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Technical Safety Appraisal of the Omega West Reactor Los Alamos National Laboratory

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TECHNICAL SAFETY APPRAISAL

OMEGA WEST REACTOR

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ABBREVIATIONS

The following abbreviations are used in Section III of this report without definition:

DOE	U.S. Department of Energy
DOE/AL	DOE's Albuquerque Operations Office
HSE	Health, Safety, and Environment Division
LANL	Los Alamos National Laboratory
OWR	Omega West Reactor
Pan Am	Pan American World Services, Inc., a subcontractor to LANL providing craft services
SOP	Standard Operating Procedure
TSA	Technical Safety Appraisal

I. INTRODUCTION

This report presents the results of the Technical Safety Appraisal (TSA) of the Omega West Reactor (OWR) at Los Alamos National Laboratory (LANL), conducted by the DOE Office of the Assistant Secretary for Environment, Safety and Health, Office of Safety Appraisals, during May 1 to May 26, 1989. TSAs are one of the initiatives announced by the Secretary of Energy on September 18, 1985, to enhance the DOE Environment, Safety and Health Program.

The overall safety assessment of the OWR by the DOE Headquarters Office of Safety Appraisals is presented in Section II, PERFORMANCE EVALUATION. The assessment was based on the direct involvement in the appraisal process by a senior Headquarters manager, discussions among Headquarters managers and staff, and consideration of the Appraisal Team's results provided in Section III, REVIEW FINDINGS.

The Laboratory employs over 8,000 people and has an annual budget of $1 billion. The LANL facilities are located in north central New Mexico, about 75 miles northwest of Albuquerque. The laboratory occupies 43 square miles of flat mesas cut by a number of east-west trending canyons, each a few hundred feet deep. The OWR is located in Los Alamos Canyon, which essentially separates the laboratory to the south from the city of Los Alamos to the north. The reactor site is designated as Technical Area TA-2.

About a half mile upstream from the OWR is Technical Area 41, occupied by two weapons design groups. About four miles upstream from the OWR is Los Alamos Reservoir. The reservoir is retained by an earth and rockfill dam, about 30 feet high, with a concrete curtain wall about one foot thick. The dam impounds about 13 million gallons of water. Also upstream from the facility on the canyon rim are two water tanks, each holding about 7-1/2 million gallons of water.

The OWR is a light-water cooled, research reactor with a normal operating power level of eight megawatts. The reactor core is surrounded by a biological shield of heavy concrete. Experimental ports (beam tubes) penetrate the shield, and a large graphite thermal column extends out from the core. Numerous ports leading into the core region and the thermal column allow access to high fluxes of thermal and fast neutrons for sample irradiations. Also, external neutron beams are extracted through the reactor shield to diffraction spectrometers and other measurement apparatus. The reactor can also be used for neutron radiography work.

The reactor is operated on a routine 40-hour week by a full time, onsite technical staff of seven people. Part-time support is provided by many other units from LANL and support contractors. About 14,000 irradiations and a number of beam experiments are performed at the OWR each year for over 100 scientists from government, private and academic institutions. A large fraction of the irradiations are for neutron activation analyses performed by the reactor staff, who provide the results to others. There are a number of persons other than the reactor operating staff who occasionally work at the reactor site. These range

from experimenters to persons providing technical and physical plant support.

The OWR is located in an area that is subject to potential external hazards: forest fires in Los Alamos Canyon, rock falls from the north canyon face, and flooding from the failure of the dam retaining the Los Alamos Reservoir and/or the water tanks (e.g., because of an earthquake). The principal hazards presented by operations at the OWR site are common industrial hazards (e.g., from lifting equipment, toxic/hazardous chemicals, pressurized gases), and radiation fields and potential radioactive contamination resulting from fuel transfers or from experimental samples irradiated with the reactor.

The appraisal activities were guided by the Performance Objectives and Criteria for Technical Safety Appraisals, issued by the Office of the Assistant Secretary for Environment, Safety and Health, May 1987 (Revision 1).

The Appraisal Team's report (Section III) contains the more significant findings collected pertaining to each Performance Objective. Findings that support a concern are identified by an asterisk (*), followed by a statement of the concern. Cross references are provided when additional supporting findings are found under another Performance Objective.

In addition to identifying concerns, the team looked for exceptionally good practices that could be applicable to other facilities. They are provided in Section IV, NOTEWORTHY PRACTICES. Other DOE facilities are encouraged to adopt these practices where applicable.

The findings and concerns developed by the Appraisal Team were presented to senior Managers of the Albuquerque Operations Office and LANL at exit meetings on May 25 and 26, 1989, respectively. Drafts of the Appraisal Team's contribution (Sections III and IV) were validated with LANL management prior to issuance of the final report.

II. PERFORMANCE EVALUATION

The Omega West Reactor (OWR) is staffed with a small, technically competent and experienced cadre. Management authority and recognition of responsibility is strong on the part of the Laboratory and the DOE Area Office. There have been no significant events reported involving personal injury, property damage, or hazardous conditions during the 33 year operational life of the reactor. Involvement of Laboratory-oriented review committees is good, and provides for assessment of experimental and operational activities on a regular basis.

This appraisal, however, found a level of informality in the conduct of operations that is inappropriate for any reactor in today's safety environment, but particularly for an aging nuclear complex such as the Omega West Reactor. Much of the OWR documentation, such as logbooks, operational, maintenance, and other procedures is abbreviated (some consist solely of end-point check lists) and unverifiable. Similarly, operations, maintenance and emergency readiness training instructors are not well versed in teaching techniques, formally developed and reviewed curricula are absent, and training records are inadequate for independent evaluation.

This appraisal also found incident reporting in need of improvement. The threshold of Unusual Operation Reports (UOR) is set too high. For example, frequent occurrences, such as reactor or system shutdown due to lightning strikes, have been rationalized out of the reporting system.

There is a heavy reliance on the reactor design being inherently fail-safe with the capability for safe walk-away after emergency shutdown. The facility cadre does not accept the possibility of a serious accident; all of the hazards of fuel handling operations have not been analyzed, and procedures to respond to associated emergencies have not been developed. Even though there is considerable potential for radioactive contamination resulting from damaged fuel and irradiated samples, the facility is not prepared to handle a serious contamination incident. A similar lack of analyses was found for action necessary to mitigate the consequence of natural phenomena.

A replacement for the reactor is under consideration, but not yet funded or fully planned. Anticipated replacement of the OWR could result in reluctance to make repairs or replace equipment. This progression could lead to an unacceptable fix-after-break maintenance program.

The margin of safety at the OWR is adequate for the short time in light of the experienced and capable staff. However, an aging facility, coupled with informality in operations, maintenance, and emergency readiness, constitutes an increasing potential for accidents. Establishment of the requisite formality and safety analyses for nuclear operations should be undertaken on an expedited basis.

III. FINDINGS AND CONCERNS

This section of the report was prepared by the Appraisal Team (Appendix C). The team gathered information over the course of about four weeks on all the DOE Performance Objectives relating to the OWR through direct observations of the condition of hardware, selected drills, and operational and maintenance practices. The team also obtained information from reviews of safety policies, operating records, selected procedures, and discussions with appropriate personnel from LANL and support contractors.

In establishing the scope of this appraisal, advantage was taken of two earlier TSAs of LANL facilities to focus the appraisal on the performance of the OWR Operating Organization and to determine how the LANL support programs manifested themselves at the OWR. Both of the previous appraisals looked extensively at the program contents of the LANL technical support and safety support organizations; concerns were identified when deficiencies were found. After formal follow up, the DOE Office of Safety Compliance found that LANL had taken appropriate steps to correct the program deficiencies identified in the previous appraisals. Consequently, an assumption for this appraisal was that the support programs are appropriately constituted and they were not specifically re-examined except in the course of determining whether deficiencies found at the facility level were the result of some previously unidentified program weaknesses, or were the product of inadequate or inappropriate implementation at OWR.

Because a TSA is designed to be an appraisal of the operating facility, the appraisers assumed that the facility and its equipment have been appropriately designed, constructed and tested. However, this appraisal does address whether the facility design and its current operations are within the bounds of the Technical Specifications established for this facility.

This appraisal was an evaluation at a fixed point in time. As a result, improvements to safety that were planned but not implemented at the time of the appraisal, were identified as concerns if the appraiser judged that failure to complete the improvements could impact the safety of facility operations.

The team took a number of steps to assure that their contribution to this report was accurate and appropriate. The Team Leader, the Team Leader-in-Training, and the Team's Technical Advisor provided extensive comments on draft versions; the team members divided into small groups to provide a peer review to other group members; each team member validated his findings and concerns with contractor counterparts; and, as a last step, considerable time was spent by the full team addressing clarity and consistency.

The team members identified 43 concerns. In the team's judgment, addressing these concerns with appropriate corrective actions will improve the level of safety of the operations in this facility. Each concern has been rated as to its seriousness in accordance with the system described in Appendix A. The results are summarized in Appendix

B-1. Appendix C provides the team composition and areas of responsibility; and Appendix D provides biographical sketches of the TSA team members.

All of the 43 concerns were judged to be Category III for seriousness. Category III concerns should be addressed in a normal, responsive manner.

A listing of the total set of concerns developed by the Appraisal Team can be found in Appendix B-2.

The resolution of the individual concerns may not be sufficient to prevent similar problems. Many of the concerns are only symptomatic of underlying causal factors. The team has made an effort, drawing upon the extensive relevant experience of its members, to identify underlying causal factors in developing its statements of concern. However, the team recognizes that this effort is at best imperfect because of the limited time it devoted to this effort. Therefore, the team believes that the contractor should consider the findings, and particularly the statements of concern, as possibly symptomatic of some set of deeper root causes, and should search out and correct root causes so that there will be reasonable assurance that improvements in the safety of the operation will be sustainable.

A. ORGANIZATION AND ADMINISTRATION

This section examines how the contractor organizes and administers its safety responsibilities with specific emphasis on how those systems and activities impact the OWR. The examination was accomplished by extensive review of policies, procedures, and other documentation. The most important activities in this examination were the observations of actual operations and interviews of personnel from the LANL executive level down to and including the OWR Operating Staff.

LANL's organization and communication channels are adequate to provide the structure needed to inform the OWR employees of their assignments and their specific safety-related objectives. LANL strongly emphasizes decentralized management with the line managers having full authority and responsibility for their operations. Guidance is broadly stated and minimal specific requirements are imposed upon the operating elements.

Organizations such as the OWR Group are responsible for their operations, with safety emphasized, and they are expected to develop the internal controls needed to effectively operate. Health, safety, and environmental professional support is provided as a part of the LANL overhead to the requesting organization; other vital support services such as quality assurance (QA), engineering, training, and maintenance are available, but the operating organization must pay for those services out of its annual operating budget.

It appears that this approach has contributed to a reluctance by the OWR Organization to seek such outside support. OWR staff time spent in providing these important services has contributed to a lack of time and focus needed to prepare or implement administrative controls important for assuring the quality and safety of the OWR operations. The LANL policy of selecting managers based on technical excellence has also contributed to the lack of fully developed administrative controls. For example, the OWR Managers spend a considerable portion of their time on technical topics at the expense of providing full-time managerial support. The fact that peer recognition at LANL is primarily based on demonstrated technical excellence and there is no corresponding peer recognition for managerial excellence contributes to the tendency for managers to give too much attention to technical topics. Also, because the OWR staff is small, and because the OWR Group Leader and reactor supervisors have frequent and daily contact with the staff, there is a strong tendency to rely on oral communication at the expense of preparing a documented record of the operations and maintenance.

Many of the organization and administration problems can be grouped into three broad areas: (1) documentation; (2) management assessment of its operations; and (3) independent review or QA. Evidence of the problems occurred throughout the performance areas examined by this appraisal. Documentation problems identified include incomplete or missing guidance and procedures, missing or inadequate historical records of decisions and evaluations, and unanalyzed incidents and unreported unusual occurrences. Management assessment problems include incomplete or missing root cause analyses, failure to use indicators or trigger points to identify needed assessments or provide early warning of problems, and

failure to recognize the lack of compliance with mandatory requirements. The present QA Program does not meet mandatory DOE and LANL requirements; needed staffing and resources are not assigned for the non-weapons QA Program. If the managerial assessment and QA efforts had been effective, most of the problems identified throughout this report would have been resolved long ago, as most of them are either of a recurring nature or have been in existence for a long time.

In contrast to these problems, this and other appraisals recognized the professionalism of the OWR staff. The reactor safety record is also impressive. However, without formal administrative controls and thorough documentation requirements, and as the present staff leaves through normal attrition, this impressive safety record and the associated staff skills and knowledge may not transfer to the replacement staff.

OA.1 FACILITY ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: Management should organize and administer the operation to provide for effective implementation of facility activities relating to safety and health.

FINDINGS:

- The LANL organizational structure is published in the Policies & Procedures Manual, Section 900/901, dated 4/18/89, and the Isotope and Nuclear Chemistry (INC) Division organizational chart, dated 3/1/89; the OWR organizational structure is published in the OWR Operating Procedures, dated 2/13/89.

- The OWR organizational structure and supervisory staff have been stable for over five years. Although the operator tenure records show that many reactor operators stay for only two years, each of the present operators has about three years of experience at the OWR. The total OWR staff has an average experience of about six years. Based upon interviews with the OWR staff, they understand the organizational structure and their responsibilities.

- LANL management policy strongly emphasizes that safety is a line management responsibility. Specific responsibility and authority for OWR safety has been successively delegated from LANL executive management, through the INC Division, to the OWR Group Leader. Decentralized management is emphasized at LANL.

- Safety oversight of the OWR site is principally performed by a facility committee structure (see Facility Safety Review Section of this report). However, the INC Division policy statement ["INC Division Environment, Safety, and Health (ES&H) Plan" of 4/28/89] does not recognize the safety oversight responsibilities of the OWR Committee or the Reactor Safety Committee.

- The November 1988 independent appraisal by DOE/AL (the Annual Reactor Safety Appraisal at LANL) and the 1988 annual inspection of the OWR by the LANL Reactor Safety Committee determined that the OWR was being operated in a safe manner and the staffing and resources were sufficient to accomplish all assigned tasks.

- There are specific examples that show that the OWR staff can develop QA plans to support the production of safety-related products. The plan for onsite materials procurement and fabrication of new OWR control rod blade assemblies is one such example.

o QA on experiments has been effective at the OWR complex.

* A new LANL requirement ("Los Alamos National Laboratory Quality Program Plan" of 3/29/89) to apply a comprehensive QA program to non-weapons activities has been initiated without assigning or identifying the future requirements for additional professional QA resources.

* The professional QA services of the Mechanical & Electronic Engineering Division are available to other divisions for a fee (i.e., the receiving division must pay for the support from its operating budget). Similar services from medical, health, safety, and environmental professionals are not charged directly to the operating budgets of the receiving organization.

* LANL reported that there are approximately 35 professional QA auditors available to service both weapons and non-weapons programs. This is insufficient to meet the needs of LANL, which employs over 8000 persons and has an annual operating budget of over $1 billion. However, it was also noted that LANL contracts with outside firms to obtain QA support. This area was not examined during this appraisal as it has not been used at the OWR complex.

* The existing OWR QA Plan (Chapter 3.0 of the OWR Operating Procedures of 2/13/89) does not meet all the requirements of the current LANL policy ("Los Alamos National Laboratory Quality Program Plan" of 3/29/89) nor of DOE 5700.6B, Quality Assurance, AL 5700.6B, Non-Weapons Quality Assurance, and DOE 1324.2, Records Retention and Disposition. For example:

  - The plan does not address all 18 criteria required by LANL policy and AL 5700.6B. Significant missing items include: test control; identification of control of items; handling, storage, and shipping; control of nonconformance items; and corrective actions.

  - QA records such as the Equipment Status Logs (a "... comprehensive list to describe deficient items ... other than routine maintenance") and the Quality Report File (which documents significant events and the number, explanation, and dates of each unplanned scram) are maintained "... for operating convenience" instead of for the six years required by DOE 1324.2.

- No formal QA audit schedule or audit check list for OWR operations and maintenance were available as required by the DOE 5700.6B series. (Also see Sections TC.5 and TS.7.)

- A formal method to assure all audit, inspection, and review items affecting safety and QA are tracked to completion was not available. (See Sections TS.5, ER.6, PP.2, and RP.2.) This is required by AL 5700.6B, Attachment 1, Requirement 16. This problem was also identified by the DOE/AL appraisal of November 7-11, 1988.

* OWR staff has prepared a draft OWR Quality Assurance Process Manual dated April 1989. It addresses all of the requirements of the DOE 5700.6B series, but a schedule and the staffing resources needed for implementation of the program was not identified.

* An integrated, comprehensive QA program for operations and maintenance has not been developed.

CONCERN: (OA.1-1) Parts of the reactor quality assurance program do not meet LANL policy or DOE Order requirements in that not all important activities at the reactor complex are covered, needed resources have not been assigned, and the required quality assurance audit functions have not been implemented.

FINDINGS:

* OWR management provides minimal criteria and guidance for the control of the quality of OWR safety-related documents. Some procedures do not adequately define the activities needed to assure the quality and safety of the OWR operations and maintenance as required by the DOE 5700.6B series. A number of different sections of this appraisal report address problems related to nonexistent or inadequate procedures and documentation. These include the appraisal areas of Operations, Maintenance, Training and Certification, Auxiliary Systems, Emergency Readiness, Technical Support, Experimental Activities, Radiological Protection, and Personnel Protection.

* Although some of the OWR Operating Procedures are comprehensive and complete, others are not; some important procedures were missing. Examples are given below. (See Sections OA.6, OP.2, AX.3, TS.3, TS.4, and TS.8.)

  - There is no procedure to perform the required weekly testing of Core Spray No. 1, an engineered safeguard to prevent fuel melting in

the event of a loss of coolant event. The checklist for testing the continued operability of the water-powered core spray stem does not specify an acceptable test flow rate.

- The start-up and operations procedures are brief and sometimes consist only of checklists. They do not identify all the steps required. Other procedures do not identify the potential hazards associated with the activity, or the required special equipment or tools needed to perform the activity.

- Fuel handling procedures do not account for emergency conditions such as a dropped fuel element or transfer cask.

- There is no procedure defining the steps to be taken if a fuel element were leaking radioactivity into the reactor coolant.

* Although many of the non-reactor procedures which are important for the safe operation of the OWR complex are complete, others lacked the quality and definition needed. Examples are given below. (See Sections ER.6, MA.4, PP.7, RP.3, and RP.12.)

  - Maintenance procedures do not provide for complete inspection of the fire side of the boiler.

  - Procedures governing emergency response do not identify the required staff training and retraining or the conduct of tests and exercises.

  - There are no personnel and equipment decontamination procedures.

  - Radiation posting criteria are not given in the procedure that govern that activity.

  - There are no leak testing procedures for sealed radioactive sources.

  - Radiation protection procedures do not clearly indicate when extremity dosimetry or when elevated protective measures (e.g., barricades, lock out, etc.) are needed.

  - Hoisting and rigging procedures do not specify the person in charge, the qualification requirements of the crane operator, or the test lift requirements needed to be performed prior to conducting a high consequence lift.

CONCERN: (OA.1-2) Many important procedures are either missing or are inadequate to provide the level of guidance needed to assure that all necessary activities and limits are known and implemented.

FINDINGS:

* Many documents, such as plans, logs, analyses, and historical files, are either missing or are inadequate to provide a record of what is required, what was done, and compliance with DOE Order requirements. Examples are given below. (See Sections OA.6, OP.1, TC.1, TC.2, TC.5, ER.2, ER.3, ER.5, RP.3, RP.13, PP.1, and PP.5.)

  - Operation and reactor supervisor logs are so brief that they cannot be used to verify that reactor operations were performed correctly or to reconstruct operational events.

  - The Safety Analysis Report includes a number of deficiencies related to natural phenomena (e.g., fires, storms, and seismic events) and complete assessments of accidents such as a dropped fuel element or cask.

  - The Technical Specifications allow conditions, such as operating with only one of the two core spray systems in service, that have not been analyzed in the Safety Analysis Report.

  - Training documentation is inadequate. Lesson plans are not always provided, and documentation of specific training given to certify reactor operators and supervisors was insufficient.

  - There is no documented plan for maintenance training. There are no records of on-the-job training performed.

  - The fire department pre-fire plan is inadequate. For example, the plan does not identify potential hazards, chemicals, and other facility-specific information that could be essential to safe firefighting. There is no documented pre-fire plan for wildfires in the OWR canyon or other LANL sites.

  - The Site Emergency Plans do not document critical information such as who provides notification of an emergency, when other neighboring facilities should be notified, or evacuation routes to take. The Omega Site Emergency Plan does not address safeguards/ security emergencies.

- A documented air sampling and monitoring program for the OWR does not exist.

- There was no formally documented As Low As Reasonably Achievable radiation program for the OWR facility.

- There was no official file for radiation occurrence reports, accidents, incidents, investigations, corrective actions, or follow-up activities.

- The documented potential health hazards at the OWR did not include the welding and soldering activities or the use of organic solvents in the machine shop.

- The chemical inventory at the OWR site was not updated annually and did not include important information such as the location of the chemicals, the estimated quantity used annually, and the current inventory.

CONCERN: (OA.1-3) Many important documents, such as plans, logs, analyses, and historical files are missing or are inadequate to provide the guidance and records needed to define what is required or what has occurred.

OA.2 Management Objectives

Performance Objective: Facility management objectives should ensure commitment to safe operation, including enforcement of work practices and procedures.

FINDINGS:

- Broad safety-related objectives are provided in the LANL Health and Safety manual; the INC Division's "Environment, Safety, and Health (ES&H) Plan" of 4/28/89; the OWR Group Safety Policy of 3/31/89; the OWR Operating Procedures of 2/13/89; and the "Employee Guide to Health, Safety and Environment."

- These policies include broadly stated safety objectives such as the requirement to use SOPs for hazardous operations, to conduct safety-related training, and to conduct emergency drills and exercises, etc.

- More detailed safety-related objectives are provided to employees in instructions and guidance for both their work assignments and next year's annual appraisal. These documents include statements such as "... maintaining facility cleanliness, ... performing daily check lists, ... promoting health and safety by setting guidelines and training requirements, ... to ensure that the OWR is operated in a safe manner in compliance with DOE regulations."

- Numerous meetings between managers and staff are held during which safety goals and needs are discussed.

- Specific quantifiable objectives or the use of the Management By Objective (MBO) process is not required at LANL. Based upon interviews with managers from the executive level through the supervisory level, MBOs are generally not used by individual managers.

CONCERN: None

OA.3 CORPORATE SUPPORT

PERFORMANCE OBJECTIVE: There should be evidence of corporate interest and support for safe operations.

FINDINGS:

- LANL is operated for the DOE by the University of California in accordance with contract W-7405-ENG-36. This contract requires the University to "... take all reasonable precautions in the performance of the work ... to protect the health and safety of members of the public and ... comply with all applicable safety and health regulations."

- The Director of LANL is selected by the University of California with concurrence by DOE.

- The University of California policy has been communicated in writing to LANL. It requires maintenance of high standards of safe and environmentally acceptable operation.

- Directors from health, safety and environment organizations at facilities in the University of California system meet biennially to exchange information. The HSE Director represents LANL at these meetings.

- The University of California's Health, Safety & Environment Advisory Committee annually reviews LANL activities. Their reviews include the environmental and occupational health and safety programs at LANL, transportation and storage of radioactive materials, emergency planning and preparedness, public health implications of the LANL nuclear programs, and other health, safety and environmental issues selected at the discretion of the Committee.

- The Committee reports directly to the University President and Regents; they do not leave a copy of their report with LANL. The University President provides feedback to LANL as he deems appropriate. No specific ES&H reactor items were identified by LANL as having been the subject of recent University of California concerns.

- Other communications between the University and LANL include the independent audit activities of the onsite University of California Audit Office. This office presently reports to both the University and DOE. DOE direct funding for this office will terminate in 1989. Present plans are for LANL to absorb the Audit Office personnel as LANL employees and be responsible for

directing their work efforts. Final decisions on their role as part of the LANL organization have not yet been made.

- Other contacts between the University and LANL managers appear to be informally structured and they are not used to provide official direction from the University to LANL.

CONCERN: None.

OA.4 MANAGEMENT ASSESSMENT

PERFORMANCE OBJECTIVE: Management and supervisory personnel should monitor and assess facility activities to improve performance in all aspects of the operation.

FINDINGS:

- o The INC Division uses some safety-related statistics (i.e., use of sick leave, individual radiation exposures, etc.) as indicators that operational problems may be present.

- o Annual employee performance appraisal criteria for the OWR Group Leader include evaluating the manager's participation in monitoring and assessing the safety of the OWR facility.

- o The OWR Group Leader has daily contact with the OWR staff. The INC Division Leader holds weekly meetings with the Group Leader, sponsors a safety committee meeting every other week within the Division, and reviews the results of quarterly facility safety inspections.

- o The OWR safety meetings and training, the use of procedures and checklists, and the inherent stability and small size of the staff provide an effective framework for dissemination of safety-related information to the OWR staff.

- * Although the existing LANL unusual occurrence reporting system previously has been accepted by the DOE/AL as meeting the requirements of DOE 5000.3, Unusual Occurrence Reporting System, all appropriate unusual occurrences at the OWR are not captured or properly addressed by the system. Examples include:

  - The DOE unusual occurrence reporting system requires that a principal cause analysis be performed. An unusual occurrence report (UOR) which discussed a power excursion (UOR HD-87-02), failed to identify the human factors aspects of the principal cause. Thus there was no motivation to evaluate all existing operating procedures to see if they too contained human factor problems. (See Section OP.7.)

  - A surveillance test of an engineered protective system (a valve in the emergency core cooling system) was not performed on the time interval required by the Technical Specifications. This Technical Specification violation was not reported as an unusual occurrence as required by DOE 5000.3. (See Section AX.7.)

- The failure of Core Spray No. 2 due to an electrical power failure was not reported as an unusual occurrence as required by DOE 5000.3. (See Section AX.7.)

- An OWR Technical Specification violation related to performing surveillance of an engineered safeguard (a flapper valve) was not reported as an unusual occurrence as required by DOE 5000.3. (See Section TS.3.)

CONCERN: (OA.4-1) The unusual occurrence reporting system at LANL is not effectively capturing all unusual occurrences and does not effectively implement DOE requirements for performance of a principal cause analysis of reported incidents.

FINDINGS:

o Follow-up and close-out of the Reactor Safety Committee findings of safety concerns at the OWR occur formally during the following annual appraisal of OWR safety by the Committee. However, Committee meeting minutes indicate that some review of the findings occurs during the period between their annual inspections. The Committee documentation is not complete enough to allow the quality of that review to be assessed.

* Although a few facility operational and maintenance indicators are used as trigger points to initiate managerial review of marginal performance, most are not routinely analyzed and trended to look for early warnings of impending problems, root cause evaluations, or lessons learned to improve the quality and safety of those functions. (See Sections MA.1, RP.2, PP.7 and OP.2 for more details.)

* The OWR staff and LANL management tolerate an old and aging facility. Failed components like the neutron shield still have operating switches on the operations console. The maintenance approach appears to be "fix after break." Examples of problems this approach is not addressing are:

  - LANL reports document a concern that the metal O-ring gasket on the reactor vessel could deteriorate because of aging and leak. However, a plan documenting acceptable leak rates and actions to be taken in the event of a leak have not been developed.

  - An old 150 kVA dry transformer was known to operate hot and noisily. No special surveillance was initiated and it abruptly

failed during an electrical storm. It was repaired by replacement and was not evaluated for potential design deficiencies.

- The 1983 aging study confirmed that the main components of the OWR could be expected to operate for 10 to 15 years, which was the anticipated needed life for the OWR at that time. This study has not been updated; LANL reported that their primary approach to this aging facility will be to propose that a new reactor be built. However, there is no present fallback plan or new aging study to evaluate the impact if the new facility will not be available by 1996.

- Additional discussions of the aging problem can be found in Sections MA.1, OP.2, and PP.7.

* LANL and OWR managements have not initiated a program of surveillance or data collection to capture and analyze incidents of a severity less than that which would be reported as an unusual occurrence, but still valuable as early indicators of a failing system or component. See Sections MA.1, AX.5, OP.1, and OP.2 for more details.

- Data trending and root cause analyses are not routinely performed for radiation exposure incidents.

- The supervisor's log at the reactor is not sufficiently detailed to permit auditing of operations.

- There is no specific system for reporting all operating incidents.

- Surveillance of supply systems vital to the OWR (e.g., electrical power, water supply, etc.) has not been adequate to detect deterioration and incipient failures.

- Electrical surges caused by storms shut down the OWR on an average of once a quarter. Information from this recurring problem has not been used in the repair of failed transformers.

CONCERN: (OA.4-2) LANL management is not requiring the collection of maintenance and surveillance data and minor incident information for trend analysis, subsequent prediction of potential problems, root cause analyses, and identification and correction of incipient problems before they become actual problems.

OA.5 PERSONNEL PLANNING AND QUALIFICATION

PERFORMANCE OBJECTIVE: **Personnel programs should ensure that positions are filled by highly qualified individuals.**

FINDINGS:

- Personnel management policy and requirements are defined in the LANL Laboratory Manual chapters.
- All position classifications, hiring, and promotions must be reviewed and approved by LANL committees constituted for that purpose.
- Employee performance appraisals are required to be performed at least annually and in accordance with specific LANL policy guidelines. This is being done at the OWR.
- Prior DOE/AL and LANL Reactor Safety Committee appraisals of the OWR have highlighted the professionalism and dedication of the staff.
- The INC Division Leader's annual appraisal criteria include evaluation of the safety program, the staff's awareness of safety, and his personal involvement in safety inspections.
- OWR employee appraisals and guidance for individual job assignments for the next review period include safety requirements. They are generally stated in broad terms such as "... your job assignment consists of ... safety of the OWR facilities." Performance in this area is worth about ten percent of the evaluation grade.
- Although the INC Division policy statements and its "Environment, Safety, and Health Plan" provide some guidance with respect to employee safety responsibilities and performance requirements, the employee performance appraisal system is used as the primary management tool for defining and communicating job responsibilities to the individual employee.
- Based upon interviews with the OWR staff, it was determined that the employees understand their job assignments and safety requirements and are qualified for their assignments.

CONCERN: None.

OA.6 DOCUMENT CONTROL

PERFORMANCE OBJECTIVE: Document control systems should provide correct, readily accessible information to support facility requirements.

FINDINGS:

- o LANL has specified documentation controls for LANL manuals and the publication of Laboratory reports. Control (i.e., document content, review and approval requirements, maintenance of records, assignment of control numbers, etc.) of other critical documents (i.e., OWR Safety Analysis Report, OWR Operating Procedures, OWR Technical Specifications, etc.) is based upon criteria imposed by the document originator.

- o Some LANL organizations, such as the Yucca Mountain Project, have issued a specific, detailed procedure for documentation control. OWR has not issued such a procedure.

