S90-081 151

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

March 23, 1990

MEMORANDUM FOR: James M. Taylor
Executive Director for Operations

FROM: Samuel J. Chilk, Secretary

SUBJECT: SECY-90-81 - SECTION 208 REPORT TO THE CONGRESS ON ABNORMAL OCCURRENCES FOR OCTOBER-DECEMBER 1989

This is to advise you that the Commission has not objected to the proposed report to Congress subject to the attached editorial corrections.

Accordingly, the report should be published and the letters and Federal Register notice should be forwarded for signature and transmittal.

(EDO) (SECY SUSPENSE: 4/17/90)

Attachment:
As Stated

cc: Chairman Carr
Commissioner Roberts
Commissioner Rogers
Commissioner Curtiss
Commissioner Remick
OGC
IG

NOTE: THE SRM AND THE SUBJECT SECY PAPER WILL BE MADE PUBLICLY AVAILABLE WHEN THE FEDERAL REGISTER NOTICE IS PUBLISHED.

Enclosure 1 152

DRAFT

IDENTICAL LETTERS TO:

The Honorable Danforth J. Quayle
President of the Senate
Washington, D.C. 20510

The Honorable Thomas S. Foley
Speaker of the United States
House of Representatives
Washington, D.C. 20515

Dear Mr. President:

Dear Mr. Speaker:

I am forwarding the Nuclear Regulator Commission's (NRC's) report on abnormal occurrences at licensed nuclear facilities or the fourth calendar quarter of 1989. These reports are required by Section 208 of the Energy Reorganization Act of 1974 (PL 93-438,). In the context of the Act, an abnormal occurrence is an unscheduled incident or event that the Commission determines is significant from the standpoint of public health or safety.

For this reporting period, there were three abnormal occurrences none involving a licensed nuclear power plant. Two of the abnormal occurrences involved nuclear material licensees and are described in detail under other NRC-issued licenses. The first a medical diagnostic misadministration and the second involved a medical therapy misadministration. The third abnormal occurrence was reported by an Agreement State (Louisiana) and involved an industrial radiographer overexposure. We also have included in the report information that updates a previously reported abnormal occurrence.

We will continue to disseminate information on reportable events through various event reports. These are routinely distributed on a timely basis to the Congress, industry, and the general public.

Sincerely,

Kenneth M. Carr

Enclosure:
Report to Congress on
Abnormal Occurrences
(NUREG-0090, Vol. 12, No.4)

ABSTRACT

Section 208 of the Energy Reorganization Act of 1074 identifies an abnormal occurrence as an unscheduled incident or event that the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from October 1 through December 31, 1989.

For this reporting period, there were three abnormal occurrences, none involving a licensed nuclear power plant. Two of the abnormal occurrences involved nuclear

material licensees and are described in detail under other NRC-issued licenses. The first involved a medical diagnostic misadministration and the second involved a medical therapy misadministration. The third abnormal occurrence was reported by an Agreement State (Louisiana and involved an industrial radiographer overexposure.

The report also contains information that updates some previously reported abnormal occurrences.

PREFACE

INTRODUCTION:

The Nuclear Regulatory Commission reports to the Congress each quarter under provisions of Section 208 of the Energy Reorganization Act of 1974 on any abnormal occurrences involving facilities and activities regulated by the NRC. An abnormal occurrence is defined in Section 208 as an unscheduled incident or event that the Commission determines is significant from the standpoint of public health or safety.

Events are currently identified as abnormal occurrences for this report by the NRC using the criteria listed in Appendix A. These criteria were promulgated in an NRC policy statement that was published in the Federal Register on February 24, 1977 (Vol. 42, No. 37, pages 10950-10952). In order to provide wide dissemination of information to the public, a Federal Register notice is issued on each abnormal occurrence. Copies of the notice are distributed to the NRC Public Document Room and all Local Public Document Rooms. At a minimum, each notice must contain the date and place of the occurrence and describe its nature and probable consequences.

