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APPENDIX "B"

MEMORANDUM

The utilization facility proposed to be acquired and operated by the Texas Agricultural and Mechanical System, College Station, Texas (Texas A&M), is a small reactor of 100 milliwatt maximum power level constructed by Aerojet-General Nucleonics, San Ramon, California (AGN) and designated by the company as Model AGN-201, Serial No. 106. It is presently the subject of License R-13, issued to the manufacturer, Aerojet-General Nucleonics and License R-15 which authorizes acquisition and transfer of title to the reactor by AGN's parent, Aerojet-General Corporation.

A complete description and hazards analysis of the reactor are contained in license applications and amendments submitted by AGN in Dockets F-15, F-32, F-44, and 50-53. A summary of the reactor description and discussion of the hazards analysis by the Commission's staff are set forth in a memorandum accompanying the Notice of Proposed Issuance of Construction Permit for this reactor in Docket F-32 published in the Federal Register on February 6, 1957, 22 FR 742.

Description of Site

The reactor is to be located in a corner of the mechanical laboratory in the mechanical engineering shop building on the Texas A&M campus, College Station, Texas.

The floor of the room is reinforced concrete. There is one sink drain which connects with the college sanitary sewer system. Texas A&M states that approximately 18 students will occupy the mechanical laboratory at any one time, and that classes of 16 students will be in the adjoining welding shop.

A diagram of the first floor plan of the mechanical engineering shop building indicates that the reactor will be located in a 20 foot by 18 foot enclosure but no mention of this room is included in the building description. It is further noted that a window connects the reactor room with the welding shop. In order to insure security of the reactor when it is unattended, and to provide some degree of isolation in the event radioactive material is released near the reactor, the enclosure should be constructed to provide a solid separation from the remainder of the building and access to the reactor should be limited to an entrance capable of being locked.

Hazards Analysis

The hazards and safety features associated with this reactor were discussed in the aforementioned memorandum published in the Federal Register.

It is concluded from an examination of the potential hazards and conceivable mishaps that (1) no significant amount of radiation or radioactive materials would be released and no hazards to the public would ensue from the proposed operation and (2) there are no characteristics of the site or proposed operations at the Texas A&M campus which would detract from the safety of operation of the reactor.

Technical Qualifications

The reactor is proposed to be utilized primarily for the training of students in various fields of nuclear technology.

The organization which has been devised for operation of the reactor by Texas A&M places responsibility for the promulgation and enforcement of administrative rules, regulations and operating procedures on the Reactor Program Coordinator. In view of these important functions assigned to the Reactor Program Coordinator, the evaluation of the technical qualifications of Texas A&M to operate the reactor in a safe and competent manner must to a large measure rely on the qualifications of the individual in this position.

Texas A&M has employed as Reactor Program Coordinator Mr. Richard E. Wainerdi whose background in nuclear matters include his work toward a Master's and Doctor's Degree at Pennsylvania State University, completion of the Radioisotopes Handling Course at the Oak Ridge Institute of Nuclear Studies and completion of the course at the Oak Ridge Institute of Reactor Technology. In addition Mr. Wainerdi was employed as Coordinator of Nuclear Activities by Dresser Industries, Inc., and upon delivery of the reactor to Texas A&M he will complete AGN's reactor operator course.

Recognizing the importance of the Reactor Coordinator's position, Texas A&M amended its original application to provide that the reactor will be operated only under the responsible supervision of Mr. Wainerdi or an individual determined by the AEC to be of adequate capability for such supervision.

In view of the qualifications and position of Mr. Wainerdi and considering the less extensive/but varied backgrounds of various other members of the Texas A&M staff in nuclear matters, it is concluded that the College is technically qualified to operate the reactor.

Financial Qualifications

Texas A&M has received a grant from the AEC to cover the approximately $95,000 purchase price of the reactor. Annual operating expenses for the reactor are estimated to be $10,000. This is a minor portion of the Texas A&M budget which amounted to $19,700,000 in the 1956 fiscal year.

Conclusions

Based on the above considerations it is concluded that:

a. There is reasonable assurance that the health and safety of the public will not be endangered by operation of the reactor at the proposed sito on the Texas A&M campus.

b. Texas A&M is technically and financially qualified to engage in the proposed activities.

FOR THE DIVISION OF CIVILIAN APPLICATION

H. L. Price
Director

Date: AUG 6 1957

Transmitted w/ proposed Const permit 2-1-57

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MEMORANDUM

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PART I - DESCRIPTION OF THE PROPOSED REACTORS

The AGN-201 reactor is a small research reactor designed to operate at a maximum power of 100 milliwatts and corresponding flux of about 4.5×10^6 neutrons per square cm. per sec. The excess reactivity will be limited to 0.19% which would yield a minimum period of 15 seconds. The temperature coefficient of reactivity is calculated to be -3.6×10^{-4} per °C.

