6.0 RADIATION PROTECTION

6.1 RADIATION PROTECTION PROGRAM

This section contains information on the administration of the Health Physics Program for SONGS 1. The Health Physics Program is a site wide program for all three units at SONGS. Following these sections is a brief description of the Radiological Environmental Monitoring 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 regulatory guidelines.

The objectives of the Radiation Protection Program are:

(1) To provide administrative control of persons on the site to ensure that personnel exposure to radiation and radioactive materials is within the guidelines of 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 concentration values and that they do not exceed the dose values given in the ODCM, and

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

The radiation protection program in effect for SONGS 2 and 3 is the basis for the program at SONGS 1. The program is implemented by procedures to ensure compliance with all requirements and is reviewed and maintained by administrative controls required by the SONGS 10 CFR 50, Appendix B, Quality Assurance Program. Administrative controls include procedures for work planning, work control, access control, and waste shipment and disposal.

The Health Physics Division responsibilities are:

- ☐ Establishing, implementing, and managing health physics/radiation protection programs and radioactive material control programs.
- ☐ Providing technical assistance to the Station regarding radiation protection and radioactive material control.
- ☐ Reviewing and auditing radiation protection and radioactive material control programs and activities.
- ☐ Providing technical expertise regarding effects of radiation, shielding design, respiratory protection, whole body counting, personnel dosimetry, decontamination, solid radioactive waste processing, packaging, shipping and disposal, and assessment of radiation dose.
- ☐ Providing protection for all persons against ionizing radiation, supervising the contamination control and radioactive material handling programs.
- ☐ Ensuring that individuals are trained to the appropriate level in radiation safety.

- ☐ Evaluating and reviewing the radiological status of the station.
- ☐ Making recommendations for control or elimination of radiation hazards and controlling the radiation exposure of individuals to maintain exposures ALARA.
- ☐ Procuring, calibrating, maintaining, and distributing portable radiation monitoring instruments.
- ☐ Directing radiation control operations, determining acceptable personnel exposures, maintaining accurate dose records, and enforcing observance of radiation protection standards.

6.1.1 HEALTH PHYSICS DIVISION ORGANIZATION

6.1.1.1 The HP Division is organized into the following sections:

(1) Radioactive Material Control (RMC) typically:

- Receives radioactive material on site.
- Stores and controls radioactive material (excluding Special Nuclear Material) on site.
- Handles, packages and ships radioactive material off site.
- Implements the Process Control Program.
- Provides decontamination services.
- Supplies protective clothing, portable ventilation and breathing air equipment.

(2) HP Technical Support typically:

- Interprets regulations and develops procedures/programs.
- Provides technical support, for all aspects of the HP program.

(3) HP Operational Support typically:

- Performs surveys to evaluate radiological conditions.
- Posts and barricades radiological areas.
- Evaluates radiological hazards associated with working in radiological areas and implements controls sufficient to maintain exposures ALARA and control radioactive material.
- Provides monitoring for external and internal occupational radiation exposure during normal and emergency conditions.
- Maintains at least 4 Emergency Plan qualified personnel on site (SONGS 1,2,3) at all times.
- Determines prior occupational dose and maintains Administrative Dose Controls for occupationally exposed individuals.
- Maintains occupational exposure records and provides occupational exposure reports.

- Provides support services as needed, including fit testing of radiological respirator devices and whole body counting.

(4) Instrumentation typically:

- Maintains and calibrates HP instruments including survey instruments, contamination monitors, air samples, continuous air monitors, and electronic dosimeters for normal and emergency conditions.
- Maintains radiological standards used in HP instrument calibration.
- Maintains custody and performs leak tests of sealed radioactive sources used by the HP, Chemistry and Maintenance Divisions.
- Evaluates and selects HP instruments used by the HP Program and Emergency Plan.

(5) HP Self-Assessment Program typically:

- Consists of several defined elements which are collectively used to improve divisional and Station radiation protection performances.
- Identifies and corrects deficiencies in radiological work practices and in the Health Physics Division programs.

