12. RADIATION PROTECTION

This chapter describes the radiation protection measures incorporated in the station design and in the procedures to ensure that internal and external radiation exposures to station personnel, contractors, and the general population due to station conditions will be within all applicable limits, and furthermore, will be as low as is reasonably achievable (ALARA).

Radiation protection measures include: separation of radioactive components into separately shielded cubicles; use of shielding designed to adequately attenuate radiation emanating from pipes and equipment which are sources of significant ionizing radiation; use of remotely-operated valves or handwheel extensions, where feasible; installation of permanent radiation monitoring systems both inside the station buildings and outside (air samplers near site boundary); control of access to the site by security personnel and to radiologically restricted areas by station personnel; training of personnel in radiation protection; and, development and implementation of administrative policies and procedures to maintain exposures ALARA.

Many of the systems and components containing radioactive materials have been deactivated with the fluids collected for waste processing. The current level of activity (source terms) remaining in these systems is well below the design basis. Consequently, decommissioning activities are planned and monitored under the Radiation Protection program, as described in this section.

12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS IS REASONABLY ACHIEVABLE (ALARA)

12.1.1 POLICY CONSIDERATIONS

Administrative programs and procedures, in conjunction with facility design, ensure that the occupational radiation exposure to personnel will be kept ALARA.

12.1.1.1 Operation Policies

The Vice President Decommissioning and CNO, as with all other aspects of station operation, bears final responsibility for implementing the ALARA policy. The CNO delegates that responsibility and authority through the General Manager, Decommissioning Oversight (GMDO) to the Manager, Radiation Protection and Waste (RPW). The RPW provides oversight of the SONGS DecommissioningSolutions (SDS) Radiation Protection Team/Programs. The authority to prevent unsafe practices, and to direct steps to prevent any unnecessary exposures, is also delegated to the SDS Radiation Protection Manager (RPM) with SCE Decommissioning Agent (DA) oversight.

Radiation protection procedures are designed to ensure that exposures are maintained ALARA. To ensure compliance with this policy, the radiation protection personnel are charged with the responsibility to promptly advise management of any unsafe practices which exceed their authority to correct. They have the authority to halt any operation which, in their judgment, is unsafe.

Radiation protection personnel have been trained in radiation protection procedures and techniques. All station personnel are trained in basic radiation protection principles, practices, and techniques as appropriate for the duty assignment, and compliance with 10 CFR 19, 10 CFR 20, and 10 CFR 50.

Annual retraining is conducted for all personnel, including contractors, in basic radiation principles and techniques as appropriate to their duty assignments. This retraining requirement may be met by satisfactory completion of performance evaluations.

Appropriate written maintenance and operating procedures are reviewed for radiation protection aspects to verify the procedures adhere to the ALARA philosophy. System or station modifications are also reviewed to see that the ALARA concept is applied.

The SDS RPM ensures the RP program is functioning properly through periodic audits and reviews of the radiation protection procedures and practices. Independent audits are conducted periodically by Nuclear Oversight in accordance with the SONGS Decommissioning Quality Assurance Program, and SCE DA oversight.

12.1.2 DESIGN CONSIDERATIONS

This subsection discusses the methods and features by which the policy considerations of Subsection 12.1.1 are applied. Provisions and designs for maintaining personnel exposures ALARA are discussed in Subsections 12.3.1, 12.3.2, and 12.4.3.

12.1.2.1 General Design Considerations for ALARA Exposures

General design considerations and methods employed to maintain in-plant radiation exposures ALARA are consistent with the recommendations of Section C.3 of NRC Regulatory Guide 8.8.

12.1.3 OPERATIONAL CONSIDERATIONS

12.1.3.1 General ALARA Techniques

A. Work involving individual whole body exposure rates in excess of 100 mrem/hr or work performed in areas having removable contamination levels which require the use of respiratory protection will be preplanned. The purpose of the preplanning is to carefully prepare for the job so that it can be expeditiously performed in a proper and safe manner with minimum number of personnel.

B. On complex jobs or jobs with exceptionally high radiation levels, "dry runs" will be made, and in some cases mockups will be used to familiarize the workers with the exact operations they must perform at the jobsite. These techniques will assist in improving worker efficiency and thus will minimize the amount of time spent in the radiation field.

C. As much of the work as is practicable will be performed outside of the Radiation Areas. This includes reading instruction manuals or maintenance procedures, adjusting tools or jigs, repairing valve internals, and prefabricating components.

D. On some jobs, special tools or jigs will be used when their use would permit the job to be performed more efficiently or would prevent errors, thus reducing the time in the radiation field. Special tools may also be used if their use would increase the distance from the source to the worker, thus reducing the exposure rate. These tools or jigs will only be used if the total exposure is reduced, including that received during installation and removal.

E. Entry and exit points will be set up in areas so that personnel are exposed to as low a level of radiation as practicable. This will be done because personnel may spend a significant amount of time changing protective clothing and respiratory equipment in these entry-exit areas. These entry and exit points are set up to limit the contamination from the jobsite to as small an area as practicable.

F. Protective clothing and respiratory equipment will be selected to minimize the discomfort of workers so that efficiency will be increased and less time will be spent in Radiation Areas.

G. Containments and plastic bags are used where practicable so that personnel can work on equipment inside the containments or bag without being exposed to the contamination produced during the work.

H. Radiation levels in work areas are provided in radiation work permits so that the areas of highest and lowest radiation levels are clearly identifiable. Individuals will be instructed to stay in the area of lowest radiation as much as possible, consistent with performing their assigned jobs.

I. Personnel wear self-reading alarming dosimeters when inside a radiologically controlled area so they can determine their accumulated exposure at any time during the job. This device will immediately warn personnel if they enter areas of higher radiation than permitted and when a preset accumulated exposure limit has been reached.

J. On jobs with exceptionally high radiation levels, a timekeeper, who knows the exposure rate of the radiation field, may keep track of the total exposure using a stopwatch (or similar device). Where appropriate, each individual in such an area will wear an alarming dosimeter. These provisions will ensure that personnel are not overexposed by staying in a High Radiation Area longer than intended.

K. On jobs, especially those which involve high radiation levels, the job preplanning will include estimates of the person-rem needed to complete the job. At the completion of the job, a debriefing session will be held with the people who actually performed the work in an effort to determine how the work could have been completed more efficiently, resulting in less exposure. This information, together with the procedures used and actual person-rem expended, will be filed. The radiation, contamination, and airborne activity levels determined during the work will be filed. In addition, if any external body contamination or internal contamination was encountered during the job, this information will be filed. This filed information will be used to provide guidance at the preplanning stage of future similar operations.

12.1.3.2 Specific ALARA Considerations for Other Operations Involving Radiation Exposure

Other operations such as radwaste handling, spent fuel handling, South Yard Facility, loading and shipping, routine maintenance, sampling, and calibration are discussed in Subsection 12.4.3.

12.1.3.3 Decommissioning

The actions taken to achieve “as low as reasonably achievable” objectives during decommissioning are the same as those taken to minimize exposure of maintenance personnel during the plant lifetime.

12.2 RADIATION SOURCES

This section discusses and identifies the sources of radiation that form the basis for shield design calculations and the sources of airborne radioactivity required for the design of personnel protective measures, and for dose assessment.

The source considerations for the fuel building and auxiliary building are briefly described; the operating facility shielding source term assumptions are no longer applicable and have been deleted. Most of the systems and components containing radioactive materials have been deactivated with the fluids collected for waste processing. The deactivated systems and components which contain residual contamination include: the reactor vessel, reactor coolant system, pressurizer, steam generators, reactor coolant pumps, chemical volume control system, emergency core cooling system, containment spray system, shutdown cooling system, and the liquid radwaste processing system. Other connected systems and storage tanks may also contain residual contamination. The current level of activity (source terms) remaining in these systems is well below the design basis. Any current work, or future decommissioning activities are planned and monitored under the Radiation Protection program, as described in this section.

