The University of Michigan

MICHIGAN MEMORIAL – PHOENIX PROJECT
PHOENIX MEMORIAL LABORATORY   FORD NUCLEAR REACTOR
ANN ARBOR, MICHIGAN 48109-2100

Office of the Director

08 September 2005

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Docket 50-2, License R-28

Subject: **Ford Nuclear Reactor Technical Specifications Amendment;** ***Elimination and Relaxation of Specifications Following Permanent Caseation of Operations***

The University of Michigan, Ford Nuclear Reactor is requesting that the Technical Specifications for the Ford Nuclear Reactor be amended to eliminate those specifications which are not applicable to and relax those specifications no longer appropriate for a facility with a prohibition on operating and not licensed to possess reactor fuel. These specifications were developed in a manner which allows for continued relaxation of the specification as the decommissioning progresses, thus minimizing licensing actions at future dates.

The University of Michigan's Ford Nuclear Reactor ceased operating on July 3, 2003. The reactor core was disassembled beginning July 7, 2003 and completed July 8, 2003 where in the irradiated reactor fuel was removed from the reactor support grid and moved to in-pool storage locations pending shipment to the DOE Savannah River Site. All new, unirradiated reactor fuel was removed from the site and transferred to the U.S. Department of Energy (DOE) via BWXT Technologies in Lynchburg, Virginia on August 20, 2003. In the Fall of 2003 seven shipments of irradiated reactor fuel to the DOE Savannah River Site were completed by the University of Michigan. With the final shipment, completed December 16, 2003, the Ford Nuclear Reactor no longer had reactor fuel on-site. On 29 January 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Steady State and Maximum Power Levels: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." Additionally the license condition allowing for the possession of reactor fuel under 10CFR70 was removed.

The evaluation supporting the requested changes to the Technical Specifications is enclosed as are the proposed Technical Specifications. These changes to the Technical Specifications are being submitted separate from the Decommissioning Plan, but approval with or before the approval of the Decommissioning Plan is requested. These changes to the Technical Specifications are necessary for and consistent with the actions described in the previously submitted Decommissioning Plan.

If there are any questions regarding this information, please feel free to contact Christopher W. Becker at (734) 764-6224.

I declare under penalty of perjury that the foregoing is true and correct.

Signature: ______________________   Executed on: 9/8/05

Steven C. Ceccio, Ph.D.
Director, Michigan Memorial Phoenix Project

Enclosure: Evaluation to Support Amendment Request
Technical Specifications: Amendment XX, undated.

A020
A001

Cc: Patrick Isaac

File: Correspondence 05-006
License Amendment - Elimination of Specifications following shutdown
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Evaluation to Support Technical Specifications Amendment; Elimination of Specifications Following Permanent Caseation of Operations

Safety Limits

Safety Limits for nuclear reactors are limits on important process variables found to be necessary to reasonably protect the integrity of certain physical barriers that guard against the uncontrolled release of radioactivity. [10 CFR 36(c)(1)(i)(A)] The University of Michigan's Ford Nuclear Reactor (FNR) ceased operating on July 3, 2003. The reactor core was disassembled beginning July 7, 2003 and completed July 8, 2003. The irradiated reactor fuel was removed from the reactor support grid and moved to in-pool storage locations pending shipment to the DOE Savannah River Site. All new, unirradiated reactor fuel was removed from the site and transferred to the U.S. Department of Energy (DOE) via BWXT Technologies in Lynchburg, Virginia on August 20, 2003. In the Fall of 2003 seven shipments of irradiated reactor fuel to the DOE Savannah River Site were completed by the University of Michigan. With the final shipment, completed December 16, 2003, the Ford Nuclear Reactor no longer had reactor fuel on-site. (See letter sent to US NRC certifying Permanent Fuel Removal dated December 17, 2003.). On 29 January 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Steady State and Maximum Power Levels: The licensee shall not operate the reactor nor place fuel elements in the reactor grid."

As the Safety Limits contained in the operating Technical Specifications were for the protection of the cladding integrity of the reactor fuel during reactor operation, these safety limits can be removed from the Technical Specifications. The Technical Specification changes required are:

2.1 Safety Limits

Applicability

As the Safety Limits were for the protection of the cladding integrity of the reactor fuel during reactor operation, all safety limits have been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~**2.1.1 Safety Limits in the Forced Convection Mode**~~

~~Applicability:~~

~~This specification applies to the interrelated variables associated with core thermal and hydraulic performance in the steady state with forced convection flow. These variables are:~~

~~Reactor Thermal Power, P~~

~~Reactor Coolant Flow Through the Core, m~~

~~Reactor Coolant Inlet Temperature, T_i~~

~~Height of Water Above the Top of the Core, H~~

~~Objective:~~

~~To assure that the integrity of the fuel clad is maintained.~~

~~Specification:~~

1. ~~The true value of reactor power (P) shall not exceed 4.68 Mw and the true value of flow (m) shall not be less than 900 gpm.~~
2. ~~The true value of reactor coolant inlet temperature (T_i) at 2 Mw shall not exceed 116 °F.~~

~~3. The true value of water height above the core (H) shall not be less than 18 feet while the reactor is operating.~~

~~Bases:~~

~~The basis for forced convection safety limits is that the calculated maximum cladding temperature in the bottom of the hot channel of the most compact FNR core (25 elements) will not reach the boiling point of the water coolant.~~

~~2.1.2 Safety Limits in the Natural Convection Mode~~

~~Applicability:~~

~~This specification applies to the interrelated variables associated with core thermal and hydraulic performance in the natural convection mode of operation. These variables are:~~

~~Reactor Thermal Power, P~~

~~Reactor Coolant Inlet Temperature, T_i~~

~~Height of Water Above the Top of the Core, H~~

~~Objective:~~

~~To assure that the integrity of the fuel clad is maintained.~~

~~Specification:~~

~~1. The true value of the reactor thermal power (P) shall not exceed 380 kw.~~

~~2. The true value of the reactor coolant inlet temperature (T_i) shall not exceed 131 °F.~~

~~3. The height of pool water above the core (H) shall not be less than 18 feet.~~

~~Bases:~~

~~The basis for natural convection safety limits is that the calculated maximum cladding temperature in the hot channel of the most compact FNR core (25 elements) will not reach the boiling point of the water coolant at a depth of 18 feet.~~

Limiting Safety System Settings

Similarly, Limiting Safety System Settings for nuclear reactors are settings for automatic protection devices related to those variable having significant safety functions.[10 CFR 50.36(c)(1)(ii)(A)]. As the Limiting Safety System Settings contained in the operating Technical Specifications were for the protection of the cladding integrity of the now removed reactor fuel, the limiting safety system settings below can be removed from the Technical Specifications. The Technical Specification changes required are:

2.2 Limiting Safety System Settings (LSSS)

Applicability

As the Limiting Safety System Settings were for the protection of the cladding integrity of the reactor fuel during reactor operation, all limiting safety system settings have been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~2.2.1 Limiting Safety System Setting in the Forced Convection Mode~~

~~Applicability:~~

~~This specification applies to the set points for the safety channels monitoring reactor thermal power (P), primary coolant flow (m), height of water above the top of the core (H), core exit temperature (Te) and core inlet temperature (Ti).~~

~~Objective:~~

~~To assure that automatic protective action is initiated to prevent a safety limit from being exceeded.~~

~~Specification:~~

1. ~~The limiting safety system settings for reactor thermal power (P), primary coolant flow through the core (m), height of water above the top of the core (H), and reactor coolant exit temperature (Te) shall be as follows:~~

~~Variable~~	~~LSSS~~
~~P (Max)~~	~~2.60 Mw~~
~~m (Min)~~	~~900 gpm~~
~~H (Min)~~	~~19 ft~~
~~Te (Max)~~	~~129 oF~~

2. ~~The limiting safety system setting for reactor coolant inlet temperature at thermal power levels above 1.6 Mw shall be:~~
   ~~Ti (max) = 114 oF~~

~~Bases:~~

~~The limiting safety system settings for forced convection assure that automatic protective action will correct the most severe abnormal situation anticipated before a safety limit is exceeded.~~

~~2.2.2 Limiting Safety System Settings in the Natural Convection Flow Mode~~

~~Applicability:~~

~~These specifications apply to the setpoint for the safety channels monitoring reactor thermal power (P), pool water level (H), and pool water temperature (T).~~

~~Objective:~~

~~To assure that automatic protective action is initiated to prevent a safety limit from being exceeded.~~

~~Specifications:~~

1. ~~The limiting safety system settings for reactor thermal power (P), height of water above the top of the core (H), and pool water temperature (T) shall be as follows:~~

~~Variables~~	~~LSSS~~
~~P (Max)~~	~~100 kw~~
~~H (Min)~~	~~19 ft~~
~~T (Max)~~	~~129 oF~~

~~Bases:~~

~~The limiting safety system settings for natural convection assure that automatic protective action will correct the most severe abnormal situation anticipated before a safety limit is exceeded.~~

Reactivity Limits

The reactivity limits currently contained in the Technical Specification are administrative constraints on operational characteristics adhered to during the operation of the reactor. These reactivity limits contained in the operating Technical Specifications applied to the reactivity of the reactor core, the reactivity worths of the control rods, and the reactivity of experiments to ensure that the reactor could be controlled and shutdown at all times and that the safety limits contained in the Technical Specification could not be exceeded. All new, unirradiated reactor fuel was removed from the site and transferred to the U.S. Department of Energy (DOE) via BWXT Technologies in Lynchburg, Virginia on August 20, 2003. In the Fall of 2003 seven shipments of irradiated reactor fuel to the DOE Savannah River Site were completed by the University of Michigan. With the final shipment, completed December 16, 2003, the Ford Nuclear Reactor no longer had reactor fuel on-site. (see letter sent to US NRC certifying Permanent Fuel Removal dated December 17, 2003). On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

It is requested that the limiting condition for operation and surveillance requirements associated with reactivity limits be removed from the Technical Specifications.

The proposed Technical Specifications are:

3.1 Reactivity Limits

Applicability:

The reactivity limits applied to the reactivity of the reactor core, the reactivity worths of the control rods, and the reactivity of experiments to ensure that the reactor could be controlled and shutdown at all times and to ensure that the safety limits contained in the Technical Specification could not be exceeded. Reactivity limits have been removed from the Technical Specifications.

~~This specification applies to the reactivity of the reactor core and to the reactivity worths of control rods and experiments. When the reactor is operated with the heavy water reflector tank in place, the limits will not include the static reactivity worth of the tank.~~

~~Objective:~~

~~To assure that the reactor can be controlled and shutdown at all times and that the safety limits will not be exceeded.~~

~~Specification:~~

1. ~~The shutdown margin relative to the cold, xenon free, critical condition shall be at least 0.025 ΔK/K with all three shim safety rods fully inserted and the regulating rod fully withdrawn and 0.0045 ΔK/K with the most reactive shim-safety rod and the regulating rod fully withdrawn, except during the process of verifying shutdown margin.~~
2. ~~The overall core excess reactivity including moveable experiments shall not exceed 0.0436 ΔK/K.~~
3. ~~The reactivity worth of experiments shall be limited as follows, except during the process of verifying experiment reactivity:~~

~~Experiment~~	~~Maximum Reactivity Worth~~
~~Individual Moveable~~	~~0.0012 ΔK/K~~
~~Individual Secured~~	~~0.012 ΔK/K~~
~~Total Moveable and Secured~~	~~0.012 ΔK/K~~

4. ~~The reactor shall be subcritical by at least 0.025 ΔK/K during fuel movements to and from the reactor core.~~

5. ~~The reactor shall be subcritical by at least 0.10 ΔK/K before shim-safety rods are removed from the core.~~
6. ~~The reactor shall be subcritical by at least 0.10 ΔK/K whenever heavy water movements that can result in positive reactivity insertions are undertaken.~~
7. ~~The reactivity worth of the regulating rod shall not exceed 0.006 ΔK/K.~~
8. ~~Experiments that could increase reactivity by flooding, shall not remain in or adjacent to the core unless the shutdown margin required in Specification 3.1.1 would be satisfied after flooding.~~

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~The shutdown margin required by Specification 3.1.1 assures that the reactor can be shutdown from any operating condition and will remain subcritical after cooldown and xenon decay even if the rod of the highest reactivity worth should be in the fully withdrawn position.~~

~~Specification 3.1.2 limits the allowable excess reactivity to the value necessary to overcome the combined negative reactivity effects of: (1) an increase in primary coolant temperature from 90 oF to 116 oF; (2) fission product xenon and samarium buildup in a clean core; (3) power defect due to increasing from a zero power, cold core to a 2 Mw, hot core; (4) fuel burnup during sustained operation for 30 days; and (5) moveable experiments.~~

~~Specification 3.1.3 limits the individual reactivity worth of moveable experiments to values that will not produce a stable period of less than 30 seconds and which can be compensated for by the action of the control and safety systems without exceeding any safety limits.~~

~~Specification 3.1.3 limits the reactivity worth of secured and total experiments to values of reactivity which, if introduced as positive step changes, will not cause fuel melting.~~

~~Specifications 3.1.4 and 3.1.5 provide assurance that the core will remain subcritical during fuel movements to and from the core and during shim-safety rod maintenance or inspection.~~

~~The largest positive reactivity increase that can be produced by replacing light water with heavy water in the heavy water reflector tank is 0.04 ΔK/K. Maintaining the core subcritical by at least 0.10 ΔK/K in Specification 3.1.6 during heavy water transfers provides adequate margin to assure that the reactor will remain subcritical during heavy water transfers that could add positive reactivity.~~

~~Specification 3.1.7 assures that failure of the automatic control system will not introduce sufficient excess reactivity to produce a prompt critical condition.~~

~~Specification 3.1.8 assures that the shutdown margin required by Specification 3.1.1 will be met in the event of a positive reactivity insertion caused by the flooding of an experiment.~~

4.1 Reactivity Limits

Applicability:

All surveillance requirements for reactivity limits have been removed from the Technical Specifications

~~This specification applies to the surveillance requirements for reactivity limits.~~

~~Objective:~~

~~To assure that the reactivity limits of Specification 3.1 are not exceeded.~~

~~Specification:~~

1. ~~Shim safety rod reactivity worths shall be measured:~~
   a. ~~Annually;~~
   b. ~~Whenever the fuel elements in more than three interior core locations are replaced;~~
   c. ~~Whenever the replacement of a fuel element in an interior core location results in an element fuel mass change of more than 10% in that location;~~
   d. ~~Whenever the addition of more than three standard fuel elements to the outer faces of the core is made to achieve the desired excess reactivity for the operation of the reactor.~~
2. ~~Shim safety rods shall be visually inspected and put through a jig to check for swelling at least annually.~~
3. ~~The reactivity worth of those experiments whose safety review indicates a need for such a determination shall be measured prior to the experiment's initial use. That worth shall be verified if core configuration changes occur which could reasonably be expected to cause increases in experiment reactivity worth whereby the experiment worth could exceed the values specified in Specification 3.1.~~
4. ~~The core negative reactivity required during heavy water transfers will be verified whenever heavy water transfers are to be made.~~

Bases:

On 29 January 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~Specification 4.1.1 will assure that shim-safety rod reactivity worths are not degraded or changed by core arrangements.~~

~~Shim-safety rod inspections are the single, largest source of radiation exposure to facility personnel. Furthermore, frequent inspections of shim-safety rods for swelling over the last ten years have produced no evidence of swelling or cracking. In order to minimize personnel radiation exposure and provide an inspection frequency that will detect early evidence of swelling and cracking, an annual inspection interval was selected for Specification 4.1.2.~~

~~The specified surveillance relating to the reactivity worth of experiments will assure that the reactor is not operated for extended periods before determining the reactivity worth of experiments. This specification also provides assurance that experiment reactivity worths do not increase beyond the established limits due to core configuration changes.~~

~~Actual verification of the core negative reactivity required for heavy water transfers will assure the reactor stays subcritical under all possible circumstances during heavy water transfers.~~

Experiments

The limits currently contained in the Technical Specification for reactor experiments which established the administrative constraints for the lowest functional capability or performance level for equipment associated with and operational characteristics of experiments conducted in the Ford Nuclear Reactor are no longer needed. On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

It is requested that the limiting condition for operation associated with experiments be removed from the Technical Specifications.

