DRAFT

REPORT TO CONGRESS

ON

ABNORMAL OCCURRENCES

FISCAL YEAR 2001

Date Published: March 2002

Office of Nuclear Regulatory Research
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

This Page Intentionally Left Blank

ABSTRACT

Section 208 of the Energy Reorganization Act of 1974 (Public Law 93-438) defines an abnormal occurrence (AO) as an unscheduled incident or event that 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. This report describes events that the NRC determined were AOs during Fiscal Year 2001.

The report describes two AOs, one at a facility licensed by the NRC and the other at a facility licensed by an Agreement State. Agreement States are States that have entered into a formal agreement with the NRC pursuant to Section 274 of the Atomic Energy Act (AEA) to regulate certain quantities of AEA material at facilities located within their borders. Currently, there are 32 Agreement States. During the period from June 13 to June 16, 2000, an individual hired by Southeast Missouri State University, an NRC licensee, received an uptake of americium-241 resulting in a committed dose equivalent of 2.63 sievert (Sv) (263 rem) to the bone surface while performing decontamination and inventory activities for the licensee. On February 16, 2001, a radiographer employed by Quality Inspection Services, Inc., an Agreement State licensee, received a radiation exposure of 392 mSv (39.2 rem) after failing to retract a radiography source into its fully locked position and failing to perform an adequate survey. In addition, Appendix C of the report, ?Other Events of Interest," describes one reactor event and discusses one materials issue.

This Page Intentionally Left Blank

CONTENTS

ABSTRACT iii

PREFACE vii
INTRODUCTION vii
THE REGULATORY SYSTEM vii
REPORTABLE OCCURRENCES viii
AGREEMENT STATES viii
FOREIGN INFORMATION ix
UPDATES OF PREVIOUSLY REPORTED ABNORMAL OCCURRENCES ix

ABNORMAL OCCURRENCES IN FISCAL YEAR 2001 1

NUCLEAR POWER PLANTS 1

FUEL CYCLE FACILITIES
(Other Than Nuclear Power Plants) 1

OTHER NRC LICENSEES
(Industrial Radiographers, Medical Institutions, etc.) 1
01-1 Occupational Overexposure at Southeast Missouri State University in Cape Girardeau, Missouri 1

AGREEMENT STATE LICENSEES
AS 01-1 Industrial Radiography Occupational Overexposure at Quality Inspection Services, Inc., in Jacksonville, Florida 3

APPENDIX A
ABNORMAL OCCURRENCE CRITERIA AND GUIDELINES
FOR OTHER EVENTS OF INTEREST 4

APPENDIX B
UPDATE OF PREVIOUSLY REPORTED ABNORMAL OCCURRENCES 9

APPENDIX C
OTHER EVENTS OF INTEREST 10

This Page Intentionally Left Blank

PREFACE

INTRODUCTION

Section 208 of the Energy Reorganization Act of 1974 (Public Law 93-438) defines an abnormal occurrence (AO) as an unscheduled incident or event that the U.S. Nuclear Regulatory Commission (NRC) determines is 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. This report discusses those events that the NRC determined were AOs during Fiscal Year 2001.

The NRC used the criteria in Appendix A to define AOs for the purpose of this report. The criteria were initially promulgated in the NRC policy statement that was published in the *Federal Register* on February 24, 1977 (42 FR 10950). This policy statement was published before medical licensees were required to report medical misadministrations to the NRC, and few of the examples in the policy statement were applicable to medical misadministrations. Therefore, in 1984, the NRC adopted additional guidance for reporting medical misadministrations as AOs. In 1996, the NRC revised the AO criteria, including the criteria for medical misadministrations. They were published in the *Federal Register* on December 19, 1996 (61 FR 67072). In 1997, the NRC again revised the AO criteria to include gaseous diffusion plants. The newest criteria were published in the *Federal Register* on April 17, 1997 (62 FR 18820).

The NRC has determined that, of the incidents and events reviewed for this reporting period, only those that are described herein meet the AO criteria for being reported as AOs. The information reported for each AO includes the date and place, the nature and probable consequences, the cause or causes, and actions taken to prevent recurrence.

Appendix A to this report presents the criteria for selecting AOs and the guidelines for selecting ?Other Events of Interest." Appendix B contains updates on previously reported AOs (there were no updates in FY 2001). Appendix C presents information on events that are not reportable to Congress as AOs but are included in the AO report as "Other Events of Interest" based on guidelines provided by the Commission and listed in Appendix A to this report.

