WASH 1192

OPERATIONAL ACCIDENTS and RADIATION EXPOSURE EXPERIENCE

Within the

UNITED STATES
ATOMIC ENERGY
COMMISSION

1943 - 1970

DIVISION OF OPERATIONAL SAFETY

PREFACE

"Study the Past... What is Past is Prologue." Although these words were penned many years before the establishment of the Atomic Energy Commission (AEC), we feel that they may be applied appropriately to the purpose of preparing this publication. It is only as we are fully aware of the history of the AEC's accident and radiation exposure incident experience that we can profit thereby.

The protection of persons and property against potential hazards in AEC activities has been a fundamental concern of the AEC from the earliest developments in the use of atomic energy. We have simultaneously evolved a new technology and a safety program adapted to the AEC's special purposes. Our continued goal is to develop and utilize this vital national resource to the maximum extent consistent with a high degree of safety.

The Atomic Energy Act of 1954, as amended, clearly demonstrates vital concern with the health and safety of the worker and the public. For example, in section 161(i) of the Act, Congress stipulated that, in the performance of its functions, the AEC is authorized to:

> "prescribe such regulations or orders as it may deem necessary ... (3) to govern any activity authorized pursuant to this Act, including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property ..."

Other examples include section 31(d) (Research Assistance):

> "The arrangements made pursuant to this section shall contain such provisions (1) to protect health, (2) to minimize danger to life or property ... as the Commission may determine."

and section 41(b) (Production Facilities):

> "... Any contract entered into under this section shall contain provisions ... obligating the contractor ... to comply with all safety and security regulations which may be prescribed by the Commission ..."

From time to time, information has been disseminated pertaining to this subject in AEC publications. However, we have long believed that a publication such as this, centralizing as much experience as feasible, would be of help to those interested in the atomic energy program. Therefore, in 1965 we gathered available information, descriptions, and statistics regarding disabling injuries, radiation exposures, contaminations, criticalities, fatalities, and property damage accidents, and presented these and other relevant data under one cover entitled, "Operational Accidents and Radiation Exposure Experience within the United States Atomic Energy Commission 1943–1964." The present publication represents the second time that the original has been revised on a three-year basis.

As in any industrial organization, the AEC's accident experience falls into two major classifications: (1) that which results in harm to people and (2) that which results in damage of property. However, because of the peculiar (or unique) nature of the atomic industry, both of these classifications must be subdivided into: (1) those occurrences which are not atomic energy-connected and (2) those occurrences which are atomic energy-connected.

In a 1956 publication, covering the period 1945–55, it was stated: "By far the most numerous (accidents) are those in no way related to atomic energy. Falls, electrocutions, motor vehicle accidents, and construction equipment accidents comprise the majority of accidents." This was not a surprising statement at that time, since so much construction work was in progress during those years. However, it is interesting to note that it is still true, although in the past 15 years, while construction has decreased, the use of atomic energy has greatly increased, and along with this increase, of course, the number of employees in occupations involving potential radiation exposure.

In summary, while, because of the AEC's singular involvement in radiation hazards, we are prone to emphasize those occurrences resulting in exposures, contaminations, and criticalities, these occurrences are in the minority in the overall picture. Actually, by far the majority of the occurrences within the AEC are comparable, in kind, to those occurring within any industrial organization.

PART I

ORGANIZATION

Since the establishment of the Atomic Energy Commission (AEC) by the Atomic Energy Act of 1946, the AEC has been responsible for the management of a complex of Government-owned nuclear energy facilities. Their design, construction, and operation is by contract with industrial, academic, and nonprofit organizations, rather than directly by Government employees. The operations at these facilities include the production and processing of special nuclear and radioactive materials, the development of nuclear reactors, the development of nuclear explosives, and research in the physical and biological sciences. The total investment in these facilities is over nine billion dollars.

A major part of the AEC's research is conducted at several national laboratories and three weapons development laboratories. Various production facilities are operated for the AEC and include nuclear feed materials plants, three uranium gaseous diffusion plants for producing enriched uranium, and two plutonium production complexes. Weapons testing is conducted at the Nevada Test Site. Similarly, various contractors operate test facilities at the National Reactor Testing Station in Idaho and at the Nuclear Rocket Development Station in Nevada.

The 1954 revision of the Atomic Energy Act established a comprehensive system of regulatory control over the private use of nuclear and radioactive by-product materials.

To implement these responsibilities of operation and regulation, there is a dual organization in which the regulatory activities are separated from promotional and developmental activities. The General Manager, with operational and promotional staffs, administers and directs operations being conducted for the AEC; the Director of Regulation, with his staff, carries out the regulatory program for licensed activities and assists the General Manager in the technical review of certain reactor proposals.

The AEC has field offices near its major sites to assist the General Manager in conducting the AEC's operations. Each office administers contracts within its area of jurisdiction with organizations operating the facilities or otherwise under contract with the AEC. The Director of Regulation has established regional offices in various parts of the United States from which licensee inspections and compliance activities are conducted. Through these contractual and regulatory systems, AEC undertakes to maintain Governmental control and direction in areas of health and safety.

The material included herein covers the experience of operational activities (not regulatory) during the period 1943–70, incorporating both information pertaining to the Manhattan Engineer District, predecessor to the AEC, as well as that of the AEC itself.

PART II

DEFINITIONS

Explanations of Terms Used in This Publication

ACCIDENT (INCIDENT)—The unexpected occurrence in a sequence of events which produces death, injury, radiation exposure, or property damage.

AEC—Atomic Energy Commission.

AEC CONSTRUCTION—Includes lump-sum, cost-plus, and architect-engineering contractors.

AEC FIELD OFFICES—See names and abbreviations listed in appendix A, page 49.

AEC OPERATIONAL ACTIVITIES—Includes AEC and AEC contractor personnel engaged in AEC operations and AEC construction.

AEC OPERATIONS—Includes production, research, and services contractors.

ANSI—American National Standards Institute.

ANSI Z16.1—Method of Recording and Measuring Work Injury Experience. Standard used by the AEC.

BODY BURDEN—The amount of radioactive material present in the body of man or animals.

CHAIN REACTION—A reaction that stimulates its own repetition. In a fission chain reaction, a fissionable nucleus absorbs a neutron and fissions, releasing more than one additional neutron. These in turn can be absorbed by other fissionable nuclei, releasing more neutrons. A fission chain reaction is self-sustaining when the number of neutrons released in a given time interval equals or exceeds the number of neutrons absorbed.

CONTAMINATION—The presence of unwanted radioactive particulate matter.

CRITICAL MASS—The smallest mass of fissionable materials that will support a self-sustaining chain reaction under stated conditions.

DEATH RATE—The number of deaths per 100,000 workers.

DISABLING (LOST-TIME) INJURY—A work injury which results in death, permanent total disability, permanent partial disability, or temporary total disability as defined in ANSI Z16.1.

FIRE LOSS RATIO—Cents loss per $100 of AEC property.

FISSIONABLE MATERIALS—Isotopes capable of being fissioned by neutrons.

FREQUENCY RATE—The number of disabling injuries per 1,000,000 man-hours worked.

GLOVEBOX (DRYBOX)—A sealed box in which workers, using gloves attached to and passing through openings in the box, can handle radioactive materials safely.

MAN-DAY—The equivalent of one man working one eight-hour day.

MAN-HOUR—The equivalent of one man working one hour.

MED—Manhattan Engineer District.

NSC—National Safety Council.

NUCLEAR CRITICALITY—The state in which the effective neutron multiplication constant (k_{eff}) of a system of fissionable material equals or exceeds unity.

NUCLEAR SAFETY (Bimonthly Technical Progress Review)—Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

PROPERTY DAMAGE RATIO—Cents loss per $100 of AEC property.

REM—Roentgen equivalent man. A unit of absorbed dose in biological matter. It is equal to the absorbed dose in rads multiplied by the relative biological effectiveness of the radiation on the part of the body of concern.

ROENTGEN—A unit of exposure dose of ion-

izing radiation. It is that amount of gamma or X-rays required to produce ions carrying one electrostatic unit of electrical charge in one cubic centimeter of dry air under standard conditions.

SEVERITY RATE—The number of days charged per 1,000,000 man-hours worked.

TID (Technical Information Document)—Available from Clearinghouse for Federal Scientific and Technical Information, National Bureau of Standards, U.S. Department of Commerce, Springfield, Va. 22151. (Note: TID–5360, Suppl. 6. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

USAEC HEALTH & SAFETY INFORMATION ISSUE

USAEC SERIOUS ACCIDENTS ISSUE

Available (if not out of print) from Division of Operational Safety, U.S. Atomic Energy Commission, Washington, D.C. 20545.

PART III

AEC EXPERIENCE—PERSONNEL

Section 1

GENERAL

The occupational injury and fatality experience, through 28 years of the development of the atomic energy industry under the guidance and direction of the Atomic Energy Commission (AEC) and its predecessor, the Manhattan Engineer District, demonstrates that when management vigorously promotes accident prevention programs, aimed at a specific type of injury, the occurrence of the injury can be practically eliminated.

The early unknown qualities and effects of nuclear energy provided the incentive to develop the most effective specialized injury prevention program ever devised, with the result that, during 28 years, there were only six deaths attributable to nuclear causes.[1] Three of these occurred at Los Alamos (August 21, 1945, May 21, 1946, December 30, 1958) and were a direct result of exposure to a massive dose of nuclear radiation. The immediate causes of death in the three additional fatalities were the physical effects (i.e., blast, flying missiles, etc.) associated with the SL–1 reactor excursion of January 3, 1961; however, the radiation levels associated with that accident were extremely high and probably would have been fatal. It is also significant that during these 28 years there were only 35 workers involved in lost-time radiation nonfatal accidents.

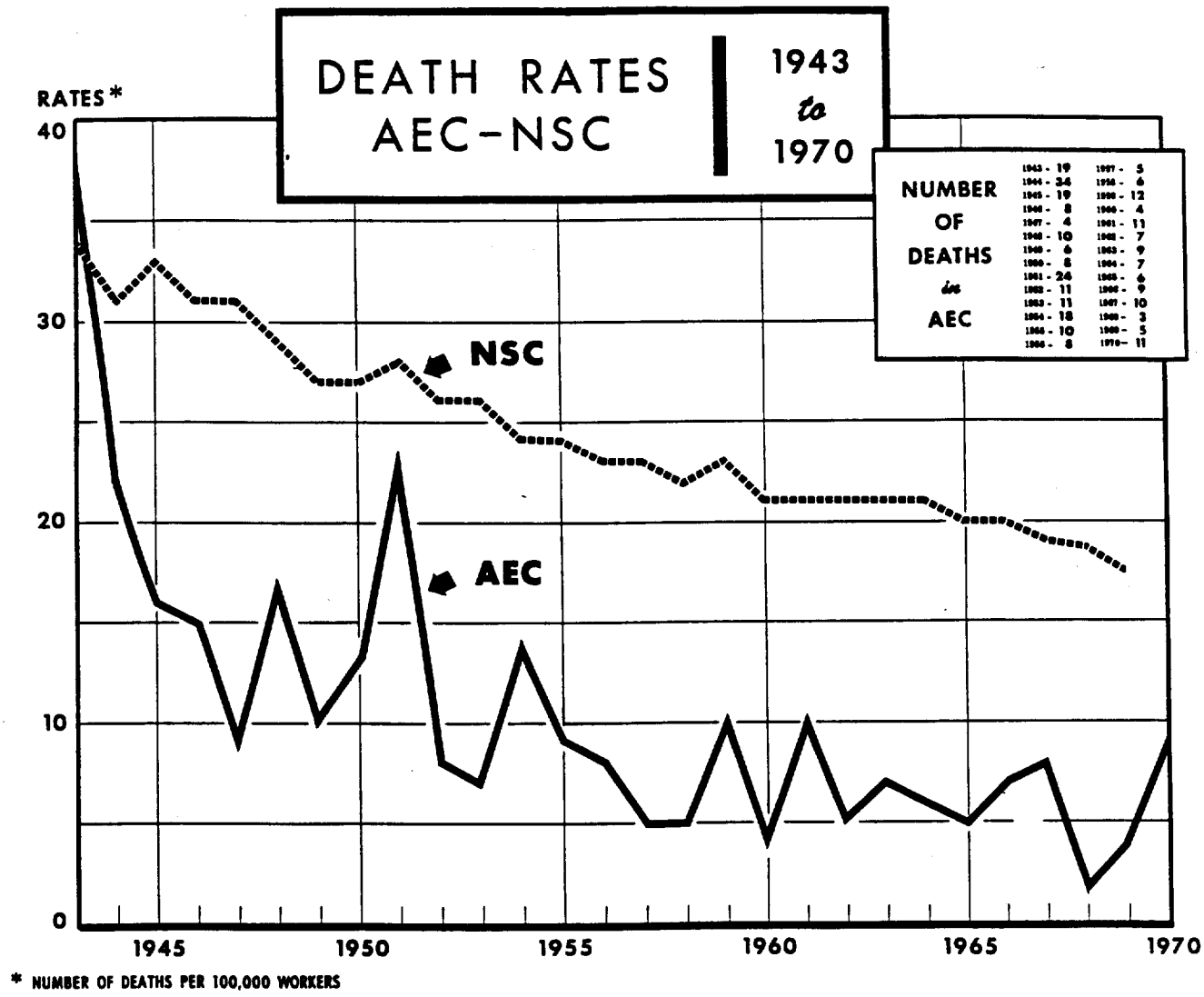
These accidents, producing ionizing radiation exposures, were caused by human error, faulty manipulation of controls, deviation from standard operating procedures, faulty mechanical equipment, and other causes such as may be encountered in any other industry.

Fatalities from all causes totaled 295 during the 28-year period (see Charts I and II). Of this number, 181 occurred in construction, 98 in AEC operations (production, research and services), and 16 in Government functions. A list of fatalities occurring in AEC operational activities appear in Appendix A.

During this period, there were 17,934 lost-time injuries (as defined in ANSI Z16.1) attributable to all accidental causes. This gives a 28-year frequency rate (number of injuries per million man-hours) of 2.91. Of the lost-time injuries (see Chart III) 51% (9,147) occurred in AEC operations. This was the experience of 539,605,388 man-days of potential accident exposure, which produced over four billion man-hours of work and a 28-year frequency rate of 2.12. As indicated above, only 38 of the 9,147 lost-time injuries, four-tenths of one percent (0.4%), were caused by nuclear radiation. This is equivalent to a frequency rate of 0.01. A list of radiation injuries occurring in AEC operations appears in Chart VIII.

[1] On July 24, 1964, the first nuclear fatality in a licensed operation occurred as a result of a nuclear criticality accident at a recovery plant for enriched uranium scrap near Charleston, R.I.

CHART I



* NUMBER OF DEATHS PER 100,000 WORKERS

In the AEC's construction activities, there were 7,954 injuries, resulting in a 28-year frequency rate of 5.36. This rate compares very favorably with the average frequency rate of the National Safety Council (NSC) of 16.8 for construction (1943–1970).

The 28-year Government (Federal employees) frequency rate was 2.38 (853 lost-time injuries). AEC Government experience won the President's Award, covering accident prevention among Federal employees, in 1957, 1959, 1960, 1962, and 1970. The AEC earned these awards in the small-agency category.

The AEC's overall industrial accident experience has always been lower than the all-industry rate reported by 41 industries in the United States to the NSC. The average NSC 28-year rate of all industry is 8.6 compared to the 28-year AEC frequency rate of 2.9.

CHART III

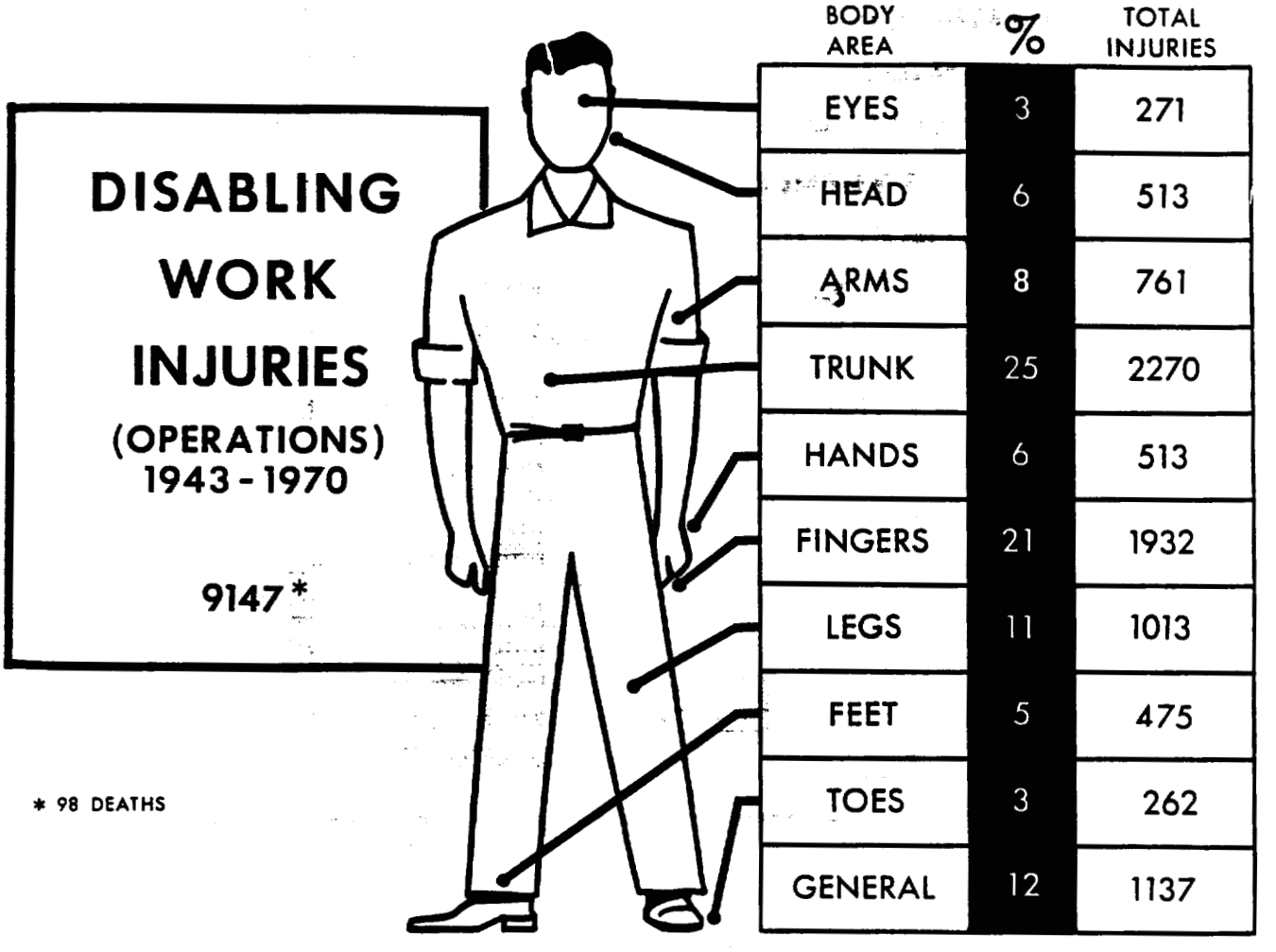
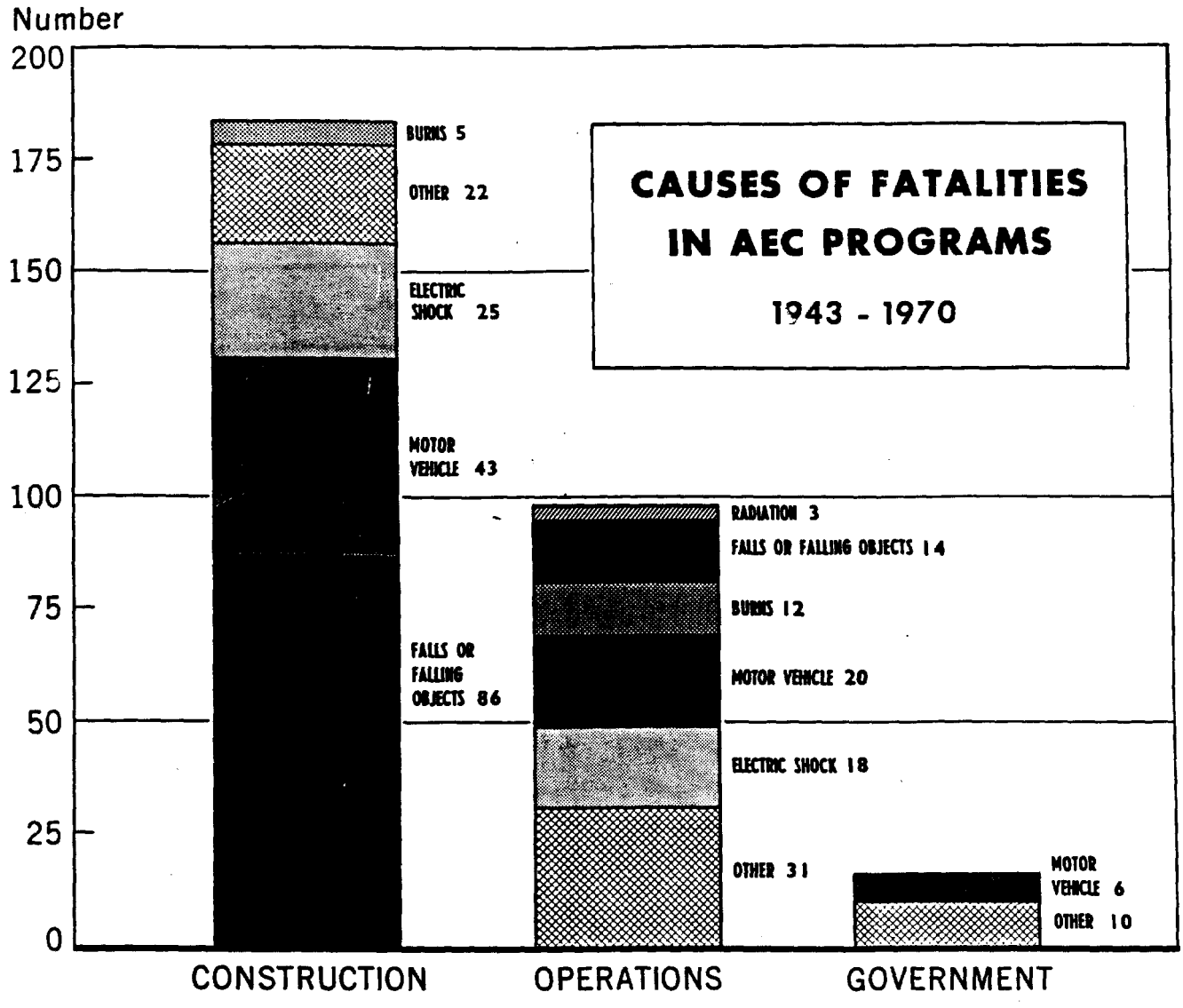


