.60E-02
5	2.60E-02

Figure 27: BVPS-1 Post-EPU SLIM Worksheet Group 12

BEAVER VALLEY UNIT 1 - GROUP 13 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURES	TRAINING	STRESS	SUM
Norm. PSF Weights	0.08	0.08	0.08	0.08	0.27	0.27	0.14	1.00
OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.69E-01	-0.0135
ZHEPAE	8	6	8	5	8	7	8	7.324	5.11E-02	-1.2912
MIN HER	0	0	0	0	0	0	0	0	1.63E-05	-4.7887
CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
SEQUOYAH FLPHDCR	4	1	3	0	4	4	5	3.486	5.80E-04	-3.2366
SEQUOYAH FLAB3C	6	8	0	8	4	4	6	4.757	4.40E-03	-2.3565
SEQUOYAH FLAB1R	4	1	3	0	4	2	5	2.946	3.80E-04	-3.4202
SEQUOYAH FLPH1R	4	1	3	0	4	4	5	3.486	5.80E-04	-3.2366
MIN HER	0	0	0	0	0	0	0	0	2.00E-05	-4.6990

Regression Output:

Constant	-4.78665
Std Err of Y Est	0.123435
R Squared	0.995087
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.477516
Std Err of Coef.	0.0167764

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURES	TRAINING	STRESS	SUM
OPERATOR ACTIONS	PSF WEIGHTS							
ZHECR3	3	3	3	3	10	10	5	37
NORMALIZED PSF WEIGHTS	0.08	0.08	0.08	0.08	0.27	0.27	0.14	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	3.17E-02

Figure 28: BVPS-1 Post-EPU SLIM Worksheet Group 13

BEAVER VALLEY UNIT 1 - GROUP 14 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE	TRAINING		STRESS	
	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.13	0.13	0.13	0.13	0.25	0.08	0.13	1.00

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.59E-01	-0.0182
ZHENSF	8	6	8	5	4	4	5	5.579	6.58E-03	-2.1819
MIN HER	0	0	0	0	0	0	0	0	1.22E-05	-4.9123

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
PLG CAL 3.1	6	5	6	5	6	5	6	5.658	1.40E-02	-1.8539
PLG CAL 3.2	4	4	4	4	4	5	4	4.079	1.00E-03	-3.0000
PLG CAL 3.3	7	6	7	6	7	6	6	6.526	2.50E-02	-1.6021
PLG CAL 3.4	9	8	9	9	9	9	9	8.868	1.50E-01	-0.8239
MIN HER	0	0	0	0	0	0	0	0	1.00E-05	-5.0000

Regression Output:

Constant	-4.91226
Std Err of Y Est	0.209332
R Squared	0.986696
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.499409
Std Err of Coef.	0.0261699

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE	TRAINING		STRESS	
	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURE	TRAINING	TIME	STRESS	SUM
OPERATOR ACTIONS	PSF WEIGHTS							
ZHENSF	5	5	5	5	10	3	5	38
NORMALIZED PSF WEIGHTS	0.13	0.13	0.13	0.13	0.25	0.08	0.13	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	3.11E-03

Figure 29: BVPS-1 Post-EPU SLIM Worksheet Group 14

BEAVER VALLEY UNIT 1 - GROUP 15 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE TRAINING	ATTENTION	TIME	STRESS	SUM
Norm PSF Weights	0.11	0.11	0.22	0.11	0.11	0.22	0.11	1.00
OPERATOR ACTIONS	PSF RANKINGS							FU HER LOG(HER)
MAXHER	10	10	10	10	10	10	10	10 9.95E-01 -0.0022
ZHEXT2	8	9	10	1	4	9	9	7.657 1.28E-01 -0.8911
MINHER	0	0	0	0	0	0	0	0 1.54E-04 -3.8117
CALIBRATION TASKS	PSF RANKINGS							FU HER LOG(HER)
MAXHER	10	10	10	10	10	10	10	10 1.00E+00 0.0000
DCZHEOS1	2	2	1	5	5	3	4	2.869 1.50E-03 -2.8239
STPHEOR07	7	5	5	4	5	6	6	5.444 2.06E-02 -1.6819
MINHER	0	0	0	0	0	0	0	0 1.75E-04 -3.7570

Regression Output:

Constant	-3.81172
Std Err of Y Est	0.009985
R Squared	0.997603
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.360060
Std Err of Coef.	0.0132029

PERFORMANCE SHAPING FACTORS

	INTERFACE	PROCEDURE	COMPLEXITY	PROCEDURE TRAINING	ATTENTION	TIME	STRESS	SUM
OPERATOR ACTIONS	PSF WEIGHTS							
ZHEXT2	5	5	10	5	5	10	5	45
NORMALIZED PSF WEIGHTS	0.11	0.11	0.22	0.11	0.11	0.22	0.11	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
3	1.03E-01

Figure 30: BVPS-1 Post-EPU SLIM Worksheet Group 15

Attachment 3 to RAI 2.a.

BVPS-2 Pre-EPU SLIM Worksheets

Beaver Valley Unit 2 – Group 1 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.116	0.233	0.116	0.116	0.116	0.233	0.07	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	8	8	8	8	8	8	8	8	4.80E-01	-3.19E-01
ZHEPR1	2	8	4	2	3	9	6	5.65	3.44E-02	-1.46E+00
ZHESM1	5	8	4	5	5	7	5	6.05	5.36E-02	-1.27E+00
ZHEWA1	7	8	7	5	5	6	5	6.40	7.93E-02	-1.10E+00
ZHEWA3	7	8	7	5	5	6	5	6.40	7.93E-02	-1.10E+00
ZHEWA5	7	8	7	7	10	6	6	7.28	2.14E-01	-6.70E-01
MIN HER	2	2	2	2	2	2	2	2	5.72E-04	-3.24E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	8	8	8	8	8	8	8	8	1.00E+00	0.00E+00
FERMI OE1	4	6	4	4	5	4	4	4.5614	4.31E-03	-2.37E+00
STP HEOR05	7	7	8	5	8	8	6	7.1628	1.24E-01	-9.07E-01
MIN HER	2	2	2	2	2	2	2	2	1.00E-03	-3.00E+00

Regression Output:

Constant	-4.2167171
Std Err of Y Est	0.411007816
R Squared	0.939482569
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.487245984
Std Err of Coef.	0.087443826

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEPR1	5	10	5	5	5	10	5	45
ZHESM1	5	10	5	5	5	10	5	45
ZHEWA1	5	10	5	5	5	10	0	40
ZHEWA3	5	10	5	5	5	10	0	40
ZHEWA5	5	10	5	5	5	10	5	45
NORMALIZED PSF WEIGHTS	0.116	0.233	0.116	0.116	0.116	0.233	0.07	1

Figure 31: BVPS-2 Pre-EPU SLIM Worksheet Group 1

Beaver Valley Unit 2 – Group 2 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.111	0.111	0.222	0.111	0.111	0.222	0.111	1

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.54E-01	-8.13E-01
ZHEOS1	1	7	7	6	9	3	4	5.2222	1.04E-02	-1.98E+00
ZHEOS2	1	8	8	8	9	4	5	6.1111	1.71E-02	-1.77E+00
ZHEOS3	1	8	8	8	9	5	7	6.5556	2.20E-02	-1.66E+00
ZHEOS4	1	8	8	8	9	8	8	7.3333	3.41E-02	-1.47E+00
ZHESL4	2	8	8	9	9	7	8	7.3333	3.41E-02	-1.47E+00
ZHEXT2	8	9	10	1	4	9	9	7.6667	4.12E-02	-1.39E+00
ZHEXT4	8	9	10	5	4	9	9	8.1111	5.29E-02	-1.28E+00
MIN HER	0	0	0	0	0	0	0	0	5.44E-04	-3.26E+00