Historically, the body of the AO report and Appendix C describe events that must be reported to the NRC or an Agreement State and the events that NRC licensees and Agreement States voluntarily report to the NRC.

To disseminate information widely to the public, the NRC issues a *Federal Register* describing AOs at facilities licensed or otherwise regulated by the NRC or an Agreement State. Information on activities licensed by Agreement States is also publicly available from the Agreement State.

THE REGULATORY SYSTEM

The system of licensing and regulation by which the NRC carries out its responsibilities is implemented through the rules and regulations in Title 10 of the *Code of Federal Regulations* (10 CFR). Public participation is an element of the regulatory process. To accomplish its objectives, the NRC regularly conducts licensing proceedings, inspection and enforcement activities, operating experience evaluations, and confirmatory research, and maintains programs for establishing standards and issuing technical reviews and studies.

The NRC adheres to the philosophy that the health and safety of the public are best ensured by establishing multiple levels of protection. These levels can be achieved and maintained through regulations specifying requirements that will ensure the safe use of radioactive materials. The regulations contain design and quality assurance criteria appropriate for the various activities regulated by the NRC. An inspection and enforcement program assists in ensuring compliance with the regulations. The NRC is seeking to make the regulatory system more risk-informed and performance-based, where appropriate.

REPORTABLE OCCURRENCES

Operating experience is essential for ensuring that licensed activities are conducted safely. Licensees are required to report certain incidents or events to the NRC. Such reporting helps to identify deficiencies and to ensure that corrective actions are taken to prevent recurrence.

The NRC and the industry review and evaluate operating experience to identify safety concerns. Information from the review and evaluation is disseminated and fed back to licensees through licensing activities and regulations. Operational data is maintained in computer-based data files for more effective collection, storage, retrieval, and evaluation.

Except for records exempt from public disclosure by statute or regulation, the NRC routinely disseminates information on reportable occurrences at facilities licensed or otherwise regulated by the NRC to the industry, the public, and other interested groups when the occurrences happen. The dissemination is done by special notifications to licensees and other affected or interested groups and by public announcements. Congress is routinely informed of significant events occurring in facilities licensed or otherwise regulated by the NRC.

AGREEMENT STATES

Section 274 of the Atomic Energy Act, as amended, authorizes the Commission to enter into agreements with States whereby the Commission relinquishes, and the States assume, regulatory authority over byproduct, source, and special nuclear materials in quantities not capable of sustaining a chain reaction. Agreement States must maintain programs that are adequate to protect public health and safety and are compatible with the Commission's program for such materials. Currently, there are 32 Agreement States.

In early 1977, the Commission determined that events that meet the criteria for AOs at facilities licensed by Agreement States should be included in the annual report to Congress. Therefore, AOs reported by the Agreement States to the NRC are included in the AO report and in the *Federal Register* notice issued to disseminate the information about each AO to the public. Agreement States report event information to NRC in accordance with compatibility criteria established by the ?Policy Statement on Adequacy and Compatibility of Agreement State Programs," published in the *Federal Register* on September 3, 1997 (62 FR 46517). Procedures have been developed and implemented for evaluating materials events to determine those that should be reported as AOs. The AO criteria in Appendix A are applied uniformly to materials events at facilities regulated by the NRC and the Agreement States.

FOREIGN INFORMATION

The NRC exchanges information with various foreign governments that regulate nuclear facilities. This foreign information is reviewed and considered in the NRC's assessment of operating experience and in its research and regulatory activities. Although foreign information may occasionally be referred to in the AO reports to Congress, only domestic AOs are reported.

UPDATES OF PREVIOUSLY REPORTED ABNORMAL OCCURRENCES

The NRC provides updates to previously reported AOs if significant new information about an AO becomes available. Previously reported ?Other Events of Interest" are similarly updated.

This Page Intentionally Left Blank

ABNORMAL OCCURRENCES
IN FISCAL YEAR 2001

NUCLEAR POWER PLANTS

Using the criteria in Appendix A to this report, none of the events that occurred at U.S. nuclear power plants during this reporting period was significant enough to be reported as an AO.

FUEL CYCLE FACILITIES
(Other Than Nuclear Power Plants)

Using the criteria in Appendix A to this report, none of the events that occurred at fuel cycle facilities during this reporting period was significant enough to be reported as an AO.