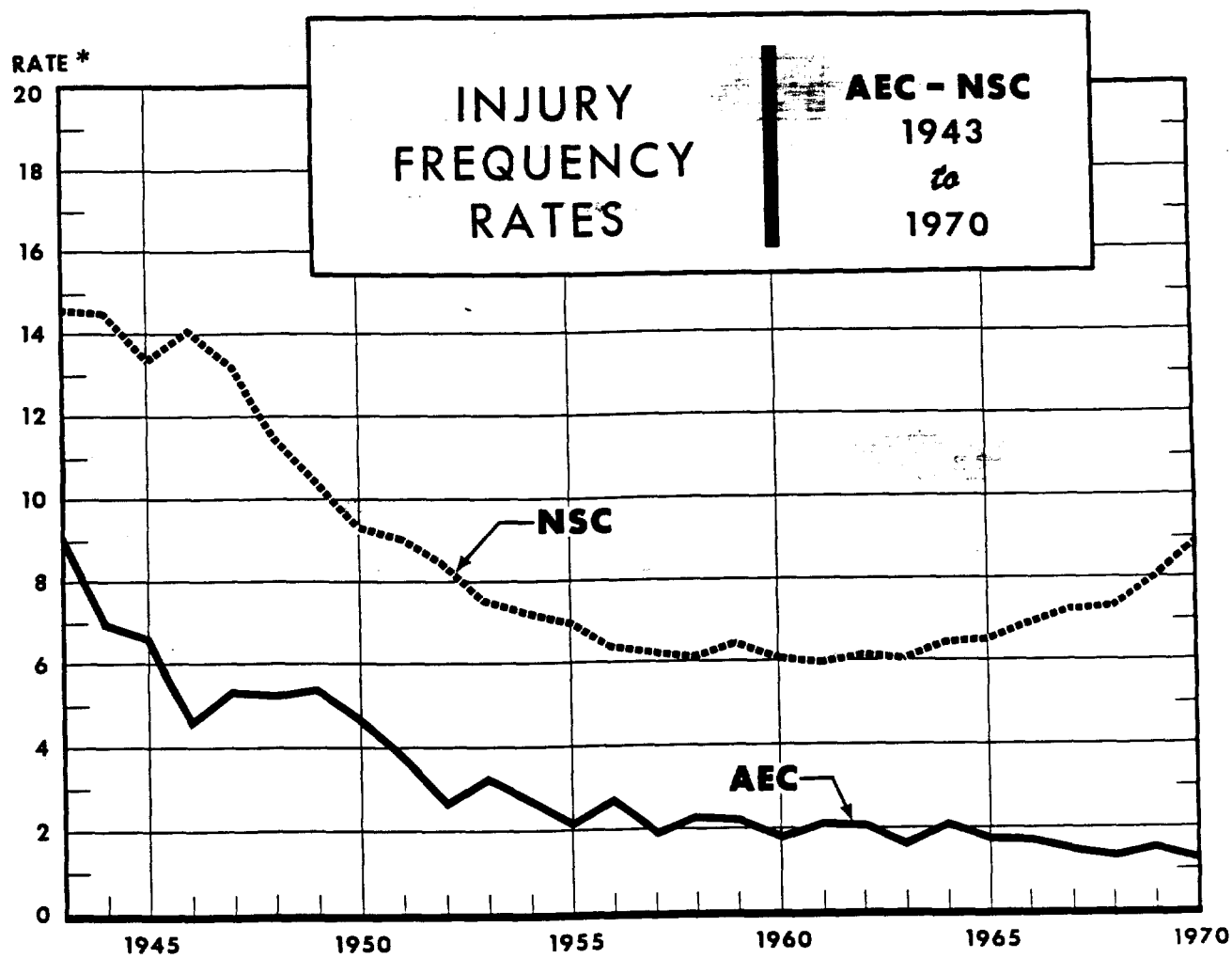
CHART II



Frequency

In 1945, and prior thereto, the pressures of war, such as heavy construction work, urgency, and shortages, all combined to produce relatively high accident frequency rates in AEC operations, although they were always below NSC rates. By 1950, the rate for work in operation had dropped to about 3.0 injuries per million man-hours. From then on, operation frequency rates were low by comparison with other industries. In 1947 through 1949, a renewed heavy construction program produced a construction injury rate of about 10.0. This held the overall frequency rates of the AEC up in those years. A vigorous program concentrating on control of accidents in construction brought the frequency down again, and since 1958, the total frequency for all activities has been 2.2 or less. The proportion of construction work thereafter was small enough to be ineffective, in the overall, even though the construction rate was up in 1959. It is notable that the trend of AEC's injury frequency (see Chart IV) in all its operations throughout the years is roughly parallel to the national average, but from a fourth to a third of the national rate.

CHART IV



* NUMBER OF INJURIES PER MILLION MAN-HOURS

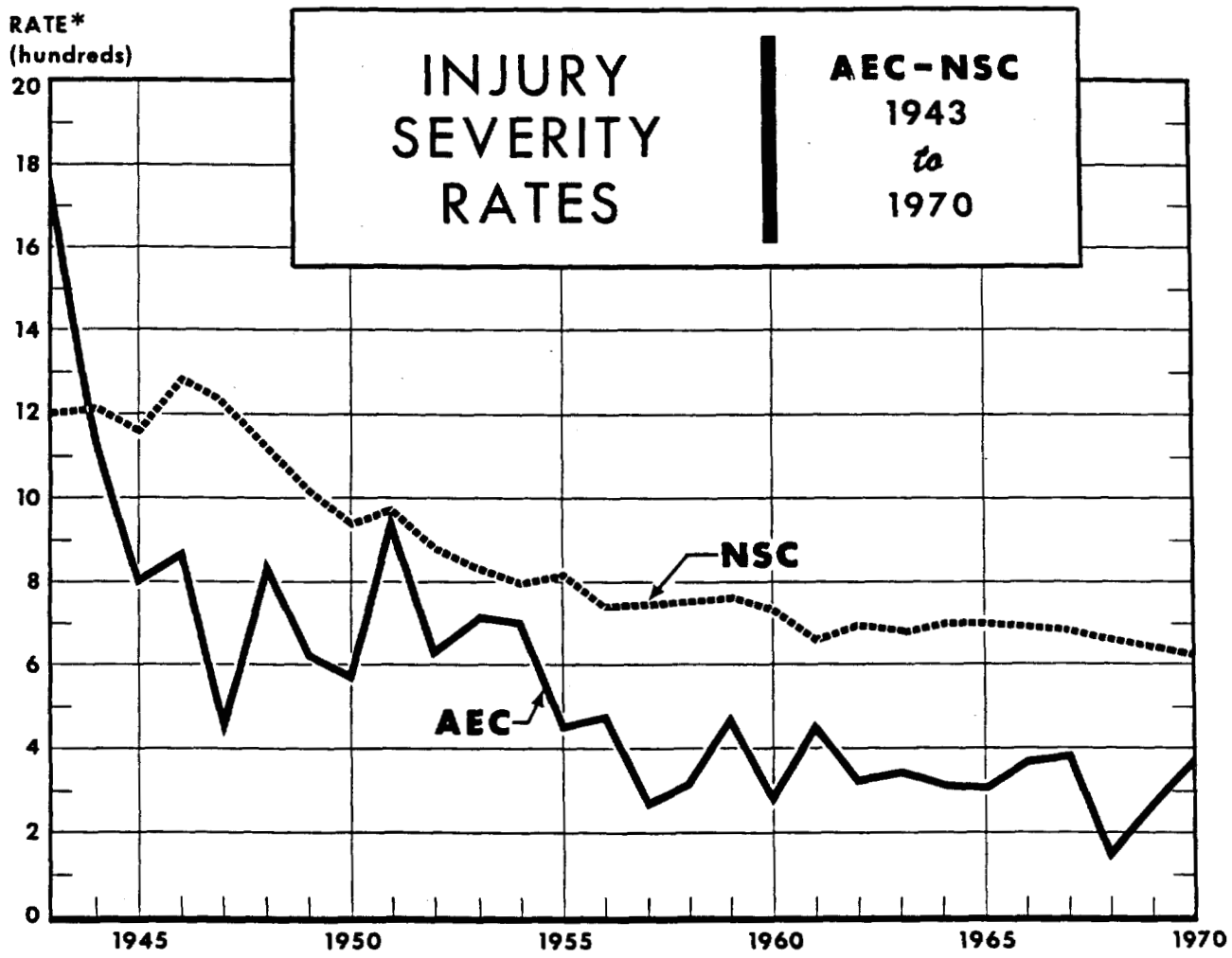
Severity

As stated regarding the AEC frequency rate, the AEC severity rate was affected adversely by the large amount of construction work during its early years.

In 1951, the AEC severity rate and the NSC severity rate were the same. Both have declined over the years; however, that of the AEC shows a greater decrease (see Chart V).

It is to be noted that a severity rate may fluctuate markedly from year to year, depending upon the fatalities and types of disabilities occurring. Whereas the actual calendar days lost are charged for temporary total injuries, charges are based on 6,000 days for a death or permanent disability, with proportionately fewer days being charged for permanent partial disabilities of varying degrees of seriousness. Thus, fatalities and certain types of injuries can result in decided peaks in a severity rate.

CHART V



* NUMBER OF DAYS CHARGED PER MILLION MAN-HOURS

Section 2

RADIATION EXPOSURES

In accordance with its health and safety responsibilities, the AEC must conduct its activities in such a manner as to assure that employee radiation exposures are reduced to the lowest practical levels within established limits. To carry out this responsibility, it has been necessary for the AEC and its contractors to monitor routinely all employees who might receive a significant radiation dose.

AEC and AEC contractor employee exposures for the past 24 years are summarized in Chart VI. This chart shows that during this 24-year period over 99.8% of the employees monitored received an annual dose of less than 5 rem and that over 94.8% received one rem or less. The majority of exposures in excess of five rem in a year resulted from accidental situations. The more significant (15 rem and over) of these accidental exposures are briefly summarized in Appendix B.

During the 28 years of operation of the AEC and its predecessor, radiation resulted in a very small percentage (0.4) of the total lost-time injuries from all causes as indicated in Chart VII. These specific radiation exposures were classified as lost-time injuries as defined in the American National Standards Institute methods for reporting work injuries, ANSI Z16.1–1967 (Rev. of Z16.1–1954) and AEC directives.

CHART VI

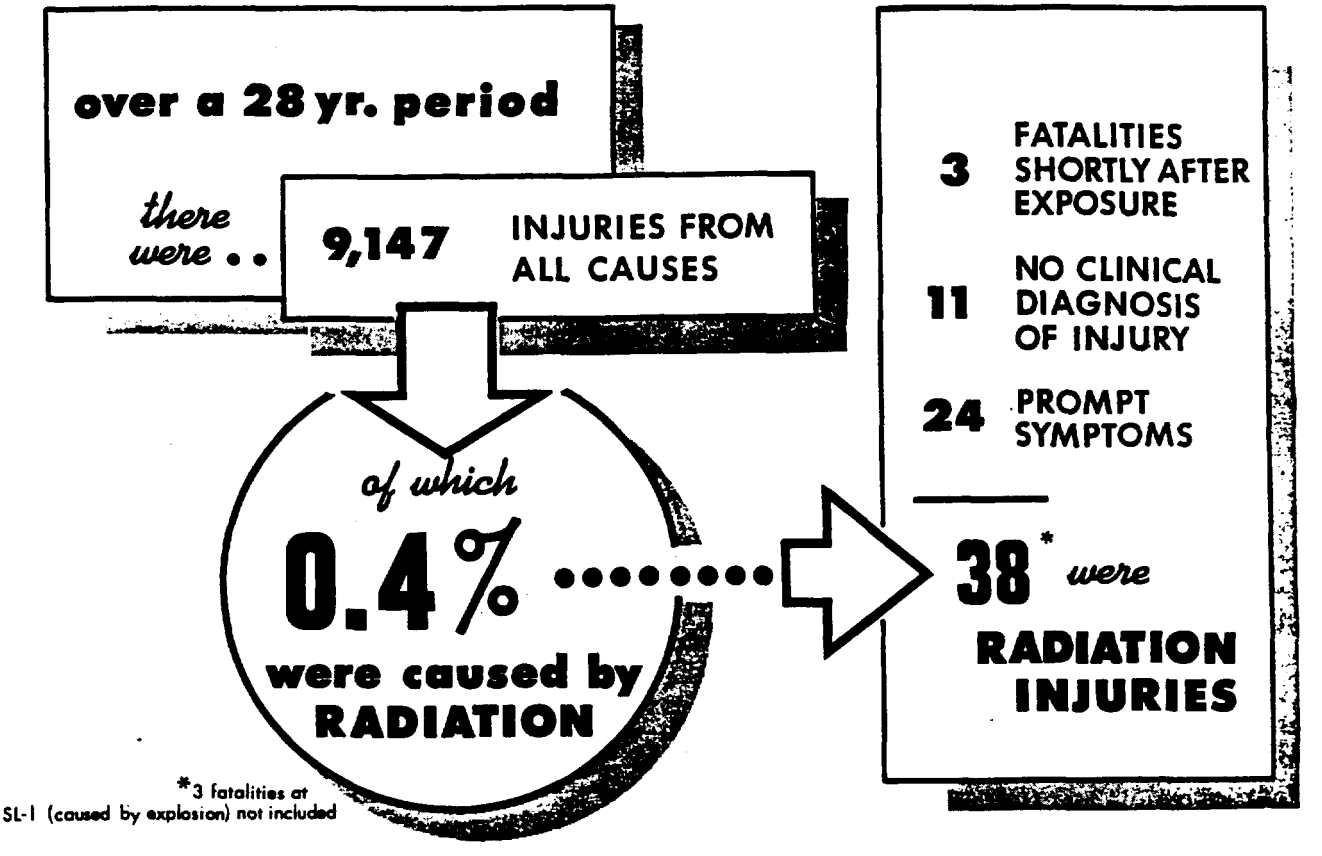
Radiation Exposure of AEC and AEC Contractor Personnel to Whole-Body Penetrating Radiation

Years	Rem Dose				
	0–1	1–5	5–10	10–15	>15
1947–54	130,128	5,311	284	32	6
1955	56,708	3,157	285	41	1
1956	38,225	2,312	100	4	3
1957	45,510	2,424	83	5	1
1958	59,455	6,271	159	10	12
1959	71,600	3,912	66	2	1
1960	77,522	4,629	41	2	1
1961	90,651	5,174	40	3	8
1962	122,437	5,707	113	0	8
1963	107,786	5,472	80	0	1
1964	122,711	6,157	86	11	0
1965	128,360	6,671	175	8	0
1966	130,552	7,218	167	0	2
1967	101,764	6,513	108	1	0
1968	103,206	4,776	4	0	0
1969	98,625	4,288	4	1	0
1970	92,185	4,464	12	0	0
TOTAL	1,577,425	84,456	1,807	120	44

CHART VII

RADIATION INJURIES 1943-1970

AEC OPERATIONS



Of the 38 workers involved in lost-time radiation accidents, 3 died, 24 showed clinical manifestations attributable to radiation, and 11 were without evidence of radiation effects. Of the second group, 2 received permanent partial disabilities due to radiation, and 3 required removal of a digit because of deposition of plutonium in tissue.

Persons listed as having "lost-time injuries" but who actually had no evidence of clinical radiation effects were classified as lost-time injuries because they were removed from work and hospitalized for diagnostic tests. Such tests were negative in these cases but loss of time was charged according to ANSI standards for hospitalizations.

Additional information on these injuries concerning date and location of accident and nature and extent of injury are found on Chart VIII. Chart IX provides a comparison of total time lost from injuries due to radiation and to other causes. It is evident from the chart that radiation exposure was responsible for only a small part of the time lost due to injuries.

CHART VIII

RADIATION ACCIDENTS RESULTING IN LOST-TIME INJURIES

(As defined in American National Standards Institute Method of Recording and Measuring Work Injury Experience—ANSI Z16.1–1967 (Revision of Z16.1–1964) and AEC Directives)

Date	Location	Number Involved	Source of Injury	Nature of Injury	Exposure		Days Lost
					80 KV X-Ray	GAMMA RAY	
8/21/45	Los Alamos	Two	Chain reaction in experimental critical assembly	(1) Fatality	(1) 480 r	110 r	6000
				(2) No clinically diagnosed injury	(2) 31 r	1 r	60
					80 KV X-Ray	GAMMA Ray	
5/21/46	Los Alamos	Eight	Chain reaction in experimental critical assembly	(1) Fatality	(1) 930 r	114 r	6000
				(2) Skin rash, loss of hair and other symptoms	(2) 390 r	26 r	70
				(3) Skin rash and other symptoms	(3) NA	NA	1/
				(4) No clinically diagnosed injury	(4) 185 r	10.7 r	14
				(5) No clinically diagnosed injury	(5) 140 r	8.7 r	18
				(6) No clinically diagnosed injury	(6) 55 r	4.4 r	4
				(7) No clinically diagnosed injury	(7) 43 r	3 r	4
				(8) No clinically diagnosed injury	(8) 32 r	2.41 r	4
5/14/48	Eniwetok Proving Ground	Four	Improper handling of fission sample	Beta ray burns to hand	1.7 r 2/ 4.5 r 2/ 5.6 r 2/ 17 r 2/		36 36 36 36
9/7/48	Los Alamos	One	Unpacking radioactive material	Beta ray burns to ankle	NA 3/		36
6/2/52	Chicago	Four	Manual withdrawal of control rod from critical assembly	No clinically diagnosed injury	190 rem 160 rem 70 rem 12 rem		23 23 34 23
7/9/52	Los Alamos	One	Handling radioactive material with torn glove	Beta ray burns to hands	NA 4/		3
3/1/55	Nevada Test	One	Entering exclusion area during test	No clinically diagnosed injury	39 r		19
7/27/55	National Reactor Testing Station	One	Radioactive particle entering ear canal	Partial loss of hearing	Not detectable		12
4/30/56	Los Alamos	One	Handling radioactive material with torn glove	Beta burns to hands	NA 5/		14
6/18/56	Hanford	One	Escape of plutonium solution into control room	Contamination of exposed skin surfaces. No clinically diagnosed injury	0.4 μc/c Pu		4
6/14/57	Rocky Flats	One	Explosion in "dry box"	Plutonium lodged in finger, necessitating partial amputation	3.2 μg Pu (0.2 μc)		50
6/16/58	Oak Ridge (Y-12 Plant)	Eight	Criticality incident caused by draining enriched uranium in drum of water	6/	461 rem 341 rem 428 rem 413 rem 298 rem 86 rem 86 rem 29 rem		83 83 83 83 83 34 65 41
12/30/58	Los Alamos	One	Criticality accident	Fatality	12000 ± 50% rem		6000
11/8/60	Albuquerque Sandia Base	One	Exposure from electronic beam	Multiple radiation burns middle section of face, abdomen and both hands	7/		10
6/12/64	Rocky Flats	One	Explosion in "drybox"	Pu lodged in finger and thumb, necessitating amputation at proximal joint	1/		1000
7/7/65	Livermore	One	Charged materials in X-ray unit unaware it was operating	2nd degree burns right hand	1000 rem		12
9/15/65	Richland	One	Wiped moisture from chamber of emission spectrometer	Amputation of distal phalanx of index finger	80000 rem		100

1/ Information Not Available.