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	5.00E-01	-3.01E-01
DC ZHEOS1	2	2	1	5	5	3	4	2.8889	1.50E-03	-2.82E+00
EPRI L1 (1)	1	8	8	8	9	4	5	6.1111	2.00E-03	-2.70E+00
STP HEOR07	7	5	5	4	5	6	6	5.4444	2.08E-02	-1.68E+00
MIN HER	0	0	0	0	0	0	0	0	1.50E-03	-2.82E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEOS2)

Regression Output:

Constant	-3.264095629
Std Err of Y Est	0.69738723
R Squared	0.69879788
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.245075073
Std Err of Coef.	0.093336437

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHEOS1	5	5	10	5	5	10	5	45
ZHEOS2	5	5	10	5	5	10	5	45
ZHEOS3	5	5	10	5	5	10	5	45
ZHEOS4	5	5	10	5	5	10	5	45
ZHESL4	5	5	10	5	5	10	5	45
ZHEXT2	5	5	10	5	5	10	5	45
ZHEXT4	5	5	10	5	5	10	5	45
NORMALIZED PSF WEIGHTS	0.111	0.111	0.222	0.111	0.111	0.222	0.111	1

Figure 32: BVPS-2 Pre-EPU SLIM Worksheet Group 2

Beaver Valley Unit 2 – Group 3 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.111	0.056	0.111	0.111	0.167	0.222	0.222	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	2.16E-01	-6.66E-01
ZHEFL2	4	1	8	5	10	8	8	7.1667	6.70E-02	-1.17E+00
ZHERE6	1	2	8	9	9	7	7	6.7222	5.58E-02	-1.25E+00
MIN HER	0	0	0	0	0	0	0	0	3.47E-03	-2.46E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HEOS01	6	4	6	3	10	10	3	6.4444	1.80E-02	-1.74E+00
FERMI RE7	6	7	6	8	6	5	8	6.50	1.32E-02	-1.88E+00
MIN HER	0	0	0	0	0	0	0	0	8.00E-03	-2.10E+00

Regression Output:

Constant	-2.45904629
Std Err of Y Est	0.74585100
R Squared	0.60132401
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.179351546
Std Err of Coef.	0.10326328

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEFL2	5	0	5	5	10	10	10	45
ZHERE6	5	5	5	5	5	10	10	45
NORMALIZED PSF WEIGHTS	0.111	0.056	0.111	0.111	0.167	0.222	0.222	1

Figure 33: BVPS-2 Pre-EPU SLIM Worksheet Group 3

Beaver Valley Unit 2 – Group 4 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.125	0.125	0.125	0.125	0.125	0.125	0.25	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.76E-01	-7.56E-01
ZHEMU1	2	4	8	4	6	3	8	5.38	5.97E-03	-2.22E+00
ZHEMU2	2	4	8	4	6	3	8	5.38	5.97E-03	-2.22E+00
ZHEMU3	2	4	8	4	6	7	8	5.88	8.60E-03	-2.07E+00
ZHEMU4	2	4	8	4	6	9	8	6.13	1.03E-02	-1.99E+00
ZHEVVM1	2	5	8	6	6	0	8	5.38	5.97E-03	-2.22E+00
MIN HER	0	0	0	0	0	0	0	0	1.17E-04	-3.93E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E-01	-1.00E+00
STP HERC4	3	2	1	8	5	6	6	4.625	9.82E-04	-3.01E+00
TMI HLTIB (1)	2	4	8	4	6	4	8	5.50	6.24E-02	-1.20E+00
FERMI HECT3	4	6	3	3	3	3	3	3.50	1.15E-03	-2.94E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-04	-4.00E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEMU2)

Regression Output:

Constant	-3.93053070
Std Err of Y Est	0.65739322
R Squared	0.79766860
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.317457722
Std Err of Coef.	0.092318066

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
OPERATOR ACTIONS	PSF WEIGHTS							
ZHEMU1	5	5	5	5	5	5	10	40
ZHEMU2	5	5	5	5	5	5	10	40
ZHEMU3	5	5	5	5	5	5	10	40
ZHEMU4	5	5	5	5	5	5	10	40
ZHEVVM1	5	5	5	5	5	5	10	40
NORMALIZED PSF WEIGHTS	0.125	0.125	0.125	0.125	0.125	0.125	0.25	1

Figure 34: BVPS-2 Pre-EPU SLIM Worksheet Group 4

Beaver Valley Unit 2 – Action Group 5 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.145	0.145	0.14	0.145	0.14	0.14	0.145	1

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.75E-01	-1.12E-02
ZHEAF2	2	3	3	2	2	0	2	2.01	3.39E-04	-3.47E+00
ZHEAF3 (ZHEMA1)	2	3	3	2	2	0	2	2.01	3.39E-04	-3.47E+00
ZHECC1	2	6	6	7	2	2	5	4.30	3.31E-03	-2.48E+00
ZHECC2	2	6	7	7	2	4	6	4.67	5.82E-03	-2.24E+00
ZHECD1	2	4	3	3	2	3	4	3.01	9.10E-04	-3.04E+00
ZHECD2	2	5	8	5	8	3	4	4.70	4.83E-03	-2.31E+00
ZHEC2	1	2	4	1	3	3	3	2.42	5.05E-04	-3.30E+00
ZHECS1	3	7	7	7	7	6	6	6.14	2.09E-02	-1.69E+00
ZHEFL1	2	7	6	4	7	1	3	4.26	3.25E-03	-2.49E+00
ZHEHH1	1	7	5	5	2	4	6	4.30	3.29E-03	-2.48E+00
ZHEHH2	2	2	3	1	3	3	4	2.57	5.87E-04	-3.23E+00
ZHEMA2	2	6	5	3	6	5	6	4.99	6.56E-03	-2.18E+00
ZHEOB1	5	3	5	3	3	7	6	4.57	4.31E-03	-2.37E+00
ZHEOD1	2	3	5	2	5	1	5	3.28	1.20E-03	-2.92E+00
ZHEOF1	2	4	5	2	3	2	5	3.29	1.20E-03	-2.92E+00
ZHEOF2	2	1	1	2	2	1	5	2.01	3.37E-04	-3.47E+00
ZHEOR1	2	3	5	3	4	2	5	3.43	1.38E-03	-2.86E+00
ZHEOR2	2	3	5	3	4	5	5	3.85	2.10E-03	-2.68E+00
ZHEOS5	1	4	2	2	4	2	5	2.86	7.89E-04	-3.10E+00
ZHEP1	0	0	1	5	3	2	5	2.29	4.46E-04	-3.35E+00
ZHERE5	1	2	8	9	9	2	5	5.13	7.54E-03	-2.12E+00
ZHERED	1	2	2	6	2	1	2	2.30	4.48E-04	-3.35E+00
ZHERR1	2	2	5	5	4	2	2	3.14	1.04E-03	-2.98E+00
ZHERR2	2	2	5	5	4	2	2	3.14	1.04E-03	-2.98E+00
ZHESE2	2	7	1	2	5	1	2	2.87	7.92E-04	-3.10E+00
ZHESE5	5	4	5	2	7	1	5	4.14	2.62E-03	-2.58E+00
ZHESL2	3	2	8	5	4	2	8	4.57	4.33E-03	-2.36E+00
ZHESL3	7	10	9	9	10	1	10	8.02	1.35E-01	-8.89E-01
ZHETB1 (ZHEC1)	2	7	1	2	5	1	2	2.87	7.92E-04	-3.10E+00
MIN HER	0	0	0	0	0	0	0	0	4.55E-05	-4.34E+00