(6) ALARA Program typically:

- Facilitates ALARA Committee work and meetings.
- Tracks and reports radiation exposure status vs goals.
- Performs ALARA design reviews.
- Administers temporary shielding program.
- Reduces and trends source terms.
- Reviews and evaluates work plans, dose reductions techniques and equipment.
- Prescribes site ALARA training.

6.1.2 RESPONSIBILITIES OF KEY PERSONNEL

The Manager, Health Physics reports to the Station Manager and is responsible for developing, implementing, and managing HP programs for normal and emergency conditions for the site in accordance with ALARA and applicable standards and regulations.

The Manager of Radioactive Material Control (RMC) reports to the Manager, HP and is responsible for implementing the responsibilities of the RMC section.

The Manager of HP Technical Support reports to the HP Manager and is responsible for implementing the responsibilities of the HP Technical Support section.

The Manager of HP Operational Support reports to the Manager, HP and is responsible for implementing the responsibilities of HP Operations Support and Dosimetry.

The Project Manager of Self-Assessment reports to the Manager of Health Physics and is responsible for implementing the responsibilities of the Self-Assessment Program.

The Manager of ALARA reports to the Manager, HP and is responsible for implementing the ALARA program.

6.1.3 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, is instructed in the fundamentals of radiation protection, and must pass an examination before performing those functions. These same individuals are also required to attend a retraining program in radiation protection held at least annually.

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).

Health physics technicians also receive 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.

Other radiation training and retraining requirements are identified by health physics supervisory personnel to the Nuclear Training Division which develops and implements this training.

6.1.4 DELETED

6.1.5 PERSONNEL MONITORING DEVICES

Station employees, contractors, support personnel, and visitors are generally required to wear personnel monitoring devices at all times while within the Radiologically Controlled Areas (RCA). 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 health physics personnel. OSLs are processed at an offsite lab on an annual basis or more frequently if necessary. Dosimeter and OSL badge readings are recorded by Health Physics personnel.

Whole body counting and bioassay are available to detect radioactivity within the body and to determine internal exposure levels. Measurements are taken whenever ingestion or inhalation of radioactive materials is suspected to have occurred. Each worker exiting the RCA is “passively” monitored for internal deposition when the worker uses the whole body frisking equipment (IPM8D or similar). When possible, a final whole body count is taken when the worker terminates radiation work at the site.

6.1.6 ACCESS TO RADIOLOGICALLY CONTROLLED AREAS

Radiation Exposure Permits, (REPs) are a key administrative tool that informs workers of the radiological conditions in the work area and the requirements for protective clothing, respiratory protective equipment, dosimetry, and engineering controls. The REP is also used as an exposure tracking device to ensure that exposures are maintained ALARA.

Most entries into, and work performed in radiologically controlled areas require an REP. The radiologically controlled areas onsite are divided into areas of progressively more stringent access control, according to radiation and contamination levels. Controlling access to contaminated and radiation areas is accomplished by appropriate contamination and/or radiation caution signs, barricades, locked doors and gates, and may include audible and visual alarm signals.

SCE provides protective clothing, as necessary, to protect individuals against contact with radioactive contamination. Radiological respiratory equipment is available and its use is required when necessary, to protect individuals against airborne radioactive contamination. Individuals are trained in the use of respiratory protection equipment. The use and maintenance of protective clothing and radiological respiratory protective equipment is managed by the Health Physics Division.

Entry to radiologically controlled areas is normally through an access control point. Additional personnel monitoring devices, protective clothing, and respiratory equipment may also be issued here, if required. Radiation and high radiation areas are segregated within the radiologically controlled areas and identified and controlled in accordance with 10 CFR 20.1601. Positive control over high radiation areas having dose rates in excess of 1000 mrem/h is exercised by locked barriers. When it is not reasonable to construct a barrier, the area is roped off and either a health physics technician is in attendance or a flashing warning light is activated. Access to other high radiation areas (less than 1000 mrem/h) administratively requires the individual to use a dose rate instrument or an alarming dosimeter, or be accompanied by a health physics technician who performs dose rate surveys and who exercises positive control over the activities within the area. Control over entries into Radiation Areas, Posted Contaminated Areas and Airborne Radioactive Areas are provided by using radiation exposure permits.

