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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, DC 20555

May 25, 1984

IE INFORMATION NOTICE NO. 83-66, SUPPLEMENT 1: FATALITY AT ARGENTINE
CRITICAL FACILITY

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or construction permit (CP) and nonpower reactor, critical facility, and fuel cycle licensees.

Purpose:

This information notice is a supplement to IE Information Notice No. 83-66, issued on October 7, 1983. It is expected that nonpower reactor, critical facility, and fuel cycle licensees will review the information for applicability to their facilities. No specific action or response is required.

Description of Circumstances:

The Argentine National Atomic Energy Commission [Comision Nacional de Energie Atomica, (CNEA)] provided the NRC Office of International Programs with the written report documenting the results of the Commissions investigation and evaluation of the September 23, 1983 RA-2 accident near Buenos Aries. A translated copy of the CNEA report is attached.

No response to this information notice is required. If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC Regional Office or this office.

Edward L. Jordan Director
Division of Emergency Preparedness
and Engineering Response
Office of Inspection and Enforcement

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Attachments:

1. CNEA Report
2. Figure 1 Fuel Element
3. Figure 2 RA-2 reactor facility
4. Figure 3B Modified core configuration
5. List of Recently Issued IE Information Notices

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REPORT OF THE ACCIDENT THAT OCCURRED TO THE
CRITICAL ASSEMBLY RA-2 REACTOR ON SEPTEMBER 23, 1984

1. Description of the Installation

The RA-2 is a critical assembly reactor operating at 0.1 watt of rated power. It has been in operation since 1966 and is used to conduct experiments with various core configurations. For experiments, the core assembly can be relocated and/or modified. The core consists of MTR-type fuel elements and control rods. The fuel elements are MTR-type, 90% enriched uranium and consist of 19 fuel plates (see Figure 1). The control rods consist of fuel elements in which four of the fuel plates are replaced with two cadmium plates. Demineralized water is the moderator; and demineralized water and graphite constitute the reflector.

The installation is shown in Figure 2.

2. The Accident

On Friday afternoon September 23, 1983, a modification of the core configuration had been scheduled so that an experiment using the pulsed source technique could be conducted. Figure 3A shows the initial core configuration and Figure 3B shows the configuration as it was to be modified. The operating procedure requires the complete removal of the moderator. However, this was only partially done. A short time afterwards, when the exchange operations were being carried out, a criticality excursion

occurred.

The operator, who was the only person present in the containment, was fatally exposed; other persons, who were in the control room and other adjacent premises were exposed, but to a much lesser degree.

3. Analysis of the Accident

The President of the Comision Nacional de Energia Atomica (CNEA) (National Atomic Energy Commission, Argentine) appointed an ad hoc commission to investigate the accident. The conclusions of this commission indicate that the basic causes of the accident were as follows:

- (a) The moderator was not completely removed from the core before the core configuration was modified.
- (b) Two fuel elements, which should have been removed, were left inside the reactor in contact with the graphite reflector.

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- (c) Sequences were performed to change the positions of fuel elements; this decreased the subcriticality of the system
- (d) Two fuel elements of 15 plates were inserted without the corresponding cadmium control plates. The second fuel element was found to be only partially inserted, wherefore it is deemed that its insertion caused the accident.
- (e) All of the operations were performed without the concurrence or presence of a safety official or the operations supervisor.

The evolution of the power and the magnitude of the released energy are still being investigated. Notwithstanding, it is estimated that the excursion was about 10 megajoules, which is equivalent to approximately 3X 10¹⁷ fissions, which occurred during a few tens of milliseconds.

Also, the ad hoc commission identified shortcomings in the installation and operational procedures, as well as in the way approval was obtained and supervision of the experiments was carried out. Because the reactor had been operating for so many years without incident, an excessive degree of confidence had been fostered in regard to minor operations. In addition, other more urgent requirements of the nuclear program took precedence.

4. Dosimetric and Medical Evaluation

The dosimetric evaluations were based on (1) measurements of Na-24 to determine whole-body dose and of P-32 from samples of hair, (2) the gamma spectrometry analysis of the activated metal elements carried by the affected persons, and (3) the readings of the radiothermoluminescent and criticality dosimeters installed in the building.

The doses received by the exposed persons are as follows:

- (a) The operator received a lethal, absorbed dose of about 2000 rads of gamma radiation and 1700 rads of neutrons, which precluded any effective therapeutic measures. The amount of P-32 (resulting from the sulfur activation) found in samples of body hair and the operator's woolen clothing, as well as the clinical manifestations, showed that the exposure had been very nonhomogeneous; the doses received on the upper right side of the body were higher than those elsewhere. Approximately 25 minutes after the accident, the operator showed signs and symptoms (vomiting, migraine headache, and diarrhea) of acute exposure over the entire body. His condition became worse the next day when he suffered gastrointestinal disorders. Then early on September 25, neurological and respiratory disorders (radiopneumonitis in the right lung) and edema of the right hand and forearm manifested themselves. Death occurred at 16:45 on the same day.
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- (b) Two persons in the control room at the time of the accident received doses of about 15 rads of neutrons and 20 rads of gamma. At present, they are under medical supervision and have not shown any clinical signs.
 - (c) Five persons received a dose ranging from 4 to 8 rads of neutrons and 7 to 10 rads of gamma. They also are under medical supervision.
 - (d) One person received a dose of about rad of neutrons and 0.4 rad of gamma. Nine other persons received doses below 1 rad.
 - (e) The doses received by the affected personnel also are being measured by biological dosimetry techniques.