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A SUMMARY OF

INDUSTRIAL

ACCIDENTS

**IN
USAEC
FACILITIES
1965-1966**

December 1967

UNITED STATES ATOMIC ENERGY COMMISSION

**Division of Operational Safety
Washington, D.C. 20545**

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A SUMMARY OF INDUSTRIAL ACCIDENTS IN USAEC FACILITIES

JANUARY 1, 1965 to DECEMBER 31, 1966

**UNITED STATES ATOMIC ENERGY COMMISSION
Division of Operational Safety
Washington, D.C. 20545**

PREFACE

"A Summary of Industrial Accidents in USAEC Facilities", TID-5360 (Suppl. 6), presents information on Types A and B radiation exposures and industrial accidents occurring during 1965-66 within the AEC or AEC-owned and -operated contractor operations. This Summary does not include the experience of private or licensed operations. Former issues of this TID series cover the years 1945-64.

Definitions of Types A and B radiation exposures and industrial accidents and reporting requirements are contained in AEC Chapter 0502, "Reporting and Investigating Accidents and Radiation Exposures". These definitions are set forth in this publication at the conclusion of the listing entitled "Types A and B accidents, Incidents, and Radiation Exposures".

Various incidents in this document refer to radiation exposures in excess of values such as 3 rem per quarter or 15 rem per year. These are administrative limits used to control the cumulative radiation exposure received by AEC and AEC contractor employees. They are not boundaries between "injury" and "no injury", in the ordinary sense of the word, and no radiation injuries should be inferred from the cases in this document unless specifically described.

In addition to the listing mentioned, this publication contains short narrative descriptions of all Types A and B accidents or incidents involving radioactive material and of all fatalities.

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TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES

USAEC FACILITIES, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-1-A	1-15	OR-Union Carbide Corp., Nuclear Div. (Operational Incident)	0	\$296,000
		A pipe, which was to have been blocked off, was mistakenly fitted with a strainer. This error resulted in the irretrievable loss of an aqueous lithium solution via its discharge into a waste pond.		
65-3-A	1-20	SAN-Lawrence Radiation Laboratory, Livermore	0	(⁵)
		An accidental release of radioactive gas (discharged through a high stack) resulted when an employee, intending to tighten a storage vessel fitting, loosened it instead. No health hazard was created. (See page 16).		
65-4-B	1-17	OR-Oak Ridge Institute of Nuclear Studies	0	11,185
		A mobile exhibit and a privately-owned vehicle collided. The exhibit driver received minor bruises.		
65-5-A	1-28	NV-Reynolds Electrical and Engineering Co., Inc.	1 fatality	0
		A rotary drill helper was killed instantly when a "finger" (a 4' length of 4" pipe weighing 87 lbs.) fell 85' from the fingerboard of the mast of a drill rig, striking him on the head, neck, and shoulders. The cause of death was given as depressed occipital skull fracture with a 4" laceration. (See page 49).		
65-6-B	2-5	SAN-Lawrence Radiation Laboratory, Livermore	0	10,795
		An antenna on a scientific trailer was damaged when it snagged a telephone line.		
65-7-A	2-23	NV-Reynolds Electrical and Engineering Co., Inc.	1 fatality	0
		A wireman foreman was electrocuted while working in a switchgear cabinet. (See page 41).		
65-8-A	2-20	OR-Government	0	0
		A truck, transporting 100 drums of thorium residues, overturned. Some decontamination was required. (See page 17).		
65-9-B	1-14	CH-Atomics International	2 exposed	0
		Two employees received estimated external whole-body radiation exposures of 4 rem each while moving an irradiated beryllium temperature probe with a high-bay crane. (See page 16).		
65-10-B	2-20	NV-Reynolds Electrical and Engineering Co., Inc.	2 exposed	0
		Two employees, participating in a post-shot drilling operation, received estimated thyroid exposures of 31 and 27 rad, respectively, when gaseous radioiodine escaped from an "abandonment" valve opened in error. (See page 17).		

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-11-B	1-11	SAN-Lawrence Radiation Laboratory, Berkeley	1 exposed	0
		An employee received an estimated external whole-body radiation exposure of 3.6 rem (film badge reading) while working in a cave adjacent to a cyclotron vault. (See page 40).		
65-12-B	3-5/25	OR-Union Carbide Corp., Nuclear Div.	1 exposed	0
		During the fabrication of strontium 89 impregnated graphite-uranium oxide spheres, an employee received an estimated cumulative radiation exposure of 50 rem to each hand. (See page 18).		
65-13-B	4-14	NV-Lawrence Radiation Laboratory	6 exposed (LRL) 3 exposed (USAF)	0
		During cloud monitoring, when the cloud rose higher than anticipated before the airplane could complete its mission, six AEC contractor employees received estimated external whole-body radiation exposures of 5.2, 4.7, 4.3, 4.2, 4.1, and 4.1 rem, respectively; three USAF personnel 5.3, 4.6, and 4.4 rem, respectively. (See page 19).		
65-14-A	4-28	OR-Union Carbide Corp., Nuclear Div.	2 exposed	0
		An X-ray unit started continuous operation because of an internal short. One employee received an estimated radiation exposure to the skin of 19 rem and to the end of the right thumb of 3500 rem (a second-degree burn developed but healed); the second employee received an estimated radiation exposure of 11 rem to the skin. (See page 19).		
65-15-B	5-5	NV-Reynolds Electrical and Engineering Co., Inc.	0	\$75,000
		A drill rig was damaged when it overturned.		
65-16-B	5-6	NY-Harvard University and Massachusetts Institute of Technology	0	127,000
		A fire, attributable to the failure of one or more capacitors in a modulator, occurred at an electron accelerator. The amount of loss includes equipment damaged beyond repair and the cost of the cleanup operation.		
65-17-B	3-29/ 4-30	AL-Monsanto Research Corp.	1 exposed	0
		While removing trash from hoods in a plutonium process line, an employee received an estimated external whole-body cumulative radiation exposure of 3.9 rem. (See page 20).		
65-18-B	3-29/ 5-9	AL-Monsanto Research Corp.	1 exposed	0
		During the processing of radioactive material, an employee received an estimated external whole-body cumulative radiation exposure of 4.6 rem. (See page 21).		
65-19-B	5-22	OR-Oak Ridge National Laboratory	1 exposed	0
		A physicist received a radiation exposure to the left forefinger estimated at 51 rem when the beam shutter on a Van de Graaff machine opened without his knowledge. (See page 21).		

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-20-A	6-14	OR-Union Carbide Corp., Nuclear Div.	1 fatality	0
A lineman was fatally injured when he fell 18' from an electric pole onto the sidewalk. Investigation revealed that his body belt was unbuckled. The cause of death was a fractured skull. (See page 41).				
65-21-B	6-14	AL-Government	1 injured	\$7,292
A firetruck being used to fight a brush fire rolled, driverless, from a parked position on a mesa into a canyon, dropping 60'. As the result of evasive action taken to avoid being struck by the rollaway vehicle, a fireman sustained severe injuries to both heels, broken bones in the right foot, a severe laceration on the head, and a severe bruise of the left thigh, together with multiple contusions and lacerations. The truck was a total loss.				
65-22-A	6-21	NV-Shaft Drillers, Inc.	1 fatality	0
An employee suffered fatal injuries when he fell 24' from a derrick platform onto a concrete pad. The cause of death was severe depressed skull fracture, frontal region; multiple fractures both arms; possible internal injuries. (See page 42).				
65-23-A	6-24	OR-Oak Ridge National Laboratory	2 injured	2,500
Two cooperative program students were injured when a chemical explosion occurred in a laboratory as one of the students was attempting to make "fireworks" for his own use by mixing red phosphorus and magnesium perchlorate. This student suffered a penetrating injury of the right eye, severe burns of the left eye, and blast injury to the chest wall, abdomen, upper extremities, and neck; very severe blast injury to the left groin. The second student, working nearby (and not involved in the "fireworks" venture) received multiple lacerations to various portions of the body.				
65-24-A	7-5	NY-Harvard University and Massachusetts Institute of Technology	7 injured 1 fatality	1,453,000
An explosion and fire occurred in the experimental hall of an accelerator complex. The incident was caused by the sequential failure of the inner and outer beryllium windows of a liquid hydrogen bubble chamber. Eight persons were injured, one of whom died fifteen days later as the result of third degree burns suffered over 60% of the body and a ruptured liver. Of the seven others, one had severe burns; one, serious burns; one, burns and back injury; two, burns; one, head injuries and cuts; one, injury to chin and leg. Two firemen were injured, also; one, smoke inhalation; one finger injury requiring ten stitches. The property loss included equipment damaged beyond repair and necessary repair costs. (See page 42).				
65-25-B	4-8	Al-Dow Chemical Co.	0	8,810
While repaneling an office wall, a carpenter leaned a ladder against a row of shelving and used the ladder as a work platform. The shelving, from which the top brackets had been removed, toppled over, damaging beyond repair some of the inspected parts it contained. The carpenter jumped to the floor, receiving only minor bruises.				

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-26-B	5-6	AL-Dow Chemical Co.	0	\$7,557
		While attempting to activate a product transfer line, contaminated acid solution was sprayed out of a flanged union that had not been tightened. Three contaminated employees were readily decontaminated. Cost was for decontamination and for replacing contaminated equipment. (See page 20).		
65-27-B	5-10	SR-E. I. du Point de Nemours & Co.	0	33,600
		Process water (2400 lbs.) was lost when it leaked through an unseated sleeve.		
65-28-B	5-16	SR-E. I. du Pont de Nemours & Co.	0	9,800
		Process water (700 lbs.) was lost when it leaked through an unseated sleeve.		
65-29-B	7-20	AL-The Bendix Corp.	0	11,183
		Nine weapons components were damaged in an overheated thermotron combination oven and refrigerator. Overheating apparently resulted from a malfunctioning automatic temperature control.		
65-30-A	7-7	SAN-Lawrence Radiation Laboratory, Livermore	1 injured	0
		When an employee, assuming an X-ray machine was turned down, reached inside of it to change materials, he received an estimated radiation exposure of 1,000 rem to the index, middle, and ring fingers of the right hand; second-degree burns developed and healed. This resulted in a lost-time injury of twelve days. (See page 23).		
65-31-B	7-31	SNPO-N-Pan American World Airways, Inc.	1 exposed	
		An employee was assigned an estimated external whole-body radiation exposure of 3 rem after he attempted to unclog a vacuum pipe during cleanup operations, unaware that fuel element fragments were caught in the coupling. (See page 24).		
65-32-B	7-31	RL-General Electric Co.	0	75,000
		An explosion occurred in a boiler during an attempt to relight the oil-fired burner with a kerosene torch after the automatic re-ignition system failed to function.		
65-33-B	7-19/ 30	AL-Monsanto Research Co.	1 exposed	0
		An employee received an estimated external whole-body cumulative radiation exposure of 5.8 rem while hand-carrying gamma-emitting neutron sources during radioactive trash recovery. (See pages 23).		
65-34-B	May	OR-Union Carbide Corp., Nuclear Div.	1 exposed	0
		An employee, whose assignment involved the fluorination of uranium oxides to uranium hexafluoride, received a cumulative lung burden of 0.035 μ c, from which an accrued 12-month exposure of 19.5 rem is expected. (See page 22).		

