

NUCLEAR REGULATORY COMMISSION

REPORT TO CONGRESS ON ABNORMAL OCCURRENCES

FISCAL YEAR 2006

DISSEMINATION OF INFORMATION

Section 208 of the Energy Reorganization Act of 1974 (Public Law 93-438) defines an abnormal occurrence (AO) as an unscheduled incident or event which the U.S. Nuclear Regulatory Commission (NRC) determines to be significant from the standpoint of public health or safety. The Federal Reports Elimination and Sunset Act of 1995 (Public Law 104-66) requires that AOs be reported to Congress annually. During fiscal year 2006, nine events that occurred at facilities licensed or otherwise regulated by the NRC and/or Agreement States were determined to be AOs. The report describes three events at facilities licensed by the NRC. The three AOs at NRC-licensed facilities included a spill of high-enriched uranium solution at a fuel fabrication facility, a medical event, and an unintended dose to an embryo/fetus. The report also addresses six AOs at facilities licensed by Agreement States. [Agreement States are those States that have entered into formal agreements with the NRC pursuant to Section 274 of the Atomic Energy Act (AEA) to regulate certain quantities of AEA licensed material at facilities located within their borders.] Currently, there are 34 Agreement States. During Fiscal Year 2006, Agreement States reported six events that occurred at Agreement State-licensed facilities, including four medical events, one unintended dose to an embryo/fetus, and one industrial event. As required by Section 208, the discussion for each event includes the date and place, the nature and probable consequences, the cause or causes, and the action taken to prevent recurrence. Each event is also being described in NUREG-0090, Vol. 29, "Report to Congress on Abnormal Occurrences, Fiscal Year 2006." This report is available electronically at the NRC Web site <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/>.

NUCLEAR POWER PLANTS

During this period, no events at U.S. nuclear power plants were significant enough to be reported as AOs.

FUEL CYCLE FACILITIES

(Other Than Nuclear Power Plants)

During this reporting period, one event at an NRC-licensed fuel fabrication facility was significant enough to be reported as an AO based on the criteria in Appendix A to this report.

06-01 Spill of High-Enriched Uranium Solution at Nuclear Fuel Services in Erwin, Tennessee

Date and Place — March 6, 2006, Erwin, Tennessee

Nature and Probable Consequences — In a facility authorized to process high-enriched uranium (HEU), a transfer of HEU solution through a transfer line resulted in a portion of the HEU solution, approximately 35 liters, leaking into a glovebox where criticality was possible and subsequently to the floor where criticality was also possible because of the presence of an elevator pit.

Immediately before the event, the facility operator decided to move the unused filter glovebox to another location. Workers opened and drained the filters so that the filter glovebox could be moved. After draining the filters, workers failed to reseal the system tightly. During the next transfer of HEU solution through the line, HEU solution leaked into the filter glovebox. On several occasions before the event, workers had reported signs of a yellowish liquid in the filter glovebox. Supervisors had failed to fully investigate the reports because they assumed the yellowish liquid was natural uranium solution which had been used to initially test the process.

Criticality was possible in the filter glovebox because of the size and shape of the glovebox and because there were no controls in the filter glovebox to prevent accumulation of solution. The

solution leaked out of the filter glovebox through uncontrolled drains to the floor. Investigation of the event revealed that the floor contained an uncontrolled accumulation point, an elevator pit, where criticality was also possible. In different circumstances, the total volume of the transfer would have been more than enough for criticality to be possible in the filter glovebox or the elevator pit. If a criticality accident had occurred in the filter glovebox or the elevator pit, it is likely that at least one worker would have received an exposure high enough to cause acute health effects or death. The NRC conducted a team inspection to determine the root causes of the event and performed a series of three readiness reviews before allowing this portion of the facility to restart. The NRC issued an order to the licensee delineating specific actions designed to address this and other performance issues at the facility.

Cause(s) — Failure to maintain configuration control of facility equipment and failure to comply with procedures.

Actions Taken to Prevent Recurrence — The operator stopped all processing of HEU in the affected processing area, removed the enclosure and associated piping, filled in an uncontrolled accumulation point (the elevator pit) with concrete, and conducted an extensive review to identify any similar configuration issues.

