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Report to Congress on Abnormal Occurrences

July - September 1979

Office of
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U.S. Nuclear Regulatory
Commission

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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, the eighteenth in the series, covers the period from July 1 to September 30, 1979 and includes all abnormal occurrences approved as of the date of preparation of this report.

The following incidents or events, including any submitted by the Agreement States, were determined by the Commission to be significant and reportable:

1. There was one abnormal occurrence at the 70 nuclear power plants with operating licenses. The event involved a major degradation of primary containment boundary.

2. There were two abnormal occurrences at the fuel cycle facilities (other than nuclear power plants). One involved a mill tailings impoundment dam failure and the second involved an unresolved nuclear material inventory difference.

3. There were no abnormal occurrences at other licensee facilities.

4. There were two abnormal occurrences reported by the Agreement States. Both incidents involved overexposure of radiography personnel.

This 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 delineated in Appendix A. These criteria were promulgated in an NRC policy statement which was published in the Federal Register (42 FR 10950) on February 24, 1977. In order to provide wide dissemination of information to the public, a Federal Register notice is issued on each abnormal occurrence with copies distributed to the NRC Public Document Room and all local public document rooms. At a minimum, each such notice contains the date and place of the occurrence and describes its nature and probable consequences.

The NRC has reviewed Licensee Event Reports, licensing and enforcement action (e.g., violations, infractions, deficiencies, civil penalties, license modifications, etc.), generic issues, significant inventory differences involving special nuclear material, and other categories of information available to the NRC. 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, the eighteenth in the series, covers the period between July 1 - September 30, 1979. The report includes all abnormal occurrences approved by the Commission up to the time of preparation of this report. Some events require considerable time and effort to analyze due to the complexity of situations where actual consequences are not readily apparent and additional facts are required.

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. 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. The NRC's role in regulating represents a complete cycle, with the NRC establishing standards and rules; issuing licenses and permits; inspecting for compliance; enforcing license requirements; and carrying on continuing evaluations, studies and research projects to improve both the regulatory process and the protection of the public health and safety. Public participation is an element of the regulatory process.

In the licensing and regulation of 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 which specify requirements which 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. Requirements for reporting incidents or events exist which help identify deficiencies early and aid in assuring that corrective action is taken to prevent their recurrence.

Most NRC licensee employees who work with radioactive materials are required to utilize personnel monitoring devices such as film badges or TLD (thermoluminescent dosimeter) badges. These badges are processed periodically and the exposure results normally serve as the official and legal record of the extent of personnel exposure to radiation during the period the badge was worn. If an individual's past exposure history is known and has been sufficiently low, NRC regulations permit an individual in a restricted area to receive up to three rems of whole body exposure in a calendar quarter. Higher values are permitted to the extremities or skin of the whole body. For unrestricted areas, permissible levels of radiation are considerably smaller. Permissible doses for restricted areas and unrestricted areas are stated in 10 CFR Part 20. In any case, the NRC's policy is to maintain radiation exposures to levels as low as reasonably achievable.

REPORTABLE OCCURRENCES

Since the NRC is responsible for assuring that regulated nuclear activities are conducted safely, the nuclear industry is required to report incidents or events which involve a variance from the regulations, such as personnel overexposures, radioactive material releases above prescribed limits, and malfunctions of safety-related equipment. Thus, a reportable occurrence is any incident or event occurring at a licensed facility or related to licensed activities which NRC licensees are required to report to the NRC. The NRC evaluates each reportable occurrence to determine the safety implications involved.

Because of the broad scope of regulation and the conservative attitude toward safety, there are a large number of events reported to the NRC. The information provided in these reports is used in the NRC and the industry in their continuing evaluation and improvement of nuclear safety. Most of the reports received from licensed nuclear power facilities describe events that did not directly involve the nuclear reactor itself, but involved equipment and components which are peripheral aspects of the nuclear steam supply system, and are minor in nature with respect to impact on public health and safety. Many are discovered during routine inspection and surveillance testing and are corrected upon discovery. Typically, they concern single malfunctions of components or parts of systems, with redundant operable components or systems continuing to be available to perform the design function.

Information concerning reportable occurrences at facilities licensed or otherwise regulated by the NRC is routinely disseminated by NRC to the nuclear industry, the public, and other interested groups as these events occur. Dissemination includes deposit of incident reports in the NRC's public document rooms, special notifications to licensees and other affected or interested groups, and public announcements. In addition, a biweekly computer printout containing information on reportable events received from NRC licensees is sent to the NRC's more than 120 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 at licensed facilities.

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). Comparable and compatible programs are the basis for agreements.

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. NRC prepares a semiannual summary of this and other information in a document entitled, "Licensing Statistics and Other Data," which is publicly available.

In early 1977 the Commission determined that abnormal occurrences happening at facilities of Agreement State licensees should be included in the quarterly report to Congress. The abnormal occurrence criteria included in Appendix A is applied uniformly to events at NRC and Agreement State licensee facilities. Procedures have been developed and implemented and any abnormal occurrences reported by the Agreement States to the NRC are included in these quarterly reports to Congress.

REPORT TO CONGRESS ON ABNORMAL OCCURRENCES

JULY-SEPTEMBER 1979

NUCLEAR POWER PLANTS

The NRC is reviewing events reported at the 70 nuclear power plants with operating licenses during the third quarter of 1979. As of the date of this report, the NRC had determined that the following event was an abnormal occurrence.

