

- DOE 5480.11 and ANSI N2.1 require that a radiation symbol with a yellow background be used to identify contamination levels greater than 10 times the levels listed in DOE 5480.11.
- LANL AR 3.7 requires posting at the levels in DOE 5480.11.

CONCERN: See Concern TSA-4, RP.3-1.

FINDINGS:

- Radiation sources in the Calibration Section of the Nuclear Materials Measurements and Accountability Group and Health Physics Measurements Group are not being periodically leak tested and no schedule for leak testing exists.
- The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.3-3)
(H2/C1)

All groups are not implementing the radiation source leak test program as required by Los Alamos National Laboratory AR 3-4.

RP.4 EXTERNAL RADIATION EXPOSURE CONTROL PROGRAM

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

- FINDINGS:**
- At the orientation briefing for TA-21, it was pointed out by the TA-21 Manager that many of the personnel there are students. When asked if any of the students were less than 18 year of age, he responded that he did not know, but some probably were.
 - DOE 5480.11 limits exposure of individual under age 18 to 0.1 rem in a year.
 - The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.4-1)
(H2/C1)

At Los Alamos National Laboratory, positive control is not exercised by TA-21 line management as necessary to ensure compliance with radiation dose limitations of DOE 5480.11 concerning minors.

RP.5 EXTERNAL RADIATION DOSIMETRY

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

FINDINGS:

- Whole body dosimeters are issued to all LANL personnel who enter areas where they might be exposed to ionizing radiation. DOE 5480.11 requires issuing of a dosimeter to anyone with the potential to receive greater than 100 mrem annual effective dose to the whole body, five rem to either the skin or any extremity, or 1.5 rem to the lens of the eye.

Because the minimum detectable limit for the LANL whole-body dosimeter is 10 mrem, an annual missed dose as large as 108 mrem is possible with monthly dosimeter exchanges.

- Whole body dosimeters are worn either directly attached to the outer clothing or on a necklace. When the dosimeter is on a necklace, the actual position of the dosimeter can be 1 to 10 cm from the outer clothing. No studies have been made to show that the dose measured at the surface of the body is the same as the dose at a distance of 10 cm.
- See Concern TSA-4, RP.5-3.
- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.5-1)
(H2/C1)

The issuance of dosimeters to all Los Alamos National Laboratory personnel is not technically based on the radiation dose criteria specified in DOE 5480.11.

FINDINGS:

- The most likely type of radiation dose to extremities in nonaccident situations at TA-55 is from neutron and gamma radiation. Extremity neutron doses are determined from ratios of gamma-to-neutron doses for whole body dosimeters. This ratio includes shielding and albedo effects that may not be applicable to extremities, especially for neutron doses.

- Extremity dosimetry is not worn when handling cast depleted uranium.
- Extremity doses from handling newly cast depleted uranium and its oxide can be significant.
- Extremity doses are not measured accurately as required by DOE 5480.11.
- The following concern was partially identified in the LANL self-assessment.

CONCERN: See Concern TSA-4, RP.5-5.

RP.6 INTERNAL RADIATION EXPOSURE CONTROL PROGRAM

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

- FINDINGS:**
- Commingling areas are areas where personnel in protective clothing (both laboratory coats and coveralls) are allowed to share the same facilities with personnel wearing street clothing. Commingling areas exist in Bldg. PF-4, including two break rooms (one smoking, one nonsmoking).
 - Eating, drinking, and using tobacco products are allowed in the break areas.
 - The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.6-1)
(H3/C1)

At the Los Alamos National Laboratory, internal radiation exposure controls do not preclude eating, drinking, and using tobacco products in commingling areas and do not minimize internal exposures as required to comply with DOE 5480.11.

- FINDINGS:**
- The frequency of surveying mandated by procedures is not consistently followed. In particular, floor surveys are performed as needed but LANL policy requires semi-annual surveys.
 - Documentation of floor surveys indicated that some laboratory floors had not been surveyed during 1991.
 - The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.6-2)
(H2/C1)

At the Los Alamos National Laboratory, radiation surveys are not performed so as to comply with Health and Safety Division procedures.

RP.7 INTERNAL RADIATION DOSIMETRY

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

FINDINGS:

- In TA-55, personnel are evaluated for inclusion in the bioassay program based on the expected type of work to be performed.
- A conservative approach to bioassay in TA-50 is taken so that all radiation workers participate in the program.



At the firing sites, including TA-36 and TA-15, LANL ~~personnel are not evaluated for inclusion in the bioassay program.~~

- Health and Safety Procedure HSE-10-06-02 and LANL AR 3-7 requires that all personnel be evaluated for inclusion in the bioassay program.
- DOE 5480.11 requires bioassay for any worker with the potential to receive 100 mrem annual effective dose equivalent from internal exposures.



Not all personnel at the plutonium and depleted uranium facilities are evaluated for participation in the bioassay program to comply with DOE 5480.11.







CONCERN:

See Concern TSA-4, RP.7-1.

RP.8 FIXED AND PORTABLE INSTRUMENTATION

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

FINDINGS:

-  The detectors on the Ludlum 214 fixed instruments (hand and foot monitors) are interchanged without recalibration or response testing.
-  The detectors on the Ludlum 139 portable instruments are interchanged and response tested at each scale, but full calibrations are not performed.
-  The check sources used to response check fixed instrumentation are disks of depleted uranium attached to each detector. The sources have not been characterized, are not documented, and emit at an unmeasured rate.
-  The backlog in calibrating Ludlum 214 hand and foot monitors resulted in a large number of instruments that were out-of-calibration. In order to relieve this backlog, a technician was trained and certified to perform a calibration that did not include the electronics check required by ANSI N323-1978. Following the calibration procedure, a calibration sticker was affixed to the instrument.
- Documented studies of the field minimum detectable activity for fixed and survey instrumentation have not been performed.
-  Several glovebox hand and foot monitors are out-of-calibration (calibration date has passed). The calibration cycle has recently been changed from 2 years to 1 year. As a consequence the calibration facility is unable to keep up with the increased number of instruments that require calibration.
-  Hand and foot monitors that are past the calibration date are not placed out-of-service as required by LANL AR 3-1 because sufficient numbers of replacement instruments are not available.
- Annual calibration of instruments is required by ANSI N323-1978.
- Printouts describing instruments that require calibration show calibration frequencies of both 12 and 24 months for the same type of instrument (Ludlum 214 hand and foot monitors).
- See Concern TSA-1, QV.4-1.

- Radiation protection instruments are not being returned for calibration and maintenance as required by ANSI N323 and the Health Physics Measurements Group procedures. (See Section 4.5.2.13.2, RP.8.)
- There are no procedures to ensure that failed radiation protection equipment at accelerators are promptly removed from operation and evaluated to determine the impact of the failure. (See Section 4.5.3.13.2, RP.8.)
- The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.8-1)
(H2/C1)

Fixed and portable radiation survey instruments are not calibrated annually or source checked in compliance with Los Alamos National Laboratory procedures and ANSI N323-1978, and instruments past calibration are not removed from service in compliance with Los Alamos National Laboratory AR 3-1.

FINDINGS:

- Tritium detectors in laboratories and on stack monitors are not source checked.
- Tritium process monitors that have an effluent control function were found out of calibration but were not taken out of service.
- The tritium process monitors are the property of one of the operating groups.
- The Health and Safety Division has no control over the tritium process monitors.

CONCERN:

See Concern TSA-2, RP.8-5.

FINDINGS:

- The following concern was fully identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.8-2)
(H2/C1)

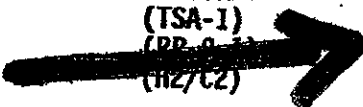
At the Los Alamos National Laboratory, process control monitors, for which calibration is required by DOE 5700.6C, are not under the oversight of Health and Safety Division even though they have the potential to be effective health and safety instruments.

RP.9 AIR MONITORING

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

- FINDINGS:**
- Air flow studies have been performed and updated at Bldg. PF-4 to ensure that the positioning of the continuous air monitors is adequate to monitor for airborne activity. However, formally documented studies do not exist for the depleted uranium facilities at TA-50 and TA-3 (Sigma Complex).
 - Particle size studies of airborne radioactive contaminants at Bldg. PF-4 have commenced but are not complete. Solubility studies have been completed and documented.
 - The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.9-1)
(H2/C2)



At the Los Alamos National Laboratory, airflow, particle size, and solubility studies have not been documented at all plutonium and depleted uranium facilities, such as TA-50, TA-3 (Sigma Complex), and the firing sites, to verify the proper positioning of the continuous air monitors for monitoring airborne activity.