12.2.1 FUEL BUILDING

12.2.1.1 Spent Fuel Storage and Transfer

The predominant radioactivity sources in the spent fuel storage and transfer areas in the fuel building are the spent fuel assemblies. For shielding design, the spent fuel pool was assumed to be filled with recently irradiated fuel assemblies that have decayed for 72 hours. Figures 12.2-1 and 12.2-2 characterize the typical decrease in dose rates above and to the side of a spent fuel assembly with increasing separation distance and elapsed decay time.

12.2.2 AUXILIARY BUILDING

12.2.2.1 Liquid and Solid Radwaste Systems

The components of the radwaste systems contain varying degrees of activity.

Shielding for each component of the radwaste systems was based on maximum activity conditions consistent with full power plant operation. Pumps were modeled as extensions of associated piping using the appropriate process point activities.

12.2.3 STORED RADIOACTIVITY

All spent fuel is stored in the Spent Fuel Pool or the Independent Spent Fuel Storage Installation (ISFSI) until it is placed in the spent fuel shipping cask for transport offsite. Storage space is allocated in the radwaste building for storage of spent filter cartridges and solidified spent resins, evaporator bottoms, and chemical wastes. Radioactive wastes stored inside plant structures are shielded so there is Zone 1 (Table 12.3-1) access outside the structure. If it becomes necessary to temporarily store radioactive wastes outside plant structures, radiation protection measures are taken by the radiological control staff to ensure compliance with 10 CFR 20 and be consistent with the recommendations of Regulatory Guide 8.8.

12.3 RADIATION PROTECTION DESIGN FEATURES

12.3.1 RADIATION ZONING AND ACCESS CONTROL

12.3.1.1 Normal Operations

The controls for entry and exit of personnel to controlled access areas, and the procedures, ensure that radiation levels and allowable working time are within the limits prescribed by 10 CFR 20.

Any accessible area having a radiation level that could cause a whole body exposure in any one hour in excess of 5 mrem at 30 centimeters from the radiation source, or from any surface that radiation penetrates is posted as a “Radiation Area.” Radiation Areas are provided with access alert barriers; e.g., chain, rope, door, etc. Any accessible area having a radiation level that could cause whole body exposure in any one hour in excess of 100 mrem at 30 centimeters from the radiation source, or from any surface that radiation penetrates is posted as a “High Radiation Area.” Access to High Radiation Areas (less than 1000 mrem/hr) administratively requires the individual to use a dose rate instrument, an alarming dosimeter, or be accompanied by a radiation protection qualified individual who performs dose rate surveys and who exercises positive control over the activities within the area. Positive control over High Radiation Areas having dose rates in excess of 1000 mrem/hr is exercised by locked barriers. When it is not reasonable to construct such a barrier, the area will be roped off and a warning light will be activated. A few special areas considered to be extremely hazardous and categorized as Very High Radiation Areas are posted and locked with the only keys being controlled by Radiation Protection Supervision and Operations Shift Manager.

The measured radiation level in any radiation or high radiation area is provided in the radiation work permit.

Table 12.3-1

RADIATION ZONES

Zone		Maximum Dose Rate (mrem/h)	Description[(a)]
I		≤ 0.25	Controlled access, unlimited occupancy
II		≤ 2.5	Controlled access, limited occupancy of 40 hours per week
III		≤ 15	Controlled access, limited occupancy of 6 to 40 hours per week
IV		≤ 100	Controlled access, limited occupancy for short periods of 1 to 6 hours per week
V		> 100	Restricted access, limited occupancy for very short periods. Normally inaccessible.

(a) Terms:

Controlled access, unlimited occupancy areas: Where entry and exit by plant employees and visitors are not under the direct supervision of the plant radiation protection staff. These areas can be occupied by plant personnel or visitors on an unlimited time basis with a minimum probability of health hazard from radiation exposure.

Controlled access, limited occupancy areas: Where higher radiation levels and/or radioactive contamination which have a greater probability of radiation health hazard to individuals can be expected. Only individuals directly involved in the operation of the plant will, in general, be allowed to enter these areas. Entry and exit are under the supervision and authorization by the plant radiation protection staff.

Occupancy: The time spent by an individual in a particular area. For Zones III-V, occupancy is to be determined on an area-by-area and individual-by-individual basis by the plant radiation protection staff.

12.3.2 SHIELDING

12.3.2.1 Design Objectives

The basic objective of the plant radiation shielding is to reduce personnel and population exposures, in conjunction with a program of controlled personnel access to, and occupancy of, radiation areas, to levels that are within the dose regulations of 10 CFR 50 and are ALARA within the dose regulations of 10 CFR 20. Shielding and equipment layout and design are considered in ensuring that exposures are kept ALARA during all anticipated personnel activities in all areas of the plant containing radioactive materials, utilizing the design recommendations given in Regulatory Guide 8.8, Paragraph C.3, where practicable.

The installed plant shielding was designed for the operating facility. The shielding structures may be removed during decommissioning with oversight provided through the Radiation Protection Program.

12.3.2.2 General Shielding Design

Shielding is provided to attenuate direct radiation through walls and penetrations and scattered radiation to less than the upper limit of the radiation zone for each area shown in Controlled Drawings 40012 through 40027. The shielding requirements for all plant areas are presented in Controlled Drawings 40012 through 40027. General locations of the plant areas and equipment discussed in this subsection are shown in the Controlled Drawings 40000 through 40010.

The material used for most of the plant shielding is ordinary concrete with a minimum bulk density of 140 lb/ft^3. Whenever poured-in-place concrete has been replaced by concrete blocks, design ensures protection on an equivalent shielding basis as determined by the density of the concrete block selected. Concrete radiation shields are designed following the recommendations of Regulatory Guide 1.69 as discussed in Controlled Document 90215. Water is used as the primary shield material for the area above the spent fuel stored in the Spent Fuel Pool.

12.3.2.2.1 Fuel Building Shielding Design

Concrete shield walls surrounding the spent fuel cask loading and storage area, fuel transfer and storage pools, and fuel transfer tube between the containment and fuel transfer pool are sufficiently thick to limit radiation levels outside the shield walls in accessible areas above elevation 45 feet to Zone II and below elevation 45 feet to Zone III. Access to the fuel transfer tube through the concrete radiation shield is provided by a labyrinth entrance and hatch through the floor of the shield.

Water in the spent fuel pool provides shielding above the spent fuel transfer and storage areas. Radiation levels at the fuel handling equipment are normally limited to approximately 8 mrem/hr.

12.3.2.2.2 Shielding Calculational Methods

The shielding thicknesses provided to ensure compliance with plant radiation zoning and to minimize plant personnel exposure were based on maximum equipment activities under the plant operating conditions.

12.3.3 VENTILATION

The plant heating, ventilating, and air conditioning (HVAC) systems were designed to provide a suitable environment for personnel and equipment during normal operation and transient events.

12.3.3.1 Design Objectives

The plant HVAC systems were designed to meet the requirements of 10 CFR 20 and 10 CFR 50.

12.3.3.2 Design Criteria

The plant HVAC systems were designed to maintain ALARA conditions under a variety of normal and abnormal conditions within the limits of 10 CFR 20. The HVAC systems are no longer credited for the mitigation of any conditions with the units defueled, however ventilation systems remain in service as needed to support equipment functions and plant personnel.