The proposed Technical Specifications are:

3.7 Limitations of Experiments

Applicability:

These limits established the administrative constraints for the lowest functional capability or performance level for equipment associated with and operational characteristics of experiments conducted in the Ford Nuclear Reactor. These limits have been removed from the Technical Specifications.

~~This specification applies to experiments installed in the FNR.~~

~~Objective:~~

~~To prevent damage to the reactor or excessive release of radioactive materials in the event of an experiment failure.~~

~~Specification:~~

1. ~~Each experiment shall be designed so that the surface temperature shall be below the temperature calculated for the inception of nucleate boiling. Prior to insertion in the reactor, any capsule which is expected to operate with an internal pressure in excess of one atmosphere shall be tested at a pressure twice the calculated maximum pressure.~~
2. ~~All experiments which are in contact with reactor coolant shall be either corrosion resistant or encapsulated within corrosion resistant containers.~~
3. ~~Explosive materials shall not be placed in the reactor pool.~~
4. ~~Neutron radiography of explosives shall be conducted with the explosives contained in a blast proof irradiation container, a prototype of which has been successfully tested and demonstrated not to fail by detonation of at least twice the amount of explosive to be irradiated.~~
5. ~~The radioactive material content, including fission products, of any singly encapsulated experiment should be limited so that the complete release of all gaseous, particulate, and volatile components from the encapsulation could not result in doses in excess of 10% of the equivalent annual doses stated in 10CFR20. This dose limit applies to persons occupying unrestricted areas continuously for two hours starting at time of release and restricted areas during the length of time required to evacuate the restricted area.~~
6. ~~The radioactive material content, including fission products, of any doubly encapsulated experiment should be limited so that the complete release of all gaseous, particulate, or volatile components from the encapsulation could not result in doses in excess of the equivalent annual doses stated in 10CFR20. This dose limit applies to persons occupying unrestricted areas continuously for two hours starting at the time of release and restricted areas during the length of time required to evacuate the restricted area.~~

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~Specifications 3.7.1 through 3.7.4 are intended to reduce the likelihood of damage to reactor components and radioactivity releases resulting from experiment failure and serve as a guide for the review and approval of new and untried experiments by facility personnel and the Safety Review Committee.~~

~~Neutron radiography is conducted in a vertical beam tube and at horizontal beamports that terminate at the heavy water reflector tank adjacent to the reactor core. In the radiography of explosives, the explosive devices will be contained, during exposure, inside a blast proof enclosure. The enclosure will not be coupled to the beamtube or beamport and will be constructed to fully contain any blast effects or missiles which might be generated by an accidental detonation.~~

~~Specifications 3.7.5 and 3.7.6 conform to the regulatory position put forth in Regulatory Guide 2.2 issued November, 1973. The calculations for experiment radioactivity limits are provided in section 14.3 of the SAFETY ANALYSIS.~~

Reactor Fuel

The limits currently contained in the Technical Specification for rector fuel are no longer needed. All new, unirradiated reactor fuel was removed from the site and transferred to the U.S. Department of Energy (DOE) via BWXT Technologies in Lynchburg, Virginia on August 20, 2003. In the Fall of 2003 seven shipments of irradiated reactor fuel to the DOE Savannah River Site were completed by the University of Michigan. With the final shipment, completed December 16, 2003, the Ford Nuclear Reactor no longer had reactor fuel on-site. (see letter sent to US NRC certifying Permanent Fuel Removal dated December 17, 2003). On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

It is requested that the limiting condition for operation, surveillance requirements, and design features associated with reactor fuel be removed from the Technical Specifications.

The proposed Technical Specifications are:

3.8 Fission Density Limit

Applicability:

The fission density limit specified the maximum burnup allowed for a fuel element to ensure fuel failures were not experience during the operation of the reactor. This limit has been removed from the Technical Specifications.

~~Objective:~~

~~To prevent fuel plate swelling which could result in clad rupture and release of radioactive fission products.~~

~~Specification:~~

~~1. The FNR fission density limit shall be 1.5x1021 fission/cc.~~

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~The fission density limit is below operational fission densities reached in other operating reactors using the same kind of fuel without failures attributed to the fuel.~~

~~An experimental data base that supports the safe use of uranium aluminide (UAlx), uranium oxide (U3O8), and uranium silicide (U3Si2) fuel in the FNR up to the fission density limit was derived from irradiation tests performed in the Materials Test Reactor (MTR), the Engineering Test Reactor (ETR), and the Advance Test Reactor (ATR) at the Idaho National Engineering Laboratory, the High Flux Isotope Reactor (HFIR) at the Oak Ridge National Laboratory, and the German Karlsruhe FR2 reactor.~~

4.7 Fission Density Limits

Applicability:

The surveillance requirement for the fission density limit has been removed from the Technical Specifications.

~~Objective:~~
~~To assure that the fission density limits of Specification 3.8 are not exceeded.~~

~~Specification:~~

~~1. The fission density of all fuel elements which have uranium-235 burnup shall be calculated at least quarterly.~~

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~Determination of fission densities on a quarterly basis will ensure that the fission density limits of Specification 3.8 are not exceeded. Fuel element swelling will be kept well below levels which could result in clad rupture and release of radioactive fission products.~~

5.2 Reactor Fuel

The license for the Ford Nuclear Reactor does not allow for possession of reactor fuel.

~~The fuel assemblies shall be of the MTR type, consisting of plates containing uranium aluminide (UAlx), uranium oxide (U3O8), or uranium silicide (U3Si2) fuel enriched to less than 20% in the isotope U235 clad with aluminum. The authorized fuel assembly designs are:~~

~~Number of Plates~~	~~Maximum Plate Loading (g U235)~~	~~Maximum Assembly Loading (g U235)~~
~~18~~	~~9.28 +/- 2%~~	~~167 +/- 2%~~
~~9~~	~~9.28 +/- 2%~~	~~84 +/- 2%~~

5.4 Fuel Storage

The license for the Ford Nuclear Reactor does not allow for possession of reactor fuel.

~~1. Irradiated fuel elements and fueled devices shall be stored in an array which will permit sufficient natural convection cooling by water or air such that the fuel element or fueled device temperature will not exceed 100 oC.~~

~~2. All reactor fuel elements and fueled devices shall be stored in a geometric array which assures subcriticality. The array spacings will be based on the experimental results reported in ORNL-CF-58-9-40 for storage array experiments performed with Oak Ridge Reactor and Bulk Shielding Facility fuel elements.~~

Reactivity Control and Reactor Instrumentation Systems

Reactivity Control - Originally reactivity control was provided by three shim safety rods and one control rod, subject to reactivity limits on the reactor core and the experiments which could be inserted in the reactor. While reactivity or reactor power was monitored by six neutron detection channels to measure reactor power from the source range to full power: two fission chamber channels (Log Count Rate), two compensated ion chamber channels (Linear Level and Log N), and two uncompensated ion chamber channels (Safety A and B). These channels provided power level indication, reactor scrams, and control interlocks. The shim safety rods and the control rods were each moved by a gear reduction motor or rod drive which were controlled by the rod control systems either manually by the operators or automatically by the auto rundown system, various interlocks, or the linear level servo controller. The shim safety rods were connected to the rod drives by magnets to allow the rods to drop in less than ½ of a second and secure the reactor as controlled by the Safety System.

The shim safety rod and control rod systems can be removed from the facility along with their limiting conditions for operation and surveillance requirements contained in the Technical Specifications for the FNR. Current license condition C (1), Maximum Power Level which currently states "The licensee shall not operate the reactor nor place fuel elements in the reactor grid." provides assurance that the health and safety of the University community and the public will not be endangered by operations at the FNR following the removal of these systems and their associated requirements in the Technical Specifications.

Log Count Rate System - The Log Count Rate System used two movable fission chambers to monitor reactor power from fuel loading through to full power. The Log Count Rate System indicated the pulses from the fission chamber on a recorder in the control room. This recorder provided and interlock which prevented outward motion of the shim safety rods unless a measurable count rate (> 5 cps) was present on the recorder.

The log count rate system can be removed from the facility along with their limiting conditions for operation and surveillance requirements contained in the Technical Specifications for the FNR. Current license condition C (1), Maximum Power Level which currently states "The licensee shall not operate the reactor nor place fuel elements in the reactor grid." provides assurance that the health and safety of the University community and the public will not be endangered by operations at the FNR following the removal of these systems and their associated requirements in the Technical Specifications.

Linear Level - Servo Control System - The Linear Level - Servo Control System monitored reactor power using a compensated ion chamber and used this power signal as an input to a automatic controlled which would provide a signal to raise and lower the control rod to maintain reactor power at a prescribed level. Power level measured by the linear level system was indicated on a recorder in the control room. This recorder provided a signal to initiate a rundown, inward motion of all three shim safety rods, if the indicated power level exceeded 107% as indicated on the recorder. The purpose of this rundown was to provide automatic action before the reactor reached its licensed maximum power limit of 2.2Mw. The linear level servo system contained a control interlock which automatically returned control to manual if the indicated power were to drop 5% below the current setpoint. This was to prevent automatic withdrawal of the control rod resulting.

The linear level - servo control system can be removed from the facility along with their limiting conditions for operation and surveillance requirements contained in the Technical Specifications for the FNR. Current license condition C (1), Maximum Power Level which currently states "The licensee shall not operate the reactor nor place fuel elements in the reactor grid." provides assurance that the health and safety of the University community and the public will not be endangered by operations at the FNR following the removal of these systems and their associated requirements in the Technical Specifications.

Log N System (Safety System Period Channel C) - The Log N Channel monitored reactor power using a compensated ion chamber Power level and reactor period measured by the log N system were indicated on two recorders in the control room. The power level recorder provided a signal to the SCRAM system when reactor power exceeded 5% or 100kW for both the high power/no flow and the high power/header down SCRAMs. The power level recorder also provided a signal to the shim safety rod control systems auto rundown feature when reactor power exceeded 80%, 1.6 MW, for use in providing an auto rundown, auto insertion of the shim safety rods, when the water temperature at an elevation near the top of the fuel exceeded 114 oF. The period recorder provided a signal to the control rod system which prevented outward motion of the control rod when the reactor period was less than 30 seconds and initiated an automatic rundown of the shim safety rods when the period reached 10 seconds.

The Log N System can be removed from the facility along with their limiting conditions for operation and surveillance requirements contained in the Technical Specifications for the FNR. Current license condition C (1), Maximum Power Level which currently states "The licensee shall not operate the reactor nor place fuel elements in the reactor grid." provides assurance that the health and safety of the University community and the public will not be endangered by operations at the FNR following the removal of these systems and their associated requirements in the Technical Specifications.

Safety System - The reactor safety system was designed to shut down the reactor and maintain safe, shutdown conditions. The safety system consisted of three separate channels, any one of which was fully capable of shutting down the reactor. The system monitored reactor power using two uncompensated ion chambers and monitored reactor period using an compensate ion chamber (see Log N System above). The safety system interrupted the current to the magnets holding the shim safety rods upon receipt of any one of several signals. The two power level monitors, Safety channels A and B, provided a signal to interrupt magnet current before the power level measured my either exceeded 2.45 MW. The Log N channel provided a signal to interrupt magnet current when reactor period was 5 seconds or less.

Power to the power supply for the magnets holding up the shim safety rods can also be interrupted, resulting in a reactor scram. The Log N System recorder and the header operating mechanism would provide a signal to interrupt magnet current when reactor exceeded 100 kW and the header mechanism was not fully down., The reactor bridge system would provide a signal to interrupt power to the power supply for the magnets when either of two mechanical clamps holding the reactor bridge in position were opened. The header operating mechanism and a flow meter in the primary coolant system would provide a signal to interrupt power to the power supply for the magnets if the header mechanism was up and flow measured in one primary coolant flow meter was below 900 gpm. The Log N recorder and a flow meter in the primary coolant system would provide a signal to interrupt power to the power supply for the magnets if the power level was above 5% or 100 kW and flow measured in one primary coolant flow meter was below 900 gpm. The Log N recorder and the butterfly valve in the primary coolant system would provide a signal to interrupt power to the power supply for the magnets if the power level was above 5% or 100 kW and the butter fly valve was not fully open. The Log N recorder and a differential pressure gauge on the holdup tank in the primary coolant system would provide a signal to interrupt power to the power supply for the magnets if the power level was above 5% or 100 kW and the pressure in the 1 psig below full flow static pressure. Each of the doors over the opening of the beam ports provides a signal to interrupt power to the power supply for the magnets if the door is raised unless this SCRAM is bypassed in the control room. And finally, if the radiation level seen by a gamma detector in the exhaust plenum from the reactor building is 1 mRem/hr or more a signal is generated which interrupts power to the power supply for the magnets, plus other functions.

Power to the power supply for the magnets can be manually interrupted via a manual scram buttons on the control consul, the beam port floor and the reactor basement and a key-switch on the control consul.

The safety or scram system can be removed from the facility along with their limiting conditions for operation and surveillance requirements contained in the Technical Specifications for the FNR. Current license condition C (1), Maximum Power Level which currently states "The licensee shall not operate the reactor nor place fuel elements in the reactor grid." provides assurance that the health and safety of the University community and the public will not be endangered by operations at the FNR following the removal of these systems and their associated requirements in the Technical Specifications.

Temperature System - The temperature system was provided to measure the temperature of the water in the reactor pool near the surface, near the inlet to the core, and several locations in the primary cooling and secondary cooling system. Each of the measured channels was indicated to the operators via a recorder in the control room. This recorder provided signals to the rod control system which initiated and auto rundown, inward motion of the shim safety rods, if the temperature of the coolant exiting the reactor exceeded 129 oF or if the bulk temperature of the reactor pool exceeding 129 oF. The temperature system combined with a signal from the Log N power level recorder provided a signal to the rod control system to initiate an auto rundown when reactor power exceeded 80%, 1.6 MW, and when the water temperature at an elevation near the top of the fuel exceeded 114 oF.