2/ Exposure refers to whole body gamma radiation. Injury caused by beta ray dose, amount of which exposure not available.

3/ Amount of beta ray dose not available. Total gamma ray exposure during week in which accident occured was 0.27 rem.

4/ Amount of beta ray dose not available. Total gamma ray exposure during week in which accident occured was 1.8 rem.

5/ Amount of beta ray dose not available. Total gamma ray exposure during week in which accident occured was 2.0 rem.

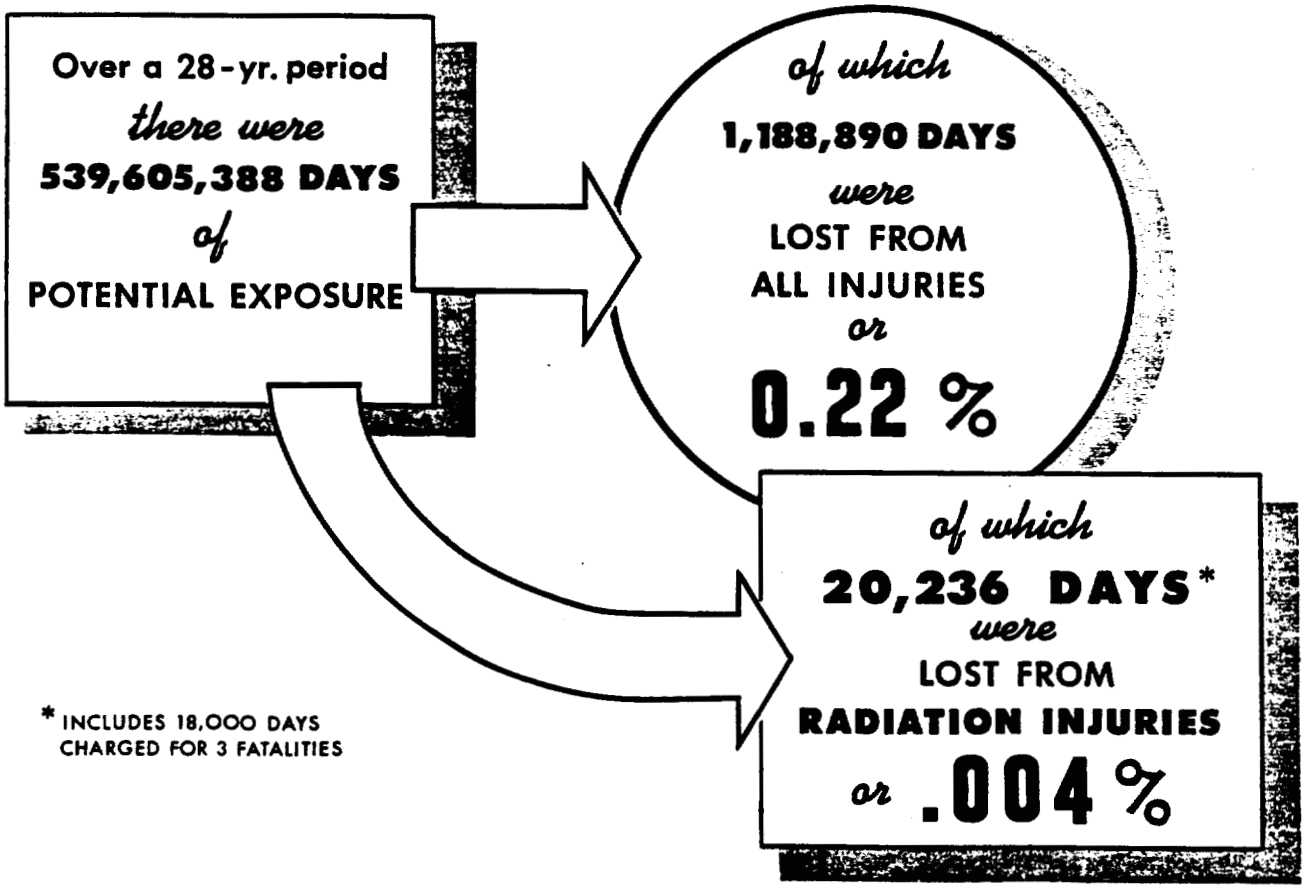
6/ Three employees not requiring prolonged hospital care exhibited mild changes in blood elements but showed no symptoms of injury. The five employees requiring longer hospitalization showed significant decreases in blood elements and other clinical and laboratory findings characteristic of more severe radiation damage such as mild nausea and vomiting, and indications of possible hemorrhagic complications, although no bleeding actually occured.

7/ Employee was not wearing his film badge. However an indirect measurement was made by placing a film badge at the 33 cm distance and exposing it under simulated conditions. Calibration was interpreted as 760 rads incident dose to the face at 33 cm.

CHART IX

TIME LOST from RADIATION INJURIES 1943-70

AEC OPERATIONS



* INCLUDES 18,000 DAYS CHARGED FOR 3 FATALITIES

PART IV

AEC EXPERIENCE—PROPERTY DAMAGE

Section I

GENERAL

During the 28-year history of the Atomic Energy Commission (AEC) and the Manhattan Engineer District (MED), its predecessor, property damage accidents caused about $79.5 million loss, of which 73% was from fire, 10% from reactor-associated incidents, and the remaining 17% divided almost equally between acts of nature, explosions, and miscellaneous causes. A single incident, the Rocky Flats fire (described below) of May 11, 1969, accounts for over 56% of the total property damage figure.

Few AEC accidents . . . typically three per year . . . result in a loss of $50,000 or more; however, these infrequent occurrences have cumulatively inflicted about 90% or more of the aggregate loss suffered to date. The seven accidents described below individually caused $1,000,000 or more damage and, collectively, account for over 75% of the total property damage suffered during the past 28 years.

Chart XIV provides a listing and brief description of each accident causing $50,000 or more loss. The incidents are listed in decreasing order of loss magnitude, e.g., incident #7 caused the seventh largest accidental loss in AEC's 28-year history. Incident numbers given in the listing correspond with those given on the charts covering AEC property damage.

1. FIRE—ROCKY FLATS
   Golden, Colorado, May 11, 1969 $45,000,000
   The AEC's costliest fire, and largest property loss incident, occurred at a plant which produces plutonium parts for nuclear weapons. The parts are made within a complex system of gloveboxes, which provide a means for working safely with plutonium while separating the operator from this potentially hazardous radioactive material. The available evidence indicates that the fire originated on the lower shelf of a storage cabinet in one of the gloveboxes. Plutonium briquettes and some loose scrap metal were stored in uncovered cans in the storage cabinet. The exact cause of ignition is unknown; however, plutonium in the form of chips or lathe turnings is a pyrophoric material. The heat from the burning plutonium metal evidently caused the storage cabinet, which was constructed mostly of cellulosic laminate material and plastic, to char and generate flammable gases which could have been ignited by burning plutonium. The heat of the burning gases could ignite other briquettes and initiate a slow burning of the storage cabinet materials, particularly in the cracks between the joined sections of the cellulosic materials.

   The financial loss for the damage to buildings and contents includes the cost of decontamination. There were no lost-time injuries to personnel. (See USAEC SERIOUS ACCIDENTS Issue #306, 12–1–69).

2. SL–1 REACTOR EXCURSION
   Idaho Falls, Idaho, Jan. 3, 1961 $4,350,000
   (See description on page 30.)

3. CHEMICAL EXPLOSION AND FIRE

Paducah, Ky., Dec. 13, 1962 $2,900,000
An explosion, followed by an intense, violent, local, chemical reaction-type fire within a gaseous diffusion cell, caused heavy damage to adjacent physical facilities. Water from overhead sprinklers was rapidly converted into high-temperature steam which actuated most of the 2,341 sprinkler heads that operated during the fire. The automatic fire sprinkler systems were successful in confining fire damage within the $162,000,000 building.

There were no injuries to personnel. (See USAEC SERIOUS ACCIDENTS Issues #194, 1–3–63; #203, 4–29–63; #215, 1–17–64).

4. ROOF DECK FIRE

Paducah, Ky., Nov. 11, 1956 $2,100,000
Failure of a process gas compressor seal permitted some of the leaking gas to escape, to impinge on, and to ignite oil in an adjacent drip pan and on flexible tygon tubing carrying oil to the compressor load bearings. The resulting intense, localized fire caused rupture of the lube oil supply line, thereby allowing additional fuel to feed the fire. The fire spread throughout the tar-treated built-up composition roof of the 70,000 sq. ft., nonsprinklered, two-story building constructed of unprotected steel frame with sheet asbestos siding and a metal roof deck. The roofing material consisted of a layer of tar which served both as a vapor barrier and to bind fiberglass insulation to the metal roof deck. The roofing was topped by a layer of tar binding the outer layer of gravel to the thermal insulation below.
One firefighter was seriously injured in a fall during efforts to escape from the intense heat. (See USAEC SERIOUS ACCIDENTS Issue #115, 2–11–57.)

5. ACT OF NATURE

Amarillo, Tex., Sept. 3, 1967 $1,872,000
Winds, up to 106 miles per hour, rain, and hail caused major widespread damage to roofs, glass, doors, and walls of numerous buildings, and general damage and destruction to various segments of the electrical power distribution system, the steam condensate return, and compressed air distribution systems. Extensive flooding and water damage were experienced inside the buildings partially or wholly demolished by the cyclonic winds. Of 120 vehicles, 92 sustained damage.

6. EXPLOSION AND FIRE

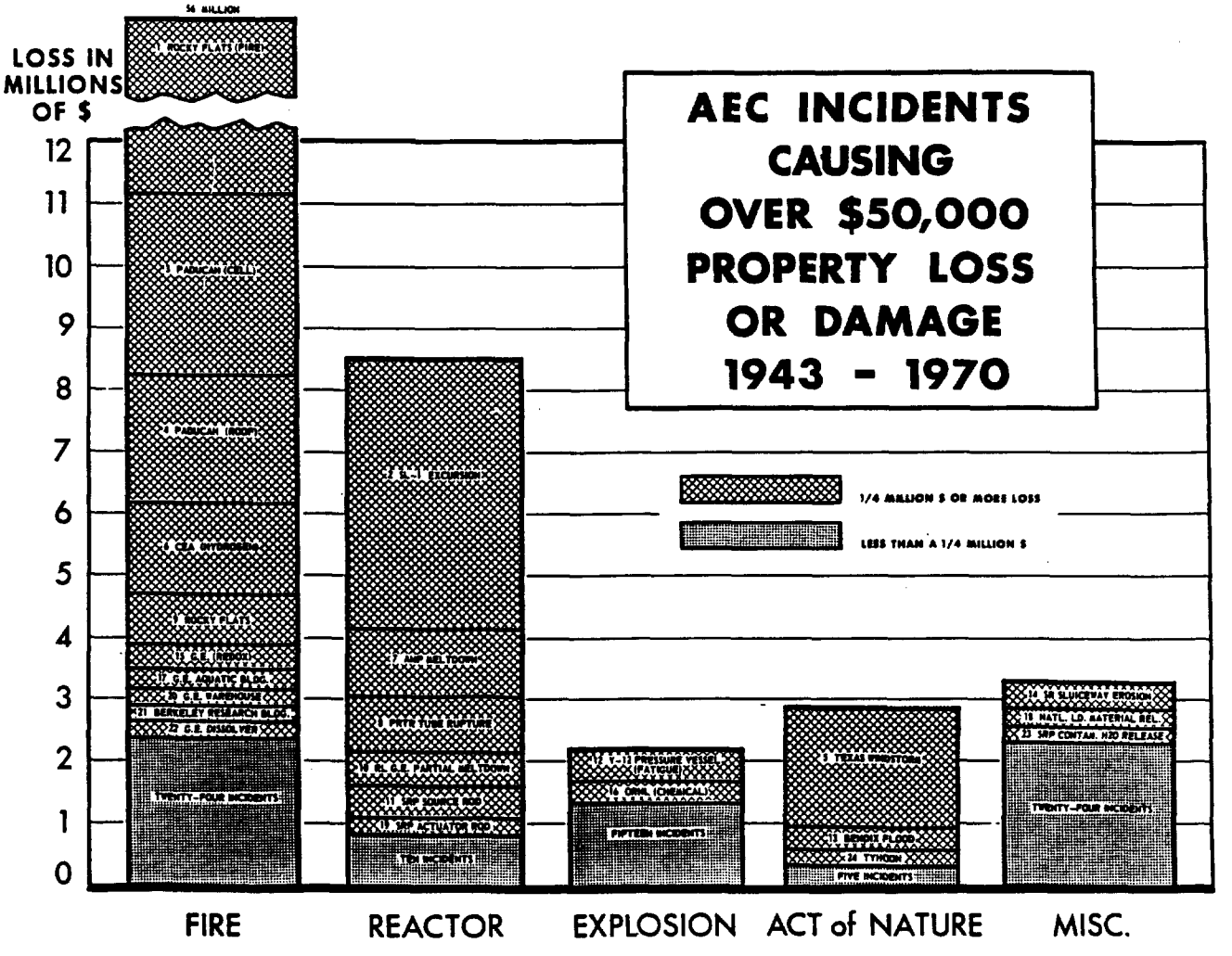
Cambridge, Mass., July 5, 1965 $1,453,000
An explosion and fire occurred in the experimental hall of an accelerator complex following the sudden release of 500 liters of liquid hydrogen. The incident was caused by the sequential failure of the inner and outer beryllium windows of a liquid hydrogen bubble chamber. During the next three hours, the initial blaze slowly spread to involve propane cylinders, the contents of which burned intensely in a secondary fire which, in turn, accentuated combustion in the explosion-fragmented roof. Eight persons were injured, one fatally. (See TID–5360, Suppl. 6, p. 42; TID–22594.)

7. REACTOR MELTDOWN

Idaho Falls, Idaho, Nov. 18, 1958 $1,100,000
To permit initial very low-level power testing of an experimental nuclear reactor aircraft engine, it was found necessary to modify instrumentation power supplies so as to reduce interference from extraneous electrical "noise" effects. However, these changes had the subsequent net effect of causing erroneously low-level power indications as the actual reactor power levels were subsequently increased. The instrumentation error (due to saturation) gave false security as the actual reactor power level was slowly increased far beyond that which the reactor was capable of safely withstanding. In addition to severe reactor damage due to overheating, small amounts of radioactive fission product activity was released within the test facility. There were no injuries. (See 1959 NUCLEAR SAFETY, Vol. 1, #2, p. 57.)

Chart X affords a broad view of the 1943–1970 accident experience broken down into five categories, which include "reactors" and four types of "loss cause." If the causes of the accidental losses associated with the nuclear reactor incidents had been distributed between the four loss causes shown on Chart X (i.e., fire, explosion, act of nature, and miscellaneous), the type and relative magnitude of AEC loss causes would be found to parallel closely those of private industry. Stated differently, fire, explosion, and acts of nature are the principal causes of property damage in both AEC and private industry.

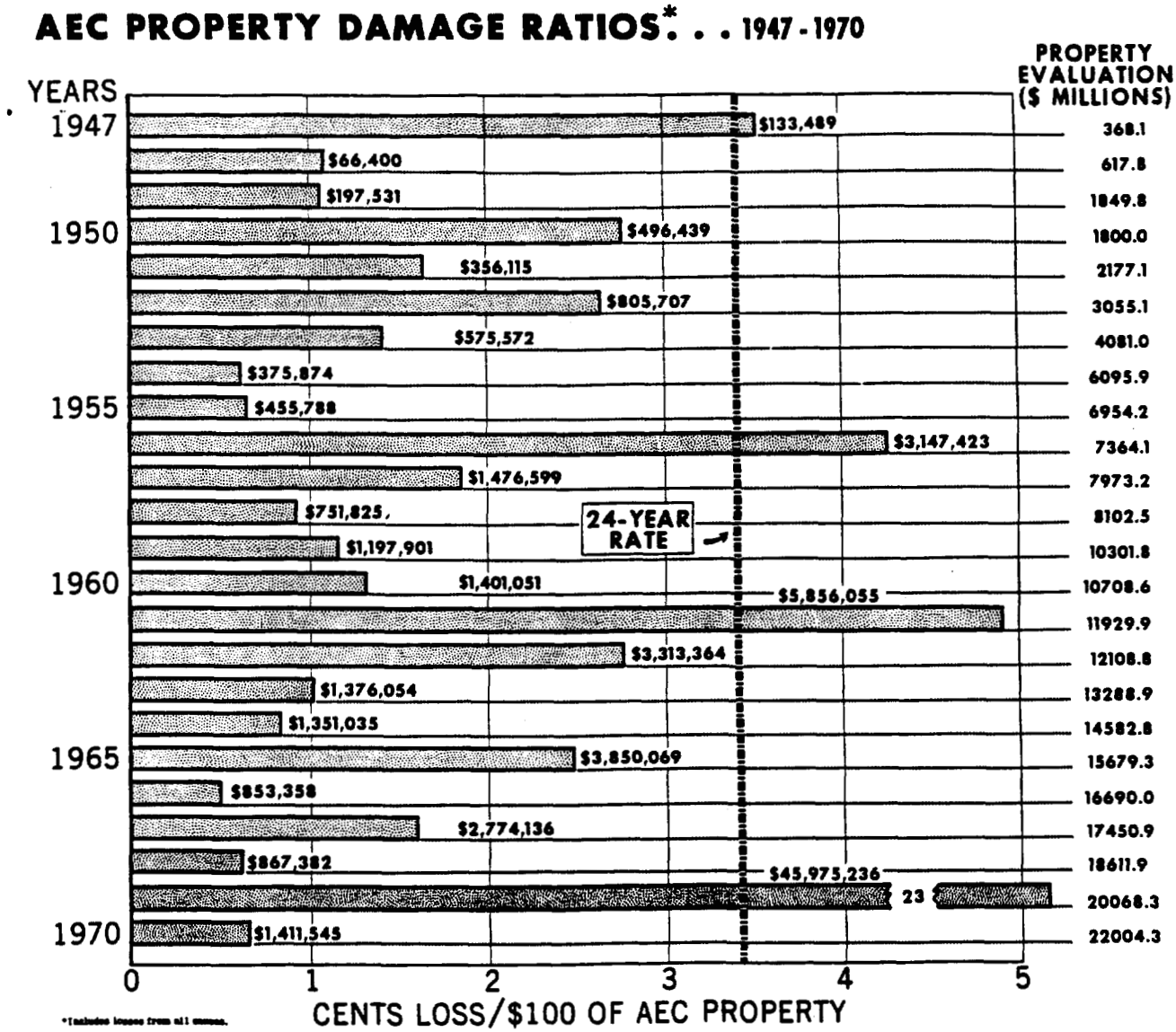
CHART X



NUMBERS CORRESPOND WITH CHART XIV

Chart XI shows a breakdown of the AEC 1947–1970 property damage experience and reflects an average annual loss rate of approximately 3.39¢/$100 of AEC-owned property. The wide deviations in the AEC annual loss experience shown on Chart XI are the result of a few high-loss incidents.

