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Technical Safety Appraisal of the Sandia Reactors, ACRR, SPR III Sandia National Laboratories, Albuquerque

May 1989

TECHNICAL SAFETY APPRAISAL

ANNULAR CORE RESEARCH REACTOR AND SANDIA PULSE REACTOR III

SANDIA NATIONAL LABORATORIES, ALBUQUERQUE

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ABBREVIATIONS

The following abbreviations are used in this appendix without definition:

ACRR	Annular Core Research Reactor
ANSI	American National Standards Institute
DOE	U.S. Department of Energy
DOE/AL	DOE's Albuquerque Operations Office
QA	Quality Assurance
Sandia	Sandia National Laboratories at Albuquerque
SLI	Sandia Laboratories Instruction
SPR III	Sandia Pulse Reactor III

I. INTRODUCTION

This report presents findings and concerns resulting from a Technical Safety Appraisal of Sandia National Laboratories' Sandia Pulse Reactor III (SPR III) and the Annular Core Research Reactor (ACRR). It was conducted by an appraisal team for the Department of Energy's Office of Safety Appraisals during site visits July 18-22 and August 1-12, 1988.

Sandia National Laboratories at Albuquerque is located at the base of the Manzano Mountains adjacent to Albuquerque, New Mexico, on Kirtland Air Force Base property leased by the DOE. Sandia National Laboratories is a wholly-owned subsidiary of AT&T Technologies, Inc. with whom DOE has executed a contract to operate this site and others. Sandia's operations at the Albuquerque site employ more that 7000 persons, of which approximately 35 are assigned to the reactor facilities.

The two reactors are located in Technical Area V of the Sandia Albuquerque site. A third reactor, SPR II, is stored assembled in a vault at the SPR III facility. While the SPR II reactor is still considered operational, there are no plans to use it in the foreseeable future. It was last operated in 1984. This appraisal addresses only the operations associated with SPR III and ACRR.

The SPR III is, as its numerical designation implies, a third-generation system. It has been operational since 1975. It is housed in the same facility that housed its predecessors dating back to 1961. It is an unmoderated, reflector-controlled, uranium-alloy reactor which provides gamma and fast neutron fluxes for a variety of research needs, but primarily in support of radiation-effects studies on electronic components and subsystems. While generally operated in the pulsed mode where it can achieve a total energy release of up to seven megajoules, depending on the requirements of the study being conducted, it is also regularly operated at steady-state power levels up to nine kilowatts thermal.

The ACRR is a second-generation pool-type reactor which has been in operation since 1978. It is in a facility which was built in 1967 to house its predecessor. It is capable of both pulsed and steady-state operations. The pulsed mode can achieve a peak power of 33,000 megawatts for a brief time, with a total energy release of 300 megajoules. Its maximum steady-state operating power is two megawatts thermal. This research facility provides a large (9-inch) central unflooded irradiation cavity, an even larger external unflooded fueled cavity for irradiations, and a neutron radiography facility. The facility's current mission is to support weapons component testing, materials research, and, to a lesser extent, reactor development studies and reactor safety experiments for the U.S. Nuclear Regulatory Commission.

The principal hazards presented by operations in these facilities are routine industrial safety hazards, the beta and gamma radiation fields experienced during maintenance operations at SPR III and during the handling of experimental packages after irradiation in either of the reactors, and localized radiation fields that could result from a highly-unlikely, severe accident.

The findings and concerns developed by the appraisal team were shared with senior managers of Sandia National Laboratories and the Albuquerque Operations Office in exit meetings held on August 11 and 12, 1988. The final report of the team has been validated for factual accuracy with Sandia and the Albuquerque Operations Office.

This report has been transmitted to the DOE Headquarters Office of Defense Programs and to the DOE Contracting Officer in the Albuquerque Operations Office for action to correct the deficiencies found by the appraisal.

II. PERFORMANCE EVALUATION

Sandia National Laboratories' safety policies emphasize individual responsibility for safety and clearly identify line management as having ultimate responsibility for safety. However, with regard to operations at the Sandia Annular Core Research Reactor (ACRR) and the Sandia Pulse Reactor III (SPR-III), this appraisal found that the line management safety responsibilities were often subrogated to the technical staff for many aspects of day-to-day operation. Without appropriate management oversights, unsafe practices can evolve and persist. For example, in one of the two Category II findings of this TSA, unsafe methods were observed being routinely used for moving heavy objects in and out of the ACRR experimental cavity. When laboratory management was apprised of the situation, an acceptable alternative method was quickly devised, and the unsafe features of the activity were eliminated.

Similarly the second Category II finding arose from the fact that personnel working at the reactors were found to be inadequately prepared to react to a nuclear criticality alarm. This item also required and received expedited corrective action by the contractor. Effective management oversight would have identified and corrected these deficiencies.

Many aspects of nuclear safety at the ACRR and SPR-III are notable. For instance, managers at the Director level were directly involved in reviewing the safety of experiments to be conducted in the reactors. In addition, strong interaction between the experimenters and the reactor operators was noted when the safety of an experiment was being considered.

Counter to these positive attributes however is a tolerance for informality in reactor operations. For example, the Reactor Operating Procedures are not controlled and were found to contain outdated material. Similarly, the Sandia Reactor Safety Committee (SRSC) was not consulted in a timely manner concerning safety issues, such as changing transient rod worth, that are clearly within the SRSC independent review charter. Coupled with items such as the training deficiencies, evidenced by the inadequate preparation to respond to a nuclear criticality alarm, exclusion of outside review, and other concerns throughout the report related to lack of documentation, there is a pattern of insufficient management involvement and reluctance to seek advice or assistance from outside sources.

The resources, both human and material, necessary for an exemplary safety program exist at ACRR, SPR-III and in the supporting technical services at Sandia. However, line management must accept and implement its safety responsibilities before this goal can be achieved.

III. REVIEW FINDINGS

All of the Performance Objectives which were applicable to this appraisal are discussed in this section. The findings which follow the statement of each Performance Objective address the more pertinent facts obtained and conclusions drawn from: observing routine operations, emergency exercises, and the physical condition of the facilities; talking with Sandia management, technical, and craft personnel; and reviewing policy statements, records, procedures and documents.

Fifty-seven concerns are expressed in this report, the correction of which would improve the safety of the operations at these facilities. The results are summarized in Attachment 3b. The findings that serve as the basis for a concern can be found immediately preceding the concern and are identified by the use of an (*). To understand the full intent of any concern, it is necessary to read its basis. However, resolution of the individual concerns will not necessarily be sufficient to prevent the occurrence of similar concerns in the future. The underlying issues also need to be sought out and addressed.

Of the 57 concerns expressed, 22 address lack of full compliance with some part of a mandatory safety and health requirement. The most significant of these involved poor documentation and evaluation of off-normal events less significant than Unusual Occurrences, and the fact that actions taken in response to emergencies, although formally delegated to an appropriate member of management, are in fact under the direction of the reentry team leader without appropriate limitation. The appraisal team believes most of its findings were symptomatic of underlying casual factors. Drawing upon the extensive relevant experience of its members, the team tried to identify the underlying causal factors in developing its statements of concern. However, that effort is at best imperfect because of the time it could devote to the problem and its unfamiliarity with all of the intricacies of the contractor's management philosophy. Therefore, the appraisal team believes the contractor needs to treat the findings, and even the statements of concern, as symptomatic of some set of deeper root causes, and to search out and correct those root causes so that there will be reasonable assurance that improvements in the safety of the operation will be sustainable.

Two of the concerns were judged to be of Category II seriousness (see Attachment 3a); i.e., they address hazards of sufficient significance to warrant expedited attention by the contractor. One of these addresses the need for better personnel safety during the handling of heavy loads with the ACRR bridge crane. The other addresses better training and evacuation path identification needed to respond to the criticality alarm at SPR-III.

A listing of the total set of concerns developed by the appraisal team can be found without their supporting findings in Attachment 2.

A. ORGANIZATION AND ADMINISTRATION

Sandia has implemented a decentralized managerial system with organizational levels in descending order as: President, Executive Vice President, Vice President, Directorate, Department, Division, Section and Staff. The management has emphasized that safety is an individual responsibility, with line management responsible for assuring that the work is conducted safely and with a proper regard for the environment and property. While there are procedures and requirements imposed for guiding the conduct of the work, the emphasis is on remaining flexible. We observed that the Sandia senior management believes this approach is working very well, that they are confident that they know what the real safety issues are, and that no major safety problems presently exist in the area of nuclear reactor activities.

Management awareness of the actual state of affairs depends upon line management either self-certifying that there are no problems; upon line management bringing an issue upward through the system; or upon having independent assessments and appraisals performed. The President of Sandia has provided guidance that such independent reviews should be "... appropriate for the nature of the work involved..." and that "...'sensible' application of controls is the keynote."

This technical safety appraisal has found strong evidence that the Sandia oversight system is not functioning at a detailed enough level to independently assess the safety implications of the day-to-day activities of the reactors. Important problems that exist and that are discussed elsewhere in this report include:

- recurring problems such as the staffing of reactor operations and health physicist functions;

- inadequate control of documents important to safe reactor operations;

- an overall lack of documentation and effective quality assurance audits;

- no intermediate system for addressing off-nominal or unusual conditions, other than either leaving the resolution to line management with usually no oversight provided, or introducing the item into the DOE reporting system that transmits the report throughout the entire DOE system; and

- the reactor operating procedures not being subjected to the same level of review and control that is applied to Sandia Safe Operating Procedures.

There are some notable successes in the Sandia management of nuclear reactor safety. They include:

- managers at the Director level being directly involved in reviewing the safety of experiments to be conducted in the nuclear reactors;

- a strong interaction between the experimenters and the reactor operators when the safety of the experiment is being considered; and

- a good safety record with respect to nuclear reactor activities.

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:

- Sandia is organized and structured with the view of implementing a strongly decentralized management structure. Documents (such as the Safety Manual or the President's policy to establish a Safety, Health, and Environment Appraisal Committee) which identify or assign staff responsibilities generally emphasize that ultimate responsibility remains with the appropriate line management.

- Based upon interviews with managers and staff selected at random from all levels of the organization, the responsibilities and authorities of line management are clearly understood by the employees. The responsibilities of staff organizations, such as industrial safety and hygiene, for their inherent responsibilities throughout the organization are not as clearly understood. This conclusion is supported by observations of their reluctance to provide oversight, training and other cross-cutting activities, and by observations documented by the individual technical safety appraisal team members (for example, see Sections PP.1, PP.2, PP.7, OP.2, and TC.4).

- In general, documented assignments of tasks to personnel are not made, nor are goals and objectives documented. Based upon randomly selected interviews with staff, personnel understand their duties and believe that they are consistent with their general job description and organizational assignment.

- In May 1988, the Vice President, Energy Programs, made a specific, documented assignment of responsibility for the safe operation of the nuclear reactors (SPR II, SPR III and the ACRR) sited at Sandia. A similar letter was sent to each reactor supervisor and operator, acknowledging their importance to the safe operation of the reactors.

- The President of Sandia has issued several policy statements that the Safety, Health and Environment Appraisal Committees (SHEAC) are the primary Laboratory mechanism for providing an annual verification that the important environment, safety, and health (ES&H) activities have been accomplished. These statements do not include references to the roles of the Sandia Reactor Safety Committee (SRSC) or the ES&H Department established within the Medical Directorate.

. The responsibilities of the SRSC are defined in a Charter approved by the committee chairman and the Vice President of Energy Programs. This authority includes the responsibility to provide independent audits of reactor activities. Additional responsibilities for the SRSC are defined in the Technical Specifications and Safety Analysis Reports for the reactors.

* The Sandia Laboratories Instruction SLI 1030, Official Sandia Laboratories Committees, does not identify the SHEAC or the SRSC as official Sandia committees, even though the SHEAC and its predecessor committee have been functioning for over a decade and the SRSC has been active since the mid 1960s.

* The guidance to the SRSC does not include any reference to the SHEAC and vise versa. The chairmen of the SRSC and the SHEAC assigned to oversee the organizations responsible for reactor activities met, and recently have met again, to divide their responsibilities for oversight of reactor activities. Their conclusions are not consistently documented, and their implementation relies upon each chairman remembering the agreements and subsequently advising his replacement. Their agreements are understood and agreed to by the Vice President to whom they both report. New chairmen are due to be assigned to these committees. The new chairman for the SRSC has already been designated.

* The ES&H Department's assigned role is primarily as a consultive organization to the line organizations. Its responsibilities are defined in a number of separate documents including the Safety Manual; SLI 2001, Environmental, Safety, and Health (ES&H); and SLI 6475, Nuclear and Radioactive Materials. In practice, a very important document that assigns responsibilities to the ES&H Department is its annual budget "case", which gives it its operating budget for the year.

* Planning for nuclear reactor safety oversight has not been undertaken on a Sandia-wide basis with the total requirements and resource needs examined and then apportioned to the individual organizations selected to carry out such functions.

* An effective industrial safety oversight program has not been implemented. See Sections PP.1, PP.2 and PP.7 for details.

CONCERN: (OA.1-1) The oversight responsibilities between all the Departments, Committees, and special staff positions that provide such oversight for reactor operations have not been institutionalized through proper documentation.

FINDINGS:

* For the past 3 years the Audit and Review Staff of the SRSC has identified recurring staffing and safety problems that were reported through the managerial system as having been resolved each year after they were identified. Examples are:

  - In September 1986, they noted that the staffing levels of the "Reactor Application Division and the health physics support group continues to be a matter of real concern..."

  - In October 1987, they noted that "... Health Physicists were in short supply and SPR operations had to be curtailed to hold overtime to reasonable levels..."

  - In July 1988, they noted that staffing of operators and health physics was an area of "... continuing need for management vigilance." In addition, there was a "... serious emerging need for additional staff and funding to address the ES&H compliance issue."

* Some staff safety functions, such as industrial hygiene, are staffed but not charged with performing their vital functions. See Section PP.4.

CONCERN: (OA.1-2) The root cause for the recurring staffing problems related to the support and operations of the reactors has not been identified and adequately addressed.

FINDINGS:

. DOE 5480.6, Safety of Department of Energy - Owned Nuclear Reactors, requires that reactor "Safety Analysis Reports" and "Technical Specifications" be prepared and maintained, that reactor personnel be trained and certified, that there be recordkeeping, that the contractor have an independent review and appraisal system, and that the contractor develop and apply a quality assurance (QA) program to review and evaluate the implementation of the above items.

  DOE 5700.6B, Quality Assurance, broadly defines the DOE requirements for a QA program and its activities.

- In April 1986, Sandia issued the Sandia "Quality Plan," which replaced a March 1984 issue. A revised plan is presently being developed at Sandia. The current plan emphasizes that QA requirements and activities should be "... appropriate for the nature of the work involved ..." and that "'sensible' application of controls is the keynote."

- Sandia has assigned about 50 QA personnel to audit the performance of its suppliers. They are managed by a professional quality assurance organization.

- Sandia has assigned 79 Quality Coordinators to the individual line organizations. They are to provide professional support to the line organization and to perform any audit responsibilities that their line managers choose to assign to them. One Quality Coordinator is associated half-time with reactor operations. He also receives some level of supervision from the vice presidential-level Quality Coordinator.

- Three QA auditors from the Sandia QA organization are assigned to audit the Sandia line organizations. They focus on reviewing Quality Plans and spend most of their time with organizations that have not yet designated a Quality Coordinator.

- In July 1986, the "Sandia Research Reactor and Experimental Programs Quality Assurance Program Plan" was approved at the Directorate level and issued.

- The Charter of the Sandia Reactor Safety Committee (SRSC) charges it "to provide an independent and objective safety review of all matters brought before the committee..." and to audit reactor operations to assure compliance with the approved Technical Specifications for each reactor. It is also charged with responsibility to approve the reactor Technical Specifications (this is a joint responsibility as the line management also approves this document).

- The Technical Specifications charge the SRSC to perform annual reviews of the reactor operations and identifies the Audit and Review Staff of the SRSC as the primary element that will conduct such annual reviews.

- Most DOE contractors have adopted the use of the standard ANSI/ASME NQA-1 1986 Edition, Quality Assurance Program Requirements for Nuclear Reactors, as the reference for their quality assurance program. This standard is also stated as being the preferred standard by DOE 5700.6B.

* The July 1986 plan contains all the elements identified in the Sandia policy statement and in the DOE orders, except for the establishment of a QA audit activity. The planning and implementation of the "quality review" element is assigned to the Quality Coordinator who reports at the Department level. Sandia has chosen to implement the quality review requirement with an approach that is less disciplined than a normal QA audit (e.g., no preaudit plans, no requirement for certified QA auditors, etc.).

* In July 1988, the "Quality Assurance Program Plan for Facility Operation in the Reactor Development and Applications Department" was approved at the Director level and issued. It does not refer to the 1986 related QA Program Plan. The Department management felt that both documents are applicable, and that together they constitute the QA program description for the reactors. This understanding has not been documented. (See Section OA.6 for more issues related to documentation control.)

* The new July 1988, QA Program Plan emphasizes that the Sandia reactors are research reactors and identifies the reactor Technical Specifications as the "Quality Assurance Plan" for operations and maintenance for each reactor.

* The Technical Specifications, in their capacity as the operations QA plan, do not:

  - adhere to the recordkeeping requirements of DOE 5480.6, which require QA records be retained for the life of the facility, and that reactor operations logs be retained for 6 years.

  - establish methods for the identification, handling, controlling and storage of all primary reactor documents as required by DOE 5480.6 for QA programs (also see Section OA.6 for other documentation problems with the Technical Specifications).

  - address how all nonconformance items are to be handled; (but see Section MA.3 for an example of how nonconforming equipment can be used during operations without the prior application of a nonconformance or deviation review and acceptance analysis).

  - identify that the QA program is to be guided by plans, procedures, and checklists (although procedures and checklists are identified as being needed for operations).

* The Audit and Review staff does not perform its reviews based upon applying planned procedures and guidelines. See Section FR.4 for more details on problems with their review activities.

* The cited elements are all an integral part of an auditable QA program. Sandia's contract with DOE and DOE 5480.6 both require that an auditable QA program be implemented.

CONCERN: (OA.1-3) The Sandia quality assurance plans for reactor activities do not completely fulfill manditory DOE requirements.

OA.2 Management Objectives

PERFORMANCE OBJECTIVE

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

FINDINGS:

- Each manager decides whether or not to use management by objectives for subordinates, individuals, or organizational units. In general, and based upon discussions with managers selected at random from all managerial levels, it was found that performance or management objectives are not used, and safety objectives in particular were not used.

- Objectives for organizational units, and in some cases for individuals, can be and were found because they are an intrinsic part of other management requirements or processes.

- Since the management goals identified were not part of a specific management by objective system, a corresponding managerial system for tracking the performance versus goal was not observed.

- For reactor operations, the documentation of the enforcement of safe work practices and procedures is best evidenced by examining the documentation of the reactor operating logs and checklists. We observed:

  - The required checklists are used.

  - From a random sample of ten start-up checklists we found they were completely filled in with check marks. The actual value of a reading was not recorded, just a check that a reading had been made.

  - Eight of the ten checklists had been initialed by the reactor supervisor to indicate that he had concurred with the checklist activity.

  - The Audit and Review Staff has also reviewed the quality of the reactor operation logs during their annual evaluation of reactor activities.

CONCERN: None.

OA.3 Corporate Support

PERFORMANCE OBJECTIVE

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

FINDINGS:

- Sandia policy statements strongly emphasize the requirement to conduct operations and design products with the highest regard for the safety and health of personnel and the public, for the protection and preservation of the environment, and for the protection of property.
- Primary responsibility for implementing the policy is clearly stated to belong to each individual, with line management charged to assure that the policy is implemented.
- Directors are periodically charged to report on safety matters to the Sandia Small Staff (the President, two Executive Vice Presidents, eight Vice Presidents, and the General Council).
- The Vice President of Energy Programs meets weekly with his Directors. Reactor operations and other safety issues are discussed, as appropriate.
- Feedback on safety-related matters is also provided to the Vice Presidents, since the Sandia Reactor Safety Committee and all the Safety, Health, and Environment Appraisal Committees report directly to Vice Presidents.
- AT&T Technologies, Inc (AT&T) formally audits Sandia operations, but those audits are of administrative and financial activities.
- Sandia is autonomous from AT&T with respect to reactor safety (as well as other nuclear-related safety items) because the contract between DOE and AT&T specifically indemnifies AT&T for such items, leaving the responsibility and risk fully with the government. Sandia, as a corporation, has no assets other than the monies it receives annually for operations from DOE.
- The AT&T Corporate Medical Director meets annually with Sandia Medical Director to review operations. This review includes health, safety and environmental matters whenever the AT&T Medical Director requests it.

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:

- The contract between DOE and AT&T Technologies, Inc. to operate the Sandia National Laboratories requires that "in the operation and maintenance of any nuclear facility ... Sandia Corporation shall: ... establish an auditable, well-defined, internal safety review and inspection system ..."

- DOE 5480.6, Safety of Department of Energy-Owned Nuclear Reactors, requires that the contractor establish an independent review and appraisal system and that they adhere to the quality assurance program requirements of DOE 5700.6B, Quality Assurance.

- The appraisal and audit studies and findings produced by organizations external to Sandia are tracked through close out by a Sandia computerized system.

- There is a system or structure for dissemination of safe operations information to the immediate reactor operations staff that includes Safety Analysis Reports, Technical Specifications, training courses, joint reviews between experimenters and reactor operators, and Directorate and Department Safety meetings.

- The reactor Technical Specifications identify that the Independent Review and Appraisal function for the reactor facilities is to be accomplished through the activities of the Sandia Reactor Safety Committee (SRSC) and its subordinate committees, the SPR Committee, the ACRR Committee, and the Audit and Review Staff.

- The President of Sandia has explicitly stated that the Safety, Health, & Environment Appraisal Committee (SHEAC), instituted at the Vice Presidential level, is to be the primary system for assessing line management's activities to provide a safe and healthful work place.

* In the Sandia management's monitoring and assessment of reactor facilities and operations, the resulting findings, and action items, are generally not documented or retained in a form suitable for audit reviews.

* Sandia does not use a formal quality assurance audit process to independently verify the promptness and adequacy of the close out of SRSC and SHEAC findings.

* There have been timely and effective actions taken to correct deficiencies identified by the SRSC system and the SHEAC. However, there are significant exceptions. For three years in a row the Audit and Review Staff of the SRSC has identified:

  - staffing of reactor operations and health physics as a significant problem area.

  - need for a comprehensive review of, and improvement of, documentation.

  - residual plutonium and uranium material from experiments completed long ago still remains in Technical Area V.

* In recognition of problems related to the timely and effective close out of audit and review findings, the SRSC and the SHEAC have instituted new administrative controls. In January and again in July, 1988, the SRSC established controls to assure that action items are presented at each committee meeting. In April, 1988, the SHEAC established an administrative control to have each Director self-certify, in writing, that they have corrected inspection-identified deficiencies.

CONCERN: (OA.4-1) The Sandia system to correct reactor facility review and appraisal findings or action items is not fully effective.

FINDINGS:

. There are two quality assurance (QA) programs for reactor operations: the July 1986 Sandia Research Reactor and Experimental Programs Quality Assurance Program Plan and the July 1988 Quality Assurance Program Plan for Facility Operations in the Reactor Development and Applications Department.

* The SRSC system, with the Audit and Review Staff taking the lead role, has been designated by Sandia as the QA auditor for the Sandia reactor operations and maintenance activities. It produces one report per year, and letter reports during the year are issued after a staff member has performed a review.

* Sandia indicated that the Audit & Review Staff evaluations have helped identify important items that have led to improvements in the level of reactor safety. Examples include: the dose reduction program; conducting critical experiments prior to conducting some reactor operations; and establishing specifications for the remote operations of the SPR III reactor.

* The Quality Coordinator at the Department level performs audits of reactor experiments and

modifications. He reports these findings to the Department level. The SRSC reports to the Vice President, Energy Programs.

* It is the standard industry practice that QA offices report to a single senior executive that is independent of the functions and organizations that are examined by the QA auditors.

* DOE 5700.6B, Quality Assurance, requires that an audit be planned and performed in accordance with procedures, and that the requirements and objectives for QA activities be established.

* The Audit and Review Staff did not have an experienced quality assurance auditor on its staff, and it did not employ the audit plans, procedures, and check lists used in QA audits in the nuclear industry. (In July, 1988, Sandia indicated that the Quality Assurance Department Manager, who is responsible for the Laboratory-wide QA activities, was assigned to the Audit and Review Staff as a collateral duty.)

* Various Technical Safety Appraisal team members observed and documented specific examples that demonstrate inadequacies of the Sandia reactor quality assurance program. For example:

  - In spite of the fact that each experimental plan has a check off for security communications, security inspectors are not provided with information and training to adequately assure their personal health and safety protection when they work near the reactors (see Section SS.2).

  - There are limited formal policies or procedures implemented to control the placement, removal and accountability of keys, jumpers, tags and lift leads (see Sections OP.3 and MA.7).

  - The annual audit has not been effective in discovering deficiencies in the training, certification and health examination of reactor operators (see Sections TC.2 and TC.4).

  - The annual audit has not been effective in discovering deficiencies in a number of areas associated with experiments (see Sections EA.1, EA.2, and TS.5) and operations (see Sections OP.2, OP.3 and TS.1).

  - The maintenance activities for the reactors are conducted, in many instances, without the use of written instructions and formal programs (see Section MA.7).

- Not all issues of safety significance are introduced in a timely manner to the SRSC (see Section FR.2).

CONCERN: (OA.4-2) The Sandia quality assurance audit program for reactor operations and activities is not fully effective (see Concern FR.4-1).

FINDINGS:

. DOE 5000.3, Unusual Occurrence Report System, provides specific guidance and criteria as to what events constitute an unusual occurrence event.

. The Sandia system for reporting unusual occurrences is documented in Sandia Laboratories Instruction 2041, Reporting System for Unusual Occurrences (SLI 2041).

. SLI 2041 provides general guidance as to the definition of unusual occurrence reporting (UOR) requirements, Sandia staff responsibilities, and procedures for documenting UORs.

* SLI 2041 does not identify a relationship to the governing DOE guidance, DOE 5000.3 or its DOE Albuquerque Operations Office subordinate instruction.

* The Sandia Environment, Safety, and Health Department is charged with follow up responsibility for UORs, and it provides consulting services to the line organizations with respect to this activity.

* Interviews were held with three managers, a Department Manager, and two Division Supervisors. They separately expressed the view that unusual occurrences are only those items, selected by their judgment, which should be of general interest to the DOE community. They were unaware of the specific requirements promulgated in DOE 5000.3.

* The Sandia line management is responsible for recognizing that an event meets the unusual occurrence criteria in DOE 5000.3 and thus must be reported through the DOE reporting system. General interest to the DOE community is not a stated criteria.