OTHER NRC LICENSEES
(Industrial Radiographers, Medical Institutions, etc.)

Using the criteria in Appendix A to this report, the following event, that occurred at a facility licensed by the NRC, was determined to be significant enough to be reported as an AO during this reporting period:

01-1 Occupational Overexposure at Southeast Missouri State University in Cape Girardeau, Missouri

Criterion I.A.1 of Appendix A to this report states that any unintended radiation exposure to an adult (any individual 18 years of age or older) resulting in an annual sum of the deep dose equivalent (external dose) and the committed dose equivalent (intake of radioactive material) to any individual organ or tissue, other than the lens of the eye, the bone marrow, and the gonads, of 2500 millisievert (mSv) (250 rem) or more will be considered for reporting as an AO.

Date and Place — June 13–16, 2000, Southeast Missouri State University (the university), Cape Girardeau, Missouri. The information available to the staff prior to the publication of the FY 2000 report was not sufficient to determine if this event met the AO criteria.

Nature and Probable Consequences — In 1970, the university was authorized by an NRC license to possess and use up to 185 megabecquerel (MBq) [5 millicurie (5 mCi)] of americium-241 (Am-241) in unsealed form. The authorized user of the Am-241 died in 1980. In 1991, the university requested and received an amendment to its NRC license to remove authorization to possess and use certain radionuclides, including Am-241. The university disposed of some radionuclides in its possession but inadvertently kept the unsealed Am-241.

On February 16, 2000, a routine NRC inspection at the university found that the radiation program had deteriorated significantly. Specifically, since August 1, 1999, the university had been without a radiation safety officer (RSO), and the university officials were not sure whether they had radioactive materials in their possession or what materials they were authorized to possess. They did not know the general terms and conditions of their license. During the inspection, the licensee and an NRC inspector found an apparently empty vial labeled as containing 185 MBq (5 mCi) of Am-241 in a safe, located in the basement of the university, along with additional unauthorized material.

After the discovery of the unauthorized material, the university hired a consultant to characterize the material in the safe, and assess contamination in and around the area. On April 19, 2000, the consultant inventoried the contents of the safe and found elevated radiation levels in the room where the safe was located. On June 13, 2000, the consultant began to perform surveys and decontamination activities and identified loose Am-241 contamination. Inadequate radiological surveys and poor handling techniques used by the consultant resulted in contamination in a number of areas in the basement.

On June 21, 2000, the NRC initiated a special inspection in response to a report from the university on loose Am-241 contamination. NRC surveys independently confirmed the Am-241 contamination.

The licensee restricted access to all contaminated areas, interrupted the decontamination process, and performed internal dose assessments of individuals potentially exposed to Am-241 contamination. These assessments indicated that the consultant received a calculated committed dose equivalent to the bone surface of 2630 millisievert (263 rem). The licensee hired a second consultant to complete the decontamination process.

Cause or Causes — The licensee possessed radioactive material not authorized by the NRC license and failed to perform adequate radiation surveys, including air sampling to measure airborne radioactivity present during the inventory and decontamination activities. The survey instruments were incapable of detecting alpha activity which is needed to identify the presence of Am-241. In addition, from August 1, 1999, to July 10, 2000, the licensee had no RSO to oversee and ensure implementation of an effective radiation protection program.

Actions Taken to Prevent Recurrence

Licensee — The licensee appointed a new RSO and revised its radiation safety program, with an emphasis on inventory control. Specifically, the university implemented new property control and surplus inventory policies and procedures that included: (1) review and approval by the RSO of property transfers of potentially contaminated equipment, (2) surveys of surplused equipment for contamination control, and (3) training of personnel in the correct procedures for surplusing equipment containing radioactive material.

NRC — On September 13, 2001, the NRC issued a Notice of Violation and Proposed Imposition of Civil Penalty against the university for the violation associated with the June 2000 radiation overexposure to the consultant. The fine was $11,000. The NRC also issued Information Notice 2001-01 to emphasize the importance of accurate inventory controls to prevent unauthorized possession of radioactive material.

This event is closed for the purpose of this report.