6.1.7 RECORD KEEPING

The Health Physics Division maintains an exposure record system which includes the exposure history and current exposure for individuals who enter radiologically controlled areas. This system contains all the information required to maintain NRC Form 4, Occupational Exposure History, and NRC Form 5, Individual Monitoring Results. The system produces Annual radiation exposure letters. The system also tracks daily exposures and provides radiological controlled area access control.

Proposed shipments of radioactive materials are reviewed to ensure conformance with 10 CFR 71, 61, and 49 CFR. The Health Physics Division maintains records of all shipments and stored wastes and submits reports to the NRC, as required.

6.1.8 RADIATION INSTRUMENTATION

A variety of instruments are used to cover the range of radiation measurements at SONGS. These include portable instruments as well as fixed systems. Portable instruments include low and high range beta-gamma survey meters, neutron survey meters, alpha survey instruments, and samplers for airborne gaseous and particulate radionuclides. Fixed systems include portal monitors and permanently installed area and process radiation monitoring systems.

Personnel contamination monitoring instruments are located at RCA exits. These instruments aid in preventing contamination from being spread into other areas. Appropriate monitoring instruments are available within the controlled areas. A portal monitor checks individuals as they leave the radiologically controlled area and again at the protected area exit.

Portable radiation survey and monitoring instruments for routine use are the responsibility of the Health Physics Division. Calibration sources are available to allow for instrument calibration, response checks, maintenance, and repair.

6.1.9 RADIATION SURVEYS

Routine surveys are performed in accordance with the Health Physics program to ensure that licensed material is surveyed and inventoried in accordance with Federal regulations and the Technical Specifications. These surveys will include radiation and contamination surveys for radiation protection, updating posted areas, leak testing sources, and free release of plant equipment and surfaces. The frequency and extent of the surveys is in accordance with approved procedures and Federal regulations.

6.1.10 CONTAMINATION CONTROL

Surveys are performed routinely to determine surface contamination levels. Additional surveys may be performed during and after maintenance work or after an operation that may have increased contamination levels. Any area found contaminated is roped off or otherwise delineated with a physical barrier, posted with appropriate signs, and decontaminated when practical. In areas where it is impractical to decontaminate the area to clean controlled area limits, a step off pad is used to prevent the spread of contamination.

Tools and equipment used in contaminated areas are monitored or bagged or both (or wrapped in polyethylene sheeting) before they are removed from the jobsite to prevent the spread of contamination. All tools and equipment being removed from the restricted area are monitored for contamination by health physics personnel (or other qualified personnel as specified in the station procedures) to ensure that they meet unrestricted area limits. If the tools or equipment do not meet the limits, they are decontaminated, disposed of as radioactive waste, or maintained for use within radiologically controlled areas only.

Regulated tools and equipment are items which, because of their design or use, are not considered practical to decontaminate. These tools and equipment are marked (by painting or otherwise) and are maintained for use within radiologically controlled areas.

Control of personnel contamination (external and internal) is provided using protective clothing, engineering controls, and respiratory equipment. Each individual is responsible for monitoring himself and his clothing when he crosses a local control point or the main access control point. If contamination is found, the individual is decontaminated, under the direction of health physics personnel.

Special coatings are applied to walls and floors of areas containing radioactive fluids. 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.

6.1.11 AIRBORNE ACTIVITY CONTROL

Airborne contamination is minimized by keeping loose contamination levels low.

If personnel entry is required into areas where the source of airborne radioactivity cannot be removed or controlled, either occupancy is restricted and/or respiratory protection equipment is provided to maintain exposures within 10 CFR 20 limits. When required, an area is posted as an airborne radioactivity area and access is controlled. Entry into these areas requires the entrant to be on a radiation exposure permit. The use of a radiation exposure permit provides radiation exposure control by controlling and recording conditions under which work in airborne radioactivity areas is performed. Air sampling results are used to ensure that appropriate respiratory protective equipment is specified on the radiation exposure permit. The respiratory protection program is organized to conform with 10 CFR 20 requirements, Regulatory Guide 8.15, and NUREG 0041 recommendations.