79-8 Major Degradation of Primary Containment Boundary

Preliminary information pertaining to this incident was reported in the Federal Register (44 FR 75243). Appendix A (Example 2 of "For Commercial Nuclear Power Plants") of this report notes that a major degradation of the primary containment boundary can be considered an abnormal occurrence.

Date and Place - On September 14, 1979, the Consumers Power Company notified the NRC of discovery of two improperly positioned valves in the containment purge system at their Palisades Nuclear Plant. The Palisades Nuclear Plant utilizes a pressurized water reactor designed by Combustion Engineering Co. and is located in Van Buren County, Michigan.

Nature and Probable Consequences - While preparing to perform a "Type C" (local isolation valve) leak test between two manual valves in a 4-inch bypass line around the main 48-inch containment purge valve, plant personnel discovered that both of these manual isolation valves were locked in the open position. These valves should have been locked closed. Investigation by the licensee indicated that the valves may have been improperly positioned since April 1978 when an efficiency test of the bypass line filters was performed. The plant has operated at power for the major portion of that time period.

The valve misalignment did not result in any actual adverse impact on the public health. However, had an accident occurred wherein fuel was damaged and primary coolant released into the containment while the valves were misaligned in the open position, a significant release of radioactive material from the containment could have occurred. Were such a release to occur, there is no instrumentation to identify those open valves as the cause.

The initial design purpose for the bypass system was to provide a long term hydrogen control capability for the containment atmosphere following a design basis accident.[1] It was intended that after approximately 30 days following an accident, when containment pressure and activity levels dropped sufficiently to permit venting, this system would be manually valved to vent the containment atmosphere, through high efficiency and charcoal filters, to the exhaust stack. Thus the components in the bypass line beyond the two manual isolation valves were not designed for the severe service they would be exposed to with the valves open during the initial pressure surge of the design basis accident,

[1] Palisades now has recombiners installed for hydrogen control.

and significant uncontrolled releases would result. High radiation in the vicinity of the bypass line would also make immediate closing of the manual isolation valves, even if identified as the source of leakage, an extremely hazardous operation.

Cause or Causes - The principle cause for this event was lack of the necessary attention to detail in development of procedures for ensuring containment integrity. The master containment integrity valve line-up checklist, which is used to perform a valve line-up prior to each startup from cold shutdown, did not include these valves. The filter efficiency test procedure for the 4-inch bypass line did not adequately specify the final position of these valves, and this is the probable cause for the valves being left incorrectly positioned in April of 1978.

Actions Taken to Prevent Recurrence

Licensee - The licensee has revised both of the above mentioned procedures to assure that proper positioning of these valves is addressed. Concurrently, the licensee is reviewing all other paths from containment to assure that procedures and checklists are complete. The licensee has also tasked a qualified consultant to perform an independent review for the same purpose.

NRC - The NRC site inspector verified the corrective actions taken by the licensee. The regional office determined that this event constitutes an item of noncompliance of the violation category.

The NRC staff determined that the event demonstrated a weakness in the licensee's ability to control testing and maintenance activities, to develop and review procedures, to adhere to approved procedures, and to conduct audit activities. The Director, Office of Inspection and Enforcement (IE), also determined that the potential public hazard had been high. As a result, on November 9, 1979 the staff proposed imposition of civil penalties in the amount of $450,000 for the prolonged violation of containment integrity. On the same date, the staff issued an order to require that appropriate review of checklists and procedures be performed to assure that engineered safety features are in compliance with the specifications of the license and that monthly inspections of these features be conducted. The order further required a meeting with NRC management prior to resumption of operation.

IE Information Notice 79-26 was issued on November 5, 1979 to all holders of operating licenses and construction permits to provide them with the details of this occurrence. On November 16, 1979 the Director, Office of Inspection and Enforcement, sent a letter to chief executives of all utilities with operating licenses and construction permits informing them of the enforcement action against Consumers Power Company and stating the intention to take similar action in any future instances where ineffective management leads to a serious breach of safety.

This incident is closed for purposes of this report.

FUEL CYCLE FACILITIES

(Other Than Nuclear Power Plants)

The NRC is reviewing events reported by these licensees during the third quarter of 1979. As of the date of this report, the NRC had determind that the following two events were abnormal occurrences.

79-9 Mill Tailings Impoundment Dam Failure

Preliminary information pertaining to this incident was reported in the Federal Register (45 FR 2424). Appendix A (Example 3 of "For Fuel Cycle Licensees") of this report notes that an event which seriously compromised the ability of a confinement system to perform its designated function can be considered an abnormal occurrence.

Date and Place - On July 16, 1979 a uranium mill tailings impoundment dam failed at the United Nuclear Church Rock Uranium Mill, located near Gallup, New Mexico. This United Nuclear Corporation facility is licensed by the State of New Mexico under the provisions of the NRC State Agreements Program. At the time of the incident, the uranium mill tailings at the Church Rock Uranium Mill were also under general license from the NRC pursuant to the Uranium Mill Tailings Radiation Control Act of 1978.

Nature and Probable Consequences - As a result of the dam failure, mill tailings solution and solids poured through the break into a catchment area below the dam. The catchment embankment was subsequently breached and tailings solution flowed into an arroyo (water-carved gully) and on into the Rio Puerco River which flows past Gallup, New Mexico.