* Several of the Sandia managers expressed the view that the wide distribution within the DOE system of the reports of Type A or Type B events (see DOE 5484.1, Environmental Protection, Safety, and Health Protection Information Reporting Requirements), would be of more use in improving safety than is the reporting of unusual occurrences.

* Sandia does not have an internal system for focusing managerial involvement on causes and corrections of "near misses" that they have not entered into the DOE UOR system (see Sections EA.5, TS.5, and RP.2 for more details).

* A UOR should have been initiated following Sandia's initial discovery that the ACRR transient rod bank static worths had small, unexplained, positive reactivity increases. One of the stated DOE criteria for issuing a UOR is that an unexplained increase in reactivity occurs. The fact that many months later Sandia explained the increase as the consequence of a flawed measurement technique does not abrogate the requirement to report (as a UOR) any increase in reactivity that is not readily explainable. (See Section OP.3 for more details.)

CONCERN: (OA.4-3) The Sandia unusual occurrence reporting system does not assure that those responsible for directing operations and activities recognize and report all unusual occurrence events.

OA.5 Personnel Planning and Qualification

PERFORMANCE OBJECTIVE

Personnel programs should ensure that positions are filled by highly qualified individuals.

FINDINGS:

- Based upon interviews of a large number of managers and staff members, the technical safety appraisal team concluded that job descriptions are not widely used at Sandia for the technical staff.

- In the reactors area, the document "Qualification Program and Position Description for Sandia National Laboratories Reactor Operation Staff" is used by the line management to develop hiring standards, but the document only describes job functions and not standards such as educational and work experience. See Section TC.2 for further issues with respect to the lack of adequate hiring standards for reactor operators.

- There is a career development program for employees. It includes on and off-site training as well as the employee having the ability to transfer within Sandia to help broaden his skills. There are examples of employees entering at the clerical or technician level and progressing into management, up to and including the Director level.

- Professional staff selections are reviewed and approved at the executive management level.

- A formal employee performance appraisal system is used. Prior year accomplishments are described and performance is evaluated.

- When performance is not satisfactory, the appraisal process provides for the development of a program to help the employee understand what improvements are needed and to define actions that could be taken to improve the performances.

CONCERN: See Concern TC.2-1.

OA.6 Document Control

PERFORMANCE OBJECTIVE

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

FINDINGS: . Reactor Operating Procedures have not been designated as Safe Operating Procedures (SOP). As SOPs they would have been subjected to Sandia administrative controls that require:

- independent review and approval by the Environment, Safety, and Health Department;
- a specified format;
- receiving a semiannual review by line management;
- receiving an annual review by the Environment, Safety, and Health Department; and
- being reviewed, reauthorized, and reissued at least every three years.

* Documents are controlled (e.g., prepared, reviewed, distributed, stored, etc.) based upon the decision of the division and department level managers. This includes responsibility for safety items such as reactor operating procedures, maintenance procedures, training records and quality assurance records. These managers do not have documented Sandia guidance on the minimum requirements for document control.

* Examples of lack of consistent document control include:

  - There are no approved maintenance procedures for the ACRR reactor (procedures are required by the approved Technical Specifications). There is an annual checkout procedure for this reactor that is used to guide the annual maintenance activities, which is the dominant maintenance activity period.
  - An Operating Procedure (the ACRR Annual Checkout) was approved for trial use in June 1980. It was still in use in that form at the time of this review.
  - Various knowledgeable Sandia supervisors identified different documents as the current Emergency Preparedness Master Plan. (See Section ER.2)
  - For the past three years, the Sandia Audit and Review Staff review of reactor operations has noted that documentation control and updating of key documents needs improvement.

- Modifications were made to the SPR III burst rod. They were not recorded on the as-built drawings, effectively negating configuration control for this reactor.

* During the initial part of this technical safety appraisal, the permanent storage site for the documents identified in the reactor Technical Specifications as requiring storage was in a room marked as being contaminated. These records where moved to a location near the reactor control room during the course of this appraisal.

* The reactor Technical Specifications require that records and logs be maintained for five years. Records are required to be maintained in accordance with DOE 1324.2, Records Disposition. DOE 1324.2 requires that: reactor Quality Assurance records be maintained until the item is removed from service; and reactor operations records be maintained for five or six years depending upon the type of record involved (e.g. control room logs must be maintained for six years).

* There were deficiencies in documentation noted throughout this report. For example, see Sections EA.1, ER.5, MA.3, MA.7, TC.1, TC.2, TC.5, OP.2, RP.2, and RP.3. These cover experiments, maintenance, training, operations and radiation protection documents.

* Neither the SPR nor the ACRR Safety Analysis Report contained a change inventory control sheet that would indicate what revisions should be entered, when the revision was made, etc.

* The SAR for the SPR III reactor was last approved and formally issued by Sandia in April, 1978. The SAR for the ACRR reactor was last approved and formally issued by Sandia in November 1981. They were both under active review and update during this appraisal.

* Section 1.2.6 of the Safety Manual, SAND81-1807 Revision A, requires that Safe Operating Procedures be "prepared for all operations involving explosives, high energy, radioactive materials, radiation-producing machines, dangerous chemicals, and other hazardous jobs." (emphasis as given)

* The reactor operations management has certified that all required Safe Operating Procedures have been prepared.

* No Safe Operating Procedures were prepared for nuclear reactor operations, maintenance, and disassembly or the handling of disassembled fuel elements and other radioactive reactor components. All of these activities occur at least annually for both the SPR III and the ACRR reactors.

CONCERN: (OA.6-1) Controls of documents important to the safe operation of Sandia reactors have not been effective.

OA.7 Fitness-for-Duty Program

PERFORMANCE OBJECTIVE

A 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:

- Sandia policy on drug and alcohol abuse is clearly stated in the brochure "Code of Conduct" and in the Sandia "Personnel Manual."

- The alcohol abuse program has been in effect since 1972. The drug and alcohol abuse program is described to employees and their families in specially designed brochures, in Sandia newsletters to the employees, and in lunch time talks available to the employees. Counseling opportunities are briefly described in the employee handbook "Environment Safety and Health (ES&H)"

- An earlier Sandia study found that 50% of the employees who successfully completed the program were subsequently promoted, based upon their subsequent performance in the work place.

- There is a random drug testing program for security guards. On June 15, 1988, a new Sandia policy was issued. It treats alcoholism and drug addiction as treatable diseases, and adds a new program of employee substance abuse testing for cause. A new brochure that fully describes the Sandia alcoholism and other drug abuse program was in preparation for distribution to all employees.

- Subcontractors are not subject to the Sandia fitness-for-duty policy as a condition for access to the facility. However, for security reasons, many subcontractors are escorted while on the site. Sandia management expressed the view that this provides a significant level of substance abuse control.

* Managers, down through the Section Supervisor level, receive formal training on how to recognize substance abuse in individuals. The Reactor Facility Supervisor position is analogous to a Section Supervisor, but it is not classified as a management position. Those newly selected to management and about 20% of the management staff receive this training each year.

* During interviews with two Division Mangers selected at random from Technical Area V, it was apparent that they were not sure they knew how to recognize individuals that might be involved with substance abuse. They both independently indicated, however, that if they felt that

such a potential situation arose, the first thing they would do is contact the Medical Department and seek guidance.

CONCERN: (OA.7-1) Important substance abuse training is not being provided to all personnel who have frequent, detailed, and direct supervisory contact with the reactor operations staff.

B. OPERATIONS

This appraisal was based on reviews of procedures, logs, audits, minutes, and appraisals; observations of reactor operations and facilities; walk-throughs; interviews; participation in an emergency exercise; and experience with an actual evacuation.

Overall, Sandia's ACRR and SPR III reactor facilities are operated in a safe manner, without undue risk to facilities or people. The reactor staff is responsible, technically competent, professional, and well informed. They are fully aware of the complexity and status of the experiments and facilities. They are competent in their knowledge of reactivity effects, reactor parameters, Technical Specifications, and potential hazards associated with operations.

However, several significant safety concerns have resulted from this appraisal. The chief concerns involve the handling of the measured increase in transient rod reactivity worths and the use of trial, unreviewed, and unapproved procedures for transient rod bank annual calibration. Other concerns were the inadequacies of the reactors' configuration control system, operations' support services, equipment control systems (keys, jumpers, etc.), document control and procedures, and the console log system. Resolving these concerns could collectively widen the margin of safety for both reactors.

There was visible evidence that new procedures and management controls were being developed to help sustain the present level of operational safety.

OP.1 Conduct of Operations

PERFORMANCE OBJECTIVE

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

FINDINGS:

- Paragraphs 6.1.2 and 6.1.3 of the Technical Specifications govern the staffing and responsibilities of the operators.
- The operator performance during preoperations checkouts and pulse operations at the ACRR and SPR III was professional, business-like, and orderly.
- Interviews with the operators found them to be knowledgeable of reactivity effects, limits of operations and Technical Specifications requirements.
- During reactor operations and on several unannounced visits to the control rooms, it was observed that the operators controlled the access to the control rooms.
- A reactor supervisor is present in the control room during all reactor operations except for steady state operations.
- Performance observations of three supervisors confirmed that they did monitor operations and adhere to facility policy and procedures in a satisfactory manner.
- It was confirmed by a one-on-one check against the procedures that all necessary technical specification test and measurement requirements were properly performed by the operators.
- Checklists were used during operations in place of procedures.

* Operations observed during the appraisal indicated that the facilities were operated safely. A measured increase in transient rod reactivity worth challenged the limiting conditions for operations (LCO) in late 1987. The way this event was handled is a concern. See Section OP.3.

CONCERN: None.

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:

- Paragraph 6.3 of Technical Specifications for both reactors requires procedures for pertinent categories of operations.
- Review of the procedures indicated they provided appropriate direction.
- All SPR III procedures were updated after the 1985 unusual occurrence (UOR 85-7, Unscheduled Pulse) associated with the reactor's elevator lift drift.
- ACRR procedures for pulse, steady state, and double pulse operations are current (March 1987) and have been appropriately reviewed and approved.
- The procedures are implemented through checklists.
- ACRR and SPR III procedures adequately account for the safety limits necessary for safe operations.
- The control room copy of SPR III procedures was current.
- The movement, location, and situation accountability of fissile material at any instance is documented and auditable in accordance with DOE 5480.5, Section II.
- Operators are trained on procedure changes by attending ACRR and SPR III Safety Committees' meetings and through staff interaction. See Concern TC.2-3.

* The ACRR post-operations checklist procedure dated January 5, 1979, was being used, even though it has been superceded by a new procedure for the last 3 years (March 28, 1985).

* The SPR III Daily Checklist, Daily Shutdown Checklist, and Annual/Semiannual Inspection Checkout have no description of actions required to satisfy the steps in the checklist.

* Review of ACRR procedures indicated no structured system for their preparation i.e., there were differing formats, no effective page listing, no revision number, no distribution lists, and no document control or distribution system.

* Review of the ACRR's control room copy of procedures revealed:

  - Two different formats for the same procedure were in use.

  - The Plant Protection System Drawer Calibration procedures are unapproved and undated.

  - Positive Period and Core Configuration procedures were not present.

  - The current post-operations checklist procedure was not present.

* The ACRR annual checkout procedure has been in trial-use status since 1980, and has not received the required formal review by either the ACRR Safety Committee or the Sandia Reactor Safety Committee (SRSC).

* The procedure for measuring the dynamic worth of the ACRR transient rod bank has not been formalized by a review by the ACRR Committee or the SRSC, nor was it available in the control room procedure book.

* Additional findings addressing deficiencies in operations procedures can be found in Section OA.6.

CONCERN: (OP.2-1) No formal system exists for the preparation, content, format, revision, distribution and control of ACRR and SPR III operating procedures.

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:

. The ACRR's limiting conditions for operations (LCO) for the transient rod bank reactivity worth limit ($4.25) is in paragraph 3.1.3 of the Technical Specifications.

. Reactivity worth calibration can be done by either the static or dynamic method, depending on the application.

. The definition of an abnormal occurrence and its reporting requirements are in paragraphs 1.3 and 6.5.2 of the Technical Specifications.

. The definition of an unusual occurrence and its reporting requirements are in paragraph 6.6.3 of the Technical Specifications and DOE 5000.3.

* The ACRR transient rod bank static worths have exhibited small positive reactivity increases since 1986:

  - January 1986 ..... $4.20
  - January 1987 ..... $4.25
  - September 1987 ..... $4.28
  - February 1988 ..... $4.39

* In recent years the static rod bank has increased slightly while the dynamic rod bank has decreased slightly. This trend is abnormal and unexplained.

* This unexplained reactivity change was not presented to the ACRR Committee or the Sandia Reactor Safety Committee (SRSC) until eight months after the reactivity concern was raised.

* To date, extensive physical measurements made have not uncovered any explanation for this reactivity anomaly.

* On September 23, 1987, the ACRR transient rod bank reactivity worth was measured by the static calibration method and was found to be $4.28. This appeared to have exceeded the LCO. However, in correlating the static worth with the dynamic worth, it was determined that the true worth of the bank was $4.00 - well below the LCO.

* The ACRR reactivity calibration of the transient rod bank worth by the static method, which had been in routine use, was changed to a dynamic method after the $4.28 measurement in September 1987. The dynamic method indicated that the transient rod bank reactivity worth had not increased.

* The dynamic worth of the transient rod bank is used in the safety analysis relating to fuel temperature limits.

* The SRSC was not informed in a timely manner of the continued unexplained reactivity change at the AACR. (See Concern FR.2-1)

CONCERN: (OP.3-1) The reason for the reactivity drift in the Annular Core Research Reactor has remained unexplained for almost one year despite extensive physical measurements.

FINDINGS:

* The procedure used for ACRR annual checkout rod bank calibration is an unreviewed, trial procedure which only addresses static rod calibrations.

* There was no procedure which provided a proper basis for measuring the dynamic worth of the rod bank.

* The procedure for measuring the dynamic worth of the ACRR transient rod bank has not been reviewed by the ACRR Safety Committee or the SRSC.

* Neither of the methods being used to measure the ACRR transient rod bank worth in order to determine compliance with the Technical Specifications has been reviewed by the Safety Committees. (See Concern FR.2-1)

CONCERN: (OP.3-2) The rationale for changing the method for determining the Annular Core Research Reactor transient rod bank worth was not adequately documented.

FINDINGS:

* DOE/AL was advised of the changes in the reactivity of the ACRR transient rod bank worth by telephone on September 23, 1987, and by letter on September 23, 1987. That memorandum indicated restrictions would be imposed on future operations.

* Based on the technical safety appraisal's assessment, the September 23, 1987 reporting to DOE/AL was not made in accordance with paragraph 6.6.1 of the Technical Specifications.

* Although an unexplained reactivity change had occurred, neither an Unusual Occurrence Report, as required by DOE 5000.3, nor an Abnormal Occurrence Report, as required by the ACRR Technical Specifications, were issued.

  - The Limiting Condition for Operation specified for the ACRR transient rod bank worth was exceeded sometime after January 1987, based on measurements made by the then-used procedure for its calibration. Paragraphs 1.3 and 6.6 of the ACRR require an Abnormal Occurrence Report to be prepared under these circumstances.

  - The above circumstance requires reporting under paragraph 9b(1) of DOE 5000.3.

  - The unexplained persistent reactivity change would be required to be reported under paragraph 9b(6) of DOE 5000.3.

* Based on the results of the modified method for measuring transient rod bank worth, ACRR management concluded that an LCO had not been exceeded during the event of September 23rd.

CONCERN: (OP.3-3) Reporting of the unexplained reactivity change at the Annular Core Research Reactor did not comply with the Technical Specifications or DOE 5000.3.

FINDINGS:

* The maintenance of a single control room console log book which adequately reflects the operating history and status of the reactor and events important to evaluating operations is a proven good practice in the research reactor industry.

* The ACRR and SPR III control room logs are an assortment of loose leaf notebooks with procedure checklists, data sheets, operations plans, personal logs and computer files.

* Control room records of unscheduled reactor trips, experimental difficulties, emergency evacuations, off-normal operating condition or irregularities, changes in equipment status or failures, special situations, or important operating parameters are incomplete.

* The "Remarks" section of the reactor operations logs includes few entries regarding outside support services' maintenance activities. See Section MA.6.

* There are no required periodical inputs to a console log book (during steady-state operations) on the console

status, e.g., radiation area monitoring systems output and status, power levels, etc.

CONCERN: (OP.3-4) There is no formal system for defining the content and maintenance of a reactor console log.

FINDINGS:

. The core configuration control procedures for both reactors comply with the Technical Specifications.

. A configuration control procedure for reactor modification is in draft.

* The Quality Assurance Program Plan for Facilities Operations in the Reactor Development and Applications Department, dated July 12, 1988, does not address the delivery of as-built drawings, revised procedures, and manuals or training material after completion of a system modification.

* As-built drawings of the SPR III pulse rod modifications are not current. See Section MA.7.

* The "Sandia Research Reactor and Experimental Program Quality Assurance Program Plan" (SRREP), printed July 1986, No. RS 6420/86/43, inadequately addresses the control of safety-related reactor modifications, systems modification followup, i.e., delivery of as-built drawings, revised procedures and manuals, and training material. The SRREP is under review for update with attention to upgrading the reactor systems modifications procedures.

* Concern TC.2-3 further addresses the training aspect of the following concern.

CONCERN: (OP.3-5) The configuration control system for reactor modifications does not ensure that as-built drawings, revised procedures and manuals, and training are provided prior to systems operations and maintenance.

FINDINGS:

. Health physics procedures prepared in July 1988 are being reviewed by operations.

* Observation of ACRR and SPR III operations, maintenance, an emergency drill, and support service activities (security, health physics, experimenters, telephone repairs, etc.) and review of memoranda showed:

  - The guidelines and procedures for the guards were inadequate. See Section ER-6.

- Some personnel were observed not to respond to the emergency exercise. See Section ER-6.

- The health physics procedures which were developed in July 1988 and relate to reactor operations and health physics sign-offs have not been formally reviewed and approved by the safety committees or operations. See Section FR.2-1.

- Procedures for changing heating and ventilation filters and Sandia maintenance of the mechanical systems (both Technical Specifications items) have not been approved by reactor operations.

* The SRSC, ACRR, and SPR committees are responsible for reviewing operating procedures and reactor maintenance procedures as required in paragraph 6.2.3 of the Technical Specifications.

* Management recognizes the problem of coordinating off-site support services in Technical Area V. A memorandum from J. P. VanDevender and D. J. McCloskey, subject: Delegation of Responsibility - TA-V, dated April 5, 1988, to T. R. Schmidt discusses the difficulties of controlling off-site support services to Technical Area V and delegates control for certain specifically identified functions to the Reactor Development and Applications Department.

CONCERN: (OP.3-6) Reactor operations management is not exercising adequate control over procedures and activities of outside support services which interact with the reactor and its safety-related systems and operations.

FINDINGS:

. SPR III operations has developed a tag control instruction which provides tag accountability.

* Sandia Safety Manual, SAND81-1807, Rev. A, August 1984 identifies some tagging requirements for Sandia activities, but does not address tag requirements for the reactors.

* ACRR operations does not have a written tag or lock control procedure, but is developing one.

* It is a standard good practice at all nuclear facilities to maintain control over facility status through use of locks and tags.

CONCERN: (OP.3-7) Guidelines and procedures controlling the use, placement, removal, and accountability of electrical jumpers and tags or vital keys for the reactor systems or support systems are inadequate.

OP.4 Operations Stations and Equipment

PERFORMANCE OBJECTIVE

Control stations and facility equipment should effectively support facility operation.

FINDINGS: It was determined by walk-throughs of reactor and support facilities, the observation of reactor checkouts and operations, and physical examination of certain stations and equipment (crane lockout, communications, labeling, etc.) that the control stations and facility equipment effectively support reactor operations.

Both reactor consoles were reviewed and found adequate to support reactor operations.

CONCERN: None.

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:

- Interviews with and observation of operators actions indicated they were fully knowledgeable of the reactor's equipment, reactivity effects, and experiment status.
- Through observations of startup, operations, and testing of operator response to hypothetical problems, it was determined that the operators were capable of diagnosing off-normal and emergency conditions in their areas of responsibilities.
- All operators exercised good operating practices in conducting operations, including access control to cranes and fuel handling tools, and communications with the reactor bay area.
- Based on their professional judgement and knowledge, ACRR operations staff did not believe they had exceeded the transient rod bank limiting conditions for operations. See Concerns OP.3-1 thru 3-5.

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 is not applicable to these reactors. They are operated five days a week on one shift only. Overtime is sporadic, and 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:

- The operators' performance during operations checkouts and pulse operations and walk-throughs at the ACRR and SPR III demonstrated their ability to differentiate between annunciator lights providing status and those indicating alarm conditions.
- Observation of the reactors consoles in the shutdown and operating modes indicated consistency of visual indicators.
- Scrams can be validated both by visual checks and by instrumentation.
- The audible alarms for abnormal conditions are discernible and different for different systems.
- Plant walk-throughs confirmed that the labeling of equipment and instruments was appropriate and understandable.
- ACRR high-bay area is visible from the control room.
- Human factors experts have been consulted in the design of the new ACRR control console.
- Sandia has a very high level capability in human factors engineering (statistics, computer, Human Factors Division).
- The present ACRR console display of radiation area monitors does not have the capability to test the "systems failure" lights (yellow).

CONCERN: None.

C. MAINTENANCE

The maintenance program for the Technical Area V reactors provides satisfactory support of reactor operations. The maintenance support of the reactors is carried out by two separate organizations. The reactor operations staff performs the maintenance on the reactors and associated fluid, instrumentation, and control systems. The Remote Area Maintenance and Support Division handles the general facility and building maintenance, but interfaces with the reactor operations staff with regard to maintenance of the ACRR High Bay Exhaust and Cavity Purge ventilation systems. These systems are considered part of the engineered safety feature system specified in the ACRR Safety Analysis Report. The reactor operations staff maintains the filter banks and instrumentation and controls associated with these systems, while the Remote Area Maintenance and Support Division maintains the remainder of the ventilation systems, including the exhaust fans and associated motors.

In general there is a minimum of procedures and formal programs in the maintenance area. The concept of "skills of the trade" is used as a substitute for procedures, programs and training by the reactor operations organization. In many cases, use of this concept is justified since the systems are not complex, and the operations staff is technically strong and provides direct supervision when required. However, there are cases beyond the "skills of the trade" threshold where maintenance activities should be conducted through the use of written procedures and formal programs which include adequate maintenance training. This is one of three concerns raised in the maintenance area.

A second concern is the lack of a formal, disciplined deviation review and approval process for material and equipment. A weakness in this area could result in the use of deficient material. A third concern is similar in nature, since failure to adequately process instruments that require calibration has the potential for degrading engineered safety features and safety-related reactor systems.

The general material condition of the reactor facilities is good. Except for one instance, the systems and equipment appear to be well maintained. Spare parts and supplies appear adequate and suitably stored. Maintenance of rigging and lifting equipment is good. The backlog of maintenance items is low, and an adequate system of annual, semi-annual, and daily checks are in place for early identification of the need for maintenance.

MA.1 Maintenance Organization and Administration

PERFORMANCE OBJECTIVE

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

FINDINGS:

- A centralized maintenance organization, the Remote Area Maintenance and Support Division, is responsible for facility and building maintenance in Technical Area V.
- The Remote Area Maintenance and Support Division is responsible for the maintenance and repair of the ACRR High Bay and Cavity Purge ventilations systems which are part of the engineered safety features of the reactor.
- Maintenance of the reactors and their support system is done for each reactor by the respective ACRR and SPR III operations staffs.
- Review of the Plant Engineering Maintenance Management Program and discussion with Plant Engineering managers verified compliance of the central maintenance organization with the requirements of DOE 4330.4.
- Compliance with DOE 5480.4 was spot-checked by reviewing the Fuel Ring External Cavity II (FREC II) modification package. This check confirmed compliance with ANSI/American Nuclear Society Standard 15.15 1978, Criteria for Reactor Safety Systems for Research Reactors.

CONCERN: None.

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:

- An inspection of the facilities indicated that the general material condition of the mechanical systems is satisfactory.
- A system walk-down of the roof portion of the Cavity Purge System indicated satisfactory material condition of the filter train, and vent motor fan train.
- Review of the lubrication records for the High Bay and Cavity Purge Ventilation fans and motors verified that lubrication of this equipment is accomplished on a set periodic basis. No deviations from the prescribed lubrication cycle were noted.
- The equipment pit in the ACRR building was the only area in either facility where poor material conditions were found for several non-critical items. Lagging was missing, several pipe flanges were badly rusted, and installed pumps were in a poor state of cleanliness.

CONCERN: None.

MA.3 Conduct of Maintenance

PERFORMANCE OBJECTIVE

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

FINDINGS:

- Records confirm that incoming Unusual Occurrence Reports are reviewed by Technical Area V reactor operations personnel for applicability to their respective reactors.

- Environmental, Safety, and Health Bulletins are given suitable distribution for review.

- Applicable U.S. Nuclear Regulatory Commission (NRC) Inspection and Enforcement (IE) Notices are distributed for review. For example IE Notice 85-57, Loss of Iridium 192 Source, and IE Notice 87-22, Operator License Requalification Examinations, were distributed to appropriate organizations for information.

- Review of the distribution of Idaho National Engineering Laboratory publications which contain NRC items of potential interest to DOE confirmed that these publications were made available to Technical Area V operations supervisors and staff.

- Discussions with operators and technicians indicated that there is a strong base of knowledge and skills among Technical Area V operations personnel who do maintenance and modification work on the reactors and their support systems.

- Review of documentation and discussions with ACRR personnel involved in the development of the Fuel Ring External Cavity II (FREC II) modifications showed that a satisfactory development, review, and approval process had been implemented.

- Review of documentation and discussions with the Technical Area V QA Coordinator verified that the FREC II modifications had been accomplished under a formal QA plan and that the QA coordinator participated frequently in the development of the modification package.

- Discussions with the Technical Area V QA coordinator revealed that he works closely with experimenters in the development of experiments.

* Transient Rod A sustained a component failure. This failure was not analyzed, although the failed part exhibited a classical fatigue failure. The part that failed had been installed for about ten years. The failed part was replaced with a part of identical design and material. Replacement of the same part in Transient Rods B and C is planned.

* A HEPA filter was installed in the ACRR Cavity Purge System even though it did not meet DOE Standard NE F 3-45 for squareness.

* This deviation was found during component testing at Rocky Flats and noted in its test report. The report also stated that the filter had satisfactorily passed an absorption test.

* After installation the filter was satisfactorily tested in accordance with ANSI/American Society of Mechanical Engineers Standard N510.

* Even though the decision to install the filter was technically correct, a deviation report was neither issued nor approved.

* The decision to install the filter was made by the ACRR reactor supervisor. There was no documented evidence that this decision had received managerial review.

* Further discussions with ACRR operations personnel revealed that there is no formal deviation control process for material and equipment.

* Additional information in support of this concern is included in Section OA.1.