The core of the reactor will consist of UO_2 embedded in radiation stabilized polyethylene which serves as the moderator. The uranium is enriched 20% in the isotope U-235 and the critical mass will be between 550 and 700 g. U-235. The core will be made up of a series of discs, about 10" dia. and of varying thickness. The top section of the core will contain approximately half of the fuel. There will be a space at the top for core expansion and fission product gas accumulation. The bottom section contains the remaining fuel discs. It is held in place by a supporting mechanism hanging from the fuse link described below. In addition, the bottom section contains the safety and control rod thimbles. The core, including part of the graphite reflector, is enclosed in an aluminum tank which serves as the primary gas-tight container.

The reflector is 20 cm of high-density graphite on all sides of the core. Holes are provided for safety and control rods, glory hole and the four access ports. The core and reflector are surrounded by a 10 cm lead shield. Over the top lead shield is a tank which may be filled with water for shielding or with graphite when a thermal column is desired. All of the above components are enclosed in a steel tank which serves as a secondary gas-tight container.

The steel tank is surrounded on all sides by a fast neutron water shield tank which contains boric acid dissolved in water.

There are two safety rods and two control rods. The rods are made of the same UO_2 impregnated polyethylene as used in the core. Thus, reactivity is in-

creased as the rods are inserted into the core. The two safety rods and the coarse control rod when fully loaded control about 1.6% reactivity each. The reactivity may be reduced by replacing some of the fuel discs with pure polyethylene discs. The rods are inserted one at a time at the rate of 0.46 cm/sec., corresponding to a reactivity change of 3×10^{-4} per second for each safety rod and the coarse control rod. The fine control rod may be driven in at a slower speed.

The safety system is "fail-safe," in that a scram signal or power failure will open the holding magnets allowing the safety and coarse control rods to be accelerated downward and out of the core by both gravity and spring loading. The total withdrawal time is 150 milliseconds. The fine control rod is designed to control too little reactivity to be of practical value in a scram; consequently on receipt of a scram signal it is driven out of the core by its DC reversible motor at the rate of 0.46 cm/sec. When the reactor is shut down all rods are out of the core. Interlocks prevent locking of the safety rods unless the control rods are down, and the control rods cannot be moved in unless the safety rods are cocked (completely inserted in the core).

The fuse is an additional safety feature consisting of polystyrene impregnated with twice as much U-235 per unit volume as the core contains. It supports the bottom half of the reactor core and a section of the reflector. The higher loading density results in a higher rate of heat generation in the fuse than in the core, so that in the event of a power excursion the fuse will melt causing the lower part of the core to drop to the bottom of the core tank.

This separation of the core results in a reduction in reactivity of from 5 to 10 per cent.

The instrumentation comprises three neutron sensitive monitors (two linear and one logarithmic) determining power and flux levels and the period. Sensitrol relays have low and high-level scram contacts which require that the monitors respond to the Ra-Be startup neutron source before the reactor can be put into

operation, and which will scram the reactor any time the associated monitors fail to detect neutrons. The logarithmic monitor is equipped with a differentiating circuit; if the period is less than about three seconds, a fourth Sensitrol relay is tripped, scramming the reactor. The reactor is equipped with an earthquake scram assembly. Scrams also result from low water level, low water temperature or power failure.

The core and reactor tanks will be tested prior to loading for adequate gas-tightness by the halogen-type leak detecting method.

PART II - HAZARDS EVALUATION

The AGN-201 reactor operates at 100 milliwatts. Consequently, there will be an insignificant inventory of fission products in the reactor. Substantially all of the fission products that are produced will be retained in the solid core materials even in the event of the accident described below. However, some of the gaseous fission products may diffuse out of the UO_2-polyethylene matrix, but these will be retained in the sealed aluminum primary container which, in turn, is surrounded by the steel secondary container.

The temperature coefficient of reactivity was calculated by the applicant to be -3.6×10^{-4} per $^{\circ}C$. They also calculated that heat would flow rapidly from the UO_2 particles into the polyethylene. If 2% reactivity were inserted instantaneously (which seems impossible since only 0.2% is ever available above cold clean critical) into the reactor, it is stated by the applicant that the period would be about 10 milliseconds. These calculations are reasonable for a reactor of this design.

The applicant's calculations further show that the resultant power excursion of 1.7 MW-seconds would be terminated in about 204 milliseconds and would be self-limiting because of core expansion due to temperature rise. The temperature would rise about 110°C at the center of the core, and the average temperature of the core would rise about 71°C. Polyethylene does not melt below 200°C. We agree that

such a postulated accident is unlikely, and that in the event of such an accident, it is expected that the fission products would be kept within the core and primary and secondary containers.

