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Supplement to Safety Analysis Report - 306-W Building

Operations Safety Requirements

C. R. Richey

August 1979

Prepared for the U.S. Department of Energy
under Contract EY-76-C-06-1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute

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SUPPLEMENT TO SAFETY ANALYSIS REPORT - 306-W BUILDING

OPERATIONS SAFETY REQUIREMENTS

C. R. Richey

August 1979

Prepared for the U.S. Department of Energy
under Contract EY-76-C-06-1830

Pacific Northwest Laboratory
Richland, Washington 99352

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OPERATIONS SAFETY REQUIREMENTS FOR 306-W BUILDING

INTRODUCTION

The operations safety requirements (OSRs) presented in this report define the conditions, safe boundaries and management control needed for safely conducting operations with radioactive materials in the PNL 306-W building. Technical bases for the operations safety requirements were developed and discussed in Safety Analysis Report 306-W Building (SAR).[1]

The safety requirements are organized in five sections:

1. Safety Limits are safety-related process variables that are observable and measurable.
2. Limiting Conditions cover: a) equipment and b) technical conditions and characteristics of the facility and operations necessary for continued safe operation.
3. Surveillance Requirements prescribe the requirements for checking systems and components that are essential to safety.
4. Equipment Design Controls require that changes to process equipment and systems be independently checked and approved to assure that the changes will have no adverse effect on safety.
5. Administrative Controls describe and discuss the organization and administrative systems and procedures to be used for safe operation of the facility.

Details of the implementation of the operations safety requirements are prescribed by internal PNL documents such as criticality safety specifications and radiation work procedures.

Any change in operations or equipment that introduces an unreviewed safety question or that significantly increases the probability or consequences of an accident discussed in the SAR shall require an addendum to the SAR. A corresponding addendum and/or modification to the OSRs shall also be required.

1.0 SAFETY LIMITS

Safety limits that apply to radioactive materials, criticality safety, effluents, and uranium melting are described below.

1.1 RADIOACTIVE MATERIALS

Applicability

This requirement applies to the radioactive material that may be processed in the 306-W building.

Objective

The objective of this requirement is to preclude any receipt, storage and processing of radioactive material that could reduce the safety margin from that described in the safety analysis report.

Requirements

1.1.1 Radioactive materials processed shall be unirradiated uranium, thorium, or other materials equivalent in radiological hazard to unirradiated uranium and thorium.

1.1.2 Operations involving plutonium are prohibited unless the plutonium is in the form of sealed sources. Plutonium sources are limited to 230 g plutonium per source.

1.1.3 Fissionable material in the SNM storage area will be in sealed metal containers, except that uncontained solid metal pieces may be stored in the low-enriched racks or in the natural and depleted uranium storage cage.

1.1.4 Fissionable material in the specialty shop is limited to uranium-bearing material in the form of ingots, bars, pellets, and other similar solid pieces.

Corrective Action

If radioactive material delivered to the 306-W building does not meet requirements 1.1.1 and 1.1.2, it shall be returned to the shipper. Material delivered to either the SNM storage area or the Specialty Shop shall be

returned to the supplier if it does not meet requirements 1.1.3 and 1.1.4, respectively. If returning material to a shipper or supplier constitutes a safety hazard, movement of the material shall be halted and the situation shall be reported to appropriate Occupational and Environmental Protection (O&EP) personnel. If the situation constitutes an "abnormal occurence," administrative action defined by Section 5.6 (a), (b), (c) shall be taken.

Basis

The safety analyses presented in the SAR were based upon processing unirradiated enriched uranium. Therefore, material equivalent in radiological hazards to unirradiated uranium is no greater risk than the material described in hypothetical accidents in the SAR.

The 306-W building does not meet the "Criteria for Plutonium Processing Facilities" or the "Criteria for Plutonium Storage Facility." Therefore, to preclude an accidental release of plutonium, any plutonium material in the facility is restricted to a form at least equivalent to double-metal encapsulation. A 230-g limit on a plutonium source is well within the two-contingency policy for criticality safety.

Low-enriched (<5.1 wt% ^{235}U) uranium in solid form causes minimal radiological risk to the public or building occupants. A criticality (analysis presented in the SAR) is the most likely scenario for a release of radioactive material and is precluded by the geometry of the low-enrichment storage racks. Natural and depleted uranium do not present a criticality hazard.

Machining operations in the Specialty Shop on solid pieces of uranium-bearing materials have a low release potential. However, the ventilation system and equipment in the Specialty Shop were not designed for work with other forms, such as powders.

1.2 CRITICALITY SAFETY

Applicability

This requirement applies to the criticality safety of receiving, storing and processing fissionable materials.

Objective

The objective is to provide criteria for assuring criticality safety in receiving, storing and processing fissionable materials.