OTHER NRC LICENSEES

(Industrial Radiographers, Medical Institutions, etc.)

During this reporting period, two events at NRC-licensed or regulated facilities were significant enough to be reported as AOs based on the criteria in Appendix A to this report.

06-02 Medical Event at Bozeman Deaconess Hospital in Bozeman, Montana

Date and Place — May 9, 2006, Bozeman, Montana

Nature and Probable Consequences — The licensee reported that a patient was prescribed a brachytherapy treatment of 145 Gy (14,500 rad) to the prostate gland for prostate cancer using 82 iodine-125 seeds, but instead received a 130 Gy (13,000 rad) dose to an unintended treatment site. The brachytherapy seeds were implanted under ultrasound guidance; however, a post-treatment computerized tomography scan confirmed that only 10 seeds were implanted in the prescribed location of the prostate, resulting in a dose of 8.6 Gy (860 rad) delivered to the intended treatment site. Concerning the 72 seeds not in the intended treatment site, the urologist was able to recover 3 seeds and determined that 69 seeds were implanted inferior to the prostate in the wrong treatment site. The referring physician and the patient were informed of this event and were advised that the patient may experience discomfort during urination. The NRC staff conducted a reactive onsite inspection on May 16, 2006. An NRC contracted medical consultant experienced in radiation oncology reviewed the case and agreed with the licensee's analysis and conclusions. An NRC inspection report has been issued.

Cause(s) — This medical event was caused by human error because the licensee did not verify that the sources were positioned in the proper location in the prostate. The urologist misidentified the anatomy viewed under the ultrasound guidance procedure.

Actions Taken to Prevent Recurrence — The licensee revised its procedures, requiring a fluoroscopic examination early in the implant procedure to ensure that the seeds are placed in the correct location, thus resolving any questions concerning ultrasound images prior to commencing with the implant. The licensee also implemented additional staff training.

06-03 Dose to an Embryo/Fetus at Munson Medical Center in Traverse City, Michigan

Date and Place — May 3, 2006, Traverse City, Michigan

Nature and Probable Consequences — The licensee reported an unintended dose to an embryo/fetus. On May 3, 2006, the licensee administered a therapy dosage of 5.55 GBq

(150 mCi) of I-131 to a 26-year-old female patient who had affirmed in writing that she was not pregnant. On May 22, 2006, the patient informed the licensee that she had been approximately 10 to 14 days pregnant at the time of the administration. Based on this new information, the licensee estimated that the dose to the embryo/fetus was approximately 400 mSv (40 rem). The referring physician and patient were informed of this event. The NRC-contracted medical consultant agreed with the licensee's dose estimate and concluded that this event should result in no harm to the embryo because the administration occurred during a stage of development when the thyroid does not take up iodine. The medical consultant recommended that a complete thyroid evaluation be performed after delivery.

Cause(s) — This medical event was caused by the patient's incorrect written statement that she was not pregnant prior to receiving the therapy dosage. The licensee did not require an independent pregnancy test for women of child-bearing age prior to administering the dosage.

Actions Taken to Prevent Recurrence — The licensee implemented a procedure that requires pregnancy tests for all women of childbearing age prior to any therapy dosage of radioactive material, a checklist to ensure that the pregnancy test is ordered, and staff training.

AGREEMENT STATE LICENSEES

During this reporting period, six events at Agreement State-licensed facilities were significant enough to be reported as AOs based on the criteria in Appendix A to this report.

AS 06-01 Industrial Radiography Occupational Overexposure at Anvil International in North Kingston, Rhode Island

Date and Place — March 3, 2006, North Kingston, Rhode Island

Nature and Probable Consequences — The licensee reported that a radiographer and a trainee received unintended radiation exposures in excess of those specified in the AO criteria. The

incident occurred at a permanent radiography facility and involved an iridium-192 source with an activity of 3.44 TBq (93 Ci). After performing surveys outside a dedicated radiography cell, where radiation levels confirmed that radiography was in process in the cell, the radiographer and the trainee went to an alternate location and performed equipment maintenance and training. They were joined by a third radiographer, who was performing radiography inside the cell. All three radiography personnel entered the cell to view the radiography setup and examine the guide tube for training purposes. However, they entered without a survey meter and were unaware that the source was still exposed. As a result, the first radiographer and the trainee handled the collimator and guide tube (which contained the source) for approximately 15 - 60 seconds. The first radiographer received a dose to the left hand ranging from 1.4 to 2.8 Sv (140 rem to 280 rem). The trainee received a dose to the left hand ranging from 11 Sv to 85 Sv (1,100 rem to 8,500 rem). The third radiographer did not receive a dose in excess of regulatory exposure limits, since he did not handle the equipment.

