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Vol. 11, No. 3

Report to Congress on Abnormal Occurrences

July - September 1988

U.S. Nuclear Regulatory Commission

Office for Analysis and Evaluation of Operational Data

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ABSTRACT

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which 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 July 1 to September 30, 1988.

For this reporting period, there were no abnormal occurrences at nuclear power plants licensed to operate. There were two abnormal occurrences under other NRC-issued licenses: multiple medical therapy misadministrations at a single hospital and a medical diagnostic misadministration. There was one abnormal occurrence reported by an Agreement State (Texas) involving a medical diagnostic misadministration.

The report also contains information updating some previously reported abnormal occurrences.

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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 which 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, including those submitted by the Agreement States, described in this report meet the criteria for abnormal occurrence reporting. This report covers the period from July 1 to September 30, 1988.

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 assured through the establishment of multiple levels of protection. These multiple levels can be achieved and maintained through regulations specifying requirements that will assure 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 assure 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 assure that corrective actions are taken to prevent recurrence.

For nuclear power plants, dedicated groups have been formed both by the NRC and by the nuclear power industry for the detailed review of operating experience to help identify safety concerns early, to improve dissemination of such information, and to feed back the experience into licensing, regulations, and operations. In addition, the NRC and the nuclear power industry have ongoing efforts to improve the operational data systems, which include not only the type and quality of reports required to be submitted, but also the methods used to analyze the data. In order to more effectively collect, collate, store, retrieve, and evaluate operational data, the information is maintained in computer-based data files.

Two primary sources of operational data are Licensee Event Reports (LERs) and immediate notifications made pursuant to 10 CFR § 50.72.

Except for records exempt from public disclosure by statute and/or regulation, information concerning reportable occurrences at facilities licensed or otherwise regulated by the NRC is routinely disseminated by the NRC to the nuclear industry, the public, and other interested groups as these events occur. Dissemination includes special notifications to licensees and other affected or interested groups, and public announcements. In addition, information on reportable events is routinely sent to the NRC's more than 100 local public document rooms throughout the United States and to the NRC Public Document Room in Washington, D.C. The Congress is routinely kept informed of reportable events occurring in licensed facilities.

Another primary source of operational data is reports of reliability data submitted by licensees under the Nuclear Plant Reliability Data System (NPRDS). The NPRDS is a voluntary, industry-supported system operated by the Institute of Nuclear Power Operations (INPO), a nuclear utility organization. Both engineering and failure data are submitted by nuclear power plant licensees for specified plant components and systems. The Commission considers the NPRDS to be a vital adjunct to the LER system for the collection, review, and feedback of operational experience; therefore, the Commission periodically monitors the NPRDS reporting activities.

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 State programs must be comparable to and compatible with the Commission's program for such material.

Presently, information on reportable occurrences in Agreement State licensed activities is publicly available at the State level. Certain information is also provided to the NRC under exchange of information provisions in the agreements.

In early 1977, the Commission determined that abnormal occurrences happening at facilities of Agreement State licensees should be included in the quarterly reports to Congress. The abnormal occurrence criteria included in Appendix A

are applied uniformly to events at NRC and Agreement State licensee facilities. Procedures have been developed and implemented, and abnormal occurrences reported by the Agreement States to the NRC are included in these quarterly reports to Congress.

FOREIGN INFORMATION

The NRC participates in an exchange of information with various foreign governments that have nuclear facilities. This foreign information is reviewed and considered in the NRC's assessment of operating experience and in its research and regulatory activities. Reference to foreign information may occasionally be made in these quarterly abnormal occurrence reports to Congress; however, only domestic abnormal occurrences are reported.

REPORT TO CONGRESS ON ABNORMAL OCCURRENCES
JULY-SEPTEMBER 1988

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.

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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.

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OTHER NRC LICENSEES

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

There are currently about 9,000 NRC nuclear material licenses in effect in the United States, principally for use of radioisotopes in 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:

88-12 Multiple Medical Therapy Misadministrations

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 - Twenty one medical therapy misadministrations during 1985 and 1986, reported to the NRC on April 6 and May 5, 1988; Marquette General Hospital, Marquette, Michigan.

Nature and Probable Consequences - On April 6, 1988, a medical physicist discovered that the doses given to two patients undergoing irradiation of the breast in November of 1985 and March of 1986 were about 85% of the prescribed doses. On the same day, the licensee notified NRC Region III of the misadministrations.

The licensee was using a proprietary computer program to calculate dose profiles in patients; however, there was an error in the procedure used to calculate the beam-on time using information generated by the treatment planning computer. The medical physicist who discovered the error in the two patient charts was conducting a quality assurance review of the treatment records.

Upon notification, the NRC requested the licensee to review its patient files to identify any additional patients who may have been treated using the erroneous computer program. On May 5, 1988, the licensee reported that 19 additional cases from September 1985 to October 1986 had been identified in which the actual doses were only about 85% of the prescribed doses. (The licensee stated that the procedure was no longer used after October 1986.) In regard to possible health effects, the licensee stated, "The radiation dose given is less than the prescribed dose. Radiobiologically, it is not harmful to the patient and no medical damage was done. The average given dose was about 15% less, however, it is still very close to the biological range. In addition, some of these patients received boost doses to the breast via electron or interstitial implants to localized areas."

Nevertheless, the event is of concern since a single error resulted in so many people receiving therapeutic doses other than were prescribed.

Cause or Causes - The cause was due to an error in the manual calculations that were performed on the treatment planning computer output. The licensee failed to detect the error before the procedure was used.

Actions Taken to Prevent Recurrence

Licensee - The particular procedure involved has not been used since October 1986. In order to prevent a recurrence of the type of event, the licensee committed to take the following actions:

(1) All current dose calibration procedures will be reviewed and documented by the physicist and the radiation oncologist to check for correctness.

(2) Before any new calculation procedures are initiated, they will be thoroughly discussed between the radiation oncologist and the physicist.

(3) If there are any questions brought up during these reviews, a physicist from an outside institution will be contacted for consultation.

The licensee submitted a quality assurance program to prevent recurrence of this type of event. The program has been incorporated into the licensee's license.

NRC - The incident, and the licensee's corrective actions, will be reviewed during the next NRC inspection at the hospital.

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

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88-13 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 - June 27, 1988; The Fairfax Hospital, Falls Church, Virginia.

Nature and Probable Consequences - A patient was administered 2.7 millicuries of I-131 MIBG rather than the intended dose of 500 microcuries of I-131 MIBG.

I-131 MIBG is currently an Investigational New Drug and is used in a relatively new and rarely ordered diagnostic study performed at the hospital. Prior to the administration, the technologist involved, who was unfamiliar with the correct amount to administer, checked both the literature which accompanied the shipment and the department's procedure manual. However, even though the correct dose was listed in the procedure manual, the technologist missed it and assumed that the entire vial of 2.7 millicuries was to be administered.

The misadministration resulted in an estimated adrenal medullae dose of 268.4 rads, as calculated in accordance with literature supplied by the United States Food and Drug Administration. The thyroid burden should be negligible because the thyroid had been blocked with Lugols prior to the administration of the I-131 MIBG, as prescribed in the protocol.

The licensee stated the patient exhibited no adverse health effects.

Cause or Causes - The cause is attributed to the technologist's error in overlooking the proper dosage as listed in the department's procedure manual.

Action Taken to Prevent Recurrence

Licensee - The technologist was admonished and retrained.

NRC - NRC Region II telephoned the hospital for additional details on the incident. The incident will be reviewed during the next NRC inspection at the hospital.