CONCERN: (MA.3-1) Without a formal, disciplined deviation control system, deficient material could be installed in engineered safety features and in reactor systems which could adversely affect safe, reliable operations.

MA.4 Preventive Maintenance

PERFORMANCE OBJECTIVE

Preventive maintenance should contribute to optimum performance and reliability of systems and equipment important to facility operation.

FINDINGS:

- Discussions with the Manager of the Plant Maintenance and Operations Department, and review of the Department's Preventive Maintenance Program verified that a preventive maintenance program has been implemented for facility and building maintenance.

- There are about 27,000 items covered in the Sandia-wide building and facility preventive maintenance program.

- Records verified that the engineered safety features, High Bay and Cavity Purge System vent fans and motors, are included in the Plant Maintenance and Operations Department Preventive Maintenance Program.

- Discussion with reactor operations personnel confirmed that the preventive maintenance program for the reactors and their support systems is accomplished through annual, semiannual and daily tests and inspections. Other than these tests and inspections, there is not a formal preventive maintenance program for the reactors and their support systems.

- Review of the records for rigging verified that rigging is:

  - visually inspected for signs of abrasion and wear every six months
  - straps are load tested on a one-year interval
  - other rigging hardware is load tested on a four-year interval

  This testing satisfies the requirements of Section 4.6.3 of the Sandia Safety Manual.

- Review of records and discussions with maintenance and Plant Engineering personnel verified that cranes listed below are:

  - inspected for mechanical and electrical conditions annually
  - load tested every two years
  - recertified annually by means of an inspection for compliance with ANSI B30.2 (for cranes five tons or greater)

- cranes less than five tons are inspected annually by Plant Engineering personnel

. The following reactor facilities equipment is covered under the above described crane inspection program:

  - ACRR - 5-Ton Bridge Crane

  - ACRR - 15-Ton Bridge Crane

  - ACRR - 3-Ton Bridge Crane

  - SPR III 5-Ton Bridge Crane

  The SPR III Crane was recently installed. It has not been contractually released to Sandia. It has been load tested and will be added to the safety certification program upon contract closure, probably by November 1988.

. A predictive maintenance program, based upon vibration signatures for certain equipment under centralized maintenance, is planned.

CONCERN: None.

MA.5 Maintenance Facilities, Equipment and Material

PERFORMANCE OBJECTIVE

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

FINDINGS:

. During a walk-thru of work area it was confirmed that the storage of tools, rigging and supplies was satisfactory.

* During discussions with reactor operations personnel it was stated that the operations staff verifies and records the current calibration status of each instrument prior to its use in safety-related activities.

* A review of the calibration records for mechanical measuring equipment used in the Technical Area V branch shop revealed that two out of nine measuring instruments were not returned for calibration when noticed even though a number of recalibration notices had been issued. The two instruments, a vernier depth gage and a micrometer, were due for calibration in 1986.

* A review of the calibration records for electrical instrumentation in the custody of Technical Area V reactor operations revealed a number of instruments that had exceeded the calibration cycle by as much as five years. The instruments include oscilliscopes, a multimeter, a picoammeter; instruments that could be used in the check and maintenance of reactor instrumentation and controls.

CONCERN: (MA.5-1) The calibration recall system presently in use allows instruments which are in need of recalibration to remain in work areas, where they might be used in safety-related work activities.

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:

- Review of the Fuel Ring External Cavity II modification package confirmed that preoperational tests are performed, approved, and documented.

- Discussions with SPR III personnel verified that prior to work on the reactor, an ALARA review is performed, and that the SPR III mock-up is used as appropriate to develop procedural steps and to train personnel.

- Interviews with the SPR III staff revealed that improved procedures and work methods have resulted in a five-fold reduction in exposure of personnel during certain work activities associated with the reactor.

- Review of the backlog associated with reactor work indicated that there was not a significant backlog.

* The turnover of equipment and systems for maintenance and the return to an operational status is not formalized and not always noted in the operations log.

CONCERN: See Concern MA.7-1.

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:

. Discussions with SPR III personnel indicated that an improved system to identify electrical and mechanical drawings is being developed. This system will be based upon the use of sequential numbers to allow for quick retrieval of desired drawings.

. Review of documentation established that a satisfactory procedure revision control system was in place.

. Review of a number of SPR III maintenance procedures confirmed that the procedures were clear and easily understandable to the user.

. A review of the SPR III drawings revealed that drawings which reflect the as-built burst element did not exist. The current drawing revision did not depict modifications accomplished after fabrication of the element. This modification is further discussed in TS.1.

. Additional drawing checks did not reveal similar deficiencies.

. Review of a number of SPR III drawings revealed that in some cases the drawing revision block does not accurately identify the reason nor the scope of the change.

. Discussion with ACRR personnel and with personnel from the Remote Area Maintenance and Support Division confirmed that post-maintenance acceptance of work on the High Bay and Cavity Purge Ventilation Systems has been done in an informal, nondocumented manner.

* Maintenance procedures have been developed and implemented for work associated with the SPR III reactor. In instances involving the potential for high radiation exposure, procedures are verified by dry-runs on the mockup.

* Safety Overview of SNL Reactor Facilities (SAND 88-1721) (Draft, 6/88), page 32, states that maintenance and tag out procedures are in use at the reactor facilities.

* Review of documentation, and discussions with Technical Area V reactor personnel verified, that with the exception of electrical danger tags, there is no tag-out procedure for control of maintenance activities. A procedure to formalize the tag-out practice is under development.

* Discussions with the Technical Area V QA coordinator confirmed that he does not review day-to-day maintenance activities associated with the reactors. He is available to provide QA assistance for maintenance work on an "as requested" basis.

* Discussions with ACRR operations personnel confirmed that maintenance procedures have not been developed for the types of maintenance performed by operations personnel.

* In place of written procedures, reliance is placed upon a "skills of the trade" concept to accomplish maintenance tasks on the ACRR.

* The repair of Transient Rod A on the ACRR was accomplished without written procedure. The complexity of disassembly and reassembly to accomplish the repair is beyond the "skill of the trade" and should have required a procedure.

* Discussion with ACRR operations personnel verified that beyond on-the-job training, there is no maintenance training program for ACRR personnel. Reliance is placed on a presumed "skills of the trade" capability. See Concern TC.5-1.

CONCERN: (MA.7-1) Maintenance activities for the reactor and their support systems are conducted, in many instances, without the use of written instructions, procedures, and formal programs.

MA.8 Maintenance History

PERFORMANCE OBJECTIVE

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

FINDINGS

- Discussions with Plant Engineering personnel confirmed that a maintenance history for the High Bay and Purge Cavity Ventilation System is not being maintained.
- A review of the maintenance history records for the ACCR cranes revealed that the history is not complete. An effort is underway to enter the missing documentation in the maintenance history record.
- A computerized maintenance history is being developed for the SPR III reactor.
- A maintenance log sheet is maintained for the ACCR which adequately reflects the equipment maintenance history.

CONCERN: None.

D. TRAINING AND CERTIFICATION

Both ACRR and SPR III are operated and maintained by personnel with strong backgrounds in reactor operations. All ten members of the reactor operations staff had at least six years of reactor operations experience before joining the staff. Four of the ten members have graduate degrees in engineering or mathematics. Both the reactor division supervisor and his supervisor have PhD's in nuclear engineering.

Both ACRR and SPR II/III have an extended history of performing experiments involving special nuclear material and other hazards without significant incidents resulting in the release of material to the environment or over exposure of facility personnel.

The principal weakness of ACRR and SPR training programs is the lack of adequate documentation. The only formal training programs specific to ACRR and SPR III are for reactor operators and reactor supervisors. For these programs, training manuals and lesson plans lack sufficient detail to ensure that each trainee receives necessary training, and that all topics required by DOE Order are addressed.

For ACRR and SPR III specific training for other areas/positions there is little or no documentation of training requirements or training conduct. Among these areas are: hazardous materials, radiation protection, criticality safety and evacuation, quality assurance, and maintenance.

The relatively low priority afforded training at ACRR and SPR III is evidenced by the comments above, as well as by the lack of scheduled training, and the deferral of training based on operational priorities.

TC.1 Organization and Administration

PERFORMANCE OBJECTIVE

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

FINDINGS:

- The organizational structure, authorities, and responsibilities for SPR and ACRR reactor operations personnel training and qualification are clearly defined in the document "Qualification Program and Position Description for Sandia National Laboratories Reactor Operations Staff," dated July 15, 1988.

- The Facilities Training Coordinator is responsible for developing and maintaining training programs for reactor operations personnel in compliance with DOE 5480.6. One individual, who has been qualified as both a SPR and ACRR reactor operator, devotes about 25 percent of his time to these responsibilities.

- The ACRR and SPR Reactor Supervisors are responsible for the practical training and performance of reactor operations personnel assigned to their facilities.

- For reactor operators and reactor supervisors, training and certification requirements are established in the Sandia document referred to above, except for their maintenance responsibilities (See Section TC.5).

- Health physics technicians assigned to reactor operations are, as of July 15, 1988, required to complete a documented training and qualification program. The program, which is not yet developed, is described in Section RP.1.

- Much of the practical recertification training for ACRR and SPR III personnel is conducted through unstructured activities, including safety committee reviews, interactions with experimenters, and supervision of activities.

- The only ACRR and SPR III specific training programs that are currently documented are for reactor operators and supervisors.

- A review of both initial and recertification training records for a randomly selected reactor operator and reactor supervisor indicated that the records were current and complete, although, as described in Section TC.2, there were deficiencies with respect to the documentation of some portions of the training programs.

- There are no schedules established for either initial or refresher training, although a six-month qualification period is

generally established for initial reactor operator and reactor supervisor training.

. Training is routinely superseded by operational needs. Examples of this include; an individual who has been an operator-in-training since 1986 because he has been responsible for major ACRR modifications, and the operator and supervisor two-year recertification training program all conducted during the last 6 months of the period.

. There has been recognition of this low training priority by both line management and the Reactor Safety Committee, and commitments made for improvement in 1988. However, there is still no training schedule, and no structured recertification training was conducted during the first quarter of the new two year recertification period (a management commitment was made to both of those items at the beginning of 1988).

* In a January 19, 1988, letter to all DOE Records Officers, the DOE HQ Chief of Information Management indicated that initial training records for training with respect to hazardous materials should be retained for 75 years after employee termination. The letter also indicated that for recertification training, records should be retained until superseded by the next recertification cycle. Cognizant Sandia personnel were not aware of this communication, and use ANSI N402-1976 "Quality Assurance Program Requirements for Research Reactors" for record retention requirements.

* Section 6 of both the ACRR and SPR III Technical Specifications are the only documents that identify retention of training records. These documents require that reactor operator and reactor supervisor training records be maintained while the individual is certified and for 2 years thereafter.

* Other than reactor operator and reactor supervisor training, most other ACRR and SPR III specific training with respected to hazardous materials, ionizing radiation, and other hazards is not documented, and therefore not amenable to audit. (See also Section TC.4 for additional information concerning training in these areas).

* Other than requiring a signature on a one-page instructional form indicating that the individual knows where to go in the event of a Technical Area (TA)-V evacuation, there is no documentation of training for temporary employees, visitors, or contract personnel in reactor areas.

CONCERN: (TC.1-1) Requirements for documentation of training and retention of records are inadequate.

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:

- Training and certification requirements for ACRR and SPR III reactor operators and reactor supervisors are identified in the document "Qualification Program and Position Descriptions for Sandia National Laboratories Reactor Operations Staff," dated July 15, 1988. With the exceptions noted below, this program meets the requirements of DOE 5480.6 for Category B reactors.

- Interviews with reactor operators and reactor supervisors, observation of their activities, and reviews of their education and experience, all indicated that the reactor operations staffs for both ACRR and SPR III are competent.

- Between SPR III and ACRR there are a total 10 reactor operations staff members. Four are currently certified as reactor supervisors, four are certified reactor operators, and two are reactor operators-in-training.

- All ten reactor operations staff members had at least six years of reactor operations experience before joining the staff.

- Four of the ten members of the reactor operations staff have graduate degrees in engineering or mathematics.

- Both the Reactor Operations Division Supervisor and his supervisor (the Manager, Reactor Development Department) have PhD's in nuclear engineering, and have over four years of supervisory experience in reactor operations.

- Based upon discussions with cognizant DOE/AL and Sandia personnel, and a review of correspondence, the requirements of DOE 5480.6, Section 8e.(2)(c) with respect to DOE review of reactor operator and reactor supervisor initial certification examinations is met.

- Based upon discussions with the Facility Training Coordinator and reactor operators, both initial and recertification written examinations are adequately controlled prior to their use and they are proctored.

- Sandia practice is to select reactor operator candidates with previous reactor operations training and experience. The majority of current reactor operators have U.S. Navy Nuclear Power Program training and experience.

. Reactor supervisors have been selected from the ranks of certified reactor operators. Two of the four reactor supervisors and two reactor operators/trainees have advanced degrees in engineering or mathematics.

* The only Sandia documents that provide selection criteria for reactor operators and reactor supervisors are Section 6.1 of the Technical Specifications.

* The Technical Specifications only specify the equivalent of a high school education for both reactor operators and reactor supervisors. No reactor operations experience is required for either position.

* There are two difficulties with respect to these selection criteria:

  - The first is that DOE 5480.6, Section 8.e.(2)(a) requires that "candidates for reactors supervisor should possess that combination of education, experience, and training which provides the equivalent of at least a college education in engineering or science."

  - Also, the training programs for reactor operators and reactor supervisors assume previous reactor operations training and experience (comparable to that provided through the U.S. Navy nuclear program). These Sandia training programs only address reactor theory and operations as they are applied to the ACRR and SPR III.

* Sandia has selected candidates without reactor operations experience in the past, who have been unable to complete the training and certification program.

CONCERN: (TC.2-1) The selection criteria in the Technical Specifications for reactor supervisors do not meet DOE requirements for educational equivalency. Reactor operator candidates who only meet the minimum published Sandia requirements for selection have a low potential to complete the reactor operator training program.

FINDINGS:

* DOE 5480.6 Section 8.e(2)(a)2 requires contractor management to "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 candidate's fitness to perform all proposed job tasks."

* The SNL Personnel Manual, Appendix F, establishes work restriction codes in the following areas: standing, walking, and sitting; bending and stooping; lifting, pushing and pulling;

vision; hearing; environmental; work schedule; and hazards. These work restriction codes are felt to address areas related to reactor operations.

. A review of health examination records for all ACRR and SPR operations personnel indicated that once reactor operators and reactor supervisors are certified, their health is appropriately evaluated every 2 years.

* Discussions with two reactor operators and the Facility Training Coordinator indicated that a physical examination beyond the base-line preemployment physical evaluation addressing the areas above is not requested until up to two years after the reactor operator is certified.

CONCERN: (TC.2-2) Reactor operators are not given health examinations to establish their fitness prior to their certification.

FINDINGS:

* Table 2-1 of the document "Qualification Program and Position Description for Sandia National Laboratories Reactor Operations Staff" identifies subjects for reactor operator and reactor supervisor training programs.

* This Table indicates that heat transfer, fluid mechanics, and thermodynamics are "optional" subjects for both reactor operators and reactor supervisors.

* DOE 5480.6, Section 8 e(2)(b) indicates that "training in heat transfer, fluid flow, and thermodynamics shall also be provided, as necessary, for the specific design of the reactor."

* While neither ACRR nor SPR III have sufficient decay heat to necessitate a forced cooling system for decay heat removal, both reactors have design features, and/or cooling systems with respect to heat transfer that reactor operators should understand to support their operation of the reactors.

* The Technical Area (TA)-V health physicist indicated that he provides both initial training and recertification training in radiation monitoring systems and radiological safety principles to reactor operators and reactor supervisors. However, the only training in these areas that has been documented is for recertification, and the lesson plan for that training is incomplete.

* There is a reliance at both ACRR and SPR III on retraining of reactor operators and reactor supervisors in plant modifications, plant procedure changes, and operating experience through attendance at ACRR and SPR III Safety Committee meetings and staff interactions.

* While such an approach has been encouraged for research reactors and may be adequate in many cases, it does not provide any assurance that such information is consistently disseminated to all affected personnel, and it isn't auditable.

* In the case of major modifications such as the Fueled Ring External Cavity (FREC)-II this approach does not ensure that operational changes and their implications are adequately addressed and documented with all ACRR staff members before the changes are implemented.

* There is no documented method for addressing operating experience (at Sandia or other nuclear facilities) that is relevant to ACRR or SPR III safety as part of the operator/supervisor recertification program.

* Oral examinations for reactor operator and reactor supervisor recertification are conducted in group settings upon completion of related training. While a listing of oral examination topics is developed, no record is maintained of what topics a particular individual addressed, or whether the response was satisfactory.

CONCERN: (TC.2-3) Reactor operator and reactor supervisor initial and recertification training programs either do not document or do not address all needed subject matter.

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.

COMMENTS: This performance objective does not apply to reactors.

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:

. Section 9 of the Sandia Safety Manual indicates that "each employee whose job requires exposure to hazardous chemicals, ionizing radiation, or laser light is to be made aware of hazards and safety procedures commensurate with the degree of risk and the related responsibility for the safety of self and others."

. Section 9 of the Sandia Safety Manual further indicates that "the selection of employees who should receive training is the joint responsibility of the Environmental Health Department or Hazards Control Division and operations supervisors."

* Discussions with Security Inspectors assigned to Technical Area (TA)-V indicated that they had not received training in reactor area specific hazards and alarms even though their assigned stations include radiation areas and potentially contaminated areas. In emergencies these security inspectors are required to maintain their posts in areas that could have high radiation and/or contamination levels. See Section SS.2 for additional information that supports the concern below.

* All personnel entering TA-V are required to sign a one-page instructional form indicating that they understand the evacuation signals in TA-V and where they are to assemble in the event of an evacuation. The reactor operator and reactor supervisor initial training programs provide documented radiation safety training. However, other personnel who work in reactor areas, such as experimenters, plant engineering personnel, and visitors are not required to participate in a documented radiation safety training program prior to having unescorted access to reactor areas.

* Indoctrination provided to the appraisal team, and apparently provided to all visitors to TA-V, only addressed one alarm (fire/evacuation) when there are at least four alarms that require a response in reactor areas. See Section ER.6 for additional information supporting the concern below.

* The TA-V Health Physicist indicated that he does provide some radiation protection training for personnel assigned to reactor facilities, but that he has not documented the training. The Security organization does maintain documentation on such training received by Security inspectors.

CONCERN: (TC.4-1) The requirements of the Sandia Safety Manual with respect to safety training are not being met for personnel working in the reactor facilities.

FINDINGS:

* DOE Orders 5480.4 and 5483.1 require that DOE contractors comply with 29 CFR 1910.1200 (OSHA Hazards Communication Standard).

* Among the provisions of this Standard is that all employees whose job involves potential exposure to hazardous chemicals be provided training with respect to their "rights to know" about the effects of these chemicals.

* This training was required to be completed by May 1986.

* Sandia, about a year ago, developed a pilot hazards communication training program for two job classifications, painters and platers. However, since then, no additional training for other positions has been either developed or conducted.

* The Sandia Environment, Safety and Health staff has recently submitted, for the Sandia President's approval, a laboratory-wide hazards communication program that includes employee "right-to-know" training.

CONCERN: See Concern PP. 3-1.

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.

FINDING:

- Maintenance and calibration of reactor equipment is the responsibility of reactor operations personnel.
- Based upon observation of maintenance activities and a review of facility records it was determined that maintenance activities are generally performed in a satisfactory manner.
- Neither the initial nor the continuing training programs for reactor operators and reactor supervisors provide documented maintenance training.
  - * Interviews with both reactor operators and reactor supervisors indicated that on-the-job training included maintenance activities. However, this training is not documented on either reactor operator or reactor supervisor qualification training worksheets.
  - * Concern MA.7-1 indicates that, in many instances, maintenance activities are performed without the use of written instructions, procedures or formal programs. This situation places a strong reliance on well trained maintenance personnel.

CONCERN: (TC.5-1) There is no documentation of the training provided to the personnel responsible for reactor-related maintenance and calibration.

TC.6 Criticality Safety

PERFORMANCE OBJECTIVE

Personnel should receive training in nuclear criticality safety consistent with their assigned tasks.

FINDINGS:

- A review of training records indicated that fissile material handlers for ACRR and SPR III participate in Los Alamos National Laboratory formal criticality safety training courses.
- Nuclear Materials Control Section personnel who are associated with transporting fissile material to and from ACRR and SPR III complete the two-day courses.
- Certified reactor operations personnel have completed the five-day course, although there is no requirement in their training programs for this training.

* DOE 5480.6, Section 8.h requires that "the requirements of DOE 5480.5 shall be applied, as appropriate, to fissile materials storage handling facilities and operations within a reactor facility."
* ACRR fuel loading and handling, and transfer of fuel to and from ACRR and the Gamma Irradiation Facility Canal, as well as SPR III assembly/disassembly operations are felt by the appraisal team to be covered by the requirements of DOE 5480.5 for fissile material storage and handling.
* Neither the reactor operator nor reactor supervisor training programs (as defined in the document "Qualification Program and Position Description for SNL Reactor Operations Staff") include criticality safety.

CONCERN: See Concern TS.9-1.

TC.7 Training Facilities and Equipment

PERFORMANCE OBJECTIVE

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

FINDINGS:

. There is little classroom training conducted that is directly related to the ACRR and SPR III reactors.

. When a classroom is needed, the Technical Area (TA)-V Assembly Building; (Bldg. 6582) has a conference room available that can accommodate in excess of 25 students.

. The principal training materials for reactor theory training are "Nuclear Reactor Engineering" by Glasstone and Sesonske, and the videotape series "Basic Nuclear Concepts" by NUS Corporation.

. The principal training materials for reactor system design and operation are the appropriate reactor Safety Analysis Report, Technical Specifications, operating procedures, and drawings, which are readily available to trainees or recertification operators and supervisors.

. There is a mockup reactor for SPR III and mock-up fuel pins for ACRR that are used for training.

. Qualification Training Worksheets provide general guidance to reactor operator and reactor supervisor trainees for walk-throughs and on-the-job training.

* Other than these Qualification Training Worksheets, there are no training manuals or lesson plans that identify specifically what an ACRR or SPR III reactor operator or reactor supervisor candidate needs to know to become certified.

* This lack of documentation results in the following difficulties:

  - there is no assurance that every candidate is trained and evaluated with respect to all necessary knowledge.

  - the training provided is not auditable (which is a requirement of DOE 5480.6 Section 8.e (2) (h)).

  - trainees do not have a clear understanding of what the requirements are to complete the program.

* The Facility Training Coordinator has under development such training manuals for ACRR and SPR III. However, given that

responsibilities other than training occupy about 7 percent of his time, based upon discussions,it is expected that it will be several years before such manuals are available for use.

* Turnover in the reactor operations staff has been about 60 percent during the past three years, and Sandia has plans to expand the reactor operations staff. Thus there is expected to be a continuing need for training of new reactor operators and reactor supervisors.

CONCERN: (TC.7-1) Training manuals for reactor operator and reactor supervisor training are inadequate.

TC.8 Quality Control Inspector and Non-Destructive Examination Technician

PERFORMANCE OBJECTIVE

The quality control (QC) inspector and non-destructive examination (NDE) technician training and qualification programs should develop and improve the knowledge and skills necessary to perform assigned job functions.

FINDINGS:

- Experiments and modifications for ACRR and SPR III are under the cognizance of the "Sandia Research Reactor and Experimental Programs (RREP) Quality Assurance Program Plan" of July 1986.

- Section 5.12 of this Plan is "Personnel Training." This section addresses orientation briefings for RREP personnel in general, but does not address training or qualification requirements for the QA Coordinator, or other personnel who may carry out QA audits, reviews or inspections.

- Discussions with the Division 6420/6450 QA Coordinator indicated that he has completed the Sandia In-hours Technical Education Course SP723, "Overview of Sandia Quality Assurance," Parts B, C, and D; which is a total of 52 hours of instruction. He has also attended over 40 hours of outside seminars on QA.

- Non-destructive examinations for ACRR and SPR III are performed by NDT Technology Division personnel who are certified in accordance with the American Society for Non-Destructive Testing (ASNT) requirements.

- The "Quality Assurance Program Plan for Facility Operations in the Reactor Development and Applications Department" of July 12, 1988, refers to individual reactor Technical Specifications for review and audit requirements.

* Section 6 of both ACRR and SPR III Technical Specifications indicate that the Audit and Review (A&R) Staff perform these audits. There are no documented training or qualification requirements for A&R Staff personnel.

CONCERN: See Concern FR. 4-1.

E. AUXILIARY SYSTEMS

The systems provided for mitigation of reactor accident consequences, the methods of handling and disposing of the wastes, and the procedures and techniques for handling fissile material were analyzed. These systems, procedures and practices are not extensive because the small size of the reactors, and the relatively low consequences of an accident do not necessitate the major systems provided for larger facilities.

The installed systems were found to be adequate. Waste generation is minimal and its disposal meets the requirements of the DOE, the Environmental Protection Agency, State of New Mexico and the Nuclear Regulatory Commission. Design of the engineered protective systems is adequate. Fissile material handling is minimal and is in accordance with DOE orders. Personnel are performing the associated tasks in a professional manner.

The one concern identified by this appraisal was associated with the filters in the facilities' air exhaust systems. Charcoal in these systems is replaced at a frequency of at least every five years but is not tested between replacements. It is standard industry practice to perform periodic tests of the charcoal filters.

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:

- There is no holdup of liquid and gaseous effluents from ACRR and SPR III. The liquid effluent goes to the ground after passing through a septic tank. The gaseous effluent goes up the building stacks.

- A recommendation to install a holdup tank for liquid effluents from both reactors has been made in a letter from G. J. Smith to T. R. Schmidt dated June 9, 1988. The holdup tank would permit sampling and analysis of the contents prior to release. The TSA team agrees with the Smith recommendation.

- The liquid effluent is from:

  - A sink in ACRR used primarily for washing hands which releases an estimated five gallons a week.

  - Floor cleaning water from SPR III reactor room which releases an estimated ten gallons per week.

- Radionuclide content of the released liquid is not monitored. There is no installed monitor.

- Radionuclide content of the released gas is assumed to be predominantly Argon-41 and the amount is calculated based on total energy produced by the reactors. Activity monitors on the stack effluent are not sensitive enough to quantify the radionuclides being released.

- The Smith to Schmidt letter (discussed above) reports that the amount of radionuclides in the liquid released is in compliance with Environmental Protection Agency, State of New Mexico, DOE and Nuclear Regulatory Commission requirements.

- Because of the small quantities released, a program has not been established for periodic review of data as a basis for reduction of the amount of radionuclides released.

