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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING ORDER AUTHORIZING DISMANTLING OF FACILITIES

AND DISPOSITION OF COMPONENT PARTS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

PLUM BROOK REACTOR AND PLUM BROOK MOCK-UP REACTOR

DOCKETS NOS. 50-30 AND 50-185

Introduction

By letters dated March 17, 1980, as revised by letters dated November 7, 1980 and February 23, 1981, NASA requested authorization to dismantle the Plum Brook Reactor and Plum Brook Mock-up Reactor, to dispose of the component parts and terminate Licenses Nos. TR-3 and R-93. The reactors are located at NASA's Plum Brook Reactor Facility near Sandusky, Ohio. In addition, NASA requested authorization to decontaminate the Plum Brook Hot Laboratory and Radiochemistry Laboratory. Both of these facilities are also located at the Plum Brook Reactor Facility. Decontamination of these laboratories was authorized on May 28, 1980, by Amendment No. 2 to Byproduct Materials License No. 34-06706-03.

Discussion

The Plum Brook Reactor is a 60 MWt light water moderated and cooled materials test reactor which operated from 1961 to 1973. After shutdown in January 1973, NASA placed the reactor facility in safe storage and License No. TR-3 was amended to "possess-but-not-operate" on July 26, 1973. The Plum Brook Mock-up Reactor is a 100 KWt swimming pool-type reactor which operated from 1963 to 1973. The Mock-up Reactor was also shutdown in January 1973, with the reactor put in safe storage and License No. R-93 amended to "possess-but-not-operate" on August 1, 1973.

All fuel from both reactors has been removed from the Plum Brook reactor site. The total integrated power for the Plum Brook Reactor was approximately 98,000 megawatt days and 0.2 megawatt days for the Mock-up Reactor.

NASA proposes to remove all radioactive material from the site during the dismantling operations. Nonradioactive structures will be left intact as much as possible.

Plum Brook Reactor

NASA estimates there are 167,000 curies of activation byproducts in the Plum Brook Reactor tank, of which 157,000 Ci are tritium fixed in the beryllium core components. The remaining activation in the reactor tank consists primarily of 7,340 curies of Fe-55 and 2,640 curies of Co-60 as of 6/30/78. The carbon steel reactor tank is stainless steel clad and is 9 feet in diameter and 31 feet high. Three concentric stainless steel thermal shields are located in the core region of the reactor tank.

All water has been drained from the primary and secondary systems and the storage canals. The reactor tank is encased in a biological shield of high density concrete varying in thickness up to 9 feet.

In addition to the radioactivity in the reactor vessel, there may be some radioactive contamination of the primary system, water storage tanks and a retention basin. All these areas will be decontaminated to levels acceptable to the NRC. Most accessible areas of the buildings have already been decontaminated. These areas will be resurveyed prior to license termination. No failures of fuel cladding or fueled experiments occurred during Plum Brook Reactor operations and, therefore, no fission products of significant quantity were observed in the primary water during reactor operations.

Mock-up Reactor

NASA estimated the Mock-up Reactor inventory to be 0.45 curies of activation byproducts. This activity consists of approximately 0.317 curies of tritium in the beryllium reflector and the remaining activity primarily Co-60 and Fe-55. The low activation inventory results in maximum exposure levels of 100 mr/hr or less on contact with the core components.

Evaluation

In this Safety Evaluation, we have considered (1) radiation exposure control for workers, (2) control of radiation release and (3) radiation levels acceptable for release to unrestricted access.