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

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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. During the third calendar quarter of 1988, an Agreement State (Texas) reported the following abnormal occurrence to the NRC:

AS88-3 Medical Diagnostic Misadministration

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 - May 17, 1988; West Houston Medical Center, Houston, Texas.

Nature and Probable Consequences - A patient was scheduled to be administered 30 microcuries of iodine-131 in capsule form for a diagnostic scan of her thyroid. Instead she was administered 30 millicuries of iodine-131 in capsule form. This resulted in an estimated dose to the thyroid of over 30,000 rads; such a dose would be expected to destroy the thyroid's function. The event was investigated by the Texas Department of Health, Bureau of Radiation Control (the "Agency").

After the patient's doctor ordered a diagnostic thyroid scan, the technologist mistakenly ordered a dose of 30 millicuries of iodine-131 on Sunday May 15, leaving the order on an answering machine. The pharmacist on duty the next day took the order but could not fill it because therapy doses are ordered from the manufacturer individually. He called the technologist to explain, and she agreed to postpone until the next day, May 17. When the dose arrived, she placed it in the dose calibrator and was perplexed by the high count rate she obtained, but administered the dose and told the patient to come back the next morning for her scan. The technologist mentioned the high count rate to the doctor, who apparently didn't get enough information to realize the potential problem and told her the count rate was relative.

On Monday May 16, she had ordered 30 millicurie doses for two other patients to be administered on May 18 and was informed it was too late to change the delivery but that there would still be 27.5 millicuries (quantity reduction due to radioactive decay) on the 19th, when the dose was to be administered. When she checked with the doctor, informing him of the 27.5 millicurie dose, he corrected her saying she meant microcuries. She still didn't realize her mistake. Later on the evening of May 17th, she ordered a 30-microcurie dose and was told it could be delivered right away. She asked why she had to wait for the others and was reminded they had been 30 millicuries. She then realized her mistake and notified another physician on the hospital staff, who after consulting with the patient's physician, called the patient back to the hospital and administered a blocking agent about 12 hours after the original dose was administered. However, the blocking agent was felt to have little effect.

The hospital's estimate of the dose to the thyroid was 30,000 rads. The Agency's calculations indicated a thyroid dose of approximately 34,000 rads. The hospital is performing follow-up examinations of the patient. No prognosis for the patient was available at the time of the Agency's report to the NRC.

Cause or Causes - The Agency's investigation indicated several contributing factors to the misadministration. The hospital performs relatively few thyroid scans and they are all performed using microcurie quantities of iodine. Scans using other radionuclides require millicurie quantities.

The technologist placing the order was not as experienced as the technologist who normally performed the scans. She had already performed several scans using millicurie quantities of other radionuclides and when the thyroid scan was ordered, went to her procedures manual for the quantity to be ordered. When she placed the order, she apparently didn't realize she was saying millicuries and continued to confuse millicuries and microcuries until after the dose was administered.

Actions Taken to Prevent Recurrence

Licensee - The licensee is rewriting its protocol for nuclear medicine scans to list each procedure with the activity and form of the material to be used. In addition, the licensee is instructing any firm supplying therapy doses of radiopharmaceuticals that they are to be prepared only when the order is accompanied by a written prescription signed by the physician user authorizing the procedure or verbal, personal authorization is obtained by the pharmacist from the physician-user.

Agency - At the time of the Agency's report to the NRC, the Agency was still reviewing the incident to determine the appropriate enforcement action.

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

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APPENDIX A

ABNORMAL OCCURRENCE CRITERIA

The following criteria for this report's abnormal occurrence determinations were set forth in an NRC policy statement published in the Federal Register on February 24, 1977 (Vol. 42, No. 37, pages 10950-10952).

An event will be considered an abnormal occurrence if it involves a major reduction in the degree of protection of the public health or safety. Such an event would involve a moderate or more severe impact on the public health or safety and could include but need not be limited to:

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 licensed facilities or material.

Examples of the types of events that are evaluated in detail using these criteria are:

For All Licensees

1. Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual to 150 rems or more of radiation; or exposure of the feet, ankles, hands or forearms of any individual to 375 rems or more of radiation [10 CFR §20.403(a)(1)], or equivalent exposures from internal sources.

2. An exposure to an individual in an unrestricted area such that the whole body dose received exceeds 0.5 rem in one calendar year [10 CFR §20.105(a)].

3. The release of radioactive material to an unrestricted area in concentrations which, if averaged over a period of 24 hours, exceed 500 times the regulatory limit of Appendix B, Table II, 10 CFR Part 20 [10 CFR §20.403(b)].

4. Radiation or contamination levels in excess of design values on packages, or loss of confinement of radioactive material such as (a) a radiation dose rate of 1,000 mrem per hour three feet from the surface of a package containing the radioactive material, or (b) release of radioactive material from a package in amounts greater than the regulatory limit.

5. Any loss of licensed material in such quantities and under such circumstances that substantial hazard may result to persons in unrestricted areas.

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

7. 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.

8. 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.

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

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

11. Serious deficiency in management or procedural controls in major areas.

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

For Commercial Nuclear Power Plants

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

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

3. Loss of plant capability to perform essential safety functions such that a potential release of radioactivity in excess of 10 CFR Part 100 guidelines could result from a postulated transient or accident (e.g., loss of emergency core cooling system, loss of control rod system).

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

5. Personnel error or procedural deficiencies that result in loss of plant capability to perform essential safety functions such that a potential release of radioactivity in excess of 10 CFR Part 100 guidelines could result from a postulated transient or accident (e.g., loss of emergency core cooling system, loss of control rod system).

For Fuel Cycle Licensees

1. A safety limit of license technical specifications is exceeded and a plant shutdown is required [10 CFR §50.36(c)].

2. A major condition not specifically considered in the safety analysis report or technical specifications that requires immediate remedial action.

3. An event that seriously compromised the ability of a confinement system to perform its designated function.

APPENDIX B

UPDATE OF PREVIOUSLY REPORTED ABNORMAL OCCURRENCES

During the July through September 1988 period, the NRC, NRC licensees, Agreement States, Agreement State Licensees, and other involved parties, such as reactor vendors and architects and engineers, continued with the implementation of actions necessary to prevent recurrence of previously reported abnormal occurrences. The referenced Congressional abnormal occurrence reports below provide the initial and any subsequent updating information on the abnormal occurrences discussed. The updating provided below generally covers events that took place during the report period; thus, some information is not current. Some updating, however, is more current as indicated by the associated event dates. Open items will be discussed in subsequent reports in the series.

NUCLEAR POWER PLANTS

77-9 Environmental Qualification of Safety-Related Electrical Equipment Inside Containment

This abnormal occurrence was originally reported in NUREG-0090-10, "Report to Congress on Abnormal Occurrences: October - December, 1977" and updated in subsequent reports in this series (NUREG-0090, Vol. 1, No. 1; Vol. 1, No. 2; Vol. 2, No. 2; Vol. 3, No. 2; Vol. 4, No. 2; Vol. 5, No. 2; Vol. 6, No.1; Vol. 8, No. 2; Vol. 9, No. 4; and closed out in Vol. 10, No. 2). It is being reopened to report a significant change in enforcement policy in regard to environmental qualification (EQ) violations. The item is then reclosed.

