



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE DISMANTLING OF FACILITY AND
DISPOSITION OF COMPONENT PARTS
THE UNIVERSITY OF VIRGINIA CAVALIER RESEARCH REACTOR
FACILITY OPERATING LICENSE NO. R-123
DOCKET NO. 50-396

1.0 INTRODUCTION

By letter dated February 26, 1990, as supplemented on June 17, 1991, the University of Virginia (UVA) submitted a request for authorization to dismantle and dispose of component parts of the Cooperatively Assembled Virginia Low Intensity Educational Reactor (CAVALIER), and to terminate Facility Operating License No. R-123. The CAVALIER reactor has been defueled and shut down since March 8, 1988.

2.0 EVALUATION

The staff has reviewed the UVA's plan to dismantle the CAVALIER research reactor located on the UVA campus in Charlottesville, Virginia. UVA operates a second nuclear research reactor, the University of Virginia Swimming Pool Reactor (UVAR) within the same building that houses the CAVALIER (Figures 1 and 2). The CAVALIER and the UVAR are two independent reactors and the normal operation of one does not affect the operation of the other. The UVAR is in a separate reactor room that can be isolated to provide confinement for its air space. The UVAR will remain in operation under Facility Operating License No. R-66 (Docket No. 50-62). The licensee has decided not to operate the CAVALIER and is seeking license termination to relieve the UVA staff from maintaining the facility license.

The staff's review of the Decommissioning Plan 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, and personnel dosimetry; waste disposal; and the final survey. The acceptance criteria used by the staff are stated in draft Regulatory Guides, (RG) 1005, "Standard Format and Content for Decommissioning of Nuclear Reactors," draft RG 1006, "Records Important for Decommissioning of Nuclear Reactor," RG 1.86, "Termination of Operating Licenses for Nuclear Reactors," and NUREG-0586 "Final Generic Environment Impact Statement on Decommissioning of Nuclear Facilities," August 1988.

9202100218 920203
PDR ADOCK 05000396
PDR

2.1 Facility Description and History

The CAVALIER reactor is located in a wing of the University of Virginia reactor building. This building also houses the UVAR, classrooms, offices, laboratories, and other support facilities for the Nuclear Engineering Department. Because the CAVALIER and UVAR use the same design fuel elements, the CAVALIER fuel elements were transferred to the UVAR license, and some of the elements are being used in the UVAR core. The core of the 100 watt CAVALIER reactor was made up of plate fuel elements from the UVAR that had not seen service in the UVAR.

The maximum CAVALIER reactor power level was set in the Facility Operating License at 100 watts. Over the past 10 years, the operation has been at a maximum power of about 60 watts. With a water level above the core of approximately 8 feet, measured dose rates have been obtained during operation at the top of the tank of about 4 mR/hr, and of less than 1 mR/hr in the general control room area. The CAVALIER was defueled on March 8, 1988, and the reactor tank was recently drained. A quantity of 2450 gallons of water was released to the onsite pond. The concentration of radioactivity in this water was below the (10 CFR Part 20) Maximum Permissible Concentration (MPC) for effluents in which the specific radionuclides are not known.

Between October 1974 and April 1984, the CAVALIER has been operated for 3347 W-hours on its original flat-plate Material Testing Reactor (MTR)-type fuel. Since April 1984 it has been operated for 230 W-hours on curved-plate fuel. The flat-plate fuel elements were transferred and used in the UVAR beginning in May 1984. These same elements had reached the end of their usefulness at the UVAR and were shipped in the early fall of 1987 to the Savannah River Plant for reprocessing.

2.2 Discussion

The licensee proposed to dismantle the CAVALIER reactor in accordance with their Decommissioning Plan. They intend to decontaminate the area below the radiation and contamination levels of RG 1.86 and the staff positions, as addressed in Section 2.2 of their Safety Analysis, for unrestricted access and use. The required essential support systems and services for the CAVALIER dismantling such as power, heat, water, communications, safety, and security will be maintained by virtue of the continuation of operations of the UVAR.

