UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

STATE UNIVERSITY OF NEW YORK AT BUFFALO

DOCKET NO. 50-57

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 24
License No. R-77

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment to Facility Operating License No. R-77, filed by the State University of New York at Buffalo (the licensee), dated July 23, 1996 and February 14, 1997, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the regulations of the Commission as set forth in 10 CFR Chapter 1;

   B. The facility will be maintained in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the regulations of the Commission;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public;

   E. This amendment is issued in accordance with 10 CFR Part 51 of the regulations of the Commission and all applicable requirements have been satisfied; and

   F. Prior notice of this amendment was not required by 10 CFR 2.105 and publication of notice for this amendment is not required by 10 CFR 2.106.

2. Accordingly, the license is amended by changes to the following paragraphs which are hereby amended to reads as follows:

2.B. 1. Pursuant to Section 104c of the Act and Title 10 CFR Chapter 1, Part 50, "Domestic Licensing of Production and Utilization Facilities", to possess, but not operate the reactor at the designated location in Buffalo, New York, in accordance with the procedures and limitations described in the application and this license.

2. Pursuant to the Act and Title 10 CFR Chapter 1, Part 70, "Domestic Licensing of Special Nuclear Material", to possess up to 55 kilograms of uranium-235 contained in enriched uranium and other Special Nuclear Material produced by past operation of the reactor.

3. Pursuant to the Act and Title 10 CFR Chapter 1, Part 70, "Domestic Licensing of Special Nuclear Material", to receive, possess, and use up to 80 grams of plutonium encapsulated in five 1-curie plutonium-beryllium neutron sources in connection with the facility.

4. Pursuant to the Act and Title 10 CFR Chapter 1, Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material", to possess a 30-curie antimony-beryllium source and to possess, but not to separate, such byproduct material as may have been produced by operation of the facility.

2.C 1. The licensee shall not operate the reactor.

2. Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 24, are hereby incorporated in the license. The licensee shall maintain the facility in accordance with the Technical Specifications as amended.

3. This license amendment is effective as of its date of issuance except for Technical Specification Section 10.3.1.1 which shall become effective 30 days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Marvin M. Mendonca, Acting Director
Non-Power Reactors and Decommissioning
Project Directorate
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Enclosure:
Appendix A Technical
Specifications Changes

Date of Issuance: June 19, 1997

ENCLOSURE TO LICENSE AMENDMENT NO. 24

FACILITY OPERATING LICENSE NO. R-77

DOCKET NO. 50-57

Revise Appendix A Technical Specifications by removing all pages and replace with the enclosed pages:

Remove	Insert
All Pages	All Pages

Buffalo Materials Research Center

State University of New York at Buffalo

License R-77
Docket 50-57

Technical Specifications

(Possession Only)

Appendix A

Table of Contents

1.0 Definitions

Certified Fuel Handler: An individual who is authorized to supervise or perform fuel handling pursuant to an NRC approved program.

Channel Calibration: A channel calibration is an adjustment of the channel so that its output corresponds, with acceptable accuracy, to known values of the parameter that the channel measures. Calibration shall encompass the entire channel, including equipment actuation, alarm, or trip and shall include a channel test.

Channel Check: A channel check is a qualitative verification of acceptable performance by observation of channel behavior. This verification should include comparison of the channel with other independent channels or systems measuring the same variable, where this capability exists.

Channel Test: A channel test is the introduction of a signal into the channel to verify that it is operating.

Cold Fuel: Cold fuel is any combination of fuel elements which may be stored within the fuel storage vault(s), in such a manner as to create a radiation level of not more than 5 mRem per hour at any accessible outer boundary of the vault.

Control Blade: A neutron absorbing blade with negative reactivity worth.

Experimental Facility: An experimental facility is any structure or device associated with the reactor that is intended to guide, orient, position, manipulate, or otherwise facilitate a multiplicity of experiments of similar character.

Fuel Assembly: A grouping of 25 Pulstar fuel pins in the standard Zircalloy box and aluminum structures.

Fuel Canister: A canister (typically aluminum or stainless steel) which is used to store fuel pins.

Fuel Element: A single Pulstar fuel pin.

Fuel Handling: The manipulation, movement, or transfer of irradiated reactor fuel within or between fuel storage facilities.

Measured Value: The measured value of a process variable is the value of the variable as indicated by a measuring channel.

Measuring Channel: A measuring channel is the combination of sensor, amplifiers, and output devices that are used for the purpose of measuring the value of a process variable.

Operable: Operable means that a component or system is capable of performing its intended function in its normal manner.

Operating: Operating means that a component or system is performing its intended function in its normal manner.

Permanent Experimental Facility: Those experimental facilities that would require considerable effort and planning to remove or alter such as the thermal column.

Potentially Radioactive Liquid Effluents: Those liquid effluents from the facility including from sinks, sumps, floor drains, etc., which have a reasonable potential to

contain radioactivity at a level in excess of 0.01% of the effluent limit prescribed by 10 CFR 20.

Removal of a Control Blade: Means to disconnect and physically remove a control blade assembly (blade, shroud, and extension) from its gridplate position.

Reportable Occurrence: A reportable occurrence is any of the conditions described in Section 12.1 of these specifications.

True Value: The true value of a process variable is its actual value at any instant.

2.0 Possession Only Limits

2.1 Authorized Activities

1) The BMRC reactor is licensed for "Possession Only" and no operation of the reactor is allowed.

2.2 Fuel Quantity Limit

1) The storage of irradiated reactor fuel within the reactor tank or within an alternative storage facilities pursuant to Section 10.3.3, shall be limited to the fuel that was present within the tank on June 30, 1994, and no additional fuel elements may be introduced into the reactor tank or irradiated fuel storage facilities. This limit will prevent the introduction of additional cold clean fuel into the tank.

2) At no time may more than 15 fuel assemblies be stored on the reactor gridplate. This limit will prevent criticality even if all control blades are completely withdrawn. The theoretical minimum number of cold clean fuel assemblies required for criticality is seventeen. The average burnup of the existing fuel assemblies is more than 13,000 MWD/Tonne.