(1) Radiation Exposure Control

Health physics radiation protection will be under the cognizance of the NASA Plum Brook Radiation Safety Officer and the NASA Plum Brook Dismantling Safety Committee. The Radiation Safety Officer occupies a line organization position separate from the Project Office. Qualified Health Physics personnel will be at the site whenever dismantling activities are in progress to provide health physics support and supervision. The Radiation Safety Officer has the authority to enforce safe dismantling activities and to shutdown any operation on a question of

radiological safety or environmental health if immediate corrective action is not taken. Exposure control will be in accordance with 10 CFR Part 20 requirements and "As Low as Reasonably Achievable" (ALARA) principles. NASA states their goal as not only minimizing the dose to individual workers but also the collective dose to the entire Plum Brook decommissioning staff. The total radiation exposure estimated by NASA for dismantling operations is 117 man-rem. In addition, the waste disposal truck drivers are estimated to receive about 17 man-rem during shipment of the waste to a licensed burial facility. Respiratory protection devices[1] will be used where there is a potential for airborne activity. In addition, containment envelopes will be used. All work where airborne activity could be generated will have continuous air monitoring. A safe work permit system will be enforced by NASA for all dismantling tasks.

Access to the facility will be controlled by security personnel who will assure that a radiation dosimetry/identification badge is worn by all personnel in the facility. All equipment and materials leaving the facility will receive health physics clearance.

Special consideration to tritium monitoring will be given during the disassembly and handling of the tritium bearing beryllium reflector plates in both reactors. The beryllium plates will be unbolted and placed in shipping casks. If the plates are too large for the casks, they will be broken into smaller pieces by use of a special jig/tool or cut up under water with an electrical discharge machining (EDM) process. The EDM process involves melting of metal but no burning such as would be involved with a cutting torch.

During the Plum Brook Reactor operating period, irradiated tritium bearing beryllium plates were cut up underwater with an EDM system. The old plates had to be cut [illegible] that they could be removed from the grid structure without damaging the grid. There was no significant release of tritium to the water or air during the EDM cutting operation. Tritium in the reactor tank water and the air over the reactor tank remained below the maximum permissible concentration (MPC) levels specified in 10 CFR Part 20, Table II, during and following EDM cutting operations. If the plates are cut up with the EDM system during dismantling operations, the cutting process would be identical to that used during the reactor operating period.

We have therefore determined that radiation exposure control procedures proposed by NASA during dismantling operations are adequate to protect the workers and others at the Plum Brook facility.

(2) Control of Radiation Releases

Airborne particulate contamination will be controlled by: a) use of containment, b) air pressure gradients control zone isolation, and/or HEPA filtration suited to the dismantling activities. All work

[1] Regulatory Guide 8.15 will be followed.

involving the cutting of high level activated materials or removal of activated concrete will be done inside the existing containment building which will remain after the dismantling is complete. Respiratory protection will be used where there is a potential for airborne activity.[1]

Liquid waste will be minimized through controlling the volume of water used, using holding systems, filtration and ion exchange cleanup. Treated liquid wastes will be collected in the Plum Brook hold tanks and analyzed for radioactivity. Water will be released on a batch basis only after NASA has determined that the water meets 10 CFR Part 20 release limits and ALARA requirements and that further treatment will not appreciably reduce the radioactivity levels.

(3) Decontamination to Acceptable Levels

NASA must remove activitated and contaminated material to levels acceptable to the NRC before we will terminate the facility licenses. NASA will provide monitoring and sample data to demonstrate that they have reached levels acceptable to the NRC. A detailed report of the results of the final survey will be prepared and submitted to the NRC. The NRC Office of Inspection and Enforcement will independently survey the site to confirm license termination radiation levels.

During our review, we determined that the radiation limits for release of the Plum Brook Reactor Facility should be revised. By letter to NASA dated February 11, 1981, we specified release criteria that would be acceptable.

By letter dated February 23, 1981, NASA revised their dismantling plans for the Plum Brook and Plum Brook Mock-up Reactors to be consistent with our release criteria. NASA's revised criteria is therefore acceptable.

Conclusion

We have concluded, based on the considerations discussed above, that dismantling the Plum Brook Reactor and Plum Brook Mock-up Reactor and disposing of component parts as described in the dismantling plans will not be inimical to the common defense and security or to the health and safety of the public.

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[1] Regulatory Guide 8.15 will be followed.