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.00E-01	-4.58E-02
TMI HSR1 (1)	2	3	5	3	4	5	5	3.85	4.74E-02	-1.32E+00
TMI HSR2 (2)	2	3	5	3	4	2	5	3.43	1.27E-04	-3.90E+00
STP HECO03	8	8	8	5	8	8	9	6.57	4.36E-02	-1.36E+00
TMI HCO1 (3)	2	4	3	3	2	3	4	3.01	1.27E-04	-3.90E+00
STP HEOSL1	5	3	4	3	3	3	6	3.87	2.13E-03	-2.67E+00
STP HECO01	8	3	2	3	4	4	4	3.72	2.31E-03	-2.64E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-04	-4.00E+00

NOTES:
(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEOR1)
(2) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEOR2)
(3) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHECD1)

Regression Output:

Constant	-4.34244300
Std Err of Y Est	0.792487245
R Squared	0.747130953
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)	0.433127309
Std Err of Coef.	0.10287016

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
	PSF WEIGHTS							
ZHEAF2	5	5	5	5	5	5	5	35
ZHEAF3 (ZHEMA1)	5	5	5	5	5	5	5	35
ZHECC1	5	5	5	5	5	5	5	35
ZHECC2	5	5	5	5	5	5	5	35
ZHECD1	5	5	5	5	5	5	5	35
ZHECD2	5	5	5	5	5	5	5	35
ZHEC2	5	5	5	5	5	5	5	35
ZHECS1	5	5	5	5	5	5	5	35
ZHEFL1	5	5	5	5	0	0	5	25
ZHEHH1	5	5	5	5	5	5	5	35
ZHEHH2	5	5	5	5	5	5	5	35
ZHEMA2	5	5	5	5	5	5	5	35
ZHEOB1	5	5	5	5	5	5	5	35
ZHEOD1	5	5	5	5	5	5	5	35
ZHEOF1	5	5	5	5	5	5	5	35
ZHEOF2	5	5	5	5	5	5	5	35
ZHEOR1	5	5	5	5	5	5	5	35
ZHEOR2	5	5	5	5	5	5	5	35
ZHEOS5	5	5	0	5	5	5	5	30
ZHEP1	5	5	5	5	5	5	5	35
ZHERE5	5	5	5	5	5	5	5	35
ZHERED	5	5	5	5	5	5	5	35
ZHERR1	5	5	5	5	5	5	5	35
ZHERR2	5	5	5	5	5	5	5	35
ZHESE2	5	5	5	5	5	5	5	35
ZHESE5	5	5	5	5	5	5	5	35
ZHESL2	5	5	5	5	5	5	5	35
ZHESL3	5	5	5	5	5	5	5	35
ZHETB1 (ZHEC1)	5	5	5	5	5	5	5	35
NORMALIZED PSF WEIGHTS	0.145	0.145	0.14	0.145	0.14	0.14	0.145	1

Figure 35: BVPS-2 Pre-EPU SLIM Worksheet Group 5

Beaver Valley Unit 2 – Action Group 6 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIG	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
PSF Weights	0.143	0.143	0.143	0.143	0.143	0	0.286	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	3.74E-01	-4.27E-01
ZHEOA1	2	0	2	0	3	2	7	3.00	3.84E-03	-2.42E+00
MIN HER	0	0	0	0	0	0	0	0	5.39E-04	-3.27E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	5.00E-01	-3.01E-01
DC ZHEOE1 (1)	2	0	2	0	3	2	7	3.00	1.70E-03	-2.77E+00
FERMI HERB2	3	4	3	3	5	5	8	4.86	1.18E-02	-1.93E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-03	-3.00E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEOA1)

Regression Output:

Constant	-3.2683E+00
Std Err of Y Est	3.2749E-01
R Squared	9.5216E-01
No. of Observations	4
Degrees of Freedom	2.0000000
X Coefficient(s)	0.284162745
Std Err of Coef.	0.045039069

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
	INTERFACE	PREDIG	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHEOA1	5	5	5	5	5	0	10	35
NORMALIZED PSF WEIGHTS	0.143	0.143	0.143	0.143	0.143	0.00	0.286	1

Figure 36: BVPS-2 Pre-EPU SLIM Worksheet Group 6

Beaver Valley Unit 2 – Action Group 7 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.12	0.24	0.14	0.12	0.12	0.12	0.14	1

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	5.29E-01	-2.76E-01
ZHECD5	1	5	8	5	6	2	8	5.08	1.84E-02	-1.74E+00
ZHEC11	1	5	7	3	2	5	2	3.77	7.52E-03	-2.12E+00
ZHEIA2	3	7	2	2	2	5	6	4.24	1.04E-02	-1.98E+00
ZHEIA3	3	8	7	9	9	9	6	7.35	8.67E-02	-1.06E+00
ZHEOB2	5	9	5	3	3	7	8	6.14	3.78E-02	-1.42E+00
ZHESE3	2	9	1	2	5	1	6	4.35	1.12E-02	-1.95E+00
ZHESE4	2	9	2	2	7	1	6	4.73	1.45E-02	-1.84E+00
ZHETB2 (ZHEIC2)	2	9	1	2	5	1	6	4.35	1.12E-02	-1.95E+00
ZHETB3	2	9	2	2	7	1	6	4.73	1.45E-02	-1.84E+00
MIN HER	0	0	0	0	0	0	0	0	5.73E-04	-3.24E+00

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HEOB02	6	4	2	3	4	7	8	4.76	8.80E-03	-2.06E+00
OPRA-8 (1)	5	9	5	3	3	7	6	5.86	1.00E-02	-2.00E+00
DC ZHEOB1	7	5	4	7	6	6	8	6.00	5.49E-02	-1.26E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-03	-3.00E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEOB2)

Regression Output:

Constant	-3.242184576
Std Err of Y Est	0.399998645
R Squared	0.90510960
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.29657300
Std Err of Coef.	0.055441051

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
	PSF WEIGHTS							
ZHECD5	5	10	5	5	5	5	10	45
ZHEC11	5	10	10	5	5	5	5	45
ZHEIA2	5	10	5	5	5	5	5	40
ZHEIA3	5	10	5	5	5	5	5	40
ZHEOB2	5	10	5	5	5	5	5	40
ZHESE3	5	10	5	5	5	5	5	40
ZHESE4	5	10	5	5	5	5	5	40
ZHETB2 (ZHEIC2)	5	10	5	5	5	5	5	40
ZHETB3	5	10	5	5	5	5	5	40
NORMALIZED PSF WEIGHTS	0.122	0.243	0.135	0.122	0.122	0.122	0.135	1

Figure 37: BVPS-2 Pre-EPU SLIM Worksheet Group 7

Beaver Valley Unit 2 – Action Group 8 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.128	0.128	0.128	0.116	0.116	0.256	0.128	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	3.53E-01	-4.53E-01
ZHECD3	2	3	3	2	2	1	5	2.38	1.46E-03	-2.84E+00
ZHECD4	2	5	8	5	6	4	7	5.12	1.04E-02	-1.98E+00
ZHEIA1	1	3	2	5	2	7	3	3.76	3.91E-03	-2.41E+00
ZHEOT1	1	0	1	0	0	5	6	2.30	1.37E-03	-2.86E+00
ZHEREE	1	2	2	6	2	4	5	3.23	2.68E-03	-2.57E+00
ZHERI1	1	0	1	0	0	5	7	2.43	1.51E-03	-2.82E+00
ZHESE1 (ZHEOC1, ZHEOC2)	2	4	2	1	4	7	5	4.03	4.79E-03	-2.32E+00
ZHESL1	2	1	5	2	3	7	6	4.16	5.25E-03	-2.28E+00
ZHESL5	2	4	5	2	4	8	8	5.17	1.09E-02	-1.96E+00
ZHEWA2	2	3	7	4	2	5	5	4.15	5.20E-03	-2.28E+00
ZHEWA4	2	6	7	7	10	5	6	5.94	1.89E-02	-1.72E+00
MIN HER	0	0	0	0	0	0	0	0	2.61E-04	-3.58E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HEOSL1	5	3	4	3	3	3	6	3.77	2.13E-03	-2.67E+00
FERMI HERS1	2	7	2	3	2	4	6	3.78	1.75E-03	-2.76E+00
STP HEOS01	6	4	6	3	10	10	3	6.50	1.80E-02	-1.74E+00
DC ZHEOX1 (1)	2	1	5	2	3	7	6	4.16	3.20E-03	-2.49E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-03	-3.00E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHESL1)