12.3.3.3 Design Guidelines

To accomplish the design objectives, the following guidelines are followed wherever practicable.

12.3.3.3.1 Guidelines to Minimize Airborne Radioactivity

A. Access control and traffic patterns are considered in the basic plant layout to minimize the spread of contamination.

B. Equipment vents and drains are piped directly to the collection system instead of allowing any contaminated fluid to flow across the floor to the floor drain.

C. All-welded piping systems are employed on systems containing radioactive fluids to the maximum extent practicable to reduce system leakage. If welded piping systems are not employed, drip trays are provided at the points of potential leakage. Drains from drip trays are piped directly to the collection system.

D. Suitable coatings are applied to the concrete floors and walls of potentially contaminable areas to facilitate decontamination.

E. Design of contaminable equipment incorporates features that minimize the potential for airborne radioactivity during maintenance operations. These features may include flush connections on pump casings for draining and flushing the pump prior to maintenance, or flush connections on piping systems that could become highly radioactive.

12.3.3.3.2 Guidelines to Control Airborne Radioactivity

A. The airflow is directed from areas with lesser potential for contamination to areas with greater potential for contamination.

B. In building compartments with a potential for contamination, the exhaust is designed for greater volumetric flow than the incoming air flow supplied to the area to minimize the amount of uncontrolled exfiltration from the area.

12.3.3.3.3 Guidelines to Minimize Personnel Exposure from HVAC Equipment

Ventilation ducts are designed to minimize the buildup of radioactive contamination within the ducts to the extent practicable

12.3.4 AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

12.3.4.1 Criteria for Location of Monitors

Generally, area radiation monitors are provided in areas to which personnel normally have access and for which there is a potential for personnel, unknowingly, to receive high-radiation doses; e.g., in excess of 10 CFR 20 limits, in a short period because of system failure or improper personnel action. Considerations for area monitor locations are based on the following criteria for monitoring:

A. Zone I areas which, during normal plant operation, could exceed the radiation limit of 0.25 mrem/h upon system failure or personnel error.

B. Zone II areas where personnel could otherwise unknowingly receive high levels of radiation exposure due to system failure or personnel error.

C. Areas in which the spent fuel is stored. In this case, detectors are provided at the operating floor of the fuel building to indicate abnormal radiation levels.

D. Area monitors are provided in accordance with General Design Criterion 63 of 10 CFR 50 Appendix A.

The location of each area high-range monitor is indicated on the radiation zoning and access control drawings, Controlled Drawings 40012 through 40027, and are listed in Table 12.3-2.

Table 12.3-2

AREA RADIATION MONITOR LOCATIONS

Quantity[a]	Building	Elevation		Location	Alarm[b] Setpoints (mrem/h)
		(ft)	(in.)		
2	Fuel Handling	63	6	Spent fuel loading area (1 per unit)	2.5
1	Auxiliary	30	0	Control Room/Command Center	0.5

[a] Total number of detectors for Units 2 and 3.

[b] Alarm setpoints are based on calculated gamma dose rates. Alarm setpoints may be reset based on measured radiation levels.

12.4 RADIATION PROTECTION PROGRAM

The radiation protection program ensures that personnel radiation exposure and, especially during emergencies, offsite doses are kept as-low-as-reasonably-achievable (ALARA) and within permissible limits.

12.4.1 PROGRAM OBJECTIVES

The objectives of the radiation protection program are:

(1) To provide administrative control of persons and licensed radioactive material on the site to ensure that personnel exposure to radiation and licensed radioactive materials is within the permissible levels set by 10 CFR 20 and that such exposure is kept ALARA.

(2) To provide administrative control over station effluent releases to ensure that these releases are below 10 CFR 20 values. Releases governed by 10 CFR 71 and 49 CFR are controlled directly by the Radiation Protection section while liquid and gaseous effluent releases are controlled and monitored by the Chemistry and Environment section of the Radiation Protection Division.

(3) To provide technical support during plant emergencies to limit any radiological consequences of those emergencies.

12.4.1.1 Radiation Protection Program Basis

The station radiation protection program was officially initiated at Unit 1, and later at Units 2 and 3, when radioactive material licensed to SCE was first brought into the respective units and will remain in effect continuously until the units are decommissioned. This program consists of rules, practices, and procedures that are used to accomplish the objectives stated above in a practical and safe manner. The program is consistent with the recommendations of NRC Regulatory Guide 8.2.

The radiation protection program ensures that:

A. Personnel receive appropriate radiation protection training.

B. Appropriate control techniques and protective clothing are used to limit external contamination.

C. Respiratory protection equipment is used as appropriate to limit internal exposure and assure that the total effective dose equivalent (TEDE) is maintained ALARA.

D. Radiation, airborne radioactivity, radioactive material and contamination areas are appropriately posted to limit exposure.

E. Radiation Protection Instruments and equipment used for quantitative radiation measurements are properly calibrated and maintained so that accurate radiological surveys can be performed.

F. Appropriate personnel monitoring devices are provided to personnel requiring external monitoring and exposure records are maintained.

G. An internal dose assessment program (whole body counting and/or bioassay) is supplied and implemented as required to determine internal exposure and records are maintained.

H. Incoming and outgoing shipments of licensed radioactive materials are properly handled.

I. Necessary measures are employed to keep exposures within 10 CFR 20 limits and ALARA.

J. Licensed Radioactive material is controlled to minimize the potential for releases to unrestricted areas.

The program assures that the radiation protection-related portions of the emergency plans can be properly implemented, if necessary, to limit the consequences of any emergencies at the station.

12.4.2 RADIATION PROTECTION (RP) ORGANIZATION

The San Onofre Nuclear Generating Station Units 2 and 3 (SONGS 2/3) organization, including the Radiation Protection Organization, is described in Chapter 13. The Manager, Radiation Protection and Waste (RPW), reports to the General Manager, Decommissioning Oversight (GMDO) and provides oversight for the RP Program. The SDS Radiation Protection Manager (RPM) has qualifications equivalent to the radiation protection manager as referenced in NRC Regulatory Guide 1.8. The RPM is responsible for administering the station radiation protection program and ensuring the facility meets the radiation protection requirements of 10 CFR 19 and 10 CFR 20. In addition to managing the RP supervisors and technicians, the RPM is also responsible for the handling and monitoring of licensed radioactive materials, byproduct materials, and special nuclear and source materials contained in calibration sources and standards. The custody and control of other sources of special nuclear and source material is the responsibility of the Nuclear Fuels Program Owner.

Radiation protection technicians perform the various surveys for radiation protection as well as defining and posting all areas with existing radiological hazards. They oversee activities and work functions in radiologically controlled areas to ensure that radiological conditions are properly characterized and that all activities are accomplished consistent with safe radiological work practices and the overall radiation protection program objectives. Radiation protection technicians and supervisors have the authority to stop any work or other activity which appears unsafe, until such activity is reviewed and appropriate actions are taken to ensure that the activity may be safely continued.

The SDS Chemistry Supervisor is responsible for the administration and implementation of the radioactive liquid and gaseous effluent monitoring program, and reports to the SDS RPM.

12.4.3 EQUIPMENT, INSTRUMENTATION, AND FACILITIES

The radiation protection facilities, equipment, and instrumentation include an access control facility, decontamination areas, radiation protection laboratory and offices, calibration areas, protective clothing, respiratory protection equipment, air sampling equipment, fixed and portable radiation detection instruments, and personnel monitoring devices as discussed below.

