DUKE POWER COMPANY
McGuire Nuclear Station - Unit 2
Application for Special Nuclear Material License

General Information

Pursuant to 10CFR 70.21 and 70.22 Duke Power Company hereby applies for a special nuclear material license for McGuire Nuclear Station - Unit 2. Duke is the holder of Construction Permit No. CPPR-84 issued by the Atomic Energy Commission on February 28, 1973. CPPR-84 permits construction of McGuire Nuclear Station - Unit 2 on the shore of Lake Norman in Mecklenburg County, North Carolina. Duke is an investor owned electric utility incorporated in the state of North Carolina with its corporate headquarters located in Charlotte, North Carolina. The company address is as follows: Duke Power Company, P.O. Box 33189, Charlotte, North Carolina 28242. Further information regarding Duke Power Company and McGuire Nuclear Station is contained in the application for operating licenses for McGuire Nuclear Station filed with the NRC (Docket Nos. 50-369 and 50-370).

Activities Sought to be Authorized

A. The receipt, possession, inspection and storage of uranium enriched in the U-235 isotope contained in fuel assemblies and in fission chambers,

B. The packaging of fuel assemblies for delivering to a carrier in accordance with 10CFR, Part 71, and

C. Movement and insertion of a single fuel assembly into the different locations of the reactor vessel for indexing purposes provided that no more than one fuel assembly be in the reactor vessel at one time and that the assembly used for indexing shall be inspected for damage prior to use in the core.

Requested License Duration

It is hereby requested that the issued special nuclear material license for McGuire Nuclear Station - Unit 2 expire on December 31, 1983 or upon conversion of Construction Permit No. CPPR-84 to an operating license, whichever is earlier.

Special Nuclear Material to be Covered

A. Nuclear Fuel

Special nuclear material will be contained in a number of fuel assemblies which will not exceed one hundred and ninety-six (196) although only one hundred and ninety-three (193) fuel assemblies are required to load the reactor core of McGuire Unit 2. A license authorizing 196 assemblies is requested to allow for contingencies.

The McGuire Unit 2 initial core is composed of the following:

65 fuel assemblies containing 2.1 wt. % U-235 which is 9.7 kilograms of U-235 per fuel assembly.

64 fuel assemblies containing 2.6 wt. % U-235 which is 12.0 kilograms of U-235 per fuel assembly.

64 fuel assemblies containing 3.1 wt. % U-235 which is 14.3 kilograms of U-235 per fuel assembly.

3 fuel assemblies containing 3.1 wt. % (or less) U-235 which is 14.3 kilograms (or less) of U.235 per fuel assembly (contingency).

The total weight of normal uranium is 461.5 kilograms (U) per fuel assembly. The total weight of a fuel assembly is 665.4 kilograms. The fuel assemblies contain no U-233, Pu, depleted uranium, or thorium.

A fuel assembly is described in the Final Safety Analysis Report (FSAR) for

the McGuire Nuclear Station, Section 4.2.1.

B. Fission Chambers

Special nuclear material will be contained in several fission chambers (movable incore neutron detectors). Each movable detector contains U_3O_8 enriched to more than 90 percent U-235. The total quantity of U-235 in each detector is less than five (5) milligrams. There will be a total of six (6) operational detectors and possibly as many as six (6) spare detectors on site at any one time. Therefore, there could be as many as 60 milligrams of U-235 (in detectors) on site at any one time.

Technical Qualifications

The qualifications of those personnel responsible for the control of special nuclear material at McGuire Nuclear Station are contained in attachments 1 and 2 of this application.

Facilities and Equipment

A. Storage Facilities

Construction of the McGuire Unit 2 Fuel Storage Facilities has been completed, and preoperational testing of the fuel handling equipment will be complete prior to receipt of new fuel. Detailed information regarding 1
the fuel storage facility structures, systems, components, and design bases is provided in the McGuire FSAR Sections 9.1 and 3.8.4. A general arrangement drawing of the McGuire Unit 2 fuel building is attached.

New fuel is received in the fuel receiving area and stored temporarily prior to being removed from the shipping container. When removed from the shipping container, the assemblies are handled one at a time by the auxiliary hoist of the fuel handling bridge crane. Upon removal from the shipping container the assembly is placed in the new fuel inspection hatch or is transported by the auxiliary hoist to the New Fuel Storage Vault or the spent fuel pool for storage. Fuel is transferred from the vault to the spent fuel pool in a similar manner.

1. New Fuel Storage Facility

The design of the new fuel facility is based on the following criteria:

- General Design Criterion 2 - Design for protection against natural phenomena;
- General Design Criterion 3 - Fire Protection;
- General Design Criterion 4 - Environmental and missile design bases;
- General Design Criterion 5 - Sharing of structures, systems and components;
- General Design Criterion 61 - Fuel storage, handling, and radioactive control;
  a. Capability of periodic inspection;
  b. Shielding for radiation protection;
  c. Provisions for containment and confinement;
- General Design Criterion 62 - Prevention of criticality in fuel storage and handling;
- ANSI N18.2-1973, Section 5.7.4.1;

  "The design of spent fuel storage racks and transfer equipment shall be such that the effective multiplication factor will not exceed 0.95 with new fuel of the highest anticipated enrichment in place assuming flooding with pure water. The design of normally dry new fuel storage racks shall be such that the effective mutliplication factor will not exceed 0.98 with fuel of the highest anticipated enrichment in place assuming optimum moderation (e.g., a uniform density aqueous foam envelope as the result of fire fighting). Credit may be taken for the inherent neutron absorbing effect of materials of construction or, if the requirements of Criterion 5.7.5.10 are met, for added nuclear poisons."
- Regulatory Guide 1.29.

Each unit at McGuire Nuclear Station has new fuel storage racks located within a New Fuel Storage Vault. Both the New Fuel Storage Vault and the new fuel storage racks are designed as Category 1 structures. The new fuel storage racks are arranged to provide dry storage for 96 new fuel assemblies. The racks consist of vertical cells grouped in parallel rows, six rows wide and 16 cells long, which provide support for the fuel assemblies and a minimum center-to-center distance of 21 inches between assemblies. The new fuel storage racks are constructed of structural steel shapes and plates with guides which provide for easy entry of the assemblies into the racks. The racks minimize the horizontal displacement of the fuel assemblies during storage.

Calculated values of K_{eff} for the storage arrays, including the effects of calculational and geometrical uncertainties, are less than those required by ANSI N18.2-1973, Section 5.7.4.1 when a full loading of the assemblies is considered.