3.0 Plant Instrumentation Systems

3.1 Reactor Tank Instrumentation for Fuel Storage

Specifications The following plant instrumentation systems shall be maintained.

1) High and Low Water level annunciators.

2) Reactor Tank temperature indicator.

3) Primary pump suction valve interlock.

In the event that these systems are temporarily out of service (such as for repair) compensating actions such as periodic monitoring, or additional administrative controls may be substituted.

Applicability These specifications shall not apply if there is no fuel in the reactor tank.

Specification 3.1.3 (suction valve interlock) shall not apply if the reactor tank water primary circulation pump is permanently disabled or electrically disconnected.

Basis

1) Specification 3.1.1 (High and Low Water Level annunciation) will warn staff members that the reactor tank water level is higher or lower than normal.

2) Specification 3.1.2 (Pool Temperature monitor) enables the staff to monitor the temperature of the reactor tank water.

3) Specification 3.1.3 (Suction Valve Closed) disables the primary pump so that it may not be started while the core outlet isolation valve is closed. Starting the pump with this valve closed could damage the N-16 delay tank.

3.2 Radiation Effluent Monitors Required During Fuel Storage

Applicability These specifications apply to the permanently mounted radiation monitors in the containment building, all of which are equipped with remote read-out in the reactor control room.

Objective The objective of these specifications is to set a minimum level of performance for the area radiation monitoring systems.

Specifications

1) Effluents from the containment building, exhausted through the Building Exhaust System (containment roof), will be continuously monitored for gaseous radioactivity by the Building Gas Monitor. Values will be recorded at intervals not to exceed 15 minutes.

2) The setpoint for the Building Gas Monitor shall be specified in writing by the Operating Committee.

3) The Building Gas Monitor may be out of service for up to 10 days provided that no fuel handling takes place.

Basis

1) Continuous operation of the Building Gas Monitor ensures that any gaseous fission product fuel leak will be detected.

2) Specification 3.2.2 will ensure that the alarm set point is clearly stated, cannot be changed without management review, and can be maintained at the lowest possible level commensurate with facility conditions and operational requirements.

3) Specification 3.2.3 allows for repair or replacement of the Building Gas Monitor.

3.3. Radiation Area Monitors Required During Fuel Handling Operations

Specifications

1) Reactor Fuel shall not be handled in the reactor tank, unless the Reactor bridge Monitor is operating. For purposes of this specification, any fuel handling in the Hot Cell which includes insertion of fuel into the pass-through tube, shall be considered "in the reactor tank."

2) The Set Point for the Reactor Bridge Monitor shall be specified in writing by the Operating Committee and may not exceed 75 mR/hr.

3) In the event of failure of the Bridge Monitor a portable unit shall be substituted and shall be frequently monitored, and a qualified individual shall be stationed in the control room to initiate manual damper scram if necessary.

Basis

1) The Bridge Radiation Monitor will provide redundant warning to the reactor operators in the event of low pool water level, and will warn operators of

unusually high radiation levels should they occur during fuel handling operations.

2) Specification 3.3.2 will ensure that the alarm set point is clearly stated, cannot be changed without management review, and can be maintained at the lowest possible level commensurate with facility conditions and operational requirements.

3) Specification 3.3.3 will ensure that radiation levels will be adequately monitored if the Bridge Monitor is not operational.

3.4 Radiation Effluent Monitors Required During Fuel Handling Operations

Specification

1) Reactor fuel shall not be handled in the reactor tank or the Hot Cell unless the Stack Particulate, Stack Gas, Building Particulate and Building Gas Monitors are operating.

2) The alarm set points for these monitors shall be specified in writing by the Operating Committee.

3) During Fuel handling operations, the outputs of the monitors shall be recorded on a strip chart, a data logger, videographic recorder, or equivalent, or shall be logged at intervals of not more than every 15 minutes.

Basis

1) Specification 3.4.1 ensures that the staff will promptly be alerted to any releases to the environment, or gaseous releases of radioactivity resulting from fuel cladding failure.

2) Specification 3.4.2 ensures that the alarm set points are clearly stated, can not be changed without management review, and can be maintained at the lowest possible levels commensurate with facility conditions and operational requirements.

3) Specification 3.4.3 ensures that any airborne radioactivity releases resulting from fuel failure shall be documented and can be quantified.

4.0 Engineered Safety Systems

Applicability These specifications apply to the facility containment vessel and ventilation systems.

Objectives The objective of these specifications is to control the release of airborne radioactivity in the event of the failure of the fuel cladding.

Specifications The reactor fuel shall not be handled in the reactor tank, Hot Cell, or in alternative facilities pursuant to Section 10.3.3 unless:

1) The Truck door is closed and sealed, and at least one of the doors for each airlock is closed and sealed. All other penetrations such as piping and electrical shall also be sealed.

2) The stack exhaust system fan located within the University Power House is operating.

3) The Building Air exhaust fan located within the Control Deck fan room is operating.

4) The air pressure within the reactor containment is negative relative to the outside air pressure.

5) For manipulations within the Hot Cell, the pressure in the stack exhaust system, at the suction side of the basement stack fan, must also be negative relative to the containment pressure.

6) A HEPA filter is installed in the emergency exhaust duct and the modulating damper (6") and its controller are operable.

7) The dampers (Pratt dampers) within the containment ventilation ducts are operable and capable of closing in 5 seconds or less. They must close automatically in response to coincident high level alarms conditions for the Building Air (gaseous radioactivity) and Reactor Bridge (area) radiation monitors, or in response to a manual signal.

Basis

1) Specification 4.0.1 ensures that containment penetrations other than the ventilation ducts are closed, preventing the unmonitored and uncontrolled release of airborne radioactivity.

2) Specification 4.0.2 and 4.0.3 ensure that fans are operating to maintain the containment and stack exhaust system at negative pressure under normal or emergency conditions.

3) Specification 4.0.4. ensures that all containment leakage is inward.