* * * * * * * *

AGREEMENT STATE LICENSEES

Using the criteria in Appendix A to this report, the NRC determined that the following event at an Agreement State licensed facility during this reporting period was significant enough to be reported as an AO:

AS 01-1 Industrial Radiography Occupational Overexposure at Quality Inspection Services, Inc., in Jacksonville, Florida

Criterion I.A.1 of Appendix A to this report states that any unintended radiation exposure to an adult (any individual 18 years of age or older) resulting in an annual total effective dose equivalent of 250 millisievert (mSv) (25 rem) or more will be considered for reporting as an AO.

Date and Place — February 16, 2001, Quality Inspection Services, Inc., Jacksonville, Florida.

Nature and Probable Consequences — Based on discussions with the involved individuals, it was determined that a radiographer retracted a 2.15 terabecquerel (58 curie) iridium-192 source into what was thought to be a locked, shielded, and fully retracted position inside the radiography camera. In setting up for the next shot, the radiographers noticed that the source had not been secured in the off position after the previous shot and that their survey meters and their pocket dosimeters were off scale. The radiographers immediately retracted the source to its fully shielded position and exited the working area. Film badges belonging to the radiographers indicated exposures of 29 mSv (2.9 rem) and 392 mSv (39.2 rem).

Cause or Causes — The radiographers failed to perform an adequate survey of the radiography camera after performing radiographic operations. In addition, the alarming ratemeter worn by one of the radiographers was not turned on during radiography. The alarming ratemeter for the second radiographer had a low battery and did not produce an audible alarm.

Actions Taken To Prevent Recurrence

Licensee — The licensee conducted a reenactment of the event and, based on lessons learned, the training procedures were revised to prevent future incidents. The licensee performed a cytogenetic test to evaluate the radiography overexposures.

State Agency — The State of Florida Bureau of Radiation Control determined that the radiographer failed to follow procedures and took enforcement action against the licensee. The State reviewed and accepted the licensee's corrective actions, which included refresher training.

This event is closed for the purpose of this report.

* * * * * * * *

APPENDIX A

ABNORMAL OCCURRENCE CRITERIA AND GUIDELINES FOR OTHER EVENTS OF INTEREST

An accident or event will be considered an abnormal occurrence (AO) if it involves a major reduction in the degree of protection of public health or safety. This type of incident or event would have a moderate or more severe impact on public health or safety and could include, but need not be limited to, the following:

(1) Moderate exposure to, or release of, radioactive material licensed by or otherwise regulated by the Commission;

(2) Major degradation of essential safety-related equipment; or

(3) Major deficiencies in design, construction, use of, or management controls for facilities or radioactive material licensed by or otherwise regulated by the Commission.

The following criteria for determining an AO and the guidelines for ?Other Events of Interest" were stated in an NRC policy statement published in the *Federal Register* on December 19, 1996 (61 FR 67072). The policy statement was revised to include criteria for gaseous diffusion plants and was published in the *Federal Register* on April 17, 1997 (62 FR 18820).

Note that in addition to the criteria for fuel cycle facilities (Section III of the AO criteria) that are applicable to licensees and certificate holders, such as the gaseous diffusion plants, other criteria that reference ?licensees," ?licensed facility," or ?licensed material" also may be applied to events at facilities of certificate holders.

The guidelines for including events in Appendix C ?Other Events of Interest" of this report were provided by the Commission in the Staff Requirements Memorandum on SECY-98-175, dated September 4, 1998, and are listed at the end of this Appendix.

<u>Abnormal Occurrence Criteria</u>

Criteria by types of events used to determine which events will be considered for reporting as AOs are as follows:

I. For All Licensees.

A. Human Exposure to Radiation from Licensed Material

1. Any unintended radiation exposure to an adult (any individual 18 years of age or older) resulting in an annual total effective dose equivalent (TEDE) of 250 mSv (25 rem) or more; or an annual sum of the deep dose equivalent (external dose) and committed dose equivalent (intake of radioactive material) to any individual organ or tissue other than the lens of the eye, bone marrow, and the gonads, of 2500 mSv (250 rem) or more; or an annual dose equivalent to the lens of the eye, of 1 Sv (100 rem) or more; or an annual sum of the deep dose equivalent and committed dose equivalent to the bone marrow, and the gonads, of 1 Sv

(100 rem) or more; or an annual shallow-dose equivalent to the skin or extremities of 2500 mSv (250 rem) or more.

2. Any unintended radiation exposure to any minor (an individual less than 18 years of age) resulting in an annual TEDE of 50 mSv (5 rem) or more, or to an embryo/fetus resulting in a dose equivalent of 50 mSv (5 rem) or more.

