6/20/79

Ray,

Per our conversation yesterday. [illegible] do not take the figures associated with licensed and reactors as being absolutely correct yet.

Don

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

MEMORANDUM FOR: Chairman Hendrie
Commissioner Gilinsky
Commissioner Kennedy
Commissioner Bradford
Commissioner Ahearne

FROM: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

THRU: Lee V. Gossick
Executive Director for Operations

SUBJECT: REPORT ON THE SELF-PROTECTION CRITERION

On April 18, 1979 the Commission was briefed on the Safeguards Upgrade Rule that would require strengthened physical protection safeguards systems for fuel cycle facilities and transportation involving formula quantities of special nuclear material. As a result of the briefing, the Commission requested that the staff report on the ongoing program evaluating the 100 rems per hour at 3 feet rule (10 CFR 73.6), including an analysis of:

(a) the original basis for this rule;
(b) the current validity of this rule, and;
(c) the impact of this rule on various licensed activities including non-power reactors, storage of spent fuel, and radioactive waste.

The following responds to this request.

Self Protection Study

The provisions of 10 CFR 73.6(b) exempt from most physical protection requirements special nuclear material which is considered "self-protecting" (Special nuclear material which is not readily separable from other radioactive material and which has a total external radiation dose rate in excess of 100 rems per hour at a distance of 3 feet from any accessible surface without intervening shielding...).

Contact:
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49-27014

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The NRR Self-Protection Study is an effort directed toward the verification of the self-protection criterion for non-power reactors and the investigation of the technical basis and validity of this criterion. The first phase of the study is the development of an industry standard for measuring or otherwise substantiating the ionizing radiation level associated with "self-protecting" special nuclear material used in non-power reactors. As this material is normally stored and handled under water, it is not readily verifiable as self-protecting.

In a letter dated June 9, 1978 (Minogue to William T. Cavanaugh, Managing Director, American Society for Testing and Material (ASTM)), the ASTM was requested to derive a standard which would: (1) define the basis for requiring a measurement of the dose rate and (2) define dosimetry techniques that are sufficiently accurate to measure the dose rate and maintain personnel exposure as low as practicable. The ASTM responded by forming a special task force chaired by Dr. Thomas Williamson from the University of Virginia. Drs. Williamson and Farrar of the University of Virginia have made in situ and air measurements of irradiated fuels. Drs. Burn and Cook of the University of Michigan have made in situ and air measurements in their hot cells. Dr. Koelling of Los Alamos Scientific Laboratory has analyzed various operating cycles and has predicted the time irradiated fuel would decay below the self-protecting dose rate. The task force has completed the majority of their analytical work and Dr. Williamson will forward the task force report in a few months to the NRC and ASTM for review.

The second phase of the Self-Protection Study has been directed toward investigating the technical basis and validity of the self-protection criterion. The staff has traced the self-protection criterion to the publication of the original rule for Physical Protection of Special Nuclear Material which appeared in the Federal Register, April 9, 1969. Discussions with members of the staff (Ong, Page, Jones, Minogue) indicated that the self-protection criterion was based on the deterrent effect of the radiation rather than the incapacitating effect.

Validity

The objective of the criterion is deterrence due to the possible dose received by an adversary. Initially, only a single adversary was considered and the thinking was more in terms of an unorganized somewhat unsophisticated theft. With the current adversary characterization of determined and violent persons with equipment appropriate to their task, it is doubtful that the stated dose rate would be a deterrent to such a group.

The current threat perception considers a group consisting of several persons; therefore, the dose per person would be much less. Also, the group would be expected to have equipment to shield the material in a manner to eliminate or reduce the dose received. Further, the dedication of the persons involved is perceived as such that receiving a radiation dose would be immaterial. On this basis, it must be concluded that the 100 rems per hour at 3 feet criterion is no longer an appropriate self-protection criterion.

Worth noting is that power reactor spent fuels and high level radioactive waste generally have radiation levels considered to be self-protecting because it is beyond even the determined terrorist group to have equipment, i.e., shielded casks, that would permit theft of such material without serious incapacitation of personnel.

The dose rate from irradiated fuel from non-power reactors is generally less than 200 rems per hour at 3 feet and frequently less than 100 rems per hour at 3 feet. It is doubtful that these fuels can be considered self-protecting in the context of incapacitating the adversary.

Impact

73.60

Currently 22 (~~23~~) non-power ~~reactors~~ LICENSEES / 28 REACTORS, (Table I) are authorized to possess greater than a formula quantity of special nuclear material. Several require those quantities for day to day operation.

The present fixed site physical protection requirements for those licensees are contained in 10 CFR 73.50, Requirements for Physical Protection of Licensed Activities. These requirements do not apply to non-power reactors when the special nuclear material is either located in the core of the reactor or contained in irradiated fuel elements removed from the core with no reference to the radiation dose rate.

The Safeguards Upgrade Rule removes the exclusion from 10 CFR 73.50 for both fuel in a core and irradiated fuel removed from the core. It does (through other sections) continue to apply the self-protection criteria of 10 CFR 73.6 as an exemption. Consequently, only special nuclear material which has a external radiation dose rate in excess of 100 rems per hour at a distance of 3 feet is exempt from the requirement of the Safeguards Upgrade Rule.

The self-protection capability of the non-power reactors is tenuous. Therefore, some non-power reactors may be operated solely to irradiate the fuel to obtain the self-protection exemption. An extended shut-down for the majority of

these non-power reactors will result in the decay of the irradiated fuel below 100 rems at 3 feet and the subsequent loss of the self-protection exemption. In this situation the facility would be required to meet the requirements of the Safeguards Upgrade Rule. Also, since most of the non-power reactors are in a tenuous situation in maintaining the self-protection capability any significant increase in the self-protecting dose rate would exclude them from the exemption and require the majority of the affected non-power reactors to meet the requirements of the Safeguards Upgrade Rule.

The impact of the requirements of the Safeguards Upgrade Rule on the 23 affected non-power reactors would be severe. The financial expense alone of the upgrade requirements would force many of the affected non-power reactors out of operation. This would lead to a possible loss in U.S. nuclear research & training capabilities and might be in violation of the Atomic Energy Act & the President's Order.

Harold R. Denton, Director
Office of Nuclear Reactor Regulation

TABLE 1

NON-POWER REACTOR ~~FACILITIES~~ LICENSEES AUTHORIZED TO POSSESS GREATER THAN A FORMULA QUANTITY OF SPECIAL NUCLEAR MATERIAL

Babcock and Wilcox (2 reactors)

General Atomic (2 reactors)

General Electric Test Reactor (2 reactors)

~~General Electric NTR~~

Georgia Institute of Technology (2 reactors)

Massachusetts Institute of Technology

National Bureau of Standards

Oregon State University (2 reactors 1 is possession only - fuel is in storage) (being transferred to Northwestern).

Pennsylvania State University

Rensselaer Polytechnic Institute

Rhode Island AEC

Texas A&M University

Union Carbide

University of California at Los Angeles

University of Michigan

University of Missouri (Columbia)

University of Missouri (Rolla)

University of Virginia (2 reactors)

University of Washington

University of Wisconsin

Virginia Polytechnic Institute

Washington State University

Westinghouse Training Reactor