The computer codes and techniques utilized in the analysis have been validated against experimental data for water moderated UO_2 latices with characteristics similar to the fuel analyzed.

The following assumptions are made in evaluating criticality safety:

- Parameters are chosen to maximize K_{eff}.
- Under postulated conditions of complete flooding by unborated water, the array is treated as an infinite array of infinitely long assemblies.
- Under posulated conditions of complete envelopment by aqueous foam, the array is assumed to contain an infinite number of assemblies and a range of foam densities is examined to ensure that the maximum reactivity is established.
- No burnable poisons, control rods or supplemental neutron poisons are assumed to be present.
- All assemblies are assumed to be 3.5 w/o enrichment U-235 and unirradiated.
- Effects of reflectors other than water are included if their neglect would have been nonconservative.
- The interaction between array members is included.

The following accidents are considered in the criticality design of the new fuel storage area:

- Flooding: complete immersion of the entire array in pure, unborated, room temperature water.
- Envelopment of the entire array in a uniform density aqueous foam of optimum density (that density which maximizes the reactivity of the array), for example as a result of fire fighting.

Accidents resulting in an increase in K_{eff} because of geometrical changes of the racks or fuel handling accidents are not considered credible due to the following design bases:

- The facility is designed in accordance with GDC 2 and 4.
- The racks are designed to Seismic Category 1 requirements.
- The only Category 1 structure that could disrupt the array should it fail during a seismic event is the crane trolley. Administrative procedure prohibits the trolley from being parked over the New Fuel Storage Vault.
- The runway conductor's for the trolley are divided and power to each section is provided through separate circuit breakers. Power to the conductors in the area of the new fuel storage vault is provided only during handling operations. The conductors are divided at a point which will prohibit the trolley being positioned over the vault when power to that end is interrupted.
- The racks and anchorages can withstand the maximum uplift force available without a significant change in geometry.
- The design of the Fuel Handling System and administrative procedures insure subcritical spacing of fuel assemblies. Only one fuel assembly will be handled at a time within each of the four areas specified in Figure 1. 1

The introduction and retention of moderators into the facility is prevented by the following:

- The storage of the new fuel within the New Fuel Storage Vault precludes flooding of the new fuel assemblies by the probable maximum flood (PMF) and the probable maximum precipitation (PMP). The dike at McGuire Nuclear Station is at elevation 780+0, which protects the site area. The bottom of the new fuel assemblies are at approximately elevation 762+6. This elevation (762+6) is higher than the maximum elevation of either the PMF or the PMP.
- There is no piping routed thru this area, the rupture of of which could introduce moderator into the vault.
- There exists a drainage system sized to handle all probable means of inadvertent flooding.
- Administrative policy has been established to preclude the use of hydrogeneous fire fighting material from the vault. All extinguishers are of the dry chemical or CO_2 type.

Two gamma radiation monitors, which alarm both locally and in the control room area upon the detection of high radiation levels, are located in the vault. These gamma radiation monitors are self testing. Should either unit become inoperable, indication of the failed state is provided in the Control Room.

There are normally no combustible materials present in the storage vault. A manual fire fighting system of appropriate capacity and capability is present should combustible material be inadvertently introduced.

Ventilation for this facility is provided by the fuel handling area ventilation supply and the fuel handling area ventilation exhaust subsystems.

2. Spent Fuel Storage Facility

The design bases of the spent fuel storage facility are the following:

- The prevention of criticality during storage.
- The prevention of damage of the fuel.
- Adequate radiation shielding.
- Protection against radioactivity release.
- Adequate monitoring of the fuel storage.
- Ability to withstand design seismic loads.

The fuel assemblies are held in a vertical position by the spent fuel pool storage racks. The fuel assemblies are supported within the fuel storage racks by a stainless steel plate located six inches above the fuel pool floor. Stainless steel plates which cover the top of each storage rack are positioned over those storage racks which contain new 1
fuel assemblies.

The fuel racks are constructed using stainless steel plates. The four sides of the fuel rack are 1/8 inch stainless steel plate. A 1/4 inch plate, with a 5 1/2 inch diameter hole in the center is welded to the sides of the fuel rack for support of the fuel assembly. The support plate is located 6 inches above the pool floor. An opening of not less than 12.5 square inches is provided in each side of the fuel rack and located below the fuel assembly support plate. A lead-in assembly is provided at the top of each rack for ease of insertion of the fuel assembly.

In order to maintain the racks in a vertical position, the bottom and top of each rack is supported laterally against the fuel pool wall by a gridwork of structural steel shapes and plates which are welded to the fuel racks. For each unit, there are 500 fuel assembly storage racks for spent fuel.

Administrative procedures require that new fuel assemblies stored dry in the spent fuel pool be stored in a checkerboard array such that for a given assembly, the four diagonally adjacent locations contain an assembly, and the four immediately adjacent storage locations are vacant. This checkberboard array insures that no two fuel assemblies will be closer than the 21 inch center-to-center spacing of the New 1

Fuel Storage Vault. The exact positioning of each fuel assembly is specified by the Reactor Engineer prior to storage of the new fuel assemblies in the spent fuel pool. The supervisor in charge of new fuel storage assures that each assembly is properly positioned 1
and records where each assembly is stored. The Reactor Engineer reviews the supervisor's records to verify that each assembly was properly positioned.

The use of hydrogenous fire fighting foam in this fuel storage area is excluded. However, a single hose station (one hose) is provided for fighting fires which could occur in the fuel receiving area. Dry chemical or CO_2 fire extinguishers are also provided for this purpose, and their use is encouraged while the hose station is used as a backup. This hose station is located on the operating deck level of the spent fuel pool and is capable of providing a minimum of 100 gpm of water 1
at a pressure of 65 psig. The maximum pressure available to this station is 100 psig. Administrative controls preclude the fire fighting crews from using this hose station to spray water into the spent fuel pool or from spraying the fuel receiving areas if new fuel is being transferred from the shipping container to its storage location. In addition, the spent fuel pool racks are designed so that water diperses through all the racks and cannot accummulate in any given single rack.

Under the above restriction, K_{eff} values were calculated for storage array, including the effects of calculational and geometric uncertainties. These values are less than those required by ANSI N18.2-1973, Section 5.7.4.1 when an infinite array of the assemblies is considered. The computer codes and techniques utilized in the anlysis have been validated against experimental data for water moderated UO_2 lattices with characteristics similar to the fuel analyzed.