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-35-B	8-23	RL-Battelle-Northwest	1 exposed	\$76,800
Plutonium contamination spread followed an explosion and fire occurring in a glovebox when cleaning fluid ignited. Ten employees left the building immediately. Prompt showering easily removed all skin contamination. One employee received 10% of a maximum permissible body burden (bone) of plutonium 239 by inhalation. Contamination did not spread outside the building. About 90% of the cost incurred was for decontamination. (See page 24).				
65-36-B	8-25	OR-Union Carbide Corp., Nuclear Div.	1 injured	7,915
After removal of the front of a large nitrogen drybox to permit machining of a lithium part, lithium residue dust ignited. The machine was damaged. A fireman fell 7' to the concrete floor while fighting the fire. He received a broken rib and other less serious injuries.				
65-37-B	8-27	CH-Argonne National Laboratory	0	35,000
Four transformers were damaged by lightning.				
65-38-A	9-9/13	ID-Government	5 exposed	0
An airfreight shipment of methyl iodide containing approximately 10 curies of iodine 131 leaked. Iodine 131 depositions were found in the thyroids of sixty-four people known to have been in contact with the shipment. Five of them received estimated thyroid doses of 18.3, 7, 5, 3.3 and 1.9 rem, respectively. (See page 25).				
65-39-B	9-13	SAN-Lawrence Radiation Laboratory, Livermore (Operational Incident)	0	30,000
A plastic bag, containing a plutonium metal rod and some plutonium-plated pieces, burst into flames when touched by an employee as he attempted to place it in a metal container. The fire damaged the plastic bag only; cost was for decontamination. (See page 25).				
65-40-B	9-5	SR-E. I. du Pont de Nemours & Co.	0	7,300
Improper material was used in the decontamination of a heat exchanger, necessitating the expense of recleaning the exchanger.				
65-41-B	8-27	CH-Argonne National Laboratory	0	8,000
Lightning caused the destruction of a breaker and the burning of a cubicle.				
65-42-A	9-29	RL-Battelle Northwest	0	895,000
A process tube failed, releasing fission products into the reactor core. Fission product activity spread within the containment vessel and activated ventilation containment. Personnel were unable to reenter the containment vessel for a period of 12 hours. The reactor scrambled on loss of loop pressure. The cost is based on the equipment and materials contaminated beyond further use and the expense of decontamination of the reactor system and containment shell. Personnel exposures were within normal administrative limits. (See page 27).				

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-43-B	1965	OR-Goodyear Atomic Corp.	8 exposed	0
While performing their regular duties in the conversion of uranium oxide to uranium hexafluoride, eight employees received uranium lung depositions resulting in estimated 12-month accrued lung doses of 36, 29, 25, 22, 20, 19, and 16 rem. (See page 31).				
65-44-A	9-15	RL-General Electric Co.	1 injured	0
An employee, unaware that the X-ray emission spectrometer tube was "ON" and the shutter was stuck on "OPEN", received X-ray burns to the thumb and three fingers of the right hand as he wiped moisture from inside the sample chamber. The radiation dose to the fingers was estimated to be 80,000 rem. This resulted in a lost-time injury of 100 days and amputation of a portion of the employee's index finger. (See page 26).				
65-45-B	10-13	SAN-Lawrence Radiation Laboratory, Berkeley	0	\$9,149
An explosion and fire occurred in a mechanically faulty voltage regulator at an outdoor switching station. The majority of the cost was incurred in repairing the regulator.				
65-46-B	5-8	RL-Battelle-Northwest	0	7,000
Failure, due to fatigue, of a $\frac{1}{2}$ " stainless steel tubing line resulted in the loss of approximately 400 lbs. and the degrading of 1,020 lbs. of heavy water.				
65-47-B	8-2	NV-Reynolds Electrical & Engineering Co., Inc.	0	7,000
An 80' crane boom fell backward across the top of the crane house, smashing the house and buckling the boom.				
65-48-B	8-25	AL-Mason & Hanger-Silas Mason Co., Inc., Burlington, Iowa	0	52,537
A hail storm damaged steam line insulation, broke windows, made dents in sheetmetal of engineering equipment and autos, and damaged roofs of buildings.				
65-49-B	10-15	AL-Dow Chemical Co.	3 exposed	17,057
An attempt to unclog a plutonium machining coolant recirculation line ignited plutonium metal, resulting in the contamination of a major portion of the building and parts of another. Fifteen employees received inhalation exposures resulting in estimated plutonium lung burdens of 0.008 to 0.17 μ c; three exceeded the 15-rem-per year exposure limit for the lung with estimated exposures of 42, 32, and 29 rem. (See page 27).				
65-50-B	10-12/ 21	AL-Los Alamos Scientific Laboratory	3 exposed	0
While removing fuel pin handling rods and reflector pins (for metallurgical study) from the remains of a partially dismantled reactor, three employees received estimated external whole-body cumulative radiation exposures of 4, 3.8 and 3.6 rem over a nine-day period. (See page 28).				

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ - Type ²	Date	Field Office ³ - Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-51-B	10-23	AL-ACF Industries, Inc.	0	\$41,000
	Fire in a plating laboratory, caused by an electrical fault, ignited flammable fume exhaust duct material at that location, and spread rapidly through the duct system, igniting several tank exhaust ducts and contents of tank consoles.			
65-52-B	10-30	RL-General Electric Co.	0	7,200
	During an aluminum jacket dissolution in a dissolver, an exothermic reaction involving ammonia and/or hydrogen occurred within an electric heater, through which these gases were accidentally vented. The reaction, which continued for three hours, totally destroyed the heater.			
65-53-B	9-30	AL-Sandia Corp.	0	11,037
	After a drop test, a pilot flew too low over the control area. A sonic boom damaged structures in the area.			
65-55-B	11-9	AL-Dow Chemical Co.	0	23,253
	An explosion and fire occurred when acetone fumes from a "cocoon," used in a glovebox paint-stripping operation, contacted a hot muffle furnace in another part of the glovebox line. Plutonium contamination spread to adjacent rooms and the second floor. Twelve employees required skin decontamination; none received significant internal radiation exposures. The cost was for decontamination of facilities. (See page 28).			
65-56-B	Oct.- Dec.	AL-Los Alamos Scientific Laboratory	2 exposed	0
	While machining irradiated reactor reflector pins, two employees received estimated external whole-body quarterly radiation exposures of 3.8 and 3.2 rem. (See page 30).			
65-57-A	12-23	SAN-Stanford Linear Accelerator Center (Statewide Steel Co., subcontractor)	1 fatality 1 injured	0
	A six-ton concrete plank fell, seriously injuring one employee and crushing another to death. (See page 43).			
65-58-B	12-26	CH-Argonne National Laboratory	0	22,600
	An explosion, resulting from the ignition of a hydrogen-air mixture, the hydrogen apparently evolved from nickel-iron batteries, occurred in the equipment airlock joining a reactor building and a fuel cycle facility. No radioactive material was involved.			
65-59-B	Oct.- Dec.	SAN-Lawrence Radiation Laboratory, Berkeley	1 exposed	0
	While performing routine startup operations at an accelerator, an employee received an estimated external whole-body quarterly radiation exposure of 3 rem. (See page 30).			
65-60-B	9-13 & 17	AL-Los Alamos Scientific Laboratory	0	5,400
	Repeated lightning strikes damaged transformers.			

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
65-61-B	10-3	ID-Phillips Petroleum Co.	1 injured (Navy)	\$ 18,540
		A bus driver, attempting to avoid hitting a private car that had crossed over into his lane, swerved the bus. It went over an embankment and turned on its side. A Navy employee received fractured ribs and a possible back injury.		
65-62-B	3-19	AL-Dow Chemical Co.	1 exposed	1,306
		When a glove failed in a glovebox, releasing plutonium, an employee received a lung deposition of 0.051 μ c of plutonium, from which is expected an accrued 12-month exposure of 36 rem. Cost was for decontamination of facilities. (See page 18).		
65-63-B	May	OR-Puerto Rico Nuclear Center	1 exposed	0
		During the construction of a room adjoining a reactor, a carpenter received an estimated external whole-body cumulative radiation exposure of 7.5 rem. (See page 22).		
65-64-B	11-23	SR-E. I. du Pont de Nemours & Co.	0	19,500
		A cooling coil in a vessel developed a leak and allowed contaminated solution from a tank to enter the cooling water system when the coil was pressurized. The cost was for cleaning the system and associated work. (See page 29).		
65-65-B	11-27	AL-Dow Chemical Co.	0	47,000
		Roofing destroyed by high winds.		
66-1-B	1-5	RL-General Electric Co.	0	7,200
		An estimated 420 pounds of uranium solution were lost to radioactive waste through a milling tank overflow, caused by the failure of a normally closed supply line valve. (See page 31).		
66-2-B	1-29/ 30	SR-E. I. du Pont de Nemours & Co.	0	56,000
		Waterlines, draintraps, water-jacketed equipment, and fire sprinkler lines were frozen when the temperature dropped to 6° F., the lowest since 1899.		
66-3-A	1-12	SNPO-Pan American World Airways	1 fatality	0
		An employee died of third-degree burns over 100% of the body surface as the result of inadvertent ignition of gasoline and acetate recording tapes in preparation for disposal in a burn pit. (See page 44).		
66-4-A	1-11	NV-Reynolds Electrical & Engineering Co., Inc.	1 fatality	0
		A miner died thirteen days after being struck on the top of the head by a falling rock. His death was caused by respiratory failure due to transverse myelitis of the cervical cord caused by the injury. (See page 44).		

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ - Type ²	Date	Field Office ³ - Contractor	Injuries ⁴ - Exposures	AEC Property Damage
66-5-B	1-21	RL-Douglas United Nuclear	0	\$52,449
A furnace explosion occurred in a boiler during a test to determine the response capability of the combustion controls to maintain a proper fuel-air ratio during changing boiler loads. Considerable stress and distortion to the boiler's refractories and exterior case were sustained. Tests were being conducted because of a previous boiler explosion. (See 65-32-B).				
66-6-B	2-2	CH-Atomics International	1 exposed	0
An employee picked up an irradiated fuel sample which fell from a transfer tunnel. The maximum radiation exposure, estimated at 58 rem, occurred to the skin of the middle phalanx of the fingers of the left hand. (See page 32).				
66-7-A	2-14	OR-National Lead Co. of Ohio	1 injured	294,826
A release of uranium hexafluoride, estimated at 3,844 lbs., occurred when an operator inadvertently unscrewed the valve from the head of a 10-ton cylinder during a routine startup operation. Equipment damage was negligible. One employee, who received an inhalation exposure, was hospitalized for six days; other personnel who received varying degrees of inhalation exposures were treated at the dispensary. There were no significant radiation exposures. Material loss, \$278,826; decontamination and cleanup, \$21,000. (See page 32).				
66-8-B	3-18	BH-Brookhaven National Laboratory	0	11,600
When the main hydrogen flow through the purifier was begun, an explosion occurred at the inlet to the adsorber coil. Immediately, the liquid hydrogen contents of the chamber were dumped to atmosphere through a safety vent system.				
66-9-A	Between 3/25 & 3/28	OR-Union Carbide Corp., Nuclear Div. (Operational Incident)	0	277,000
A loss of approximately 50,000 pounds of mercury was caused by the failure to close a valve isolating the temporary support system.				
66-10-B	3-15	SR-E. I. du Pont de Nemours & Co.	1 exposed	0
An employee received an estimated radiation exposure of 29.5 rem to the right hand while using a contaminated pipet. (See page 34).				
66-11-B	Jan.- Mar.	SAN-Lawrence Radiation Laboratory, Berkeley	2 exposed	0
Two members of a bubble chamber crew received neutron exposures during normal operations. Their estimated external quarterly whole-body neutron exposures were 4.6 and 3 rem. (See page 34).				
66-12-B	4-1	SR-E. I. du Pont de Nemours & Co.	0	20,049
A forest fire destroyed 178 acres of pine and hardwood trees.				