The NRC has determined that only those events described in this report, meet the criteria for abnormal occurrence reporting. This report covers the period from October 1 through December 31, 1989.

Information reported on each event includes date and place, nature and probable consequences, cause or causes, and actions taken to prevent recurrence.

THE REGULATORY SYSTEM

The system of licensing and regulation by which NRC carries out its responsibilities is implemented through rules and regulations in Title 10 of the Code of Federal Regulations. This includes public participation as an element. To accomplish its objectives, NRC regularly conducts licensing proceedings, inspection and enforcement activities, evaluation of operating experience, and confirmatory research, while maintaining programs for establishing standards and

issuing technical reviews and studies.

In licensing and regulating nuclear power plants, the NRC follows the philosophy that the health and safety of the public are best ensured assured through the establishment of multiple levels of protection. These multiple levels can be achieved and maintained through regulations specifying requirements that will ensure the safe use of nuclear materials. The regulations include design and quality assurance criteria appropriate for the various activities licensed by NRC. An inspection and enforcement program helps ensure compliance with the regulations.

REPORTABLE OCCURRENCES

Actual operating experience is an essential input to the regulatory process for assuring that licensed activities are conducted safely. Licensees are required to report certain incidents or events to the NRC. This reporting Helps to identify deficiencies early and to ensure that corrective actions are taken to prevent recurrence.

REPORT TO CONGRESS ON ABNORMAL OCCURRENCES 155
OCTOBER-DECEMBER 1989

NUCLEAR POWER PLANTS

The NRC is reviewing events reported at the nuclear power plants licensed to operate. For this report, the NRC has not determined that any events were abnormal occurrences.

FUEL CYCLE FACILITIES

(Other Than Nuclear Power Plants)

The NRC is reviewing events reported by these licensees. For this report, the NRC has not determined that any events were abnormal occurrences.

OTHER NRC LICENSEES

(Industrial Radiographers, Medical Institutions,
Industrial Users, etc.)

There are current about 9,000 NRC nuclear material, licenses in effect in the United States, principally for use of radioisotopes it, the medical, industrial, and academic fields. Incidents were reported in this category from licensees such as radiographers, medical Institutions, and byproduct material users. The NRC is reviewing events reported by these licensees. For this report, the NRC has determined that the following events were abnormal occurrences:

89-13 Medical Diagnostic Misadministration

The following information pertaining to this event is also being reported concurrently in the Federal Register. Appendix A (see the general criterion) of this report notes that an event involving a moderate or more severe impact on public health or safety can be considered an abnormal occurrence.

Date and Place - October 18, 1989; Mayo Foundation; Rochester, Minnesota.

Nature and Probable Consequences - On October 27, 1989, the licensee reported to NRC Region III that on October 18, 1989, a patient received a diagnostic dose of a radioactive iodine compound that was 10 times the intended dose.

The referring physician intended that a patient receive a neck scar, using 100 microcuries of iodine-131, but checked the box on the referral form indicating a scan using 1 millicurie of iodine-131. The hospital reported that the patient received an additional radiation exposure of about 1200 rem to the thyroid beyond that intended by the referring physician. Had the intended dose of 100 microcuries been administered, the thyroid would be expected to receive an exposure of no more than about 140 rem.

1

A medical consultant, retained by the NRC, indicated that the added dose would result in a very slight increase in the risk that the patient could develop hypothyroidism or thyroid cancer. The consultant recommended that the hospital monitor the patient with annual thyroid function tests.

Cause or Causes - This misadministration occurred because the referring physician checked the wrong box on the nuclear medicine referral sheet. The nuclear medicine physician approved the neck scan procedure, but did not specify that it should be the neck scan with the lower dose of 100 microcuries (i.e., the nuclear physician did not write the prescription on the order form).

Actions Taken to Prevent Recurrence

Licensee - The hospital has revised its procedures to require additional precaution for procedures involving greater than 20 microuries of radioactive iodine. Under the revised procedures, the nuclear medicine physician is to review the request for the diagnostic test and the patient's chart arid not only approve the test but also write the prescribed dosage on the referral request form. The hospital's radiopharmacy will not dispense any quantities of iodine greater than 20 microcuries without a properly prepared referral request form, which includes a prescription by a nuclear medicine physician.