The temperature system can be removed from the facility along with their limiting conditions for operation and surveillance requirements contained in the Technical Specifications for the FNR. Current license condition C (1), Maximum Power Level which currently states "The licensee shall not operate the reactor nor place fuel elements in the reactor grid." provides assurance that the health and safety of the University community and the public will not be endangered by operations at the FNR following the removal of these systems and their associated requirements in the Technical Specifications.

Flow Measurement System - Two differential pressure transducers in the primary cooling system provided a signal to the safety system for the scrams described in that section whenever the measured flow rate fell below 900 gpm. With the permanent cessation of operations AND the permanent removal of all reactor fuel, these systems can be removed.

The flow measurement system can be removed from the facility along with their limiting conditions for operation and surveillance requirements contained in the Technical Specifications for the FNR. Current license condition C (1), Maximum Power Level which currently states "The licensee shall not operate the reactor nor place fuel elements in the reactor grid." provides assurance that the health and safety of the University community and the public will not be endangered by operations at the FNR following the removal of these systems and their associated requirements in the Technical Specifications.

The proposed Technical Specifications are:

3.2 Reactor Safety System

Applicability:

This establishes the administrative constraints on equipment and operational characteristics that are the lowest functional capability or performance level for safe operation of the reactor. These limits have been removed from the Technical Specifications.

~~These specifications apply to the reactor safety system and other safety related instrumentation.~~

~~Objective:~~

~~To specify the lowest acceptable level of performance or the minimum number of acceptable components for the reactor safety system and other safety related instrumentation.~~

~~Specification:~~

~~The reactor shall not be made critical unless:~~
1. ~~The reactor safety systems and safety related instrumentation are operable in accordance with Tables 3.1 and 3.2 including the minimum number of channels and the indicated maximum or minimum setpoints;~~
2. ~~All shim-safety rods are operable;~~
3. ~~The time from the initiation of a scram condition in the scram circuit until the shim-safety rods are fully inserted (release-drop time) shall not exceed 500 milliseconds;~~
4. ~~Mechanical devices are installed which prevent the lifting of fuel elements through the movement of control rods.~~

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid."

and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~Neutron flux level scrams provide redundant automatic protective action to prevent exceeding the safety limit on reactor power. The period scram limits the rate of rise of the reactor power to periods which are manually controllable without reaching excessive power levels or fuel temperatures.~~

~~Power-flow coincident scrams provide redundant channels to assure that an automatic loss of flow scram will occur in the event of a loss of flow when the reactor is operating at power levels above 100 kw.~~

~~The rod withdrawal interlock on the Log Count Rate channel assures that the operator has a measuring channel operating and indicating neutron flux levels during the approach to criticality.~~

~~The reactor coolant inlet temperature, reactor coolant exit temperature, reactor pool temperature auto rundown functions and the pool level auto rundown assure that the reactor will not be operated above the safety limit for core inlet temperature and below the safety limit for pool level in either natural or forced convection mode.~~

~~The manual scram button and the magnet power keyswitch provide two methods for the reactor operator to manually shutdown the reactor if an unsafe or abnormal condition should occur and the automatic reactor protection does not function.~~

~~The use of the area radiation monitor system assures that areas of the facility in which a high radiation area could exist are monitored.~~

~~Specifications 3.2.2 and 3.2.3 assure that the safety system response will be appropriate.~~

~~Mechanical holddown devices specified in 3.2.4 ensure that a fuel element cannot be lifted from the core by withdrawal of a control rod and be released back into the core resulting in a sudden positive reactivity insertion.~~

Table 3.1
REQUIRED SAFETY CHANNELS

~~Channel~~	~~Setpoint~~	~~Minimum Number Required~~	~~Function~~
~~Log Count Rate~~	~~2 cps~~	~~1~~	~~Rod Withdrawal Interlock~~
~~Log N Period~~		~~1~~	~~Wide range power level; power level interlocks, and input for period scram~~
~~Period Safety~~	~~5 sec~~	~~1~~	~~Scram~~
~~Level Safety~~	~~122.5% (2.45 Mw)~~	~~2~~	~~Scram~~
~~High Power/No Water Flow~~	~~(a) 900 gpm~~ ~~(b) holdup tank isolation valve not fully open~~ ~~(c) holdup tank static pressure 1 psig below full power value~~	~~1~~	~~Scram > 100 kw~~
~~High Power/ Header Down~~		~~1~~	~~Scram > 100 kw~~
~~Header Up/No Water Flow~~	~~900 gpm~~	~~1~~	~~Scram~~
~~Building Exhaust Radiation Level~~	~~1 mrem/hr~~	~~1~~	~~Scram~~

~~Building Alarm Manual Switch~~		~~1~~	~~Scram~~
~~Manual Scram Switch~~		~~1~~	~~Scram~~
~~Magnet Power Keyswitch~~		~~1~~	~~Scram~~
~~Reactor Coolant Inlet Temp.~~	~~114 oF~~	~~1~~	~~Auto Rundown > 1.6 MW~~
~~Reactor Coolant Exit Temp.~~	~~129 oF~~	~~1~~	~~Auto Rundown~~
~~Reactor Pool Temperature~~	~~129 oF~~	~~1~~	~~Auto Rundown~~
~~Pool Level~~	~~1 foot below pool overflow~~	~~1~~	~~Auto Rundown~~
~~Bridge Not Clamped~~	~~When clamps released~~	~~1~~	~~Scram~~

~~Table 3.2~~

~~REQUIRED SAFETY RELATED INSTRUMENTATION~~

~~Channel~~	~~Setpoint~~	~~Minimum Number Required~~	~~Function~~
~~Linear Level Channel~~	~~As Required~~	~~1~~	~~Linear power level measurement and input for the automatic control mode~~
~~Power Level Deviation Interlock~~	~~95% of control point setting~~	~~1~~	~~Return reactor to manual control mode if setpoint is reached~~
~~Reactor Coolant Inlet Temperature~~	~~Not Applicable~~	~~1a~~	~~Provide information for reactor power level determination by heat balance~~
~~Facility Radiation Monitor System~~			
~~1. Building Air Exhaust~~	~~1(1)b mrem/hr~~	~~1~~	~~Alarm, scram, initiate confinement evacuation~~

Note: The limiting conditions for operation associated with the building exhaust radiation monitor have been moved to 3.3, FNR Confinement as described in another section of this Technical Specification Amendment.

~~2. Reactor Bridge~~	~~40(50)b mrem/hr~~	~~1~~	~~Alarm~~
~~3. NW Column, Beamport Floor~~	~~20(50)b mrem/hr~~	~~1c~~	~~Alarm~~
~~4. N Wall, Beamport Floor~~	~~5(50)b mrem/hr~~	~~1c~~	~~Alarm~~
~~5. NE Column, Beamport Floor~~	~~5(50)b mrem/hr~~	~~1c~~	~~Alarm~~

Note: The limiting conditions for operation associated with the area radiation monitors have been moved to 3.5, Radiation Monitoring as described in another section of this Technical Specification Amendment.

~~Footnotes:~~

a. ~~Not required for natural convection operation.~~
b. ~~The facility radiation monitoring system consists of 5 radiation detectors which alarm and read out locally,~~

~~and are recorded in the control room. The normal setpoints for this system are shown. The value in parentheses is the maximum setpoint which will be used depending on local conditions. Use of higher than normal setpoints will require approval of the Nuclear Reactor Laboratory Manager or one of the Assistant Managers. Any reactor staff member may adjust a setpoint lower than the normal value.~~

c. ~~If facility radiation monitor 3., 4., or 5. is placed out of service for a period of more than 7 days, the reactor shall be shut down or the monitor shall be replaced by a locally alarming unit of similar range. Should a second of these monitors be placed out of service, the reactor will be shut down unless the monitor is returned to service within 24 hours or is replaced by a second locally alarming unit of similar range.~~

4.2 Reactor Safety System

Applicability:

This specification applied to the surveillance of the reactor safety system. These surveillance requirements have been removed from the Technical Specifications.

~~This specification applies to the surveillance of the reactor safety system.~~

~~Objective:~~

~~To assure that the reactor safety system is operable as required by Specification 3.2.~~

~~Specification:~~

1. ~~A channel test of the neutron flux level safety channels, period safety channel, log count rate channels, and power-flow coincidence scrams shall be performed:~~
   a. ~~Prior to each reactor startup following a period when the reactor was secured;~~
   b. ~~After a channel has been repaired or deenergized.~~
2. ~~A channel calibration of the safety channels listed in Table 3.1, which can be calibrated, shall be performed annually.~~
3. ~~A channel check of the neutron flux level safety channels during reactor operation comparing the channel outputs with a heat balance, shall be performed shortly after reaching operating power level and weekly thereafter if the reactor is to be operated at a thermal power level above 500 kw.~~
4. ~~The operation of the radiation monitoring system required in Table 3.2 shall be verified:~~
   a. ~~Prior to each reactor startup following a period when the reactor was secured;~~
   b. ~~After a channel has been deenergized.~~
   c. ~~If a channel has been repaired, an operation and setpoint verification will be performed prior to use.~~
5. ~~The radiation monitor system required in Table 3.2 shall be calibrated semiannually.~~

Note: *The surveillance requirements for the building exhaust radiation monitor have been moved to 4.3, FNR Confinement as described in another section of this Technical Specification Amendment.*

Note: *The surveillance requirements associated with the area radiation monitors have been moved to 4.5, Radiation Monitoring as described in another section of this Technical Specification Amendment.*

6. ~~Shim-safety rod release-drop time shall be measured:~~
   a. ~~Annually;~~
   b. ~~Whenever a shim-safety rod's core location is changed;~~
   c. ~~Whenever maintenance is performed that could affect the rod's drop time.~~

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

~~Prestartup tests of the safety system channels assure their operability. Annual calibration detects any long term drift that is not detected by normal intercomparison of channels. The channel check of the neutron flux level channels assures that the detectors are properly adjusted to accurately monitor the parameter they are measuring.~~

~~Radiation monitors are checked for proper operation in Specification 4.2.4. Calibration and setpoint verification involve use of a calibration source and significant personnel radiation exposure. Semiannual calibration of radiation monitors, which have displayed excellent stability over many years of operation, is adequate to verify the setpoint unless instrument repairs have been made.~~

~~The measured release-drop times of the shim-safety rods have been consistent since the installation of the boron/stainless steel shim safety rods in 1962 and the boron-aluminum alloy shim-safety rods in 1994. Annual check of these parameters is considered adequate to detect any deterioration which could change the release-drop time. Binding or rubbing caused by rod misalignment could result from maintenance; therefore, release drop times will be checked after such maintenance.~~

Reactor Building Confinement

The reactor building is designed to restrict leakage and is equipped with a general ventilation system that provides the primary heating for the building and exhausts through a stack on the roof. Supply air and primary exhaust air are drawn through the air handling equipment room, where all supply air enters the building and most exhaust air is pushed to the stack on the roof. Both the supply and exhaust ducts can be isolated by dampers to establish confinement and utilize single pneumatic cylinder which holds the dampers open using the reactor building compressed air system. A signal from the building exhaust monitoring system described in the following section can cause the pneumatic cylinder to vent, closing both dampers. A smaller exhaust ventilation system in the reactor building is also connected to the a laboratory exhaust stack in the contiguous Phoenix Memorial Laboratory (PML). This system draws air from the reactor building via a bolted flange to two circular ducts that are sleeved through the north wall of PML and the south wall of the reactor building.

Previous evaluations of the potential radiation exposure to persons at the operations boundary (outside the reactor building) following an accidental release of fission products within the reactor building used a leakage rate from the reactor building of 10% of the building volume per day and concluded that the accident doses would be acceptable. To ensure the basis of this evaluation the Technical Specifications requires the following automatic actions upon the detection of a radiation level or release of radioactive materials from the reactor building exhaust system equal to or greater than the limits discussed in the following section: a) The reactor building ventilation supply and exhaust fans shall automatically turn off; b) The reactor building ventilation supply and exhaust dampers shall automatically close; c) Unless the duct is otherwise closed or sealed shut, the beam port exhaust damper to Stack 2 shall automatically close; and d) Unless the duct is otherwise closed or sealed shut, the room 3103 hood exhaust damper to Stack 2 shall automatically close. These conditions are continued from the previous license, except that the automatic closure of the dampers to stack 2 is not required if the duct is otherwise closed, i.e. the damper has been manually closed, or the penetrations through the reactor building wall have been mechanically sealed, i.e. permanently closed.

It is proposed that the operation of the required dampers be tested quarterly. Experience with testing these dampers for the past years of operation of the reactor shows that this interval is sufficient to ensure their ability to provide automatic isolation when the radiation level or concentration of radioactive materials from the reactor building exhaust system is equal to or greater than the limits discussed in the following section. The proposed quarterly functional confinement closure test is also consistent with the recommendation of ANSI 15.1 (1990), *The Development of Technical Specifications for Research Reactors*.

Additionally, during the conduct of activities within the reactor building which could lead to the release of radioactivity from the facility the following conditions will continue to be administratively controlled: a) Personnel access doors will be closed except as necessary for the passage of personnel or equipment; b) The main equipment access door onto the beam port floor will be opened only long enough to permit the passage of equipment; c) The personnel door to the cooling tower area will remain closed except to permit the passage of personnel or equipment to the cooling tower area; d) The access hatch from grade level to the beam port floor will be sealed closed. and e) The personnel exit door located in the north wall of the building will be sealed.

The semiannual inspection of the gaskets for the building ventilation system intake and exhaust dampers, the personnel access doors, the equipment access doors, and cooling tower access door will continue.

To facilitate equipment access for decommissioning it is requested that the door located on the beamport floor which connects to the PML hot cave operating area also be allowed to be administratively controlled as closed except to permit the passage of personnel or equipment. This 4 foot 8 inch by 6 foot 8 inch opening on the east side of the reactor pool was administratively kept closed because it was not needed during reactor operation and it would have interfered with the operation of the north hot cell and the beam port experiments. However, the usage of this door for equipment during decommissioning is requested. This opening is only 44% of the opening for the main equipment access door onto the beam port floor, on the opposite side of the reactor pool, already controlled administratively under the Technical Specifications.

The applicability of the requirement for the building confinement and its surveillance is proposed until that point during decommissioning where the removal of radioactive materials from the facility reduces the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building to less than 1.5 x 10^{-2} times the quantity of materials listed in 10 CFR 30.72, *Schedule C.* A quantity of radioactive materials 1.5 x 10^{-2} times the quantity of materials listed in 10 CFR 30.72, *Schedule C,* was selected to account for the difference of the 1 rem limit in 10 CFR 30.32(i)(1)(i) and the 15 mrem limit for an Unusual Event (the lowest level of emergency for a non-power reactor). This facilitates increased equipment access for subsequent decommissioning activities and would allow the use of the access hatch from grade level through the beam port floor ceiling the west side of the first floor of the reactor building. This access hatch contains four removable slabs which, when lifted out, provide a 21 ½ foot by 6 foot opening to the parking area. These removable slabs will be needed to facilitate the removal of large sections of the reactor pool from the reactor building. The 129 square feet of opening provided by these removable slabs is 80% larger than the next largest opening in the reactor building. This also allows for the placement of holes in the roof of the reactor building through which an external crane can lift large items within the reactor building.