The following assumptions are made in evaluating optimum moderation criticality safety:

- Parameters are chosen to maximize K_{eff}.
- The array is assumed to be infinite in all directions, and a range of foam densities is examined to ensure that the maximum reactivity is established.
- No burnable poisons, control rods, or supplemental neutron poisons are assumed to be present.
- All assemblies are assumed to be 3.5 w/o U-235 enrichment and unirradiated.
- Credit is taken for the inherent neutron absorbing effect of some of the rack structure in accordance with Section 5.7.4.1 of ANSI N18.2-1973.
- Geometric uncertainties and misalignment of the assemblies in the rack are assumed to occur in the worst possible combinations.

A 16 group cross-section data set was obtained from the standard KENO library tape. Most of the microscopic cross-section data is of the Hanson and Roach 16 x 16 cross-section data for several elements. The cross sections for U-235 and U-238 were corrected for self shielding. Utilizing this 16 group cross-section set the Monte Carlo code KENO is then used to perform the series of criticality calculations on detailed representations of assembly arrays.

Results of the analysis indicate that an infinite checkerboard array of assemblies, under the criteria stated above, would have a value of K_{eff} of approximately 0.92. Separate analyses were performed to compare results of this optimum moderation analysis method with those obtained by reactor vendors. 1

The heaviest objects which could possibly be moved over the spent fuel pool racks are the two spent fuel pool weir gates. However, these weir gates will not be moved from their storage locations while the spent fuel pool is being used to store new fuel. Therefore, the heaviest object which will be moved over the new fuel assemblies stored in the spent fuel pool is a fuel assembly. The spent fuel pool racks are designed to protect stored fuel assemblies from damage resulting from a dropped fuel assembly. 1

3. Temporary Storage in Shipping Containers

The new fuel will be temporarily stored in shipping containers in the fuel receiving area before being removed and placed in either the New Fuel Storage Vault or spent fuel storage pool. The Westinghouse shipping container is a reusable metal container (certification number US54-50AF) designed for shock and vibration isolation, humidity control and leak tightness to protect fuel assemblies from damage during normal handling and shipping at temperatures from -40°F to + 150°F. Each container may contain one or two fuel assemblies with or without core components. No more than twelve shipping containers are expected to be on site at any one time. 1

4. Removal From Storage

The container lateral clearance dimensions are 47" high by 45" wide. At 191" long shipping container is used to ship the 12' fuel assemblies and weighs 6100 pounds fully loaded.

Fuel assemblies may be removed from storage for either of these three reasons:

- Inspection - This involves a visual or otherwise nondestructive examination of the fuel assembly to determine its acceptability before exposure in the reactor core.

- Precharacterization - This involves measurements and examination to determine the pre-exposure characteristics of a given fuel assembly.

- Indexing - One assembly may be removed from storage and inserted into various locations of the reactor vessel for purposes of indexing the core.

Fuel assembly movements while being removed from or replaced in approved storage, shall be controlled by approved operating procedures.

The ability to remove one fuel assembly from storage is necessary in order to perform the tasks of inspection, precharacterization, and indexing. The design of the fuel handling system and the proper control of these movements by approved operating procedures, shall preclude the possiblity of positioning two or more fuel elements within the limits previously analyzed in Section 2.2.3 of Regulatory Guide 3.15. One single element cannot achieve criticality under optimum conditions of spacing, moderation and reflection.

B. Health Physics and Chemistry Facilities

The Health Physics and Chemistry facilities are centrally located in the Auxiliary Building for efficiency of operation. Laboratory facilities consist of a conventional chemistry laboratory, a radio-chemistry laboratory, and a shielded radiation survey instrument calibration room. These facilities are equipped for conducting the health physics and chemistry programs for the station, for detecting, analyzing and measuring all types of radiation and for evaluating any radiological problem that may reasonably be expected. Equipment for preparing environmental radioactivity samples, performing measurements for internal personnel dosimetry purposes, and for radio-bioassay is also included. In addition, a Health Physics operations office is provided in this location.

C. Additional 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 service the reactor buildings, the Auxiliary Building, the spent fuel pools, and the Hot Machine Shop. 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. Provisions for change and personnel decontamination are also available in the first aid room in the Radiation Control Area. Showers, sinks, and necessary radiation monitoring equipment are provided in all of the change rooms to aid the decontamination of personnel.

Equipment decontamination facilities are also provided at the station for large and small items of station equipment, components and tools. There is one such facility for each unit, and in addition, a cask decontamination area is provided adjacent to each spent fuel pool. A decontamination laundry is also provided.

Decontamination of work areas throughout the station is facilitated by the provision of janitor's sinks on each floor level in the Auxiliary Building and in the reactor containments.

Drains from all 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.

In order to protect personnel from radiation and radioactive materials, the Restricted Area of the station is divided into areas of increasingly controlled access depending on radiation levels. Protection of personnel from access to 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, as required by 10CFR20. Administrative controls are also used in conjunction with the above and keys are issued to authorized station personnel for access to the Radiation Control Area of the plant and to limited access areas within the Radiation Control Area under certain conditions.

The boundaries of the Radiation Control Area for each elevation are given in terms of Radiation Zones. The main personnel entrance/exit point to/from the Radiation Control Area in the Auxiliary Building is located at QQ-59, elevation 786. A contamination control checkpoint that is equipped with appropriate monitoring instrumentation is located at this access point. All other personnel-access points into the Radiation Control Area in the Auxiliary Building are protected by restricted-in/free-out doors, and are for emergency exits only. Stairs located on the north, south, east, and west sides of the Auxiliary Building are provided for personnel access from one elevation to another. Contamination control checkpoints are appropriately-located at the stairwell locations. Additional checkpoints are strategically placed throughout the Radiation Control Area, to prevent the spread of high levels of contamination within this area.

The Radiation Work Permit system is also utilized to control access to high radiation areas.

Before leaving the Radiation Control Area, personnel are required to monitor themselves (with thin window G-M count rate meters, positioned near each exit door), to make sure that they are free of significant contamination.

Authorized personnel enter the Radiation Control Area through key-operated doors, generally on the Turbine Building-Service Building-Control Room-side of the station, and leave through these doors (after monitoring themselves with the count rate meters) when exiting the Radiation Control Area.

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 move outer contaminated protective clothing, in the Radiation Control Zone set up about the work area. They then proceed to the "contaminated" side of the Change Room, where they remove any remaining protective clothing items, wash and shower as necessary, monitor themselves; and then proceed to the "clean" side, where they put on their personal clothing and leave.