- FINDINGS:**
- The tritium stack monitors are not calibrated due to the large quantities of tritium released during calibration. Electronic calibrations are performed at a specified frequency.
 - The Kanne chamber used as a stack monitor can measure concentrations up to 20 mCi/m³.
 - Short-term releases in excess of 20 mCi/m³ have occurred at TA-55.
 - See Concern TSA-1, QV.4-1.
 - The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-1)
(RP.9-2)
(H2/C1)

At the Los Alamos National Laboratory, the tritium stack monitor at Building PF-4 are not calibrated as required by ANSI N13.10-1974, and the range of response of the instrument does not ensure accurate determination of released quantities of tritium during accident situations.

RP.10 RADIATION MONITORING/CONTAMINATION CONTROL

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

FINDINGS:

- Floor surveys in TA-55 are performed with go/no go instruments. The minimum detectable activity of these instruments is greater than the levels specified in ANSI N323-1978. ←
- Floor surveys are not performed in TA-50 as required by LANC procedures:
- Surface contamination in TA-55 is determined through surveys of booties. Booty surveys are performed with portable instrumentation with a much higher minimum detectable activity than smear surveys can achieve. ←

CONCERN: See Concern TSA-4, RP.10-1.

FINDINGS:

- Smear surveys of objects carried into Bldg. PF-4 are performed prior to their release. However, unless specifically reminded by management, no documentation is consistently generated regarding the release of these materials. ←
- The basement area of Bldg. PF-4 is used as a staging area for radioactive waste, including equipment. Documented smears are not performed on the high (greater than 50,000 counts per minute) count areas. Smears are performed when equipment is moved, but the results are not documented.
- At TA-3 (Sigma Complex), procedures for removal of protective clothing are not posted at step-off pads, and surveying procedures are not being followed. The operational group realizes that training is needed, but they are delaying this training until sufficient numbers of monitoring equipment are available.
- At Bldg. PF-4, procedures for removal of protective clothing are posted at exits from the controlled areas. Radiation protection technicians are posted at these areas to ensure that procedures are followed.
- In the TA-21 Chemistry Laboratory, an air filter had fallen off the fixed vacuum head, no means is provided for real-time checking of the airflow from the room into the hoods, and no check source is provided at the hand and foot monitor at the exit from the laboratory. ←
- See Concern TSA-1, QV.1-2.

CONCERN: See Concern TSA-4, RP.10-4.

Tritium

TRITIUM FACILITIES

4.5.2.13 Radiological Protection

4.5.2.13.1 Overview

All 12 performance objectives in the Radiological Protection technical area were addressed in this appraisal. However, findings and concerns in RP.4 External Radiation Exposure Control Program are included in other technical areas. Data was gathered through site visits, interviews with operational personnel, radiation protection technicians, Health and Safety Division personnel, and health physicists and through review of LANL policies, procedures, standard operating procedures, and internal correspondence regarding conduct of radiation protection. Data also came from management's description of responsibilities deriving from DOE 5480.11.

Tritium facilities include the following: TA-3 Bldg. 16 (Ion Beam Facility), TA-16 Bldg. 205 (WET Facility), TA-21 Bldg. 155 (Tritium Systems Test Assembly), TA-21 Bldg. 209 (Tritium Salt Facility), TA-33 Bldg. 86 (High Pressure Tritium Laboratory), TA-35 Bldg. 34 (Beta Decay Experiment), TA-35 Bldg. 213 (Target Fabrication Facility), and TA-41 Bldg. 4 (Ice House). Additional facilities included in the appraisal were TA-2 Bldg. 1 (OWR), TA-18 (Pajarito Site), and TA-3 Bldg. 40 (Radiological Calibrations Facility).

The radiation protection functions in the facilities visited by S&H Subteam 2 demonstrate the nonuniformity of the radiation protection program at LANL. The reasons for this nonuniformity are apparently numerous; for example, until recently the health physics operating groups were geographically controlled and philosophically separate. Consequently, the programs were operated differently. In several instances a vacuum appears to exist at LANL in the implementation of the more conservative requirements of DOE 5480.11. Management has unilaterally instituted changes which are contrary to DOE 5480.11 and/or LANL requirements. Management develops standard operating procedures, radiation work permits, and special work permits without review or approval of the Health and Safety Division.

Posting and contamination control in tritium facilities is nonuniform (even when the facilities are in the same division). This nonconservative aspect of the program coupled with the absence of timely tritium smear and bioassay analyses makes the quality of radiation worker protection hard to quantify. In addition, it will be difficult or impossible to demonstrate that exposures are ALARA and that timely response will be taken in the event of an undetected tritium release.

An occurrence identified by S&H Subteam 2 at the Ion Beam Facility, involving maintenance of a highly contaminated building vacuum pump, demonstrated the apparent absence of management concern for the conduct of a conservative radiation protection program. This occurrence, coupled with the decision that it was not reportable under DOE 5000.3A and LANL requirements, has led to a strong concern on the part of the S&H Subteam as to whether continued safe operation of the facility from a radiation protection point of view can be assured.

Operations staff in some of the tritium facilities apparently believe they are dealing only with tritium gas, in which case, the risk to workers would be extremely low because tritiated water or tritiated organics would not be present. At TA-41 Bldg. 4, management does not appear to have accepted the

Lessons learned from a Class C incident that occurred in May 1990. Staff continually tried to impress the S&H Subteam with the assurance that they are the experts and that the risk from exposure to tritium gas is minimal.

Many of the concerns identified in this S&H Subteam 2 report relate to an inadequacy in allocation or reallocation of physical and human resources to and within the Health and Safety Division. Operating organization management and personnel continually complain that they cannot obtain timely support from the Health and Safety Division. However, in only a few instances has management provided direct funding to increase health and safety support. Some of the same organizations have provided direct support for the senior health and safety personnel that they are adding to their own groups under the "safety and radiation protection officer" concept. This new effort has further led to the nonuniformity of the radiation protection program at LANL rather than improvement. For at least the past 4 years, the Health and Safety Division has identified the need for a new centralized calibration facility to meet the tough new requirements of DOE 5480.11, ANSI N323, and DOE 5480.15. LANL may be the only major DOE site which does not have either a new calibration facility or approval for constructing one.

The LANL self-assessment marginally addressed the concerns identified by S&H Subteam 2. The Health and Safety Division self-assessment dealt primarily with management responsibilities of the division. They were not asked to provide an independent assessment of the sitewide problems in the area of radiation protection. Thus, the LANL self-assessment suffered because there was inadequate input from the excellent staff of health physics professionals available at LANL.

While there is some isolated improvement in radiation protection in the facilities visited by S&H Subteam 2, the overall quality of the program is lower than in the past. The increased emphasis on line management responsibilities has added to the attitude of some managers that they do not need direct support and approval from the safety professionals. The attitude of "don't call us, we'll call you" appears to be stronger than in the past. If management does not want the review or approval of the Health and Safety Division they simply do not request it. LANL management must make a substantial commitment toward the upgrade of the radiation protection program if the Laboratory is to be fully committed to the quality program currently envisioned in the DOE Orders and by the Secretary of Energy.

4.5.2.13.2 Findings and Concerns

RP.1 ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: Site/facility organization and administration should ensure effective implementation and control of radiological protection activities.

FINDINGS:

→ Radiation protection technicians are not being provided a formal radiation protection technician training course as required by DOE 5480.11.

→ Some radiation protection technicians have received no job-specific training after joining LANL.

• Some radiation protection technicians do not understand the requirements of DOE 5480.11 and have not received special instruction on these requirements.

→ Some radiation protection technicians do not demonstrate proper knowledge of how to use sources for checking instrument operation. Their demonstrated knowledge of the use and interpretation of results from radiation protection instrumentation is nonuniform. Misuse and misinterpretation of instrument results could in some instances result in an overexposure.

- Management has not provided the resources for proper training of radiation protection technicians.
- Training of radiation protection technicians was identified as one of the DOE 5480.11 implementation problems.
- The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.1-1)
(H2/C1)

Los Alamos National Laboratory radiation protection technicians have not been trained to meet minimum requirements specified in DOE 5480.11.