Building Exhaust Radiation Monitor/Building Exhaust Continuous Air Monitor

The building exhaust radiation monitor is a gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum. When the radiation levels measured by this detector exceed 1 mrem/hr, the building exhaust radiation monitor sounds an alarm in the control room and the building evacuation alarm is actuated. The building exhaust radiation monitor also scrams the reactor automatically, shuts down the reactor building supply and exhaust fans, and closes the reactor building supply and exhaust dampers.

The goal is to replace the building exhaust radiation monitor with a continuous air monitor which collects particulate discharges in the exhaust from the reactor building. The beta radioactivity collected on the filter paper is measured utilizing a thin window Geiger Mueller tube to measure the beta radioactivity collected on a filter paper. The continuous air monitor is capable of actuating the building or evacuation alarm, shutting down the reactor building supply and exhaust fan, and closing the reactor building supply and exhaust dampers. Until this monitor is installed and operational, the building exhaust radiation monitor will be used.

With the permanent cessation of operations (Amendment 47 dated 29 January 2004) the requirement for an automatic scram to secure the reactor and eliminate the production of radiation is not required. Additionally the providing an alarm in the control room is no longer appropriate as personnel are not usually present in the control room.

A concentration of gamma emitting nuclides of10^{-3} to 10^{-4} micro curies per cubic centimeter in the exhaust plenum is estimated to produce a gamma exposure of 1.0 mrem/hr as measured by the Geiger Mueller tube in the building exhaust radiation monitor (taken from the current FNR licensing basis). This building exhaust gamma radiation monitor provides for the automatic protective actions necessary for isolating the reactor building ventilation system as described above. The new continuous air monitor provides a direct measure of the concentration of particulate radioactivity being released from the facility through the reactor building exhaust system. This continuous air monitor will actuate the building or evacuation alarm, shut down the reactor building supply and exhaust fan, and close the reactor building supply and exhaust dampers to limit the release of radioactivity from the facility. Except for the control room alarm and the scram initiation signal, the continuous air monitor is functionally equivalent to the existing building exhaust radiation monitor which it will replace and has comparable or better sensitivity.

The minimum emergency level for a non-power reactor requires declaring an Unusual Event for an actual or projected effluent at the site boundary which is measured and could result in a Committed Effective Dose Equivalent of 15 mrem for an exposure of 24 hours or less. For radionuclides other than noble gases, Information Notice 97-34, *Deficiencies in Licensee Submitals Regarding Terminology for Radiological Emergency Action Levels in Accordance with New Part 20* provides the methodology for relating measured effluent concentration to committed effective dose equivalent:

$$100 \text{ EC} \times 24 \text{ hr} \approx 15 \text{ mrem}$$

Applying the 400 dillution factor for releases up the stacks contained within the current license, a concentration of 4 x 10^4 times the applicable Airborne Effluent Concentration specified in 10 CFR 20, Appendix B, Table 2, *Effluent*

Concentrations may result in the declaration of an Unusual Event and provides a basis for protective actions.

Note: Application of the above is for radionuclides other than noble gases. The removal of all reactor fuel and permanent cessation of operations has eliminated noble gases as a source term and has also eliminated radio-iodine as a source of exposure for the thyroid..

As a limiting condition for operation, the building exhaust radiation monitor OR the continuous air monitor shall be operable whenever the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building exceeds the 1.5 x 10^{-2} times the quantities in 10 CFR 30.72, *Schedule C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release* AND one or more of the following is open: 1) the reactor building supply damper, 2) the reactor building exhaust damper, 3) the beam port exhaust damper to Stack 2, or 4) the room 3103 hood exhaust dampers to Stack 2. Additionally, the building evacuation alarm is no longer required once the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building is less than 1.5 x 10^{-2} times the quantities in 10 CFR 30.72, *Schedule C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release*

It is proposed that the building exhaust radiation monitor AND the continuous radiation monitor may be out of service for one week, but no activities which could lead to the release of radioactivity from the facility may conducted within the reactor building during this period. This allows for repair, calibration or replacement of the instruments during periods where the probability of a release of radioactivity from the facility is minimal.

The applicability of the requirement for the building exhaust radiation monitor or the continuous air monitor shall be maintained until that point where the removal of radioactive materials from the facility reduces the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building to less than 1.5 x 10^{-2} times the quantity of materials listed in 10 CFR 30.72, *Schedule C* which require an Emergency Plan. The 1.5 x 10^{-2} times is to account for the difference between the 1 rem limit in 10 CFR 30.(i)(1)(i) and the lower 15 mrem limit for an Unusual Event (the lowest level of emergency for a non-power reactor). Once the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building has been reduced to less than 1.5 x 10^{-2} times the quantity of materials listed in 10 CFR 30.72, *Schedule C*, then the removal of the need for the automatic protective actions associated with the reactor building exhaust radiation monitor or the continuous air monitor may be removed. The parallel comes from byproduct material licensee decrease in quantity of radioactive materials below the requirement for an emergency plan. The licensee recognizes that the requirements of 10 CFR 20.1301, *Dose Limits for Individual Members of the Public* would continue to apply subject to the allowances of 10 CFR 20.1302, *Compliance with Dose Limits for Individual Members of the Public.*

If required to be operational, then the building exhaust radiation monitor shall be calibrated annually (same as in the current technical specifications). The continuous air monitor self monitors its performance and actuates a trouble alarm if any parameter falls outside of normal operating characteristics or upon failure of the detectors. The manufacturer recommends that a radiological calibration of the instrument should be conducted annually. If required to be operational, then the building exhaust continuous air monitor shall be calibrated annually to be consistent with the calibration requirements of the building exhaust radiation monitor. It is proposed that when required to be operational, the reactor building exhaust radiation monitor shall be tested quarterly or that if required to be operational, the reactor building exhaust continuous air monitor shall be verified tested quarterly. This periodicity is consistent with the testing of the confinement functions presented in the section above and recommendation of monthly to quarterly from ANSI 15.1 (1990).

The proposed Technical Specifications are:

3.3 FNR Confinement

<u>Applicability:</u>
This specification applies whenever the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building exceeds 1.5 x 10^{-2} times the quantities in 10 CFR 30.72, *Schedule*

C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release.

Objective:

1. To assure that automatic protective action is initiated to limit the release of radioactive effluents from the reactor building when required.

2. To assure that the FNR reactor building confinement integrity is maintained when required.

Specification

1. Whenever one or more of the following is open: 1) the reactor building supply damper, 2) the reactor building exhaust damper, 3) the beam port exhaust damper to Stack 2, or 4) the room 3103 hood exhaust dampers to Stack 2 THEN:

   a. Gamma Radiation Detector
      i. A gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum shall be operating,
      ii. When the radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum indicates a dose rate equal to or greater than 1 mrem/hr, THEN
         1) The reactor building ventilation supply and exhaust fans shall automatically turn off;
         2) The reactor building ventilation supply and exhaust dampers shall automatically close;
         3) IF open, THEN the beam port exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required, AND
         4) IF open, THEN the room 3103 hood exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required.

   OR

   b. Beta Particulate Continuous Air Monitor
      i. A beta particulate continuous air monitor for the building air exhaust shall be operating.
      ii. When the concentration of radioactive materials measured by the beta particulate continuous air monitor for the building air exhaust is equal to or greater than 4×10^4 times the applicable Airborne Effluent Concentration specified in 10 CFR 20, Appendix B, Table 2, *Effluent Concentrations*, THEN
         1) The reactor building ventilation supply and exhaust fans shall automatically turn off;
         2) The reactor building ventilation supply and exhaust dampers shall automatically close;
         3) IF open, THEN the beam port exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required, AND
         4) IF open, THEN the room 3103 hood exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required.

   The gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum AND the beta particulate continuous air monitor for the building air exhaust may be out of service, BUT during that period, no activities which could lead to the release of radioactivity from the facility may conducted within the reactor building.

2. While the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building exceeds 1.5×10^{-2} times the quantities in 10 CFR 30.72, *Schedule C*, THEN the following conditions shall be administratively controlled:

a. Personnel access doors will be closed except as necessary for the passage of personnel and/or equipment;
b. The main equipment access door onto the beam port floor will be opened only long enough to permit the passage of equipment;
c. The personnel door to the cooling tower area will remain closed except to permit the passage of personnel and/or equipment to the cooling tower area;
d. The door located on the beam port floor which connects to the Phoenix Memorial Laboratory hot cave operating area will remain closed except to permit the passage of personnel and/or equipment,

AND

e. The access hatch from grade level to the beam port floor AND the personnel exit door located in the north wall of the building will be sealed closed.

Bases:

The potential radiation exposure to persons at the operations boundary following an accident releasing fission products within the confinement building has been evaluated. The evaluation used a leakage rate from the confinement building of 10% of the building volume per day, and concluded that the accident doses would be acceptable.. Conformance to Specifications 3.3.1 and 3.3.2 will assure that the building leak rate will not exceed the leak rate used in the evaluation.

The 1.0 mrem/hr set point for the facility exhaust radiation monitor provides a mechanism for isolating the building ventilation system in the event of a significant release of radioactive material into the reactor building. This setpoint, for the detector location involved, represents a gamma emitting nuclide concentration of 10-3 to 10-4 microcuries/cc of building air.

The 4.0×10^4 times the applicable Airborne Effluent Concentration specified in 10 CFR 20, Appendix B, Table 2, *Effluent Concentrations* provides a mechanism for isolating the building ventilation system in the event of a significant release of radioactive material into the reactor building. The 4.0×10^4 factor accounts for the difference the airborne concentration to dose conversion factor (100EC x 24 hr = 15 mrem) and the facility specific dilution factor of 400.

By requiring that the access doors and equipment hatch remain closed, except for brief, attended periods to permit personnel or equipment passage, the integrity of the confinement will be maintained at or above the level assumed in the Hazards Summary Report, and the release of radioactive material will be minimized.

4.3 FNR Confinement

Applicability:
These surveillance requirements apply whenever the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building exceeds 1.5×10^{-2} times the quantities in 10 CFR 30.72, *Schedule C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release.*

Objective:
1. To assure that automatic protective action is initiated to limit the release of radioactive effluents from the reactor building when required.

2. To assure that the FNR reactor building confinement integrity is maintained when required.

Specification
1. a. Gamma Radiation Detector
   i. The gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in

the building air exhaust plenum shall be calibrated annually, AND
ii. The ability of the radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum to initiate the automatic protective action required by 3.3.1.a.ii shall be tested quarterly.

OR

b. Beta Particulate Continuous Air Monitor
   i. The beta particulate continuous air monitor for the building air exhaust shall be calibrated annually, AND
   ii. The ability of the beta particulate continuous air monitor for the building air exhaust to initiate the automatic protective action required by 3.3.1.b.ii shall be tested quarterly.

2. The condition of the following gaskets shall be inspected semiannually, and the gaskets shall be replaced whenever any evidence of deterioration is found:
   a. Building ventilation system intake and exhaust dampers;
   b. Personnel access doors;
   c. Equipment access doors;
   d. Cooling tower access door.

Basis
The gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum has been calibrate annually for most of the operating history of the FNR. This instrument has displayed excellent reliability over many years of operation. The continuous air monitor continuously assesses its performance and actuates a trouble alarm if any parameter falls outside of normal operating characteristics or upon failure of the detectors. The manufacturer recommends that a radiological calibration of the instrument should be conducted annually. The semiannual inspection of the gasket materials has been occurring for most of the operating history of the FNR. These materials are not in a damaging environment and semiannual inspection has been found sufficient to assure that the gasket will perform their function of limiting leakage through these openings in the event of a release of airborne radioactivity within the reactor building.

5.3 Reactor Building

The reactor building is a windowless, four story, reinforced concrete building with 12 inch walls structurally integral with the footings and foundation mats. The building is approximately 69 feet wide x 68 feet long x 70 feet high with approximately 44 feet exposed above grade. The building has the following general features:

1. The reactor is housed in a closed room designed to restrict leakage.
2. The reactor room is equipped with a ventilation system designed to exhaust air or other gases present in the building atmosphere into an exhaust stack which exhausts a minimum of 54 feet above ground level.
3. The ventilation system provides ventilation for certain storage and experimental facilities and exhausts these a minimum of 54 feet above ground level.
4. The openings into the reactor building are an equipment access door, three personnel doors, an equipment access hatch, air intake and exhaust ducts, room 3103 fume hood exhaust duct, beam port ventilation duct, a sealed north wall door, a door between the hot cave operating face and the beam port floor, a sealed foundation tile drain to the cold sump, and a pneumatic tube system for sample transfer between the FNR and several laboratories in the Phoenix Memorial Laboratory.

These design features apply until the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building is less than 1.5×10^{-2} times the quantities in 10 CFR 30.72, *Schedule C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release.*

Primary Coolant Conditions

The limits on conditions for the primary coolant currently contained in the Technical Specification are administrative constraints on operational characteristics adhered to during the operation of the reactor.

The pH and conductivity limits on the primary coolant were to control the corrosion of the aluminum components of the primary cooling system and the fuel element cladding. With the removal of fuel from the Ford Nuclear Reactor (see letter sent to US NRC certifying Permanent Fuel Removal dated December 17, 2003), the removal of the license condition allowing for the possession of reactor fuel under 10CFR70, and the license condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." the limits on pH and conductivity are no longer necessary.

The requirement that all grid positions of the reactor grid contain fuel elements, reflector elements, sample holders or experimental facilities is also no longer necessary as operation of the reactor is not longer allowed by the license condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid."

The surveillance requirement for tracking the makeup water for the reactor pool be maintained to discover significant leakage of water from the facility is being moved to the limiting condition for operation and a surveillance requirement is being added that this record of makeup water be reviewed quarterly. The requirement for a quarterly review of the makeup of water to the reactor pool is sufficiently long enough that pool leaks should be identifiable. This interval is also consistent with the quarterly recommendation for monitoring of pH and conductivity in ANSI 15.1 (1990), *Development of Technical Specifications for Research Reactors*. These requirements would only be applicable when greater than 900 gallons, approximately 6 inches, of water is present in the reactor pool.

The surveillance requirement for monitoring the radioactivity content of the water in the reactor pool was to detect the presence of leaking fuel elements. With the removal of fuel from the Ford Nuclear Reactor (see letter sent to US NRC certifying Permanent Fuel Removal dated December 17, 2003) and the removal of the license condition allowing for the possession of reactor fuel under 10CFR70 this monitoring is not required. The applicable monitoring of the radioactivity in the water from the reactor pool would still be subject to the requirements of specification 3.6, *Liquid Effluents* if the licensee elects to dispose of the water in the reactor pool via the sanitary sewerage system as described in the Decommissioning Plan submitted to the Commission in an earlier license amendment request.

The proposed Technical Specifications are:

3.4 ~~Primary Coolant Conditions~~Pool Water Conditions

Applicability:

This specification applies to the makeup water added to the reactor pool while the quantity of water in the reactor pool is greater than 900 gallons.

~~This specification applies to the limiting conditions for available pool water volume, primary coolant pH, conductivity, radioactivity, and flow distribution.~~

Objective:

Record of the makeup water needs over a period of time allows for the detection of significant pool water leaks.

