December 15, 2017

Dr. Robert Dimeo, Director
NIST Center for Neutron Research
National Institute of Standards and Technology
U.S. Department of Commerce
100 Bureau Drive, Mail Stop 8561
Gaithersburg, MD 20899-8561

SUBJECT: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY - ISSUANCE OF AMENDMENT NO. 11 TO RENEWED FACILITY OPERATING LICENSE NO. TR-5 FOR THE NATIONAL BUREAU OF STANDARDS TEST REACTOR (CAC NO. 000955)

Dear Dr. Dimeo

The U.S. Nuclear Regulatory Commission has issued the enclosed Amendment No. 11 to Renewed Facility Operating License No. TR-5 for the National Institute of Standards and Technology (NIST), National Bureau of Standards Test Reactor (NBSR). The amendment consists of changes to the facility operating license and technical specifications (TSs) in response to your letters dated March 2, 2017, as supplemented by letters dated March 29, 2017, May 25, 2017, November 17, 2017, November 20, 2017, December 1, 2017, December 14, 2017 (which withdrew parts of the application), and electronic mail dated December 11, 2017. This amendment modifies the NBSR TSs by removing limitations that prohibit use of a test procedure and revising the licensee's organizational chart. In addition, the amendment revises the license to allow NBSR to receive, possess, and use instrumentation calibration and testing sources in connection with the operation of the reactor.

The safety evaluation supporting Amendment No. 11 is enclosed. The Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

If you have any questions, please contact me at (301) 415-1404, or by electronic mail at Xiaosong.Yin@nrc.gov.

Sincerely,

/RA/

Xiaosong Yin, Project Manager
Research and Test Reactors Licensing Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Docket No. 50-184
License No. TR-5

Enclosures:
1. Amendment No. 11
2. Safety Evaluation

cc: w/enclosures: See next page

cc:

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SUBJECT: NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, ISSUANCE OF AMENDMENT NO. 11 TO THE RENEWED FACILITY OPERATING LICENSE NO. TR-5 FOR THE NATIONAL BUREAU OF STANDARDS TEST REACTOR (CAC NO. 000955) DATE: DECEMBER 15, 2017

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NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

DOCKET NO. 50-184

NATIONAL BUREAU OF STANDARDS TEST REACTOR

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 11
License No. TR-5

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

   A. The application for an amendment to Renewed Facility Operating License No. TR-5, filed by the National Institute of Standards and Technology (the licensee) on March 2, 2017, as supplemented by letters dated March 29, 2017, May 25, 2017, November 17, 2017, November 20, 2017, December 1, 2017, December 14, 2017, and electronic mail dated December 11, 2017, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in Chapter I of Title 10 of the *Code of Federal Regulations* (10 CFR);

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

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

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

   E. The issuance of this license amendment is in accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the license as indicated in Attachment 1 to this license amendment, and paragraph 2.B.3 of Renewed Facility Operating License No. TR-5 is hereby amended to read as follows:

    3. Pursuant to the Act and 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," to receive, possess, and use in connection with the operation of the reactor: (1) a two-curie americium-beryllium neutron source, which may be used for reactor startup, and (2) up to a total of 8 curies of byproduct material (Atomic number 1 through 83) and up to 100 micro curies of americium-241, in the form of instrument calibration sources.

3. Accordingly, the license is amended by changes to the technical specifications as indicated in Attachment 2 to this license amendment, and paragraph 2.C.2 of Renewed Facility Operating License No. TR-5 is hereby amended to read as follows:

    2. The technical specifications contained in Appendix A, as revised by Amendment Nos. 9, 10, and 11, are hereby incorporated in the license. The licensee shall operate the reactor in accordance with the technical specifications.

4. This license amendment is effective as of its date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Alexander Adams, Jr., Chief
Research and Test Reactors Licensing Branch
Division of Licensing Projects
Office of Nuclear Reactor Regulation

Attachments:
1. Changes to Renewed Facility Operating License No. TR-5
2. Changes to Appendix A, "Technical Specifications"

Date of Issuance: December 15, 2017

ATTACHMENT TO LICENSE AMENDMENT NO. 11

RENEWED FACILITY OPERATING LICENSE NO. TR-5

DOCKET NO. 50-184

Replace the following page of the Renewed Facility Operating License No. TR-5 with the revised page. The revised page is identified by amendment number and contains lines in the margin indicating the areas of change.

Facility Operating License

Remove	Insert
Page 3	Page 3

a. up to 45.0 kilograms of contained uranium-235 of any enrichment, provided that less than 5.0 kilograms of this amount be unirradiated;

b. to possess and use, but not to separate such special nuclear material as may be produced by operation of the reactor.

3. Pursuant to the Act and 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," to receive, possess, and use in connection with the operation of the reactor: (1) a two-curie americium-beryllium neutron source which may be used for reactor startup, and (2) up to a total of 8 curies of byproduct material (Atomic number 1 through 83) and up to 100 micro curies of americium-241, in the form of instrument calibration sources.

4. Pursuant to the Act and 10 CFR Part 30 to possess, use, and transfer but not to separate, except for byproduct material produced in non-fueled experiments, such byproduct material as may be produced by operation of the reactor.

C. This license shall be deemed to contain and is subject to the conditions specified in Parts 20, 30, 50, 51, 55, 70, 73, and 100 of the Commission's regulations; is subject to all applicable provisions of the Act and rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified below:

1. The licensee is authorized to operate the reactor at steady-state power levels up to a maximum of 20 megawatts (thermal).

2. The technical specifications contained in Appendix A, as revised by Amendment Nos. 9, 10, and 11, are hereby incorporated in the license. The licensee shall operate the reactor in accordance with the technical specifications.

3. The licensee shall maintain and fully implement all of the provisions of the Commission-approved physical security plan, including changes made pursuant to the authority of 10 CFR 50.54(p). The approved physical security plan consists of a National Institute of Standards and Technology document, withheld from public disclosure pursuant to 10 CFR 73.21, entitled, "NBSR Safeguards Plan," dated May 1983, transmitted by letter dated May 5, 1983.

ATTACHMENT TO LICENSE AMENDMENT NO. 11

RENEWED FACILITY OPERATING LICENSE NO. TR-5

DOCKET NO. 50-184

Replace the following pages of the Appendix A, “Technical Specifications,” with the revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Technical Specifications

Remove	Insert
Page 11	Page 11
Page 12	Page 12
Page 14	Page 14
Page 16	Page 16
Page 17	Page 17
Page 18	Page 18
Page 24	Page 24
Page 39	Page 39
Page 55	Page 55

2.0 Safety Limit and Limiting Safety System Settings

2.1 Safety Limit

Applicability: Fuel temperature

Objective: To maintain the integrity of the fuel cladding and prevent the release of significant amounts of fission products.

Specification

The reactor fuel cladding temperature shall not exceed 842°F (450°C) for any operating conditions of power and flow.

Basis

Maintaining the integrity of the fuel cladding requires that the cladding remain below its blistering temperature of 842°F (450°C). For all reactor operating conditions that avoid either a departure from nucleate boiling (DNB), or exceeding the Critical Heat Flux (CHF)), or the onset of flow instability (OFI), cladding temperatures remain substantially below the fuel blistering temperature. Conservative calculations have shown that limiting combinations of reactor power and reactor coolant system flow and temperature will prevent DNB and thus fuel blistering.

2.2 Limiting Safety System Settings

Applicability: Power, flow, and temperature parameters

Objective: To ensure protective action if any combination of the principal process variables should approach the safety limit.