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:

- The quantity of solid radioactive waste generated by the ACRR and SPR III is small. This amounts to about 100 cubic meters of uncompacted waste annually.
- A compactor is being procured which should yield a six-fold reduction in volume.
- Solid radioactive waste is disposed of in an on-site burial ground. This burial ground will not be available to Sandia beginning in 1990. Subsequent disposal will be at an off-site facility.
- Cloth protective clothing is used infrequently and when used it is cleaned offsite and returned for reuse. Because of the relatively low levels of contamination, for routine work in contaminated areas paper protective clothing is used which is then disposed of as solid waste.
- Other than the compactor mentioned above, there are no management programs for the reactors to reduce solid waste volume.
- Solid waste is bagged and disposed of by the personnel in the health physics group. The health physics personnel are trained in the proper techniques and requirements for waste handling.

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:

- Personnel at both reactors are knowledgeable of handling requirements for fissile material as specified in DOE 5480.6.e.(2) for Category B reactors and DOE 5480.6.e(3).
- Spare unirradiated fuel components are stored in a remote location (Manzano) in a configuration which meets the DOE 5480.5 Section 13 requirements for fuel storage.
- Experiments containing unirradiated fissile material are stored in critically safe repositories. Irradiated experiments with fissile material are stored in critically safe storage locations including repositories in the ACRR high-bay floor.
- Technical Specifications do not specify fissile material storage and handling requirements.
- * Training deficiencies with respect to nuclear incident monitors and criticality emergency procedures are discussed in Sections TS.9 and TC.6.

CONCERN: See Concern TS.9-1.

AX.4 Ventilation Systems

PERFORMANCE OBJECTIVE

Ventilation systems should reliably direct all airborne effluents 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:

- The ACRR ventilation exhaust has two flow paths. The first path exhausts the experimental cavity continuously through a series of High Efficiency Particulate Air (HEPA) filters and charcoal filters to a stack. The second path exhausts room air directly to the stack under normal conditions but is diverted through a HEPA filter in the emergency mode.

- The SPR III exhaust air under all conditions passes through a HEPA filter and a charcoal filter in series.

- Rooms where contamination is most likely to occur in both facilities are maintained at pressures that are negative with respect to clean areas of the building such that air always goes from a clean area to one that is less clean.

- Building inlet air for both facilities goes through filters to remove airborne debris.

- Two series fans exhaust air from the SPR III facility. A failed fan cannot be repaired with the other fan online but air circulation continues.

- Two parallel fans exhaust the ACRR experimental cavity. A failed fan can be repaired with the other one online. A single fan exhausts the remainder of the ACRR process area.

- HEPA filters are checked annually using a standard industry-wide test method to ensure that ANSI N510-1980 requirements are met for both reactors and Technical Specifications 3.6.3.3 and 4.6.3.3 are met for SPR III and 3.5.3.3 and 4.5.3.4 are met for ACRR.

- Instrumentation to measure pressure drops across filter banks is installed but not routinely monitored.

* Technical Specification 4.6.3.4 for SPR III specifies that the charcoal filters be replaced every five years.

* There is no Technical Specification for replacement of the charcoal filters at ACRR. These filters would play an important role in reduction of radioactive iodine releases following an accident.

* In practice charcoal filters are replaced before their five-year lifetime is exceeded as indicated by recent replacements at SPR III which occurred in September 1983, August 1985 and December 1987.

* Technical Specifications 4.5.3.4 for the ACRR reads as follows: "The filters in the reactor high-bay ventilation exhaust system and the cavity purge system will be tested annually and replaced as required. Filter tests will be performed by using the standard DOP test or equivalent." The first sentence can be read that the charcoal filters must be tested annually, but the DOP test referred to in the second sentence is not designed to test the charcoal.

* Charcoal filters are never tested between replacements. Standard practice in the nuclear industry is to test charcoal filters annually using either an iodine or freon penetration test.

CONCERN: (AX.4-1) The charcoal filters are not tested between replacements.

AX.5 Vital Supply Systems

PERFORMANCE OBJECTIVE

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

FINDINGS:

- There are no vital water or emergency power systems for either the SPR III or the ACRR.
- If normal power were to be lost, the reactors would automatically shut down and subsequent fuel temperatures would not result in fuel damage.
- If water were to be drained from the ACRR tank, the residual decay heat would not be sufficient to cause fuel melting.
- Emergency electrical power is available as follows:
  - A portable emergency generator is available to power the SPR III elevator to place the reactor in its raised storage position.
  - The radiation activity monitors have a self-contained battery.
  - The criticality monitors have self contained batteries.

CONCERN: None.

AX.6 Heat Removal

PERFORMANCE OBJECTIVE

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

FINDINGS:

- Heat removal systems are not required for the SPR III and the ACRR.
- Reactor fuel in the SPR III is cooled by a chilled nitrogen system to permit pulse runs to be performed with minimal time delays. Technical Specifications require that the fuel temperature be less than 50?C for initiation of pulse operations.
- Reactor fuel in the ACRR is cooled by the water in the reactor tank. This water is maintained at less than the 60?C Technical Specification limit by a cooling tower located outside the reactor building. Water is usually at ambient room temperature; pulsed operation does not increase the temperature significantly.
- The cooling system is started up before the SPR III is operated and is turned off after the reactor is shut down. The ACRR cooling system is placed online before reactor startup, is shut down just before a pulse operation and is then restarted.

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: . The only Engineered Safety Systems that have been provided for the ACRR and SPR III facilities are the ventilation systems. These systems are discussed in detail in Section AX.4.

CONCERN: See Concern AX.4-1.

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: There is no coolant cleaning system at SPR III, because the modest cooling needs are met by using a gas which is not recirculated.

The ACRR has a primary coolant cleanup system, the effectiveness of which is determined by measurement of water resistivity and pH. These data are recorded in the Preoperational Checklist each operating day as specified by Technical Specifications 3.6.3.1 and 4.6.3.1.

A deionizer is used to maintain the primary coolant within the pH and resistivity bounds. Deionizer depletion is indicated by a reduction in resistivity at which point the deionizer resin is replaced.

The heat exchanger transfers the heat from the primary coolant to the secondary coolant. A cooling tower then dissipates the secondary coolant heat to the atmosphere.

Chemicals are not added to the primary or secondary coolants.

CONCERN: None.

F. EMERGENCY READINESS

This appraisal was based on an inspection of the emergency preparedness facilities in Sandia Technical Area V (TA-V), the central Emergency Operations Center in Technical Area I and the emergency Medical facilities. Emergency preparedness policies, procedures, and critiques of past drills were also examined. A TA-V exercise in the ACRR on August 3, 1988, was also observed.

Sandia has made preparations for a modern emergency operations center (EOC), established a site-wide plan, and trained and equipped medical and security support groups to respond to a wide variety of events including accidents involving the ACRR and SPR III reactors.

Because of the rather small fission product inventory and the very large government controlled site, offsite consequences are not expected from reactor accidents. Nevertheless, TA-V has planned and prepared for accidents by training and equipping emergency reentry teams, providing for personnel accountability, and establishing an emergency management organization.

The TA-V response is, however, seriously compromised by two links in the response that are the subject of two concerns. First, the TA-V emergency management organization does not control and direct the activities of the reentry team, either through prior approval of response procedures (although procedures exist, they are not always followed), or by directing response actions. Second, communications between the site emergency management organization and the duty officer who would activate the EOC is not assured. The need for prompt dissemination of information to DOE and through DOE to the press, and the need for timely notification of the family of an accident victim makes this communication important.

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:

- Emergency preparedness activities for Technical Area V (TA-V) are governed by the Sandia Emergency Preparedness Master Plan, February 1988 and the TA-V Emergency Plan, October 1986.

- The Master Plan covers activation of the Emergency Operations Center (EOC), classification of events and communications with DOE, offsite agencies and the press (through DOE only). The TA-V Emergency Plan governs onsite activities. Except as noted below these plans define interfaces for emergencies.

- TA-V emergencies that are not primarily security events are exceptions to the normal Sandia procedure in that the TA-V operations staff rather than the security staff takes command of the emergency.

- Technical support during emergencies is provided by the health and safety organization. Due to the size of the site and the low radionuclide inventory in the reactors it is doubtful that offsite monitoring would be required. For research reactors up to 50 MW the NRC requires an emergency planning zone of 800 meters or less (NUREG-0849).

- The TA-V reentry team was equipped with self contained breathing apparatus and portable radios. Oxygen monitoring equipment has been obtained within the last month and new communications equipment and mask glasses kits were reportedly onsite but not yet in place.

- Staff assignments for the TA-V emergency organization were defined in a May 1988 chart signed by the area manager.

- Past exercises have resulted in identification, documentation, and correction of deficiencies; however, the follow up system is informal.

- Procedures are in place for response to building alarms during non-working hours. These provide for the protection of emergency response personnel and plant equipment.

* Neither the TA-V Emergency Plan or the Emergency Preparedness Master Plan contained an indication of radiation limits for emergencies, the approval required to exceed established radiation exposure limits, or the level of approval required to deviate from established procedures during an emergency. This violates DOE 5500.3 which indicates that emergency planning

requirements include, "Authority for emergency management functions...."

* From actions during the August 3, 1988 exercise and statements made at the critique it appears that the emergency reentry team regards its status as trained volunteers sufficient to allow the team members to exceed DOE exposure limits for normal operations.

* It was not clear to the appraisal team observers who on the reentry team was in charge during the exercise.

* During the emergency exercise, a member the emergency reentry team deviated from the statement on page 16 of the TA-V Emergency Plan, "The Reentry Team SHALL NOT attempt to remove high-radiation sources...." by picking up simulated irradiated fuel pins (bare handed) and throwing them across the room. No authorization for this deviation was sought and there was no indication that the emergency director was even aware that the fuel had been moved. (Although a case can be made for the dose reduction achieved by this action, the guidance in the TA-V Emergency Plan appears to be soundly based on a consideration of the consequence of rupturing a radiation source.)

* Statements made by the reentry team leader, a reactor operator, at the critique indicated that he was aware that routine exposure limits would have been exceed by the action described above and that the felt that the dose was justified given the simulated condition of the victim. This appears contrary to the intent of DOE 5480.1A Chapter XI (1981) which addresses emergency radiation exposure and gives guidance to the "official in charge".

* The contractor's critique of the exercise addressed the failure of a visiting experimenter to follow the evacuation procedure. Although fuel movement was discussed at length it was not identified as a procedure violation. Approximately 17 other lessons learned from the exercise were noted.

* Some of the managers with whom preliminary conclusions were discussed were disturbed by the suggestion that there might be a culture that accepted violation of procedures. Others indicated that the "SHALL NOT" statements of the emergency plan (in a section preceding "guidelines") were never intended to be mandatory.

* The appraisal team was therefore unable to determine if the deviations from the emergency plan occurred because of a lack of training or because procedures are not viewed as mandatory.

CONCERN: (ER.1-1) Management does not maintain adequate control of onsite emergency response.

ER.2 Facility Emergency Plan

PERFORMANCE OBJECTIVE

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

FINDINGS:

- The TA-V Emergency Plan has not been updated since 1986, however, the call lists available at important locations were current.

- Neither the Emergency Preparedness Master Plan nor the TA-V Emergency Plan addresses the consequences of potential emergencies but the responses suggested appear appropriate for the events that are addressed in the Technical Specifications.

- The TA-V Emergency Plan does not address classification of events or notification of offsite personnel however, the Emergency Preparedness Master Plan does and its procedures appear to be in concert with DOE N 5500.3. Activation of the EOC and operations according to the Master Plan were not observed during the appraisal.

- The TA-V Emergency Plan contains the only emergency implementing procedures for the reactors except for those involving security events, and they were not evaluated. A few checklists are available as appendices to the plan.

* Document control of the Emergency Preparedness Master Plan appeared to be a problem in that the Technical Area V (TA-V) Emergency supervisor identified the current plan as a draft out for comment and another supervisor contacted during the appraisal was not aware that his September 1987 version of the plan was not the current one.

* In discussion with the central emergency planning organization they indicated that the Emergency Preparedness Master Plan was not distributed because it is already being updated.

CONCERN: See Concern OA.6-1.

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:

- In the past major emergency exercises have been conducted every 18 to 24 months. The required frequency is not specified.
- Additional training is provided by minor events and false alarms.
- Additional training and review sections are conducted with various onsite organizations. 1988 training records indicated that the emergency response team received training in Self Contained Breathing Apparatus (SCBA's) in January, water and electrical orientation in February, fire extinguisher training in June, and, prior to the TSA five additional training sessions on various topics between June 20 and July 29.
- Observation of the emergency response exercise indicated that team members were familiar with their SCBAs and radios. First aid training for most of the team is reported planned but was not completed prior to the exercise.
- During the exercise only those individuals with adequate training administered first aid.
- During the emergency exercise a reactor operator did not adjust the ventilation to the emergency mode as recommended in the emergency plan.

* As indicated in Section ER.1, procedures were violated during the exercise.

CONCERN: See Concern ER.1-1.

ER.4 Emergency Facilities, Equipment, and Resources

PERFORMANCE OBJECTIVE

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

FINDINGS:

- The Emergency Operations Center (EOC) was observed to be well equipped. The EOC is sufficiently remote from the site so that it is unlikely to be affected by a reactor accident. It is equipped with multiple communications systems and sources of information about site facilities.

- Limited first aid supplies and an ambulance are maintained in Technical Area V for emergency use. The site medical department maintains a well equipped decontamination facility and has by a Radiation Emergency Procedure Manual.

- High range self reading dosimeters were available but were not observed to the used.

* The portable radiation monitoring instruments used for emergencies are the same as for routine use, although there may not be an adequate supply. (See Section RP.8)

CONCERN: See Concern RP.8-1.

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:

. The Emergency Preparedness Master Plan classifies emergency events according to the guidance of DOE N 5500.2, but does not assign the authority/ responsibility to classify the event. Classification of an event by the Emergency Operations Center (EOC) in Technical Area I was not observed due to early termination of the August 3, 1988 exercise.

. Both the Emergency Preparedness Master Plan and the TA-V Emergency Plan specifically address actions for a plane crash within Technical Area V (TA-V). The Emergency Preparedness Master Plan indicates that security would be in command where the TA-V Emergency Plan indicates that the technical organization would take charge.

* The TA-V Emergency Plan does not specifically assign responsibility to communicate with the Laboratory Duty Officer, before the EOC is activated.

* The Emergency Preparedness Master Plan does address communications from the command post to the EOC or duty officer but only in the context of an emergency where security is in charge.

* During the exercise, the onsite command post began getting information about the nature of the event within one minute. The log sheet kept by security personnel at the EOC indicated that information indicating that the event involved both personnel injury and contamination was available 15 minutes into the drill.

* The security personnel involved said that they knew there was a "contaminated injury" from TA-V, but did not know if the contamination was radiological.

* During the critique, reactor personnel indicated that they did not ask for activation of the EOC because they were able to respond to the situation on site. They did not however, address notification of DOE or the press.

* The duty officer did not use every means available to keep abreast of the situation but relied on security to keep him informed. He decided to activate the EOC 45 minutes following initiation of the exercise. At that time he had no information

on the initiating event or contamination levels on the injured victim, although the latter had been given by phone to the Area I health physicist who was to assist medical.

CONCERN: (ER.5-1) The effective transfer of information about an accident in Technical Area V to the duty officer and/or the Emergency Operations Center in Technical Area I is not assured.

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:

- An electronic personnel accountability system is in place. During drills and false alarms missing persons are routinely identified by name within ten minutes of an alarm.

- During the drill the security inspector at the badge station was able to rapidly identify missing individuals and their location from accountability records and picture identification maintained in the guard house.

- Emergency exposure limits are not addressed in any of the Sandia Emergency preparedness documentation review during the appraisal, although key personnel were conversant with the applicable DOE guidance.

- The adequacy of radiation protection instrumentation is addressed Section RP.8 and by Concern RP.8-1.

- Limited first aid supplies and an ambulance are maintained at Technical Area V (TA-V) for emergency use.

- The site medical department maintains a well equipped decontamination facility and has a Radiation Emergency Procedure Manual.

- Agreements are in place to transport a radiologically contaminated victim by air to the University of New Mexico hospital and this capability has been demonstrated during a past exercise.

- A supply of bottles for self contained breathing apparatus is maintained at TA-V. Additional bottles and a refilling compressor are available approximately 15 minutes away from the site in Technical Area 1. The distance is sufficient to assure its usefulness during an emergency.

* Visitors to the site normally receive a card directing them to the proper building for personnel accountability during an area evacuation. They sign a sheet indicating they have received this information. There is, however, no onsite orientation.

* The appraisal team was told that there was one alarm in TA-V, and were told what to do for the fire/evacuation alarm.

* There are multiple alarms in TA-V with distinct sounds. The reactor facilities have different alarms for fire, criticality, high radiation and airborne radioactivity. There are also alarms for oxygen deficiencies elsewhere in TA-V. Response to these conditions should not be identical.

* The card and signature form given to personnel who visits the facility address only one alarm.

* During the emergency drill two Air Force telephone repair men and a visiting experimenter did not respond adequately to the fire/evacuation alarm.

CONCERN: See Concerns TC.4-1 and TS.9-1.

G. TECHNICAL SUPPORT

A review of the technical disciplines of on-site support personnel, the administrative documents that specify their functions, and an analysis of their work formed the basis for this appraisal. The relationship and interactions of support personnel with reactor operating supervisors and operators was evaluated in discussions with members of Technical Area V representatives of the affected groups.

The technical expertise needed to support all facets of reactor operation is available at the Sandia-Albuquerque site. In addition, backup support is available and utilized from Los Alamos and regional universities. The reviews and analyses performed by support personnel have been professional and have contributed to the good safety record of the reactors. The redesign and replacement of the SPR III pulse element illustrates how operating and support personnel cooperated to successfully achieve the desired result. Analyses of each experiment to ensure that in-reactor irradiation is safe is another example of technical support personnel reinforcing the operating groups. These examples illustrate the technical expertise of the support personnel.

There were no concerns noted that required immediate corrective action. Five concerns were identified that, if corrected, would lead to improvements of reactor safety and overall performance. These address improvements needed in Technical Specifications, incident reporting, criticality monitoring, and criticality alarm response.

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:

- The number of modifications made to the reactor systems is not extensive.
- Technical support personnel from all needed disciplines are available from Sandia personnel on site. Many of the support personnel are assigned to Technical Area V, the area where the reactors are located, and as such are readily available when needed.
- Off-site personnel from Los Alamos and regional universities are also used on overview committees.
- The documentation for modification of the SPR III pulse element was reviewed. This documentation consisted of a number of memoranda, excerpts from maintenance records and a set of original design drawings. A complete set of these data was compiled from various Sandia files specifically at the TSA Team's request. This modification is discussed further in Section MA.7.
- The pulse element modification was properly reviewed and approved by appropriate Sandia and DOE personnel.
- An as-built set of modification drawings for the pulse rod that reflected a subsequent modification was not available. Sandia plans to provide updated drawings.
- Design, purchase, fabrication, installation and checkout of this modification was under the direct purview of the operating personnel.
- * Both reactors have radiation instruments that monitor the effluent air that goes to the stacks. These instruments do not meet the specifications outlined in standards ANSI N13.1-1969 and N13.10-1974. Purchase specifications for a replacement instrument for ACRR do not list the two standards as having to be met.

CONCERN: (TS.1-1) Reactor personnel do not have a program to ensure complete compliance with mandatory DOE standards for facility modifications.

TS.2 Organization and Administration

PERFORMANCE OBJECTIVE

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

FINDINGS:

- Technical support personnel are knowledgeable concerning safety concerns, Technical Specifications, and general design criteria. They are less knowledgeable of specific hardware details, operating procedures, and day-to-day operations.
- Administrative controls such as operating procedures and checklists are used to ensure safe reactor operation.
- The Sandia Research Reactor and Experimental Programs Quality Assurance Program Plan requires reactor operators and supervisors to be involved in equipment procurement, shipping, handling, storage, and control of purchase items.

CONCERN: None.

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:

. The following safety analysis reports and Technical Specifications exist:

- Sandia Annular Core Research Reactor (ACRR) Safety Analysis Report, November 1981.
- Sandia Pulsed Reactor III (SPR III) Safety Analysis Report, April 1978.
- Sandia Annular Core Research Reactor (ACRR) Technical Specifications, July 1988.
- Sandia Pulsed Reactor III (SPR III) Technical Specifications, July 1988.

. Drafts of updated safety analysis reports for both ACRR and SPR III are circulating for approval.

. Procedures that guide the actions of technical support personnel do not exist.

. Reactor operations personnel perform their own technical support functions in many areas because of their technical expertise. One such area is in procedure writing as illustrated by the following findings.

. Operating procedures are reviewed by the applicable committees (ACRR committee or SPR III committee and the Radiological and Criticality Safety Committee) and then approved by the division supervisor prior to being used.

* A random sample of operating procedures was analyzed. Two of the ten ACRR and three of the 25 SPR III procedures were reviewed in detail.

* The following problems with ACRR procedures were noted:

- The "ACRR Preoperational Checkout" procedure (approval date January 4, 1984) contains items that are not listed on the associated "Preoperational checklist" (e.g., items 5.1 and 5.2 of the checkout are not covered in the checklist).
- Step 2.3d of "ACRR Preoperational Checkout" procedure requires the tank water level to be "greater than

57 inches below the top of the skimmer". The "Preoperational Checklist" requires only that the tank and core be inspected. Technical specification 3.6.3.3 requires the water level to be greater than 12 inches below the top of the skimmer. This procedure permits the water level to be outside the technical specification requirement. The approval date of the procedure is January 4, 1984. There is no evidence that the water level has ever been below the technical specification limit.

- Page 3 of procedure ACRR Preoperational Checkout refers to blue caution tags. Caution tags are mustard color.

- Procedural requirements are not always consistent. The "ACRR Preoperational Checklist" in step 10.3 specifies that control rod #1 be positioned at about 500 units and that rods 2 through 6 be within + 15 units of rod #1. The "Preoperational Checklist" specifies that all rods be at 500 units with no tolerance listed.

- In procedure "ACRR Pulse Operations," the section C HEADING refers to a NOTE section. There is no NOTE section.

- Step B-1 of the "ACRR Pulse Procedure" requires that the "ACRR Preoperational Checklist" be complete. Subsequent steps then require that many of the checkouts be repeated as shown on "ACRR Pulse Operations Checklist." This is an inefficient redundancy.

- Asterisks are used both to designate technical specification requirement steps in the procedure and to identify steps with other significant safety requirements.

- Procedures are not numbered.

- Files of previous versions of the procedures are not maintained.

* The following problems with SPR III procedures were noted:

- In the "Daily Checklist," in one step, an asterisk indicating a technical specification requirement was left off. A revision to the procedure was prepared immediately after this omission was pointed out.

- The use of asterisks is not consistent in the procedure. In the "Daily Checklist" procedure an asterisk indicates a step which contains a technical specification requirement. In other checklists, an asterisk indicates the need for initials of a reactor supervisor (e.g., "Annual/Semiannual Inspection Checklist")

- SPR III procedure FHP-3 "SPR Exchange" does not require that a portable criticality monitor be operational before the reactor is moved from its normal mount and/or returned.

* The following general problems with SPR III and ACRR procedures were noted:

  - There is no procedure writers guide except for Safe Operating Procedures.

  - Procedures for the two reactors are not of uniform format. Uniform format would help revisors and approvers.

  - The most recent procedure changes are not identified to aid users in identifying modified steps.

  - Some checklists have a section near the end for comments. There is no system for followup of entries in this section.

  - Procedures do not reflect a revision number. ACRR procedures and some SPR III log sheet pages do not reflect the revision date on each page.

  - Some ACRR procedures and some log sheets from both reactors do not have page numbers or do not show the total number of pages (e.g., page 8 of 10).

* The above items indicate that procedures are not being reviewed thoroughly.

* Master copies of the procedures are not being controlled in a manner which precludes unauthorized changes. The approval signature is on the first page of each procedure. Some checklist procedures do not have approval signatures. At SPR III, the master copy of each procedure is in the supervisor's computer. There are only three controlled copies of each procedure. It would not be difficult for a change to be made to one or more pages of a procedure (pages that do not contain an approval signature) and these pages inserted in the controlled copies. There is no evidence that such unauthorized changes have ever been made.

CONCERN: See Concern OP.2-1.

* Technical Specifications do not reflect the existence of the nuclear incident monitors.

* Section 6.1.3 of the ACRR Technical Specifications allow "operators-in-training" to fulfill requirements for staffing the control room. It was observed that the supervisor and operator are jointly required to operate the ACRR such that one cannot observe the other's actions. ANSI/ANS-15.4 (1988) permits a trainee to perform reactor control activities only under the direct supervision of a certified person.

* Section 3.1.3 of the ACRR Technical Specifications is not specific as to how the worth of the transient rod bank is to be measured.

CONCERN: (TS.3-1) Technical Specifications do not adequately address some items required to bound the operations.

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:

- Performance monitoring of the reactor instrumentation is performed by reactor operators and supervisors using approved procedures as required by Section 4 of the Technical Specifications.
- Data are recorded on checklists which specify acceptable values for measured parameters. Data are not trended at present but Sandia says they plan to start.
- The High Efficiency Particulate Air filters are tested by an off-site vendor. The results of these tests are evaluated by qualified reactor supervisors. See Section AX.4 for additional discussion.
- Equipment is calibrated against National Bureau of Standards traceable standards, some of which are located in the reactor area with additional standards located in the Technical Area I.

CONCERN: None.

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:

- Significant unusual operating events are presently reported in Unusual Occurrence Reports (UORs). Four UORs have been issued for SPR III since 1983, none for ACRR.
- UORs are prepared as outlined in SLI 2041, Reporting System for Unusual Occurrences, October 6, 1987.
- UORs are evaluated by management to determine how to improve safety of the operation. A followup system is in place to correct items listed in the UORs.
- DOE-wide UORs are reviewed by reactor operators and supervisors to determine applicability to Sandia reactors.
- Other nuclear industry information documents such as NRC I&E Bulletins, I&E Notices and Licensee Event Reports which have some application to the Sandia reactors are not made available to the operating personnel.
- Technical support personnel who are in the Reactor Development and Applications Department are knowledgeable of reactor operation. However, those in other organizations have less familiarity with the reactors.

* There is no system for documenting operating events that are a deviation from normal operation of the reactors or their associated equipment but are less significant than UORs. Such a system is useful to ensure that all abnormal occurrences are reported.
* Review of the SPR III log for the period April 1, 1988 to July 31, 1988 revealed no entry regarding any incident such as a power outage or other types of incident normally found in reactor logs.
* No record is made in logs of incidents such as power outages, problems with experiments, and such important information as scrams caused by procedural error.
* During the briefing by the head of the ES&H Department, it was stated that if incidents were deemed not to be of interest outside Sandia, Unusual Occurrence Reports (UORs) were not issued.

* No policy was found which required that all incidents be reported in a manner which would provide a permanent auditable record.

* The log record in use at the SPR III and ACRR does not contain lower level incidents below the unusual occurrence level.

* No log record amenable to audit was made of a spurious shutdown during a pulse experiment at ACRR on August 2, 1988.

* An incident on May 18, 1988 at SPR III where a Security Inspector remained at his post during an experiment pulse was not reported either in the SPR III log or as an Unusual Occurrence.