Cause(s) — This event was caused by the failure of radiography personnel to follow safety procedures and use survey meters inside the cell.

Actions Taken to Prevent Recurrence

Licensee — The licensee provided additional training to the personnel. The licensee also solicited the assistance of a medical physicist and the source manufacturer in determining the dose to the radiographers. The licensee also committed to keep the State updated on the medical conditions of the radiographer and trainee until they are released from medical oversight.

State Agency — On March 7, 2006, the State issued a suspension letter to the licensee. On March 8 and March 16, 2006, the State, accompanied by NRC Region I staff, conducted an investigation of the event. On April 13, 2006, the State issued a Notice of Violation and on November 3, 2006, terminated the license after an onsite inspection to confirm decommissioning actions.

AS 06-02 Medical Event at 21st Oncology, Inc., in Coral Springs, Florida

Date and Place — March 31 through April 7, 2006, Coral Springs, Florida

Nature and Probable Consequences — The licensee reported that an 80-year-old female patient received 100 Gy (10,000 rad) to an unintended area of approximately 2 cm (0.8 in) that was three times the prescribed dose for the mammosite brachytherapy procedure, using a high dose rate (HDR) afterloader containing an iridium-192 source with an activity of 240.5 GBq (6.5 Ci). The patient received less than 30 percent of the prescribed dose to the prescribed treatment site. The source stopped 6 cm (2.4 in) short of the intended position. The patient visited the attending physician for followup on May 2, 2006. The physician discovered that the patient's skin was abnormally red. The referring physician, patient, and patient's family were notified of the incident. The patient was treated for erythema (skin reddening) and moist desquamation (skin thinning and weeping).

Cause(s) — This medical event was caused by human error. The authorized user entered an incorrect distance into the computer entry data.

Actions Taken to Prevent Recurrence

Licensee — The licensee developed new procedures requiring the authorized user to verify the source wire distances during HDR treatments and provided additional training in these procedures.

State Agency — The State reviewed and accepted the licensee's corrective actions.

AS 06-03 Medical Event at the McKay Dee Hospital, Inc., in Ogden, Utah

Date and Place — June 19, 2006, Ogden, Utah

Nature and Probable Consequences — The licensee reported that a patient undergoing treatment for hyperthyroidism received 1.08 GBq (29.3 mCi) of I-131 instead of the prescribed dosage of 0.56 GBq (15 mCi). On June 19, 2006, two patients were scheduled to receive I-131 treatments at the same time. However, the first patient was administered the second patient's prescribed dosage resulting in the patient receiving a higher than intended dose. The error was identified by the licensee prior to the administration of I-131 to the second patient. The administration resulted in a thyroid dose of 1,066 Gy (106,600 rad). The patient and referring physician were notified of the error. No negative health effects from this administration are expected. On July 17, 2006, the licensee sent a letter to the State confirming that a medical event had occurred.

Cause(s) — This medical event was caused by human error. The licensee failed to verify the prescribed dosage for a specific patient.

Actions Taken to Prevent Recurrence

Licensee — Corrective actions taken by the licensee included revising procedures to improve patient identification techniques and not scheduling patients with similar treatments at concurrent times.

State Agency — The State reviewed and accepted the licensee's corrective actions.

AS 06-04 Medical Event at Central Arkansas Radiation Therapy Institute in Little Rock,
Arkansas

Date and Place — March 28, 2006, Little Rock, Arkansas

Nature and Probable Consequences — The licensee reported that a patient undergoing implant brachytherapy for prostate cancer received a radiation dose to an unintended area during an I-125 prostate-seed implant procedure. The patient was prescribed 108 Gy (10,800 rad) to the

base of the prostate gland with 84 I-125 seeds but it was delivered 4 cm (1.6 in) inferior to the intended treatment site. The post-implant dose calculation confirmed that the dose was delivered to the wrong treatment site. The patient will require further brachytherapy treatment. The patient did not incur adverse health effects as a result of the medical event. The patient and referring physician were notified of the medical event.