Specifications

(1) Reactor power shall not exceed 130% of full power.

(2) Reactor outlet temperature shall not exceed 147°F.

(3) Forced coolant flow shall not be less than 60 gpm/MW for the inner plenum and not less than 235 gpm/MW for the outer plenum.

(4) Reactor power, with natural circulation cooling flow, shall not exceed 10 kW. Operation in this mode shall only be made with a core that has been previously analyzed and shown to be within the envelope of conditions described in the SAR.

Basis

At the values established above, the Limiting Safety System Settings provide a significant margin from the Safety Limit. Even in the extremely unlikely event that reactor power, coolant flow, and outlet temperature simultaneously reach their Limiting Safety System Settings, the critical heat flux ratio (CHFR) is at least 2. For all other conditions the CHFR is considerably higher. This will ensure that any reactor transient caused by equipment malfunction or operator error will be terminated well before the safety limit is reached. Overall uncertainties in process instrumentation have been incorporated in the Limiting Safety System Settings.

Steady state thermal hydraulic analysis shows that operation at less than 500 kW with natural circulation results in a CHFR and OFI ratio greater than 2. Transient analysis of reactivity insertion accidents shows that the fuel cladding temperature remains far below the safety limit. The limit of 10 kW was chosen since that was deemed adequate for any operational situation requiring natural circulation operation, such as testing of a previously measured core loading.

Basis

(1) An excess reactivity limit provides adequate excess reactivity to override the xenon buildup and to overcome the temperature change in going from zero power to 20 MW, without affecting the required shutdown margin. In addition, the maximum reactivity insertion accident at startup, which assumes the insertion of 0.5% $\Delta\rho$ into a critical core, is not affected by the total core excess reactivity.

(2) These specifications ensure that the reactor can be put into a shutdown condition from any operating condition and remain shutdown even if the maximum worth shim arm should stick in the fully withdrawn position with the regulating rod also fully withdrawn.

3.1.3 Core Configuration

Applicability: Core grid positions

Objective: To ensure that effective fuel cooling is maintained during forced flow reactor operation.

Specification

The reactor shall not operate unless all grid positions are filled with full length fuel elements or thimbles, except during subcritical and critical startup testing with natural convection flow.

Basis

Core grid positions shall be filled to prevent coolant flow from bypassing the fuel elements for operation of the reactor with forced coolant flow.

3.1.4 Fuel Burnup

Applicability: Fuel

Objective: To remain within allowable limits of burnup beginning-of-life shim arm worths with the shim arms operating at the design speed of their constant speed mechanisms. The analysis shows that the most severe accident, a startup from source level, will not result in core damage.

3.2.2 Reactor Safety System Channels

Applicability: Required instrument channels

Objective: To provide protective action for nuclear and process variables to ensure the LSSS values are not exceeded.

Specifications

The reactor shall not be operated unless the channels described in Table 3.2.2 are operable and the information is displayed in the reactor Control Room.

Table 3.2.2 Reactor Safety System Channels
Minimum Nuclear and Process Channels Required

Channel	Scram	Major Scram	Rundown
(1) High Flux level	2		
(2) Short period below 5% rated power	2		
(3) Low reactor vessel D_2O level [1, 3]	2		
(4) Low flow reactor outlet [2, 3]	1		
(5) Low flow reactor inner or outer plenum [2, 3]	1		
(6) Manual (outside of the Control Room)	1		
(7) Manual	1	1	
(8) Reactor Outlet Temperature[3]			1
(9) Gaseous Effluent Monitors[4]		2	

[1] One (1) of two (2) channels may be bypassed for tests or during the time maintenance involving the replacement of components and modules or calibrations and repairs are actually being performed.

[2] One (1) of these two (2) flow channels may be bypassed during tests, or during the time maintenance involving the replacement of components and modules or calibrations and minor repairs are actually being performed. However, outlet low flow may not be bypassed unless both inner and outer low flow reactor inlet safety systems are operating.

[3] May be bypassed during periods of reactor operation when a reduction in Limiting Safety System Settings are permitted by the specifications of Sections 2.2(4) and 3.3.1(1).

[4] See specifications of Section 3.7.1

Basis

The nuclear and process channels of Table 3.2.2 initiate protective action to ensure that the safety limit is not exceeded. With these channels operable, the safety system has redundancy.

3.3 Coolant System

3.3.1 Primary and Secondary

Applicability: Primary fluid systems

Objective: To prevent degradation of primary systems' materials.

Specifications

The reactor shall not be operated unless:

(1) The reactor vessel coolant level is no more than 25 inches below the overflow standpipe.

Exception: To perform periodic surveillance of the effectiveness of the moderator dump or approach to critical testing for a previously unmeasured core loading, it is necessary to operate the reactor as permitted in the specifications of Section 2.2(4) and without restriction on reactor vessel level above the top of the 6" overflow pipe (refueling level).

(2) The D_2 concentration in the Helium Sweep System shall not exceed 4% by volume.

(3) All materials, including those of the reactor vessel, in contact with the primary coolant shall be compatible with the D_2O environment.

Basis

(1) The limiting value for reactor vessel coolant level is somewhat arbitrary because the core is in no danger so long as it is covered with water. However, a drop of vessel level indicates a malfunction of the reactor cooling system and possible approach to uncovering the core. Thus, a measurable value well above the minimum level is chosen in order to provide a generous margin of approximately 7 feet (2.13 m) above the fuel elements. To permit periodic testing, such as surveillance of the effectiveness of the moderator dump or approach to critical for a previously unmeasured core loading, it is necessary to operate the reactor without restriction on reactor vessel level. This is permissible under conditions when forced reactor cooling flow is not required, such as is permitted in the specifications of Section 2.2(4).

(2) Deuterium gas will collect in the helium cover gas system because of radiolytic disassociation of D_2O. Damage to the primary system could occur if this gas were to reach an explosive concentration (about 7.8% by volume at 77°F (25°C) in helium if mixed with air). To ensure a substantial margin below the lowest potentially explosive value, a 4% limit is imposed.

(3) Materials of construction, being primarily low activation alloys and stainless steel, are chemically compatible with the primary coolant. The stainless steel pumps are heavy walled members and are in areas of low stress, so they should not be susceptible to chemical attack or stress corrosion failures. A failure of the gaskets or valve bellows would not result in catastrophic failure of the primary system. Other materials should be compatible so as not to cause a loss of material and system integrity.

3.3.2 Emergency Core Cooling

Applicability: Emergency Core Cooling System

Objective: To ensure an emergency supply of coolant.

Specifications

The reactor shall not be operated unless:

(1) The D_2O emergency core cooling system is operable, except when operating under specification 2.2(4), and

(2) A source of makeup water to the D_2O emergency cooling tank is available.

Basis

(1) In the event of a loss of core coolant, the emergency core cooling system provides adequate protection against melting of the reactor core and associated release of fission products.

Full operability is not available, nor is it needed, when operating as permitted by the specifications of Sections 2.2(4) and 3.3.1(1). However, the 3000 gallon D_2O emergency cooling tank and a source of makeup water would be available.

(2) The emergency core cooling system employs one sump pump to return spilled coolant to the overhead storage tank. Because only one sump pump is used, it must be operational whenever the reactor is operational. There is sufficient D_2O available to provide approximately 2.5 hours of cooling on a once-through basis. In the event that the sump pump fails and the D_2O supply in the overhead storage tank is exhausted, domestic water or a suitable alternative would be used to furnish water for once-through cooling. The water makeup capacity must be in excess of 25 gpm, which was found adequate in cooling calculations to prevent fuel damage.