The break in the dam allowed approximately 100 million gallons of tailings solution and 1100 tons of tailings solids (sand) to flow out of the impoundment before it could be closed. Most of the solids were deposited in an area very near the impoundment in a backup containment area on United Nuclear Corporation property and in an adjacent stream, the "Pipeline Arroyo." The tailings solutions travelled in the Pipeline Arroyo to the Rio Puerco which flows through Gallup, New Mexico, a town about 20 miles southwest of the mill site, and into Arizona. The spilled solutions eventually dissipated at a point estimated to be about 30 miles into Arizona. (See Figure 1.)

The radioactive isotopes in the mill tailings and tailings solutions are those which naturally occur in the soil of the area but which have been concentrated by the milling process. These isotopes, primarily thorium-230 and radium-226, did not present any immediate health hazard when released by the dam failure. The concentrated contamination of normally dry areas of the Pipeline Arroyo and the tailings solids in the Arroyo would contribute a relatively small increment[1] to the estimated normal background dose rate of 140 mrem/year for

[1]Calculated values are: 1.3 mrem/year to the whole body, 22.0 mrem/year to the bone from all exposure pathways.

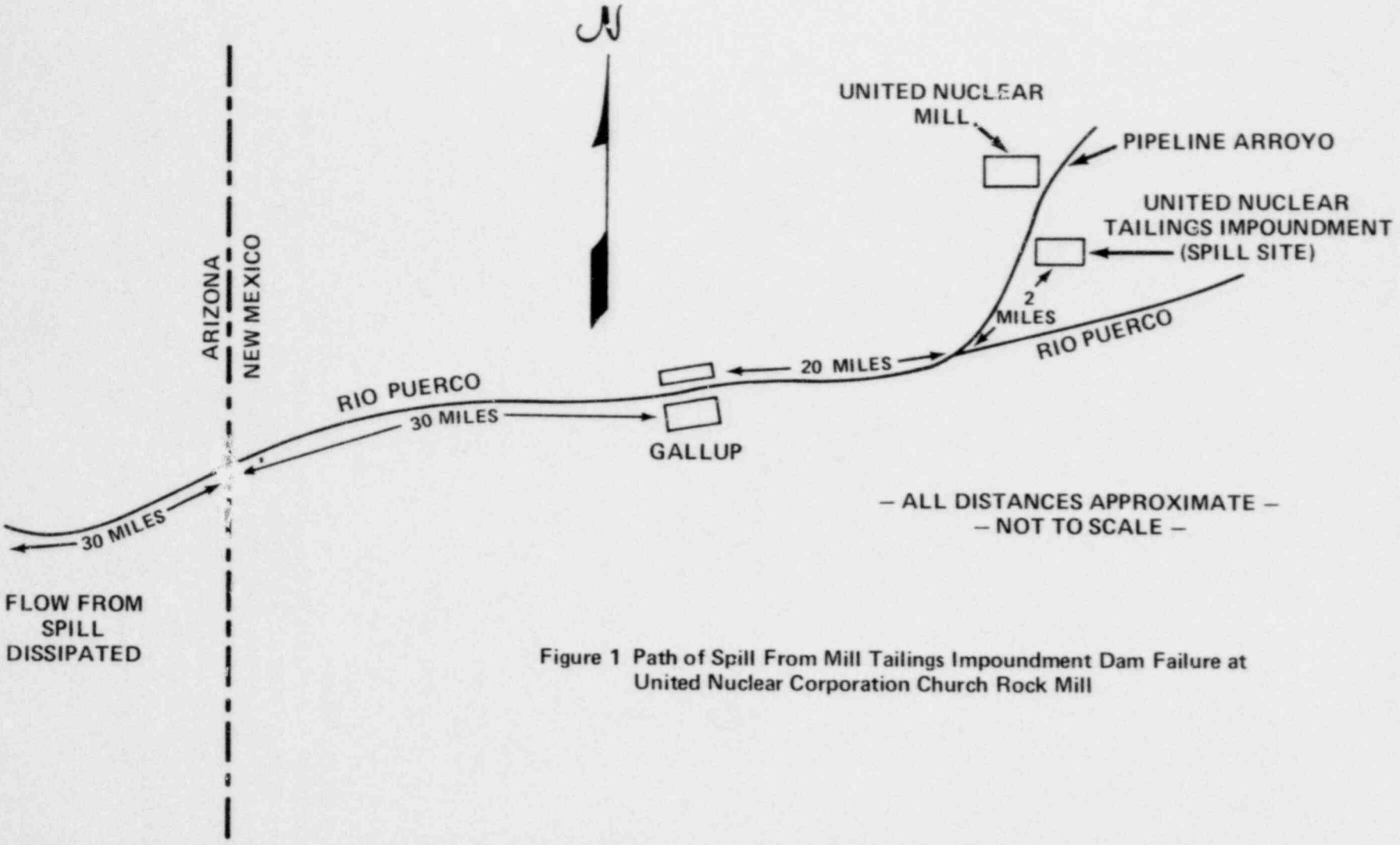

Figure 1 Path of Spill From Mill Tailings Impoundment Dam Failure at United Nuclear Corporation Church Rock Mill

persons living near the Arroyo. However, cleanup of these sources has been undertaken in accordance with maintaining doses as low as reasonably achievable and lowering the potential for radiological contamination of groundwater.

The immediate health hazard arose from the acidic nature of the tailings solution which could cause chemical burns if ingested or brought in contact with skin. The potential for acute chemical effects persisted for approximately 2 days, until water from the upstream mining operations and the natural alkalinity of the stream bed neutralized the tailings solution. Chemical contamination (e.g., elevated trace metal concentrations) of groundwater presents a long-term problem.