FINDINGS:

- At the Ion Beam Facility, where an incident occurred during this appraisal, the responsibilities of the radiation protection technician are divided among seven buildings. Line management has requested full-time support at this facility.

→ Management personnel at several facilities complained that they do not get radiation protection technicians assigned to their facilities in response to their requests.

→ Approximately 100 radiation protection instruments are out of calibration at one building. One of the

explanations for not returning the instruments for recalibration was the amount of time required.

- The number of tritium smears that are counted has increased by 75 percent over the past 3 years. It takes from 2 to 5 weeks to get the smear processed. Currently, there is a backlog of nearly 3000 samples even though at least one-half person year in overtime is being expended.
- A counting room used in the smear- and air-sample counting laboratory is located in a hallway between two rooms in which smearable contamination exceeds the limits specified by DOE 5480.11, Appendix 2. The presence of alpha contamination in the counting room could bias results or could result in the room being shut down. This is reportedly the only space available for this valuable, important resource for the contamination control program. In comparison, in the counting room at TA-55 Bldg. PF-4, only clean protective clothing is permitted and the area is not a contaminated area.
- Approximately 12 temporary radiation protection technicians are being used by LANL to supplement the available staff of radiation protection technicians. These temporary radiation protection technicians are required to provide valuable health physics support with only limited plant-specific training.
- The calibration of high-level, portable, fixed radiation (TA-2) and criticality (TA-55) detection instruments cannot be properly performed because of the limited dose rate available in the old LANL calibration facility.
- The health physics groups have identified the shortfall of people and facility resources through their organization self-assessment.
- Line management oversight of the LANL Radiation Protection Program for radiation-producing devices does not ensure that all requirements of mandatory standards in DOE 5480.11 are implemented. Responsibility is not defined or assigned to ensure that the radiation safety officer and qualified expert requirements associated with accelerators and radiation-producing machines are implemented in accordance with ANSI 43.1, ANSI 43.2, and ANSI 43.5. (See Section 4.5.3.13.2, RP.1.)
- The following concern was partially identified in the LANL self-assessment.

Management at Los Alamos National Laboratory has not implemented a high-quality radiation protection program as required by SEN-60-91 and DOE 5480.1B.

CONCERN:
(TSA-2)
[REDACTED].1-2)
[REDACTED]/(C1)

FINDINGS:

- Safety and radiation protection officers are being assigned to various levels in operating groups, divisions, and directorates.
- Many of the safety and radiation protection officers were senior staff hired from the Health and Safety Division; thus, they understand health and safety requirements and can and do institute changes in radiation protection without the involvement of Health and Safety Division personnel.



A few safety and radiation protection officers reported that they did not need to seek approval from the Health and Safety Division for changes in standard operating procedures, etc. In addition, they did not need to accept recommendations from Health and Safety Division.

- In the standard operating procedure for one radiation generating machine, line management is permitted to authorize continued operation of a malfunctioning unit without obtaining approval from the Health and Safety Division or the presence of a radiation protection technician.
- The following concern was not identified in the LANL self-assessment.


CONCERN:
(TSA-2)
(RP.1-3)
(H2/C2)

Los Alamos National Laboratory has not defined the responsibilities and authorities of safety and radiation protection officers and their relationship with the Health and Safety Division.

FINDINGS:

- DOE 5000.3A requires that occurrences and off-normal events be reported, even when the event did not result in personnel exposure and/or release of radioactive material to the environment.
- LANL developed DOE 5000.3A categorization criteria to be used by facility management in deciding whether an off-normal event is reportable.
- There is no oversight required by Health and Safety Division staff or higher management when facility management decides that the incident is not reportable.
- S&H Subteam 2 discovered a building vacuum system in the basement of the Ion Beam Facility that had been opened in violation of the standard operating procedure and LANL AR 1-3, "Standard Operating Procedures and Special Work Permits," dated October 31, 1987. Tritium contamination in excess of the LANL smearable tritium contamination limit of 10^3 D/M/100 cm^2 (1000 disintegrations per minute per 100 square centimeters) was found on the outside of the vacuum pump and piping. The level of contamination was in excess of 10^6 D/M/100 cm^2 . Operations had no

current measurement of the contamination level in the oil, and they have not established a limit above which the oil must be replaced.

- The Health and Safety Division staff recommended that this occurrence be reported since several of the LANL Categorization Criteria (DOE 5000.3A reporting criteria) were applicable.
- ~~Management made a decision that this occurrence was not reportable under DOE 5000.3A since "the bioassay of the individual involved has indicated no contamination" and "no detectable release has been measured."~~ 
- See Concern TSA-2, OA.5-1.

CONCERN:

See Concern TSA-4, RP.2-2.

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:

- LANL has an internal audit program that meets the criteria and requirements of DOE 5482.1B.
- The Health and Safety Division performed audits in 1989 and 1990. A tracking system is in place which provides the status of the findings from these audits.
- The audit and tracking system does not include review of standard operating procedures for correctness, approval by Health and Safety Division, or to determine whether standard operating procedures are current. ←
- A printout dated August 14, 1991, lists 52 action items with their due dates and status. To date, 22 items have been completed.
- The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.2-1)
(H3/C2)

The internal audit system at Los Alamos National Laboratory does not include all elements of the Radiation Protection Program to ensure prompt action.

RP.3 RADIOLOGICAL PROTECTION PROCEDURES AND POSTING

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

FINDINGS:

- LANL has a policy on posting controlled and radiological areas in administrative requirements (See LANL AR 3-7, "Radiation Exposure Control," dated January 11, 1991) which parallel the requirements of DOE 5480.11.
- This policy does not include the criteria for determining how to establish a comprehensive posting and control program in the workplace. Consequently, posting primarily reflects the practices established at each building.
- Posting is inconsistent throughout LANL; sometimes it is inconsistent within a building, and sometimes it is also inconsistent within buildings operated by the group.
- LANL management failed to provide the necessary resources to assure that the posting requirements were uniformly implemented in the zoning and posting of each facility.
- Some signs are prepared and posted by line management in a facility without input by the Health Physics Operations Group and the Health Physics Policy and Programs Group. These signs do not meet DOE 5480.11 requirements.
- Posting intended for use within buildings, which is based on DOE 5480.11, has been inappropriately used on fences outside buildings.
- Posting on the fence outside the Ion Beam Facility Building was changed to "Controlled Area" during the appraisal. However, no control over visitors or private vehicles was instituted. Subsequently, the signs were removed.
- Management, radiation workers, and radiation protection technicians are not trained in the new posting requirements.
- The LANL DOE 5480.11 Compliance Plan, Rev. 2, made the following commitments:
 - All work areas will be evaluated for sign requirements (April 20, 1990).
 - Signs and labels will be provided and installed (July 31, 1990).

These commitments were not met.



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:**
- LANL has an internal audit program that meets the criteria and requirements of DOE 5482.1B.
 - The Health and Safety Division performed audits in 1989 and 1990. A tracking system is in place which provides the status of the findings from these audits.
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 - A printout dated August 14, 1991, lists 52 action items with their due dates and status. To date, 22 items have been completed.
 - The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.2-1)
(H3/C2)

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FINDINGS:

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- This policy does not include the criteria for determining how to establish a comprehensive posting and control program in the workplace. Consequently, posting primarily reflects the practices established at each building.
- Posting is inconsistent throughout LANL; sometimes it is inconsistent within a building, and sometimes it is also inconsistent within buildings operated by the group.
- LANL management failed to provide the necessary resources to assure that the posting requirements were uniformly implemented in the zoning and posting of each facility.
- Some signs are prepared and posted by line management in a facility without input by the Health Physics Operations Group and the Health Physics Policy and Programs Group. These signs do not meet DOE 5480.11 requirements.
- Posting intended for use within buildings, which is based on DOE 5480.11, has been inappropriately used on fences outside buildings.
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- Management, radiation workers, and radiation protection technicians are not trained in the new posting requirements.
- The LANL DOE 5480.11 Compliance Plan, Rev. 2, made the following commitments:
 - All work areas will be evaluated for sign requirements (April 20, 1990).
 - Signs and labels will be provided and installed (July 31, 1990).

These commitments were not met.

CONCERN:

See Concern TSA-4, RP.3-1.

