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12.0 Radiation Protection

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12.1 Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA)

12.1.1 Policy Considerations

Duke Energy Carolinas, LLC management is firmly committed to the “As Low As Reasonably Achievable” (ALARA) philosophy for all nuclear operations. This commitment is stated in the Duke Energy Fleet ALARA Manual. A formal ALARA program has been established in order to convey and enforce Duke management's commitment to ALARA. This program was established in conformance with the requirements of Regulatory Guide 8.8, 8.10 and 10CFR20 to ensure that occupational exposures are maintained ALARA. In accordance with the requirements of 10CFR20, procedures and engineering controls will be used, to the extent practicable, to ensure that occupational doses and doses to members of the public are ALARA. This program consists of the following:

1. a published DPC ALARA Manual;
2. continued surveillance and evaluation of in-plant radiation and contamination conditions, as well as the monitoring and control of the exposure of personnel, by the station and General Office Radiation Protection staff; and
3. an ALARA Committee consisting of site management and representatives from applicable groups, whose purpose is to refine the site ALARA program.

The committee members have extensive background in nuclear plant radiation and exposure control, including such areas as layout, shielding, personnel access, ventilation, waste management, monitoring systems, operations, and maintenance.

Although upper level management is vested with the primary responsibility and authority for administering the Duke ALARA program, the responsibility for ALARA is extended through lower management to the individual employee. The specific responsibilities of the General Office and Station Radiation Protection staffs are to ensure that:

1. An effective ALARA program is established at each Duke nuclear station that appropriately integrates Duke management philosophy and NRC regulatory requirements and guidance;
2. A periodic written review of the on-site radiation control program is performed to assure that objectives of the ALARA program are attained;
3. Pertinent information concerning radiation exposure of personnel from other utilities and research work are reflected in the design and operation of Duke stations;
4. Appropriate radiological experience gained during the operation of nuclear power stations is factored into revisions of procedures to assure that the procedures continually meet the objectives of the ALARA program;
5. Necessary assistance is provided to ensure that operations, maintenance, and decommissioning activities are planned and accomplished in accordance with ALARA objectives; and
6. Trends in station personnel and job exposures are analyzed in order to permit corrective actions to be taken with respect to adverse trends.

Reports of the findings of the General Office and Station Radiation Protection staffs are also effectively conveyed to management.

Specific responsibilities of station personnel are to ensure:

1. Activities are planned and accomplished in accordance with the objectives of the ALARA program;
2. Procedures and their revisions are implemented in accordance with the objectives of the ALARA program; and
3. The General Office Radiation Protection staff and the Site Engineering staff are consulted as necessary for assistance in meeting ALARA program objectives.

Other group and individual responsibilities to the ALARA program are outlined in Section III of the DPC ALARA Manual.

12.1.2 Design Considerations

ALARA is a major design consideration which is carried out in accordance with section C.1 of Regulatory Guide 8.8. Consideration was given to such factors as projected component dose rates, space, mobility, accessibility, etc., during the initial design and construction phases of Oconee Nuclear Station. There is a large degree of component separation between high and low radiation levels. Several components are provided with flushing capability where the potential of exposure from CRUD exists. Engineering evaluations supplement a formal operational feedback program which is used to identify specific and/or generic problems and implement design improvements.

ALARA exposures receive further attention through the training of designers and in equipment selection. Section IX of the System ALARA Manual provides guidance to ensure that personnel who initiate and plan modifications are cognizant of dose reduction considerations by formal training.

This guidance provides designers with a working knowledge of radiation protection. Remedial or refresher training is also provided based upon experience and regulatory guidance, including any new technology or refinements.

12.1.3 ALARA Operational considerations

Consistent with Duke Power Company's overall commitment to keep occupational radiation exposures as low as is reasonably achievable (ALARA), specific plans and procedures are followed by station personnel to assure that ALARA goals are achieved. Operational ALARA policy statements are formulated at the corporate staff level in the Nuclear Generation Department through the issuance of the Radiation Protection Policy Manual, ALARA Manual and procedures. These statements and procedures are consistent with the intent of Section C.1 of Regulatory Guides 8.8, 8.10 and 10CFR20.

Personnel and job exposure trends are reviewed by site management and the general office, and appropriate action is taken. Summary reports of occupational exposure are provided that describe problem areas and jobs where high radiation doses are encountered. The reports identify which work group is accumulating the highest doses. Recommendations are then made for changes in operating, maintenance, and inspection procedures or for modifications to the station as appropriate to reduce doses.