(2) One fission product monitor is operable or sample analysis for fission product activity is conducted daily, [1]

(3) One secondary coolant activity monitor is operable or a D_2O storage tank level monitor is operable.

(4) Two area radiation monitors are operable on floors C-100 and C-200.

(5) The primary tritium concentration is less than or equal to 5 Ci/l.

(6) Removed to 3.7.2.

When required monitors are inoperable, then portable instruments, survey or analysis may be substituted for any of the normally installed monitors in specifications (1) – (4) for periods of one (1) week or for the duration of a reactor run.

[1] Operability of the monitor specified in (2) above is not required for operation permitted by the specifications in Section 2.2(4) since the fission product monitor is neither operable nor needed without forced primary coolant flow.

Basis

(1) The requirements of 10 CFR 20.1502(b) (2007) are met by regular monitoring for airborne radionuclides and bioassay of exposed personnel. The two primary airborne radionuclides present at the NBSR are ^{41}Ar and ^{3}H. The normal air exhaust system draws air from areas supplied by conditioned air, such as the first and second floors of the confinement building. The irradiated air exhaust system draws air from areas most likely to have contaminated air, such as waste sumps and penetrations in the biological shield. Normal and irradiated air are monitored continuously with detectors sensitive to β and γ emissions and the combined air is exhausted through the stack. The stack release is monitored with a detector sensitive to β and γ emissions.

(2) A fission products monitor located in the helium sweep gas will give an indication of a "pin-hole" breach in the cladding so that early preventive measures can be taken. When this monitor is not functional, daily testing will ensure that the fuel cladding is intact. These two measures ensure that there are no undetected releases of fission products to the primary coolant. Specification (1) alone is adequate to assure detection of abnormal effluent radioactivity during operation as permitted by Section 2.2(4).

(3) Monitoring for primary water leakage into the secondary coolant is done by a secondary water monitor that is sensitive to radionuclides in the primary water. Leakage of primary to secondary would also be detected by a change in the D_2O storage tank level.

(4) Fixed gamma area radiation monitors are positioned at selected locations in the confinement building. Typical alarm setting are less than 5 mrem/hr and adjusted as needed for non-routine activities, generally with the objective of identifying unusual changes in radiation conditions.

(5) At the end of the term of the NBSR license the maximum tritium.

(4) The voltage and specific gravity of each cell of the Vented Lead Acid (VLA) battery shall be tested annually. A discharge test of the entire battery shall be performed once every 5 years.

(5) A discharge test of the Valve-Regulated Lead Acid (VRLA) batteries shall be performed once every two years.

Basis

(1) The NBSR is equipped with two diesel power generators, each capable of supplying full emergency load; therefore, only one of the generators shall be required. The diesel generators have proven to be very reliable over decades of service. The quarterly test frequencies are consistent with industry practice and are considered adequate to ensure continued reliable emergency power for emergency equipment.

(2) This testing frequency of the operable generator will ensure that at least one of the required emergency generators will be operable.

(3) An annual test of the emergency power equipment under a simulated complete loss of outside power will ensure the source will be available when needed.

(4) and (5), Specific gravity and voltage checks of individual cells are the accepted method of ensuring that all cells of a VLA battery are in satisfactory condition. The annual frequency for these detailed checks is considered adequate to detect any significant changes in the ability of the battery to retain its charge. During initial installation, the station batteries were discharge tested to measure their capacity. Experience has shown that repeating these tests at the specified intervals is adequate to detect deterioration of the cells and loss of battery capacity.

4.7 Radiation Monitoring System and Effluents

4.7.1 Monitoring System

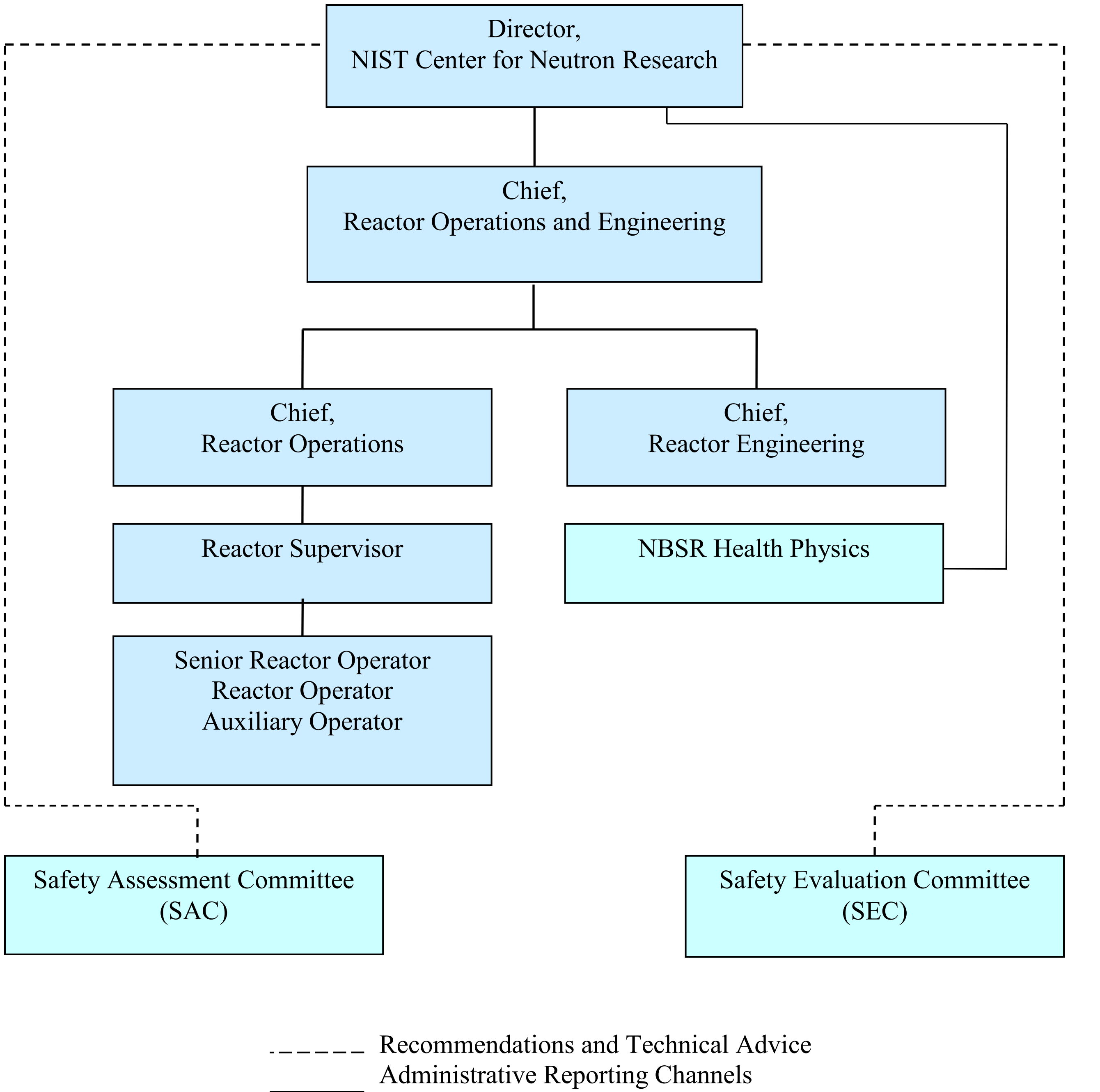
Applicability: Radiation monitoring equipment

Objective: To ensure operability of radiation monitors.

