



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

DISMANTLING OF FACILITY AND DISPOSITION OF COMPONENT PARTS

MICHIGAN STATE UNIVERSITY

TRIGA RESEARCH FACILITY

FACILITY LICENSE NO. R-114

DOCKET NO. 50-294

1.0 INTRODUCTION

By application dated January 20, 1989, as supplemented on May 4, 1989 (response), the Michigan State University (licensee) submitted a plan that requested authorization to dismantle the 250 kilowatt (thermal) TRIGA reactor located at East Lansing, Michigan, to dispose of its components parts and radioactive material, and decontaminate the facility. The objective of this plan is to terminate the license of the Michigan State University Research Reactor (MSURR) facility, and to return the facility to unrestricted use. The MSURR was shut down in October 1987, and has not been operated since then. The reactor fuel for the MSURR has been removed from the facility and shipped to Department of Energy facilities in accordance with DOE, NRC, and DOT requirements.

The staff review considered management responsibilities and commitments to follow applicable regulations, relevant regulatory guides and standards, the health physics program, including procedures, equipment, instrumentation, survey techniques, training, personnel dosimetry, waste disposal and the final survey. The acceptance criteria used by the staff are stated in Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors," and additional criteria were extracted from the general principles of Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Exposures at Nuclear Power Stations Will Be As Low As Reasonably Achievable (ALARA)," (Revision 4, February 1984). The format of the evaluation is in accordance with the Office of Nuclear Reactor Regulation document entitled, "Guidance and Discussion of Requirements for an Application to Terminate a Non-Power Reactor Facility Operating License," (Revision 1, September 15, 1984).

1.1 Plan Background and Management

The plan states that the radioactive wastes generated during reactor operation have been shipped offsite in accordance with regulatory requirements, and liquid wastes were decayed by storage in carboys and disposed to the sanitary sewer system in accordance with 10 CFR 20.303 limits. Residual radioactivities from the operation of the reactor include activation of the core components and surrounding structures. The radiological monitoring of the facility typically

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results in airborne activities on the order of 10^{-15} micro-Ci/cc and removable contamination on floors and work surfaces of 100 dpm/100 cm². Before the refueling in 1974, a leak was discovered in the aluminum cladding of a fuel element. Small amounts of radioactivity were released, and the facility was isolated and the reactor was shutdown. No contamination was found outside the reactor room, either on surfaces or in air samples. The total activity released to the reactor room was estimated to be 2.5 microcuries, and 99% of this activity was estimated to have been collected on the HEPA filter that was operating while the room was isolated. The leaky fuel element was identified and shipped offsite in 1974. The plan addresses the dismantling and decommissioning of the MSU TRIGA reactor facility which will be managed by the MSU staff and their contractor, Chem-Nuclear Systems, Incorporated. The plan supports the MSU application to voluntarily surrender the license (R-114) in the appropriate format and acknowledges responsibility to monitor the overall project and to ensure compliance with all applicable regulations. Furthermore, MSU will ensure that the dismantling of the facility and transfer and/or disposal will not be inimical to the common defense and security or to the health and safety of the public.

The staff finds this portion of the plan acceptable.

1.2 Summary Description

The MSU TRIGA reactor is in room 184 of the Engineering Building located at the corner of Shaw Lane and Engineering Road on the main campus of MSU in East Lansing, Michigan. The reactor is a pool type, rated at 250 KW (th) with a 24 foot 8 inch reactor pit sheathed with 1/4 inch aluminum. The reactor pit is surrounded by ordinary concrete and supported with steel reinforced concrete on the bottom. On the north side, the basement level is below grade, and laboratories are on the first floor (above grade) level; on the east is an exterior wall that faces a parking lot and street; on the south, at the basement level, is a machine shop, and on the first floor are laboratories; on the west is a hall separating the reactor from faculty offices; and over the reactor on the second floor is a classroom. The plan summary contains a description of the principle reactor design characteristics and support facilities and systems.

The operating license was issued on March 21, 1969. Most of the reactor operation was between 1969 and 1972. During the entire operation the total thermal output was approximately 735 MW hours with an integrated burn-up of 38.4 g U-235 or 2.0 g per average year. The operation of the reactor was terminated in October 1987. Since the space occupied by the reactor facility is desired for unrestricted use, DECON is the only alternative acceptable to MSU, and the total cost is estimated to be less than \$500,000. MSU has appropriated the necessary funding to support the decommissioning, however, a portion of the funding for the decommissioning is anticipated from Arkansas Technical University (ATU). ATU intends to install and re-use the reactor and will pay for the packaging and transportation of the salvaged equipment.