The safety features of the control system and instrumentation, including the safety fuse system, are designed to shut down the reactor in the event of malfunction of equipment or personnel error.

We agree with the applicant's statement that normally, personnel next to the reactor (operating at 100 milliwatts) will receive a maximum gamma dose of about 0.2 millirem per hour or 8 mr/week. Even in the event of the highly improbable 1.7 MW-second accident described above, the total dose to a person standing next to the reactor would be about 1 rem.

For an extreme case such as a combined scram circuit failure, loss of shield water and the 1.7 MW-second excursion, a person next to the reactor would receive an exposure of about 200-300 rem of fast neutrons. Although an exposure of this magnitude would be received, this accident is due to the compounding of so many very slightly probable events that it is, in our opinion, barely conceivable. In view of these considerations we believe that the reactor should present no unacceptable hazard to operating personnel or to the public either during normal operation or during a conceivable accident.

Summary

Important safety features of the reactor include the low power (100 milliwatts) of the reactor and insignificant fission product inventory, the small (0.19%) excess reactivity, strong negative temperature coefficient (-3.6×10^{-4}), adequate containment, well-planned control system and instrumentation, and acceptable hazards relative to the maximum credible accident.

It may be concluded that there is reasonable assurance that the AGN-201 reactor as designed can be constructed and operated at the proposed San Ramon, California site without undue risk to the health and safety of the public.

In arriving at this conclusion, cognizance has been taken of the fact that an AGN Model 201 reactor, Serial No. 100, has been operated without incident by AGN pursuant to License R-6 issued October 19, 1956.

Operational tests on this reactor have proven the validity of preliminary calculations, shown that the control mechanisms function as described, and that the shielding attenuates the radiation from the core to within the tolerance set out in 10 CFR Part 20.

TECHNICAL QUALIFICATIONS

AGN has expanded its technical staff from that available to it at the time of its application in Docket No. F-15 for authorization to construct the AGN-201 reactor presently operated by it pursuant to License R-6. It now employs over forty personnel including some eighteen with technical degrees, one being a PhD and eleven others having Masters degrees. Of those having Masters degrees, five have majored in reactor engineering. Eight other of its employees have been trained in reactor engineering.

FINANCIAL QUALIFICATIONS OF APPLICANT

AGN is a subsidiary of Aerojet-General Corporation (AGC) which in turn is a subsidiary of The General Tire & Rubber Company. AGC has assumed financial

responsibility for the production of the three AGN-201 type nuclear reactors, serial numbers 101, 102 and 103. Upon the basis of the evidence in these proceedings, including the assumption of financial responsibility by AGC, it has been concluded that AGN is financially qualified to carry out the proposed activities in accordance with the requirements of the Commission regulations.

PART V - CONCLUSIONS

Based on the above considerations, it is concluded that:

a. There is reasonable assurance that the facilities proposed can be constructed and operated at the proposed site without undue risk to the health and safety of the public.

b. The applicant is technically and financially qualified to engage in the proposed activities.

FOR THE DIVISION OF CIVILIAN APPLICATION

Frank K. Pittman
Acting Director

Dated at Washington, D. C.
this 1st day of February, 1957.

SAFETY EVALUATION BY THE DIVISION OF REACTOR LICENSING

DOCKET NO. 50-59

TEXAS A&M UNIVERSITY (REVISED LICENSE) 2/26/69.

AMENDMENT NO. 8

INTRODUCTION

By application dated May 15, 1968, the Texas A&M University requested an amendment to Facility License No. R-23 which would (1) incorporate proposed Technical Specifications for the AGN-201 reactor into the facility license pursuant to Section 50.36(c) of 10 CFR Part 50, (2) approve a revised critical experiment based on experiences gained by previous performances of the experiment, and (3) authorize the performance of pulse neutron kinetic experiments using the AGN-201 reactor. Items (1) and (2) are considered in this evaluation. By letter dated January 4, 1969, the Texas A&M University withdrew its request for consideration of item (3).

DISCUSSION

The Technical Specifications proposed by the applicant include:

1. definition of key terms used in the specifications,

2. delineation of the facility's control and instrumentation systems important to reactor safety,

3. delineation of the limiting conditions for operation which define the lowest acceptable performance level for equipment, and the technical conditions necessary for continued safe operation,

4. requirements for surveillance of equipment which are essential to reactor safety,

5. administrative controls required for facility operation, and

6. delineation of the limiting safety system settings for those variables having safety significance.

These specifications set forth the requirements and limitations for reactor operation more clearly and precisely than the Hazards Summary Report, as amended (hereafter, safety analysis report (SAR)). Our

evaluation of the proposed Technical Specifications was based on the considerable experimental and operational experience accumulated on reactors of this type and power level, and on our review of the SAR which shows that all requirements significant to reactor safety are maintained. The Texas A&M University reactor has completed eleven years of safe operation under these safety requirements.