Regression Output:

Constant	-3.583059682
Std Err of Y Est	0.455189634
R Squared	0.867599013
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.31302434
Std Err of Coef.	0.061141234

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHECD3	5	5	5	5	5	10	5	40
ZHECD4	5	5	5	5	5	10	5	40
ZHEIA1	5	5	5	5	5	10	5	40
ZHEOT1	5	5	5	0	5	10	5	35
ZHEREE	5	5	5	5	5	10	5	40
ZHERI1	5	5	5	5	5	10	5	40
ZHESE1 (ZHEOC1, ZHEOC2)	5	5	5	5	5	10	5	40
ZHESL1	5	5	5	5	5	10	5	40
ZHESL5	5	5	5	5	5	10	5	40
ZHEWA2	5	5	5	5	0	10	5	35
ZHEWA4	5	5	5	5	5	10	5	40
NORMALIZED PSF WEIGHTS	0.128	0.128	0.128	0.116	0.116	0.256	0.128	1

Figure 38: BVPS-2 Pre-EPU SLIM Worksheet Group 8

Beaver Valley Unit 2 – Action Group 9 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0	0.176	0.176	0.176	0.176	0.118	0.176	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	6.28E-01	-2.02E-01
ZHECD6	2	9	3	3	7	3	9	5.82	7.65E-02	-1.12E+00
ZHECD7	2	9	8	5	8	4	9	7.35	1.65E-01	-7.82E-01
ZHEWA6	2	4	5	4	5	2	1	3.59	2.48E-02	-1.61E+00
MIN HER	0	0	0	0	0	0	0	0.00	4.05E-03	-2.39E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HECD03	6	6	6	5	6	8	9	6.5882	4.38E-02	-1.36E+00
EPRI SH1 (1)	2	9	3	3	7	3	9	5.8235	1.00E-01	-1.00E+00
MIN HER	0	0	0	0	0	0	0	0	5.00E-03	-2.30E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHECD6)

Regression Output:

Constant	-2.392031371
Std Err of Y Est	0.339302955
R Squared	0.9151131
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.219017541
Std Err of Coef.	0.047167948

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
	PSF WEIGHTS							
ZHECD6	0	5	5	5	5	5	5	30
ZHECD7	0	5	5	5	5	5	5	30
ZHEWA6	0	5	5	5	5	0	5	25
NORMALIZED PSF WEIGHTS	0	0.176	0.176	0.176	0.176	0.118	0.176	1

Figure 39: BVPS-2 Pre-EPU SLIM Worksheet Group 9

Beaver Valley Unit 2 – Group 10 Human Actions Evaluation

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.14	0.14	0.29	0.00	0.14	0.14	0.14	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.96E-01	-1.78E-03
ZHEXT1	8	9	10	1	4	5	8	7.71	3.56E-02	-1.45E+00
MIN HER	0	0	0	0	0	0	0	0.00	4.67E-07	-6.33E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
SEABROOK ON	0	0	1	0	2	0	0	0.5714	1.00E-06	-6.0000
MIN HER	0	0	0	0	0	0	0	0	5.00E-07	-6.3010

Regression Output:

Constant	-6.33E+00
Std Err of Y Est	4.29E-02
R Squared	0.999927115
No. of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.632865998
Std Err of Coef.	0.005403158

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
	INTERFACE	PREDIING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHEXT1	5	5	10	0	5	5	5	35
NORMALIZED PSF WEIGHTS	0.14	0.14	0.29	0.00	0.14	0.14	0.14	1

Figure 40: BVPS-2 Pre-EPU SLIM Worksheet Group 10

Attachment 4 to RAI 2.a.

BVPS-2 Post-EPU SLIM Worksheets

BEAVER VALLEY UNIT 2 - GROUP 1 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.116	0.233	0.116	0.116	0.116	0.233	0.07	1

OPERATOR ACTIONS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	FLI	HER	LOG(HER)
MAX HER	8	8	8	8	8	8	8	8	4.80E-01	-3.19E-01
ZHEPR1	2	8	4	2	3	8	6	5.42	2.65E-02	-1.58E+00
ZHESM1	5	8	4	5	5	7	5	6.05	5.36E-02	-1.27E+00
ZHEWA1	7	8	7	5	5	6	5	6.40	7.93E-02	-1.10E+00
ZHEWA3	7	8	7	5	5	6	5	6.40	7.93E-02	-1.10E+00
ZHEWA5	7	8	7	7	10	6	6	7.28	2.14E-01	-6.70E-01
MIN HER	2	2	2	2	2	2	2	2	5.72E-04	-3.24E+00

CALIBRATION TASKS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	FLI	HER	LOG(HER)
MAX HER	8	8	8	8	8	8	8	8	1.00E+00	0.00E+00
FERMI OE1	4	6	4	4	5	4	4	4.5814	4.31E-03	-2.37E+00
STP HEOR05	7	7	8	5	8	8	6	7.1628	1.24E-01	-9.07E-01
MIN HER	2	2	2	2	2	2	2	2	1.00E-03	-3.00E+00

Regression Output:

Constant	-4.2167171
Std Err of Y Est	0.411007816
R Squared	0.939482569
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.487245984
Std Err of Coef.	0.087443826

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHEPR1	5	10	5	5	5	10	5	45
ZHESM1	5	10	5	5	5	10	5	45
ZHEWA1	5	10	5	5	5	10	0	40
ZHEWA3	5	10	5	5	5	10	0	40
ZHEWA5	5	10	5	5	5	10	5	45
NORMALIZED PSF WEIGHTS	0.116	0.233	0.116	0.116	0.116	0.233	0.07	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	1.64E-02
5	3.32E-02
5	4.91E-02
5	4.91E-02
3	1.71E-01

Figure 41: BVPS-2 Post-EPU SLIM Worksheet Group 1

BEAVER VALLEY UNIT 2 - GROUP 2 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.111	0.111	0.222	0.111	0.111	0.222	0.111	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.54E-01	-8.13E-01
ZHEOS1	1	7	7	6	9	5	4	5.6667	1.33E-02	-1.88E+00
ZHEOS2	1	8	8	8	9	2	5	5.6667	1.33E-02	-1.88E+00
ZHEOS3	1	8	8	8	9	3	7	6.1111	1.71E-02	-1.77E+00
ZHEOS4	1	8	8	8	9	8	8	7.3333	3.41E-02	-1.47E+00
ZHESL4	2	8	8	9	9	5	8	6.8889	2.66E-02	-1.58E+00
ZHEXT2	8	9	10	1	4	9	9	7.6667	4.12E-02	-1.39E+00
ZHEXT4	8	9	10	5	4	9	9	8.1111	5.29E-02	-1.28E+00
MIN HER	0	0	0	0	0	0	0	0	5.44E-04	-3.26E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	5.00E-01	-3.01E-01
DC ZHEOS1	2	2	1	5	5	3	4	2.8889	1.50E-03	-2.82E+00
EPRI L1 (1)	1	8	8	8	9	4	5	6.1111	2.00E-03	-2.70E+00
STP HEOR07	7	5	5	4	5	6	6	5.4444	2.08E-02	-1.68E+00
MIN HER	0	0	0	0	0	0	0	0	1.50E-03	-2.82E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEOS2)