The major portion of the respiratory equipment is available at the access control point(s). Supplementary emergency respiratory equipment is available in the control room.

Whole-body counting, bioassay analysis, nasal smears, or face-piece interior smears may be performed to evaluate the protection afforded by respiratory protective equipment. To ensure an adequate program for respiratory protection, the program includes the following controls:

(1) Each respirator user is advised that he/she may 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.

(2) Sufficient air samples are taken and surveys conducted to identify the hazard, evaluate individual exposures, and permit proper selection of respiratory protective equipment.

(3) Written procedures are established to ensure respiratory equipment is properly selected and personnel using the equipment are supervised and trained.

(4) Written procedures are established to ensure that respirators are individually and adequately fitted, and the respiratory protective equipment is individually tested for operability immediately before each use.

(5) Written procedures are established to ensure that respiratory protective equipment is fully effective including procedures for cleaning and disinfection, decontamination, inspection, repair, and storage.

(6) Written operational and administrative procedures are established for control, issuance, proper use, and return of respiratory protective equipment, including provisions for planned limitations or duration of respirator use for any individual, as necessitated by operational conditions.

(7) Bioassays and other surveys are performed, as appropriate, to evaluate individual exposures and to assess the protection actually provided.

(8) Records are maintained sufficient to permit periodic evaluation of the adequacy of the respiratory protection program.

(9) Before any individual is assigned to tasks requiring the use of respirators, it is determined that such an individual is medically and physically able to perform the work and use the respiratory protective equipment. A physician determines what health and physical conditions are pertinent. The medical status of each radiological respirator user is reviewed annually.

6.1.12 RADIATION PROTECTION FACILITIES

Radiation Protection facilities include assess control locations, decontamination areas, radiation protection offices, locker rooms with shower facilities and toilets, 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.

6.1.12.1 South Yard Facility

Equipment is staged in the South Yard Facility (SYF) for reuse in the Unit 1 Restricted Areas. In addition, this area is used to stage equipment expected to be free of contamination that is destined for unconditional release, until it can be surveyed and be proven free of licensed radioactive material contamination.

The facility consists of a fenced area and access to the area is strictly from the Owner Controlled Area. The SYF is controlled as a restricted area as defined in 10 CFR 20. The REMS Storage Area, the Multi-Purpose Handling Facility (MPHF), and the Hazardous Material (HazMat) Staging Areas are included within this restricted area.

Stored items known to be contaminated with licensed radioactive material are tracked under the Radioactive Equipment and Materials System (REMS). These items are typically staged in containers or are covered, or staged inside buildings to protect them from the weather. Radiological health and safety measures are instituted by the Health Physics Division to ensure protection against a release of licensed radioactive material.

The SYF has facilities for decontamination of tools and equipment and includes a CO_2 decontamination unit, a Plasblast unit and water, hot water and steam cleaning equipment.

6.1.12.2 Deleted

6.1.12.3 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. A more extensive description of the MPHF can be found in DSAR Section 5.5.6.

6.1.12.4 Unit 1 Restricted Area

Temporary radiologically controlled areas may be established, as needed, 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. Calculation N-0320.007, “Airborne Source Term for South Yard Shops Facility and Outdoor Activities,” Revision A, April 16, 1995, evaluated the work activities and established allowable contamination levels to ensure that the effluent limits of 10 CFR 20, Appendix B, will not be exceeded. Contamination control and effluent control measures are also implemented, as appropriate, to minimize worker exposure and the potential for an unmonitored effluent release. HP&E Position Paper “Airborne Effluent Controls During Decommissioning,” dated September 27, 2000, provided additional guidance on effluent control measures to minimize airborne effluents.

6.1.12.5 Units 2&3 Truck Bay

Areas in the Units 2&3 Protected Area adjacent to the Truck Bay access to the Units 2&3 Auxiliary Building are used as outdoor staging areas for potentially contaminated equipment and for waste segregation and packaging activities. A fenced area immediately adjacent to the Truck Bay access provides a designated area for these activities.

6.2 AS LOW AS REASONABLY ACHIEVABLE (ALARA) PROGRAM

During Decommissioning, the site ALARA program in place during plant operation will continue to be maintained.