Specifications

(1) The gaseous effluent monitors for normal air, irradiated air and stack air shall be channel tested before startup, after a shutdown of longer than twenty-four (24) hours, or quarterly. Each of the above air monitors shall be channel calibrated annually.

(2) The fission products monitor shall be channel tested monthly and channel calibrated annually.



Director,
NIST Center for Neutron Research
Chief,
Reactor Operations and Engineering
Chief,
Reactor Operations
Chief,
Reactor Engineering
Reactor Supervisor
NBSR Health Physics
Senior Reactor Operator
Reactor Operator
Auxiliary Operator
Safety Assessment Committee
(SAC)
Safety Evaluation Committee
(SEC)
Recommendations and Technical Advice
Administrative Reporting Channels

Figure 6.1

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 11 TO

RENEWED FACILITY OPERATING LICENSE NO. TR-5

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

DOCKET NO. 50-184

1.0 INTRODUCTION

By letters dated March 2, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML17068A163 and ML17068A164), as supplemented by letters dated March 29, 2017 (ADAMS Accession No. ML17097A243), May 25, 2017 (ADAMS Accession No. ML17153A172), November 17, 2017 (ADAMS Accession No. ML17324A441), November 20, 2017, (ADAMS Accession No. ML17328A504), December 1, 2017, (ADAMS Accession No. ML17335A369), December 14, 2017 (ADAMS Accession No. ML17348A099), and electronic mail dated December 11, 2017, (ADAMS Accession No. ML17345A904), the National Institute of Standards and Technology Center for Neutron Research (NIST or the licensee) requested that U.S. Nuclear Regulatory Commission (NRC) issue a license amendment to the renewed facility operating license for the National Bureau of Standards Test Reactor (NBSR). The proposed license amendment would modify the NBSR technical specifications (TSs) to remove limitations and would change the licensee's organizational chart. In addition, the license amendment request (LAR) seeks revisions to allow NBSR to receive, possess, and use instrumentation calibration and testing sources in connection with the operation of the reactor. The NRC had previously issued a proposed finding in the *Federal Register* on September 12, 2017 (82 FR 42851), that the amendment involves no significant hazards consideration, and there has been no public comment on this finding. The supplemental letters dated November 17, 2017, November 20, 2017, December 1, 2017, December 11, 2017, and December 14, 2017 (which withdrew parts of the application) provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the staff's original proposed no significant hazards consideration determination as published in the *Federal Register.*

2.0 EVALUATION

2.1 Background

The reactor uses four shim arms to control reactivity. These shim arms contain cadmium metal as the poison material, which is clad in 6061 alloy aluminum. During reactor operation at a 20-megawatt thermal (MWt) power level, the cadmium is depleted by neutron absorption and the shim arms lose negative reactivity worth. After 28 operational cycles (approximately 4 years) of 20 MWt operations, the shim arms must be replaced in order to ensure they are capable of providing necessary negative reactivity for the safe operation of the reactor. Replacing all four shim arms at one time requires the reactor core to be fully unloaded and the fuel placed into a storage pool.

After the shim arms are replaced, the reactor is reloaded with the previously stored and partially spent fuel elements. The shim arms are manufactured under a quality assurance program, but the licensee assumes that the new shim arms may contain insufficient cadmium poison to control the reactor with all 30 fuel elements in the reference core condition (xenon free and at ambient temperature) until verified. To assure a safe core reloading and monitor for anomalous conditions, the reactor (with new shim arms) is loaded using an inverse-multiplication, or 1/M (one over M), experiment procedure. In this experiment, the subcritical neutron multiplication of the reactor is monitored while fuel is sequentially added to the core. For the process of reloading the reactor core following normal shim arm replacement, the licensee follows its internally approved procedure RP-20 that establishes the conditions and steps to load the core while monitoring conditions using the inverse multiplication method. In one of the reloading processes in August 2013, the licensee partially loaded the reactor and then completed the process on the following day because of equipment problems. Following the steps outlined in RP-20, the reactor went critical twice before the completion of the reactor reloading. Because the reactor went critical before all grid positions were filled, the licensee believed that TS 3.1.3, "Core Configuration," was violated. Upon further review, the licensee concluded that three limiting conditions for operations (TSs 3.1.3, 3.3.1, and 3.9.2.1) were violated during the performance of RP-20. The licensee also concluded that these TSs had been violated during the performance of nearly every shim arm replacement (six total) since 1980. During an inspection conducted by NRC staff in November 2013, the inspector determined that the problem had been identified and reviewed by the licensee and reported to the NRC. The inspection noted that corrective actions had been identified and were in the process of being completed as well. As a result, the licensee was informed that this non-repetitive, licensee-identified and corrected violation would be treated as a Non-Cited Violation (NCV), consistent with section VI.A.8 of the NRC Enforcement Policy (NCV 50-184/2013-202-02). The inspection report (IR) further concluded that this issue is considered closed (IR-05000184-13-202, dated December 5, 2013, ADAMS Accession No. ML13336A631).

The licensee is preparing to perform its first shim arm replacement after the NCV. The licensee is requesting changes to Renewed Facility Operating License No. TR-5 TSs that would permit core loading using the inverse multiplication procedure and prevent future TS violations. The inverse multiplication procedure is standard practice for loading a reactor core, and all NIST reactor operators licensed by the NRC are expected to know how to perform the procedure and the required calculations to determine criticality.

The licensee submitted this LAR as part of the corrective actions for the NCV.

2.2 Regulatory Requirements

The NRC staff reviewed the licensee's amendment request, as supplemented, to ensure that there is reasonable assurance that the activities authorized by this amendment can be conducted without endangering the health and safety of the public and that such activities will be conducted in compliance with the Commission's regulations, and that the issuance of this license amendment will not be inimical to the common defense and security or to the health and safety of the public. The NRC staff considered the following regulatory requirements and guidance during its review of the proposed changes:

- The regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, "Standards for Protection against Radiation," establish standards for the protection against ionizing radiation resulting from activities conducted under licenses the NRC issues.

- The regulations in 10 CFR Part 30, “Rules of General Applicability to Domestic Licensing of Byproduct Material,” in part, provide regulatory requirements for storage and use of byproduct material.

- The regulations in 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” provide regulatory requirements for licensing of non-power reactors.

- The regulations in 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions,” provide regulatory requirements for the protection of the environment.

- The Atomic Energy Act of 1954, as amended, Section 182a, requires that each utilization facility operating license include TSs. The regulatory requirements related to the content of the TSs for nuclear reactors are in 10 CFR 50.36, “Technical specifications,” which requires that a TS include the following categories: (1) safety limits and limiting safety system settings, (2) limiting conditions for operation, (3) surveillance requirements, (4) design features, and (5) administrative controls.

- NUREG-1537, Part 1, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Format and Content,” issued in February 1996, provides guidance for the format and content of non-power reactor licensing applications submitted to the NRC. NUREG-1537, Part 1, Appendix 14.1, “Format and Content of Technical Specifications for Non-Power Reactors,” provides guidance on the format and content of non-power reactor TSs. Appendix 14.1, references American Nuclear Standards Institute/American Nuclear Society-15.1-2007, “The Development of Technical Specifications for Research Reactors”.

- NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors: Standard Review Plan and Acceptance Criteria,” issued in February 1996, provides guidance to NRC staff on conducting licensing application reviews for non-power reactor licensing applications. NUREG-1537, Part 2, Chapter 14, “Technical Specifications,” provides guidance for the review acceptability of proposed TSs.