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
66-13-B	1-24/ 2-24	AL-Los Alamos Scientific Laboratory	1 exposed	0
An employee received an estimated external whole-body cumulative radiation exposure of 5.1 rem (according to his film badge) while engaged in his regular duties in plutonium processing. (See page 33).				
66-14-B	4-6	NV-Reynolds Electrical & Engineering Co., Inc.	0	\$11,600
An overload caused the top section of the mast on a drill rig to buckle, damaging the mast.				
66-15-B	4-17	SR-University of Georgia	0	6,000
A fire occurred when a drying oven overheated. Faulty loading blocked the thermostat sensing element, causing it to indicate an erroneously low temperature and call for additional heat. Damage was confined to the room of origin.				
66-16-B	Jan.- Mar.	SAN-Stanford Linear Accelerator Center	1 exposed	0
While tuning an RF circulator, an employee received an estimated quarterly radiation exposure to the left foot of 300 rem of soft X-rays of less than 35 kv. There was no evidence of erythema. (See page 35).				
66-17-A	5-1	AL-Mason & Hanger- Silas Mason Co., Inc., Burlington, Iowa	1 fatality	0
An employee died from crushing injuries to chest and head in a head-on motor vehicle collision while driving a Government-owned car. (See page 45).				
66-18-B	4-14	AL-Sandia Corp. (Bermite Powder Co., subcontractor)	0	6,956
While spin rocket grains that had been removed from their molds after the inhibiting process were being processed, a flash fire occurred, caused by the aluminum core rubbing against the propellant.				
66-19-B	4-21/ 22	NV-EG&G, Inc.	1 exposed	0
An employee carried home in his pants pocket four small cobalt 60 sources. They were on his person about 12 hours. He received an estimated dose to the skin of the left thigh of 70 rem. (See page 36).				
66-20-A	5-26	AL-Chaney & Hope (Ditmars & Boxley, subcontractor)	1 fatality	0
While painters were engaged in spray painting the outside and top surfaces of a water storage tank, one painter stepped backward into an opening on the tank top, and fell 35' onto the bottom of the tank. (See page 45).				
66-21-B	6-6	OR-Union Carbide Corp., Nuclear Div.	0	5,500
A fire, of undetermined cause, occurred in a laboratory. It was confined to one hood and a section of ductwork because of the successful operation of a sprinkler head, a fire damper in the exhaust system, and other fire protection controls.				

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ - Type ²	Date	Field Office ³ - Contractor	Injuries ⁴ - Exposures	AEC Property Damage
66-22-B	Apr.- June	NV-Lawrence Radiation Laboratory	1 exposed	0
While participating in the "high-grading," or recovery, of selected radioactive samples from drill cores at post-shot drilling sites, an employee received an estimated quarterly radiation exposure of 26.5 rem to the left hand. No physical effects have been noted. (See page 38).				
66-23-B	5-20	SR-E. I. du Pont de Nemours & Co.	0	(⁵)
A weld failure on a container in a gloveport hood permitted release of tritium gas through a stack to the atmosphere. (See page 36).				
66-24-A	6-24	SAN-Lawrence Radiation Laboratory, Berkeley (Halbach & Flynn, subcontractor)	1 killed	0
An employee was killed when the dirt loader he was operating overturned and crushed him. (See page 47).				
66-25-A	6-17	NY-Government	1 fatality	0
Two employees were involved in a single-car accident; one died eight days later as the result of brain and chest injuries; the other received only minor injuries. (See page 47).				
66-26-B	6-27	OR-Union Carbide Corp., Nuclear Div.	0	\$40,000
An explosion (cause undetermined) occurred in a nitrogen compressor, followed by a lower-intensity explosion in an oil demister downstream from the compressor. Two men five and ten feet from the point of major failure of the compressor received no bodily injuries. The majority of the cost was for the repair of damaged equipment.				
66-27-B	6-24	CH-Argonne National Laboratory	0	7,200
A trailer containing electronic equipment, being moved by an overhead crane, was dropped. Both the trailer and the equipment were damaged.				
66-29-B	6-2	RL-Isochem, Inc.	0	19,746
During the repair of an air circulation valve, approximately 10 gallons of high-level radioactive waste solution were spilled onto the floor. Three employees, wearing protective clothing, were sprayed with droplets of the solution, but were readily decontaminated. (See page 37).				
66-30-A	6-10	NV-Reynolds Electrical & Engineering Co.	1 fatality	0
An employee died on July 16 of a pulmonary embolism suffered as a complication of injuries (compound fracture of the right ankle, fracture of the right shoulder, scalp lacerations) received on June 10, when a bucket fell on him during the filling of sandbags. (See page 46).				
66-32-B	6-5	CH-Atomics International	0	50,000
Approximately 21 gallons of sodium leaked from a gas-fired sodium heater and burned. There were no significant exposures to the released sodium combustion products, and no significant fallout.				

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ -Type ²	Date	Field Office ³ -Contractor	Injuries ⁴ - Exposures	AEC Property Damage
66-33-B	Apr.- June	AL-Los Alamos Scientific Laboratory	1 exposed	0
	An employee received an estimated quarterly external whole-body radiation exposure of 3.4 rem while dissolving samples from a test shot. (See page 38).			
66-34-B	4-15	AL-Los Alamos Scientific Laboratory	1 exposed	0
	An employee received an estimated whole-body tritium exposure of 3.1 rem while loosening flange bolts on a container in a vacuum hood. (See page 35).			
66-36-A	9-22	AL-Timmons, Butt & Head, Inc. (Ray E. Johnson Co., subcontractor)	1 fatality	0
	A crane moving a steel stanchion contacted an 11,000-volt powerline. The employee guiding the stanchion into place died a few hours later as the result of the electric shock he received. (See page 48).			
66-37-B	9-23	RL-Isochem, Inc.	0	\$13,443
	Less than 5 grams of concentrated plutonium nitrate solution spilled on the elevator floor when a product receiver assembly overturned and the lid of the inner container came off. Cost was for decontamination. (See page 39).			
66-38-A	9-23/ 24	RL-Douglas United Nuclear	0	15,904
	Approximately 100,000 lbs. of sodium dichromate were discharged to a river via a process sewer due to an improperly installed float mechanism, which was designed to stop the flow when the storage tank was full.			
66-39-A	10-12	AL-J. R. Brennand Construction Co. (Triple A Electric Co., subcontractor)	1 fatality	0
	An electrician was electrocuted while working alone on a transformer. (See page 49).			
66-40-B	7-9	NV-Reynolds Electrical & Engineering Co., Inc.	0	8,410
	Rainwater leaking into the control panel of a generator caused a short circuit. Wiring insulation ignited, damaging switchgear and the control panel.			
66-41-A	6-6/19	CH-University of Minnesota	1 exposed	0
	A suspect film badge reading of 50 rem was charged to an employee's record. (See page 37).			
66-42-B	7-21/ 10-18	CH-Argonne National Laboratory	1 exposed	0
	While engaged in the removal, repair, maintenance, and installation of target manipulators, an employee received an estimated external whole-body cumulative radiation exposure of 3.2 rem. (See page 39).			

TYPES A AND B ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES (cont)
USAEC Facilities, 1965-66

No. ¹ - Type ²	Date	Field Office ³ - Contractor	Injuries ⁴ - Exposures	AEC Property Damage
66-43-B	10-21	AL-Monsanto Research Corp.	0	\$ 19,100
An undetermined small quantity of plutonium 238 was released when a double-contained vessel, nearly full of drybox sieved material exploded, dispersing a quantity of the waste material into the laboratory (See page 40).				
66-44-B	10-12	OR-Goodyear Atomic Corp. (Operational Incident)	0	51,745
A lubricating oil failure occurred in a cell during normal operations. A valve was probably closed inadvertently. Repair of equipment damage, \$50,925; offstream losses, \$820.				
66-45-B	12-20	NV-Reynolds Electrical & Engineering Co., Inc. (Operational Incident)	0	50,000
Experimental activities created sufficient ground motion to knock a trailer, containing TV equipment and cables, off its mounts. The combustible shock mounts came to rest against the hot exhaust pipe of a gasoline-powered generator. The shock mounts and then the trailer caught fire.				
66-46-B	12-9	BH-Brookhaven National Laboratory	0	8,300
A rubber cooling water hose on an experimental magnet ruptured, causing water to spray on two main magnets. A short circuit occurred across the bus connections of one of the main magnets. Polyethylene sheeting, used to protect the main magnets from dust and water, was ignited. Most of the damage was charring due to electrical arcing.				
66-47-B	11-17	NV-Reynolds Electrical & Engineering Co., Inc.	0	6,500
A hydrocrane, mounted on a truck was involved in a rollover accident. The driver was unharmed. Truck damage \$3,500; crane damage \$3,000.				
66-48-A	10-26	AL-Sandia Corp. (Operational Incident)	0	189,800
A transport plane crashed and burned at Santa Maria, Brazil, with complete loss of cargo, consisting of the last shipment of material to support the rocket eclipse program. The crew escaped unharmed.				

¹ Division of Operational Safety, USAEC Headquarters, File Number.

² "Type A" and "Type B" accidents as defined in AEC Chapter 0502, "Reporting and Investigating Accidents and Radiation Exposures."

"TYPE A"

1. Radiation

a. Exposure of the whole body of an individual to 25 rem or more of radiation; exposure of the skin of the whole body of an individual to 150 rem or more of radiation; exposure of the feet, ankles, hands, or forearms of an individual to 375 rem or more of radiation.

b. Any unplanned release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5000 times the limits specified for such materials in AEC appendix 0524, annex 1.

c. Any release of radioactive material offsite where it is believed any member of the general population may have received an exposure greater than that set forth in AEC appendix 0524, II.2.

d. Any accident in which an atomic or nuclear weapon (under the jurisdiction of AEC) is involved and where damage is inflicted to persons or private property.

e. Any notice that an individual has received an estimated 25 rems or more of external whole-body radiation during a calendar year.

f. Any injury or industrial illness following cumulative or massive exposure to internal or external ionizing radiation which might reasonably be expected to have caused the illness or injury and when so diagnosed by a physician competent in nuclear medicine.

g. Allegations that persons previously employed by AEC or its contractors are disabled from injuries or diseases incurred as a result of radiation or exposure to toxic materials which are peculiar in kind or degree to atomic energy operations.

"TYPE A" (cont)

2. Injury or Death.

- a. Any fatal or imminently fatal injury or illness of industrial origin associated with an AEC activity of an AEC or contractor employee or a member of the public in an accident or fire.
- b. Any other injury or industrial illness of five or more persons in an AEC operation.
- c. Allegations that persons previously employed by AEC or its contractors died from or were injured as a result of their duties in atomic energy operations.