12.4.3.1 Facilities Related to Radiation Protection

Radiation Protection facilities include access control locations, decontamination areas and offices, calibration areas, and storage areas for protective clothing, respiratory protection equipment, and instrumentation for air sampling equipment, radiation detection, and personnel monitoring. Personnel monitor(s) and/or frisker(s) are normally located at the exit from the radiologically controlled areas.

Additional access control points may be initiated at the personnel entrance to each reactor containment and its respective spent fuel building at elevation 63 ft. 6 in. These access control points may have step-off pads, friskers, and various supplies as appropriate during outage conditions.

The following facilities principally provide controlled locations for work involving radioactive materials and equipment. They include:

a. Calibration Facilities

   Portable gamma, neutron and alpha-beta-gamma survey instruments are calibrated in the calibration facility. The calibration involves shielded instrument calibrators that can provide gamma exposure rates from 0.01 mrem/h to >1000 R/hr using Cs-137 and neutron sources, emitting dose rates to approximately 1 Rem/hr. The dose rate outside each calibrator is less than 5 mrem/hr when the system is not in use. Additional smaller alpha, beta, and gamma sources can be used as necessary to calibrate or check the lower ranges of the various portable instruments. Neutron sources are used to check the neutron monitoring instruments. Self reading dosimeters are normally calibrated using an open air irradiator, or other smaller sources. The sources used for calibration are traceable to the National Institute of Science and Technology (NIST) or other standards laboratory. Where such standards are non-existent, the method of calibration will be documented and approved by radiation protection management.

b. Auxiliary Building

   i) Personnel Decontamination area is located on elevation 70 ft. of the auxiliary building. It is equipped with a shower, sink, and storage cabinet(s) for clean protective clothing, decontamination chemicals, and various supplies.

   ii) Lockable high radiation storage areas are available in the radwaste area of the auxiliary building.

c. A cask and large equipment decontamination pad is provided in each of the spent fuel buildings at elevation 63 ft. 6 in.

d. South Yard Facility (SYF)

   i) Equipment may be staged or decontaminated in the South Yard Facility (SYF) for reuse in the Units 2/3 Restricted Areas or for free release as applicable. Appropriate sections of the SYF are controlled as a restricted area as defined in 10 CFR 20.

   ii) The REMS Storage Area is used to stage items known to be contaminated with licensed radioactive material.

e. Multi-Purpose Handling Facility (MPHF)

The Multi-Purpose Handling Facility is located within the SYF yard area. The MPHF provides a staging facility for waste that has been processed and packaged and is awaiting shipment for disposal. Specific areas are set aside for segregation of waste based on the radioactivity content and the waste classification.

f. Hazardous Material (HazMat) Staging Area

Portions of the HazMat Staging Area are used for staging and packaging of mixed waste (waste that has both hazardous and low-level radioactive contamination). Access to the HazMat Staging Area is controlled through the SYF.

g. Protected Area

Areas in the Protected Area adjacent to the Truck Bay access to the Units 2&3 auxiliary building and adjacent to the Equipment Hatches of the Containment buildings are used as outdoor staging areas for potentially contaminated equipment. Additionally, equipment is staged at the Truck Bay access for segregation into contaminated and non-contaminated.

As needed, temporary radiologically controlled areas may be established within the Protected Area for work activities involving radioactive materials and/or systems. Work activities may include refurbishment of equipment, or segregation, decontamination, and/or packaging of materials, equipment, or solid waste. Allowable contamination levels will be established to ensure that the effluent limits of 10 CFR 20, Appendix B will not be exceeded. Additional contamination control and effluent control measures are also implemented as appropriate to minimize worker exposure and the potential for an unmonitored effluent release.

12.4.3.2 Radiation Protection - Instrumentation

The instrumentation used by radiation protection personnel or used for radiation protection monitoring is discussed below. The categories are fixed radiation detection instrumentation (laboratory type), portable radiation detection instruments, personnel monitoring instruments, area radiation monitoring system, and airborne radioactivity sampling and monitoring equipment. Instrumentation and installed plant equipment is maintained by qualified site personnel or vendors.

12.4.3.2.1 Fixed Radiation Detection Instrumentation

The fixed radiation detection instruments, which can be used for low level analyses of various air, liquid, solids, and smear samples, is normally located in the counting room. However, one or more beta counters may be used at the access control point or elsewhere for such things as counting smears to determine contamination levels in areas and on floors, tools, and equipment.

The criteria for selection of these various counters was to obtain instrumentation that could reliably and quickly count samples, and that could provide the necessary low backgrounds and sensitivities.

These instruments are calibrated at intervals based on the required accuracy, purpose, degree of usage, stability characteristics and other conditions affecting measurement. The standards are counted in various geometries and/or sample positions that are normally used to count the different types of station samples. Usually, background and check source counts are performed periodically and quality control charts and/or logs are maintained to assure that the background and calibration of the instrument remains acceptable.

The types and minimum quantities of counting room instruments, with some of their peripherals, are listed below. A representative manufacturer's name and model number are included to typify design and performance characteristics. The instruments include:

A. HPGe detectors with lead shield are connected to a multichannel analyzer (MCA), a computer with software for data analysis, a disc for data storage, a CRT for spectrum display and input of commands, and a printer for output of data. The system is used for identification and analysis of gamma emitting radionuclides. (A representative system is a CANBERRA ALPHA system).

B. A liquid scintillation counting system for low energy beta analysis is available. This system is used for analysis of low energy beta emitters such as tritium and carbon-14. (A Beckman LS-6000 series is representative).

C. A scintillation type alpha counting system, Eberline SAC-4 or equivalent is available.

D. A GM type smear/sample counting system, Eberline BC-4 or equivalent is available.

12.4.3.2.2 Portable Radiation Detection Instrumentation

The portable radiation detection instruments include all portable instruments used to perform alpha, beta, gamma, or neutron surveys for radiation or contamination control.

The criteria for selection of these instruments was to obtain accurate and reliable instrumentation that could be easily serviced and that would cover the entire spectrum of radiation measurements expected to be made at the station during normal operation, during shutdowns, and during accident conditions.

These instruments are calibrated at intervals discussed in Paragraph 12.4.3.2.1. Sufficient quantities of each type of instrument are available to permit calibration, maintenance, and repair without diminishing the ability to provide adequate radiation protection. Some typical instruments are listed below. A representative manufacturer's name and model number are included to typify design and performance characteristics. The instruments include:

A. Dose rate meters, such as Eberline RO series, Bicron RSO series or equivalent are used to measure beta-gamma dose rates. The detector is an air ionization chamber with 7.0 mg/cm^2 end window.

B. Portable high-range gamma dose rate meters, such as Eberline Model RO-7 or equivalent, are used to measure high level gamma exposure rates. The detector is an air-filled ion chamber with a 430 mg/cm^2 window and a continuous readout from 1 mR/hr to 20,000 R/hr, depending on the detector probe used.

C. Portable low-range gamma dose rate meter, such as Bicron MicroRem or equivalent, used for measuring gamma exposure rates. The instrument has a range up to 200 mRem/hr, depending on the detector probe used.

D. Telescoping gamma dose rate meters, such as MGPI Telepole. The probe contains a low-range and high-range GM detector. The digital readout gives a continuous readout from 0.05 mR/hr to 1000 R/hr.

E. Alpha survey meters, such as Eberline Model ASP-1 with AC3 scintillation probes or equivalent.

F. Neutron survey meters, such as Eberline ASP/NRD. The readout covers ranges from 0.1 to 10,000 mrem/hr.

12.4.3.2.3 Personnel Monitoring Instruments (and Services)

Personnel monitoring is provided to measure the radiation dose received by personnel and to detect and quantify external and internal contamination levels.