4) Specification 4.0.5 ensures that in the event of fuel compromise within the Hot Cell, airborne radioactivity shall be exhausted by the stack and shall not immediately diffuse though the Hot Cell wall penetrations.

5) Specification 4.0.6 ensures that in the event of fuel compromise, negative pressure within the containment may be maintained in a controlled manner, without unnecessary releases of radioactivity to the environment.

6) Specification 4.0.7 ensures operability of the containment isolation systems in the event of fuel cladding compromise.

5.0 Reactor Tank Water Conditions

Applicability These specifications apply to the purity of the reactor tank water whenever fuel is stored within the tank. These specifications also apply to any water which is in contact with fuel stored within alternative storage facilities pursuant to section 10.3.

Objectives The objective of these specifications are to limit corrosion of the reactor fuel and other in-tank materials.

Specifications

1) The pH of the reactor tank water shall be maintained between 5.0 and 7.5.

2) The Resistivity of the reactor tank water shall be maintained at an average of not less than 200,000 ohm-centimeters. For purposes of interpreting compliance

with this specification, the minimum level must be met when averaged over any 30 day period.

Basis Specifications 5.0.1 and 5.0.2 will prevent excessive corrosive attack of the fuel cladding and hardware, control blades, and other activated in-tank components. It also provide adequate clarity of the shielding water so that fuel may be visually monitored. Limits are imposed on the average values because the time weighted values will determine corrosion rates, and short term deviations will not create a safety hazard.

6.0 Airborne Effluents

Applicability These specifications apply to the levels of radioactivity discharged to the environment through the building air and power plant exhaust ducts.

Objective The objective of these specifications is to ensure that persons within the facility and persons outside of the facility are not exposed to concentrations of airborne radioactivity in excess of the limits established by 10 CFR 20.

Specifications

6.1 Stack Exhaust Effluent Radiation Limit

1) The concentration of radioactivity in the stack exhaust air, at the point of release (top of stack), shall not exceed 700 times the effluent limit established in 10 CFR 20, when averaged over the calendar year.

6.2 Building Air Effluent Radiation Limit

1) The concentration of radioactivity in the Building Air Exhaust, at the point of release (containment roof), shall not exceed the effluent limit established in 10 CFR 20, when averaged over the calendar year.

Basis Specification 6.1 ensures that the ground level concentration when averaged over the calendar year will be less than the NRC effluent limit. This limit was derived from calculations which demonstrate that the minimum worst case dilution factor for the stack exhaust is 10,000, with an annual wind direction persistence of 0.28. A conservative error factor of 50 was further used to allow for correlation error, and the proximity of the 10 story Veterans Administration Medical Center located adjacent to the campus (10,000 x 1/50 x 1/0.28 = 714; rounded to 700). Specification 6.2 ensures that the concentration of radioactivity in the air which exits through the containment roof, is below the NRC limit. Since the NRC Effluent Limits are lower than the Derived Air Concentrations, workers within the containment building will not be exposed to gaseous radioactivity in excess of occupational limits. Because the sampling point is downstream of the HEPA filters, for airborne particulate radioactivity, the relationship between effluent levels and potential occupational exposures, will depend on the efficiency of the HEPA filtration system.

7.0 Liquid Effluents

Applicability These Specifications apply to liquid radioactive effluents to the Sanitary Sewer System.

Objectives The Objectives of these specifications are:

1) To Prevent unmonitored discharges of radioactivity to the Sanitary Sewer.

2) To ensure that discharges to the Sanitary Sewer are within the limits prescribed by 10CFR Part 20.

Specifications

1) All potentially radioactive liquid effluents shall be collected and retained in a hold tank(s).

2) Before release to the Sanitary Sewer the contents of the tank(s) shall be mixed and a representative sample shall be drawn and analyzed for radioactive content.

3) The contents of the tank(s) shall not be released to the sanitary sewer unless the analysis demonstrates that the release shall be within the limits prescribed by 10 CFR 20.

4) For purposes of determination of the effluent discharge concentration in **3)** above, the dilution by the most recently established Sewage flow rate of the Winspear Avenue trunk may be incorporated.

8.0 Surveillance Requirements

Applicability These specifications apply to the surveillance requirements for reactor control systems, radiation monitoring systems, and engineered safety systems.

Objective The objective of these specifications is to prescribe the minimum surveillance activities to maintain the reactor in a safe, subcritical mode, to protect the safety of the reactor staff and the public.

Specifications

8.1 Plant Instrumentation Systems

1) The reactor tank low and high water level annunciators shall be tested monthly, at intervals not to exceed 6 weeks.

8.2 Radiation Monitoring Systems

1) The Reactor Bridge Monitor and the Effluent Radiation Monitors shall be tested for operability monthly, at intervals not to exceed 6 weeks.

2) The Reactor Bridge Monitor and the Effluent Monitors shall be calibrated Quarterly, at intervals not to exceed four months. For the purpose of meeting this requirement, the monitors shall be calibrated by determination of their response to appropriate reference sources.

3) Any radiation monitors associated with Fuel Storage Facilities utilized pursuant to Section 10.3, shall be calibrated before fuel is installed in the facility, and shall be Operability checked as appropriate.

8.3 Engineered Safety Feature (Containment) Tests

The following items shall be tested quarterly at intervals not to exceed four months:

1) All ventilation isolation dampers close in less than 5 seconds in response to both manual trip and simultaneous alarm signals from the Building Gas and Bridge Monitors.

2) The Control Systems maintain negative pressure in the building under normal and emergency conditions.

8.4 Other Instrumentation System Surveillance

The following additional instrumentation systems shall be calibrated or tested quarterly at intervals not to exceed four months:

1) Pool Temperature Monitor

2) Suction Valve Closed pump inhibit interlock.

These specifications shall not apply if there is no fuel in the reactor tank. Specification 2) shall not apply if the reactor tank water primary circulation pump is permanently disabled or electrically disconnected.

8.5 Reactor Fuel Shielding Water Monitoring

Applicability These specifications apply to the surveillance and quality of reactor tank water and are in effect so long as there is fuel in the reactor tank. These specifications similarly apply to any other on site fuel storage facilities for which water is in contact with the Reactor Fuel.