Requirements

1.2.1 PNL-approved criticality safety specifications shall be provided for receiving, storing and processing fissionable materials. These specifications shall be based on technical analyses that demonstrate compliance with the two-contingency policy and incorporate the following:

1.2.1.1 Fissionable material batch sizes based solely upon mass control shall be limited to 45% of a critical mass.

1.2.1.2 Operations with fissionable material based solely upon physically restricting geometry are limited to:

- 75% of the critical volume
- 85% of the critical slab thickness
- 85% of the critical cylinder diameter

assuming optimum moderation and full water reflection.

1.2.1.3 For operations with fissionable material during which moderator control provides one contingency for criticality safety, the second contingency may be provided by either limiting batch sizes of fissionable material to 90% of a minimum critical mass or restricting materials to a geometry that assures subcriticality.

1.2.1.4 The K_{eff} of fixed storage arrays not meeting the requirements of 1.2.1.1 or 1.2.1.2 shall not exceed 0.95 with each storage position loaded to the specified limit, optimum interspersed moderation, and full water reflection. No single loading error in a storage position shall result in a criticality; i.e., $K_{eff} \geq 1.0$.

1.2.1.5 Spacing between batches of fissionable material, process or other vessels containing fissionable materials, and fissionable material being transported past other fissionable material shall be established by technical analysis. The technical analysis shall demonstrate that no single spacing violation could result in criticality. Fissionable material not separated by specified safe spacing shall be considered as part of the same batch.

Corrective Action

If a criticality safety specification limit is violated, operations shall be halted immediately as prescribed in PNL-MA-25, Criticality Safety , Section 10.

Basis

The two-contingency policy requires that at least two unlikely, independent and concurrent events must occur before criticality is possible.

Requirements of the two-contingency policy can be met by any of the following methods:

- limiting batch sizes to 45% of a critical mass so that accidental double batching cannot result in criticality
- physically restricting vessels to 75% of the minimum critical volume, 85% of the minimum critical diameter, or 85% of the minimum critical slab thickness so that criticality cannot be achieved under credible conditions.
- providing moderator control for criticality safety when the loss of that control alone cannot cause criticality
- providing a fixed storage array having $K_{eff} < 0.95$ with each storage position loaded to a specified limit, optimum interspersed moderation, and full water reflection, and providing an adequate safety margin to prevent accidental criticality so that no single loading error could result in a criticality
- requiring that no single violation of a spacing limit could result in a criticality.

1.3 EFFLUENTS

Applicability

This requirement applies to the gaseous and aqueous effluent releases from the 306-W building.

Objective

The objective is to define criteria for effluent releases from the 306-W facility that adequately protect onsite personnel, the public, and the environment from undue exposure to radioactive materials.

Requirements

1.3.1 Gaseous effluents from the 306-W building shall have an average radioactive release concentration within Table II values in DOE (ERDA) Manual Chapter 0524.[a]

1.3.2 Aqueous effluents discharged to the process sewer shall be in compliance with limits specified in DOE (ERDA) Manual Chapter 0524 Appendix, Annex A, Table II.

Corrective Action

If gaseous effluents or aqueous discharges exceed limits specified in 1.3.1 and 1.3.2, respectively, such releases shall be investigated immediately. This situation is an "abnormal occurrence" requiring reporting and recovery actions specified by Section 5.6 (a), (b), (c).

Basis

Compliance of gaseous and aqueous effluents with DOE (ERDA) Manual Chapter requirements provides adequate protection for onsite personnel located outside the 306-W building, the public, and the environment.

(a) Will be replaced by DOE 5400, Chapter XI when issued.

1.4 URANIUM MELTING

Applicability

This requirement applies to uranium melting operations performed in vacuum or inert gas chambers.

Objective

The objective is to prevent an explosive reaction between water and uranium in melting operations.

Requirement

1.4.1 Hydrogenous materials shall be excluded from uranium (implies thorium also) to be melted in a vacuum or inert gas furnace.

Corrective Action

At any time a water leak is detected, the cooling water supply shall be turned off. If the leak occurs during melting, the heating power shall also be turned off.

Basis

A water leak during uranium melting could result in a reaction between water and uranium, which could result in water flashing to steam and in the evolution of hydrogen. A breach of the melting chamber could permit hydrogen to enter the working area, which could result in an explosive mixture.

Uranium melting is performed with an operator present at all times, from the time the power is turned on to solidification of the ingot. Surveillance requirement 3.4.1 requires continuous operator surveillance during the melting operation. If a water leak occurred after the melting power was turned on, it would be detected because of a rise in furnace pressure or by the operator's direct observation of the molten metal. The operator can turn off the furnace power and cooling water in less than 5 seconds.

2.0 LIMITING CONDITIONS

Limiting conditions are discussed below for ventilation systems, effluent samplers and air monitors, aqueous effluent retention, process equipment safety features, and emergency alarms and lighting.

2.1 VENTILATION SYSTEMS

Applicability

These conditions apply to the ventilation system for the 306-W building.