Selection criteria for dosimeters include a requirement to have devices that are accepted as a legal record, can be quickly and accurately evaluated by station personnel, and could be easily read by an individual (self-reading dosimeters). Thermal Luminescent dosimeters (TLDs), are processed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory. The services of an offsite NVLAP accredited laboratory are retained for routine service.

The criteria for selecting external contamination measuring equipment are to have portable devices available at appropriate locations that are suited for identifying contamination (friskers) and other devices available at exits from most radiologically controlled areas that do not require any action by the personnel being checked (personnel contamination monitors - PCMs). The criterion for selecting the whole-body counting system is to have equipment readily available to consistently monitor personnel for internal contamination. In addition, these devices can be used as indicators of possible external contamination.

The personnel contamination monitors and hand-held friskers are calibrated electronically and with sources. The whole-body counting system is calibrated, using a phantom containing appropriate radionuclides. Pocket ion chambers (PICs) and personnel electronic dosimeters (PEDs) are calibrated with sources.

Sufficient quantities of each type of device are available to permit calibration, maintenance, and repair without diminishing the station's radiation protection capabilities. The personnel monitoring devices are listed below. Some representative manufacturer's (or supplier's) names and model numbers are provided to typify design and performance characteristics.

A. Count rate meters, such as Eberline model RM-14 or equivalent, that are used as friskers to detect beta-gamma external contamination. They are normally used with a pancake GM detector (2-inch-diameter window, 1.4-2.0 mg/cm^2 thick). A speaker and adjustable alarm are provided.

B. Personnel contamination monitors are used to check for external beta and gamma emitting contamination at the exits of the major radiologically controlled areas. Each monitor consists of an instrument console, a portal, and an array of sensitive radiation detectors. Visual and audible alarms are provided.

C. Self-reading personal electronic dosimeters (PEDs) plus pocket ion chambers (PICs) with a variety of ranges.

D. Sufficient quantities and types of equipment to read and reset both PEDs and PICs.

E. A whole-body counters such as the Canberra System is available to check for internally deposited radionuclides.

F. Programs for collection of urine samples (normally used for tritium) and fecal samples (possibly used under accident conditions) are established. These samples are sent to a vendor for analysis.

12.4.3.2.4 Air Sampling and Monitoring Instrumentation

Air sampling and monitoring instrumentation is used to determine the levels of airborne radioactivity in plant areas where personnel are likely to be exposed, and to be consistent with the recommendations of NRC Regulatory Guide 8.8.

The criteria for selection of the various types of equipment were:

- To use portable CAMs, where appropriate for in-plant determinations, to monitor critical work areas where airborne activity levels are likely to increase rapidly.

- To use portable air samplers for evaluation of airborne activity at work areas and throughout the unit during normal operation (to establish normal levels).

The samplers and monitors are calibrated at intervals discussed in Paragraph 12.4.3.2.1. The types of air sampling and monitoring instrumentation are listed below. A representative manufacturer and model number are included to typify design and performance characteristics. The equipment includes:

A. A portable CAM, such as Eberline model AMS-4. This unit has sealed gas detectors that can measure gross beta-gamma activity. This monitor has a strip chart recorder or data history file capabilities for evaluating trends, and visual and audible alarms.

B. Air samplers, such as SAIC Radeco model H809V or equivalent, are used for short-term air sampling. The pump has a high flowrate. It can be used to obtain quick grab samples such as at the beginning of a job or during activities that could significantly increase the airborne activity level.

C. Low-volume air samplers, such as the SAIC RadeCo HD-29A or equivalent are used to collect air samples over longer periods of time.

12.4.3.3 Radiation Protection Equipment

Equipment is supplied for the protection of personnel as discussed in the following paragraphs:

12.4.3.3.1 Respiratory Protection Equipment

The following are examples of respiratory protection equipment available to protect against, or minimize the uptake of, airborne radioactive material:

- NIOSH-MSA approved full-facepiece filter respirators.
- Full-face self-contained breathing apparatus, or equivalent, which have NIOSH-MSA approval.
- Portable ventilation systems equipped with HEPA and activated charcoal filters.

12.4.3.3.2 Protective Clothing

Various types of protective clothing are stocked at the plant to protect against personnel contamination. Typical clothing includes but is not limited to:

A. Body protection

1. Lab coats
2. Coveralls

3. Plastic suits

B. Head Protection

1. Cloth hoods

2. Plastic hoods

C. Hand protection

1. Rubber gloves

D. Foot protection

1. Plastic shoe covers

2. Cloth boot covers

3. Rubber overshoes

12.4.3.3.3 Contamination Control Equipment

Contamination control equipment is used to prevent or limit the spread of radioactive contamination and to assist in its removal. The equipment includes items such as:

A. Vacuum cleaners with absolute filters

B. Mops and wringer buckets

C. Plastic sheeting

D. Rolls of absorbent paper

E. Plastic bags of assorted sizes

F. Masking tape

G. Stanchions with radiation rope or tape

H. Appropriate radiological postings

I. Step off pads

J. Portable containments

12.4.4 PROCEDURES

Strict adherence to radiation protection procedures ensure that personnel radiation exposures are less than the limits of 10 CFR 20 and are as low as reasonably achievable (ALARA). Policy and operational considerations for radiation protection are set forth in Section 12.1. A general discussion of radiation protection practices is also given in this section.

12.4.4.1 Personnel Monitoring

Station employees, contractors, support personnel, and visitors are generally required to wear personnel monitoring devices at all times while within the Radiologically Controlled Areas. Neutron badges are issued to those individuals subject to significant neutron exposure. When issued, personal electronic dosimeters are read and recorded by automated computer controlled systems. In the event of a computer outage they are read and recorded by radiation protection personnel. TLDs sent to an off-site lab, quarterly or more frequently if necessary. Dosimeter and TLD badge readings are recorded by radiation protection personnel.

Bioassays will be performed to be consistent with the recommendations of NRC Regulatory Guide 8.9. The type of bioassay and the frequency of performing the bioassay depends upon the work environment of the individual under consideration and the present work situation at the station.

The current year exposure totals for all personnel who work in the radiologically controlled areas are collected and recorded on NRC Form 5, Occupational Dose Record For A Monitoring Period, or the equivalent. Occupational exposures incurred by individuals prior to working at the station are summarized on NRC Form 4, Cumulative Occupational Dose History, or the equivalent. These records are maintained at the station and are preserved indefinitely or until the NRC authorizes their disposal pursuant to Paragraph 20.2106 of 10 CFR 20.

12.4.4.2 Radioactive Materials Safety Program

The entire radiation protection program is designed to handle the normal byproduct, source, and special nuclear material directly associated with the power production aspects of the station. Types of sealed and unsealed sources are used for calibration. Non-exempt sources are normally used by or under the direction of radiation protection personnel. Radiation protection personnel and other individuals who routinely work with sources have received training in the safe use and handling of sources as part of their normal job training.

Some sources involved are used to calibrate the process and effluent radiation monitors described in Chapter 11, the area radiation monitors described in Subsection 12.3.4, and the portable and laboratory radiation detection instruments described in Subsection 12.4.3. Check sources that are integral to the monitors or portable instruments, and are exempt quantities, do not require special handling, storage, or procedures for radiation protection purposes. This also applies to exempt quantities of sources used to calibrate or check laboratory instruments.

Recognized methods for the safe handling of radioactive materials (especially unsealed sources), such as those recommended by the National Council of Radiation Protection and Measurement (NCRP), are implemented to maintain potential external and internal doses at levels that are as low as reasonably achievable. External doses are minimized by a combination of time, distance, and shielding considerations. Internal doses are minimized by the measurement and control of loose contamination. The handling of licensed material is addressed in the plant radiation protection procedures.