NRC - A special inspection will be conducted at the hospital to review the incident and other aspects of the licensee's nuclear medicine program.

Unless new, significant information becomes available, this item is considered closed for the purposes of this report.

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89-14 Medical Therapy Misadministration

The following information pertaining to this event is also being reported concurrently in the Federal Register. Appendix A (see the general criterion) of this report notes that an event involving a moderate or more severe impact on public health or safety can be considered an abnormal occurrence.

Date and Place - November 30. 1989; Kuakini Medical Center; Honolulu, Hawaii.

Nature and Probable Consequences - On November 30, 1989, the licensee reported to the NRC that a medical therapy misadministration had taken place at its facility earlier that da when a therapeutic dose of 9 millicuries of iodine-131 was inadvertently given to the wrong patient (Patient A rather than Patient B).

Patient A was intended to receive only a 20 millicurie diagnostic dose of technetium-99m MDP. This dose was administered and the patient was seated in the waiting room pending a bone scan. Meanwhile, Patient B arrived. Patient B, who was scheduled to receive an iodine-131 hyperthyroidism treatment complete an interview, signed a consent form, and was seated in the waiting room pending the iodine treatment.

The technologist prepared a dose of 9 mi1licuries (if iodine-131 for administration and reportedly called Patient B. However, Patient A responded. The technologist explained the iodine-131 treatment, scheduled a follow-up appointment, and administered the dose to Patient A. The patient then questioned the technologist, and it became evident that the wrong patient had been treated.

Patient A was immediately informed of the error, and the patient's stomach was pumped, retrieving millicuries of the material. The patient was then given potassium Perchlorate and Lugol's solution to release any iodine-131 already trapped in the thyroid and to block further uptake. The use of Lugol's solution continued for 14 days.

This misadministration resulted in an estimated dose to the thyroid of approximiately 820 rem. A medical consultant, retained by the NRC, indicated that the

added dose would result in a very slight increase in the risk that the patient could develop hypthyroidum or thyroid cancer. The consultant recommended that the hospital monitor the patient with annual thyroid function tests.

Cause or Causes - The licensee stated that the misadministration was caused by human error on the part of technologist and by inadequate procedural controls. The root cause was due to inadequate supervision of activities.

Actions Taken to Prevent Recurrence

Licensee - The licensee stated that: (1) a training class has been scheduled for a technologists, (2) a single technologist will be required to handle all aspects of the iodine-131 therapy and must be able to recognize the correct patient prior to the treatment, and (3) the technologist, physician, and patient are required to concurrently sign the therapy worksheet prior to the administration.

NRC - A special inspection will be conducted at the hospital to review the incident and other aspects of the licensee's nuclear medicine program. An inspection has been scheduled to review this misadministration.

Unless new, significant information becomes available, this item is considered closed for the purposes of this report.

AGREEMENT STATE LICENSEES

Procedures have been developed for the Agreement States to screen unscheduled incidents or events using the same criteria as the NRC (see Appendix A) and report the events to the NRC for inclusion in this report. For this period, an Agreement, State (Louisiana) reported the following abnormal occurrence to the NRC.

AS89-2 Industrial Radiographer Overexposure

Appendix A (see Example 1 of "For All Licensees") of this report notes that an exposure of the feet, ankles, hands, or forearms of any individual to 375 rem or more of radiation can be considered an abnormal occurrence.

Date and Place - August 26, 1989; mobil-Lab, Inc. (the licensee) of Harvey, Louisiana, while performing industrial radiography at Shell Oil Refinery in Norco, Louisiana.

Nature and Probable Consequences - On August 26, 1989, the licensee notified the Louisiana Department of Environment Quality, Nuclear Energy Division ("Agency") that earlier that day one of the licensee's radiographers had apparently received

a significant exposure to his left hand while performing radiography with a SPEC 2-T exposure device containing an 82 curie iridium-192 source.