In completing the fuel removal process, all reactor components and all equipment which was in contact with the reactor fuel and start-up source were surveyed for contamination. A minor amount of fixed and removable contamination was found on some components. Most of these components have been decontaminated. All fixed radiation monitors and alarms will remain in operation. Presently, the entire building (Reactor Facility) is a restricted area, with a single access point for both reactors. Access to the Reactor Facility and the CAVALIER room will continue to be restricted during the entire decommissioning phase. If the proposed CAVALIER decommissioning and license termination is accepted by

NRC, the licensee may take the regulatory steps necessary to transfer the CAVALIER room to the UVAR Facility Operating License No. R-66 and maintain it as a restricted area under Facility Operating License No. R-66. This transfer would occur after the CAVALIER decommissioning, but before or at the time of the CAVALIER license termination.

2.3 Radiation Sources

The CAVALIER's 16 fuel elements, comprising of 2639 grams of U-235, have been unloaded and transferred to the UVAR Facility Operating License No. R-66. Some of the curved-plate elements from the CAVALIER were surveyed and it was determined that the highest dose rate from a typical element at 1 foot was 2mR/hr. The low exposure rate was indicative of the low burn-up of the fuel and the low flux in the reactor and the fact that the reactor had not operated since 1987. Because the flux and usage was so low, no significant contamination and/or activation has been found on the reactor fuel. However, a minor amount of fixed and removable contamination has been found on a few of the internal surfaces of the reactor that were in direct contact with the fuel. Most of these components have been decontaminated and sealed in plastic. The licensee may choose to transfer some CAVALIER components to the UVAR license for reuse. The UVAR license would be amended to accept this material prior to transfer. This transfer would occur prior to or at the time of CAVALIER license termination.

The CAVALIER's neutron source was a 1 curie Pu-Be source. It will remain at the Reactor Facility under the University's Byproduct Materials License No. 45-0003426.

The staff finds that the licensee's plan for controlling radiation sources is acceptable.

2.4 Health and Safety Management

The Radiation Protection Program for the Dismantling and Decommissioning Program is an extension of the existing Radiation Protection Program. The individuals directly responsible for the implementation and safety of the CAVALIER Decommissioning Plan are the Reactor Supervisors. They have 22 years of reactor experience at the UVA facility. The reactor supervisors will be responsible for the safe dismantling of the CAVALIER reactor, assuring that operations are conducted in a safe manner, within the limits prescribed by the facility license, federal regulations, the facility QA/QC plan, and the requirements of the Decommissioning Plan. They shall be advised by the Reactor Director on compliance matters and by the Radiation Safety Officer (RSO) and reactor health physicists. The RSO is a certified health physicist with five years experience in radiation safety. The licensee stated that it is their policy that all dismantling operations will be governed by the relevant federal, state and local regulations, regulatory guides, and standards associated with nuclear reactor dismantling, safety, radiological and environmental health, and industrial hygiene. The staff finds the above program to be acceptable.

2.5 Health Physics Program Objectives

The goal of the health physics program is to assure that the criteria for release of the facility and equipment therein for unrestricted use are satisfied and that this end product will be achieved with as low as reasonable achievable (ALARA) exposure to the workers and the general public. Health physics functions will be provided by the University of Virginia Reactor Facility staff. No contractor assistance is anticipated, as all waste that needs to be discarded can be performed as part of the University's low level waste disposal program. The radiation protection program will be in accordance with 10 CFR Part 20. Decommissioning practices will conform to Regulatory Guide 1.86.

The CAVALIER and its environs will be monitored during the decommissioning operation in the same manner as that in effect during the normal operating period. Additional monitoring will be performed and documented during the dismantling phase. The licensee intends to perform a closeout survey after all decommissioning activities are complete. The staff finds the above commitments to be acceptable.