Maintenance activities that could involve significant radiation exposure of personnel are carefully planned. They utilize any previous operating experience and are carried out using well trained personnel and proper equipment. Radiation Work Permits (RWP's) for non-routine operations, or Standing Radiation Work Permits (SRWP's) for routine operations are issued for each radiological job. (S)RWP's lists Radiation Protection requirements that shall be followed by all personnel working in the Radiation Control Area (RCA)/Radiation Control Zone (RCZ).

Where applicable, specific radiation exposure reduction techniques, such as those set out in Regulatory Guide 8.8, are evaluated and used. Applicable procedures for maintenance, inservice inspection, radwaste handling, and refueling, are well planned and developed by cognizant groups. These procedures are reviewed by the station radiation protection staff to ensure that exposures will be ALARA.

Careful personnel radiation and contamination monitoring are integral parts of such maintenance activities. During and upon completion of major maintenance jobs, personnel radiation exposures are evaluated and assessed relative to estimated exposures. From this appropriate changes can be made in techniques or procedures as soon as practicable for future jobs. The General Office Radiation Protection staff also conducts reviews of radiation exposure related activities to assure that procedures are adequate, that they are being followed properly, and that deficiencies are corrected as soon as practicable.

The station ALARA Committee carefully reviews operations and maintenance activities involving the major plant systems to further assure that occupational exposures are kept ALARA.

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12.2 Radiation Sources

System activity levels are based on the Reactor Coolant System design activity levels defined in Table 11-5. Operation of each unit at rated power is assumed. Other parameters employed in shielding analysis are listed in Table 12-1.

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12.3 Radiation Protection Design Features

12.3.1 Facility Design Features

The shielding is designed to perform two primary functions: (1) to ensure that, during normal operation, the radiation dose to operating personnel and to the general public is within the limits set forth in 10CFR 20 and is ALARA; and (2) to ensure that operating personnel are adequately protected in the event of a reactor accident so that the accident can be terminated without undue hazard to the general public.

Paragraph(s) Deleted Per 2000 Update

Piping and equipment components are shielded by concrete walls and floors of varying thickness, depending on the magnitude of the sources in each pipe section and component, and on the access requirements in a particular area. In some areas local shielding in the form of removable lead or concrete blocks are utilized to facilitate maintenance or repair operations.

12.3.2 Shielding

The material used for the primary, secondary, and Reactor Building shields is ordinary concrete with a density of approximately 140 lbs./ft^3. Since the primary and secondary shielding walls serve as the refueling structure, give support for the reactor coolant components under pipe rupture conditions, and provide missile shielding, they are reinforced and designed to be self-supporting. Descriptions of areas requiring shielding are presented below.

12.3.2.1 Reactor Building Shielding

12.3.2.1.1 Primary Shield

The primary shield consists of reinforced concrete which surrounds the reactor vessel and extends upward from the Reactor Building floor to form the walls of the fuel transfer canal. The shield thickness is 5 ft. up to the height of the reactor vessel flange, where the thickness is reduced to 4.5 ft. The primary shield is designed to meet the following objectives:

1. To attenuate the neutron flux in order to limit the activation of component and structural materials.
2. To limit the radiation level after shutdown so that access to the Reactor Coolant System equipment is permissible.
3. To reduce, in conjunction with the secondary shield, the radiation level from sources within the reactor vessel to allow limited access to the Reactor Building during normal full power operation.

12.3.2.1.2 Secondary Shield

The secondary shield is a 4 ft. thick reinforced concrete structure which surrounds the reactor coolant equipment, including the piping, pumps, and steam generators. The shielding is designed to reduce radiation levels from activity in the reactor coolant and to supplement the primary shield in the attenuation of neutrons and secondary gamma rays to permit limited access to the Reactor Building during full power operation.

12.3.2.1.3 Reactor Building Shield

The Reactor Building shield is a reinforced, prestressed concrete structure with 3.75 ft. thick cylindrical walls and a 3.25 ft. thick dome. In conjunction with the primary and secondary shields, it limits the radiation level outside the Reactor Building from all sources inside the Reactor Building to no more than 0.5 mrem/hr. at full power operation. The shielding is also designed to protect station personnel from radiation sources inside the Reactor Building following the Maximum Hypothetical Accident (gross release of fission products).

Other significant shielding inside the Reactor Building is listed in Table 12-2.

12.3.2.2 Auxiliary Building Shielding

The major radiation sources are piping and equipment components handling potentially contaminated fluid, practically all of which are located on the 758'-0", 771'-0", and 783'-9" levels. Groups of equipment or individual equipment items are separated by shielding walls such that systems and equipment can be isolated for maintenance with no significant radiation interference from other systems or equipment. During normal operation, there is no need to occupy these potentially radioactive equipment areas. Potential radiation sources and associated shielding are listed in Table 12-2. Additional shielding is also provided around the control room to ensure that exposure to operating personnel in the control room is within the design limits following a Design Basis Accident (DBA).