- * The LANL documentation control system does not keep important documents and records up to date, accurate, and complete, and does not assure that only approved documents are used by the staff. Examples follow:

  - Identification, certification, and inspection of items procured for the reactor (except fuel) are to "... be in accordance with Laboratory procedures." Further, LANL procurement procedures state that items will be procured in accordance with the requirements of the requesting organization. Specific procedures and requirements for the OWR were not available, with the exception of the guidance used for purchase of control rods and control rod blades.

  - The LANL guidance for reactor supervisor and reactor operator certification training does not identify information the candidate needs to know to become certified; there is no policy on the minimum passing grade for written examinations; the training records are inadequate to allow an independent audit to establish what specific training was provided for certification or recertification.

  - OWR procedures require that QA-related records such as the Equipment Status Logs and the Quarterly Report File be retained "... for operating convenience" instead of for the six years required by DOE 1324.2.

  - OWR management has decided not to define the OWR Operating Procedures as SOPs. Thus, the Operating Procedures do not receive the checks

and reviews normally applied to LANL SOPs. Some OWR procedures do not identify the potential hazard associated with the activity, some procedures do not adequately define the activities that must be performed, managerial approval of some procedures is not indicated on the procedures, and the procedures are not assigned a control number or a controlled distribution list.

- The LANL Health & Safety manual (Administrative Requirements 1-6) requires that Safety Analysis Reports (SARs) receive an annual review to determine if their use should be continued or if they should be revised. The OWR SAR has not been reviewed annually. (The present OWR documentation does not establish when the SAR was last reviewed by Management.) The SAR was under review at the time of this TSA. (See Section TS.3.)

- The "OWR Radioactive Ion Exchange Resin Disposal Standard Operating Procedure" was reissued in 1985. However, the 1984 version has been retained in the file with a separate memorandum indicating it is no longer in effect.

- Although the key document LA-UR-87-682, "Assessment of the Probable Lifetime of the Omega West Reactor," was written in the 1982-1983 time period, it was not published until March 1987.

- The basis for some of the Technical Specification limits are two unpublished LANL documents. Those documents are not identified in the index of the SAR.

- Controlled files for maintaining official radiation occurrence reports, accidents, incidents, investigations, corrective actions, and follow-up activities did not exist.

- The present documentation control system has allowed draft, unapproved maintenance procedures to be distributed to and used by the staff for periods of months.

CONCERN: (OA.6-1) Document control is not adequate to provide proper and approved safety analyses, Technical Specifications, procedures, training records, and other records needed to demonstrate and assure the quality and safety of the reactor facility and operations.

OA.7 FITNESS-FOR-DUTY PROGRAM

PERFORMANCE OBJECTIVE: The facility fitness-for-duty program should identify persons who are unfit for their assigned duties as a result of drug or alcohol use, or other physical or psychological conditions, and remove them from such duty and from access to vital areas of the facility.

FINDINGS:

- o Two prior TSAs at other LANL facilities have determined that a substance abuse policy is documented and provided to the LANL employees.
- o These TSAs have determined that drug screening and random drug abuse testing will not be required at LANL until and unless DOE specifically requires such a program as part of its contractual requirements.
- o The LANL drug and alcohol abuse policy distributed to all employees on 4/13/89 strongly states the laboratory policy of placing employee personal safety at the highest priority and maintaining a drug-free workplace. This policy relies heavily upon employees voluntarily seeking assistance and treatment for their problems. However, LANL does perform drug testing for cause.
- o The INC Division management stated that they monitor employee use of sick leave as a possible indicator of drug or alcohol abuse problems.
- o The LANL fitness-for-duty program is far more comprehensive than drug and alcohol abuse alone. Other important components include an employee wellness program, health and fitness training, the publication of informative articles on health and fitness, the use of medical examinations, the operation of a medical treatment facility staffed with health professionals, and a medical assistance rehabilitation program.
- o LANL has an occupational medical outreach program where doctors spend time observing the work place. The doctors reported that supervisors will consult with them about marginal employee performance and fitness-for-duty, whereas such consultation would not occur if the doctor were not so readily available. See the Noteworthy Practice Section.
- o Reactor operators and supervisors receive an annual fitness-for-duty physical examination.

- o No evidence of alcohol or drug abuse was observed at the OWR during this appraisal.

CONCERN: None.

B. OPERATIONS

Review of OWR operations was accomplished by: observing reactor startups and shutdowns, steady-state operations, and an emergency drill; examination of records and procedures; reviews of Technical Specifications against operating practices; and interviews with operating personnel.

From observing operators and supervisors perform their duties, and through interviews with personnel, it was concluded that the staff of the OWR is experienced and capable. The two supervisors have degrees and strong naval reactor backgrounds. The three operators have either naval reactor backgrounds or extensive experience. One supervisor is on a one year sabbatical leave.

Weaknesses were identified in procedures, incident and unusual occurrence reporting, Technical Specifications, and human factors, although a considerable improvement has been made in the clarity of the Technical Specifications document.

OP.1 CONDUCT OF OPERATIONS

PERFORMANCE OBJECTIVE: Operational activities should be conducted in a manner that achieves safe and reliable facility operation.

FINDINGS:

- Operators interviewed were familiar with reactivity effects and were aware of Technical Specifications and procedure restrictions.
- Control room activities were conducted in a professional manner in the three startups and other operations observed.
- Access to the control room is limited to a reasonable number of people.
- Some success has been experienced in trending data on equipment to anticipate failures such as on the main pump bearings.
- Observation of three startups and other operations indicated that supervisors were diligent in controlling and monitoring operations. One supervisor was observed to perform an adequate review of the conditions of the reactor before authorizing startup following an unplanned shutdown.
- Five procedure manuals are kept and controlled at the OWR and new or changed procedures are inserted in these. Three other information copies are kept at other LANL areas. A "required reading file" is used to ensure that all operators and supervisors read the new or changed procedures.
- OWR Operating Procedures, Section 1.2.3, subpart 6, dated 4/14/89, provides that the "supervisor on duty is authorized to take whatever actions he deems necessary" in event of an emergency beyond the scope of the OWR Operating Procedures.
- Sections 1.1.2, 1.1.3, 1.1.4, and 1.1.5, of the OWR Operating Procedures describe the duties and responsibilities of reactor supervisors and operators. Minimum staffing is specified in Section 1.2.1. The reactor can be operated with a staff of one operator and one supervisor.
- Observation of three startups, one fuel handling operation, the use of various procedures, and Technical Specification checks confirmed that operators are attentive to facility monitors and to procedures.

* Review of the Supervisor's log revealed it was very brief, abbreviated, and, therefore, inadequate for a safety review.

* For example, some actions were omitted because the staff all understood that these were taken automatically, such as changes in the operating status of the primary coolant pump.

* Information on operating problems normally to be found in the Supervisor's log was not being recorded, and is thus not available to the other reactor supervisors, to management, to LANL safety review groups, and to DOE.

CONCERN: See Concern OA.4-2.

FINDINGS:

* Operators perform scheduled surveillance tests or observations required by Technical Specifications. One such observation on the flapper valve was missed recently in a quarterly check. This is a Technical Specification violation, which requires reporting as an unusual occurrence. It was not so reported.

CONCERN: See Concerns TS.3-2 and OA.4-1.

OP.2 OPERATIONS PROCEDURES AND DOCUMENTATION

PERFORMANCE OBJECTIVE: Operations procedures and documents should provide appropriate direction and should be effectively used to support safe operation of the facility.

FINDINGS:

- Review of the procedures and Technical Specifications revealed considerable recent effort and significant improvements. While shortcomings still exist and are identified in this report, the fact that the very small staff has been improving these important documents should not be overlooked.

- A good system is used for handling procedure changes. The procedure is retyped and the pages inserted into the five manuals at the reactor and three others mailed to manual holders in other areas of LANL. New procedures are put into a "Required Reading File" and all operators and supervisors must acknowledge by their signatures that they have read them.

- Inspection of the control room indicated that a good selection of operating and safety documents were available.

- Procedures related to safety policy and emergency response procedures are approved directly by the Reactor Safety Committee. Other procedures are approved by the OWR Committee. LANL claims all procedures are reviewed annually by the Reactor Safety Committee.

- Reactor drawings were found to be mostly as-built, although about one man-year of effort will be required to complete them. Most of the drawings remaining to be updated are reported to be on the buildings.

- Procedures require that the control rod positions at critical be predicted independently by both the supervisor and the operator. Estimates made using measured effects of xenon and of sample or fuel changes must be within 1/4 inch of each other before startup is begun.

- LANL believes that a "cocked rod" accident cannot occur because holddown arms prevent any fuel element being raised more than 1/4 inch when the holddown arms are fastened. If criticality is not achieved within 0.4% of the predicted value, the reactor must be shut down until the reasons for the discrepancy are resolved.

* While procedures exist for most important operations, they tend to be very abbreviated. Even so, the operators appear to understand well what must be done.

* Some procedures are no more than an item on a check list. This is unsatisfactory because the lack of detail leaves more possibility for error, training cannot be done with a vague procedure, and no guidance is provided for future operators.

* Data forms are used to record reactor readings and are filed in the "operator log." A "supervisors' log" contains information such as time of operation, unusual events, maintenance, etc. This log is very abbreviated, as noted before, with some information omitted; in general it does not adequately document the incidents which have occurred.

* The Technical Specifications contained a number of editorial errors such as incorrect references. Most of these were corrected during this appraisal.

* Inspection of the console and instrument cabinets showed that some information posted or used in the control room, such as rod-worth curves and instrument diagrams, did not contain sufficient information on the intended use, origin, or the approvals necessary to ensure that posted information was current and authorized.

* Section 1.2.2, subpart 4.5 of the OWR Operating Procedures specifies that the control console be manned during fuel handling, but does not specify what actions are to be taken by the person at the console.

* Procedures were sometimes nonexistent. For example, the Operating Procedures do not address the testing of Core Spray No. 1, an "Engineered Safeguard to prevent fuel melting."

* Procedures usually lack such information as:

  - references to other relevant documents or procedures,

  - special equipment or tools required for safe performance,

  - a step-by-step description of the operation, and

  - notes or caution statements.

* Technical Specification surveillance items on checksheets are not always marked "T.S." to indicate their significance as required in the OWR Operating Procedures.

* The startup checklist and other checklists do not always indicate a relevant limiting value to assist the operator in identifying an out-of-bound value.

* Observation of an operation involving removal of a spent fuel element from the reactor vessel indicated that the operators were aware of the potential hazard of plastic sheet restricting flow through the fuel. However, no caution statement was found in the procedures.

CONCERN: See Concern OA.1-2.

FINDINGS:

* There is no inventory required of material on the reactor top.

* Observations of various operations confirmed that checksheets are used to verify that the necessary plant conditions are met, although the detailed procedures are often missing.

* Lock wires are sometimes used where this is a more appropriate control than the lock and tag system. OWR Operating Procedures Section 8.11.7 deals with lock wires, but does not deal with many matters addressed by the lock and tag procedure. To mention just one, there is no guidance on whether the installation and removal of a lock wire should be entered into the tag log.

CONCERN: See Concern OA.1-2.

FINDINGS:

* Incident reporting is one of the most important management tools for maintaining a safe operation.

* There is no requirement to report all incidents so that both the quality of the operation and failure trends can be judged. This is particularly important for an aging facility. For example, electrical and water system outages are not being systematically recorded.

* Review of the incidents which have occurred is necessary to give clues to weaknesses in equipment, procedures, training, and root cause analyses.

* An unusual occurrence reporting system is in place, but its use is restricted to high-level incidents.

* In an old plant, it is especially important to record all incidents in a permanent record so that reviews can be made for aging problems.

* As an example of the type of data that can be obtained from analyzing incidents which may be lost by the absence of an incident reporting system:

  - On 5/9/89, the two power sources for the core spray No. 2 engineered safeguard failed due to a common-mode failure (transformer).

  - No common-mode failure analysis has been done on the electrical system.

  - The Safety Analysis Report calculated a failure probability of about 10^{-12} for the three power sources of the two core spray system engineered safeguards.

  - A common-mode failure in such a protective system is very serious - it indicates that the system is not nearly as reliable as it should be.

  - The system was simply repaired, leaving it subject to the same common mode failure.

  - If the incident had been recorded and analyzed, needed improvements to the safety and reliability of the reactor would have been identified.

  - Even though much can be learned from any failure if it is properly analyzed, the OWR staff has the attitude that "if the reactor is down, failures don't count."

  - The failure also points to an error in the Technical Specifications which do not identify emergency power as a safety-related system.

CONCERN: See Concern OA.4-2.

FINDINGS: * When the No.1 core spray system is out of service, the power sources are reduced to two, and when the No.2 spray is out of service the number of power sources is reduced to one.

* A common-mode failure caused loss of two of the three sources of power on 5/9/89.

* A Technical Specification permits one of the core spray engineered safeguards which prevent fuel melting

to be out of service for a period of two days. No justification for this could be found.

CONCERN: See Concern TS.3-3.

OP.3 FACILITY STATUS CONTROLS

PERFORMANCE OBJECTIVE: Operations personnel should know the status of the systems and equipment under their control and should ensure that systems and equipment are controlled in a manner that supports safe and reliable operation.

FINDINGS:

- o Observation of a number of operations from the control room revealed that only one annunciator panel was usually in the alarmed position while the reactor was operating. This was the "experiment shut down" annunciator, which alarms when not in use.

- o Observations during operation indicated that plant equipment was adequately monitored so that the operators had information about the status of the plant.

- o Procedures and checklists were used to ensure that the proper configuration was restored when jumpers were lifted or leads were used during checking or repair of instrumentation.

- * Observation of the reactor instrumentation indicated it was in good working order, although some portions are old.

- * A new digital control system is being designed and tested. It will move the control rods under manual control, so the operator will not see much difference in his manual operations at the control console. The digital control is designed to be entirely separate from the safety system while providing greatly enhanced ability to monitor and record data.

- * Although it is planned to have the new system ready for trial in the next few months, an appropriate safety analysis meeting the requirements of DOE 5480.1B has not yet been completed.

- * A number of the safety improvements identified by the Appraisal Team will require the efforts of the OWR staff to implement. Among these are:

  - a common-mode fault in the electrical system (Section OP.2);

  - an aging-replacement program (Section MA.2);

  - incident reporting and analysis (Sections OA.4, OP.2, and MA.3);

  - surveillance testing (Sections OP.2, AX.4, AX.6, and AX.7);

- safety analysis (Section TS.3); and

- procedures (Sections OA.1, TS.4, and TS.8).

CONCERN: (OP.3-1) The effort required of the small reactor staff to place the new control system into service may take precedence over safety improvements identified as needed by this appraisal.

LANL COMMENT: The TSA Team should not concern itself with the new digital control system beyond noting that "(1) with respect to the aging problem, we are preparing to upgrade a portion of our overall control system that is in need of replacement, and (2) the control system has been presented no less than 3 times before the OWR committee and twice before the RSC as an on-going review process. The new system has not yet been approved by the RSC or DOE/AL, who will have electronic experts and reactor-control experts make independent assessments of the advisability and safety of using the system that we have designed."

FINDINGS:

o OWR Operating Procedures, Section 8.11, "General Lock and Tag Procedure at TA-2," covers the steps of authorizing, tagging or locking, logging, verifying, removing, and clearing the isolation tag log. It appears to be complete and to be enforced.

o In one instance, an OWR supervisor displayed commendable vigor in reprimanding craft forces who violated a tag.

o There were only a few changes in plant configuration which were found; in these cases appropriate approvals were obtained and good quality control was used.

* While most reactor equipment, piping, and wiring were found to be appropriately labeled, there were exceptions. Examples are:

  - control rod drive wiring,

  - ports on the reactor shield, and

  - vent valves.

* Good labelling is important in maintenance and operations to avoid mistakes and to alert personnel to safety-related and procedure-related equipment.

CONCERN: (OP.3-2) Some equipment which can be manipulated and some important parts of the safety and control system for the reactor are not distinctively marked.

OP.4 OPERATIONS STATIONS AND EQUIPMENT

PERFORMANCE OBJECTIVE: Control stations and facility equipment should effectively support facility operation.

FINDINGS:

- o Tours through the reactor areas revealed good housekeeping and freshly painted stairways, railings, etc.
- o Equipment used for special operations such as the fuel handling tools were clean and well organized.
- o The very clean reactor water and good practices in cleaning spills contribute to the low contamination levels observed at the top of the reactor as well as in other areas.
- o Special tools such as lifting slings were provided in convenient areas and the slings had recent inspection tags.
- o Communications equipment observed during an accident scenario appeared to work well in the immediate reactor area.
- o The only electrical controls which might be subject to an adverse environment in accident conditions are in the control room where two sprinkler heads are located in the area of the console.
- o Monitoring and maintenance can be performed on all plant equipment outside the reactor vessel.
- * Labeling of equipment was not provided in some cases.

CONCERN: See Concern OP.3-2.

OP.5 OPERATOR PERFORMANCE

PERFORMANCE OBJECTIVE: Operator knowledge and performance should support safe and reliable operation of the equipment and systems for which he is responsible.

FINDINGS:

- o OWR Operating Procedures define the responsibilities of the operations supervisors, reactor supervisors, and reactor operators in Sections 1.1.2, 1.1.3, 1.1.4, and 1.1.5 of the OWR Operating Procedures.
- o Reactor supervisors and operators are formally certified by the Isotope and Nuclear Chemistry Division Leader.
- o Interviews demonstrated that operators and supervisors have very good, detailed knowledge of the plant and various aspects of normal and emergency conditions.
- o Most operators hired in recent years have naval reactor backgrounds, and they have proven to be knowledgeable and easy to train. Most were reported to be qualified within about three months.
- o Operators are required to study new procedures and procedure revisions by means of a "Required Reading File."
- o Records of operator tenure show that some stay only two years. There are only three operators and this turnover seems to be significantly higher than at most other reactors.

CONCERN: None.

OP.6 SHIFT TURNOVER

PERFORMANCE OBJECTIVE: Turnovers conducted for each shift station should ensure the effective and accurate transfer of information between shift personnel.

COMMENT: This performance objective does not apply to the OWR since it is operated by only one shift, five days a week. When overtime operation is required, it is done by the same crew.

OP.7 HUMAN FACTORS

PERFORMANCE OBJECTIVE: Human factors considerations should be evident in the design of systems, controls, and displays to facilitate the observation and interpretation of instruments, alarms, and other information, and the operation and maintenance of equipment.

FINDINGS:

- o Alarms, annunciators and other visual and audible signals are used to alert the operators to significant changes in operating conditions. Observation of various operations including an emergency shutdown indicated that the operators understood the various signals and were able to react properly to them.

- o The annunciator, alarms, instrument and meter readouts in the control room and in the rest of the plant were understandable and had little chance of creating confusion between different readings.

- o The bells and buzzers used to distinguish between different types of alarms were distinctive and readily understandable.

- * Some equipment, piping and wiring of importance to safety and facilities were not labeled. (See Concern OP.3-2.)

- * The Unusual Occurrence Report, UOR HD-87-02, describes an incident in 1987 which occurred because a procedure kept the operator so busy that standard practice was to observe only one power level instrument. The neutron level channel the operator was using had just received maintenance and was giving a reading of about half the true power. The power was raised to about 9.6 MW instead of 4.0 MW indicated by the instrument before the operator realized his error.

- * In spite of the lessons learned from Three Mile Island and other accidents, a procedure deficient in human factors continued to be used until 1987.

- * There is no documented evidence that operating procedures are reviewed for human factors, although OWR staff says this is now being done.

CONCERN: (OP.7-1) There is indication that human factors problems are not fully appreciated.

C. MAINTENANCE

Maintenance activities of the OWR Operations Group as well as the Pan Am support subcontractor and the various LANL support organizations performing maintenance at the OWR were reviewed during this appraisal. The control exerted by OWR management and the quality of maintenance work were evaluated. Special attention was given to component aging and self-appraisal activities.

Maintenance accomplishment for the OWR complex appeared to be very good from a general industry perspective. The associated organizational matrix was found to be functioning well despite considerable complexity in prerogatives and responsibility. Cooperation among the individual managers has extended to persons at the working level as evidenced by excellent response to day-to-day needs. Minor exceptions, to the otherwise effective-appearing program, were in the area of procedures for inspection activities. These need additional attention by LANL. Evidence for this was noted in (1) the boiler inspection program which gives less attention to the fire side of installed units than to the water, and (2) the elevator/crane/hoist inspection program which uses draft procedures.

The broader perspective shows additional weaknesses, however. LANL has not developed a meaningful written maintenance plan embracing the OWR complex as required since 1982 by DOE 4330.4, Real Property Maintenance Management. The Laboratory is managed under lower-level directives geared to individual organization needs and which do not truly integrate the higher-level elements of maintenance management. The use of significant goals and meaningful indicators is not apparent for either maintenance expenditures or performance accomplishments. The 33-year old reactor and its associated 44-year old facility are being maintained with routine Preventive Maintenance (PM) measures and a "fix after break" philosophy. This generally is not matched by equal attention to design deficiency correction and reliability enhancement. Reliance is being placed on (1) a 1983 study of major reactor components generally indicating a 10-to-15 year life expectancy, and (2) complete replacement by a new reactor and facility by 1996. The latter was reported as not being in a firm construction program at the time of this appraisal and thus can be considered subject to deferral. Neither a current and detailed study nor a replacement program to address component aging was evident. External influences on safety at the OWR complex such as flooding, rockfall, and electric power surges are not being addressed by up-to-date studies, adequate compensatory measures, or effective correction programs.

MA.1 MAINTENANCE ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: Maintenance organization and administration should ensure effective implementation and control of maintenance activities.

FINDINGS:

- o Interviews with cognizant managers and inspection of the OWR complex disclosed that staffing and resources for routine maintenance activities are adequate to support OWR operations in a safe and responsive manner.

- o Administrative control of maintenance activities at the OWR complex is exercised by OWR Operations personnel and is closely coordinated with reactor schedules and operations.

- o Maintenance of the OWR complex is performed by a matrix comprised of five separate organizations, including one subcontractor, Pan Am. These are distributed among two management reporting chains which have a common manager only at the laboratory directorate level. Pan Am provides maintenance craft services within the general framework of three organizationally related LANL groups: Area Coordination (ENG-5), Maintenance Engineering (ENG-6), and Fire Protection and Utilities (ENG-8).

- o Documents providing policy and management level direction for maintenance were:

  - OWR General Policy Manual, Section 1.3
  - ENG OPS Policies and Procedures Manual, and
  - ENG-6 Charter.

  Inspection of these disclosed the first to be very brief and general, the second is a collection of working level procedure/ information documents, and the third defines the role of Maintenance Engineering.

- * Neither of the two existing policy documents provides a written plan ". . .which establishes the maintenance and repair policies and objectives. . ." as required by Section 9.b of DOE 4330.4. Also, neither represents a well-developed upper-management level policy and implementation format for:

  - needs identification,
  - resource allocation,
  - effort organization, and
  - effectiveness measurement.

- * Each maintenance organization appeared to be free to evolve its own methods and style, limited by situation

requirements. Over the years, a good working matrix has evolved as evidenced by excellent cooperation among its members. Missing, however, are uniformly integrated responsibilities for budget defense, program decisions, and work accomplishment. Also missing are clear and meaningful objectives for management improvement, backlog reduction, and performance measurement.

* Maintenance involves the annual expenditure of millions of dollars at LANL and potentially affects safety at the OWR. Adequate attention to this at higher management levels is not being given.

CONCERN: (MA.1-1) LANL lacks a maintenance management plan that includes the reactor complex and which effectively provides for needs identification, resource programming, effort organization, and effectiveness measurement.

FINDINGS:

* Discussion with cognizant managers and inspection of available information disclosed that indicators for maintenance needs, expenditures and performance are not effectively established and/or periodically assessed to enhance maintenance effectiveness.

CONCERN: See Concern OA.4-2.

MA.2 FACILITY MATERIAL CONDITION

PERFORMANCE OBJECTIVE: The material condition of components and equipment should be maintained to support safe operation of the facility.

FINDINGS:

- o The appearance of the OWR Complex reflects excellent attention to routine maintenance. The facility was clean, well lighted, and had protective coatings in very good condition. The facilities and equipment did not show neglect, or lack of recent activities to repair breakage and correct malfunction. Fluid leaks were not apparent.

- * The facility is approximately 45 years old and the OWR is 33 years old.

- * Many OWR components are old in both years and use. Although functional and receiving routine preventive maintenance, they occasionally fail. The loss of the 150 kVA dry transformer for 120/208 volts AC equipment service on 5/9/89 during an electrical storm was reported as being preceded by high temperature and noisy hum. These conditions may have indicated imminent failure. After the failure, the transformer was found to have brittle insulation on the connecting wiring. This failure had safety system implications. (See Sections AX.5 and AX.7.)

- * Only two major equipment replacements are expected later this year. These are a motor control center for 480 volts AC service and the rod control drive currently under development.

- * Review of major component replacements between 1958 and 1988 pointed to by management as evidence of attention to aging disclosed that only seven of the total of 27 replacements were age related. Three of the seven were control rod replacements which have a predicted operational life.

- * Reliance is being placed on a 3/30/83 study, Assessment of the Probable Lifetime of the Omega West Reactor, (LA-UR-87-682). This study indicated that the OWR main components could be expected to last 10 to 15 years (until the period 1993 to 1998). This period enveloped the projected need of the OWR seen at the time. The expectation currently reported is for use until at least 1996 at which time operations will be transferred to a new reactor. The new reactor is proposed but presently is not included in a firm construction program.

* Reliance is placed on routine preventive maintenance and a "fix after break" repair philosophy, although some predictive methods such as vibration analysis and infrared scanning are being used. Detailed analysis for life cycle expectancy was not reported other than in the 1983 study.

* A fully effective and engineered aging/replacement program has not been developed in anticipation of OWR operation until 1996 or beyond that time, if needed.

CONCERN: (MA.2-1) The reactor complex lacks an effective and engineered aging/replacement program for older facility and reactor components not covered by the 1983 lifetime study.

* A 6/27/79 study (Memo WX-4-2292) indicated a low risk but potentially more serious consequence of flash floods resulting from failure of the water impoundments located upstream happening coincidentally with an unseasonable rainstorm. The impoundments include one earthfill dam and lake plus two water storage tanks. These are located in the same canyon upstream from the OWR complex. This potential is not described in the Safety Analysis Report (SAR) for the OWR. (See Section TS.3.) Additionally, the report concludes that worst-case flooding would not reach the reactor floor, but suggests that more accurate analyses could be performed.

* Inspection of the dam during the TSA disclosed floating trash accumulating at the spillway head, rock rip-rap having slid down the earthfill dam face, accumulation of rocks in the lower reach of the spillway, and only sparse grass cover for the dam-face soil. Checks among the various organizations potentially responsible for the dam indicated there is no clear responsibility for the dam at LANL. Evidence of an effective inspection program also was not found.

* The existence of badly fractured rock outcroppings on the canyon walls was noted in the current SAR. Numerous large boulders (50 to 500 cubic feet) in size are located near the canyon floor from past rock falls. One such event happened in the near vicinity of the OWR during 1988.

* Reliance is placed on a 1971 geology study included in the SAR which indicated that a significant earthquake is unlikely so that a seismic-induced rock fall is discounted. It was noted from available reports that the vicinity is in Seismic Zone 2 and that equivalent horizontal loadings up to 0.38g should be used for

design depending on the expected seismic response of a particular item and the consequence of its failure.

* Compensatory measures observed were one boulder anchored with cables and a fence-type rock "catcher" behind the OWR Complex. The catcher consists of eight inch diameter iron pipe posts spaced approximately eight feet apart and supporting five steel cable strands of approximately 1/2 inch thickness. The catcher is many years old and unpainted. Furthermore, it does not appear capable of retaining the larger rocks which could fall. A similar catcher at the nearby TA-41 area was reported as having been penetrated by a falling boulder. The catcher and the outcroppings are being inspected annually. The outcropping inspection is by means of binoculars from a vantage point on the slope below the outcroppings.

* The fall of a large round boulder and penetration of the rock catcher could cause serious damage to the OWR complex and potentially serious injury to occupants.

* Electrical storms are reported as causing power surges that shut down the OWR an average of once each quarter. The failure of the 150 kVA dry transformer on 5/9/89 was reported by an observer to have occurred simultaneously with a lightning flash. Although the 150 kVA transformer is somewhat isolated by the OWR complex main service transformer (from lightning-caused surges on the 13.2 kV distribution line), the repeated shutdowns indicate that the surges (possibly recloser-initiated switching surges) are impacting the OWR systems. The trend toward more sophisticated electronics (e.g., new control rod drive) may increase operational vulnerability to electric power surges.

* The impact of natural phenomena on the OWR complex, including flash flooding, rock falls, and electric power surges are not receiving adequate, up-to-date analyses for safety implications.

CONCERN: See Concern TS.3-3.

FINDINGS:

* There is no adequate analysis of available information on natural phenomena to provide a basis for action to mitigate the consequences of natural events.

CONCERN: See Concern OA.4-2.

MA.3 CONDUCT OF MAINTENANCE

PERFORMANCE OBJECTIVE: Maintenance should be conducted in a safe and efficient manner to support facility operation.

FINDINGS:

- o Maintenance is performed at the OWR complex under close control of OWR operations personnel and is done in a manner that substantially assures non-interference with safe operation of the OWR.

- o All work performed by non-OWR personnel is within a properly documented work control system.

- o Maintenance work performed by OWR operational maintenance personnel is done within a less formal, but equally effective, log book control system.

- o The lock and tag procedure is specific to the OWR complex. It is adequate, used under control of OWR operations personnel and fully accepted by maintenance personnel. (See Section PP.7.)

- o Maintenance work completed at the OWR complex is subject to completion inspection and sign-off by OWR operations personnel.

- o Discussion with both managers and supervisors disclosed the existence of a lessons learned program directed towards work package preparation. The program was found only in LANL Maintenance Engineering and consists of a five person committee meeting once each month; it did not appear to be having substantial effect on other maintenance activities.

- * The 150 kVA transformer failure (see Section MA.2 and Concern MA.2-1) was repaired by replacement-in-kind and by restoring the existing service to original design. Response to the failure was very prompt as evidenced by prompt deployment of a portable generator and replacement of the transformer within 24 hours. However, this was not followed by adequate engineering analysis for root cause and design deficiency.

- * Design inadequacies are apparent in the 120/208 volts AC system. For example, the time-current characteristics of circuit breakers are not coordinated, and a single transformer is used for both normal and emergency electric supply.

- * The emergency generator was replaced recently, but there was no recognition that the 150 kVA transformer is necessary for supplying emergency power.

* Discussion of the potential consequences of component failure with cognizant OWR personnel indicated heavy reliance on the reactor design which is intended to permit safe walk-away after emergency shut down.

CONCERN: (MA.3-1) Significant system/component failures and replacements are generally addressed by restoration to original design and without failure-mode analysis followed by engineered measures for any needed upgrade.

