SALP REPORT - BEAVER VALLEY POWER STATION

UNITS 1 AND 2

50-334/92-99, 50-412/92-99

I. BACKGROUND

The SALP Board convened on December 9, 1993, to assess the nuclear safety performance of the Beaver Valley Power Station, Units 1 and 2 for the period June 14, 1992, through November 27, 1993. The Board was conducted pursuant to NRC Management Directive (MD) 8.6 (see NRC Administrative Letter 93-20). Board members were Wayne D. Lanning (Board Chairman), Deputy Director, Division of Reactor Projects, NRC Region I (RI); M. Wayne Hodges, Director, Division of Reactor Safety, NRC RI; Charles W. Hehl, Director, Division of Reactor Safety and Safeguards, NRC RI; and Walter R. Butler, Director, Project Directorate I-3, NRC Office of Nuclear Reactor Regulation. The Board developed this assessment for the approval of the Region I Administrator.

The performance ratings and the functional areas used below are described in NRC MD 8.6, "Systematic Assessment of Licensee Performance (SALP)."

II. PERFORMANCE ANALYSIS - OPERATIONS

During the previous SALP period, the Operations area was rated Category 1. A professional and knowledgeable staff conducted operations safely. Operators responded well to plant transients and other events, and did not cause any reactor trips during the assessment period. Management involvement and oversight were strong, particularly in the planning and conduct of the refueling outage and risk assessment. The operator training program was effective and well implemented.

During this assessment period, management oversight and involvement contributed to the safe conduct of complex and infrequently performed activities. Among these activities were plant shutdowns and startups, reactor coolant system draindown and recovery, refueling operations, fuel pool cooling modifications, and winter storm preparations. Additionally, the Offsite Review Committee provided effective oversight of plant operations and licensing issues. However, exceptions were noted to the good management oversight such as the lack of Quality Services surveillance for infrequently performed activities, the failure to include turbine operator logs during the review of an industry issue, and the weak control of troubleshooting by the Operations Department.

Shutdown risk management remained a strength and ensured that safety systems were available. A defense-in-depth philosophy was adhered to, as demonstrated by maintaining one level of redundancy for the key safety functions. The effectiveness of outage planning in ensuring equipment availability was demonstrated during the loss of offsite power event at

Unit 2. Additionally, the licensee aggressively pursued such industry issues as malfunctions in rod control circuitry and potential inadvertent lifting of fuel assemblies during reactor vessel upper internals removal.

Plant operators consistently responded to plant transients and other abnormal plant conditions in an outstanding manner. Swift and correct operator actions averted plant trips and shutdowns during feedwater transients and the inadvertent actuation of the bottled air system in the control room. During operational events, the operators demonstrated excellent knowledge of plant systems and equipment, and awareness of the activities impacting the safe operation of the plants. Particularly noteworthy was the excellent operator response to the loss of four of five air compressors at Unit 2. For the three plant trips (two at Unit 1 and one at Unit 2), none were attributed to operator error.

Excellent operator attentiveness and questioning were highlighted by the alert responses to abnormal conditions, such as the identification of an intermittent high containment sump pump-out rate that led to the identification of the leak and the identification of an improperly defeated reactor coolant pump undervoltage trip signal. Operators demonstrated professionalism, generally good attentiveness and a questioning attitude, but a number of lapses in these areas resulted in failures to follow procedures and failures to identify and question equipment deficiencies. Although these instances were minor in safety significance and appeared unrelated, the number of errors indicated a decline in performance and detracted from the overall strong performance.

The licensee demonstrated a commitment toward improving procedures as indicated by the procedure upgrade program. Approximately 70 percent of the procedures had been reviewed through the procedure upgrade program, which resulted in improvements in both quality and scope. The NRC, however, identified procedural deficiencies such as weak guidance in some abnormal and emergency operating procedures, and the use of an incorrect reactor coolant system pressure/temperature limitation curve. Although these deficiencies were minor in safety significance, they indicated the need for the licensee to continue its commitment to improving procedures.

In summary, the licensee exercised good oversight and involvement, and an excellent safety perspective in the operation of the plants. Plant operators consistently responded well to plant transients and other abnormal conditions, and generally demonstrated excellent attentiveness and safety skepticism. The procedure upgrade program continued on schedule and resulted in improvements in procedural quality and scope; however, some minor deficiencies identified by the NRC indicated a need for a continuing commitment to improving procedures. Although overall operator performance remained a strength, many operator lapses during routine or planned activities indicated weaknesses in self-checking practices, and recognition and disposition of equipment deficiencies. The number of examples, although minor in safety significance and apparently unrelated, indicated a decline in performance.

The operations area is rated **Category 1**.

III. PERFORMANCE ANALYSIS - ENGINEERING

In the previous assessment period, Engineering was rated Category 2. Management support and involvement were good in promoting ongoing improvement programs and in conducting self-evaluation audits to identify and correct weaknesses. The systems engineering oversight project management programs, minor modification program, and constructability reviews were positive initiatives. However, the lack of timeliness and adequacy or thoroughness in performing certain engineering evaluations and operability assessments was a weakness.