We have determined that the limits on reactor power, excess reactivity and reactivity worths of experiments provide sufficient assurance that an uncontrolled release of radioactivity will not occur. Furthermore, it is our conclusion that the safety system settings and the limits on plant equipment performance and plant technical characteristics, the specifications on surveillance of reactor components and systems, and the administrative controls will provide assurance of safe facility operation.

Amendment No. 5 to the facility license was issued to the Texas A&M University on April 27, 1962, authorizing the performance of core disassembly and critical loading experiments. The procedures and requirements for these experiments have been updated to include improvements developed from experience in performing the experiment. Provisions for these experiments and the review and approval of experimental procedures have been incorporated in the proposed Technical Specifications.

CONCLUSION

Based on the above discussion, we conclude that the incorporation of the proposed Technical Specifications, with minor modifications agreed to by the applicant, into Facility License No. R-23, does not involve significant hazards considerations different from those previously evaluated and that there is reasonable assurance that the health and safety of the public will not be endangered.

Donald J. Skovholt
Donald J. Skovholt
Assistant Director for Reactor Operations
Division of Reactor Licensing

Date: February 26, 1969

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

Transmitted with Amdt. 12 with new license & revised T/S

SAFETY EVALUATION AND ENVIRONMENTAL IMPACT APPRAISAL BY THE

OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 12 TO LICENSE NO. R-23

THE TEXAS A&M UNIVERSITY

DOCKET NO. 50-59

Introduction

By letter dated May 31, 1977, the Texas A&M University (the licensee) requested that Facility Operating License No. R-23 for their AGN-201M research reactor, Serial No. 106, be renewed for a period of twenty years. This would extend the expiration date of the license to August 26 ,1997. In response to our request, the licensee provided additional information in support of this renewal application by letters dated September 29, 1978, December 11, 1978 and December 18, 1978. The proposed revised Technical Specifications (TS) submitted with the renewal application have been modified to meet regulatory requirements. The modifications have been discussed with and accepted by the licensee.

Discussion

This AGN-201M reactor is located in College Station, Texas, and is of a design developed by Aerojet-General Nucleonics. The reactor was first licensed to operate on August 26, 1957, for a period of twenty years. The reactor is currently licensed to operate up to a steady state power level of 5 watts (thermal). A number of AGN-201M reactors have been licensed to operate at this power level and greater. Moreover, considerable operating experience to date indicates that the AGN-201M reactor parameters can be accurately predicted. No unusual problems have arisen or are anticipated from operation of the Texas A&M University AGN-201M reactor in the manner authorized by the license.

Reactor Description

The AGN-201 is a small research reactor designed to operate at power levels up to 20 watts. This type of reactor has been used extensively for education and training and for experimental programs requiring a low neutron flux level. The reactor core consists of a number of polyethylene disks impregnated with uranium dioxide

enriched in U-235. The inherent design features of this reactor and the low power level at which it is operated preclude the buildup of significant amounts of fission products.

I. Safety Evaluation

The present facility has not significantly changed from that described in the licensee's application for Amendment No. 9, February 4, 1972, when the reactor was moved to its permanent location in the Engineering Center Building on the licensee's campus at College Station, Texas.

By virtue of their power, negligible fission product inventory and strong negative temperature coefficient of reactivity, the AGN-201 reactors do not present significant hazards to the public. Their safety and reliability have been demonstrated in several facilities for many years.

The proposed TS have been reviewed and revised. The TS generally incorporate the design features, characteristics, and operating conditions described in the original Hazards Summary Report for the AGN-201 Reactor (1) submitted in support of Dockets F-15 and F-32 and referenced in the licensee's application. Inclusion of comprehensive surveillance requirements and administrative controls will assure acceptable performance of safety related equipment and require safety related reviews, audits, and operating procedures. Record keeping and reporting requirements will provide sufficient information to permit an assessment by the Commission of safety related activities and changes.

There are, however, several differences between the accompanying TS and the original AGN documentation. These are discussed below.

The AGN-201 Preliminary Design Report(2), submitted on the F-15 docket, mentioned thermal fuses in the control and safety rods and a boron-loaded polyethylene sheet surrounding the graphite reflector. The function of the thermal fuses in the control and safety rods was to cause the rods to fall from the core in the event of excessive temperatures produced in a nuclear excursion. They would, therefore, serve as a backup to the core thermal fuse which already serves as a backup to the normal scram system. The function of the boron-loaded sheet was to absorb thermal neutrons thereby reducing gamma ray production from neutron capture in the shield water and the resulting radiation level outside the shield.