3. Any radiation exposure that has resulted in unintended permanent functional damage to an organ or a physiological system as determined by a physician.

B. Discharge or Dispersal of Radioactive Material from its Intended Place of Confinement

1. The release of radioactive material to an unrestricted area in concentrations which, if averaged over a period of 24 hours, exceeds 5,000 times the values specified in Table 2 of Appendix B to 10 CFR Part 20, unless the licensee has demonstrated compliance with § 20.1301 using § 20.1302 (b) (1) or § 20.1302 (b) (2) (ii).

2. Radiation levels in excess of the design values for a package, or the loss of confinement of radioactive material resulting in one or more of the following: (a) a radiation dose rate of 10 mSv (1 rem) per hour or more at 1 meter (3.28 feet) from the accessible external surface of a package containing radioactive material; (b) a radiation dose rate of 50 mSv (5 rem) per hour or more on the accessible external surface of a package containing radioactive material and that meet the requirements for ?exclusive use" as defined in 10 CFR 71.47; or (c) release of radioactive material from a package in amounts greater than the regulatory limits in 10 CFR 71.51(a)(2).

C. Theft, Diversion, or Loss of Licensed Material, or Sabotage or Security Breach[1]

1. Any lost, stolen, or abandoned sources that exceed 0.01 times the A_1 values, as listed in 10 CFR Part 71, Appendix A, Table A-1, for special form (sealed/nondispersible) sources, or the smaller of the A_2 or 0.01 times the A_1 values, as listed in Table A-1, for normal form (unsealed/dispersible) sources or for sources for which the form is not known. Excluded from reporting under this criterion are those events involving sources that are lost, stolen, or abandoned under the following conditions: sources abandoned in accordance with the requirements of 10 CFR 39.77(c); sealed sources contained in labeled, rugged source housings; recovered sources with sufficient indication that doses in excess of the reporting thresholds specified in AO criteria I.A.1 and I.A.2 did not occur during the time the source was missing; and unrecoverable

[1] Information pertaining to certain incidents may be either classified or under consideration for classification because of national security implications. Classified information will be withheld when formally reporting these incidents in accordance with Section 208 of the Energy Reorganization Act of 1974, as amended. Any classified details regarding these incidents would be available to the Congress, upon request, under appropriate security arrangements.

sources lost under such conditions that doses in excess of the reporting thresholds specified in AO criteria I.A.1 and I.A.2 were not known to have occurred.

2. A substantiated case of actual or attempted theft or diversion of licensed material or sabotage of a facility.

3. Any substantiated loss of special nuclear material or any substantiated inventory discrepancy that is judged to be significant relative to normally expected performance, and that is judged to be caused by theft or diversion or by substantial breakdown of the accountability system.

4. Any substantial breakdown of physical security or material control (i.e., access control containment or accountability systems) that significantly weakened the protection against theft, diversion, or sabotage.

D. Other Events (i.e., Those Concerning Design, Analysis, Construction, Testing, Operation, Use, or Disposal of Licensed Facilities or Regulated Materials)

1. An accidental criticality [10 CFR 70.52(a)].

2. A major deficiency in design, construction, control, or operation having significant safety implications requiring immediate remedial action.

3. A serious deficiency in management or procedural controls in major areas.

4. Series of events (where individual events are not of major importance), recurring incidents, and incidents with implications for similar facilities (generic incidents) that create a major safety concern.

II. For Commercial Nuclear Power Plant Licensees

A. Malfunction of Facility, Structures, or Equipment

1. Exceeding a safety limit of license technical specification (TS) [10 CFR 50.36(c)].

2. Serious degradation of fuel integrity, primary coolant pressure boundary, or primary containment boundary.

3. Loss of plant capability to perform essential safety functions so that a release of radioactive materials, which could result in exceeding the dose limits of 10 CFR Part 100 or 5 times the dose limits of 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 19, could occur from a postulated transient or accident (e.g., loss of emergency core cooling system, loss of control rod system).

B. Design or Safety Analysis Deficiency, Personnel Error, or Procedural or Administrative Inadequacy

1. Discovery of a major condition not specifically considered in the safety analysis report (SAR) or TS that requires immediate remedial action.

2. Personnel error or procedural deficiencies that result in loss of plant capability to perform essential safety functions so that a release of radioactive materials, which could result in exceeding the dose limits of 10 CFR Part 100 or 5 times the dose limits of 10 CFR Part 50, Appendix A, GDC 19, could occur from a postulated transient or accident (e.g., loss of emergency core cooling system, loss of control rod system).