FINDINGS:

- At LANL yellow rope, tape, and paint are used for many purposes (e.g., to control entry and to seal packages). It is not uniformly used to identify a special radiation area or condition.
- Step-off pads are used at several locations where shoe covers are required. Instructions are not always available on or near the pad.
- In some locations, step-off pads are not used as required by DOE 5480.11, even though shoe covers are required.
- Tools used in maintenance work involving radioactive material contamination are not uniquely identified to prevent use in an uncontrolled area.
- A yellow rope is used at TA-2 Bldg. 1 (outside the building) to prevent personnel from exiting a potentially contaminated area and proceeding directly into an uncontrolled area. Staff have reportedly removed this temporary barrier several times. Thus, contamination control requirements are violated. The two signs posted at this location ("Control Area" and "Radiation Area") are incompatible.
- Personnel at TA-18 were working in a posted contamination area wearing blue protective clothing in violation of LANL policy.
- In most tritium facilities at LANL, hoods and gloveboxes are posted as contamination areas and the surrounding areas are posted as controlled areas. In actual practice, the space in front of these hoods is treated by operations as a contamination area. Protective clothing must be changed frequently (as often as every 15 minutes) and the used clothing is to be placed in a receptacle located close to the hood and glovebox. This practice is inconsistent with the existing posting.
- At the Ion Beam Facility, the S&H Subteam 2 passed through controlled and contamination areas without any clear demarkation. This included an unenclosed area in which smearable tritium contamination in excess of 10^6 D/M/100 cm² is routinely found. No special posting or other warning was available to show the presence of high levels of tritium contamination.
- See Concerns TSA-2, MA.2-4, and TSA-2, WS.4-1.
- The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.3-1)
(H2/C1)

The contamination control policy at Los Alamos National Laboratory tritium facilities does not cover all required elements, does not meet the requirements of DOE 5480.11 for control, does not provide positive control of personnel in contaminated areas, and is not rigorously enforced.

RP.4 EXTERNAL RADIATION EXPOSURE CONTROL PROGRAM

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

FINDINGS:


- Records are not provided at some workplaces to demonstrate that warning lights and interlocks are fail-safe for radiation-generating machines (e.g., x-ray radiography units).
- Radiation protection technicians assigned to buildings where these units are housed are unaware of the results of the annual leakage survey and interlock test.
- Posting at the machines was nonuniform and, in most cases, did not identify the purpose or requirements of the warning lights. This does not meet DOE 5480.11 requirements for control of potentially high radiation levels.
- Neither the Health Physics Policy and Programs Group radiation-producing device control office nor the Health Physics Operations Group is required to approve standard operating procedures or the annual review and update of such procedures.
- The interlocks on an x-ray radiography machine at the Tritium Salt Facility could be bypassed and the machine operated without proper shielding. Additional administrative controls were in place to prevent deliberate tampering. However, S&H Subteam 2 continues to be concerned about the absence of a positive physical control. The standard operating procedure for this machine permits the operation of the unit even if it is malfunctioning without obtaining a special work permit from the Health Physics Operations Group and without the presence of a radiation protection technician. The Health Physics Policy and Programs Group radiation-producing device control office did not have a copy of the current standard operating procedure for that installation because it was not on the distribution list for the procedure.
- See Concern TSA-3, RP.4-4.
- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.4-1)
(HI/C1)

The Los Alamos National Laboratory x-ray safety program does not provide the level of protection required by DOE 5480.11 for potentially high levels of radiation.

RP.5 EXTERNAL RADIATION DOSIMETRY

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

- FINDINGS:**
- In many of the buildings where tritium operations are conducted, there are no external radiation areas as defined by DOE 5480.11. Even so, personnel in the tritium facilities are assigned external dosimeters which are processed on a monthly basis.
 - Annual doses in most cases for these personnel are less than 100 mrem.
 - Positive or negative errors can be introduced in the annual dose records when the dosimeters are used for control of dose rather than measurement for compliance. 
 - See Concern TSA-4, RP.5-X.
 - The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.5-1)
(H3/C2)

A documented basis has not been provided for choosing the processing frequency of or need for external dosimetry for personnel in the tritium facilities at Los Alamos National Laboratory.

FINDINGS:

- Personnel Nuclear Accident Dosimeters are assigned to personnel entering TA-18 as required by DOE 5480.11.
- The International Atomic Energy Agency Safety Series Bulletin No. 152 suggests the need for developing a quick-sort method to be applied in the event of a criticality incident to quickly identify persons who are exposed.
- One quick-sort method involves the direct survey of Personnel Nuclear Accident Dosimeters.
- Radiation protection technicians have not been trained to survey Personnel Nuclear Accident Dosimeters after a suspected criticality incident to separate highly exposed personnel.
- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.5-2)
(H2/C2)

A method to use Personnel Nuclear Accident Dosimeters for quickly identifying personnel who are exposed has not been developed at the Los Alamos National Laboratory.

RP.6 INTERNAL RADIATION EXPOSURE CONTROL PROGRAM

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

- FINDINGS:**
- The engineered controls for airborne tritium contamination ranged from superior in a new facility (e.g., the WET Facility) to marginal in some old facilities.
 - Vacuum systems and pumps are not contained in enclosures (e.g., hoods and gloveboxes); thus, personnel can come into direct contact with tritium-contaminated oil and airborne contamination.
 - Not all hoods or gloveboxes are posted correctly as to airflow conditions and restrictions.
 - With the exception of the WET Facility, documented studies of airflow in the workplace were not available to identify the airflow patterns and problem areas.
 - See Concern TSA-2, AX.5-2.
 - The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.6-1)
(H2/C2)

Los Alamos National Laboratory cannot demonstrate that engineering controls in tritium facilities will minimize internal tritium exposure.



- FINDINGS:**
- Airflow studies have not been performed and documented to demonstrate proper location and number of air monitors for tritium as suggested by DOE 5480.11, except at the WET Facility.
 - Tritium air monitors do not have a uniform alarm setpoint, and no written justification was available for the alarm setpoints that were chosen.
 - No air samples are collected to quantify the levels of airborne tritium contamination in the workplace. At the WET Facility, a portable bubbler sampler is available for special work.
 - It takes from 2 to 5 weeks to obtain the results of analyses of tritium smears rather than overnight. The number of smears for tritium contamination has increased by approximately 75 percent over the past 3 years. There is a current backlog of approximately 3000 samples.
 - Routine tritium bioassay samples scheduled by the field may remain in the field for several weeks rather than being turned in immediately after they are provided.

- Even if the tritium bioassay samples⁸⁹ are returned on schedule, the results may be delayed for 2 to 5 weeks.
- The need for additional resources (staff and equipment) to cope with the backlog has been identified by the Health and Safety Division but has not received management approval.
- See Concerns TSA-2, RP.7-1, and TSA-2, RP.7-2.
- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.6-2)
(H2/C1)

The internal contamination control program at Los Alamos National Laboratory relies primarily on administrative controls to maintain tritium exposures as low as reasonably achievable instead of obtaining quantitative data from airborne, surface, and bioassay samples results.

FINDINGS:

- At the building housing the Ion Beam Facility, a vacuum system was dismantled without the presence of a radiation protection technician or the issuance of a radiation work permit.
- The vacuum system was left open to the air with only aluminum foil covering the open pipes. The power to the vacuum pump was not locked out to prevent inadvertent activation.
- No special air or surface contamination sampling was performed during the work. 
- Levels of surface contamination equal to greater than 10^5 D/M/100 cm^2 were detected during a followup survey after S&H Subteam 2 identified the problem.
- The area surrounding the vacuum pump was a controlled area leaving no place to establish control to prevent the spread of contamination.
- The area occupied by the vacuum pump was not properly posted as a contamination area which contained high levels of contamination. In addition, there were no barricade, warning sign, or step-off pad to effect control over the potential spread of contamination.
- A LANL employee was potentially exposed to substantial quantities of tritium contamination (i.e., oxide and organic bound) at the Ion Beam Facility. The facility does not provide proper controls and protection or require bioassay analyses for potentially exposed personnel. 
- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.6-3)
(HI/CI)
CAT. II



At Los Alamos National Laboratory, the contamination control program at the Ion Beam Facility does not provide necessary protection for radiation workers against internal tritium exposure as required by DOE 5480.11.