All persons entering the Restricted Area of the station must wear the personnel monitoring equipment (TLD, pocket dosimeters, etc.) prescribed by the Station Health Physicist in accordance with NRC Regulations and must comply with applicable Radiation Work Permits.

All work on systems or in locations where radioactive contamination or external radiation is present requires a specific Radiation Work Permit prepared under the direction of the Station Health Physicist and issued by the Shift Supervisor before work can begin. The radiological hazards associated with the job are determined and evaluated prior to issuing the permit. The Radiation Work Permit lists the precautions to be taken including 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 to the people who perform the work; a copy is retained by the Shift Supervisor and a working copy is maintained by the Health Physics Section.

All persons working under a permit are required to read the instructions on the permit and to fill out the information necessary on their Daily Exposure Time Record Card before and after entering the Radiation Control Zone. The information from the permit and the card is entered into the Radiation Exposure Control and Job Exposure Control computer programs and serves, in part, as a personnel monitoring record for the individuals involved.

The counting room is shielded on all sides to facilitate low level counting work. The instrument calibration room also has shield walls. In addition, extensive shielding of components has been utilized in the Auxiliary Building for the protection of personnel, both for routine operation and for maintenance.

D. Protective Clothing and Respiratory 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, surgeon caps, hoods, gloves, and shoe covers. Change rooms are conveniently located throughout 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 and the possibility of internal radiation exposure. This equipment consists of full-face air-purifying respirators and self-contained breathing apparatus. Also, a breathing air system has been installed in the station, and respiratory protective equipment consisting of air-line full-face respirators, hoods, and plastic suits is provided, should its use become necessary or desirable.

Maintenance of the above equipment is in accordance with the manufacturer's recommendations and rules of good practice, such as those published by the American Industrial Hygiene Association in its "Respiratory Protective Devices Manual." The use and maintenance of protective clothing and respiratory protective equipment is under the direct control of the Health Physics Section and personnel are trained in the use of this equipment before using it in the performance of their work. The use of this equipment is in accordance with the Technical Specifications.

E. Portable and Laboratory Equipment

Different types of instruments are selected to cover the entire spectrum of radiation measurement requirements expected. This includes instruments for detecting and measuring alpha, beta, gamma and neutron radiation. These consist of Counting Room and portable radiation survey/monitoring instruments. These instruments are required to provide protection against radiation for station personnel (for surveys required by 10CFR20.201); to control the release of effluents for the protection of the health and safety of the public; and to provide for all other radiological measurements necessary for personnel and public safety and for the protection of property. Sufficient quantities are obtained to allow for use, calibration, maintenance and repair.

Counting Room instruments for radioactivity measurements include the following:

- Computer-based multi-channel gamma analyzer with multiple Ge(Li) detectors, used for identification and measurement of gamma emitting radionuclides in samples of reactor primary coolant, liquid and gaseous waste, airborne contaminants and similar samples.

- Automatic and manual beta-gamma counter-scales used primarily for gross beta measurements of surface contamination on swipes.

- Alpha counter-scaler used for gross alpha measurements such as uranium or plutonium in reactor primary coolant samples or alpha contamination from surface or air samples.

- NaI well crystal counter-scaler used for gross gamma measurements of various radionuclides in samples of reactor primary coolant, liquid and gaseous wastes, or for measurement of specific radio nuclides.

- Dual channel liquid scintillation counter used for measurement of tritium in reactor primary coolant, liquid and gaseous wastes, and for gross measurement of beta activity other than tritium.

- Shielded body-burden and thyroid-burden analyzer used for measuremant of possible internally deposited radio-isotope for determination of internal dose of personnel.

Portable radiation survey and monitoring instruments for routine use are selected to cover the entire range from background to high levels for the radiation types of concern. These include (with nominal range characteristics as indicated):

- Beta-gamma survey meters (Geiger counters, 0-100 mR/hr) used for detection of radioactive contamination on surfaces and for low level dose rate measurements.

- Low and high range beta-gamma ionization chamber survey meters (0 mR/hr - 1000 R/hr) used to cover the general range of dose rate measurements necessary for radiation protection purposes.

- Neutron rem dosimeter instruments (0 mrem/hr - 5 rem/hr) used to measure the sum of thermal, intermediate and fast neutron dose rates for radiation protection puproses.

- Thermal and fast neutron detectors (0 mrem/hr - 100 rem/hr) used to detect and measure neutron flux and dose rates for radiation protection purposes.

- Alpha scintillation counters (0 - 1,000,000 dpm/100 cm^2, 30 percent efficiency) used for measurement of alpha contamination on various surfaces that may result from any uranium or plutonium in the reactor primary coolant, for example.

The Process Monitoring System is relied-upon for continuous monitoring of airborne radioactivity. This is supplemented by grab air samples collected and analyzed by Health Physics during maintenance and routine and abnormal operations where airborne radioactivity may be evolved. In addition, portable continuous air monitors (CAM's) are utilized during operations that may demand a long period of time for completion, and/or where there is a probability that airborne contamination may be a problem. The CAM's consist of mobile air samplers, equipped with filter(s) and detector(s), which collect and measure gross activity concentrations of airborne particulates and/or iodine. CAM's are utilized as part of the Duke Power radiation protection program, to effect as-low-as-reasonabily-achievable (ALARA) occupational exposure.

Airborne gaseous, particulate, and iodine samplers are also available for routine use as well as an assortment of special purpose and emergency type radiation survey instruments including bubblers for tritium, gas sample containers, low volume air samplers, particulate filters, and activated charcoal and silver zerolite cartridges. All of this equipment is kept in the Health Physics Operations office. Necessary emergency instruments are also located in the Control Room and at a remote assembly point.

In addition to the portable radiation monitoring instruments, fixed beta-gamma count rate meters are located at exits from the Radiation Control Area. These instruments are intended to prevent any contamination on personnel, materials or equipment from being spread to the unrestricted secondary systems areas of the station. Appropriate monitoring instruments are also available at various locations within the Radiation Control Area for contamination control purposes. Portal monitors, (GM thin side windows, ~30 percent efficiency, 150-7000 cpm) are also utilized, as appropriate, to monitor personnel leaving the Radiation Control Area and to monitor persons leaving the station.