Background:

NRC Generic Letters, Bulletins, and Information Notices have been issued to provide guidance regarding the application and enforcement of 10 CFR §50.49, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants." Generic Letter 85-15, issued August 6, 1985 (Ref. B-1), and Generic Letter 86-15, issued September 22, 1986 (Ref. B-2), provided information related to the deadlines for compliance with 10 CFR §50.49 and possible civil penalties applicable to licensees who were not in compliance with the rule as of the November 30, 1985 deadline. Upon review, the Commission found that the EQ Enforcement Policy promulgated in Generic Letter 86-15 could result in imposition of civil penalties that did not properly reflect the safety significance of EQ violations with respect to civil penalties imposed in the past. In the interest of continuing a tough but fair enforcement policy, the Commission determined that the EQ Enforcement Policy should be revised. On April 7, 1988, the NRC issued Generic Letter 88-07, which described the modified enforcement policy for EQ violations (Ref. B-3). This letter replaced the guidance provided in Generic Letters 85-15 and 86-15.

Modified EQ Enforcement Policy:

The modified EQ enforcement policy includes the following considerations: (1) aggregate significant EQ violations together, rather than consider each separate item of unqualified electrical equipment, for assessment of a civil penalty; (2) assess a base civil penalty according to the number of systems or

components that are affected by the unqualified equipment in a graded approach by assignment of the aggregate EQ problem into one of three categories; (3) establish a maximum EQ civil penalty of $750,000 for most cases; (4) maintain a minimum civil penalty of $50,000 for a significant EQ violation in most cases; and (5) consider mitigation or escalation of the base civil penalty based on the factors of identification and reporting, best efforts to complete EQ within the deadline, corrective actions, and duration of the violation.

In regard to Item 2, the base civil penalty would be determined as described below, and subject to mitigation or escalation as described in Item 5.

EQ Violation Category	Description	Base Civil Penalty
A	Extensive: EQ violations affecting many systems and many components.	$300,000
B	Moderate: EQ violations affecting some systems and some components.	$150,000
C	Isolated: EQ violations affecting a limited number of systems and components.	$ 75,000

The modified policy should not be interpreted as a lessening of the NRC's intention to assure that all plants comply with EQ requirements. The modified policy is intended to give a significant civil penalty to those licensees with significant EQ violations. The NRC's view is that the modified policy more closely reflects the relative safety importance of EQ violations compared to other enforcement issues.

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

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79-3 Nuclear Accident at Three Mile Island

This abnormal occurrence was originally reported in NUREG-0090, Vol. 2, No. 1, "Report to Congress on Abnormal Occurrences: January-March 1979," and updated in each subsequent report in this series (NUREG-0090, Vol. 2, No. 2 through Vol. 11, No. 2). It is planned to continue these updates until defueling activities at the site are completed. The update of activities for the period of July 1, 1988 through September 30, 1988 (except where otherwise noted) is as follows:

Reactor Vessel and Ex-Vessel Defueling Operations

During the July through September 1988 period, approximately 8,000 pounds of fuel and debris were removed from the reactor vessel. At the end of the period, the total material loaded into canisters is approximately 204,000 pounds (68 percent) out of a total of approximately 300,000 pounds of core debris and other materials. The total material to be removed includes the mass of the core; structural and absorber materials; mass added by oxidation of core and structural material; and portions of the baffle plates, formers, and other components that will become comingled with core debris during cutting operations. The original core area has been defueled; principal remaining areas are the Lower Core Support Assembly (LCSA), lower head, core baffle plates, and core bypass flow holes.

LCSA disassembly and defueling have begun, using the core drilling rig and a plasma arc cutting torch. The LCSA consists of five layers or sections. The two uppermost sections of the LCSA, the lower grid rib section (LGRS) and the flow distributor plate (FDP), have been sectioned and removed. Radiation levels from pieces of the LGRS have measured up to 80 rem/hour at one foot. The radiation is due to neutron activation of the LGRS. Both the LGRS and the flow distributor plate pieces have been removed from the reactor vessel and placed underwater in a modified core flood tank for shielding. Work on defueling and sectioning of the next layer, the grid forging, is in progress. Later the two remaining layers, the incore guide support plate and the flow distributor will be sectioned and removed.

The steam generators, pressurizer, and hot legs have been defueled. The decay heat drop line is the principal remaining ex-vessel component remaining to be defueled.

Decontamination and Dose Reduction Activities

Scarification (abrasive removal of thin layers of concrete using ultra high pressure water sprays) of the reactor building basement walls has been completed. A flush of the hollow concrete block wall at the elevator shaft in the containment basement was completed. Water was pumped into the center of the hollow block wall in an effort to leach out soluble isotopes and, subsequently, processed through the EPICOR II filter/demineralizer system. The effectiveness of these activities is being evaluated. Preliminary results indicate approximately a 30 percent reduction in strontium and cesium from the block wall.

Scabbling, steam vacuuming, and hands-on decontamination continue in the auxiliary and fuel handling buildings. As of the end of August, 120 of 143 cubicles have been decontaminated to end point criteria.

System flushes are in progress with 61 of 76 identified system flowpaths having been completed.

Efforts to remove the resins from the makeup and purification demineralizers have had partial success, but are currently suspended. These resins contain high levels of activity because they were in service at the time of the 1979 accident. Thus far, a number of methods have been tried, including sparging and using a hydrolance.

Fuel Cask Shipments

During the period, no additional shipments of core debris were made from TMI-2 to the Idaho National Engineering Laboratory (INEL). The total remains at 191,000 pounds of core debris.

Pos -Defueling Monitored Storage

On April 27, 1988, the NRC staff issued Draft Supplement 3 to the Programmatic Environmental Impact Statement (PEIS) related to the decontamination and disposal of radioactive waste resulting from the March 29, 1979, accident at TMI-2 (Ref. B-4). This Supplement evaluates the impacts of the licensee's proposal to place the facility in a state of Post-Defueling Monitored Storage (PDMS). The comment period on the draft Supplement ended on August 1, 1988. The NRC staff is evaluating the comments and preparing the final Supplement 3 to PEIS. The licensee submitted a Safety Analysis Report (SAR) on PDMS on August 16, 1988, with a revision submitted on September 19, 1988. The SAR is under review by the NRC staff and a contractor.

Proposal to Dispose of Accident-Generated Water

The proposal by the licensee to dispose of the approximately 2.3 million gallons of accident generated water (AGW) by evaporation is before the NRC Atomic Safety and Licensing Board Panel (ASLBP). On August 25, 1988 the ASLBP issued an order ruling on the licensee's motion for summary disposition of admitted contentions. The ASLBP ruled that four contentions and parts of one other failed to raise genuine issues of material fact and will not be considered further in the proceedings. One contention and parts of three other contentions were found to raise genuine issues of material fact and will be litigated in the forthcoming hearing. No decision on the licensee's proposal to evaporate the AGW will be made until the ASLBP proceeding is concluded.

TMI-2 Advisory Panel Meetings

The Advisory Panel for the Decontamination of Three Mile Island Unit 2 (Panel) met on July 14, 1988. At the meeting, Dr. Neil Wald gave a presentation on his trip to Chernobyl; the licensee updated the Panel on the status of the cleanup, their PDMS proposal, and funding plan for decommissioning. The Panel discussed the licensee's proposal for long term storage of the facility.

The Panel also met on September 7, 1988. Mr. Michael B. Roche, the new GPUN Director of TMI-2, was introduced to the Panel. In addition, the licensee further updated the Panel on the status of the cleanup and provided additional information on the PDMS proposal. Also at the meeting, the Panel voted on a recommendation to the NRC Commissioners regarding PDMS. The recommendation was that at the present time, there was no compelling evidence in favor of PDMS in light of the uncertainties regarding the length of time of PDMS and the funding of decommissioning.