Objective

The objective is to define the operating conditions for the 306-W ventilation system that provide adequate control of airborne contamination and to assure that gaseous effluents from the building are well within DOE requirements.

Requirements

2.1.1 The gaseous effluent exhaust system for the main high-bay R&D work areas shall include one stage of HEPA filtration. The exhaust system for the Nuclear Fuels Laboratory (Ceramics Laboratory, including the Thorium Oxide Fuel Development processes) shall include two stages of HEPA filtration.

2.1.2 The north high-bay area (Nuclear Fuels Laboratory) shall be maintained at a negative differential pressure to atmospheric pressure of at least -0.05 in. of water.

2.1.3 In hoods in which radioactive powder is being processed, the inward flow of air shall be maintained at a minimum of 125 linear ft/min.

Corrective Action

Processing operations at work locations with radioactive materials shall be halted at any time requirements 2.1.1, 2.1.2, and 2.1.3 are not met. Access to the laboratory will be limited until the Nuclear Fuels Laboratory (NFL) has been surveyed by Radiation Monitoring.

Basis

The HEPA filtration requirements (2.1.1) assure that average radioactive release concentrations from normal operations in the 306-W building are within PNL's ALAP goal of 1% of Table II values in DOE (ERDA) Manual Chapter 0524.

A differential pressure of -0.05 inches of water in the north high-bay area, with reference to atmospheric pressure, provides adequate confinement of potential airborne radioactive contamination within the NFL. Also, the airflow in the 306-W building is such that a pressure of -0.05 inches of water in the NFL results in a negative pressure in the other high-bay areas and laboratories of the 306-W building. Processing operations with radioactive materials in powder form are conducted in hoods or gloveboxes and a minimum airflow of 125 linear ft/min provides adequate control for airborne contamination in the hoods.[a]

2.2 EFFLUENT SAMPLERS AND AIR MONITORS

Applicability

These requirements apply to the systems for sampling gaseous and aqueous effluents from the 306-W building and to air-monitoring requirements for work areas.

Objective

The objective is to define effluent sampling systems and air-monitoring systems that shall be operable to assure that the processing operations in the 306-W building can be conducted without undue risk to onsite personnel, the public, and the environment.

Requirements

2.2.1 The 306-W building gaseous effluent exhaust systems for the high-bay area, including the Nuclear Fuels Laboratory (Ceramics Fuel Laboratory), shall be sampled continuously except for maintenance periods.

(a) Radiological Design Criteria, BNWL-MA-3.

2.2.2 During releases of aqueous effluents from the Nuclear Fuels Laboratory to the process sewer, samplers located in the laboratory's two process sewers shall be operable.

2.2.3 A continuous air monitor shall be in operation in the Nuclear Fuels Laboratory whenever the material being processed has a potential for airborne contamination levels exceeding 10% of Table I, DOE (ERDA) Manual Chapter 0524 limits.

Corrective Action

Should a gaseous effluent sampling system fail, action shall be taken to restore the system to operation as soon as practicable. If restoration time exceeds one day, portable room air samplers shall be placed in areas where processing operations with radioactive materials are continued.

Releases of aqueous effluents from the Nuclear Fuels Laboratory to the process sewer shall be halted if requirement 2.2.2 is not met.

Processing of materials in the NFL having the potential for airborne contamination exceeding requirement 2.2.3 limits shall be halted if a continuous air monitor located in the laboratory is not operable.

Basis

Processing operations in the 306-W building shall be conducted such that the average radioactive release concentrations of gaseous effluents are within Table II values in DOE (ERDA) Manual Chapter 0524. Radioactive release concentrations monitored by the samplers located in the 306-W exhausts demonstrate compliance with these requirements.

Radioactive material discharges in the process sewer shall be in compliance with limits specified in DOE (ERDA) Manual Chapter 0524 Appendix, Annex A, Table II. Samplers in the process sewer sumps serving the Nuclear Fuels Laboratory sample aqueous releases to the process sewer for compliance with those limits.

Where the possibility exists that airborne contamination levels could exceed 10% of Table I, DOE (ERDA) Manual Chapter 0524 limits, PNL requires that a continuous air-monitor system be employed to assure compliance with those limits.

2.3 AQUEOUS EFFLUENT RETENTION

Applicability

This requirement applies to the collection of aqueous contaminated wastes from the 306-W building operations.

Objective

The objective is to prevent accidental discharge of contaminated liquid waste to either the sanitary or process sewer systems.

Requirements

2.3.1 Liquid wastes that would violate requirement 1.3.2 limits if discharged to the process sewer systems shall be collected in carboys for removal and disposal in accordance with BNWL-MA-8, Waste Management.

2.3.2 All laboratory sinks that could be used to rinse contaminated equipment or to dispose of radioactive material shall be capped, provided with retention capability, or posted with a sign indicating the limitations on their use.