The Agency performed an investigation on August 29, 1989, to determine the circumstances associated with the incident. This involved interviews with the radiographer and the licensee, and a reenactment of the incident using a dummy source. The incident is briefly described below.

After performing an exposure, the radiographer cranked in the source; however, the source was not fully retracted into the exposure device. The radiographer then performed an inadequate radiation survey that failed to detect the exposed source. He locked the exposure device, took it to a piperack, and set the device into a rack. While preparing for the next exposure, he was located approximately 2 feet from the front of the exposure device in a squatting position, with his back to the device. After an estimated 8 minutes, he reached back, without turning around, and disconnected the source tube with his left hand. He pulled the tube away and may have grazed the source capsule with his left palm.

Within a couple of seconds, he noticed that the source was protruding from the nipple about 4 inches. He immediately left the area and notified the lead radiographer. The lead radiographer saw the exposed source, cranked it fully into the exposure device, and then surveyed and locked the device. After directing the radiographer to return to Mobil-Lab to turn in his TLD badge, he carried the exposure device to SPEC Inc., in Kenner, Louisiana, for inspection. The exposure device appeared to be working properly.

The radiographer's hand may have contacted the source while it was unshielded. The original calculated exposure was 3000 to 3500 rem. As discussed below, this was later revised downward to about 1400 rem, based on the Agency's investigation. The whole-body exposure was about rem, based on the reading of the radiographer's thermoluminescent dosimeter (TLD). The Agency advised the licensee to provide immediate medical attention, including a doctor's examination of the hand and obtaining blood tests.

Though the calculated exposure of the radiographer's hand may have been as high as 100 rem, as estimated from an reenactment of the incident, the hand showed no indications of injury. Blood tests taken shortly after the incident, and again 48 hours later, were normal.

Cause or Causes - The Agency investigator concluded that the primary cause was the radiographer's failure to perform, a proper radiation survey to determine if the source was in the safe position following a radiographic exposure. No training or significant management deficiencies were identified.

4

Actions Taken to Prevent Recurrence

Licensee - The licensee circulated a notice to its employees with their pay-check; the notice described the incident and stated the cause was due to the radiographer not performing a radiation, survey. In addition, the licensee increased the number of field audits of radiography work being performed at job sites.

Agency - The licensee was cited for three violations: (1) failure of the radio-grapher to perform a proper survey following an exposure. (b) permitting an indi-vidual to receive an exposure in excess of specified limits, and (c) permitting the individual to act as a radiographer prior to the licensee's submission of proper forms to the Agency.

This item is considered closed for the purposes of this report.

5

APPENDIX C

OTHER EVENTS OF INTEREST

The following item is described because it may possibly be perceived by the public to be of public health or safety significance. The item did not involve a major reduction in the level of protection provided for public health or safety; therefore, it is not reportable as an abnormal occurrence.

1. Significant Degradation of Reactor Fuel Rod Cladding at Haddam Neck

On September 3, 1989, the Haddam Neck Plant (a Westinghouse-designed pressurized water, reactor located in Middlesex County, Connecticut) was shut down for refueling after 461 days of continuous operation. Because fission product con-centrations in the reactor coolant were higher than normal during the operating cycle, the licensee (Connecticut Yankee Atomic Power Company) conducted extensive examinations of the reactor fuel assemblies. The licensee found damage to the stainless steel Cladding of a significant number of fuel rods. While there was no effect on public health or safety (which is discussed further below), the event is of particular interest because: (1) a very large number of fuel rods was involved; (2) the unusual nature of the damage; and the damage. partially compromised one of the three fission product barriers common to nuclear power plants (i.e., fuel rod cladding, primary coolant pressure boundary, and primary containment boundary). The details of the event are as follows.