Future reports will be made as appropriate.

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85-14 Management Deficiencies at Tennessee Valley Authority

This abnormal occurrence was originally reported in NUREG-0090, Vol. 8, No. 3, "Report to Congress on Abnormal Occurrences: July-September 1985," and updated in subsequent reports in this series (Vol. 9, No. 1; Vol. 9, No. 2; Vol. 9, No. 3; Vol. 10, No. 2; Vol. 10, No. 4; Vol. 11, No. 1; and Vol. 11, No. 2). It is further updated for this report period, except as otherwise noted, as follows:

Overview of Sequoyah Issues

Since the shutdown of both Sequoyah Units in August 1985, Tennessee Valley Authority (TVA) and the NRC have worked to resolve the issues to be addressed before restart of Sequoyah. The NRC staff reviewed and approved TVA's program to resolve these issues in the NRC's NUREG-1232, Volume 1, "Safety Evaluation Report (SER) on Tennessee Valley Authority Revised Corporate Nuclear Performance Plan," published in July 1987 (Ref. B-5) and in NUREG-1232, Volume 2, "Safety Evaluation Report (SER) on Tennessee Valley Authority Sequoyah Nuclear Performance Plan," published in May 1988 (Ref. B-6). Based on these reviews and on the completion of the corrective actions described in the Sequoyah Nuclear Performance Plan, the NRC authorized TVA to restart Unit 2 on March 30, 1988. The unit reached criticality on May 13, 1988.

Sequoyah Unit 1 Restart

Even though TVA's corrective action programs addressed both units at Sequoyah, the NRC staff authorized the restart only of Unit 2. The TVA corrective programs required examination, analysis, and, where required, corrective actions for components. All of these actions had not been completed at Unit 1 at the time Unit 2 was authorized to restart; further, the adequacy of certain systems common to both units had been verified by calculation assuming only Unit 2 was operating. These calculations required reanalysis to reflect a two unit operation at Sequoyah. TVA was to complete these items, and the NRC staff was to review and inspect their completion prior to the restart of Unit 1. With few exceptions, over the past six months, TVA completed the reviews, analyses and calculations required for the restart of Unit 1.

The NRC monitored the completion of the remaining items through inspections and technical reviews and conducted two major inspections to assess TVA's readiness for the restart of Sequoyah Unit 1. In order to examine the effectiveness of TVA's implementation of the corrective action programs, the staff undertook a detailed inspection of one of the safety systems at Unit 1 - containment spray. From this inspection, the staff determined that the various programs had resulted, collectively, in an adequate resolution in all problem areas affecting that system. Based on this and other ongoing programmatic reviews, the staff concluded that TVA's corrective action programs were adequate for the restart of Unit 1.

The staff also conducted a restart readiness inspection, which addressed specific areas important to operation. These areas included:

- Employee Concerns
- Maintenance Program
- Conditions Adverse to Quality Process
- Restart Acceptance Criteria Implementation
- System Valve Lineups

The NRC also planned 24-hour-per-day inspector coverage in the control room at various times during heatup and power ascension. This would provide additional assurance of TVA's readiness to conduct power operations at Unit 1.

(Editor's Note: TVA was authorized by the NRC to restart Unit 1 on November 5, 1988; criticality was achieved on November 6, 1988. Details of the events leading to the restart authorization, and a summary of operational experience as of December 31, 1988, will be described in the next report in this series, i.e., NUREG-0090, Vol 11, No. 4.)

TVA General Management and Personnel Issues

On July 1, 1988, Marvin Runyon, Chairman of the Board, TVA, announced a financial austerity program at TVA that included major cutbacks in personnel and funding. As a consequence of these cutbacks, TVA indefinitely deferred the licensing of Watts Bar Unit 2 and Bellefonte Units 1 and 2 and also delayed the licensing schedule for Watts Bar Unit 1 and the restart schedule for Browns Ferry Units 1 and 3. The staff has monitored the impact of these cutbacks on Sequoyah Units 1 and 2 and Browns Ferry Unit 2 and has observed no adverse impact on safety or schedule at these units at this time.

On September 8, 1988, TVA announced that Oliver D. Kingsley, Jr. would replace Steven A. White as the Senior Vice President, Nuclear Power, at TVA. This change was to be effective November 1, 1988. Mr. Kingsley was Vice President of Nuclear Operations at Systems Energy Resource, Inc., the generation subsidiary of Mid-South Utilities. Also, TVA announced the appointment of Warren (Bus) Cobean as Senior Advisor (Nuclear) to the TVA Board of Directors. Mr. Cobean had recently retired as President of Burns and Roe, a nuclear architect/engineering company.

Future reports will be made as appropriate.

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87-1 NRC Order Suspends Power Operations of Peach Bottom Facility Due to Inattentiveness of the Control Room Staff

This abnormal occurrence was originally reported in NUREG-0090, Vol. 10, No. 1, "Report to Congress on Abnormal Occurrences: January-March 1987," and updated in subsequent reports in this series (NUREG-0090, Vol. 10, No. 2 and Vol. 10, No. 3). It is further updated from August 1987 to mid-October 1988 as follows:

In early August 1987, a Peach Bottom Restart Panel, composed of management from NRC Region I and the NRC Office of Nuclear Reactor Regulation, was established to coordinate the planning and execution of NRC's activities on plant restart. There have been several panel meetings. A team assessment during the weeks of September 21, 1987, and January 5, 1988, focused on licensed operator performance and attitude training programs. Another inspection evaluated each of the

six operating teams as they responded to events on the Limerick simulator. Team inspections have also been completed on the site Maintenance Program and Emergency Operating Procedures.

The licensee, Philadelphia Electric Company (PECo), has reorganized its entire nuclear program. The Nuclear Review Board reports directly to the Office of the Chief Executive and to the Board of Directors. PECo's nuclear operation is centralized under one executive vice president, one senior vice president, and four vice presidents. The NRC, on December 18, 1987, told the company it could proceed with the corporate management changes proposed in Section I of the Restart Plan. On January 4, 1988, PECo instituted their new nuclear organization. The Limerick Plant Manager became the new Plant Manager at Peach Bottom. On February 16, 1988, PECo named an Executive Vice President, Nuclear.

In April 1988, the licensee submitted Revision 1 to its corrective action plan for the restart of the plant. The revised plan reflected the new licensee management organization and responded to the NRC staff's concerns with respect to the root causes of the Peach Bottom issues and their relationship to the corrective action tasks. The NRC solicited comments on the revised restart plan from Pennsylvania and Maryland, and held public meetings near the plant in York and Lancaster Counties, Pennsylvania, and Harford County, Maryland, to receive public comments on the plan.

On October 19, 1988, the NRC staff issued a Safety Evaluation Report (Ref. B-7), which concluded that the licensee's corrective action plan, as revised, was acceptable to meet the requirements of the March 31, 1987 NRC shutdown order for a detailed and comprehensive plan and schedule to ensure that the facility will be operated safely and comply with all requirements. The licensee is continuing with its plans to prepare for plant restart. The NRC staff will continue to monitor the effectiveness of the licensee's implementation of the restart plan and associated activities.