Regression Output:

Constant	-3.264095629
Std Err of Y Est	0.69738723
R Squared	0.69679788
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.245075073
Std Err of Coef.	0.093336437

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PRECEDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHEOS1	5	5	10	5	5	10	5	45
ZHEOS2	5	5	10	5	5	10	5	45
ZHEOS3	5	5	10	5	5	10	5	45
ZHEOS4	5	5	10	5	5	10	5	45
ZHESL4	5	5	10	5	5	10	5	45
ZHEXT2	5	5	10	5	5	10	5	45
ZHEXT4	5	5	10	5	5	10	5	45
NORMALIZED PSF WEIGHTS	0.111	0.111	0.222	0.111	0.111	0.222	0.111	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	8.26E-03
5	8.26E-03
5	1.06E-02
5	2.11E-02
5	1.65E-02
5	2.55E-02
5	3.28E-02

Figure 42: BVPS-2 Post-EPU SLIM Worksheet Group 2

BEAVER VALLEY UNIT 2 - GROUP 3 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.111	0.056	0.111	0.111	0.167	0.222	0.222	1

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	2.16E-01	-6.66E-01
ZHERL2	4	1	8	5	10	8	8	7.1667	6.70E-02	-1.17E+00
ZHERE6	1	2	8	9	9	8	7	6.9444	6.12E-02	-1.21E+00
MIN HER	0	0	0	0	0	0	0	0	3.47E-03	-2.46E+00

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HECS01	6	4	6	3	10	10	3	6.4444	1.80E-02	-1.74E+00
FERM RE7	6	7	6	8	6	5	8	6.50	1.32E-02	-1.88E+00
MIN HER	0	0	0	0	0	0	0	0	8.00E-03	-2.10E+00

Regression Output:

Constant	-2.45904629
Std Err of Y Est	0.74585100
R Squared	0.60132401
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.17935154
Std Err of Coef.	0.10326328

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
ZHERL2	5	0	5	5	10	10	10	45
ZHERE6	5	5	5	5	5	10	10	45
NORMALIZED PSF WEIGHTS	0.111	0.056	0.111	0.111	0.167	0.222	0.222	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	4.15E-02
5	3.79E-02

Figure 43: BVPS-2 Post-EPU SLIM Worksheet Group 3

BEAVER VALLEY UNIT 2 - ACTION GROUP 4 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.125	0.125	0.125	0.125	0.125	0.125	0.25	1

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.76E-01	-7.56E-01
ZHEMU1	2	4	8	4	6	2	8	5.25	5.45E-03	-2.26E+00
ZHEMU2	2	4	8	4	6	2	8	5.25	5.45E-03	-2.26E+00
ZHEMU3	2	4	8	4	6	5	8	5.63	7.17E-03	-2.14E+00
ZHEMU4	2	4	8	4	6	7	8	5.88	8.60E-03	-2.07E+00
ZHEWM1	2	5	8	6	6	0	8	5.38	5.97E-03	-2.22E+00
MIN HER	0	0	0	0	0	0	0	0	1.17E-04	-3.93E+00

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E-01	-1.00E+00
STP HERC4	3	2	1	8	5	6	6	4.625	9.82E-04	-3.01E+00
TMI HLTIB (1)	2	4	8	4	6	4	8	5.50	6.24E-02	-1.20E+00
FERMI HECT3	4	6	3	3	3	3	3	3.50	1.15E-03	-2.94E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-04	-4.00E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEMU2)

Regression Output:

Constant	-3.93053070
Std Err of Y Est	0.65739322
R Squared	0.79766860
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.317487722
Std Err of Coef.	0.092318056

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
NORMALIZED PSF WEIGHTS	0.125	0.125	0.125	0.125	0.125	0.125	0.25	1

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEMU1	5	5	5	5	5	5	10	40
ZHEMU2	5	5	5	5	5	5	10	40
ZHEMU3	5	5	5	5	5	5	10	40
ZHEMU4	5	5	5	5	5	5	10	40
ZHEWM1	5	5	5	5	5	5	10	40

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	2.57E-03
7.5	2.57E-03
7.5	3.38E-03
7.5	4.06E-03
7.5	2.82E-03

Figure 44: BVPS-2 Post-EPU SLIM Worksheet Group 4

BEAVER VALLEY UNIT 2 - ACTION GROUP 5 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.145	0.145	0.14	0.145	0.14	0.14	0.145	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	9.75E-01	-1.12E-02
ZHEAF2	2	3	3	2	2	0	2	2.01	3.36E-04	-3.47E+00
ZHEAF3 (ZHEMA1)	2	3	3	2	2	0	2	2.01	3.36E-04	-3.47E+00
ZHECC1	2	6	6	7	2	2	5	4.30	3.31E-03	-2.48E+00
ZHECC2	2	6	7	7	2	4	6	4.87	5.82E-03	-2.24E+00
ZHECD1	2	4	3	3	2	1	4	2.73	6.88E-04	-3.16E+00
ZHECD2	2	5	6	5	6	1	4	4.42	3.73E-03	-2.43E+00
ZHECI2	1	2	4	1	3	3	3	2.42	5.05E-04	-3.30E+00
ZHECS1	3	7	7	7	7	7	6	6.28	2.37E-02	-1.62E+00
ZHEFL1	2	7	6	4	7	1	3	4.28	3.25E-03	-2.49E+00
ZHEHH1	1	7	5	5	2	2	6	4.02	2.49E-03	-2.60E+00
ZHEHH2	2	2	3	1	3	1	4	2.29	4.44E-04	-3.35E+00
ZHEMA2	2	6	5	3	8	5	6	4.99	6.56E-03	-2.18E+00
ZHEOB1	5	3	5	3	3	7	6	4.57	4.31E-03	-2.37E+00
ZHEOD1	2	3	5	2	5	0	5	3.14	1.04E-03	-2.98E+00
ZHEOF1	2	4	5	2	3	4	5	3.57	1.59E-03	-2.80E+00
ZHEOF2	2	1	1	2	2	3	5	2.29	4.46E-04	-3.35E+00
ZHEOR1	2	3	5	3	4	0	5	3.15	1.05E-03	-2.98E+00
ZHEOR2	2	3	5	3	4	5	5	3.85	2.10E-03	-2.68E+00
ZHEOS5	1	4	2	2	4	2	5	2.86	7.88E-04	-3.10E+00
ZHEPI1	0	0	1	5	3	2	5	2.29	4.46E-04	-3.35E+00
ZHERE5	1	2	8	9	9	3	5	5.27	8.67E-03	-2.06E+00
ZHERED	1	2	2	6	2	3	2	2.58	5.93E-04	-3.23E+00
ZHERR1	2	2	5	5	4	2	2	3.14	1.04E-03	-2.98E+00
ZHERR2	2	2	5	5	4	2	2	3.14	1.04E-03	-2.98E+00
ZHESE2	2	7	1	2	5	1	2	2.87	7.92E-04	-3.10E+00
ZHESE5	5	4	5	2	7	1	5	4.14	2.82E-03	-2.55E+00
ZHESL2	3	2	8	5	4	0	8	4.29	3.28E-03	-2.48E+00
ZHESL3	7	10	9	9	10	0	10	7.88	1.18E-01	-9.29E-01
ZHETB1 (ZHEIC1)	2	7	1	2	5	1	2	2.87	7.92E-04	-3.10E+00
MIN HER	0	0	0	0	0	0	0	0	4.55E-05	-4.34E+00