* Without complete incident data on experiments it is difficult to evaluate whether:

  (1) appropriate review and corrective action was taken,

  (2) any risk is present which had not been recognized or provided for in safety analyses procedures or by safety devices.

  (3) procedures have been followed.

  (4) the frequency or category of incidents indicate that some important to safety trend existed or a root cause had not been recognized.

CONCERN: (TS.5-1) A third party cannot evaluate the frequency or severity of incidents, determine trends, or review procedural errors because a system for reporting all incidents associated with the reactors does not exist.

TS.6 Environmental Impact

PERFORMANCE OBJECTIVE

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

FINDINGS:

- The amount of radioactive and hazardous material released to the environment is small.
- Release of radioactive gases and liquids is discussed in Sections AX.1 and AX.4.
- Hydraulic fluid that leaks from the SPR III elevator operating mechanism is the only hazardous material routinely released to the environment. The amount of the fluid is only a few gallons per year under normal operations. This release goes to a rock pit and is not monitored.
- Because of the small leakage rates, no management program addresses volume reduction.

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:

- DOE 5480.3, Section 10 governs the functions of Nuclear Materials Control Section personnel concerning packaging of hazardous materials.
- Review of records of fissile material shipments indicated that DOE 5480.3, Section 10e requirements are being met.
- Some experiment equipment is packaged preliminarily at the reactor site by reactor operating and health physics (HP) personnel.
- Final packaging is done by packaging and shipping personnel in Technical Area I.
- The amount of the predominate radioactive isotope is estimated by HP personnel from experiment equipment and reactor exposure. These data are required for shipments offsite.
- Material to be shipped is picked up at the reactor site by packaging and shipping personnel who have been trained in criticality safety by Los Alamos personnel at that site.

CONCERN: None.

TS.8 Reactor Engineering

PERFORMANCE OBJECTIVE

Reactor engineering activities should ensure optimum nuclear reactor operation without compromising design, safety, or nuclear fuel limits.

FINDINGS:

- There has been no fuel element failure in the last 14 years at SPR III and the last 22 years (since startup of SPR III, ACRR and its predecessor). Fuel failure at SPR III would be detected by changes in either floor contamination levels or pulse characteristics. In ACRR, fuel failure would be indicated by a higher activity level in the primary coolant.

- Most reactor engineering is associated with providing the desired neutron flux level and spectra to the experiment. These parameters are determined by qualified reactor personnel.

- The reactivity worth of new experiments is also determined as part of the reactor engineering activities.

CONCERN: None.

TS.9 Criticality Safety

PERFORMANCE OBJECTIVE

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:

. Nuclear criticality safety training is provided by Los Alamos personnel. A two day session is provided for personnel in the Nuclear Materials Control Section who are associated with packaging and transporting fissile material to and from the ACRR and SPR III reactors. A five day criticality safety training session at Los Alamos has been completed for all ACRR and SPR III certified reactor operating personnel.

* A criticality monitoring system is installed in the SPR III north vault (NOVA). The audible alarm, a relatively high pitched warble, is heard locally at the NOVA: it is not audible inside the reactor room kiva. If an unwanted criticality were to occur in NOVA, which is located adjacent to the normal kiva building entrance, personnel working inside the kiva would not be warned. Personnel inside the kiva would probably be warned by the stack monitor alarm; response to it would be to evacuate in the direction of the criticality rather than away from it.

* Portable criticality monitors are required when using SPR III procedure FHP-1, "Fuel Loading and Unloading," and FHP-2, "Mechanical Core Disassembly." Portable criticality monitor coverage is not required when using procedure FHP-3, "SPR Exchange," which physically relocates the reactor. The potential for the fork lift truck colliding with the wall or other fixed object necessitates that a criticality monitor be in place for this operation.

* Criticality evacuation routes are not identified.

* Criticality evacuation drills have not been conducted. American National Standard ANSI/ANS-8.3-1986 specifies that an evacuation drill be conducted annually.

* A procedure for response to a criticality monitor alarm is being prepared. A letter from G. L. Cano to all Area V residents, dated July 6, 1988, and a letter from D. M. Minnema and T. F. Luera to G. L. Cano, dated July 30, 1988, report the current status of this procedure and the program for implementing it. The Minnema-Luera letter lists hardware, training, testing and procedure items that must be addressed. Two items that must be implemented in addition to that in the above letters is training in alarm signal recognition and

briefing for personnel who work or visit Area V infrequently (e.g., visitors and maintenance personnel who work site-wide). Refer to Section ER.6.

CONCERN: (TS.9-1) Appropriate response to criticality alarms has not been addressed.

FINDINGS:

* An analysis has not been made to evaluate need for a criticality monitor at ACRR.

* It is possible to insert more than one experiment containing fissile material into one storage location in the floor in the high bay near the ACRR and to remove and handle more than one experiment at a time.

* This building area including the Gamma Irradiation Facility pool where fuel is sometimes stored is comparable to a spent fuel pit area at a larger facility.

CONCERN: (TS.9-2) The need for a criticality monitor at ACRR during handling and storage of experiments at ACRR has not been evaluated.

H. SECURITY/SAFETY INTERFACE

Sandia has implemented measures to evaluate the safety and health impact of recent initiatives to the Safeguard and Security Program. Efforts made at th Sandia reactor facilities to strike an appropriate balance between the Security and Safety missions include reviews of security enhancement projects for hazards that would impede the safe operation of the reactors; and the implementation of measures to protect personnel--firearms safety, emergency response training, and planning.

A concern was noted in the area of communication and training of security forces to assure the attainment of both safety and security goals without adverse impact upon the Sandia programs.

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:

- The Sandia Administrative Practices Manual prescribes instructions for the review, comment, and sign-off of projects by the following organizations: Environmental, Safety, and Health Department, Safeguards and Security Services Department, Plant Engineering (maintenance, design, fire protection, planning), the using Sandia organization, and the DOE Management Support Division (Albuquerque Operations Office).

- Plant Engineering coordinates the review of all design and construction projects at Sandia.

- A review of project documentation files and discussions with plant engineering, security, safety, and operations staffs and managers indicate that all proposed Technical Area V security enhancement projects are evaluated by the appropriate disciplines to minimize risks to safe and reliable operation or shutdown of the reactor and associated facilities.

- The status of security enhancement projects is tracked by computer and updated by Plant Engineering project engineers. Current information is provided to operations, security, and safety organizations. Periodic meetings are held with the appropriate parties to discuss security enhancement projects at Technical Area V.

- The "Building and Facilities Planning Committee" as described in SLI 1030 (Official Sandia Laboratories Committees) is responsible to the President and assists Plant Engineering in an advisory capacity to meet Sandia and DOE requirements. This role includes the review, approval and resolution of issues involving security/safety interface in buildings and facilities.

- The Manager, Reactor Development, and Applications Department, 6450, has been delegated the authority and responsibility for overall Technical Area V functions for emergency planning, safety, security interface, nuclear materials, space requirements, control of visitors, area maintenance and coordination of plant engineering projects.

- The ACRR and SPR III reactor safety committees review all experiment plans and notify security personnel of any unusual safety hazards involving the experiments.

CONCERN: None.

SS.2 Compatibility

PERFORMANCE OBJECTIVE

Security/safeguards improvements should use design criteria consistent with the facility equipment/structures being protected.

FINDINGS:

. Design plans for new construction and modifications to existing facilities are reviewed by safety, security, operations, and all other concerned personnel during conceptual design and Title I and II design phases. Plant Engineering coordinates, reviews, and maintains design criteria for protection against natural phenomena. Sandia design manuals implement the requirements of DOE 6430.1A "General Design Criteria."

. The Safeguard and Security Services Department reviews all plant construction projects from a security perspective to identify vulnerabilities, risks and potential consequences. These analyses include evaluations for nuclear, seismic, fire, wind, and other events.

. All Security Inspector forces receive job task training for the use of firearms, vehicles, metal and gamma detectors, and initial radiation safety training in the vicinity of the protected areas where special nuclear material is present.

. Additional areas of security force training include ambulance training, cardiac pulmonary resuscitation and refresher, and Lifeguard One Activation training.

* Some of the security forces have expressed concerns with their own personal safety and health in the exercise of their security duties during normal and emergency operations. These include:

  - Concern about timely transmittal of information and instructions to Security Inspectors at their duty stations during emergencies so that unnecessary risks to their own safety and health can be minimized (some Security Inspectors have interpreted that they are instructed to remain at their stations during emergencies even in radiation environments until instructed to do otherwise by the security supervisor). Local gamma monitors (remote and continuous area monitors) are at every location where Security Inspectors are posted during a Technical Area V evacuation. Security Inspectors have orders to evacuate if a radiation monitor alarms or instructed by security supervision.

- Concern that the new perimeter control building and perimeter monitoring system security enhancement project will impact emergency egress of Technical Area V personnel. The obstruction to egress that existed during the construction of the perimeter fencing at Technical Area V has been corrected.

- Concern that consumption of food and drink is now prohibited at the ACRR security station when eating, smoking, and drinking were permitted previously. Consumption of food and drink has been prohibited at the ACRR security station as a result of stricter requirements of the new DOE 5480.11, "Radiation Protection." It was noted that there has not been any radiation contamination found from health physics surveys at that location.

- Concern (from a single incident) about receiving unnecessary radiation exposures and not being provided with written evidence of the investigation of the incident involving potential or suspected exposure to radiation. There was no evidence that the employee received any radiation exposure. In a meeting with management and health physics the same day of the occurrence, the employee was told that there was no exposure. The incident occurred in an area where health physics surveys indicated that there is no requirement to evacuate but normal practice is to clear the area.

* There was no evidence that any Security Inspector at Technical Area V received any radiation exposures.

* It was noted from discussions with Security Inspectors that uncertainty existed about how to resolve safety and health-related matters.

* Discussions with management personnel indicated that appropriate actions have been or are being taken with Security Inspector concerns. However, feedback to the working level may not be effectively accomplished or communicated.

* Some Security Inspectors indicated that little or no radiation training is given to them as it pertains to their particular duties at an assigned location/site.

CONCERN: See Concern TC.4-1.

SS.3 Emergency Access

PERFORMANCE OBJECTIVE

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

FINDINGS:

- Special orders have been issued by the Safeguards and Security Services Department to all security inspectors to permit emergency personnel and vehicles through the security gates and stations during an emergency at Technical Area V. These instructions authorize unrestricted access to fire fighting and other emergency personnel in the areas designated by the Emergency Supervisor.

- Additional instructions have been provided to Security Inspectors to permit Technical Area V reactor personnel unrestricted egress while evacuating special nuclear material protected areas during an emergency.

- All emergency exit doors in the ACRR and SPR III facilities have been equipped with door alarms and afford the ability for emergency egress during any alarm situation or life-threatening emergency conditions.

- The emergency exercise on August 3, 1988, demonstrated that emergency equipment and response personnel were not impeded; and that evacuation of personnel from the special nuclear material protected areas occurred without incident.

- The new perimeter control building and perimeter monitoring system will obviate the need for security inspectors at ACRR and SPR III special nuclear material protection stations, thereby enhancing egress and minimizing the risks and reducing the hazards of accidental firearms discharges. It also will markedly enhance operational and industrial safety by virtue of the ability of personnel to move freely with tools and other equipment, etc., otherwise complicated by the metal detection and other protocol at the security stations. The target for completion of the security enhancement project is late 1988 - early 1989.

CONCERN: None.

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:

- Responsibilities of facility operations and security personnel during safeguards/security emergencies at Technical Area V are defined in the "TA-V Emergency Plan," dated October 1986.

- Responsibilities of security and operations personnel are defined for both security-type incidents and operational-type emergencies and are not redundant. During operational emergencies involving radiation, fires, and explosions security personnel would assist the Technical Area V Emergency Organization as required and directed by the Emergency Supervisor.

- During events or emergencies that involves the imminent compromise of the security of special nuclear materials or classified materials as determined by the Senior Security Officer on-site, the Security Officer will assume command and coordinate activities with the Emergency Supervisor.

- Training for all security personnel stationed at Technical Area V includes responses to emergencies involving radiation, fire, explosions, and hazardous materials.

- Drills and exercises are held periodically to test and maintain the readiness of all parties for emergencies requiring involvement of security inspectors (re-entry teams, etc.).

- Critiques are conducted after each drill or exercise of the emergency plan and weaknesses (including security/safety interface problems) are identified for corrective action and improvement.

CONCERN: None.

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:

- Analyses have been performed to evaluate the potential consequences associated with using firearms, vehicles, and other security equipment in the vicinity of safeguarded systems. As a result of these analyses, potential vulnerabilities were identified that may pose risks to facility personnel, visitors, the security force or to the public. An example of a recent evaluation is the concern about the proximity of the liquid propane tanks to facilities occupied by operations and security personnel. As a result of the study, a project has been proposed to relocate the propane tank farm at Technical Area V.

- Additional analyses were conducted to examine the impacts of accidental firearms discharges or unauthorized detonation of explosives at the ACRR and SPR III facilities. These analyses determined that damage and the associated risks with accidental firearm discharges or unauthorized detonations of explosives were minimal and would not impact the safety of the reactor facilities.

- A charter to form a firearms safety committee at Sandia National Laboratories - Albuquerque has been proposed by the Safeguards and Security Services Department and has been reviewed by the Environment, Safety and Health Department. This committee would be composed of a chairman from the Safeguards and Security Services Department, members from the security forces, a safety representative from the Environment, Safety and Health Department and advisors from the Albuquerque Operations Office and the DOE Central Training Academy. This committee will evaluate overall firearms safety concerns and conduct formal internal appraisals as prescribed by the recently issued DOE 5480.16, "Firearms Safety," dated January 12, 1988.

- All Security Inspectors receive training in firearms use and safety from the DOE Central Training Academy located at Sandia National Laboratories, Albuquerque.

- Operations personnel at Technical Area V have participated in workshops that discussed the security, safeguards, and safety at fast burst reactor facilities.

CONCERN: None.

I. EXPERIMENTAL ACTIVITIES

The experiment staff have performed some very complicated, potentially hazardous experiments without endangering the reactors or personnel. They have controlled the technical hazards very well, and require only some improvement in the more administrative safety matters.

Appropriate procedures and safety committees are in place for categorizing experiments and performing safety reviews. A very good informal system is used to assemble the experiment package which contains experiment design, the safety analyses, operating limitations, and QA and operating procedures. The Experiment Plan can be readily reviewed by the safety committee.

Some concerns exist but none require immediate action. These concerns are in areas of procedures, incident reporting and detailed inspection of facility operations.

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:

- An Experiment Plan, an assembly of the design description, safety analyses, procedures, and a QA program plan and other documents is prepared for each experiment in a form easily reviewed by the safety committee.
- Individual Experiment Plans are generated for each experiment. Simple experiments, may have a plan as short as two pages. More complicated experiments may have a plan of more than 100 pages.
- The responsibilities of experimenters, operators, and health physicists are defined in the Experiment Plan.
- Operational limits including such items as number of fissions, reactor power, pressure, and temperatures are provided in the plan where necessary.
- A QA appendix is provided which lists the methods and procedures to be followed and records to be maintained.
- Procedures are provided for inserting the experiment package in the reactor, for operating the experiment while it is in the reactor, and for removing and post- irradiation testing. Only parts of a complete procedure for preparing the Experiment Plan are available. It is customary to follow previous plans in preparing new ones.
- Requirements for reapproval of experiments are established in the safety committee charters.
- Good coordination exists between the experimenters and reactor staff. For example some experiments are provided with manual and automatic scram capability and either group may initiate a scram if they should deem it necessary.
- In order that the high quality of the present plans will be maintained for future experiments and for new experiments, especially for experiments from outside Sandia, it is desirable to institutionalize the present practices in a procedure.

* No procedure detailing the steps in developing the complete experiment plan was found. Without a procedure for the experiment plan, it is difficult to audit against any standard.

CONCERN: (EA.1-1) There is no formal procedure institutionalizing the present successful Experiment Plan and giving the experimenter details of the steps necessary for preparation of the Plan.

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:

- DOE 5480.6-8g(4) requires that the contractor "provides technical competence in areas being reviewed. . . ." and DOE 5480.6g (7) "Provides an appraisal of the overall operation of each facility . . ."

- Sandia's - Contract, with DOE DE-AC04-76DP00789, Mod. No. M086, Appendix B, 4.d., requires an "auditable, well-defined, internal safety review and inspection system . . . that shall provide frequent and periodic checks of facility performance . . . and . . . for investigation of any unusual or unpredicted conditions that might affect safe operation."

- ACRR Committee Charter, SPR III Committee Charter, Sandia Reactor Safety Committee (SRSC) Charter, requires that irregularities be investigated.

- The SRSC satisfies the criteria of DOE 5480.6-8g in most respects with a few slight deviations as follows.

  - The SRSC chairman is appointed by a vice president but the chairman appoints all other members.

  - The Audit and Review staff is used to conduct the annual audit. This group may not have the breadth of background and time necessary to conduct the audit and review in the detail necessary to detect problems.

  - The SRSC conducts much of its business through two sub-committees.

  - The SPR III Committee and the ACRR committee are largely composed of the reactor operating staff. While these committees may not always meet the criteria of independence and breadth of background, there does not appear to have been any compromise of safety as far as experiments are concerned. Their function is somewhat similar to the review process at many other reactors where the independent safety review committee delegates certain authority to the reactor operating group, such as approving simple or repetitive experiments.

. Authority for approval is based upon four classes of experiments. Class I simple, repetitive experiments, may be approved by the reactor supervisor; Class II, more complicated experiments, may be approved by the reactor committee; Class III, experiments having safety problems but not violating a technical specification; may be approved by the SRSC; Class IV, Experiments which may cause some technical specification to be exceeded must be approved by DOE/AL after the SRSC recommends approval.

. In all cases the final approval rests with reactor supervision after safety committee approval is received.

. Review of SRSC minutes indicated that technical considerations in experiments were well reviewed, and a sufficiently broad spectrum of technical competence was brought to bear on each problem.

* More routine matters such as adequacy of procedures, document control, incidents and QA were not audited in sufficient detail by an internal review, inspection or audit to detect deficiencies.

* Significant items that had not been picked up by any internal review, audit or inspection include:

  - The lack of an independent QA audit of a completed experiment.

  - The lack of a complete procedure covering preparation of the Experiment Plan.

  - The lack of an auditable reporting system for experiment incidents below the level of Unusual Occurrences.

* One member of the Audit and Review Staff has reactor experiment experience, but he is at SNLA only eight to ten days per year.

* Interviews with an SRSC member indicated that the committee did not have time to do detailed audits (as required by DOE 5482.1B, Section 9.d.).

CONCERN: (EA.2-1) The Sandia internal review and inspection system has not been effective in discovering deficiencies in a number of areas associated with experiments.

Also see Concern FR.4-1.

EA.3 Experiment Categories

PERFORMANCE OBJECTIVE

All proposed experiments should be approved before they are performed.

FINDINGS:

- The operational charter for the Sandia Reactor Safety Committee, September, 1987 defines the responsibilities and authority of the committee.
- The charter for the Annular Core Research Reactor Committee, revised April, 1982 defines the responsibilities and authority of the committee.
- The charter for the Sandia Pulsed Reactor Committee, August, 1985 defines the responsibilities and authority of the committee.
- The charters for the Sandia Reactor Safety Committee (SRSC), the ACRR Committee and SPR III Committee provide criteria for dividing experiment proposals into four categories: Class I, Class II, Class III or Class IV.
  - Class I can be approved by the reactor supervisor.
  - Class II can be approved by the ACRR on SPR III Committees which consist largely of personnel associated with the reactors or experiments.
  - Class III, those having significant safety problems, and Class IV, those where the safety problems may cause a Technical Specification to be exceeded, must be referred to the SRSC after review by the local reactor committee.
  - The SRSC must approve all Class III experiments.
  - All Class IV experiments (those which in the opinion of the SRSC exceed a Technical Specification or introduce an unreviewed safety question) must be referred to DOE/AL for approval after the SRSC review.
- Reviews of safety review documents reveal an active interplay between operators, experimenters, and safety committees.
- The classification of experiments depends on the reactor supervisor; no indication was found that reactor supervisors had approved experiments which should have been approved at a higher level.

CONCERN: None.

EA.4 Experiment Proposals

PERFORMANCE OBJECTIVE

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

FINDINGS:

- The experiment plan discussed in Section EA.1 provides the experiment information package for the safety review.
- DOE 5480.6-8.f. lists requirements for QA. DOE 5700.63 is the general order covering QA.
- Sandia National Laboratories Quality Plan, April 1986 is the overall QA document at SNLA.
- Research Reactor Experiment Program (RREP) Quality Assurance Program Plan RS6420/86/43 (Internal Memo by Dale Pipher) lists the information to be considered for inclusion in the QA plan for the experiment.
- The experiment QA Plan is an appendix to the Experiment Plan generated for each experiment and is included in the Experiment Plan presented from review by the safety committee.
- A commendable QA Program for experiments is underway at the reactors.
- A QA specialist has been assigned to the reactor area and devotes most of his time to assisting experimenters in setting up the QA portion of their Experiment Plans.
- The QA specialist also provides inspection service during the design and fabrication of experiment hardware.
- The June 27, 1988 minutes of the Sandia Reactor Safety Committee indicate that a QA representative would be appointed to the Audit and Review Staff to increase QA oversight.
- * A request for a copy of an independent QA review of a completed experiment revealed that no such independent review had been done.

CONCERN: See Concern OA.4-2.

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:

. Contract DE-AC04-76DP00789 between DOE and Western Electric Co, Inc., Mod. No. M086 October 1, 1983, Appendix B.4.d. --- requires Sandia to:

> Establish an auditable, well-defined internal safety review and inspection system approved by the Contracting officer (including review of inspection reports by competent technical personnel) that shall: (I) provide frequent and periodic checks of facility performance --- and (II) provide for investigation of any unusual or unpredicted condition that might affect safe operation.

. DOE 5480.6, 8g.(3) states "--- performance of the system shall be recorded in sufficient detail to permit --- and DOE to evaluate its effectiveness ---."

* Review of the SPR III log for the period April 1, 1988, to JulY 31, 1988, revealed no entry regarding any incident such as a power outage or other types of incident normally found in reactor logs.

* No record is made in logs of incidents such as power outages, problems with experiments, and such important information as scrams caused by procedural error.

* During the briefing by the head of the ES&H Department, it was stated that if incidents were deemed not to be of interest outside Sandia, Unusual Occurrence Reports (UORs) were not issued.

* No policy was found which required that all incidents be reported in a manner which would provide a permanent auditable record.

* The log record in use at the SPR III and ACRR does not contain lower level incidents below the unusual occurrence level.

* No adequate log record amenable to audit was made of a spurious shutdown during a pulse experiment at ACRR on August 2, 1988.

* An incident on May 18, 1988, at SPR III where a Security Inspector remained at his post during an experiment pulse was not reported either in the SPR III log or as an an Unusual Occurrence.

FINDINGS: * Without complete incident data on experiments it is difficult to evaluate whether:

(1) appropriate review and corrective action was taken,

(2) any risk is present which had not been recognized or provided for in safety analyses procedures or by safety devices.

(3) procedures have been followed.

(4) the frequency or category of incidents indicate that some trend important to safety existed or a root cause had not been recognized.

CONCERN: See Concern TS.5-1.

J. FACILITY SAFETY REVIEW

The Sandia Reactor Independent Review and Appraisal System (SIRAS) has provided a technically strong and sufficiently independent review of ACRR and SPR III experiments and modifications that are submitted for committee review. However, a concern was identified that reactor facility line management is not submitting, in a timely manner, all required issues for safety review.

SIRAS independent oversight of day-to-day ACRR and SPR III operations was found to be inadequate. This was most evidenced by the significant number and breadth of weaknesses in day-to-day operations in areas such as crane operations, procedure deficiencies, and recordkeeping that were identified by the Technical Safety Appraisal team.

It was determined that the "safety approval" responsibility assigned to SIRAS does not detract from line management's feeling of responsibility for the safety of reactor operations.

The triennial appraisal of SIRAS does not provide a sufficiently in-depth review to identify areas for improvement in the safety review system.

FR.1 Safety Review Committee

PERFORMANCE OBJECTIVE

A safety committee should be available to review safety questions.

FINDINGS:

- The Sandia Reactor Independent Review and Appraisal System is composed of four elements: the Sandia Reactor Safety Committee (SRSC), the Audit and Review (A&R) Staff, the ACRR Safety Committee, and the SPR Safety Committee.

- The SRSC operates under a charter dated January 29, 1988 that has been approved by both the Chairman of the SRSC and the Sandia Vice President responsible for reactor operation. This charter supersedes the SRSC charter dated April 13, 1984. The SRSC is not recognized in the applicable Sandia Laboratories Instruction as an official Sandia committee.

- The SRSC charter indicates that the SRSC reports directly to the Sandia Vice President responsible for reactor operation.

- The A&R Staff is composed of:

  - Chairman, Nuclear Engineering Department, University of Arizona,

  - Assistant Director, Inhalation Toxicology Research Institute, and

  - a Sandia Internal Auditor

- A new staff member is to be added this year. He is the Sandia Manager of the Quality Assurance Department. All A&R Staff members are independent of the line organization responsible for the operation of ACRR and SPR III.

- The ACRR and SPR Safety Committees each consist of a division supervisor level chairman and eight to ten resident reactor and environment, safety and health experts.

- The three reactor safety committees described above work together to provide review and safety approval of ACRR and SPR III Technical Specifications, operating procedures, experiment proposals, and proposed modifications.

- Experiments are classified as Class I, II, III, or IV based upon specific criteria in these committee charters.

- Review and safety approval authority for these experiments are as follows:

Class	Safety Approval Authority
I	Reactor Supervisor
II	ACRR or SPR Committee
III	Sandia Reactor Safety Committee
IV	DOE/AL

- Based upon discussions with committee members and review of committee meeting minutes for 1988, these criteria for classification of experiment review are being appropriately applied.

- A majority of the members of each of the committees are independent of line organization responsibilities for reactor operation, or for the experiment being reviewed, as applicable. Committee charters indicate that unanimous agreement is required for all committee approvals.

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:

. The Sandia Reactor Safety Committee (SRSC) charter of January 29, 1988 indicates that the Committee is responsible for reviewing ACRR and SPR III:

  - proposed modifications having safety significance,
  - proposed changes to the Safety Analysis Report and Technical Specifications,
  - proposed experiments,
  - administrative, operating, maintenance, test, quality assurance, and emergency procedures, and significant changes thereto,
  - training program requirements and procedures,
  - reactor occurrences, including violations of Technical Specifications, and
  - the accuracy and completeness of record keeping and documentation.

. The SRSC was generally found to function in the capacity of receiving and reviewing information provided to it by line management. Some exceptions were noted where the SRSC has taken a proactive role. Among these were: facility staffing, safety/security interface in Technical Area V (TA-V), and long-term storage of special nuclear material in TA-V.