3. Loss.

- a. Estimated loss or damage to Government property amounting to \$100,000 or more or estimated costs of \$100,000 required for cleaning, renovating, replacing, or rehabilitating structures, equipment, or property.
- b. Any apparent loss or theft of radioactive material in such quantities and under such circumstances that it is believed there may result a substantial hazard to the health and safety of individuals.

4. Public Interest

- a. Any accident or radiation exposure of any kind which gives rise to an inquiry by members of the public or press, providing that after initial analysis by a field office, it is considered of sufficient importance to notify Headquarters.
- b. Any accident or radiation exposure of any kind which the field office manager believes to have public information significance or where a press release has been made either by the field office or AEC contractor.
- c. Any incident where radiological assistance has been requested as defined in AEC chapter 0526.

"TYPE B"

1. Radiation Exposures

- a. Any radiation exposure which in one calendar quarter exceeds the following:
 - (1) 3 rem to the external whole body.
 - (2) 10 rem to skin of whole body or thyroid.
 - (3) 25 rem to the hands, forearms, feet, or ankles.
 - b. Any radiation exposure which causes an individual's cumulative dose to exceed (N-18)⁵ rem whole-body penetrating radiation.
 - c. Any internal body deposition of radioactive material where, on the basis of a small number of early biological assay results, the estimated exposure averaged over a period of one year will exceed the standards set forth in AEC chapter 0524.
2. Accidents
- a. Loss or damage to Government property of \$5,000 to 99,999 where costs are incurred for cleaning, renovating, replacing, repairing, or rehabilitating structures, equipment or property.
 - b. Any vehicle transporting radioactive material that is:
 - (1) involved in an offsite accident.
 - (2) found to be contaminated (beta-gamma radiation on the interior surface of the vehicle exceeding 10 millirem in 24 hours, or alpha contamination greater than 500 disintegrations per 100 square centimeters per minute) on arrival at an AEC facility.
 - c. Any shipment of radioactive material that arrives at an AEC facility damaged to the extent that there is substantial reduction in effectiveness of the package.

² N equals the age in years at last birthday.

³ Abbreviations used for USAEC Field Offices are:

- AL - Albuquerque Operations Office
- BH - Brookhaven Office
- CH - Chicago Operations Office
- GJ - Grand Junction Office
- ID - Idaho Operations Office
- NV - Nevada Operations Office
- NY - New York Operations Office
- OR - Oak Ridge Operations Office
- RL - Richland Operations Office
- SAN - San Francisco Operations Office
- SR - Savannah River Operations Office
- SNPO-N-Space Nuclear Propulsion Office-Nevada

⁴ Lost-time injury as defined in United States American Standards Institute (USASI) Z16.1

⁵ Radioactive gas releases resulted in material losses only (\$ figure classified).

RADIATION EXPOSURE OF AEC AND AEC CONTRACTOR PERSONNEL

A survey of AEC and AEC contractor employees showed that, of the more than 135,000 employees monitored in 1965 and the more than 137,000 employees monitored in 1966, 99.9 percent received less than 5 rem within the year and that 95.1 percent received only one rem or less. The following table gives details for the two years.

EXPOSURE OF AEC AND AEC CONTRACTOR PERSONNEL TO WHOLE-BODY PENETRATING RADIATION, SUMMARIZED FOR 1965-66

Range of annual total exposure in Rem*	1965 No. of employees	1966 No. of employees
0-1	128,360	130,552
1-2	4,158	4,649
2-3	1,704	1,659
3-4	515	597
4-5	294	313
5-6	70	88
6-7	32	47
7-8	26	24
8-9	25	6
9-10	22	2
10-11	6	0
11-12	2	0
12-plus	0	**1
TOTAL	135,214	137,938

*A rem is the quantity of any type of radiation which produces the same biological effect as one roentgen of X-ray radiation.

**66-41-A (See page 37).

ACCIDENTS AND INCIDENTS IN AEC FACILITIES INVOLVING RADIOACTIVE MATERIAL 1965-1966

Two Radiation Exposures

Canoga Park, Calif., Jan. 14, 1965--Ref: 65-9-B

Nature of Incident

Two employees received external whole-body radiation exposures.

Description of Operation

Removing irradiated samples from a reactor storage cell.

Details of Incident

While two employees were moving an irradiated beryllium temperature probe with a high-bar crane, they received exposures to radiation, resulting from inaccurate estimates of the radiation fields to be encountered in the operation, and inadequate monitoring during the actual operation.

Nature of Exposure or Loss

The two employees received estimated external whole-body radiation exposures of 4 rem each.

Radioactive Gas Release

Livermore, Calif., Jan. 20, 1965--Ref: 65-3-A

Nature of Incident

The accidental release of radioactive gas to the atmosphere through a stack.

Description of Operation

Leak-testing a gas-filled storage vessel.

Details of Incident

An accidental release of radioactive gas resulted when an employee, intending to tighten a storage vessel fitting, loosened it instead. The release occurred in a ventilated hood and was automatically discharged into the atmosphere through a high stack.

Nature of Exposure or Loss

The radioactive gas was diluted rapidly in the atmosphere; therefore, no health hazard was created either onsite or offsite.

Truck Transporting Radioactive Material Overturned

Weldon Spring, Mo., Feb. 20, 1965--Ref: 65-8-A

Nature of Incident

A truck transporting radioactive material overturned.

Description of Operation

Trucks transporting rare earth and thorium residues low in radioactivity.

Details of Incident

One of the trucks loaded with 100 drums of residues overturned.

Nature of Exposure or Loss

The driver received minor injuries only. Although the material was low in radioactive values, the accident site required some decontamination. There were no exposures or spread of contamination beyond the immediate site.

Two Thyroid Exposures

Mercury, Nev., Feb. 20, 1965--Ref: 65-10-B

Nature of Incident

Thyroid exposures.

Description of Operation

Post-shot drilling.

Details of Incident

Several employees were participating in a post-shot drilling operation, unaware that gaseous radioiodine was escaping from an "abandonment" valve opened in error.

Nature of Exposure or Loss

Two employees received estimated thyroid exposures of 31 and 27 rad, respectively. Four other employees received thyroid exposures well under reporting requirements.

Lung Exposure

Golden, Colo., Mar. 19, 1965--Ref: 65-62-B

Nature of Incident

A glovebox failure resulted in lung exposure to plutonium.

Description of Operation

Processing plutonium.

Details of Incident

When an employee withdrew his hand and arm from the glovebox glove he had been using, he observed a tear or rip (cause undetermined) at the shoulder, near the gloveport.

Nature of Exposure or Loss

The employee received a lung deposition of 0.051 μ c of plutonium, with an estimated lung dose for the first year of 36 rem.

Cumulative Radiation Exposure to Hands

Oak Ridge, Tenn., Mar. 5/25, 1965--Ref: 65-12-B

Nature of Incident

An employee received a cumulative radiation exposure to each hand.

Description of Operation

The fabrication of ceramic spheres.

Details of Incident

The exposure occurred during the fabrication of strontium 89 impregnated graphite-uranium oxide spheres of ~ 1 mm diameter involving 179 mc of strontium. Operations of this type had been performed previously with minimal hand exposures (< 600 mr). Exposures were controlled by shielding and distance. Analysis of the incident indicates the major factors contributing to the exposure were: (1) the exposure potential of the material was underestimated on the basis of previous experience, and (2) operating difficulties led to minor changes in procedures and shielding requirements which, collectively, were inadequate for the necessary exposure control.

Nature of Exposure or Loss

The employee received an estimated cumulative radiation exposure of 50 rem to each hand.

Radiation Exposures During Plane Monitoring

Mercury, Nev., Apr. 14, 1965--Ref: 65-13-B

Nature of Incident

Nine plane occupants received external whole-body radiation exposures (six AEC contractor employees; three USAF personnel).

Description of Operation

Cloud monitoring during a Plowshare nuclear crating event.

Details of Incident

An airplane was on a cloud-sampling mission, during which equipment was to be dropped from it by parachute at a distance of 500 feet above the visible cloud. However, before the mission was completed, the cloud rose to a greater height than had been anticipated. The pilot elected to fly the plane through an apparent opening in the cloud.

Nature of Exposure or Loss

The contractor employees received estimated external whole-body radiation exposures of 5.2, 4.7, 4.3, 4.2, 4.1 and 4.1 rem, respectively; the USAF personnel 5.3, 4.7 and 4.4 rem, respectively.

Two Skin Exposures From X-Ray Unit

Oak Ridge, Tenn., Apr. 28, 1965--Ref: 65-14-A

Nature of Incident

Two employees were exposed accidentally to X-rays.

Description of Operation

Attempting to radiograph a small metal object.

Details of Incident

During the course of a series of exposures, an X-ray unit started continuous operation because of an internal short so located that all interlocks and controls were bypassed. Two employees performed several operations in the direct beam, unaware that the machine was operating.

Nature of Exposure or Loss

One employee received an estimated radiation exposure of 19 rem to the skin of the back of the head, shoulders, arms, and hands and 3500 rem to the inside end of the right thumb (a second-degree burn developed but healed); the second employee received an estimated radiation exposure of 11 rem to the skin of the back of the head, shoulders, arms, and hands.

Cumulative Radiation Exposure

Miamisburg, Ohio, Mar. 29/Apr. 30, 1965--Ref: 65-17-B

Nature of Incident

An employee received an external whole-body cumulative radiation exposure.

Description of Operation

Reactivating a process line used for converting plutonium nitrate into plutonium metal.

Details of Incident

Reactivation of the line included repairing and replacing part of the equipment in two hoods, which necessitated the removal of trash highly contaminated with alpha activity.

Nature of Exposure or Loss

While engaged in this work, an employee received an estimated whole-body cumulative external radiation exposure of 3.9 rem, consisting principally of exposure to gamma rays and neutrons.

Contamination Incident

Golden, Colo., May 6, 1965--Ref: 65-26-B

Nature of Incident

Contamination of a room and equipment.

Description of Operation

Attempting to activate a recently-installed product transfer line.

Details of Incident

As employees were attempting to activate the product transfer line, contaminated acid solution sprayed out of a flanged union that had not been tightened.

Nature of Exposure or Loss

Three employees were contaminated; however, none suffered chemical burns. They were successfully decontaminated.

The room and its equipment were contaminated. The cost of replacing some of the contaminated equipment and the decontamination costs amounted to \$7,557.

Cumulative Radiation Exposure

Miamisburg, Ohio, Mar. 29/May 9, 1965--Ref: 65-18-B

Nature of Incident

An employee received an external whole-body cumulative radiation exposure.

Description of Operation

Processing radioactive material in a laboratory.

Details of Incident

An employee was performing duties in the processing of radioactive material, including working with the process lines and the hoods involved.

Nature of Exposure or Loss

While engaged in this work, the employee received an estimated external whole-body cumulative radiation exposure of 4.6 rem, consisting principally of exposure to gamma rays and neutrons.

Finger Exposure From Van De Graaff

Oak Ridge, Tenn., May 22, 1965--Ref: 65-19-B

Nature of Incident

A physicist received a radiation exposure to the left forefinger while using a Van de Graaff machine.

