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A SUMMARY OF INCIDENTS INVOLVING
RADIOACTIVE MATERIAL IN ATOMIC
ENERGY ACTIVITIES, JANUARY -
DECEMBER 1956

By
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August 1957

Safety and Fire Protection Branch
Division of Organization and Personnel
Washington, D. C.

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IN
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PREFACE

This publication is intended to summarize the incidents involving radioactive materials which occurred in atomic energy activities during 1956. It supplements TID-5360, "A Summary of Accidents and Incidents Involving Radiation In Atomic Energy Activities - June 1945 Thru December 1955."

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COBALT-60 EXPOSURE

Nature of Incident

Workman picked up an encapsulated 1,600 mc cobalt-60 source.

Description of Operation

A cobalt-60 source, attached to a string and suspended to a floor below, was being used on a construction job to radiograph welds.

Details of Incident

An employee of the construction contractor removed the cobalt-60 capsule from the string and put the capsule into his shirt pocket, removing it several minutes later to the glove compartment of his automobile.

Nature of Injuries or Loss

The employee received an estimated whole body gamma dose of 22 to 26 rads and an estimated dose to two small skin areas of about 3,600 r each. There were no latent effects and no blood changes were detected. Three others in his car pool were exposed to estimated doses of less than 7 r.

Milford, Connecticut
January 10, 1956

SLIGHT CONTAMINATION OF CONSTRUCTION AREA

Nature of Incident

The work area of a construction company was slightly contaminated as a result of nearby laboratory operations.

Details of Incident

A construction area was slightly contaminated when radioactive dust was ejected from a nearby laboratory. As a routine precautionary measure, articles of clothing, such as caps, gloves, coats, and shoes, were removed from the 26 employees in the area for cleaning.

Nature of Injuries or Loss

No one was exposed to more than a small fraction of the maximum permissible daily dose. No ill effects resulted.

Oak Ridge National Laboratory
January 16, 1956

PLUTONIUM CONTAMINATION TO HANDS

Nature of Incident

Plutonium contamination to employee's hands.

Description of Operation

Manual handling of radioactive material.

Details of Incident

Operator was doing routine work when a plutonium bearing organic solution caused deterioration of his rubber gloves.

Most of the initial skin contamination (about 100 milligrams of plutonium) was removed by washing, although it required a period of 50 days to remove the remaining 200 micrograms of radioactive material.

Nature of Injuries or Loss

Bioassay results obtained several months after the incident indicated that the internal deposition of soluble plutonium did not exceed 5 percent of the maximum permissible body burden.

Remarks

The main objective of the decontamination procedures was to minimize absorption through the skin.

Hanford, Washington
January 17, 1956

EXPOSURE INCIDENT

Nature of Incident

Four employees were exposed to radiation.

Description of Operation

The employees were recovering samples from a nuclear test area in Nevada.

Details of Incident

After the prescribed time which was set up before the test, four men, dressed in proper protective clothing, entered the hazardous area to recover samples. It had been pre-arranged to have a monitor enter the area in advance of the men; however, they entered the area without the monitor to redeem the samples.

Nature of Injuries or Loss

The four employees received external radiation exposures of 4 r, 14 r, 19 r, and 28 r, respectively (the recommended permissible level at the time was 3.9 r/13 weeks). After examination, the men showed no signs of ill effects.

Las Vegas, Nevada
January 18, 1956

CRITICALITY INCIDENT

Nature of Incident

Neutron and gamma ray exposure.

Description of Operation

Criticality experiment with experimental reactor.

Details of Incident

A homogeneous UO_2F_2 water moderated critical assembly was put on a prompt critical period by an over-addition of fuel to the assembly. Before reaching the critical point, the hand-operated valve (see sketch - (a)) was turned off. However, fuel continued to be added to the reactor due to air pressure in the line. Although the automatic safety system operated, assuring termination of the burst, considerable fuel was displaced from the reactor. The number of fissions in the burst was estimated to be about 1.6×10^{17} .

Nature of Injuries or Loss

No serious exposures resulted since all personnel were shielded by a minimum of 5 feet of concrete. There was no significant property damage and all uranium was recovered.

Remarks

Although it was determined that this incident was initiated by an over-addition of solution to the reactor, later measurements showed that fuel will continue to be added to the reactor for several seconds after the control switch is placed in the "drain" position if insufficient time is allowed for the operating pressure to be vented.

Oak Ridge National Laboratory
February 1, 1956

RAILROAD CAR CONTAINING SCRAP URANIUM DEMOLISHED

Nature of Incident

Train derailed (see photograph); one car contained scrap uranium.