The ALARA methods, techniques, and practices implemented during Decommissioning will be the same as those used during plant operation. The existing ALARA program meets or exceeds the requirements of 10 CFR 20; Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable;" and Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable." The program ensures radiation exposure to workers and the public are maintained ALARA. SCE's commitment is stated in various station directives and implementing procedures. This is underscored by high level management oversight.

The Radiation Protection Program is the focal point of the ALARA program. Key elements of the ALARA program include dose reduction goal setting, in-depth radiation work review and job planning, industry experience review and implementation of beneficial technology and lessons learned from other nuclear sites.

6.2.1 GOALS

Annual ALARA exposure goals are developed (by individual department) for the site. ALARA exposure estimates for work are tracked and evaluated as the work progresses. For work that requires ALARA job planning, a job specific file is compiled. Performance indicators are tracked and evaluated, including the ALARA exposure goals. The exposure is tracked and reported to management on a routine basis. Performance is measured against the goals. When the task is completed, the lessons learned are documented and reviewed with appropriate personnel. This review is included in the file for future reference.

6.2.2 TRAINING

General Employee Training reinforces the ALARA program goals by providing methods for employees to keep their radiation exposure ALARA.

Practical factors in ALARA technique are examined during training. Mock-up training is performed for high dose jobs as a technique for reducing exposure.

6.2.3 ENGINEERING CONTROLS

Engineering controls to reduce radiation exposures are considered during the ALARA planning effort. Engineering controls are used when beneficial in reducing exposures in a cost effective manner. Engineering controls are also evaluated during the project planning process.

Work enclosures and HEPA ventilation are available for use in controlling potential or actual areas of airborne radioactivity.

SCE evaluates and revises the ALARA program as appropriate. The program will continue to be implemented at SONGS 1 as it is at SONGS 2 and 3. Enhancements to the program will occur as industry experience grows and work techniques are developed or improved.

6.2.4 EFFLUENTS

The Station Chemistry division has the responsibility to monitor gaseous and liquid effluent pathways. Monitoring of effluent pathways is specified the ODCM. The station policy is to maintain all effluent releases ALARA.

The effluent releases are compiled and reported in the Annual Effluent Release Report. This is in accordance with 10 CFR 20 and the reporting format of Regulatory Guide 1.21.

6.2.5 REFERENCES

1. SO123-VII-20, “Health Physics Program Description”

6.3 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)

The REMP is designed to quantify ambient radiation levels in the environs of SONGS 1 and to identify and quantify concentrations of radioactivity, which have a potential exposure pathway to man, in various environmental media in the vicinity of SONGS 1. Sampled environmental media selection is based on the objectives stated below. Each sample is analyzed for both naturally occurring and SONGS-related radionuclides.

The objectives of the operational REMP are:

(1) To fulfill the obligation for radiological surveillance required by Offsite Dose Calculation Manual specifications,

(2) To determine whether there is any significant increase in the concentration of radionuclides in critical dose pathways,

(3) To detect any significant change in ambient gamma radiation levels, and

(4) To determine whether the operation of SONGS 1 has any measurable effects on the health and safety of the public or the environment.

The REMP is conducted in accordance with 6.8.4.b of the Permanently Defueled Technical Specifications and Section 5 of the ODCM.

6.3.1 EXPECTED BACKGROUND

Results of the preoperational REMP are presented in section I of table 11.6-1. (See Rev. 3 of SONGS 1 UFSAR) The measurements were taken during the period from 1964 through 1967 to provide a baseline for future comparison. Because the number and type of samples collected during that time was limited, results of an expanded operational REMP from 1968 through 1987 for SONGS 1 have been included in section II of table 11.6-1 for general information.

6.3.1.1 Critical Pathways

6.3.1.1.1 Land Environment

The only significant route of transfer of material from the plant to the land surrounding San Onofre is via stack releases. Under routine operating conditions, small quantities of noble gases, airborne tritium, particulate matter, and iodines were released through the plant vent stack. With all spent fuel transferred to the ISFSI, the source of noble gas and iodine from Unit 1 has been removed.