All of the above instruments are subjected to initial operational checks and calibration and to a continuing quality control program to assure the accuracy of all measurements of radioactivity and radiation levels. These instruments are recalibrated with standards whenever their operation appears statistically to be out of the accepted limits. In addition, routine calibrations are performed periodically on all of this equipment and after all repairs. These periodic calibrations are performed at least quarterly with the exception of calibrations 1 of the liquid scintillation counters and the GeLi detecters which are performed at least annually. 1 A shielded calibration range capable of exposure rates from essentially background to hundreds of R/Hr is used for calibration of radiation monitoring instruments. Also available is a small (mCi level) source for certain low level calibrations and a nominal 5 Ci Pu-Be neutron source for neutron instrument calibration. The gamma sources are calibrated with an exposure rate meter traceable to the National Bureau of Standards.

The body burden and thyroid analyzers are calibrated using phantoms and solution standards of the radionuclides of concern (CO^{60}, CO^{58}, Cs^{134}, Cs^{137}, and I^{131}). These detectors are used in conjunction with a computer-based multi-channel gamma analyzer and associated readout to obtain a permanent record.

Records of all calibrations are kept and personnel dosimetry, survey and monitoring records, etc., are maintained as required by NRC regulations.

F. Personnel Dosimetry Equipment

Personnel monitoring equipment consisting of thermoluminescent dosimeters (TLD's) and self-reading pocket dosimeters are assigned by the Station Health Physics Section and worn by all personnel (employees and visitors) whose jobs involve radiation exposure as defined in 10CFR20. Additional personnel dosimetry equipment such as high range self-reading pocket dosimeters, extremity TLD's and neutron dosimeters may be assigned as needed depending on the radiological conditions encountered.

Personnel whose jobs require them to frequently enter the Restricted area of the station may ordinarily be assigned a permanent personnel monitoring badge and a dosimeter. Whereas personnel working under a specific Radiation Work Permit in a job situation where a sizeable fraction of the quarterly allowable dose may be received in a relatively short period of time may additionally be assigned a high range self-reading dosimeter and/or extremity monitoring equipment, depending on job conditions. Extremity monitoring equipment is issued for jobs or situations where extremity dose is expected to be limiting or controlling or in excess of the whole body dose. The use of additional personnel monitoring equipment beyond that routinely used depends on the job and on existing radiological conditions as evaluated and determined by Station Health Physics.

Records of Radiation exposure history and current occupational exposure are maintained by the Health Physics Section for each individual for whom personnel monitoring is required. The external radiation dose to personnel is determined on a daily basis by means of self-reading pocket dosimeters. Personnel monitoring badges (TLD's) are processed at least 1
monthly. If necessary, they may be processed more frequently.

A body burden analyzer system for routine screening of personnel to determine internal exposure is available on-site. Outside services for radio-bioassay and whole body counting may be used as required for backup and support of the program. The station equipment is sufficiently sensitive to detect in the thyroid, lungs or whole body a small fraction of the permissible body burden for those gamma emitting radionuclides expected.

Body burden analyses are performed as soon as practicable on individuals who have been newly-assigned a visitor or permanent Health Physics badge or who are terminating employment or assignment with Duke Power Company. In addition all permanently badged individuals are required to receive at least one body-burden analysis per year.

Anyone onsite, whether badged or not, who was involved in a radiological accident where internal exposure was likely, would be given a body-burden scan as soon as practicable. If radioactive material uptake had occurred, proper action would be taken as stated in the System Health Physics Manual.

Personnel monitoring badges (TLD) are supplied by a central in-house service which is responsible for the calibration and maintenance of all TLD and TLD readout equipment. Self-reading pocket dosimeters are calibrated and leak tested at the station as part of the station instrument maintenance Quality Assurance program.

Health Physics Program

A. Program Objectives

The three basic objectives of the Health Physics Program at McGuire are to:

- Protect station personnel
- Protect the public
- Protect the station

Protection of personnel means surveillance and control over the internal and external radiation exposure of personnel and maintaining the exposure of all personnel within permissible limits, and as low as reasonably achievable in compliance with applicable regulations and license conditions.

Protection of the public means surveillance and control over all station conditions and operations that may affect the health and safety of the public. It includes such activities as radioactive gaseous, liquid and solid waste disposal and the shipment of radioactive materials. It also involves conducting an environmental radioactivity monitoring program and maintaining an effective emergency plan.

Protection of the station means the continuous determination and evaluation of the radiological status of the station for operational safety and radiation exposure control purposes. This work is done 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.

The program organization is as follows:

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 System Health Physicist establishes the Health Physics Program for McGuire that is designed to assure compliance with applicable regulations, licenses and regulatory guides. He also provides technical guidance for conducting this program, audits the effectiveness and the results of the program and modifies it as required. He also provides Technical assistance to the Vice President, Steam Production, who has management authority to implement the "as low as reasonably achieveable", (ALARA), occupational exposure policy, to which Duke Power Company is committed.

The Station Health Physicist is responsible for conducting the Health Physics Program that has been established for the station. The Station Health Physicist has the duty and the authority to measure and control the radiation exposure of personnel to a level that is as low as reasonably achievable and within regulatory exposure limits; to continuously evaluate and review the radiological status of the station; to make recommendations for control or elimination of radiation hazards; to train personnel in radiation safety; to assist all personnel in carrying out their radiation safety 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 Health Physics Program and fulfill these responsibilities for radiation safety, radiation monitoring, survey and personnel exposure control work are performed on a continuous basis for all station operations and maintenance. This requires a Health Physics Technician on each operating shift. The extent of this surveillance is outlined below.

The Health Physics section performs the major portion of the Health Physics work for the station. Personnel in the Health Physics section normally work on the day shift, seven days a week, during periods of routine operation; and deploy onto the other shifts for major maintenance, shutdown and refueling work. The Health Physics Section is organized into three or more major units, each headed by a Health Physics Coordinator. These units are: (1) Staff, (2) Surveillance and Control, and (3) Support Functions.

For the purpose of defining and assigning work to be performed by the operating shifts and the Health Physics Sections, the routine station radiation surveillance work can be described as consisting of radiation monitoring, radiation survey, radiation exposure control and radioactive waste disposal activities.

The Health Physics Technicians on each shift perform radiation monitoring and exposure control work for the routine shift operations, particularly on the back shifts (other than day shifts). This work is performed under the direction of the appropriate Health Physics Supervisor. A "Shift Health Physics Guide," prepared by appropriate Health Physics Supervisor, will designate routine work to be performed.

The Health Physics Section also performs essentially all of the work necessary to calibrate and maintain (other than repair) the Counting Room instruments and the portable radiation monitoring instruments.

Duties concerning radioactive liquid, gaseous and solid waste disposal are performed under Health Physics direction. The detailed analyses and records required to characterize the nature of these releases, both qualitatively and quantitatively, are under the control of Health Physics. In addition, solid waste disposal and shipments of radioactive materials are under the control of Health Physics.