Cause or Causes - The tailings impoundment dam failed as a result of differential settlement and direct exposure of the dam to tailings solutions. The first factor was the result of the manner in which the dam was constructed; the second factor was the result of failure of the operator to maintain a buffer of mill tailings between the dam and the tailings solutions.

The dam is located on a site containing alluvial soils overlying bedrock having an irregular surface. Depths of this relatively loose soil ranged from less than 20 feet up to a maximum of 100 feet. During design and construction of the dam, tests were conducted to determine how much the alluvial soil would compress under a load. These tests indicated that settlement of about 5 percent would result from the loading of the embankment under dry conditions. With water in the impoundment, additional settlement ranging from 1-1/2 percent to 13 percent was experienced due to collapse of the soil structure. As a result of this high compressibility of the alluvial soil and the irregular bedrock surface, large differential settlement of the dam occurred. As a result of differential settlement, cracks developed in the embankment. These cracks coupled with the lack of a buffer of solid tailings between water and the dam allowed tailings water to penetrate and weaken the embankment.

Actions Taken to Prevent Recurrence

Licensee - The United Nuclear Corporation (UNC) performed an evaluation of the dam failure and examined the serviceability of the remaining portions of the dam. UNC is also performing a study of alternate sites for the tailings impoundment. UNC is conducting cleanup operations to standards established by the State of New Mexico and the NRC. Cleanup of contamination has been completed in the most heavily affected areas near the mill. Cleanup in the remaining sections of the Arroyo will probably take several more months to complete.

State of New Mexico - Soon after the spill State officials arrived at the site to begin an investigation. The State requested aerial surveillance of the site and began an extensive sampling program along the route of the spill.

On July 16, 1979 the Environmental Improvement Division (EID) issued an order requiring termination of operations. EID issued a second order on July 18 requiring the licensee to take steps to minimize dispersion of materials. The State engineer also issued an order on July 18 requiring an investigation of

the cause of the dam failure prior to any repair and resumption of tailings discharge to the impoundment. New Mexico officials subsequently met on July 20 with representatives of the NRC, the Army Corps of Engineers and UNC to discuss the dam failure.

New Mexico amended its July 16 order on October 23, 1979, to allow operation of the facility subject to provisions for monitoring tailings solution levels and impoundment dam integrity. The October 23 amendment also required a study of alternative sites for long-term disposal of tailings solution and solids.

On November 8, 1979, a State engineer again ordered the facility to stop the generation of tailings because the licensee was not maintaining the required beach of tailings solids between the tailings solution and the dam. Operations were allowed to resume on November 13, 1979.

NRC - The NRC has worked in conjunction with numerous other State and Federal organizations in responding to the accident and formulating longer-term corrective action, including cleanup of contamination and continued monitoring of groundwater quality.

The NRC issued an order on October 12, 1979, banning generation of additional tailings until a review provided adequate assurance that all causes of the dam failure had been identified and that the remaining portions of the embankment were free of deficiencies. The NRC reviewed the licensee's evaluation of the dam failure, concurred in the findings with regard to the major causes, and determined that limited generation and storage of uranium tailings could be conducted with reasonable assurance of protection for the public and the environment. The staff issued an order to this effect on October 24, 1979. The order allowed operation for a limited time subject to continued demonstration of dam integrity by documented inspection, prohibited planned expansion of the current tailings area until NRC staff approval was given, and required that UNC submit a proposal for development of a new tailings site for ultimate disposal. Direct NRC regulatory authority over tailings in Agreement States was subsequently removed by an act of Congress amending the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 96-106, November 6, 1979) and the NRC order can no longer be enforced. However, a State of New Mexico order which imposes essentially the same terms and conditions remains in effect. NRC is continuing to provide technical assistance to New Mexico.

The staff reviewed docket files on the tailings dams at operating mills in non-Agreement States and in all but one case found that differential settlement was satisfactorily addressed. The exception was a dam authorized in 1971 and documentation does not indicate that differential settlement was addressed. However, no evidence of excessive differential settlement leading to cracking has shown up in routine inspection of the dam.

An NRC summary report on the dam failure at Church Rock will be completed in the near future. The report will address the cause of the failure, what aspects the States should look at for tailing impoundments in their States and

an offer of technical assistance by the NRC. The report will be provided to all Agreement States so that they can take appropriate action.

The NRC had also proposed prior to the accident regulations which specify requirements for mill tailings disposal. These regulations identify certain siting and design features which must be incorporated into tailings disposal programs to assure long-term isolation and containment of tailings without continuing active maintenance. The regulations identify burial of tailings below the surrounding grade as the preferred mode of tailings disposal. In this way, dams such as the one which failed at the Church Rock mill would be avoided.

This incident is closed for purposes of this report.

79-10 Unresolved Nuclear Material Inventory Difference

During preparation of this report, the following item was determined reportable using the criteria given in Appendix A of this report. Example 7 ("For all Licensees") notes that any substantiated loss of special nuclear material or any substantiated inventory discrepancy which is judged to be significant relative to normally expected performance and which is judged to be caused by theft or diversion or by substantial breakdown of the accountability system can be considered an abnormal occurrence. Federal Register noticing is being made in conjunction with the noticing of issuance of this report.

Date and Place - On September 17, 1979, Nuclear Fuel Services, Inc., Erwin, Tennessee (NFS) reported that a special nuclear material inventory difference involving highly enriched uranium was in excess of the limit specified in the license for continued operation of the fuel facility.