These design features were not mentioned in subsequent submittals including the Hazards Summary Report(1), the AGN-201 Reactor Manual (3), and the Shield Design Report(4). They were not referred to in the original AEC Hazards Analysis(5) or subsequent safety evaluations. They were not incorporated into the assembled AGN reactors and are not included in the existing or proposed TS.

Many years of experience operating AGN-201 research reactors without thermal fuses in the control and safety rods and without a boron-loaded polyethylene sheet surrounding the graphite reflector has established that these reactors can operate safely, as assembled, at licensed power within acceptable radiation levels to both operating personnel and the general public. Based on our review and the above considerations, we have concluded there is reasonable assurance that operation without thermal fuses in control and safety rods and the boron-loaded polyethylene sheet referred to in the Preliminary Design Report will not endanger the health and safety of the public.

The original AGN-201 documentation [1-3] limited the total available excess reactivity to 0.2% $\Delta k/k$. As a result of a detailed test and evaluation conducted at Georgia Institute of Technology and subsequent NRC staff evaluation, AGN-201 reactor licensees were advised that increases in the excess available reactivity, including contributions from positive worth experiments, to 0.65% $\Delta k/k$ could be authorized. Because of the self-limiting action of the large negative temperature coefficient, an instantaneous reactivity insertion as high as 2.0% $\Delta k/k$ would not result in core damage or radioactivity release. Limiting the total available excess reactivity to 0.65% $\Delta k/k$ assures that the reactor will not become prompt critical and that the reactor periods will be sufficiently long such that the reactor protection system and/or operator action can effectively scram the reactor well before any safety limits are exceeded.

When converting from AGN-201 to AGN-201M for operation at 5.0 watts (Amendment No. 10), the staff evaluated a postulated most severe accident resulting from the instantaneous addition of 1.0% $\Delta k/k$ in reactivity. It was determined that a step reactivity addition of this magnitude would result in an energy release of 0.905 megajoules of energy. There would be no significant radiation damage to the polyethylene moderator from the excursion, and any fission products which diffuse from the UO_2-polyethylene matrix would be retained in the sealed core tank. Even assuming the most pessimistic release of fission products, no person would receive a dose in one week which would exceed the limits specified in 10 CFR Part 20 for restricted areas. We have concluded, therefore, that the postulated excursion will not endanger the health and safety of the public.

Experience with similar reactors has indicated that gaseous fission products and hydrogen are released from the fuel matrix when operated at 20 watts. Texas A&M recognizes that gas evolution could occur as a result of operation at 5 watts for extended periods and there could be a pressure buildup within the core tank or control rod cans. To preclude such a pressure buildup, Texas A&M has provided an alarm when the core tank pressure reaches 5 psig. If the core tank pressure reaches 5 psig, the reactor will be scrammed manually and flux, temperature, radiation levels, and pressure observed. If the pressure reading remains abnormal, the head of the Nuclear Engineering Department or his designated alternate will be notified. If a high level of fission gas activity is observed, appropriate radiological procedures will be followed during the opening of the core tank to preclude exposure to personnel from the release of radioactive effluents. We have concluded that the proposed precautions are acceptable measures to prevent excessive

personnel exposures or pressure buildup within the reactor core tank due to the production of radioactive gases; and that for the normal operating cycle experienced over the past 20 years of operation, it is very remote that any gas evolution will occur.

The fuel consists of polyethylene material with uranium dioxide (enriched to less than 20% in U-235) uniformly dispersed throughout the polyethylene. Polyethylene is an organic material that can sustain radiation damage when exposed to fission product bombardment. Test data was provided by Aerojet-General Nucleonics of samples of core material exposed in the Argonne National Laboratory CP-5 reactor. The CP-5 reactor is a 5 megawatt (flux-10^{12} n/cm^2-sec) reactor. Tests included exposures at full power for periods up to one week continuous operation. Analyses of these tests revealed that radiation damage was evident in a reduced density and there was some loss of hydrogen from the polyethylene. An extrapolation of these results, assuming that the integrated flux-time (nvt) is responsible for the damage, for continuous operation at 100 watts equates to a core life of six years prior to any damage occurring. At 5 watts continuous operation the core life would be approximately 120 years and at 0.1 watt continuous operation about 6,000 years. As the normal operating cycle is less than 40 hours per week, or less than 24%, the projected life approaches 25,000 years at 0.1 watt and 500 years at 5 watts. From this analysis it is reasonable to conclude that the AGN-201M core operating 40 hours per week at 5 watts (flux - 2.5 x 10^8 n/cm^2 - sec) would sustain no radiation damage over the 20 years of reactor operation requested by the licensee's application.