To emphasize the seriousness of the violations that resulted in the NRC suspension of power operations, a significant civil penalty was imposed on the licensee; in addition, civil penalties were imposed on certain NRC licensed individuals who were members of the shift operations staff at Peach Bottom on or about the time of the NRC shutdown order. The individual enforcement actions were issued on August 9, 1988; the maximum civil penaltywas $1,000. On August 10, 1988, the NRC issued a proposed civil penalty of $1,250,000 to PECo as well as an Order restricting activities of three former Peach Bottom managers (Ref. B-8). All civil penalties have been paid.

Future reports will be made as appropriate.

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88-3 Cracked Pipe Weld in Safety Injection System at Farley Unit 2

This abnormal occurrence was originally reported in NUREG-0090, Vol. 11, No. 1, "Report to Congress on Abnormal Occurrences: January-March 1988." It is updated as follows:

As mentioned in the previous report, unacceptable thermal stresses in unisolable piping connected to reactor coolant systems (RCSs) could have generic implications for other plants. Thermal fatigue of such piping could result in crack initiation. Subjecting flawed piping to excessive stresses, induced by a seismic event, waterhammer, or some other cause, conceivably could result in failure of the pipe.

Therefore, on June 22, 1988, the NRC issued Bulletin No. 88-08 ("Thermal Stresses in Piping Connected to Reactor Coolant Systems") to all holders of operating licenses or construction permits for light-water-cooled nuclear power reactors (Ref. B-9). The Bulletin requested that the addressees: (1) review their RCSs to identify any connected, unisolable piping that could be subjected to temperature distributions which would result in unacceptable thermal stresses and (2) take action, where such piping is identified, to ensure that the piping will not be subjected to unacceptable thermal stresses. Included was a request to nondestructively examine piping sections that may have been subjected to excessive thermal stresses to provide assurance that there are no existing flaws.

Meanwhile the NRC became aware of an event, similar to the Farley Unit 2 event, which occurred on June 18, 1988 at a foreign plant. The latter, like Farley, is a Westinghouse-designed, 3 loop, pressurized water reactor. However, unlike the Farley event, a crack developed suddenly rather than slowly, and the crack was in base metal rather than in the weld or heat affected zone. On June 24, 1988, the NRC issued Bulletin No. 88-08, Supplement 1 (Ref. B-10) to: (1) provide preliminary information to addressees about the foreign event that appears to be similar to the Farley 2 event, and (2) emphasize the need for sufficient examinations (including base metal, as appropriate) of unisolable piping connected to the RCS to assure that there are no rejectable crack or flaw indications.

Experience at Farley and at the foreign plant showed that problems could be encountered when applying the usual ultrasonic testing to detect flaw indications. Therefore, on August 4, 1988 the NRC issued Bulletin No. 88-08, Supplement 2 (Ref. B-11), which emphasized to the addressees the need for enhanced ultrasonic testing and for experienced examination personnel to detect cracks in stainless steel piping.

Responses to the Bulletin from the licensees will be evaluated on a case by case basis to resolve the issue. Action resolution will be tracked under the NRC Safety Issue Management System.

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

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OTHER NRC LICENSEES

87-12 NRC Order Issued to Remove a Hospital's Radiation Safety Officer

This abnormal occurrence, which involved Milford Memorial Hospital of Milford, Delaware, was originally reported (and closed out) in NUREG-0090, Vol. 10, No. 2, "Report to Congress on Abnormal Occurrences: April-June 1987." It is being reopened (and then reclosed) to report new significant information.

As discussed in the previous report, on June 15, 1987, an Order Modifying License, Effective Immediately, was issued to the licensee (Ref. B-12). The action was based on: (1) the falsification of daily constancy checks of the dose calibrator by the licensee's two technologists, and (2) the falsification of records of Radiation Safety Committee (RSC) meetings by the Radiation Safety Officer (RSO) for about 15 years.

The Order required: (1) the removal of the RSO; (2) the suspension of the RSO's authorization to independently use or supervise the use of licensed material as currently permitted by the license; (3) the performance of monthly independent audits of the licensee's radiation safety program by an independent party; and (4) a review of the Radiation Safety Program by the new RSO, correction of deficiencies identified, and certification by the licensee to the NRC that the Nuclear Medicine Program is being operated safely and in accordance with NRC requirements. A subsequent NRC inspection showed that the licensee was in compliance with the Order.

The NRC continued its review of the findings of the NRC Office of Investigations to determine what additional enforcement action would be appropriate. On June 6, 1988, the NRC issued a Notice of Violation and Proposed Imposition of Civil Penalty in the amount of $27,500 (Ref. B-13). The violations included: (1) the falsification of records of constancy checks of their isotope dose calibrator by two technologists from approximately May 6, 1986 to December 17, 1986; (2) the initial deliberate denial of that falsification by one of the nuclear medicine technologists during the inspection; (3) the falsification of the RSC meeting minutes for several years by the former RSO; (4) the submittal of falsified RSC meeting minutes to the NRC for review during several inspections, and in support of license renewal on one occasion; (5) the failure to secure licensed material stored in an unrestricted area from unauthorized removal; and, (6) the failure to obtain NRC approval prior to moving the Nuclear Medicine Department into facilities other than those described in the license application.

The licensee maintained compliance with the Order, as determined by a subsequent NRC inspection and review of monthly audit reports from the licensee's consultant. The licensee has admitted the violations, paid the civil penalty, and proposed corrective actions acceptable to the NRC. These actions will be reviewed during future inspections of their program.

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

88-6 Release of Polonium-210 from Static Elimination Devices Manufactured by 3M Company

This abnormal occurrence was originally reported in NUREG-0090, Vol. 11, No. 1, "Report to Congress on Abnormal Occurrences: January-March 1988." It is updated, and closed out, as follows.

NRC Actions

NRC inspectors performed a special safety inspection of the 3M Company (3M) from January 25 through April 29, 1988, in response to the identification of polonium-210 contamination at Ashland Chemical Company. The results of this inspection are documented in Inspection Report Nos. 030-04971/88-1 and 030-04951/88-1, which were forwarded to the licensee on July 1, 1988 (Ref. B-14). On April 27-29, 1988, NRC inspectors conducted an inspection to ascertain the extent to which 3M was complying with the Orders of January 25, February 5, 12, and 18, 1988 (Refs. B-15, B-16, B-17, and B-18, respectively). The results of this inspection are documented in Inspection Report No. 030-04971/88-2, which was forwarded to the licensee on June 16, 1988 (Ref. B-19). No violations were identified. On June 14-17, 1988, an inspection was made of 3M radioactive products other than the polonium static elimination devices. The results of the inspection are documented in Inspection Report Nos. 030-04951/88-1, 030-04971/88-1, and 030-10825/88-1, which were forwarded to the licensee on August 19, 1988 (Ref. B-20).

Based on the latter inspection effort, a Confirmatory Action Letter (R III-CAL-88-016) was issued on June 21, 1988 (Ref. B-21). The letter suspended distribution by 3M, under certain conditions, of Model 703 static meters containing tritium and medical sources containing cesium-137 until the licensee improved certain operating practices and properly instructed operating personnel. On August 1-5, 1988, a team inspection was made with representatives of state and other federal agencies. The report for that inspection was issued on September 21, 1988. The team inspection revealed only minor violations.

Surveys were conducted by NRC inspectors at a sample of plants that had been stated by 3M or its contractor to be free of polonium-210 contamination. These surveys confirmed that the 3M followup had been adequately done.

The NRC, through a contract with Brookhaven National Laboratory, has produced a report, "Failure Investigation of 3M Series 900 Static Elimination Devices," NUREG/CR-5145, published July 1988 (Ref. B-22). A subsequent report, now in preparation, will present the results of investigation of selected 3M static elimination devices manufactured prior to 1984, the year that 3M made certain design and processing changes in the devices.