Nature and Probable Consequences - Nuclear Fuel Services - Erwin could not demonstrate accountability for the highly enriched uranium processed at the facility between June 18 and August 14, 1979, by closing a measured material balance within the established limits of accounting accuracy.

A re-inventory was completed and results reported on November 2, 1979. The re-inventory only partially reconciled the inventory difference which continued to be in excess of the license limit. A re-measurement program conducted by the licensee did not significantly alter the reinventory results. An NRC Inventory Verification Team confirmed the reinventory results; overflights and ground surveys of the facility site did not locate any additional material. Investigation of liquid and gaseous effluents, analytical data, uranium wastes for burial, and a search for unmonitored release paths did not account for quantities of material that would explain the inventory difference.

The inventory discrepancy is of concern because of the possibility of theft of special nuclear material. Investigations have been conducted both by the NRC and the FBI. The investigation into the possibility of a theft of material was inconclusive. Investigators developed no factual information other than the

presence of an inventory difference (which is of itself inconclusive because of uncertainties in accounting activities such as measurement, clean-out, etc.) to indicate whether or not a theft had occurred; however, the possibility of such an act cannot be ruled out.

Cause or Causes - The cause of the inventory discrepancy is unknown. It is highly possible that the complex design of the plant made accounting within the required tolerance impossible.

Actions Taken to Prevent Recurrence

Licensee - Nuclear Fuel Services started an orderly shutdown of the highly enriched uranium operations on September 18, 1979, in preparation for a plant re-inventory. Nuclear Fuel Services then conducted an extensive plant clean-out, security reviews, record audits, surveys of the plant grounds, surveys of the plant buildings, and additional inventory data reviews. (These actions were in compliance with an NRC order issued September 17, 1979.)

NRC - On September 17, 1979, the NRC issued an order modifying the facility license, halting further introduction of feed material and requiring an immediate re-inventory. An NRC Inspection Team was dispatched from Region II, Atlanta, and arrived on site September 18. NRC senior headquarters management arrived on September 19. The Department of Energy Nuclear Emergency Search Team (NEST) arrived on September 20 and began aerial monitoring activities. The NEST overflight and ground surveys were completed by September 24.

The NRC Region II mobile laboratory arrived at Erwin on September 23 and an NRC Inventory Verification Team began a complete check of the fabrication plant inventory. The NRC team monitored the licensee's activities and verified the results of a re-inventory and continuing scrap recovery operations.

The Commission voted on January 17, 1980, to permit the resumption of operation following NRC verification that NFS has implemented improvements in the accounting, internal control, and physical security systems.

The NRC is requiring that the facility's internal control of material and physical security systems be upgraded to provide substantially increased protection against theft, including possible thefts by collusive acts between employees. These license modifications include requirements for increased surveillance and control over all personnel having access to special nuclear material as well as improved search procedures. The improvements include new guard force procedures and additional security equipment; establishment of an exclusion zone around material areas and continuous guard observation of this area; and an escort for all material moving between work areas.

In addition to these physical security improvements, the NRC staff identified several areas in which new equipment or procedures should result in improved uranium accountability. Accordingly, the amended NFS license requires:

-- Equipment and procedures to reduce the uranium content in waste material as well as improved measurements of these materials;

-- Implementation of a strengthened monitoring program in material processing in order to localize, on a more timely basis, any abnormalities in uranium accountability;

-- Substantial upgrading of the NFS safeguards organization to provide for increased oversight and reporting to NFS management and to NRC to ensure that approved accountability procedures are followed during plant operations.

The Department of Energy is also being requested to review the Erwin facility to determine what additional changes might be in order, including whether it should be significantly modified or a new facility should be built. The Commission intends to review the results of this design study.

The license was further amended to incorporate slightly higher inventory difference control levels.

In taking the above actions the Commission noted:

-- The essential role of the NFS-Erwin facility in supplying material for the Naval nuclear propulsion program and thus for the common defense and security;

-- That the nature of the processing steps performed at NFS-Erwin, the quantities of material processed, and the technological limits on the precision of material inventory measurements in such processes make it impossible to obtain material inventory data of high precision;

-- That the physical security and material control and accounting procedures required above are adequate to meet all legal requirements for safeguarding special nuclear material;

-- That the Commission's decision is not to be taken as diminishing its emphasis on material control and accounting at other facilities or as in any way decreasing the level of attention to be paid to public and employee health and safety at the Erwin facility.

This incident is closed for purposes of this report.

OTHER NRC LICENSEES

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

There are currently more than 8,000 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 during the third quarter of 1979. As of the date of this report, the NRC had not determined that any events were abnormal occurrences.

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. As of the date of this report, the Agreement States reported the following abnormal occurrences to the NRC.

AS79-3 Overexposure of a Radiographer

Date and Place - On the evening of July 20, 1979, at the U.S. Department of Energy's St. James terminal near St. James, Louisiana, a radiographer received an overexposure from an iridium-192 source.

Nature and Probable Consequences - A supervising radiographer for an out-of-state company (Bill Miller X-Ray, a subsidiary of Peabody Testing) working in Louisiana received sufficient dose to produce blistering of the thumb, index finger and middle finger of his right hand. He had retrieved a disconnected 100 Curie source of iridium-192 on July 20, 1979. Approximately 7 days later he experienced a tingling sensation in his right hand and on August 3, 1979, he noticed the tingling sensation also beginning in his left hand.