In order to meet the guidance of draft RG 1006, the licensee has committed to having the capability to assure the accuracy of all measurements as part of their final report to the NRC. Reactor health physics personnel will be responsible for maintenance of radioactive exposure records, implementation of the environmental survey program, ensuring compliance with work procedures, training, and specific work tasks. Additionally, the RSO continues to be responsible for area and airborne radioactivity surveys; administering the respiratory protection program; assisting in decontamination of personnel, equipment and facilities; conducting radiation protection training; personnel dosimetry; and assuring that all personnel working in radiation areas properly utilize protective clothing.

The training program was recently evaluated by NRC Inspectors and found to be acceptable. (NRC Inspection Report Nos. 50-62/90-03 and 50-396/90-01).

Resumes were provided for all managerial personnel involved in decommissioning. The decommissioning organization is shown in Figure 3. The staff finds the above to be acceptable.

2.6 Dose Evaluation

The licensee has estimated that the collective dose equivalent expected for the entire decontamination/dismantling operation will be less than 0.5 person-rem. This estimation is based on the expected low levels of radioactivity from all sources and the manner in which staff members perform their tasks with the aim of maintaining personnel exposure to a minimum. The measures for assuring that the collective exposure will be ALARA and the estimate of collective dose equivalent are acceptable to the staff.

2.7 "Unrestricted Use" Release Criteria

The surface contamination criteria used by the NRC staff in past decommissionings of non-power reactors for release of areas for unrestricted use or unrestricted access are found in Regulatory Guide 1.86, Table 1. In addition, external exposure rates must be less than 5 $\mu\text{R/hr}$ above natural background at 1 meter from the measured surfaces. Alternately, for external exposure levels, if it can be shown, based on potential occupancy in the vicinity of the radiation source, that the radiation exposure guideline of 10 mR/yr would not be exceeded, then levels greater than 5 $\mu\text{R/hr}$ would be acceptable. The licensee has committed to these criteria and the staff finds this commitment acceptable for this specific site.

2.8 Radioactive Materials and Waste Management

The reactor fuel has been transferred to the UVAR; only minimal radioactive material in the form of activated metallic components remain. During the defueling process, all areas of the reactor vessel were surveyed by the licensee for contamination. No significant contamination was found. The licensee expects no releases of airborne contamination. The CAVALIER's tank water was analyzed for contamination and disposed of according to regulatory requirements. All swipes, gloves, filter papers, wiping papers, and rags were stored in a disposal barrel. All packaging and shipping of any low-level radioactive waste for transport and burial will adhere to 10 CFR Part 71, 10 CFR Part 20, and 49 CFR Part 173 thru 178, and the standards set forth by the CAVALIER "Radioactive Shipment Checklist."

The staff finds the above licensee practice for handling solid radioactive waste to be acceptable.

2.9 DECON

The selected decommissioning method is DECON. In this method, the CAVALIER reactor will be dismantled and any residual radioactivity of the reactor structure or its component parts removed or decontaminated to a level that permits the property to be released for unrestricted use.

3.0 ENVIRONMENTAL CONSIDERATION

An environmental assessment and finding of no significant impact relative to the proposed action was published in the Federal Register on January 31, 1992. Pursuant to 10 CFR 50.32, the Commission has determined that the issuance of the order will have no significant impact on the environment. (57 FR 3801)

4.0 CONCLUSION

Based on our review of the facility health physics organization, equipment, and procedures, the staff concludes that the licensee's health physics program follows the guidelines of RG 1.86 and the draft RGs 1005 and 1006 for providing adequate protection to assure a radiologically safe program for dismantling the CAVALIER reactor, disposing of associated radioactive