Description of Operation

Scrap uranium was being transported between plants by rail.

Details of Incident

A train which contained a carload of scrap uranium was derailed by a rock and snowslide. The car containing the scrap uranium was demolished and the contents spilled on to the right-of-way. Radiation detection instruments were used in locating the material.

Nature of Injuries or Loss

Loss involved 60 lbs. of uranium scrap believed to be buried under the earth and rock. There was no radiation exposure to personnel.

Remarks

All the material involved, with the exception of the 60 lbs., was recovered and it was determined that further search for the unrecovered scrap was not economically justifiable.

Between St. Maries and St. Joe, Idaho
March 24, 1956

DERAILMENT OF FREIGHT CAR TRANSPORTING A URANIUM COMPOUND

Nature of Incident

Train derailed (see photograph).

Description of Operation

Transporting drums of uranium compound by rail.

Details of Incident

Twenty-six cars of a freight train were derailed as a result of a broken rail. The car containing the uranium compound was immersed in a river. The car was removed from the river bed intact and all the material was recovered.

Nature of Injuries or Loss

The material was not highly radioactive and no health hazard was involved.

Western Montana
April 20, 1956

BETA RADIATION BURN

Nature of Incident

Beta radiation injury to employee.

Description of Operation

During a routine radio-chemistry procedure, a tool used for preparing neutron sources was removed from a hot cell to be decontaminated.

Details of Incident

The tool was removed from the hot cell into the radiation room by the use of a long pole. Then it was put into a bucket (by hand) and taken to the sink for decontamination. During the decontamination process, the employee noticed that his pocket dosimeter was off scale. He immediately went to the monitoring station for a check. It was ascertained that rubber gloves were worn during the entire operation; the manner of contamination therefore could not be determined.

Nature of Injuries or Loss

The injured was hospitalized 14 days, for skin grafting to the middle finger, left hand, as a result of a beta burn received apparently when the tool was placed in the bucket by hand.

Los Alamos Scientific Laboratory
April 30, 1956

GAMMA EXPOSURE INCIDENT

Nature of Incident

Fifteen to Twenty-five employees were exposed to gamma rays.

Description of Operation

Radioactive iridium 192 was being used for field X-raying welds.

Details of Incident

While working near a portable radiographic source, the employees were exposed to small doses of gamma radiation when a cap was knocked off a pig containing a 32-curie iridium source. The cap was set lightly on top of the pig with a string coming out of the pig. The string became entangled some time during the day and was pulled out of the pig, knocking off the cap and exposing the source. The men working on and around the scaffold, on which the pig had been placed, were exposed.

Nature of Injuries or Loss

The maximum amount (6 r) of radiation which could have been received by these employees would not be enough to cause any illness. No abnormalities were indicated by results of laboratory examinations. They returned to work the following day.

Remarks

This incident is attributed directly to the fact that the employee failed to store the source in accordance with outlined procedure.

Fort Belvoir, Virginia
May 14, 1956

EXPOSURE TO PLUTONIUM

Nature of Incident

Several employees received significant body burden of plutonium.

Description of Operation

The men were doing semi-routine work in a chemical plant control room.

Details of Incident

Some highly concentrated plutonium solution backed up in the instrument line of an air-operated valve and about a pint escaped into the control room. Personnel in the area were exposed to airborne plutonium.

Nature of Injuries or Loss

One employee was hospitalized 4 days for observation, decontamination, and special treatment; a second and third were given treatment at the hospital (no lost time) in connection with inhaled plutonium.

An estimated cost of \$5,000 was incurred for decontamination of the plant.

Remarks

The committee investigating the incident made the following recommendations:

1. The plant should review existing process equipment where pipe-type connections are present between process cells and operating area.
2. Action should be taken immediately to eliminate obvious potential hazard of the type which caused this incident and on a long-range basis to reduce generally the potential for process solution blow-backs.
3. All building safety rules should be reviewed and revised as necessary to specify the minimum requirements for protective personal clothing to be worn while working in chemical plant area.

Hanford, Washington
June 18, 1956

CONTAMINATION INCIDENT

Nature of Incident

Contaminated blotting paper blew around the room during an experiment.

Description of Operation

Experiment involved highly radioactive material.

Details of Incident

During the course of the experiment, the piece of blotting paper, which had become contaminated with radioactive material, blew around the room for some unexplained reason, causing contamination of the area. There was a possibility that all of the occupants of the room were exposed.

Nature of Injuries or Loss

Eight employees were exposed within the permissible limits; two received maximum permissible exposure. No one required hospitalization or treatment.