The plan has an outline for the timing of major tasks. The staff finds that the estimated durations of the major tasks are feasible, given the commitment of resources submitted in the response. Based on the commitment of the contractor to various quality assurance standards described in the plan, including ASME Boiler and Pressure Code Section VIII, ANSI N45.2, MIL-Q-9858A, 10 CFR 50, Appendix B, the staff finds the quality assurance plan acceptable.

The estimated total whole body collective dose for the decommissioning is 9.05 man-rem. The dose from beta particles will be controlled by surveys conducted by procedure, radiation work permits and increased monitoring for high specific activity particles (hot particles). In the response, MSU committed to minimizing radiation exposure by careful pre-planning, routine area surveys, tracking of personnel exposures, and a strong commitment to ALARA goals.

The plan describes the tasks to be performed by the contractor, and the termination radiation survey, as amended in the response meets the limits specified in Table 1 of Regulatory Guide 1.86.

The staff finds this section of the plan as amended by the response adequate and acceptable.

1.3 Facility Operating History

The staff concurs with the conclusion in the plan that no significant events in the operating history occurred which would inhibit the decommissioning of the reactor. Furthermore, the staff finds this section of the plan adequate.

1.4 Current Radiological Status of the Facility

As mentioned in the previous section, the air, floors and working surfaces are virtually free of radioactive contamination, since measured levels are indistinguishable from background. The plan categorizes radioactive sources in the reactor according to fixed activity resulting from neutron activation and secondly, contamination deposited on the surfaces of the reactor and its support systems. The plan identifies the radioactive components and materials in the reactor. Dose rates for various components were calculated on the basis of a comparison with an identical reactor at the University of Texas adjusted for relative integrated power. The highest calculated exposure rate (11.2 R/hr at 1 meter) is from the rotary specimen rack. Calculated exposure rates at 1 meter from other components are lower than the maximum value by four orders of magnitude. The exposure rate 1 meter above the reactor tank floor, including the reinforced steel, is estimated to be 10 mR/hr.

With regard to contamination, the highest levels are found at the ion exchange vessel and are 2.5 mR/hr at contact. Accessible areas of the facility have nominally background levels of contamination. A detailed baseline survey will be performed by the contractor to verify and fully characterize the radioactive environment on site.

In the response MSU provided detailed procedures (Radiological Control Procedure for Field Projects, CNSI FS-RP-001) which will be used in the decommissioning. These procedures provide for adequate surveys and controls of radiation exposures as discussed in Section 2.0 below.

The staff finds this section of the plan, in conjunction with the response, to be adequate.

1.5 Decommissioning Alternative

The plan describes consideration of alternatives other than DECON as inappropriate and not cost-effective. The staff concurs that given the physical location in the academic institution, that DECON is appropriate. MSU modified their release criteria and plan in the response. ENTOMB as an alternative is not desired, and the facility will be decontaminated to the levels specified in Table 1 of Regulatory Guide 1.86 and the nominal limit of 5 micro-R/hr above background will be applied.

The staff finds this section of the plan, as modified by the response, to be adequate.

1.6 Decommissioning Organization and Responsibilities

The plan and response identifies the key positions in the decommissioning organization and describes their functions. Lines of authority are established, and the key persons have acknowledged their roles and responsibilities in writing. The qualifications of personnel having major roles in safety have submitted statements of their qualifications. MSU and the contractor have a strong commitment to ALARA as evidenced in the plan and response.

The staff finds this section of the plan, as modified by the response, adequate.

1.7 Regulations, Regulatory Guides and Standards

MSU and the contractor have committed to ensuring full compliance with all federal and state regulations. The plan specifically lists applicable federal regulations, namely, 10 CFR Parts 19, 20, 30, 50, 51, 61, 71, 140; 29 CFR Parts 1910, 1926; and 49 CFR Parts 170-199. Furthermore, State of Michigan Health Standards, NRC Regulatory Guides (including 1.86) and ANSI Standards are specifically acknowledged. MSU is clearly aware of the need to meet applicable regulations.

The staff finds this section of the plan adequate.

1.8 Training and Qualifications

The plan divides the training into groups according to job function. The contractor's Project Manager and Corporate Health Physicist are responsible for ensuring that the qualifications of the personnel are met as stated by procedure. The staff finds that the personal qualifications of these individuals

appear adequate. An outline of the training program is contained in the same procedure, "Radiological Control Procedure for Field Projects, CNSI-FS-RP-001." The training standards include, but are not limited to, topics such as physics of radiation, biological effects, dosimetry, contamination control, ALARA, individual responsibilities, and air borne radioactivity.

The staff finds this portion of the plan, as supplemented by the response, to be adequate.