Training and qualification of personnel in Health Physics is the responsibility of the Station Health Physicist and is performed under his direction. All administrative aspects of training, such as scheduling and documentation are handled by Adminstrative services. Administrative services also administers the general standardized Health Physics Training.

The Health Physics Section also conducts the Offsite Radiological Monitoring Program for the station.

B. Inspection of New Fuel

Although no contamination of the new fuel assemblies is expected, upon receipt, each assembly will be swiped with disc swipes and counted for alpha and beta-gamma activity prior to storage, for the detection of any residual contamination.

In the unlikely event contamination greater than 50 dpm/100 cm^2 alpha and or 200 dpm/100 cm^2 beta-gamma above background is detected the person(s) monitoring the shipments will contact the Station Health Physicist or his designee who will then supervise contamination control. The Station Health Physicist or his designee will take the appropriate action to assure that the contaminated item is controlled.

Transfer of Special Nuclear Material

The Westinghouse Electric Corporation is responsible for the shipment of new fuel to the McGuire Nuclear Station.

Should the need arise for McGuire Nuclear Station to package and transport new fuel, the station would ship the new fuel in Westinghouse Electric Corporation owned new fuel shipping containers. This would be in accordance with the provisions of 10CFR Part 71 and DOT regulations.

Security

The Security Plan and Contingency Plan associated with storage of new fuel in the Unit 2 spent fuel pool was submitted to the NRC for review under separate letter dated May 18, 1981.

Emergency Plans

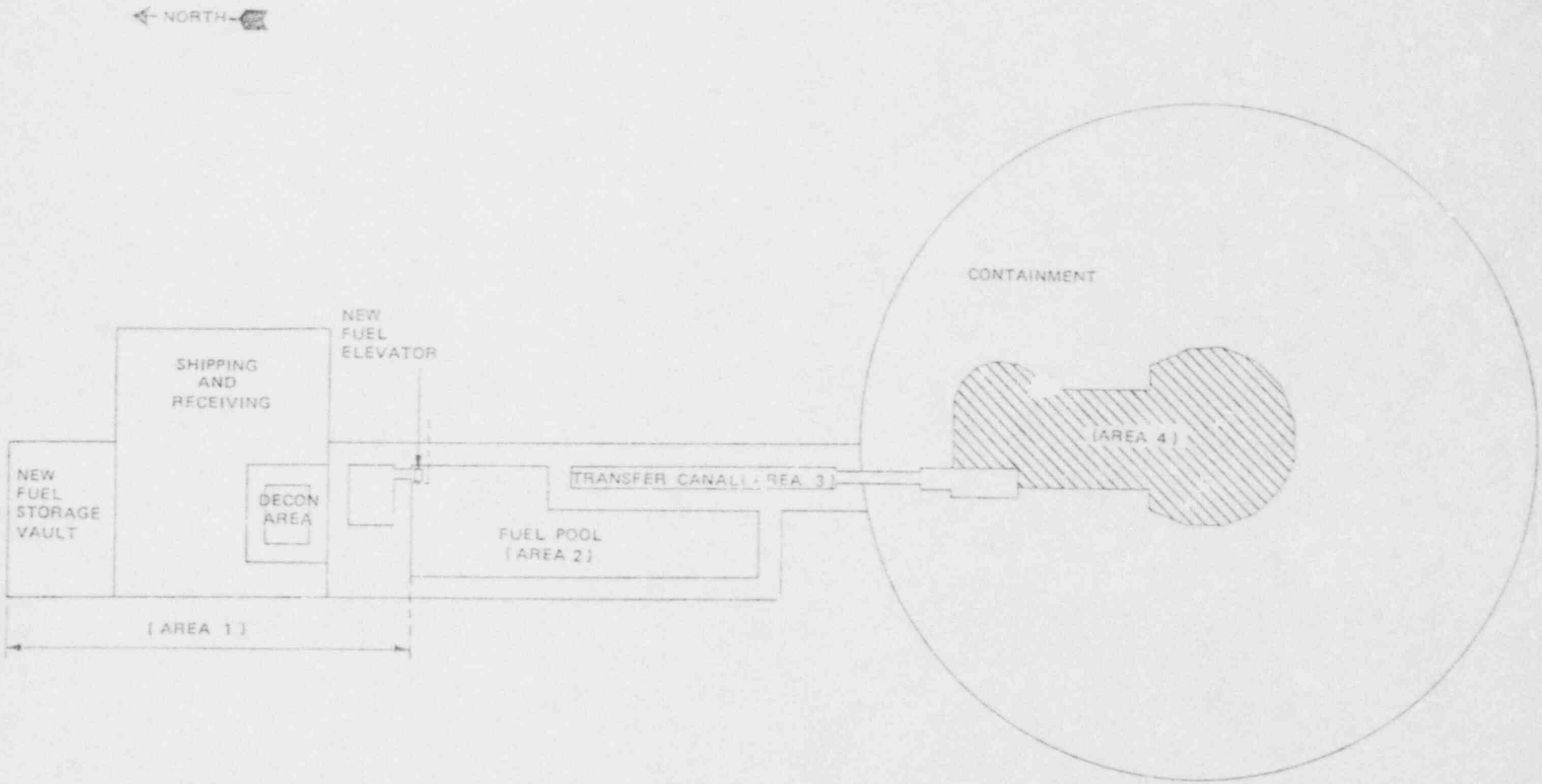
The emergency planning effort is governed by the provisions of the Station Emergency Plan, other off-site agency plans and station implementing procedures.

Financial Protection

Duke Power Company has obtained 560 million dollars of Nuclear Liability Insurance for McGuire Nuclear Station Units 1 and 2. This insurance coverage satisfies the requirements specified in the Price-Anderson Act for licensed nuclear power plants.

Exemptions

The applicant requests exemption from the monitoring and emergency procedures requirements of 10 CFR 70.24. This exemption is requested because the nature of the special nuclear material storage arrangements and procedural controls which the applicant proposes to employ, precludes any possibility of accidental criticality during receipt, unloading, inspection, storage or packaging of the new fuel assemblies.