2.3 Staff Evaluation

2.3.1 TS 2.2, “Limiting Safety System Settings”

The current TS 2.2(4) states:

> Reactor power, with natural circulation cooling flow, shall not exceed 10 kW.

The proposed TS 2.2(4) states:

> Reactor power, with natural circulation cooling flow, shall not exceed 10 kW. Operation in this mode shall only be made with a core that has been previously analyzed and shown to be within the envelope of conditions described in the SAR.

The proposed change would add a statement to TS 2.2(4) that requires that reactor operation with natural convection cooling up to 10 kilowatts thermal (kW) power be previously analyzed and shown to be bounded by the safety analysis report (SAR) the licensee had conducted. It does not change the limit on reactor power in the natural circulation flow operation mode. All core configurations are analyzed before any fuel-loading operation including those after shim arm replacement. In accordance with its procedure required by TS 6.4, the licensee has a fixed refueling pattern that has been extensively neutronically and thermal-hydraulically modeled in the SAR, and any deviations from that pattern would require further analysis before fuel movement to ensure SAR compliance from both a reactivity and power peaking standpoint. Infrequently, the core is fully unloaded for maintenance purposes such as shim arm replacement. Upon reloading, an internal procedure requires that a small number of fuel elements to be loaded in predetermined positions (the number and position depend on whether or not the shim arms are new), along with inverse multiplication measurements and verification of estimated criticality. The licensee's procedures for startup is required by TS 6.4, Procedures, and any significant changes to the procedure must be reviewed by the licensee's safety committee and approved by the reactor director. The licensee's renewal SAR for natural circulation cooling flow for up to 500 kW power level shows that the core coolant flow is stable and subcooled. The peak fuel centerline temperature is about 25 degrees Celsius below the saturation temperature. The peak flux is at least a factor of five below the calculated critical heat flux.

The NRC staff reviewed the licensee's SAR and determined that the thermal hydraulic design section adequately demonstrates the thermal-hydraulic characteristics necessary to provide the limits on cooling conditions that ensure fuel integrity will not be lost under natural convection conditions. For natural convection, the licensee used the Sudo-Kaminaga and Oh/Chapman correlations to check for departure from nucleate boiling and onset of flow instability (OFI), respectively. These calculations were performed for both the inner and outer plenums, at both the hot spot and the exit of the hottest fuel channel of the upper fuel section. Critical heat flux (CHF) and OFI ratios calculated by the licensee show ample thermal safety margins (greater than a factor of 2) for steady-state operating conditions. The licensee used the RELAP5 code to analyze abnormal transients during 500-kW power operation with natural convection. These analyses show peak clad temperatures lower than the blistering temperature at which cladding would begin to fail, thereby demonstrating the acceptability of the limiting safety system settings required by TS 2.2, "Limiting Safety System Settings," for operation with natural convection. Although the licensee performed calculations for operation at 500 kW, the licensee chose the maximum reactor power permitted without forced flow is 10 kW, which provides a substantial margin to CHF. Based on its review, the NRC staff finds that the proposed change to TS 2.2(4) specifically requires licensee to demonstrate that the natural convection flow operation is bounded by the safety analysis prior to operation in that mode, thus ensuring that such operation can be done safely. Therefore, the NRC staff concludes that the proposed changes to TS 2.2(4) are acceptable.

2.3.2 TS 3.1.3, "Core Configuration"

The current TS 3.1.3 states:

> Objective: To ensure that a failed shim arm does not adversely affect core reactivity and cooling flow is maintained.

Specification

The reactor shall not operate unless all grid positions are filled with full length fuel elements or thimbles.

The proposed TS 3.1.3 states:

Objective: To ensure that effective fuel cooling is maintained during forced flow reactor operation.

Specification

The reactor shall not operate unless all grid positions are filled with full length fuel elements or thimbles, except during subcritical and critical startup testing with natural convection flow.

Proposed TS 3.1.3 would add an exception to allow the licensee to perform subcritical and critical startup testing without all grid positions filled with full length fuel elements or thimbles. Subcritical and critical startup tests are conducted with natural convection flow using the licensee's procedure required by TS 6.4. When the reactor is operating with natural convection flow, the potential for coolant flow bypassing the fuel elements does not exist because the natural convection circulation is driven by the heat produced by the fuel elements and causes most of the flow to go through the elements as desired. Little flow goes through the open grid positions. During startup testing, the reactor (with new shim arms) is loaded using an inverse-multiplication, or 1/M (one over M), written experiment procedure. In this experiment, the subcritical neutron multiplication of the reactor is monitored while fuel is sequentially added to the core.

Shim arm stops are permanently installed in the core grid. Shim arms control core reactivity and there are multiple shim arms. A shim arm could fall outside of a shim arm stop, but that would only occur during a shim arm change-out or other activity when the fuel around the shim arms is removed. Any such shim arm failure would result in a negative reactivity insertion. TS 3.1.2(2) requires a minimum shutdown margin during reactor operation, which means that the reactor will be subcritical if there is a failure of a shim arm. Immediately following shim arm replacement, the first fuel elements to be reinserted are those adjacent to the shim arm positions. These, along with installed vertical thimbles, ensure that the shim arms remain in place. The reactor is still subcritical in this configuration. Assuming the raising and lowering mechanisms remained functional, a failed shim arm would be detected by abnormalities in the required 1/M plots. If the mechanisms failed, the operator would immediately take notice and halt any further activities until the cause of the failure was investigated.

Based on its review, the NRC staff finds that the proposed change is acceptable. Because during the startup testing the fuel elements are added to the core one by one, starting around the shim arms and until the core is fully loaded, grid positions are not initially all filled with full length fuel elements or thimbles. For the startup testing, natural convection flow limits the reactor power level to 10 kW. As noted in the evaluation of TS 2.2(4), the startup testing operation mode is analyzed in licensee's renewal SAR. In addition, the TS 3.1.2(2) requirement for a minimum shutdown margin helps to ensure the safety of the reactor in the event of a shim arm failure without a shim arm stop. Therefore, the NRC staff concludes that the change helps to ensure safe facility operation during necessary subcritical and critical startup testing in the natural convection flow condition, and therefore the change is acceptable.

2.3.3 TS 3.2.2, "Reactor Safety System Channels"

The current TS 3.2.2 states:

(8) Reactor Outlet Temperature 1

The proposed TS 3.2.2 states:

(8) Reactor Outlet Temperature[3] 1

The licensee also proposed a revision to annotation [3,] which is currently in 3.2.2(3), (4) and (5).

The current TS 3.2.2 annotation [3] states:

> [3] May be bypassed during periods of reactor operation (up to 10 kW) when a reduction in Limiting Safety System Setting values is permitted per the specifications of Sections 2.2 and 3.3.1.

The proposed TS 3.2.2 annotation [3] states:

> [3] May be bypassed during periods of reactor operation when a reduction in Limiting Safety System Settings are permitted by the specifications of Sections 2.2(4) and 3.3.1(1).

The proposed change would add TS 3.2.2(8), "Reactor Outlet Temperature," to the bypassed channels. Currently, the bypassed channels include the low reactor vessel D_2O (heavy water) level, the low-flow reactor outlet, and the low-flow reactor inner and outer plenum when a reduction in limiting safety system setting values are allowed. The proposed addition and revision of annotation [3] would allow the reactor outlet temperature measure/display to also be bypassed if the requirements of TSs 2.2(4) and 3.3.1(1) can be satisfied. TS 2.2(4) limits the reactor power level to 10 kW with natural circulation flow, and TS 3.3.1(1) specifies the reactor vessel coolant level of primary fluid when the reactor is operating.