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PREDING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHEAF2	5	5	5	5	5	5	5	35
ZHEAF3 (ZHEMA1)	5	5	5	5	5	5	5	35
ZHECC1	5	5	5	5	5	5	5	35
ZHECC2	5	5	5	5	5	5	5	35
ZHECD1	5	5	5	5	5	5	5	35
ZHECD2	5	5	5	5	5	5	5	35
ZHECI2	5	5	5	5	5	5	5	35
ZHECS1	5	5	5	5	5	5	5	35
ZHEFL1	5	5	5	5	0	0	5	25
ZHEHH1	5	5	5	5	5	5	5	35
ZHEHH2	5	5	5	5	5	5	5	35
ZHEMA2	5	5	5	5	5	5	5	35
ZHEOB1	5	5	5	5	5	5	5	35
ZHEOD1	5	5	5	5	5	5	5	35
ZHEOF1	5	5	5	5	5	5	5	35
ZHEOF2	5	5	5	5	5	5	5	35
ZHEOR1	5	5	5	5	5	5	5	35
ZHEOR2	5	5	5	5	5	5	5	35
ZHEOS5	5	5	0	5	5	5	5	30
ZHEPI1	5	5	5	5	5	5	5	35
ZHERE5	5	5	5	5	5	5	5	35
ZHERED	5	5	5	5	5	5	5	35
ZHERR1	5	5	5	5	5	5	5	35
ZHERR2	5	5	5	5	5	5	5	35
ZHESE2	5	5	5	5	5	5	5	35
ZHESE5	5	5	5	5	5	5	5	35
ZHESL2	5	5	5	5	5	5	5	35
ZHESL3	5	5	5	5	5	5	5	35
ZHETB1 (ZHEIC1)	5	5	5	5	5	5	5	35
NORMLAIZED PSF WEIGHTS	0.145	0.145	0.14	0.145	0.14	0.14	0.145	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
10	1.26E-04
10	1.26E-04
7.5	1.56E-03
7.5	2.75E-03
10	2.58E-04
7.5	1.76E-03
10	1.90E-04
5	1.47E-02
7.5	1.53E-03
7.5	1.18E-03
10	1.67E-04
7.5	3.10E-03
7.5	2.04E-03
7.5	4.92E-04
7.5	7.51E-04
10	1.67E-04
7.5	4.94E-04
7.5	9.93E-04
10	2.96E-04
10	1.67E-04
7.5	4.09E-03
10	2.23E-04
7.5	4.89E-04
7.5	4.89E-04
10	2.97E-04
7.5	1.33E-03
7.5	1.55E-03
3	9.41E-02
7.5	3.74E-04

Figure 45: BVPS-2 Post-EPU SLIM Worksheet Group 5

CAUSATION TASKS	PSF RANKINGS							RU	HEP	LOG(HEP)
MAX HEP	10	10	10	10	10	10	10	10	9.00E-01	-4.55E-02
TM HEP1 (1)	2	3	5	3	4	5	5	3.85	4.74E-02	-1.32E+00
TM HEP2 (2)	2	3	5	3	4	2	5	3.43	1.27E-04	-3.90E+00
STP HEP03	6	6	6	5	6	8	9	6.57	4.38E-02	-1.36E+00
TM HEP1 (3)	2	4	3	3	2	3	4	3.01	1.27E-04	-3.90E+00
STP HEP1.1	5	3	4	3	3	3	6	3.87	2.13E-03	-2.67E+00
STP HEP01	6	3	2	3	4	4	4	3.72	2.31E-03	-2.64E+00
MIN HEP	0	0	0	0	0	0	0	0	1.00E-04	-4.00E+00

NOTES
(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV-2 (ZHEOR1)
(2) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV-2 (ZHEOR2)
(3) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV-2 (ZHEOD1)

Regression Output:

Constant	-4.34244300
Std Err of Y Est	0.79248724 5
R Squared	0.74713093
No. of Observations	8
Degrees of Freedom	6
X Coefficient(s)	0.43312709
Std Err of Coef.	0.10257016

Figure 45: BVPS-2 Post-EPU SLIM Worksheet Group 5 (continued)

BEAVER VALLEY UNIT 2 - ACTION GROUP 6 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
PSF Weights	0.143	0.143	0.143	0.143	0.143	0	0.286	1

OPERATOR ACTIONS	PSF RANKINGS							PU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	3.74E-01	-4.27E-01
ZHEDA1	2	0	2	0	3	2	7	3.00	3.84E-03	-2.42E+00
MIN HER	0	0	0	0	0	0	0	0	5.39E-04	-3.27E+00

CALIBRATION TASKS	PSF RANKINGS							PU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	5.00E-01	-3.01E-01
DCZHEDE1 (1)	2	0	2	0	3	2	7	3.00	1.70E-03	-2.77E+00
FERM HERB2	3	4	3	3	5	5	8	4.86	1.18E-02	-1.93E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-03	-3.00E+00

NOTE

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEDA1)

Regression Output:

Constant	-3.2683E+00
Std Err of Y Est	3.2749E-01
R Squared	9.5216E-01
No. of Observations	4
Degrees of Freedom	2.0000000
X Coefficient(s)	0.284162745
Std Err of Coef.	0.045009089

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEDA1	5	5	5	5	5	0	10	35
NORMALIZED PSF WEIGHTS	0.143	0.143	0.143	0.143	0.143	0.00	0.286	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
7.5	1.81E-03

Figure 46: BVPS-2 Post-EPU SLIM Worksheet Group 6

BEAVER VALLEY UNIT 2 - ACTION GROUP 7 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIG	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm. PSF Weights	0.12	0.24	0.14	0.12	0.12	0.12	0.14	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	5.29E-01	-2.76E-01
ZHECD5	1	5	8	5	6	5	8	5.45	2.36E-02	-1.63E+00
ZHECI1	1	5	7	3	2	5	2	3.77	7.52E-03	-2.12E+00
ZHEIA2	3	7	2	2	2	5	6	4.24	1.04E-02	-1.98E+00
ZHEIA3	3	8	7	9	9	9	6	7.35	8.67E-02	-1.06E+00
ZHEOB2	5	9	5	3	3	7	8	6.14	3.78E-02	-1.42E+00
ZHESE3	2	9	1	2	5	1	6	4.35	1.12E-02	-1.95E+00
ZHESE4	2	9	2	2	7	1	6	4.73	1.45E-02	-1.84E+00
ZHETB2 (ZHEIC2)	2	9	1	2	5	1	6	4.35	1.12E-02	-1.95E+00
ZHETB3	2	9	2	2	7	1	6	4.73	1.45E-02	-1.84E+00
MIN HER	0	0	0	0	0	0	0	0	5.73E-04	-3.24E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HEOB02	6	4	2	3	4	7	8	4.76	8.80E-03	-2.06E+00
OPRA-8 (1)	5	9	5	3	3	7	6	5.86	1.00E-02	-2.00E+00
DC ZHEOB1	7	5	4	7	6	6	8	6.00	5.49E-02	-1.26E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-03	-3.00E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHEOB2)

Regression Output:

Constant	-3.242184576
Std Err of Y Est	0.396998645
R Squared	0.90510960
No. of Observations	5
Degrees of Freedom	3
X Coefficient(s)	0.29657300
Std Err of Coef.	0.055441061

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PREDIG	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
	PSF WEIGHTS							
ZHECD5	5	10	5	5	5	5	10	45
ZHECI1	5	10	10	5	5	5	5	45
ZHEIA2	5	10	5	5	5	5	5	40
ZHEIA3	5	10	5	5	5	5	5	40
ZHEOB2	5	10	5	5	5	5	5	40
ZHESE3	5	10	5	5	5	5	5	40
ZHESE4	5	10	5	5	5	5	5	40
ZHETB2 (ZHEIC2)	5	10	5	5	5	5	5	40
ZHETB3	5	10	5	5	5	5	5	40
NORMALIZED PSF WEIGHTS	0.122	0.243	0.135	0.122	0.122	0.122	0.135	1