MA.4 PREVENTIVE MAINTENANCE

PERFORMANCE OBJECTIVE: Preventive Maintenance should contribute to optimum performance and reliability of systems and equipment important to facility operation.

FINDINGS:

- o Preventative Maintenance (PM) is performed at OWR complex within documented programs. The work is subject to appropriate procedures and checklists.
- o History is maintained in computer databases for PM work and results. Support equipment PMs generally are managed and performed by Pan Am under the direction of LANL Maintenance Engineering. Reactor components and equipment are covered by a PM program conducted by OWR operations personnel.
- o Positive follow-up occurs for deficiencies noted during PM that are beyond the scope of the PM activity.
- o Evidence of faulty or delayed PM efforts was not observed.
- o The commonly used methods for tests and predictive measurements were found within the PM programs.
- o A specific program to test and service backflow preventers connected to potable water systems is in operation and uses a specially equipped vehicle.
- o A program for testing electrical equipment (including circuit breakers) is being operated out of an excellently equipped semi-trailer that is moved to each facility for the test operations.
- o Pressure vessels are subject to specific inspection and certification in a well-controlled program.
- o Boilers receive PM by Pan Am and "third party" inspection and certification by a subcontractor specialty firm. This inspection concentrates on the water side of the boilers.
- * Boiler inspections by the third party are performed in accordance with industry standards for the water (pressure) side; these standards are not adequate for fire side inspections.
- * A comprehensive annual inspection is not performed by individuals qualified to perform both detailed safety inspections and code conformance evaluations of boiler fire sides.

* Routine safety checks are made by craftsmen once every one or two weeks using a detailed procedure and inspection-ticket checklist which is adequate for routine operational checks but is not adequate for detailed annual certification inspections. Additionally, the procedure does not specify the minimum frequency for combustion checks.

CONCERN: (MA.4-1) The inspection of the fire side of boilers is not equal to the best industry practices.

FINDINGS:

* PM for the OWR building elevator was performed by Pan Am with inspection/certification by a "third party" subcontractor specialty firm. The inspections were preceded by PM servicing in accord with a Pan Am draft procedure dated 3/27/89. The program for elevator PM and inspection has been undergoing improvement and the draft procedure was reported as nearing approval.

* The OWR building crane and several hoists at the OWR complex are subject to a PM program conducted by Pan Am. The equipment was being inspected by an engineering specialist for general safety and structural support. The program for crane and hoist PM and inspection has been subject to recent improvement. PM activities were performed using a Pan Am draft procedure dated 1/26/89. The draft procedure was reported as nearing finalization and approval some four months after being issued for use.

CONCERN: See Concern OA.6-1.

MA.5 MAINTENANCE FACILITIES, EQUIPMENT, AND MATERIAL

PERFORMANCE OBJECTIVE: Facilities, equipment, and material should effectively support the performance of maintenance activities.

FINDINGS:

- Maintenance facilities, equipment, and materials used to support maintenance activities generally appeared well maintained and adequate for both contractor (Pan Am) and reactor operations maintenance activities. Interviews with cognizant Pan Am, LANL Maintenance Engineering, and reactor personnel did not disclose inadequacies.

- Spare parts identified as "critical" for the OWR complex service and support equipment are procured, controlled, and inventoried within a documented program. Many of the parts are kept in secure storage at the OWR complex and these are inventoried each month. Specific provision is made within the program for critical needs identification, expedited procurement, and appropriate receiving inspection.

CONCERN: None.

MA.6 WORK CONTROL SYSTEM

PERFORMANCE OBJECTIVE: The control of work should ensure that identified maintenance actions are properly completed in a safe, timely, and efficient manner.

FINDINGS:

- Maintenance work performed by Pan Am is being conducted within a fully controlled system. Requested work generally is evaluated by LANL Maintenance Engineering and formally released to Pan Am. Work is planned, scheduled, and accomplished using appropriate work control methods.
- Work priorities are identified, materials staged, and efforts coordinated in an effective manner.
- Shop backlogs were found to be unusually small, reportedly due to the flexibility that Pan Am has to vary work force size.
- Maintenance work performed by OWR personnel is in the nature of operational maintenance. It is performed under less formal but fully effective, log-book work control. The less formal OWR work control is acceptable since maintenance activities are performed repeatedly by the same trained OWR operations technicians. They are familiar with the systems being worked on, and can respond to immediate operational needs or to routine requirements that are closely associated with reactor operations.
- Preplanned maintenance work for the OWR complex (exclusive of the reactor systems) is managed by system specialists within the LANL Maintenance Engineering and the Fire Protection and Utilities organizations. Individuals in these organizations maintain cognizance over assigned technical areas/systems and control the funding for associated maintenance work. Work performed by Pan Am is followed through to completion by these individuals.
- Completed maintenance work is subject to effective sign off and work package closeout for work performed by both OWR operations and Pan Am.

CONCERN: None.

MA.7 PROCEDURES AND DOCUMENTATION

PERFORMANCE OBJECTIVE: Maintenance procedures should provide appropriate directions for work and should be used to ensure that maintenance is performed safely and effectively.

FINDINGS:

- Most maintenance work for the non-reactor portions of the OWR complex is not covered by procedures. This is typical for this type of maintenance work at other DOE and commercial installations. Such work is covered by individually tailored work packages for larger jobs and skill-of-the-craft for smaller jobs. PM and specialized work in preparation for system inspection/certification is covered by written procedures.

- Work on reactor systems involving performance tests/calibrations also is covered by procedures that were governed by reactor technical specifications.

- Inspection of a sample of these procedures indicated that they generally are complete, up to date, and subject to formal control.

- A deficiency was found in the procedures for inspection of the fireside of boilers.

CONCERN: See Concerns MA.4-1 and OA. 1-2.

MA. 8 MAINTENANCE HISTORY

PERFORMANCE OBJECTIVE: Maintenance history should be used to support maintenance activities and optimize equipment performance.

FINDINGS:

- o OWR facility maintenance history is being maintained within a database operated by Pan Am. The information collected appeared to be meaningful and being used for maintenance planning. The database can be sorted easily as demonstrated by specific printouts produced upon request for TSA team examination.

- o The Pan Am maintenance history records are used informally by cognizant LANL Maintenance Engineering area specialists but are not seen as having significant use within an organized system for long range planning.

- o Maintenance history also is maintained at OWR in a computer database. All OWR complex facility maintenance history is being accumulated within this database.

- o The existing system used for the OWR complex is considered to be adequate for safety. Additional use could be made of the data to support enhanced planning and funding for maintenance/ replacement needs that will be required if the OWR life cycle is to be extended beyond 1996.

CONCERN: None.

D. TRAINING AND CERTIFICATION

The OWR facility and its supporting organizations have been appraised to determine if the training and certification of personnel are sufficient and adequate to ensure continued safe operation in the future without undue risk to the facility, the employees, and the public.

The operations and maintenance staff is stable and has a strong background in reactor operations. The operators average six years of experience. The two supervisors are experienced, degreed engineers.

The OWR has been operated safely for 33 years. The present and projected utilization program will call for increased attention to OWR training to ensure that this good record continues.

The present operator training program represents a noticeable improvement over the past few years. However, it still falls short of the industry's standards and requirements. There are no formal training plan, program structure or definition, no use of an acceptable training development system like the "Instructional System Development," and a significant absence of documentation of training requirements and of training conducted in reactor operations.

There is little documentation on the specifics of the reactor maintenance training program or records for on-the-job training. The program for fuel handlers qualification is not auditable.

It is evident from the above that training has not been given the priority it warrants.

TC.1 ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: The training organization and administration should ensure effective implementation and control of training activities.

FINDINGS:

- o The organization structure, authorities and responsibilities for OWR operations, personnel training and qualifications are adequately defined in the OWR Operating Procedures and Technical Specifications.
- o The authorized operations staff consists of one operations supervisor, one reactor supervisor, one senior operator and two reactor operators. The OWR staff performs its own maintenance on reactor related equipment.
- o The operations supervisor is responsible for training new operators and supervisors and organizing periodic training exercises and reviews for the operating crew. He personally conducts some of the training classes for the qualification and requalification of crew members.
- o The maintenance supervisor, who is also the OWR reactor supervisor, is responsible for training operators and other supervisors in new or extraordinary maintenance procedures and quality assurance.
- * The OWR training program is informally administered according to need as determined by OWR management.
- * There is no documented training plan that describes how OWR management implements and controls training activities.
- * Acceptable licensed research reactor training programs containing bases for personnel selection, lesson plans with learning objectives based on task analysis, instructors qualified in instructional skills, and examination and certification policies. The OWR has none of these.

CONCERN: (TC.1-1) A comprehensive formal reactor training plan and program has not been established and documented to assure implementation and control of training activities.

FINDINGS:

- o The OWR library has texts on guidelines for instructors and on-the-job (OJT) instructional techniques.
- o Training for OWR new employees, contract personnel, and transient workers are established and implemented. Quarterly reports are issued by OWR management reflecting this training.

- o The OWR staff members who provide training have the necessary technical competence and experience to carry out their training responsibilities.

- o There are only 16 formal OWR training Plans to cover the entire range of required operator training. The subjects covered include:

  - Criticality Considerations, Fueling and Storage;
  - Safety Analysis of Reactor Tank Level and Emergency Cooling; and
  - Emergency Core Cooling and Reactor Tank Level System.

- * The materials contained in the OWR training plan packages are not adequate for the lesson plans needed by instructors. For example, they do not contain training objectives.

- * Outlines and checklists ("one-liners") are used for operator training and qualification on walk-throughs and OJT. These are not adequate to ensure that the necessary training and qualification are accomplished.

- * There is no identification of what an OWR operator or reactor supervisor candidate needs to know to become certified. This results in the following:

  - No assurance that every candidate is trained and evaluated with respect to all required knowledge.
  - Specific training received which is not auditable as required by DOE 5480.6, Safety of Department of Energy Owned Nuclear Reactors, Section 8e(2)(h).
  - Trainees who do not have a clear understanding of the requirements for completing the program.

- * There is no formal training program for instructors to help them develop classroom and OJT instructional skills.

- * Observation of two scheduled training classes revealed deficiencies including instructor training skills, lack of planning and organization, use of an outdated drawing, and no existing lesson plans.

- * Lesson plans are generally not used in training.

- * The details of implementation of the reactor training activities have not been adequately documented.

CONCERN: See Concern OA.1-3.

FINDINGS:

* There is a noticeable absence of the application of basic principles and standard practices found in such nationally accepted training program development systems as the "Instructional System Development" process.

* The OWR staff who have responsibility for operations and maintenance training have additional duties which include installation of the new digital control console, demolition of the old Water Boiler Reactor shield, planning for a new reactor in the 1990s, and revision of the Safety Analysis Report. These all compete with their training responsibilities both energy- and time-wise.

* Funding for the OWR training effort comes from the OWR operating budget. There is no specific funding for training or the systematic development of the program, nor is priority given to training needs.

* The Job Assignment Annual Reviews for the operations supervisor and maintenance supervisor do not specifically address maintenance training responsibilities.

* While no single item above is by itself of concern, when considered in the aggregate, they give the appraisal team cause for concern.

CONCERN: (TC.1-2) Training has not been given the high priority it warrants.

TC.2 REACTOR OPERATIONS

PERFORMANCE OBJECTIVE: The reactor operator and reactor supervisor training and certification programs should be based on Standard ANS 3.1-1980 (Draft), as applicable, and should develop and improve the knowledge and skills necessary to perform assigned job functions.

FINDINGS

- o DOE 5480.6 and the OWR Technical Specifications establish the selection criteria for operators and supervisors.
- o The present operations personnel meet the selection criteria of DOE 5480.6.
- o DOE 5480.6, Section 8e(2)(a) requires that contractor management "specify the demands on health, physical condition, coordination, and manual dexterity required to perform both routine and emergency functions" and further that a "health examination be given to establish the candidates' fitness to perform all proposed job tasks."
- o The HSE Occupational Medicine Program (HSE-2) has established an excellent comprehensive series of 24 special examinations for various occupations, including reactor operators. The interval between the examinations is one year. There are 12 required tests within the reactor operator physical examination. These tests appear to meet the requirements regarding work restrictions relevant to fitness for duty.
- o The present OWR operations staff is comprised of one operations supervisor, one reactor supervisor, one senior operator, one reactor operator, and one operator in training. The average operating time on the reactor is about six years, of which 17 years is concentrated in one operator. The two supervisors have engineering degrees.
- o It is OWR management practice to select reactor operator candidates with previous reactor operator and maintenance training and experience with U.S. Navy or research reactors.
- o OWR operators are also responsible for certain areas of reactor maintenance. These areas are generally defined in each employee's Annual Job Assignment Review.
- o DOE 5480.6, Section 8e(2)(6), identifies those areas of on-the-job training and specific training categories to be given in reactor operator and supervisor training courses.

- o Section 6.1.3 of the OWR Technical Specifications states the training requirements for reactor operators and supervisors.

- o The Operations Supervisor used ORAU 265 "Research Reactor Job Analysis" to develop an initial training checklist for reactor control room operators. It is called the OWR Training Checklist.

- o Participation in daily startup and shutdown activities, working with experimenters, the safety committee and performance of maintenance, are important contributors to the operators' knowledge and proficiency.

- o Through interviews, observation of operations and maintenance activities, and review of records, the present staff is judged to be qualified to operate and maintain the OWR.

- * There are no instructions on use of the OWR training checklist. In addition, there is no training document which identifies the lesson plans, references, manuals, procedures, etc., for use in self-study for completing the checklist.

- * There is no document which ties the subject matter of the OWR training checklist to the training requirements of DOE 5480.6 and OWR Technical Specifications.

- * The Operations Supervisor stated that the depth of training in the areas of heat transfer, thermodynamics and fluid flow is adequate for the OWR design. Records do not exist to substantiate that the content of training in these areas is that of similar reactor designs and power levels.

- * The training materials available are not sufficient to verify that operators have been adequately trained in fuel handling.

- * Documentation and training materials for reactor operator and supervisor training and certification are insufficient to determine whether the on-the-job training and training categories requirements of DOE 5480.6 and the Technical Specifications are being met.

CONCERN: See Concern OA.1-3.

FINDINGS:

- o Examinations are given in accordance with DOE 5480.6, OWR Technical Specifications and OWR Operating Procedure 1.5.

- o OWR operators are evaluated annually by written examination on emergency response and abnormal procedures as required by DOE 5480.6.

- o Operator and supervisor certifications and recertifications are performed in accordance with DOE 5480.6 and OWR Technical Specifications.

- o NRC guidelines are used in the protection and proctoring of examinations.

- o Through discussions with the Operations Supervisor, the OWR secretary, and operators, as well as checking the database of the OWR office word processor, it was determined that written examinations are adequately controlled prior to their use.

- o Examination records are adequate and are maintained in an auditable manner.

- o DOE/AL has reviewed the OWR reactor operator and reactor supervisor initial certification examinations as required by DOE 5480.6 and found them satisfactory.

- * A recent Senior Operator examination had no questions on past unusual occurrences and incidents, unscheduled shutdowns, major changes in procedures, fuel handling, or basement flooding.

- * One oral examination with only 25 questions was given to five candidates at a group sitting. The examination did not include a tour of the facility. Normally oral examinations are given individually and include a facility tour.

- * Acceptable responses to written examinations are not established prior to administering examinations. Point values assigned to questions are not designated.

- * A policy on the minimum passing grade for written examinations, (e.g., 70% or above) has not been formally established.

- * There is no formal method for ensuring that operating experiences relevant to the OWR are addressed in the operator/supervisor certification and recertification programs.

* While collectively the operator examinations (written, oral, and operational) address all the categories required by DOE 5480.6, Section 8e(2)(c), it is the appraiser's opinion that coverage of all categories in each type of examination (to the extent appropriate) is necessary to give reasonable assurance that the operators are sufficiently knowledgeable.

CONCERN: (TC.2-1) The reactor examination process does not adequately measure supervisor and operator knowledge in the subject areas required by DOE Orders and the Technical Specifications.

TC.3 NUCLEAR FACILITY OPERATIONS OTHER THAN REACTORS

PERFORMANCE OBJECTIVE: The nuclear facility operator and supervisor training and certification programs should develop and improve the knowledge and skills necessary to perform assigned job functions.

COMMENT: This performance objective does not apply to reactor facilities.

TC.4 PERSONNEL PROTECTION

PERFORMANCE OBJECTIVE: The personnel protection training programs should develop and improve the knowledge and skills necessary for facility personnel to perform their assigned job functions, while minimizing exposure of individuals to radiation and chemicals to as low as reasonably achievable.

FINDINGS:

- o The LANL Health and Safety Manual states:
  - Employees will be provided with health, safety and environment training to help them safely perform their assigned tasks.
  - Supervisors will instruct their employees in applicable health, safety and environmental procedures relevant to specific job assignments, and will maintain records to reflect the current status of training received by each employee, including certification and retraining.
  - Group Leaders must establish a health and safety training program that includes the periodic assessment of training needs, the development and implementation of training needs and the documentation of the training received by each employee.
  - As new employees join the group, training needs must be assessed and documented promptly and a schedule established for acquiring the necessary training and certification.
- * There is no documentation of the assessed training needs of each person in the OWR organization.
- * Related insufficiencies in assessing training needs are addressed in Section PP.3.

CONCERN (TC.4-1): Requirements in the LANL Health and Safety manual for the assessment of training needs for reactor personnel are not being met.

TC.5 MAINTENANCE PERSONNEL

PERFORMANCE OBJECTIVE; The maintenance personnel training and qualification/certification programs should develop and improve the knowledge and skills necessary to perform assigned job functions.

FINDINGS:

- o DOE 5480.6, Section 8(e)(2)(i) requires training of maintenance personnel to be based on the class of maintenance to be performed, the degree of supervision required and the required knowledge of the reactor.

- o The official job assignment for the OWR Maintenance Supervisor includes only the duty of training operators and other supervisors on new or extraordinary maintenance procedures.

- o DOE 5480.6 Section 8e(2)(i) also requires that all maintenance shall be performed by personnel trained in their respective discipline; written policy be established that describes functions, assignments and responsibilities of the maintenance organization; and that successful completion of the training and qualification effort be documented.

- o The delivery plan for the new digital control system includes a commitment to provide special maintenance training to those operators who will be performing maintenance on the system.

- o Annual Job Review Assignments for the operators include specific reactor maintenance responsibilities.

- o Based on observations of several maintenance activities, discussions with the operators and a review of records, the OWR maintenance personnel are judged to be qualified to perform their work.

- * The operations supervisor's Annual Job Review Assignment contains no specific responsibility for training OWR maintenance personnel. (See Concern TC.1-1.)

- * There is no documented plan and program for maintenance training of the OWR staff which would provide confidence that maintenance is properly carried out on the OWR.

- * There is no documentation of training for maintenance personnel in their assigned areas and specialties.

- * There are no records of OJT being performed, even though interviews with operators and technicians indicate that some OJT training has been done prior to their release for duty.

* There are no qualification cards with performance criteria to document completion of OJT.

* The maintenance instructions, procedures and manuals are not sufficient in detail, nor are they designed for maintenance training.

* Even though OWR operators have maintenance responsibilities, there are no questions on maintenance in their written examinations.

* In summary, there is no documentation that confirms the adequacy of the reactor maintenance training plan and program as required by DOE Orders.

CONCERN: See Concern OA.1-3.

- o Maintenance operations are also performed by Pan Am and other LANL subcontractors. Pan Am allows only journeymen level maintenance personnel to perform work at the OWR site.

- o Pan Am uses a "Job Qualification Criteria System" to ensure craftsmen and technicians are qualified and trained to maintain critical equipment at LANL facilities, including the OWR site.

- o For maintenance requiring welding, procedures identify the welding certification requirements. Only personnel meeting these requirements are assigned to the job. A review of records confirm those certifications.

- o The Associate Director for Support negotiates the contract with and oversees the performance of Pan Am and other subcontractors. The contracts include quality assurance requirements to ensure qualification and certification of Pan Am employees.

CONCERN: None.

TC.6 CRITICALITY SAFETY

PERFORMANCE OBJECTIVE: **Personnel should receive training in nuclear criticality safety consistent with their assigned tasks.**

COMMENT: This performance objective is covered in Section TC.2.

TC.7 TRAINING FACILITIES AND EQUIPMENT

PERFORMANCE OBJECTIVE: The training facilities, equipment, and materials should effectively support training activities.

FINDINGS:

- o OWR classroom training facilities can easily accommodate the students, instructor, and equipment.
- o A great deal of the reactor operator, supervisor and maintenance training is actually carried out on shift as OJT.
- o The operations supervisor has an excellent personal library of textbooks applicable to operator and maintenance training.
- o Mock-ups for instructor aids usually come from the spare parts bins/shelves.
- o The HSE Division's video and film library has extensive visual aids for use in training.
- o Some operators are using the PLATO computer assisted training courses to improve their job knowledge.
- o There is a complete set of "Reactor Training Coordination Program Manuals" at the OWR site. These have every generic lesson plan needed for research reactors.
- o A manual entitled "Guide to Instructional Skill" is available for improving the instructional skills of the training instructors.

CONCERN: None.

TC.8 QUALITY CONTROL INSPECTOR AND NONDESTRUCTIVE EXAMINATION TECHNICIAN

PERFORMANCE OBJECTIVE: **The quality control (QC) inspector and nondestructive examination (NDE) technician training and qualification programs should develop and improve the knowledge and skills necessary to perform assigned job functions.**

FINDINGS: o The LANL Quality Assurance Plan, Section 9.1, defines the training and certification programs for quality assurance (QA) personnel assigned to audits or surveillance of quality related activities.

- o QA personnel are certified prior to being assigned to independent audit or surveillance tasks.
- o Neither quality control (QC) inspectors nor nondestructive examination (NDE) technicians are normally required at the OWR facility.
- o Depending on the project, QC inspector functions and NDE technician functions may be conducted by a systems designer or by the designated agency within the QA plan for the project.
- o For the OWR control rod blade replacement project, which is being managed by the OWR staff through their Quality Program Plan, the LANL Division of Mechanical and Electronic Support (MEC-4) performs the measurement inspections, while the Division of Weapons Technology does the NDE.
- o To date, there has been no inspection or NDE requirements at the OWR for Pan Am or other contractor work. If there should be, the official monitoring office in the LANL Support Division would define the QC requirements within the contract. In the case of Pan Am, an internal audit system is in place which checks the contractor's inspector and NDE technician training and certification against the American Society of Non-Destructive Testing standards.

CONCERN: None.

E. AUXILIARY SYSTEMS

Auxiliary systems encompass a diverse group of activities and systems. These include waste generation and disposal, fuel handling, vital electrical and engineered safety systems, and heat removal and coolant cleanup systems. At OWR these are minimal because of the reactor's relatively low power and safe design. Most of the systems have operated reliably. The coolant cleanup system's performance and the staff's waste management activities have been good.

Symptoms of component aging may be surfacing. This is evidenced by failure of a transformer due to an electrical line surge and the embrittled insulation found on its wiring. The transformer, which supplies power to an engineered safety system, failed during an electrical storm during the course of the appraisal. This failure would have prevented one of engineered safety systems from providing its design function, if needed.

Significant procedural deficiencies were found. One of these resulted in an engineered safety system not being functionally tested at the required frequency. This was a Technical Specification violation. The procedure for testing a different engineered safety system did not fully assure that the system would have been able to produce the required action if called upon under accident conditions. In addition, some procedures were not sufficiently detailed to provide users with enough information to determine if the test data obtained were acceptable.

AX.1 EFFLUENT HOLDUP AND TREATMENT

PERFORMANCE OBJECTIVE: Effluent holdup and treatment should ensure that the amount of hazardous substances released to the environment meets DOE and EPA standards.

FINDINGS:

- o Liquids that are known to be or could be contaminated are collected in the three waste tanks. These liquids come from such sources as the decontamination sinks, resin regeneration operations, and drainage from the primary system. When two of the tanks are about full, the solutions are agitated and sampled and then pumped through an above ground three-inch cross-country waste line to the LANL liquid waste disposal facility.

- o There is no need for an installed radiation monitor in the line that feeds the cross-country waste line. The total activity to be released is based on the sample results and the amount of liquid transferred.

- o Gaseous waste is released from two points.

  - The purge gas from the reactor thermal column is purged through a stack that is located on the mesa to the south of the reactor. This gas takes about 45 minutes to reach the stack where it is continuously monitored for Argon-41 content. The monitor has a readout in the control room but there is no alarm that would indicate an abnormal release. Approximately 10-15 Ci of Argon-41 are released from the stack monthly.

  - Gas from the reactor surge tank is vented directly to the atmosphere unless fission products are detected in the primary water. If fission products were to be present, the gas would be manually diverted through a charcoal filter to the stack. There is no continuous monitor on the surge tank vent; periodic samples are taken during routine operation and analyzed to ensure that the releases are normal.

- o There is no program to periodically review or trend volume or curie contents of waste liquids and gases. The releases are very low and therefore it is not practical to establish goals to form a basis for a waste reduction program.

- o HSE personnel keep records of total releases based on a combination of monitoring data and extrapolations and estimates based on periodic samples.

CONCERN: None.

AX.2 SOLID WASTES

PERFORMANCE OBJECTIVE: Solid hazardous wastes should be controlled and handled to minimize the volume generated, and provide for safe storage and transportation.

FINDINGS:

- o Solid waste generated at OWR includes paper, latex gloves, plastic, and used charcoal.
- o All solid waste in the reactor room, the control room, and three auxiliary buildings is arbitrarily classified as radioactive. These buildings are: Bldg. 4 where equipment that is slightly radioactive or contaminated is stored, Bldg. 44 which is the pump house and Bldg. 50 which contains general storage.
- o Personnel are trained at the OWR in the handling, packaging, and shipping of hazardous waste which includes radioactive waste. A training class on this subject was monitored by the team during the appraisal.
- o A LANL waste management specialist is available to aid OWR personnel if any question arises.
- o "Standard Operating Procedure For Waste Management at TA-2, Omega Site" (SOP#3) covers the handling of waste.
- o Very little protective clothing is used at OWR because the building is generally free of contamination. No fuel element, to date, has leaked radioactivity and contaminated the reactor primary system. Protective clothing except for latex gloves is cleaned and reused at LANL.
- o Because of the very low amount of waste generated, management does not have a program directed toward reducing the amount of radioactive waste generated at OWR. Solid waste is packaged and shipped to another LANL site for compaction and disposal.

CONCERN: None.

AX.3 STORAGE AND HANDLING OF FISSILE MATERIAL

PERFORMANCE OBJECTIVE: Fissile material should be stored and handled in a manner which minimizes the chances of loss, contamination, release, or inadvertent criticality.

FINDINGS:

- o Unirradiated fissile material is not stored at OWR. It is stored at another LANL site which has approved criticality safe storage facilities.

- o OWR Technical Specification 5.5 applies in general to fuel handling operations. Because only two unirradiated or four irradiated fuel elements are permitted outside of a criticality safe configuration at a time, the operations do not need to be bounded by Technical Specifications. Analyses have shown that eight unirradiated fuel elements cannot be made critical.

- o Irradiated fuel is first stored in criticality safe racks inside the reactor tank. After the fuel has cooled for a specified time, it is transferred, one element at a time, to the fuel handling pool. The appraisal team observed one fuel element being transferred from the reactor to the fuel handling pool. This transfer was completed smoothly. The fuel is then transferred into a shipping cask for transport to a separate LANL site for subsequent shipment to the Idaho Chemical Processing Plant.

- o Personnel who handle fuel elements are trained by hands-on operations. One operator is required to be at the console to monitor reactor instrumentation during fuel manipulations. The training for fuel handling personnel as demonstrated by the transfer of the fuel element from the reactor to the fuel handling pool indicates that they have the knowledge required by Section 8.e of DOE 5480.6, Safety of Department of Energy-Owned Nuclear Reactors.

- o OWR Operating Procedure 2.5, "Fuel Burnup Calculations," provides accountability data. These calculations are performed by OWR staff.

- o OWR Special Procedures 8.1, "Handling and Transfer of OWR Spent Fuel," and 8.7, "Storing Fuel in the Reactor Tank Lower Storage Well," cover manipulations of irradiated fuel elements.

- o A work plan is prepared and approved for each case where fuel elements are moved into or out of the reactor. This work plan is authorized only for the specific manipulations covered; any deviations require that a new work plan be approved.

- o Two fuel elements are transferred from the designated storage area to OWR when new fuel is required.

- o Each element is removed from its shipping wrapper in the reactor room and inspected before being placed in the reactor core. The plastic shipping wrappers have distinctive tape stripes so that the plastic can easily be accounted for and thereby prevent its inadvertent insertion into the reactor where it could block flow to the fuel.

- * The dropping of an irradiated fuel assembly from its transfer cask, or dropping of the cask itself onto the reactor top or onto the room floor has not been analyzed in the Safety Analysis Report.

CONCERN: See Concern TS.3-3.

- * There are no emergency procedures pertaining to fuel handling operations.

CONCERN: See Concern OA.1-2.

AX.4 VENTILATION SYSTEMS

PERFORMANCE OBJECTIVE: Ventilation systems should reliably direct all airborne effluent from contaminated zones or potentially contaminated zones through cleanup systems to ensure that the effluent reaching the environment is below the maximum permissible concentration.

FINDINGS:

- o The reactor room and the remainder of the building do not have separate ventilation systems. Two small ventilation fans exhaust the reactor room air directly to the outside air. One fan is on-line in cold weather and both are on-line when it is hot; there are no backup fans. Air intake is through coarse filters that are maintained by Pan-Am as scheduled through the preventive maintenance program.

- o An Eberline Particulate, Iodine and Noble Gas 3B air monitor is located in the reactor room. This monitor was installed in 1989 to monitor general room air. This monitor complies with the specifications of American National Standards Institute Standards N13.1-1969 and N13.10-1974. See RP.10 for additional discussion.

- o High efficiency particulate air (HEPA) filters are associated only with the rabbit and the two hood exhausts where radioactive materials are processed.

- o The HEPA filter installed in the reactor room hood exhaust has not passed the required efficiency test. This hood is not being used and will not be returned to service until an acceptable filter is installed.

- * A charcoal filter is associated with the vent on the reactor surge tank. This filter is tested with Freon II at another LANL location (Bldg. TA-59) by HSE personnel before installation to determine its iodine retention efficiency. After testing, the filter is transported to OWR for installation.

- * After two years, a new filter is prepared, tested, and installed. Technical Specification 4.4.3.3 requires that the charcoal filter be tested biennially. The old charcoal filter is neither tested after installation nor before it is discarded.

- * Normal industry practice is to test charcoal filters in place to ensure that there is no leakage through the charcoal and to ensure that the filter is not damaged during transport and installation.

- * It is not currently known if the biennial replacement of charcoal is adequate to ensure that the required iodine retention efficiency is sustained.