Objective The objective of these specifications is to ensure that water quality is measured frequently enough to prevent excessive corrosion of the system components and to detect higher than normal levels of radioactivity in the system water.

Specifications

1) System water pH, conductivity and gross Beta activity shall be measured weekly, at intervals not to exceed 10 days.

2) Gamma Spectroscopy of the system water shall be conducted three times per year at intervals not to exceed five months.

3) Records shall be maintained of all pool water additions.

Bases

Specification 8.5.1 ensures that poor water quality would be detected in a timely manner.

Specification 8.5.2 ensures that fuel leakage or excessive corrosion may be detected.

Specification 8.5.3 provides a means to monitor for excessive water addition rates, which could be indicative of system leakage.

9.0 Plant Design Features

9.1 Site Description

The site of the BMRC reactor is the South East corner of the South campus of the State University of New York at Buffalo.

The South campus lies in a triangle bounded by Bailey Avenue, running almost due north and south, Winspear Avenue, running roughly east and west, and Main St., running north of Winspear Avenue. The nearest buildings are Acheson Hall, Howe Building, the McKay steam plant, and Clark Gym. A large Veterans Affairs Medical Center is situated approximately 2000 ft east of the BMRC. The nearest residential area is South of the reactor on the North Side of Winspear Avenue.

The reactor restricted access area consists of the containment building and the attached laboratory and office wing.

9.2 Containment Building

The containment building is a flat roofed, right circular cylinder, nominally 70 ft. in diameter and 52 ft. high. The containment is constructed of normal density reinforced concrete. The walls are nominally 2 ft. thick and the roof is 4 inches thick and supported by steel and concrete beams. The bottom floor is nominally 3.5 ft. thick and the entire building rests in bedrock. The total free volume of the building is approximately 186,000 cubic feet.

The building is equipped with two personnel airlocks and a single barrier "truck door". All electrical and piping penetrations are sealed. Drain lines which penetrate the containment wall are provided with 24 inch dip legs to maintain pressure seal.

9.3 Ventilation Systems

Under normal conditions, the containment building is ventilated by a single pass system. Conditioned air is supplied to the containment through a 30 inch diameter duct. A second 30 inch supply system can also be employed, however, it is not necessary under most conditions.

Air from the general (occupied) areas of the containment, and certain low activity fume hoods, is exhausted through a 36 inch duct which penetrates the containment roof (commonly referred to as the "Building Air" system). The Building Air exhaust system is HEPA filtered and includes a vortex control damper on the suction side which is used to control the negative pressure in the containment building.

The reactor irradiation facilities and the high level fume hoods exhaust through an 18 inch duct which discharges at the top of the McKay power plant chimney (the "stack exhaust"). This release point is 167 feet above ground. The stack exhaust may be driven by two blowers which operate in series, one of which is located in the BMRC sub basement, while the other is located at the power house. For routine radioactive materials handling operations, only the stack fan located in the power house is required to provide adequate flow.

All air which exhausts though the containment exhaust systems is HEPA filtered. The two 30" supply ducts, the 18" exhaust duct, and the 36" exhaust duct are equipped with "Pratt" hydraulic isolation dampers which can be manually or automatically triggered if high airborne radioactivity is detected.

When the isolation dampers are closed, all fans in the containment and the basement stack exhaust fans, automatically turn off. The fan in the power house remains on. Under these conditions the containment is maintained at a negative pressure by exhausting air through a 6" emergency bypass duct which is equipped with a HEPA filter. A second bypass damper in the power plant allows additional non-contaminated air to enter the duct on the suction side of the blower. This air provides dilution and prevents excessive negative pressure in the exhaust line.

9.4 Reactor Tank

The reactor tank is constructed of concrete with an aluminum liner. It is nominally 29 feet deep and will hold approximately 13,700 gallons of shielding water. When the reactor was in operation, the cooling system also included an N-16 delay tank, a heat exchanger and a circulating pump. The Heat Exchanger was permanently removed in 1994 and replaced with a pipe. The balance of the original cooling system can be used to circulate the shielding water, and to provide flow for the demineralizer system. However, these components are no longer required and provide no safety functions. They may be removed without impacting upon reactor safety, as long as blocking flanges are installed outboard of the isolation valves.

Two demineralizer systems are required. One provides new "make up" water to replenish losses. The second is a "clean up" system used to maintain the quality of the water in the reactor tank. The clean up system and make up water addition system may be connected to the tank through the formerly utilized coolant circulation loop, or alternatively may be directly coupled to the reactor tank.

An emergency pool fill system is available for adding city water to the pool should this be desired, such as in the event of a gross leak in the tank. This system includes a manual valve at the top of the tank and an isolation valve in the BMRC sub-basement.

9.5 Reactor Fuel

Fuel Assemblies are 3.15 by 2.74 inches in cross section and 38 inches high. Each assembly contains 25 fuel elements in a 5 x 5 array. The pins are positioned by aluminum grids at each end, these grids each contain 25 holes 1/4 inch in diameter which were used for coolant passage. The lower end of the assembly includes an aluminum nosepiece that mates with holes in the reactor grid plate. The top of the assembly contains a bail for handling purposes. The vertical box itself is constructed of .060 in thick Zircalloy.

Each fuel element is made up of a Zircalloy cladding tube (.47 in OD) with a .0185 inch thick minimum wall. Each element contains 40 sintered UO-2 fuel pellets. Welded caps form the closure of the cladding tubes. The fuel pellets are 0.42 inches in diameter and have a minimum density of 10.2 g/cc. Nominal enrichment is 6.0%. The fueled height is nominally 24 inches

Typical initial (cold/clean) composition of a fuel assembly was:

Uranium 235 .... 0.768 Kg

Uranium................ 12.83 Kg

Uranium Dioxide......... 14.56 Kg

Complete Fuel Assembly .. 20.37 Kg

Table 1 lists the irradiated fuel assemblies which were located within the reactor tank on June 30, 1994 and their respective burnups.