In the current assessment period, there was a proactive approach towards the identification and reporting of significant generic safety issues. The licensee was the first to report the generic issue involving the single failure of a low head safety injection valve that could result in inadequate core cooling. The technical assessment of another issue (volume control tank outlet check valve) was of high quality and the licensee's pursuit of this issue from an industry event report was exemplary. The licensee was also the first to report a potential high head safety injection pump runout condition during hot leg recirculation. Management support and involvement were good in identifying potential safety problems and in conducting a self-evaluation for the charging system. A thorough investigation of unexpected fuel failures, in cooperation with Westinghouse, allowed for the identification of a generic design deficiency associated with Vantage 5H fuel. The licensee demonstrated a strong safety perspective and sound engineering practice in identifying these issues and performing engineering evaluations and operability assessments.

Root cause analyses were well developed and thorough. In-depth root cause analyses were performed, where appropriate, and corrective actions were prompt. In particular, the Independent Safety Evaluation Group investigation to determine the cause of the underfrequency circuit actuation (which resulted in the loss of offsite power event) was thorough and accurate. Licensee Event Reports were found to be of high quality with good documentation of event analyses, root cause determinations and corrective actions.

Most engineering evaluations and modifications were technically accurate and thorough. Design changes and modifications were generally complete, technically accurate, and were supported by plant operational tests. Station blackout modifications were well documented and were backed up by sound station blackout procedures. Most license amendments were well supported by engineering evaluations. Significant revisions for the inservice test program indicated strong engineering support and were well grounded in industry practice.

However, weaknesses noted in some modification packages prepared late in the assessment period were indicative of a declining trend. Further, the engineering evaluation to support the modification that installed solid state ATC timer/relays in the emergency electrical loading sequencers failed to address the potential for adverse effects caused by short duration voltage transients (voltage spikes), even though vendor information existed which clearly identified that potential. Trouble-shooting activities and testing following sequencer failure were poorly planned and were not well documented and the initial design change

implemented to address the failure was inadequate. The licensee's engineering organization thus demonstrated weak performance by not adequately controlling the application of solid-state digitally-based technology within an otherwise electro-mechanical system.

Programmatic deficiencies existed within the licensee's motor operated valve (MOV) program. These included inadequate test control, poor documentation of preventive maintenance, lack of an in-depth preventive maintenance program, and poor communications with the nuclear engineering department. The division of responsibility between maintenance engineering and nuclear engineering was not well defined in the MOV program and contributed to confusion regarding the disposition of MOV deficiencies. Programmatic weaknesses also existed in the erosion/corrosion program. Only a small number of components was selected for examination and predictive methods were used sparingly to identify components susceptible to erosion/corrosion.

In summary, numerous instances existed where a strong safety perspective and high quality engineering were demonstrated. These included identification of generic safety issues and high quality engineering modifications. Also, root cause analyses were well developed and thorough. This strong proactive performance was marred by deficiencies in the programs dealing with MOVs and erosion/corrosion. Moreover, the engineering for the solid-state timer/relays in the Unit 2 load sequencer for the emergency diesel generators and the weaknesses in troubleshooting and redesign that followed were notable failures in performance by the engineering organization. These examples of weak engineering coupled with recent examples of inadequate control of the MOV program reflect an overall decline in performance.

The engineering area is rated **Category 2**.

IV. PERFORMANCE ANALYSIS - MAINTENANCE

In the previous rating period, Maintenance was rated as a Category 2. Strong and effective management involvement in the preparation and implementation of work for refueling outages was apparent. However, mixed performance was noted during maintenance activities. Staffing and the performance of maintenance personnel were generally good; however, performance deficiencies occurred where workers proceeded with unclear or incomplete instructions. The inservice inspection (ISI) program was generally well conducted; however, inadequate corrective action resulted in an insufficient review of ISI findings before a plant mode change. Extensive steam generator tube eddy current and plug examinations demonstrated a strong safety perspective.

During this evaluation period, corrective maintenance efforts, including troubleshooting, were usually well coordinated, planned, prioritized, and executed. There was the well planned and executed repair of a Unit 1 reactor coolant system leak where minimum down time resulted from application of lessons learned from previous, similar repairs.

Troubleshooting efforts were well planned and documented for the emergency diesel generator output breaker investigation. Troubleshooting guidelines for maintenance work requests were well established.

Root cause analyses for equipment failures were comprehensive, detailed, and thoroughly documented. The root cause analysis for the Unit 2 resistance temperature detector (RTD) failure was comprehensive and resulted in the replacement of all RTDs in the reactor coolant system. The Independent Safety Evaluation Group (ISEG) was actively involved in evaluating various maintenance issues including investigation of root causes.

Inservice testing and inspection programs were proactive and focused on ensuring that the operability of safety-related equipment was maintained. Steam generator tube inspections involved examination of 100% of the tubes. The containment integrated leak rate testing (ILRT) was well coordinated with operations. The ILRT lead test engineer demonstrated excellent knowledge of requirements and implementation of test procedures.