2.0 OCCUPATIONAL AND RADIATION PROTECTION PROGRAMS

2.1 Radiation Protection Program

The radiation protection program is detailed in the plan and in the response. MSU has placed occupational and radiological worker health and safety as the top priority for the entire decommissioning project through programs established by the contractor. The objective of these programs include: ALARA; minimizing exposures to the public and environment; contamination control; accepted waste disposal; and safe shipping practices. The plan together with the response and established procedures describe the radiation protection program for the entire decommissioning in adequate detail. The descriptions include, among other things, criteria for controlling high specific activity, small, radioactive (hot) particles; respiratory protection; beta exposures; and maximum dose rates through shielding before disassembly of reactor parts. The authority and responsibility of each position is identified.

Further, the administrative limits for radiation exposures are listed as well as access controls and the radiation work permit procedures. The available equipment, instrumentation, associated ranges, and calibration quality assurance are described, as well as the methodology for conducting surveys and personnel monitoring. Overall, the staff finds the radiation protection program adequate for decommissioning.

2.2 Industrial Safety and Hygiene Program

MSU has committed, in the plan, to compliance with the following regulations: 29 CFR Part 1910, "Occupational Safety and Health Standards," and 29 CFR Part 1926, "Safety and Health Regulations for Construction," as well as, "Occupational Health Standards" published by the State of Michigan Bureau of Environmental and Occupational Health (MIOSHA).

2.3 Contractor Assistance

As noted in the foregoing, MSU has contracted the entire decommissioning project to Chem-Nuclear Systems Incorporated while recognizing that the responsibility for health and safety during all aspects of decommissioning rests with the licensee.

The staff finds this section of the plan adequate.

2.4 Cost Estimate and Funding

The plan presents a cost estimate of the tasks and a commitment encumbering such costs.

3.0 DISMANTLING AND DECONTAMINATION TASKS AND SCHEDULES

3.1 Tasks

The plan includes a detailed task analysis, schedule of completion, and dose estimates for specific tasks. Details for decontamination, respiratory protection and contamination control are presented in the plan, the response and the radiation protection procedures. The total collective dose for this decommissioning is projected to be 9.05 person-rem.

The staff finds the aggregate of the plan, the response and the radiation protection procedures adequate for this section.

3.2 Safe Storage

Safe storage is not applicable to this decommissioning, since the facility will be decontaminated to the levels required for unrestricted use.

4.0 SAFEGUARDS AND PHYSICAL SECURITY

Since no fuel exists at the facility the physical security requirements will consist of access controls such as control of barriers and entrance points. During times when the reactor facility is unoccupied, security, such as locked doors, will be provided to prevent casual, inadvertent, and unauthorized entrance. The staff finds this section of the plan adequate.

5.0 RADIOLOGICAL ACCIDENT ANALYSIS

This analysis is not applicable, since the reactor has been defueled and the fuel has been shipped off site for the purpose of this SER.

6.0 RADIOACTIVE MATERIALS AND WASTE MANAGEMENT

The plan addresses the potential sources of both solid and liquid radioactive wastes and discusses disposal. Liquids will be processed for low level waste disposal or, if the conditions of 10 CFR 20.303 are met, released to the sanitary sewer. Potential sources of liquid radioactive waste are: reactor pool water; liquids from the decontamination of components and parts; liquids from decontamination of personnel; and liquids from the decontamination of structures and floors. Solid wastes will come from decontamination equipment, demolition materials and tools. Solid wastes will be appropriately packaged, sealed, surveyed, labeled and located in accordance with applicable regulations. These wastes will be disposed as radioactive wastes.

The licensee has committed to minimizing the volume of waste for disposal by minimizing the generation and by compaction and filling voids of non-compactable wastes with other wastes.

All operational reactor components, radioactive and nonradioactive, will be appropriately shipped to Arkansas Technical University.

The staff finds this section of the plan adequate.

7.0 PROPOSED TERMINATION RADIATION SURVEY PLAN

The plan describes the methodology and instrumentation for the final surveys. Basically, all the areas will be gridded and the density of surveys in the grids will increase in accordance with the likelihood of finding residual radioactivity. As clarified by the response, surveys will include analysis for surface contamination on the floor and walls of the reactor tank cavity as well as exposure-rate measurements. These latter measurements will be taken at approximately 1 meter above the center of the cavity floor. Surface contamination will be reduced to within the limits specified in Table 1 of Regulatory Guide 1.86. The nominal limit of 5 micro-Roentgen/hr above background at 1 meter from the surface will be applied to the exposure-rate measurement.

The staff finds this section of the plan, as modified by the response, to be adequate.

8.0 ENVIRONMENTAL CONSIDERATION

An environmental assessment and finding of no significant impact relative to the proposed action was published in the Federal Register on July 7, 1989. Pursuant to 10 CFR 50.32, the Commission has determined that the issuance of this Order will have no significant impact on the environment.

9.0 CONCLUSION

Based on the foregoing considerations, the staff concludes that the dismantling and decontamination operations can be conducted without undue risk to the health and safety of the public or workers, and without any significant impact on the public or the environment.

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