9.6 Control Blades

Gross reactivity control within the reactor core was provided by six control blades of which five were scramming and one was not. Each blade is composed of nominally 80% silver, 15% indium and 5% cadmium. The blades are 4.85 inches wide, by 0.18 inch thick, by 29 inches long and are plated with 0.003 inches of nickel.

Because the number of fuel assemblies stored on the gridplate is limited to fifteen, the control blades are not required to prevent criticality. Therefore, they may be disconnected from their drive units and there are no restrictions on their position.

10.0 Fuel Storage and Transfer

10.1 Cold Fuel Storage

Applicability These specifications apply to the storage of cold reactor fuel (see definitions).

Objectives The objectives of these specifications are to maintain the fuel in a subcritical configuration, to deter the theft or diversion of the fuel, to detect such diversion should it occur and to prevent excessive exposures of personnel and the public from radiation arising from the fuel.

Specifications

1) Cold fuel shall be stored within the containment building, in secure vaults, constructed of nonflammable materials. Fuel shall be stored in rows of metal cylinders which have a minimum center to center spacing of five inches and the rows shall have a minimum center to center spacing of 16 inches. Each cylinder shall contain no more than 25 fuel elements. Those fuel storage vaults which were in use on June 30, 1994, shall continue to be exempted from the criticality alarm requirements of 10 CFR 70.24.

2) Alternatively cold fuel which has been packaged for shipment in accordance with NRC and DOT requirements may be stored within a locked room within the BMRC containment building, provided that appropriate administrative controls are instituted to prevent the introduction of the fission plate, or isotopic neutron sources within one meter of the packages.

10.2 Storage of the BMRC Fission Plate

Applicability These specifications apply to the storage of the BMRC fission plate.

Objective The objectives of these specifications are to prevent the unsafe neutron coupling of the fission plate with other fissile materials, to deter the theft or diversion of the fission plate, to detect such diversion should it occur, and to prevent excessive exposures of personnel and the public from radiation arising from the fission plate

Specifications

1) The Fission Plate may be stored within the fuel vault(s), a locked cask within the containment building, or within the dry chamber or thermal column. A minimum distance of 16 inches shall be maintained between the fission plate and any other fissile material.

2) Alternatively, the fission plate may be stored within a shipping container, within the containment building, in accordance with NRC and DOT regulations provided that appropriate administrative controls are instituted to prevent the introduction of other fissile materials, or isotopic neutron sources, within one meter of the package.

10.3 Irradiated Fuel Storage and Transfer

Applicability These specifications apply to the storage and transfer of the irradiated fuel, which shall be limited to that fuel which was present within the reactor tank on June 30, 1994.

Objectives The objectives of these specifications are to maintain the fuel in a subcritical configuration, to deter the theft or diversion of the fuel, to detect such diversion should it occur and to prevent excessive exposures of personnel and the public from radiation arising from the fuel.

Specifications

1) Irradiated reactor fuel shall be stored within the reactor tank, the Hot Cell, or within alternative fuel storage facilities in accordance with Section 10.3.3. All fuel elements will be stored within the standard PULSTAR fuel assembly hardware, or within closed canisters of similar dimension, which may contain no more than 27 elements each. If canisters contain more than 25 fuel elements, (the number of fuel elements in a standard fuel assembly) the Reactor Decommissioning Safety Committee must approve the container design, loading, storage and handling procedures.

10.3.1 Storage within the Reactor Tank

1) Up to 15 fuel assemblies may be stored on the grid plate in alternate rows. Unused grid plate locations will be plugged to prevent storage of more than 15 assemblies.

2) Within the reactor tank, fuel may be stored in the existing pool storage racks. The storage racks are in linear array with a minimum center to center spacing of five inches.

3) Additional fuel storage racks may be installed within the reactor tank so long as they provide equivalent subcriticality margin, mechanical strength and seismic performance.

4) During fuel transfer or loading operations, up to two assemblies may be placed in interim storage racks or holding devices on the pool shelf or Hot Cell pass through tube.

10.3.2 Storage within the Hot Cell

1) Irradiated fuel may be stored within the Hot Cell subject to following requirements:

2) Calculated or demonstrated Keff of the storage array must be less than or equal to 0.85 for the flooded condition.

3) Transfer of the fuel into and out of the Hot Cell must be in accordance with detailed written procedures, approved by the Operating Committee.

4) If more than 374 fuel elements are located within the Hot Cell, it must be equipped with a neutron sensing criticality alarm. (note: 375 fuel elements is equivalent to 15 fuel assemblies)

5) In order to prepare fuel for shipment to a disposal facility, fuel may be manipulated in the Hot Cell such as to load fuel elements into shipping/storage canisters. Written procedures shall ensure that criticality margins are maintained during such manipulations.

10.3.3 Storage Within Alternative Facilities

Irradiated fuel may be stored within alternative facilities within the containment building subject to the following requirements.

1) Calculated or demonstrated K_{eff} of the storage array must be less than or equal to 0.85 for the flooded condition.

2) Transfer of the fuel into and out of the Storage Facility (from the Hot Cell or Reactor Tank) must be in accordance with detailed written procedures, approved by the Operating Committee.

3) If more than 374 fuel elements (375 fuel elements are equivalent to 15 fuel assemblies) are located within the storage facility, it must be equipped with a neutron sensing criticality alarm.

4) Shielding must be adequate to reduce the radiation level such that the radiation levels at the outer boundary of the Storage Facility will not create a High Radiation Area as defined by 10 CFR 20.

5) Use of the storage facility must be approved by the Reactor Decommissioning Safety Committee.

6) The facility must be vented to the Stack Exhaust system.

10.3.4 Transfer of Fuel between Fuel Storage Facilities

In addition to the requirements of sections 3.2, 3.3, 3.4 and 4.0, the following additional requirements must be met when fuel is being transferred between fuel storage facilities (Pool, Hot Cell, or Alternate facilities)

1) The airlocks and truck door are sealed.