CONCERN: (AX.4-1) The efficiency of the charcoal filter is not assured because the filter is not checked at any time after it is installed.

AX.5 VITAL SUPPLY SYSTEMS

PERFORMANCE OBJECTIVE: The electric, water, and emergency power systems should reliably provide vital services needed by the facility.

FINDINGS:

- o City water serves as the supply for one of the two core spray systems. This provides for emergency core cooling in the event water were to be suddenly lost from the reactor tank, such as from a leak from one of the penetrations through the reactor tank wall, as discussed in the Safety Analysis Report.

- o Emergency and abnormal operations are part of the requalification program conducted to ensure that operators know how to respond to outages of vital supply systems.

- o A preventive maintenance program is applied to some reactor supply system components, but not to parts of the electrical distribution systems. Maintenance service includes:

  - quarterly inspection,
  - regular lubrication,
  - ultrasonic and vibration tests,
  - infrared inspection to detect hot spots in electrical equipment,
  - backflow-preventor inspection,
  - electrical breaker inspection, and
  - overload tests on large motors.

  The maintenance history is recorded for large equipment.

- o The emergency diesel electrical system is tested in accordance with the Institute of Electrical and Electronic Engineers (IEEE) Standard 308-1980, Section 7, and its referenced Standard IEEE 338-1977, Section 6.

- * No scheduled surveillance is performed to detect deterioration of the city water system other than testing flow from hydrants, which indicates whether the lines are free of any substantial restriction. The city water piping is inspected only when the system is opened for other reasons.

* Monitoring systems provide information on the status of water, electric, and air systems except when all normal and emergency power is lost.

* Preventive maintenance service is available and is used on some important equipment. However, the transformer for the 120/208 Volts AC power at the OWR failed on 5/9/89; subsequent inspection indicated that insulation on some wiring had deteriorated.

* The transformer which failed on 5/9/89 had been reported to have operated at abnormally high temperatures and was noisy.

* The surveillance program used to detect deterioration of vital supply systems has not been sufficient to detect incipient failures such as deterioration of electrical insulation.

* A number of safety features are provided so that if any one is ever called upon, it will protect the core. Two diverse core spray systems are provided. Failure of any one reduces the margin of safety but does not result in core damage.

* One of the two spray systems became inoperable while the reactor was shut down because of the 5/9/89 transformer failure. This failure may be indicative of an aging problem.

CONCERN: See Concern MA.2-1.

AX.6 HEAT REMOVAL

PERFORMANCE OBJECTIVE: The heat removal system should reliably remove heat as required from the reactor or process.

FINDINGS:

- o The primary coolant system is continuously monitored and the control room has alarms and readouts sufficient to provide the operator with information on the status.
- o The secondary water system transfers heat from the primary system to the atmosphere in a cooling tower which sprays water over tubes containing the primary water.
  - Chemicals are added to the secondary water to control silica scale formation and algae growth.
  - A blowdown of the secondary water after about 2.5 cycles limits the concentration of impurities to acceptable levels.
  - HSE takes weekly samples of the secondary water and analyzes for radioactivity to determine if a primary water leak exists.
- o Cooling tower blowdown has been widely investigated by LANL to ensure that downstream public water supplies are not affected.
- o No fouling of the heat exchanger tubes has been observed. Because the whole primary system is composed of stainless steel and the conductivity and pH of the water are controlled, corrosion is not a problem.
- o In the event of normal primary flow failure during operation the reactor is protected by convective flow through the fuel. If the primary system water is lost due to a line break, the flapper valve prevents the water from dropping to the level of fuel. If, however, the break is in the reactor vessel, such as in the lower through-port, the fuel will be adequately cooled as long as the water level is five inches above the bottom of the fuel. If the water level is less than five inches above the bottom of the fuel, activation of one of the emergency core sprays would be necessary to prevent fuel damage if the time to drain is less than 525 seconds and the power is greater than 8.24 MW. The Safety Analysis Report concludes that this combination of events is highly improbable.

CONCERN: None.

AX.7 ENGINEERED SAFETY SYSTEMS

PERFORMANCE OBJECTIVE: Engineered safety systems should be reliable and available to provide protection to the facility when needed.

FINDINGS:

- o LANL support groups provide preventive maintenance on continuously operating equipment which includes noise analyses and infra-red inspection. OWR supervisors reported that some success had been achieved in informally forecasting problems.

- o There are three start-on-demand engineered safety systems (two core spray systems and a flapper valve). City water is sprayed over the fuel by manually opening a valve in the control room (Core Spray No. 1). Primary water is sprayed over the fuel by an electrical pump (Core Spray No. 2).

- o Technical Specifications and OWR procedures specify that one of the two core spray systems may be out of service for up to two days. No specification is placed on the flapper valve except for quarterly surveillance to ensure that it operates during a shutdown of the primary coolant system.

- o At least one of the core spray systems must be available to prevent fuel melting in the event the water is suddenly lost from the reactor vessel during operation.

- o The flapper valve closes when the primary coolant is being pumped and opens when flow ceases so that the water level cannot be siphoned down as far as the core. Thus as long as the leak is not at a low level in the reactor tank, the core will remain covered with water.

- * The time interval between the surveillance tests of the flapper valve was found to be twice that required by Technical Specifications. This is a Technical Specification violation, but an Unusual Occurrence Report was not submitted. OWR management stated that DOE/AL had concurred and that an Unusual Occurrence Report was not required in this instance.

CONCERN: See Concern TS.3-2.

FINDINGS:

- o One of the core spray systems depends upon electrical power and the other upon city water, either of which can fail. The two systems together were assumed in the Safety Analysis Report to be reliable.

- * A Technical Specification requirement allows the reactor to be operated with one system inoperative up

to two days. Documented justification for this could not be found.

CONCERN: See Concern TS.3-3.

FINDINGS:

* The failure of the electrical power on 5/9/89 (when the reactor was not in operation) rendered Core Spray No. 2 incapable of performing its intended function.

* Any failure (as distinct from intentional inoperability such as for maintenance) which causes a protective system to be incapable of performing its intended action constitutes an unusual occurrence (even if the reactor is not in operation) and should be reported as such as required by DOE 5000.3, Unusual Occurrence Reporting System. These reports serve multiple useful purposes, including:

  - alerting contractor upper management and DOE,
  - becoming part of a database from which the overall safety can be judged,
  - forcing rigorous analyses of root causes, and
  - allowing management and DOE to investigate and determine whether an affected system needs to be improved or redesigned.

  Unusual Occurrence Reports should document all such failures whether the reactor was operating or not because not formally reporting such events may give an overly optimistic perception of rate of failure.

CONCERN: (AX.7-1) Inoperability of an engineered safety system (the No. 2 core spray system) is required to be reported by DOE 5000.3, Unusual Occurrence Reporting System.

FINDINGS:

o The No. 2 core spray system is tested by simulating actual conditions.

* The No. 1 core spray system is tested by sequentially bleeding a small amount of city water and reactor water from the same point in the system.

* No procedure exists for the test of the No. 1 core spray except for a description in the Safety Analysis Report.

* The core spray flow is required by Technical Specifications to be more than 10.4 gallons per minute. However, the flow used in each test is not measured.

* The test flow direction is from the reactor side which is the opposite of the flow in emergency conditions.

* Under accident conditions the estimated core spray flow of about 100 gallons per minute is likely to pick up scale or rust which might clog the spray nozzles.

* There has been no high flow test in 22 years to flush out the city water piping near the reactor.

CONCERN: (AX.7-2) The method of testing Core Spray No. 1 does not verify that the required flow of 10.4 gallons per minute could be achieved.

AX.8 COOLANT CLEANUP SYSTEMS

PERFORMANCE OBJECTIVE: Recirculating coolants should be cleaned continuously or intermittently to minimize the buildup of contamination and reduce corrosion.

FINDINGS:

- o There are two main coolant water systems at the OWR: the primary coolant system, and the secondary water system.
- o The primary coolant system is maintained at the proper pH and conductivity by passing a side stream through a mixed bed ion column.
- o Technical Specifications require that the pH be maintained between 6.2 and 7 and the conductivity below 2.0 micro mho per cm. In practice the conductivity is kept well below this.
- o The secondary water system utilizes raw water chemically treated to control corrosion and algae. A blowdown of the secondary water after about 2.5 cycles maintains the chemical concentrations at the desired levels. It is reported that the blowdown does not affect the environment.
- o Make up water for the primary system is obtained from a reverse osmosis unit. About 250 gallons per week are lost through the surge tank vent.
- o Decreased conductivity of the output water from the ion exchange column indicates depletion of the resin. When this occurs, the spare column is put on line, replacing the depleted one.
- o Spent resin is regenerated. After regeneration can no longer be done, the resin is removed as waste.
- o Small ion exchange columns are also used to maintain the fuel handling pool water at high purity.
- o Samples of the primary water are counted regularly by procedures described in the HSE Routine Monitoring Instructions. The main contaminant is Na-24 with small amounts of Tc-99m, Co-60, Mn-54, and Mn-56.

CONCERN: None.

F. EMERGENCY READINESS

The evaluation of emergency readiness covers organization and administration of the emergency response group; the emergency response plan; training; emergency facilities, equipment, and resources; emergency assessment and notification; and personnel protection.

The Emergency Management (EM) group at LANL is well organized and administered. EM provides guidance and oversight for emergency readiness at the LANL site. The EM staff is competent and professional, and provides the emergency response structure for the LANL site. The EM staff is assisted by the On-Scene Control Group (OSCG) containing matrixed support organizations covering the various disciplines required for effective site-wide emergency response. The OSCG is the communications focal point for the Emergency Operations Center and the Crisis Management Team. A duty officer system is in place, staffed by members of the EM Group. The duty officer system provides 24-hour coverage for emergencies on the LANL site. The Duty Officer becomes the On-Scene Commander (OSC) after being thoroughly briefed of the emergency situation by the facility Emergency Coordinator. An emergency readiness exercise performed on May 16, 1989, indicated this concept of operation is effective and efficient for emergency response at LANL.

The Emergency Operations Center (EOC) is of adequate size, well equipped and maintained. A sufficient supply of instruments and supplies are maintained by the Radiation Protection Group (HSE-1). The Environmental Group (HSE-8) evaluates off-site radiological consequences of potential accidents. Emergency equipment is readily accessible for accident conditions.

The Omega Site Emergency Plan (OSEP) and implementing procedures are concise and usable, and key to the LANL Emergency Response Plan (ERP). However, the OSEP has not been developed in accordance with DOE 5500.3, Reactor and Nonreactor Nuclear Facility Emergency Planning, Preparedness and Response Program for Department of Energy Operations. Implementing procedures are vague in some areas and nonexistent in other areas. For example, notification procedures do not specify who is to make the notification, who decides notifications are necessary, or what input information is required to make the decision. Planning details for evacuation of OWR personnel for emergencies at neighboring facilities or evacuation of neighboring facilities personnel for emergencies at OWR are not developed.

The LANL Health and Safety manual contains guidance for training of facility personnel. However, the OSEP does not implement the training guidance.

While many elements of the emergency response during the 5/16/89 emergency drill were adequate, considerable concern exists as to the response capability of the Fire Department.

Although the LANL ERP emergency classifications are consistent with DOE 5500.3, the Health and Safety manual, the OSEP, and the HSE support group emergency plans are not. There are inconsistencies in classification and definition of emergencies from plan to plan.

ER.1 ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: Emergency preparedness organization and administration should ensure effective planning for, and implementation and control of, facility emergency response.

FINDINGS:

- The LANL ERP clearly defines organizational structure and responsibilities of the site-wide emergency response staff and defines the tasks and procedures to perform the tasks for emergency situations. Alternates for each of the site-wide response positions are defined. The required support staff for EOC and OWR complex response are identified.
- Section 7.3 of the OSEP requires the OWR Group Leader, or in his absence, the OWR supervisor, to act as Emergency Coordinator (EC). These personnel are familiar with the day-to-day operations at the OWR and are knowledgeable of the spectrum of credible accidents and their remediation.
- If a radiological emergency is beyond the control of the OWR staff, the EC contacts HSE-1, which initiates the ERP.
- If the emergency situation requires activation of the EOC, the EM staff, after consultation with the Associate Director for Support, notifies the members of the Crisis Management Team.
- The response personnel (EM, HSE, Operational Security, Fire Department, and the Protective Force Shift Commander) clearly understand their authority, responsibilities, and interfaces.
- Technical support groups are identified.
- The decision to activate the EOC places authority and responsibility for overall coordination with the Crisis Manager in the EOC.
- The interfaces between DOE/AL and the EOC are clearly defined.
- If DOE assistance is required, the LANL Emergency Planning Office contacts the Los Alamos Area Office who calls the DOE/AL EOC for assistance. They, in turn, contact the DOE Headquarters EOC if additional assistance is needed.
- The Crisis Manager in the EOC has checklists available for orchestration of emergency response activities.

The emergency response teams are under the direction and coordination of the Crisis Management Team.

- o During the 5/16/89 emergency exercise it was evident that the Onsite Commander, Security Force, Fire Department, and Emergency Coordinator understood their authorities and responsibilities. The staffing and resources for this scenario were sufficient to accomplish their emergency duties.

- o Emergency Response Plans for LANL and OWR site are reviewed and updated annually, as necessary, by appropriate members of the EM and OWR staffs.

- o Findings and lessons learned are incorporated into the emergency plans through the critique process.

CONCERN: None

ER.2 FACILITY EMERGENCY PLAN

PERFORMANCE OBJECTIVE: The emergency plan and its supporting documents should provide for effective response to abnormal conditions.

FINDINGS:

- o Approval and distribution of revisions to the LANL ERP and the OSEP are controlled and reviewed annually and are updated as necessary.
- o The LANL ERP has been developed in accordance with DOE 5500.3.
- o The LANL ERP is keyed to the OSEP. Both plans provide the notification process and the telephone numbers for mobilizing support groups.
- o The LANL ERP assigns the responsibility for establishing site control during an emergency to the Protective Force.
- o The OSEP is based on the accidents analyzed in the OWR Safety Analysis Report. The maximum credible accident provides the radiological basis for emergency planning. Hazardous material emergency planning for the OWR site is being developed. (See Concern ER.6-1).
- o EM has recently been tasked to perform functional, operational, and facility emergency management appraisals on an annual basis for all sites, including the OWR site. EM also evaluates emergency plans to improve their effectiveness.
- * The Fire Department prefire planning is not complete. Additionally, the important OWR features that OWR staff should identify for Fire Department and Protective Force personnel are not clearly documented. (See Concerns FR.2-1 and SS.5-1.)
- * The OSEP is concise and usable. However, the implementing procedures are vague. Topics which are vague include assembly points and evacuation routes, accounting for personnel, and emergency equipment.
- * Both the OSEP and the TA-41 Site Emergency Plan indicate that if site evacuation were indicated due to a major emergency, the evacuating site should call the neighboring facility to provide notification of the hazard. However, critical details are not provided on who makes the call, how it is determined that the neighboring facility will be affected, or which evacuation route to take.

* OWR Technical Specifications, Appendix A, state that the Technical Specifications are consistent with listed DOE Orders, including DOE 5500.3. As the Technical Specifications do not include classifications of emergencies, this statement is not accurate.

* The accountability process for emergencies is not well defined. (See Section ER.6)

* There are no radiological monitoring procedures to determine habitability of assembly areas for evacuees. (See Section ER.3)

* The responsibilities of the OWR operations personnel during a safeguards/security emergency at the OWR building are not defined in the OSEP.

CONCERN: (ER.2-1) Emergency procedures developed for implementation of the Omega Site Emergency Plan do not fully meet DOE Order requirements.

ER.3 EMERGENCY RESPONSE TRAINING

PERFORMANCE OBJECTIVE: Emergency response training should develop and maintain the knowledge and skills for emergency personnel to respond to and control an emergency effectively.

FINDINGS:

- o Section 14.0 of the OWR Training Plans, "Emergency Procedures and Abnormal Operating Conditions," presents seven Unusual Occurrence Reports (UORs) and abnormal incident reports as part of emergency readiness training.
- o Section 1.5, "Qualification of OWR Operators, Senior Operators, and Supervisors," and Section 1.6, "Training of Experimenters and Other Employees at TA-2," of the OWR Operating Procedures specify the training requirements for personnel.
- * These sections do not identify the required training and retraining or provide guidance for the conduct of emergency tests and exercises as required by Sections 7 and 8 of DOE N 5500.3, "Emergency Preparedness Program and Notification Systems."
- * The OSEP does not address the guidance provided in LANL Technical Bulletin 101 for training in emergency readiness plans and procedures for emergency response personnel.
- * OSEP training given by site management is performed without lesson plans and the examination used is specific to OWR abnormal and emergency operating conditions rather than the OSEP.

CONCERN: See Concern OA.1-3.

FINDINGS:

- o The most recent orientation for Fire Department personnel on the OWR building was conducted by OWR Management on 2/16/89 and 2/17/89.
- o Handouts of a portion of the OSEP were given to the Fire Department attendees.
- o Protective Force personnel are trained in radiation protection and types of signs and posting.
- * Protective Force personnel do not receive site-specific training on the OSEP and responses.

CONCERN: See Concern SS.5-1.

FINDINGS:

- o Fire Department personnel are trained in radiation protection and types of signs and posting.
- * Fire Department personnel do not receive adequate site-specific training on the OSEP and responses.

CONCERN: See Concern FP.2-1.

FINDINGS:

- o OWR conducts annual emergency readiness exercises.
- o EM, supported by a member of the OWR staff, develops realistic scenarios to test personnel and emergency equipment and resources.
- o The exercise scenarios are based on stated objectives to test personnel and emergency equipment and resources.
- o OSEP emergency readiness exercises were conducted on 9/22/88 and 3/30/89. An exercise was conducted on 5/16/89 as part of the TSA to demonstrate OWR and support group response.
- o EM conducts a critique with all responders immediately after the exercise. The 5/16/89 critique was performed well with response problems logged for corrective follow-up action.
- o EM conducts a formal critique with group leaders and supervisors on the day after the exercise to formulate an action plan on problems identified. Such a critique was observed on 5/17/89, with a formal action plan written to cover identified weaknesses and improve training effectiveness.
- o During the 5/16/89 emergency readiness drill, Protective Force inspectors at the Central Alarm Station and the OWR site participated and carried out their duties of perimeter control.
- o During the 5/16/89 emergency readiness drill, an evacuation of the OWR complex occupants was performed.
- o Evacuees assembled at the west gate and the OSC and OSCG assembled southwest of the facility.
- * Radiological monitoring to determine safe habitability of personnel in those areas did not appear to be performed for the drill and no monitoring equipment was seen at the assembly site. Furthermore, during the post-drill critique the HSE representative stated that assembly areas are not routinely surveyed.

* There are no procedures for safe habitability surveys.

CONCERN: See Concern ER.2-1.

FINDINGS:

o During the 5/16/89 emergency readiness exercise, fire-fighters were required to rescue and provide on-scene medical treatment for a contaminated and injured individual.

o The immediate rescue response by the responding firemen was adequate.

* However, their performance regarding the removal of the individual to the ambulance was unsatisfactory. A Stokes stretcher should have been used to transport the individual out of the building instead of dragging the individual on a carpet.

* Further, the victims vital signs were not checked nor was oxygen administered.

CONCERN: (ER.3-1) During the 5/16/89 emergency readiness exercise, rescue personnel did not administer first aid appropriately and did not move the victim appropriately.

FINDINGS:

* Interviews with Fire Department personnel regarding emergency response to fires in Los Alamos Canyon which could affect the OWR complex indicated that a first response would be from Fire Station Number 1. If additional help were needed, Station 1 would contact Station 7 to request mutual aid assistance from the U.S. Forest Service.

* Subsequently it was learned that calls to the U.S. Forest Service for mutual aid assistance should be initiated from the EOC. This misunderstanding was apparently due to inadequate emergency readiness planning and training of Fire Department personnel.

CONCERN: See Concern FP.2-1.

ER.4 EMERGENCY FACILITIES, EQUIPMENT, AND RESOURCES

PERFORMANCE OBJECTIVE: Emergency facilities, equipment, and resources should adequately support facility emergency operations.

FINDINGS:

- o EM has developed and maintains and manages the LANL site EOC. The EOC is of adequate size and is equipped with computer based displays, decisional aids, and situation boards. Based on interviews, demonstration, and evaluation, the EOC is maintained in ready state by a highly trained and competent staff consisting of a Group Leader and three professionals.

- o Adjoining the EOC is an area staffed by an HSE-8 representative who performs environmental assessments of potential radiological releases during incidents on a timely basis.

- o EOC and HSE-8 equipment, including computers, is marked for emergency use and is maintained in a ready state.

- o EOC and response personnel are adequately equipped with radiological and meteorological equipment and instrumentation, dosimetry, transportation, emergency power, and water supplies. Response personnel have the ability and equipment to monitor and decontaminate personnel onsite and in the EOC.

- * During the 5/16/89 emergency readiness exercise, a recurring communication problem was observed when HSE-8 personnel had difficulty with radio transmission out of the Los Alamos Canyon to a receiver on the mesa. Although the immediate problem was solved by changing radios, the team was told that there is a generic problem of "dead spots" at LANL.

- * Fire Department personnel do not have in-mask communication capability and have difficulty communicating while wearing self-contained breathing apparatus.

CONCERN: (ER.4-1) The communication equipment planned for use during emergencies is not sufficient to provide needed communications in all cases.

ER.5 EMERGENCY ASSESSMENT AND NOTIFICATION

PERFORMANCE OBJECTIVE: Emergency assessment and notification procedures should enable the emergency response organization to correctly classify emergencies, assess the consequences, notify emergency response personnel, and recommend appropriate actions.

FINDINGS:

- o The system for classification of emergencies specified in the LANL ERP is consistent with DOE 5500.3. This plan provides notification procedures, recall procedures for manning the EOC and a description of the communications equipment and radio frequencies for use in various emergency situations.

- * The OSEP describes classes of events at the OWR as Minor Incident, Site Emergency, and Major Emergency. This classification is not in accordance with DOE 5500.3.

- * The HSE Emergency Operations Plan defines in Section 6, HSE Emergency Actions, Minor HSE Incidents, Major HSE Incidents, and Major Emergency. These classifications are also not consistent with the classifications given in DOE 5500.3.

- * The LANL Medical group (HSE-2) Emergency Operations Plan defines three general levels of emergencies as: Unusual Occurrences, Emergency Alert, and Major Emergency. These classifications are not consistent with DOE 5500.3.

- * LANL Health and Safety manual, Administrative Requirement 1-2, "Emergency Preparedness," and Technical Manual 101, "Emergency Preparedness," do not address DOE 5500.3 requirements defining emergency classifications.

CONCERN: (ER.5-1) The emergency classification systems used to develop emergency plans and procedures for the reactor site and for the organizations supporting the site are inconsistent and not in conformance with DOE requirements.

ER.6 PERSONNEL PROTECTION

PERFORMANCE OBJECTIVE: Personnel protection procedures should control and minimize personnel exposure to hazards during abnormalities, ensure that exposures are accurately determined and recorded, and ensure proper medical support.

FINDINGS:

- o Attachment 3 of the HSE-1 Emergency Operations Plan lists the number of neutron, alpha, tritium, gamma, and beta-gamma radiation detection/measurement instruments available at various LANL facilities. A sufficient quantity of calibrated instruments are available for radiological accidents at OWR. An HSE-1 emergency van with an inventory of instruments and supplies is available to augment OWR supplies, if necessary.

- o HSE-1 provides radiation protection surveys and external dosimetry and whole body counting services for personnel under normal and emergency conditions.

- o First aid and decontamination supplies are available at the OWR. A decontamination facility, instruments, and medical personnel are available at the Los Alamos Medical Center for contaminated and injured personnel.

- o Evacuation routes within the OWR facility are marked with exit signs and emergency lights are provided. Two exits had obstacles impeding egress from the building. (See Concern SS.3-1.)

- o Transportation of contaminated and injured personnel is provided by Fire Station 1 ambulance to either the HSE-2 Medical Facility or to the Los Alamos Medical Center. Both facilities are approximately four minutes from the OWR site.

- o During the 5/16/89 emergency readiness exercise at OWR, the evacuation of personnel to the assembly point was prompt and orderly, transfer of command and control was smooth, and the OSC and support personnel performed well and in a timely manner.

- * However, the accountability process appeared to be weak in that there was some confusion over the accountability of the simulated victim, strong leadership was not exhibited in controlling evacuated personnel, and the accountability duties and responsibilities are not documented in detail.

CONCERN: See ER.2-1.

FINDINGS:

- o EM is presently developing computerized methods to provide timely information on the quantity, nature and

magnitude of hazard for hazardous materials by building and location.

* During the June 1987 TSA of the TA-55 Plutonium Facility, a recommendation was made to "... establish toxic material and radiation exposure guides in emergency response plans conforming to DOE 5480.1A, Chapter XI and DOE 5500.3 for emergencies such as saving a life or protecting vital equipment." The OSEP has not been revised to include toxic material and radiation exposure guides.

CONCERN: (ER.6-1) Exposure guides for toxic material and radiation exposure have not been provided in a timely manner in the emergency response plan for the reactor.

G. TECHNICAL SUPPORT

A review of the technical disciplines providing support to the OWR operation, the administrative documents that specify their functions, and analysis of their work formed the basis for this appraisal area. Most technical work in support of the reactor is performed by the OWR staff. The relationship and interactions between the OWR staff and other LANL personnel who provide support was assessed in discussions with representatives of the affected groups.

Technical expertise for support of all facets of reactor operation is available onsite at LANL. Safety features included in the design of the reactor augmented by a technically competent staff and the professional analyses of the reactor and associated experimentation have contributed to the good safety record. The engineering work for replacement of the emergency diesel generator illustrates how the OWR staff worked with some support groups to achieve the desired result.

The Safety Analysis Report needs to be updated so that Technical Specifications will have a current basis and operating procedures can be improved. Procedures that implement Technical Specifications Surveillance Requirements were found to be deficient in some instances. Some Technical Specification Requirements were worded so they could be misunderstood.

High priorities have not been assigned to updating the Safety Analysis Report and improving the operating procedures.

TS.1 FACILITY MODIFICATIONS

PERFORMANCE OBJECTIVE: Technical support services required by the facility to execute modifications should be carried out in accordance with sound engineering principles.

FINDINGS:

- o A formal system of approved procedures is used to ensure that facility modifications are in compliance with Attachment 2 of DOE 5480.4, Environmental Protection, Safety, and Health Protection Standards.

- o A formal multidisciplinary review by well qualified personnel is provided for significant changes or modifications to the OWR.

- o The history file for replacement of the OWR emergency generator in 1986 was reviewed. The following observations were noted:

  - The design review board included persons with the following disciplines: electrical, civil, structural, mechanical, energy management, maintenance, safety, health physics, financial, and quality control. Each of these reviewers is responsible to ensure that applicable codes and standards in their field of expertise are met.

  - The file appeared to be complete. It contained records of the request for design, drawings, meeting notices, routing sheets, review and approval sheets with signatures, the Pan Am work plan for installation, and the final acceptance notice.

  - Applicable drawings were approved and issued more than a year before work was started.

- o Appropriate technical support personnel are available at LANL for review of other types of modifications. These include, but are not limited to criticality safety, computers, electronics, and reactor core analysis.

CONCERN: None.

TS.2 ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: Technical support organization and administration should ensure effective implementation and control of technical support.

FINDINGS:

- o Organization charts show the hierarchy of management for LANL down to and including OWR personnel. The charts also show the relationship of the various advisory committees to the line organizations.

- o Most technical support work is performed by OWR operating personnel. Educational background and reactor operating experience qualify them for the work required. The reactor supervisor also serves as the maintenance supervisor; the operations supervisor serves as the in-reactor fuel analyst. Two former members of OWR supervision, now retired, are available as consultants.

- o Examples of technical support work performed by operating personnel are the maintenance of reference documents such as the Safety Analysis Report and System Modification work.

- o Additional technical support is provided, when called upon, from other LANL groups (e.g., The Nuclear Technology and Engineering Division). In addition, standing committees such as the Electrical Safety Committee and the Nuclear Criticality Safety Committee can be called on to review potential problem areas if warranted.

- o As a means of improving personnel performance, employees are encouraged to pursue work that is related to and compatible with OWR operations. Examples of these items are the development of a digital reactor control system and implementation of a computer-assisted system for producing OWR drawings. Periodic reviews of individuals' overall performances are used to detect areas where more emphasis can be applied to improve work output.

- o The replacement of the diesel-driven emergency generator illustrates how administrative controls and technical support personnel efforts were effective in guiding the flow of the project from request for design through installation and final acceptance.

- * The emergency generator replacement project was narrow in scope in that the need for replacement of associated

equipment such as transformers, wiring, and switch gear were not assessed.

CONCERN: See Concern MA.3-1.

TS.3 PROCEDURES AND DOCUMENTS

PERFORMANCE OBJECTIVE: Technical support procedures and documents should provide appropriate direction, and should be effectively used to support safe operation of the facility.

FINDINGS:

- o The majority of the technical support work is performed by OWR staff. This work includes items such as planning for reactor core changes, surveillance testing, fuel burnup calculations, and maintaining the Safety Analysis Report and Technical Specifications.

- o The monitor on the OWR exhaust stack operates continuously. This monitors the release of Ar-41 from the reactor thermal column. The Ar-41 release is 10 to 15 Ci/month.

- * The Technical Specifications were revised in February 1989. A review of this revision and the implementing procedures revealed that:

  - A number of references in Section 3, "Limiting Conditions for Operation," to other parts of the document were found to be incorrect during the appraisal. This stemmed from a word processor and/or proofreading problem. The references were corrected while the appraisal was being conducted by a further revision.

  - Surveillance specification 4.3.4.3 requires that both emergency core spray systems be functionally tested each week. The spray system supplied from city water is not tested completely; city water is not allowed to flow through the spray nozzles. See Sections AX.7 and OP.2 for further discussion.

  - Surveillance specification 4.4.3.3 specifies that the efficiency of the charcoal filter on the purge tank be measured biennially. OWR practice is to replace the installed filter with a pretested filter every two years rather than testing it in place.

  - The installed charcoal filter is not tested at any time after installation to determine its efficiency.

CONCERN: (TS.3-1) Some Technical Specification Surveillance Requirements are not being interpreted correctly.

FINDINGS:

- * Procedures used to comply with Technical Specification Surveillance Requirements are located both in the

Operating Procedures and Special Procedures sections. The degree of detail in these procedures varies widely, with some being as simple as a check point on a check sheet, while others consist of a number of steps describing how to perform the surveillance test. The lack of detail in procedures is presumably due to the knowledge and experience of the OWR staff. However if the existing experienced staff were to be replaced, the current procedures for some Technical Specification Surveillance tests are inadequate to ensure that requirements of the tests are met.

CONCERN: See Concern OA.1-2.

FINDINGS:

- o A quarterly visual verification of flapper valve operation is required by Technical Specification 4.3.1.3.