3M Actions

On April 28, 1988, 3M sent a followup letter to those customers (general licensees) that had not yet returned their devices in accordance with the Order of February 18, 1988. General licensees that then did not return their devices were followed up further by 3M with additional letters and telephone calls.

3M surveyed each returned device. Those devices found to be leaking were reported to the NRC or Agreement State having jurisdiction and to the customer. Followup surveys are being made at the facilities with leaking devices to ensure that contamination has been detected and removed.

Section V of the NRC Order of February 18, 1988, required 3M, within 60 days, to show cause why License No. 22-00057-32G should not be revoked in its entirety and why License No. 22-00057-06 should not be revoked to the extent that it authorizes manufacturing of static elimination devices containing polonium-210.

The due date was subsequently extended to July 18. On July 18, 1988, 3M submitted its response to the "Show Cause" portion of the Order. That response is now under evaluation by the NRC.

Return of Devices by General Licensees

It is estimated that, prior to this problem, 3M had distributed as many as 50,000 devices. As of September 2, 1988, all devices used in food, beverage, cosmetic, and pharmaceutical applications had been returned except for a few devices that cannot be located. Of those returned, about 1.9% were found to have leakage less than 5 nanocuries and 4.7% had leakage exceeding 5 nanocuries. Of the devices in other applications, about 4500 devices nad not been returned as of early November 1988.

Samples of products made using the 3M devices were taken by the NRC, Agreement States, and the U.S. Food and Drug Administration. No confirmed evidence of product contamination was found in any of the samples. Urinalyses from workers in contaminated plants indicated no health problems.

By May 18, 1988, a majority of the devices had been returned for testing and evaluation. Review of the information on these devices indicated to the NRC that the potential health and safety hazards for uses of the devices not involved with food, beverages, pharmaceuticals, or cosmetics were not as extensive as initially considered possible. Devices still possessed by customers were continuing to undergo radioactive decay, reducing the amount of polonium-210 in the devices. In addition, replacement devices were in short supply preventing the replacement of 3M devices without causing severe hardship. Thus, on May 18, 1988, the NRC issued a notice that permitted licensees to retain their devices until the expiration of their leases. (Leases were for a one-year term.) After this notice was issued, the rate of return slowed considerably.

Action at Contaminated Plant Sites

Surveys have been made at all plants from which returned devices were found to be leaking. Where contamination was found, the general licensee (device user) was required to have the plant cleaned up until a survey showed that it was free of contamination. Of 192 plant sites identified as having actual or potential contamination, all but 10 have now been cleared for unrestricted use. Most of these 10 have been decontaminated, but reports of the final surveys have not yet been received.

Exceptions for Continued Use on the Basis of Workplace Safety

Prior to the notice of May 18, 1988, requests from 10 companies desiring authorization for continued use were denied because they claimed, but failed to show, that the devices were essential to safety. On the other hand, 52 companies were granted authorization for continued use because the devices were essential to workplace safety. Five companies transferred authorization for possession and use of their devices from their general license to a specific license.

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

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APPENDIX C

OTHER EVENTS OF INTEREST

The following items are described because they may possibly be perceived by the public to be of public health significance. The items did not involve a major reduction in the level of protection provided for public health or safety; therefore, they are not reportable as abnormal occurrences.

Occasionally, this Appendix will include events involving exposures to very small areas of the skin (one square centimeter or less) that technically exceed the exposures shown in Appendix A (see Example 1 of "For All Licensees") of this report. The radiobiological literature indicates that an overexposure to a small area of skin (less than one square centimeter) would have much less health significance than a similar dose to larger areas of the body; consequently, such exposures would generally not be considered a major reduction in public health or safety (the general abnormal occurrence criterion) and therefore not reportable as abnormal occurrences. However, all such events, together with the circumstances associated with the events, are reviewed individually to determine their relative significance, and if warranted, will be reported as abnormal occurrences.

1. Thinning of Incore Neutron Monitoring System Thimble Tubes in Westinghouse-Designed Pressurized Water Reactors

During the summer of 1987, the NRC staff became aware that several licensees of Westinghouse-designed pressurized water reactors (PWRs) with standard length fuel (i.e., 12-foot core) had detected thinning of the incore neutron monitoring system thimble tubes. The thinning is attributed to flow-induced vibration. The thimble tubes are part of the reactor coolant system (RCS) pressure boundary. Therefore, excessive thinning of the tubes is a safety concern because failure of a tube (or tubes) results in a breach of the RCS pressure boundary, and would create a potentially non-isolable leak of reactor coolant. Furthermore, thimble tube thinning could result in multiple thimble tube failures beyond a facility's design basis during flux mapping operations or a transient event.

About November, 1987, during the NRC staff's ongoing review of this issue, the staff became aware of a foreign facility similar to the South Texas Project Unit 1 (STP-1) having detected a failed incore neutron monitoring system thimble tube after only approximately 16 weeks of operation. Additional information on this subject was obtained by the NRC staff from foreign regulatory authorities. NRC staff review of this foreign information raised concerns regarding the susceptability of STP-1 to a similar problem.

STP-1 is a Westinghouse PWR that utilizes extended length fuel (i.e., 14-foot core), located in Matagorda County, Texas, and operated by Houston Lighting and Power Company (the licensee). STP-1 and STP-2 are currently the only Westinghouse PWRs in the United States that utilize extended length fuel.

In response to the NRC staff's concerns, the licensee committed to performing inspections of STP-1's incore neutron monitoring system thimble tubes prior to achieving 16 weeks of full flow operation. The licensee also committed to taking appropriate corrective actions should incore neutron monitoring system thimble tube thinning be detected.

In early May, 1988, inspections conducted at STP-1 revealed thinning of 19 of the unit's 58 incore neutron monitoring system thimble tubes after approximately 16 weeks of full flow operation. The thinning detected ranged from 12% to nearly 60% of the wall thickness.

The licensee's corrective actions include adoption of an enhanced inspection and monitoring program to ensure incore neutron monitoring system thimble tube integrity at STP-1. Pre-operational modifications made to STP-2 should preclude the occurrence of a similar problem at STP-2.

In response to detection of incore neutron monitoring system thimble tube thinning at Westinghouse PWRs that utilize standard length fuel (i.e., 12-foot core), the NRC issued Information Notices No. 87-44 and No. 87-44 Supplement 1 "Thimble Tube Thinning in Westinghouse Reactors," on September 16, 1987 and March 28, 1988, respectively (Refs. C-1 and C-2). These Notices were sent to all holders of operating licenses or construction permits for nuclear power reactors that employ a Westinghouse nuclear steam supply system to alert them to the problems being experienced.

Data indicates that the amount of vibration the thimble tubes experience is determined by various plant specific factors and that it is not cur ntly possible to accurately predict thimble wear rates. Since there was no NRC required inservice inspection or testing, significant thimble tube degradation may have gone undetected, creating a condition that may be adverse to safety. Therefore, on July 26, 1988, the NRC issued Bulletin No. 88-09, "Thimble Tube Thinning in Westinghouse Reactors," to request that licensees establish an inspection program to periodically confirm incore neutron monitoring system thimble tube integrity (Ref. C-3). The NRC staff is currently reviewing licensees' responses to the Bulletin.