Corrective Action

If requirements 2.3.1 and 2.3.2 are not met, immediate action shall be taken to restore compliance. If discharges are in violation of requirement 1.3.2 limits, they constitute an "Abnormal Occurrence," subject to Section 5.6 (a), (b), (c) instructions.

Basis

Compliance of aqueous effluents with DOE (ERDA) Manual Chapter requirements provides adequate protection for onsite personnel located outside the 306-W building, the public, and the environment.

2.4 PROCESS EQUIPMENT SAFETY FEATURES

Applicability

This requirement applies to engineered safety features of melting and sintering process equipment and to instrumentation for monitoring the safe operation of those processes.

Objective

The objective is to preclude the formulation of explosive hydrogen mixtures in the melting and sintering operations.

Requirements

2.4.1 Sensors shall be installed that monitor the melting-chamber pressure during uranium-melting operations. For enriched-uranium heats, an audible alarm electronically linked to the chamber pressure sensors shall alarm at 5mm of Hg absolute (normal operation is $\sim$0.05 mm Hg absolute).

2.4.2 The manifold for the hydrogen mixture[(a)] supply shall be equipped with a double pressure-reducing station and a pressure-relief pop-valve set at 75 psig or less.

2.4.3 A source of inert gas shall be available for the hydrogen furnace system whenever a flowing hydrogen mixture is used. The inert gas source shall be available to purge the furnaces before a hydrogen mixture is introduced and at the completion of a process cycle. A supply of inert gas sufficient to displace fire furnace volumes shall be on standby to automatically purge the furnace in the event of furnace power failure, hydrogen mixture supply failure, or exit burnoff failure.

2.4.4 A burnoff system is required to burn any hydrogen mixture flowing from a sintering furnace.

2.4.5 For any system that uses a flowing hydrogen mixture, a safety interlock system shall be operative to prevent hydrogen flow to the furnace in the event of burnoff flame failure, gas pressure drop, or power failure.

Corrective Action

At any time the pressure sensor instruments defined in requirement 2.4.1 fail, the heat cycle shall be aborted by turning the melting power off.

At any time requirements 2.4.2, 2.4.3, 2.4.4, and 2.4.5 are not met, startup of the affected furnace(s) is prohibited.

(a) Mixtures containing more than 4% hydrogen are termed "hydrogen mixtures" in subsequent discussions.

Basis

A rise in furnace pressure during uranium melting is an indication that water may be leaking into the melting chamber. This leaking could result in water flashing to steam and the evolution of hydrogen. A breach of the melting chamber would allow hydrogen to enter the working area, possibly resulting in a potentially explosive mixture. Also, water leaking into the chamber during enriched-uranium melting may reduce the criticality safety of the operation to only one contingency of protection; i.e., possible violation of the two-contingency policy.

The manifold supplying a hydrogen mixture, equipped with a double pressure-reducing station with a backup pressure-relief valve set at 75 psig (maximum), precludes the possibility of a high pressure (up to 2000 psig bottle pressure) entering the 306-W building.

To prevent a possibly explosive mixture of hydrogen and oxygen, a furnace is purged with inert gas before startup and at the conclusion of a processing cycle. For a flowing-gas furnace, the inert gas safety system is also available to automatically purge the furnace in the event of: a drop in the pressure of the hydrogen mixture (manufacturer's recommended trip setting), an extinguishment of the flame on the burnoff system, or a loss of electrical power to the furnace. A purge equivalent to fire furnace volumes reduces a 100% hydrogen mixture to $< 0.7\%$ hydrogen.

The burnoff system is required to preclude a hydrogen mixture flowing from the furnace to the work area.

2.5 EMERGENCY ALARMS AND LIGHTING

Applicability

This requirement applies to the availability of emergency alarms and lighting to initiate and conduct emergency actions.

Objective

The objective is to assure that building personnel receive appropriate warning of an emergency situation.

Requirement

2.5.1 The following audible alarm systems, with corresponding emergency backup power, shall be operable at the 306-W facility:

- criticality alarm
- fire alarm
- building evacuation siren.

The emergency electric power shall provide emergency lighting.

Corrective Action

The movement and processing of any fissionable material shall be halted at any time the criticality alarm system is not operable. Immediate action shall be taken to restore any of the alarm systems or the emergency electric power whenever failure is detected.

Basis

The primary purpose of the alarm systems is to immediately notify building personnel of an emergency situation so that they may take prearranged emergency action. These alarms also notify emergency response forces that aid is needed.

Emergency electric power assures the ability to respond to an emergency situation in the event that primary electric power is lost concurrently with the emergency. Battery-powered lights are also provided to assure safe egress of personnel in the event of total power failure.

3.0 SURVEILLANCE REQUIREMENTS

Surveillance requirements discussed below are related to the ventilation system, effluent analyses, accumulations of nuclear materials, process equipment, and emergency alarm testing.

3.1 VENTILATION SYSTEM

Applicability

These requirements apply to the surveillance and testing of the ventilation system.