- * The flapper valve ensures that coolant flows through the reactor core when the main circulating pump is on and that a natural convection flow path through the core exists when the main circulating pump is off.

- * The quarterly test listing in OWR Operating Procedure 4.0, "Operational QA Procedures" did not require verification of the flapper valve operation; the semiannual test listing did. OWR Operating Procedure 4.0 was revised during the appraisal to correct this deficiency.

- * A search of the OWR records did not reveal that the valve operability had been verified at the frequency the Technical Specification requires. This is a violation of Technical Specifications.

CONCERN: (TS.3-2) The Technical Specification requirement for the flapper operation check is not being met.

- * The bases for Technical Specification limits are not always provided in the OWR Safety Analysis report (or elsewhere). For example, no analysis could be found to support permitting operation for up to two days with one of two core spray engineered safeguards out of service.

- * The Safety Analysis Report has a number of associated addenda covering subjects that have been considered subsequent to publication of the original report. An update of the report is planned for later this year. The new report is to be formatted in accordance with Nuclear Regulatory Commission Regulatory Guide 1.70.

* Deficiencies in the existing Safety Analysis Report include inadequate assessment of:

  - flooding from failure of the dam (see Section MA.2),

  - one or more large boulders from the adjacent hillside impacting on the OWR complex (see Section MA.2),

  - seismic events (see Section MA.2),

  - electrical storms (see Section MA.2), and

  - certain potential hazards of fuel handling operations (see Section AX.3).

CONCERN: (TS.3-3) The Safety Analysis Report is out of date and in need of revision.

TS.4 EQUIPMENT PERFORMANCE TESTING AND MONITORING

PERFORMANCE OBJECTIVE: Equipment performance testing and monitoring conducted by technical support groups to assure operations are within safety parameters and limits should be effective.

FINDINGS:

- o About 90% of the surveillance and performance monitoring is performed by OWR personnel with the remainder performed by other LANL groups. For example, rotating equipment vibration analyses and diesel generator testing are performed by specialist personnel who service all groups on site.

- o A computer program was initiated by OWR staff in November 1988 to record data on equipment failure items. The intent is to use the data for detailed analyses. However, this database is not yet complete enough for performance analyses to be made. See Section MA.8 for further discussion.

- o Data from surveillance testing are available in OWR files, as specified in OWR Operating Procedure 5.2, "OWR Records."

- o OWR Operating Procedure 3.5, "Control of Measuring and Test Equipment," lists the calibration requirements including accuracy, calibrating facility, and frequency of recalibration. The data are recorded on checklists and stored as specified in OWR Operating Procedures Sections 4.0 and 5.0.

- o Procedures for surveillance and performance monitoring are approved by those supervising the group performing the work.

- o There is evidence of procedure improvement in recent years. Most procedures were revised in the past year.

- * Surveillance procedures are not complete. For example, there is no procedure to test the emergency spray systems weekly as required by Technical Specification 4.3.4.3.1. The only record that the tests have been performed is recorded on the Daily Checklist in OWR Operating Procedure 2.3, "Level Operation." There are no flow data recorded and no minimum flow is specified on the checklist such that a determination of acceptable operation can be made.

CONCERN: (TS.4-1) Detailed procedures do not exist for performing some tests required by Technical Specifications.

TS.5 EVALUATION OF OPERATING EXPERIENCES

PERFORMANCE OBJECTIVE: Industry and in-house operating experiences should be evaluated by technical support analysts and appropriate actions taken to improve facility safety and reliability.

FINDINGS:

- o The Reactor Safety Committee annually performs an independent review of the OWR as required by Section 8.g of DOE 5480.6, Safety of Department of Energy-Owned Nuclear Reactors. The members of this committee are required to be knowledgeable of OWR and to have hands-on experience in operation of a reactor. For cases where relevant technical expertise does not reside in the committee, specialists are called in from other LANL groups for assistance.

- o Recommendations of the Reactor Safety Committee and of DOE are tracked by the Reactor Safety Committee through resolution.

- o The operations supervisor receives notices of reactor events that occurred at other sites. Those that have application to OWR are put into the "Required Reading" folder for OWR personnel.

- o The operations supervisor attends meetings of representatives of the Test, Research, and Training Reactor Group and of the Reactor Training Coordination Program group. Problems and programs discussed at these meetings are subsequently discussed with the remainder of OWR staff.

- o Studies of reactor status are periodically made. One such study is of potential failures that could lead to long term reactor shutdown. Assessment of the Probable Lifetime of the Omega West Reactor (LA-UR-87-682, dated 5/30/83), documents the results of this study. No aging problems were revealed in the above report that might make the reactor permanently inoperable. Refer to Section MA.2 for further discussion.

- o Most of the technical support activities are done by the operating personnel. The remainder of the technical work is done by specialists from other LANL groups under the purview of the operating group.

- o Temporary changes to procedures are not permitted. A permanent change can be effected expeditiously.

- * There is no formal followup system to ensure improvements are made, based on reactor events or

associated observations that could impact reactor operations.

CONCERN: See Concern OA.4-2.

TS.6 ENVIRONMENTAL IMPACT

PERFORMANCE OBJECTIVE: The impact on the environs from the operation of the facility should be minimized.

FINDINGS:

- Exhausts tubes from OWR locations such as the reactor room, surge tank vent, hoods and the rabbit tube are vented directly to the atmosphere. These exhausts are not monitored. The surge tank vent exhaust is required to be directed manually to the OWR stack through a charcoal filter if abnormal radioactivity levels were to be detected in the reactor coolant.

- The Environmental Group (HSE-8) has responsibility for independent monitoring of the environs. They provide monitoring for all of LANL and for the surrounding areas. Sampler locations as far as 28 miles from LANL are shown in Figure 8 of LA-11306-ENV, "Environmental Surveillance at LANL During 1987." Release data for LANL are also presented in this report. HSE-8 maintains records that show the quantities of radioactivity released from the reactor site.

- The most significant component of the radioactive releases to the environs is the Ar-41 generated in the thermal column. The source is argon in the air which, upon neutron capture, converts to Ar-41. Attempts to replace the air with carbon dioxide have been only partially effective in reducing the amount of radioactive argon released.

- The monitor on the OWR exhaust stack operates continuously. This monitors the release of Ar-41 from the reactor thermal column. The Ar-41 release is 10 to 15 Ci/month.

- The newly installed Eberline Particulate, Iodine and Noble Gas 3B air monitor in the reactor room will give an early indication if airborne activity were to be present in the room. This instrument alarms in the control room, thereby permitting quicker recognition and mitigation of a problem than existed previously.

CONCERN: None.

TS.7 PACKAGING AND TRANSPORTATION OF HAZARDOUS MATERIALS

PERFORMANCE OBJECTIVE: Performance of the packaging and transportation functions should assure conformance with existing standards and accepted practices as given in DOE 5480.3, and its references.

FINDINGS:

- Hazardous materials packaging and transportation are described in the Administrative Requirements of the LANL Health and Safety manual, Section 1 of the On-Site Transportation Manual, and the QA Manual for Hazardous Material Packaging. The last two of these manuals are relatively new. These three manuals provide the procedures that ensure compliance with DOE 5480.3, Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes, and AL 5480.3 with the same title.

- The Hazardous Materials Packaging Office provides the training specified in DOE 5480.3 for appropriate personnel. Further training is provided by OWR personnel for work specific to the OWR.

- There have been no reportable events at OWR associated with hazardous materials.

- Audits of the OWR hazardous materials have not been made. The Hazardous Materials Packaging Office plans to perform an audit later this year.

- Certificates of Compliance for shipping containers are not used for on-site shipments. Irradiated fuel elements are shipped from OWR to another LANL location where they are transferred to a cask approved by the Department of Transportation and then transhipped to the reprocessing plant in Idaho. Records of shipments, such as shipping manifests, are maintained by the Hazardous Materials Packaging Office. These records meet the requirements of DOE 5480.3, Section 10e.

- An acceptance test is performed at Mound Laboratories on a sample of each type of shipping package used for transport of irradiated experimental material. Subsequent use of additional packages is contingent upon passing inspection prior to use.

CONCERN: None.

TS.8 REACTOR ENGINEERING

PERFORMANCE OBJECTIVE: (Reactors Only): Reactor engineering activities should ensure optimum nuclear reactor operation without compromising design, safety, or nuclear fuel limits.

FINDINGS:

- o Reactor engineering duties are performed by or under the guidance of operating personnel. Section TS.2 discusses this in more detail.

- o Operating parameters such as reactor thermal power and reactivity shutdown margin are routinely measured using OWR Operating Procedures Section 2.3.9, "Measuring Reactor Thermal Power," and 8.3, "Measurements of Reactivity Shutdown Margin."

- o Fuel elements are removed from the reactor core when the specified burnup is achieved. Normally two elements are removed during one refueling period. The remaining elements are relocated in the core and the replacement elements placed in precalculated positions to yield optimum core performance.

- o Burnup status records are maintained for each fuel element. Individual element burnup can be calculated manually using OWR Operating Procedure Section 5.2.4, "Fuel Burnup Calculations" or by using a computer code. Burnup records are stored as specified in the procedure.

- o There has never been a fuel element that leaked activity in the 33 years that OWR has operated.

- o Parameters that might indicate activity leaking from a fuel element are routinely monitored as follows:

  - Samples of the reactor coolant are analyzed by the Radiation Protection Group (HSE-1) weekly.

  - A noise monitor is on-line to detect boiling.

  - The activity monitor located near the coolant pipe in the pump house has a control room readout that is under the surveillance of the operator.

- * Response to an abnormal condition is to notify the supervisor. Instructions such as how to shut the reactor down, direct the surge tank vent effluent to the stack through the charcoal filter, and manage the coolant flow, are not specified.

CONCERN: (TS.8-1) There is no procedure that specifies the actions to be taken if a fuel element were to leak radioactivity into the reactor coolant.

TS.9 CRITICALITY SAFETY

PERFORMANCE OBJECTIVE: (Reactors Only) Specialized support for criticality safety issues should be fully integrated into the operation of the reactor, and the handling and storage of fuel by facility personnel.

FINDINGS:

- o LANL administers a site-wide criticality program. A major part of this program is the evaluations and audits performed by the Criticality Safety Committee.
- o Criticality monitoring systems are not required at OWR. Four gamma monitor instruments provide alarm protection for high radiation levels at four building locations and would alarm if an unwanted criticality were to occur.
- o Nuclear criticality safety is assured at OWR by limiting the number of fuel elements that can be outside of the criticality safe containers to not more than two unirradiated or four irradiated elements.
- o A work plan is prepared and approved for each instance of fuel handling.

CONCERN: None.

H. SECURITY/SAFETY INTERFACE

The evaluation of Security/Safety Interface covers the following topics: the impact of security/safeguards improvements on safe, reliable operation or shutdown of the OWR; the compatibility of design criteria of security/safeguards improvements with respect to the facility equipment and structures being protected; access or exit of facility and safety support personnel during an emergency; authority and responsibility of response personnel for security/safeguards emergencies; and the safety of security activities during emergency response.

Through the LANL Quality Assurance (QA) organization, a program has been implemented to ensure facility upgrades receive safety and security review. The program is based on Facilities Engineering Division Procedure No. 4.2 (Rev. 7, dated 2/21/89), "Detailed Design Review," which requires that design verification be performed by security and safety groups.

The OWR facility was designed and built prior to August 1956. There are presently no security/safety interface design impediments for emergency egress from the building. Modifications to upgrade the facility are designed to meet present-day safety/security interface design criteria. Emergency egress from the OWR building is unimpeded by locks. Crash bars are installed on many of the doors.

During the 5/16/89 emergency exercise, emergency vehicles responded in a timely manner and were unimpeded in their access to the OWR site. There are two evacuation routes from the OWR site: west on a paved road up the canyon, and east on an unpaved rough road to State Highway 4 which is 3.6 miles away.

Evacuation to the east from the OWR site may be untimely or impossible if a sufficient number of 4-wheel-drive vehicles are not available.

Potential consequences of accidents involving the use of weapons, missiles, or other protective force equipment in the vicinity of the OWR or in the OWR building would be minimal. The amounts and types of hazardous materials observed and recorded at the OWR site are negligible.

SS.1 SAFETY OF IMPROVEMENTS

PERFORMANCE OBJECTIVE: Security/safeguards improvements should not create or increase hazards that would impede the safe, reliable operation or shutdown of the facility in normal, abnormal, or emergency situations.

FINDINGS:

- Facilities Engineering Division Procedure No. 4.2, Rev. 7, dated February 21, 1989, "Detailed Design Review," requires that design verification be performed by security and HSE groups to provide input in their areas of discipline into the design packages. Any comments are made formally and are tracked and maintained in the Facility Engineering Division's database.
- Operational Security and Safeguards (OS) Division's OS-10 Group provides technical design verification of the design packages.
- The HSE QA Coordinator for construction projects has approval authority for resolution of comments which call for design changes based on safety and security input and resubmission of the construction design package. He assures that safety/security comments are incorporated into the construction design package or that satisfactory resolution is achieved.
- The Detailed Design Review procedure is implemented at the Conceptual Design Report Phase (Title I) of the construction project.
- OS has provided security input on one project: "Back-up Power Generator, Building 1, TA-2," dated 9/6/85. This is the only recent project which has had a security/safety interface.
- There have been no security upgrades at OWR that impede safety interfaces.

CONCERN: None.

SS.2 COMPATIBILITY

PERFORMANCE OBJECTIVE: Security/Safeguards improvements should use design criteria consistent with the facility equipment/structure being protected.

FINDINGS:

- Facility's Engineering Division Procedure No. 4.2 provides for the QA review process in which the HSE and Security Divisions are required to provide input to security/safeguards improvements with respect to design specifications and criteria.
- The security/safeguards improvement project office is responsible for assuring comments on small jobs or work orders are resolved and the design package is approved.
- The HSE QA Coordinator is responsible for assuring comments on the project are resolved and design package is approved for large construction projects.

CONCERN: None.

SS.3 EMERGENCY ACCESS

PERFORMANCE OBJECTIVE: Authorized facility and safety support personnel should not be denied access or exit in an emergency.

FINDINGS:

- o During an emergency readiness drill conducted on 5/16/89, emergency response vehicles were observed to respond to the reactor site unimpeded with the first fire truck responding within five minutes of notification.
- o Exit from the OWR building doors is unimpeded by locks. Crash bars are installed on many of the doors.
- o Two evacuation routes from the OWR site are available: west on a paved road up the canyon, and east on an unpaved rough road to State Highway 502 which is 3.6 miles away.
- o OWR personnel drive the east evacuation route monthly. The keys to the three gates for the east evacuation route are kept in the control room and by the security force. The security force would provide the keys if the control room keys were missing.
- o The east evacuation road is inspected and maintained annually.
- * There is one 4-wheel-drive (3/4 ton pickup truck) emergency vehicle at OWR to transport evacuees to the east. The vehicle does not have the capacity to carry all personnel who might be at the reactor site.
- * Vehicle logs at the site showed that the 4-wheel-drive emergency vehicle is used for non-emergency purposes 10-15% of the time, during which no backup vehicles are provided for response to emergencies.
- * It would be impossible for a two-wheel-drive vehicle with conventional road clearance to negotiate the east evacuation route.
- * Evacuation by foot would be slow.
- * During a tour of the reactor site on 5/18/89, two exit doors (the east double door at the Water Boiler Reactor Room and the double door at the shop loading dock) were observed to have boxes and a liquid nitrogen dewar obstructing the exits. The exits were immediately cleared after OWR staff was informed.

* The door marked "EXIT" from the Water Boiler Reactor Room to the staff shop was obstructed with stored materials. There was an adjacent door unobstructed.

CONCERN: (SS.3-1) Observations during the appraisal indicate that that emergency egress from the facility and evacuation routes away from the site have not been completely and adequately evaluated.

SS.4 FACILITY PLANNING FOR SECURITY/SAFEGUARDS EMERGENCIES

PERFORMANCE OBJECTIVE: Safety authorities and responsibilities for all types of security/safeguards emergencies should be clearly defined and understood by all involved parties.

FINDINGS:

- o Operational Security and Safeguards (OS) General Security Order 21, Procedure 27, Station Order 316, and the Emergency Response Plan define responsibilities of security and emergency response personnel.
- o The OS Safety Management Plan requires that Protective Force inspectors be trained and maintain proficiency.
- o HSE provides training to the Protective Force inspectors with respect to emergency response in radiation protection, safety, industrial hygiene, chemical safety upon entry into the Protective Force and semiannually thereafter.
- * The responsibilities of the OWR operations personnel during a safeguards/security emergency at the OWR building are not defined in the Omega Site Emergency Plan.

CONCERN: See Concern ER.2-1.

SS.5 SAFETY OF SECURITY ACTIVITIES

PERFORMANCE OBJECTIVE: Safety aspects of security activities involving use of weapons and other protective force equipment in the vicinity of safety systems and/or hazardous materials should be identified and understood by all involved parties.

FINDINGS:

- o Potential consequences of incidents using weapons, vehicles, protective force equipment or missiles at the OWR site and within the OWR building would be minimal. The design of the reactor and ancillary equipment would mitigate loss of coolant accidents.
- o Weapons training, firing range safety training, and the administrative measures used by the Protective Force would minimize risks due to missile incidents in OWR.
- o The OS Safety Management Plan requires initial and semiannual training in weapon and firing range safety.
- o General Orders and SOPs provide for lesson plans, examinations of OS inspectors for proficiency exercises, retaining records of examinations, and 80 hours of on-the-job training under supervision.
- o The armed field force Protective Force of 300 inspectors and supervisors will receive 61,000 person-hours of training this year.
- * The Omega Site Emergency Plan does not address safeguards/security emergencies at the OWR complex.
- * Protective Force personnel are trained in their general emergency response duties during an emergency. However, they are not trained on the Omega Site Emergency Plan and site-specific responses.
- * During the 5/16/89 emergency readiness drill, the Central Alarm System inspectors and the Protective Force inspectors participated and carried out their duties of perimeter control. However, they did not participate in the critiques conducted after the drill.

CONCERN: (SS.5-1) Emergency readiness planning and training of Protective Force personnel for safeguards/security emergencies at the reactor site are not site-specific and do not cover the Omega Site Emergency Plan.

I. EXPERIMENTAL ACTIVITIES

This element of the TSA covers safety review and approval requirements for experiments, the structure and functions of the committee that performs the independent safety review, the information requirements for experiment proposals, and the interfacing of experimenters and OWR staff for experiment safety.

The review, authorization, and control of experimental activities is achieved through a well-developed and documented multi-level system designed to fit the degree of reviews required to the potential hazards of the proposed experiments.

The OWR Operating Procedures and the Technical Specifications adequately detail the safety review requirements and mandate the review and approval chains, including the LANL Reactor Safety Committee and higher authorities for certain classes of experiments.

Experimenters have adequate knowledge and experience relative to their experiments and have a good understanding of their obligations with respect to the facility. Facility personnel have an appropriate level of knowledge of the potential hazards of the experiments.

EA.1 INTERFACE WITH EXPERIMENTERS

PERFORMANCE OBJECTIVE: Persons conducting experiments in or with the facility should have their relationship to the operating group clearly defined.

FINDINGS:

- Sections 5.0 and 6.0 of the OWR Operating Procedures provide the requirements for sample records, authorization of sample irradiations, and procedures and cautions for use of the sample irradiation facilities.

- The OWR Operating Procedures require experimenters wishing to use the OWR facilities to become familiar with the hazards at the OWR. Familiarity is obtained by review of the several safety documents specified in the "TA-2 Employee Responsibility Sheets," which each must sign before beginning work.

- As required in Section 1.0 of the OWR Operating Procedures and Section 6.4 of the Technical Specifications, the OWR Committee must review and approve in-core and other experiments that might affect the safety of the reactor or personnel, all long-term vertical port experiments, and long-term or major beam port experiments.

- Such reviews and approvals are based on SOPs which the facility staff requires to be prepared to describe the experiment and its operation and specify the principal hazards and associated controls. The SOPs define any required interfaces between the experimenters and operations personnel and receive the required HSE reviews. Work Plans might also be required to guide insertion/removal of the experiment.

- Outside experimenters must pass through the OWR control room to reach their experimental areas and must advise the console operator of their plans. Considerable familiarity is thus gained by operations personnel as to who is associated with what experiment, what is currently taking place, and who should be contacted if any unusual conditions develop. Further, operations personnel advise experimenters of any special conditions relative to reactor startup, shutdown, and power level change plans.

- The OWR Operating Procedures require experimenters to obtain control room personnel consent or action to move

beam tube shutters. Such changes are entered in the console log.

- Use of the manually controlled pneumatic and hydraulic irradiation facilities (rabbits) has to be enabled by the control room personnel, who log sample identification and start and stop times.

- The automated rabbit is operated only by OWR personnel, who obtain control room approval for their irradiations. The sample identification and start and stop times are logged.

- Interviews with the OWR Deputy Group Leader and two principal investigators indicated that the experimenters in general have many years experience with the OWR or similar reactors, have advanced scientific degrees, and are well acquainted with facility operations.

- Interviews regarding several current experiments were held with the reactor supervisor and a certified operator. The discussions revealed that they knew the identity of the principal investigators and were adequately familiar with the nature of the experiments and the associated hazards. Further, they stated they made it a habit to be watchful for any changes in conditions with respect to the various experiments.

CONCERN: None.

EA.2 EXPERIMENT SAFETY REVIEW COMMITTEE

PERFORMANCE OBJECTIVE: A safety review committee should be available to review the safety impacts of experiments. This committee is part of the "Contractor Independent Review and Appraisal System" specified in DOE 5480.5, DOE 5480.6, and DOE 5482.1B, Section 9.d.

FINDINGS:

- The LANL Reactor Safety Committee (RSC) is the committee that performs the independent safety review of experiments at the OWR. The RSC also performs the independent safety review of the reactor-safety-related aspects of OWR operations.
- Information concerning the RSC charter, membership, operation, etc. is given in the Facility Safety Review section of this report, principally in Section FR.1.
- Information regarding the distribution of experiment review and approval authority between the RSC and the OWR Committee is given in Section EA.3.

CONCERN: None.

EA.3 EXPERIMENT CATEGORIES

PERFORMANCE OBJECTIVE: All proposed experiments should be approved before they are performed.

FINDINGS:

- o In accordance with the requirements of the OWR Technical Specifications and the OWR Operating Procedures, review and approval of experiments, including rabbit sample irradiations, are accomplished through a tiered system which clearly defines the level at which approvals of experiments may be made.

- o Section 6.1 of the OWR Operating Procedures specifies the rules for authorizing rabbit irradiations and packaging of small samples when past experience in the kinds and amounts of materials is applicable. Approvals at the level of reactor supervisor, operations supervisor, OWR Committee member, or the full OWR Committee may be required depending upon the degree of congruity to past experience.

- o The OWR Committee, as charged in Section 1.1.2 of Operating Procedure 1.0 and Section 6.2 of the Technical Specifications, is required to review and approve those irradiations and experiments which might affect reactor safety or availability; might result in appreciable contamination; or are proposed for in-core, long term vertical port, or beam hole positions.

- o Experiments and irradiations approved by the OWR Committee that present unique, significant safety questions require RSC approval.

- o Those experiments thought to present an Unreviewed Safety Question require RSC and DOE review and approval.

- o OWR Committee functions, membership, quorums and other matters are defined in Section 6.2 of the Technical Specifications.

- o The OWR Committee informs the RSC of all its actions by copy of the OWR Committee minutes.

- o The RSC may accept the OWR Committee review and approval or may open the matter to further discussion.

- o The OWR Committee held a meeting on May 4, 1989 to consider measuring the reactivity worth of a He-3 detector. Observation at the meeting indicated that

the Committee did a professional job of considering the various reactor safety issues involved and in meeting the applicable requirements of the OWR Operating Procedures and the Technical Specifications.

- o A review of the credentials of the OWR Committee indicated its members are well qualified to perform their functions.

- o A review of the OWR Committee minutes indicated they are of acceptable quality and are auditable.

CONCERN: None.

EA.4 EXPERIMENT PROPOSAL

PERFORMANCE OBJECTIVE: Sufficient information on a proposed experiment should be submitted to permit a safety evaluation to be made.

FINDINGS:

- o OWR Operating Procedure 1.0 requires that for significant beam tube, in-reactor, and in-core experiments, the OWR Committee is to review and approve the experiments. The facility staff requires the experimenter to provide an SOP, as defined in the LANL Health and Safety manual.

- o The SOP requirements address:

  - assignment of authority for preparing the SOP,
  - experiment and equipment description,
  - operating procedures,
  - identification of hazardous operations and materials,
  - safety procedures and safety devices,
  - possible failures and emergency procedures,
  - responsible experimenter(s),
  - experimenter approval requirements, and
  - facility staff and HSE Division approval requirements.

- o Work Plans for installation and removal of experiments are required, as appropriate.

- o For the above-mentioned experiments, Section 1.2.2 of OWR Operating Procedure 1.0 and Section 4.5 of the Technical Specifications apply. The OWR Committee specifies and approves the quality assurance procedures to be carried out before installation.

- o Precautions and/or design changes resulting from OWR Committee and RSC review are incorporated in the SOP, as are any changes resulting from operating experience with the experiment.

- o Discussions with the OWR Deputy Group Leader concerning the current "outside" experimenters using the OWR, and

personal interviews with two of them who are major experimenters, indicated the experimenters generally have excellent backgrounds and training relative to their experiments.

- o Review of an SOP for an in-core experiment and review of a typical Work Plan indicated that adequate scope and depth were provided for each case.

- * A one-gallon can containing 150 grams of ammonia nitrate was found in a non-food refrigerator in the OWR lunch room. The material was dated 1985 and was used to provide samples for an OWR experiment performed in one of the rabbit facilities in the spring of 1986.

CONCERN: See Concern PP.2-1.

EA.5 OPERATION OF EXPERIMENTS

PERFORMANCE OBJECTIVE: Experiments performed in reactors or process facilities or experiments performed with a reactor should not present undue risks.

FINDINGS:

- o SOPs are prepared for significant experiments. (See the discussion of SOP requirements in Section EA.4.)
- o Responsibilities for experiment safety and installation are covered by the SOP and augmented by a Work Plan as appropriate.
- o Interviews with an experimenter and several operations personnel regarding a particular experiment indicated:
  - All were aware of the nature of the experiment and the degree of hazards involved.
  - Facility operators note any changes in facility equipment operation, including experiment equipment, and report any significant changes to the experimenter and to facility management, as required.
  - Significant abnormalities are reported and corrective action taken.
- o Facility management is knowledgeable of the requirements of DOE 5000.3, Unusual Occurrence Reporting System, and DOE 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements, for reporting abnormal occurrences.

CONCERN: None.

J. FACILITY SAFETY REVIEW

This performance area evaluates the structure and functions of the independent safety review committee; the items that require review by the committee; the mechanisms by which the committee receives, processes, and approves matters brought before it; areas for the committee's annual appraisal of the facility; and the requirements for the triennial appraisal of the committee's activities by management.

The safety review program for the OWR is well developed and managed. The OWR Committee, composed of facility personnel having appropriate background and experience, provides the first level of safety surveillance and review at the OWR.

The LANL Reactor Safety Committee (RSC) provides the independent reactor safety review functions specified in DOE 5480.6, Safety of DOE-Owned Reactors. The RSC is multi-disciplined and generally adequately covers the facility and experiment reviews and facility appraisals required for reactor safety. However, several discrepancies were found with respect to Technical Specifications.

The RSC is overseen by the Health, Safety, and Environment Council, a top management body which, among other responsibilities, is assigned and satisfactorily performs the triennial reviews of the RSC.

The RSC charter requires review of quality assurance and radiological, fire, and personnel protection activities during the annual facility appraisals. Necessary expertise is provided by the HSE on an ad hoc basis.

The Isotope and Nuclear Chemistry (INC) Division's Safety Committee performs quarterly industrial safety inspections of the OWR.

FR.1 SAFETY REVIEW COMMITTEE

PERFORMANCE OBJECTIVE: A safety committee should be available to review safety questions.

FINDINGS:

- The LANL Reactor Safety Committee (RSC) provides the contractor independent safety review and appraisal of reactor safety matters required by DOE 5480.6. It also provides independent safety review of experiments performed using the OWR.
- The current charter for the RSC, dated 2/3/89, fulfills all the requirements of DOE 5480.6, 8g.
- The RSC serves as an agent of the LANL Director and its members report directly to the LANL Director's Office.
- The RSC may approve certain matters, as defined in the charter, by issuance of its meeting minutes through an official distribution list which includes the LANL Director's Office; the Health, Safety, and Environment Council; and the line management of the affected facility and the facility management.
- The RSC recommends approval to the LANL Director's Office for matters which are to be sent to DOE for review and approval.
- The RSC utilizes additional ad hoc members with expertise in quality assurance, radiological protection, fire protection and personnel protection when performing the annual facility safety reviews of the OWR.
- The RSC consists of ten members, including two who are not directly associated with LANL. A review of the credentials of the LANL members indicated a more than adequate depth and breadth of expertise in reactor design, operation, and safety reviews.
- One member of the RSC is the OWR Group Leader who is responsible for the operation of the OWR. He does not vote on OWR matters.

CONCERN: None.

FR.2 SAFETY REVIEW TOPICS

PERFORMANCE OBJECTIVE: Items that require review by the safety committee should be well defined and understood by facility management.

FINDINGS:

- o In addition to the RSC, the facility committee (the OWR Committee) gives the initial review and approval for facility safety matters.
- o OWR Operating Procedure 1.0 requires OWR Committee review and approval of (1) proposed changes to the reactor safety system, (2) significant functional changes in major reactor equipment, (3) proposed experiments and irradiations which could have significant effects, and (4) in-core experiments and certain long term vertical port or beam hole experiments.
- o Items 1 and 2 above and experiments that could have significant safety effects are sent to the RSC for review and approval after OWR Committee approval.
- o The RSC is kept informed of all other OWR Committee matters by copy of the OWR Committee minutes.
- o Discussions with the RSC Chairman indicated his agreement with the selection of items forwarded by the OWR Committee to the RSC for approval.
- o Section 5.2.5 of the OWR Operating Procedures requires the OWR Committee to specify the extent of quality assurance (QA) procedures to be carried out before installation of in-core experiments. Also, the Committee determines the extent to which system or equipment modifications or new components are reactor-safety-related and specifies the required QA procedures. The RSC is informed of these actions by copy of the OWR Committee minutes. The RSC examines QA activities during the annual appraisals of the facility, as now required by the RSC charter.
- o OWR management understands they may invite RSC review of any items they feel may have safety significance. They have exercised this option informally on several occasions to obtain policy advice and have been interacting with the RSC on safety questions related to the proposed new reactor control system addition. OWR management has also requested assistance from the RSC on matters related to safety-security interfaces at the facility.