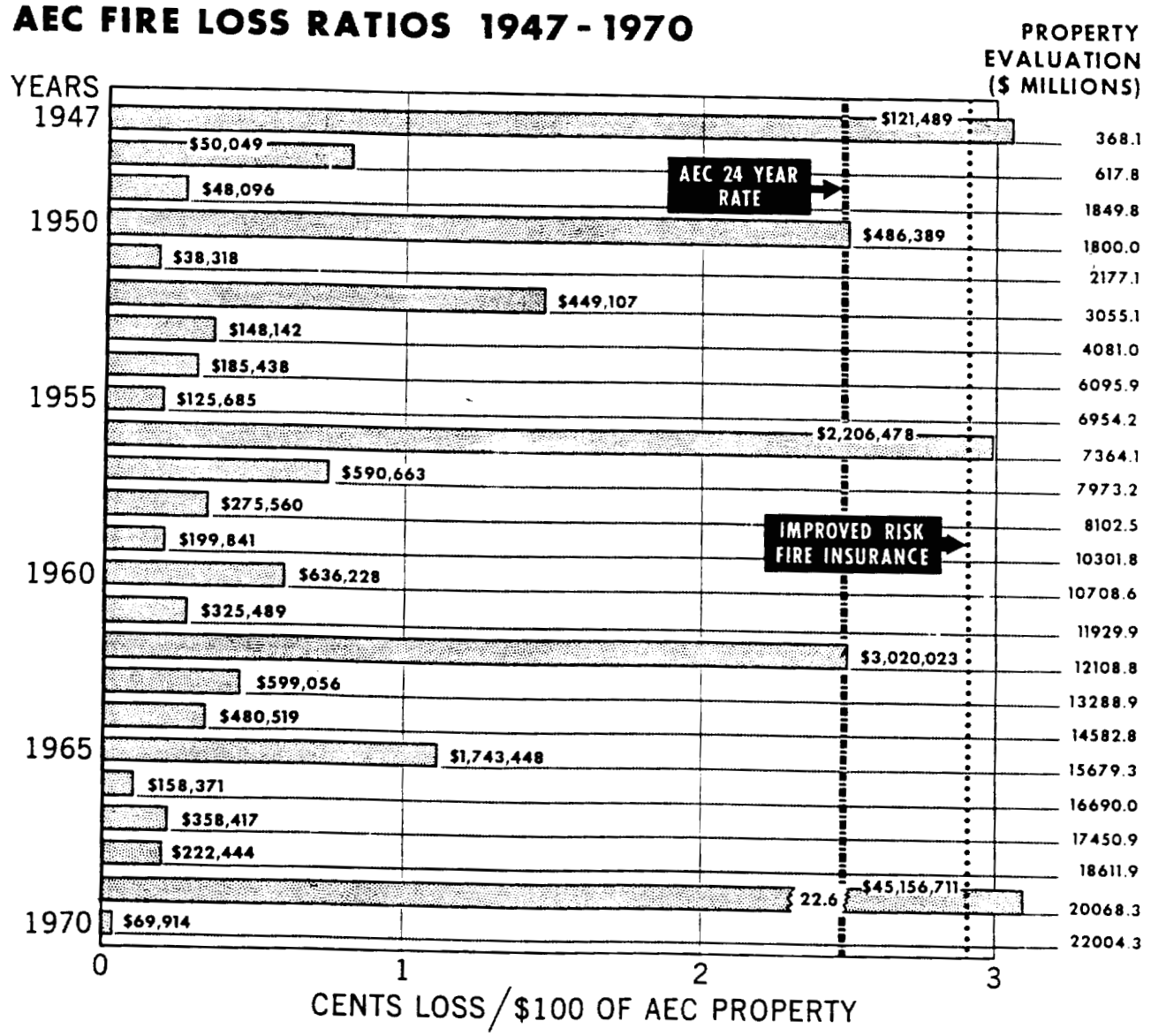
CHART XI



LOSS FROM FIRE

As indicated on Chart X, fire has been the largest single cause of AEC property damage. The May 11, 1969, fire at Rocky Flats (see page 15) more than tripled the AEC's average annual fire loss ratio maintained up to that time. However, the present AEC average fire loss ratio of 2.47 (see Chart XII) compares favorably with that of private industry, a fact similarly true of the MED experience from 1943–1946.

CHART XII



LOSS FROM CONTAMINATION

Chart XIII presents a breakdown by years of AEC property damage from contamination. As noted in the chart, AEC experienced its largest loss due to contamination in 1969 when a fire occurred in a plutonium processing facility at Rocky Flats, Colorado, on May 11. Personnel exposures were within normal administrative limits and no appreciable radioactivity was released to the environment. The cost of the incident was $45,000,000, of which approximately $9,600,000 was based on the expense for cleanup of radioactive contamination in the facility.

CHART XIII

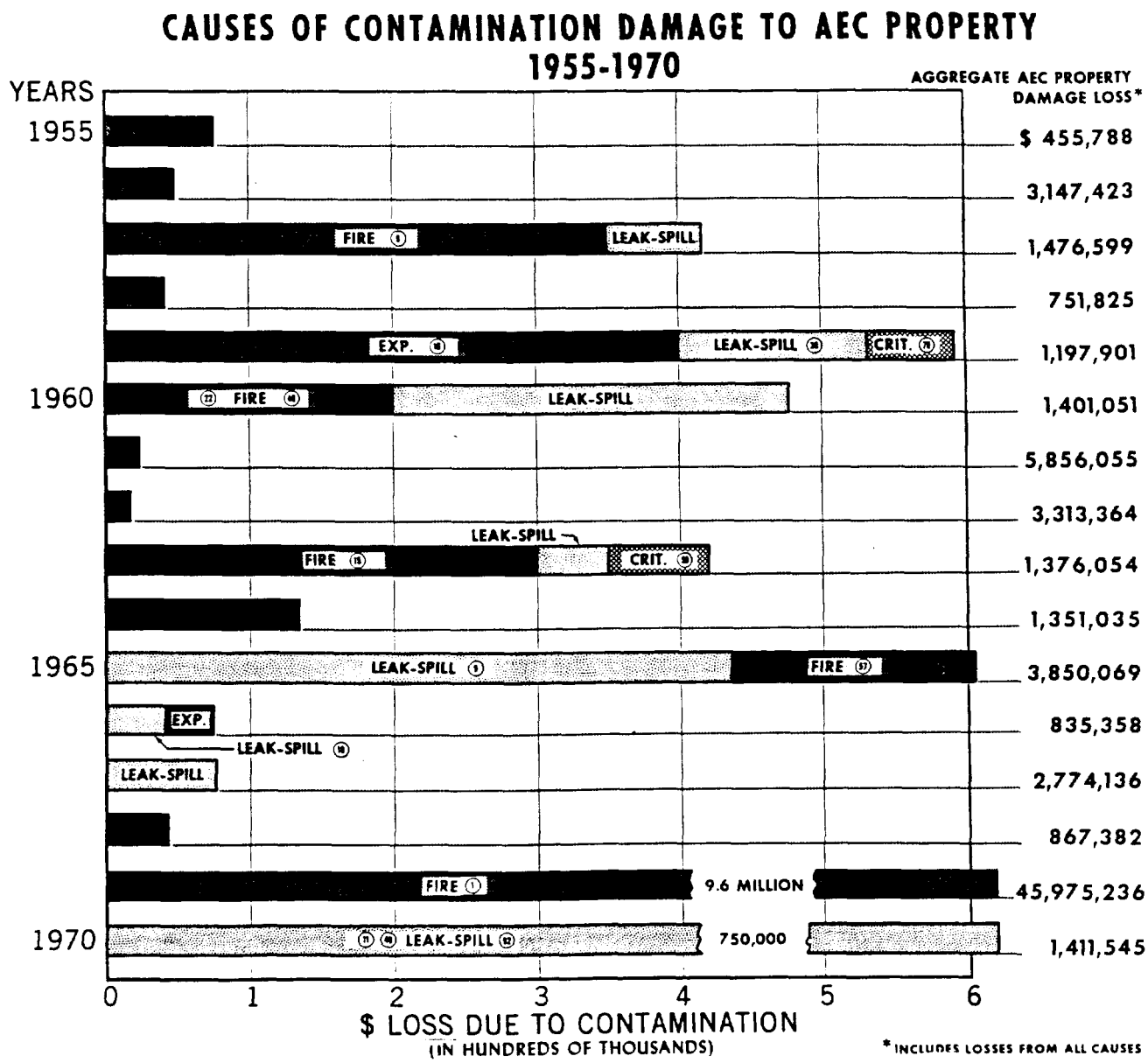


CHART XIV

AEC INCIDENTS CAUSING OVER $50,000 PROPERTY DAMAGE OR LOSS 1943–1970

Incident No.	Date	Field Office [1]—Contractor	Remarks	AEC Property Damage
1	5-11-69	AL—Dow Chemical Co	*Fire*, starting in glovebox storage cabinet, resulted in widespread damage to, and contamination of, building and contents. (See USAEC SERIOUS ACCIDENTS Issue #306, 12-1-69)	$45,000,000
2	1- 3-61	ID—Combustion Engineering	*Reactor* excursion. (See TID-5360, Suppl. 4, p. 8; 1962 NUCLEAR SAFETY, Vol. 3, #3, p. 64.)	4,350,000
3	12-13-62	OR—Union Carbide Corp	*Explosion* and *fire* in gaseous diffusion cell. (See USAEC SERIOUS ACCIDENTS Issues #194, 1-3-63; #203, 4-29-63; #215, 1-17-64.)	2,900,000
4	11-11-56	OR—Union Carbide Corp	Intense localized *fire* from lube oil-process gas reaction spread to metal deck roof where fire got out of control due to combustible vapor barrier in roof deck. Damage limited to upper story of building. (See USAEC SERIOUS ACCIDENTS Issue #115, 2-11-57.)	2,100,000
5	9- 3-67	AL—Mason & Hanger-Silas Mason Co.	*Wind* and *hailstorm* damage	1,872,000
6	7- 5-65	NY—Harvard University; Massachusetts Institute of Technology.	*Fire* and *explosion* damage in experimental area ensued following beryllium window failure on liquid hydrogen bubble chamber. Eight people were injured, one fatally. (See TID-5360, Suppl. 6, p. 42; TID-22594.)	1,453,000
7	11-18-58	LAR—General Electric Co	*Reactor* fuel element *meltdown* resulted from radiation monitoring power system deficiency. (See 1959 NUCLEAR SAFETY, Vol. 1, #2, p. 57.)	1,100,000
8	9-29-65	RL—Battelle Northwest	Test *reactor* zirconium tube failure permitted gross contamination of reactor core and interior of containment shell. (See TID-5360, Suppl. 6, p. 27; 1965 NUCLEAR SAFETY, Vol. 7, #2, p. 242.)	895,000
9	9-11-57	AL—Dow Chemical Co	Spontaneous metallic *plutonium fire* in production drybox line spread to flammable plastic drybox window through ventilating system to main filter bank. Much of damage due to spread of plutonium *contamination* during the fire. (See TID-5360, Suppl. 2, p. 23; USAEC SERIOUS ACCIDENTS Issue #130, 11-27-57.)	818,600
10	11- 9-70	SR—E. I. du Pont de Nemours & Co.	Antimony-beryllium *source rod* separated, causing widespread contamination to the reactor room. No overexposures.	511,833
11	1- 5-55	RL—General Electric Co	Partial *meltdown of reactor* during startup. Principal loss resulted from need to remove and replace part of reactor core. (See 1962 NUCLEAR SAFETY, Vol. 4, #1, p. 104.)	480,134
12	1-10-56	OR—Union Carbide Corp	Large process *pressure vessel rupture* from fatigue	480,134
13	9-13-61	AL—Bendix Corp	*Flood* damage, attributed to effects of hurricane Carla, which caused adjoining creek to rise to record high of 44.5 feet.	449,200
14	10-61	SR—E. I. du Pont de Nemours & Co.	Dislocation and fracture of *sluiceways* in reactor effluent canals.	400,000

See footnotes at end of table.

Chart XIV—Continued

AEC INCIDENTS CAUSING OVER $50,000 PROPERTY DAMAGE OR LOSS 1943–1970

Incident No.	Date	Field Office [1]—Contractor	Remarks	AEC Property Damage
15	11- 6-63	RL—General Electric Co	*Explosion* and *fire* in plutonium purification facility. (See TID-5360, Suppl. 5, p. 23; USAEC SERIOUS ACCIDENTS Issue #237, 12-4-64.)	397,000
16	11-20-59	OR—Union Carbide Corp	Chemical *explosion* occurred in processing vessel during cleanout and decontamination procedure. (See TID-5360, Suppl. 3, p. 16; USAEC SERIOUS ACCIDENTS Issue #162, 3-30-60.)	350,000
17	11- 3-64	RL—General Electric Co	Roof *fire* severely damaged aquatic laboratory building.	316,900
18	2-14-66	OR—National Lead Co	Inadvertent *release* of *uranium hexafluoride*. No significant radiation exposures. (See TID-5360, Suppl. 6, p. 32.)	294,826
19	6-10-53	SR—E. I. du Pont de Nemours & Co.	Platform failed, damaging *reactor* actuator rods	270,000
20	1-28-52	RL—General Electric Co	*Fire* destroyed one-story 75' x 140' frame construction warehouse. No sprinklers, (See USAEC SERIOUS ACCIDENTS Issue #21, 3-7-52.)	269,578
21	4-23-50	SAN—Lawrence Radiation Laboratory.	Multistory, unsprinklered frame research building destroyed by *fire*.	258,712
22	4-17-60	RL—General Electric Co	*Fire* involving *spent fuel elements* within process dissolver led to damage of equipment and contamination spread, (See TID-5360, Suppl. 3, p. 20; 1961 NUCLEAR SAFETY, Vol. 2, #4, p. 52.)	250,443
23	9-13-60	SR—E. I. du Pont de Nemours & Co.	*Contaminated cooling water* discharged from canyon onto floor. No overexposures. (See TID-5360, Suppl. 3, p. 22.)	250,050
24	12-29-52	AL—Holmes and Narver	*Typhoon* damage	250,000
25	12-13-63	OR—Goodyear Atomic Corp	*Transformer* in switchyard suffered internal *failure*	244,800
26	5- 4-57	SR—E. I. du Pont de Nemours & Co.	*Leak* in *reactor* heat exchanger resulted in loss of heavy water moderator.	202,000
27	10-29-52	OR—Government	*Fire* following tractor-trailer accident spread to, and ultimately destroyed, cargo and tractor-trailer, Bulk of loss due to self-sustaining combustion of massive uranium. (See TID-5360, p. 45; AECU 3613, p. 9.)	200,000
28	12-26-69	AL—Mason & Hanger—Silas Mason	*High* explosives detonated during remotely-controlled pressing operations.	200,000
29	8-15-58	OR—Union Carbide Corp	Welding sparks ignited fiberboard and *fire* spread rapidly through wood frame building. (See USAEC SERIOUS ACCIDENTS Issue #139, 10-23-58.)	199,923
30	1-20-65	SAN—Lawrence Radiation Laboratory	*Material release* to atmosphere. (See TID-5360, Suppl. 6, p. 16)	185,000•
31	6-21-67	RL—Douglas United Nuclear	Oil *fire* in heat exchanger cell of *reactor*	185,000
32	7- 2-50	OR—Union Carbide Corp	Transformer in main switchyard. *Fire*	171,000
33	8- 6-70	SAN—Lawrence Radiation Laboratory.	Accidental *release* of tritium occurred when automatic safety devices discharged the gas through a 100-foot-high exhaust stack. No overexposures.	165,000•
34	4-23-58	SAN—Lawrence Radiation Laboratory.	Rotor bolt sheared off and got between *generator* rotor and stator, tearing insulation and shorting wiring.	140,000

See footnotes at end of table.

Chart XIV—Continued

AEC INCIDENTS CAUSING OVER $50,000 PROPERTY DAMAGE OR LOSS 1943–1970

Incident No.	Date	Field Office [1]—Contractor	Remarks	AEC Property Damage
35	3–18–60	SR—E. I. du Pont de Nemours & Co.	*Fire* followed a hydrogen-sulfide gas release from a tritium process equipment condenser.	135,300
36	6–17–55	OR—Union Carbide Corp.....	Hydrogen *explosion* occurred in 125,000-gallon evaporator feed tank. (See USAEC SERIOUS ACCIDENTS Issue #86, 9–1–55.)	132,275
37	10–26–61	AL—Sandia Corp. (Sub-Wurlitzer.)	*Fire* followed friction or static ignition of "heat pad paper" containing powdered zirconium. (See TID–5360, Suppl. 4, p. 30.)	131,210
38	8–21–59	SR—E. I. du Pont de Nemours & Co.	Solution *leaked* from loosened flange during maintenance work on waste evaporator in hot canyon, vaporized and *contaminated* a crane. (See TID–5360, Suppl. 3, p. 13; USAEC SERIOUS ACCIDENTS Issue #157, 12–15–59.)	129,423
39	5– 6–65	NY—Harvard University; Massachusetts Institute of Technology.	*Fire* in modulator electrical pulsing equipment for accelerator.	127,000
40	1–23–49	RL—General Electric Co.....	Hexone-nitric acid chemical *explosion* followed by fire seriously damaged building. Spread of contamination was minor factor from loss viewpoint.	125,217
41	1945	AL—Los Alamos Scientific Laboratory.	*Fire* initiating in oil quench tank ignited and spread through frame shop building.	125,000
42	5– 4–70	SR—E. I. du Pont de Nemours & Co.	Solution containing 20 grams of curium-244 and americium-243 was *mistakenly transferred* to the high level (waste) drain. No overexposures.	124,523
43	1946	OR—Mallinckrodt Chemical Works.	Uncontrolled ether-nitric acid *explosion* in uranium solution purification plant.	110,000
44	7–23–57	LAR—General Electric Co.....	Crane overturned while handling a reactor core. Bulk of loss due to damaged *reactor core.*	105,225
45	7–24–64	SR—E. I. du Pont de Nemours & Co.	Radioactive *gas release* accidentally from stack to atmosphere. No property damage or personnel exposures resulted. (See TID–5360, Suppl. 5, p. 35)	102,000*
46	11–10–60	SAN—Lawrence Radiation Laboratory.	*Fire* started in curium processing cave by apparent overheating of oil bath in glovebox. Loss confined to one room, but all contents complete loss. Minor release of radioactive materials to environment. Damage due largely to fire destroying equipment. (See USAEC SERIOUS ACCIDENTS Issues #169, 11–25–60, #175, 4–5–61).	101,000
47	10–30–59	SNR—General Electric Co.	Air-oil *explosion* occurred in air flask component of a 3,000-psi hydraulic oil system. (See USAEC SERIOUS ACCIDENTS Issue #155, 11–19–59.)	100,000
48	11– 8–57	SR—E. I. du Pont de Nemours & Co.	Zirconium-clad fuel element failed under test. A series of complications followed, chief of which was *contaminated water leakage* from earth basin through abandoned construction pipelines. No personnel exposure or property damage.	99,007
49	3–22–70	RL—Battelle Northwest	Estimated 1,000 curie strontium-90 *release* occurred during an attempt to measure the liquid level in a strontium-90 storage tank. No significant exposure.	95,000
50	3–26–63	SAN—Lawrence Radiation Laboratory.	*Criticality* occurred during subcritical experiment involving fissionable materials and small *fire* developed within enclosed concrete vault. (See TID–5360, Suppl. 5, p. 17.)	94,881

See footnotes at end of table.

Chart XIV—Continued

AEC INCIDENTS CAUSING OVER $50,000 PROPERTY DAMAGE OR LOSS 1943–1970

Incident No.	Date	Field Office [1]—Contractor	Remarks	AEC Property Damage
51	2-20-52	SAN—Lawrence Radiation Laboratory.	*Fire* initiating in hot plate in research laboratory broke out in attic and spread through two-story, frame, unsprinklered building.	92,798
52	11-13-63	AL—Mason & Hanger-Silas Mason Co., Inc.	Chemical *explosion* in explosives storage igloo	92,568
53	8- 5-58	RL—General Electric Co	Disintegration of emergency *turbo generator* from overspeed following dual failure of the governor and the overspeed trip devices. (See USAEC SERIOUS ACCIDENTS Issue #142, 1-21-59.)	90,000
54	1-17-59	OR—Union Carbide Corp	Multiple circuit breaker failure led to severe *electrical fire.* (See USAEC ACCIDENT AND FIRE PREVENTION INFORMATION Issue #92, 2-17-59.)	86,020
55	12- 8-54	SR—E. I. du Pont de Nemours & Co.	*Weld failure* in large water pipe at river pumphouse.	81,800
56	11-11-56	SR—E. I. du Pont de Nemours & Co.	Heavy water moderator loss due to *leak* in *reactor* heat exchanger.	80,000
57	8-23-65	RL—Battelle Northwest	Minor *fire* and *explosion* following acetone ignition in glovebox caused extensive contamination spread. (See TID-5360, Suppl. 6, p. 24; USAEC SERIOUS ACCIDENTS Issue #261, 2-15-56.)	76,800
58	5-19-57	AL—Sandia Corp	*Fire* destroyed 36′ x 60′ Butler building. Major damage to generator.	76,120
59	2-13-58	RL—General Electric Co	Chemical *explosion* occurred in silver nitrate reaction vessel used to absorb iodine vapors from process offgases. Incident occurred following introduction of efforts to extend useful life of iodine 131 removal equipment. (See USAEC SERIOUS ACCIDENTS Issue #134, 7-28-58.)	75,700
60	5- 5-65	NV—Reynolds Electrical & Engineering Co.	Drill *rig overturned*	75,000
61	7-31-65	RL—General Electric Co	*Explosion* during manual reignition of oil-fired boiler after flameout during test.	75,000
62	8-31-57	AL—Holmes and Narver	*Helicopter* seriously damaged when dropped while being unloaded by crane from boat.	75,000
63	2- 1-51	OR—Mallinckrodt Chemical Works.	Ether-nitric acid explosion during attempts to remove scale from process tank in uranium solution purification building. (See USAEC SERIOUS ACCIDENTS Issue #2, 2-15-51.)	75,000
64	9-19-64	NV—Reynolds Electrical & Engineering Co.	While electrical cables were being lowered into a test hole, *cable broke* and fell into hole below drill rig. (See TID-5360, Suppl. 5, p. 44.)	74,000
65	12- 2-45	OR—Union Carbide Corp	*Fire* in cork pipe covering in purge and product room.	73,000
66	3-29-57	PNR—Westinghouse Electric Corp.	*Explosion* (pressure rupture) of high pressure autoclave during normal operation due to fatigue resulting from cyclic thermal and mechanical stresses. (See USAEC SERIOUS ACCIDENTS Issue #133, 6-24-58.)	71,500
67	3- 3-67	SR—E. I. du Pont de Nemours & Co.	*Heavy water loss* when water flowed onto reactor top from hydraulic lifting of upper shield plug.	71,000
68	9-21-58	AL—Holmes and Narver	Severe *wave action* from storm resulted in damage to cargo pier, barge slip, and fuel barge.	70,844

See footnotes at end of table.