Objective

The objective is to assure that adequate ventilation, pressure differentials, and filtration are maintained. These measures will assure that processing operations with nuclear materials in the 306-W building can be conducted without undue risk to onsite personnel, the public and the environment.

Requirements

3.1.1 The final HEPA filters shall be tested upon installation of new filters and at least annually, using dioctylphthalate (DOP), to determine the particle-removal efficiency.[2] Fluid-seal HEPA filters will be DOP tested: 1) individually by HEHF prior to installation, 2) in place prior to being placed in service, and 3) in place on a quarterly basis.[a] The HEPA filter elements shall be replaced if the particulate removal efficiency drops below 99.95% for particles 0.3 to 0.8μ in size. If the ΔP is <0.5 inches water or >4.0 inches water, filter elements shall be replaced.

3.1.2 The differential air pressure in the north high-bay areas shall be checked quarterly for compliance with requirement 2.1.2.

3.1.3 The airflow into the hoods in the 306-W facility shall be checked quarterly for compliance with requirement 2.1.3.

(a) With concurrence of DOE-RL, frequency may change to annual testing when an adequate data base is established for fluid-seal filters.

Corrective Action

HEPA filters will not be used unless they comply with initial installation criteria and/or shall be removed and replaced if they fail subsequent tests described in Section 3.1.1.

If requirements 3.1.2 and 3.1.3 are not met, the required checks shall be made promptly.

Basis

The HEPA filter installations provide the final treatment of the exhaust air and protect the environment from accidental release of radioactive particles. Periodic testing of these filters is necessary to demonstrate their effectiveness. Quarterly testing of fluid-seal filters is needed to generate test data to better evaluate these filters.

The 306-W high-bay areas and laboratories are maintained at a slightly negative pressure with reference to atmospheric pressure to minimize the potential for environmental release of airborne contamination. Also, a minimum inward air flow of 125 linear ft/min adequately controls the potential airborne contamination in the hoods. Routine verification that requirements 2.1.2 and 2.1.3 are being met assures that adequate ventilation is being maintained to control potential airborne contamination in the 306-W building.

3.2 EFFLUENT ANALYSES

Applicability

These requirements apply to the frequency for analyzing samples of gaseous and aqueous effluents from the 306-W building.

Objective

The objective of these requirements is to provide assurance that gaseous and aqueous effluents are in compliance with DOE (ERDA) Manual Chapter 0524 requirements.

Requirements

3.2.1 Effluent exhaust samples shall be taken from the 306-W exhaust stack samplers and analyzed weekly.

3.2.2 Aqueous effluent samples shall be taken from the two sumps servicing the Nuclear Fuels Laboratory and analyzed weekly.

Corrective Action

If effluent sampling requirements 3.2.1 and 3.2.2 are not met, immediate action shall be taken to restore compliance.

Basis

Data from the analysis of effluent samples are needed to demonstrate that gaseous and aqueous effluents are as low as practicable and in compliance with DOE (ERDA) Manual Chapter 0524 requirements.

3.3 ACCUMULATIONS OF NUCLEAR MATERIALS

Applicability

This requirement applies to the detection of nuclear material accumulations in the 306-W building waste drain lines and sumps.

Objective

The objective of the requirements is to assure detection of any accumulation of nuclear materials in a 306-W building waste drain line or sump.

Requirement

3.3.1 Inspections shall be made for possible accumulations whenever "inventory differences" exceed 0.45 of a minimum critical mass for fissionable materials.

Corrective Action

If requirement 3.3.1 is not met, the required inspections shall be promptly made.

Basis

Undetected accumulations over an extended period of time may present a criticality hazard.

3.4 PROCESS EQUIPMENT

Applicability

These surveillance requirements pertain to the operations using melting and sintering furnaces.

Objective

The objective is to provide surveillance during uranium-melting operations to detect the inadvertent intrusion of water into the melting chamber and to abort the operation should a water leak be detected. In addition, the objective is to provide assurance, before startup of a hydrogen furnace in the sintering operation, that the safety interlocks and the inert-gas purge system are operable.

Requirements

3.4.1 During uranium-melting operations, an operator shall be present at all times from the time the power is turned on to solidification (end of incandescence for enriched uranium).

3.4.2 Before startup of a furnace using a hydrogen mixture, the fail-safe safety interlock system shall be checked for operability.

3.4.3 Before startup of a furnace using a hydrogen mixture, it shall be confirmed that adequate inert gas for purging the furnace is available.

Corrective Action

Melting power shall be turned off at any time an operator is not present at a vacuum furnace being used for uranium melting. The operator shall not start up a furnace using a hydrogen mixture unless requirements 3.4.2 and 3.4.3 have been met.

Basis

A rise in furnace pressure during uranium melting is an indication that water may be leaking into the melting chamber. This leaking could result in water flashing to steam and the evolution of hydrogen. A breach of the melting chamber would allow hydrogen to enter the working area, possibly

resulting in a potentially explosive mixture. Also, water leaking into the chamber during enriched-uranium melting may reduce the criticality safety of the operation to only one contingency of protection; i.e., possible violation of the two-contingency policy.