12.3.2.3 Post LOCA Shielding Review

A post LOCA Shielding review of the Oconee Nuclear Station was conducted pursuant to the requirements of NUREG-0578. Shielding review identified a potential for exceeding personnel exposures in GDC-19 for the control room due to its proximity to the mechanical penetration room. The low pressure recirculation piping routed through the mechanical penetration room could potentially contain highly radioactive water post LOCA. Permanently installed lead shielding was provided along the control room walls adjacent to the mechanical penetration rooms to ensure that the personnel exposures in the control rooms do not exceed the limits specified in GDC-19 (NSM-1393) for all units. Previously, caustic addition valves were relocated and provided with remote operators to assure operability and access. These valves are no longer required to be used due to the addition of Tri-Sodium Phosphate (TSP) Baskets. The Shielding review performed per NUREG-0737 II.B.2.2 verified that the required personnel access to all vital areas was feasible without exceeding the radiation exposure limits following a LOCA accident.

12.3.2.4 Original Steam Generator Retirement Facility

The Retirement Facility is a reinforced, cast-in-place concrete structure with 2-ft. thick walls and roof designed to hold the six retired Steam Generators, three retired Reactor Head assemblies and multiple strong-tight containers filled with original steam generator sub-components. The walls limit the radiation level at the perimeter of the Retirement Building to no more than 0.25 mrem/hr. The building is designed to protect station personnel from radiation sources possible at the location of the facility.

12.3.3 Area Radiation Monitoring System

12.3.3.1 Design Bases

The Area Radiation Monitoring System, consists of coaxial ion chambers, G-M detectors, and beta scintillation detectors. It is designed to indicate existing radiation levels and to alarm when levels exceed setpoints in various remote locations throughout the station where personnel are most likely to be exposed. Indications from the monitors are used in conjunction with station operating procedures to assure that radiation exposure of personnel does not exceed 10CFR 20 limits.

12.3.3.2 Description

Number, detector type, location, range, and nominal sensitivity are shown in Table 12-3.

Control room indication is provided for each monitor indicating R/hr, mrad/hr, or cpm. Indication for Oconee 1 and 2 monitors are located in Oconee 1 and 2 control room. Indication modules for Oconee 3 monitors are located in Oconee 3 control room.

Each detector assembly (except for the high range area detectors, and the beta scintillation detector assemblies) is equipped with a check source that is actuated on a periodic basis. The failure of any applicable channel to respond to the source will initiate an alarm in the control room. Radiation levels exceeding the alarm setpoint for any detector will cause an alarm at that detector location and in the control room.

12.3.3.3 Evaluation

The Area Radiation Monitoring System detectors are located throughout the station in locations where significant radiation levels may exist, and change with time and the operation being performed. They are designed primarily for the protection of personnel performing such operations as routine coolant sampling, refueling, Reactor Building entry, radioactive waste disposal operations, and for certain other operating and maintenance work. The system has sufficient range and flexibility to permit readout during routine operations and during any transient or emergency conditions that may exist. The equipment is self-checking for proper operation, and alarms both in the local area and in the respective control room. Where necessary or desirable, readout is also provided locally in certain locations.

Several channels of the Area Radiation Monitoring System will be utilized for primary indication and backup in evaluating the extent of fission product release involved in both the LOCA and DBA.

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12.4 Radiation Protection Program

The administrative organization of the Radiation Protection program and the qualifications of the personnel responsible for the program and for handling and surveying radioactive material are discussed in Section 13.1. The administrative organization is responsible for and has appropriate authority for assuring that the three basic objectives of the Radiation Protection program at Oconee Nuclear Station are achieved. These objectives are to:

1. Protect personnel
2. Protect the public
3. Protect the station

Protection of Personnel, includes surveillance and control over internal and external radiation exposure and maintaining the exposure of all personnel within permissible limits and as low as is reasonably achievable (ALARA).

Protection of the public, includes surveillance and control over all station conditions and operations that may affect the health and safety of the public. Included are such activities as radioactive gas, liquid and solid waste disposal, shipment of radioactive materials, an environmental radioactivity monitoring plan and maintaining portions of the station emergency plan.

Protection of the station, includes the continuous determination and evaluation of the radiological status of the station for operational safety and radiation exposure control purposes. This work is performed in order to warn of possible detrimental changes and exposure hazards, to determine changes or improvement needed, and to note trends for planning future maintenance work.