Moreover, due to the fact that: (1) no unusual problems have arisen during over 20 years of authorized operation at 0.1 watt(T) and 5.0 watts (T), (2) the revised TS require surveillance and periodic testing of safety related equipment to assure continued safe operation of the reactor and to assure that any significant component degradation will be detected in a timely manner, and (3) other AGN-201M reactors of this type also have considerable operating experience without evidence of any unusual problems, we have concluded that the Texas A&M University AGN-201M reactor can continue to be operated in a safe manner for the requested 20 year period. Furthermore, based on these considerations, we have concluded that the estimated useful life of the facility will extend at least to the end of the requested 20 year period. Therefore, from a reactor safety standpoint the proposed amendment is acceptable.

Furthermore, reactors virtually identical to this one with similar TS have been licensed for operation for periods of up to 40 years. Hence, the bases and conclusions with respect to the safety of operation that were determined in our Safety Evaluation supporting the original license, as amended, and in support of the current operating license, remain unchanged. The revised TS are more definitive than the original TS and will provide the necessary controls and surveillance requirements to ensure safe operation during the period of the license renewal.

The subject facility has been in operation since August 1957, for education and training and for experimental programs requiring a low neutron flux level. The current facility staff consists of 7 senior reactor operators with effective senior reactor operator licenses. Familiarity with the facility is maintained through facility operation and active programs in operator training and requalification.

II. Environmental Impact Appraisal

The environmental impact associated with operation of research reactors has been generically evaluated in the attached memorandum (Reference 6). This memorandum concludes that there will be no significant environmental impact associated with the licensing of research reactors to operate at power levels up to 2MWt and that no environmental impact statements are required to be written for the issuance of construction permits or operating licenses for such facilities. We have determined that this generic evaluation is applicable to operation of the Texas A&M University AGN-201M reactor and that there are no special or different features which would preclude reliance on the generic evaluation. Consequently, we have determined that the conclusion reached in the generic evaluation is equally applicable to this license renewal action and that an environmental impact statement need not be prepared. Furthermore, based on our review of specific facility items which are considered for potential environmental impact, discussed below, we have concluded that this license renewal action is insignificant from the standpoint of environmental impact.

Facility

There are no pipelines or transmission lines entering or leaving the site above grade. All utility services (water, steam, electricity, telephone and sewage) are below grade and are comparable to those required for typical campus laboratories. Heat dissipation is accomplished by radiation in a large water tank which serves as the heat sink and is a sealed unit. The reactor is designed as a sealed system, and in normal operation does not have any gaseous or liquid radioactive effluent. Solid, low-level radioactive waste generated in the research effort will be packaged in accordance with USNRC and DOT regulations and shipped for storage at NRC approved sites. The transportation of such waste will be done in accordance with existing NRC-DOT regulations in approved shipping containers. Chemical and sanitary waste systems are similar to those existing at other university laboratories and buildings.

Environmental Effects of Facility Operation

Release of thermal effluents from a reactor of 5.0 W will not have a significant effect on the environment. This small amount of waste heat is rejected to the surrounding water tank and eventually to the atmosphere by means of conduction and radiation. There will be no release of gaseous or liquid effluents. Yearly doses to unrestricted areas from external radiation will be at or below

established limits.* Solid radioactive wastes generated in the research program will be shipped to an authorized disposal site in approved containers. These wastes should not amount to more than a few shipping containers a year.

No release of potentially harmful chemical substances will occur during normal operation. Small amounts of chemicals and/or high-solid content water may be released from the facility through the sanitary sewer from laboratory experiments.

Other potential effects of the facility, such as esthetics, noise and societal or impact on local flora and fauna are expected to be too small to measure.

Environmental Effects of Accidents

Accidents ranging from the failure of experiments up to the largest core damage and fission product release considered possible result in doses of only a small fraction of 10 CFR Part 100 guidelines and are considered negligible with respect to the environment.

Unavoidable Effects of Facility Operation

The unavoidable effects of operation involve the fissionable material used in the reactor. No adverse impact on the environment is expected from these unavoidable effects.

Alternatives to Operation of the Facility

To accomplish the objectives associated with research reactors, there are no suitable alternatives. Some of these objectives are training of students in the operation of reactors, production of radioisotopes, and use of neutron and gamma ray beams to conduct experiments.

Long-Term Effects of Facility Construction and Operation

The long-term effects of research facilities are considered to be beneficial as a result of the contribution to scientific knowledge and training. There is no construction planned during the renewal period, and therefore, no construction is authorized under this licensing action.

Because of the relatively low amount of capital resources involved and the small impact on the environment very little irreversible and irretrievable commitment is associated with such facilities.

*10 CFR 20

The licensee's Operator Requalification Program has been reviewed and found to be acceptable.