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2. Overexposure of a Maintenance Worker's Skin of the Leg at Rancho Seco

On February 4, 1988, while performing maintenance activities at Rancho Seco, a licensee welder received an exposure to a small area of skin behind the left knee from a microscopic particle of activated cobalt, which resulted in a calculated dose in the range of 19 to 278 rem. Rancho Seco is a Babcox and Wilcox-designed pressurized water reactor operated by the Sacramento Municipal Utility District (the licensee) and located in Sacramento County, California.

The 23.8 microcurie cobalt-60 particle was found on the inside of the worker's pant leg of his street clothes as he was leaving the radiologically controlled portion of the facility. Based on the licensee's investigation, a calculated maximum dose of 278 rem to one square centimeter of skin was assigned to the worker.

However, it was not possible to determine the exact dose to the precise area of the skin exposed. The licensee's calculated maximum dose was based on the assumption that the particle remained lodged near the same square centimeter of skin from the very beginning of the job until the particle was discovered and removed. The licensee calculated a "best engineering estimate" of the most likely dose to be 19 rem based on the particle becoming lodged on the skin after the pipe was cut and the particle moving about exposing 10 square centimeters

of skin. A physician examined the worker and did not identify any clinically observable symptoms.

NRC inspections concluded that the licensee had performed a thorough evaluation of the unplanned exposure, including a critical self-assessment of the circumstances that allowed the exposure to occur. The licensee was in the process of implementing a hot particle exposure control program in response to previous industry problems and NRC Information Notice No. 87-39, "Control of Hot Particle Contamination at Nuclear Power Plants" (Ref. C-4), when the worker was exposed. The exposure was caused by incomplete implementation of the program, failure of Radiation Protection Technicians to follow procedures, and a failure by the worker involved to survey himself for radioactive contamination on leaving the work location prior to donning his street clothing.

In response to the unplanned exposure, the licensee took prompt and extensive corrective actions to prevent recurrence. NRC held a Management Meeting with senior licensee representatives on March 16, 1988; an Enforcement Conference on July 7, 1988; and issued a Notice of Violation on July 29, 1988 (Ref. C-5). The violation was assigned a Severity Level III (on a scale in which Severity Levels I and V are the most and least significant, respectively). The licensee responded on August 26, 1988. The NRC has reviewed the response and found it to contain appropriate corrective actions.

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3. Diagnostic Medical Misadministrations Caused by Mislabeled Doses Leading to a Change in Enforcement Policy

On June 22, 1988, the NRC issued a Notice of Violation to Syncor Corporation of Chatsworth, California, for violations identified at their facility in Allentown, Pennsylvania (Ref. C-6). The licensee is a nuclear pharmacy that provides radiopharmaceuticals ordered by hospitals for diagnostic and therapeutic administrations to patients. One of the violations involved six mislabeling incidents over a 16-month period, which resulted in 14 patients receiving diagnostic misadministrations. The NRC is concerned about the number of diagnostic, as well as therapeutic, medical misadministrations which have occurred in the past at medical licensees. Based on the inspection findings at Syncor's Allentown facility, the NRC has decided that a more aggressive enforcement approach is warranted for diagnostic misadministrations at all medical licensees.

In regard to the six Syncor Allentown facility mislabeling incidents, none of the resulting misadministrations involved a significant dose to the patients. The various hospitals affected had reported the misadministrations to the NRC as required. In each case, the label placed by Syncor personnel on the vial of material provided the correct radionuclide and correct quantity (activity) of material, but the chemical form of the material was incorrect. Correct labeling (i.e., radionuclide and chemical form) was required by the NRC license. Once such an error had been made, the recipient hospital had no mechanism to verify the chemical form of the radiopharmaceutical. Because different chemical forms are used to transport the radioactive material to different parts of the body (e.g., liver vs. brain vs. bone, etc.), mislabeling can cause unnecessary radiation exposure to a part of the body other than that intended, as well as failure to produce the needed diagnostic information.

In the past, the failure to properly label radiopharmaceuticals would have been classified as a Severity Level V violation (on a scale in which Severity Levels I and V are the most and least significant, respectively). However, in accordance with the more aggressive approach, discussed below, now being taken by the NRC, the violation was classified as a Severity Level III violation. A Severity Level III violation can result in a civil penalty.

A civil penalty was considered for this case in view of similar labeling errors at other Syncor facilities. [Appendix C, Item 3 of NUREG-0090, Vol. 10, No. 3 ("Report to Congress on Abnormal Occurrences: July-September 1987") described a single mislabeling error at Syncor's Pittsburgh, Pennsylvania facility that resulted in 33 mislabeled doses, leading to 26 diagnostic misadministrations. On March 17, 1988, the NRC issued a Severity Level V citation for the violation (Ref. C-7).] However, a civil penalty was not proposed because: (1) upon notification of the misadministrations by the clients' medical facilities, Syncor promptly notified all of its other clients to prevent further administrations of the mislabeled product, (2) Syncor informed the NRC of the mislabeling incidents, (3) the prior enforcement history at the Allentown facility has been good, and (4) this would have been a substantial departure from previous NRC enforcement practice. However, any similar violations in the future may result in civil penalties.

Classification of the violation as Severity Level III is consistent with the NRC's recent more aggressive enforcement approach for diagnostic misadministrations. A violation that results in a medical diagnostic misadministration is to be classified at Severity Level IV. Additionally, a violation involving multiple errors of the same or similar root cause that results in several misadministrations over the inspection period, or a recurrent violation from the previous inspection period that results in a misadministration, may be classified at a higher level to increase the licensee's sensitivity to this issue. Such sensitivity is especially important for labeling errors involving chemical forms because these errors cannot be easily detected by the customer. Therefore, violations involving multiple errors or recurrent violations contributing to diagnostic misadministrations may constitute a significant failure to control licensed material, could be categorized at Severity Level III, and may result in a civil penalty. The NRC modified its existing Enforcement Policy to reflect the new categorization of violations in this area.

On July 28, 1988, the NRC issued Information Notice No. 88-53 to all manufacturers and distributors of radiopharmaceuticals for human use, nuclear pharmacies, and medical licensees (Ref. C-8). The Notice informed the recipients of the mislabeling incidents at Syncor's Allentown facility, and described the modification in severity classification of violations which have led to diagnostic misadministrations.

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4. Leak Due to Failure of Spent Fuel Pit Cooling System Pump at Turkey Point Unit 4

On August 16, 1988, Florida Power and Light Company (the licensee) declared an unusual event at Turkey Point Unit 4 when approximately 3100 gallons of slightly

radioactive water leaked from a spent fuel pit (SFP) pump. About 1500 gallons of the leakage overflowed to the outside area of the auxiliary building. The licensee estimated that about 6 or 7 gallons were released to the closed cooling canal by way of the storm drain. Turkey Point Unit 4 is a Westinghouse-designed pressurized water reactor located in Dade County, Florida.

There was no radioactive release offsite and the safety significance of the event is considered minimal. However, the event received nationwide media coverage and therefore may have been perceived by the public to be of public health significance.

At the time of the event, Unit 4 was shut down for repairs to the pressurizer spray line. At 12:03 a.m. (EDT), the Unit 4 control room received an alarm indicating a low water level in the Unit's SFP. Investigation showed that the leak was caused by the failure of SFP cooling water recirculation pump 4A, which caused the associated casing vent valve to vibrate open. Normally, the entire leakage would have been directed to the waste hold-up tanks. However, blockage in the drain system resulted in flooding of the drains in the auxiliary building. The spent fuel pit water level was lowered about six inches by the leak.