The supervising radiographer was not wearing a pocket dosimeter or film badge at the time he performed the retrieval; therefore, dose estimates were obtained from the clinical symptoms that had been displayed and a time-and-motion study. From the clinical indications, it is estimated that the right hand received a dose of 3,000 to 10,000 rems, and from the time-and-motion study, it was estimated that the whole body dose was less than 20 rems. A second estimate of 6,000 rads to the fingers and 1.8 rads whole body was performed by the University of Oklahoma Health Sciences Center where the individual is receiving medical treatment.

Cause or Causes - The source disconnect was caused by the female connector pulling loose from the drive cable; however, this disconnect was discovered through the routine survey procedures and, if it had been handled properly, would not have resulted in the excessive dose received by the supervising radiographer. The primary cause of the excessive dose was the method by which the disconnected source was retrieved.

When a radiographer discovered that the disconnect had occurred and that the source was still in the source tube, he removed the source tube from the camera and placed it behind some shielding. The dosimeter indicated that

during this procedure, the radiographer received a dose of 180 mr. The radiographer then contacted the supervising radiographer and reported the disconnect. The supervising radiographer removed the tip from the source tube, shook the source out of the tube and removed the female connector from the pigtail assembly by hand. He then placed the source pigtail assembly (connector end first) into the outlet nipple of the exposure device. The source tube was reattached to the outlet nipple of the exposure device and the supervising radiographer held the open end of the source tube against the end of a drive cable assembly while the first radiographer cranked the drive cable through the source tube to push the pigtail assembly back into the camera in the correct position. During this procedure there were several occasions when the individual may have actually touched the source capsule.

Actions Taken to Prevent Recurrence

Licensee - Although the investigation is complete, formal notice of violation has not been transmitted, pending reply to a letter requesting additional information concerning this incident. However, the company has notified the Louisiana Nuclear Energy Division of the corrective action that has already been taken. This includes removing the radiographer from work with radioactive material or in a radiation area until he has received re-training in the company's operating and emergency procedures, specifically covering personnel monitoring and emergency procedures. Also, at least once a year, all drive cables are to be cut back eight (8) inches from the connector and new connectors swaged to the cable.

Louisiana Nuclear Energy Division - Appropriate violations have been cited. In addition, a Radiation Advisory was issued to all Louisiana industrial radiography licensees, warning of the potential for pulling the female connector off the drive cable after repeated use and requesting the submission of a program of preventive maintenance. This advisory will be made available to the NRC and all Agreement States.

This incident is closed for purposes of this report.

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AS79-4 Overexposure of a Radiographer's Assistant

Date and Place - On August 3, 1979 the State of Texas was notified of a source disconnect and possible overexposure of a radiographer's assistant at Dow Chemical Company in Freeport, Texas. The radiography company was Mobilab, Inc. of Houston, Texas.

Nature and Probable Consequences - The radiographer's assistant was working along a pipeline in a trench. The radiographer had told the assistant to crank in the source at the end of the exposure while the radiographer went back to the truck to process film. The assistant cranked the source back into the camera and carried the camera to the truck. At the truck, he disconnected

the source guide tube and the source assembly dropped out of the camera. He then picked up the source assembly by the pigtail and knocked on the door of the truck dark room to call it to the radiographer's attention. When the radiographer opened the door (about 2 minutes later) and saw the source, he knocked it out of the assistant's hand and shielded the source as best he could. The source was later placed back in its container.

Four or five days after the incident, blood studies showed a temporary (lasting for about 24 hours) drop (about 55%) in the assistant's white blood cell count. He also had a lesion on his left mid-thigh measuring 3 inches in diameter. The State estimates that the whole body dose to the assistant is from 200 to 300 rems.

Cause or Causes - The primary cause of the incident was the radiographer allowing the assistant to crank the source back into the device unsupervised. The assistant also failed to perform a survey of the device to determine if the source was in the shielded position.

Actions Taken to Prevent Recurrence

Mobilab, Inc. - The licensee has "suspended" the radiographer responsible for activities at the site of the incident. He has been assigned non-radiation related work. The licensee has also conducted a retraining program for its other radiographers.

State of Texas - The State inspected the licensee and conducted an investigation of the incident on August 3, 6 and 15, 1979. The investigation included an enactment of the incident on August 15. An enforcement letter was sent to the licensee on August 9 listing seven items of noncompliance. A pre-hearing was conducted on October 10, 1979 for the licensee to present a written response to the seven items of noncompliance. The licensee has adequately responded in writing to the State's enforcement letter and request for the film badge report.

This incident is closed for purposes of this report.

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 (42 FR 10950) on February 24, 1977.

Events involving 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 Part 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 Part 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 Part 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 (10 CFR Part 71.36(a)).

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 which is judged to be significant relative to normally expected performance and which 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 Part 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 Part 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 which 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 systems).

For Fuel Cycle Licensees

1. A safety limit of license Technical Specifications is exceeded and a plant shutdown is required (10 CFR Part 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 which 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 1979 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 updating information on the abnormal occurrences discussed. Those occurrences not now considered closed will be discussed in subsequent reports in the series.