Financial Considerations

Based on the Texas A&M's financial information submitted with the application dated May 31, 1977 and the additional information provided in response to NRC staff request of February 2, 1978, we have concluded that the licensee possesses or can obtain the necessary funds to meet the requirements of Section 50.33(f) of 10 CFR Part 50 and that the licensee is financially qualified to continue operation of the facility over the 20 year renewal period requested.

Emergency Planning

The Emergency Plan was submitted with the application dated May 31, 1977 and revised December 12, 1978, in response to NRC-staff guidance. We have reviewed the plan and conclude that it conforms to the requirements of 10 CFR Part 50, Appendix E and provides a basis for an acceptable state of emergency preparedness. A few questions arising from the review were satisfactorily responded to by the licensee March 23, 1979.

Security Planning

We have reviewed the current security plan submitted September 13, 1974, and find it acceptable to meet the requirements of 10 CFR Part 50, Section 50.34(c) and 10 CFR Part 73. This document and our evaluation findings are in the Commission's files and are withheld from public disclosure pursuant to the provisions of 10 CFR 2.790(d). This amendment, in keeping with current Commission practice, adds a paragraph to the license which identifies the currently approved security plan and incorporates the plan as a condition of the license.

Conclusion on Safety

We have 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, and (2) such activities will be conducted in compliance with the Commission's reulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Costs and Benefits of Facility and Alternatives

The monetary costs involved in operation of the facility are less than $5,000/year. There will be very limited environmental impacts. The benefits include, but are not limited to, some combination of the following: conduct of activation analyses, conduct of neutron radiography, training of operating personnel and education of students. Some of these activities could be conducted using particle accelerators or radioactive sources which would be more costly and less efficient. There is no reasonable alternatives to a nuclear research reactor for conducting this spectrum of activities.

Conclusion and Basis for Negative Declaration

Based on the foregoing analysis, we have concluded that there will be no significant environmental impact attributed to this proposed license renewal. Having made this conclusion, we have further concluded that no environmental impact statement for the proposed action need be prepared and that a negative declaration to this effect is appropriate.

Dated: April 25, 1979

References

1. "Hazards Summary Report for the AGN-201 Reactor," Aerojet General Nucleonics, February 1962 (see Docket F-15).

2. "AGN Model 201 Reactor, Preliminary Design Study," Aerojet General Nucleonics, May 1956 (see Docket F-15).

3. "AGN-201 Reactor Manual," Aerojet General Nucleonics, July 1957 (see Docket F-15).

4. "Shield Design for the AGN-201 Reactor," Appendix F to Reference 1, September 1956 (see Docket F-15).

5. AEC Memorandum accompanying License R-10, March 29, 1957 (see Docket F-32).

6. D. Muller to D. Skovholt memorandum "Environmental Considerations Regarding the Licensing of Research Reactors and Critical Facilities" dated January 28, 1974(attached).

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

JAN 28 1974

D. Skovholt, Assistant Director for Operating Reactors, L

ENVIRONMENTAL CONSIDERATIONS REGARDING THE LICENSING OF RESEARCH REACTORS AND CRITICAL FACILITIES

Introduction

This discussion deals with research reactors and critical facilities which are designed to operate at low power levels, 2 MWt and lower, and are used primarily for basic research in neutron physics, neutron radiography, isotope production, experiments associated with nuclear engineering, training and as a part of the nuclear physics curriculum. Operation of such facilities will generally not exceed a 5 day week, 8 hour day or about 2000 hours per year. Such reactors are located adjacent to technical service support facilities with convenient access for students and faculty.

Sited most frequently on the campus' of large universities, the reactors are usually housed in already existing structures, appropriately modified, or placed in new buildings that are designed and constructed to blend in with existing facilities.

Facility

There are no exterior conduits, pipelines, electrical or mechanical structures or transmission lines attached to or adjacent to the facility other than utility service facilities which are similar to those required in other campus facilities, specifically laboratories. Heat dissipation is generally accomplished by use of a cooling tower located on the roof of the building. These cooling towers are on the order of 10' X 10' X 10' and are comparable to cooling towers associated with the air-conditioning system of large office buildings.

Make up for this cooling system is readily available and usually obtained from the local water supply. Radioactive gaseous effluents are limited to Ar 41 and the release of radioactive liquid effluents can be carefully monitored and controlled. These liquid wastes are collected in storage tanks to allow for decay and monitoring prior to dilution and release to the sanitary sewer system. Solid radioactive wastes are packaged and shipped off-site for storage at AEC approved sites. The transportation of such waste is done in accordance with existing AEC-DOT regulations in approved shipping containers.

Chemical and sanitary waste systems are similar to those existing at other university laboratories and buildings.