Chart XIV—Continued

AEC INCIDENTS CAUSING OVER $50,000 PROPERTY DAMAGE OR LOSS 1943–1970

Incident No.	Date	Field Office [1]—Contractor	Remarks	AEC Property Damage
69	12–55	AL—Holmes and Narver	Damage by *wave action* to man-made island	70,000
70	1–18–57	SR—E. I. du Pont de Nemours & Co.	Heavy *water loss* due to leak in heat exchanger for reactor.	70,000
71	8–14/17–61	RL—Government	*Range fire.* Over three-day period, 62 known grass and range fires occurred involving 30,480 acres.	69,866
72	5–47	OR—Union Carbide Corp	*Fire* destroyed two-story, frame, unsprinklered office building.	69,000
73	3–18–69	NV—EG&G; NV—Govt; AL—LASL	*Fire* in electronics laboratory and office trailer	67,900
74	1–22–64 & 3–2–64	RL—Peter Kiewit Sons' Co	*Tunnel collapsed* while backfilling over tunnel roof	66,000
75	6–22–68	RL—Douglas United Nuclear	*Reactor* scrammed	66,000
76	9– 9–57	OR—Goodyear Atomic Corp	*Transformer failure.* No fire. Principal cost for transformer repair.	65,000
77	3–12–67	NV—Reynolds Electrical & Engineering Co.	Trailer *fire* caused by overheating of heater unit	65,000
78	5–16–54	RL—Blaw-Knox	*Fire* followed by sportaneous combustion in janitor's closet, destroying building. (See USAEC SERIOUS ACCIDENTS Issue #67, 7–27–54.)	62,355
79	10–16–59	ID—Phillips Petroleum Co	*Criticality* accident occurred in process equipment waste collection tank. (See TID–5360, Suppl. 3, p. 14; USAEC SERIOUS ACCIDENTS Issue #163, 4–18–60; 1960 NUCLEAR SAFETY, Vol. 1, #3, p. 75.)	61,800
80	2–25–64	AL—Mason & Hanger-Silas Mason Co., Inc.	*Detonation of high explosives* during normal processing operation.	60,400
81	12– 9–56	SR—E. I. du Pont de Nemours & Co.	*Heavy water* moderator *loss* due to leak in heat exchanger for *reactor.*	60,000
82	12– 4–63	AL—Sandia Corp. (Sub-Eagle Picher).	Transporting heat-pad paper in fibre containers to vault; the paper flashed and *fire* spread from paper to other parts of the dryroom adjacent to vault.	58,507
83	1–10–68	AL—Mason & Hanger-Silas Mason Co., Inc.	*High explosives detonated* during remotely-controlled pressing operations.	57,763
84	10–29–61	AL—Government	*Aircraft* struck 500′ radio tower. Tower collapsed and wing tank torn from plane.	57,000
85	6–12–64	AL—Dow Chemical Co	*Explosion* occurred within drybox when burning *plutonium* chips dropped into carbon tetrachloride bath. (See TID–5360, Suppl. 5, p. 32; USAEC SERIOUS ACCIDENTS Issue #246, 3–12–65.)	56,400
86	1–29–66	SR—E. I. du Pont de Nemours & Co.	*Water supply lines* and fire sprinkler lines *froze*	56,000
87	6–20–68	AL—Sandia Corp	*Truck Fire.* Computer and electronic test equipment damaged.	55,673
88	5–17–52	AL—Mason & Hanger-Silas Mason Co., Inc.	*Water damage* due to ruptured 4" waterline	54,000
89	9– 7–55	AL—Reynolds Electrical & Engineering Co.	*Fire* in temporary construction warehouse destroyed frame building housing combustible construction materials. Adjoining acetylene cylinder storage building also destroyed. (See USAEC SERIOUS ACCIDENTS Issue #111, 11–9–56.)	53,608
90	8–25–65	AL—Mason & Hanger-Silas Mason Co.	*Hailstorm damage*	52,537

See footnotes at end of table.

Chart XIV—Continued

AEC INCIDENTS CAUSING OVER $50,000 PROPERTY DAMAGE OR LOSS 1943–1970

Incident No.	Date	Field Office[1] —Contractor	Remarks	AEC Property Damage
91	1-21-66	RL—Douglas United Nuclear	Boiler at *reactor* suffered internal damage from firebox *explosion.*	52,400
92	4- 9-70	CH—Argonne National Laboratory	*Seal plug blown* from research reactor's experimental tube when an experimenter overpressurized the tube during a leak test. No overexposures.	52,300
93	12- 9-63	OR—Goodyear Atomic Corp	*Compressor* in *cell debladed* while onstream. Deblading took place while psi test being conducted, and was accompanied by small fire on exterior of compressor shell.	51,500
94	9-12-70	NY—Princeton Univ. Plasma Physics Lab	*Short circuit* occurred on the secondary side of a power system in a 4160-volt circuit breaker cubicle. Three switchgear units damaged.	51,050
95	4-17-64	RL—General Electric Co	The erroneous placement of some enriched (0.947 %) fuel elements within reactor necessitated *reactor* reloading with attendant increased costs for fuel handling and processing. (See TID-5360, Suppl. 5, p. 28.)	51,000
96	Jan-Feb.	RL—Battelle Northwest	*Flood* damage	51,000
97	6- 5-54	AL—Government	Forest *fire* on an AEC reservation	50,000
98	1-12-53	SR—E. I. du Pont de Nemours & Co.	*Explosive chemical reaction* in evaporator outside building. Minor building and contamination damage. (See TID-5360, p. 58; USAEC SERIOUS ACCIDENTS Issue #41, 3-23-53.)	50,000
99	12- 4-51	RL—General Electric Co	*Fire* of spontaneous origin broke out in nitric acid-saturated combustible waste used for cleaning up *contamination* from prior criticality incident. Extent and magnitude of contamination spread by fire caused abandonment of building. (See TID-5360, p. 53.)	50,000
100	9-29-59	SR—E. I. du Pont de Nemours & Co.	*Hurricane* Gracie damaged storage pond dam wall	50,000
101	6- 5-66	CH—Atomics International	*Sodium leak* occurred in gas-fired sodium heater	50,000
102	6- 2-67	AL—Mason & Hanger-Silas Mason Co.	*High explosives detonated,* cause not determined	50,000

[1] See footnote 1, page 49.
* These property loss figures are based on a current commercial price of about 55¢ per curie of tritium and do not represent the actual classified loss figures.

Section 2

CRITICALITY ACCIDENTS

In the AEC's operational activities (not licensed) for the past 28 years there have been a total of 26 occasions (see Chart XV) when the power level of fissile systems became uncontrollable because of unplanned or unexpected changes in the system reactivity. On three occasions, the power excursions were planned; however, the fission energy released during the excursion was significantly larger than was expected. There have been a total of six deaths attributable to criticality accidents. The property damage resulting from these excursions has been approximately $4,455,000; however, 98% of the property loss was due to the SL–1 reactor excursion.

Further study of this accident record reveals that nine of the unplanned excursions occurred behind heavy shielding and three of them occurred in facilities remotely located with respect to personnel. Hence, the probability of injuries to people was reduced almost to the vanishing point. It is also noted that fourteen of the accidents occurred during experiments, six occurred in production or processing facilities, and five in reactor activities. In these laboratory, production, and reactor facilities there were, respectively, two, one, and three fatalities.

A review of these incidents has been made by W. R. Stratton, University of California, Los Alamos Scientific Laboratory, Los Alamos, N. Mex. All we have done below is to prepare a brief description of each incident.

CHART XV

CRITICALITY ACCIDENTS IN USAEC FACILITIES*

Date	Location	Active Material	Geometry	Total Fissions	Cause	Physical Damage	$ Loss
			METAL SYSTEMS IN AIR				
Aug. 21, 1945	Los Alamos, New Mexico	6.2 Kg δ-phase Pu	Spherical core tungsten-carbide reflected	~10^{18}	Hand stacking reflector	None	–
May 21, 1946	Los Alamos, New Mexico	6.2 Kg δ-phase Pu	Spherical core Be reflected	~8×10^{16}	Hand stacking reflector	None	–
Apr. 18, 1952	The Los Alamos Scientific Lab., New mexico	92.4 Kg uranium metal, 93% U-235	Cylinder unreflected	1.5×10^{18}	Computation error	None	–
Feb. 3, 1954	The Los Alamos Scientific Lab., New Mexico	53 Kg uranium metal, 93% U-235	Sphere unreflected	5.6×10^{18}	Incorrect operation	Slight warping of pieces	$600
Feb. 12, 1957	The Los Alamos Scientific Lab., New Mexico (GODIVA)	54 Kg uranium metal, 93% U-235	Sphere unreflected except for experiment	1.2×10^{17}	Shift of experiment	Warping, oxidation near melting close to center	$2,400
Nov. 10, 1961	The Oak Ridge National Lab., Tennessee	75 Kg uranium metal, 93% U-235		~10^{19}	Too rapid assembly	None	–
Mar. 26, 1963	LRL Livermore Calif.	47 Kg 93% U-235	Cylinder reflected	5×10^{17}	Too rapid assembly	Assembly machine and fire effects	$94,881
			SOLUTION SYSTEMS				
Dec., 1949	The Los Alamos Scientific Lab., New Mexico	~1 Kg U-235 $UO_2(NO_3)_2$ in 18.6 liters water	Sphere graphite reflected	$3–4 \times 10^{18}$	Manual withdrawal of two poison control rods	None	–
Nov. 16, 1951	The Hanford Works, Richland, Washington	1.15 Kg Pu $PuO_2(NO_3)_2$ in 68.8 liters water	Sphere 93% full unreflected	8×10^{18}	Poison control rod run out too fast	None	**
May 26, 1954	The Oak Ridge National Lab., Tennessee	18.3 Kg U-235 UO_2F_2 in 55.4 liters water	Cylindrical annulus unreflected	1×10^{17}	Tilting of inner poison cylinder	None	—
Feb. 1, 1956	The Oak Ridge National Lab., Tennessee	27.7 Kg U-235 UO_2F_2 in 58.9 liters water	Cylinder unreflected	1.6×10^{17}	Falling scram set up waves creating a critical geometry	Warping of bottom of cylinder	—
June 16, 1958	Y-12 Processing Plant, Oak Ridge, Tennessee	2.5 Kg U-235 $UO_2(NO_3)_2$ in 56 liters water	Cylinder concrete reflected below	1.8×10^{18}	Wash water added to $UO_2(NO_3)_2$ solution	None	$1,000
Dec. 30, 1958	The Los Alamos Scientific Lab. New Mexico Pu Processing Plant	8.27 Kg Pu $PuO_2(NO_3)_2$ in ~168 liters water	Cylinder water reflected below	1.5×10^{17}	Agitator created a critical geometry	None	—
Oct. 16, 1959	Chemical Processing Plant, Idaho Reactor Testing Area	34.5 Kg U-235 ~800 liters $UO_2(NO_3)_2$ water	Cylinder concrete reflected below	~4×10^{19}	Solution surged from safe to unsafe geometry	None	$61,800 (to recover contam. solution)
Jan. 25, 1961	Chemical Processing Plant, Idaho Reactor Testing Area	8 Kg U-235 $UO_2(NO_3)$ in 40 liters water	Cylinder	6×10^{17}	Solution pumped from safe to unsafe geometry	None	$6,000
Apr. 7, 1962	Hanford Atomic Products	Pu Solution	Cylinder	8×10^{17}	Solution over flow down unsafe geometry transfer tank		$1000
Jan. 30, 1963	Y-12 Processing Plant, Oak Ridge, Tennessee	3.3 Kg U-233 $UO_2(NO_3)_2$ in 20 liters water	Sphere water reflected	1.1×10^{18}	Solution surged from safe to unsafe geometry	None	—
			INHOMOGENEOUS WATER MODERATED SYSTEMS				
June 4, 1945	Los Alamos, New Mexico	35.4 Kg uranium ~93% U-235 1/2-in. cubes	Pseudosphere water reflected	~8×10^{18}	Water seeping between blocks	None	—
Mar. 20, 1951	The Los Alamos Scientific Lab., New Mexico	2 cylinders uranium 24.4 and 38.5 Kg 93% U-235	2 cylinders water reflected	10^{17}	Scram increased reactivity	Slight oxidation	—
June 2, 1952	The Argonne National Lab.	6.8 Kg U-235 oxide particles in plastic	Inhomogeneous cylinder water reflected	1.22×10^{17}	Manual withdrawal of central safety rod	Plastic destroyed	—
July 22, 1954	The Reactor Testing Area, Idaho Falls, Idaho (BORAX)	U-Al plates clad with Al	Inhomogeneous cylinder water moderated	4.68×10^{18}	Estimate of expected excursion too low	Reactor destroyed intentionally by test	—
Jan. 3, 1961	Idaho Reactor Testing Area (SL-1)	U-Al plates clad with Al	Inhomogeneous cylinder water moderated	1.5×10^{18}	Under study	Extensive to reactor	$4,350,000
			MISCELLANEOUS SYSTEMS				
Feb. 11, 1945	Los Alamos, New Mexico	UH pressed in styrex	Cylinder	~6×10^{16}	Reflector added and/or source too large	UH-styrex cubes swollen and blistered	—
Nov. 29, 1955	Idaho Reactor Testing Area (EBR-1)	1/2-in. U-235 rods	Cylinder, rods cooled by NaK	4.7×10^{17}	Incorrect scram used	Core molten	Not reported
July 3, 1956	The Los Alamos Scientific Lab., New Mexico	58 Kg uranium 93% U-235, 2 and 5 mil foils	Cylinder	3.2×10^{18}	Too rapid assembly	None	—
May 15, 1957	Los Alamos, New Mexico	U-235 in graphite	Cylindrical	4×10^{18}	Improper procedures	None	—

*For additional information on these accidents, see previous TID-5360 series and "A Review of Criticality Accidents" by W. R. Stratton, University of California (LASL).

CRITICALITY EXCURSION INCIDENT

Oak Ridge, Tenn., Jan. 30, 1968

Unexpected criticality was achieved in a volume of an aqueous solution of a salt of U^{238} during a series of routine critical experiments in progress in a well-shielded assembly area of a critical experiments facility. The criticality-radiation alarm system functioned as designed, the evacuation of personnel from the building was prompt and orderly, and the excursion was terminated expeditiously by a negative coefficient of reactivity and was prevented from recurring by the action of the safety devices. The fission yield was 1.1×10^{16}. Gamma-ray sensitive personnel dosimeters read immediately following the excursion showed no direct exposure greater than 5 mr to any person present. There was no property damage or loss of fissile materials. An estimated 100 cm^3 of solution (15 *g* of U) were spilled when a rubber-stoppered connection immediately above the sphere was dislocated.

The purpose of the particular experiment in progress was to establish the critical concentration of a sphere of the solution of uranyl nitrate surrounded by a thick water reflector. In the course of approaching criticality by incremental additions of solution, a small volume of air was observed entrapped in a flexible transparent tube. Supercriticality occurred during an attempt, by remote manipulation of liquid levels, to remove the air.

ACCIDENTAL CRITICALITY EXCURSION

Los Alamos, N. Mex., May 18, 1967

A nuclear excursion of 4×10^{16} fissions took place in the critical mockup of a high power density reactor. There was neither damage to the equipment nor significant exposure to persons; nevertheless, the incident indicated poor practice and an undesirable interpretation of operating procedures which has been corrected. The reactor mockup is fueled with elements composed of fully enriched uranium in a graphite matrix, and a smaller number of graphite moderating elements. This permits a relatively small core volume (250 liters). The core, housed in a graphite cylinder, drops out of its Be reflector for loading. Control and safety drums are within the annular reflector.

Before the incident, fuel along the core axis was replaced by additional moderating elements to investigate flux-trap effects. Instead of the usual step-wise interchange of elements, the entire moderating island was installed. Then, instead of step-wise multiplication measurements while inserting the core into the reflector, which is proper for initial approaches to criticality, there were no measurements during interrupted insertion. It had been inferred from the behavior of different moderating elements in an earlier mockup that the overall reactivity change would be minor. This was a serious mistake, for the actual change proved to be about \$10. Before complete closure was achieved, a very short period and scram (dropping the core and actuating the safety drums) occurred.

NUCLEAR EXCURSION AND FIRE

Livermore, Calif., Mar. 26, 1963

A nuclear excursion and subsequent fire took place during a subcritical experiment in a shielded vault designed for critical assembly experiments. The excursion was estimated at 4×10^{17} fissions and was followed by oxidation of the enriched uranium metal in the assembly.

The cause of the excursion is believed to have been directly attributable to mechanical failure.

The total property loss was \$94,881.

NUCLEAR EXCURSION

Richland, Wash., Apr. 7, 1962

An unplanned nuclear excursion occurred in a plutonium processing facility because of the inadvertent accumulation of approximately 1500 grams of plutonium in 45–50 liters of dilute nitric acid solution in a 69-liter glass transfer tank. The sequence of events which led to the accumulation of the plutonium in the tank cannot be stated positively. However, it is believed that, when a tank valve was opened, the solution from another process vessel overflowed to a sump and was drawn into the transfer tank through a temporary line between this tank and the sump.

When the excursion occurred, radiation and evacuation alarms sounded. All but three employees left the building immediately, according to well-prepared and -rehearsed evacuation plans. Fortunately, they were not in close prox-

imity to the involved system nor in a high radiation field.

The course of the nuclear reaction involved initial criticality (10^{16} fissions); a subsidence; one or more later peaks; and after approximately one-half hour, a declining rate of fission, which terminated in a subcritical condition 37 hours later. The total number of fissions was approximately 8×10^{17}.

Of the 22 persons in the building at the time, only four employees, those who were in the room with the system, were hospitalized for observation. Three of them were the system operators, who were in close proximity to the excursion, and who received estimated radiation doses of 110, 43, and 19 rem. None of them showed symptoms definitely referable to their radiation exposures. The fourth was sent to the hospital only because he was in the room at the time of the incident.

Some fission product activity, airborne via the vent system and the exhaust stack, was detected in the atmosphere for a brief period after the accident. The physical damage amounted to less than $1,000. (See TID 5360, Suppl. 4, page 17.)

NUCLEAR EXCURSION
Oak Ridge, Tenn., Nov. 10, 1961

A criticality excursion occurred as enriched uranium metal, neutron reflected and moderated by hydrogen, was being assembled. The excursion was caused by a too rapid approach

6×10^{17} fissions occurred in a first-cycle product evaporator at a chemical processing plant. The criticality accident resulted when a solution of enriched uranyl nitrate accidentally surged from a geometrically safe section of the evaporator into the upper critically unsafe, vapor disengagement section. The accident occurred behind thick concrete walls in a processing cell which is part of the first cycle for processing highly radioactive spent-fuel elements.

Personnel response to the radiation alarms and the evacuation signal was prompt and orderly.

Analyses of badges from 65 individuals indicated a maximum exposure of 55 millirem gamma and 0 beta. The maximum thermal neutron exposure detected in the badges analyzed was less than 10 millirem. Analyses of nuclear accident dosimeters indicated that there was negligible fast neutron flux associated with personnel exposures.

The radioactivity released to the atmosphere as a result of the accident was about twice normal background when it left the area. Less of $6,000 resulted from cleanup of the incident. (*See* TID–5360, Suppl. 4, p. 9; 1961 *Nuclear Safety*, Vol. 3, #2, p. 71.)

[redacted] EXCURSION
Idaho Falls, Idaho, Jan. 3, 1961

A nuclear excursion occurred within the re-

[redacted]

tion exposures in the range of three to 27 rem gamma radiation total-body exposure. The maximum whole-body beta radiation was 120 rem.

Some gaseous fission products, including radioactive iodine, escaped to the atmosphere outside the building and were carried downwind in a narrow plume. Particulate fission material was largely confined to the reactor building, with slight radioactivity in the immediate vicinity of the building.

The total property loss was $4,350,000. (*See* TID–5360, Suppl. 4, p. 8; 1962 *Nuclear Safety*, Vol. 3, #3, p. 64.)

CRITICALITY INCIDENT
Idaho Falls, Idaho, Oct. 16, 1959

A nuclear incident occurred in a process equipment waste collection tank when an accidental transfer was made of about 200 liters of uranyl nitrate solution, containing about 34 kilograms of enriched uranium (91 percent U^{235}), from critically safe process storage tanks to a geometrically unsafe tank through a line formerly used for waste transfers.

Limited visual inspections and test indicated that no significant property damage or loss resulted beyond the approximately $60,000 cost to recover contaminated uranium solution resulting from the incident.

Of the 21 personnel directly involved in this incident, seven received external exposures to radiation. The exposures were 8, 6, 3.95, 1.50, 1.38, 1.17, and 1.17 rem. Two individuals also received external exposures to the skin of 50 rem and 32 rem. No medical treatment was required for the 21 personnel involved. (*See* TID–5360, Suppl. 3, p. 14; *USAEC Serious Accidents* Issue #163, 4–18–60.)