Sealed radionuclide sources having activities greater than the quantities of radionuclides defined in Appendix C to 10 CFR 20 and Schedule B of 10 CFR 30 will be subject to material controls for radiological protection. Those controls will include:

A. Monitoring of all packages containing licensed radioactive materials for external dose rate and removable contamination upon receipt at the station and prior to shipment away from the station. If incoming packages are found to have removable surface contamination, the transport vehicle may also be monitored.

B. Monitoring and inventorying of each non-exempt source for removable surface contamination (leakage testing) at six-month intervals. Excluded are sealed sources of 100 μCi or less beta- and/or gamma-emitting materials and 5 μCi or less of alpha-emitting materials or sources that are stored and not in use.

C. Labeling of each non-exempt source with the radiation symbol, stating the activity, radionuclide, and source identification number.

D. Access to sources that are not installed in an instrument or other piece of equipment is controlled, and such sources will normally be stored in a locked area.

12.4.4.3 Radiation Protection Training

Each member of the permanent operating organization whose duties entail entering radiologically controlled areas or directing the activities of others who enter radiologically controlled areas, are instructed in the fundamentals of radiation protection. They must pass an examination to be allowed to enter the radiologically controlled areas unescorted. These same personnel are also required to attend a periodic retraining program in radiation protection.

The radiation protection training program includes instructions in applicable provisions of the NRC regulations for the protection of personnel from radiation and radioactive material (10 CFR 20) and instructions concerning prenatal radiation exposure (NRC Regulatory Guide 8.13).

Additional radiation protection training and testing is given to Certified Fuel Handlers and Certified Operators.

Radiation protection technicians receive additional training in such areas as radiation and contamination surveys, air sampling techniques, use of portable and laboratory instrumentation, release limits, and safe handling of sources that apply to their specific job functions.

12.4.4.4 Radiation and Contamination Surveys

Radiation protection personnel normally perform routine radiation and contamination surveys of all accessible areas of the units. Routine surveys are performed at a frequency that may vary from daily to annually, depending upon the probability of contamination and radiation levels changing, and the frequency with which the area is visited. These surveys consist of radiation measurements and/or smears as appropriate for the specific area. Air samples are also routinely taken in representative accessible portions of radiologically controlled areas, typically with CAMs. These samples verify that the ambient airborne radiation level is low. Additional surveys related to specific operations and maintenance activities are performed. These surveys may be performed prior to, during, or after the activity, or any combination thereof, based upon the necessity for obtaining information required for protection of personnel and the necessity for keeping exposures (including those of radiation protection personnel) ALARA. Short-term (high-volume) air samplers are used as appropriate for evaluation of airborne activity prior to a job or during specific phases, while CAMs or long-term air samplers are normally used for the duration of the job.

12.4.4.5 Procedures and Methods to Maintain Exposures ALARA

Activities performed in radiologically controlled areas with a potential for high personnel exposure are subject to ALARA pre-job review. Appropriate engineering and administrative controls to keep exposure ALARA are initiated. Exposure controls are established for such work and actual exposure received on the job is reviewed. Significant discrepancies are evaluated to find improved methods of analysis and control.

Procedures, methods and the use of engineering controls to maintain exposures ALARA are not exclusive to radiation protection procedures but may be included in many operating and maintenance procedures as well.

12.4.4.5.1 Radwaste Handling

The handling of radwaste has been minimized by plant design which includes a spent resin system* (so that used demineralizer resins can be sluiced remotely to a shielded shipping cask). For high-level liners, a shielded overpack may be used when filling or moving the liners. (*removed from service)

12.4.4.5.2 Spent Fuel Handling, Loading, and Shipping

Spent fuel handling and loading of a shipping cask is performed under water, using the fuel handling cranes and/or manual tools. This normally requires a small work crew in the fuel handling building and usually involves little exposure. Some of the methods used to assure this are to:

A. Maintain at least eight feet of water above the fuel assembly to minimize direct radiation

B. Purify fuel pool water, as required, to minimize exposure due to water-borne activity

C. Cool the fuel pool water and provide an air sweep of the pool surface to minimize airborne exposures

D. Provide continuous air sampling while moving fuel to evaluate airborne activity

E. Have emergency procedures in place.

After the shipping cask is loaded it may be decontaminated using a hydro brush or similar device (pressurized washing device) to minimize the amount of hand cleaning.

12.4.4.5.3 Normal Operation

The station was designed so that significant radiation sources are separately shielded or placed in cubicles. Much instrumentation required for normal operation reads out remotely. Instrumentation that cannot be placed remotely or that is read infrequently is situated, where possible, so that it can be read from the entrance to the cubicle or from an area of low, radiation levels within the cubicle. Operators are instructed to stay outside cubicles as much as possible and are apprised of the areas inside cubicles where the radiation level is usually the lowest. Routine local operation of valves in Zone IV radiological areas is allowed where the plant radiation protection staff has determined that radiological conditions are acceptable.

12.4.4.5.4 Routine Maintenance

Routine maintenance falls into the categories of preventive maintenance (planned and scheduled maintenance such as lubrication, adjustments, and tests) and normal maintenance (unscheduled maintenance such as valve packing, pump seal replacement, and stopping leaks). Procedures are written for the usual preventive maintenance jobs and for some recurring normal maintenance jobs. These procedures specify the precautions to be taken, which include tagging of valves and electrical breakers where inadvertent operation during maintenance would increase radiation or contamination levels as well as cause other safety problems. The procedure also lists the required lubricants, special tools and equipment, (which minimizes time in the radiation area) and the acceptance standards (so the individual knows if the job was performed correctly). In addition, the procedure may also note if a radiation work permit is normally required. When the radiation work permit is issued, the radiological conditions are annotated, and additional specific instructions are given to personnel as appropriate.

For normal maintenance jobs in radiologically controlled areas, for which a general procedure is issued, a similar approach is used. A member of the Radiation Protection section staff will assess the radiological conditions in the work area. Based upon the initial survey, work involved, plant status, and past experience, a radiation work permit may be issued with specific instructions. Additional requirements may be imposed to reduce exposures, as discussed in Subsection 12.1.3.

12.4.4.6 Controlling Access and Stay Time

12.4.4.6.1 Restricted Areas

The permanently established restricted area includes all areas within the protected area and portions of the South Yard/Multi-Purpose Handling Facility. The protected area is described in detail in the physical security plan. The South Yard/Multi-Purpose Handling Facility is described in Section 12.4.3.1. Temporary restricted areas occasionally may be established outside of permanent restricted areas. They are posted and appropriately barricaded in accordance with written procedures to identify the radiological hazard and ensure proper protection. Access to these areas is controlled by radiation protection personnel.

12.4.4.6.2 Radiologically Controlled Areas

Within the restricted areas are areas where an increased potential exists for exposure to radiological hazards. Examples of such areas include the containment buildings, fuel handling buildings, radwaste building and radiochemistry laboratory. These areas are designated as radiologically controlled areas.

12.4.4.6.3 Other Area Designations for Radiological Controls

Areas within radiologically controlled areas are further designated as radiation areas, high radiation areas, very high radiation areas, airborne radioactivity areas, and radioactive materials areas consistent and in compliance with 10 CFR 20. In addition, contaminated areas are posted at limits discussed in appropriate procedures. A few special areas considered to be extremely hazardous due to very high radiation levels are appropriately posted and locked. Access to these areas is controlled by the Radiation Protection Supervisor. All work and other activities performed within these areas are evaluated by radiation protection personnel to ensure that safe radiological work practices are implemented and that the overall ALARA objectives are achieved.