2) The containment pressure is negative with respect to outside atmosphere.

3) Hydraulic pressure is available to close the ventilation isolation dampers.

4) Fuel storage canisters, transfer casks, or baskets, shall be:

- DOT certified packaging

or

- Equipped with bales, handles or lifting lugs and or cables or similar lifting gear which are capable or supporting at least twice the weight of the load in air. In addition appropriate safety margins will be used in designing such equipment.

and

- Shall be designed so that fuel elements or assemblies will not spill out in the event the load is dropped.

5) The transfers must be conducted in accordance with a Radiation Work Permit approved by the Radiation Safety Officer.

6) A criticality alarm(s) shall be operating in appropriate location(s), if greater than 374 fuel elements are located in the transfer container, unless the container is DOT certified packaging.

7) Items (1),(2), and (3) above do not apply when handling fuel which is contained in sealed DOT approved canisters or containers.

10.3.5 Fuel Handling within the reactor tank

In addition to the requirements of sections 3.2., 3.3, 3.4 and 4.0, whenever fuel is handled in the reactor tank the following requirements shall apply:

1) The airlocks and truck door are sealed.

2) The containment pressure is negative with respect to outside atmosphere.

3) Hydraulic pressure is available to close the ventilation isolation dampers.

4) If fuel assemblies are being placed into a geometric configuration which has not been previously loaded, a neutron count rate monitor shall be operating and monitored.

5) The neutron count rate monitor is not required when fuel assemblies are being loaded into or transferred between the standard fuel racks which were originally installed in the reactor tank, or similar racks installed pursuant to 10.3.1 (2), which utilize an identical geometry. This would include the transfer of fuel assemblies from the grid plate to the fuel racks.

11.0 Administration

11.1 Organizational Structure

1) The organizational structure shall be as illustrated in Figure I.

2) The Acting Director of Environmental Health and Safety Services bears direct administrative and Safety responsibility for the Facility.

3) The BMRC Director bears direct responsibility for all surveillances, operations, testing and experiments conducted at BMRC.

4) The Radiation Safety Officer bears direct responsibility for all aspects of radiological safety at BMRC and is empowered to stop, or modify any activity for purposes of ensuring the radiological safety of the staff and the public.

5) The Operations Manager is responsible for all activities related to safe storage and handling of the reactor fuel, maintenance and testing of plant safety systems and other engineered safety systems, the training and supervision of licensed operators and Certified Fuel Handlers.

11.2 Minimum Staffing Requirements

As long as irradiated fuel is stored within BMRC, the University staff shall include at minimum:

1) The Acting Director of Environmental Health and Safety Services

2) The Director of BMRC

3) The Operations Manager of BMRC

4) The Radiation Safety Officer

5) At least one licensed Sr. Reactor Operator or Certified Fuel Handler.

For purposes of meeting the requirements of 11.2:

1) A single individual may serve as both the BMRC Director and Acting Director of Environmental Health and Safety Services, or a single individual may serve as both Director and Operations Manager.

2) The Operations Manager may be the Senior Reactor Operator or Certified Fuel Handler, provided there is at least one additional licensed Reactor Operator or Certified Fuel Handler on staff.

3) Staff members may perform collateral duties in other areas of the University or be part time employees.

11.3 On-Call Staffing Requirements

As long as irradiated fuel is stored within BMRC, the University shall meet the following "on-call" requirements.

1) The Operating Committee will maintain a roster of personnel who are trained in appropriate aspects of facility operation and health physics.

2) At least one individual from this roster will remain within a 50 mile radius of the facility at all times and be reachable by phone, pager or radio.

11.4 Operational Requirements

1) All fuel handling must supervised or performed by a licensed Sr. Reactor Operator or Certified Fuel Handler. Non-licensed personnel may assist in the conduct of the manipulations, but must receive training commensurate with their level and nature of participation.

2) All licensed Operators or Certified Fuel Handlers shall participate in the BMRC Requalification program or CFH recertification respectively, as a condition of

their continued assignment to operator or Certified Fuel Handler duties. The Requalification program shall be commensurate and consistent with the current scope and nature of operational activities on site.

11.5 Review Functions

11.5.1 Reactor Decommissioning Safety Committee

1) A Reactor Decommissioning Safety Committee (RDSC) shall exist for the purpose of reviewing matters related to the health and safety of the public and the staff, in accordance with the Constitution and Bylaws of the committee.

2) The RDSC shall report to the Associate Vice President for Facilities who shall appoint the members and Chair.

3) The RDSC shall include at least eight members including as ex-officio members the BMRC Operations Manager, BMRC Director, the Radiation Safety Officer, and the Acting Director of Environmental Health and Safety. The BMRC Director and Operations Manager shall be non-voting members.

4) The RDSC shall meet at least three times per year.

5) A quorum of the RDSC shall consist of at least six members, and all questions before the Committee must be approved by a simple majority of the voting members present, but by not less than four voting members.

6) Minutes of all meetings will be maintained on file and distributed to all members.

7) The RDSC shall review and approve the following:

   A) The substantive aspects of short and long term action plans relative to the reactor decommissioning, reactor plant maintenance and monitoring, except for those which may be reviewed and approved by the Operating Committee.

   B) Reportable Occurrences related to health and safety, and corrective actions.

   C) Notices of Violation related to health and safety and corrective actions.

   D) Applications for amendment to NRC licenses.

   E) Changes in Procedures or facilities implemented in accordance with 10 CFR 50.59, in Post Audit, after Operating Committee approval.

11.5.2 Operating Committee

1) An Operating Committee shall exist as a sub-group of the RDSC.

2) The Operating Committee shall consist of the ex-officio members of the RDSC plus additional members appointed pursuant to the by-laws.

3) The Operating Committee shall meet as often as required and minutes shall be kept of all formal meetings.

4) The Operating Committee is authorized to act for the RDSC regarding routine occurrences, and approvals for which the safety implications are minor, are well understood, and are within the scope of past practice. This would include but not be limited to:

A) Applications for license or Plan amendments such as to update names, equipment lists, procedures etc.