Cause(s) — This medical event was caused by human error. The urologist was not able to clearly identify the base of the prostate gland during the ultrasound used to view the target organ during the treatment.

Actions Taken to Prevent Recurrence

Licensee — The licensee implemented a new policy to ensure that the urologist clearly defines the base of the prostate and urethra.

State Agency — The State reviewed and accepted the licensee's corrective actions.

AS 06-05 Medical Event at Children's Memorial Medical Center in Chicago, Illinois

Date and Place — July 24, 2006, Chicago, Illinois

Nature and Probable Consequences — The licensee reported that a patient received a higher than intended dosage of 74 MBq (2 mCi) of I-131 instead of the prescribed dosage of 0.19 MBq (0.005 mCi). The physician did not prepare a written directive. The authorized user noted the error on July 25, 2006. The licensee estimated a whole body dose of 0.0189 Sv (1.89 rem) and a dose to the thyroid of 41.4 Sv (4,140 rem), based on a 59.2-percent uptake. Using the same assumptions, the intended dosage of 0.19 MBq (0.005 mCi) would have given the patient a thyroid dose of 0.104 Sv (10.4 rem). The patient and referring physician were notified of the medical event. The patient incurred no adverse health effects from the medical event.

Cause(s) — This medical event was caused by inadequate verbal communications between the nuclear medicine technologist (NMT) and the physician and the lack of a written directive.

Actions Taken to Prevent Recurrence

Licensee — The licensee reviewed previous administrations of radioiodine to confirm that this event was an isolated occurrence. The licensee added additional procedures to ensure proper oversight by a physician during all future radiiodine administrations.

State Agency — The State investigated the event and concurred with the licensee's dose estimates. The State issued a Notice of Violation to the licensee.

AS 06-06 Dose to an Embryo/Fetus at McLeod Regional Medical Center in Florence, South Carolina

Date and Place — May 26, 2006, Florence, South Carolina

Nature and Probable Consequences — The licensee reported an unintended dose to an embryo/fetus. The licensee administered 555 MBq (15 mCi) of technetium-99m on May 24, 2006, and 518 KBq (0.014 mCi) of I-131 on May 25 as a prelude to a thyroid ablation to a patient. Prior to the administrations and following a detailed explanation provided by the physician, the patient signed an informed consent indicating that she was not pregnant. The licensee's radioactive materials license requires that a pregnancy test be done on any female of child-bearing age undergoing radiation therapy. However, the patient convinced the attending NMT that she could not possibly be pregnant. The NMT did not perform the pregnancy test and on May 26, 2006, administered 0.548 GBq (14.8 mCi) of I-131 to the patient for a thyroid ablation. At approximately 32 - 34 weeks of pregnancy, the patient visited an obstetrician and mentioned that she had undergone a thyroid ablation procedure when she was approximately 17 weeks pregnant. The obstetrician notified the licensee on October 3, 2006. The licensee estimated that the fetus received a whole body dose of 0.0517 Gy (5.17 rad) and a thyroid dose

of 139.2 Gy (13,920 rad). The child was born in November 2006. The newborn appears to have no apparent problems resulting from the radiation exposure with the exception of an underactive thyroid gland (hypothyroidism). The child is currently receiving a small amount of thyroid supplement. The referring physician and patient were notified of the event.

Cause(s) — This event was caused by human error. At the time of the administration, the patient indicated that she was not pregnant, and the licensee failed to perform the required pregnancy test.

Actions Taken To Prevent Recurrence

Licensee — The licensee provided instructions to staff emphasizing its policy to administer a pregnancy test to female patients of child-bearing age prior to undergoing radiation therapy.

State Agency — The State reviewed and approved the corrective actions taken by the licensee and will followup at the next inspection. The State is in the process of issuing a Notice of Violation.

Dated at Rockville, Maryland this 20th day of April 2007.

For the Nuclear Regulatory Commission.

/RA/

Andrew L. Bates,
Acting Secretary of the Commission.