McGUIRE NUCLEAR STATION–UNIT 2
FUEL HANDLING SYSTEM LAYOUT
FIGURE 1

ATTACHMENT 1

RESUME OF TRAINING AND EXPERIENCE

Lionel Lewis

PROFESSIONAL SUMMARY:

Completed AEC Fellowship in Radiological Physics and obtained MS degree in Biophysics. Since then have had 23 years of responsible supervisory and managerial experience in the fields of Health Physics, General Safety, Fire Prevention and Industrial Hygiene, at a National Laboratory and in the nuclear industry, including two power reactor facilities. Certified in Health Physics by the American Board of Health Physics - 1961 and Re-Certified in 1978. Certified in Reactor Health Physics - 1979.

EDUCATION:

1. Bachelor of Arts Degree (BA) - Pre-Medical Sciences - University of Vermont - 1949.

2. Atomic Energy Commission Fellowship in Radiological Physics - University of Rochester and Brookhaven National Laboratory 1952-53.

3. Master of Science Degree (MS) - Biophysics (Radiological) - University of Rochester - 1955. Degree awarded after completion of thesis project on gamma and thermal neutron dosimetry of Brookhaven Reactor Thermal Column.

Miscellaneous Information:

1. Graduate work in Limnology - Colorado State University - 1951-52.

2. Completed course in Nuclear Radiation Detection for Medical Health Scientists - University of Michigan - 1968.

3. Health Physics Society Summer School in Radiation Protection Dosimetry - University of Minnesota, June 26-30, 1978.

EXPERIENCE:

1. System Health Physicist - Duke Power Company, June 1967 to date. Responsibilities include establishing and directing the Health Physics and Environmental Radioactivity Monitoring Programs for all company nuclear power stations and participating in all other company nuclear activities as Radiation Safety Officer, advisor and coordinator. Also, participate in design, construction, licensing and operational aspects of nuclear power stations.

   Served as Chairman for Nuclear Safety Review Committee for Oconee Nuclear Station.

2. Health Physicist and Safety Coordinator - January 1961 to June 1967; also Plant Superintendent - November 1963 - December 1964. Carolinas Virginia Nuclear Power Associates, Inc. Carolinas Virginia Tube Reactor (CVTR) Facility, Parr, South Carolina.

   As Health Physicist, established and directed the health and safety program at the CVTR (a heavy water power demonstration reactor) which consisted of health physics, general industrial safety, industrial hygiene and fire prevention aspects. Participated in design, construction, checkout and operation of the CVTR. Duties included preparing testimony and testifying at facility license hearing and intervention hearing, assisting in preparation of Facility License Applications and in preparation of By-Product, Special Nuclear Material and Reactor Operator and Senior Operator license applications. Also participated in preparation of Final Hazards Summary Report, Technical Specifications, and amendments to the Technical Specifications.

   Served as member and secretary of Reactor Safety Committee. Responsibility as Health Physicist also included conventional radio-chemistry. Prepared comprehensive Health Physics Manual. Also assisted in preparation of nuclear fuel accountability procedure.

   Duties as Safety Coordinator were to integrate reactor safety activities of all plant personnel and sections within the plant with those of the Reactor Safety Committee and the AEC Division of Compliance to insure compliance with all AEC regulations and conditions of licenses and to see that reactor plant is operated within the limitations of the "Technical Specifications."

   Duties as Plant Superintendent included, in addition to administrative duties, directing activities of reactor plant Operations, Maintenance and Chemistry sections of the Plant Operations Group during one (1) year period of initial operation at power levels up to full licensed power.

3. Supervisor of Health Physics, Safety and Industrial Hygiene - Nuclear Division and Naval Reactors Division Combustion Engineering, Inc., Windsor, Connecticut, 1957 - December 1960.

   Experience includes establishing and directing Health Physics and Safety programs at Power Reactor (S1C Prototype Submarine Power Reactor) and two Critical Facilities, Engineering and Materials Development Laboratories and Reactor Fuel Element Manufacturing Plant. Participated in design, construction and operation of S1C Prototype Reactor.

   Served on Reactor Safety Committee (S1C Prototype). Prepared Radiation Safety Manuals for Nuclear and Naval Reactors Divisions. Contributed to preparation of U.S. Navy Radiological Safety Manual.

4. Assistant Supervisor of Health Physics - Nuclear Division, The Martin Company, Baltimore, Maryland, 1955-57.

   Experience includes assisting in establishing and directing Health Physics programs at Fuel Element Fabrication Facility and Fuel Element Laboratory. Participated in licensing of Critical Facility and establishment of Health Physics program.

5. Health Physicist (Jr.) - Brookhaven National Laboratory, Upton, New York, 1953-55.

   Main responsibility was Biology and Medical Departments. However, experience as Health Physicist also includes Research Reactor, Radio-Chemistry Laboratory, Radioactive Waste Disposal, Instrumentation Calibration, Personnel and Environmental Monitoring, Nuclear Engineering Facility, Accelerator and Cosmotron, Hot Laboratory and emergency health physics responsibilities for entire Brookhaven National Laboratory.

TECHNICAL PAPERS:

1. "Neutron and Gamma-Ray Dosimetry of a Thermal Neutron Irradiation Facility" - included in the proceedings of the 1st Geneva Converence on the Peaceful Uses of Atomic Energy, 1955.

2. "Thermal Neutron Equivalence of Whole Body X-Irradiation" - Radiation Research Journal, Vol. 4, No. 1, 1956.

3. "Pre-Operational Health Physics Training of Reactor Personnel" - presented at the Health Physics Society Annual Meeting, Gatlinburg, Tennessee, 1959, and published in Health Physics, Volume 6, No. 3/4, 1961.

4. "Radiation Design and the Health Physicist" - presented at the annual meeting of the Health Physics Society, Las Vegas, Nevada, 1961.

5. "The Development and Use of Meteorological Map Overlays for Emergency Purposes at a Power Reactor Facility" - International Symposium on Fission Product Release and Transport Under Accident Conditions, Oak Ridge, Tennessee, 1965.

6. "The Administration of Radiation Safety at the CVTR" - Nuclear Safety (May 1966).

7. "Environmental Monitoring for Nuclear Power Plants - A Utility Health Physicist's Viewpoint." Invited paper, panel discussion, Southeastern Electric Exchange, Atlanta, Georgia, 1968.

8. "Gaseous Wastes in a Nuclear Power Plant: Control, Monitoring and Release" - Invited paper presented at N.C. Nuclear Environmental Workshop, sponsored by N.C. State University, Pinehurst, N.C., 1970.

9. "The Terrestrial Radiological Monitoring Program at Duke Power Company's Oconee and McGuire Nuclear Stations" - an invited paper, Southern Conference on Environmental Radiation Protection From Nuclear Power Plants, Region IV, Environmental Protection Agency, 1971.