12.4.4.6.4 Restricted Area Access

In order to gain access to the restricted area, workers and visitors receive training commensurate with the hazards they are likely to encounter. Dosimetry may be provided and worn when required by regulatory guidance.

12.4.4.6.5 Access to Radiologically Controlled Areas and Areas within Radiologically Controlled Areas

Entrance to radiologically controlled areas for Units 2 and 3 is normally through an access control point (discussed in Subsection 12.4.3.1.) Entrance to radiologically controlled areas normally requires a radiation work permit. All individuals who require monitoring are provided with and required to wear personnel monitoring devices. Additional instructions commensurate with the hazards they are likely to encounter are provided. Additional personnel monitoring devices, protective clothing, and respiratory equipment may also be issued, if required.

Radiation, High Radiation Areas, and Very High Radiation Areas are segregated within the radiologically controlled areas and identified in accordance with 10 CFR 20.1902. Control of access to Very High Radiation Areas is accomplished by implementation of procedures and programs consistent with the requirements of 10 CFR 20.1602. Positive control over High Radiation Areas having dose rates in excess of 1000 mrem/hr is exercised by locked barriers, if possible. When it is not reasonable to construct a barrier, the area will be roped off and a flashing warning light will be activated. Access to other high radiation areas (less than 1000 mrem/hr) administratively requires the individual to use a dose rate instrument, an alarming dosimeter, or be accompanied by a radiation protection qualified individual who performs dose rate surveys and who exercises positive control over the activities within the area. Control over entries into radiologically controlled areas is normally provided by using radiation work permits.

12.4.4.6.6 Radiation Work Permits and Stay Times

Radiation work permits identify the work to be done and the radiological controls necessary to perform the work in a radiologically safe manner. This permit states information pertinent to the job such as potential radiological conditions, stay times, protective clothing required, and respiratory equipment required. Notes specifying continuous radiation protection coverage, stay time, limitations or requirements for a debriefing session may also be added. All such permits require the approval of qualified radiation protection personnel.

During major outages radiation work permits may also be used to maintain control of personnel exposures and to correlate these to specific jobs. By using these permits, as described in the station procedures, radiation information relating to specific jobs can be accumulated for preplanning sessions in the future. In addition, on complex or new jobs involving significant exposure, a review may be performed after the completion of the job in an attempt to improve methods and keep exposures ALARA.

12.4.4.7 Contamination Control

Contamination limits for personnel, equipment, and areas are provided in the station procedures. Surveys are performed routinely, as discussed in Paragraph 12.4.4.4, to determine contamination levels. Additional surveys may be performed after maintenance work or after an operation that may have altered contamination levels. Any area found contaminated is roped off or otherwise delineated with a physical barrier, posted with appropriate signs, and decontaminated as soon as practical. In areas where the radiation level is high or where it is considered impractical to decontaminate the area to general controlled area limits, a step-off pad is used to prevent the spread of contamination.

Tools and equipment used in contaminated areas are monitored and/or bagged (or wrapped in plastic sheeting) prior to being removed to a clean area to prevent the spread of contamination.

If the tools or equipment do not meet the release limits, they are decontaminated, disposed of as radioactive waste, or restricted to use within radiologically controlled areas.

Some tools and equipment, which, because of their design or use, are not considered practical to decontaminate. These tools and equipment are used only within radiologically controlled areas as approved by radiation protection personnel.

Control of personnel contamination (external and internal) is provided by using protective clothing and respiratory equipment.. Each individual is responsible for personnel monitoring of body and clothing when crossing a local control point or the main access control point. If contamination is found, the individual is decontaminated, under the direction of radiation protection personnel.

Special coatings may be applied to walls and floors of areas containing radioactive fluids and, together with a system of floor drains, aid in decontaminating areas using the equipment listed in Subsection 12.4.3.

In addition, equipment vents and drains are piped directly to sumps (or other collection devices) where practicable to prevent radioactive fluids from flowing across the floor to the drains.

12.4.4.8 Airborne Activity Control

The plant ventilation systems (Chapter 9) provide a means of purging areas of the reactor containment and other plant buildings to minimize the accumulation of airborne radioactive materials. Airflow is always directed from normally occupied or routinely accessible areas of low-potential contamination to areas of higher potential contamination. Airborne contamination is minimized by keeping loose contamination levels low and by reducing sources of leakage as much as practical. The ventilation airflow prevents the buildup of air contamination concentrations.

Portable, temporary ventilation systems with a variety of filtration capabilities are available to control local sources of airborne radioactivity. These systems are commonly used to ventilate primary plant components, such as steam generators*, during maintenance and inspection. (*removed from service)

If personnel entry is required into areas where it is not practical to apply process or other engineering controls such that the source of airborne radioactivity cannot be removed or controlled, then consistent with the objective of maintaining the total effective dose equivalent as low as reasonably achievable either access is restricted, exposure times are limited, respiratory protection equipment is provided and/or other controls are implemented to maintain the total effective dose equivalent as low as reasonably achievable within the limits of 10 CFR 20.1201. When airborne radioactivity is detected in excess of the limits of 10 CFR 20, the area is posted as an airborne radioactivity area and access is controlled.

Entry into these areas requires the issuance of a radiation work permit. The use of a radiation work permit (discussed in Paragraph 12.4.4.6.6) and the radiological work planning process provides optimum radiation exposure control assuring the total risk benefit for respiratory protection is evaluated. If the evaluation determines that the use of respiratory protection equipment is warranted, the appropriate type of respiratory equipment is specified. The respiratory protection program is organized to conform with 10 CFR 20 requirements, Regulatory Guide 8.15, and NUREG-0041 recommendations (References 1 and 2). Whole-body frisking or counting, bioassay analysis, nasal smears, or face-piece interior smears may be performed to evaluate the protection afforded by the respiratory protection equipment. Whole body counting is used to assess internal exposure in accordance with approved Radiation Protection procedures.

The major portion of the respiratory equipment (discussed in Subsection 12.4.3) is available near the main access control point. Supplementary emergency respiratory equipment is available in the control room and emergency kits.

To ensure an adequate program for respiratory protection, the following controls are incorporated into the program:

A. Each respirator user is advised to leave a high airborne-radioactivity area for psychological or physical relief from respirator use. Each user must leave the area in the case of respirator malfunction or any other condition that might cause reduction in the protection afforded the user.

B. Sufficient air samples and surveys are made to identify the various nuclides present and to estimate the individual exposures, such that selection of appropriate respiratory equipment can be made.