- o Section 6.5.2 of the Technical Specifications requires that Unusual Occurrence Reports (UORs) be sent to the RSC for review and approval following OWR Committee approval of the OWR group's investigation, analysis, and corrective action decisions. UOR-87-02 and the UOR covering the 1/14/89 motor-controller failure were sent to the RSC for review and were discussed in the 141st and 154th RSC meetings, respectively.

- * The root cause analyses of some UORs were found to be inadequate.

CONCERN: See Concern OA.4-1.

FINDINGS:

- o The RSC charter requires RSC review and approval of changes to the Technical Specifications and reports of violations of Technical Specifications.

- * In spite of the review requirements in place, questionable practices and documentation deficiencies occurred:

  - The methods of testing Core Sprays 1 and 2 do not verify that the minimum flow rates can be achieved.

  - The charcoal filter for the surge tank vent is not tested in place.

  - There is an unacceptable lack of detail in some procedures for performing Technical Specification surveillance tests. (See Section TS.4.)

  - No justification can be found for the Technical Specification permitting one of the two core spray systems to be out of service for up to two days.

CONCERN: (FR.2-1) The process for review, approval, and implementation of the Technical Specifications failed to identify several questionable practices with respect to the core spray systems and the interpretation of and procedures for performing surveillance tests.

FR.3 OPERATION OF SAFETY COMMITTEE

PERFORMANCE OBJECTIVE: Review of facility activities by the safety committee should ensure achievement of a high degree of safety.

FINDINGS:

- Informal contacts between the OWR Group Leader and the RSC are frequent. (See Section FR.2.)
- The RSC is immediately apprised by facility management of any abnormal occurrences. In cases where radiation doses have exceeded onsite or offsite limits, or a Technical Specification has been violated, a special meeting of the RSC would be called. Otherwise, the RSC would review the incident following receipt of the associated UOR via regular copy to the RSC.
- Concerns raised by facility management and passed on to the RSC for review are handled through a standard procedure. The RSC Chairman notifies the members of the date and topic of the associated meeting and provides any pertinent information. Information copies are sent to the LANL Director and Deputy Director; the Health, Safety, and Environment Council Executive Secretary; the line management chain; and the facility manager.
- RSC approvals are noted in the meeting minutes, and are distributed as above.
- For review requests to be sent to DOE for approval, the RSC recommends approval to the Laboratory Director, using the distribution listed above.
- If the RSC had reservations concerning giving any approval, it would so note in the meeting minutes. Upon resolution of the reservations, the RSC would advise the LANL Director's Office of its approval. The LANL Director's Office would issue formal approval to the facility and its line management.
- Review of the RSC meeting minutes from January 1987 through April 1989 indicates they were of good quality and acceptable in scope and depth.

CONCERN: None.

FR.4 ANNUAL FACILITY SAFETY REVIEW

PERFORMANCE OBJECTIVE: An annual operating review of the facility should be performed by a committee appointed by top contractor management.

FINDINGS:

- The RSC charter requires the performance of annual appraisals of the LANL reactor facilities.
- The areas specified by the charter to be covered include all the items required by DOE 5480.6, 8.g.(8).
- Quality Assurance (QA), radiological protection, fire protection, and personnel protection are new areas which are to be reviewed, as required by the current charter. Ad hoc members will be appointed by the Associate Director for Support to provide the necessary expertise in these areas.
- Each RSC member is provided advance copies of documentation on the history of operations in the appraisal period and other pertinent documentation available.
- The annual review is conducted as an RSC meeting at the facility site.
- The facility manager usually gives a briefing on the significant activities of the appraisal period.
- The RSC gives special emphasis to follow-up of previous RSC recommendations and the recommendations of other entities.
- Review of the minutes for the three previous annual appraisals showed them to be acceptable for third party review, although there was a decrease in the amount of detail given in the minutes of the most recent meeting.

CONCERN: None.

FR.5 TRIENNIAL APPRAISAL OF FACILITY SAFETY REVIEW SYSTEM

PERFORMANCE OBJECTIVE: A triennial appraisal of the safety review system should be performed by contractor management.

FINDINGS:

- The Reactor Safety Committee (RSC) charter requires the Health, Safety, and Environment Council (Council) to review the RSC for adequacy of performance every three years.
- Minutes of RSC meetings are routinely distributed to the LANL Director's Office and to the Council's Executive Secretary, who supplies copies to Council members. Thus, the Council is continuously apprised of the RSC's activities.
- The RSC provides an annual summary report of its activities to the same distribution.
- To facilitate preparation of the Council for the review, the RSC Chairman usually makes a formal presentation summarizing the RSC's activities for the appraisal period.
- The Council has as its members the top line managers from the scientific divisions and HSE, assuring capability for judging the performance of the RSC.
- Triennial appraisals were performed in December 1980, November 1983, and December 1986. The records of the 1983 and 1986 appraisals were reviewed and were found to be of adequate quality.
- Interviews with the principal staff of the OWR indicated they have a high regard for the technical capabilities of the RSC members and are pleased with the RSC's responsiveness to OWR needs.

CONCERN: None.

K. NUCLEAR CRITICALITY SAFETY

For reactors, this topic is addressed in Sections TS.9 and AX.3.

L. RADIOLOGICAL PROTECTION

The OWR radiation protection program appraisal was based on a review of the LANL Health and Safety manual, DOE Orders, applicable American National Standards Institute (ANSI) standards and records. The review was supplemented by observations of radiological protection activities at the OWR site; inspections of dosimetry, calibration, and respiratory protection facilities; and discussions with OWR and HSE staffs and management. Items formally identified by LANL as needing an extension for compliance with DOE 5480.11, Radiation Protection for Occupational Workers, were appraised against DOE 5480.1A, Environmental Protection, Safety, and Health Protection Program for DOE Operations, Chapter XI requirements.

HSE is responsible for providing occupational radiological safety support to the OWR facility. All levels of HSE management appear to be well qualified and have impressive professional credentials. The health physicists and health physics technicians appear to be well qualified and dedicated to the protection of workers at the OWR site. A resident health physics technician is assigned to the OWR on a full time basis and is supplemented as needed from the Operational Health Physics (OHP) technician pool. Frequent OHP management involvement and oversight was observed during site visits.

The radiation protection program policies are well stated in the Administrative Requirements of the LANL Health and Safety manual. However, implementation of these policies through technically sound, approved procedures did not meet DOE or industry standards. This incomplete or non-existent procedural guidance resulted in program weaknesses in posting, contamination control, source leak testing, record keeping, air monitoring, and As Low As Reasonably Achievable (ALARA).

Several aspects of the radiation protection program at the OWR were recently upgraded and implemented; however many personnel are not comfortable with them. For example, controlled and radiological areas were identified and posted in accordance with the recently issued DOE 5480.11 requirements. However, a lack of familiarity and understanding of these new requirements and inadequate implementing procedures resulted in personnel leaving the controlled area without being monitored for contamination, inadequate contamination controls for controlled areas, and a failure to clearly define the boundaries of radiation areas.

Finally, the radiological measurements program supporting OWR is very good. Whole body and extremity dosimetry was appropriate for the application intended and was used as required by LANL policy. External dosimetry evaluations received accreditation from the DOE Laboratory Accreditation Program in all categories available. An adequate complement of radiological instruments was available at the OWR. All instruments were operational, calibrated, tested, and used properly by

the resident health physics technician. The instrument maintenance and calibration program met or exceeded ANSI standards and no problems with instrument calibrations were detected.

RP.1 ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: Facility organization and administration should ensure effective implementation and control of radiological protection activities within the facility.

FINDINGS:

- HSE line management responsibilities and specific responsibilities of Radiation Protection (HSE-1) management are defined in the LANL Health and Safety manual policies. Individual HSE-1 staff member responsibilities are defined annually in the form "Job Assignment for Next Review Period."

- The responsibilities of the resident health physics technician at OWR are specified in "Routine Monitoring Instructions for the Omega Research Reactor" (HSE-1-OHP-RMI-06-RO).

- "General Radiation Safety Procedures and Controls at Omega Site (TA-2)" (SOP #1) specifies the general radiation safety procedures and controls for working with radioactive material at OWR. This SOP has been reviewed and approved by OWR line management.

- Interviews with OWR and HSE-1 line management and observations of daily activities indicate the existence of good rapport between the two groups. Communications are frequent and open. Health physics support is requested often during normal and abnormal operations.

- OWR line management and operators maintain a good level of knowledge of existing radiological conditions and safety requirements.

- The health physics technician is authorized to stop unsafe work until OWR management and HSE negotiate a solution.

- HSE has established an internal appraisal program which meets the requirements of DOE 5482.1B, Environment, Safety, and Health Appraisal Program, Section 10, and DOE 5480.1A, Chapter XI. The appraisals are scheduled to cover all areas during a three year period and are performed by personnel independent of the area or facility being audited. See Section RP.2 for more detailed information.

CONCERN: None.

RP.2 INTERNAL AUDITS AND INVESTIGATIONS

PERFORMANCE OBJECTIVE: The internal audit program for both routine operations and unusual radiological occurrences should provide adequate performance assessments.

FINDINGS:

- o HSE has an established internal appraisal program designed to meet the requirements of DOE 5482.1B, Section 10 and DOE 5480.1A Chapter XI. The health and safety appraisal program is described in the Health and Safety manual, Administrative Requirement 1-5. A three-year cycle has been established for appraisals of all LANL divisions and major facilities.

- o HSE has developed six operational and 11 facility performance objectives and supporting criteria which address all pertinent radiation protection program elements.

- o The internal appraisal team is comprised of individuals who are knowledgeable in radiation protection but are independent of the programs appraised.

- o The internal appraisals are scheduled to evaluate all radiation protection performance objectives every three years.

- o Internal appraisals in 1986 and 1987 addressed three and four performance objectives respectively, at a few locations receiving HSE support.

- o The 1986 Internal Health Physics Audit appraised the involvement of the health physics technician on radiation experiments at OWR and found his involvement to be adequate.

- o LANL policy and procedures for accident and incident reporting are specified in the LANL Health and Safety manual, Administrative Requirement 1-1. Reporting criteria for radiation occurrences are specified on the back of the Radiation Occurrence Report form (HSE Form Number 3-1B).

- o The LANL internal radiation occurrence reporting system requires investigation of radiation occurrences, identification of specific causes, and corrective actions.

- * Trend analysis was not being used to identify generic similarities between incidents or to determine root causes.

* On 5/15/85 an OWR operator became contaminated while assisting in the removal of a lower through port tube. Skin and shirt contact contamination levels of 5 mR/hr and nose swipes in excess of 41,000 dpm were measured. Radiation Occurrence Report AHP-85-2 was issued, but associated records do not provide adequate evidence of recommended corrective actions or a determination of the root cause of the occurrence.

* On 4/3/86 four personnel stationed at the OWR were exposed to a potentially hazardous situation while changing components in the West End Port. In removing the neutron filter material to gain access to the components, the filter was found to be producing much higher radiation fields than anticipated. Radiation Occurrence Report AHP-86-4 was subsequently issued. However, records do not provide evidence of adequate corrective actions or a determination of the root cause of the occurrence.

CONCERN: See Concern OA.4-2.

CONCERN: (RP.2-1) Determination of root causes and identification and follow-up of corrective actions for radiation occurrences at the reactor are insufficient to preclude recurrence.

RP.3 RADIOLOGICAL PROTECTION PROCEDURES AND POSTING

PERFORMANCE OBJECTIVE: Radiation protection procedures for the control and use of radioactive materials and radiation generation devices should provide for safe operations and for clearly identifying areas of potential hazards.

FINDINGS:

- o The procedure development, review, and approval system is controlled by the document control procedure for HSE-1 (OHP-HSE-1-QP-01). The HSE-1 Section Leader is responsible for HSE-1 document control and approval. An annual review of all HSE procedures is required by this procedure.

- o Administrative Requirement 1-3 of the Health and Safety manual requires all work with safety implications to be performed under an SOP or a Special Work Permit. HSE includes the SOP Office which was tasked to coordinate HSE reviews of SOPs and maintain a LANL-wide SOP database. SOPs are required to be reviewed initially, annually, and after major job changes.

- o The two procedures pertaining to radiation protection at OWR (SOP #1 and HSE-1-OHP-RMI-06-R0) have been approved by both operations and HSE. Survey forms were completed and posted as specified in procedures. Completed forms were reviewed by HSE and Operations prior to posting. The units on the airborne contamination data sheet were not consistent with DOE 5480.11 Attachment 1, Table 1 or DOE 5480.1 Attachment XI-1, making direct comparisons difficult.

- o OWR was posted to meet the requirements of DOE 5480.11, Section 9K. The facility posting was evaluated against DOE 5480.1A, Chapter XI requirements because full implementation of DOE 5480.11 posting requirements is scheduled for completion in December 1989. All postings observed complied with DOE 5480.1A, Chapter XI.

- o OWR had no radiation generating devices.

- * Current radiation protection procedures do not contain sufficient information to fully document and implement the radiation protection program.

  - Several areas and rooms within OWR were posted with "authorized personnel only." Procedures did not specify who was "authorized". Interviews with several OWR employees indicated no one knew what "authorized" meant.

- Procedures did not provide adequate instructions to ensure that all personnel, equipment, and tools leaving the controlled area were surveyed by trained and qualified personnel.

- OWR had no personnel or equipment decontamination procedure.

- HSE procedures did not provide specific events or criteria for requiring special biological evaluations. In addition, not all procedures used for internal dose evaluations were completed and approved.

- Internal dosimetry results are reviewed by the Assistant Group Leader monthly. Professional judgement is used to determine when a detailed investigation should be initiated as a result of an abnormal trend. No procedural guidance or criteria exist.

- Professional judgement was also used to determine work restrictions to be implemented as a result of confirmed or suspected internal depositions. No procedural guidance or criteria exist.

- Procedures providing posting criteria did not exist. As a result, the boundary of a radiation area near the equipment building was not clearly identified. SOP #1 did reference DOE 5480.11 posting requirements, but this did not provide sufficient information to the radiation protection technician.

- A procedure for monitoring personnel, tools, and equipment leaving the controlled area did not exist. Vague wording in the survey requirement confused two persons who failed to perform an individual radiation survey when leaving the controlled area. Contamination limits stated in OWR SOP #1 do not specify fixed, removable, or total contamination.

- Administrative Requirement 3-1 of the LANL Health and Safety manual requires use of exposure monitoring devices or dosimeters if an individual's dose is expected to exceed 10% of annual dose standards. It is not clear whether the requirement applies to extremity dosimetry. In addition, when radiation protection personnel were asked what

projected extremity dose would require dosimetry, they provided a dose level that was not consistent with 10% of the annual dose standard for extremities.

- No criteria were provided for when elevated protective measures (e.g., barricades, lockout, etc.) are to be implemented.

- An approved procedure for performing sealed source leak tests per Administrative Requirement 3-4 did not exist. However, a procedure had been drafted for review.

CONCERN: See Concern OA.1-2.

FINDINGS: * Administrative Requirement 3-4 of the Health and Safety manual requires periodic leak testing of Class II sources. Radioactive A-73, CO-0011, and SN-1170 were not leak tested in accordance with the testing requirement.

CONCERN: (RP.3-1) Sealed source leak tests are not being performed as required in Administrative Requirement 3-4 of the LANL Health and Safety manual.

RP.4 EXTERNAL RADIATION EXPOSURE CONTROL PROGRAM

PERFORMANCE OBJECTIVE: External radiation exposure controls should minimize personnel radiation exposure.

FINDINGS:

- The policy on external radiation exposure control at OWR is provided in Administrative Requirement 3-1 of the LANL Health and Safety manual. Implementation of this policy is guided by OWR SOP #1 and HSE-1-OHP-RMI-06-RO.

- A very effective external exposure control program was in effect at the OWR. Critical components of this program were comprehensive and well documented radiological surveys, appropriate posting, good health physics coverage of radiation work, and application of As Low As Reasonably Achievable (ALARA) principles by the OWR staff. This has resulted in a "reasonable" total dose of 2-3 person-rem per year for the facility.

- Routine surveys to determine dose rate levels and contamination levels are performed weekly, unless required more frequently by job requirements. Contamination sample analysis previously required one week to return results to OWR, but this has been reduced to one or two days due to recent upgrades in analysis capability. Survey results are reviewed by HSE and Operations and posted at the entrance of the controlled area.

- Where effective, special controls were used to minimize exposure to the skin and eyes. Technical Bulletin 1201 (August 1984) and HSE Newsletter Issue 16 (March 1989) discuss the requirement for wearing glass eyeshields when working with beta sources.

- The inclusion of radiation safety concerns in job planning was evident. Methods of minimizing source terms, contamination control, and use of shielding were considered for job planning. Allowance for decay of short-lived activation products has proven very valuable to controlling doses at OWR. Job planning did not include a dose projection for specific jobs.

- Exposure trends for OWR staff were plotted each month by the radiation protection technician. This data was reviewed by HSE management during periodic walk throughs of the facility. Since ALARA goals were not developed, exposure trends were not compared to goals.

CONCERN: None.

RP.5 EXTERNAL DOSIMETRY (ROUTINE AND ACCIDENT USE)

PERFORMANCE OBJECTIVE: The routine and accident personnel dosimetry programs should ensure that personnel radiation exposures are accurately determined and recorded.

FINDINGS:

- The LANL policy on external radiation dosimetry is stated in Administrative Requirement 3-1 of the Health and Safety manual. This policy meets the requirements of DOE 5480.1, Chapter XI, 4a(2)(d).

- The LANL whole body dosimeter is a four-thermoluminescent-chip badge that is sensitive to penetrating, non-penetrating, and neutron radiation. This dosimeter received accreditation from the DOE Laboratory Accreditation Program on 10/30/87 in all categories available.

- All dosimeters are collected by the External Dosimetry subsection on a monthly frequency. Dosimeters are evaluated by well qualified and experienced personnel with adequate equipment. Penetrating and non-penetrating dose results are determined using a single algorithm. Neutron dose results are determined using calibration factors developed from job-specific characterizations.

- HSE selected 410 mrem/month as an official investigation level. However, both the External Dosimetry subsection and the Operational Health Physics (OHP) section investigated abnormal exposures significantly below this level and applied corrective action as appropriate.

- Dosimetry reports were sent to all Division heads for review and dissemination and to HSE for review and evaluation. Dosimetry reports for OWR employees were filed in the radiation protection technologist's office at OWR. Records of personnel exposures and the assessment methods used were permanently maintained on magnetic disk and on a hard copy.

- Unless more reliable information is available, personnel with lost dosimeters are assigned a dose value equal to the average of the previous three months.

- The need for nuclear accident dosimetry was evaluated by the OWR group, HSE-1, and the Criticality Safety group. It was determined that nuclear accident dosimeters were not necessary at the OWR.

* Extremity dosimetry consists of a two-thermoluminescent-chip finger ring for each hand. These are provided to workers when the potential exists for exceeding 200 mrem to the upper extremities. This criteria is not specified in procedures.

CONCERN: See Concern OA.1-2.

RP.6 INTERNAL RADIATION EXPOSURE CONTROL PROGRAM

PERFORMANCE OBJECTIVE: Internal radiation exposure controls should minimize internal exposures.

FINDINGS:

- Special Work Permits (SWPs) for radiation work are prepared for non-routine jobs and other activities that are not covered by standard operating procedures. Radiological precautions are specified and taken to prevent the generation of airborne radioactivity and minimize the spread of contamination.

- Weekly smear surveys at the OWR complex are performed by the health physics technician in accordance with HSE-1-OHP-RMI-06-RO, at 85 preselected locations. Smears taken in the reactor room are prescreened by the technician prior to being sent to the Health Physics Analysis Laboratory for analysis. Results are normally received within five days.

- Eating, drinking, smoking, and chewing are not permitted in contaminated or potentially contaminated areas. No violations of this rule were observed.

- Airborne radioactivity areas are not permitted to exist on a routine basis at the OWR. The use of respiratory protection equipment is generally reserved for jobs requiring SWPs (i.e., filter changeout and shield plug removal).

- Contamination areas are also not permitted to exist on a routine basis at the OWR. Any detectable contamination is immediately cleaned up.

- Irritant smoke tests of all persons donning respirators are performed by the health physics technician. Any person failing the test twice must be re-certified by the Industrial Hygiene Group prior to using a respirator at OWR.

- The health physics technician maintains a file of in-vivo results for OWR personnel. A review of the results obtained since 1987 indicates no uptakes as a result of OWR operations.

- Interviews with OWR personnel indicate they are aware of the results of in-vivo counts and are committed to maintaining internal exposure levels ALARA.

CONCERN: None.

RP.7 INTERNAL DOSIMETRY

PERFORMANCE OBJECTIVE: The internal dosimetry program should ensure that personnel radiation exposures are accurately determined and recorded.

FINDINGS:

- o The LANL policy for biological monitoring of radioactive materials is in Administrative Requirement 3-6 of the Health and Safety manual.
  - o HSE determined in 1982 that in-vitro monitoring of OWR personnel would be terminated in favor of in-vivo monitoring. The routine program consists of annual whole body, liver, and lung scans for personnel assigned to OWR.
  - o The in-vivo monitoring program is described in In-Vivo Assessment of Whole Body Radioisotope Burdens at the Los Alamos National Laboratory (LA-9858-MS), and In-Vivo Assessment of Lung Burdens at the Los Alamos National Laboratory (LA-9979-MS). These documents contain a derivation of the minimum detectable true activity which is used to trigger an investigation of a suspected intake.
  - * The In-Vivo subsection performing biological evaluations has the capability to calculate committed dose from radioactivity deposited in the body. Not all calculation procedures for determining committed dose had been completed.
  - * Administrative Requirement 3-6 of the LANL Health and Safety manual designates health physics personnel responsible for determining the type and frequency of biological monitoring. HSE procedures do not provide specific events and criteria for requiring special in-vivo evaluations. Specifically excluded are evaluations triggered as a result of significant personnel contamination, puncture wounds in radiological areas, and termination of employment.

CONCERN: See Concern OA.1-2.

RP.8 FIXED AND PORTABLE INSTRUMENTATION (NORMAL AND EMERGENCY USE)

PERFORMANCE OBJECTIVE: Radiological protection instrumentation used to obtain measurements of radioactivity or personnel dosimetry should be calibrated, used, and maintained so that results are accurately determined.

FINDINGS:

- The LANL policy on radiological instrumentation is in Administrative Requirement 3-2 of the Health and Safety manual.
- New instrument specifications are developed by the Instrument and Calibration subsection with input from the OWR staff and Operational Health Physics (OHP).
- The complement of instruments was observed to be adequate for both routine and emergency response at OWR. Instruments were available for contamination monitoring, neutron measurement, and beta/gamma dose rate measurement. All instruments were operational and tagged with a valid calibration sticker.
- The OWR facility contained several fixed area monitors to provide early detection of radiological problem. Observations and a review of records indicated these instruments were calibrated and performance checked per Technical Specification requirements. Instruments were equipped with audible and visual alarms both locally and on the OWR control room panel.
- The Instrument and Calibration subsection provides radiological instrument calibration and maintenance service to the OWR facility. A computer database managed by this group provides advance notification of instruments needing calibration and tracks the location of all radiological instruments on the LANL site. Instruments removed from service for calibration or malfunctions are tagged and certified "clean" by the radiation protection technologist prior to removal from OWR.
- The HSE calibration facility is well equipped and is staffed with qualified and experienced personnel. Instrumentation is tested and calibrated in compliance with requirements of DOE 5480.1A, Chapter XI, Sections 4.F(2)(a)3 b and 4.F(2)(a)3 e.
- Instrument calibration sources were traceable to standards maintained by the National Institute of Standards and Technology.

- Instructions for periodic performance testing of radiological instruments were located in HSE-1-OHP-RMI-06-RO. Instruments are checked with a source traceable to the National Institute of Standards and Technology prior to each use and intermittently during use.

- OWR has no radio frequency or magnetic fields that interfere with radiation instruments.

CONCERN: None.

RP.9 RESPIRATORY PROGRAM

PERFORMANCE OBJECTIVE: **The respiratory program should ensure optimum protection against internal radiation exposures to workers.**

COMMENT: This Performance Objective is addressed in Section PP.2.

RP.10 AIR MONITORING

PERFORMANCE OBJECTIVE: Air monitoring systems selection, location, calibration, and maintenance should ensure reliable estimates of air activity for radiological control purposes.

FINDINGS:

- o Air monitoring instrumentation at OWR consists of two fixed-head particulate air samplers and one Particulate, Iodine, and Noble Gas (PING) constant air monitor.

- o All air monitoring instrumentation is operated 24 hours per day. A review of air monitoring records indicates fixed-head particulate filters are changed out on a weekly basis and counted by the health physics technician prior to being sent to the Health Physics Analysis Lab for analysis. The iodine cartridges in the PING are replaced and analyzed on a monthly basis.

- o The air samplers and PING are calibrated annually by the HSE-1 Instrumentation and Calibration Section.

- o The OWR thermal column purge gas is monitored by a Nuclear Measurements Corporation Model AM-33-BF gas and particulate detection system. A weekly check is performed to ensure that the instrument is functioning properly.

- o A review of the health physics technician file demonstrated that Ar-41 calculations are being performed and documented in accordance with Appendix F, "OWR Stack Effluent Report," of HSE-1-OHP-RM1-06-RO.

- * A documented air sampling and monitoring program does not exist for the OWR. However, the HSE-1 Group Leader recommended in his response to Item 5 of the 1986 Internal Health Physics Audit, dated 9/21/87, that an air sampling/monitoring policy be incorporated into a revision of the LANL Health and Safety manual Administrative Requirement 3-1 upon issuance of DOE 5480.11.

- * HSE-1-OHP-RMI-06-RO and INC-5 (SOP #1) do not provide adequate instruction on the placement of air monitoring instrumentation to meet recommendations of DOE 5480.1A, Chapter XI, 4.(1)(a)3 a.

- * The PING constant air monitor samples the reactor room air from a point located adjacent to the stairs leading up to the second level of the reactor while the particulate air samplers are located on the north and

south side of the first floor of the reactor room. There is no routine constant air monitoring or sampling performed on the second or third levels of the reactor building. Air flow in the reactor building was generally upward, away from the air monitors and samplers.

CONCERN: (RP.10-1) It has not been demonstrated that the locations of air monitoring instrumentation are adequate to monitor the reactor room atmosphere in accordance with DOE Orders.

RP.11 RADIOLOGICAL MONITORING/CONTAMINATION CONTROL

PERFORMANCE OBJECTIVE: The radiological monitoring and contamination control program should ensure worker protection from radiological exposures.

FINDINGS:

- o Administrative Requirement 3-7 of the LANL Health and Safety manual provides the LANL policy on radioactive contamination control. Surface contamination guidelines for posting and control are listed in Table 1 of that document.

- * Surface contamination limits are provided in OWR SOP #1. However, the limits do not specify the type of contamination (i.e., fixed, removable, or both) addressed.

- * OWR SOP #1 contains a requirement for a survey upon exit from the controlled area. However, the statement does not clearly define vague on when a personal survey is required. As a result, two persons were observed to exit the controlled area without surveying on 5/5/89.

CONCERN: See Concern OA.1-2.

FINDINGS:

- o The monitoring and contamination control program at OWR is operated by a well-qualified radiation protection technician. All surveys were performed per procedure HSE-1-OHP-RMI-06-RO, were well documented, and were completed on schedule. The radiation protection technician and operations personnel appeared to cooperate well in assuring work was performed safely.

- o Response to a personal contamination event was observed on 5/19/89. A researcher exiting the control area detected slight contamination on one hand and on his clothing. Personnel responded very well as the contamination was quickly located, removed from the researcher, traced back to the source, and eliminated as a possible future source of contamination.

- * Documentation did not allow determination of who was qualified to perform personal surveys and surveys of tools and equipment removed from the controlled area for unrestricted use. Qualifications (e.g., training and proficiency in using survey equipment) for performing these tasks were not established. Operations personnel at the OWR facility were trained on contamination survey methods and limits, but this training was not fully documented.

* Some personal items removed from the controlled area were not surveyed.

CONCERN: (RP.11-1) The contamination control program does not ensure that only trained and qualified personnel conduct personal and equipment contamination surveys upon exit from the controlled area.

FINDINGS:

* Personnel working with unsealed radioactive materials in Room 115 are not required to survey prior to leaving the room and must traverse approximately 80 feet of uncontrolled hallway to reach the closest survey instrument. LANL Radiation Protection personnel reported that corrective actions addressing this finding had been implemented prior to completion of the TSA. These corrective actions were not evaluated by the appraisal team.

* An outside area where personnel spend leisure time is located inside a controlled area. This is not consistent with good health physics practices of limiting time in controlled areas (i.e., ALARA). Although this area has not been contaminated in the past, there is a potential for contamination because it is located in a controlled area. LANL Radiation Protection personnel reported that corrective actions addressing this finding had been implemented prior to completion of the TSA. These corrective actions were not evaluated by the appraisal team.

CONCERN: (RP.11-2) The contamination control program at the reactor is not consistent with good health physics or industry practices.

RP.12 ALARA PROGRAM

PERFORMANCE OBJECTIVE: A formally structured, auditable program should be in place with established milestones to ensure that exposures are maintained As Low As Reasonably Achievable (ALARA).

FINDINGS:

- o The LANL policy on maintaining radiation exposures ALARA is in Administrative Requirement 3-1 and Technical Bulletin #302 of the Health and Safety manual. The policy is consistent with the requirement in DOE 5480.1A, Chapter XI, Section f.(1).

- o Sufficient evidence exists to demonstrate radiation exposures at OWR are maintained ALARA. Interviews with most OWR employees determined a widespread awareness of the ALARA concept and its application. Total facility radiation exposures at the OWR facility have remained fairly constant at about 2-3 person-rem per year.

- o The health physics technician plots monthly OWR external radiation exposure results and compares them to the individual's previous yearly total.

- * Procedures for implementing the ALARA policy for OWR do not incorporate all applicable practices required by DOE Orders:

  - There are no procedures for trending radiation exposures.

  - LANL had no formally documented ALARA program for the OWR facility. This is being corrected as a DOE 5480.11 implementation item.

  - LANL had no approved procedures for assuring exposures are ALARA as required by DOE 5480.1A, Chapter XI, Section 4.F(1) and as recommended by DOE 5480.1A, Chapter XI, Section 4.F(2)(a)4 a.

  - The ALARA program at OWR has never been audited.

  - ALARA goals for OWR were not developed and compared against actual exposures.

  - The ALARA program did not incorporate, to the extent feasible, the concepts presented in DOE/EV/1830-T5, "A Guide to Reducing Radiation Exposures to As Low As Reasonably Achievable (ALARA)," as required by DOE 5480.1, Chapter XI, Section 4.F (1).

CONCERN: See OA.1-2.

RP.13 RECORDS

PERFORMANCE OBJECTIVE: Records related to occupational radiation exposure should be maintained in a manner that permits easy retrievability, allows trend analysis, and aids in the protection of an individual and control of radiation exposure.