The predominant effect of the noble gases, on a person derives from the external radiation exposure they may contribute since as inert gases they cannot be concentrated in environmental media in the human food chain.

Since these gases constituted the major contribution of the plant to the environment, one facet of the REMP is intended to detect changes in environmental radiation levels attributed to this source. Because very low levels of radiation exposure were expected, the only detector of suitable reliability and sensitivity is one that integrates exposure over a long period of time. Consequently, Thermoluminescent Dosimeters (TLDs) are being used at appropriate locations in the vicinity of SONGS 1. In order to provide adequate detection sensitivity, the TLDs are collected quarterly and annually from established REMP locations.

Internal exposure to radiation occurs from the ingestion or inhalation of radioactive materials. Samples are still collected in the environment surrounding SONGS 1 and are subsequently analyzed for both naturally-occurring and station-related activity. For landward sectors, sampled environmental media include the following: air, local crops, and drinking water. Soil is also collected in order to detect any potential build-up of radionuclides in the land near SONGS 1. Figures 5-1 through 5-4 of the ODCM show the sampling locations. Sample analyses

include one or more of the following: gross alpha activity determination, gross beta activity determination, tritium activity determination, and radiostrontium activity determination, as well as the determination of the activities of various gamma emitters.

6.3.1.1.2 Marine Environment

During normal operation of the plant, controlled quantities of radioactive liquids are released to the marine environment via the circulating water discharge. These discharges have been terminated from Unit 1.

As in the land environment, it is the intent of the monitoring program to use marine organisms as indicators of any accumulation processes occurring in the marine environment. For seaward sectors, sampled environmental media include the following: beach sand, ocean water, nonmigratory marine species, kelp, and ocean bottom sediment. Figures 5-1 through 5-4 of the ODCM show the sampling locations. Sample analyses are similar to those used in the analysis of terrestrial samples.

6.3.1.1.3 Exposure Estimates

Offsite doses due to radioactive liquid and gaseous effluent are calculated as required by the SONGS 1 technical specifications. The methodology and parameters to be used in those calculations are described in the Offsite Dose Calculations Manual (ODCM). These evaluations are performed independently of the REMP.

6.3.1.2 Sampling Media, Location and Frequency

Possible exposure to man could result from direct radiation, atmospheric immersion, inhalation, consumption of radionuclides deposited as particulates from the plant gaseous effluents, and consumption of radionuclides deposited in the marine environment by plant radioactive liquid effluents. In order to monitor the above pathways, various types of terrestrial and marine samples are collected and analyzed. Table 5-1 of the ODCM lists the required types of samples to be collected, the minimum number of locations, the frequency, and the type of analysis to be performed. Table 5-4 of the ODCM gives the sample collection points. These locations were selected to provide data from all landward sectors surrounding the plant, from major population centers, and to represent various food products that are produced in the area. In addition, several locations are selected in areas that would not be affected by plant operations to serve as control stations.

Direct radiation measurements are made at 45 locations using TLDs. Other sample types collected include air, soil, ocean water, drinking water, beach sand, local crops, marine animals, kelp, and ocean sediment. The selection of sample types is based on established critical pathways for the transfer of radionuclides through the environment to man, experience gained during the preoperational phase, and the evaluation of data during the operational phase.

Sampling locations were determined with consideration given to site meteorology, local demographics, and land uses.

A land-use census is conducted annually and identifies the location of the nearest milk animal, the nearest residence, and the nearest garden of greater than 500 square feet producing fresh leafy vegetables in each of the 16 meteorological sectors within a distance of 5 miles of SONGS 1.

The land-use census is provided to ensure that the changes in the use of unrestricted areas are identified and that modifications to the monitoring program are made if required by the results of this census. Restricting the census to gardens of greater than 500 square feet provides assurance that significant exposure pathways via leafy vegetables will be identified and sampled since a garden of this size is the minimum required to produce the quantity (25 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, it was assumed that: (1) 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) the vegetation yield was 2 kg/m^2

6.3.1.3 Analytical Sensitivity

The types of radiological analysis performed on each sample are presented in the Offsite Dose Calculation Manual (ODCM) Table 5-1. The REMP emphasizes analysis for naturally occurring radionuclides, and for those radionuclides that may be attributable to the effluents from the facility and those that may be primary contributors to exposure of the public. In addition to gamma spectrometry, gross beta, gross alpha, radiostrontium, and tritium analyses are also performed on selected media as appropriate.