The radioactivity level of the spilled water was calculated to be 2.3×10^{-2} microcuries/milliliter of cobalt-60 and 7.9×10^{-4} microcuries/milliliter of cesium-137. The total activity released to the closed cooling canal (which is confined to the licensee's property) was estimated to be 7.0×10^{-4} curies. Continuing measurements of water from the canal indicated that the radioactivity levels were well below 10 CFR Part 20 limits.

Soon after the discovery of the leak, the licensee formed an Event Response Team to investigate and analyze the event, identify root causes, establish corrective actions, and provide recommendations to prevent recurrence of similar events. Immediate corrective actions included placing sandbags around spill areas to control leakage in case of rain, placing protective plastic over contaminated dirt, and initiating decontamination efforts. In addition, since the other two recirculation pumps were out of service when pump 4A failed, the licensee installed a portable backup pump to reestablish forced cooling in the SFP.

NRC Region II Resident Inspectors closely monitored the licensee's response efforts. In addition, a Region II radiation specialist was sent to the site to monitor the licensee's cleanup efforts and to review the circumstances associated with the event.

Meanwhile, since the event had not affected Unit 4, the licensee completed the repairs to the pressurizer spray line and returned Unit 4 to operation late on August 16, 1988.

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REFERENCES (FOR APPENDICES)

B-1 Generic Letter 85-15, "Environmental Qualification of Electrical Equipment Important to Safety for Nuclear Power Plants," from H. L. Thompson, Director, Division of Licensing, NRC Office of Nuclear Reactor Regulation, to all power reactor licensees and applicants, August 6, 1985.*

B-2 Generic Letter 86-15, "Environmental Qualification of Electric Equipment Important to Safety for Nuclear Power Plants," from H. R. Denton, Director, NRC Office of Nuclear Reactor Regulation, to all power reactor licensees and applicants, September 22, 1986.*

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B-5 U.S. Nuclear Regulatory Commission, "Safety Evaluation Report (SER) on Tennessee Valley Authority Revised Corporate Nuclear Performance Plan," USNRC Report NUREG-1232, Volume 1, published July 1987.**

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B-7 Letter from W.T. Russell, Administrator, NRC Region I, to C.A. McNeill, Executive Vice President-Nuclear, Philadelphia Electric Company, forwarding "Peach Bottom Atomic Power Station Safety Evaluation Report," Docket Nos. 50-277 and 50-278, October 19, 1988.*

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* Available in NRC Public Document Room, 2120 L Street, NW, (Lower Level), Washington, D.C., for public inspection and/or copying.

**Available for purchase from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082. Also available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. A copy is also available for public inspection and/or copying at the NRC Public Document Room, 2120 L Street, NW, (Lower Level), Washington, DC.

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B-10 U.S. Nuclear Regulatory Commission, NRC Bulletin No. 88-08, Supplement 1, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," June 24, 1988.*

B-11 U.S. Nuclear Regulatory Commission, NRC Bulletin No. 88-08, Supplement 2, "Thermal Stresses in Piping Connected to Reactor Coolant Systems," August 4, 1988.*

B-12 Letter from James M. Taylor, NRC Deputy Executive Director for Regional Operations, to Glenn Davis, Administrator, Milford Memorial Hospital, forwarding an Order Modifying License, Effective Immediately, Docket No. 30-08228, June 15, 1987.*

B-13 Letter from William T. Russell, Regional Administrator, NRC Region I, to Glenn Davis, Administrator, Milford Memorial Hospital, forwarding a Notice of Violation and Proposed Imposition of Civil Penalty, Docket No. 30-08228, June 6, 1988.*

B-14 Letter from Charles E. Norelius, Director, Division of Radiation Safety and Safeguards, NRC Region III, to Allen F. Jacobson, Chairman and Chief Executive Officer, Minnesota Mining and Manufacturing Company, forwarding Inspection Report Nos. 030-04971/88-1 and 030-04951/88-1, Docket Nos. 030-04971 and 030-04951, July 1, 1988.*

B-15 Letter from Hugh L. Thompson, Jr., Director, NRC Office of Nuclear Material Safety and Safeguards, to Robert G. Wissink, Chairman, Isotope Committee, Minnesota Mining and Manufacturing Company, forwarding an Order Modifying License, Effective Immediately, Docket Nos. 030-04951 and 030-04971, January 25, 1988.*

B-16 Letter from Hugh L. Thompson, Jr., Director, NRC Office of Nuclear Material Safety and Safeguards, to Robert G. Wissink, Chairman, Isotope Committee, Minnesota Mining and Manufacturing Company, forwarding a Confirmatory Order Modifying License, Effective Immediately, Docket Nos. 030-04951 and 030-04971, February 5, 1988.*

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B-17 Letter from Robert M. Bernero, Deputy Director, NRC Office of Nuclear Material Safety and Safeguards to Robert G. Wissink, Chairman, Isotope Committee, Minnesota Mining and Manufacturing Company, forwarding an Order Modifying License, Effective Immediately, Docket Nos. 030-04951 and 030-04971, February 12, 1988.*

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C-2 U.S. Nuclear Regulatory Commission, NRC Information Notice No. 87-44, Supplement 1, "Thimble Tube Thinning in Westinghouse Reactors," March 28, 1988.*

C-3 U.S. Nuclear Regulatory Commission, NRC Bulletin No. 88-09, "Thimble Tube Thinning in Westinghouse Reactors," July 26, 1988.*

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*Available in NRC Public Document Room, 2120 L Street, NW, (Lower Level), Washington, DC, for public inspection and/or copying.

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C-4 U.S. Nuclear Regulatory Commission, NRC Information Notice No. 87-39, "Control of Hot Particle Contamination at Nuclear Power Plants," August 21, 1987.*

C-5 Letter from J. B. Martin, Regional Administrator, NRC Region V, to J. F. Firlit, Chief Executive Officer, Nuclear, Sacramento Municipal Utility District, forwarding Notice of Violation, EA 88-173, Docket No. 50-312, July 29, 1988.*

C-6 Letter from William T. Russell, Regional Administrator, NRC Region I to Monty Fu, Chairman of the Board, Syncor Corporation, forwarding a Notice of Violation, Docket No. 30-19768, June 22, 1988.*

C-7 Letter from John R. White, Chief, Nuclear Materials Safety Section C, NRC Region I, to Jack Coffey, Corporate Radiation Safety Officer, Syncor Corporation, forwarding a Notice of Violation and Inspection Report No. 030-15134/87-001, Docket No. 30-15134, March 17, 1988.*

C-8 U.S. Nuclear Regulatory Commission, NRC Information Notice No. 88-53, "Licensee Violations of NRC Regulations Which Led to Medical Diagnostic Misadministrations," July 28, 1988.*

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13. ABSTRACT (200 words or less)

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health and safety and requires a Quarterly report of such events to be made to Congress. This report covers the period July 1 to September 30, 1988. For this reporting period, there were no abnormal occurrences at nuclear power plants licensed to operate. There were two abnormal occurrences under other NRC-issued licenses: multiple medical therapy misadministrations at a single hospital and a medical diagnostic misadministration. There was one abnormal occurrence reported by an Agreement State (Texas) involving a medical diagnostic misadministration. The report also contains information updating some previously reported abnormal occurrences.

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Medical Therapy Misadministrations; Medical Diagnostic Misadministration; Neutron Monitoring System; Thinning of Thimble Tubes; Overexposure Due to Hot Particle; Mislabeled Diagnostic Doses; Spent Fuel Pit Pump Leak.

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