The availablity of a burnoff system assures burnoff of any hydrogen mixtures flowing from the furnace. The fail-safe safety-interlock system assures that a hydrogen furnace is operating safely, or it will shut down the furnace to a safe mode.

3.5 EMERGENCY ALARM TESTING

Applicability

These surveillance and testing requirements pertain to the emergency alarm systems for the 306-W building.

Objective

The objective is to provide assurance that an emergency alarm is operative and capable of providing appropriate warning of an emergency situation.

Requirements

3.5.1 The maintenance and testing of the criticality alarm system shall comply with the requirements specified in PNL-MA-25, Criticality Safety, Section 2, "Criticality Alarm and Dosimeters."(a)

3.5.2 The maintenance and testing of the fire alarm system shall comply with requirements NFPA 72D-1232(b) of the National Fire Protection Association.(3)

3.5.3 The building evacuation siren shall be tested quarterly.(a)

Corrective Action

If an alarm system testing requirement is not met, immediate action shall be taken to restore compliance with the requirement.

(a) Mechanical testing of the audible criticality alarms is conducted quarterly by HEDL. They also test the building evacuation alarm system at that time.

Basis

Testing of the alarm systems provides a high degree of assurance that appropriate emergency warnings and notification will be signaled to building personnel and emergency forces.

4.0 EQUIPMENT DESIGN CONTROLS

Equipment design controls that apply to design changes are described below.

4.1 DESIGN CHANGES

Applicability

This requirement is applicable to the 306-W building and its services, and to major modifications to current or planned process equipment.

Objective

The objective is to assure that modifications to the 306-W building, its services, process equipment, and the design and installation of additional equipment will not have an adverse impact on safe operation.

Requirements

4.1.1 Modifications to the 306-W building and its services shall be reviewed and approved by the resident facilities specialist. The facilities specialist shall initiate modifications by applying for the appropriate modification permits.

4.1.2 Major modifications to existing process equipment and the design and installation of additional equipment shall be reviewed and approved by the resident facilities specialist. Additional reviews, i.e., for criticality, radiation protection, and industrial safety, shall be performed as appropriate. These reviews are in addition to those provided by line management.

4.1.3 Facilities, services, and equipment that have been modified or newly installed at the 306-W building shall not be operated until approved by the resident facilities specialist.

Corrective Action

If compliance with the requirements 4.1.1-4.1.3 is not maintained, immediate action shall be taken to restore compliance with the requirements.

Basis

Modification of facilities, services, and process equipment is an integral part of the research and development work conducted in the 306-W building. A modification could affect other unrelated equipment and activities and reduce the safety of the 306-W facility. To guard against introducing unexpected and unwanted safety effects, an independent review of modifications to the facility and process equipment by the resident facilities specialist is required.

5.0 ADMINISTRATIVE CONTROLS

Requirements related to organizational controls, specifications, operating safety procedures, personnel, review and audit, and records are discussed below.

5.1 ORGANIZATION

The management organizations of PNL and of the 306-W facility are responsible for assuring safe operations.

5.1.1 Management

The operational organization for the 306-W facility and its relationship to the PNL management structure is indicated in Figure 1. Groups that provide an independent technical review of the safe operation of the facility are also shown in the chart.

5.1.2 Facility

The Manager, Materials Department, shall have line responsibility for the operation of the 306-W facility, including: safeguarding the public and facility personnel from radiation exposure, assuring that the conduct of the 306-W operations are within the limits of the operations safety requirements, and auditing the operations for compliance with these specifications.

5.2 SPECIFICATIONS

Criticality safety specifications shall be established for all activities in the 306-W facility involving the handling, processing and storage of fissionable material. For packaged materials, DOT specifications or DOE or NRC certificates of compliance are recognized as approved criticality safety specifications.

The manager for a specific operation is responsible for preparing and revising the criticality safety specifications covering that operation. The criticality safety specifications shall be reviewed and approved in accordance with the requirements specified in PNL-MA-25, Criticality Safety.