NUCLEAR POWER PLANTS

The following abnormal occurrence was originally reported in NUREG-0090-3, "Report to Congress on Abnormal Occurrences: January-March 1976," and updated in subsequent reports in this series, i.e., NUREG-0090-4, 6, Vol. 1, No. 1, and Vol. 1, No. 3. It is further updated as follows:

76-1 Deficiencies in the Mark I Containment Systems of Certain Boiling Water Reactors (BWRs)

Actions Taken to Prevent Recurrence

Licensee/Vendor - The Mark I Owners Group (licensees) and the General Electric Company (GE) are continuing to conduct the Mark I Containment Long Term Program (LTP). In December 1978 and April 1979, GE submitted proposed hydrodynamic load definition techniques and structural acceptance criteria for the LTP.

Following a review of data from the Mark I Full Scale Test Facility (FSTF), the staff identified a potentially serious concern relating to condensation loads on the downcomers following a postulated large-break LOCA. The specific issue related to dynamic amplification of the downcomer condensation loads which could cause fatigue cracking in the downcomer-vent header intersection, which subsequently could lead to an overpressurization of the containment. The staff expected a significant dynamic amplification because the condensation driving frequency observed in the test data was very close to the fundamental natural frequency (i.e., first or "swinging" mode response) of the downcomer-vent header system.

Subsequently, the staff determined that all operating plants have "tied" downcomers (i.e., a strap connects the ends of a pair of downcomers). FSTF test data indicates that the loads on "tied" downcomers are lower than the loads on "untied" downcomers. However, this finding did not completely alleviate the staff's concern regarding the potential for dynamic amplification of the condensation loads.

On September 5, 1979, the staff met with representatives of the Mark I Owners Group to discuss this concern. The Mark I Owners Group presented structural response analyses and additional FSTF data from which they concluded that the majority of the condensation load was exciting the second mode response (i.e., downcomer "spreading" or "wishbone" effect) for downcomers structurally tied together, because the highest loads result from a vertical thrust in the downcomer elbow. This finding was supported by strain and pressure measurement comparisons from the FSTF data. The Mark I Owners estimated the fraction of the load that could excite the first mode response and, assuming dynamic amplification of that fraction, concluded that only approximately five percent of the ASME allowable fatigue usage would result for a design basis accident.

The staff agreed that this phenomenological description is adequately supported by strain and pressure measurement comparisons, and that there is sufficient margin in the fatigue usage to accommodate the uncertainties in the assessment presented by the Mark I Owners Group. Based on this finding the staff concluded that there is not an immediate safety concern, and there is sufficient margin in the existing plant configurations to permit this issue to be finally resolved as previously scheduled as part of the Mark I Long Term Program plant-unique analyses.

In October 1979 the staff issued criteria to begin the implementation of this program. The scheduled completion for the LTP, including the issuance of license amendments and the installation of plant modifications, continues to be December 1980.

Further reports will be made as appropriate.

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The following abnormal occurrence was originally reported in NUREG-0090-5, "Report to Congress on Abnormal Occurrences: July-September 1976," and updated in subsequent reports in the series, i.e., NUREG-0090-8 and NUREG-0090, Vol. 1, No. 4. It is further updated as follows:

76-11 Steam Generator Tube Integrity

Since the last update report, another type of steam generator tube degradation occurred. Although the degradation was due to entirely different reasons than those previously reported, it is being reported here as an update item since it can be considered under the general category of steam generator tube integrity.

On October 2, 1979, a steam generator tube ruptured at Northern States Power Company's Prairie Island Unit 1, a pressurized water nuclear power plant located near Red Wing, Minnesota, in Goodhue County. Unit 1 was operating at 100% at the time the tube ruptured. At 2:14 p.m. the control room received a high radiation alarm from the steam jet air ejector monitor. At 2:21 p.m. low pressurizer pressure and level alarms were received. At 2:24 p.m. a reactor trip and a safety injection occurred as a result of low pressurizer pressure.

All safety systems functioned normally. At 2:41 p.m. the No. 11 Steam Generator was identified as having the ruptured tube and the main steam isolation valve was shut. Between 2:41 p.m. and 3:15 p.m. the plant was depressurized and cooled down to the point that the steam generator pressure and reactor coolant pressure were equal. The plant was brought to cold shutdown (less than 200°F) by 11:45 a.m. on October 3, 1979.

During the event there was a small release of radioactivity from the steam jet air ejectors due to primary coolant leaking into the main steam system through the ruptured steam generator tube. The steam jet air ejectors remove non-condensible gases from the steam system at the condenser. The gases removed are not normally radioactive. The air ejectors are vented to the atmosphere through the turbine building stack. The amount of radioactivity released was well within technical specification limits.

Licensee examination of the steam generator tube determined that a single tube (out of 3,388 in the steam generator) had ruptured. The size of the rupture was 2 inches long and 3/8-inch wide in the wall of the 7/8-inch diameter tube. Plant personnel found a small steel coil spring lodged near the ruptured tube. The spring apparently had rubbed against the tube during operation, causing the tube to wear away and eventually rupture. An adjacent tube was also worn by the spring vibration. The spring is believed to have been part of a hose used to loosen corrosion products from the tube support sheet during an early refueling outage.

The ruptured tube and five adjacent tubes were plugged to preclude the possibility of future leakage problems. A detailed visual inspection of both steam generators revealed no signs of other foreign objects. In addition, eddy current tests were performed on the affected steam generator and the other steam generator with no other abnormal indications noted. The unit returned to service on October 23, 1979.

The NRC resident inspector was at the site at the time of the tube rupture. A team of reactor inspectors and radiation specialists was dispatched by charter aircraft to the plant from the NRC Regional Office in Chicago. NRC radiation surveys and environmental samples determined that there were no detectable increases in radiation in the vicinity of the plant. Surveys by the licensee, the State of Minnesota, and the State of Wisconsin also confirmed that there was no detectable increase in radiation levels as a result of the tube rupture.