INTERNAL TRITIUM

RP.7 INTERNAL RADIATION DOSIMETRY

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

FINDINGS:

- DOE 5480.11 contains specific requirements for a bioassay program for all radiation workers who are likely to receive 100 mrem annual effective dose equivalent as a result of internal exposure:
- If proper decisions are to be made, applications of the above requirements to work situations and potential exposures requires the direct involvement of health physics personnel who are knowledgeable about internal dose evaluation.
- Because of constraints on the internal dosimetrists time and the large number of buildings where internal exposure is possible, the Internal Dosimetry Program has not been upgraded to meet the requirements at all facilities. 
- Some line managers are determining who should be placed on the bioassay program without direct input by the Health Physics Operations Group and the Health Physics Policy and Programs Group staff.
- Management at TA-33 Bldg. 86 decided that a spot tritium bioassay sample was to be collected from each individual who enters the building. Instructions were prepared by line management without the knowledge or involvement of LANL internal dosimetrists. 
- See Concern TSA-2, RP.6-2.
- The following concern was identified by LANL in their self-assessment.

CONCERN: (TSA-2) (RP-7-1) (H2/C1)

DOE 5480.11 requirements for tritium internal dosimetry are not uniformly applied throughout all buildings at Los Alamos National Laboratory and are not defined by internal dosimetrists in all cases.

FINDINGS:

- As a result of a Class C incident in at TA-41 Bldg. 4 (dated May 1990), one of the causes of the increased dose was a delay in processing bioassay samples and, therefore, a delay in treatment brought about by the level of exposure.
- A chain-of-custody program for bioassay samples was initiated as a result of the above incident.
- Appendix G of LANL AR 3-6, "Personnel Radiation Dosimetry," dated August 30, 1991, requires chain-of-custody control of bioassay samples. This requirement places the responsibility on operations management for

appointing a custodian and an alternate to conduct the program.

- The chain-of-custody requirement for bioassay samples involves staff signing for receipt of the sample container and the sample custodian signing when the sample is returned.
- Line management at some facilities has not accepted responsibility for conducting the chain-of-custody program. Consequently, the responsibility was placed on radiation protection technicians. In several instances, radiation protection technicians are not permanently located in the building where bioassay samples are to be left, making it difficult to conduct an effective program.

→ Radiation protection technicians were trained in the new chain-of-custody requirements; however, a few do not properly conduct the program. At TA-35 Bldg. 2, several overdue bioassay samples were found. Three of the samples were dated July 1991 (almost 4 months before they were found). Several others were dated September 16, 1991. Sample labels were not properly completed, and some samples were not sealed. The chain-of-custody program was not functioning properly.

- At TA-18, several bioassay samples were left beyond the 1-week pickup requirement.

CONCERN: See Concern TSA-4, RP.7-2.

- FINDINGS:**
- It is a common industry practice to pick up tritium bioassay samples the same day they are submitted and process them within 48 hours in order to conduct an effective contamination control program.
 - At LANL, tritium bioassay samples are picked up from field locations once a week (on Tuesdays). Normally these samples are processed on the following Friday, and the results are available the following week (1 to 2 weeks after the sample is submitted by the staff person).
 - Some studies indicate that varying amounts of tritium may be held up in the polyethylene container when timely (within a few hours) processing of samples does not occur. This retention process can be reversed if an extra step is introduced into the analytical procedure.

CONCERN: See Concern TSA-2, RP.6-2.

RP.8 FIXED AND PORTABLE INSTRUMENTATION

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

- FINDINGS:**
- ANSI N323 requires the type, acceptance, and performance testing of radiation protection instrumentation. Testing of instruments at a factor of two to 10 times the top range is required to determine whether the instrument will saturate (paralyze) and, thus, not respond at all.
 - ANSI N42, paragraphs 17a, b, and c, further defines testing criteria and procedures in support of ANSI N323.
 - The Health Physics Measurement Group has not established a comprehensive performance and acceptance program. Many of their instruments receive only limited testing of performance capabilities.
 - The Health Physics Measurement Group does not have the capability to calibrate and test instruments used to measure high dose equivalent rates (such as the Eberline RMS-II) which are used to detect a criticality event.
 - The Eberline RMS-II which is used as a criticality detector in some facilities (e.g., TA-55 Bldg. PF-4) may saturate (paralyze) if exposed to a high dose rate. These instruments were not tested using gamma dose of a sufficient level to determine whether equivalent rates could occur. If it does, the instrument might paralyze during a critical radiation event, even though the alarm setpoint is at the low end of the range.
 - See Concern TSA-2, RP.8-5.
 - The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.8-1)
(H1/C1)
CAT. II

Los Alamos National Laboratory does not have the capability to calibrate and test the Eberline RMS-II to determine whether instrument performance meets the requirements for a high-range instrument used for emergency warning and evacuation by workers.

- FINDINGS:**
- The Health Physics Measurement Group does not use available resources to calibrate and test portable instruments used to measure high dose equivalent rates.
 - A teletector similar to the one used at LANL has exhibited problems with saturation (paralyzing) which can result in a downscale (or zero) reading. A serious overexposure occurred in a U.S. nuclear facility as a result of this problem.

- See the findings for Concern TSA-2, RP.8-1.
- The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.8-2)
(HI/C1)

Los Alamos National Laboratory does not use available resources to calibrate and test portable high dose equivalent rate instruments to determine proper instrument performance as required by ANSI N323.

FINDINGS:

- As a result of findings from the TA-55 TSA in 1987, LANL established an inventory system for use in identifying and retrieving overdue instruments. The Health Physics Measurement Group procedures require that radiation protection instruments be returned at a set frequency for maintenance and recalibration.



At one LANL facility, approximately 100 radiation detection instruments have been identified as being overdue for 1 to 2 years. Reasons for the delay included (1) too few instruments to make the exchange, (2) too much time to get instruments recalibrated, and (3) a preference for field calibration.

- The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.8-3)
(H2/C1)

Radiation protection instruments at Los Alamos National Laboratory are not being returned for calibration and maintenance as required by ANSI N323 and Health Physics Measurements Group procedures.

FINDINGS:

- LANL AR 3-1, "Radiation Protection Program," dated August 30, 1991, requires the review and approval of the purchase of all instruments used for radiation protection purposes.
- Chirpers (electronic dosimeters) were purchased by operations management at one site for use by visitors entering the facility. These devices were not purchased through, calibrated by, or tested at the calibration facility.



Tritium room air monitors were purchased at TA-41 Bldg. 4 by operations personnel without support from calibrations staff or calibration and testing at the calibration facility.

- Against the advice of calibrations personnel, a portable passive hand-held tritium survey instrument was purchased by operations. It was not calibrated and tested by calibrations personnel. Operations did not mark it "use for test and evaluation purpose only."

- One tritium room air monitor was installed without an air sample pump.
- One new stack air monitor was equipped with a moisture trap by operations without contacting the Health Physics Measurement Group. This omission made the calibration invalid.
- The following concern was partially identified in the LANL self-assessment.

DNCERN:
TSA-2)
RP.8-4)
H2/C1)

Operations management purchases radiation protection instruments without review, approval, testing, and calibration by the Health Physics Measurements Group as required by Los Alamos National Laboratory AR 3-1.

INDINGS:

- ANSI N323 requires the use of check sources that can be referenced to the instrument calibration for periodic checks. Some check sources cannot be referenced to the calibration.
- Results of periodic (i.e., daily, weekly, etc.) instrument checks are to be recorded to demonstrate continued proper operation. Instrument response checks are not performed uniformly at all buildings.
- Some check sources will drive an instrument off scale when they should be checking the alarm setpoint on an instrument used for qualification rather than quantification.
- Some instruments (e.g., tritium air monitors and high-range gamma detectors) are "calibrated" in the field under less than ideal conditions. The "calibration" is not always performed under fixed geometric conditions. Not all scales can be calibrated. A quality control program has not been established to demonstrate the continued quality of calibration under nonideal conditions.
- Maintenance is performed in the field for some instruments such as the Eberline RMS-II used for criticality detection. The maintenance program is not the same as the one conducted in the Health Physics Measurement Group. ~~Records of maintenance as required by ANSI N323 are not generated and maintained by the Health Physics Measurement Group.~~ Testing of electronic rise time, a requirement of ANSI 8.3, is not routinely performed to ensure that electronic components have not deteriorated. This same test was not performed on the new Eberline RMS-IIs when they were received.
- Operational response checks of tritium monitors, including stack monitors, are not routinely performed as required by ANSI N323. (See Concern TSA-1, RP.8.)