III. For Fuel Cycle Facilities

1. A shutdown of the plant or portion of the plant resulting from a significant event and/or violation of a law, regulation, or a license/certificate condition.

2. A major condition or significant event not considered in the license/certificate that requires immediate remedial action.

3. A major condition or significant event that seriously compromises the ability of a safety system to perform its designated function that requires immediate remedial action to prevent a criticality, radiological, or chemical process hazard.

IV. For Medical Licensees

A medical misadministration that:

(a) Results in a dose that is (1) equal to or greater than 1 gray (Gy) (100 rads) to a major portion of the bone marrow, to the lens of the eye, or the gonads, *or* (2) equal to or greater than 10 Gy (1,000 rads) to any other organ; and

(b) Represents either (1) a dose or dosage that is at least 50 percent greater than that prescribed in a written directive *or* (2) a prescribed dose or dosage that (i) is the wrong radiopharmaceutical,[2] or (ii) is delivered by the wrong route of administration, or (iii) is delivered to the wrong treatment site, or (iv) is delivered by the wrong treatment mode, or (v) is from a leaking source(s).

<u>Guidelines for ?Other Events of Interest"</u>

The Commission may determine that events other than AOs may be of interest to Congress and the public and should be included in an Appendix to the AO report as ?Other Events of Interest." Guidelines for events to be included in the AO report for this purpose may include, but not necessarily be limited to, events that do not meet the AO criteria but that have been perceived by Congress or the public to be of high health and safety significance, have received significant media coverage, or have caused the NRC to increase its attention to or oversight of a program area, or a group of similar events that have resulted in licensed materials entering the public domain in an uncontrolled manner.

---

[2] ?The wrong radiopharmaceutical" as used in the AO criterion for medical misadministrations refers to any radiopharmaceutical other than the one listed in the written directive or in the clinical procedures manual.

APPENDIX B

UPDATE OF PREVIOUSLY REPORTED ABNORMAL OCCURRENCES

During this reporting period, there was no significant new information regarding previous abnormal occurrences.

APPENDIX C

OTHER EVENTS OF INTEREST

This Appendix discusses ?Other Events of Interest," that do not meet the abnormal occurrence (AO) criteria but have been perceived by Congress or the public to be of high health and safety significance, have received significant media coverage, or have caused the NRC to increase its attention to or oversight of a program area, or a group of similar events that have resulted in licensed materials entering the public domain in an uncontrolled manner.

NUCLEAR POWER PLANTS

Circumferential Cracks on Reactor Vessel Head Penetrations at the Oconee Nuclear Station Unit 3

This event did not meet the AO reporting criteria since it did not involve a serious degradation in the reactor coolant system pressure boundary or a major reduction in the protection of public health or safety.

On February 18, 2001, with Oconee Nuclear Station Unit 3 (ONS3) in Mode 5, Duke Energy Corporation (the licensee) performed a visual examination of the outer surface of the unit's reactor pressure vessel (RPV) head to look for indications of borated water leakage. This RPV head inspection was part of a normal surveillance during a planned maintenance outage. The visual examination revealed the presence of small amounts of boric acid residue in the vicinity of 9 of the 69 control rod drive mechanism (CRDM) penetration nozzles. Subsequent nondestructive examinations (NDEs) identified recordable crack indications in these nine degraded CRDM penetration nozzles. While repairing the nozzles, the licensee discovered that two CRDMs had significant circumferential cracks in the nozzle above the weld. Post-outage third party review of the NDE records identified a third circumferential crack above the weld, in a nozzle that was repaired during the outage. Circumferential cracking of CRDM nozzles and welds is a degradation of the reactor coolant system pressure boundary and raises concerns about a potentially risk-significant generic condition affecting all domestic pressurized water reactors (PWRs). Further investigations and metallurgical examinations revealed that these cracks had initiated from the outside diameter (OD) of the CRDM penetration nozzles. Based on metallurgical examinations, the root cause for the CRDM penetration nozzle cracking was primary water stress corrosion cracking (PWSCC).