No dollar loss due to contamination was involved.

Los Alamos, New Mexico
June 21, 1956

JACKET FAILS ON SOURCE

Nature of Incident

Plutonium oxides were released from a plutonium alloy instrumentation source.

Description of Operation

Plutonium instrumentation source stored in trailer.

Details of Incident

Plutonium oxides were released when the jacket failed on the source stored in a house-type trailer. The failure of the jacket caused contamination to about 15 persons and their living quarters, including clothing and bedding. Decontamination was carried out according to standard procedure and items too heavily contaminated to be made usable were buried at sea.

Nature of Injuries or Loss

Bioassays were made on all personnel exposed and it was found that all body burdens were negligible and well below permissible amounts.

Eniwetok Proving Ground
June 23, 1956

THORIUM EXPLOSION

Nature of Incident

A thorium explosion occurred in a metallurgy laboratory which resulted in injury to nine employees.

Description of Operation

Burning of thorium metal for conversion to oxide in a hood. (This conversion is standard procedure for handling uranium and thorium scraps to reduce fire potential during subsequent shipment.)

Details of Incident

One of the employees in the laboratory (wearing personal protective equipment) took a piece of thorium metal about the size of a golf ball from a drum which contained 30 to 40 pounds of the material and put it onto a tray, located inside the ventilated burning hood, by means of a pair of tongs. (Some of the metal in the form of wafers had already been fired in the tray to act as a source of ignition for the new material.) There was an immediate sharp explosion, followed almost immediately by a second blast.

Nature of Injury

Nine persons received injuries as a result of the explosion; four of these were hospitalized because of burns and other injuries, and one died about 5 weeks later. Except for four laboratory workers, the analyses of urine specimens from all persons associated with the incident (firemen, policemen, etc.) showed no detectable intake of radioactive materials. The four men directly involved did not exceed the permissible body burden for uranium or thorium.

Measurements were made both inside and outside the building during the first 4 hours after the explosion for alpha surface contamination and for direct radiation from beta and gamma; no significant radiation was evident. Property damage was estimated at approximately \$125,000.

Bayside, New York
July 2, 1956

INTERPLANT SHIPMENT ACCIDENT

Nature of Incident

Trailer-truck overturned and caught fire.

Description of Operation

Transportation of slightly radioactive material.

Details of Incident

The braking system reportedly failed on a downgrade and the driver lost control of the unit as he attempted to negotiate an "S" curve. The vehicle skidded across the highway into a soft ditch, plowed up the shoulder for approximately 100 feet, then up an embankment on the left side of the road, overturned, and burned (see photographs).

Nature of Injuries or Loss

The driver was hospitalized for burns and bruises resulting from the accident. There was no loss of material.

Monterey, Tennessee
July 9, 1956

WORKMEN EXPOSED TO RADIATION ON A REACTOR

Nature of Incident

Eight men received radiation exposures from large gamma source.

Description of Operation

The Materials Testing Reactor was shut down for scheduled re-fueling and experiment installation operations.

Details of Incident

Six employees were working on the reactor top adjacent to the reactor tank opening; two men were present as observers and advisors. The exposure occurred when a highly radioactive reactor component was placed in a position where it was not adequately shielded because of lowered water level in the reactor tank. The moving of the component and the coincident lowering of the water level were both done to facilitate insertion and removal of experiments in the reactor.

Nature of Injuries or Loss

The eight employees received radiation exposures ranging from 2.5 r to 21.5 r, which was not sufficient to cause illness to any of the men, although they were placed under routine medical observation.

Remarks

Full-time radiation monitoring service will be provided at this location as soon as the necessary health physics personnel can be obtained.

Materials Testing Reactor, Idaho Falls
July 23, 1956

DOCKSIDE TEST OPERATIONS RESULT IN SLIGHT EXPOSURE

Nature of Incident

Seven persons were exposed to radiation.

Description of Operation

Dockside test operations on the SEAWOLF.

Details of Incident

The men received minor radiation doses, the highest of which was 1.1 r. The exposure occurred during the testing procedure and was not the result of a malfunction of the nuclear reactor or of normal plant operations.

Nature of Injuries or Loss

No radioactivity was released to the air or water. No ill effects to the exposed personnel resulted, and no damage to the ship or equipment was involved.

SEAWOLF

August 19, 1956

PLUTONIUM CONTAMINATION INCIDENT

Nature of Incident

Plutonium-bearing solution splashed on employee.

Description of Operation

A container of plutonium-bearing solution was being prepared for shipment.