- Source checks of portable health physics instruments used at accelerator facilities are not performed in accordance with the requirements of ANSI N323. (See Section 4.5.3.13.2, RP.8.)
- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.8-5)
(H2/C1)

Calibration, maintenance, and periodic source checks of fixed and portable radiation protection instruments at Los Alamos National Laboratory do not meet ANSI N323 requirements.

9 AIR MONITORING

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

DEFICIENCIES:

- ~~Except at the WET Facility, no air samples are collected from tritium facilities to quantify levels of airborne radioactive material contamination in the workplace, even though the potential exists to exceed 10 percent of the derived air concentration.~~
- Except at the WET Facility, the location selected for air monitors is not based on airflow studies.
- Not enough air monitors are available to cover all of the tritium areas. Some air monitors are not calibrated at the calibration facility, and some are not calibrated at all.
- LANL instrument response checks for room and stack air monitors do not provide a good indication of proper operation and are not referenced to the calibration in accordance with ANSI N323 requirements.
- The requirements for proper location of air samples and air monitors are described in ANSI N13.1.
- Written bases have not been provided for establishing the alarm setpoint, and setpoints vary from building to building.
- See Concern TSA-2, AX.2-1.
- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.9-1)
(H2/C1)

The Los Alamos National Laboratory air-sampling and monitoring program does not meet the requirements contained in DOE 5480.11, ANSI N13.1, and ANSI N323.

RP.10 RADIATION MONITORING/CONTAMINATION CONTROL

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

FINDINGS:

- No consistent radiation monitoring survey program that includes an established frequency and location for surveys is in evidence in the Health Physics Operations Group.



No training program has been established to ensure that routine dose rate and contamination surveys are conducted in a consistent manner.

- The Health Physics Measurements Group has not prepared a field manual for use by radiation protection technicians that explains proper use and interpretation of all radiation protection instruments.
- Facility air monitor alarm points used in accordance with the requirements of DOE 5480.11 to warn workers that airborne radioactive material contamination levels have exceeded an action level, are not always set at a uniform level. The setpoint may vary from monitor to monitor even in the same building.



CONCERN: See Concern TSA-4, RP.10-1.

- FINDINGS:**
- DOE 6430.1A, Section 1300-6.5.7, requires that, in addition to local alarms, radiation monitoring systems (criticality alarms and room and stack air monitors) "shall have central (i.e., control room or radiation monitoring office) readout and alarm panels that are assessable after a design basis accident (DBA) to evaluate internal conditions."
 - LANL has developed a systematic control, alarm, and monitoring (SCAM) system which meets the intent of DOE 6430.1A and is staffed 24 hours a day.
 - The decision to place critical building alarms on the SCAM system is left to operating management rather than being required. Radiation instrumentation alarms from two buildings (TA-2 and TA-35 Bldg. 213) are involved in the system.
 - Most room, stack, and return air monitors do not feed into a central location that can be occupied during an accident.
 - See Concern TSA-2, AX.8-1.

- The following concern was not identified in the LANL self-assessment.

CONCERN:
(TSA-2)
(RP.10-1)
(H2/C1)

Alarm signals from critical building radiation monitoring instrumentation at Los Alamos National Laboratory are not routed to a continuously staffed central location as required in DOE 6430.1A.

RP.12 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:

- ANSI N13.6 requires that all standard operating procedures, radiation work permits, and special work permits, involving the control of work with radiation or radioactive material be included in an occupational exposure record system.
- LANL standard operating procedures are not being routed to the Health Physics Policy and Programs Group for inclusion in occupational exposure records.

CONCERN:

See Concern TSA-1, RP.12-1.

4.5.3.14 Personnel Protection

4.5.3.14.1 Overview

This portion of the appraisal was performed using each of the six performance objectives in the Personnel Protection technical area. Concerns related to accelerator facilities at LANL were identified in each of the six performance objectives. The appraisal was performed by means of (1) interviews with professional health and safety staff, (2) interviews with facility supervisors and managers, (3) reviews of program documentation, and (4) walkthroughs of representative accelerator facilities. The performance of both LANL and DOE was evaluated. Findings and concerns in the Worker Safety technical area were also considered in preparing this portion of the report.

Performance in the area of personnel protection varies greatly at LANL. In a few cases, such as with hoisting and rigging activities within the Dynamics Testing Division, no deficiencies were observed. Overall, however, programs related to personnel protection are substantially deficient. Health and safety leadership on the part of LANL managers and oversight from DOE have been ineffective.

Health and safety issues at the Laboratory have traditionally been addressed from the bottom of the organizational chart instead of from the top. Although a highly qualified professional health and safety staff is in place, none of these individuals have the authority to cause a change in the program.

ES&H programs related to personnel protection, as described in the LANL ES&H Manual, frequently do not reflect the requirements of long-standing mandatory DOE requirements. For example, the administrative requirement for eye protection does not state that the use of safety eyewear with side protectors is mandatory for shop operations such as grinding. Within this portion of the appraisal, programmatic-related deficiencies were identified--including those for confined spaces, safety eyewear, lasers, steady-state magnetic fields, and ventilation--that had not been established to meet mandatory requirements.

Historically, there has been no oversight to ensure that LANL activities related to nonnuclear facilities are in compliance with either the existing ES&H Manual or with mandatory DOE requirements. Each division, and in many cases each group within a division, has been free to comply with these requirements to whatever extent the organization deemed appropriate. A mechanism is not even in place to require that all operations involving hazardous materials or operations be reviewed and approved by cognizant health and safety professionals.

Oversight of LANL activities by DOE has not been effective in ensuring that LANL is in compliance with the requirements of applicable DOE Orders. The system of appraisal management is cumbersome and insensitive to the need to proceed in a timely manner. In some cases, hazards persist for months while appraisal-related documentation is processed.

The LANL self-assessment reflects a lack of experience in managing health and safety issues. The LANL self-assessment fully documented only a fraction of the deficiencies identified during the preparation of this portion of the appraisal report. It was noted, however, that the professional health and safety personnel were aware of virtually all the deficiencies identified but, in some cases, have been unable to convince management that these issues should be addressed in the LANL self-assessment report.

PP.2 PROCEDURES AND DOCUMENTATION

PERFORMANCE OBJECTIVE: Procedures and documentation should provide appropriate direction, record generation, and support for the personnel protection program.

- FINDINGS:**
- The Confined Space Entry Program at LANL does not incorporate all requirements of ANSI Z117.1-1989. Omitted requirements include controls for physical or mechanical hazards, use of double block and bleed, and lockout/tagout requirements.
 - No chemical hygiene plan has been published or implemented for LANL accelerator facilities as required by 29 CFR 1910.1450.
 - Contrary to 29 CFR 1910, Subpart Z, LANL policy currently does not address the application of cosmetics in workplaces where materials are present.
 - Procedures applicable to LANL accelerator facilities have not been developed to ensure proper response to low oxygen level alarms.
 - No program or procedures applicable to LANL accelerator facilities have been developed to ensure that flammable liquids, gases, and vapors will be used only in laboratory hoods that meet the requirements of 29 CFR 1910.307.
 - A program has not been established to ensure that exhaust hoods used for welding in LANL accelerator facilities comply with 29 CFR 1910.252.
 - The LANL Laser Program and its standard operating procedures applicable to accelerator facilities do not address all requirements of ANSI Z136.1-1986. For example, standard operating procedures related to lasers do not require approval by the Laser Safety Officer.
 - A nonionizing radiation program applicable to LANL accelerator facilities is not in place to address the requirements of ANSI C95.1-1982 for radio frequency hazards.
 - Although several sources of static magnetic fields were identified in LANL accelerator facilities, a program has not been established to implement the requirements of the American Conference of Governmental Industrial Hygienists as set forth in, "Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices," dated 1990-1991, with respect to static magnetic fields.

PP.5 PERSONNEL COMMUNICATION PROGRAM

PERFORMANCE OBJECTIVE: Site/facility personnel should be adequately informed of chemical, physical, and biological stresses that may be encountered in their work environment. Written programs, of sufficient quality to comply with all Department of Energy prescribed occupational safety and health standards, should be available.