This administrative organization is also responsible for and has appropriate authority for maintaining occupational exposures as far below the specified limits as reasonably achievable by assuring that:

1. Station personnel are made aware of management's commitment to keep occupational exposures as low as is reasonably achievable;
2. Formal reviews are performed periodically to determine how exposures might be lowered;
3. There is a well-supervised radiation protection capability with specific defined responsibilities;
4. Station workers receive sufficient training;
5. Sufficient authority to enforce safe station operation is provided;
6. Modification to operating and maintenance procedures and to station equipment and facilities are made where they should substantially reduce exposures at a reasonable cost;
7. The radiation protection staff understand the origins of radiation exposures in the station and seeks ways to reduce exposures;
8. Adequate equipment and supplies for radiation protection work are provided.

The Station Manager is responsible for the protection of all persons against radiation and for compliance with NRC regulations and license conditions. This responsibility is in turn shared by all supervisors. Furthermore, all personnel are required to work safely and to follow the regulations, rules, and procedures that have been established for their protection.

The Duke Power Company, General Office Technical System Manager, Radiation Protection, establishes the Radiation Protection Program including the program for handling and monitoring radioactive material for Oconee that is designed to assure compliance with applicable regulations, technical specifications, and regulatory guides. The General Office Technical System Manager also provides technical guidance and support for conducting this program, reviews the results of the program to determine its effectiveness and modifies it as required based on experience and regulatory changes, to assure that occupational radiation exposure and exposure to the general public are maintained as low as is reasonably achievable.

This individual also provides technical assistance to the Executive Vice President, Nuclear Generation, who has management authority to implement the “as low as is reasonably achievable” (ALARA) occupational exposure policy, to which Duke Power Company is committed.

The Station Radiation Protection Manager at Oconee is responsible for conducting the Radiation Protection Program that has been established for the station. The Station Radiation Protection Manager has the duty and the authority to measure and control the radiation exposure of personnel; to continuously evaluate and review the radiological status of the station; to make recommendations for control or elimination of radiation hazards; to assure that all personnel are trained in radiation protection; to assist all personnel in carrying out their radiation protection responsibilities; and to protect the health and safety of the public both on-site and in the surrounding area.

In order to achieve the goals of the Radiation Protection Program and fulfill these responsibilities for radiation protection; radiological monitoring, survey and personnel exposure control work are performed on a continuing basis for station operations and maintenance.

The Radiation Protection Section performs the major portion of the radiation protection work for the station. Personnel in the Radiation Protection Section normally work on the day shift during periods of routine operation; and deploy onto the other shifts for major maintenance, shutdown, and refueling work. A supervisor and several Radiation Protection Technicians are also assigned to each operating shift. The Radiation Protection Section is organized into major areas, such as surveillance and control, support functions, staff and shift.

12.4.1 Personnel Monitoring Systems

Monitoring instruments are located at exits from the Radiation Control Area. These instruments are intended for use to prevent any contamination on personnel, materials, or equipment from being spread into the unrestricted/secondary systems areas of the station. Appropriate monitoring instruments are also used at various locations throughout the station for contamination control purposes. Portal monitors are utilized as appropriate, to monitor personnel leaving the station.

Personnel monitoring equipment consists of thermoluminescent dosimeters (TLD's), electronic dosimeters, or “self-reading” dosimeters which are worn by those persons who ordinarily work in the Radiation Control Area or RCZ. In addition, monitoring devices are readily available for use for measurement of extremity dose. This personnel monitoring equipment is issued by Radiation Protection. Personnel monitoring equipment is also available on a day-to-day basis for those persons, employees or visitors, not assigned to the station who have occasion to enter the Radiation Control Area or to perform work involving possible exposure to radiation.

The use of personnel monitoring equipment mentioned above refers specifically to compliance with 10CFR 20.1502. The Station Radiation Protection Manager may require additional

equipment to be worn based on the actual or anticipated dose rates and other radiological problems encountered on the job.

Personnel monitoring badges are supplied by a centralized in-house personnel dosimetry service which meets all applicable requirements for sensitivity, range, and accuracy of measurement. This service is NVLAP approved. Conformance with appropriate standards is also required. This service has the response capability for both routine and emergency purposes.

A body burden analyzer for routine screening of personnel for internal exposure is provided in the low background counting area in the Administration Building. Outside services for radiobioassay and whole body counting are utilized as required for backup and support of this program. The station equipment is sufficiently sensitive to detect in thyroid, lungs or whole body a few percent of the allowable limit of intake for those gamma emitting radionuclides encountered.

12.4.2 Personnel Protective Equipment

Special “protective” or “anti-contamination” clothing is furnished and worn as necessary to protect personnel against contact with radioactive contamination.