As analyzed in the licensee's SAR section 4.6.5, the reactor can be safely operated with natural convection up to 500 kW, well above the 10 kW limit of TS 2.2(4). The coolant temperature generated by the reactor operating at 10 kW is insignificant due to its low power. In addition to the temperature channel bypass change, there are also TSs reference changes, i.e., from sections 2.2 and 3.2.1 to sections 2.2(4) and 3.3.1(1) under the annotation [3]. These additional changes continue to allow bypasses for low reactor vessel D_2O level, low flow reactor outlet, and low flow reactor inner or outer plenum channels available for natural convection coolant operation. Because the reactor is cooled by natural convection, coolant temperature would not be detected by the reactor outlet temperature sensor, because the reactor primary coolant pumps are not running. The location of the sensor requires the coolant pumps to be running to carry the coolant from the core to the detector. Power level indication via neutron detection is the best way to provide indication of reactor status in natural convection mode. The reactor is equipped with more than one such neutron detection channel, all of which are required to be operable during operation by TS 2.2(4).

Based on its review, the NRC staff finds the reactor outlet temperature is not operable without primary flow. When operating in natural circulation mode under TS 2.2(4) at power level less than or equal to 10 kW, the heat generated by the reactor operation is so small that it would not be detectable by the reactor outlet temperature sensor even if the coolant pumps were running. The bypassed channels during natural convection flow operation are compensated by the licensee's neutron detection channels that are operable during TS 2.2(4) operation and provide a good indication of reactor operating power level. Therefore, the NRC staff finds that the change helps ensure safe facility operation and is acceptable.

2.3.4 TS 3.3.1, "Primary and Secondary"

The current TS 3.3.1(1) states:

(1) The reactor vessel coolant level is no more than 25 inches below the overflow standpipe.

Exception: To permit periodic surveillance of the effectiveness of the moderator dump, it is necessary to operate the reactor without restriction on reactor vessel level.

The proposed TS 3.3.1(1) states:

(1) The reactor vessel coolant level is no more than 25 inches below the overflow standpipe.

Exception: To perform periodic surveillance of the effectiveness of the moderator dump or approach to critical testing for a previously unmeasured core loading, it is necessary to operate the reactor as permitted in the specifications of Section 2.2(4) and without restriction on reactor vessel level above the top of the 6" overflow pipe (refueling level).

The licensee proposed an additional exception that would permit approach to critical testing for a previously unmeasured core loading with the vessel level at the refueling level, which is lower than normal operation level of 25" below the overflow standpipe. The licensee's procedures allow the licensee to adjust the level of coolant in the reactor vessel during the reactor refueling 1/M process as long as the level does not go below the refueling level. For the refueling process, the licensee needs to lower the coolant level in the reactor vessel below the normal operation level required by TS 3.3.1(1) in order to move fuel and then raise the level to operate the reactor to obtain data for each step of the 1/M measurement. This process of adjusting reactor vessel level and obtaining data using 1/M measurement steps is part of the licensee's approach to critical testing process. The proposed exception would also incorporate the proposed TS 2.2(4), which requires that the reactor power with natural circulation flow not exceed 10 kW. The core condition under this exception has been previously analyzed in the SAR.

When the reactor is operating under natural convection cooling, to perform an approach to critical testing for an unknown core loading configuration involving fuel movement, the minimum reactor vessel coolant level is required. The reactor refueling vessel level can be as low as 70 inches which is equivalent to the top of the 6" overflow pipe level. The exception requires the reactor vessel level to be at least at the refueling level. To prevent primary coolant from draining into the fuel storage pool, irradiated elements are not moved within the vessel unless the water level is lowered to the refueling level. The analysis in the licensee's SAR shows that safe reactor operation can be maintained during operation in the natural circulation mode with the refueling vessel level at 70 inches. At that level, the fueled sections of fuel elements remain immersed in D_2O except when the element is being moved to a new position within the core or into or out of the vessel in accordance with TS 3.9.2.2, which requires that a fuel element shall not be removed from water in the reactor vessel unless the reactor has been shutdown for a period equal to or longer than one hour for each megawatt of operating power level.

Based on its review, the NRC staff finds that the proposed change is acceptable. When the reactor is operating for the purpose of performing critical testing with natural convection, the lower vessel level becomes necessary because irradiated fuel elements are not moved within the vessel unless the coolant level is lowered to the refueling level to allow easy handling. The lowered reactor vessel level still provides necessary coolant for the fuel elements. The movement of the elements happens each time the reactor is refueled and no significant degradation has been found during the licensee's long operating history when the elements have been placed in the spent fuel pool for storage before shipment. In addition, the operable shim rods, and with the low coolant level, assures the availability of negative reactivity that is capable of shutting down the reactor and maintaining it in a shutdown condition. Therefore the NRC staff finds that the change continues to ensure the safety of facility operation and is acceptable.

2.3.5 TS 3.3.2, "Emergency Core Cooling"

The current TS 3.3.2 states, in part:

> The reactor shall not be operated unless:
>
> (1) The D_2O emergency core cooling system is operable.
>
> (2) A source of makeup water to the D_2O emergency cooling tank is available.

The proposed TS 3.3.2 states:

> The reactor shall not be operated unless:
>
> (1) The D_2O emergency core cooling system is operable, except when operating under specification 2.2(4), and
>
> (2) A source of makeup water to the D_2O emergency cooling tank is available.

The proposed change (as modified by letter dated December 14, 2017), would add the exception that the emergency core cooling system operable requirement need not be met when the reactor is operating under the TS 2.2(4) with natural convection flow, and add "and" between TS 3.3.2(1) and (2) to clarify that those two conditions are required for reactor operation.

The licensee's SAR demonstrates that, under natural convection operation with a coolant level lowered to the refueling level, the inner reserve tank, which is part of the emergency core coolant system and normally contains 20 minutes of emergency cooling water, will be empty (i.e., the emergency core cooling system is not operable). However, all other components of the emergency cooling systems are operable and fully capable of cooling the core. An emergency cooling tank, located outside the reactor vessel will still be available to supply 3,000 gallons of D_2O via the same flow path as when the inner reserve tank is full. The reactor cooling system has a distribution system to direct the flow of water into each cooling element even if the inner reserve tank is initially empty. The flow rate is adequate to cool the fuel elements even if the reactor had been recently shutdown from extended operation at a 20 MW thermal power level. The emergency cooling tank holds about 2 hours' worth of cooling water even without the emergency sump pump. An alternate source of makeup water would also be available.

Based on its review, the NRC staff finds that, when the reactor is operated in natural convection cooling mode, there is adequate emergency coolant available which would provide flow of coolant to cool the reactor core even when the inner reserve tank of the emergency core cooling system is not available. The availability of the emergency cooling tank and makeup water, the NBSR loss-of-coolant accident analysis, and the safety analysis for natural convection operation shows that the reactor can continue to operate safely even with the lower coolant level during the refueling process. Therefore the NRC staff concludes that the change will continue to ensure safe facility operation and is acceptable.

<u>2.3.6 3.7, “Radiation Monitoring Systems and Effluents”</u>

The current TS 3.7.1(2) states:

> (2) One fission product monitor is operable or sample analysis for fission product activity is conducted daily.