FINDINGS:

- o The following files are maintained by the resident health physics technician at OWR:
  - Purge Gas Activity Calculations
  - Air Sample Analysis
  - Moderator Water Analysis
  - Waste Water Analysis
  - Contamination Surveys
  - SWP/RWPs
  - In-vivo and Nose Swipe Analysis
  - Radioactive Waste Disposal Records
  - Exposure Records
  - Source File
  - Special Contamination Surveys
  - Radiation Surveys
  - Instrument Source Checks
- o Most file folders contained several years of information from which OWR personnel could perform trend analysis if needed.
- o OWR personnel exposure results are tracked and compared on an individual basis to the cumulative exposure of each individual for the previous year.
- o The health physics technician maintained a daily logbook as required by HSE-1-OHP-RMI-06-RO.
- o Interviews with OWR line management indicated they were familiar with the location and content of the files maintained by the technician.
- * Documentation of information pertinent to radiological assessment is incomplete:
  - On 5/6/89 an OWR reactor operator's clothing was contaminated by a puff of air from a reactor port. Airborne radioactivity measurement results or estimates for this occurrence were not documented.
  - A file for radiation occurrence reports, accidents, incidents, investigations, corrective actions, or follow-up activities did not exist.

- An inspection of the health physics technician's daily logbooks revealed missing information for several days during May and June of 1985, insertion of information on loose pages into the logbooks, and storage of logbooks in a manner which may not allow them to be maintained as usable references.

CONCERN: See OA.1-3.

M. PERSONNEL PROTECTION

The Personnel Protection program at OWR was reviewed to verify that industrial hygiene and industrial safety hazards are adequately identified, evaluated and controlled. Specific performance objectives were used to evaluate control of chemicals, hazards communication, staffing, and surveillance and evaluation of exposures.

The Personnel Protection program at OWR has, in general, been successful. Supervision and employees at the OWR complex exhibit a strong interest in promoting a safe and healthy workplace. They are supported by a hierarchy of Laboratory, Division, and Group policies and procedures and have available to them a highly qualified support staff from the HSE Division.

LANL policies and procedures specify the authority and responsibilities of line management and support organizations. These policies and procedures provide an institutionalized framework of guidance to assure that safety and health program requirements are implemented. They also very clearly place responsibility for successful program implementation on line management. A decentralized management system is endorsed. This system allows each Division, including the Isotope and Nuclear Chemistry (INC) Division, to develop and implement requirements appropriate for their needs within the framework of the LANL Health and Safety manual.

In general, OWR management has been successful at establishing and implementing programs that meet their needs and satisfy LANL requirements. Exceptions identified include an inadequate chemical inventory process to ensure identification and control of chemicals at OWR, failure to document industrial hygiene hazards at OWR, procedure and qualification deficiencies for hoisting and rigging required for fuel transfers, and failure to perform required electrical inspections of the OWR facility.

PP.1 INDUSTRIAL HYGIENE PROGRAM CONTENT

PERFORMANCE OBJECTIVE: The industrial hygiene program should minimize the probability of employee illness, impaired health or significant discomfort by identifying, evaluation and controlling those stresses arising in the workplace.

FINDINGS:

- o There is a hierarchical documentation of health and safety policies and procedures for OWR operations in accordance with DOE 5480.10, Contractor Industrial Hygiene Program:
  - LANL Health and Safety manual policies, Administrative Requirements, and Technical Bulletins.
  - "Isotropic Nuclear Chemistry Group-5 Safety Policy," OWR Operating Procedures, SOPs, and Special Work Procedures (SWPs).
  - Health, Safety, and Environmental Programs; SOPs; and SWPs for each of the supporting organizations at the OWR site.
- o The minimal use of chemicals at the OWR site and the few personnel working there reduce the potential for nonradiological health risks.
- o The Occupational Medicine Group indicated that there have been no aggregate occupational illness problems reported by OWR employees that would indicate occupational exposures to health hazards.
- o HSE is tasked to participate in the review of appropriate work orders, small job tickets, and general plant projects for LANL upon request by the HSE design review coordinator.
- o HSE is tasked to review reactor or experimental activities upon request by OWR management, the OWR Safety Committee, or the Reactor Safety Committee.
- o Assessments of operations and periodic walk-through inspections of the OWR site are conducted:
  - Quarterly inspections of the OWR site are conducted jointly by the OWR Operations Supervisor and HSE.
  - Monthly inspections of the Mechanical and Electronic Support Division machine shop at the OWR site are conducted by the Mechanical and Electronic Engineering Division safety representative.

- Annual inspections are conducted by the Reactor Safety Committee.

- An annual inspection of the OWR site was conducted by the INC Division Safety Committee.

- An INC Division internal appraisal was conducted in 1988.

- Daily oversight is provided by OWR management as evidenced by the compliance to industrial hygiene procedures and the good industrial hygiene practices observed.

o LANL programs have been implemented at the OWR site for asbestos, noise exposures, confined space entries, and hazards communication.

o Implementation of control measures and corrective actions are clearly stated as a line management responsibility in the LANL documentation. Interviews with OWR Management and HSE support organizations indicate that this responsibility is understood, accepted and implemented.

o Findings from inspections and appraisals of the OWR site are addressed to line management. Follow-up and correction of identified hazards or program deficiencies has, generally, been prompt.

o Review of chemical inventories and walk throughs did not reveal the presence of any carcinogens. Based on a quarterly safety inspection recommendation, OWR staff had recently reviewed their chemical inventory to identify any carcinogens for disposal.

o The credibility and defensibility of the Industrial Hygiene Group data is supported by the Industrial Hygiene Group Quality Assurance Plan, and the Industrial Hygiene Group Field Operations Manual.

* Documented surveillance of potential health hazards at the OWR site is limited and does not meet the intent of DOE 5480.10.

CONCERN: See Concern PP.5-1.

PP.2 CHEMICAL CONTAMINATION

PERFORMANCE OBJECTIVE: Chemicals should be controlled so as to minimize contamination of areas, equipment, and personnel.

FINDINGS:

- o Requirements for the control of chemicals in accordance with DOE 5480.10 are specified in the LANL Health and Safety manual.
- o The proposed use of new chemicals, processes, operations, and experiments at OWR are reviewed by OWR staff, the OWR Committee, and the Reactor Safety Committee as appropriate.
- o HSE does not review the proposed use of new chemicals unless specifically requested.
- o Chemical inventories have been conducted by OWR Staff, the Mechanical and Electronic Engineering Division, and the Mechanical and Electronics Support Division for their respective areas or activities.
- o The majority of the chemicals at the OWR site are small quantities of laboratory-type chemical standards stored in two small chemistry labs. Approximately 100 to 200 pounds per year of sulfuric acid, hydrochloric acid and sodium hydroxide are used for OWR water treatment. Relatively small quantities of Stoddard solvent; 1,1,1 trichloroethane; trichloroethylene; and acetone are used for cleaning and degreasing in the machine shop. The Mechanical and Electronic Engineering Division capacitor experiment tank holds approximately 1600 gallons of mineral oil.
- o Chemicals for OWR are ordered and received by two specifically authorized persons who are the prime users of the chemicals and who are knowledgeable of the hazards the chemicals present.
- o Material Safety Data Sheets are received and kept on file for OWR chemicals.
- o There are no chemicals generated at the site that require preparation of Material Safety Data Sheets.
- o Mixed storage of food and chemicals is not allowed at the OWR site. Refrigerators were clearly marked for food or nonfood use only. At no time during the TSA was any employee observed eating, drinking, smoking or chewing in unauthorized areas.

- o Ventilation hoods are used to control exposures to welding fumes in the staff shop, chemicals in the chemistry labs, and the acids and caustics in the equipment building. The hoods are flow tested on an annual basis.

- o Proper storage, labeling and handling of chemicals were observed at the OWR site. The chemicals are stored in appropriate cabinets and are labeled with the required information in accordance with LANL Health and Safety manual Administrative Requirement 6-1. One exception noted was the storage, labeling, and tracking of a can of ammonium nitrate and fuel oil mixture.

- o Full face air-purifying respirators and Self-Contained Breathing Apparatus are used at the OWR site. The respiratory protection program requirements are documented in the LANL Health and Safety manual Administrative Requirement 12-1, Technical Bulletin 1203, and OWR SOPs.

- o The respiratory protection program is implemented at OWR site in accordance with American National Standards Institute Standard Z 88.2, "Practices for Respiratory Protection":

  - Personnel authorized to wear respiratory equipment receive quantitative fit testing and training annually.

  - The full face respirators used at the OWR site are tested and inspected by the Industrial Hygiene Group.

  - The Self-Contained Breathing Apparatus at the OWR site are inspected by OWR staff.

  - Breathing air bottles are filled by the Industrial Hygiene Group and certified to Grade D air minimum.

  - The equipment was observed to be stored properly and in excellent condition.

  - Employees authorized to use respiratory protection have been evaluated by a LANL physician for fitness to wear a respirator.

- * A number of chemicals identified during walk-throughs of the OWR site are not included on the site chemical inventories. These include 4 gallons of polymide resins, 150 grams of an ammonium nitrate and fuel oil mixture, and several dewars of liquid nitrogen.

* The ammonium nitrate and fuel oil mixture, found in a non-food storage refrigerator in the OWR building lunchroom, was left over from an earlier OWR experiment. The material was dated 1985. It was apparently placed in the refrigerator for storage and then forgotten. The material was removed during the TSA.

* Chemical inventories at the OWR site are performed by four different Divisions: INC, Mechanical and Electronic Engineering, Mechanical and Electronics Support, and HSE for their respective areas. There is no single organization that acts as a coordinator for (1) the total chemical inventory at the OWR site and (2) inter-group communications regarding chemical inventories.

* The chemical inventory of the Mechanical and Electronic Support Division at OWR does not comply with the requirements of the LANL Health and Safety manual Administrative Requirements 1-9 and 6-1:

  - The inventory has not been updated annually.

  - The inventory does not include the manufacturer's name, Chemical Abstract Services Registry numbers, locations of the chemicals, the estimated quantity of the chemical used annually, or the amount currently on hand.

  - The inventory is not compiled by group, technical area, building, room or work area.

* There is no program to identify or track chemicals coming into the OWR site that have a limited shelf life.

* The 13.2 kVA transformer at the OWR site contains 290 gallons of PCB oil. There is no containment around the transformer to contain leaks or spills.

CONCERN: (PP.2-1) The chemical inventory process at the reactor site is not identifying, documenting, and providing for control of all chemicals in accordance with DOE and LANL policies.

PP.3 HAZARD COMMUNICATION

PERFORMANCE OBJECTIVE: **Facility personnel should be adequately informed of chemical, physical, and biological stresses they may encounter in their work environment.**

FINDINGS:

- o Requirements for Hazards Communication at LANL are specified in LANL Health and Safety manual Administrative Requirements 1-9 and 6-1.
- o The OWR supervisor provides Hazards Communication training for the OWR staff. The supervisor attended the Hazard Communication training course for supervisors 10/29/87. Course outlines and resources to assist the supervisors in presenting Hazards Communication training was provided at the training course.
- o The Industrial Hygiene Group provided Hazards Communication overview training to site employees during the October 1987 OWR Safety Meeting.
- o Hazards Communication was also a meeting topic at an INC Division Safety Committee meeting.
- o The Mechanical and Electronics Support Division machinist at the OWR site received Hazard Communication training 4/7/89.
- o Each OWR employee has signed an employee responsibility sheet on hazards associated with the OWR site.
- o Chemicals at the OWR site are ordered and received by authorized persons who are knowledgeable of the hazards the chemicals present. Material Safety Data Sheets are received and filed for each chemical ordered.
- o Chemicals at the OWR site were observed to be stored properly and well labeled in accordance with LANL Health and Safety manual Administrative Requirements 1-9 and 6-1.
- * Chemical inventory deficiencies at the OWR site are discussed in Section PP.2.

CONCERN: See Concern PP.2-1.

FINDINGS

- o Areas where chemical or physical hazards are present, including asbestos-containing material, high noise exposure areas, confined spaces, and safety glass areas, are posted properly.

* The LANL Health and Safety manual does not include an Administrative Requirement on compressed gas safety, although one is in draft form.

* The OWR site has numerous compressed gas bottles, two small chemical laboratories, and uses liquid nitrogen; yet no documented training in these areas is evident.

* Two OWR employees were observed transferring liquid nitrogen without the use of proper personnel protective equipment.

* Fifteen to twenty video display terminals are in use at OWR, yet no documented training has been provided to the users regarding possible hazards and associated prevention. Informative newsletter articles have been distributed to all LANL employees.

CONCERN: See Concern TC.4-1.

PP.4 STAFFING

PERFORMANCE OBJECTIVE: The evaluation of chemicals and physical and biological stresses should be performed by personnel that have the knowledge and practical abilities necessary to implement personnel protection practices effectively.

FINDINGS:

- o The health and safety authorities and responsibilities of the HSE support organizations and the OWR line management are clearly delineated in the LANL Health and Safety manual and the INC Policies and Procedures.
- o The HSE support staff assigned to the OWR site are well qualified:
  - The safety engineer is a Certified Safety Professional and has 17 years of experience.
  - The industrial hygienist is a Certified Industrial Hygienist and has 13 years experience.
  - Qualified staff are assigned to provide back-up to the primary staff.
- o Continued professional development has been encouraged as evidenced by strong participation in local and national professional organizations and meetings.
- o Industrial Hygiene Group supervision indicated that the recent new hires in the group and the authorized open staff positions, when filled, will improve the industrial hygiene field support at LANL.

CONCERN: None.

PP.5 SURVEILLANCE

PERFORMANCE OBJECTIVE: The surveillance of chemical, physical and biological stresses should insure that potential personnel exposures are accurately determined and recorded.

FINDINGS:

- Surveillance requirements are specified in LANL Health and Safety manual Administrative Requirement 6-2. The quality assurance and field protocols followed for the Industrial Hygiene Group surveillance are included in the "Quality Assurance Plan for Industrial Hygiene Sampling and Monitoring to Assess Occupational Health Hazards at the Los Alamos National Laboratory," and in the Industrial Hygiene Group Field Operations Manual.

- The types and frequency of use of chemicals at the OWR site minimize the potential for personnel exposure to nonradiological stresses.

- The Industrial Hygiene Group conducted a noise survey 3/29/89 of the equipment building and the boiler house. The cumulative dose measured for the boiler house was 81.5 and for the equipment building was 88.3 decibels, A-weighted network (dBA). Work time in these buildings is sporadic and of short duration. Specific requirements for hearing protection are posted on the affected buildings. Based on the assessed exposure levels, no one from OWR is currently identified as being included in the LANL Hearing Conservation Program.

- An asbestos inventory of the OWR site was conducted 1/14/89 by Pan Am. They documented a total of 917 linear feet of asbestos-containing pipe insulation, 16 feet of which was classified as friable and falling free. The friable asbestos has been removed. Asbestos-containing wall board and floor tile was also identified in the east portion of the OWR Building.

- Sampling for exposures to sodium hydroxide and sulfuric acid during mixing of these chemicals for the eductor column in the equipment building was conducted 2/2/89. The exposure levels recorded were well below the established Occupational Exposure Levels for these substances.

- The Industrial Hygiene Group sends monitoring and survey results to affected OWR site employees and supervisors.

- Flow tests and inspections of the vent hoods are conducted annually by the Industrial Hygiene Group.

- o Pan Am conducts potable water sampling at the LANL water source. The Facility Engineering Division has implemented a backflow prevention program to review new construction and modifications to prevent potential backflow contamination problems. Review of the OWR site facilities did not reveal any potential backflow concerns.

- * Surface samples for lead, collected at the soldering bench in Room 118 at the OWR building in December 1988, showed extremely high lead levels. The Industrial Hygiene Group requested that they be notified by OWR staff so that personnel sampling could be conducted for the individual(s) doing the lead soldering. Notification has not yet occurred.

- * Acetone; 1,1,1 trichloroethane; and trichloroethylene are used by the Mechanical and Electronics Support Division machinist at the OWR site for cleaning and degreasing. No documented assessment or exposure monitoring has been conducted.

- * There are fifteen to twenty video display terminals at the OWR site. There have been no documented assessments to identify exposure duration, lighting levels, screen placement, chair type and placement, or key board height.

- * There has been no documented lighting survey of OWR sites.

CONCERN: (PP.5-1) Potential and existing industrial hygiene exposures at the reactor site are not being fully identified and documented in accordance with DOE requirements.

PP.6 HAZARD EVALUATION

PERFORMANCE OBJECTIVE: An evaluation of potential exposures to chemical, physical, and biological agents should insure effective implementation and control of personnel protection activities within the facility.

FINDINGS:

- The LANL Health and Safety manual specifies the responsibilities and program requirements for evaluation and control of identified hazards at LANL. Administrative Requirement 1-3 of this manual outlines the steps to be taken in providing SOPs and SWPs to identify and control hazards specific to an operation.
- The OWR Operating Procedures, SOPs and SWPs address the control of hazards identified at the site.
- The appropriate HSE reviews the SOPs and SWPs depending on the hazard. For example, the Safety Group and the Industrial Hygiene Group reviewed the INC Group SOPs on general lock and tag outs, limited egress/confined space entry, and use of Self-Contained Breathing Apparatus.
- The SOPs are required to be reviewed by the appropriate organizations annually. HSE coordinates this review system.
- Quarterly joint inspections are conducted by the HSE and the OWR supervisor, and the reports are prepared and distributed by the OWR supervisor.
- The Industrial Hygiene Group has a comprehensive library of standards, codes and regulations, and technical references that would be needed for the evaluation of health and safety risks.

CONCERN: None

PP.7 OCCUPATIONAL SAFETY

PERFORMANCE OBJECTIVE: All workplaces of the facility should be as free as possible from occupational safety hazards so that employees are effectively protected against accidental death or injury.

FINDINGS:

- Safe work practices for the OWR site employees are documented in the LANL Health and Safety manual, Safety and Health Policy Statements, Safety and Health Plans, SOPs, and SWPs, of the Divisions in residence at OWR site.

- The Safety Group operates an illness/injury information system which includes quarterly reports on experience rates.

- There has been one recordable injury at the OWR site in each of the last three years, with the injury in 1988 being lost-time. While this number of injuries at a small facility seems high, review of the incidents do not indicate this is an OWR-specific problem. The incidents appear random, occurring to employees from three different Divisions, but they may be related in that two of the three injuries were back-strain type injuries occurring in lifting activities. A review of the data for 1984 through 1988 identifies back strains as accounting for the highest percentage of injuries at LANL. No evidence of any type of training on prevention of back injuries was documented in the OWR site employees training records.

- The OWR site facility is supported by an assigned Safety Engineer from the Safety Group. The assigned Safety Engineer is a Certified Safety Professional with 17 years experience. A qualified alternate has also been assigned.

- Safety inspections of the OWR site are conducted quarterly by HSE and the OWR supervisor. Review of the inspection reports indicates the inspections are timely and comprehensive, distribution is adequate, and followup is prompt. The OWR supervisor and the safety engineer participate in the inspections regularly.

- Annual inspections are conducted by the Reactor Safety Committee.

- The few injuries that occur at the OWR site are reported to the Occupational Medicine Group. The Occupational Medicine Group initiates the Medical

Report Form and transmits them to the Safety Group for follow up.

- o There is no formal employee safety suggestion system, but there is extensive use of safety committees within LANL and at OWR. These committees facilitate employee involvement in the safety program.

- o The Safety Group is tasked to participate in the review of appropriate work orders, small job orders, and general plant projects for LANL upon request by the HSE design review coordinator. The Safety Group is tasked to review reactor or experimental activities upon request by the OWR staff, the OWR Safety Committee, or the Reactor Safety Committee.

- o A scan of the Safety Group reviews of past OWR design packages, plant projects, reactor and experimental activities indicates adequate involvement. The Safety Group reviews all small job tickets at the OWR site. The Pan Am safety organization also reviews all work orders that Pan Am employees perform. A review of recent work orders for the OWR site showed adequate review and involvement by Pan Am safety.

- o There is no DOE health and safety poster at the OWR site.

- o Plant equipment at the OWR site is well marked and labeled:

  - OWR plant equipment is well tagged,

  - process, service, and support system lines are well labeled,

  - confined spaces are clearly marked,

  - safety glass areas are well defined, and

  - electrical hazards are well marked.

- o The walking and working surfaces at the OWR site are generally free of tripping and slipping hazards. The shop area air and electrical services are provided by overhead drops, floors throughout the OWR site facility were generally clean and freshly painted, and snow and ice removal is provided by Pan Am. However, the ladder on the OWR building brick stack did not have cage protection, and the east portion of the OWR building was somewhat congested and cluttered due to the quantity and location of stored materials.

- Machine guarding at the OWR site was observed to be excellent.

- Tag out and lock out procedures are specified in the LANL Health and Safety manual and in the OWR Special Procedures. Pan Am also has a tag out and lock out procedure. Observations of work at the OWR site and interviews with the employees and supervisors indicates strong acceptance and adherence to tag out and lock out principles.

- The use of required personnel protective equipment was observed to be good. Compliance to safety glass and hearing protection requirements was consistent. One exception noted was the failure by two employees to use proper equipment when transferring liquid nitrogen between dewars.

- A review of testing and inspection records and walk-throughs of the facility verified that inspection and testing of safety-related equipment is generally up to date. Hoisting and rigging equipment inspections and tests, inspection and testing of the safety showers and eye wash, and inspections and maintenance on the Toyota forklift truck are up to date. Machines in the machine shop are inspected on a regular basis. The unfired pressure vessels and the heating boilers at the OWR site were recently inspected by an outside insurance firm. However, in-house tests and inspections on the boilers at the OWR site are less than adequate. (See Section MA.4.)

- Review of training records showed that the industrial safety training and certification is up to date for the following OWR employees:

  - the Qualified Crane Operator and three Incidental Crane Operators,

  - the two qualified fork truck operators, and

  - the five people qualified in CPR and the four qualified in first aid.

- The frequency, attendance, and content of the INC Division Safety Committee meetings and the OWR staff safety meetings is very good.

  - INC Division Safety Committee meetings are held monthly and are attended by the Safety Group, the Industrial Hygiene Group, the INC Division Office

and OWR supervisor. Topics have included housekeeping, hazards communication, training, and inspections.

- The OWR staff safety meetings are held monthly to bimonthly and are regularly attended by the OWR staff and the Mechanical and Electronics Support Division machinist. Topics have included electrical safety, confined space entry, use of Halon extinguishers, emergency exercises, and hazards communication.

* There are no lift plans for the high consequence lifts at the OWR site.

* The OWR Special Procedures for handling and transfer of OWR fuel do not include all of the hoisting and rigging lift plan requirements specified by the DOE Hoisting and Rigging Manual. For example, the OWR Special Procedures do not specify the Person in Charge, the expiration date of the hoist and rigging, and the qualification requirements and expiration date of the Qualified Crane Operator. Interviews with OWR staff identified that the Qualified Crane Operator performs the lifts during the handling of the fuel, but that one of the Incidental Crane Operators may perform the lift if the Qualified Crane Operator is absent. Incidental crane operators are not qualified or approved to perform high consequence lifts per LANL Health and Safety manual Administrative Requirement 13-2, "Cranes and Hoists."

CONCERN: See Concern OA.1-2.

FINDINGS:

o An SOP was prepared for the capacitor experiment located in the old water boiler reactor room. The SOP identified potential failures and hazards and the controls used to prevent or minimize the hazards.

o The LANL Health and Safety manual Administrative Requirement 7-1 requires documented electrical safety inspections annually.

* Inspection of records and discussions with personnel indicate there have not been any electrical safety inspections conducted at the OWR.

* The large electrical cable feeding the capacitor is secured to the capacitor with a common hose clamp, indicating a make shift cable anchor, and the cable is suspended in place with a rope.

* An improper wall penetration, and an apparent improper electrical splice were noted in an old electrical service to the OWR site Security Station. Both of these were in violation of the National Electric Code. The service and flex cord had been abandoned and were removed during the TSA.

* The OWR complex is over 30 years old. Interviews with OWR personnel indicates there have been minimal upgrades to the electrical system at the OWR complex since original installation, and that spare parts such as switchgear and circuit breakers are difficult to get. The age of the OWR complex electrical system makes electrical inspections more critical.

CONCERN: (PP.7-1) Periodic electrical safety inspections and appraisals, as differentiated from routine maintenance, have not been conducted at the reactor complex as required by LANL policy.

N. FIRE PROTECTION

The OWR complex was reviewed for life safety considerations and compliance with "improved risk" criteria. It was also reviewed for programmatic and property loss threats, and for threats to the public and employees that could result from a fire.

The OWR complex is judged to meet the DOE "improved risk" equivalency requirements used in industry. While the older portion of the reactor building and the cooling tower are built of combustible material, the reactor building is fully sprinklered and the cooling tower is protected by a dry pipe sprinkler system. The newer part of the reactor building is made of noncombustible materials, and the contents of the buildings are predominantly noncombustible. There are no contents or processes that present an unusual fire hazard and the safety of the reactor would not be affected by a fire.

The fire system inspection, maintenance, and assurance programs at the OWR complex are very good, and the system impairments have been minimal, providing confidence that the fire systems will be available when needed.

The OWR site buildings meet the requirements of the National Fire Protection Association (NFPA) 101 Life Safety Code. A credible fire will not cause unacceptable impairment of operations or unacceptable impact on other LANL sites or DOE programs. Nor will a credible fire cause an unacceptable property loss.

The concerns raised in the July 1988 TSA of the Tritium Systems Test Assembly at LANL regarding the response capability of the fire department have not been resolved. Problems arising from the proposed transfer of the fire department from DOE to the County of Los Alamos continue to deteriorate the response capability of the fire department. Document reviews, observation of an emergency drill at the OWR, and interviews indicated that the fire department prefire planning, procedures, and training were inadequate, thus jeopardizing the emergency response capability to the OWR complex. Effective follow-up and interim measures to correct these concerns have not been provided.

FP.1 LIFE PROTECTION

PERFORMANCE OBJECTIVE: The facility should not present an unacceptable hazard to life from the results of accidental fire.

FINDINGS:

- The design of exits and means of egress from the OWR site buildings are adequate to ensure safe personnel egress. The OWR site buildings meet the requirements of the NFPA 101 Life Safety Code.
- The original part of the OWR building is constructed of combustible materials. The newer portion is constructed of steel. The entire OWR building is fully protected with a wet pipe sprinkler system and the combustible loading in the building is low.
- There are no special fire or life safety hazards presented by OWR operations.

CONCERN: None.

FP.2 PUBLIC PROTECTION

PERFORMANCE OBJECTIVE: The facility should not pose an added threat to the public as the result of an onsite fire permitting the release of hazardous materials beyond the site boundary.

FINDINGS:

- o There are no unusual hazards or materials at the OWR site that would present a threat to the public in the event of a fire. The safety of the reactor would not be affected by a fire at the OWR site.
- o The OWR building is fully protected by a wet pipe sprinkler system.
- o The cooling tower is protected by an automatic dry pipe sprinkler system and the boiler house is protected by an automatic fire detection system.
- o The fire detection and suppression systems and pull stations alarm locally and at the Central Alarm Station.
- o The fire detection and suppression systems, along with the minimal fire hazards presented by the OWR operations, should preclude any offsite releases from a credible fire at the OWR site.
- o The fire systems inspection, testing and maintenance program at the OWR site is very good. System impairments have been minimal and impairments when they do occur are tracked from inception to closeout by the Fire Protection and Utilities Group on a computer database.
- o The inspection and testing program at the OWR site is up to date.
- o Fire systems assurance at the OWR site facility is provided by locked and alarmed post indicator valves, supervised air pressure on the dry sprinkler system, sealed alarm valves,and weekly inspections of the pressure-reducing valves on the water supply. The water supply is gravity fed from water storage tanks.
- o The average time of response from the nearest LANL fire station is 5 minutes. Access from the station, located approximately 2 miles away, is via a 2-lane paved road. The only other access to the OWR site is a four-wheel-drive trail from the east.
- o A Memorandum of Agreement (MOA 1A-7120-7903) for Mutual Fire Protection Assistance, dated 7/22/88, exists between DOE, the Department of the Army, the Bureau of Indian Affairs, the United States Forest Service, and

the National Park Service. This MOA has not been signed by the National Park Service.

- o The MOA defines the joint effort for protection from and control of wildfire upon adjacent lands administered by each agency. It includes a list of responsible positions with each agency to be contacted during fire emergencies, and it defines the responsibilities and agreements to be followed by the agencies in the event of a wildfire.

- o The Fire Department has a fire map that shows the layout of the OWR site, the titles of the buildings, and the fire protection systems available at the facility.

- * The Fire Department does not have a plan that includes potential hazards, chemical inventories, details of the buildings, and other specific information on the facility that might be essential to fighting a fire.

- * The Fire Department personnel have not been sufficiently familiarized with the OWR site. Even though the firemen had a recent orientation walk-through of the site, interviews and observations during the OWR site emergency drill conducted during the TSA indicate that the firemen are not familiar enough with the OWR site buildings, processes and procedures. For example, during the emergency drill, two firemen called to the roof were unsure of the way to the roof, and walked into the reactor room and back out unnecessarily before they found their way.

- * There is no documented Fire Department prefire plan for wildfires at LANL. While there is an MOA for wildfire, there are no Fire Department procedures that implement the DOE responsibilities identified in the MOA. There are also no documented LANL prefire plans that identify the wildfire potential, fuel loading, response procedures, or available equipment.

- * When the Fire Department was asked to "walk through" the notification process that would take place in the event of a wildfire, it was evident that they were not familiar with the process. (See Concern ER.3-5).

CONCERN: (FP.2-1) Inadequate Fire Department prefire planning and training jeopardizes the emergency response capability to the reactor site.

- * The Fire Department has been in the process of being transferred from the DOE to the County of Los Alamos for almost four years. The effects of this move on the morale and capability of the Fire Department were documented in a TSA of a LANL facility conducted in

July 1988. The situation still exists and the effects on the morale and capabilities of the Fire Department continue to deteriorate.

* Correction of deficiencies in Fire Department prefire planning, procedures, and training should not be dependent on whether DOE or the County of Los Alamos has jurisdiction over the Fire Department. In spite of this, no effective, documented interim measures have been instituted to mitigate the risk to LANL or the OWR site from the degraded capability of the Fire Department.

CONCERN: (FP.2-2) The previously identified Fire Department problems have not been effectively resolved in a timely manner and effective interim steps have not been taken for the protection of the LANL and the reactor site.

FP.3 IMPAIRMENT OF OPERATIONS

PERFORMANCE OBJECTIVES: The facility should not be vulnerable to being shut down for an unacceptable period as the result of a credible fire.

FINDINGS:

- Review of the building construction, fire protection systems, and the combustible loading in the building indicates a fire which would result in shutdown of OWR for six months or more is not credible.
- From discussions with OWR supervision and Fire Protection and Utilities Group personnel, it was concluded that a credible maximum fire at the OWR site would not present unacceptable impact to other LANL sites or DOE programs.