10. "Nuclear Radiation. What About It? - Invited paper presented before the general meeting of the National Board of Boiler and Pressure Vessel Inspectors, St. Paul, Minnesota, May 1972.

11. "Health Physics Computer Programs for a Nuclear Power Plant" - presented at Health Physics Society Annual Meeting, Las Vegas, Nevada, 1972.

12. "The Reactor RSO", An invited paper for the Workshop on the Changing Responsibilities of the Radiation Safety Officer, at the annual meeting of the Health Physics Society, Miami Beach, Fla., June 1973.

13. Presented invited paper, "Problems with Process Monitoring Systems" at ANS Winter Meeting, 1974.

14. "Occupational Radiation Exposure: An Industry Viewpoint", an invited paper for the AIF Seminar on Government Regulation of Nuclear Power, Wash., D.C., 1975.

15. "Occupational ALARA at Duke Power Company", an invited paper for the ANS/ENS meeting, Wash., D.C., 1976.

16. "Health Physics, Personnel Training and Security Aspects of Operating Nuclear Power Plant Modification and Maintenance", presented at ANS Topical Meeting in Charlotte, N.C., 1978.

Miscellaneous Information:

1. Participated in symposium on "Off-Site Public Health Aspects of Nuclear Power Plant Operations" - sponsored by U.S. Public Health Service, Region IV, Atlanta, Georgia, 1967. (Session Chairman, presented paper)

2. Participated in State Environmental Radiation Laboratory Symposium, sponsored by Environmental Protection Agency, Region IV and Florida Department of Health, Orlando, Florida, 1972. (Session Chairman, presented paper)

3. Presently participating as Industry Representative on Southern Radiation Emergency Assistance Plan, Region IV, Environmental Protection Agency.

4. Participated in S.E. Workshop on the Utilization and Interpretation of Environmental Radiation Data, 1976. (Session Chairman, presented paper)

MEMBERSHIP IN TECHNICAL ORGANIZATIONS:

1. Charter Member - Health Physics Society, served on Public Information Committee, Standards Committee, Program Committee, President N.C. Chapter.

2. Member - American Nuclear Society - Reactor Operations and Environmental Sciences Section.

3. Member - American Industrial Hygiene Association - served on Radiation Committee.

4. Power Reactor Health Physicists Group - served as Chairman for three successive terms. Now EEI Health Physics Task Force, (Chairman)

5. Completed four-year term on Panel of Examiners, American Board of Health Physics.

PARTICIPATION ON STANDARDS COMMITTEES

1. Member - National Council on Radiation Protection (NCRP) Scientific Committee 46 on Operational Radiation Safety
2. ANS-6.7 Radiation Zoning for Design of Nuclear Power Plants
3. ANS-3.7 Radiological Emergency Planning, Chairman of Sub-Committee.
4. Alternate Representative APHA to ANSI Nuclear Standards Management Board.
5. AIF Low Level radioactive Waste Disposal Task Force.
6. AIF Task Force on Occupational Radiation Exposure
7. Involved in preparation of IAEA Safety Guide SG-05, "Radiological Protection During Operation of Nuclear Power Plants", Vienna, Austria, 1977.

ATTACHMENT 2

RESUME OF TRAINING AND EXPERIENCE

TERRENCE J. KEANE

Terrence J. Keane, Station Health Physicist, has sixteen years of practical Health Physics experience in both military and commercial nuclear power programs.

EDUCATION:

A. General

1. 1970-71 College of the Mainland, Lamarque, Texas, Business Management
2. 1964-65 Bryant College, Providence, R.I., Business Management
3. 1963-64 University of Conn., Storrs, Conn., Engineering

B. Technical

1. 1968 Electric Boat Div., General Dynamics, S5W Reactor Systems, Test Engineering
2. 1967 Electric Boat Div., General Dynamics, S5W Reactor Systems, Basic
3. 1965 Electric Boat Div., General Dynamics, U.S.P.H. Basic Radiological Health

SOURCE USE EXPERIENCE:

^{60}Co	15mCi - 100 Ci	Todd Shipyards/Electric Boat	Inst. Calib./Radiography
^{137}Cs	10µCi - 30 Ci	Todd Shipyards/Electric Boat	Inst. Calib.
^{192}Ir	10 Ci - 100 Ci	Todd Shipyards	Inst. Calib./Radiography
Pu Be	2 Ci - 10 Ci	Todd Shipyards/Electric Boat	Inst. Calib.

EXPERIENCE:

A. Duke Power Company - March 8, 1976

1. Station Health Physicist - McGuire Nuclear Station - March 1, 1977 to present. Responsible for the overall implementation and administration of the Station Health Physics Program.

2. Assistant Health Physicist - General Office Staff - March 8, 1976 to March 1, 1977. Assisted in performance of section function including: ALARA program development and implementation, design and modification review for new and existing facilities, planning and scheduling assistance to nuclear stations during outages and maintenance of corporate radiation exposure records.

B. Todd Shipyards Corp. - Research and Technical Division - 1969 to 1976

1. Field Office Manager - 1974 to 1976
   Responsible for operating and administering a program of technical services to the nuclear industry including: Health Physics, Maintenance and Decontamination. Served as R.S.O. for all field licenses.

2. Field Service Supervisor, Nuclear Services 1973 - 1974
   Responsible for on-site direction of nuclear services including Health Physics, Fuel Handling, Decontamination, Consulting and Third Party Quality Assurance.

3. Nuclear Program Supervisor - 1969 to 1972
   Responsible for in-house nuclear operations including fuel accountability spent fuel shipment and site Health Physics program. Responsible for layup-site administration of the N.S. Savannah and development of service program to the Nuclear Industry.

4. Health Physics Supervisor - 1969 to 1972
   Responsible for Health Physics operations and personnel training for servicing the N.S. Savannah during operation, defueling and layup.

C. Electric Boat Division - General Dynamics - 1965 to 1969

1. First Class Health Physics Monitor 1967 - 1969
   Responsible for line Health Physics control during refueling and overhaul of Naval Nuclear Power Plants and on the job training of Learner and Apprentice Monitors.

2. Technical Assistant, Radiological Engineering 1966 - 1967
   Responsible for preplanning of H.P. functions for power plant refueling and overhaul, shield surveys and instrument development and calibration.

3. Health Physics Monitor 1965 - 1966
   Functioned as an H.P. Monitor with group.
   Responsibility for survey and control of radioactive material, personnel dosimetry and monitoring, radiological guidance and training of Yard trades.