Description of Operation

Conducting an experiment.

Details of Incident

An experiment was being conducted by a physicist involving the use of a Van de Graaff machine. While he was in the target room, the beam shutter failed, permitting the proton beam to impinge on a tritium gas target "cell" in the shielded target room. This resulted in about 6×10^9 neutrons/second. He worked in the vicinity of the neutron source for approximately fifteen minutes and held his finger adjacent to the tritium target for approximately ten seconds.

Nature of Exposure or Loss

The physicist received a radiation exposure to the left forefinger estimated at 51 rem.

Cumulative Lung Exposure

Oak Ridge, Tenn., May 1965--Ref: 65-34-B

Nature of Incident

An employee received a cumulative lung exposure.

Description of Operation

Fluorination of uranium oxides to uranium hexafluoride.

Details of Incident

The primary assignment of the employee involved the fluorination of uranium oxides to uranium hexafluoride, which included such activities as charging feed powder, rodding the reactor tower when plugged, and changing ash receivers.

Nature of Exposure or Loss

While performing his normal duties, the employee received a cumulative lung burden of 0.035 μ c, from which is expected an accrued 12-month exposure of 19.5 rem.

Construction Worker Exposed to Radiation

Mayaguez, P. R., May 1965--Ref: 65-63-B

Nature of Incident

A carpenter received an external whole-body cumulative radiation exposure.

Description of Operation

Constructing a room adjoining a reactor.

Details of Incident

During the period of construction, a 15"-thick beam plug was inadvertently replaced by an 8" plug. A beam catcher, moved while removing the beam plug, was not returned to the correct position.

Nature of Exposure or Loss

A carpenter working on the construction of the room received an estimated external whole-body cumulative radiation exposure of 7.5 rem.

Fingers Exposed to X-Ray Machine

Livermore, Calif., July 7, 1965--Ref: 65-30-A

Nature of Incident

An employee received a radiation exposure to three fingers of the right hand.

Description of Operation

Using a low-energy X-ray machine.

Details of Accident

Assuming that the X-ray machine was turned down, an employee removed the shielding, reached into the machine and changed materials. It is estimated that this took from two to five seconds. As the employee reached down to turn up the current and voltage to the tube, he discovered that they were already on.

Nature of Exposure or Loss

The employee received a radiation exposure estimated at 1,000 rem to the index, middle and ring fingers of the right hand; second-degree burns developed and healed. This resulted in a lost-time injury of twelve days.

Cumulative Radiation Exposure

Miamisburg, Ohio, July 19/30, 1965--Ref: 65-33-B

Nature of Incident

An employee received an external whole-body cumulative radiation exposure.

Description of Operation

Recovery of radioactive material from trash.

Details of Incident

An employee's assignment was to develop a method of gamma-scanning radioactive trash contained in 55-gallon steel drums to determine the amount of gamma-emitting material contained in it. The use of radioactive sources was required and the employee hand-carried them from the storage place to the work area 15-20' distant.

Nature of Exposure or Loss

The employee received an estimated external whole-body cumulative exposure of 5.8 rem, consisting of exposure to gamma rays and neutrons.

Radiation Exposure

Jackass Flats, Nev., July 31, 1965--Ref: 65-31-B

Nature of Incident

An employee received an external whole-body radiation exposure.

Description of Operation

Using a vacuum pipe to collect fragmented fuel elements.

Details of Incident

During cleanup operations, an employee was using a vacuum pipe to collect fragmented fuel elements when the coupling located under his left shoulder became clogged. The employee attempted to unclog the vacuum pipe, unaware that fuel element fragments were caught in the coupling.

Nature of Exposure or Loss

After a careful study of the dosimeter reading and the film badge reading following this occurrence, the employee was assigned an estimated external whole-body radiation exposure of 3 rem.

Internal Radiation Exposure and Building Contamination

Richland, Wash., Aug. 23, 1965--Ref: 65-35-B

Nature of Incident

A glovebox explosion, followed by fire, spread contamination.

Description of Operation

Cleaning a glovebox by scraping off an accumulation of wax-like material from electrical leads to an offgas furnace.

Details of Incident

Two employees were cleaning a glovebox. When a small quantity of acetone proved successful in removing the wax-like material from electrical leads to an offgas furnace, an additional quantity (two partly-filled quart cans) was placed in the glovebox. The total amount used approximated one pint.

An explosion, followed by fire, occurred in the glovebox during the cleaning process. The low rate of airflow permitted acetone vapors to accumulate prior to ignition. The ignition source is not known definitely; however, static discharge from the gloves or the cleaning rags is considered as the most probable.

Nature of Exposure or Loss

Ten men in the room left immediately after the explosion. Prompt showering easily removed all skin contamination. One employee received an estimated 10% of a maximum permissible body burden (bone) of soluble plutonium 239.

The room was contaminated; however, there was no contamination detected outside the building. About 90% of the cost of \$76,800 incurred was for decontamination of facilities.

Airfreight Shipment of Methyl Iodide Leaked

En Route from Tuxedo, N.Y., to Idaho Falls, Idaho, Sept. 9-13, 1965--Ref: 65-38-A

Nature of Incident

A shipment of methyl iodide, containing approximately 10 curies of iodine 131, leaked.

Description of Operation

Methyl iodide, containing approximately 10 curies of iodine 131, being transported from Tuxedo, New York, to Idaho Falls, Idaho.

Details of Incident

When a shipment of methyl iodide, containing approximately 10 curies of iodine 131, arrived at its destination, it was examined briefly and no apparent indication of a leak in the containers was found. (The methyl iodide was enclosed in five glass ampules placed in two casks and shipped via air.) It was stored in a locked building over the weekend. On Monday, upon a more thorough examination of the shipment, it was found that the first ampule removed was nearly empty. It was immediately returned to the shipping container, which was closed and transferred to a hot cell.

Nature of Exposure or Loss

Iodine 131 depositions were found in the thyroids of sixty-four people known to have been in contact with the shipment. Four people received thyroid exposures exceeding the 1.5 rem per year value for individuals in uncontrolled areas; these were estimated at 7, 5, 3.3, and 1.9 rem, respectively. The fifth person received an estimated exposure of 18.3 rem to the thyroid, which exceeded the 10 rem per quarter value for individuals in controlled areas.

Plutonium Fire Spreads Contamination

Livermore, Calif., Sept. 13, 1965--Ref: 65-39-B

Nature of Incident

Contamination spread as the result of a plutonium fire.

Description of Operation

Preparing to place a plastic bag containing a metallic plutonium rod and some plutonium-plated pieces into a metal container.

Details of Incident

A metallic plutonium rod and some plutonium-plated pieces were inadvertently exposed to moisture while being handled in an enclosure having an argon atmosphere. During placement of these pieces in a double plastic bag and subsequent removal from the enclosure, some air may have been introduced. Storage of the material on the floor over the weekend violated hazard control procedures. It is thought that, during this period of storage, the metal reacted with the argon-air-moisture atmosphere to form plutonium hydride and hydrated plutonium oxides. After the weekend, it was observed that the metal had a "strange color" and an employee promptly left to obtain a metal can in which to place the bagged plutonium. Upon his return, the bottom of the plastic bag burst into flames (three to four inches high) when the bag was "touched."

Nature of Exposure or Loss

There were no injuries, no exposures, and employees contaminated were readily decontaminated; the fire damaged the plastic bag only; costs for cleaning up the contamination, which was confined to the room, were \$30,000.

X-Ray Exposure to Fingers

Richland, Wash., Sept. 15, 1965--Ref: 65-44-A

Nature of Incident

An employee incurred X-ray burns to the thumb and three fingers of the right hand.

Description of Operation

Counting samples in an X-ray emission spectrometer.

Details of Incident

An employee using an X-ray emission spectrometer, saw moisture on the sample drawer and dried it. When the moisture reappeared, it seemed to be originating from inside the sample chamber and the decision was made to dry it. Consequently, the employee wrapped a tissue around the index and middle fingers of the right hand, holding the tissue in place with his right thumb. He thus inserted the tissue into the sample chamber to dry the inside, unaware that the X-ray tube was "ON" and the shutter was stuck on "OPEN."

Nature of Exposure or Loss

The employee's injury was diagnosed as X-ray burns to the posterior distal right thumb, to the distal palmar surface of the index and middle fingers, and to the lateral side of the distal right ring finger. The radiation dose to the fingers was estimated to be 80,000 rem. Information received in August 1967 states that amputation of distal phalange of index finger was required. This resulted in a lost-time injury of 100 days. The employee subsequently terminated his employment with the contractor.

Loop Rupture

Richland, Wash., Sept. 29, 1965--Ref: 65-42-A

Nature of Incident

Failure of a process tube occurred, releasing fission products into the reactor core.

Description of Operation

A fuel element with an intentionally defected UO_2 4 wt% PuO_2 fuel rod was being irradiated in a fuel element rupture test facility.

Details of Incident

The reactor was automatically shut down due to a scram signal from safety instrumentation. Post-incident examination showed that the pressure tube had ruptured in the vicinity of the defect in the fuel rod. The defected fuel rod had ruptured in gross manner and had lost approximately 700 grams of fuel material to the loop and to the reactor system.

The calandria shroud tube surrounding the pressure tube was found to be intact after the incident. It is postulated that the steam-water mixture carrying fission product activity from the failed pressure tube entered the reactor dry gas system between the pressure tube and the concentric shroud tube. From here the activity spread to the containment vessel ventilation system via seals in the dry gas system. The major inflow of H_2O from the reactor to the calandria was through the shim rod and temperature probe seals on the calandria top tube sheet and through the interconnecting dry gas piping system.

Nature of Exposure or Loss

Fission product activity spread within the containment vessel activating the containment system and requiring evacuation of the containment vessel for about 12 hours. Personnel exposures were within the normal administrative limits and no appreciable radioactivity was released to the environment. The heavy water was degraded. The cost was \$895,000.

Glovebox Fire Spread Contamination

Golden, Colo., Oct. 15, 1965--Ref: 65-49-B

Nature of Incident

Fire in a glovebox caused contamination spread.

Description of Operation

Attempting to unclog a coolant recirculation line on a plutonium machining operation.

Details of Incident

While initial attempts to clear a coolant recirculation line (by flushing with carbon tetrachloride) proved unsuccessful, the decision was made to try to clear the line by rodding the pipes and connections located beneath the glovebox. The cap was removed and a welding rod used to

probe inside the drainpipe in an attempt to dislodge the obstruction. It was noted that this probing produced a few sparks. Subsequently, a center punch was inserted into the drainpipe in an attempt to remove the obstruction forcefully. The first light blow on the center punch caused a spark at the location of the obstruction. The second blow produced a large amount of sparking, accompanied by a football-sized ball of fire, attributed to ignition of vaporized hydrocarbon oil. The fire, which ignited the plutonium, burned about one minute, being brought under control by a portable extinguisher.

Nature of Exposure or Loss

Contamination, generated by the fire, spread throughout the building and through 25,000 square feet of an adjoining building. Contamination cleanup costs accounted for most of the \$17,000 loss. Air samples, taken inside the building 100' to the north, 190' to the northwest, 125' to the west, and 60' to the south of the fire, were highly contaminated.