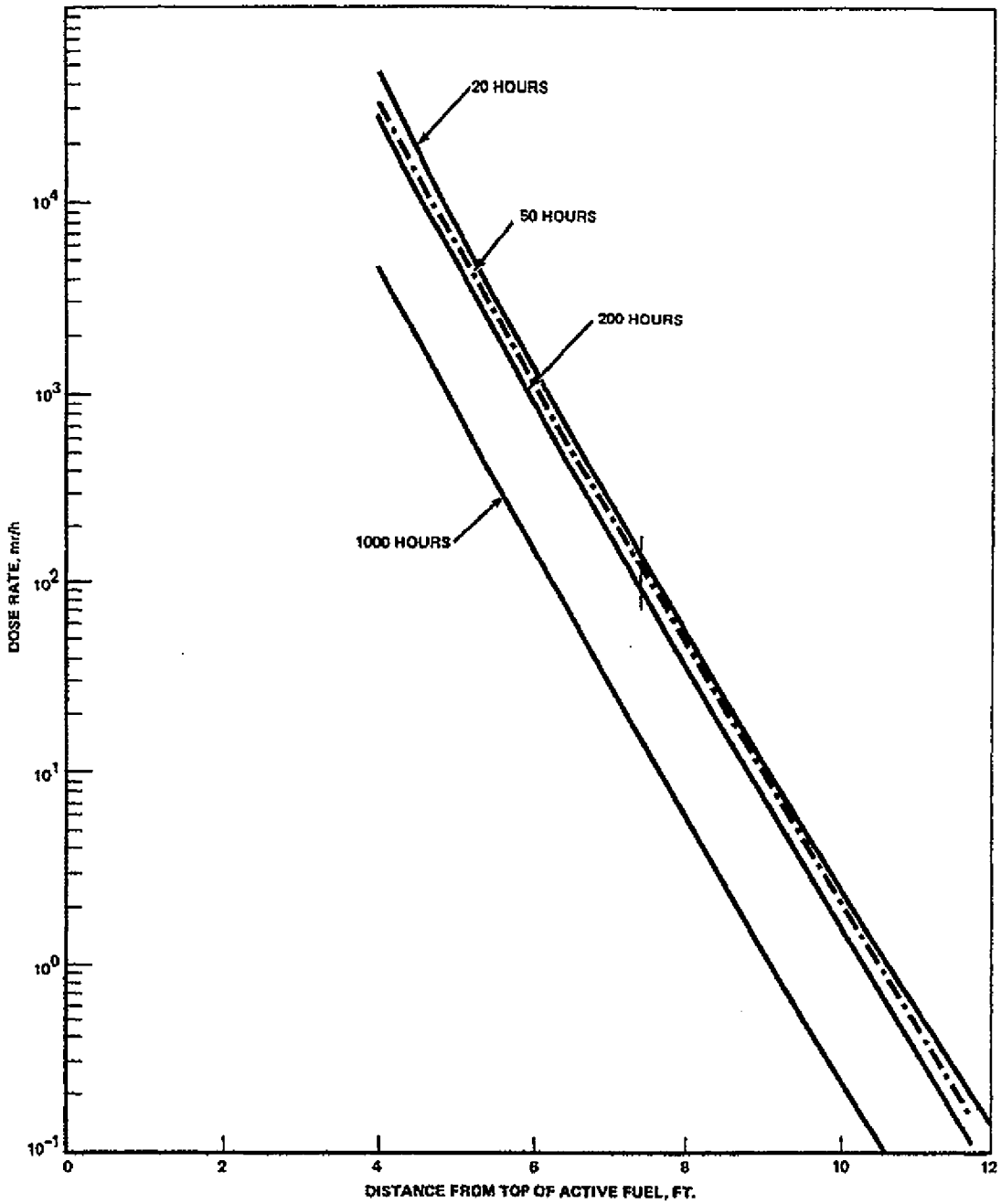
C. Training procedures are established to ensure correct fitting, use, maintenance, and cleaning of the various types of respiratory equipment. Each employee will be individually tested for fit prior to each required use by performing negative pressure tests to verify that an effective facial seal has been obtained.

D. Whole-body counts or other bioassays of individuals will be made as required to evaluate individual body (organ) burdens of radioactivity and to assess the overall effectiveness of the respiratory protection program as discussed in Paragraph 12.4.4.1.

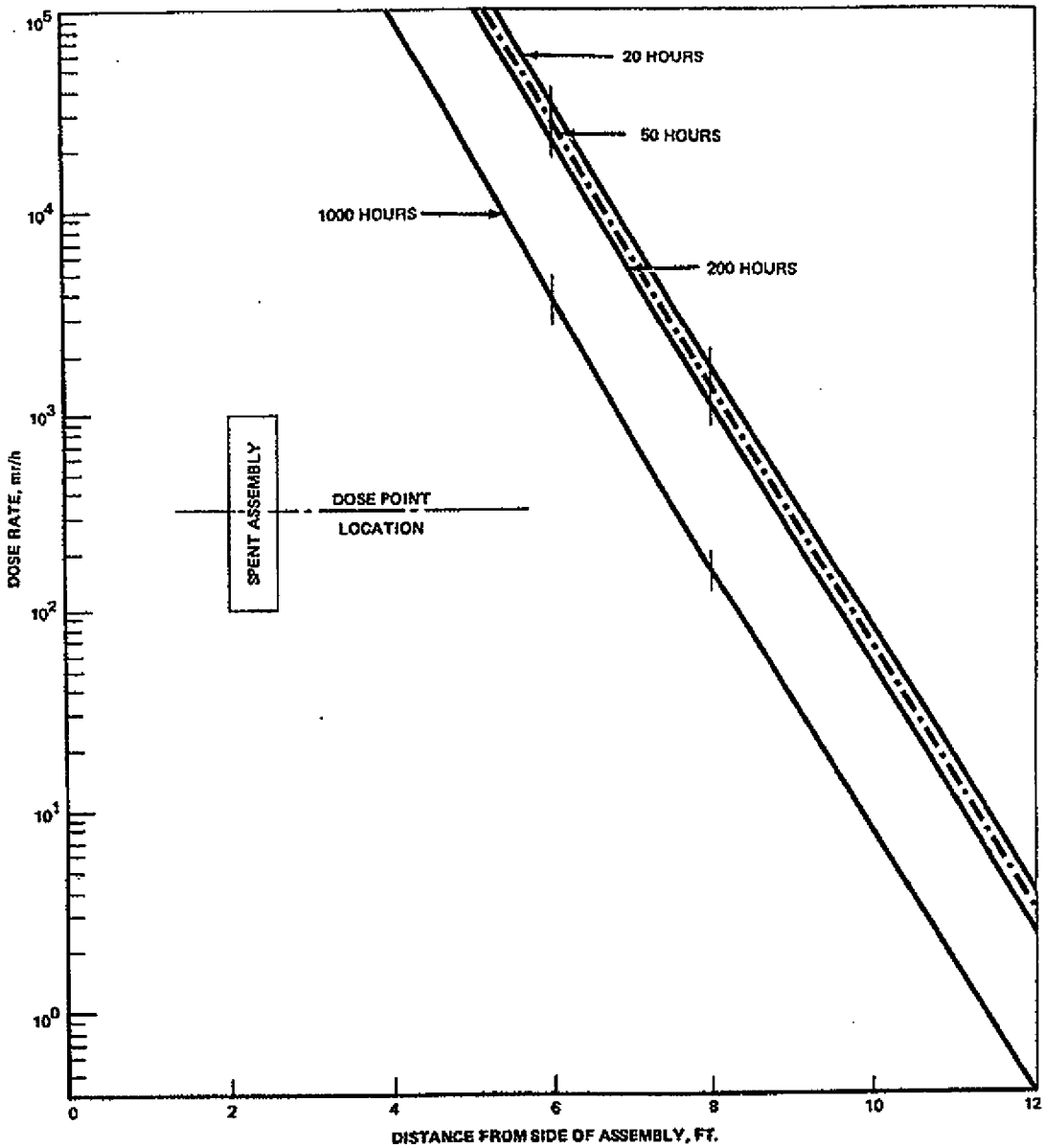
12.4.5 REFERENCES

1. Regulatory Guide 8.15, “Acceptable Programs for Respiratory Protection,” October 1976.

2. NUREG-0041, “Manual of Respiratory Protection Against Airborne Radioactive Materials.”



SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3 Updated Final Safety Analysis Report
DOSE RATE IN WATER AXIALLY ABOVE MAXIMUM SPENT ASSEMBLY
Figure 12.2-1



SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3 Updated Final Safety Analysis Report
DOSE RATE IN WATER FROM SIDE OF MAXIMUM SPENT ASSEMBLY
Figure 12.2-2