The proposed TS 3.7.1(2), as reformatted by the NRC staff to change “1” to “[1]”, states:

> (2) One fission product monitor is operable or sample analysis for fission product activity is conducted daily, [1]

The proposed annotation [1] to TS 3.7.1(2) states:

> [1]Operability of the monitor specified in (2) above is not required for operation permitted by the specifications in Section 2.2(4) since the fission product monitor is neither operable nor needed without forced primary coolant flow.

The proposed change would add a note to TS 3.7.1(2) that allows the listed monitor to be inoperable in the natural convection mode at up to 10 kW. When operating in natural convection cooling mode permitted by TS 2.2(4), the fission product monitor identified in TS 3.7.1(2) is not capable of performing its function because primary flow is necessary to operate the helium sweep gas system which would carry fission products through the monitor. Because there is no helium flow when the helium sweep gas system is inoperable during operation under TS 2.2(4), the fission product monitor would not detect fission product activity in the core.

Based on its review, the staff finds that when operating in natural circulation mode under TS 2.2(4) the fission product monitor is not capable of performing its function without primary flow. The licensee’s safety analysis of natural convection operation in accordance with TS 2.2(4) demonstrated that fission products cannot be detected, thus, a requirement that the fission product monitor be operable is not needed for safe operation. In the unlikely event of a fission product release from the fuel, the release would be detected when primary flow and helium sweep gas were reestablished. Therefore the NRC staff concludes that the change will not affect safe facility operation and is acceptable.

2.3.7 TS 4.7.1, "Monitoring System"

The current TS 4.7.1 states:

4.7.1 Monitoring System

Applicability: Radiation monitoring equipment

Objective: To operability of radiation monitors.

The proposed TS 4.7.1 states:

4.7.1 Monitoring System
Applicability: Radiation monitoring equipment

Objective: To ensure operability of radiation monitors.

The proposed change would add the word "ensure" to make the statement under "Objective" understandable.

Based on its review, the NRC staff finds that this editorial change clarifies the objective of the TS which is to ensure that radiation monitor are operable to monitor radiation exposure in accordance with 10 CFR 20.1502 and is therefore acceptable.

2.3.8 TS "Figure 6.1"

TS Figure 6.1 is the licensee's organization chart. The proposed change to TS Figure 6.1 would correct a line of reporting between the NBSR Health Physics and the Director, NIST Center for Neutron Research. The current TS Figure 6.1 does not show an "Administrative Reporting Channel," but shows reporting of "Recommendations and Technical Advice." The proposed figure changes this channel to "Administrative Reporting Channels," a direct reporting channel. Thus, the dashed line between the NBSR Health Physics box and the Director, NIST Center for Neutron Research box would be changed to a solid line to reflect this reporting change. This change will reflect the reporting channel that has been the actual reporting practice between the NBSR health physics and the reactor director.

The current TS Figure 6.1:

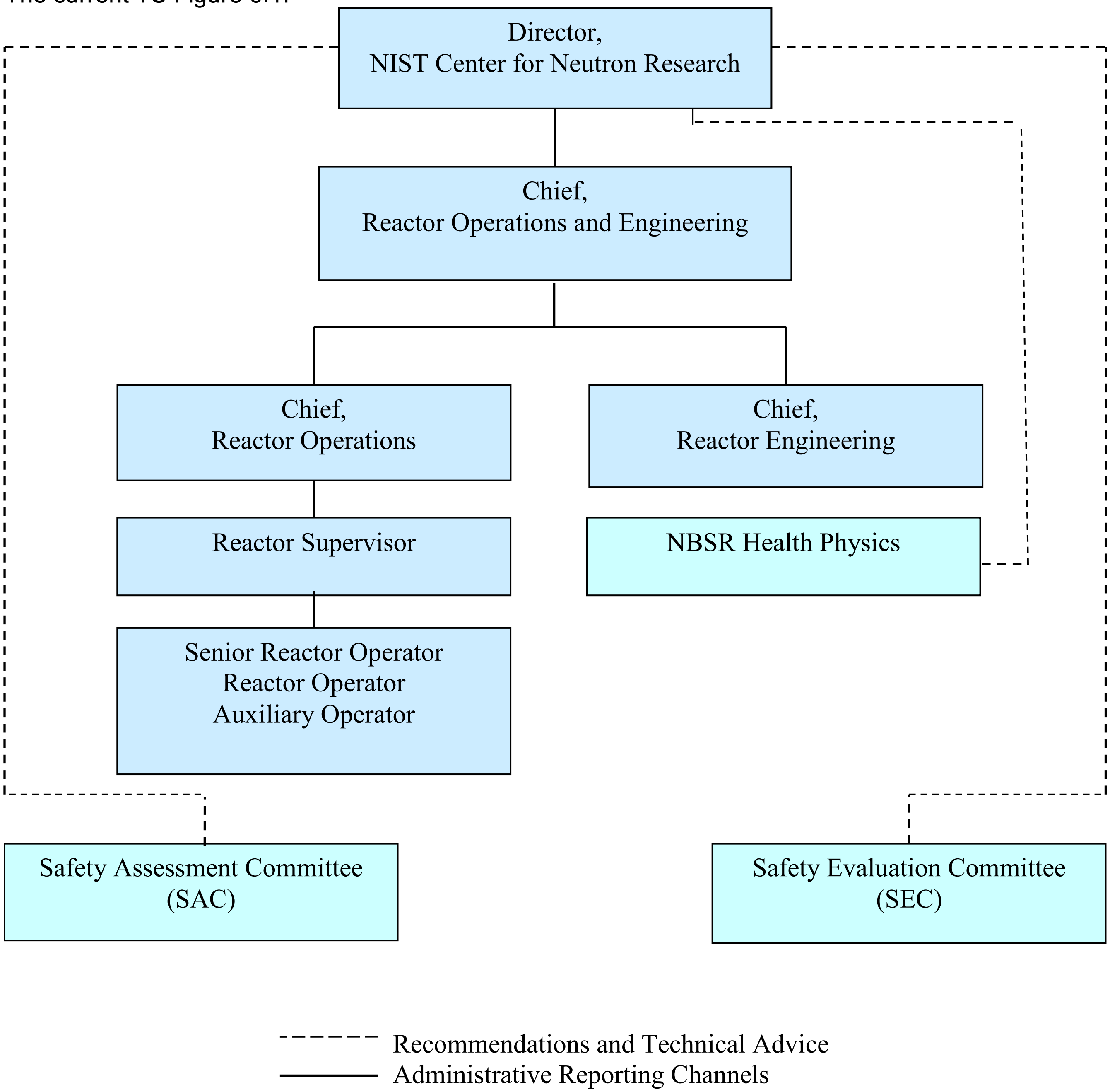


Figure 6.1

The proposed TS Figure 6.1:

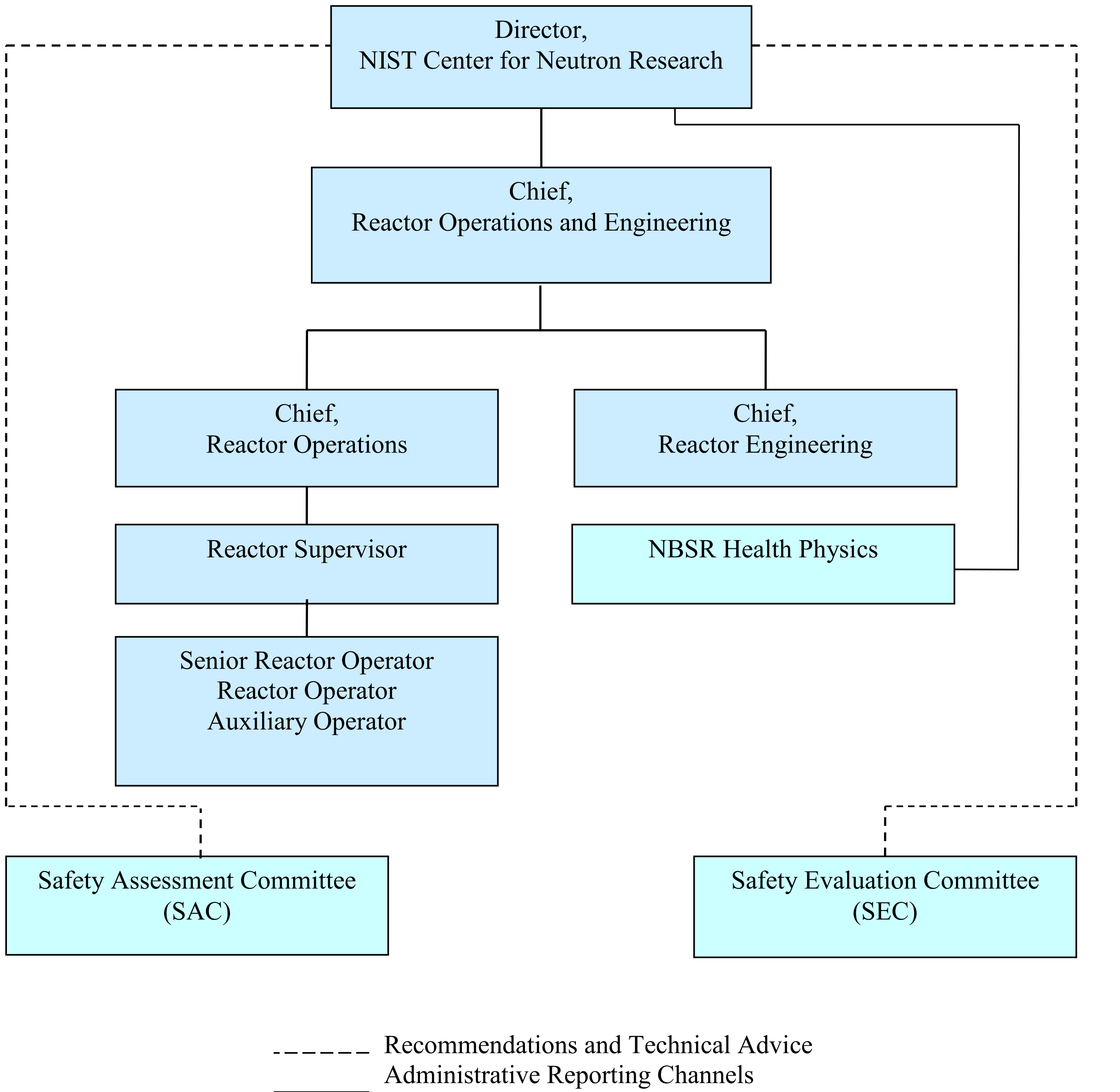


Figure 6.1

Based on its review, the NRC staff concludes that the change requires a direct administrative reporting function for the licensee's health physics in the organization and is consistent with the licensee's actual practice. NBSR health physics directly reports any radiation safety issues and concerns to the director. The NRC staff concludes that the change is corrective in nature, is consistent with the ANSI/ANS-15.1 standard that radiation safety personnel report to higher management in the organization, and is acceptable.

2.3.10 Facility Operating License

The current license condition 2.B.3 states:

> Pursuant to the Act and 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," to possess and use a two-curie americium-beryllium neutron source for reactor startup.

The proposed license condition 2.B.3 states:

> Pursuant to the Act and 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material," to receive, possess, and use in connection with the operation of the reactor: (1) a two-curie americium-beryllium neutron source which may be used for reactor startup, and (2) up to a total of 8 curies of byproduct material (Atomic number 1 through 83) and up to 100 micro curies of americium-241, in the form of instrument calibration sources.

The licensee proposes that the license be changed to allow the licensee to receive, possess, and use the sources necessary for reactor-associated instrumentation calibration and testing in connection with operation of the reactor. The licensee states that the purpose of the change is to assure that the availability of sources needed to perform the surveillance required for the safe operation of the reactor is not dependent on a license external to the TR-5 license.

Based in its review, the NRC staff finds that the proposed change is consistent with safe operation of the reactor. It adds flexibility to the licensee's calibration and testing process between the two licenses held by the NIST (i.e., reactor license No. TR-5 and materials license No. SNM-362), and ensures that the licensee can receive and use adequate radioactive sources for instrument calibration and testing in connection with reactor operation. Therefore, the NRC staff finds that the change supports safe facility operations and is acceptable.

2.3.11 Conclusion

The NRC staff reviewed the licensee's proposed changes to Renewed Facility Operating License TR-5 and TSs 2.2, 3.1.3, 3.2.2, 3.3.1, 3.3.2, 3.7.1, 4.7.1, and TS Figure 6.1 related to reactor operation, which are also part of the license. Based on its review, the NRC staff finds that the proposed changes to the TSs provide the licensee the flexibility to perform necessary startup testing and requires a direct reporting function for the health physics organization. The proposed TS changes ensure facility operation during natural convection coolant flow is consistent with the SAR to prevent future potential violations when performing reactor startup testing procedures that have been approved by the licensee in accordance with the requirements of TS 6.4. The proposed change to TS Figure 6.1 emphasizes the health physics function in the Organization. Based on the staff's evaluation, the staff finds that the amendment does not change how the licensee is performing its subcritical and critical testing procedures after shim arms replacement, and the situations involving the testing procedure have been well analyzed. Because the TSs revisions evaluated above would result in the revised TSs continuing to include TS safety limits that the SAR shows are necessary to reasonably guard against the uncontrolled release of radioactivity; limiting conditions that specify the lowest functional capability required for safe operation; surveillance requirements related to test, calibration, and inspection to assure that necessary component quality is maintained; and administrative control measures that assure operation of the facility in a safe manner, NRC staff finds that proposed TS changes meet the requirements in 10 CFR 50.36(c)(1), (2), (3), and (5). In addition, the proposed changes to Facility Operating License TR-5 would authorize the licensee to receive, possess, and use radioactive sources needed for the reactor instrumentation calibration. Therefore, the staff finds the proposed changes in the LAR acceptable.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Maryland State official was notified of the proposed issuance of the amendment on September 14, 2017. The State official did not provide any comments.

4.0 ENVIRONMENTAL CONSIDERATION

The amendment involves changes to the TS requirements to allow testing after shim arms replacement of the reactor. The amendment also changes reporting requirements and modifies other requirements concerning the use and operation of the facility component located within the restricted area as defined in 10 CFR Part 20 and makes editorial, corrective and other minor revisions. The NRC staff has determined the amendment involves no significant increase in the amounts and no significant changes in the types, of any effluent that may be released offsite, and that there is no significant increases in individual or cumulative occupational radiation exposure. In addition, the NRC had previously issued a proposed finding in the *Federal Register* on September 12, 2017 (82 FR 42851), that the amendment involves no significant hazards consideration, and there has been no public comment on this finding. Accordingly, the license amendment meets the eligibility criteria for categorical exclusion in 10 CFR 51.22(c)(9) and (c)(10). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the license amendment.

5.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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Date: December 15, 2017