Fifteen employees within the general area of the fire received inhalation exposures resulting in depositions of 0.008 to 0.17 microcurie of plutonium in the lung; three exceeded the 15-rem-per-year exposure limit for the lung with estimated exposures of 42, 32, and 29 rem, respectively.

Three Cumulative Radiation Exposures

Los Alamos, N. Mex., Oct. 12-21, 1965--Ref: 65-50-B

Nature of Incident

Three employees received external whole-body cumulative radiation exposures.

Description of Operation

Dismantling a reactor.

Details of Incident

Fuel pin handling rods and reflector pins were being removed (for metallurgical study) from a partially dismantled reactor. The fuel had been removed several months previously. The high-level gamma activity emitted by the pins and rods was due to neutron-induced activity.

Nature of Exposure or Loss

Three employees received estimated external whole-body cumulative radiation exposures of 4, 3.8 and 3.6 rem, respectively, over a nine-day period.

Contamination Spread by Glovebox Fire

Golden, Colo., Nov. 9, 1965--Ref: 65-55-B

Nature of Incident

An explosion and fire resulting in plutonium contamination spread.

Description of Operation

Removing "strippable" paint from a glovebox.

Details of Incident

An explosion and fire occurred when acetone fumes from a "cocoon" paint remover used in a glovebox paint-stripping operation, contacted a hot muffle furnace in another part of the glovebox line. The fire apparently flashed back to containers of "cocoon" which were in an open airlock.

Plutonium contamination was released into the room through the open airlock and through a blown-out plastic bag at the opposite end of the glovebox line. The contamination spread to adjacent rooms and to the second floor of the building through open ducts and cracks in the walls.

Nature of Exposure or Loss

All of the employees at the scene of the accident were wearing respirators. While the skin of twelve employees was contaminated, decontamination was readily obtained in all but one case, where treatment over several days was required; none received significant internal radiation exposures.

There was no significant property damage; however, material and labor costs for the extensive facility decontamination necessary totaled \$23,253.

Cooling Water System Contaminated

Aiken, S. C., Nov. 23, 1965--Ref: 65-64-B

Nature of Incident

A cooling water system was contaminated.

Description of Operation

Preparing to return to service a cooling coil which had been disconnected more than a year.

Details of Incident

A tank cooling coil had been out of service for about fifteen months. A new connecting pipe was installed preparatory to putting the coil into service; however, the coil had deteriorated during its inactive period. Although the automatic valve on the inlet line was not opened, cooling water leaked through it when the manual block valve was opened. As the cooling water flowed through the coil, it flushed the activity to the circulating cooling system.

Nature of Exposure or Loss

The cost of the work associated with preventing the radioactivity from reaching unrestricted areas and cleaning of the cooling water system amounted to \$19,500.

Quarterly Radiation Exposure

Berkeley, Calif., Oct.-Dec. 1965--Ref: 65-59-B

Nature of Incident

An employee received an external whole-body quarterly radiation exposure.

Description of Operation

Modification of water cooling for the post-stripper tank and adjustments of focusing magnets in an ion linear accelerator in preparation for startup.

Details of Incident

Although the employee was forewarned that his exposure was approaching the quarterly limit, he continued the above startup preparations, knowing that he might exceed the quarterly limit.

Nature of Exposure or Loss

The employee received an estimated external whole-body quarterly exposure of 3 rem.

Two Quarterly Radiation Exposures

Los Alamos, N. Mex., Oct.-Dec. 1965--Ref: 65-56-B

Nature of Incident

Two employees received external whole-body quarterly radiation exposures.

Description of Operation

Machining reactor irradiated reflector pins.

Details of Incident

Two employees were engaged in machining reactor irradiated reflector pins. The machining operation was performed on a small lathe positioned near a large fume hood, requiring frequent and close inspection of the parts being machined.

Nature of Exposure or Loss

The two employees received estimated external whole-body quarterly radiation exposures of 3.8 and 3.2 rem, respectively.

Eight Uranium Lung Depositions

Piketon, Ohio, 1965--Ref: 65-43-B

Nature of Incident

Eight employees received uranium lung depositions.

Description of Operation

The conversion of uranium oxide to uranium hexafluoride.

Details of Incident

During the latter part of 1964, the contractor started processing higher enrichments and larger quantities of uranium than heretofore. This oxide conversion facility was inadequate for all levels of enrichment, i.e., it was a source of radioactive contamination at the low enrichment level and more so at the higher enrichments, since the specific activity of U-235 is greater than that of U-238. These operations were continued primarily to develop information for a new facility expected to be in operation within a period of six to eight months thereafter. The new facility was to be designed for the safe handling of highly enriched uranium.

Nature of Exposure or Loss

Eight employees received uranium lung depositions from which are expected accrued 12-month exposures of 36, 29, 25, 22, 22, 20, 19, and 16 rem, respectively.

Uranium Lost to Radioactive Waste

Richland, Wash., Jan. 5, 1966--Ref: 66-1-B

Nature of Incident

The loss of uranium in solution to radioactive waste through a milling tank overflow.

Description of Operation

Chemical processing.

Details of Incident

A 1¼-inch supply valve in the nitric acid supply line of a chemical milling tank in need of repair was replaced with a new valve purchased in 1963. The morning after the new valve was installed, the milling tank was returned to normal operation. In the afternoon, the operator noticed that the level in the tank was higher than normal and proceeded to check the water, nitric acid, and sulfuric acid supply valves. When he checked the nitric acid supply valve, he was able to turn the valve wheel approximately two turns in the "close" direction. When his supervisor rechecked the valve, he was able to turn the valve wheel approximately one turn in the "close" direction. Investigation revealed that the tank was overflowing; therefore, the discharge valve from the nitric acid storage tank was closed. Further investigation revealed that the new nitric acid supply valve was not nitric acid resistant. Nitric acid had eaten away the valve seat and the

valve stem where it was recessed in the valve gate, and nitric acid had been leaking into the chemical milling tank, diluting the uranium solution and creating an overflow condition. The overflow line carried the solution to a neutralizing pit; effluent from the pit drained the solution to a retention pond.

Nature of Exposure or Loss

An estimated 420 pounds of uranium in solution were lost to radioactive waste. The cost consisted of \$6,800 for uranium, \$300 for acid, and \$100 for labor, totaling \$7,200.

Radiation Exposure to Fingers From Irradiated Fuel Sample

Canoga Park, Calif., Feb. 2, 1966--Ref: 66-6-B

Nature of Incident

An employee received a radiation exposure to the fingers of the left hand.

Description of Operation

Routine operations in a transfer tunnel between a metallograph room and a cell.

Details of Incident

A transfer tunnel and associated equipment were used routinely to transport irradiated fuel samples, as well as items such as fixtures, tools, etc., between the metallograph room and a cell. An aluminum pan holding a fixture was placed in the transfer mechanism. When the pan jammed against the edge of the tunnel, it was necessary to stop the transfer mechanism. One operator, looking down the transfer tunnel through a lead glass window, could see an object lying under the pan. The second operator pushed the pan aside, recognized the object as an irradiated fuel sample, picked it up and placed it in the sample holder. He held the sample in his hand for approximately one second.

Nature of Exposure or Loss

Since the sample was embedded in a resin capsule exposing only the upper surface, and since this surface was directed toward the palm of the hand during the one-second exposure, the maximum radiation exposure, estimated at 58 rem, occurred to the skin of the middle phalanx of the fingers of the left hand.

Release of Uranium Hexafluoride

Fernald, Ohio, Feb. 14, 1966--Ref: 66-7-A

Nature of Incident

Uranium hexafluoride released.

Description of Operation

Routine startup operations at a pilot plant of a feed materials production center.

Details of Incident

An employee, attempting to open the valve of a UF_6 cylinder, actually unscrewed the valve from the cylinder. He was manipulating the valve wrench through a door in the steam vaporizer hood with a rubber grommet encasing the shaft of the wrench; therefore, he could not see the valve.

Nature of Exposure or Loss

Nine employees were sent to the dispensary as a result of exposure to uranium hexafluoride gas. All received oxygen inhalations prophylactically. Eight were retained in the dispensary and rechecked throughout the day and again on the following morning. The ninth employee developed rales in his chest within one-half hour after being brought to the dispensary, and it was felt that he was developing pulmonary edema. He was taken to the hospital where he was treated with positive-pressure oxygen until the next day. He was released from the hospital on February 20 and returned to work on February 23.

Equipment damage was negligible; feed product loss estimated at 3,844 pounds was experienced; production was suspended for two weeks. The material loss amounted to \$273,826; decontamination and cleanup costs were \$21,000; total \$294,826.

Radiation Exposure During Plutonium Processing

Los Alamos, N. Mex., 1-24/2-24, 1966--Ref: 66-13-B

Nature of Incident

A questionable external whole-body radiation exposure.

Description of Operation

Regular duties in plutonium processing.

Details of Incident

When film badges for the period of January 24 through February 24 were processed, one indicated that an employee had received a reportable radiation exposure. No explanation for this exposure was found. The type of operation carried out in the area where the employee worked had not been changed in three months.

Nature of Exposure or Loss

The employee's film badge indicated an external whole-body cumulative radiation exposure of 5.1 rem. Although there was some doubt as to whether this was a true exposure, it was charged to the employee's record.

Hand Radiation Exposure

Aiken, S. C., Mar. 15, 1966--Ref: 66-10-B

Nature of Incident

An employee received a radiation exposure to the right hand.

Description of Operation

Routine analytical work.

Details of Incident

Two technicians were performing routine determinations of acidity and gross alpha activity on a sample of highly radioactive solution. The step in the procedure that involves potential radiation exposure consists of using a beta-shielded pipet control to transfer samples from a shielded container to dilution vessels. Apparently, the inside of one pipet control had become contaminated when some of the sample was inadvertently drawn past the upper tip of the pipet. Unaware of this, the technicians continued to use the pipet control until they completed the dilutions.

Nature of Exposure or Loss

One technician received an estimated radiation exposure of 29.5 rem to the right hand; the other received 21.9 rem (an amount less than the 25 rem quarterly limit).

Two Neutron Exposures

Berkeley, Calif., Jan.-Mar. 1966--Ref: 66-11-B

Nature of Incident

Two employees received external quarterly whole-body neutron exposures.

Description of Operation

Working in a bubble chamber control facility.

Details of Incident

Two members of a bubble chamber crew were exposed as they worked in a bubble chamber control facility. Exposures to these individuals were higher than had been anticipated on the basis of routine radiation measurements.

Nature of Exposure or Loss

The two men received external quarterly whole-body neutron exposures estimated at 4.6 and 3 rem, respectively.

Foot Radiation Exposure

Stanford, Calif., Jan.-Mar. 1966--Ref: 66-16-B

Nature of Incident

An employee received a radiation exposure to the left foot.

Description of Operation

Tuning an RF circulator.

Details of Incident

An employee was tuning an RF circulator. The circulator was operating at about 12 megawatts and it is conceivable that an RF beam in such a cavity could have an energy of up to 2 MeV.

Nature of Exposure or Loss

The employee received an estimated quarterly exposure to the left foot (which was near the accelerator section of the resonant ring) of 300 rem of soft X-rays of less than 35 Kv. There was no erythema.

Tritium Exposure

Los Alamos, N. Mex., Apr. 15, 1966--Ref: 66-34-B

Nature of Incident

An employee received a tritium exposure.