- FINDINGS:**
- LANL does not have documents for a laboratory safety program or a chemical hygiene plan as required by 29 CFR 1910.1450.
 - Laboratories observed in accelerator facilities were operating without laboratory-specific safe operating procedure as required by 29 CFR 1910.1450.
 - An interview was conducted with a LANL employee whose job required that he periodically cut and weld stainless steel. This employee was unaware that the chromium and nickel compounds emitted during welding were potentially carcinogenic.
 - Unlabeled process piping was observed in several LANL accelerator facilities.
 - Accelerator facility personnel were unable to locate material safety data sheets for selected chemicals found in the workplace.
 - LANL does not have a uniform policy regarding the labeling of secondary containers. LANL policy currently permits the use of several labeling systems.

CONCERN: See Concern TSA-4, WS.3-1.

FINDINGS:

- The LANL ventilation system data base does not include information related to whether ventilation systems are rated for the use of flammables:
- Exhaust systems in LANL accelerator facilities do not have signs or labels indicating whether they are approved for use with flammable liquids, vapors, and gases.
- A cleaning operation was observed in TA-53 Bldg. MPF-2 wherein open trays of flammable liquids (acetone and alcohol) were being used with an exhaust system that was not electrically rated for flammable vapors.
- The following concern was partially identified in the LANL self-assessment.

CONCERN:
(TSA-3)
(PP.6-3)
(HI/CI)

Flammable liquids at Los Alamos National Laboratory are being used with ventilation systems that are not properly rated for flammable vapors as required by 29 CFR 1910.307.

FINDINGS:

- Welding, cutting, and brazing were conducted in LANL accelerator facilities using exhaust systems that have not been quantitatively tested.
- A ventilation program has not been developed to require that ventilation systems for welding exhaust to have a minimum of 100 feet per minute of linear flow, as required by 29 CFR 1910.252, or that welding be performed within that envelope.
- The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-3)
(PP.6-4)
(HI/CI)

Los Alamos National Laboratory does not have a ventilation program that implements the requirements of 29 CFR 1910.252

FINDINGS:

- LANL has not documented radio frequency emissions for the portable linear accelerator.
- LANL has not conducted radio frequency surveys of the PHERMEX facility.
- LANL has not conducted radio frequency surveys of the Rework Laboratory in TA-53 Bldg. MPF-19.
- LANL has not prepared an administrative requirement or otherwise established a program to implement the requirements of ANSI C95.1-1982.
- The following concern was partially identified in the LANL self-assessment.

Table WS-3

Technical Area Inspections and Noncompliance Information

Location	Number of Noncompliances			
	Serious	Other-Than-Serious	Willful	Imminent Danger
TA-11	0	2	0	0
TA-15	11	3	0	0
TA-16	5	0	0	0
TA-18	5	0	0	0
TA-3	47	1	0	0
TA-35	3	0	0	0
TA-36	3	0	0	0
TA-46	6	0	0	0
TA-53	53	7	0	0
TA-8	<u>2</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL	135	13	0	0
Percentage	91.22	8.78	0	0

Total Noncompliance 148

Compressed gas cylinder systems were found that have been locally constructed, have not been identified or inspected, or are missing pressure relief devices. There is no program in place to ensure that these systems, operating in a research environment, conform to industry standards and are appropriately certified. The confined space entry program is inconsistent. The monitoring program for entry does not contain enough checks to ensure that the spaces are safe to enter. Oxygen monitors in place are not calibrated on a regular basis or according to the manufacturer's recommendations. Personnel protective equipment is not readily available and is not always located in areas where routinely required. The requirements for such equipment are not uniformly defined or made mandatory in work areas where serious injuries could occur.

Training related to safety and health issues in the workplace has not been provided to all managers and personnel responsible for complying with these mandated regulations. When training has been provided, it has not been of sufficient depth or quality to ensure that DOE objectives for workers safety and health are achieved.

The LANL self-assessment found the Laboratory was not in compliance with eight complete subparts and four mandated programs of the OSHA standards. The findings in the LANL self-assessment are written so broadly that it will be very difficult to develop a plan of action to abate the deficiencies identified throughout these areas.

CONCERN:
(TSA-4)
(PP.4-1)
(H2/C1)

A program to perform health and safety surveillance, oversight, and appraisals has not been implemented at Los Alamos National Laboratory as required by DOE 5480.10 and DOE 5482.1B.

* CONCERN:
(TSA-4)
(PP.4-2)
(H1/C1)

At the Los Alamos National Laboratory, effective programs are not in place to identify, evaluate, monitor, and control credible chemical, physical, and safety hazards as required by DOE 5480.10, DOE 5480.4 and Occupational Safety and Health Administrations regulations.

CONCERN:

See Concern TSA-4, WS.3-1.

CONCERN:

See Concern TSA-4, TC.1.1.

* CONCERN:
(TSA-4)
(PP.6-1)
(H1/C1)
CAT. II

Los Alamos National Laboratory exercises little, if any, management or technical oversight and control of asbestos abatement activities, and abatement actions are not conducted in compliance with 29 CFR 1926.58 and Environmental Protection Agency "Guidance for Controlling Asbestos Containing Materials in Buildings."

CONCERN:
(TSA-4)
(PP.6-2)
(H1/C1)

Los Alamos National Laboratory has not developed and implemented an effective carcinogen program as required by DOE 5480.10 and 29 CFR 1910.1200 and does not consistently enforce its own procedure.

CONCERN:
(TSA-4)
(PP.6-3)
(H1/C1)
CAT. II

Laser operations are not in compliance with Los Alamos National Laboratory AR 5-2, ANSI Z136.1-1986, and DOE 5480.4.

CONCERN:
(TSA-4)
(PP.6-4)
(H1/C1)
CAT. II

Los Alamos National Laboratory confined space entry is not controlled by a qualified person and procedures do not conform to ANSI Z117.1-1989 which is mandated by DOE 5480.4 and Draft 29 CFR 1910.146.

CONCERN:
(TSA-4)
(PP.6-5)
(H1/C1)

At the Los Alamos National Laboratory, chemical handling and storage does not comply with requirements of Occupational Safety and Health Administration regulations mandated by DOE 5480.4, such as 29 CFR 1910.1200 and 29 CFR 1910, subpart H.

4.5.4.15 Worker Safety and Health (OSHA) Compliance

CONCERN:

See Concern TSA-4, PP.6-4.

CONCERN:
(TSA-4)
(WS.3-1)
(HI/CI)

Los Alamos National Laboratory, does not fully comply with the requirements of 29 CFR 1910.1200, Hazard Communications and 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories.

CONCERN:
(TSA-4)
(WS.3-2)
(HI/CI)

At the Los Alamos National Laboratory, emergency eyewash and shower facilities are not always available or readily accessible as specified in 29 CFR 1910, Subpart K, Medical and First Aid.

CONCERN:
(TSA-4)
(WS.4-1)
(HI/CI)

At the Los Alamos National Laboratory, danger, warning, and safety information signs are not consistently posted as required by 29 CFR 1910, and 29 CFR 1926.

CONCERN:
(TSA-4)
(WS.4-2)
(HI/CI)
CAT. II

At the Los Alamos National Laboratory, machine guarding does not meet the requirements of 29 CFR 1910, Subpart O, Machinery and Machine Guarding.

CONCERN:

See Concern TSA-4, FP.2-1.

CONCERN:
(TSA-4)
(WS.4-3)
(HI/CI)
CAT. II

Los Alamos National Laboratories does not comply with 29 CFR 1910, Subpart S, Electrical, in that electrical hazards present shock or electrocution hazards.

CONCERN:
(TSA-4)
(WS.5-1)
(HI/CI)
CAT. I

Excavation work at the Los Alamos National Laboratory is not conducted in accordance with 29 CFR 1926, Subpart P, Excavations, and Subpart C, General Safety and Health Provisions.

CONCERN:
(TSA-4)
(WS.5-2)
(HI/CI)
CAT. II

Los Alamos National Laboratory has not developed, implemented, and enforced a comprehensive safety oversight program to ensure that construction subcontractors comply with all applicable sections of 29 CFR 1926.

4.5.4.16 Fire Protection

CONCERN:
(TSA-4)
(FP.1-1)
(H2/CI)

The Los Alamos National Laboratory Fire Protection Program and organization is not well defined and does not achieve compliance with DOE 5480.7.

CONCERN:
(TSA-4)
(FP.1-2)
(H2/CI)

The Albuquerque Field Office is not performing fire protection appraisals of Los Alamos National Laboratory in a manner which will assure compliance with DOE 5480.7.