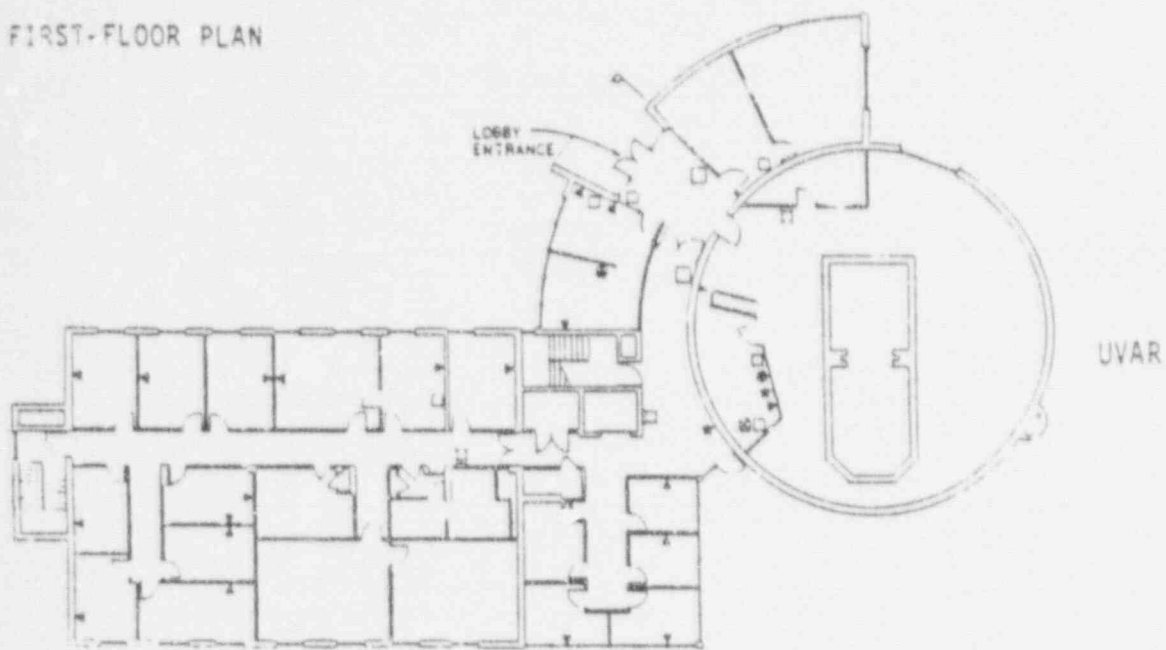
material, and decontamination for unrestricted use. The staff also concludes that the dismantling and decontamination operations can be conducted without undue risk to the health and safety of the public or the University of Virginia Reactor Facility staff and without any significant impact on the environment. The staff, therefore, finds the licensee's Decommissioning Plan to be acceptable.

Principal Contributors: J. Minns
A. Adams, Jr.