Description of Operation

Loosening flange bolts on a container in a vacuum hood.

Details of Incident

While an employee was loosening flange bolts on a container in a vacuum hood, tritium sniffers alarmed, indicating release of the gas. He and a second employee immediately left the laboratory.

Nature of Exposure or Loss

An employee received an estimated whole-body tritium exposure of 3.1 rem, believed to be the result of inhalation and skin absorption of tritium oxide.

Thigh Exposure From Cobalt 60

Las Vegas, Nev., Apr. 21-22, 1966--Ref: 66-19-B

Nature of Incident

An employee received a radiation dose to the skin of the left thigh.

Description of Operation

Four cobalt 60 radiation calibration sources were to be used in the installation of radiation detection instrumentation.

Details of Incident

Four cobalt 60 radiation calibration sources in a plastic packet were removed from the lead box in which they had been transported and handed to an employee for use in the installation of radiation detection instrumentation. The employee placed the sources in his left front trousers pocket pending carrying out his instructions for their use. The work schedule precluded his performing the duties involved that day; therefore, he inadvertently left the packet in his pocket. He discovered this later but decided to leave the sources where they were so that he would be sure to return them to work the next day. He wore the trousers with the sources in the pocket for approximately 12 hours.

Nature of Exposure or Loss

The employee received an estimated radiation dose to the skin of the left thigh of 70 rem.

Tritium Release

Aiken, S. C., May 20, 1966--Ref: 66-23-B

Nature of Incident

An accidental release of tritium gas to the atmosphere through a stack.

Description of Operation

Loading operations.

Details of Incident

The contents of a container were released into a gloveport hood when the closure weld failed. The weld was a non-standard one, caused by an operating error. The weld did not leak immediately, but approximately ten hours later, when the container was being removed from the loading-welding station, a gross leak developed.

Nature of Exposure or Loss

Tritium gas was released to the atmosphere via a gloveport hood through a stack. There were no tritium exposures to personnel and no area contamination.

Contamination Spread From Radioactive Waste Solution

Richland, Wash., June 2, 1966--Ref: 66-29-B

Nature of Incident

High-level radioactive waste solution was spilled onto the floor.

Description of Operation

Maintenance work on an underground waste tank storage facility.

Details of Incident

Maintenance workers were carrying out their assignment of installing a pressure gage on the air feed control system for an air circulator in an underground radioactive waste storage tank, when they decided to replace a previously contaminated section of pipe and a closed valve. Removal of the contaminated pipe required that the valve bonnet be removed because the valve stem interfered with the adjacent piping. Upon removal of the valve bonnet, highly radioactive waste solution flowed from the valve body onto the floor.

Nature of Injury or Loss

Three employees, wearing protective clothing, were sprayed with droplets of the radioactive liquid but were readily decontaminated. Total damage and facility decontamination costs were \$19,746.

Cumulative Radiation Exposure

Minneapolis, Minn., June 6-19, 1966--Ref: 66-41-A

Nature of Incident

A questionable external whole-body cumulative radiation exposure.

Description of Operation

Routine duties at a linear accelerator.

Details of Incident

An employee's film badge indicated an external whole-body cumulative exposure had occurred over a period of approximately 14 days while he was engaged in his routine duties at a linear accelerator.

Nature of Exposure or Loss

Although neither proved nor disproved, since the employee's film badge showed an estimated external whole-body cumulative radiation exposure of 50 rem, it was charged to his record.

Hand Radiation Exposure

Las Vegas, Nev., Apr.-June 1966--Ref: 66-22-B

Nature of Incident

An employee received a radiation exposure to the left hand.

Description of Operation

Participating in the "high-grading," or recovery, of selected radioactive samples from drill cores at post-shot drilling sites.

Details of Incident

The "high-grading" procedure for upgrading radioactive core samples consists of "hand-picking" hot particles from a gross sample core recovered from a post-shot drill hole. An employee performed this operation from behind a lead whole-body shield and a lead glass viewing window. Plastic gloves (not lead gloves) were worn because of the need for manual dexterity.

Nature of Exposure or Loss

An employee received an estimated quarterly radiation exposure of 26.5 rem to the left hand. No physical effects associated with, or resulting from, the exposure have been noted or reported.

Quarterly Radiation Exposure

Los Alamos, N. Mex., Apr.-June 1966--Ref: 66-33-B

Nature of Incident

An employee received an external whole-body quarterly radiation exposure.

Description of Operation

Dissolving samples from a test shot.

Details of Incident

An employee dissolved samples from a test shot for about two weeks during the second quarter.

Nature of Exposure or Loss

The employee received an estimated external whole-body quarterly radiation exposure of 3.4 rem during the second quarter, the bulk of it during the two weeks he spent dissolving samples from a test shot.

Plutonium Nitrate Solution Spill

Richland, Wash., Sept. 23, 1966--Ref: 66-37-B

Nature of Incident

Spilling of plutonium nitrate solution on the floor of an elevator.

Description of Operation

Routine movement of a product receiver assembly.

Details of Incident

A product receiver assembly was overturned in an elevator during routine movement. The lid on the inner container came off, and a small amount of concentrated plutonium nitrate solution was spilled.

Nature of Exposure or Loss

The floor of the elevator cage was contaminated. Decontamination costs amounted to \$13,443.

Cumulative Radiation Exposure

Argonne, Ill., July 21-Oct. 18, 1966--Ref: 66-42-B

Nature of Incident

An employee received an external whole-body cumulative radiation exposure.

Description of Operation

Removal, repair, maintenance, and installation of target manipulators.

Details of Incident

An employee received a radiation exposure while engaged in his duties in the removal, repair, maintenance, and installation of target manipulators, the majority of the exposure being received between September 29 and October 12 and between October 13 and October 18.

Nature of Exposure or Loss

The employee received an estimated external whole-body cumulative radiation exposure of 3.2 rem.

Plutonium 238 Release

Miamisburg, Ohio, Oct. 21, 1966--Ref: 66-43-B

Nature of Incident

Plutonium 238 was released in a laboratory.

Description of Operation

Separating coarse and fine drybox waste material.

Details of Incident

A small quantity of plutonium 238 was released when a double-contained vessel, nearly full of drybox-sieved material intended for recovery of the isotope, exploded and dispersed a quantity of the material in a laboratory. It was suspected that some nitrated anion resin, which is unstable to heat, especially when dry, found its way into the waste material through normal drybox cleaning activities.

Nature of Exposure or Loss

No personnel radiation exposures resulted. Decontamination costs were \$19,100.

Radiation Exposure While Working Near Cyclotron

Berkeley, Calif., Jan. 11, 1965--Ref: 65-11-B

Nature of Incident

An employee received an external whole-body radiation exposure (according to his film badge).

Description of Operation

Preparing for an experiment in a cave area.

Details of Incident

The radiation exposure is presumed to have occurred during a beam-tuning period, while an employee was working in a cave adjacent to a cyclotron vault, because of a narrow crack in the shielding wall between the cave and the vault.

Nature of Exposure or Loss

The employee received an estimated external whole-body radiation exposure of 3.6 rem (according to his film badge). Although there was reasonable doubt that the film badge reading was sustained as a whole-body exposure, it was charged to the employee's record.

ACCIDENTS IN AEC FACILITIES INVOLVING FATALITIES 1965-1966

Electrocution

Las Vegas, Nev., Feb. 23, 1965--Ref: 65-7-A

Nature of Accident

Electrocution.

Description of Operation

Installation of electrical equipment.

Details of Accident

While working in a switchgear cabinet, a wireman foreman (for reasons unknown) placed one foot on the bottom portion of the switchgear housing, which is approximately four inches off the floor, reached into the upper (hot) portion of the panel, and contacted a connector with one hand.

Nature of Injuries or Loss

The wireman foreman died instantly as the result of the electrical shock he received.

Killed in Fall From Utility Pole

Oak Ridge, Tenn., June 14, 1965--Ref: 65-20-A

Nature of Accident

A fall from a utility pole onto the sidewalk.

Description of Operation

Transferring the electrical controls of a traffic light to a new utility pole.

Details of Accident

A lineman climbed a utility pole to complete the transfer of traffic light controls. He was working at a height of approximately 18' when he fell from the pole to the sidewalk. Investigation revealed that his body belt was unbuckled at the time of the fall.

Nature of Injuries or Loss

The lineman was killed by the fall, the cause of death being given as fracture of the skull.

Killed in Fall From Derrick Platform

Las Vegas, Nev., June 21, 1965--Ref: 65-22-A

Nature of Accident

A fall from a derrick platform onto a concrete pad.

Description of Operation

The installation of a derrick platform floor.

Details of Accident

Derrick flooring, consisting of 3"x12"x18' planks, was being placed on the heavy superstructure of the derrick by a winch truck. The man in charge of the operation was standing on one of the floor planks which had not been nailed in place. He instructed the truck driver to raise and remove the winch line. In so doing, the knot affixing the wire rope to the tail chain caught and displaced the loose plank upon which the man was standing.

Nature of Injuries or Loss

When the plank, upon which the man was standing, was displaced, he lost his balance and fell through the opening between the steel beams of the substructure onto the concrete pad 24' below. The cause of death was given as severe depressed skull fracture, frontal region; multiple fractures both arms; possible internal injuries.

Death From Burns Received in Explosion

Cambridge, Mass., July 5, 1965--Ref: 65-24-A

Nature of Accident

An explosion and fire in the experimental hall of an accelerator complex.¹

¹ See TID-22594, REPORT ON INVESTIGATION OF EXPLOSION AND FIRE, EXPERIMENTAL HALL, CAMBRIDGE ELECTRON ACCELERATOR, for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Price 60¢

Description of Operation

The 40" bubble chamber was in the final stages of a 10-day continuous program of cooling down and filling with liquid hydrogen for the first time, and was about 95% filled.

Details of Incident

A number of models of the accident were considered. In general, the body of evidence was best fitted by the following sequence of events:

1. The bubble chamber inner beryllium window failed in an outward direction, followed almost instantaneously by the failure of the outer beryllium window, as it was struck by fragments from the inner window and a jet of liquid hydrogen. The hydrogen ignited (there were several possible ignition sources present).
2. The initial explosion and flash fire caused an overpressure of about 1.5 psi, lifting the roof and exposing large sections of tar-coated vegetable fiberboard roof insulation, some of which ignited, as did other combustibles in the area.
3. The fire intensity caused the release of liquid petroleum gas from two 100-lb. cylinders supplying the emergency generator. This resulted in a second explosion and an intense gas fire, which accelerated the burning of the tar and fiberboard portions of the fragmented roof.
4. The large "Mylar" beam window on the propane Cerenkov counter, weakened by heat, partially ruptured and propane was ignited.
5. The intense heat caused the pressure to rise in six instrument grade propane tanks for the Cerenkov counter. The relief valves on these tanks lifted and propane gas was vented to the hall where it ignited and caused a fierce localized fire.
6. The final stages of the incident involved an intense roof fire, accompanied by combustion of flammable material on the floor below.

Nature of Injuries or Loss

At the time of the explosion there were 20 people present at the site. The eight injured persons were associated with groups from Harvard (five men) and from the Massachusetts Institute of Technology (three men). All of them were taken to nearby hospitals. Their injuries ranged from minor cuts and lacerations to a serious back injury and severe burns. Two of the three listed as critical, with severe burns, survived. The third (an MIT technician) died on July 20 as the result of third-degree burns, suffered over 60% of the body, and a ruptured liver.