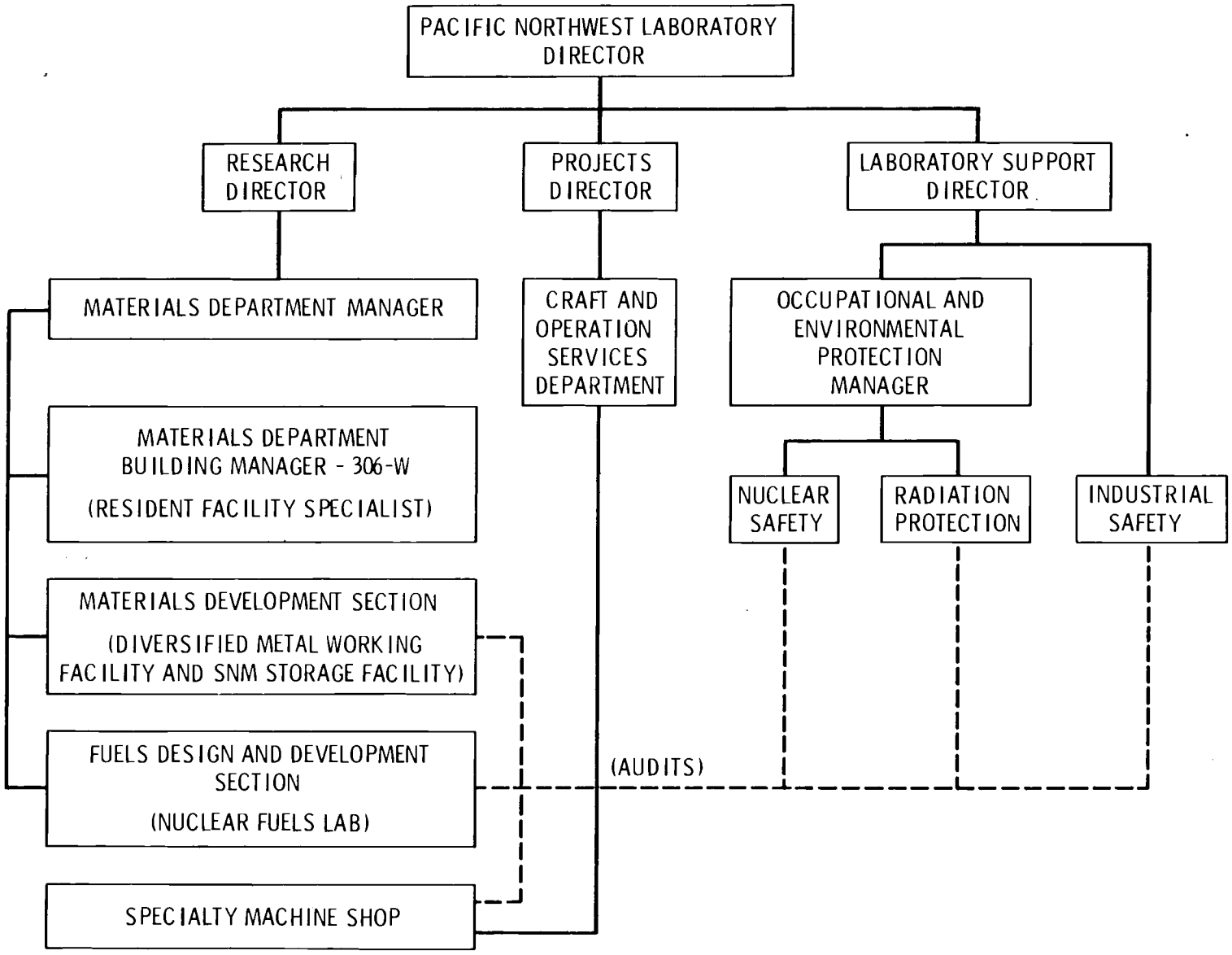

FIGURE 1. Operational Organization for the 306-W Facility and Its Relationship to the PNL Management Structure

5.3 OPERATING SAFETY PROCEDURES

Operating safety procedures that apply to the 306-W facility include: job hazard breakdowns and safe operation procedures; PNL manuals and radiation work procedures; and a comprehensive building emergency plan.

5.3.1 Job Hazard Breakdowns and Safe Operation Procedures

There shall be a system of job hazard breakdowns (JHBs) and/or safe operation procedures (SOPs) covering planned process operations to assure that the conduct of operations remains within the operations safety requirements.[4] The manager responsible for a specific operation is responsible for preparing and revising JHBs and SOPs and for assuring review by appropriate safety functions; i.e., resident facility specialist, Industrial Safety, Radiation Monitoring, and the appropriate criticality safety representative.

5.3.2 PNL Manuals and Radiation Work Procedures

The PNL radiation protection program is designed to meet or exceed requirements in the DOE (ERDA) Manual Chapters. The program procedures and requirements are contained in the following PNL manuals:

- BNWL-MA-3, Radiological Design Criteria
- BNWL-MA-6, Radiation Protection Procedures
- BNWL-MA-8, Waste Management
- PNL-MA-81, Radioactive Materials Shipping Manual.

Radiation work procedures (RWPs) shall be prepared for all activities involving the handling and processing of radioactive materials, in accordance with the requirements of BNWL-MA-6. The manager for the operation is responsible for preparing the RWPs, which must be reviewed and approved by the resident facility specialist and Radiation Monitoring.

5.3.3 Building Emergency Plan

A comprehensive building emergency plan shall be in effect, delineating action to be taken in the event of emergency conditions that could endanger the health and safety of employees and/or the general public.

5.4 PERSONNEL

Training requirements and minimum personnel requirements follow.