RECT'S

TA-3

-15

-21

-35

-43

-48

-54

REFS, ETC:

TA-3, 15, 21,
35, 43, 48, 54

4.5.4.13 Radiological Protection

4.5.4.13.1 Overview

Appraisal of the radiological protection programs and activities at LANL by S&H Subteam 4 addressed all 12 performance objectives in the Radiological Protection technical area; however, concerns were only identified under seven performance objectives. The appraisal was conducted by interviewing management and staff of the Health and Safety Division, interviewing other division managers and personnel, and by reviewing documents relevant to radiological protection activities at LANL. The appraisal also involved tours and inspections of various technical areas, facilities, buildings, equipment, and operations.

The primary technical areas and facilities visited by S&H Subteam 4 included the TA-3 Sigma Complex, Bldgs. SM-130, 39, 102, and the Chemistry and Metallurgical Research Building; the PHERMEX site in TA-15; the TA-21 Laboratories and DP-West facilities; TA-35 Bldg. 2; the Health Research Laboratory and In Vivo Counting Facility in TA-43; TA-48 Bldg. 1 Radiochemistry; the TA-54 areas G and L low-level waste management sites; and the offsite laundry facility used by the Laboratory.

Laboratory operations, processes, weapons research and development, and associated experiments involve a wide variety of radiation sources and radioactive materials. Radioactive materials include tritium, enriched and depleted uranium, plutonium, americium, technetium, and a variety of other natural and manmade radionuclides. Nuclear reactors at the site generate both fission and activation products. High-dose-rate cobalt and cesium sources and linear accelerators are used in the study of radiation effects, while other radiation-generating devices are used for and in a variety of experiments (most of which were reviewed by S&H Subteams 1, 2, and 3).

The primary responsibility for radiological protection at LANL is assigned to line managers, who develop individual radiation protection programs for their own organization or facilities. Administrative requirements of ES&H Manual, Section 3, describes the scope of the radiological protection program at LANL.

Technical support for the various LANL divisions for radiological protection is provided by the Health and Safety Division. Technical groups in this division having radiation protection responsibilities include the Health Physics Operations Group, the Health Physics Measurements Group, the Nuclear Criticality Safety Group, and the Health Physics Policy and Programs Group. Field health physics activities such as radiation monitoring, surveying, and contamination control are performed by radiation protection technicians under the management of the Health Physics Operations Group. Radiological laboratory measurements, calibrations, and in vivo counting are functions of the Health Physics Measurements Group, and external and internal dose assessment are performed in the Health Physics Policy and Programs Group.

Several characteristics of the radiological protection program at LANL were evident from the appraisal. Radiological protection programs vary considerably from group-to-group and division-to-division within the Laboratory, even though the requirements and conditions are similar. There are many reasons for these inconsistencies, including (1) lack of adequate

review by Health and Safety Division professionals, (2) the lack of rigor and formality in the administrative requirements, (3) the reassignment of safety personnel and technicians away from the Health and Safety Division into the research and development divisions, and (4) the lack of oversight by Laboratory managers from all divisions.

The quality of the radiation protection programs at LANL also varies. Many of the elements of the good programs could easily be transferred to weaker programs. Examples include training and retraining programs (especially for radiological protection technicians), procedures, record keeping systems, routine survey programs, and others. It is not a question of not wanting to share information and ideas throughout the Laboratory, but rather, lack of effective promotion of excellence in ES&H program elements by line management.

There is evidence of need for better management of personnel resources within the Health and Safety Division. The distribution of work appears to be skewed, with the Health Physics Operation Groups having the larger share, particularly in day-to-day operations. The interactions required to maintain an excellent program will increase as the Laboratory program mix changes from a few large programs to many smaller research and development programs.

Line managers have not uniformly provided the information needed to determine which personnel should be included in the various radiation protection programs, including extremity dosimetry and radiobioassay. Many have not met their responsibility for the timely collection and processing of radiation dosimeters and bioassay samples.

The decommissioning and decontamination of aging plutonium and uranium facilities will require particular emphasis on quality radiation protection. At the same time, efforts to minimize the generation of radioactive waste, as required by DOE Orders, will necessitate a greater commitment from management and staff. This current commitment is not satisfactory, perhaps due to lack of incentive.

Comments were made to S&H Subteam members that responses to requests from research and development divisions for various radiological protection services have been less than satisfactory. Radiological protection services will deteriorate in the future unless current structures, staffing levels, authorities and responsibilities, and other priorities improve within the Health and Safety Division. The Division is hindered in conducting its programs and supplying technical support as a result of lack of facilities, equipment, and other resources. An example is the difficulty experienced by the Health Physics Measurements Group in obtaining a germanium detector array for lung measurements on personnel working with plutonium.

Most of the concerns were previously identified or were partially identified in the LANL self-assessment. However, the root causes for these concerns are not, in every case, similar. The S&H subteam identified several findings and concerns having a common root cause associated with the lack of oversight by Health and Safety Division line managers, review of standard operating procedures and special work permits, and review of radiation protection plans by Health and Safety Division personnel. Program deficiencies also resulted from the lack of "striving for excellence" in health and safety practices and operations by LANL line managers and staff.

4.5.4.13.2 Findings and Concerns

RP.1 ORGANIZATION AND ADMINISTRATION

PERFORMANCE OBJECTIVE: Site/facility organization and administration should ensure effective implementation and control of radiological protection activities.

- FINDINGS:**
- Health and safety audits are conducted by the Laboratory Assessment Office. They are not comprehensive throughout the Laboratory and do not have oversight by or participation from the Health and Safety Division.
 - Neither a formalized audit nor an inspection program is conducted by Health and Safety Division specialists.
 - Oversight of radiological protection activities is dependent on the priorities of the individual division or group manager, and consistency of oversight is not a general Laboratory requirement.
 - Many open items remain on auditable inspections and reports performed by various organizations in the past.
 - Appraisals of accelerator facilities have not been conducted as required by DOE 5482.1B and DOE 5480.11. (See Section 4.5.3.13.2, RP.2.)
 - See Concerns TSA-4, PP.1-3, and TSA-4, PP.3-1.
 - The following concern was identified in the LANL self-assessment.

CONCERN:
(TSA-4)
(RP.1.1)
(H2/C1)

At the Los Alamos National Laboratory, scheduled inspections and audits are not conducted by health and safety specialists as required by DOE 5480.11 and DOE 5482.1B; the closure of open items from previous audits has not been completed.

- FINDINGS:**
- There is a lack of review or approval by the Health and Safety Division of standard operating procedures, radiation work permits, and division ES&H plans and programs throughout the Laboratory.
 - The review by Health and Safety Division of ES&H standard operating procedures, radiation work permits, and DOE 5480.11 implementation plans occurs only upon the request of the originators of those documents. There is no assurance that the required reviews are accomplished.
 - See Concern TSA-4, OP.2-4.

CONCERN: See Concern TSA-1, RP.3-1.

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:

- There are no documented procedures or administrative requirements for evaluating personnel exposures from unusual internal exposures to radioactive materials as a consequence of an accident or incident.
- LANL ES&H policies and procedures do not describe the action to be taken by Health Physics Policy and Programs Group in conjunction with the Occupational Medicine Group following a major exposure to radiation. Policies and procedures do not include methods for work restrictions, decontamination, chelation therapy, and followup dose assessment.
- The following concern was identified by the LANL self-assessment.

CONCERN:
(TSA-4)
(RP.2-1)
(H2/C2)

Los Alamos National Laboratory does not have documented procedures for evaluating and managing worker exposures to radioactive materials, as required by DOE 5480.4 and National Council on Radiation Protection and Measurements Report Number 65.

FINDINGS:

- The Laboratory Assessment Office is responsible for analysis and trending of occurrence reports. There are no procedures and methods for performing this function.
- AR 1-1, "Accident/Incident Reporting," April 1988, incorrectly describes the current organization for occurrence reporting.
- AR 1-1 provides a description of events that require reporting, but its criteria for reportable radiation occurrences are not consistent with those required in DOE 5000.3A.
- Personnel have not been trained in use of the new reporting system.
- The management system developed by LANL to meet the reporting criteria in DOE 5000.3A does not lead to correct reporting decisions and followup actions. (See Section 4.5.2.13.2, RP.1.)
- See Concerns TSA-4, EA.4-2, and TSA-4, OP.2-2.
- AR 1-1 requires that the Health Physics Operations Group be notified of each radiation incident and that they document these incidents in a Radiation Occurrence Report. However, the Radiation Occurrence Report system is not defined in a formal program. The system does not