OPERATOR ACTIONS	INPUT TO RISKMAN FOR HER DISTRIBUTION	
	RANGE FACTOR	MEDIAN
ZHECD5	5	1.46E-02
ZHECI1	7.5	3.55E-03
ZHEIA2	5	6.43E-03
ZHEIA3	5	5.37E-02
ZHEOB2	5	2.34E-02
ZHESE3	5	6.92E-03
ZHESE4	5	8.97E-03
ZHETB2 (ZHEIC2)	5	6.92E-03
ZHETB3	5	8.97E-03

Figure 47: BVPS-2 Post-EPU SLIM Worksheet Group 7

BEAVER VALLEY UNIT 2 - ACTION GROUP 8 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDIND	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.128	0.128	0.128	0.116	0.116	0.256	0.128	1

OPERATOR ACTIONS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	3.53E-01	-4.53E-01
ZHECD3	2	3	3	2	2	0	5	2.13	1.21E-03	-2.92E+00
ZHECD4	2	5	8	5	6	0	7	4.09	4.99E-03	-2.30E+00
ZHEIA1	1	3	2	5	2	7	3	3.76	3.91E-03	-2.41E+00
ZHEOT1	1	0	1	0	0	5	6	2.30	1.37E-03	-2.86E+00
ZHEREE	1	2	2	6	2	5	5	3.49	3.23E-03	-2.49E+00
ZHER11	1	0	1	0	0	5	7	2.43	1.51E-03	-2.82E+00
ZHESE1 (ZHEOC1, ZHEOC2)	2	4	2	1	4	7	5	4.03	4.79E-03	-2.32E+00
ZHESL1	2	1	5	2	3	5	6	3.65	3.63E-03	-2.44E+00
ZHESL5	2	4	5	2	4	6	8	4.66	7.53E-03	-2.12E+00
ZHEWA2	2	3	7	4	2	5	5	4.15	5.20E-03	-2.28E+00
ZHEWA4	2	6	7	7	10	5	6	5.94	1.89E-02	-1.72E+00
MIN HER	0	0	0	0	0	0	0	0	2.61E-04	-3.58E+00

CALIBRATION TASKS	PSF RANKINGS							FLI	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HEOSL1	5	3	4	3	3	3	6	3.77	2.13E-03	-2.67E+00
FERMI HERS1	2	7	2	3	2	4	6	3.78	1.75E-03	-2.76E+00
STP HEOS01	6	4	6	3	10	10	3	6.50	1.80E-02	-1.74E+00
DC ZHEOX1 (1)	2	1	5	2	3	7	6	4.16	3.20E-03	-2.49E+00
MIN HER	0	0	0	0	0	0	0	0	1.00E-03	-3.00E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHESL1)

Regression Output:

Constant	-3.583059682
Std Err of Y Est	0.455189634
R Squared	0.867599013
No. of Observations	6
Degrees of Freedom	4
X Coefficient(s)	0.31302434
Std Err of Coef.	0.061141234

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	INTERFACE	PREDIND	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHECD3	5	5	5	5	5	10	5	40
ZHECD4	5	5	5	5	5	10	5	40
ZHEIA1	5	5	5	5	5	10	5	40
ZHEOT1	5	5	5	0	5	10	5	35
ZHEREE	5	5	5	5	5	10	5	40
ZHER11	5	5	5	5	5	10	5	40
ZHESE1 (ZHEOC1, ZHEOC2)	5	5	5	5	5	10	5	40
ZHESL1	5	5	5	5	5	10	5	40
ZHESL5	5	5	5	5	5	10	5	40
ZHEWA2	5	5	5	5	0	10	5	35
ZHEWA4	5	5	5	5	5	10	5	40
NORMALIZED PSF WEIGHTS	0.128	0.128	0.128	0.116	0.116	0.256	0.128	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

OPERATOR ACTIONS	RANGE FACTOR	MEDIAN
ZHECD3	7.5	5.72E-04
ZHECD4	7.5	2.36E-03
ZHEIA1	7.5	1.85E-03
ZHEOT1	7.5	6.48E-04
ZHEREE	7.5	1.52E-03
ZHER11	7.5	7.11E-04
ZHESE1 (ZHEOC1, ZHEOC2)	7.5	2.26E-03
ZHESL1	7.5	1.71E-03
ZHESL5	7.5	3.55E-03
ZHEWA2	7.5	2.46E-03
ZHEWA4	5	1.17E-02

Figure 48: BVPS-2 Post-EPU SLIM Worksheet Group 8

BEAVER VALLEY UNIT 2 - ACTION GROUP 9 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0	0.176	0.176	0.176	0.176	0.118	0.176	1

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	6.28E-01	-2.02E-01
ZHECD6	2	9	3	3	7	3	9	5.82	7.65E-02	-1.12E+00
ZHECD7	2	9	8	5	8	4	9	7.35	1.65E-01	-7.82E-01
ZHEWA6	2	4	5	4	5	2	1	3.59	2.48E-02	-1.61E+00
MIN HER	0	0	0	0	0	0	0	0.00	4.05E-03	-2.39E+00

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAX HER	10	10	10	10	10	10	10	10	1.00E+00	0.00E+00
STP HECD03	6	6	6	5	6	8	9	6.5882	4.36E-02	-1.36E+00
EPRI SH1 (1)	2	9	3	3	7	3	9	5.8235	1.00E-01	-1.00E+00
MIN HER	0	0	0	0	0	0	0	0	5.00E-03	-2.30E+00

NOTE:

(1) RANKINGS ARE THOSE FOR SIMILAR ACTION IN BV2 (ZHECD6)

Regression Output:

Constant	-2.392031371
Std Err of Y Est	0.339302955
R Squared	0.9151131
No. of Observations	4
Degrees of Freedom	2
X Coefficient(s)	0.219017541
Std Err of Coef.	0.047167948

PERFORMANCE SHAPING FACTORS

OPERATOR ACTIONS	PSF WEIGHTS							
	INTERFACE	PREDICTING	COMPLEXITY	PROCEDURES	TRAINING	TIME	STRESS	SUM
ZHECD6	0	5	5	5	5	5	5	30
ZHECD7	0	5	5	5	5	5	5	30
ZHEWA6	0	5	5	5	5	0	5	25
NORMALIZED PSF WEIGHTS	0	0.176	0.176	0.176	0.176	0.118	0.176	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	4.74E-02
3	1.32E-01
5	1.53E-02

Figure 49: BVPS-2 Post-EPU SLIM Worksheet Group 9

BEAVER VALLEY UNIT 2 - GROUP 10 HUMAN ACTIONS EVALUATION

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURING	TRAINING	TIME	STRESS	SUM
Norm PSF Weights	0.14	0.14	0.29	0.00	0.14	0.14	0.14	1

OPERATOR ACTIONS	PSF RANKINGS							FU	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	9.95E-01	-1.78E-03
ZHEXT1	8	9	10	1	4	5	8	7.71	3.55E-02	-1.45E+00
MINHER	0	0	0	0	0	0	0	0.00	4.67E-07	-6.33E+00

CALIBRATION TASKS	PSF RANKINGS							FU	HER	LOG(HER)
MAXHER	10	10	10	10	10	10	10	10	1.00E+00	0.0000
SEABROOK ON	0	0	1	0	2	0	0	0.5714	1.00E-05	-5.0000
MINHER	0	0	0	0	0	0	0	0	5.00E-07	-6.3010

Regression Output:

Constant	-6.33E+00
Std Err of Y Est	4.23E-02
R Squared	0.999927115
No of Observations	3
Degrees of Freedom	1
X Coefficient(s)	0.63286998
Std Err of Coef.	0.005403158