5.4.1 Training

Individuals who work in the 306-W facility, handling or supervising the handling of fissionable material, shall meet the training and qualifications requirements for fissionable material workers given in PNL-MA-25, Criticality Safety, Section 7, "Training," Section II.C. Similarly, "radiation workers" shall meet the training requirements in BNWL-MA-6, Radiation Protection Procedures, Section 5, "Control of Personnel Access to Sources of Radiation Exposure." Where applicable, "radiation workers" shall also meet requirements in BNWL-MA-6, Section 9, "Radiation Generating Devices." A record of the training received and the qualification examination, where applicable, shall be maintained for each qualified person.

Research operations are conducted in accordance with the highest standards of quality commensurate with project objectives, cost, and other sponsor requirements. Project management, research management, and quality assurance principles and practices are used to help achieve and demonstrate quality performance. The principles and practices used for any specific task are influenced by the impact of the task on the final results of the project.

The project management system for research projects is described in BNWL-MA-95, Research Project Management System.

The quality assurance program is described in PNL-MA-65, Quality Assurance Manual.

Research management involves those activities and practices exercised by PNL line managers to assure that compliance to PNL policy and sponsor requirements is achieved. Research management includes assignment of competent staff, staff performance appraisal and development, management review of project progress and results (technical), peer reviews and control of notebooks.

Specific processes or equipment operations that may have an adverse impact on criticality safety or control of radioactive materials are assigned

to Responsible Engineers. These persons are qualified to operate or supervise the operation as a result of training, knowledge of design and operating procedures, and experience in the operation of that equipment or process. Other personnel may operate the equipment under the supervision of the Responsible Engineer and may become authorized operators following review by the Responsible Engineer and approval by management.

The Responsible Engineers and authorized operators are designated in the job hazard breakdowns or safe operating procedures (Section 5.3.1).

The training, experience, etc., that qualify persons for assignment as Responsible Engineers and authorized operators will be documented and maintained as part of the system of JHBs or SOPs.

5.4.2 Minimum Personnel

An operator shall be present at all times from the time the power is turned on to solidification (end of incandescence for enriched uranium) of an ingot during uranium-melting operations (requirement 3.4.1).

5.5 REVIEW AND AUDIT

Responsible audit personnel, requirements for keeping audit records, and responsibilities of Occupational and Environmental Protection staff are described below.

5.5.1 Audit Personnel

The Manager, Materials Department, shall be responsible for auditing 306-W operations for compliance with the operations safety requirements on a quarterly basis. The Manager, Occupational and Environmental Protection, shall be responsible for performing independent reviews and audits, separate from audits by operations management. The staff of Occupational and Environmental Protection shall have a strong technical competence in criticality, industrial safety and radiation safety. Other technical experts, independent of the 306-W operations, may be enlisted to supplement the Occupational and Environmental Protection staff.

5.5.2 Audit Records

Materials Department management is responsible for maintaining records of audits of the facility. The record file shall include copies of all current specifications and procedures as well as reports of deviations. Occurrences or observations needing prompt action shall be recorded, and the corrective action shall be documented.

5.5.3 Occupational and Environmental Protection Responsibilities

Occupational and Environmental Protection shall:

a) review all proposed revisions to the safety analysis report and the operations safety requirements for the 306-W building

b) investigate abnormal occurrence violations of operations safety requirements, review and concur on the measures to recover from an abnormal occurrence, and provide recommendations to preclude a reccurrence

c) audit the facility operations at least twice a year for compliance with criticality safety specifications. Radiation safety requirements are audited annually.

5.6 ADMINISTRATIVE ACTION IN THE EVENT AN OSR IS NOT MET

If a safety limit, limiting condition, or surveillance requirement is not met, the corrective action indicated for that requirement shall be taken immediately. Failure to perform the required corrective action is classified as an abnormal occurrence and shall be:

a) reported promptly to the Manager, Materials Department, and the Manager, Occupational and Environmental Protection Department

b) reported to DOE-RL in accordance with established PNL procedures given in Management Guide 12.8, "Reporting and Investigation of Occurrences"

c) investigated by appropriate Materials Department and Occupational and Environmental Protection Department personnel.

5.7 RECORDS

In addition to the records required by applicable regulations, PNL shall maintain records that demonstrate compliance with the operations safety requirements for the 306-W facility.

REFERENCES

1. Hays, D. D., D. D. Lanning, R. M. Anthis, and R. G. Nelson, Safety Analysis Report 306-W Building, PNL-2549, Battelle, Pacific Northwest Laboratory, Richland, Washington 99352, January 1979.

2. PNL Standard Maintenance Procedure, "In-place DOP testing of HEPA Filters" General Purpose No. 17, revised August 1977.

3. National Fire Protection Association, "Proprietary Protective Signaling Systems." 72D-1, National Fire Codes, Volume 7, 1978.

4. Safety Guides. BNWL-MA-43, Section I: 1.3.

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