. Annual reports for 1985, 1986, and 1987, and the SRSC meeting minutes for 1988 were reviewed.

. The SRSC Chairman and two other members were interviewed.

. Based on the above, it was concluded that items requiring safety review are well understood by safety committee members.

* The review topics that the SRSC charter addresses are also required by DOE 5480.6, Section 8.g.

* Several items were identified by the appraisal team where reactor facilities' line management had not, in a

timely manner, submitted items/issues for safety review that ar
required by the SRSC charter and by DOE 5480.6, Section 8.g.
These are:

- the reactor occurrence in September 1987 involving an increase in ACRR transient rod worth above the Technical Specification limiting condition for operations (LCO). The SRSC was informed of this condition in May 1988. (The Reactor Division Supervisor informed DOE/AL of the condition in September 1987.)

- the ACRR procedure for annual rod bank calibration (this is "trial procedure" issued in 1980). This procedure has not yet been submitted for SRSC review.

- health physics procedures issued in July, 1988, used to ensure compliance with ACRR and SPR health physics related Technical Specification surveillances. These procedures are in use even though they have not yet been submitted for SRSC review. The intent of the SRSC Charter is that procedures such as these be reviewed by the SRSC prior to their implementation.

CONCERN: (FR.2-1) Reactor line management is not submitting to the Sandia Reactor Safety Committee in a timely manner all items required to have an independent safety review.

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:

- The Sandia Reactor Safety Committee (SRSC) and supporting ACRR and SPR Safety Committees have in their charters safety approval authority for proposed activities and for proposed safety documentation.
- Based upon interviews with line managers responsible for ACRR and SPR III operations, it is clear that line organization management views these committees's safety approvals as necessary but not sufficient conditions for authorizing the subject activities.
- Sandia documentation at all levels emphasizes that safety is a line organization responsibility.
- Committee annual reports for 1985, 1986, and 1987,and meeting minutes for 1988 were reviewed.
- The SRSC Chairman and two other committee members were interviewed.
- Based on the above information, it was determined that topics which reach the SRSC for review receive a comprehensive safety review.

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:

. Sandia management relies upon the Audit and Review (A&R) Staff of the Sandia Reactor Safety Committee to provide independent oversight of reactor operations through two programs:

  - The annual appraisal of the overall operation of each facility required by DOE 5480.6,

  - The audit portion of the Reactor Operational Quality Program.

* The June 1985 DOE HQ "Nuclear Safety Program Appraisal of the Albuquerque Operations Office," Appendix A, Section 3.2, indicated that for Sandia, "the Contractors Independent Review and Appraisal system is not providing the required coverage and/or depth necessary to find problem areas as noted by the large number of problems found during a cursory review and enumerated in this report . . ."

* The Audit and Review Staff is composed of senior outside members who have very limited time to devote to the effort (8 to 10 days per year/per person) and a Sandia Corporate Audit staff member who has no technical knowledge of the reactor facilities.

* A review of the last three Audit and Review Staff annual reports indicated that three reports each addressed all nine areas required in DOE 5480.6, Section 8.g. However, the topics addressed in each of these areas were generally at a management level.

* Discussions with the A&R staff member responsible for the health physics and industrial hygiene areas indicated to the appraisal team that his responsibility was to review, not audit, the reactor facilities.

* The following are examples of day-to-day weaknesses in the operation of SPR III and ACRR noted by the Technical Safety Appraisal team that had not been identified by a Sandia audit/review activities.

- Not all procedures and other issues of safety significance are submitted, in a timely manner, by line management for safety review, as required by DOE orders and Sandia requirements (see Section FR.2).

- numerous deficiencies were noted in reactor facility procedures including: use of unapproved procedures, use of superseded procedures, and the lack of a procedure control system (see Sections OP.2, TS.3, and MA.7).

- facility record keeping provides inadequate information to document the operation of the reactors (see Section OP.3).

- lack of adequate control by the operations organization of outside support services (see Section OP.3).

- inadequate guidelines for control of tag-outs, jumpers, lift leads, and vital keys (see Section OP.3).

- the lack of evaluation of abnormal events of less significance than unusual occurrences (see Section TS.5).

- deficiencies in a number of areas associated with experiments (see Section EA.2).

- lack of internal or external appraisals of radiation protection or industrial hygiene for reactor facilities (see Sections RP.1, RP.2, and PP.1).

- hazardous routine crane operations in the ACRR high bay observed by the appraisal team (see Section PP.7).

CONCERN: (FR.4-1) The Sandia independent review and quality assurance functions have been ineffective in identifying weaknesses in the day-to-day operations of Sandia reactors.

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 Sandia Vice President responsible for reactor operations has documented triennial reviews of the Sandia Reactor Independent Review and Appraisal System (SIRAS) on July 7, 1988, and December 11, 1985.

. The content of both of these triennial appraisals addressed the range of topics of DOE 5480.6, Section 8.g.

* Both of these triennial appraisals were based on:

  - a presentation/discussion with the Chairman of the Sandia Reactor Safety Committee.

  - a review of the last three SIRAS annual reports.

  - a tour of the reactor facilities by the Vice President.

* This review methodology does not use any independent methods, other than a tour of the facilities, on which to assess the effectiveness of the SIRAS.

* The June 1985 "Nuclear Safety Program Appraisal of the Albuquerque Operations Office," Appendix a, Section 3.2 indicated that for the Sandia October 1982 triennial appraisal "the documentation of this review is simply a compilation of viewgraphs used during the meeting to brief the committee" and that "neither of these reports are auditable to show the `adequacy of performance' of the Sandia Reactor Safety Committee."

CONCERN: (FR.5-1) The triennial appraisal of reactor safety review systems is not in sufficient detail to identify opportunities for safety review system improvements.

K. NUCLEAR CRITICALITY SAFETY

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

L. RADIOLOGICAL PROTECTION

This appraisal was based on a review of Sandia Technical Area V health protection policies, procedures, audits, appraisals and actual work practices. The review was supplemented by discussions with operating staff, management, and other supporting personnel (guards, radiation protection technicians, maintenance, etc.).

The overall radiation protection program is well developed and managed. The staff is well qualified, have excellent credentials and are dedicated to achieve the highest levels of safety possible with the resources available. For the most part they have been successful as evidenced by an exceptional overall dose reduction program. The obtaining and use of the ALNOR RAD 80 and 85 systems is another example of forward thinking. These actions are truly professional and exceed expectations especially in light of extremely high work loads.

There were no concerns that require immediate action nor has there been any significant losses of contamination control or radiation over exposures. There were 11 concerns that would lead to improvement in the overall program. These address lack of health physics guidance, inadequate audits, inadequate documentation, and a questionable supply of portable instruments.

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:

- Sandia Laboratory Instruction (SLI) 2001, Environment, Safety, and Health (ES&H), assigned the line Vice Presidents responsibility for establishing ES&H policies for their particular operation.
- SLI 2001 assigned the responsibility for safety oversight to the Safety, Health, and Environment Appraisal Committees (SHEAC) and defined their purpose.
- SLI 2001 assigned line supervisor responsibility for conducting operations in compliance with the Safety Manual, Safe Operating Procedures, correcting deficiencies, and conducting and documenting ES&H training of employees.
- SLI 2001 specifically assigned to the ES&H Department responsibility for providing guidance for environmental and health protection, safety, and environmental, and for developing and/or providing guidance for appropriate training, and for developing and preparing the Safety Manual.
- The ES&H organization was specifically authorized to stop operations that they deem unsafe.
- The Safety Manual, SAND81-1807, Revision A, described the Sandia safety policy.
- Radiation protection technicians and managers indicated during interviews that they clearly understood their responsibilities.
- Discussions with the TA-V Health Physicist revealed that 30 to 40 percent of his time was required to perform health physics technician functions, i.e., relief when absent, busy elsewhere, etc. An additional 40 to 50 percent of his time was required for participation in reactor committee activities, leaving essentially no time for health physics management and overview.
- On at least one occasion during the TSA, the SPR operations organization was without health physics technician support until after 10 AM because the HP technician was absent for personal business.

* The Safety Manual charged the Environmental Health Department with providing for line organizations: 1) guidance and standards for working safely with radiation and 2) radiation surveillance services for line organizations.

* The Safety Manual also assigned each first-line supervisor or project leader, direct responsibility for safety of his particular operation.

* The Safety Manual, Section 6.6 through 6.10, provided limited guidance and criteria for activities involving radioactive materials and radiation machines.

* The ES&H Department had not provided line management with adequate formal guidance criteria, or protocol for health physics activities in the areas of (1) radiation protection training requirements for general access to Technical Area V, (2) radiation protection dosimetry requirements for special exposure conditions, or (3) detailed formal definition of radiation worker training requirements (see concern TC.4-1).

* The ES&H had prepared seventeen Health Physics procedures that provided criteria for some elements of the reactor facilities radiation protection, however, the procedures had not been formally agreed to by the operations organization.

* SLI 2001 stated the Sandia policy to comply with Federal, State, and local ES&H regulations.

* The Organization 3000 and 6000 Safety, Health, and Environment Appraisal Committees (SHEAC) had informally delegated responsibility for radiation protection audits and inspections to the Sandia Reactor Safety Committee which, in turn, has assigned the responsibility to its Audit and Review Staff.

* Interviews with the member of the Audit and Review Staff responsible for the radiation protection function indicated that he performed a review function and that formal, in-depth audits of the radiation protection program were not conducted.

CONCERN: (RP.1-1) The ES&H Department had not provided adequate radiation protection guidance to the line organizations.

CONCERN: (RP.1-2) Independent in-depth audits and inspections of the radiation protection program were not conducted.

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:

. While not formalized, each Health Physics Technician assigned to the reactor facilities was responsible for a monthly walk-through of a facility in Technical Area V (TA-V) other than the one he was responsible for. On a quarterly basis the TA-V health physicist conducted a walk-through of all TA-V facilities. Documented results of both these actions were sent to TA-V line managers.

* The Sandia Reactor Safety Committee, did not audit the radiation protection program in the reactor facilities.

* The responsibility for auditing the Environment, Safety and Health (ES&H) program lies with the Safety, Health, and Environment Appraisal Committee (SHEAC). SHEAC had not conducted these audits as required by SLI 2001, DOE 5482.1B, 9.d.1 and Sandia contract DE-AC04-76DP 00789m 184.d page six of Appendix B.

* The investigation of an incident is left up to the discretion of the investigating committee, or subcommittee of SRSC or line managers on a case by case basis. For any radiation protection related incident less than those qualifying as Unusual Occurrences there were no consistent formal documentation or follow up provisions in place.

CONCERN: (RP.2-1) Internal audits of the radiation protection program were not being conducted as required by DOE orders, Sandia Laboratories Instructions, and the Sandia contract.

CONCERN: (RP.2-2) No formal documentation and tracking system existed for radiological incidents other than that for Unusual Occurrences.

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 operation and for clearly identifying areas of potential hazards.

FINDINGS:

- The radiation protection documentation system was traceable from DOE Orders through Company Policy, Sandia Laboratories Instructions, Safety Manual and finally to Health Physics procedures.
- Health Physics procedures which had been developed provided adequate technical bases for the methods described.
- Inspections of the ACRR, SPR III and related facilities indicated the posting of radiation contamination areas at the facilities were in compliance with requirements.
- Inventories of stored radioactive materials were available to the Health Physics staff.
- Sandia did not use a Radiation Work Permit system to control work in radiation areas but relied on Safe Operating Procedures and interactions between line management and facility assigned health physics staff.
- Leak checks, using smears, of sealed sources were conducted and documented semi-annually except for specified special sources.

* Fourteen procedures for implementation of the health physics program in Technical Area V (TA-V) were prepared and approved by Health Physics management in July, 1988. These procedures were written to comply with DOE 5480.11 criteria (which become effective January 1, 1989) in addition to current requirements.
* The TA-V Health Physicist had a listing of approximately twenty additional procedures in the process of being prepared or to be prepared for TA-V health physics program implementation.
* Supporting documentation for the reactor facilities health physics personnel training program had not been developed, i.e., lesson plans, class length or schedules, examinations, etc.

CONCERN (RP.3-1): Procedures for implementation of the reactors' health physics health physics program were incomplete.

RP.4 External Radiation Exposure Control Program

PERFORMANCE OBJECTIVE

External radiation exposure controls should minimize personnel radiation exposure.

FINDINGS:

- There is an excellent dose reduction program in place at the reactor facilities. Exposures at SPR III, the major source of SNL personnel exposures, has been reduced to less than half of previous years totals.

- The establishment of a lower value of the total radiation exposure estimate, currently 200 mR, which a planned activity may exceed, required the operating reactor division supervisor's approval before proceeding with the activity. This was an effective tool and required good planning on the part of maintenance, experimenters and health physics.

- The use of the ALNOR Rad 80 and 85 radiation monitoring systems (real time self reading dosimeters for beta-gamma exposure monitoring) for personnel exposure control was an excellent tool for controlling radiation exposure for specific jobs or activities.

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 routine personnel dosimetry program was excellent. DOE Laboratory Accreditation Program criteria had been met (except for beta for which testing was underway), the staff was well qualified and all documentation was in place.

. The ALNOR Rad 80 and 85 systems, and pencil dosimeters were not currently in a routine calibration schedule.

. Numerous individuals were observed wearing their reactor area dosimeter incorrectly. The reactor area dosimeter incorporated neutron capability in addition to beta-gamma and therefore required wearing in a specified manner.

. Several individuals were observed wearing their extremity dosimeters on a chain around the neck.

. The design of the extremity dosimeter is such that it may not measure the extremity exposure correctly. It could be turned away from the source and therefore not measure the true exposure.

* The reactor areas use both fixed and personal nuclear accident dosimeters. Discussions with staff members indicated that the dosimeters had been tested but documentation of the results wer not available.

* There was no formal documentation in place relating to the location of or need for nuclear accident dosimeters as required by DOE 5480.11.2.f.

CONCERN: (RP.5-1) There was no performance or location analysis documentation for fixed nuclear accident dosimeters.

RP.6 Internal Radiation Exposure Control Program

PERFORMANCE OBJECTIVE

Internal radiation exposure controls should minimize internal exposures.

FINDINGS:

- Swipes and smears were used to determine potential air borne radioactivity levels.
- There was no routine bioassay program or whole body counting program in place for reactor area personnel.
- No routine air samples were taken of room breathing air, therefore, it was not possible to determine whether or not personnel could potentially be exposed to greater than 10% of a derived air concentration.
- * No documented basis was available which established the expected or actual levels of airborne radioactivity as required in DOE 5480.11, Section 1.3.a.

CONCERN (RP.6-1): There was no documented internal radiation exposure control program for the reactor facilities.

RP.7 Internal Dosimetry

PERFORMANCE OBJECTIVE

The Internal Dosimetry Program should ensure that personnel radiation exposures are accurately determined and recorded.

FINDINGS:

- A baseline whole body count was performed of the reactor operations and health physics staff approximately three years ago.
- An agreement was in place for use of the Los Alamos National Laboratory whole body counter if needed.
- * Procedures were not established for measurement and evaluation of intakes of radionuclides used in the reactor areas as required in DOE 5480.11.
- * There was no documented program establishing methods, frequency or procedures for internal dosimetry for the reactor areas.

CONCERN (RP.7-1): There was no internal dosimetry program for the reactor areas.

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:

- Inspection of the radiation protection instrument calibration program found it consistent with ANSI standards requirements.
- Functional tests of portable radiation protection instruments in the field did not meet the requirements of ANSI N323 in that preuse checks only verified response to a source, not the maintenance of calibration.
- Each reactor facility had six portable instruments as a routine complement including one high range extendable detector instrument.
- Each reactor facility had a fixed survey instrument or hand and foot counter at the exit to the reactor area.
- A four month instrument calibration frequency was established for portable radiation protection instruments.
- Discussions with calibration and reactor health physics staff indicated that fixed Remote Area Monitors (RAMs) were removed (including detector) from the facility and calibrated annually.
- Documentation verifying traceability of calibration sources to NBS standards was reviewed and found to be current.
- Instrument repair and calibration records were maintained in both hard copy and on computer. A monthly listing was printed listing instrument status, location and date due for recalibration. Cards were sent to users when instruments were due for calibration.
- A review of alpha detector calibration records showed that for two instrument records of recent calibrations, the identification number of the source used was not entered in the record. This could be a symptom of one or both of the following; a very heavy work load of the calibration staff limiting time for attention to details, and/or inadequate overview by management.

. No past due for calibration instruments were observed in either reactor facility.

. One neutron measuring instrument was available at ACRR.

. The types of radiation instruments used at the reactors were appropriate for detection and measurement of the radiations currently available.

* One high range extendable detector instrument was observed in each reactor facility. During an emergency near the instrument storage location, the instrument would not be accessible.

* During an emergency exercise, the radiation survey instrument being used failed. A replacement instrument had to be retrieved from a survey point. Spare instruments were not readily available.

* Discussions with responsible staff and management indicated that the number of instruments processed for calibration each month (50 to 80) had reached the current staffs capacity.

* With a total of approximately 450 instruments in active use throughout Sandia, only four instruments of each type, i.e., ion chamber, alpha detector, beta gamma detector, etc., were maintained as available spares.

* The ACRR Control Room panel as well as the health physics offices showed the readings of RAMs positioned throughout the facility. Two of the Control Room RAM readings (required by Technical Specifications) indicated readings at the alarm point (10 mR/hr) while the meters on the RAMs themselves were reading approximately 2 mR/hr. Since the control room indicators were the only indications the reactor operator had, they should be accurate. In addition the reactor procedures should define actions to be taken when the meters reach the limit or alarm point setting.

CONCERN: (RP.8-1) The supply of radiation instruments readily available at the reactors was marginally adequate to meet routine and emergency needs.

CONCERN: (RP.8-2) Remote Area Monitor (RAM) meters in the control room and health physics office did not reflect the local readings at the RAMs.

RP.9 Respiratory Program

PERFORMANCE OBJECTIVE

The respiratory program should ensure optimum protection against internal radiation exposure to workers.

COMMENT: This Performance Objective is addressed in 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:

- A routine contamination survey program had been established to quantify radioactive material that could become airborne.
- Continuous Air Monitors (CAMs) were operating in the ACRR and SPR III as required by the Technical Specifications for each facility.
- CAMs were calibrated using an electronic pulse, which does not determine the actual response of the detector, rather than with a radiation source.

* Air sampling lines to CAM units were either wholly or partly plastic tubing which increased the potential for static attractive plate out in those lines.
* Air flow meters on the CAM units were not calibrated.
* Requirements for air sampling or monitoring of locations or operations not covered in the Technical Specifications have not been established.
* The respiratory protection program does not comply with ANSI Z88.2. See Concern PP.2-1.

CONCERN (RP.10-1): There was no documented air monitoring program for the reactor facilities.

RP.11 Radiological Monitoring/Contamination Control

PERFORMANCE OBJECTIVE

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

FINDINGS:

- The routine monitoring/contamination program appears to be adequate for current operation conducted at the reactor facilities since the introduction of the health physics series of General Procedures (HP.G).
- No leaks or other sources indicative of potential loss of contamination control were observed during numerous walk-throughs of the facilities.
- Radioactive contamination release levels were established in compliance with DOE 5480.11 and instruments were available with adequate sensitivity to measure them.
- There were no contamination surveys of the instruments being returned for calibration either when sent from Technical Area V or when received at the calibration facility in Technical Area I.
- Vehicles did not receive a contamination survey when leaving the reactor facilities' controlled area.

CONCERN: None.

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.

FINDINGS:

- The Safety Manual assigned responsibility for keeping radiation exposures as low as reasonably achievable (ALARA) to line management and to individuals.
- ALARA and dose reduction activities were described in Area V Nuclear Facilities ES & H Plan and in letters from line management to SPR staff.
- Similar letters from line management to ACRR staff were not available.
- Dose reduction activities and administrative controls for management review of high exposure tasks were well documented.
- ALARA goals have been established. Tracking of performance by both management and health physics was being conducted.

CONCERN: None.

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:

- Upon review, personnel exposure records were found to be maintained in accordance with ANSI N13.6, DOE 5480.11, and 5484.1A.
- Instrument calibrations records were also reviewed and were current and readily accessible. No out-of-calibration instruments were found.
- Dose trend analysis was being done and the results used.
- Current radiation survey records were found to be both adequate and complete.
- There was a minimum of historical records (other than personnel exposure) available.
- * There was an absence of training records within the Environmental Safety and Health (ESH) department personnel files of those personnel who are not assigned to the reactor facilities but who routinely are within the reactor facilities performing various activities such as maintenance, repair and security activities. Their individual files did not document their having received training specific to the reactor facilities ESH safety requirements.

CONCERN: See Concern TC.1-1.

M. PERSONNEL PROTECTION

This appraisal was based on inspections of the ACRR, SPR III and associate facilities and a review of Sandia Technical Area V industrial hygiene and occupational safety policies, procedures, audits, appraisals and actual work practices. The review was supplemented by discussions with operating staff, management, the Sandia Industrial Hygiene and Safety Engineering staffs, and other supporting personnel (security inspectors, maintenance, etc.).

Current operation of the ACRR and SPR III involves very little exposure to toxic substances or stressful physical agents. There have been instances where experiments associated with these facilities require the use of a wide variety of laboratory chemicals as well as the occasional use of lasers. There is no evidence that persons at the reactors are being exposed to significant industrial hygiene hazards.

All responsibility for appropriate industrial hygiene practices rests with the line organization. All of the contractor's oversight is provided by persons who are not professional industrial hygienists. An organization of highly qualified and well equipped industrial hygienists is maintained for consultation only. The line organization asks for industrial hygiene consultation when the use of new or exotic chemicals is planned. However, professional industrial hygienists are not always sufficiently involved in more mundane operations such as the occasional use of organic solvents. This is contrary to DOE 5480.10.

The lack of regular oversight by professional industrial hygienists is of greater concern because of the contractors delay in establishing the most rudimentary features of a hazard communication program as required by DOE 5480.4). Some of the more difficult aspects, such as the collection of a comprehensive set of material safety data sheets, are well underway. However, the adoption of a plan and the initial advisory to workers of their right to know have yet to be done 18 months after the deficiency was identified by DOE Albuquerque. These programmatic deficiencies could effect reactor personnel during new or changing processes at these facilities.

The personnel protection programs in occupational safety are developed, implemented, and supported in a manner consistent with the needs and scope of the hazards associated with the Sandia reactor facilities. The competent practices of the professional staffs in the reactor facility operations and the Safety Engineering Division were observed during the appraisal. Two concerns were noted in the areas of hoisting and rigging practices and the review, approval and authorization of operational procedures for hazardous activities.

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, evaluating, and controlling those stresses arising in the workplace.

FINDINGS:

- The Safety Manual, subtitled Industrial Safety, Fire Prevention and Environmental Health, SAND81-1807 August 1984 (SAND81-1807) prescribes policies and responsibilities for various aspects of the safety program including industrial hygiene (referred to as Environmental Health). It prescribes industrial hygiene (IH) review for appropriate categories of purchase requisitions, requires written Safe Operating Procedures and training for personnel who are exposed to hazardous chemicals and laser light.

- The Sandia philosophy is that safety is a line organization function and that IH and other safety professionals are consultants to the line organization. Virtually every person contacted during the appraisal, either within or outside of the safety organization, articulated this philosophy.

- The "Industrial Hygiene/Toxicology Division Quality Plan" further elaborates this position by stating, "(The division) has no responsibility for assuring compliance to any specific regulation; we do advise line management about how they can comply...."

- The Industrial Hygiene Division Operations Manual, gives suggested procedures for IH staff to use in addressing 34 different hazards. Sections are dated from 1979 through 1985, with the majority being 1984 or before. Reviews of records and discussions with IH staff indicated that many are obsolete or no longer followed.

- Inspection of the reactor facilities showed that many of the hazards addressed in The Industrial Hygiene Division Operations Manual, are not significant in the reactor areas. Examples include magnetic field, microwaves, biohazards, noise, heat stress, and confined spaces.

- The Industrial Hygiene Division Operations Manual, Section 18, dated March 1984, addresses laser safety. The only lasers in use in the reactor facilities were observed to be posted in accordance with ANSI - 136.1 (1986) and the applicable internal instructions. They were not operating during the inspection.

. Based on the age of the reactor facilities they are expected to contain asbestos. The current version of the Safety Manual does not mention asbestos. The Industrial Hygiene Division Operations Manual, Section I, issued in March 1984, deals with asbestos. It requires asbestos monitoring by IH personnel in "all work environments where asbestos may be present". It is somewhat outdated in that it requires half-mask respirators, and does not address current requirements for wet removal etc.

. A November, 1987 letter giving operational work assignments makes no mention of asbestos as an IH program element.

. In practice Sandia employees do not work with asbestos except for the IH staff who collect and analyze samples.

. Sandia maintains a contract with a New Mexico certified asbesto removal contractor who handles all asbestos removal including monitoring and disposal.

. The potential for radiologically contaminated asbestos exists, but it has not yet been found and no mechanism is in place to deal with it.

. There is no system of marking either old asbestos once it is discovered, or new insulation that is asbestos free.

. There is no documented carcinogen control program. Posting, labeling, etc. were not observed in laboratories associated wit the reactors where benzene, a suspected carcinogen for man, was present.

. Employees in the reactors do not participate in the bioassay program for heavy metals other than uranium.

* The IH organization has not performed self audits or self appraisals of any program elements.

* The Industrial Hygiene Division Operations Manual, Section 4, dated January 1982, addresses "Building Audits". The requirement for documented walk-through surveys of a now-obsolete DOE Order is referenced. The Section requires "a special walk-through survey of every structure and every facility....at least once each calendar year." Documentation o findings, even if there were no reportable hazards, is required

* Two industrial hygienists and the Supervisor, Industrial Hygiene/Toxicology indicated that "building audits" or systematic walk-through inspections have not been done

for many years. They indicated variously that the requirement was being met by the inspections done by the line organization and by the Safety, Health, and Environment Appraisal Committee (SHEAC). This violates Doe 5480.10 which requires that, "the industrial hygiene staff shall identify and document existing and potential health hazards through:....periodic walk through surveys; information provided by inter-organizational communication; the review of proposed projects,....and maintenance of a hazards tracking system."

* The IH organization has no hazards tracking system.

* Inspection reports by the operating group indicated they had found some problems with the storage of respirators.

* Neither line organization nor SHEAC inspections identified several unlabled and improperly labeled containers of chemicals which were observed during the TSA.

* The IH staff does not receive facility inspection reports prepared by line management or the minutes of SHEAC meetings and inspections. (The industrial safety division did have reports of the division inspections and minutes of the SHEAC meetings but had not routed them to IH.)

* The SHEAC does not appear to understand the role of IH as evidenced by their January 1988 inspection of TA-V which, included a recommendation for a room in the building next to the ACRR. Their recommendation read "... chemicals are stored in a metal cabinet. Contact Division 3311 to inventory the chemicals." In fact, IH has no responsibility to inventory chemicals and had not been contacted. (However, there were chemicals awaiting disposal in that room during the inspection.)