Axial cracking in PWR CRDM nozzles has been previously identified, evaluated, and repaired at domestic PWRs. Numerous small-bore Alloy 600 nozzles and pressurizer heater sleeves have experienced leaks attributed to PWSCC. Generally, these components are exposed to temperatures of 600 degrees Fahrenheit or higher and to primary water, as are the ONS3 CRDM nozzles. However, circumferential cracks above the weld from the OD to the inside diameter have not been previously identified in the United States.

On July 30, 2001, the NRC issued a letter documenting its decision to exercise enforcement discretion in accordance with Section VII.B.6 of the NRC Enforcement Policy and refrain from issuing enforcement action for a violation of the Technical Specifications for reactor coolant system pressure boundary leakage. Enforcement discretion was warranted because the violation involved an equipment failure that was not avoidable by reasonable quality assurance measures or management controls and was considered to have resulted from matters not within the licensee's controls.

To assess the generic implications of this issue, the NRC issued Bulletin 2001-01, "Circumferential Cracking of Reactor Vessel Head Penetration Nozzles," on August 3, 2001. Previously, the NRC issued Information Notice 2001-05 on April 30, 2001, to alert licensees to the findings at ONS3.

All license holders for pressurized water reactor plants have responded to Bulletin 2001-01. In their responses, licensees included such details as their vessel head configurations, any previously identified leakage, past inspections performed and future planned inspections. Inspections of CRDM nozzle penetrations continue to be performed as plants shut down for refueling outages. The staff is using the Bulletin responses and new inspection results to develop a long-term strategy for managing this issue.

NRC AND AGREEMENT STATE MATERIALS LICENSEES

During FY 2001, 684 events involving materials licensees were reported to the NRC. In 298 of these events, licensed material entered the public domain in an uncontrolled manner. Seventy of the 298 events were reported by NRC licensees and 228 were reported by Agreement State licensees. In some cases, the material caused radioactive contamination or radiation exposure. Most of these events posed little risk to public health. The NRC is aware of only a few events in which members of the public received measurable radiation doses from the loss of control of licensed material, and no events in which acute health effects to a member of the public are expected.

The 298 events of loss of control of licensed material involved both medical and industrial licensed materials. Examples are (1) radioactive sources used in medical treatments or research and development, (2) gauges used to measure the moisture density in soils and to monitor production processes for quality control in construction and civil engineering, (3) chemical agent monitors/detectors used by the military to detect the presence of chemical warfare agents, and (4) tritium used to illuminate exit signs and mortar-sighting mechanisms in the military.

Any loss of control of material is undesirable. To prevent future incidents the NRC and Agreement States have issued generic communications to inform licensees about these events and their consequences. In some cases, enforcement actions have been taken, and regulatory changes intended to increase licensees' accountability for generally licensed devices have been developed and are being implemented. The NRC is currently evaluating additional security and control requirements for sources. Further, in response to the events of September 11, 2001, the NRC is conducting a top-to-bottom review of security matters concerning materials licensees.

The following example of loss of control of material is provided for an illustration.

<u>Lost Portable Gauge in Richmond, Virginia</u>

On February 8, 2001, Draper Aden Associates, an NRC licensee, reported the loss of a Troxler Electronic Laboratories portable gauge that contained 1.48 gigabecquerels (GBq) [8.5 millicurie (mCi)] of cesium-137 and 0.3 GBq (49 mCi) of americium-241.

The loss of control was caused by gauge operator's failure to block and brace the portable gauge prior to and during transport on February 8, 2001. The gauge was returned to the licensee on February 9, 2001.

Draper Aden's corrective actions included an immediate search for the gauge, prompt notification of local authorities and the NRC, a leak test of the gauge after its recovery confirming normal radiation levels, and additional training of all users on proper storage, transportation, and security of gauges containing radioactive material. In addition, Draper Aden informed the NRC in a response letter dated May 7, 2001, that Draper Aden would increase the frequency of audits and training sessions to ensure proper storage, transportation, and security of portable nuclear gauges in the future.

The licensee's failure to block and brace the gauge during transport, resulting in the failure to maintain control and constant surveillance of the portable gauge, was identified as a violation of Department of Transportation regulation 49 CFR 177.842(d) and NRC regulations 10 CFR 20.1801 and 1802 governing the transport of licensed material. On June 4, 2001, the NRC issued a Notice of Violation for a Severity Level III violation. In accordance with the NRC's Enforcement Policy, a civil penalty was not proposed because of the licensee's prompt and comprehensive corrective actions and in recognition of the absence of previous escalated enforcement action.

This Page Intentionally Left Blank