~~To maintain the primary coolant in a condition to minimize the corrosion of the primary coolant system, fuel clad, and other reactor components, and to assure proper conditions of coolant for normal and emergency requirements.~~

Specification:

1. IF the quantity of water contained in the reactor pool is greater than 900 gallons, THEN a record of the

makeup water added to the reactor pool shall be maintained.

~~1. The primary coolant pH shall be maintained between 4.5 and 7.5.~~

~~2. The primary coolant conductivity shall be maintained at a value less than 5 micromho/cm except for periods of time not to exceed 7 days when the conductivity may not be greater than 20 micromho/cm..~~

~~3. For operation at power levels in excess of 100 kW in the forced convection mode, all grid positions shall contain fuel elements, reflector elements, sample holders, or experimental facilities..~~

Bases:

Record of the makeup water needs over a period of time allows for the detection of significant pool water leaks.

~~Experience at this and other facilities has shown that the maintenance of primary coolant system water quality in the ranges specified in Specification 3.4.1 and 3.4.2 will control the corrosion of the aluminum components of the primary coolant system and the fuel element cladding.~~

~~Specification 3.4.3 that all grid positions be occupied will prevent the degradation of flow rates due to flow bypassing the active fueled region through an unoccupied grid plate position.~~

4.4 Primary Coolant System

Applicability:

This specification applies to the makeup water added to the reactor pool while the quantity of water in the reactor pool is greater than 900 gallons

~~This specification applies to the surveillance of the primary coolant system.~~

Objective:

Review of the makeup water needs over a period of time allows for the detection of significant pool water leaks.

~~To assure high quality pool water and to detect the release of fission products from fuel elements.~~

Specification:

1. IF the quantity of water contained in the reactor pool is greater than 900 gallons, THEN the quantity of makeup water added to the reactor pool shall be reviewed quarterly.

~~1. The pH of the primary coolant shall be measured weekly.~~

~~2. The conductivity of the primary coolant shall be measured weekly.~~

~~3. The radioactivity content of the primary coolant shall be measured biweekly.~~

Bases:

A small portion of the pool structure is in direct contact with the soil under the reactor building. Routine inspection of the makeup water records over a period of time provides early warning of significant pool leaks.

~~Regular surveillance of pool water quality and radioactivity provides assurance that pH and conductivity changes that could accelerate the corrosion of the primary coolant system would be detected before significant corrosive damage would occur, and that the presence of leaking fuel elements in the reactor is detected.~~

Radiation Monitoring

The facility has three area radiation monitors which measure the general gamma radiation levels on the west side of the beam port floor, the north side of the beam port floor and the east side of the beam port floor. Each of these area radiation monitors provides local indication of the radiation level and provides a local alarm whenever the measured radiation level exceeds a set point established by the management of the facility subject to a maximum set point specified in the Technical Specifications. Each of these area monitors also provides a recorded signal to the control room which allows the operator to monitor radiation levels throughout the beam port floor. These monitors were intended to notify personnel on the beam port floor and the reactor operator of a significant change in the radiation emitted from any of the ten (10) six inch diameter or two 8 inch diameter penetrations through the biological shield while the reactor was operating. With the permanent cessation of operation and the removal of all reactor fuel, the levels of radiation which can be produced from these beam ports has been substantially reduced. Recent experience from the unloading of collimators from the beam ports after permanent cessation of operation and the removal of all reactor fuel found that the radiation levels emitted from a fully open beam port in on the order of a few 10s of milli Rem directly at the beam port opening from the biological shield. These radiation levels would generally not be detectable by the three area monitors on the beam port floor. It is proposed that the requirements for the three area radiation monitors on the beam port floor be removed from the Technical Specifications.

The facility has an area radiation monitor which measures the general gamma radiation levels on the reactor bridge. This area radiation monitors provides local indication of the radiation level and provides a local alarm whenever the measured radiation level exceeds a set point established by the management of the facility subject to a maximum set point specified in the Technical Specifications. The area monitor on the reactor bridge also provides a recorded signal to the control room which allows the operator to monitor radiation levels throughout the facility. Due to the possibility of elevated levels of general area radiation from the irradiated materials being stored in the reactor pool, the reactor bridge area radiation monitor is being maintained in the Technical Specifications but would only be required to be operational when radiation levels from radioactive materials could produce radiation levels in accessible areas in excess of 100 mrem in 1 hour at 30 centimeters (consistent with the requirement for a High Radiation Area in 10CFR20). The removal of the requirement that the signal from the reactor bridge area monitor be recorded in the control room is requested as the control room is not normally occupied and neither provides protective features nor initiates corrective action necessary to protect the health and safety of the public. Currently the Technical Specification Limiting Conditions for Operations requirements for area monitoring are contained in Section 3.2, *Reactor Safety System*. It is proposed that the requirements for the area monitors be combined with the requirement in Section 3.5, *Airborne Effluents* and that this section be renamed *Radiation Monitoring*. This is consistent with the guidance provided in ANSI 15.1 (1990), *Development of Technical Specifications for Research Reactors*.

The facility currently has two gaseous activity detector systems which monitor the level of gaseous radioactivity from the reactor facility during reactor operation. With the removal of all irradiated fuel from the facility in the Fall of 2003 (see letter sent to US NRC certifying Permanent Fuel Removal dated December 17, 2003) and the current license condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." (January 29, 2004 license for the Ford Nuclear Reactor) radioactive gases such as argon-41 no longer exist and can no longer be generated as fission products or neutron activation products at the facility. Therefore, the requirement for the gaseous activity detector systems can be removed without decreasing the safety of the facility. It is requested that the limiting condition for operation and the surveillance requirements for the gaseous activity detectors be removed from the Technical Specifications.

The facility currently has two airborne particulate monitors which monitor the concentration of airborne radioactive materials on the pool floor and the beam port floor. Currently only the pool floor airborne radioactive particulate monitor is required by the Technical Specifications, as the reactor pool presented the highest probable source of high levels of airborne radioactive materials during reactor operation, particularly from the failure of an experiment or the failure of a fuel element. The airborne particulate monitor on the beam port floor is being added to the Technical Specifications to facilitate the removal of the Stack 2 mobile air particulate monitor, discussed below. These airborne particulate monitors would be required to be operational during licensed activities which could lead to the generation of airborne radioactivity exceeding 1% of the applicable concentrations specified in 10CFR20, Appendix B, Table 1, Column 3, Derived Air Concentration (DAC).

The reactor building was designed to restrict leakage and is equipped with a general ventilation system that provides the primary heating for the building and exhausts through a stack on the roof. A smaller exhaust ventilation system in the reactor building is also connected to a laboratory exhaust stack in the contiguous Phoenix Memorial Laboratory (PML), Stack 2. A signal from the building exhaust radiation monitoring system can close dampers in the primary air system supply and exhaust ducts as well as dampers in the smaller ventilation system connected to the laboratory exhaust stack in PML. The smaller ventilation system draws air from the pneumatic tube system blower and the fume hood in room 3103 in the reactor building which contains the pneumatic tube system loading and unloading station. When the reactor was operating, a failure of an experiment in the pneumatic tube system had the potential to produce high levels of radioactive effluent from the smaller ventilation system connected to the laboratory exhaust stack in PML. A mobile air particulate monitor was required by the Technical Specifications to monitor this effluent and provide an indication to the operator in the control room so that the necessary corrective action could be taken upon the detection of a high level of radioactive effluent from the smaller ventilation system connected to the laboratory exhaust stack in PML. The permanent caseation of the operation of the reactor has eliminated the pneumatic tube system as a source for a high level of radioactive effluent from the smaller ventilation system connected to the laboratory exhaust stack in PML. The only source of radioactive effluent to the smaller ventilation system is the already monitored volume of the reactor building. The airborne radioactivity in the reactor building is monitored by the reactor building exhaust radiation monitoring system which provides automatic action to isolate the smaller ventilation system connected to the laboratory exhaust stack in PML. This reactor building exhaust radiation monitoring system is covered by the Technical Specifications associated with FNR Confinement (discussed below). The monitoring of the particulate airborne radioactivity in the smaller ventilation system connected to the laboratory exhaust stack in PML is redundant and the system can be removed. It is requested that the limiting conditions for operation and the surveillance requirements associated with the Stack 2 mobile particulate monitor be removed from the Technical Specifications.

To facilitate this change, some deletions from the Technical Specification 3.2 are required:

3.2 Reactor Safety System

Applicability:

These specifications apply to the reactor safety system and other safety related instrumentation.

Objective:

To specify the lowest acceptable level of performance or the minimum number of acceptable components for the reactor safety system and other safety related instrumentation.

Specification:

The reactor shall not be made critical unless:

1. *The reactor safety systems and safety related instrumentation are operable in accordance with Tables 3.1 and 3.2 including the minimum number of channels and the indicated maximum or minimum setpoints;*

Bases:

. . . .

~~The use of the area radiation monitor system assures that areas of the facility in which a high radiation area could exist are monitored.~~

. . . .

Table 3.2
REQUIRED SAFETY RELATED INSTRUMENTATION

Instrumentation	*Setpoint*	*Minimum Number Required*	*Function*
. . . .			

~~Facility Radiation Monitor System~~

. . . .

~~2. Reactor Bridge~~	~~40(50)b mrem/hr~~	~~1~~	~~Alarm~~
~~3. NW Column, Beamport Floor~~	~~20(50)b mrem/hr~~	~~1c~~	~~Alarm~~
~~4. N Wall, Beamport Floor~~	~~5(50)b mrem/hr~~	~~1c~~	~~Alarm~~
~~5. NE Column, Beamport Floor~~	~~5(50)b mrem/hr~~	~~1c~~	~~Alarm~~

Footnotes:

. . . .

~~b. The facility radiation monitoring system consists of 5 radiation detectors which alarm and read out locally, and are recorded in the control room. The normal setpoints for this system are shown. The value in parentheses is the maximum setpoint which will be used depending on local conditions. Use of higher than normal setpoints will require approval of the Nuclear Reactor Laboratory Manager or one of the Assistant Managers. Any reactor staff member may adjust a setpoint lower than the normal value.~~

c. ~~If facility radiation monitor 3., 4., or 5. is placed out of service for a period of more than 7 days, the reactor shall be shut down or the monitor shall be replaced by a locally alarming unit of similar range. Should a second of these monitors be placed out of service, the reactor will be shut down unless the monitor is returned to service within 24 hours or is replaced by a second locally alarming unit of similar range.~~

The proposed Technical Specifications are:

3.5 Radiation Monitoring ~~Airborne Effluents~~

Applicability:

This specification applies to the monitoring of effluent releases from the Ford Nuclear Reactor, area radiation levels within the reactor building, and particulate airborne activity within the reactor building.

Objective:

To assure that the release of airborne radioactive material from the Ford Nuclear Reactor is maintained below the limits established in 10CFR20 and to ensure that occupational exposures are controlled as established in 10CFR20.

Specification:

1. The concentration of radioactive materials in the effluent released from the facility exhaust stacks shall not exceed 400 times the concentrations specified in 10CFR20, Appendix B, Table 2, Column 1, Air Effluent Concentration (AEC), averaged over time periods permitted by 10CFR20.
2. During ~~operation of the reactor~~ licensed activities which could lead to the generation of airborne radioactivity exceeding 1% of the applicable concentrations specified in 10CFR20, Appendix B, Table 1, Column 3, Derived Air Concentration (DAC), the following conditions shall be met:
   ~~a. The mobile air particulate monitor and the gaseous activity detector for the Stack 2 exhaust shall be operating. If either unit is out of service for more than 24 hours, either the reactor shall be shutdown or the unit shall be replaced by one of comparable monitoring capability;~~
   a. An air particulate monitor shall be operating on or near the pool floor. ~~The reactor pool floor mobile air particulate monitor and the gaseous activity detector for the reactor building exhaust stack shall be operating. If either unit is out of service for more than 24 hours, either the reactor shall be shutdown or the unit shall be replaced by one of comparable monitoring capability;~~

~~c. The building exhaust air radiation monitor shall be operating whenever the reactor is in operation as required by Table 3.2 of specification 3.2.~~

b. An air particulate monitor shall be operating on the first floor.

If an air particulate monitor required by above is found to be not operable or is taken out of service, then licensed activities which could lead to the generation of airborne radioactivity exceeding 1% of the applicable concentrations specified in 10CFR20, Appendix B, Table 1, Column 3, Derived Air Concentration (DAC), shall be stopped in a safe condition and shall not resume until the air particulate monitor is restored to operating.

Note: *The limiting conditions for operation associated with the building exhaust radiation monitor have been moved to 3.3, FNR Confinement as described in another section of this Technical Specification Amendment.*

3. Area Radiation Monitors:
   a. Licensed activity involving radioactive materials that could produce radiation levels in areas accessible to individuals in excess of 100 mrem in 1 hour at 30 centimeters (measured from an accessible surface that emits radiation) shall not be performed on the pool floor unless an operating area radiation monitor which measures the general gamma radiation level and provides a local alarm at or below 50 mrem/hr is located on the third floor near the reactor pool.

      If a local area radiation monitor required above is found to be not operable or is taken out of service, then licensed activity involving radioactive materials that could produce radiation levels in areas accessible to individuals in excess of 100 mrem in 1 hour at 30 centimeters (measured from an accessible surface that emits radiation) shall be stopped in a safe condition and shall not resume until the affected local area radiation monitor is restored to an operating condition.

Bases:

The limits established in this specification incorporate a dilution factor of 400 for effluents released through the exhaust stacks. This dilution factor was calculated from actual FNR site meteorological data and represents the lowest dispersion factor determined and the highest frequency of wind in any sector. Because of the use of the most conservative measured values of wind directional frequency and dispersion factors, this dilution factor will assure that concentrations of radioactive material in unrestricted areas around the FNR site will be far below the limits of 10CFR20.

The pool floor area radiation monitor provides local indication of elevated levels of radiation from the irradiated materials in the reactor pool.

The requirements of this specification are considered adequate to assure proper monitoring of area radiation and airborne radioactivity levels within the reactor building.

4.2 Reactor Safety System

Applicability:

This specification applies to the surveillance of the reactor safety system.

Objective:

To assure that the reactor safety system is operable as required by Specification 3.2.

Specification:

. . . .

~~4. The operation of the radiation monitoring system required in Table 3.2 shall be verified:~~
   ~~a. Prior to each reactor startup following a period when the reactor was secured;~~

~~b. After a channel has been deenergized.~~
~~c. If a channel has been repaired, an operation and setpoint verification will be performed prior to use.~~
~~5. The radiation monitor system required in Table 3.2 shall be calibrated semiannually.~~

....

Bases:

....

~~Radiation monitors are checked for proper operation in Specification 4.2.4. Calibration and setpoint verification involve use of a calibration source and significant personnel radiation exposure. Semiannual calibration of radiation monitors, which have displayed excellent stability over many years of operation, is adequate to verify the set point unless instrument repairs have been made.~~

....

4.5 Radiation Monitoring ~~Airborne Effluents~~

Applicability:

This specification applies to the surveillance of the monitoring equipment used to measure area gamma levels and airborne radioactivity.