FATAL INJURY ACCOMPANIES CRITICALITY ACCIDENT
Los Alamos, N. Mex., Dec. 30, 1958

The chemical operator introduced what was believed to be a dilute plutonium solution from one tank into another known to contain more plutonium in emulsion. Solids containing plutonium were probably washed from the bottom of the first tank with nitric acid and the resultant mixture of nitric acid and plutonium bearing solids was added to the tank containing the emulsion. A criticality excursion occurred immediately after starting the motor to a propeller type stirrer at the bottom of the second tank.

The operator fell from the low stepladder on which he was standing and stumbled out of the door into the snow. A second chemical operator in an adjoining room had seen a flash, which probably resulted from a short circuit when the motor to the stirrer started, and went to the man's assistance. The accident victim mumbled he felt as though he was burning up. Because of this, it was assumed that there had been a chemical accident with a probable acid or plutonium exposure. There was no realization that a criticality accident had occurred for a number of minutes. The quantity of plutonium which actually was present in the tank was about ten times more than was supposed to be there at any time during the procedure.

The employee died 35 hours later from the effects of a radiation exposure with the whole-body dose calculated to be 12,000 rem ±.

Two other employees received radiation exposure of 134 and 33 rem, respectively. Property damage was negligible. (*See* TID–5360, Suppl. 2, p. 30; *USAEC Serious Accidents* Issue #143, 1–22–59.)

NUCLEAR EXCURSION
Oak Ridge, Tenn., June 16, 1958

A nuclear accident occurred in a 55-gallon stainless steel drum in a processing area in which enriched uranium is recovered from various materials by chemical methods in a complex of equipment. This recovery process was being remodeled at the time of the accident.

The incident occurred while they were draining material thought to be water from safe 5-inch storage pipes into an unsafe drum.

Eight employees were in the vicinity of the drum carrying out routine plant operations and maintenance. A chemical operator was participating in the leak testing which inadvertently set off the reaction. He was within three to six feet of the drum, while the other seven employees were from 15 to 50 feet away.

Using special post hoc methods for determining the neutron and gamma exposures of the employees involved, it was estimated that the eight men received: 461 rem, 428 rem, 413

rem, 341 rem, 298 rem, 86 rem, 86 rem, and 29 rem.

Area contamination was slight, with decontamination costs amounting to less than $1,000.

During this incident 1.3×10^{18} fissions occurred. (*See* TID–5360, Suppl. 2, p. 25; *USAES Serious Accidents* Issue #136, 8–25–59; *USAEC Health and Safety Information* Issue #82, 9–5–58; 1959 *Nuclear Safety*, Vol. 1, #2, p. 59.

GODIVA EXCURSION
Los Alamos, N. Mex., Feb. 12, 1957

The "Godiva" assembly was to be used to irradiate uranium-loaded graphite samples. The samples were to be heated in a shielded furnace, exposed to a "prompt" burst of neutrons and then transferred to a counter for evaluation. The experiments are conducted at an isolated site in a building separated from the control room and all personnel by about a quarter of a mile.

On the occasion of the accident, preliminary bursts were being produced. In the process of lowering the top safety block, an unexpected burst occurred that was estimated to have produced 1.2×10^{17} fissions. The energy was great enough to tear the uranium parts from the assembly, knocking one to the floor, and to distort the steel rods in the frame. The uranium was deformed and there was much more surface oxidation than usual.

There were no personal injuries or overexposures. No gamma radiation above background was detected outside the reactor building. Radiation levels in the building were high initially . . . seven roentgens per hour gamma just inside the door (12′ from Godiva) and 5,000 to 20,000 counts per minute (per 55 cm² probe) alpha on horizontal surfaces about the room; therefore cleanup procedures were delayed 2½ days until they could be completed without unnecessary exposure to cleanup personnel.

The total property loss was estimated at $2,400. (*See* TID–5360, Suppl. 2, p. 18; *USAEC Health and Safety Information* Issue #75, 1–8–58.)

HONEYCOMB EXCURSION
Los Alamos, N. Mex., July 3, 1956

Too rapid assembly caused the system to become promptly critical. The burst yield was 3.2×10^{16} fissions.

There were no radiation exposures nor any property damage as a result of the incident.

EXPERIMENTAL REACTOR
Oak Ridge, Tenn., Feb. 1, 1956

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

No serious exposures resulted, since all personnel were shielded by a minimum of five feet of concrete. There was no significant property damage and all uranium was recovered. (*See* TID–5360, Suppl. 1, p. 5.)

CORE MELTDOWN
Idaho Falls, Idaho, Nov. 29, 1955

The Experimental Breeder Reactor (EBR–I) was undergoing a series of experiments.

Without modification, certain safety instrumentation would not permit the conduct of the experiment; therefore, reliance was placed on manual control to shut down the reactor.

During an experiment, the scientist in charge told the operator to press the "emergency reactor off" button. This would have instantaneously removed sufficient reactivity. Owing to a misunderstanding, the operator began by withdrawing the control rods at normal speed. This allowed the reactor to reach a higher power than anticipated and resulted in consequent melting of the fuel elements.

Shortly after the accident, there was a rise in the radiation level in the building. The building was evacuated. There were no personnel injuries. There was minor contamination of the sodium potassium coolant. (*See* TID–5360, p. 30.)

BORAX I EXPLOSION
Idaho Falls, Idaho, July 22, 1954

Destruction of the Borax I Reactor released

135 MW-sec of fission energy.

More than 200 safety experiments were made on the Borax I Reactor simulating control rod accidents. For the last test, conditions were set up so that the reactor would be run to destruction.

The tests were carried out by withdrawing four of the five control rods far enough to make the reactor critical at a very low power level. The fifth rod was then fired from the core by means of a spring. In this test, the rod was ejected in approximately 0.2 seconds. After the control rod was ejected, an explosion took place in the reactor which carried away the control mechanism and blew out the core. At half a mile, the radiation level rose to 25 mr/hr. Personnel were evacuated for about 30 minutes.

No one was injured and the destruction of the reactor was part of the cost of the experiment. (*See* TID–5360, p. 29.)

EXCURSION IN AN ENRICHED URANIUM WATER SOLUTION

Oak Ridge Tenn., May 26, 1954

The experiment in progress at the time of the incident was one in a series designed to study criticality conditions of uranium-water solutions in annular cylindrical containers.

The cause of the accident was a displacement of the central tube, effectively a poison rod, to a region of less importance. This displacement resulted from a dislocation of the positioning spider by a pin, used to connect sections of the liquid level indicator rack, protruding beyond the side of the rack and engaging a leg of the spider as the indicator was raised. Removing the compressional force from the top of the central tube allowed it to fall against the inside of the 10-inch cylinder. Although the displacement was small, it was sufficient to cause a large increase in the effective neutron multiplication.

The safety system apparently operated normally and the reaction was stopped automatically. All personnel in the building during the incident were protected by a minimum of five feet of concrete shielding; therefore, no serious exposures were incurred. (*See* TID–5360, p. 18.)

SUPERCRITICALITY EXPERIMENT

Los Alamos, N. Mex., Feb. 3, 1954

The incident occurred in the course of an extensive study of the properties of supercritical radiation bursts produced by an assembly of fissionable metal. This study was covered by a specific procedure. A reference check of critical conditions preceded each supercritical burst.

To attain rapidly sufficient power for a delayed critical check, it was customary to set control rods at the position of minimum reactivity and insert a reactivity booster in the form of a fissionable metal slug. This time, when the booster was inserted, radiation indicators and the assembly temperature recorded went offscale (to return in a few minutes), and scrams were actuated. The resulting shock separated parts of the assembly and damaged steel supporting members.

There was no injury. The property loss was an expenditure of $600 for repair of the assembly. (*See* TID–5360, p. 9.)

SUDDEN INCREASE IN REACTIVITY DURING CONTROL ROD TESTS

Lemont, Ill., June 2, 1952

Manual withdrawal of a control rod from a critical assembly caused an accidental supercriticality.

The operation being conducted was the comparison of a series of newly manufactured control rods. The assembly had been operated with the standard control rod. It was then shut down by inserting all control rods and draining the water moderator, a standard safe method of shutting down the assembly when core changes are to be made. The standard rod was removed and the first of the series of control rods to be tested was inserted.

The assembly was filled with water with the test control rod fully in and the standard type control rods fully inserted. Withdrawal of one of the standard control rods 32 centimeters caused the assembly to become critical and the power was leveled off while the desired measurements were made. The control rod was then reinserted into the original "in" position.

With the water still in the assembly, the four members of the crew then went into the assembly room for the purpose of replacing the control rod which they had just tested. The group

leader went up on the platform, reached out with his right hand and started to pull out the tested rod. As soon as he had withdrawn it about one foot, the center of the assembly emitted a bluish glow and a large bubble formed. Simultaneously, there was a muffled explosive noise. The group leader let go of the control rod which he was removing and it fell back into position. The crew left the assembly room immediately and went to the control room.

Four employees received radiation exposures ranging from 12 to 190 rem. (*See* TID–5360, p. 23.)

CRITICALITY RESULTS FROM ERROR IN CALCULATIONS

Los Alamos, N. Mex., Apr. 18, 1952

Two stacks of fissionable disks were being built up stepwise to give a slightly subcritical assembly with the two stacks brought together by remote control. The individual stacks were built up by hand in fixed assemblies and the two stacks brought together only by remote mechanisms.

After two members of the operating crew calculated erroneously from previous steps that one more disk could be added safely, the disk was added and, with attempted caution, the system was assembled remotely. Radiation indicators went off-scale, actuating scrams, neutron counters jammed, and a puff of smoke was observed on the television viewer. Within three to five minutes indicators and counters returned to operating ranges.

There was no injury, no loss of material, no damage to facilities, and negligible loss of operating time. (*See* TID–5360, p. 7.)

EXCURSION IN A PLUTONIUM NITRATE SOLUTION

Richland, Wash., Nov. 16, 1951

Upon completion of volume measurements, it was thought that some additional information as to the required dilution could be determined by finding where criticality might occur on the rods. The control rod was pulled first with very minor reactivity effect. Following this, the safety rod was withdrawn intermittently at high speed (2.3"/sec). A waiting period for the delayed neutron effect of about 15 seconds was made just prior to the incident. This was too short a time to determine whether or not the assembly was critical. The operators next heard the safety controls actuate, instrument indicators moved offscale, scalers jammed, and the most startling manifestation was that of the breakdown of "counters" playing back through the public address system. The portable "Juno" in the control room was offscale. Presumably, a further rod withdrawal had been made.

There were no injuries. The building was successfully decontaminated, except for the test room and assembly. Before decontamination of this area was completed, a fire occurred and, subsequently, the building was abandoned because of the respread of contamination. (*See* TID–5360, p. 14.)

SCRAM MECHANISM CAUSES CRITICALITY

Los Alamos, N. Mex., Mar. 20, 1951

Interactions between two masses of fissionable material in water were measured at progressively decreasing horizontal separations. Remotely controlled operations established the desired horizontal separation of the two components and flooded the system.

After the final measurement, the system was "scrammed" (a rapid disassembly mechanism was actuated). Safety monitor indicators went off scale, neutron counters jammed, and the television viewer indicated steaming. Within a few minutes, indicators and counters returned to operating ranges and indicated a rapid decay of radiation.

There was no injury, no loss of material, and no damage to facilities. (*See* TID–5360, p. 13.)

CRITICALITY DURING CONTROL ROD TESTS

Los Alamos, N. Mex., December 1949

The reactor was being remodeled for higher power operation. As part of the required alterations, two new control rods had been placed in the system in addition to the three existing control rods.

The employee who had built the rod control mechanism wanted to test the comparative fall times of these new rods. He opened the enclosure on top of the reactor and manually lifted the rods, neglecting the possibility that this would affect the reactivity of the reactor because of its higher power arrangement. Here-

tofore, the three existing rods were sufficient for safety.

Normally, rods are raised remotely from the control room when the control panel is activated by a key switch. Since the rods were pulled out manually with the panel being off, no equipment was turned on except a direct reading temperature meter. Therefore, there were no neutron sensitive devices to record or warn of a rise in the neutron level. It was not observed until after the incident that the reactor temperature had risen about 25° centigrade.

The removal of the two rods probably gave a ΔK of about 0.86 percent, producing an initial period of about 0.16 second. Since the measured temperature coefficient is approximately —0.034 percent k/C°, the observed temperature rise indicates the rods were out sufficiently long so that the reactor was stopped by the negative temperature coefficient.

There were no injuries. The employee doing the work received 2.5 rem of gamma radiation according to his film badge. There was no damage done to the reactor and no loss of active material. (*See* TID–5360, p. 21.)

INADVERTENT SUPERCRITICALITY RESULTS IN DEATH

Los Alamos, N. Mex., May 21, 1946

A senior scientist was demonstrating the technique of critical assembly and associated studies and measurements to another scientist. The particular technique employed in the demonstration was to bring a hollow hemisphere of beryllium around a mass of fissionable material which was resting in a similar lower hollow hemisphere.

The system was checked with two one inch spacers between the upper hemisphere and the lower shell which contained the fissionable material; the system was subcritical at this time.

Then the spacers were removed so that one edge of the upper hemisphere rested on the lower shell while the other edge of the upper hemisphere was supported by a screwdriver. This latter edge was permitted to approach the lower shell slowly. While one hand held the screwdriver, the other hand was holding the upper shell with the thumb placed in an opening at the polar point.

At that time, the screwdriver apparently slipped and the upper shell fell into position around the fissionable material. Of the eight people in the room, two were directly engaged in the work leading to this accident.

The "blue glow" was observed, a heat wave felt, and immediately the top shell was slipped off and everyone left the room. The scientist who was demonstrating the experiment received sufficient dosage to result in injuries from which he died nine days later. The scientist assisting received sufficient radiation dosage to cause serious injuries and some permanent partial disability.

The other six employees in the room suffered no permanent injury. (*See* TID–5360, p. 4.)

FATALITY FROM CRITICAL MASS EXPERIMENTS

Los Alamos, N. Mex., Aug. 8, 1945

During the process of making critical mass studies and measurements, an employee working in the laboratory at night alone (except for a guard seated 12 feet away) was stacking blocks of tamper material around a mass of fissionable material.

As the assembly neared a critical configuration, the employee was lifting the last piece of tamper material which was quite heavy. As this piece neared the setup, the instrument indicated that fission multiplication would be produced, and as the employee moved his hand to set the block at a distance from the pile, he dropped the block, which landed directly on top of the setup.

A "blue glow" was observed and the employee proceeded to disassemble the critical material and its tamper. In doing so, he added heavily to the radiation dosage to his hands and arms.

The employee received sufficient radiation dosage to result in injuries from which he died 28 days later.

The guard suffered no permanent injury. (*See* TID–5360, p. 2.)

UNANTICIPATED CRITICALITY IN WATER-SHIELDED ASSEMBLY

Los Alamos, N. Mex., June 4, 1945

An experiment was designed to measure the critical mass of enriched uranium when surrounded by hydrogenous material. The enriched uranium was in the form of cast blocks of the

metal, ½"×½"×½" and ½"×½"×1". The blocks were stacked in a pseudospherical arrangement in 12 courses in a 6"×6"×6" polyethylene box. The voids in the courses were filled with polyethylene blocks of appropriate dimensions. The polyethylene box was supported by a 2-foot-high stool within a 2 foot cubical steel tank. The tank had a 2 inch opening in the bottom through which it could be filled and drained by means of supply and drain hoses attached to a ¾-inch tee. The opening in the tank was fitted with a shutoff valve, as was the drain hose. A polonium beryllium source of about 200 mc strength was placed on top of the assembly. A fission chamber and a boron proportional counter were used to follow the experiment.

The immediate supervisor was absent from the scene when the experiment was begun. According to one of the operators, the water level was raised above the polonium beryllium source with the supply valve almost fully open. At this point, a slight increase in counting rate was observed, which corresponded with what had been observed previously when the source alone was immersed in water. A few seconds later, the counting rate began to increase at an alarming rate.

At this point, the supervisor returned, walked to within three feet of the tank and noted a blue glow surrounding the box. Simultaneously, the two operators were hastily closing the supply valve and opening the drain valve. The building was evacuated.

The three individuals involved received excessive radiation exposures, estimated in two cases as about 66.5 rem and in the third as 7.4 rem. The doses delivered to the head and neck of these individuals may have been considerably greater. They were hospitalized for observation, but no untoward symptoms appeared. No significant changes in blood counts were observed, and sperm counts on one occasion, sometime after the incident, were normal. It is not believed that the individuals concerned received any significant radiation damage. There was no damage to equipment, no loss of active material, and no local contamination problem. (*See* TID–5360, p. 10.)

DRAGON REACTOR EXCURSION
Los Alamos, N. Mex., Feb. 11, 1945

This was the first reactor designed to generate prompt power excursions. Prompt critical was obtained by dropping a slug of UH$_3$ in styrex through a vertical hole in a small assembly of the same material, which was diluted with polyethylene and reflected by graphite and polyethylene. Near the end of the planned sequence of burst of increasing power, a 6×10^{18} fission burst blistered and swelled the small cubes comprising the assembly matrix. No material was lost, there was no contamination, and there were no exposures.

PART V

BEST NO-INJURY RECORDS KNOWN IN AEC ACTIVITIES

The following list, broken down into the six principal categories of work involved in the AEC's activities, shows the names of the top three contractors and field offices completing the largest number of continuous man-hours in their category without a disabling injury.

Contractor or Field Office and Location	Man-Hours	Dates
Production:		
E. I. du Pont de Nemours & Co., Inc., Aiken, S.C.	28,872,156*	6/24/67 to 12/31/70
The Dow Chemical Co., Rocky Flats Division, Golden, Colo.	24,295,842	5/17/57 to 7/10/62
The Dow Chemical Co., Rocky Flats Division, Golden, Colo.	19,816,996	9/ 6/66 to 12/31/70
Research:		
Westinghouse Electric Corp., Bettis Atomic Power Laboratory, West Mifflin, Pa.	19,194,917	10/27/62 to 11/22/65
Sandia Corp., Albuquerque, N. Mex.	14,936,169	7/15/59 to 9/ 6/63
Phillips Petroleum Co., Idaho Falls, Idaho	12,921,162	12/ 5/62 to 1/12/66
Services:		
EG&G, Inc., Las Vegas, Nevada	2,475,000	11/10/69 to 6/28/70
Lucius Pitkin, Inc., Grand Junction, Colo.	2,305,288	12/12/63 to 12/31/70
The Zia Co., Los Alamos, N. Mex.	1,480,774	11/23/51 to 7/ 5/55
Construction:		
E. I. du Pont de Nemours & Co., Inc., Augusta, Ga.	4,251,396	2/26/57 to 12/30/57
E. I. du Pont de Nemours & Co., Inc., Augusta, Ga.	3,130,361	2/22/54 to 11/ 7/51
Peter Kiewit Sons' Co., Portsmouth, Ohio	3,225,180	3/31/53 to 3/25/55
Architect-Engineering:		
Ebasco Services, Inc., New York, N.Y.	1,522,000	11/17/60 to 12/11/70
Hanford Engineering Services, Richland, Wash.	1,142,862	5/15/63 to 3/31/67
Fenix & Scisson, Inc., Las Vegas, Nevada	974,000	7/23/58 to 12/31/68
Government:		
Richland Operations Office	4,844,125	3/28/51 to 3/10/58
Idaho Operations Office	4,301,826	1/22/62 to 5/ 1/66
Chicago Operations Office	3,721,454	11/23/57 to 12/ 3/64

*Record continuing as of 12/31/70

APPENDIX A

FATALITIES

Manhattan Engineer District, Atomic Energy Commission
1943–1970

BRIEF DESCRIPTIONS OF FATALITIES

MED–AEC 1943–1970

No.	Date	Field Office [1] & Facility [2]	Remarks
1	4–15–43	ALA–C	A plumber drowned when the driver of a pickup truck in which ten men were riding, lost control of the truck and it overturned, landing in a water-filled drainage ditch.
2	5– 3–43	CL–C	A laborer was crushed to death when he walked in front of a moving Caterpillar tractor.
3	5– 5–43	CL–C	While working under a railway cement car, a laborer was crushed to death when a mechanical failure caused the brakes to release the car and it ran over him.
4	5–29–43	HA–C	While a truck driver was servicing a dump truck with the bed in the raised position, the bed dropped, crushing his chest.
5	7–26–43	HA–C	While a tractor was being operated, it dropped into an unbarricaded gravel pit, crushing the driver, a mechanic.
6	7–26–43	CL–C	While working on a scaffold, bricklayer suffered a broken neck when he was thrown 10′ to the ground after the staging collapsed.
7	7–28–43	HA–C	A heavy equipment operator was crushed by a Caterpillar when it dropped off the edge of the working area, throwing him onto the Caterpillar track which carried him over the front of the track and ran over him.
8	7–28–43	CL–C	A lineman was electrocuted while working on a transformer platform when he placed his hand, protected by a canvas glove only, on a primary bushing which connected directly to an insulated neutral bus.
9	8–16–43	CL–C	A laborer was decapitated by a Caterpillar drawn scraperpan which ran over him after he had slipped in soft dirt and fallen in the track of the machine.
10	8–17–43	WR–C	A painter died of multiple internal injuries from a 25′ fall to the ground when stepping through a door into a room where the temporary flooring had been removed, preparatory to the installation of the permanent flooring.
11	8–19–43	CL–C	An oiler was crushed to death under the wheels of a railway freight engine where he was thrown from a truck. The driver of the truck had started across the tracks at a railway crossing after the engine had passed, when the engine suddenly backed up and struck the truck.
12	9– 9–43	CL–C	A brakeman was crushed to death under the wheels of a railway freight engine where he had fallen when he slipped while crossing in front of the drawbar.
13	10– 3–43	HA–C	The driver of a water truck stopped by the roadside to offer assistance to another trucker. The driver of a third truck, attempting to avoid a head-on collision, veered, striking both of the standing drivers, resulting in the death of the water tank driver from multiple internal and skeletal injuries. The other driver fractured both legs.
14	10–16–43	HA–C	A lineman, in changing his position on a pole, erroneously thought his safety belt had "clicked" shut, and fell 26′. He died from a fractured skull and brain injury.
15	11– 2–43	CL–C	While standing on wet ground, a crane oiler was electrocuted when the crane boom contacted overhead wires.
16	11– 9–43	HA–C	A truckdriver was riding in a tractor with an inexperienced driver. The tractor skidded, causing the trailer to push the truckdriver into a windshield frame. He died four days later as a result of a crushed chest and a collapsed lung caused by the accident.
17	11–17–43	CL–C	A laborer was burned to death when his oil splashed clothing ignited after he had thrown fuel oil on an open fire. He increased the intensity of the flames by running through an open field for help.
18	11–20–43	HA–C	During the unloading of heavy structural steel from a freight car, a 24′ steel column fell on a rigger, crushing his chest cage.
19	11–29–43	CL–C	A laborer's chest was crushed when a wall section of an unshored 8-foot trench in which he was working caved in and covered him with dirt.
20	1– 4–44	CL–C	The skull of a laborer was fractured when he was thrown from the bed of a convoy truck, with no tailgate, after the driver hit a small depression in a dirt road, causing the truck to lunge to one side.
21 22 23 24	1–13–44	HA–C	The collision of two onsite railroad trains, operating in a fog, resulted in the deaths of two engineers, a conductor and a fireman from multiple internal and skeletal injuries.
25	2–11–44	CL–C	Fatal injuries were suffered by a welder when the chain hoist broke and the suspended station wagon, under which he was working, fell across his back.
26	2–14–44	CL–C	The skull of a carpenter was fractured as the result of a 10′ fall from a ladder after the ground, which had been frozen when the ladder was put in place, thawed sufficiently to allow one of the footings to settle and the ladder to slip.
27	2–29–44	IO–O	A chemist was working on an experiment when a chemical explosion took place. He died of multiple internal injuries.
28	3–31–44	CL–C	A carpenter received a fractured skull and brain injury when he fell 8′, striking his head against a 12′x12′ piece of lumber.