Details of Incident

In filling the container, some of the solution rested in the recess at the mouth of the container in which the gasket sits. When the cover was applied, drops of the solution splashed out on to the employee's chest and face and into his mouth. Decontamination procedures were instituted and all accessible parts of his body were adequately cleaned.

Nature of Injuries or Loss

Employee was sent to the hospital (no lost time) for observation. The results of biological tests indicated that the amount of plutonium in his body was below the permissible body burden.

Remarks

No serious consequences are anticipated as a result of this incident.

Hanford, Washington
September 21, 1956

SPONTANEOUS MASSIVE THORIUM FIRE

Nature of Incident

A spontaneous fire occurred in a drum of thorium metal pellets en route to an AEC licensee.

Description of Operation

Railroad shipment of thorium pellets.

Details of Incident

The shipment arrived at the Railway Express Agency warehouse where it was loaded onto a truck for further transport. A few minutes after loading the truck, smoke was noted rising from the load. The source of smoke was found to be a drum which was pushed from the trailer and allowed to burn itself out. The fire lasted about $2\frac{1}{2}$ hours.

Nature of Injuries or Loss

No one involved in the incident received any exposure of thorium or radiation in excess of maximum permissible amounts.

Detroit, Michigan
September 22, 1956

RADIOACTIVE SHIPMENT ACCIDENT

Nature of Incident

Semi-tractor-trailer truck loaded with two casks containing radioactive slugs went over an embankment.

Description of Operation

The slugs were being transported between plants by tractor-trailer.

Details of Incident

On a rainy morning (temperature 26°, resulting in a glazed road) a semi-trailer was coming out of a downgrade "S" curve when the trailer started slipping toward the right on the outside of the curve. In the next 150 feet, the trailer went over the bank (see photograph) and was dragged behind the tractor which was maintaining traction on the shoulder. The weight of the trailer (21 tons) was straining on the kingpin and fifth wheel and, as the trailer slipped further down the 25° slope, the fifth wheel tore loose from the tractor causing the tractor to flip over on its right side. The trailer started rolling down the embankment. The rear cask broke loose during the roll and stopped in an inverted position on a shelf about 30 feet below the road surface. The trailer continued rolling to an upright position where it stopped with the forward cask still secured to the bed although it had slipped to the left about 12 inches and flattened the stainless pan side.

Nature of Injuries or Loss

Neither the driver nor the relief driver was seriously injured; the latter was sent to the hospital for observation.

An instrument survey was made of the equipment, area, and personnel. All slugs remained safely in the casks.

Pleasant Valley, Oregon
December 11, 1956

PLUTONIUM CONTAMINATION INCIDENT

Nature of Incident

Contamination by plutonium carried by flushing solution.

Description of Operation

Cleaning of a plutonium concentrator cell line by means of steam pressure.

Details of Incident

The plant had been shut down to clear a plugged line in the plutonium concentrator cell. In the course of the work, inadequate venting resulted in the system being pressurized with air. Plutonium-containing flushing solution and mist were forced into the gallery from temporary instrumentation connected to the tank, contaminating about 300 feet of the gallery, and causing extensive skin and clothing contamination of a chief operator. A maintenance foreman also received hand and clothing contamination, but to a lesser extent.

Nature of Injuries or Loss

No employees were overexposed to radiation. The costs for plant decontamination and equipment replacement were \$20,000 and \$30,000.

Remarks

Clear step-by-step procedure should be written for all non-standard operations and given formal status. The use of temporary manometers on plant process equipment should be rigidly limited and controlled.

Hanford, Washington
(Date - not given)

TRITIUM EXPOSURE

Nature of Incident

An employee was exposed to tritium.

Description of Operation

Employee entered a ventilated area to make an equipment change.

Details of Incident

When the employee opened the shielding door to the extraction furnace, the plastic bag pulled off the ring and, due to the lower pressure, was drawn into the space between the furnace and the shielding wall. Instinctively, the employee attempted to grab the bag but failed, so he inserted one hand and arm up to his shoulder into the port to retrieve the bag. He did not know whether he had handled the clean or contaminated side. After fastening the bag in place, the employee removed his gloves and did not wash his hands. Approximately 30 minutes later he went for a smear count which indicated that he had received more contamination than the permissible limit. He was instructed to immediately take a shower.

Nature of Injuries or Loss

The employee did not suffer any injury nor was he hospitalized.

Remarks

Although the cause of this incident cannot be determined, it has pointed out the need for additional control of access to areas of high potential hazards.

(Location and date - not given)