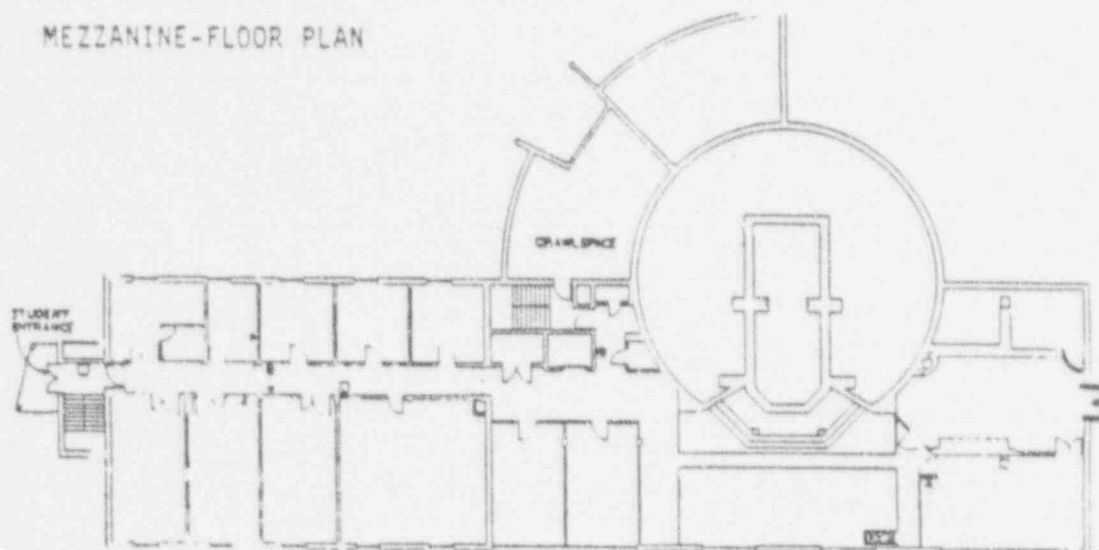
Attachments:
Figures 1, 2, and 3

Date: February 3, 1992

FIRST-FLOOR PLAN



MEZZANINE-FLOOR PLAN



GROUND-FLOOR PLAN