Objective:

The objective is to assure that accurate assessment of area gamma levels and airborne radioactivity is available during the conduct of licensed activities.

Specification:

~~1. The building exhaust air radiation monitor shall be calibrated semiannually.~~

Note: The surveillance requirements associated with the building exhaust radiation monitor have been moved to 4.3, FNR Confinement as described in another section of this Technical Specification Amendment.

2. Air Particulate Monitors
   a. The air particulate monitors shall be calibrated semiannually.
   b. The operation of the air particulate monitors shall be checked daily when the reactor staff is present in the facility.
   c. An air particulate monitor shall be calibrated upon replacement or following maintenance which could affect calibration.

~~3. The gaseous activity detectors shall be calibrated for Argon-41 semiannually.~~

3. Area Radiation Monitors:
   a. The area radiation monitors shall be calibrated semiannually.
   b. The area radiation monitors shall be channel checked monthly.
   c. An area radiation monitor shall be calibrated and a channel check shall be performed upon replacement or following maintenance which could affect the calibration.

   These surveillance requirements shall be met during the conditions specified in the Limiting Condition for Operation. Surveillances do not have to be performed on inoperable equipment.

Bases:

The Ford Nuclear has upgraded to the Eberline AMS-4 for the air particulate monitors. The AMS-4 continuously monitors all critical operating parameters of the unit, such as air flow, detector response, etc., and generates a local alarm whenever one of the monitored parameter falls outside the operator established range.

The AMS-4 has several years of demonstrated reliable performance in the power reactor community. The surveillance intervals provided for the air particulate monitors are sufficient to ensure the operability of the air particulate monitors between surveillance intervals.

Semiannual calibration of radiation monitors, which have displayed excellent stability over many years of operation, is adequate to verify the set point unless instrument repairs have been made.

1.0 DEFINITIONS

Channel Calibration - A channel calibration is an adjustment of the channel such that its output corresponds with acceptable accuracy to known values of the parameter which the channel measures. Calibration shall encompass the entire channel, including equipment actuation, alarm, and trip, and shall be deemed to include the channel test.

Channel Check - A channel check is a qualitative verification of acceptable performance by observation of channel behavior. This verification where possible shall include comparison of the channel with other independent channels or systems measuring the same variable.

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

Experiment - An experiment, as used herein, is any of the following:

1. An activity utilizing the reactor system or its components or the neutrons or radiation generated therein;
2. An evaluation or test of a reactor system operation, surveillance, or maintenance technique;
3. An experimental or testing activity which is conducted within the confinement or containment system of the reactor;
4. The material content of any of the foregoing, including structural components, encapsulation or confining boundaries, and contained fluids or solids.

Experimental Facility - An experimental facility is any structure or device which is intended to guide, orient, position, manipulate, or otherwise facilitate a multiplicity of experiments of similar character.

Explosive Material - Explosive material is any solid or liquid which is categorized as a severe, dangerous, or very dangerous explosion hazard in DANGEROUS PROPERTIES OF INDUSTRIAL MATERIALS by N.I. Sax, Third Ed. (1968), or is given an Identification of Reactivity (Stability) Index of 2,3, or 4 by the National Fire Protection Association in its publication 704-M, 1966.

Limiting Conditions for Operation (LCO) - Lowest functional capability or performance levels of equipment required for safe operation of the reactor (10CFR50.36).

Limiting Safety System Setting (LSSS) - Settings for automatic protective devices related to those variables having significant safety functions, and chosen so that automatic protective action will correct an abnormal situation before a safety limit is exceeded (10CFR50.36).

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 which are used for the purpose of measuring the value of a process variable.

Moveable Experiment - A moveable experiment is one which may be inserted, removed, or manipulated while the reactor is critical.

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.

Potential Reactivity Worth of an Experiment - The potential reactivity worth of an experiment is the maximum absolute value of the reactivity change that would occur as a result of intended or anticipated changes or credible malfunctions that alter equipment position or configuration.

Reactivity Limits - The reactivity limits are those limits imposed on reactor core excess reactivity. Quantities are referenced specifically to a cold core (nominally 90 °F) with the effect of xenon poisoning on core reactivity accounted for if greater than or equal to 0.05% $\Delta K/K$. The reference core condition will be known as the cold, xenon free critical condition.

Reactor Operation - Reactor operation means that the control rods installed in the core are not fully inserted or that the control console key is in the keyswitch. Reactor operation is not considered possible when there are less than six standard fuel elements in addition to the four control elements that house the control rods on the grid plate.

Reactor Safety System - The reactor safety system is that combination of safety channels and associated circuitry which forms the automatic protective system for the reactor or provides information which requires manual protective action to be initiated.

Reactor Scram - Shutoff of electrical current to the rod holding magnets and subsequent insertion of the rods into the core by gravity.

Reactor Secured - Reactor Secured is defined as follows:

1. The full insertion of all control rods has been verified;
2. The control console key is removed; and
3. No operation is in progress which involves moving fuel elements to or from the core, moving reflector elements to or from the core, the insertion, or removal of secured experiments from the core, or control rod maintenance.

Readily Available on Call - Readily available on call shall mean that an individual can be contacted and is within a reasonable driving time (1/2 hour) from the reactor building.

Regulating Rod - The regulating rod is a control rod of low reactivity worth fabricated from stainless steel and used to control reactor power. The rod may be controlled by the operator with a manual switch or by an automatic controller.

Removable Experiment - A removable experiment is any experiment, experimental facility, or component of an experiment, other than a permanently attached appurtenance to the reactor system, which can reasonably be anticipated to be moved one or more times during the life of the reactor.

Reportable Occurrence - A reportable occurrence is any of the following:

1. A safety system setting less conservative than the limiting setting established in the Technical Specifications;
2. Operation in violation of a limiting condition for operation established in the Technical Specifications;
3. A safety system component malfunction or other component or system malfunction which could, or threatens to, render the safety system incapable of performing its intended safety functions;
4. Release of fission products from a failed fuel element;
5. An uncontrolled or unplanned release of radioactive material from the restricted area of the facility;
6. An uncontrolled or unplanned release of radioactive material which results in concentrations of radioactive materials within the restricted area in excess of the limits specified in Appendix B, Table 1, Column 3, Derived Air Concentration (DAC) of 10CFR20;
7. An uncontrolled or unanticipated change in reactivity in excess of 0.005 $\Delta K/K$;
8. Conditions arising from natural or man made events that affect or threaten to affect the safe operation of the facility;
9. An observed inadequacy in the implementation of administrative or procedural controls such that the inadequacy causes or threatens to cause the existence or development of an unsafe condition in connection with the operation of the facility.

Rundown - A rundown is the automatic insertion of the shim safety rods.

Safety Channel - A safety channel is a measuring channel in the reactor safety system.

Safety Limit (SL) - Limits upon important process variables which are found to be necessary to reasonably protect the integrity of certain of the physical barriers that guard against the uncontrolled release of radioactivity (10CFR50.36).

Secured Experiment - Any experiment, experimental facility, or component of an experiment is deemed to be secured, or in a secured position, if it is held in a stationary position relative to the reactor by mechanical means. The restraint shall exert sufficient force on the experiment to overcome the expected effects of hydraulic, pneumatic, buoyant, or other forces which are normal to the operating environment of the experiment, or of forces which might arise as a result of credible malfunctions.

Shim-Safety Rod - A shim-safety rod is a control rod fabricated from either borated stainless steel or a boron-aluminum alloy which is used to compensate for fuel burnup, temperature, and poison effects. A shim safety rod is magnetically coupled to its drive unit allowing it to perform the function of a safety rod when the magnet is deenergized.

Static Reactivity Worth - The static reactivity worth of an experiment is the absolute value of the reactivity change which is measurable by calibrated control rod comparison methods between two defined terminal positions or configurations of the experiment. For moveable experiments, the terminal positions are fully removed from the reactor and fully inserted or installed in the normal functioning or intended position.

Time Intervals - The average over any extended period for each surveillance time interval shall be closer to the normal surveillance time than the extended time. Any extension of these intervals shall be occasional and for a valid reason, and shall not affect the average as defined.

Annually - 12 to 15 months.

Biannually - 24 to 30 months.

Biweekly - 14 to 20 days.

Daily - 24 to 32 hours.

Monthly - 30 to 40 days.

Quarterly - 3 to 4 months.

Semiannually - 6 to 8 months.

Weekly - 7 to 10 days.

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

Unscheduled Shutdown - An unscheduled shutdown is defined as any unplanned shutdown of the reactor caused by actuation of the reactor safety system, operator error, equipment malfunction, or a manual shutdown in response to conditions which could adversely affect safe operation, not to include shutdowns which occur during testing or checkout operations.

2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 Safety Limits

Applicability

As the Safety Limits were for the protection of the cladding integrity of the reactor fuel during reactor operation, all safety limits have been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

2.2 Limiting Safety System Settings (LSSS)

Applicability

As the Limiting Safety System Settings were for the protection of the cladding integrity of the reactor fuel during reactor operation, all limiting safety system settings have been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed. ??

3.0 LIMITING CONDITIONS FOR OPERATION

3.1 Reactivity Limits

Applicability:

The reactivity limits applied to the reactivity of the reactor core, the reactivity worths of the control rods, and the reactivity of experiments to ensure that the reactor could be controlled and shutdown at all times and to ensure that the safety limits contained in the Technical Specification could not be exceeded. Reactivity limits have been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed. ??

3.2 Reactor Safety System

Applicability:

These specifications applied to the reactor safety system and other safety related instrumentation. The Reactor Safety System requirements have been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

The area radiation monitor system has been moved to Limiting Condition for Operation 3.5, *Radiation Monitoring*.

The facility radiation exhaust monitor has been moved to Limiting Condition for Operation 3.3, *Confinement*.

3.3 FNR Confinement

Applicability:

This specification applies to the major openings in the Ford Nuclear Reactor building, the confinement dampers in the general building exhaust, and the confinement dampers in the smaller exhaust connection to the Phoenix Memorial Laboratory laboratory exhaust (Stack 2).

This specification applies whenever the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building exceeds 1.5×10^{-2} times the quantities in 10CFR30.72, Schedule C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release ??

Objective:

1. To assure that automatic protective action is initiated to limit the release of radioactive effluents from the reactor building when required.
2. To assure that the FNR reactor building confinement integrity is maintained when required.

Specification:

1. Whenever one or more of the following is open: 1) the reactor building supply damper, 2) the reactor building exhaust damper, 3) the beam port exhaust damper to Stack 2, or 4) the room 3103 hood exhaust dampers to Stack 2 THEN:
   a. Gamma Radiation Detector
      i. A gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum shall be operating,
      ii. When the radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum indicates a dose rate equal to or greater than 1 mrem/hr, THEN
         1) The reactor building ventilation supply and exhaust fans shall automatically turn off;
         2) The reactor building ventilation supply and exhaust dampers shall automatically close;
         3) IF open, THEN the beam port exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required, AND
         4) IF open, THEN the room 3103 hood exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required.

   OR

   b. Beta Particulate Continuous Air Monitor
      i. A beta particulate continuous air monitor for the building air exhaust shall be operating.
      ii. When the concentration of radioactive materials measured by the beta particulate continuous air monitor for the building air exhaust is equal to or greater than 4 x 10^4 times the applicable Airborne Effluent Concentration specified in 10CFR20, Appendix B, Table 2, Effluent Concentrations, THEN
         1) The reactor building ventilation supply and exhaust fans shall automatically turn off;
         2) The reactor building ventilation supply and exhaust dampers shall automatically close; ??

3) IF open, THEN the beam port exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required, AND

4) IF open, THEN the room 3103 hood exhaust damper to Stack 2 shall automatically close OR IF the penetration through the reactor building wall is mechanically sealed, THEN no action is required.

The gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum AND the beta particulate continuous air monitor for the building air exhaust may be out of service, BUT during that period, no activities which could lead to the release of radioactivity from the facility may conducted within the reactor building.

2. While the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building exceeds 1.5 x 10^{-2} times the quantities in 10CFR30.72, Schedule C, THEN the following conditions shall be administratively controlled: ??

a. Personnel access doors will be closed except as necessary for the passage of personnel and/or equipment;

b. The main equipment access door onto the beam port floor will be opened only long enough to permit the passage of equipment;

c. The personnel door to the cooling tower area will remain closed except to permit the passage of personnel and/or equipment to the cooling tower area;

d. The door located on the beam port floor which connects to the Phoenix Memorial Laboratory hot cave operating area will remain closed except to permit the passage of personnel and/or equipment, ??

AND

e. The access hatch from grade level to the beam port floor AND the personnel exit door located in the north wall of the building will be sealed closed.

Bases:

The potential radiation exposure to persons at the operations boundary following an accident releasing fission products within the confinement building has been evaluated. The evaluation used a leakage rate from the confinement building of 10% of the building volume per day, and concluded that the accident doses would be acceptable. Conformance to Specifications 3.3.1 and 3.3.2 will assure that the building leak rate will not exceed the leak rate used in the evaluation.

The 1.0 mrem/hr setpoint for the facility exhaust radiation monitor provides a mechanism for isolating the building ventilation system in the event of a significant release of radioactive material into the reactor building. This setpoint, for the detector location involved, represents a gamma emitting nuclide concentration of 10^{-3} to 10^{-4} microcuries/cc of building air.

The 4.0 x 10^4 times the applicable Airborne Effluent Concentration specified in 10CFR20, Appendix B, Table 2, Effluent Concentrations provides a mechanism for isolating the building ventilation system in the event of a significant release of radioactive material into the reactor building. The 4.0 x 10^4 factor accounts for the difference the airborne concentration to dose conversion factor (100EC x 24 hr = 15 mrem) and the facility specific dilution factor of 400. ??

By requiring that the access doors and equipment hatch remain closed, except for brief, attended periods to permit personnel or equipment passage, the integrity of the confinement will be maintained at or above the level assumed in the Hazards Summary Report, and the release of radioactive material will be minimized.

3.4 Primary Coolant Conditions

Applicability:

This specification applies to the makeup water added to the reactor pool while the quantity of water in the pool is greater than 900 gallons.

Objective:

Record of the makeup water needs over a period of time allows for the detection of significant pool water leaks.

Specification:

1. IF the quantity of water contained in the reactor pool is greater than 900 gallons, THEN a record of the makeup water added to the reactor pools shall be maintained. ??

Bases:

Record of the makeup water needs over a period of time allows for the detection of significant pool water leaks.

3.5 Radiation Monitoring

Applicability:

This specification applies to the monitoring of airborne effluents from the Ford Nuclear Reactor, area radiation levels within the reactor building, and particulate airborne activity within the reactor building. ??

Objective:

To assure that the release of airborne radioactive material from the Ford Nuclear Reactor is maintained below the limits established in 10CFR20 and to ensure that occupational exposures are controlled as established in 10CFR20. ??

Specification:

1. The concentration of radioactive materials in the effluent released from the facility exhaust stacks shall not exceed 400 times the concentrations specified in 10CFR20, Appendix B, Table 2, Column 1, Air Effluent Concentration (EAC), averaged over time periods permitted by 10CFR20.