B) Operating Procedures, Emergency Procedures, Health Physics Procedures, or Maintenance Procedures.

C) Changes in procedures, equipment of facilities pursuant to 10 CFR 50.59.

D) Audit Reports.

11.5.3 Audits and Reviews

1) An independent audit shall be conducted annually of BMRC decommissioning, maintenance, operations, and surveillance activities. The auditor(s) shall have appropriate experience and education. The audit may be broken into modules, using the same or separate auditors. A written report(s) shall be provided to the BMRC Director, and shall be reviewed by the Reactor Decommissioning Safety Committee. The audit shall include at minimum a review of:

- Operational records for compliance with internal rules, procedures, policies, regulatory compliance, and license compliance.
- Adequacy of Procedures.
- Plant equipment Performance and surveillance requirements.
- Records of release and discharges of radioactivity to the environment.

2) Radiation Safety and ALARA Review shall be conducted pursuant to 10 CFR 20 requirements.

12.0 Actions To Be Taken In the Event of a Reportable Occurrence

A reportable occurrence shall be any of the following:

1) Release of fission products from a leaking fuel element.

2) An uncontrolled or unplanned release of radioactive materials from the restricted area of the facility which when averaged over any 24 hour period exceeds the applicable limits established by 10CFR20 or Technical Specifications, whichever is greater.

3) An uncontrolled or unplanned release of radioactive materials that results in concentrations of airborne radioactive materials within any portion of the restricted area which results in measured or calculated exposures to personnel in excess of 40 DAC-hours.

4) Declaration of an Emergency pursuant to the BMRC Emergency Plan.

5) An observed inadequacy in the implementation of administrative or procedural controls that caused or threatens to cause the existence or development of a immediately dangerous or otherwise significant unsafe condition in connection with the operation of the facility.

In the event of a reportable occurrence, as defined above, the following shall occur:

1) Immediate steps shall be taken to correct the situation and to mitigate the consequences of the occurrence.

2) The Operating Committee will investigate the occurrence and its causes, and will report its findings to the Reactor Decommissioning Safety Committee and to the Senior Vice President, and Associate Vice President for University Facilities.

3) A report shall be filed with the NRC which shall include an analysis of the causes of the occurrence, the effectiveness of corrective actions taken and recommendations of measures to be taken to prevent or reduce the probability or consequences of recurrence.

13.0 Written Procedures

13.1 Required Procedures

Written procedures will exist that define how and when various aspects of facility operations will be performed. These procedures may include "Operating Procedures", "Emergency Procedures" and "Maintenance and Calibration Procedures."

Written procedures shall at minimum address the following areas:

1) Fuel Handling Operations.
2) Use, surveillance, and maintenance of auxiliary systems.
3) Abnormal and emergency situations.
4) Required reactor electrical and mechanical surveillance and maintenance.
5) Operation and calibration of fixed radiological monitors as required by this Technical Specification.

13.2 Approval, Review and Update

1) Operating Procedures and Maintenance and Calibration Procedures will be reviewed and updated as appropriate, but such review shall be no less frequent than once every two years.
2) Emergency Procedures shall be reviewed and updated in accordance with the BMRC Emergency Plan.
3) All new or revised procedures shall be approved by the Operating Committee.

13.3 Temporary Deviation from Written Procedures

Temporary changes to written procedures that do not change the original intent may be made with the approval of a Sr. Reactor Operator, the Operations Manager, or the Director. All such changes shall be documented.

14.0 Record Keeping

14.1 Records Which Shall be Retained for Five Years

In addition to the requirements of applicable regulations, the following records and logs shall be maintained in a manner reasonably convenient for review, and retained for at least five years:

- Operation and Maintenance Logs and records
- Records and reports related to "reportable Occurrences" as defined by section 12.
- Logs and records which document the conduct of test, checks, and measurements in compliance with surveillance requirements established by Technical Specifications
- Records of experiments performed
- Operator Requalification program records
- Facility radiation and contamination surveys
- Minutes of Operating Committee meetings
- Principal Maintenance records

14.2 Records Which Shall be Maintained for the Life of the Facility

The following records shall be maintained for the life of the facility:

- Records of radioactive materials discharged to the air or water (sewer)
- Radiation exposure records for all facility personnel
- Fuel inventories and transfer records
- Up-dated, corrected, and as-built facility drawings
- Minutes of Reactor Decommissioning safety Committee, (formerly the Nuclear Safety Committee) Meetings
- Off Site environmental radiation monitoring surveys

15.0 Reporting Requirements

15.1 Annual Technical Report

A report summarizing technical operations will be prepared for each calendar year. A copy of this report shall be submitted to the Director , Office of Nuclear Reactor Regulation, with a copy to the Regional Administrator (Region I) by March 31 of each year. The report shall include the following:

1) A brief narrative summary of changes in facility design or performance that relate to nuclear safety and results of surveillances tests and inspections.
2) Discussion of major maintenance operations performed during the period including the effects if any on nuclear safety and the reason for any corrective maintenance required.

3) A brief description of any changes in the facility to the extent that it changes a description of the facility in the Safety Analysis Report.

4) A brief review of changes test and experiments made or conducted pursuant to 10 CFR 50.59 including a summary of the safety evaluation of each.

5) A summary of the nature and amount of radioactive effluents discharged or released to the environment.

6) A description of environmental radiological surveys conducted outside the facility.

7) A summary of radiation exposures received by facility personnel and visitors, including details of any unusual exposures.

8) A summary of the results of radiation and contamination surveys performed within the facility.

9) Any changes in facility organization.

10) A discussion of major operations performed during the reporting period related to decontamination, dismantling or decommissioning of the facility.

15.2 Reportable Occurrence Reports

Notification shall be made within 24 hours by telephone or facsimile, to the NRC Operations Center and Region I, followed by a written report within 14 days to the U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, ATTN: Document Control Desk, with a copy the Regional Administrator of Region I, in the event of a reportable occurrence as defined by technical specification. The written report, and to the extent practicable, the initial notification, shall:

1) Describe, analyze, and evaluate safety implications.