PERFORMANCE SHAPING FACTORS

	INTERFACE	PREDICTION	COMPLEXITY	PROCEDURING	TRAINING	TIME	STRESS	SUM

OPERATOR ACTIONS	PSF WEIGHTS							
ZHEXT1	5	5	10	0	5	5	5	35
NORMALIZED PSF WEIGHTS	0.14	0.14	0.29	0.00	0.14	0.14	0.14	1

INPUT TO RISKMAN FOR HER DISTRIBUTION

RANGE FACTOR	MEDIAN
5	2.21E-02

Figure 50: BVPS-2 Post-EPU SLIM Worksheet Group 10

L-05-140 Enclosure 2

Proprietary Response to RAI Question Number 4

L-05-140 Enclosure 3

Non-Proprietary Response to RAI Question Number 4

"Probability Risk Assessment (PRA) RAI Response #4 for the RSG/EPU Program"

BVPS EPU Submittal

August 29, 2005

Westinghouse Electric Company LLC
P.O. Box 355
Pittsburgh, PA 15230-0355

Question

4. **Section 10.16.1.5 states that the RSGs will result in a lower frequency for steam generator tube rupture (SGTR) because of the use of Alloy 690. Please provide the basis for the new SGTR frequency including the supporting reference(s) (or excerpts).**

Response:

Beaver Valley Power Station Unit No. 1 will be installing Westinghouse Model 54F steam generators, designed and constructed with Alloy 690 tubes. It was recognized that current, industry generic steam generator tube rupture (SGTR) initiating event frequencies are based on years of operating experience of Alloy 600 steam generator tubes and that operating experience may not be applicable to new steam generator tube designs, such as designs utilizing Alloy 690. A methodology was prepared, by Westinghouse, for calculation of a generic SGTR initiating event frequency for steam generators constructed with Alloy 690 tube material. This methodology does not ignore the many years of data currently available for Alloy 600 steam generator design, but incorporates that information with current understanding of the SGTR failure modes and improvements to steam generator tube designs and improvements to plant operating practices.

STEAM GENERATOR TUBE RUPTURES EVENTS

Most of the PWR steam generator tubes which have failed over the years have been mill-annealed Alloy 600 tubes. However, some failures of thermally treated Alloy 600 tubing have been reported, primarily due to fretting (degradation mechanisms due to the design of the support plates and anti-vibration bars (AVBs), and the presence of loose parts, rather than the tubing material). But there have also been a few failures of thermally treated Alloy 600 tubing due to primary and secondary-side stress corrosion cracking (SCC).

Degradation mechanisms include primary water stress corrosion cracking (PWSCC), outside diameter stress corrosion cracking (ODSCC), transgranular stress corrosion cracking, intergranular stress corrosion cracking (IGSCC) (fretting, wear and thinning), pitting, denting, high-cycle fatigue, and wastage (erosion-corrosion and corrosion-fatigue).

A search of the INPO database for SGTR License Event Reports was performed. The search confirmed the following SGTR events, which are provided in Table 4-1.

Table 4-1: SGTR Industry Events

Plant	Year	Failure Mechanism
Point Beach 1	1975	Wastage/SCC
Surry 2	1976	PWSCC
Doel 2	1979	PWSCC
Prairie Island 1	1979	Loose Parts Wear
Ginna 1	1982	Loose Parts Wear
North Anna 1	1987	High-Cycle Fatigue
McGuire 1	1989	IGSCC

Table 4-1: SGTR Industry Events		
Plant	**Year**	**Failure Mechanism**
Mihama 2	1991	High-Cycle Fatigue
Indian Point 2	2000	PWSCC

STEAM GENERATOR TUBE RUPTURE FREQUENCY METHODOLOGY

A methodology was created by Westinghouse for a generic SGTR initiating event frequency for use with Westinghouse Alloy 690 steam generator designs. The methodology considers the history of steam generator operating experience (total tube years and plant availability) and calculates a steam generator tube non-plugging factor to determine a "tube years adjusted" value. The Alloy 690 SGTR initiating event frequency is the postulated number of SGTR events (based on expert elicitation) divided by the "tube years adjusted" value.

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Expert Elicitation

A Westinghouse expert opinion discussion was held to discuss the likelihood of SGTR due to various failure mechanisms.

The expert opinion discussion focused on the known, potential failure mechanisms for current steam generator tubes. Based on current knowledge of Alloy 690 steam generator tubes, the likelihood of a SGTR event due to a given failure mechanism was debated and the results were documented.

The results of the expert opinion discussion can be used to calculate a postulated number of steam generator tube rupture events.

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Steam Generator Tube Rupture Frequency Calculations

For mill annealed steam generators, a frequency per tube-year has been calculated to be 1.25 E-06 (see Table 4-3); and, for thermally treated or Alloy 690 steam generators, the frequency per tube-year has been calculated to be 1.94 E-07 (see Table 4-4).

An extensive search of data was performed for all domestic, foreign and foreign licensee Westinghouse type steam generators.

The data points for the overall database consist of the following:

- Plant name
- Steam generator model
- Number of plant loops
- Number of tubes per steam generator
- Total number of tubes in all steam generators at that plant
- Date plant was commissioned or date the plant replaced the original steam generator
- Effective date of analysis or the date the plant ceased operation
- Total number of years between commission or replacement date and the date of analysis or ceased operation
- Tube-years (a multiplication between total number of years and the total number of tubes)
- 3 year availability
- 3 year capability
- Shutdown date if the plant ceased operation
- Steam generator replacement date if the steam generator was replaced
- Replacement model

- Date the plant is considering future steam generator replacement
- Total number of tubes plugged at each plant

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BVPS-1 Steam Generator Tube Rupture Frequency Calculation

BVPS-1 has three SGTR initiating events (one for each steam generator); thus, the calculation here will be on a per steam generator basis. Based on the frequency (tube-year) value of 1.94E-07 for Model 54F (Alloy 690) steam generators, the calculation for BVPS-1 results in the following:

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Frequency = 6.96E-04 SGTR per year per steam generator

L-05-140 Enclosure 4

Affidavit

Westinghouse

Westinghouse Electric Company
Nuclear Services
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Direct tel: (412) 374-4419
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e-mail: maurerbf@westinghouse.com

Our ref: CAW-05-2046

August 26, 2005

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: "Probability Risk Assessment (PRA) RAI Response #4 for the RSG/EPU Program" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-05-2046 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by FirstEnergy Nuclear Operating Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-05-2046, and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: B. Benney
L. Feizollahi

bcc: B. F. Maurer (ECE 4-7A) 1L
R. Bastien, 1L (Nivelles, Belgium)
C. Brinkman, 1L (Westinghouse Electric Co., 12300 Twinbrook Parkway, Suite 330, Rockville, MD 20852)
RCPL Administrative Aide (ECE 4-7A) 1L, 1A (letter and affidavit only)

CAW-05-2046

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared J. A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Sworn to and subscribed
before me this 26th day
of August, 2005

Notary Public

Notarial Seal
Sharon L. Fiori, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires January 29, 2007
Member, Pennsylvania Association Of Notaries

(1) I am Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse "Application for Withholding" accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market-advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390, it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in "Probability Risk Assessment (PRA) RAI Response #4 for the RSG/EPU Program," (Proprietary) dated August 26, 2005, for support of the RSG/EPU project, being transmitted by the FirstEnergy Nuclear Operating Company letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse for Beaver Valley Units 1 & 2 is expected to be applicable for other licensee submittals in response to certain NRC requirements for justification of Alloy 600 SG Tube Rupture Frequency methodology.

This information is part of that which will enable Westinghouse to have a:

(a) competitive position for RSG.

(b) competitive position for PRA Data Analysis.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of similar information to its customers for purposes of future PRA and RSG analysis contracts.

(b) Westinghouse can sell support and defense of SGTR Initiating Event Frequency Methodology.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar calculations for SGTR Initiating Event Frequency and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

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