2. During license activities which could lead to the generation of airborne radioactivity exceeding 1% of the applicable concentrations specified in 10CFR20, Appendix B, Table 1, Column 3, Derived Air Concentration (DAC), the following conditions shall be met:

   a. An air particulate monitor shall be operating on or near the pool floor.

   b. An air particulate monitor shall be operating on the first floor.

If an air particulate monitor required by above is found to be not operable or is taken out of service, then licensed activities which could lead to the generation of airborne radioactivity exceeding 1% of the applicable concentrations specified in 10CFR20, Appendix B, Table 1, Column 3, Derived Air Concentration (DAC), shall be stopped in a safe condition and shall not resume until the air particulate monitor is restored to operating.

3. Area Radiation Monitors:

   a. Licensed activity involving radioactive materials that could produce radiation levels in areas accessible to individuals in excess of 100 mrem in 1 hour at 30 centimeters (measured from an accessible surface that emits radiation) shall not be performed on the pool floor unless an operating area radiation monitor which measures the general gamma radiation level and provides a local alarm at or below 50 mrem/hr is located on the third floor near the reactor pool.

If a local area radiation monitor required above is found to be not operable or is taken out of service, then licensed activity involving radioactive materials that could produce radiation levels in areas accessible to individuals in excess of 100 mrem in 1 hour at 30 centimeters (measured from an accessible surface that emits radiation) shall be stopped in a safe condition and shall not resume until the affected local area radiation monitor is restored to an operating condition. ??

Bases:

The limits established in this specification incorporate a dilution factor of 400 for effluents released through the exhaust stacks. This dilution factor was calculated from actual FNR site meteorological data and represents the lowest dispersion factor determined and the highest frequency of wind in any sector. Because of the use of the most conservative measured values of wind directional frequency and dispersion factors, this dilution factor will assure that concentrations of radioactive material in unrestricted areas around the FNR site will be far below the limits of 10CFR20. ??

The pool floor area radiation monitor provides local indication of elevated levels of radiation from the irradiated materials in the reactor pool. ??

The requirements of this specification are considered adequate to assure proper monitoring of area radiation and airborne radioactivity levels within the reactor building. ??

3.6 Liquid Effluents

Applicability:

This specification applies to the monitoring of radioactive liquid effluents from the FNR.

Objectives:

The objective is to assure that exposure to the public resulting from the release of liquid effluents will be minimized.

Specification:

1. The concentration of radioactive materials in the effluent released from the facility liquid waste system to the city of Ann Arbor sanitary sewer system shall be readily soluble (or readily dispersible biological material) in water and shall not exceed 315 times the concentrations specified in 10CFR20, Appendix B, Table 3, Releases to Sewers.
2. The amount of liquid discharged shall be limited to the equivalent of 3,000 gallons of liquid at the concentration limit specified in 3.6.1 each day.
3. Liquids from the facility's radioactive liquid waste system shall not be discharged into the storm drain system.

Bases:

All radioactive liquid effluents are collected in a series of three, 3,000 gallon, coated, steel retention tanks, and they are normally recycled to the reactor pool to make up for surface evaporation. However, after sampling, analysis, and dilution, if the concentration of radioactivity is less than the limit of 10CFR20, liquid effluents can be discharged to the sanitary sewer system.

In the past, less than 50 retention tank discharges per year have been required. During 1970, the North Campus water released into the sanitary sewer system averaged 946,000 gallons per day. This provides a daily dilution factor of 315 for a 3,000 gallon waste tank, which assures that there will be no significant exposure to the public from radioactive waste discharged to the sanitary sewer system.

3.7 Limitations of Experiments

Applicability:

These limits established the administrative constraints for the lowest functional capability or performance level for equipment associated with and operational characteristics of experiments conducted in the Ford Nuclear Reactor. These limits have been removed from the Technical Specifications. ??

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed.

3.8 Fission Density Limit

Applicability:

The fission density limit specified the maximum burnup allowed for a fuel element to ensure fuel failures were not experience during the operation of the reactor. This limit has been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed. ??

4.0 SURVEILLANCE REQUIREMENTS

4.1 Reactivity Limits

Applicability:

All surveillance requirements for reactivity limits have been removed from the Technical Specifications

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed. ??

4.2 Reactor Safety System

Applicability:

This specification applied to the surveillance of the reactor safety system. These surveillance requirements have been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed. ??

4.3 FNR Confinement

Applicability:

These surveillance requirements apply whenever the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building exceeds 1.5 x 10^{-2} times the quantities in 10CFR30.72, Schedule C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release.

Objective:

1. To assure that automatic protective action is initiated to limit the release of radioactive effluents from the reactor building when required.
2. To assure that the FNR reactor building confinement integrity is maintained when required.

Specification:

1. a. Gamma Radiation Detector
   i. The gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum shall be calibrated annually, AND
   ii. The ability of the radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum to initiate the automatic protective action required by 3.3.1.a.ii shall be tested quarterly.

   OR

   b. Beta Particulate Continuous Air Monitor
   i. The beta particulate continuous air monitor for the building air exhaust shall be calibrated annually, AND
   ii. The ability of the beta particulate continuous air monitor for the building air exhaust to initiate the automatic protective action required by 3.3.1.b.ii shall be tested quarterly. ??
2. The condition of the following gaskets shall be inspected semiannually, and the gaskets shall be replaced whenever any evidence of deterioration is found:
   a. Building ventilation system intake and exhaust dampers;
   b. Personnel access doors;
   c. Equipment access doors;
   d. Cooling tower access door.

Bases:

The gamma radiation detector which utilizes a Geiger Mueller tube to measure the radiation level in the building air exhaust plenum has been calibrated annually for most of the operating history of the FNR. This instrument has displayed excellent reliability over many years of operation. The continuous air monitor continuously assesses its performance and actuates a trouble alarm if any parameter falls outside of normal operating characteristics or upon failure of ??

the detectors. The manufacturer recommends that a radiological calibration of the instrument should be conducted annually. The semiannual inspection of the gasket materials has been occurring for most of the operating history of the FNR. These materials are not in a damaging environment and semiannual inspection has been found sufficient to assure that the gasket will perform their function of limiting leakage through these openings in the event of a release of airborne radioactivity within the reactor building. ??

4.4 Primary Coolant System

Applicability:

This specification applies to the makeup water added to the reactor pool while the quantity of water in the reactor pool is greater than 900 gallons

Objective:

Review of the makeup water needs over a period of time allows for the detection of significant pool water leaks.

Specification:

1. IF the quantity of water contained in the reactor pool is greater than 900 gallons, THEN the quantity of makeup water added to the reactor pool shall be reviewed quarterly.

Bases:

A small portion of the pool structure is in direct contact with the soil under the reactor building. Routine inspection of the makeup water records over a period of time provides early warning of significant pool leaks.

4.5 Radiation Monitoring

Applicability:

This specification applies to the surveillance of the monitoring equipment used to measure area gamma levels and airborne radioactivity.

Objective:

The objective is to assure that accurate assessment of area gamma levels and airborne radioactivity is available during the conduct of licensed activities.

Specification:

1. Air Particulate Monitors
   a. The air particulate monitors shall be calibrated semiannually.
   b. The operation of the air particulate monitors shall be checked daily when the reactor staff is present in the facility.
   c. An air particulate monitor shall be calibrated upon replacement or following maintenance which could affect calibration.
2. Area Radiation Monitors:
   a. The area radiation monitors shall be calibrated semiannually.
   b. The area radiation monitors shall be channel checked monthly. ??

c. An area radiation monitor shall be calibrated and a channel check shall be performed upon replacement or following maintenance which could affect the calibration.

These surveillance requirements shall be met during the conditions specified in the Limiting Condition for Operation. Surveillances do not have to be performed on inoperable equipment

Bases:

The Ford Nuclear has upgraded to the Eberline AMS-4 for the air particulate monitors. The AMS-4 continuously monitors all critical operating parameters of the unit, such as air flow, detector response, etc., and generates a local alarm whenever one of the monitored parameter falls outside the operator established range. The AMS-4 has several years of demonstrated reliable performance in the power reactor community. The surveillance intervals provided for the air particulate monitors are sufficient to ensure the operability of the air particulate monitors between surveillance intervals.

Semiannual calibration of radiation monitors, which have displayed excellent stability over many years of operation, is adequate to verify the set point unless instrument repairs have been made. ??

4.6 Liquid Effluents

Applicability:

This specification applies to the surveillance of the monitoring equipment used to measure the activity in liquid effluents.

Objective:

The objective is to assure that accurate assessment of liquid effluents can be made.

Specification:

1. The monitoring equipment used to measure the radioactive concentrations in the waste retention tank contents shall be calibrated semiannually when releases are made to the sanitary sewer.
2. The contents of each tank released shall be sampled and evaluated prior to its release.

Bases:

Experience with the counting equipment used in measuring the radioactivity in the waste retention tanks suggests that the above period is a suitable calibration frequency. Waste water is normally recycled to the reactor pool. Consequently, discharges are not normally made to the sewer and calibrations are not normally needed.

4.7 Fission Density Limits

Applicability:

The surveillance requirement for the fission density limit has been removed from the Technical Specifications.

Bases:

On January 29, 2004 the license for the Ford Nuclear Reactor was modified with the following condition: "Maximum Power Level: The licensee shall not operate the reactor nor place fuel elements in the reactor grid." and the condition allowing for the possession of reactor fuel under 10CFR70 was removed. ??

5.0 DESIGN FEATURES

5.1 Site Description

The Ford Nuclear Reactor (FNR) is located on the North Campus of the University of Michigan at Ann Arbor, Michigan. The North Campus area is under the administrative control of the Regents of the University of Michigan.

The North Campus is a tract of nearly 900 acres, about 1-1/2 miles northeast of the center of Ann Arbor. It is bounded on the north by Plymouth Road and on the south by Glazier Way. A VA hospital and some apartments are south of Glazier Way. Apartments are located north of Plymouth Road. Open land and the Arborcrest Cemetery lie to the east. To the west are University athletic fields, municipal parks and a wooded ridge. The Huron River flows through land bordering the area on the west and south and some marsh land lies adjacent to the river on the south.

The reactor building is located near the center of the North Campus area. No housing or buildings containing housing facilities are erected within 1500 feet of the reactor.

The University of Michigan controls all the land within 1500 feet of the reactor site, with the exception of a small portion of the highway right of way along Glazier Way on the southeast and the Arborcrest Cemetery located 800 feet to the east of the site.

The reactor site consists of all the land 500 feet to the east, 1000 feet to the west and north and 1200 feet to the south. The boundary of this area consists of roadways around the site whose traffic flow can be controlled should such control be desirable.

The reactor restricted area consists of the reactor building and the contiguous Phoenix Memorial Laboratory (PML). The reactor building is the operations boundary and the emergency planning zone.

5.2 Reactor Fuel

The license for the Ford Nuclear Reactor does not allow for the possession of reactor fuel. ??

5.3 **Reactor Building**

The reactor building is a windowless, four story, reinforced concrete building with 12 inch walls structurally integral with the footings and foundation mats. The building is approximately 69 feet wide x 68 feet long x 70 feet high with approximately 44 feet exposed above grade. The building has the following general features:

1. The reactor is housed in a closed room designed to restrict leakage.
2. The reactor room is equipped with a ventilation system designed to exhaust air or other gases present in the building atmosphere into an exhaust stack which exhausts a minimum of 54 feet above ground level.
3. The ventilation system provides ventilation for certain storage and experimental facilities and exhausts these a minimum of 54 feet above ground level.
4. The openings into the reactor building are an equipment access door, three personnel doors, an equipment access hatch, air intake and exhaust ducts, room 3103 fume hood exhaust duct, beam port ventilation duct, a sealed north wall door, a door between the hot cave operating face and the beam port floor, a sealed foundation tile drain to the cold sump, and a pneumatic tube system for sample transfer between the FNR and several laboratories in the Phoenix Memorial Laboratory.

These design features apply until the quantity of radioactive materials in unsealed form, on foils or plated sources, or sealed in glass contained in the reactor building is less than 1.5 x 10^{-2} times the quantities in 10CFR30.72, Schedule C - Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release. ??

5.4 **Fuel Storage**

The license for the Ford Nuclear Reactor does not allow for the possession of reactor fuel.

6.0 ADMINISTRATIVE CONTROLS

6.1 Organization

1. The organizational structure of the University of Michigan relating to the Ford Nuclear Reactor (FNR) shall be as shown in Figure 6.1.

2. The Nuclear Reactor Laboratory Manager shall be responsible for the safe operation of the Ford Nuclear Reactor. He shall be responsible for assuring that all operations are conducted in a safe manner and within the limits prescribed by the facility license, including the technical specifications and operating procedures. During periods of his absence, his responsibilities are delegated to the Assistant Manager for Operations or to the Assistant Manager for Research Support Activities.

3. In all matters pertaining to the operation of the plant and these technical specifications, the Nuclear Reactor Laboratory Manager shall report to and be directly responsible to the Director, Michigan Memorial-Phoenix Project.

4. Qualifications, Nuclear Reactor Laboratory Manager and Assistant Managers: Minimum qualifications for the Nuclear Reactor Laboratory Manager and Assistant Managers shall be bachelor's degrees and at least four years of reactor operating experience in increasingly responsible positions. Years spent in graduate study may be substituted for operating experience on a one for one basis up to a maximum of two years. Within six months after being assigned these positions, the Nuclear Reactor Laboratory Manager and the Assistant Managers shall apply for NRC senior operator licenses if they do not already hold licenses.

5. A health physicist who is organizationally independent of the Ford Nuclear Reactor operations group shall be responsible for radiological safety at the facility.