CONCERN: None.

FP.4 PROPERTY PROTECTION

PERFORMANCE OBJECTIVE: A credible fire should not result in an unacceptable property loss.

FINDINGS:

- Property Loss and Risk Evaluation Forms have been completed for the OWR site buildings by the Fire Protection and Utilities Group. The maximum property loss due to a credible fire in the OWR building, assuming the automatic sprinkler system operates, is projected at $250,000.
- The maximum property loss from a credible fire, assuming failure of all protection systems, is listed as $10,000,000.
- Review of the building construction, fire protection systems, and building contents, as well as interviews with OWR supervision, indicate the projected losses are appropriate.

CONCERN: None.

FP.5 IMPROVED RISK

PERFORMANCE OBJECTIVE: The facility should qualify as an "improved risk" or "highly protected risk" as commonly defined by the property insurance associations specializing in such coverage.

FINDINGS:

- The OWR site meets the criteria for improved risk as defined in DOE 5480.7, Fire Protection.
- Factory Mutual Research Corporation conducted a Fire Protection Survey of LANL, including the OWR site. The survey was completed in May 1989.
- Documented biennial fire inspections of the OWR site are conducted by the Fire Protection and Utilities Group engineers.
- Special Work Permits are used at the OWR site for control of cutting and welding in accordance with the LANL Health and Safety manual requirements.
- The Fire Protection and Utilities Group prepares Property Loss and Risk Evaluation Forms for the OWR site buildings in accordance with the DOE 5480.7. The forms include a status of any outstanding fire protection problems and the maximum credible loss projections.
- The fire system inspection and testing program at LANL and the OWR site is very good.
- Proper storage of flammable liquids and combustible waste was noted during walk-throughs of the OWR site.
  - Flammable liquids at the OWR site are stored in flammable liquid cabinets or outside in metal cabinets.
  - Approved flammable liquid safety cans are used at the OWR site.
  - Combustible waste is disposed of in approved containers.
- Fire loss records for the LANL are maintained, analyzed and reported in accordance with DOE 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements.
- Reviews of the boilers at the OWR site indicate the boiler controls at the OWR site are in compliance with NFPA requirements, but the inspections and tests are not up to date. (See Section MA.4.)

- o The Fire Protection and Utilities Group has been involved in the review of new construction or modifications at the OWR site affecting fire or life safety.

- * The capability of the Fire Department to control credible fires at the OWR site is inadequate.

CONCERN: See Concern FP.2-1.

IV. NOTEWORTHY PRACTICES

One Noteworthy Practice was identified in Organization and Administration. Noteworthy Practices are exceptionally good ways of accomplishing a Performance Objective or some aspect of it, and are worthy of emulation by other DOE facilities.

OA.4 MANAGEMENT ASSESSMENT

PERFORMANCE OBJECTIVE: Management and Supervisory personnel should monitor and assess facility activities to improve performance in all aspects of the operation.

NOTEWORTHY PRACTICE: LANL has recognized that employee performance can be improved significantly if the supervisor can recognize marginal performance and respond appropriately. As an initial part of this program, LANL has developed a draft "Manager's Guide to Marginal Performance Interventions." The guide discusses: who is the marginal performer?; recognize and confront the problem; when to take action; how to handle the employee; documentation needs; finding and fixing the reason for declining performance; how to eliminate the causes; following through; checklists; resources and support services. This guide appears to be very useful.

APPENDIX A

System for Categorizing Concerns

Each concern contained in the report is categorized for SERIOUSNESS using the following criteria:

CATEGORY I: Addresses a situation for which a "clear and present" danger exists to workers or members of the public. A concern in this category is to be immediately conveyed to the managers of the facility for action. If a clear and present danger exists, the Assistant Secretary for Environment, Safety, and Health (EH-1), or his designee, is informed immediately, so that consideration may be given to exercising the Secretary's facility shutdown authority or direction of other immediate mitigation.

CATEGORY II: Addresses a significant risk or substantial noncompliance with DOE Orders (but does not involve a situation for which a clear and present danger exists to workers or members of the public). A concern in this category is to be conveyed to the manager of the facility no later than the appraisal close-out meeting for immediate attention. Category II concerns have a significance and urgency such that the necessary field response should not be delayed until the preparation of a final report and the routine development of an action plan.

Any issues surrounding the concern should be addressed during the appraisal or immediately thereafter. Again, consideration should be given to whether compensatory measures, mitigation or facility shutdown are warranted under the circumstances.

CATEGORY III: Addresses significant noncompliance with DOE Orders, or significant need for improvement in the margin of safety, but is not of sufficient urgency to require immediate attention.

Each concern in the report is also categorized by its POTENTIAL HAZARD CONSIDERATIONS using the following criteria:

Level 1. Has the potential for causing a severe injury or fatality, a fatal occupational illness, or loss of the facility.

Level 2. Has the potential for causing minor injury, minor occupational illness, major property damage, or has the potential for resulting in, or contributing to, unnecessary exposure to radiation or toxic substance.

Level 3. Has little potential for threatening safety, health, or property.

Each concern in the report is categorized for its COMPLIANCE CONSIDERATIONS using the following criteria:

Level 1. Does not comply with mandatory DOE requirements (DOE Orders), prescribed policies or standards, or documented accepted practice (the latter is a professional judgment based on the acceptance and applicability of national consensus standards not prescribed by DOE requirements).

Level 2. Does not comply with DOE reference standards, guidance, or with good practice (as derived from industry experience, but not based on national consensus standards).

Level 3. Has little or no compliance considerations; these concerns are based on professional judgment in pursuit of excellence in design or practice (i.e., these are improvements for their own sake--not deficiency-driven).

APPENDIX B

Categorization and Tabulation of Concerns

Using the criteria in Appendix A, all of the concerns have been categorized as Category III for seriousness. The concerns were also characterized by potential risk and compliance considerations. Appendix B-1 summarizes the results of the characterizations.

All of the concerns are tabulated in Appendix B-2 without their supporting bases. The user is cautioned that to fully understand any concern, it is necessary to read its basis, as provided by asterisked findings immediately preceding the concern in Section III.

APPENDIX B-1

Categorization of Concerns

CONCERN NUMBER	POTENTIAL HAZARD LEVEL	COMPLIANCE LEVEL
OA.1-1	2	1
OA.1-2	1	1
OA.1-3	2	1
OA.4-1	2	1
OA.4-2	2	2
OA.6-1	2	1
OP.3-1	2	2
OP.3-2	3	2
OP.7-1	2	2
MA.1-1	2	1
MA.2-1	2	2
MA.3-1	3	2
MA.4-1	2	2
TC.1-1	2	2
TC.1-2	2	2
TC.2-1	2	2
TC.4-1	2	2
AX.4-1	3	2
AX.7-1	2	2
AX.7-2	2	2
ER.2-1	2	1
ER.3-1	1	3
ER.4-1	2	1
ER.5-1	2	1
ER.6-1	2	1
TS.3-1	2	2
TS.3-2	2	1
TS.3-3	2	2
TS.4-1	2	2
TS.8-1	2	2

APPENDIX B-1 (cont'd)

CONCERN NUMBER	POTENTIAL HAZARD LEVEL	COMPLIANCE LEVEL
SS.3-1	2	2
SS.5-1	2	2
FR.2-1	2	2
RP.2-1	3	2
RP.3-1	2	2
RP.10-1	2	2
RP.11-1	2	2
RP.11-2	2	2
PP.2-1	2	1
PP.5-1	2	1
PP.7-1	2	2
FP.2-1	2	1
FP.2-2	2	2

APPENDIX B-2

Tabulation of Concerns

A. Organization and Administration

CONCERN: (OA.1-1) Parts of the reactor quality assurance program do not meet LANL policy or DOE Order requirements in that not all important activities at the OWR complex are covered, needed resources have not been assigned, and the required quality assurance audit functions have not been implemented.

CONCERN: (OA.1-2) Many important procedures are either missing or are inadequate to provide the level of guidance needed to assure that all necessary activities and limits are known and implemented.

CONCERN: (OA.1-3) Many important documents, such as plans, logs, analyses and historical files, are missing or are inadequate to provide the guidance and records needed to define what is required or what has occurred.

CONCERN: (OA.4-1) The unusual occurrence reporting system at LANL is not effectively capturing all unusual occurrences and does not effectively implement DOE requirements for performance of a principal cause analysis of reported incidents.

CONCERN: (OA.4-2) LANL management is not requiring the collection of maintenance and surveillance data and minor incident information for trend analysis, subsequent prediction of potential problems, analyses for root cause analyses, and identification and correction of incipient problems before they become actual problems.

CONCERN: (OA.6-1) Document control is not adequate to provide proper and approved safety analyses, Technical Specifications, procedures, training records, and other records needed to demonstrate and assure the quality and safety of the reactor facility and operations.

B. Operations

CONCERN: (OP.3-1) The effort required of the small staff to place the new digital control system into service may take precedence over safety improvements identified as needed by this appraisal.

CONCERN: (OP.3-2) Some equipment which can be manipulated and some important parts of the reactor safety and control system are not distinctively marked.

CONCERN: (OP.7-1) There is indication that the problem of human factors are not fully appreciated.

C. Maintenance

CONCERN: (MA.1-1) LANL lacks a maintenance management plan that includes the reactor complex and which effectively provides for needs identification, resource allocation, effort organization, and effectiveness measurement.

CONCERN: (MA.2-1) The reactor complex lacks an effective and engineered aging-replacement program for older facility and reactor components not covered by the Assessment of the Probable Lifetime of the Omega West Reactor.

CONCERN: (MA.3-1) Significant system/component failures and replacements are generally addressed by restoration to original design and without adequate failure-mode analysis followed by engineered measures for any needed upgrade.

CONCERN: (MA.4-1) The inspection of the fire-side of boilers is not equal to the best industry standards.

D. Training and Certification

CONCERN: (TC.1-1) A comprehensive formal reactor training plan and program has not been established and documented to assure implementation and control of training activities.

CONCERN: (TC.1-2) Training has not been given the high priority it warrants.

CONCERN: (TC.2-1) The reactor examination process does not adequately measure supervisor and operator knowledge in the subject areas required by DOE Orders and the Technical Specifications.

CONCERN: (TC.4-1) Requirements in the LANL Health and Safety manual for the assessment of training needs for reactor employees are not being met.

E. Auxiliary Systems

CONCERN: (AX.4-1) The efficiency of the charcoal filter is not assured because the filter is not checked at any time after it is installed.

CONCERN: (AX.7-1) Inoperability of an engineered safety system (the No. 2 core spray system) is required to be reported by DOE 5000.3, Unusual Occurrence Reporting System.

CONCERN: (AX.7-2) The method of testing Core Spray No. 1 does not verify that the required flow of 10.4 gallons per minute could be achieved.

F. Emergency Readiness

CONCERN: (ER.2-1) Emergency procedures developed for implementation of the Omega Site Emergency Plan do not fully meet DOE Order requirements.

CONCERN: (ER.3-1) During the 5/16/89 emergency readiness exercise, rescue personnel did not administer first-aid appropriately and did not move the victim appropriately.

CONCERN: (ER.4-1) The communication equipment planned for use during emergencies is not sufficient to provide needed communications in all cases.

CONCERN: (ER.5-1) The emergency classification system used to develop emergency plans and procedures for the reactor site or for the organizations supporting the site are inconsistent and not in conformance with DOE requirements.

CONCERN: (ER.6-1) Exposure guides for toxic material and radiation exposure have not been provided in a timely manner in the emergency response plan for the reactor.

G. Technical Support

CONCERN: (TS.3-1) Some Technical Specification Surveillance Requirements are not being interpreted correctly.

CONCERN: (TS.3-2) The Technical Specification requirement for the flapper valve operation check is not being met.

CONCERN: (TS.3-3) The Safety Analysis Report is out of date and in need of revision.

CONCERN: (TS.4-1) Detailed procedures do not exist for performing all tests required by Technical Specifications.

CONCERN: (TS.8-1) There is no procedure that specifies the actions to be taken if a fuel element were to leak radioactivity into the reactor coolant.

H. Security/Safety Interface

CONCERN: (SS.3-1) Observations during the appraisal indicate that emergency egress from the facility and evacuation routes away from the site have not been completely and adequately evaluated.

CONCERN: (SS.5-1) Emergency readiness planning and training of Protective Force personnel for safeguards/security emergencies at the reactor site are not site-specific and do not cover the Omega Site Emergency Plan.

I. Experimental Activities

CONCERN: None

J. Facility Safety Review

CONCERN: (FR.2-1) The process for review, approval, and implementation of the Technical Specifications failed to identify several questionable practices with respect to the core spray systems and the interpretation of and procedures for performing surveillance tests.

L. Radiological Protection

CONCERN: (RP.2-1) Determination of root causes and identification and follow-up of corrective actions for radiation occurrences at the reactor are insufficient to preclude recurrences.

CONCERN: (RP.3-1) Sealed source leak tests are not being performed as required in Administrative Requirement 3-4 of the LANL Health and Safety manual.

CONCERN: (RP.10-1) It has not been demonstrated that the locations of air monitoring instrumentation are adequate to monitor the reactor room atmosphere in accordance with DOE Orders.

CONCERN: (RP.11-1) The contamination control program did not ensure that only trained and qualified personnel conduct personal and equipment contamination surveys upon exit from the controlled area.

CONCERN: (RP.11-2) The contamination control program at the reactor was not totally consistent with good health physics or industry practices.

M. Personnel Protection

CONCERN: (PP.2-1) The chemical inventory process at the reactor site is not identifying, documenting, and providing for control of all chemicals in accordance with the DOE and LANL policies.

CONCERN: (PP.5-1) Potential and existing industrial hygiene hazards at the reactor site are not being fully identified and documented in accordance with DOE requirements.

CONCERN: (PP.7-1) Periodic electrical safety inspections and appraisals, as differentiated from routine maintenance, have not been conducted at the reactor complex as required by LANL policy.

N. Fire protection

CONCERN: (FP.2-1) Inadequate Fire Department prefire planning and training jeopardizes the emergency response capability to the reactor site.

CONCERN: (FP.2-2) The previously identified Fire Department problems have not been effectively resolved in a timely manner, and effective interim steps have not been taken for the protection of the LANL or reactor site.

APPENDIX C

Team Composition and Areas of Responsibility

Technical Safety Appraisal
Omega West Reactor

EH Senior Manager	Oliver D. T. Lynch, Jr. Office of Safety Appraisals Department of Energy
Team Leader	Herbert C. Field Office of Safety Appraisals Department of Energy
Team Leader-in-Training	Owen O. Thompson Office of Safety Appraisals Department of Energy
Coordinators	Mary Meadows Office of Safety Appraisals Department of Energy
	Barbara K. Bowers Office of Safety Appraisals Department of Energy
Liaison with Team	Marvin P. Norin, representing Office of Military Applications Department of Energy
	Robert W. Walston Safety Programs Division DOE/Albuquerque Operations Office
Technical Advisor to the Team	Janet S. Davis Westinghouse Hanford Co.
Organization and Administration	Phillip A. Lowe Intech, Inc.
Operations Auxiliary Systems	James S. Cox Private Expert
Maintenance	C. Gregory Bruch EG&G Idaho, Inc.

Training and Certification	James R. Bohannon, Jr. Private Consultant
Auxiliary Systems Technical Support	Woodson B. Daspit W. B. D. Consulting Corporation
Emergency Readiness Security/Safety Interface	Jesse A. Pagliaro Private Expert
Experimental Activities Facility Safety Review	John G. Condelos Condelos Management Consultants
Radiological Protection	William N. Herrington Battelle Pacific Northwest Lab
	W. Craig Conklin Eneract Management Services, Inc.
Personnel Protection Fire Protection	Timothy J. Mulligan MSE, Inc.

APPENDIX D

Biographical Sketches of TSA Team Members

Technical Safety Appraisal
Omega West Reactor
Los Alamos National Laboratory

NAME: Herbert C. Field (Team Leader)

ASSOCIATION: DOE Headquarters, Office of Safety Appraisals

EXPERIENCE: 34 years

- o DOE Headquarters
  - Team Leader for Technical Safety Appraisals
  - Acting Director, Division of Safety Inspections
  - Technical Advisor to Director, Office of Nuclear Safety
  - Senior Executive for development of ES&H policy and ES&H performance measurement system
  - Consultant to U. S. Navy on safety of PM-3A reactor

- o Atomics International
  - Experimental reactor physics research
  - Physicist-in-charge, critical experiment facilities
  - Member, space reactor safety review committee

- o Lawrence Livermore National Laboratory
  - Neutron cross-section measurements
  - Experimental shock hydrodynamics

EDUCATION: B.S., Physics, Case Institute of Technology
M.S., Applied Mathematics, Purdue University

OTHER: American Nuclear Society
Sigma Xi; Tau Beta Pi
New York Academy of Science
American Men of Science; "Who's Who"

NAME: Owen O. Thompson (Team Leader-in-Training)

ASSOCIATION: DOE Headquarters, Office of Safety Appraisals

EXPERIENCE: 25 years

- o DOE Headquarters
  - Office of Safety Appraisals, Team Leader
  - Office of Compliance Programs, Project Manager for Idaho Operations
  - Office of Civilian Radiological Waste Management, Licensing Project Manager for proposed Basalt Waste Isolation Project

- o Nuclear Regulatory Commission
  - Licensing Project Manager, TMI-1 restart
  - Technical Assistant to Director, Div. of Engineering
  - Staff reviewer on Geosciences for power plants, low level waste sites, mill tailings dams
  - NRC Deputy Dam Safety Officer
  - ANSI subcommittee on NQA-2

- o ATEC Associates of Maryland, Inc.
  - Chief Engineer: consulting services for foundations, highways, dams, hazardous waste sites; expert witness

- o U.S. Waterways Experiment Station
  - Research Engineer on heavy duty pavement studies

- o University of Illinois
  - Lecturer for Illinois Highway Dept. training program
  - Research on dynamic response of highway pavements

EDUCATION: B.S., Royal Melbourne Inst. of Technology (Australia)
Ph.D., Civil Engineering, University of Illinois (Urbana)
NRC, Chattanooga Training Center, BWR & PWR series

OTHER: American Society of Civil Engineers
Registered Professional Engineer

NAME: James R. Bohannon, Jr. (Training and Certification)

ASSOCIATION: Nuclear Utility Consultants

EXPERIENCE: 38 years

- o Consultant
  - Provides consultation and project leadership to nuclear utilities and government in the areas of training, quality assurance, off-site emergency planning, and business planning

- o Carolina Power and Light Company
  - Manager for planning, development and implementation of nuclear and fossil power plants, operator, craft and technician training.
  - Director of Special Projects (simulator delivery, business plans) assigned by the Vice President

- o North Carolina State University
  - Professor of Nuclear Engineering and Director of Pulstar research reactor
  - Consultant to Carolina Power and Light Company, Assistant Project Engineer, Harris Plant emergency preparedness plan
  - Consultant to DOE Operational and Safety Division for appraisals
  - Consultant to NRC, Reactor Operator Licensing Division, as examiner and training programs evaluator

- o U. S. Air Force
  - Project engineer and Director for design and delivery of 10 MW Air force Nuclear Engineering Test Facility
  - Project engineer for delivery and checkout of 10 MW PM-1 nuclear power plant

EDUCATION: B.S., Nuclear Engineering, North Carolina State University
M.S., Nuclear Engineering, North Carolina State University

OTHER: American Nuclear Society
National Emergency Management Association
American Society of Quality Examination
American Men of Science
Sigma Xi; Tau Beta Pi; Phi Kappa Phi; Sigma Pi Sigma
Registered professional engineer

NAME: Charles G. Bruch (Maintenance)

ASSOCIATION: EG&G Idaho, Inc.

EXPERIENCE: 35 Years

- o EG&G Idaho, Inc.
  - Performed appraisals of operation/restart readiness at DOE and commercial nuclear reactors
  - Performed five Performance Oversight Evaluations/Technical Safety Appraisals at contractor operated DOE installations
  - Reviewed and evaluated maintenance at five contractor-operated DOE installations and developed Maintenance Management Program Manual for EG&G Idaho
- o Engineering Consultant
  - Provided specialized consulting services to Architects and Engineers for design related activities
- o EG&G Services, Inc.
  - Member of management start-up team for new company division
  - Prepared Technical proposals for multi-million dollar company initiatives
- o EG&G Idaho/Aerojet Nuclear Company
  - Performed company-level technical studies and management effectiveness appraisals
  - Managed computer operation and construction management programs
  - Chaired two class B accident/incident investigations
  - Compiled work of 19 scientists and engineers into user's manual for internationally used nuclear-reactor computer simulation
- o U. S. Navy
  - Served as career Civil Engineer Corps Officer in various facility engineering management roles including design, construction, operation, maintenance and transportation

EDUCATION: B.S., Electrical Engineering, Univ. of Wyoming
B.C.E., Civil Engineering, Rensselaer Polytechnic Institute
M.S.E., Electrical Engineering, Univ. of Michigan

OTHER: Registered Professional Engineer
Institute of Electrical and Electronic Engineers
Society of American Military Engineers

NAME: John G. Condelos (Experimental Activities/Facility Safety Review)

ASSOCIATION: Condelos Management Consultants

EXPERIENCE: 39 years

- o Consultant
  - Provides consultation to the Department of Energy in the areas of reactor, nuclear criticality, plutonium facility, and transportation safety; decontamination and decommissioning of nuclear facilities; and applied health physics

- o DOE/ERDA/AEC
  - Special Assistant for Technical Projects, Safety Division, Chicago Operations Office: Managed projects for decontamination and decommissioning of research reactors and plutonium fabrication facilities
  - Assistant Director for Nuclear Safety, Safety Division, Chicago Operations Office: Managed safety programs for reactors and in the areas of criticality, transportation and plutonium safety.
  - Reactor Safety Engineer, Safety Division, Chicago Operations Office: Technical and administrative work in reactor safety and criticality safety.
  - Reactor Inspector, Region III Compliance: Field inspection of power, test and research reactors licensed by AEC.

- o Argonne National Laboratory
  - Reactor Supervisor: Responsible for operation of CP-5 reactor and supervision of all operations, maintenance, and administrative personnel
  - Assistant Mathematician: Performed neutron flux, spectrum and reactor physics measurements on the CP-5 reactor.

EDUCATION: B.S., Mathematics, Northwestern University

OTHER: American Nuclear Society
Health Physics Society

NAME: W. Craig Conklin (Radiological Protection)

ASSOCIATION: Eneract Management Services, Inc.

EXPERIENCE: 11 years

- o Eneract Management Services, Inc.
  - Developed performance-based training program for Emergency Preparedness Exercise Controller/Evaluator at Comanche Peak Steam Electric Station
- o General Physics Corporation
  - Performed Susquehanna Nuclear Power Station Emergency Preparedness Audit
  - Performed Emergency Preparedness Training Assessment for Sacramento Municipal Utility District
  - Performed Post-Accident Sampling System (PASS) shielding analysis for the Browns Ferry Nuclear Power Plant
- o Texas Utilities Generating Company
  - Developed Radiation Protection and Emergency Preparedness programs and procedures for the Comanche Peak Steam Electric Station
  - Performed INPO-based audits on Radiation Protection and Emergency Programs at CPSES
- o Newport News Reactor Services
  - Provided Radiological Control and Emergency Readiness support for the refueling and defueling of the A1W prototype at the Naval Reactors Facility
  - Responsible for the Radiological Control Audit program

EDUCATION: B.S., Biology, Virginia Polytechnic Institute and State University
M.S., Health Physics, Georgia Institute of Technology

OTHER: Health Physics Society
American Nuclear Society

NAME: James Cox (Operations/Auxiliary Systems)

ASSOCIATION: Private Consultant

EXPERIENCE: 35 years

- o Consultant
  - Provides consulting services to The International Atomic Energy Agency, the National Bureau of Standards, and DOE in the areas of operations, experiments, training and research reactors

- o Union Carbide, Oak Ridge National Laboratory
  - Director of Operations Division - Reactors included Health Physics Research Reactor, Oak Ridge Critical Facility, Tower Shielding Reactor, High Flux Isotope Reactor, Bulk Shielding Reactor, Oak Ridge Research Reactor, Low Intensity Testing Reactor, and X-10 reactor - Hot Cell Operations included 20 cells - Waste Operations included low- and intermediate-level radioactive liquid wastes, radioactive solid waste, and low-level and hot off-gas - Radioisotope Production and sales
  - Superintendent of Reactor Operations for X-10 Graphite Reactor and Low Intensity Testing Reactor

- o Clinton Laboratories, Oak Ridge, Tennessee
  - Manager of Radioisotope sales

- o U.S. Army, Manhattan District, Oak Ridge, Tennessee
  - Nuclear Engineer

EDUCATION: B.S., Chemical Engineering, Washington State University
Graduate Work, Brown University

OTHER: Authored Manual For Safe Operation of Research Reactors and of Critical Assemblies for IAEA
Fellow, American Nuclear Society

NAME: Woodson B. Daspit (Auxiliary Systems/Technical Support)

ASSOCIATION: WBD Consulting Corporation

EXPERIENCE: 38 years

- o Consultant
  - Provides consultation to nuclear utilities and government in the areas of auxiliary systems, technical support, reactor design and general reactor technology

- o Du Pont, Savannah River Plant
  - Reactor Associate for advanced studies
  - Process Associate for advanced studies: procedure enhancement; training; simulator procurement committee
  - Chief Supervisor for reactor physics: hydraulics, heavy water technology, production reactor charge design, test reactor technical assistance, production calculations (manual and automated).
  - Site Emergency Response Committee
  - Responsible for mechanical, electrical and instrument assistance group
  - Area Assistance: assigned in reactor building providing direct assistance to operating personnel; wrote incident reports, reviewed job plans, process improvements, etc.
  - Shielding and instrumentation Group Leader.
  - Experimental Physics: start up of critical facility; construction checkout; planning and performing experiments for application to production reactors

- o U.S. Naval Ordinance Test Station
  - High explosive research including use of very high speed photography.

EDUCATION: B.S., Physics, Louisiana State University
M.S., Physics, Louisiana State University

OTHER: American Nuclear Society
Sigma Xi

NAME: William N. Herrington (Radiological Protection)

ASSOCIATION: Battelle Pacific Northwest Laboratories, Richland, Washington

EXPERIENCE: 13 years

- o Battelle Pacific Northwest Laboratories
  - Senior Research Scientist, Health Physics Department: Radiological surveys, environmental studies, decontamination, program development, and employee training
  - Evaluated adequacy of state-of-the-art radiological instrumentation when applied to accident conditions
  - Performed dose calculations for Hanford Defense Waste Project
  - Assisted in the development and presentation of radiological safety courses for the Department of Army and various DOE contractors
  - Contributed to the task of rewriting the DOE ALARA manual and writing a Plutonium Facility Good Practices manual
  - Served as consultant Radiological Engineering Inspector to the NRC during emergency preparedness exercises, annual emergency preparedness inspections, and emergency preparedness appraisals at selected nuclear power and research reactors
  - Appraised Radiation Protection program in the Technical Safety Appraisal of four DOE facilities

EDUCATION: B.S., Radiation Protection Engineering, Texas A & M University

OTHER: Health Physics Society

NAME: Phillip A. Lowe (Organization and Administration)

ASSOCIATION: Intech, Inc.

EXPERIENCE: 28 years

- o Consultant
  - Provides consultation to nuclear utilities and government in the areas of management, application of advanced power generation technologies, and control and mitigation of environmental pollution

- o DOE/ERDA/AEC
  - Deputy Assistant Inspector General for Inspections - DOE
  - Assistant Director for Inspections, Chief Thermal Energy Storage Branch - ERDA
  - Chief Steam Generator Branch - AEC

- o Combustion Engineering
  - Manager of Experiments for Product Engineering for nuclear power plant systems

- o Westinghouse Bettis Atomic Power Laboratory
  - Senior Engineer for thermal hydraulic reactor design

- o U.S. Navy
  - Officer, Civil Engineer Corps

EDUCATION:
B.S., Mechanical Engineering, University of Utah
M.S., Mechanical Engineering, University of Rhode Island
PhD., Mechanical Engineering, Carnegie Mellon University

OTHER:
AEC - Westinghouse Fellowship
Fellow, American Society of Mechanical Engineers
- Chairman, Advanced Energy Systems Division
- Board for Research and Technology Development

Registered Professional Engineer
Advisor to Electric Power Institute

NAME: Timothy J. Mulligan (Personnel Protection/Fire Protection)

ASSOCIATION: MSE Inc.

EXPERIENCE: 12 years

- o MSE, Inc.
  - Risk Management Division Manager: responsible for management of the Industrial Safety, Industrial Hygiene, Fire Protection, Environmental, Quality Assurance, and Internal Audit Programs
  - Safety Advisory Committee Chairman: responsible for review of SARS
  - Safety Office Manager: responsible for management of the Industrial Safety, Industrial Hygiene, Fire Protection, and Environmental programs
  - Safety Engineer: responsible for development and implementation of safety, industrial hygiene, and fire protection programs including procedures; technical support; inspections; training; investigations; monitoring and surveillance; hazard communication program; fire protection engineering; fire system inspections and tests; review of designs, procedures, work controls; personal protective equipment; record keeping and reporting

- o Anaconda Copper Company
  - Safety and Health Engineer: responsible for safety engineering and industrial hygiene, including inspections, investigation, training, record keeping and reporting, safety committee meetings, technical support, audiometric testing, dust and noise monitoring

EDUCATION: B.S., Occupational Safety and Health, Montana College of Mineral Science and Technology
B.S., Zoology, Montana State University

NAME: Jesse A. Pagliaro (Emergency Readiness and Security/Safety Interface)

ASSOCIATION: J. Pagliaro Management Consultants

EXPERIENCE: 35 years

- o Consultant
  - Provides consultation to nuclear utilities and government in the areas of emergency preparedness, health physics, radiological engineering, fire protection and environmental qualifications
- o Environmental Protection Agency
  - Project Officer for DOE Yucca Mountain repository
  - Emergency planning project officer for the Nevada Test Site
- o Southern California Edison (SCE)
  - Interfacing between NRC and SCE regarding Licensee Event Reports, Prompt Reports, Special Reports, and response to Notices of Violation
- o Nuclear Regulatory Commission (NRC)
  - Emergency Planning Analyst
  - Chief of Materials Radiological Protection Section
  - Radiation Specialist
- o Argonne National Laboratory (Idaho)
  - Radiation Safety Supervisor
- o Atomic Energy Commission
  - Senior Health Physicist (Chicago)
- o Argonne National Laboratory (Chicago)
  - Health Physicist
  - Senior Radiation Safety Technician

EDUCATION: B.S., Elmhurst College, Elmhurst, Illinois

OTHER: Special Achievement Certificate for significant contribution in Emergency Preparedness Implementation Appraisal Program (1982)
Special Achievement Certificate for Contribution toward TMI response (1979)
Health/Physics Society
American Nuclear Society