The Haddam Neck reactor core is 10 feet long and consists of 157 fuel assemblies. Each assembly is made up of a 15 by 15 array containing 204 fuel rods, 20 con-trol rod thimbles and one incore instrument sheath. The stainless steel fuel clad is 16.5 mils thick with an outer diameter of 0.422 inch. Iodine concentra-

tion in the reactor coolant, which is typically used to monitor fuel rod integrity, during operation, indicated that a. limited number of fuel rods (about six to twelve) @ad failed during the first few months of the operating cycle. The iodine levels stabilized during the cycle and the iodine-131 activity at the end of the cycle averaged 0.025 microcurie per milliliter, about- a factor of four higher than previous operating cycles. Following reactor shutdown, the iodine-131 spiked to about 0.8 microcurie per milliliter. During the subsequent cool-down and depressurization, the iodine-131 spiked to about 11.5 microcuries per milliliter.

In September 1989, the reactor core was unloaded to the spent fuel storage pool. Ultrasonic examinations of the fuel identified a total of about 450 failed fuel rods. Of these failures, 143 were in 95 fuel assemblies intended for reuse in the next cycle. That number of failures far exceeded the anticipated failures. Rod clad failure was confirmed with eddy current tests; the failure rate was about 1.5% of the rods within the core. The defects were generally pinhole sized and primarily concentrated in the bottom 1.2 inches of the fuel rods. The failures were caused by small, fingernail-sized metal chips or shavings that had accumulated in the region between the fuel assembly lower nozzle and the first fuel rod spacer grid. Less than 0.2 cubic foot of debris were collected following cleaning efforts. Long-term fretting between the debris and the adjacent fuel rods resulted in penetration of the fuel cladding.

Although the source of the debris has not been absolutely identified, it is believed to be stainless steel chips which escaped the controls to capture them during machining operations associated with modifications to the reactor vessel thermal shield supports which were performed during the last refueling. During the work, which was all performed remotely and under water-, mechanical devices such as dams, trays, and water suction probes were used to catch tailings from end mill machines. Although extensive cleanup efforts were conducted, the licensee did not flush the reactor coolant system to remove hidden debris prior to reactor coolant pump operation with an assembled reactor.

At present, eddy current inspections are being made of fuel rods believed to be defective following ultrasonic examination, alone with rods at debris sites, rods adjacent to damaged rods and rods selected randomly. A rods is rejected if found with a defect greater than 20% of wall thickness. Rejections are occurring at the rate of about 11% for known debris and failure sites, and about 4% for the randomly selected rods. The core also contained four test fuel assemblies of fuel rods clad with Zircaloy rather than stainless steel. (The licensee plans to use cores with all fuel rods clad in Zircaloy sometime in the future.) There were no unacceptable detects found in the fuel red cladding in these test assemblies. The Zircaloy cladding is considerably thicker, than the cladding of the steel assemblies (i.e., 27 mils vs. 16.5 mils). Seventy-five percent of the

damaged rods have been located in the outer two peripheral rows of the stainless steel clad fuel.

The licensee is replacing rejected rods with acceptable fuel rods from once-and-twice used fuel assemblies. Each rod is inspected to be free of defects and has an accumulated power history similar to that of the damaged rod being replaced. The licensee is currently evaluating programs for the cleaning and flushing of reactor components and the reactor coolant system. The fuel assemblies have been mechanically cleaned of all visible debris. Since donor fuel rods are being obtained from assemblies which would have been reused, the licensee has ordered additional new assemblies.

Prior to Plant startup, it will be necessary for the licensee to reevaluate the modified reload reactor core to verify that safety analyses inputs remain valid. The NRC will closely monitor the actions taken by the licensee.

As previously mentioned, there was no effect from the event on public health or safety. Although many fuel rods were affected, the release of radioactivity to the coolant was not very large, i.e., the coolant activity remained within the technical specification limitations. Because of the location and the failure mode (pin-hole failures), damage to the fuel rods only partially compromised the fuel rod cladding barrier. At all times, the releases offsite remained within the technical specification limits. Based on these considerations, the event was considered below the threshold for an abnormal occurrence.