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
29	3-24-44	CL–C	While standing near a crane, a carpenter was electrocuted when the crane boom contacted high voltage wires.
30	5- 2-44	CL–C	During a welding operation in an elevator shaft, an ironworker was fatally burned in an explosion caused by a spark from his welding torch igniting oxygen remaining after the air had been purged.
31	5- 4-44	CL–C	When a truck driver lost control of the truck he was driving, it overturned and he was crushed under it.
32	5- 9-44	CL–C	A truckdriver was crushed between the seat and the steering wheel of the Dumpster he was operating when a dump truck backed into him.
33	5-27-44	CL–C	While standing on the unplaced end of a 24' steel I-beam, an ironworker received fatal head and neck injuries when the beam end sheared off when he struck it with his sledge hammer to force it into place, causing him to fall into the angle formed by the beam and the upright column.
34	6-12-44	DE–C	An electrician was fatally injured by receiving an electric shock caused by short in a rectifier.
35 36 37 38 39	6-14-44	HA–C	Five welder chippers were crushed to death when a 49-ton steel tank fell upon them when its shoring failed.
40	6-22-44	HA–C	While standing on a 4' pipe, a carpenter foreman fell 23'. He died the following day of a fractured skull and brain injury received from the fall.
41	7-11-44	CL–C	When a sheet metal worker crawled through an opening in the roof to pry open a hatch cover, he fell 35' through transite flooring to the cell floor. He died from a fractured skull and brain injury.
42	7-15-44	CL–C	An electrician was electrocuted while standing adjacent to exposed leads operating an electrical testing machine, when he threw the switch on the tester, energizing the cables, and his leg came into contact with the leads.
43	7-17-44	HA–C	A machine operator was crushed between two 9400-lb. concrete pipes, while engaged in storing the pipe.
44	7-22-44	HA–O	While driving a pickup truck at a high rate of speed, the driver, an instrument engineer, was thrown from the truck and killed when it turned over twice. He died of multiple internal and skeletal injuries.
45 46 47	8-12-44	CL–C	Three crew members disappeared (presumed dead) when an airplane was lost. Numerous searching missions failed to yield any evidence of plane or crew.
48	8-17-44	CL–O	An electrician was electrocuted when he climbed upon the top of the cab in the course of repairing a crane and fell into a 440-volt bus.
49	10-14-44	CL–C	A cement finisher received a fractured skull and brain injury from a 28½' fall through the transite cover over a floor opening.
50	10-19-44	CL–C	A boilermaker received a fractured skull and brain injury in a 35' fall to a concrete floor when he lost his balance.
51	10-25-44	CL–O	After testing motor field coils for faulty insulation, an electrician failed to open the switch to disconnect the current and was electrocuted when he removed the electrodes simultaneously with both hands.
52	11- 6-44	CL–O	A low-voltage panel cover had been removed and the leads within the cubicle extended outside. A serviceman, holding the leads in his hand, was startled when they contacted, creating an arc, causing him to strike his knee against the energized cubicle, resulting in his electrocution.
53	11-11-44	CL–C	When an ironworker lost his hold while descending between two joists from a scaffold, he fell 11' to a concrete floor, fracturing his skull.
54 55	1-15-45	CL–C	An ironworker and an inspector were crushed to death when a boom collapsed and the load and boom fell on them.
56	1-18-45	CL–C	When a carpenter placed his hands, bearing the weight of his body, on the unsupported end of a scaffold, it tilted, throwing him 18' to the floor below. He died from a fractured skull and brain injury.
57	1-22-45	CL–O	A millwright was burned to death when he drew gasoline from a welding generator into a metal pail, which contacted the energized terminal on the starter motor, causing a spark to ignite the gasoline.
58	2- 6-45	CL–O	A millwright died as the result of the inhalation of chemical fumes while replacing a plug cock in a distillation line.
59	4- 5-45	CL–C	An electrician was electrocuted when his arm contacted exposed terminals as he was drilling a hole in a panel box.
60	5- 8-45	CL–O	A process operator was electrocuted when his arm made contact with a metal part of a circuit while he was cleaning glass in a tank.
61	6- 4-45	CL–C	An ironworker rigger was electrocuted when the rigging swung into a 13,800-volt powerline as he was steadying the load by holding to the choker line.

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
62	6–11–45	CL–O	A carpenter was electrocuted while repairing a door hinge on an inoperative unit when he removed the insulated barrier from the adjacent operating unit and reached through the opening to tighten the nut holding the hinge assembly, and his hand contacted the current-carrying part.
63	7– 2–45	CL–C	The chest cage of a rigger was crushed when a crane boom fell on him.
64	7–23–45	CL–O	A painter was electrocuted when he lost his balance, and grasped a 460-volt trolley line and an I-beam and fell 9′ to the floor.
65	8– 4–45	CL–O	An electrician was electrocuted while repairing a light fixture when he contacted the circuit through the pliers in his right hand and the conduit in his left hand.
66	8– 7–45	SF–G	A carpenter was crushed to death when a bulldozer, being used to push dirt onto the roof of a leanto shelter, was run onto the top of the shelter, collapsing the roof and burying him in the dirt that caved in.
67	8– 8–45	SF–O	A physicist, working alone at night, caused an inadvertent criticality, which resulted in his receiving radiation from which he died 28 days later. (See TID–5360, p. 2).
68	9–12–45	HA–C	While riding in the back of a pickup truck, a laborer received fatal internal injuries when he was thrown out of the truck when it was hit by another truck.
69	9–21–45	CL–C	A steamfitter was about to ascend a stairway when a piece of angle iron fell 35′ from the floor above, fracturing his skull.
70	10– 9–45	CL–C	An electrician was electrocuted while conducting a dummy load test at a tank that had not been de-energized. He neglected to use ground hooks before entering the unit, and his hand contacted the current when he attempted to attach the dummy load cable.
71	11–14–45	CL–O	While working in a dimly lighted area, an inspector stepped into a duct to inspect a fan, unaware that the grating had not been installed, and fell 15′ through the opening to the floor.
72	11–19–45	CL–O	A baker was electrocuted while working in his bare feet washing the floor and hosing down the walls of a bakeshop when he contacted current from a defective ungrounded pedestal electric fan.
73	2– 5–46	SF–G	A blacksmith was struck by a truck.
74	3–19–46	SL–C	While installing a light fixture, an electrician fell approximately 7½′ from a scaffold. He died from a fractured skull and brain injury.
75	4– 4–46	CL–G	A guard drowned when he lost control of the jeep he was driving and ran off a bridge into a creek.
76	5–21–46	SF–O	While demonstrating the technique of critical assembly, an inadvertent criticality occurred, resulting in the death nine days later of the demonstrator, senior scientist. (See TID–5360, p. 4).
77	7– 1–46	SF–O	A truckdriver was killed when his truck turned over.
78	8– 2–46	SF–O	An engineer was killed as the result of a chemical explosion.
79	8– 7–46	SF–O	A tractor driver died from multiple internal injuries when he lost control of the tractor he was driving.
80	8–10–46	HA–G	A pilot was killed in an airplane crash.
81	10– 7–47	OR–O	An electrician was electrocuted when he contacted a 460-volt line which he assumed to be de-energized.
82	11–13–47	SF–O	An ironworker was electrocuted when a crane beam came into contact with a high tension line while he was attempting to block up the outriggers of the crane.
83	11–28–47	OR–C	An oiler received fatal second and third degree burns when the hose from a gasoline tank truck sprayed gasoline on him, as well as on the surrounding area, after which fire from a nearby salamander ignited the gasoline.
84	1943–46	SF–O	A junior scientist received chronic beryllium poisoning as a contractor employee between 1943 and 1946. He died in December 1947.
85	3–18–48	SF–O	Speeding while driving resulted in an automobile accident which pinned the driver under the automobile. He died of a skull fracture and brain injury.
86	3–29–48	HA–C	A truckdriver was pinned between the body and the frame of a concrete dump truck when the elevated body fell. He died of multiple internal and skeletal injuries.
87	4– 9–48	OR–C	A runaway gondola car containing sand pinned a bin operator, working on a nearby cement car, under its wheel crushing his chest.
88	6–26–48	SF–O	A lineman was electrocuted while climbing a pole.
89	7–31–48	HA–O	The driver of a weapons carrier was pinned between the ground and the rim of the steering wheel when the carrier went out of control and landed in a ditch. He died from a skull fracture and a crushed chest.

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
90	9–25–48	SF–C	An ironworker was electrocuted during the installation of electrical cables.
91	11–22–48	HA–G	A motor vehicle collision resulted in internal injuries to a records analyst. He died from pneumonia complications of his injuries five days later.
92	11–25–48	OR–O	During horseplay, a guard accidentally shot another guard in the abdomen, thinking the gun was unloaded.
93	12–13–48	OR–C	An air tool operator and a pipelayer died of suffocation as the result of the cave-in of a newly-dug trench.
94			
95	6–20–49	SF–C	A truckdriver was killed when the truck he was driving hit debris in the roadway and went out of control. The driver jumped from the truck and the truck passed over his body, crushing him.
96	6–29–49	CH–O	While working in a pit of a power plant steamline, a steam valve broke, enveloping a maintenance man in steam, resulting in fatal second and third degree burns.
97	8–26–49	SF–C	When a scaffold rope broke, a painter fell 26′ to the bottom of a steel tank, striking his head, causing a basal skull fracture.
98	11–14–49	OR–O	A laborer died of multiple internal injuries received when he got caught between a truck and a loading platform.
99	11–23–49	HA–C	A piledriver operator fell 4′ into a river and drowned.
100	12– 1–49	SF–C	During the construction of a building wall, one section fell, killing an ironworker and injuring six others.
101	2–11–50	SF–G	Two security guards were killed in an airplane crash.
102			
103	4– 6–50	SF–C	A deckhand received foot injuries when his foot was caught between the deck of a boat and the guardrail of a tug. Complications of the injuries caused his death.
104	6–23–50	OR–C	A laborer, cleaning cement residue from supporting beams while standing on a ladder, fell 18′, striking his head on the concrete floor, causing a basal skull fracture.
105	8– 2–50	OR–C	An ironworker foreman was electrocuted when a crane boom contacted overhead energized wires as he was making a hitch.
106	8–31–50	SF–G	A warehouseman was riding on the running board of a pickup truck. When it became evident that the truck was going to collide head-on with a bus, the warehouseman either jumped or fell from the truck into the path of the bus. He died of the internal injuries received.
107	9–21–50	OR–O	A tractor, being driven by a farm laborer, got out of control, turned over and crushed him to death.
108	11–29–50	SF–C	While working in a pipe trench, an air tool operator was crushed by a 16″ pipe falling on him.
109	1– 2–51	SF–C	A painter fell 45′ from a scaffold fracturing his skull. (See USAEC SERIOUS ACCIDENTS Issue #1, 1–24–51.)
110	1–23–51	SF–C	A carpenter fell 23′ from a fire tower striking the base of his skull on a concrete pad. (See USAEC SERIOUS ACCIDENTS Issue #2, 2–15–51.)
111	2– 9–51	OR–O	A rigger died as a result of injuries received when his head was caught between two switchgear cabinets being loaded on a railroad car. (See USAEC SERIOUS ACCIDENTS Issue #2, 2–15–51.)
112	3– 8–51	OR–C	While lowering a transformer section, a lineman's hands slipped off the hoist handle, which swung upward and struck him under the right eye. He died as a result of head and neck injuries. (See USAEC SERIOUS ACCIDENTS Issue #3, 3–16–51).
113	3–18–51	SNR–O	A laboratory employee was asphyxiated by the accidental presence of nitrogen in a process air line to which his respirator was attached. (See TID–5360, p. 9; USAEC SERIOUS ACCIDENTS Issue #4, 4–10–51).
114	3–20–51	OR–C	A truck driver was electrocuted when a crane boom came into contact with an energized electric powerline while he was helping adjust the cables of the crane.
115	3–20–51	ID–C	While working on a water tower, a welder fell 15′ when a truck was driven over a cable supporting the platform upon which he was standing, breaking the cable. He died of a fractured skull and brain injury. (See USAEC SERIOUS ACCIDENTS Issue #5, 4–12–51).
116	4–11–51	SF–O	A painter died after using carbon tetrachloride in cleaning procedures prior to spraying with paint. (See USAEC SERIOUS ACCIDENTS Issue #8, 6–20–51).
117	6–25–51	OR–C	During the cleaning procedures of a condenser being installed, the use of carbon tetrachloride resulted in the death of a millwright.
118	7–23–51	SR–C	A steamfitter suffered a heatstroke while helping to hook up a river suction pump.

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
119 120	7-27-51	SF–C	The head-on collision of two 5,000-gal. water tank trucks crushed the bodies of both drivers. (See USAEC SERIOUS ACCIDENTS Issue #10, 8-24-51).
121	8-13-51	OR–C	During the unloading of crane sections from a boxcar with a winch truck, one load fell on an ironworker foreman, resulting in his death from a skull fracture and brain injury. (See USAEC SERIOUS ACCIDENTS Issue #12, 10-4-51).
122	8-13-51	SF–C	A mechanical engineer's chest was crushed when a dump truck he was directing backed over him.
123	8-24-51	OR–O	A lineman fell 15' while checking the output current of a lighting transformer. He died from a fractured skull and brain injury.
124	10-13-51	OR–C	While working 22½' aboveground, a carpenter stepped on a faulty board and fell, dying two days later as a result of head and brain injuries received in the fall.
125	10-20-51	OR–C	When a sheetmetal worker stepped on an unsupported piece of metal roofing, he fell 41', resulting in his death from multiple internal and skeletal injuries.
126	10-29-51	ID–C	The wall of a warehouse under construction was blown over by high winds, pinning a carpenter underneath it. He died as the result of a broken neck. (See USAEC SERIOUS ACCIDENTS Issue #14, 1-3-52).
127	11-14-51	SR–C	A traffic clerk was killed when the car he was driving got out of control and dropped into a 6' ditch. He died from a crushing injury to his chest with total transection of the aorta.
128	11-14-51	SF–C	A laborer was suffocated when he was buried alive under loose earth which was pushed down upon him by a bulldozer.
129	11-21-51	CH–O	A machinist was electrocuted when the boom of a crane came into contact with a live powerline as he lifted a floodlight from a truck, the current traveling through the boom and truck. (See USAEC SERIOUS ACCIDENTS Issue #16, 1-11-52).
130	11-23-51	SR–C	An ironworker fell 70' when the unfastened board he was standing on was pushed off its bearing by the reactionary force of the impact wrench he was using. He died from a comminuted basal skull fracture. (See USAEC SERIOUS ACCIDENTS Issue #17, 1-14-52).
131	12- 7-51	OR–C	An ironworker died from a skull fracture and brain injury in a 22' fall onto a concrete floor. (See USAEC SERIOUS ACCIDENTS Issue #17, 1-14-52).
132	12-14-51	SR–C	A carpenter died from a broken neck in a 28' fall when he removed a piece of plywood covering from a floor opening, and fell through the hole to the concrete floor below. (See USAEC SERIOUS ACCIDENTS Issue #17, 1-14-52).
133	1-30-52	OR–C	A pipefitter's head was crushed when a dumptruck backed over him.
134	3-13-52	SF–O	A truckdriver died of a compound fractured skull when a large magnet fell on him.
135	3-21-52	OR–C	An ironworker was electrocuted when a crane hit live electric wires while he was guiding the crane with his hand on the load.
136	3-27-52	SF–C	A heavy equipment foreman died of multiple internal and skeletal injuries when the track of a heavy crane passed over him. (See USAEC SERIOUS ACCIDENTS Issue #25, 6-23-52).
137	5-26-52	SF–C	An ironworker was crushed between the counterweight of a crane and the angle iron at the equipment box on the truck chassis of the crane. (See USAEC SERIOUS ACCIDENTS Issue #25, 6-23-52).
138	7- 3-52	SF–C	An ironworker was electrocuted when the boom of a crane came into contact with a temporary distribution line while he was handling a steel column suspended from the crane.
139	8-11-52	SF–C	While repairing a boat, a mechanic was electrocuted while handling an electric pump.
140	9- 4-52	OR–C	A painter was killed, during the moving of a scaffold, when he fell 45' to the concrete floor, fracturing his skull. (See USAEC SERIOUS ACCIDENTS Issue #35, 1-7-53).
141	9-18-52	GJ–O	An equipment operator apparently fell asleep while driving a jeep and was killed when the jeep struck a bridge abutment. He died of a skull fracture and brain injury. (See USAEC SERIOUS ACCIDENTS Issue #31, 10-15-52).
142	9-29-52	OR–C	A laborer hauling concrete fell 29' when a concrete-hauling cart started moving backward, causing him to be pushed off the platform on which he was standing. He died of a skull fracture and brain injury.
143	11- 8-52	OR–C	A crane flagman was struck by a dirt-loading truck when he stepped in its path after signaling its driver to proceed. He died of multiple internal injuries.
144	1-14-53	OR–C	While repairing a road scraper, which was blocked up, a welder was pinned under the machine when the blocking gave way. He died two days later from multiple internal injuries.
145	3- 6-53	SR–C	While spray-painting a pump intake basin, two employees received fatal second and third degree burns during a

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
146			flash fire, probably caused by the ignition of the flammable solvent in the paint by an open light bulb. (See USAEC SERIOUS ACCIDENTS Issue #42, 3–24–53).
147	3–17–53	OR–C	The right wheels of a dump truck ran over an operating engineer when he stepped into its path as it was backing up. He died of multiple internal injuries.
148	4–27–53	HA–C	An equipment operator was crushed against a concrete basin wall by the counterweight of a crane. (See USAEC SERIOUS ACCIDENTS Issue #49, 6–30–53).
149	6–16–53	HA–C	A rigger died as the result of multiple internal injuries received in a fall from a flatbed truck.
150	6–20–53	OR–C	A truckdriver was standing beside a truck crane when the crane swung around, struck him in the head, and threw him between the counterweight and the truck cab, crushing his head (compound fracture of the skull). (See USAEC SERIOUS ACCIDENTS Issue #49, 6–30–53).
151	9–15–53	OR–C	A pipefitter was crushed between the counterweight and frame of a crane truck. (See USAEC SERIOUS ACCIDENTS Issue #56, 12–15–53).
152	9–19–53	HA–C	While working on steel girders at the 90′ level and attempting to move a scaffold plank, it swung upward, striking a steel construction foreman in the face, throwing him off balance and he fell. He died of multiple internal and skeletal injuries.
153	10–15–53	SR–C	An ironworker fell 50′ while engaged in removing an air duct. He died as a result of a fractured skull and brain injury.
154	10–30–53	HA–C	An operator received a compound skull fracture when the bulldozer he was driving overturned, pinning him underneath. (See USAEC SERIOUS ACCIDENTS Issue #54, 12–2–53).
155	1–14–54	OR–C	An ironworker fell 21′ from a steel girder while engaged in bolting procedures. He died of a fracture at the base of his skull.
156	1–29–54	HA–C	An electrician fell 9′ from a scaffold. He died as a result of a fractured skull and brain injury. (See USAEC SERIOUS ACCIDENTS Issue #62, 3–22–54).
157	2–18–54	SF–C	An electronics technician was electrocuted while disconnecting an energized 110-volt power lead when his body came into contact with grounded equipment. (See USAEC SERIOUS ACCIDENTS Issue #66, 7–7–54).
158 159	3–15–54	NY–O	Two pilot plant operators died as a result of second and third degree burns received in a chemical explosion. (See USAEC SERIOUS ACCIDENTS Issue #63, 6–9–54.)
160	3–17–54	NY–C	A crane backed over an oiler, crushing his entire body.
161	5– 5–54	OR–C	A laborer's chest and trunk were completely crushed between a dump truck tailgate and a Gradall while giving a truck driver signals.
162	5–19–54	OR–C	A welder fell from the roof, through a ventilator shaft, 82′ to the ground, receiving multiple internal and skeletal injuries from which he died two days later.
163	5–24–54	HA–C	A cement finisher fractured his skull in a 25′ fall through an access hole to a concrete floor.
164	6– 5–54	GJ–C	A laborer's chest and trunk were completely crushed between the boom of a crane and the forms into which he was helping to pour concrete.
165	7–30–54	OR–O	A lineman was electrocuted while working on a street lighting circuit from the platform of a ladder truck.
166	8– 9–54	OR–O	A plumber received fatal injuries (crushed chest and lacerations of left lung) when he fell 38′ from a 24″ pipe.
167	8–11–54	SF–O	A supervisory employee broke his neck in a 25′ fall from a built-in iron ladder to the concrete floor in a power generating plant.
168	8–18–54	OR–O	An electrician was electrocuted while handling a 115-volt extension cord.
169 170	9– 7–54	SR–O	Two maintenance mechanics, removing a blank flange from a rundown tank, released toxic gas and scalding liquid resulting in extensive second and third degree burns of their entire bodies, causing their deaths. (See USAEC SERIOUS ACCIDENTS Issue #72, 10–19–54).
171	10–12–54	OR–O	A chemical operator fell 20′ to a concrete floor. He died as a result of a fractured skull and brain injury. (See USAEC. SERIOUS ACCIDENTS Issue #79, 3–21–55).
172	11–16–54	OR–C	While climbing a ladder, a pipefitter fell 17′ to the concrete floor below, fracturing his skull and causing brain injury.
173	4– 2–55	SF–C	An asbestos worker received a fractured skull when he was struck on the head by a piece of 4″ iron pipe thrown from the top of a water tower 30′ above ground.