* While the Industrial Hygiene Division Operations Manual, Section 14, dated October 1984 appoints IH representatives to the various division SHEACs, it has been superseded by a decision that the industrial safety engineers will represent the entire safety and health organization on the SHEACs. The safety engineer assigned to the reactors, and who serves on their SHEAC, has minimal IH training and has not taken the laser safety course.

* In conversation, the safety engineer assigned to the reactor facilities indicated minimal responsibility for IH aspects of his assigned facilities. This lack of responsibility was further evidenced by his approval of the safe Operating

Procedure for the hot cell (6454- 15600 8706. 6/12/87) even though it identified a potential for oxygen deficient atmosphere and discussed lasers. IH had not seen or approved the procedure.

CONCERN: (PP.1-1) There is no effective program which permits the industrial hygiene staff to identify health hazards.

PP.2 Chemical Contamination

PERFORMANCE OBJECTIVE

Chemicals should be controlled so as to minimize contamination of areas, equipment, and personnel.

FINDINGS:

. According to the Safety Manual SAND81-1807 (printed in August 1984) approval of the Industrial Hygiene (IH) division is required for the purchase of a few specific stocked chemicals and all non-stocked chemicals. The Industrial Hygiene Division Operations Manual, Section 23, dated March 1984, discusses the IH approval process for these materials (referencing a discontinued SLI). The manager, IH stated that he personally takes care of the review and also reviews records of the purchase of stocked chemicals.

. The IH division primarily relies on the line organization, using guidance from the Safety Manual, to obtain IH consultation when necessary regarding toxic chemicals. One such consultation occurred within the last year when the line organization consulted IH prior to ordering phosphorus oxychloride and selenium oxychloride for an experiment. Written guidance was provided by IH. However, the hygienists was not aware that the chemicals had indeed been received.

. IH also relies on the line organization to prepare Safe Operating Procedures (SOPs) and to send them to IH for annual review. The industrial safety division maintains a data base of SOPs and sends out notices when they are due for review, however the database does not currently contain those SOPs required because of hygiene hazards.

. A review of three SOPs from the database for the reactor facilities showed that one involving potentially oxygen deficient atmosphere and lasers had not received IH review.

* According to the IH staff they monitor for noise, chemicals, etc. only in response to a request or expressed concern. An initial evaluation is made and documented in an "Industrial Hygiene Inspection Report". If a chemical exposure is below the Threshold Limit Value (TLV), no follow up monitoring is scheduled.

* Monitoring of an ozone problem (outside of the reactor areas in Technical Area V) showed peak concentrations of 70 to 90 parts per million Technical Area (ppm), compared to a TLV of 100 ppm for continuous exposure and a ceiling value of 300 ppm. No follow up monitoring was scheduled. The report also

failed to identify the instrument used or calibration date as recommended by the Industrial Hygiene Division Operations Manual.

* Noise monitoring is also performed when requested. In the case of possibly damaging noise exposure hearing protection is provided and the exposed employees are assigned to the hearing conservation program so that they will receive annual audiometric evaluations. Follow up noise monitoring is only performed if requested or if medical evaluations indicate a hearing loss. This practice violates DOE 5480.10 which states, "The satisfactory control of occupational health hazards shall be given continuing attention despite the imposition of control measures....."

CONCERN: (PP.2-1) Routine workplace monitoring is not performed to document that exposures to toxic substances and stressful physical agents are below limits and to analyze trends.

FINDINGS

. The respiratory protection program was examined in some detail because ANSI Z88.2 is a DOE prescribed standard. The reactor division has limited use of air purifying respirators and relies on self contained breathing apparatus (SCBA) units for emergency response.

. Only approved respirators were in evidence. A data base of personnel who have received respirator training, medical evaluation and fit test was available.

. Certificates were available to show that the three individuals who perform maintenance on SCBAs had been trained to do so. Training took place in 1982, 1984 and 1987. Retraining is not required by the ANSI standard.

* There is no single individual responsible for the program as required by ANSI Z88.2. A single responsible individual from IH would probably be counter to the Sandia position, articulated in "The Quality Plan for the Industrial Hygiene/Toxicology Division," that states that the Division "has no responsibility for assuring compliance to any specific regulation..."

* Section 36 of the Industrial Hygiene Division Operations Manual addresses respiratory protection for air purifying type respirators. Responsibility for requiring respiratory protection, respirator selection, fit testing, training and issue is assigned to the IH organization.

* The content of respirator training is addressed but omits some of the items required by ANSI Z88.2-1980, eg. the reason that

the reason that respiratory protection is required and the limitations of the respirator. Refitting and retraining is not specifically addressed, however, a questionnaire is supplied for distribution to respirator users when the respirator is due for return that asks if a replacement is necessary.

* The IH Staff reported that they talk to the respirator user to determine if the respirator being used is appropriate for the hazard. It is not apparent that the supervisor of the employee is contacted either with regard to the need for respiratory protection or to assure that his knowledge is sufficient to supervise a respirator user.

* Written procedures did not cover respirator cleaning and fit testing. Fit testing is qualitative using irritant smoke.

* The "Quality Plan for the Industrial Hygiene/Toxicology Division" requires that respirator fit test and medical evaluation records be maintained for a period of one year. ANSI Z88.2-1980, the DOE prescribed respiratory protection standard, standard, requires that respirator fit test records be maintained for at least the duration of employment. Therefore the "Quality Plan" is in opposition to the standard.

* ANSI Z88.2 (Section 3.5.15) requires that an appraisal of the effectiveness of the respirator program be carried out at least annually, however this has not been done.

* A June 14, 1988 investigation report by the industrial hygienist (in preparation for the TSA) listed current Technical Area-V respirator users. There were 22 people listed as requiring SCBA's for use on the emergency reentry team for Technical Area V. A review of the records of 21 of these indicated that only 10 met the contractor's medical and training requirements for SCBA use, and two of these were indicated on the records as having beards. One additional employee's only disqualification was training approximately 3 months out of date.

* SCBAs were used during the Technical Area V emergency drill and the users appeared to be familiar with the equipment and well trained in its use.

CONCERN: (PP.2-2) The respiratory protection program does not comply with ANSI Z88.2 in that program administration, procedures, the hazard evaluation process, training and annual internal audits are all deficient.

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:

. The chemical procurement process and inventories of certain areas has provided information for the industrial hygiene (IH) organization to identify many of the chemicals in use and to procure Material Safety Data Sheets (MSDS) for them. In addition they have subscribed to a microfilm MSDS service and obtained lists of those available through other sources.

. A random check of 13 chemicals observed during TSA inspections failed to find any for which IH did not have a MSDS available either on paper or microfilm.

. A file of some MSDSs was also available in Technical Area V.

. The Industrial Hygiene Division Operations Manual, Section 7, dated January 1982, addresses chemical toxicity and the requirement to keep employees informed. Although the Section clearly pre-dates the current OSHA hazard communications requirement, it lists numerous authoritative sources of information available to IH and recognizes the need to keep workers informed. It indicates that "Personal communication with the user of the material in question is the preferred method of transmitting data with recommended controls." The documentation of such communication or training is not addressed.

* The Safety Manual, Section 6.2.6 states, "Supervisors of operations where toxic materials are used are responsible for informing the employees engaged in that operation of the potential health effects of the toxic material." Supervisors, however, have not been informed that they must notify employees of their right to know and must train them in the interpretation of MSDS information and this has not been done in the reactors.

* A December 1986 appraisal by DOE Albuquerque Operations office found that the first step in a hazard communications program, the Hazards Communications Plan, which was due the first quarter of 1986, was not in place. DOE reported that the Plan was prepared but had yet to receive management approval. The Plan reportedly has been revised, and is again awaiting management approval.

* The operations covered in this appraisal do not require the extensive use of chemicals; however, there were instances where bottles were unlabeled or labeled only with the name of the person responsible.

CONCERN: (PP.3-1) There is no hazard communications program for the reactors.

PP.4 Staffing

PERFORMANCE OBJECTIVE

The evaluation of chemicals and physical and biological stresses should be performed by personnel who have the knowledge and practical abilities necessary to implement personnel protection practices effectively.

FINDINGS:

. Industrial hygienists have the opportunity to attend various training courses at company expense. The hygienist assigned to the reactor facility has received onsite training in laser safety and offsite training in industrial ventilation, radio frequency/microwave radiation protection, indoor air quality and sampling since joining Sandia about a year and a half ago.

. A November 1987 letter from D.R. Parker (unsigned) provides operational work assignments for the industrial hygiene (IH) organization. Particular facilities, program elements and organizations are assigned to individual staff members. Industrial hygienists have no other job description which defines their responsibilities and authorities.

* A single IH professional, board certified, is assigned all of the facilities and activities in Technical Areas IV and V (which includes the reactors which are the subject of this appraisal) and several facilities in Technical Area I (five process development and three photographic processing laboratories). He also is assigned the local exhaust ventilation systems performance testing (done by a subcontractor), the audiometric test program, and five operating divisions plus the information services division within the organization.

* Given the statement in the IH Division QA Plan that industrial hygiene has "no responsibility for assuring compliance with any standard," it is difficult to determine what responsibilities the industrial hygienists have. They reportedly have the authority to stop work if conditions warrant, however, this authority does not appear in the Safety Manual. It has not been exercised in the reactors.

CONCERN (PP.4-1): The professional industrial hygiene staff, who are best able to assure the health protection of the workers, have no documented responsibility to do so.

PP.5 Surveillance

PERFORMANCE OBJECTIVE

The surveillance of chemical, physical and biological stresses should ensure that potential exposures are accurately determined and recorded.

FINDINGS:

. Industrial Hygiene (IH) surveillance is documented in investigation reports. Four investigation reports (in addition to the Technical Area V respirator users investigation report discussed in PP.2.) were available for all of Technical Area V for the period from June 1987 to the present. None involved the reactor facilities. Two of these dealt with advice on building modifications and two were in response to requests for investigation or consultation.

  IH monitoring is generally discussed with the workers as the monitoring is done. The investigation report is sent to the supervisor of the facility.

* Section PP.2 describes deficiencies in the IH surveillance activities required by DOE 5480.10.

CONCERN: See Concern PP.2-2.

PP.6 Hazard Evaluation

PERFORMANCE OBJECTIVE

An evaluation of potential exposures to chemical, physical, and biological agents should ensure effective implementation and control of personnel protection activities within the facility.

FINDINGS: The Division subscribes to several data bases for information on chemicals and has a large amount of reference material available.

A toxicologist is also on the Industrial Hygiene Division staff.

Documented investigation reports are prepared by the industrial hygienists and approved by the supervisor.

An onsite analytical laboratory is equipped for numerous analysis and has an up-to-date procedure manual for a large number of analysis.

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: Employees are required to adhere to safety rules. The Safety Manual, SAND81-1807, Revision A, dated August 1984, requires Sandia employees to comply with and participate in the Environment, Health and Safety program.

It is noted that only one recordable occupational injury has occurred in Technical Area V reactor facilities from January 1986 to the present time (32 months). This record includes the accident/injury experience of the security force and maintenance personnel as well as reactor operations.

Inspections and reviews for safety and health compliance of the Technical Area V reactor facilities have been conducted twice a year by the line organization (operations). Additionally, the Safety, Health and Environment Appraisal Committee (SHEAC) for the Vice President, Energy Programs (6000) has reviewed industrial safety, fire protection, and facility housekeeping at Technical Area V facilities.

Safe Operating Procedures (SOPs) are in place for activities that involve the use of explosives, dangerous chemicals, radioactive materials, hazardous systems, and for certain types of operational facilities which present hazards.

A review of the procedures for tests involving explosive devices/materials at Technical Area V indicates compliance with the DOE Explosives Safety Manual, DOE/EV/06194, which is a mandatory safety standard required by DOE 5480.4, "Environmental Protection, Safety, Health Protection Standards." This observation is supported by:

- An SOP has been developed for testing explosive devices at the ACRR and SPR III reactor facilities (SOP No. 272008711, "Safe Operating Procedure for Tests Involving Explosive Devices at Technical Area V Reactor Facilities," October 12, 1987).

- The allowable amounts of explosives have been limited to 500 grams at the ACRR and 1000 grams at the SPR III (laboratory quantities).

- Explosive safety training is required for operators, experimenters and handlers of explosive materials.

- Explosive devices are not stored or used in the same container with fissile materials unless they are part of the same component or test.

- The "Reactor Experiment Containment Requirements, Design and Proof Testing" procedures were developed to satisfy the requirements of the Sandia Pressure Safety Practices Manual and the Technical Specifications for the reactor facilities. These requirements address the safety procedures for the containment of explosive materials used and tested at the ACRR and SPR III reactor facilities.

- The safety analyses and Technical Specifications for the ACRR and SPR III indicate design considerations and safety factors have been incorporated to contain both planned and accidental detonation of explosive devices.

- Explosives are stored in an approved location and storage container at the ACRR. No explosives are stored at the SPR III.

. Work orders, purchase orders and SOPs are reviewed by the Safety Engineering personnel assigned responsibility in Technical Area V.

. Employees have been made aware of occupational safety and health protection rights and responsibilities through periodic issuance of bulletins to all Sandia employees and by the posting of information on bulletin boards.

. Based upon observations of the Technical Safety Appraisal Team members:

  - The ACRR and SPR III facilities were clean, uncluttered, and free of tripping and slipping hazards on working and walking surfaces.

  - Ladders and other climbing equipment met DOE safety standards.

  - Compressed gas containers were secured and maintained.

  - Procedural reminders for obstruction clearances were posted.

. Safety meetings are conducted twice a year for reactor personnel. At this time employees are encouraged to provide informal feedback to management to solve occupational safety problems in the workplace.

* The present practice of lifting heavy loads with the ACRR bridge crane directly over and in very close proximity to personnel presents a potential for accidental death or injury.

* The Sandia Safety Manual and the DOE Hoisting and Rigging Manual recommend that loads not be suspended over anyone unless it is absolutely necessary and proper precautions have been taken to support the load by auxiliary means.

* It was observed by members of the Technical Safety Appraisal team during a routine lift of the shielding plug at the ACRR that the crane operator was standing near the edge of the exposed pool and the load was suspended over another person.

* "Guidelines for Material and Equipment Handling in the ACRR High Bay" have been developed to apply to rigging and hoisting at the ACRR. These guidelines apply to rigging and tackle used to handle or move any material or equipment which could cause significant damage to the reactor, reactor components, reactor support equipment or the high bay structure if any part of the rigging were to fail under load.

* The guidelines (prepared by the reactors' line management and reviewed/approved by the ACRR committee) require users to prepare a safety analysis for the rigging used for any operation that has a potential to cause significant damage. The analysis must include verification of load tests, visual inspections, safety factors in the design of the rigging and other criteria that apply to the equipment and hardware. However, the guidelines do not require an analysis of the human element in the work environment: the verification of crane operator training and certification or job safety analyses of the particular steps of the lifting tasks to be performed by the operator.

* Line management has reviewed safety and health hazards in the reactor facilities and have indicated that "outside the reactor and radiological issues, only the handling of explosives requires an SOP."

* There is no Safe Operating Procedure developed for the use of the bridge cranes in ACRR, and other ACRR operating procedures

do not prohibit the carrying of loads over people. Sandia Safety Manual (SAND81-1807, August 84) and Guidelines for SOP Preparation (SAND76-0438, March 81) do not require SOPs for hoisting and rigging activities.

CONCERN (PP.7-1): The system for review, approval, and authorization of operational procedures does not assure identification of all hazardous activities.

CONCERN (PP.7-2): The lifting of loads with the Annular Core Research Reactor (ACRR) bridge crane over personnel is inconsistent with Sandia and DOE recommended practice and presents a potential for accidental death or injury.

N. FIRE PROTECTION

ACRR and SPR III and their support and contiguous areas have been appraised from the standpoint of insurability by the two domestic nuclear insurance groups, American Nuclear Insurers (ANI) and MAERP Reinsurance Association (MAERP RA). Both are dedicated to "Highly Protected Risk" (HPR) standards and the provision of complete automatic suppression systems in areas in which such systems are required.

The dedication of management is evident at all levels and by the excellent Fire Protection Engineering Staff of the Sandia National Laboratories. The Fire Protection Engineering Staff has access through appropriate channels to top management. If needed, the normal channels can be bypassed. Performance standards for safety to life, public protection, impairment of operations, property protection, and improved risk were all met.

ACRR and SPR III and their contiguous and support areas would be insured by either ANI or MAERP RA at the best possible HPR rate for this type of activity.

FP.1 Life Protection

PERFORMANCE OBJECTIVE

The facility should not present an unacceptable hazard to life from the results of accidental fire.

FINDINGS:

- The ACRR and SPR III Reactors and their necessary support and contiguous areas meet the intent of the National Fire Protection Association (NFPA) 101 "Life Safety Code."

- This is accomplished by non-combustible construction, low levels of combustibles, adequately marked exits, emergency lighting, automatic sprinklers in the ACRR support and contiguous areas and strong management control. The SPR III areas have no sprinklers and none are recommended because of noncombustible construction and occupancy.

- The interface between security and life safety were observed on two occasions, once as a result of a false alarm and once as a part of a planned, but unannounced medical emergency drill. On both occasions we found that security provisions in terms of hardware controls and procedures did not jeopardize life safety or impede emergency response.

CONCERN: None.

FP.2 Public Protection

PERFORMANCE OBJECTIVE

The facility should not pose an added threat to the public as the result of onsite fire permitting the release of hazardous materials beyond the site boundary.

FINDINGS:

- The maximum credible fires postulated in the July 1988 analyse conducted by the Sandia Fire Protection Engineering group and observations during this Technical Safety Appraisal show that credible fire would pose a threat to the public as a result of an onsite fire permitting the release of hazardous materials beyond the site boundary.

- A combination of inspections, supervision, alarm equipment (su as waterflow alarms, heat detection equipment and manual pull boxes) and maintenance, assures that fire protection systems function adequately from a public protection stand point.

- The Kirtland Air Force Base Fire Department in combination wit ACRR and SPR III management can initiate control and limitatio against any credible release of hazardous materials caused by fire.

CONCERN: None.

FP.3 Impairment of Operations

PERFORMANCE OBJECTIVE

The facility should not be vulnerable to being shut down for an unacceptable period as the result of a credible fire.

FINDINGS:

- No credible postulated fire in the ACRR and SPR III reactors or their support areas and no credible exposure fire to them should result in a shutdown of either facility for greater than three months.
- This is accomplished by non-combustible construction, strict control of combustibles, automatic heat detection, automatic sprinklers with an adequate water supply in areas where needed and the excellent Kirtland Air Force Base Fire Department.
- An interview with ACRR and SPR III management indicated that loss by a credible fire at these facilities would not affect operations at another site.

CONCERNS: None.

FP.4 Property Protection

PERFORMANCE OBJECTIVE

A credible fire should not result in an unacceptable property loss.

FINDINGS:

- Based upon observations during this Technical Safety Appraisal and on the findings of a Fire Safety analyses conducted by Sandia's Group Fire Protection Engineering in July 1988, no credible fire in SPR III and its necessary contiguous or suppo areas would exceed one million dollars.

- Based upon observations during this Technical Safety Appraisal and upon the analyses conducted by Sandia in July 1988, no credible fire in the ACRR and its necessary contiguous and support areas would exceed one million dollars assuming the functioning of installed automatic fire suppressi systems.

- The present reliability of the water supply for the SPR III ar ACRR and their necessary contiguous and support areas meet the requirements of the DOE, MAERP Reinsurance Association and The Factory Mutual System for the value of this plant.

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 ACRR and SPR III and their contiguous and support areas qualifies as an "improved" or "highly protected risk" as defined by the American Nuclear Insurers (ANI) and the MAERP Reinsurance Association. Property damage insurance for these would be provided at the preferred risk level.

- There are no exceptions at ACRR and SPR III to the basic objectives listed in DOE 5484.1 and 5480.1B based on discussion with DOE/AL.

- ACRR and SPR III were included in the independent fire protection survey conducted under contract to the DOE Headquarters Office of Operational Safety. The last such survey was made during July and August of 1985 by the Factory Mutual Research Corporation.

- A fire safety analyses was prepared by the Sandia's Fire Protection Group in July 1988. The analysis was reviewed during the appraisal and found to be well thought out and credible.

- A documented fire inspection (self appraisal) program exists for the facility and its fire protection equipment and processes. It is updated annually.

- A documented fire protection plan is in effect including cutting and welding permit systems, unattended work permits and hazardous materials controls. These reports were reviewed and found to be in order.

- Fire loss records for the Sandia National Laboratories are maintained analyzed and brought up to date promptly. There have been no reported fire losses in the ACRR and SPR III areas during the past 20 years.

- An assurance program exists for maintaining the integrity of fire protection system controls through the use of locks, seals, electrical supervision of heat detectors, a shutoff permit system, routine inspections, and tests.

- Flammable liquid handling is very limited. What little exists is carefully controlled.

- Portable fire extinguishers are provided where needed and locations properly marked. All inspections were up to date based on a tour of these facilities.

- Prefire plans exist for the facility. The Kirtland Air Force Base Fire Department updates them and drills are periodically performed. The nature of the operation requires all personnel to immediately evacuate on a fire alarm, precluding an on-site fire brigade. This is not a serious deficiency.

- There were no boilers, furnaces, or ovens requiring flame failure devices as defined by the NFPA Standards.

- Adequate surveillance of unoccupied areas for fire protection purposes exists. The facility operates one shift five days a week and is constantly patrolled by security guards.

- Water supplies are included in the inspection, test, and maintenance schedules. Tests are conducted annually and a waterflow test was performed during this appraisal with satisfactory results.

- There are no special hazards in the ACRR and SPR III areas requiring special extinguishing systems. The SPR III reactor does have an installed nitrogen inerting system.

- Fire protection engineering is provided during planning and design review.

- Acceptance testing after installation or modification of fire protection equipment is conducted by personnel with fire protection engineering expertise.

- Water supplies in the ACRR and SPR III areas are adequate for calculated demands. The reliability for these areas meet ANI-MAERP Reinsurance Association requirements.

CONCERN: None.

IV . NOTEWORTHY PRACTICES

Four practices were identified during the course of this appraisal which were felt to be an especially good way of accomplishing some aspect of a Performance Objective, and consequently worthy of emulation by other DOE facilities. These practices are presented under the subject areas to which they pertain.

A. ORGANIZATION & ADMINISTRATION

PERFORMANCE OBJECTIVE: A 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.

NOTEWORTHY PRACTICE: Employee Wellness Program

Sandia has instituted a "Total Life Concept" employee "wellness" program. It includes a detailed medical health risk examination and evaluation for each participant, counseling on what the examination results imply for the employee, and several training modules that cover a wide variety of topics (such as stress reduction, exercise, healthful living, etc.) Also, a periodic newsletter titled "Total Life Concept" is distributed to the employees. The newsletter is informative, and the employees seem to be reading it.

F. EMERGENCY READINESS

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.

NOTEWORTHY PRACTICE: Computerized Personnel Accountability System

Technical Area V (TA-V) at Sandia National Laboratory has used computerized accountability systems for more than 10 years. The current system, based on a compact personnel computer and commercially available bar code readers, has operated for the past 5 years. Within 10 minutes of an evacuation alarm, the names of all employees and visitors in the area who have not reported to the assembly area for emergency personnel (or to the emergency command center) are identified.

Employees who are routinely assigned to TA-V have picture badges with their name and social security number bar-coded on the back. They also have transponder units attached to their badges to operate the back-up personnel accountability system. Each time an employee enters or leaves the area, the security inspector runs the employee's badge through a reader which adds or removes their name from the computer data base of personnel to be accounted for.

Visitors and employees who do not ordinarily enter the area are given a bar-coded visitor's badge in exchange for their driver's license or some other piece of identification. (The preferred identification is one with a picture on it.) The security inspector types the visitor's name into the computer or enters it from the bar code on the Sandia general employee badge. This identifies the individual with the bar code of the specific visitor badge. The security inspector also keeps the identification car in place of the visitor badge on a visitor badge board.

In the event of an alarm, the computer system is put into the "emergency mode" to maintain both a data base of people in the area and a separate data base of those that are not accounted for. All personnel, except those with specific emergency assignments, report to an assembly point where their bar-coded badges are read into the computer. The computer then removes their names from the data base of personnel who are not accounted for. Multiple readers are used to speed up the process. The emergency cadre report to the guard station where their badges are also read. When only 15 names remain to be read, the computer automatically displays the list of the unaccounted-for persons. This list can also be printed at any time on demand.

An inquiry of supervisors and co-workers at the assembly area usually identifies the whereabouts of missing employees. The picture identification cards from visitors are helpful in soliciting information about missing visitors if necessary.

To provide for back-up in case of a computer failure, each employee also has a transponder badge attached to his/her picture badge. This programmable badge operates like a crystal radio to identify each employee entering and leaving the area as the employee passes through a portal transceiver in the badge house. The transceiver lights the employee's light on the status board upon

entry and extinguishes it upon departure. Power to the lights is assured by a battery back-up so that they remain lit even if the computer system and/or off-site power fails. Accounting for visitors in the area under these circumstances is easily made by the pictured identification cards in the badge rack.

The transponder badges are a commercially available item. They measure about 1/4 x 3/4 x 2 inches and have shown impressive reliability and resistance to abuse. If water soaked, they must be dried for proper functioning. The transponders can be reprogrammed and reused if, for example, employment is terminated.

I. EXPERIMENTAL ACTIVITIES

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

NOTEWORTHY PRACTICE: Experimental Plans

The reactor experiment groups at Sandia National Laboratories at Albuquerque have developed an approach to preparation of the experiment proposal which has many useful features. A package containing the experiment description and design, safety analyses, operational limitations, and other information necessary for safety review is assembled in a form which can be easily reviewed for safety. After review of the safety modifications and any other committee minutes, important information is added.

This approach has great flexibility. It is adaptable to very simple experiments by use of a two page form or to very complex experiments using attachments and appendices.

A Quality Assurance Program Plan is followed to provide assurance that the experiment will have the necessary quality designed into it. A QA appendix is added to the experiment proposed package with all necessary procedures.

A number of very complex experiments, some potentially hazardous, have been successfully performed using this system, termed an Experiment Plan.

The experiment plan lacks only a provision for reporting incidents in an auditable reactor area-wide system which provides for review and escalation of incidents to higher level reports and eventually to UORs.

L. RADIOLOGICAL PROTECTION

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

NOTEWORTHY PRACTICE: Use of Personal Alarming Dosimeters

The Security Inspector (SI) stations within the reactor areas are supplied with a Remote Area Monitor and alarm. Instructions are given to all SI staff as to radiation levels at which evacuation should be considered. This provides adequate radiation protection for fixed guard locations and the personnel staffing them. There are, in addition, roving SIs who are not covered by the fixed monitoring units. ALNOR RAD 85 personal alarming dosimeters are provided to the roving SIs. The RAD 85s are preset with total dose and dose rate alarms (which are not user adjustable) and the SIs are given procedural instructions as to actions required when the unit alarms. The SI is instructed to call in to the Lieutenant who then provides specific instructions based on overall security and personnel protection needs. This provides real-time radiation exposure monitoring to the roving SIs and establishes an excellent method of radiation exposure control not previously afforded. The system is expected to be operational and training provided to appropriate personnel by the end of the year.