This consists of coveralls, lab coats, hoods, gloves, and shoe covers. Change rooms are conveniently located in the Radiation Control Area of the station for proper utilization of this protective clothing. Approved respiratory protective equipment is also available to supplement process containment and ventilation controls, for the protection of personnel against airborne radioactive contamination. This equipment consists of compressed air systems, air-supplied respirators, air-purifying (filter) respirators and Self-Contained Breathing Apparatus (SCBA).

Maintenance of the respiratory protective equipment is in accordance with the manufacturer's recommendations and NUREG 0041. The use and maintenance of protective clothing and radiological respiratory protective equipment is under the direct control of the Radiation Protection Section and personnel are trained in the use of this equipment before using them in the performance of their work. The use of respiratory protective equipment is in accordance with appropriate regulations (10CFR 20.1202, 1204 and 1701-1704) Regulatory Guides and ANSI Standards.

12.4.3 Facilities and Access Provisions

Change room facilities are provided where personnel obtain clean protective clothing and other equipment required for station work. The change rooms serve the Reactor Buildings, the Auxiliary Building, the Spent Fuel Pools, and the Hot Machine Shop. A change room is also provided for female employees. These facilities are divided into clean and contaminated sections. The contaminated section of the change rooms is used for the removal and handling of contaminated protective clothing after use.

Radiation monitoring equipment is available in all change rooms for personnel monitoring. Decontamination facilities i.e. sinks, showers, are available in the unit 1 & 2, and Unit 3 men's change room, the women's change room located on the ground floor of the auxiliary building and in the Radwaste facility.

Personnel who are required to utilize protective clothing obtain these items in the change rooms. They first enter the change room on the “clean” side, don the required protective clothing, and then proceed to the job location. After completing work, they remove outer contaminated protective clothing at the exit of the Radiation Control Zone set up about the work

area. They then proceed to the “contaminated” side of the change room, where they monitor themselves, if contaminated contact RP, if clean, remove inner protective clothing items, and proceed to the “clean” side, where they put on their personal clothing before leaving.

Routine entrance to and exit from the RCA is through the Single Point of Access (SPA). The SPA is located adjacent to the Work Control Center on the Unit 2 Turbine Floor. The SPA is equipped with appropriate monitoring equipment for individuals exiting the RCA through the SPA. Other RCA entrance and exit locations may be approved by RP management as needs dictate. The personnel entrance/exit points to/from the Auxiliary Building (RCA) are provided with contamination control checkpoints that are equipped with appropriate monitoring instrumentation. All other personnel-access points into the RCA in the Auxiliary Building are protected by restricted-in/free out doors in case of emergency. Contamination control check-points are strategically placed throughout the RCA to prevent the spread of contamination within this area.

Before leaving the Radiation Control Area, personnel are required to monitor themselves with the appropriate equipment, positioned near each control point exit door, to make sure that they are free of significant contamination.

In order to protect personnel from radiation and radioactive materials, the Radiation Control Area of the station is divided into areas of increasingly controlled access depending on radiation levels. Protection of personnel from access to radiation areas, high radiation areas, locked high radiation areas, and very high radiation areas that exist temporarily or permanently as a result of station operations and maintenance is by means of appropriate radiation warning signs, barricades, locked doors, audible and visual indicators and alarms, etc., as required by 10CFR 20 (References 1 and 2).

All work on systems or in locations where radioactive contamination or external radiation is present requires a Radiation Work Permit (RWP) prepared under the direction of the Station Radiation Protection Manager before work may begin. The radiological hazards associated with the job are determined and evaluated prior to issuing the permit whenever practical, and historical data will be used when this is not practical.

Keeping exposures ALARA is a major consideration. The Radiation Work Permit lists the precautions to be taken including, as appropriate, working time limits (for external and internal exposure), protective clothing to be worn, and any radiation monitoring that may be required during the performance of the work. The permit is issued for personnel use. A working copy is maintained by the Radiation Protection Section.

All persons performing radiological work are required to read and understand the instructions on the appropriate RWP and to respond to the prompts provided by the Electronic Dose Capture System (EDC), or fill out the required information on their Daily Exposure Time Record dose card before entering and after leaving the RCZ and/or Radiation Control Area if the EDC system is unavailable for use. The information from the EDC system or the dose card is entered into the Radiation Monitoring and Control (RM&C) System computer programs and serves, in part, as a personnel monitoring record for the individuals involved.

An equipment decontamination facility is provided at the station for large and small items of station equipment, components and tools. In addition, a cask decontamination area is provided adjacent to each spent fuel pool. A decontamination laundry and a respiratory protective equipment cleaning and repair facility are also provided.