The Prairie Island Unit 1 event described above is closed for purposes of this report.

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The following abnormal occurrence was originally reported in NUREG-0090, Vol. 2, No. 1, "Report to Congress on Abnormal Occurrences: January-March 1979," and updated in a subsequent report in this series, i.e., NUREG-0090, Vol. 2, No. 2. It is further updated as follows:

79-3 Nuclear Accident at Three Mile Island

EPICOR-II

As a result of the March 28, 1979, accident at the TMI Unit 2 facility, a significant amount of radioactive contaminated water has been generated (approximately 400,000 gallons) and collected in Unit 2 auxiliary building tanks. This water could not be processed by the TMI-1 and TMI-2 radwaste processing systems because its activity was too high (for example, Cs-137 concentration 2000 times higher than the concentration in reactor coolant during normal operation) and the TMI-2 radwaste processing control panel could not be manned on a continuous basis due to contamination of the auxiliary building. The Metropolitan Edison Company (the licensee) therefore designed and constructed a new radwaste system known as EPICOR II.

The EPICOR-II system is a liquid radwaste processing system designed to decontaminate the water contained in Unit 2 auxiliary building tanks by filtration and ion exchange. The system was not intended to clean up the highly radioactive waste water in the TMI-2 reactor containment building (approximately 640,000 gallons) or water contained in the reactor coolant system (approximately 85,000 gallons).

The NRC onsite staff reviewed and approved design, construction, and operational procedures of the EPICOR-II system prior to its operation. In addition, the NRC onsite staff has monitored and inspected actual construction, testing, and system operation.

The EPICOR-II system has been in operation since October 1979 and has reduced radioactivity in the waste water to a level less than the maximum permissible concentrations specified in 10 CFR 20, Appendix B, Table II, Column II, except for that of tritium. Tritium concentrations can be reduced by dilution prior to final disposition.

Further reports will be made as appropriate.

APPENDIX C

OTHER EVENTS OF INTEREST

The following events are described below because they may possibly be perceived by the public to be of public health significance. None of the events involved a major reduction in the level of protection provided for public health or safety; therefore, they are not reportable as abnormal occurrences.

1. Construction Deficiencies

During NRC inspections conducted in April and May 1979 of construction activities at the Public Service Company of Indiana Marble Hill 1 and 2 facilities, various problems were discovered that indicated inadequacies in the licensee's quality assurance program. On June 12, 1979, NRC received allegations of improper concrete honeycomb repairs. Subsequent inspections and investigations confirmed these allegations. These findings, together with the previously identified quality assurance problems associated with concrete placement activities, led to to the cessation of concrete placement work in safety related structures.

On July 10, 1979, the National Board of Boiler and Pressure Vessel Inspectors issued a report documenting the results of their inspection conducted on June 12-14, 1979 of the licensee's activities. Extensive noncompliance to ASME Code requirements was identified in this report, thereby indicating additional inadequacies in the licensee's quality assurance program. Following further NRC inspections and investigations, the licensee ceased all safety-related construction at the site, and the NRC issued a confirmatory order on August 15, 1979 enforcing the cessation of such construction. The licensee is currently developing corrective actions. At the present time, a schedule for resolution of this matter has not been established.

The U. S. Attorney is conducting an investigation at the plant site as a result of findings by NRC regarding the alleged coverup of civil construction deficiencies. Congressional hearings were held by the Subcommittee on Environment, Energy and Natural Resources regarding the construction deficiences.

2. Low Level Radioactive Gas Release

At 6:09 a.m. on September 25, 1979, the North Anna Unit 1 power plant experienced a secondary system component failure which resulted in the plant shutting down and operating safety equipment to control the transient. During recovery operations, which entail securing the safety equipment and restoring system valve lineups to normal, the Volume Control Tank (VCT), which holds 300 cubic feet of radioactive primary coolant water and hydrogen gas under low pressure, was overpressurized. This resulted in releasing a mixture of hydrogen gas and noble gases from the reactor coolant water to radiological waste tanks and from there to the auxiliary building atmosphere.

Two plant personnel were evacuated from the auxiliary building when radiation monitors alarmed in the auxiliary building. Radioactive gas was released through the two auxiliary building vents to the atmosphere.

NRC inspectors verified the amount of gas release from the plant which, combined with knowledge of meteorological data at the time of the event, resulted in negligible radiation doses at the nearest residence in the direction of wind travel.

Design inadequacies and incomplete construction and testing controls apparently led to this occurrence.

Correction of a radiation waste system piping deficiency was conducted by the licensee immediately. Followup evaluation of the incident and operator training on operation are continuing while the plant is shut down for refueling.

The NRC inspectors, on site when notified of the event, verified that adequate controls were in force. An investigation was completed of the event and the information has been issued to other licensees to avoid similar situations.

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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, the eighteenth in the series, covers the period July 1 to September 30, 1979.

During the period, there were five abnormal occurrences. One occurred at the 70 nuclear power plants with operating licenses and involved a major degradation of primary containment boundary. Two occurred at fuel cycle facilities; one involved a mill tailings impoundment dam failure and the second involved an unresolved nuclear material inventory difference. The other two occurred at Agreement State licensees; both involved overexposure of radiography personnel.

This report also contains information updating previously reported abnormal occurrences.

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