ATTACHMENTS

TO

APPENDIX A

ATTACHMENT 1: APPRAISAL TEAM MAKEUP

1a. Assignments of Primary Responsibility

Area of Responsibility	Name/Organization
EH Senior Manager	James P. Knight, Director Department of Energy Office of Safety Appraisals
Team Leader	Herbert C. Field Department of Energy Office of Safety Appraisals
Appraisal Coordinators	Mary E. Meadows Department of Energy Office of Safety Appraisals
	Patricia L. Davidson Oak Ridge Associated Universities
Advisor to the Team	Jan Griebe Private Consultant
Liaison with Team	Marvin P. Norin Department of Energy Office of Military Application
	Robert W. Walston Safety Programs Division DOE/AL
Organization and Administration	Phillip A. Lowe Intech, Inc.
Operations	James R. Bohannon, Jr. Viking Systems International
Maintenance	Vincent W. Panciera Scientech, Inc.
Training and Certification Facility Safety Review	Thomas J. Mazour Private Consultant
Auxiliary Systems Technical Support	Woodson B. Daspit Private Consultant

Emergency Readiness Personnel Protection (Industrial Hygiene)	Linda F. Munson Evergreen Innovations, Inc.
Security/Safety Interface Occupational Safety	Roy W. Lee Department of Energy Office of Quality Programs
Experimental Activities	James A. Cox Private Consultant
Radiological Protection	Leo Munson/Leo Faust Battelle/Pacific Northwest Laboratory
Fire Protection	George E. Weldon Factory Mutual Research Corp.

1b. Biographical Sketches

NAME: Herbert C. Field (Team Leader)

ASSOCIATION: Department of Energy Headquarters

EXPERIENCE: 33 years

- Team Leader for seven earlier Technical Safety Appraisals
- U.S. Department of Energy
  - 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
- Atomics International
  - Experimental reactor physics research
  - Physicist-in-charge, critical experiment facilities
  - Member, space reactor safety review committee
- 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: James R. Bohannon, Jr. (Operations)

ASSOCIATION: Private Consultant

EXPERIENCE: 30 years

. Private Consultant

- Providing consultant and project leadership in Quality Assurance, Training, Business Planning and Off-Site Emergency Planning

. Carolina Power and Light Company

- Manager for planning, development and implementation of nuclear and fossil power plants, operation, craft and technical training

- Director of Special Projects assigned by the Vice President, Operations Training and Technical Services Department

. North Carolina State University

- Professor of Nuclear Engineering

- Provided consulting services to Carolina Power and Light Company, served on QA and Safety Committees

- Provided consulting services to DOE Headquarters, Operational and Safety Division

- Provided consulting services to NRC, Headquarters, Reactor Operating Licensing Division

. United States Air Force

- Project engineer for design, deliver, and checkout of 10 mW Air Force Nuclear Engineering Test Facility and laboratories

- Project engineer for delivery and checkout of 10 mW PM-1 nuclear power plant

EDUCATION: M.S., Nuclear Engineering, with honors - North Carolina State University, 1953
B.S., Nuclear Engineering, with honors - North Carolina State University, 1950
Diploma, Air War College - Air University, 1965
Diploma, Air Command & Staff School - Air University, 1957

NAME: James A. Cox (Experimental Activities)

ASSOCIATION: Private Consultant, Oak Ridge Associated Universities

EXPERIENCE: 35 years

. Union Carbide Corporation, Oak Ridge, TN

- Superintendent of Reactor Operation, X-10 Graphite Reactor, and Low Intensity Testing Reactor

- Director of Operations Division

- Reactor Operations - X-10 Reactor; Low Intensity Testing Reactor; Oak Ridge Research Reactor, 1958; High Flux Isotope Reactor, 1966; Tower Shielding Reactor; Bulk Shielding Reactor; ORNL Critical Facility; Health Physics Research Reactor

- Hot Cell Operations - Operation of 20 hot cells

- Radioactive Waste Operations - Low and Intermediate-Level Radioactive Liquid Waste, Radioactive Solid Waste, and Low-Level and Hot Off-Gas

- Radioisotope Production and Sales - Production of Radioisotopes which were not available from private sector in reactors and accelerators, processing in chemical hot cells, and sale.

. Clinton Labs, Oak Ridge, TN

- Manager of Radioisotope Sales

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: Private Consultant

EXPERIENCE: 38 years

. DuPont, Savannah River Plant, Aiken, S.C.
  - Senior Reactor Associate - Advanced Studies.
  - Process Associate - Advanced Studies, procedure enhancement, training, set up system for certification examiners, simulator procurement committee.
  - Chief Supervisory reactor physics and heavy water technology.
  - Site Emergency Response Committee.
  - Responsibility for mechanical, electrical and instrument assistance group.
  - Reactor physics, production reactor charge design, test reactor technical assistance, production calculations (manual and automated).
  - 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.

. DuPont, Savannah River Laboratory, Aiken, S.C.
  - Experimental Physics - helped start up critical facility, construction checkout, helped plan and perform experiments for application to production reactors.
  - DuPont (Training at Argonne National Laboratory).

. U.S. Naval Ordinance Test Station.
  - Did high explosive research including use of very high speed photography. Shaped charge research.

. U.S. Marine Corps

. South Coast Sugar Corp., Franklin, LA
  - Lab Technician

EDUCATION: B.S., Physics, Louisiana State University
M.S., Physics, Louisiana State University

NAME: Leo G. Faust (Radiological Protection)

ASSOCIATION: Chief Scientist, Health Physics Department
Battelle-Pacific Northwest Laboratory

EXPERIENCE: 29 years

. Battelle-Pacific Northwest Laboratory

- Various management positions covering all phases of health physics

- Broad range of health physics and dosimetry research and development activities, including various dosimetry upgrade programs

- Serves on several national and international standards committees, both as a participating member and as chairman of working groups

- DOE representative to the Interagency Intrinsic Radiation (INRAD) Committee and Joint Radiation Protection Group

. General Electric Company at the Hanford Atomic Energy Project

- Managed the radiation monitoring program of the Hanford Laboratories.

- Responsible for establishing improved routine surveillance programs resulting in better contamination control and reduced exposures within the facilities of the Laboratory.

- Development and application of radiological engineering criteria for new and old facilities; research and development of personnel dosimeters; dose rate determinations and shielding calculations.

EDUCATION: B.S., Physics, Humboldt State College
Graduate studies in Physics and Nuclear Engineering, University of Washington Center for Graduate Study

OTHER: Health Physics Society Fellow and American Nuclear Society Member

Authored and co-authored numerous technical publications and presentations. Active in committee work in Health Physics Society and American Nuclear Society

NAME: Roy W. Lee (Security/Safety Interface, Occupational Safety)

ASSOCIATION: U.S. DOE/Headquarters, Office of Quality Programs

EXPERIENCE: 18 years

. Safety Engineer (U.S. DOE)

  - Development of industrial and occupational safety policy

  - Appraisal of occupational safety programs

. Safety Director (U.S. Army)

  - Safety management of OSHA compliance programs at the Army's material development and health care facilities

. Chemical Engineer

  - Petrochemical research and development

EDUCATION: B.S., Chemical Engineering, Neward College of Engineering (NJ Institute of Technology)
M.S., Industrial Safety Engineering, Texas A&M University

OTHER: Graduate Safety Engineer of the U.S. Army Safety Engineering Intern Program
Registered Professional Engineer (Safety Engineering)
N Reactor Technical Safety Appraisal Team Member
Pantex Technical Safety Appraisal Team Member
Feed Materials Production Center TSA Followup Team Member

NAME: Phillip A. Lowe (Organization and Administration)

ASSOCIATION: Intech, Inc.

EXPERIENCE: 26 years

- Professional Consulting Services (Energy and Environment)
- Deputy Assistant Inspector General for Inspections - DOE
- Assistant Director for Inspections, Chief Thermal Energy Storage Branch - ERDA
- Chief Steam Generator Branch - AEC
- Manager of Experiments for Product Engineering - Combustion Engineering
- Senior Engineer - Westinghouse Bettis Atomic Power Lab
- Officer Civil Engineer Corps, U.S. Navy

EDUCATION: PhD., Mechanical Engineering, AEC - Westinghouse Fellowship - Carnegie Mellon University, 1968
M.S., Mechanical Engineering - University of Rhode Island, 1964
B.S., Mechanical Engineering - University of Utah, 1961

OTHER: Professional Engineer - Pennsylvania
Fellow - American Society of Mechanical Engineers
Chairman of Advanced Energy Systems Division - American Society of Mechanical Engineers
Member - Board for Research & Technology Development - American Society of Mechanical Engineers

NAME: Thomas J. Mazour (Training and Certification, Facility Safety Review)

ASSOCIATION: Private Consultant, Oak Ridge Associated Universities

EXPERIENCE: 18 years

- Participated in DOE Technical Safety Appraisals of: Rocky Flats Plant Building 771, Sandia Livermore Tritium Research Laboratory, N Reactor, Fast Flux Test Facility, Los Alamos National Laboratory TA-55 Plutonium Processing Facility, the Pantex Plant, the Idaho Chemical Processing Plant, and the Experimental Breeder Reactor II.

- Conducted reviews of training and operations for a commercial utility's BWR and PWR plants based upon INPO and NRC evaluation criteria.

- Program Manager, Analysis & Technology, Inc.
  - Supported the NRC Division of Human Factors Safety in evaluating utility-training programs and developing training-review criteria and regulations.
  - Designed and developed training programs for commercial utilities and DOE Category A reactors.
  - Supported INPO development of a performance-based training program for reactor operator, chemistry technician, and health physics technician positions.

- Burns & Roe, Inc.
  - Design engineer for pressurized water reactor and breeder reactor auxiliary systems
  - Licensing engineer for Clinch River Breeder Reactor

- U.S. Navy - Nuclear trained officer - supervised nuclear reactor operations and served as nuclear weapons officer

EDUCATION: B.S., Mathematics, U.S. Naval Academy
M.B.A., University of New Havan (UNH)
M.S., Industrial Engineering, UNH
Sc.D. Candidate, Management Systems, UNH

OTHER:

- Registered Professional Engineer (Nuclear/Mechanical)

- Adjunct faculty member, University of Rhode Island and UNH, instruct graduate and undergraduate courses in industrial engineering

NAME: Leo H. Munson (Radiological Protection)

ASSOCIATION: Battelle, Pacific Northwest Laboratories

EXPERIENCE: 34 years

. Battelle Pacific Northwest Laboratories

- Provide project management
- Evaluation and assessment of programs, equipment, systems, and criteria
- Develop upgrade programs and corrective actions in the Health Physics and Radiation Protection Fields
- Conducted Emergency Readiness Appraisals of commercial nuclear power plants
- Conducted Health Physics Appraisals of commercial nuclear power plants
- Conducted Health Physics Appraisals of uranium mills

. UNC Nuclear Industries, Richland, Washington

- Manager of Reactor Quality Assurance at a dual purpose reactor
- Responsible for implementation of the Industrial Safety Program and Overview of the Radiological Safety Program

. Donald W. Douglas Laboratories

- Responsible for Health Physics in the Radioisotope Laboratory, including dosimetry, waste handling, shipping and radiological control

EDUCATION: A.A., Columbia Basin College in Radiation Technology
Additional coursework at Joint Center for Graduate Study, Richland, Washington

OTHER: Certified by the American Board of Health Physics in 1970, Recertified in 1981 and 1985

NAME: Linda Munson (Emergency Readiness, Industrial Hygiene)

ASSOCIATION: Evergreen Innovations, Inc.

EXPERIENCE: 15 years

. President
  - Project Manager to assist EPRI in preparation of a rad waste desk reference
  - Consultant to Battelle Northwest on cleanup of Three Mile Island
  - Participant through ORAU on Technical Safety Appraisals for DOE-HQ

. Battelle Pacific Northwest Laboratories, Associate Section Manager, Dosimetry Technology Section
  - Project Manager for various programs including technical assistance to the NRC on the cleanup of Three Mile Island and upgrade of the Health Physics program at RMI
  - Participated in the team appraisal of six uranium mills for and with the NRC
  - Conducted, with DOE-HQ, an appraisal of Emergency Preparedness of the Rocky Flats Plant
  - Served as an observer at about six Emergency Preparedness exercises at commercial power plants
  - Participated in previous Technical Safety Appraisals for DOE-HQ

. UNC Nuclear Industries, Manager, Industrial Safety
  - Responsible for industrial hygiene at N Reactor and the associated fuel fabrication facilities
  - Responsible for the industrial safety and fire protection at N Reactor and the associated fuel fabrication facilities
  - Instituted the safety control program for purchasers of excessed facilities

. UNC Nuclear Industries, Senior Environmental Engineer
  - Managed the preparation of Environmental Information Reports and license applications for various nuclear facilities, primarily uranium mills and fuel fabrication plants.
  - Evaluated decontaminating alternatives for the West Valley Reprocessing Plant.

EDUCATION: B.A., Chemistry, United States International University
M.S., Analytical Chemistry, Iowa State University
Short Courses in Radiation Protection, Industrial Hygiene, Industrial Safety, MORT, Respiratory Protection, Management, and Communications

NAME: Vince Panciera (Maintenance)

ASSOCIATION: Scientech, Inc.

EXPERIENCE: 30 years

. Scientech, Inc.
  - Provided project management services for Government and utility activities
  - Led and participated in safety and regulatory projects involving nuclear power plants

. International Energy Associates, Ltd.
  - Led team in a readiness review of a nuclear power plant being readied for an operating license
  - Participated in technical specification reviews and provided operational support to reactor facilities

. U.S. Nuclear Regulatory Commission
  - Deputy Director, Division of Reactor Safety, Atlanta region - Managed the NRC Regional Inspection Program
  - Led NRC investigation teams following operational events at nuclear power plants
  - Directed the activities of resident inspectors at various nuclear power plants
  - Managed technical inspection programs of nuclear power plants, including maintenance, operation, technical specifications, surveillance, quality assurance and training
  - Participated in safety reviews, including accident analysis, systems analysis and review required for the Systematic Evaluation Programs for older plants

. U.S. Navy
  - Nuclear Power Superintendent, Pearl Harbor Naval Shipyard - Directed activities for overhaul and refueling of nuclear submarines
  - Naval Reactors - Directed engineering activities in the design of submarine and surface system propulsion plant
  - Engineer Officer - Shipboard Propulsion Plant

EDUCATION: Naval Engineer Degree (Nuclear Specialty), MIT 1957
M.S., Marine Engineering and Naval Architecture, MIT 1957
B.S., U.S. Naval Academy, 1951

NAME: George E. Weldon (Fire Protection)

ASSOCIATION: Factory Mutual Research Corporation (FMRC)

EXPERIENCE: 36 years

- Manager of Special Hazards Section (6 years)
- Engineering Specialist Special Hazards. Responsible for fire and explosion hazards connected with major industrial occupancies, chemical and nuclear facilities.
- Concurrent with the above, MAERP Reinsurance Association Engineering Manager for approximately the past 15 years.
- Served on eight earlier Technical Safety Appraisals.
- Chairman of National Fire Protection Association Atomic Energy Committee for 15 years.
- Has made property damage inspections for nuclear research reactors at over 15 sites.
- Has made property damage inspections at over 30 nuclear power sites, domestic and foreign.

EDUCATION: B.S., Chemistry with minors in Physics and Mathematics, Northeastern University

OTHER: Registered Professional Engineer (Fire Protection) Massachusetts.

ATTACHMENT 2

LIST OF CONCERNS

A. Organization and Administration

CONCERN: (OA.1-1) The oversight responsibilities between all the Departments, Committees, and special staff positions that provide such oversight for reactor operations have not been institutionalized through proper documentation.

CONCERN: (OA.1-2) The root cause for the recurring staffing problems related to the support and operations of the reactors has not been identified and adequately addressed.

CONCERN: (OA.1-3) The Sandia quality assurance plans for reactor activities do not completely fulfill mandatory DOE requirements.

CONCERN: (OA.4-1) The Sandia system to correct reactor facility review and appraisal findings or action items is not fully effective.

CONCERN: (OA.4-2) The Sandia quality assurance audit program for reactor operations and activities is not fully effective (see Concern FR.4-1).

CONCERN: (OA.4-3) The Sandia unusual occurrence reporting system does not assure that those responsible for directing operations and activities recognize and report all unusual occurrence events.

CONCERN: (OA.6-1) Controls of documents important to the safe operation of Sandia reactors have not been effective.

CONCERN: (OA.7-1) Important substance abuse training not being provided to all personnel who have frequent, detailed, and direct supervisory contact with the reactor operations staff.

B. Operations

CONCERN: (OP.2-1) No formal system exists for the preparation, content, format, revision, distribution and control of ACRR and SPR III operating procedures.

CONCERN: (OP.3-1) The reason for the reactivity drift in the Annular Core Research Reactor has remained unexplained for almost 1 year despite extensive physical measurements.

CONCERN: (OP.3-2) The rationale for changing the method for determining the Annular Core Research Reactor transient rod bank worth was not adequately documented.

CONCERN: (OP.3-3) Reporting of the unexplained reactivity change at the Annular Core Research Reactor did not comply with the Technical Specifications and DOE 5000.3.

CONCERN: (OP.3-4) There is no formal system for defining the content and maintenance of a reactor console log.

CONCERN: (OP.3-5) The configuration control system for reactor modifications does not ensure that as-built drawings, revised procedures and manuals, and training are provided prior to systems operations and maintenance.

CONCERN: (OP.3-6) Reactor operations management is not exercising adequate control over procedures and activities of outside support services which interact with the reactor and its safety-related systems and operations.

CONCERN: (OP.3-7) Guidelines and procedures controlling the use, placement, removal, and accountability of electrical jumpers and tags or vital keys for the reactor systems or support systems are inadequate.

C. Maintenance

CONCERN: (MA.3-1) Without a formal, disciplines deviation control system, deficient material could be installed in engineered safety features and in reactor systems which could adversely affect safe, reliable operations.

CONCERN: (MA.5-1) The calibration recall system presently in use allows instruments which are in need of recalibration to remain in work areas, where they might be used in safety-related work activities.

CONCERN: (MA.7-1) Maintenance activities for the reactor and their support systems are conducted, in many instances, without the use of written instructions, procedures, and formal programs.

D. Training & Certification

CONCERN: (TC.1-1) Requirements for documentation of training and retention of records are inadequate.

CONCERN: (TC.2-1) The selection criteria in the Technical Specifications for reactor supervisors do not meet DOE requirements for educational equivalency. Reactor operator candidates who only meet the minimum published Sandia requirements for selection have a low potential to complete the reactor operator training program.

CONCERN: (TC.2-2) Reactor operators are not given health examinations to establish their fitness prior to their certification.

CONCERN: (TC.2-3) Reactor operator and reactor supervisor initial and recertification training programs either do not document or do not address all needed subject matter.

CONCERN: (TC.4-1) The requirements of the Sandia Safety Manual with respect to safety training are not being met for personnel working in the reactor facilities.

CONCERN: (TC.5-1) There is no documentation of the training provided to the personnel responsible for reactor-related maintenance and calibration.

CONCERN: (TC.7-1) Training manuals for reactor operator and reactor supervisor training are inadequate.

E. Auxiliary Systems

CONCERN: (AX.4-1) The charcoal filters are not tested between replacements.

F. Emergency Readiness

CONCERN: (ER.1-1) Management does not maintain adequate control of onsite emergency response.

CONCERN: (ER.5-1) The effective transfer of information about an accident in Technical Area V to the duty officer and/or the Emergency Operations Center in Technical Area I is not assured.

G. Technical Support

CONCERN: (TS.1-1) Reactor personnel do not have a program to ensure complete compliance with mandatory DOE standards for facility modifications.

CONCERN: (TS.3-1) Technical Specifications are not up-to-date and contain ambiguous entries.

CONCERN: (TS.5-1) A third party cannot evaluate the frequency or severity of incidents, determine trends, or review procedural errors because a system for reporting all incidents associated with the reactors does not exist.

CONCERN: (TS.9-1) Appropriate response to criticality alarms has not been addressed.

CONCERN: (TS.9-2) The need for a criticality monitor at ACRR during handling and storage of experiments at ACRR has not been evaluated.

I. Experimental Activities

CONCERN: (EA.1-1) There is no formal procedure institutionalizing the present successful Experiment Plan and giving the experimenter the details of the steps necessary for preparation of the Plan.

CONCERN: (EA.2-1) The Sandia internal review and inspection system has not been effective in discovering deficiencies in a number of areas associated with experiments.

J. Facilities Safety Review

CONCERN: (FR.2-1) ACRR and SPR III line management is not submitting to the Sandia Reactor Safety Committee in a timely manner all items required to have an independent safety review.

CONCERN: (FR.4-1) The Sandia independent review and quality assurance functions have been ineffective in identifying weaknesses in the day-to-day operations of Sandia reactors.

CONCERN: (FR.5-1) The triennial appraisal of reactor safety review systems is not in sufficient detail to identify opportunities for safety review system improvements.

L. Radiological Protection

CONCERN: (RP.1-1) The ES&H Department had not provided adequate radiation protection guidance to the line organizations.

CONCERN: (RP.1-2) Independent in-depth audits and inspections of the radiation protection program were not conducted.

CONCERN: (RP.2-1) Internal audits of the radiation protection program were not being conducted as required by DOE orders, Sandia Laboratories instructions, and the Sandia contract.

CONCERN: (RP.2-2) No formal documentation and tracking system exists for radiological incidents other than for Unusual Occurrences.

CONCERN: (RP.3-1) Procedures for implementation of the reactors' health physics program were incomplete.

CONCERN: (RP.5-1) There was no performance or location analysis documentation for fixed nuclear accident dosimeters.

CONCERN: (RP.6-1) There was no documented internal radiation exposure control program for the reactor facilities.

CONCERN: (RP.7-1) There was no internal dosimetry program for the reactor areas.

CONCERN: (RP.8-1) The supply of radiation instruments readily available at the reactors was marginally adequate to meet routine and emergency needs.

CONCERN: (RP.8-2) Remote Area Monitor (RAM) meters in the control room and health physics office did not reflect the local readings at the RAMs.

CONCERN: (RP.10-1) There was no documented air monitoring program for the reactor facilities.

M. Personnel Protection

CONCERN: (PP.1-1) There is no effective program which permits the industrial hygiene staff to identify health hazards.

CONCERN: (PP.2-1) Routine workplace monitoring is not performed to document that exposures to toxic substances and stressful physical agents are below limits and to analyze trends.

CONCERN: (PP.2-2) The respiratory protection program does not comply with ANSI Z88.2 in that program administration, procedures, the hazard evaluation process, training and annual internal

CONCERN: (PP.3-1) There is no hazard communications program for the reactors.

CONCERN: (PP.4-1) The professional industrial hygiene staff, who are best able to assure the health protection of the workers, have no documented responsibility to do so.

CONCERN: (PP.7-1) The system for review, approval, and authorization of operational procedures does not assure identification of all hazardous activities.

CONCERN: (PP.7-2) The lifting of loads with the Annular Core Research Reactor bridge crane over personnel is inconsistent with Sandia and DOE recommended practice and presents a potential for accidental death or injury.

ATTACHMENT 3: RATING OF CONCERNS

3a. System for Rating Concerns

Each concern presented in this appendix has been categorized for SERIOUSNESS by the following criteria:

CATEGORY I: Addresses a situation for which a "clear and present" danger exists to workers or members or the public. A concern in this category is to be immediately conveyed to the manager of the facility for action. At this point, consideration shall be given to whether the facility shutdown authority of the Assistant Secretary for Environment, Safety and Health should be exercised. If so, the Assistant Secretary or his designee is informed immediately.

CATEGORY II: Addresses a significant risk (but does not involve a situation for which a clear and present danger exists to workers or members of the public) or substantial non-compliance wiht a DOE order. A concern in this category is to be conveyed to the manager of the facility no later than the appraisal closeout meeting for immediate attention. These concerns have a significance and urgency such that the necessary field response should not await the preparation of a formal report and the routine development of an action plan. Any issues surrounding the concern of the suggested response are addressed during the appraisal or immediately thereafter.

CATEGORY III: Addresses a significant non-compliance with DOE Orders, or a significant improvement in the margin of safety, but is not of sufficient urgency to require immediate attention.

Each concern presented has also been characterized by its POTENTIAL HAZARD CONSIDERATIONS and by the significance of its COMPLIANCE CONSIDERATIONS. The criteria used were:

HAZARD POTENTIAL CONSIDERATIONS

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 substances.

Level 3. Has little potential for threatening safety, health, or property, but is not consistent with some specific safety or health requirement.

COMPLIANCE CONSIDERATIONS

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 or 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 recommendations are based on professional judgement in pursuit of excellence in the safety of the appraised operation (i.e., these are improvements for their own sake--not deficiency-driven).

3b. Ratings Assigned to Concerns

Concern Number	Hazard Level	Compliance Level	Concern Number	Hazard Level	Compliance Level
OA.1-1	2	2	TS.1-1	2	1
OA.1-2	2	2	TS.3-1	2	2
OA.1-3	2	1	TS.5-1	2	2
OA.4-1	2	2	* TS.9-1	2	1
OA.4-2	2	1	TS.9-2	2	1
OA.4-3	2	1			
OA.6-1	2	1	EA.1-1	2	1
OA.7-1	3	3	EA.2-1	2	2
OP.2-1	2	2	FR.2-1	2	1
OP.3-1	2	1	FR.4-1	2	2
OP.3-2	1	2	FR.5-1	3	2
OP.3-3	2	1			
OP.3-4	2	2	RP.1-1	3	2
OP.3-5	2	2	RP.1-2	3	1
			RP.2-1	3	1
OP.3-6	2	2			
OP.3-7	2	2	RP.2-2	3	2
			RP.3-1	3	1
			RP.5-1	3	1
MA.3-1	2	2			
MA.5-1	2	2	RP.6-1	3	2
MA.7-1	2	2	RP.7-1	3	2
			RP.8-1	3	2
TC.1-1	3	2	RP.8-2	3	2
TC.2-1	3	2	RP.10-1	3	1
TC.2-2	3	1			
TC.2-3	2	1	PP.1-1	2	1
TC.4-1	2	2	PP.2-1	2	1
TC.5-1	2	2	PP.2-2	2	1
TC.7-1	2	2	PP.3-1	2	1
			PP.4-1	2	2
			PP.7-1	2	2
AX.4-1	2	2			
			*PP.7-2	1	2
ER.1-1	1	1			
ER.5-1	3	2			

*These concerns are Category II. All other concerns are Category III.