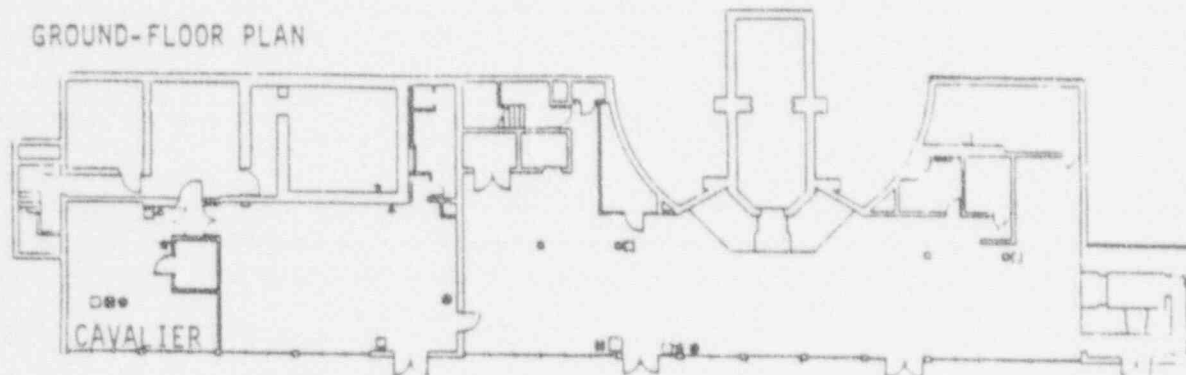


Figure 1 Plans for nuclear reactor facility

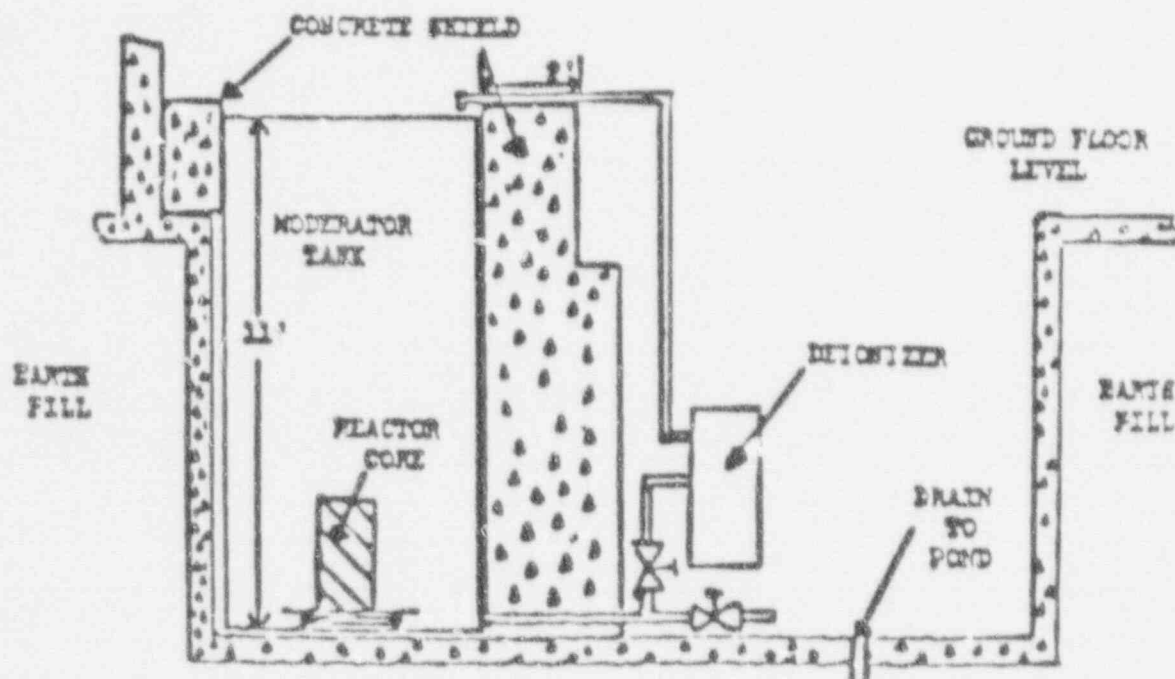
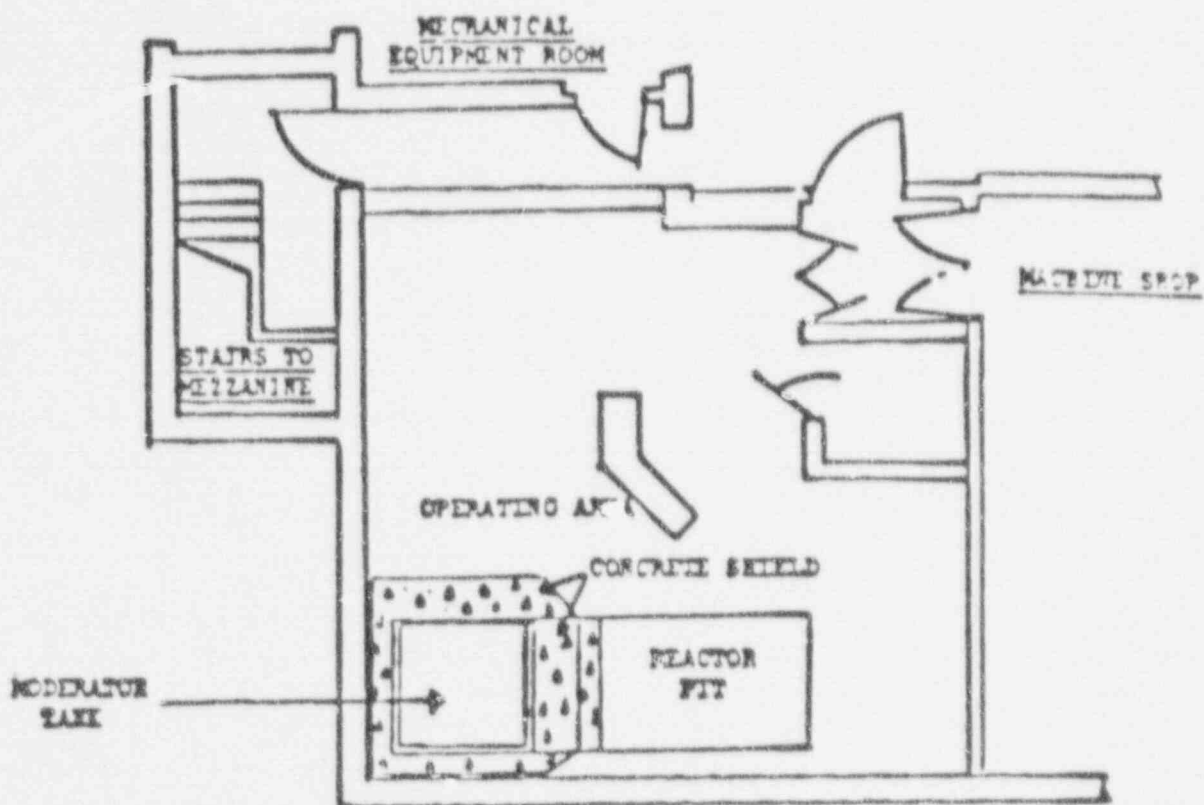