Maximum acceptable values for the lower limit of detection (LLD) for the various isotopes expected to be present in plant effluents are defined in the ODCM Table 5-3.

An interlaboratory comparison program is also required by SONGS 1 technical specifications. Participation in this program ensures that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices can be made. This is done as part of the quality assurance program for environmental monitoring to demonstrate that the results are reasonably valid. Analyses are performed on radioactive materials supplied as part of an interlaboratory comparison program.

6.3.1.4 Data Analysis and Presentation

Information acquired from the environmental monitoring program fall into the following categories:

(1) Radioactivity distributions in various environmental media at San Onofre,

(2) Direct radiation measurements in the vicinity of San Onofre, and

(3) Concentrations of radionuclides in crops and marine life that may result in a dose to a member of the public.

In examining the distribution of radionuclides in the environment, comparisons are made of the preoperational data to determine if there are any biological or physical compartments in nature that are accumulating radioactivity.

Similarly, external radioactivity measurements for the operating plant are compared with the mean and range of data obtained in the preoperational program. Data from control locations that are considered to be outside of the area radiological impact of the plant are also compared with data collected near the plant.

For radionuclides found in foodstuffs, estimates of radiation dose are made that utilize the best estimates of food consumption. These dose calculations may then be compared with those based on plant emission data with the appropriate meteorological and aquatic dispersion models as discussed in the ODCM.

The data from the REMP are reported annually. The Annual Radiological Environmental Operating Report (AREOR) includes:

(1) Summarized and tabulated results in the format of Regulatory Guide 4.8, December 1975 of all radiological environmental samples taken during the report period,

(2) A summary description of the radiological environmental monitoring program,

(3) A map of all sampling locations, keyed to a table giving distances and direction from a site reference point,

(4) The results of licensee participation in the interlaboratory comparison program,

(5) Raw data and statistical summaries, interpretations, and analyses of trends of the results of the radiological environmental surveillance activities for the report period,

(6) A comparison with preoperational studies, operational controls, and previous environmental surveillance reports,

(7) An assessment of the observed impacts of the plant operation on the environment,

(8) The results of the land-use census,

(9) A description of the reasons for not conducting the REMP as required, and the plans for preventing recurrence,

(10) A description of any exceedences of reporting levels listed in the ODCM Table 5-2,

(11) When analyses were not performed as required by the interlaboratory comparison program, a description of the corrective actions taken to prevent recurrence,

(12) And, if harmful effects or evidence of irreversible damage are detected by the REMP, the report also provides an analysis of the problem and a planned course of action to alleviate the problem.

(13) Graphs to trend radioactivity concentration in different environmental media and its variation as a function of time.

6.3.1.5 Program Statistical Sensitivity

The activity in environmental samples is expected to be low after radionuclides released by the power plant are diluted and dispersed. For many isotopes, the radioactivity is below the lower limits of detection (LLD) that are listed in the ODCM Table 5-3. Doses calculated from environmental measurements at the LLD demonstrate exposures below 5 mrem/yr. With exposures estimated from effluent data, much lower exposure levels can be demonstrated even though large errors may be introduced in the dispersion modeling. Thus, exposures evaluated using effluent data provide a more detailed definition of the dose increments due to the operation of SONGS 1 than exposure calculated from the environmental measurements.

Counting errors for effluent data and errors associated with the calculational models are used to determine the overall sensitivity of dose evaluation. Where dose calculations are based on environmental data, errors in the environmental sample analysis are included in the overall program sensitivity analysis.

6.3.2 REFERENCES

1. “Permanently Defueled Technical Specifications,” Amendment No. 155 to License No. DPR-13, Issued December 28, 1993
2. “San Onofre Generating Station Unit 1, Updated Final Safety and Analysis Report,” Docket 50-206