The loss of \$1,453,000 included equipment damaged beyond repair, the repair of damaged equipment and the roof of the experimental hall, and incidental expenses.

Crushed to Death by Concrete Slab

Menlo Park, Calif., Dec. 23, 1965--Ref: 65-57-A

Nature of Accident

A concrete plank fell, seriously injuring one employee and crushing another to death.

Description of Operation

A crane was placing concrete planks on a roof.

Details of Accident

A precast steel reinforced concrete plank approximately 8"x5'x20', weighing almost 6 tons, had been raised by a 90-ton crane for placement on the roof of a building under construction. While suspended, the plank suddenly dropped, pinning two men, an ironworker and a carpenter, working on the roof, between it and a similar plank previously set in position. Apparently, the brake on the crane drum holding the plank slipped, permitting the plank to drop.

Nature of Injuries or Loss

The carpenter received permanent disabling injuries of the body, and the ironworker died instantly from fatal crushing injuries.

Falling Rock Causes Miner's Death

Las Vegas, Nev., Jan. 11, 1966--Ref: 66-4-A

Nature of Accident

A falling rock struck a miner on the top of the head.

Description of Operation

Drill holes for blasting had been completed at the bottom of a 426' deep shaft and were being loaded with explosives.

Details of Accident

Four miners were loading drill holes with explosives for blasting. During this operation, a rock fell, striking one of the miners (wearing a hard hat) on the top of the head, and he fell to the ground. During the investigation of the accident, it was concluded that a rock, which had become lodged on the base plate of the "jumbo" (a metal frame supporting four air-hammer drills, hoses and tools), was dislodged about 20' above the bottom of the shaft as the jumbo was raised.

Nature of Injuries or Loss

The miner was taken to the hospital, where he was listed as being in fair condition; however, he did not improve but died thirteen days later of respiratory failure due to transverse myelitis of the cervical cord caused by the injury.

Death From Third-Degree Burns

Las Vegas, Nev., Jan. 12, 1966--Ref: 66-3-A

Nature of Accident

Inadvertent ignition of gasoline and acetate tapes.

Description of Operation

Preparing acetate tapes for disposal in a burn pit.

Details of Accident

Boxes of acetate recording tapes were dumped into a burn pit by a dump truck in preparation for destruction by burning. One employee, while in the pit, splashed a five-gallon can of gasoline on top of the boxes, which immediately ignited.

Although it is not definitely known what caused the gasoline to ignite prematurely, the evidence strongly indicates that the gasoline vaporized, the vapors flowed down into the pit and reached hot materials remaining from the previous day's trash burn.

Nature of Injuries of Loss

The employee died of severe third-degree burns over 100% of the body surface.

Killed in Head-On Collision

Keokuk, Iowa, May 11, 1966--Ref: 66-17-A

Nature of Accident

The collision of a Government-owned car and a privately-owned car.

Description of Operation

A Government-owned car being driven on official business.

Details of Accident

A contractor employee was driving a Government-owned car on official business when his car and a privately-owned car collided. It has not been possible to determine the cause of the accident since there were no eyewitnesses.

Nature of Injuries or Loss

The contractor employee was killed instantaneously, it is believed, from crushing injuries to the chest and head. The driver of the privately-owned car was in the hospital in serious condition at the time of the investigation of the accident, and the single passenger in the privately-owned car was pronounced dead upon arrival at the hospital. Evidence at the scene of the accident indicates that the privately-owned vehicle crossed the center line.

Fall Into Water Storage Tank

Los Alamos, N. Mex., May 26, 1966--Ref: 66-20-A

Nature of Accident

A painter fell 35' through an opening on top of a 1,500,000-gallon water storage tank.

Description of Operation

Painters were engaged in spray painting the outside and top surface of a water storage tank.

Details of Accident

Painters were in the process of painting the top rolled edge of a water storage tank. One painter rode on a boatswain's chair attached to a rolling carriage positioned on the top edge of the tank. The carriage was held in place by a cable attached to the center knob at the top of the tank. A second painter, standing on top of the tank, pulled the carriage around the perimeter top by means of a scrap piece of electrical cable tied to the carriage.

An opening had been left in each half-tank top, by omitting a steel panel, to provide light and ventilation for a sandblasting operation in the interior of the tank. While walking backward pulling the carriage, the second painter stepped into one of the openings and fell approximately 35' onto the bottom of the tank.

Nature of Injuries

The victim did not regain consciousness, and is presumed to have died immediately, or soon thereafter, from injuries sustained, and was pronounced dead on arrival at the hospital.

Death From Falling Bucket

Las Vegas, Nev., June 10, 1966--Ref: 66-30-A

Nature of Accident

A bucket fell from the forks of a forklift truck.

Description of Operation

Filling sandbags from a bucket hung on the forks of a forklift truck.

Details of Accident

A crew of men were filling sandbags by means of a bucket previously used for pouring concrete. Short sections of channel iron (about 4" long) were welded on opposite sides of the upper rim of the bucket, an expanded metal screen was affixed to the top of the bucket, and an air-operated vibrator, normally used for concrete formwork, was welded to the screen and bucket frame. It was intended that the vibrator would be used only when the bucket was being filled with mine-run sand by a front-end loader, with the bucket resting on the ground. However, the crew involved in this particular assignment did not know this.

At the time of the accident, the vibrator was actuated, the bucket was filled with 1200 to 1400 pounds of sand, then elevated about 4' by the forklift.

Two of the crew stooped or bent over under the improvised equipment, both holding the top of each sandbag as it was filled. Three bags had been filled when the bucket fell from the forks of the forklift.

During the investigation following the accident, it was discovered that the locking pin for the left fork of the forklift was not engaged, although it had been observed to be in place earlier in the day. It was impossible to determine whether vibration had caused the bucket to rotate so that the lugs slipped off of the forks or had caused the forks to move apart. Either action would have caused the bucket to be released and fall. Its position indicated that rotation had occurred.

Nature of Injuries or Loss

Of the two employees holding the sandbag for filling, one was hit a glancing blow on the back. He rolled clear as he fell and was not injured. The other employee was knocked to the ground by the impact of the bucket. He received a compound fracture of the right ankle, a fracture of the right shoulder, and scalp lacerations. He was taken to the hospital, and on July 15 (shortly more than a month after the accident) seemed to be progressing satisfactorily, and was walking around with the aid of crutches. He died on July 16. A post mortem examination was performed and the cause of death given as "pulmonary embolism."

Death From Single-Car Accident

Near South Bend, Ind., June 17, 1966--Ref: 66-25-A

Nature of Accident

A Government-owned car got out of control of the driver.

Description of Operation

A Government-owned car being driven on official business.

Details of Accident

An AEC employee was driving a Government-owned car on official business, accompanied by another AEC employee. The driver passed another vehicle on the road, made a sharp turn to get back into the right lane, then turned to the left, apparently overcompensating, went onto the grass medial strip, traveled several hundred feet along the medial strip, re-entered the road and crossed it. The car turned over twice in the grass area on the side of the road, finally coming to rest on its wheels. No other vehicle or stationary object was involved.

Nature of Injuries or Loss

The passenger in the car was released after treatment for minor injuries, without being admitted to the hospital. The driver of the car died one week later of brain and chest injuries received in the accident.

Driver Killed When Loader Overturned

Berkeley, Calif., June 24, 1966--Ref: 66-24-A

Nature of Accident

A driver lost control of a dirt loader.

Description of Operation

Moving dirt.

Details of Accident

Dirt was being moved from the lower level of a road to the top of the road. Inadequate turn-around space necessitated the dirt loader being driven backward to reload after each load was deposited. The loader was operated in this manner until about 2:20 p.m., when, while driving backward, the driver lost control of the loader. It went off the edge of the road, apparently slid downhill slightly and then overturned, coming to rest against the track of the clamshell crane being used for digging.

It was the conclusion of the investigating committee that the accident was due to driver error.

Nature of Injuries or Loss

The loader operator was pinned between the overturned loader and the top of the right tread on the clamshell crane, receiving fatal crushing injuries.

Ironworker Dies as Result of Electric Shock

Miamisburg, Ohio, Sept 22, 1966--Ref: 66-36-A

Nature of Accident

A crane cable momentarily contacted a high-voltage line while an ironworker had his hand on a stanchion guiding it to the ground.

Description of Operation

Steel columns (pipe stanchions) were being moved during construction work by a hydraulic truck crane.

Details of Accident

An ironworker was stationed at the location where steel stanchions were being lowered to the ground by a hydraulic truck crane. His duties consisted of guiding the stanchions to the ground as they were lowered and then removing the cable from them. As he grasped one stanchion for the purpose of guiding it to its position on the ground, the accident happened.

Based on the investigation findings, it was concluded that the accident was caused when the crane cable momentarily contacted an overhead high-voltage line while the ironworker had his hand on the stanchion. Because of the location of the crane, the operator was unable to judge properly the proximity of the crane cable to the line. A contributing factor was that the ground was wet, which tended to produce a high current through the ironworker's body.

Nature of Injuries

The ironworker was given mouth-to-mouth resuscitation and external heart massage, which revived him. A resuscitator was also brought to the scene and put into use. Within a few minutes, an ambulance arrived and transported him to a hospital, where he died within approximately three hours.

Electrocuted While Working Alone

Los Alamos, N. Mex., Oct. 12, 1966--Ref: 66-39-A

Nature of Accident

Electrocution of an electrician while working alone at an electrical switch control cubicle.

Description of Operation

Installation of an electrical system.

Details of Accident

An electrician, who had been working with two other men, left them without indicating his destination or his job intentions. About ten minutes later, one of the two men, walking through a basement room, found the electrician motionless and slumped on his knees in front of an electrical switch control cubicle containing three exposed energized 480-volt bus bars.

The exact manner in which the accident occurred is not known, of course, since the electrician was alone at the time; however, it was concluded by the investigating committee that he must have contacted two of the bus bars at the same time, thereby completing an electric circuit from one hand through his body to the other hand.

Nature of Injuries

Although resuscitation efforts were made for 45 minutes, the electrician did not respond and was pronounced dead on arrival at the hospital. His death was attributed to cardiac arrest due to electric shock.

Killed by Falling "Finger"

Las Vegas, Nev., Jan. 28, 1965--Ref: 65-5-A

Nature of Accident

A "finger" of the fingerboard fell from a drill rig mast.

Description of Operation

Drilling a 600' hole.

Details of Accident

A component piece of a drill rig, technically known as the front "finger" (a 4' length of 4" pipe weighing 87 lbs.) of the finger-board, was provided to support stands of pipe while stacked in the derrick during certain phases of the drilling operation. The finger had been modified to incorporate a hinge arrangement which permitted it to be tipped out of place when not in use. Its base was tackwelded in place (it was to have been completely welded later). While other employees were using the drill rig, the finger came loose and dropped approximately 85', striking a rotary drill helper on the back of the head, neck, and shoulders.

Nature of Injuries or Loss

The rotary drill helper was killed instantly by the impact of the finger, the cause of death being given as depressed occipital skull fracture with a 4" laceration.