2) Outline the measures taken to ensure that the cause of the condition is determined.

3) Indicate the corrective action taken to prevent repetition of the occurrence, including changes to procedures.

4) Evaluate the safety implications of the incident in light of the cumulative experience obtained from the report of previous failure and malfunction of similar systems and components.

15.3 Safety Event Reports

A written report shall be forwarded within 30 days to the U.S. Nuclear Regulatory Commission, Washington, D.C. 2[illegible]55, ATTN: Document Control Desk, with a copy the Regional Administrator of Reg[illegible], in the event of:

1) Discovery of any substantial errors in the transient or accident analysis or in the methods used for such analysis as described in the Safety Analysis Report or in the basis for Technical Specifications

2) Discovery of any substantial variance from performance specifications contained in the Technical Specifications or Safety Analysis Report.

3) Discovery of any condition involving a possible single failure which, for a system designed against assumed failure, could result in a loss of the capability of the system to perform its safety function.

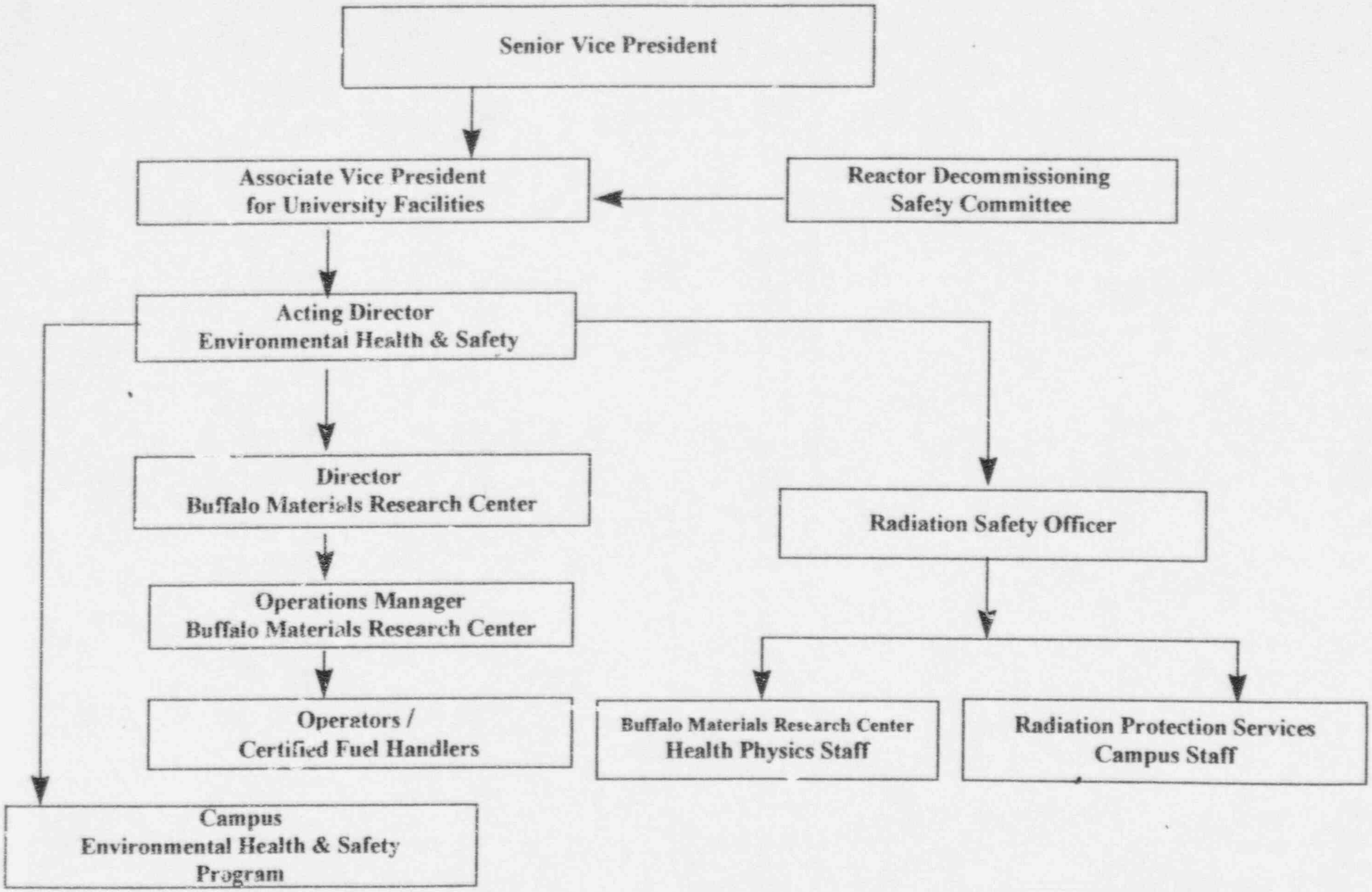
15.4 Special Nuclear Materials Status Reports

Materials status reports and nuclear materials transfer reports for special nuclear material, shall be made in accordance with applicable section of 10 CFR 70.

• Table 1-Fuel Assemblies in Reactor Tank as of June 30, 1994

Assembly Number	**Burnup** (MWD/Tonne U)
1	17470.38
2	14606.14
3R	12189.11
4R	14751.23
5	16160.89
6	14918.24
7	18104.11
8R	14906.87
9R	13633.79
10	18917.42
11R	16163.94
12R	13678.76
13	19523.86
14	18875.81
15	19030.08
16	18265.14
17R	13443.08
18R	10555.88
19R	10769.17
20R	10700.76
21R	5176.49
22R	14929.68
23	16540.68
24	14025.08
25R	14868.15
26R	11690.76
27R	15897.91
28	19352.25
29R	9203.55
30R	10329.85
31R	1826.54
32	18525.83
33R	1578.72
34R	332.30
36R	6620.32
37	15625.35
38	15833.18
40	12943.25
42	16904.13
Can #25	> 10000

Figure 1



Effective March 1, 1997