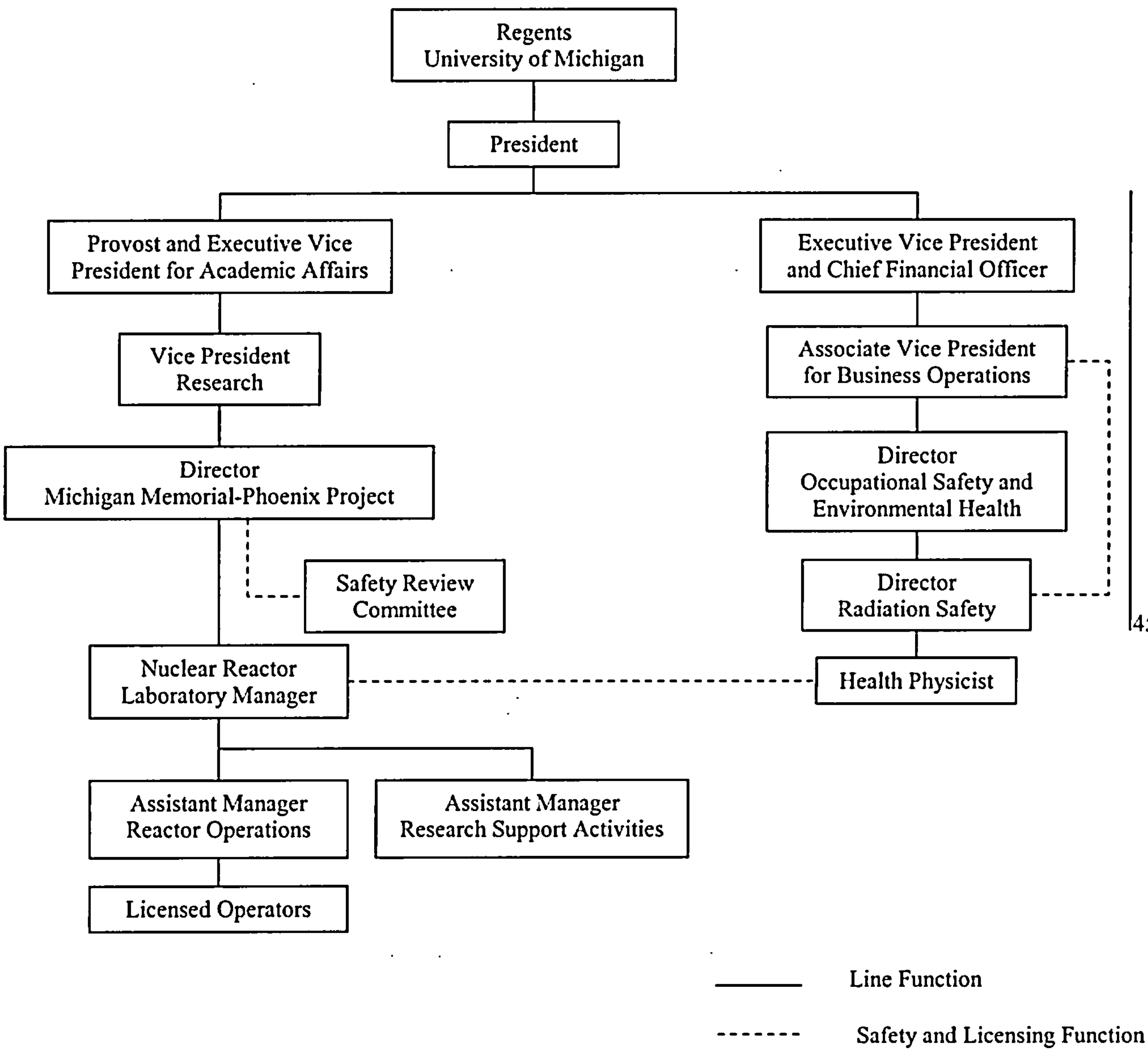
6. A licensed operator or licensed senior operator pursuant to 10CFR55 shall be present in the control room whenever the reactor is in operation as defined in these specifications. The minimum operating crew shall be composed of two individuals, at least one of whom shall be a licensed senior reactor operator.

7. The Nuclear Reactor Laboratory Manager, one of the Assistant Managers, or a licensed senior reactor operator shall be readily available on-call 24 hours per day, seven days per week. The identity of and method for rapidly contacting the on-call supervisor shall be known to the reactor operator or shutdown watchman on duty.

8. Licensed operators are not required to be present in the facility when the reactor is secured.

9. All licensed operators at the facility shall participate in an approved operator requalification program as a condition of their continued assignment to operator duties.

Figure 6.1 Organization Chart for the Ford Nuclear Reactor



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6.2 Review and Audit

1. A Safety Review Committee (SRC) shall review reactor operations and advise the Director, Michigan Memorial-Phoenix Project, in matters relating to the health and safety of the public and the safety of facility operations.

2. The Safety Review Committee shall have at least eight members of whom no more than the minority shall be from the line organization shown in Figure 6.1 or shall administratively report to anyone in that line organization below the Vice President for Research. The Committee shall be made up of University faculty and staff and an individual from outside the University appointed by the Vice President for Research who shall collectively provide experience in reactor engineering, instrumentation and control systems, radiological safety, and mechanical and electrical systems.

3. The Committee shall meet at least semiannually.

4. A quorum shall consist of not less than a majority of the full committee and shall include the chairman or his designated alternate.

5. Those changes, experiments, and tests that require specific SRC review must be approved by a majority of the full Committee Membership. Votes may be cast at SRC meetings or via individual polling of members.

6. Minutes of each Committee meeting shall be distributed to the Director, Michigan Memorial-Phoenix Project, all Safety Review Committee members, and such others as the chairman may designate.

7. The Safety Review Committee shall:

   a. Review and approve proposed experiments and tests utilizing the reactor facility which are significantly different from tests and experiments previously performed at the Ford Nuclear Reactor. In the event of a disagreement over approval of an experiment between the Committee and the Nuclear Reactor Laboratory Manager, the matter shall be referred to the Director, Michigan Memorial-Phoenix Project for resolution.

   b. Review reportable occurrences.

   c. Review and approve proposed standard operating procedures and proposed changes to standard operating procedures. This requirement pertains to those procedures prepared pursuant to Section 6.4 of these specifications.

   d. Review and approve proposed changes to the technical specifications and proposed amendments to the facility license and review proposed changes to the facility made pursuant to 10CFR50.59(c).

   e. Review the audit report provided by the consultant for reactor operations.

8. A consultant will be retained by the University of Michigan to perform an annual audit of reactor operations and the safety of facility operations. The consultant shall be selected by the Director, Michigan Memorial-

Phoenix Project and shall be an individual presently or recently engaged in the management of a research or test reactor of comparable power level and type. He shall provide a report on the conclusions drawn from that audit to the Director, Michigan Memorial-Phoenix Project. The Director shall provide the members of the Safety Review Committee with copies of this report.

9. The audit shall be conducted with the following guidelines:

   a. At least once every five years, a broad review will be made of the following areas: (1) Administration; (2) Safety Review Committee; (3) Reactor operators; (4) Procedures; (5) Surveillance; (6) Quality Assurance Program; (7) Logs and Records; (8) Experiments; (9) Emergency Plan; (10) Security Plan; and (11) Health physics support. The purposes of the review are: (1) Evaluate the adequacy of the organization, training, plans, procedures, surveillance, and records for safe operation of the facility; (2) Verify that the requirements of Technical Specifications are being met; (3) Establish whether plans and procedures are being implemented; and (4) Determine whether responsibilities within the organization are appropriate.

   b. Routine audits will review a limited number of systems in depth each year and will include as applicable to each system: (1) Operating procedures and records; (2) Calibration procedures and records; (3) Equipment operation, condition, and failures; (4) Modifications; and (5) Reportable occurrences.

6.3 Action to Be Taken in the Event of a Reportable Occurrence

In the event of a reportable occurrence, as defined in these technical specifications, the following action shall be taken:

1. The Nuclear Reactor Laboratory Manager shall be notified of the occurrence. Corrective action shall be taken to correct the abnormal conditions and to prevent its recurrence.

2. A report of such occurrence shall be made to the Safety Review Committee; the Director, Michigan Memorial-Phoenix Project; and the Nuclear Regulatory Commission in accordance with Section 6.6.2.a. The report shall include an analysis of the causes of the occurrence, the effectiveness of corrective actions taken, and recommended measures to prevent or reduce the probability or consequences of recurrence.

6.4 Operating Procedures

Written procedures, including applicable check lists, reviewed and approved by the Safety Review Committee shall be in effect and followed for the following operations:

1. Startup, operation and shutdown of the reactor;

2. Installation and removal of fuel elements, control rods, experiments and experimental facilities;

3. Actions to be taken to correct specific and foreseen potential malfunctions of systems or components, including responses to alarms, suspected primary coolant system leaks, and abnormal reactivity changes;
4. Emergency conditions involving potential or actual release of radioactivity, including provisions for evacuation, reentry, recovery, and medical support;
5. Maintenance procedures which could have an effect on reactor safety;
6. Periodic surveillance of reactor instrumentation and safety systems, area monitors, and continuous air monitors;
7. Facility security plan;
8. Radiation protection procedures.

Substantive changes to the above procedures shall be made only with the approval of the Safety Review Committee. Temporary changes to the procedures that do not change their original intent may be made with approval of the Nuclear Reactor Laboratory Manager or one of the Assistant Managers. All temporary changes to the procedures shall be documented and subsequently reviewed by the Safety Review Committee.

6.5 Operating Records

1. The following records and logs shall be prepared and retained by the licensee for at least five years:
   a. Normal facility operation and maintenance;
   b. Reportable Occurrences;
   c. Tests, checks, and measurements documenting compliance with surveillance requirements;
   d. Records of experiments performed;
   e. Records of radioactive shipments;
   f. Operator requalification program records (the five year period will commence after termination of the assignment of the operator to operative duties);
   g. Facility radiation and contamination surveys.
2. The following records and logs shall be prepared and retained by the licensee for the life of the facility:
   a. Gaseous and liquid waste released to the environs;
   b. Off site environmental monitoring surveys;
   c. Radiation exposures for all FNR personnel;
   d. Fuel inventories and transfers;
   e. Updated, corrected, and as built facility drawings;
   f. Minutes of Safety Review Committee meetings.

6.6 **Reporting Requirements**

In addition to reports required by Title 10, Code of Federal Regulations, the following reports shall be submitted to the United States Nuclear Regulatory Commission.

1. Annual Operating Report

   A written annual operating report shall be submitted by March 31 of each year to the U. S. Nuclear Regulatory Commission, Attn.: Document Control Desk, Washington, D.C. 20555 and to the Administrator, Region III.

   The report shall include the following information for the preceding year.

   a. Operations Summary

      A summary of operating experience having safety significance occurring during the reporting period.

      1. Changes in facility design.
      2. Performance characteristics (e.g., equipment and fuel performance).
      3. Changes in operating procedures which relate to the safety of facility operations.
      4. Results of surveillance tests and inspections required by these technical specifications.
      5. A brief summary of those changes, tests, and experiments which required authorization from the commission pursuant to 10CFR50.59(a).
      6. Changes in the plant operating staff serving in the following positions:

         a. Nuclear Reactor Laboratory Manager;
         b. Health Physicist;
         c. Safety Review Committee members.

   b. Power Generation

      A monthly tabulation of the thermal output of the facility during the reporting period.

   c. Shutdowns

      A listing of unscheduled shutdowns which have occurred during the reporting period, tabulated according to cause, and a brief discussion of the actions taken to prevent recurrence.

   d. Maintenance

      A discussion of corrective maintenance, excluding preventive maintenance, performed during the reporting period on safety related systems and components.

   e. Changes, Tests, and Experiments

A brief description and a summary of the safety evaluation for those changes, tests, and experiments which were carried out without prior commission approval, pursuant to the requirements of 10CFR50.59(a).

f. Radioactive Effluent Releases

A statement of the quantities of radioactive effluents released from the plant.

1. Gaseous Effluents

   a. Gross Radioactivity Releases

      1. Total gaseous radioactivity in curies.

      2. Average concentration of gaseous effluents released during normal steady state operation averaged over one year.

      3. Maximum instantaneous concentration of noble gas radionuclides released during special operations, tests, or experiments.

      4. Percent of diluted, 10CFR20, Appendix B, Table 2, Column 1, air effluent concentration limit.

   b. Iodine Releases

      (Required if iodine-131 is identified in primary coolant samples, or if fueled experiments are conducted at the facility.)

      1. Total iodine radioactivity in curies released by isotope, based on representative isotopic analyses.

      2. Percent of diluted, 10CFR20, Appendix B, Table 2, Column 1, air effluent concentration limit.

   c. Particulate Releases

      1. Total particulate gross beta and gamma radioactivity released in curies excluding background radioactivity.

      2. Gross alpha radioactivity released in curies excluding background radioactivity. (Required if the operational or experimental program could result in the release of alpha emitters.)

      3. Total gross radioactivity in curies of nuclides with half lives greater than eight days.

      4. Percent of diluted, 10CFR20, Appendix B, Table 2, Column 1, air effluent concentration limit, for particulate

radioactivity with half lives greater than eight days.

2. Liquid Effluents

   a. Total gross beta and gamma radioactivity released in curies excluding tritium and average concentration released to unrestricted areas or sanitary sewer averaged over period of release.

   b. The maximum concentration of beta and gamma radioactivity released to unrestricted areas.

   c. Total alpha radioactivity in curies released and average concentration released to unrestricted areas averaged over the period of release. (Required if the operational or experimental program could result in the release of alpha emitters.)

   d. Total volume in ml of liquid waste released.

   e. Total volume in ml of water used to dilute the liquid waste during the period of release prior to release from the building to the sanitary sewer system.

   f. Total radioactivity in curies, and concentration averaged over the period of release by nuclide released, based on representative isotopic analyses performed for any release from a waste storage tank.

   g. Percent of diluted, 10CFR20, Appendix B, Table 3, Releases to Sewers

g. Environmental Monitoring

For each medium sampled:

1. Number of sampling locations and a description of their location relative to the reactor.

2. Total number of samples.

3. Number of locations at which levels are found to be significantly higher than the remaining locations.

4. Average annual concentrations or levels of radiation for the sampling point with the highest average concentration or level and the location of that point with respect to the site.

5. The maximum cumulative radiation dose which could have been received by an individual continuously present in an unrestricted area during reactor operation from:

   a. Direct radiation and gaseous effluent;

   b. Liquid effluent.

6. If levels of radioactive materials in environmental media, as determined by an environmental monitoring program, indicate the likelihood of public intakes in excess of 10% of those that could result from continuous exposure to the concentration values listed in 10CFR20, Appendix B, Table 2, Columns 1 and 2, estimates of the likely resultant exposure to individuals and to population groups and assumptions upon which estimates are based.

7. If significant variations of off site environmental concentrations with time are observed, correlation of these results with effluent release shall be provided.

h. Occupational Personnel Radiation Exposure

A summary of annual whole body radiation exposures greater than 500 mrem (50 mrem for persons under 18 years of age) received during the reporting period by facility personnel including faculty, students, or experimenters.

2. Non-Routine Reports

a. Reportable Occurrence Reports

In the event of a reportable occurrence as defined in section 1.0, notification shall be made within 24 hours by telephone and FAX to the Reactor Project Manager, Headquarters, U.S. Nuclear Regulatory Commission and to the Administrator, Region III, followed by a written report within 14 days to the U. S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington, D. C. 20555, and to the Administrator, Region III. FAX notification may be sent on the next working day in the event of a reportable occurrence during a weekend or holiday period. The written report of a reportable occurrence, and, to the extent possible, the preliminary telephone and FAX notification shall:

1. Describe, analyze, and evaluate safety implications;

2. Outline the measures taken to assure that the cause of the condition is determined;

3. Indicate the corrective action including any changes made to the procedures and to the quality assurance program taken to prevent repetition of the occurrence and of similar occurrences involving similar components or systems;

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

b. Technical Specification, Safety Analysis, and System Deficiencies

A written report shall be forwarded within 30 days to the U. S. Nuclear Regulatory Commission, Attn: Document Control Desk, Washington D. C. 20555, and to the Administrator, Region III, in the event of:

1. Discovery of any substantial errors in the transient or accident analyses or in the methods used for such analyses, as described in the safety analysis or in the bases for the technical specifications;
2. Discovery of any substantial variance from performance specifications contained in the technical specifications and safety analysis.
3. Discovery of any condition involving a possible single failure which, for a system designed against assumed failures, could result in a loss of the capability of the system to perform its safety function.