Environmental Effects of Site Preparation and Facility Construction

Construction of such facilities invariably occurs in areas that have already been disturbed by other university building construction and in some cases solely within an already existing building. Therefore, construction would not be expected to have any significant affect on the terrain, vegetation, wildlife or nearby waters or aquatic life. The societal, economic and esthetic impacts of construction would be no greater than that associated with the construction of a large office building or similar university facility.

Environmental Effects of Facility Operation

Release of thermal effluents from a reactor of less than 2 MWt will not have a significant effect on the environment. This small amount of waste heat is generally rejected to the atmosphere by means of small cooling towers. Extensive drift and/or fog will not occur at this low power level.

Release of routine gaseous effluent can be limited to Ar 41 which is generated by neutron activation of air. This will be kept as low as practicable by minimum air ventilation of the tubes. Yearly doses to unrestricted areas will be at or below established limits. Routine releases of radioactive liquid effluents can be carefully monitored and controlled in a manner that will ensure compliance with current standards. Solid radioactive wastes will be shipped to an authorized disposal site in approved containers. These wastes should not amount to more than a few shipping containers a year.

Based on experience with other research reactors, specifically TRIGA reactors, operating in the 1 to 2 MWt range, the annual release of gaseous and liquid effluents to unrestricted areas should be less than 30 curies and 0.01 curies respectively.

No release of potentially harmful chemical substances will occur during normal operation. Small amounts of chemicals and/or high-solid content water may be released from the facility through the sanitary sewer during periodic blowdown of the cooling tower or from laboratory experiments.

Other potential effects of the facility, such as esthetics, noise, societal or impact on local flora and fauna are expected to be too small to measure.

Environmental Effects of Accidents

Accidents ranging from the failure of experiments up to the largest core damage and fission product release considered possible result in doses of only a small fraction of 10 CFR Part 100 guidelines and are considered negligible with respect to the environment.

Unavoidable Effects of Facility Construction and Operation

The unavoidable effects of construction and operation involves the materials used in construction that cannot be recovered and the fissionable material used in the reactor. No adverse impact on the environment is expected from either of these unavoidable effects.

Alternatives to Construction and Operation of the Facility

To accomplish the objectives associated with research reactors, there are no suitable alternatives. Some of these objectives are training of students in the operation of reactors, production of radioisotopes, and use of neutron and gamma ray beams to conduct experiments.

Long-Term Effects of Facility Construction and Operation

The long-term effects of research facilities are considered to be beneficial as a result of the contribution to scientific knowledge and training.

Because of the relatively low amount of capital resources involved and the small impact on the environment very little irreversible and irretrievable commitment is associated with such facilities.

Costs and Benefits of Facility and Alternatives

The costs are on the order of several millions of dollars with very little environmental impact. The benefits include, but are not limited to, some combination of the following: conduct of activation analyses, conduct of neutron radiography, training of operating personnel and education of students. Some of these activities could be conducted using particle accelerators or radioactive sources which would be more costly and less efficient. There is no reasonable alternative to a nuclear research reactor for conducting this spectrum of activities.

Conclusion

The staff concludes that there will be no significant environmental impact associated with the licensing of research reactors or critical facilities designed to operate at power levels of 2 MWt or lower and that no environmental impact statements are required to be written for the issuance of construction permits or operating licenses for such facilities.

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UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-59

TEXAS A&M UNIVERSITY

NOTICE OF RENEWAL OF FACILITY OPERATING LICENSE

AND NEGATIVE DECLARATION

The U. S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 12 to Facility Operating License No. R-23, issued to the Texas A&M University (the licensee), which renews the license for operation of the AGN-201M nuclear research reactor (the facility) located in College Station, Texas. The facility is a research reactor that has been operating since August 26, 1957, and is currently licensed to operate at 5.0 watts (thermal). The amendment is effective as of its date of issuance.

The amendment extends the duration of Facility License No. R-23 until August 26, 1997.

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Notice of the proposed issuance of this action was published in the FEDERAL REGISTER on September 8, 1977 (42 FR 45046). No request for a hearing or petition for leave to intervene was filed following notice of the proposed action.

The Commission has prepared an environmental impact appraisal for the renewal of the Facility Operating License and has concluded that an environmental impact statement for this particular action is not warranted because there will be no significant environmental impact attributable to the action.

For further details with respect to this action, see (1) the application for amendment dated May 31, 1977, as supplemented September 29, December 11, December 18, 1978, and March 23, 1979, (2) Amendment No. 12 to License No. R-23 and (3) the Commission's related Safety Evaluation and Environmental Impact Appraisal. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, N. W., Washington, D. C.

A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Director, Division of Operating Reactors.

Dated at Bethesda, Maryland, this 25th day of April 1979.

FOR THE NUCLEAR REGULATORY COMMISSION

Robert W. Reid

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