Decontamination of work areas throughout the station is facilitated by the provision of janitor's sinks in the reactor containments and on elevations 783+9, 796+6, and 838+0 in the Auxiliary Building.

Drains from all of these facilities go to appropriate radioactive liquid waste drain tanks. Written procedures govern the proper use of protective clothing, the change rooms, and the decontamination facilities.

Radioactive material and contaminated equipment associated with plant operations shall be labeled/posted controlled and stored within the Restricted Area and/or the Owner Controlled Area in accordance with 10CFR20 requirements until such time that it is appropriate to transfer it to another location licensed to receive such radioactive material.

Note that the Reactor Coolant Pump Motor Refurbishment Facility ventilation system and ventilation sampling system were “abandoned in place” in the last quarter of 2004, after completion of the Reactor Head Replacement Project. Electrical power to the ventilation and ventilation sampling systems was disconnected as part of the “abandonment” process. Although the ventilation system equipment and the ventilation system sampler remain in-place, this facility no longer discharges airborne radioactivity to the environment. This paragraph remains as a description of the operation of the ventilation system that was installed in the building to support the Reactor Head Replacement Project. This paragraph also remains in the event power is later restored to the ventilation and ventilation sampling systems. The Reactor Coolant Pump Motor Refurbishment Building is available for maintenance activities. An effluent sampling system, including a negative pressure ventilation exhaust system, may be used during specified maintenance evolutions such as the Reactor Head Replacement Project. For instances in which the ventilation system is not available, controls are imposed by the radiological procedure governing the work to prevent or minimize airborne releases and to ensure that airborne radioactivity is sampled prior to release to the environment. The radiological control procedure will also specify conditions under which work will be performed in an enclosure with a HEPA-filtered exhaust. The HEPA-filtered exhaust will be monitored for the discharge of radioactivity during periods of HEPA system operation.

Note that the Carbon Dioxide Blast Facility has been “abandoned in place.” Electrical power and air supply to the equipment were disconnected as part of the “abandonment” process. Although the Carbon Dioxide Blast equipment remains in-place, this facility is no longer used for decontamination purposes. This paragraph remains as a description of the operation of the decontamination system. This paragraph also remains in the event electrical power and air supply are later restored to the decontamination equipment. The Carbon Dioxide Blast Facility is available for decontamination activities that will not release uncontrolled airborne radioactivity to the environment. Controls are imposed by the radiological procedure governing the decontamination work to ensure that uncontrolled airborne radioactivity is not released to the environment from the facility. The blast facility is housed within a building that does not exhaust to the environment. Additionally during periods of operation, the process is exhausted through a HEPA filtration unit, to the outer facility. The HEPA-filtered exhaust is constantly monitored for the discharge of radioactivity during periods of HEPA system operation.

12.4.4 Radiation Protection and Chemistry Facilities

The major Radiation Protection facilities including a shielded counting room are centrally located at the Oconee 1 and 2 Auxiliary Building interface for efficiency of operation. These facilities are equipped for detecting, measuring, and analyzing radiation(s) of primary concern and for evaluating radiological problems that may be reasonably expected. Portable equipment calibration and respirator maintenance facilities are located at the Oconee 3 Auxiliary Building.

The chemistry facilities located in the auxiliary building include a primary lab and office area located at the Oconee 1 and 2 Auxiliary Building interface and a secondary lab and office area located in Oconee 3's Auxiliary Building. The primary lab is used to analyze primary system

(reactor coolant, pressurizer, BWST, etc.) samples while the secondary lab is used to analyze secondary system (feedwater, hotwell, etc.) samples.

The chemistry facilities located outside the auxiliary building include a chemistry laboratory in the Radwaste Facility. The laboratory is used to perform chemical analyses on radwaste samples and to prepare samples for gamma spectra and beta counting.

Body burden analysis measurements for personnel internal dosimetry purposes is performed in the administration building. Environmental samples are collected and sent to a Duke Power Company environmental facility for analysis.

12.4.5 Radiation Protection Instrumentation

12.4.5.1 Laboratory and Portable Instruments

The various types of portable and laboratory instruments used in the Radiation Protection program measure alpha, beta, gamma, or neutron radiation. These instruments are required for measurements to provide protection against radiation for station personnel through surveys required by 10CFR 20.1501; to analyze and measure radioactivity prior to the release of effluents for the protection of the health and safety of the public; and to provide for all other radioactivity and radiation measurements and analyses necessary for personnel and public safety and for protection of property. They were selected to provide the appropriate detection capabilities, ranges, sensitivities, and accuracies for the anticipated levels of radiation at Oconee Nuclear Station during normal operation, anticipated transients and emergency conditions. Portable instrument and equipment calibrations are supported by the system calibration facility. Sufficient quantities are maintained for use, calibration, maintenance and repair.