Figure 2 CAVALIER facility details

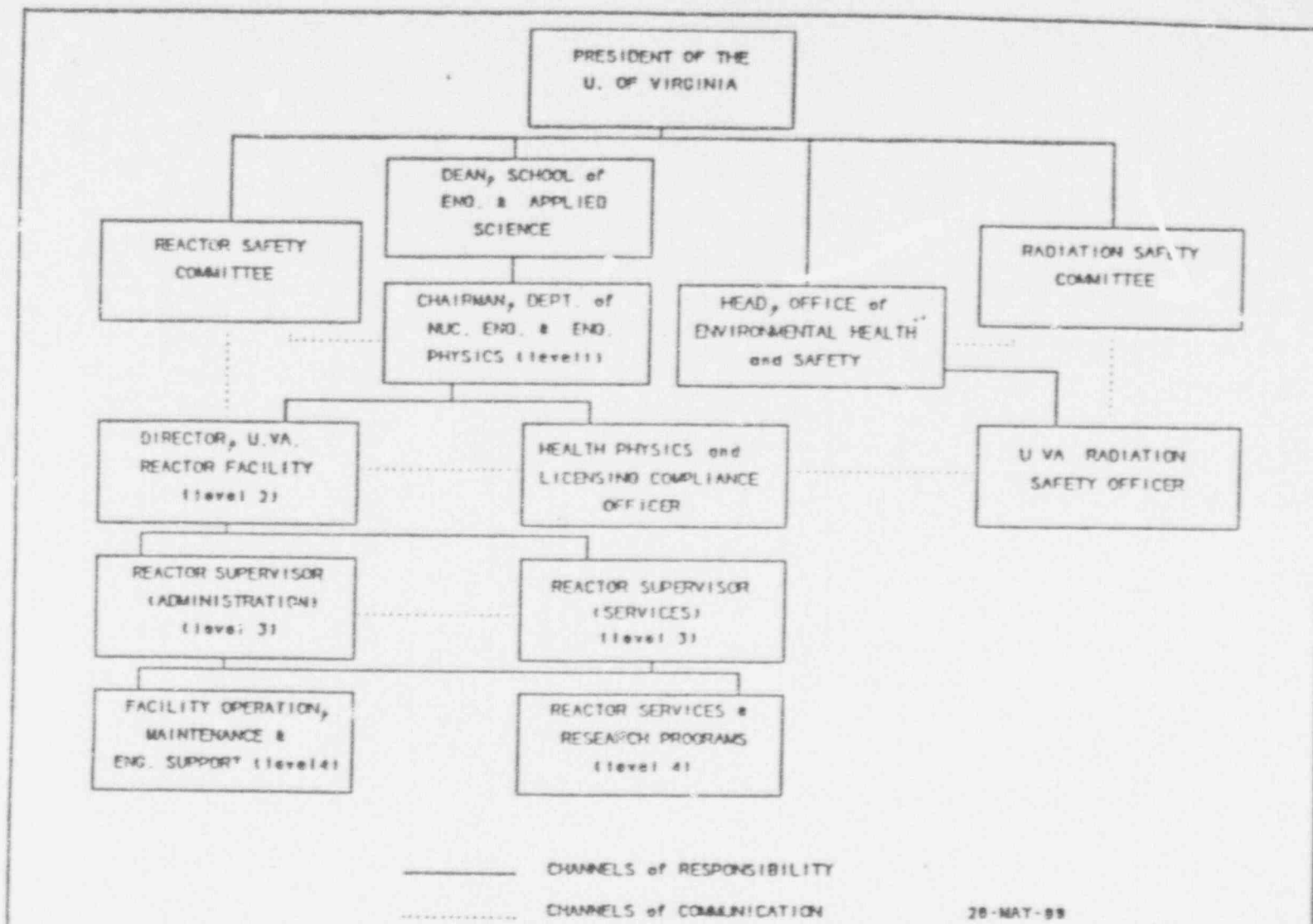


Figure 3 Organizational Structure of U.Va. Reactor Facility