Personnel errors during maintenance and surveillance activities resulted in several plant transients, unacceptable plant conditions, and, on one occasion, equipment damage. Errors in switchyard maintenance led to a complete loss of offsite power and trip of Unit 1. Weak procedural adherence and quality control oversight contributed to inadequate maintenance on a containment penetration temporary seal. The previous SALP discussed numerous personnel errors, yet the above mentioned and other personnel errors continued throughout the evaluation period.

Several weaknesses were identified that could affect the operability of safety equipment. Control of a control room ventilation temporary modification was inadequate; yet, past audits had not identified the inadequacy. Several MOVs had their declutch shaft levers installed incorrectly. Ventilation system velocity probe calibration due dates were not being tracked. There was no formal mechanism to ensure that overdue preventive maintenance items were brought to management attention.

In summary, corrective maintenance efforts, including trouble shooting, were usually well managed and executed. Root cause analyses for equipment failures were comprehensive, detailed, and well documented. Inservice testing and inspection programs were focused on maintaining safety-related equipment in an operable status. Weaknesses related to tracking of preventive maintenance and calibrations were identified. Despite identification in the previous SALP evaluation, personnel errors continued to cause plant transients and unacceptable plant conditions, and in one instance resulted in degraded equipment.

The maintenance area is rated **Category 2**.

V. PERFORMANCE ANALYSIS - PLANT SUPPORT

This functional area is new, representing a significant change from the previous SALP process. The Plant Support functional area covers all activities related to Plant Support functions, including radiological controls, emergency preparedness, security, fire protection, chemistry, and housekeeping controls.

In the previous SALP report, the radiological controls, emergency preparedness, and security functional areas were rated as Category 1. Performance strengths in radiation protection included management oversight, job performance, audits and self-assessments, and training of health physics technicians and other employees. The effluent and environmental monitoring programs were highly effective. Strengths in the radwaste and transportation areas included thorough quality control of shipments and good vendor audits. A weakness was noted in the oversight of liquid and solid radwaste processing. The security program was identified as a strength, with excellent plant and corporate support, significant capital improvements and upgrades, and a well-trained and professional security force. Performance in the emergency preparedness area was excellent, with strengths identified in management involvement, self-assessments, liaison with local officials, and causal analysis. Areas for improvement included control of emergency repair teams and communications of in-field radiation assessments.

During the current assessment period, radiological controls remained strong. Excellent health physics coverage of radiological activities and extensive as low as reasonably achievable (ALARA) planning during significant tasks, such as steam generator eddy current testing, spent fuel pool cleanup, and refueling activities, contributed to the attainment of exposure goals. Contamination controls were effective in minimizing the spread of radioactive contamination. Contamination incidents and skin dose assignments were well documented, with effective tracking and followup. A strong internal exposure control program included a comprehensive air-sampling program and good assessment of respiratory protection. An aggressive health physics surveillance program and the use of quality assessors during outages were effective means of self-identifying and quickly resolving problem areas.

Several problems involving attention to detail were identified in the radiological controls area during the period. Some of these involved failures to adhere to the requirements of radiation work permits and high-radiation-area boundary controls. At the end of the period, the licensee had assigned a task group to study these issues. Plant housekeeping was generally very good; however, some out-of-the-way contaminated areas were not well maintained.

Performance in the radiological environmental monitoring and effluent control programs continued to be strong. Quality assurance audits were thorough and of high technical quality. An aggressive chemistry program continued to be effective in identifying and correcting

adverse trends. Radioactive material shipment records were well organized, complete, and effectively reviewed. The transportation/radwaste program improved; however, some procedure adherence problems with radwaste operators continued.

The emergency preparedness program continued to be effectively implemented. Emergency response facilities were operationally ready, independent program audits were effective in identifying areas for improvement, the emergency response training program remained strong, and support from site management was evident. During NRC-administered table-top exercises, all events were properly classified. Performance during the annual emergency exercise was excellent, with proper event classifications, prompt and accurate information flow between emergency response facilities, and effective working relationships with State and local governments. No exercise weaknesses were identified; however, areas for improvement included emergency squad coordination of a personnel injury, health physics practices during an event involving a contaminated person, and several procedural weaknesses. During a subsequent actual event involving a potentially contaminated, injured person, the licensee performed well. The emergency plan was appropriately implemented for events requiring its activation during the SALP period.

The effectiveness of the security program continued to be excellent. Management attention and involvement continued at a high level, as evidenced by such further program improvements as enhancements to the perimeter alarm system and upgraded weapons. Transition from one security contractor to another was well planned and implemented. Maintenance support of security equipment improved and resulted in more timely repairs and a significant reduction in manhours expended or compensatory measures.

A special NRC fire protection inspection confirmed the ability to achieve safe shutdown following a postulated fire in a cable spreading room. A good safety perspective and sound engineering practice were noted. Routine inspection of the fire protection program revealed improvement during the period and overall satisfactory implementation.

Overall, the Plant Support functions continued to be effective and substantially contributed to safe plant performance. Performance in radiological protection continued to be very effective. Excellent performance continued in the emergency preparedness. Good performance in fire protection and housekeeping was noted; and, security program performance continued to be a strength.

The Plant Support area is rated **Category 1**.