Portable radiation survey and monitoring instruments for daily routine use are maintained with operational characteristics as indicated below:

Beta-gamma survey meters (Geiger counters) are used for detection of radioactive contamination on surfaces and for low level dose rate measurements.

Beta/gamma ionization chamber survey meters are used to cover the range of dose rate measurements necessary for radiation protection purposes.

The above mentioned portable instruments are subject to preoperational response checks to low activity Cs-137 sources. Calibrations are performed periodically. The Cs-137 Shepherd calibration sources and the variable pulse generator are also calibrated periodically using National Institute of Standards and Technology (NIST) traceable secondary standards.

Neutron REM survey instruments are used to measure the sum of thermal, intermediate, and fast neutron dose rates for radiation protection purposes. These instruments are calibrated periodically with a variable pulse generator and source checked using a Pu-Be source.

The laboratory equipment is maintained as indicated below:

Multi-channel analyzers are utilized in conjunction with solid state detectors, for identification and measurement of gamma emitting radionuclides in samples of reactor primary coolant, liquid and gaseous waste, airborne contaminants, etc.

Dual channel liquid scintillation counters are used for counting tritium, as well as gross beta activity, in reactor primary coolant and other radioactive liquids and wastes.

Smears for beta/gamma contamination are counted utilizing proportional or GM counter-scalers. Smears for alpha contamination are counted utilizing scintillator or proportional counter-scalers.

A shielded body-burden analyzer having adequate sensitivity to detect radionuclides of interest is located in the Administration Building and is used for personnel bioassay purposes.

The counting room equipment is subject to annual calibration/calibration check by NIST traceable sources in addition to daily response checks and routine inter-laboratory cross checks when equipment is in service.

Various portable airborne gaseous, particulates, and iodine samplers are available for routine use to evaluate air contamination. Samplers are calibrated periodically. Air flow standards used for calibration of these samplers are calibrated periodically by NIST traceable instruments.

Respiratory protective equipment includes air purifying full-face masks, air supplied respirators. Chemical cartridge particulate respirators are also available. All are maintained according to applicable regulations such as those contained in 10CFR Part 20. Respiratory protective equipment is stored in the respirator issue facility, the Control Room(s), the Operations Support Center, and other emergency locations.

Portable instrumentation for use in emergency situations is stored in emergency kits which are located at various assembly points and in the respirator issue facility. The kits are examined periodically for maintenance and calibration.

12.4.5.2 Inplant Radiation Monitoring

Inplant Radiation Monitoring Systems provide station personnel with capabilities to assess the radiological situation in various areas of significance during normal operation as well as during off-normal and emergency situations. The monitoring systems include the Area Radiation Monitoring Systems and the Process Radiation Monitoring System. Portable radiation and air monitoring equipment is also used to supplement these systems.

The Area Radiation Monitoring System is provided to monitor radiation levels in various plant locations that are potential personnel exposure areas. This system consists of gamma sensitive detectors, signal conditioning and readout instrumentation, radiation level alarm sensing logic, audible and visible alarm devices and outputs available for recording. A complete description of the number, detector type, location, range, and nominal sensitivity are presented in Section 12.3.3.2.

The Process Radiation Monitoring System is provided in part to monitor station effluents that are potential sources of radioactivity. Also, gases, particulates, and liquid and iodine levels are monitored in primary and secondary systems during normal operation, anticipated operational occurrences and emergencies. This system provides an indication of the radioactivity in the process line monitored and provides alarms in the control room at a preset level to ensure that concentrations are maintained within the limits specified in the DPC Oconee Nuclear Station Selected Licensee Commitments Manual. In addition some of the monitors perform control functions during postulated accident conditions. A complete description of the Process Radiation Monitoring system, including its number, function, range, nominal sensitivity, and detector type is presented in Section 11.5.

The process and area radiation monitoring systems are supplemented by periodic surveys and by periodic grab air samples, which are collected and analyzed by Radiation Protection and Chemistry, during normal and abnormal operations and maintenance. Appropriate cartridges are used for sampling air when the presence of iodine is suspected.

12.4.6 Radio-Bioassay and Medical Programs

Duke employees and contract service employees issued a personnel monitoring badge and who plan on entering the RCA/RCZ are given a body-burden analysis when the badge is initially issued and when employment is terminated or alternatively, when the person is transferred to a non-radiological assignment. Visitors who plan on entering the RCA/RCZ are generally given a body-burden analysis each time a monitoring badge is issued and at the termination of the station visit. In addition, badged station personnel and appropriate other Duke system personnel participate in a routine body-burden analysis program which provides for at least one body-burden analysis per year for each participant. Additional body-burden analysis can be required for personnel who experience significant exposure to airborne contamination or other conditions, (such as pregnancy or change in employee status). The Station Radiation Protection Manager may waive the requirement for any analysis on a case by case basis if in his judgement, the analysis is inappropriate or impracticable. No special medical examination is considered to be necessary for radiation workers whose exposure is maintained within permissible dose limits. However, a pre-employment physical is required of prospective radiation workers to determine their health status and their ability to perform the job. Also, personnel are also examined or screened by a physician to ensure that they are medically able to use respiratory equipment. Personnel using respiratory equipment are given the appropriate training for respiratory use and fit tested as required for the respirator(s) to be used.

Anyone onsite, whether badged or not, who is involved in a radiological accident where internal exposure is likely, is given a body-burden analysis as soon as practicable thereafter.

Dose commitments are calculated by the Site or General Office Radiation Protection Staff.

Medical observation and treatment are available in case of over-exposure or excessive contamination. Physicians, a medical clinic, and hospital facilities are available for the treatment of injuries. A local physician has been retained, and trained in the care and treatment of radiation injuries, and facilities have been established in a local hospital for the handling and treatment of possibly contaminated injured or irradiated patients. Back-up support is also available through the Oak Ridge Radiation Emergency Assistance Center/Training Site, REAC/TS. Radiation Protection personnel are responsible for the radio-bioassay program and are available to assist the physicians and the hospital in maintaining medical control of over-exposed or contaminated personnel.

These programs are designed to monitor and protect the health of all employees concerned, to confirm the adequacy of the radiation control methods employed at the station and to provide for the treatment of injuries.

12.4.7 Tests and Inspections

Routine radiological monitoring to detect radiation, radioactive contamination, and airborne radioactivity is performed throughout the plant on periodic schedules. Monitoring frequencies are determined by the Station Radiation Protection Manager based upon the actual or potential radiological conditions. Schedules of routine monitoring are issued to the technicians who initial the schedule when the routine is completed. As plant conditions change, the schedule is updated. Radiological surveys are performed before personnel enter potential or actual radiation areas where there is any doubt as to the existing conditions. Radiological surveys are also performed as a backup to routine monitoring when conditions change. All survey and routine monitoring data is recorded and filed in the Radiation Protection files. Retention of survey and monitoring records follows the requirements of 10CFR 20.2103 and the QA Topical Report.

The Radiation Protection Section and the system calibration facility perform the work necessary to maintain (other than repair) the Counting Room instruments and the portable radiation monitoring instruments. Periodic NIST traceable calibrations, instrument checks and evaluations, and other manual checks are performed. Duke Power Company participates in NRC approved performance testing programs. Electronic/Self-reading dosimeters are subjected to periodic tests and calibration.

Personnel monitoring instrumentation is subjected to a continuing Quality Control Program. The Quality Control Program includes the use of a computer program that compares TLD values and Electronic/ "self-reading" dosimeter totals covering the same monitoring period and lists those correlations that are unacceptable so that effective problem resolution can be performed as necessary, thus helping to maintain a high level of personnel monitoring equipment performance.

Duties concerning radioactive gaseous and solid waste disposal are performed by the Radiation Protection section. The detailed analyses and records required to characterize the nature of radioactive gaseous waste releases and solid waste disposal are under the control of the Radiation Protection section.

Duties concerning radioactive liquid waste disposal are performed by the Chemistry section. While the analyses of radioactive liquid waste releases are under the control of the Radiation Protection section, the records required to characterize the nature of liquid waste releases, both qualitatively and quantitatively, are under the control of the Chemistry section.

Training and qualification of personnel in Radiation Protection are the responsibility of the Station Radiation Protection Manager and are performed by the Radiation Protection Section, or by Nuclear Generation Department Training personnel, under his direction.

The Radiation Protection Section maintains the Offsite Radiological Monitoring Program for the station in conjunction with the system radiological environmental laboratory.

12.4.8 References

1. Regulatory Guide 8.38, "Control of Access to High and Very High Radiation Areas Section 2.4 Alternative Method for Control."
2. Letter from L.A. Wiens (NRC) to J.W. Hampton (ONS) dated February 14, 1994 regarding: Approval to control High Radiation Areas at the Oconee Nuclear Station in accordance with the alternate controls described in the Regulatory Position 2.4 of the Regulatory Guide 8.38.

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