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
174	5- 2-55	OR–C	An ironworker received a compound fractured skull and brain injury when he slipped from a ladder, falling 50' to the concrete floor.
175	6- 6-55	SF–G	An equipment operator was crushed to death when a pickup truck he was driving turned over, pinning him in the truck.
176	7-29-55	SF–O	A hot-mix plant operator was electrocuted when he touched the load and the load line cable of the crane contacted an overhead powerline.
177	8-30-55	HA–O	An explosion occurred in an electric furnace, causing hot dry salt to be blown into the face of the operator, who died as a result of second and third degree burns. (See USAEC SERIOUS ACCIDENTS Issue #88, 10–14–55.)
178	9- 9-55	GJ–O	A utility man suffocated in a fine ore bin while trying to determine why the ore was not feeding into the conveyor belt when an undetermined area gave way, killing him by suffocation. (See USAEC SERIOUS ACCIDENTS Issue #98, 3–22–56).
179 180	10–16–55	OR–O	Two chemical operators suffocated in a tank during degreasing operations involving the use of Freon–113. (See USAEC SERIOUS ACCIDENTS Issue #91, 11–30–55).
181	11–22–55	NY–O	A cyclotron operator was electrocuted while investigating the cause of the trouble in a modulator circuit. (See USAEC SERIOUS ACCIDENTS Issue #96, 3–19–56).
182	11–25–55	HA–O	A coal handler suffocated when the coal slid, covering him, as he prodded it with a bar. (See USAEC SERIOUS ACCIDENTS Issue #98, 3–22–56).
183	4–11–56	OR–C	During the installation of girders, an ironworker was thrown off balance as a crane load dropped suddenly, causing him to fall 17' to the ground. He died as a result of a broken neck.
184 185	5–14–56	OR–O	Zirconium drums exploded, followed by fire, resulting in second and third degree burns to two salvage handlers, both of whom died as a result of their burns. (See USAEC ACCIDENT AND FIRE PREVENTION INFORMATION Issue #44, 6–20–56).
186	6–26–56	AL–O	The accidental detonation of an experimental explosive caused fatal multiple blast injuries to a technician.
187	7- 2-56	NY–O	A chemical engineer died as a result of extensive second and third degree burns received in a fire following a thorium explosion. (See TID–5360, Suppl. 1, p. 16; USAEC SERIOUS ACCIDENTS Issue #107, 8–20–56).
188	7–24–56	AL–C	A labor relations director was killed when the car he was driving overturned on a curve. He died from a crushed chest and internal injuries.
189	8–26–56	CH–O	An ironworker was electrocuted when a truck crane struck and broke an overhead high-voltage line. (See USAEC SERIOUS ACCIDENTS Issue #112, 11–16–56).
190	9–19–56	AL–O	A pipefitter received internal crushing injuries when a truck backed over him while he was working on a hydrant. (See USAEC SERIOUS ACCIDENTS Issue #113, 12–7–56).
191	1–29–57	OR–C	A millwright was electrocuted while helping to move a cover plate assembly fixture into position when it came into contact with two power cables. (See TID–5360, Suppl. 2, p. 7; USAEC SERIOUS ACCIDENTS Issue #120, 5–17–57).
192	3–11–57	OR–C	A rigger was electrocuted when a boom on a crane contacted a 13,800-volt feeder line while he had hold of a pipe being lifted by the crane. (See TID–5360, Suppl. 2, p. 8).
193	6–22–57	AL–O	A surveyor was killed when his body was thrown 40' from a car which overturned several times after he lost control of it. He died from multiple skull and internal injuries. (See TID–5360, Suppl. 2, p. 8).
194	8- 1-57	GJ–G	A geologist died of multiple skull and internal injuries received in an airplane crash. (See TID–5360, Suppl. 2, p. 9).
195	12- 4-57	SR–O	An area engineer was thrown out of the car he was driving when it collided with a train, which he apparently did not see until it was too late. He died of multiple skull and internal injuries. (See TID–5360, Suppl. 2, p. 9).
196	1–13–58	WASH–G	A project officer was killed in a motor vehicle accident.
197	4- 7-58	SAN–O	A nuclear physicist was drowned when a helicopter crashed in the ocean. (See TID–5360, Suppl. 2, p. 10).
198	6–17–58	AL–C	A laborer died from a fractured skull and brain injury when two tons of rock fell on him. (See TID–5360, Suppl. 2 p. 10).
199	8–25–58	AL–C	A lineman was electrocuted while chipping rust on a switch. (See TID–5360, Suppl. 2, p. 11).
200	12–18–58	OR–C	A laborer was asphyxiated when trapped under 192 cubic feet of earth when a trench wall toppled. (See TID–5360, Suppl. 2, p. 11).
201	12–30–58	AL–O	A chemical operator died as the result of radiation received during a criticality accident. His whole-body exposure was 12,000 rem ±50%. (See TID–5360, Suppl. 2, p. 30; USAEC SERIOUS ACCIDENTS Issue #143, 1–22–59).
202 203	2–24–59	AL–O	A machine operator and a toolmaker were blown to fragments when the explosives they were machining detonated. (See TID–5360, Suppl. 3, p. 26).

See footnotes at end of table.

BRIEF DESCRIPTIONS OF FATALITIES—Continued

MED–AEC 1943–1970

No.	Date	Field Office [1] & Facility [2]	Remarks
204	4–10–59	HA–C	While attempting to move himself along a 4" pipe which he was straddling, a boilermaker rigger lost his balance and fell 50'. He died from a skull fracture and brain injury. (See TID–5360, Suppl. 3, p. 27; USAEC SERIOUS ACCIDENTS Issue #146, 7–15–59).
205	5–13–59	ID–C	When the overhead tielines of the scaffold upon which a sheetmetal man was working were removed, the scaffold crashed to the concrete floor, causing him to fall 60'. He died from multiple internal and skeletal injuries. (See TID–5360, Suppl. 3, p. 27; USAEC SERIOUS ACCIDENTS Issue #146, 7–15–59).
206	8– 7–59	OR–C	An electrician was electrocuted while attempting to start an arc welder at a time when the ground was wet and charged with electricity. (See TID–5360, Suppl. 3, p. 28; USAEC SERIOUS ACCIDENTS Issue #149, 10–9–59).
207 208 209 210	10–14–59	AL–O	Four laborers were killed while unloading explosives scraps at a burning ground when the explosives inadvertently exploded. They died from multiple blast injuries. (See TID–5360, Suppl. 3, p. 29).
211	12– 2–59	AL–O	A medical administrator was killed in an automobile collision when an oncoming car tried to pass another vehicle and hit his car head on. He died from multiple internal injuries. (See TID–5360, Suppl. 3, p. 29).
212	12–18–59	CH–O	A reactor assembly inspector was asphyxiated while taking measurements, without proper respiratory equipment on the bottom of an argon-filled pit. (See TID–5360, Suppl. 3, p. 30; USAEC SERIOUS ACCIDENTS Issue #159, 1–18–60).
213	12–23–59	AL–C	A broken pendant line on a crane caused a one-cubic-yard bucket of concrete to fall on a laborer, crushing him. (See TID–5360, Suppl. 3, p. 31).
214	1–29–60	AL–O	A skindiver, engaged in placing dynamite charges under water, drowned. (See TID–5360, Suppl. 3, p. 31).
215	3–18–60	AL–C	A kitchen helper slipped while carrying a 20-gal. container of hot soup, and died of uremia, a direct complication of the burns he received. (See TID–5360, Suppl. 3, p. 32).
216	4–12–60	NY–C	A carpenter, while standing on a 36" wall, lost his balance and fell 20' to a concrete floor. The cause of death was a fractured cervical vertebrae and a crushed chest. (See TID–5360, Suppl. 3, p. 32).
217	8–31–60	ID–C	A painter, engaged in painting railings, ladders and cages on a silo, fell 70' to the ground. He died from a skull fracture (See TID–5360, Suppl. 3, p. 33).
218 219 220	1– 3–61	ID–O	All three members (military) of an operating crew were killed when a reactor excursion occurred. The three men died of multiple blast skeletal and internal injuries. (See TID–5360, Suppl. 4, p. 1962 NUCLEAR SAFETY, Vol. 3 #3, p. 64).
221	1–24–61	AL–O	While working atop a bunker, a physics laboratory technician lost his balance and fell backward over the edge of the bunker 10' to a concrete pad. He died of severe brain damage and brain hemorrhage resulting from the fall. (See TID–5360, Suppl. 4, p. 27; USAEC SERIOUS ACCIDENTS Issue #173 2–24–61).
222	2– 2–61	AL–O	A technician died of multiple internal injuries received in a head-on collision when the car he was driving veered (cause unknown) to the wrong side of the road. (See TID–5360, Suppl. 4, p. 28).
223	2–14–61	AL–O	A fabrication technician was asphyxiated by solvent vapors (methyl chloroform) while working alone inside of a vacuum annealing furnace shell. (See TID–5360, Suppl. 4, p. 28; USAEC SERIOUS ACCIDENTS Issue #174, 2–28–61).
224 225	2–10–61	OR–C	While two tower erectors were helping to erect the top beam section of an instrument tower, the top 70' of the tower broke off, catapulting both employees 145' to the ground. One employee died from a broken neck the day of the accident; the other employee died almost a year later from complications of internal injuries received from the fall. (See TID–5360, Suppl. 4, p. 29).
226	2–16–61	PNR–C	While engaged in painting a ceiling, the scaffold upon which a painter was standing collapsed, and he fell 15' to the

No.	Date	Field Office [1] & Facility [2]	Remarks
231	8-23-62	OR-C	A pipeman's chest cage was crushed when a large, solid section of a trench caved in upon him. (See TID-5360, Suppl. 4, p. 32; USAEC SERIOUS ACCIDENTS Issue #183, 6-1-62).
232	8-29-62	CH-C	A pipefitter fractured his skull in a 21' fall while walking on an 18" pipe. (See TID-5360, Suppl. 4, p. 32).
233	6-20-62	OR-O	While two coal handlers were using rods to break a bridge formation in a coal pile, the pile suddenly gave way, the men were covered with coal; one escaped, the other died of suffocation. (See TID-5360, Suppl. 4, p. 32).
234	8-15-62	OR-O	An electrical maintenance supervisor died nine days after receiving second degree burns when an explosion occurred during routine maintenance of a circuit breaker tank. (See TID-5360, Suppl. 4, p. 33; USAEC SERIOUS ACCIDENTS Issue #189 11-19-62).
235	10- 7-62	NV-O	A fireman was thrown out of a power wagon when it overturned. He died of a fractured skull and a brain injury (See TID-5360, Suppl. 4, p. 33).
236	1- 5-63	CH-O	A shift supervisor died of internal injuries and a basal skull fracture resulting from a 54-foot fall when he stepped backward into an open shield plug hole while giving signals to a crane operator. (See TID-5360, Suppl. 5, p. 39;- USAEC SERIOUS ACCIDENTS Issue #204, 5-13-63).
237	2-16-63	NV-C	During excavation work, a construction worker was crushed by a Caterpillar when the entire length of the Caterpillar tread ran over his body, causing multiple internal injuries. (See TID-5360, Suppl. 5, p. 40).
238	4-30-63	OR-O	While testing an ion source on a developmental power supply, a physicist was electrocuted. (See TID-5360, Suppl. 5, p. 40).
239	6-25-63	SNR-C	A carpenter fell 65' from a cooling tower. The cause of death was a compound fractured skull, broken neck and multiple internal injuries with massive hemorrhage. (See TID-5360, Suppl. 5, p. 40).
240	6-25-63	NY-O	While an operator's helper was kneeling on the top of a box, being moved by a forklift truck, to counterbalance the overhanging weight, the box tipped forward and he fell to the ground, He was reported to have died of a pulmonary embolism 17 days after the accident. (See TID-5360, Suppl. 5, p. 41; USAEC ACCIDENTS Issue #218, 11-8-63).
241	7-23-63	OR-C	An apprentice pipefitter was asphyxiated while checking for an inert gas leak in a valve pit. (See TID-5360, Suppl. 5 p. 42; USAEC SERIOUS ACCIDENTS Issue #223, 4-3-64).
242	8- 1-63	OR-C	While an ironworker was climbing down a rolling-type scaffold, the scaffold began to swing and fold, finally toppling to the floor. He held on until the scaffold was about halfway down, then fell the remaining distance to the concrete floor, dying five days later as a result of multiple skull fractures. (See TID-5360, Suppl. 5, p. 42; USAEC SERIOUS ACCIDENTS Issue #218, 2-14-64).
243	7-10-63	NV-C	A custodial employee suffered a fatal pulmonary embolism as the result of injuries (femoral vein thrombosis) received in an automobile accident three months earlier. (See TID-5360, Suppl. 5, p. 41).
244	9-26-63	AL-O	When a truck backed over a can of paint thinner, the can ruptured, spraying the contents on a laborer's clothing. Flames from a dump fire ignited his coveralls, and he died about six weeks later as a result of the chemical burn received. (See TID-5360, Suppl. 5, p. 42).
245	3-11-64	SAN-O	An electronics coordinator died as the result of a skull fracture received when the car in which he was driving overturned when he failed to manipulate a curve. (See TID-5360, Suppl. 5, p. 43; USAEC SERIOUS ACCIDENTS Issue #234, 10-23-64).
246	4-21-64	NV-C	A teamster was crushed to death beneath an 8,000-gallon water tanker which he was driving when it got out of control. (See TID-5360, Suppl. 5, p. 44).
247	7- 1-64	AL-C	A roofer died three days after a fall 22' from a flat roof from injuries sustained in the fall. (See TID-5360, Suppl. 5, p. 44).
248	9-19-64	NV-C	Electrical cables were being lowered into an underground complex when a drill rig cable broke causing the cable spools to be jerked from their racks. Four men were hit by the spools, one receiving extensive head and chest injuries from which he died. The other three received multiple contusions and abrasions. (See TID-5360, Suppl. 5, p. 44).
249	9-23-64	SAN-C	A drill rig crew member was electrocuted when a rig boom contacted overhead electric powerlines. (See TID-5360, Suppl. 5, p. 45; USAEC SERIOUS ACCIDENTS Issue #238, 12-15-64).
250	12-15-64	NV-C	When a drill rig assembly failed, allowing the swivel assembly pipe to fall, the rig operator was killed instantly from a crushing blow on the head. (See TID-5360, Suppl. 5, p. 46).
251	12- 8-64	RL-O	A track maintenance man died two weeks after an accident in which the maintenance car in which he was riding had a head-on collision with a locomotive. He died from a fractured skull and brain injury. (See TID-5360, Suppl. 5, p. 45).
252	1-28-65	NV-C	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 depressed occipital skull fracture with a 4" laceration of the scalp. (See TID-5360, Suppl. 6, p. 49).

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
253	2-23-65	NV–C	A wireman foreman was electrocuted while working in a switchgear cabinet. (See TID–5360, Suppl. 6, p. 41).
254	6-14-65	OR–O	A lineman was fatally injured when he fell 18' from an electric pole to the sidewalk. Investigation revealed that his body belt was unbuckled. The cause of death was a fractured skull. (See TID–5360, Suppl. 6, p. 41; USAEC SERIOUS ACCIDENTS Issue #252, 8–27–65).
255	6-21-65	NV–C	An employee suffered fatal injuries when he fell 24' from a derrick platform to a concrete pad. The cause of death was severe depressed skull fracture, frontal region; multiple fractures both arms; possible internal injuries. (See TID–5360, Suppl. 6, p. 41).
256	7- 5-65	NY–O	An explosion and fire occurred in the experimental hall of an accelerator complex. Eight persons were injured, one of whom died fifteen days later as the result of third-degree burns over 60% of the body and of a ruptured liver. (See TID 5360, Suppl. 6, p. 42; TID–22594).
257	12-23-65	SAN–C	A six-ton concrete plank fell, seriously injuring one employee and crushing another to death. (See TID–5360, Suppl. 6, p. 43).
258	1-11-66	NV–C	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 TID–5360, Suppl. 6, p. 44.)
259	1-12-66	SNPO–N–C	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 TID–5360, Suppl. 6, p. 44; USAEC SERIOUS ACCIDENTS Issue #263, 5–27–66).
260	5- 1-66	AL–O	An employee died from crushing injuries to chest and head in a head-on motor vehicle collision while driving a Government-owned car. (See TID–5360, Suppl. 6, p. 45).
261	5-26-66	AL–C	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' to the bottom of the tank. The cause of death was a fractured skull. (See TID–5360, Suppl. 6, p. 45).
262	6-10-66	NV–C	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 sand bags. (See TID–5360, Suppl. 6, p. 46).
263	6-17-66	NY–G	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 TID–5360, Suppl. 6, p. 47).
264	6-24-66	SAN–C	An employee was killed when the dirt loader he was operating overturned and crushed him. (See TID–5360, Suppl. 6, p. 47).
265	9-22-66	AL–C	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 TID–5360, Suppl. 6, p. 48).
266	10-12-66	AL–C	An electrician was electrocuted while working alone on a transformer. (See TID–5360, Suppl. 6, p. 49).
267	3-11-67	SR–O	During normal railroad car switching movements, an employee fell under a moving train and was decapitated. Since there were no witnesses, the cause was not determined.
268	4- 5-67	AL–O	When his foot slipped while servicing a tractor, an employee fell 7' to the ground. Surgery was performed the following day to pin the fracture of neck of left femur that resulted from the fall. He appeared to be recovering satisfactorily when he died unexpectedly five days after the accident of a pulmonary embolism secondary to the injury sustained.
269	4-10-67	AL–O	A painter fell 14' from a roof to the ground when, apparently, he slipped on a freshly painted area. He died six days later of a fat embolism secondary to fractures of the pelvis and arm.
270	4-14-67	RL–C	A clamshell bucket assembly toppled over, striking an employee on the neck and shoulder and driving him to the ground, the arm of the assembly coming to rest on his chest. He died immediately. Post mortem examination revealed the cause of death as ruptured aorta at aortic arch. (See USAEC SERIOUS ACCIDENTS Issue #282, 7-28-67).
271	5-25-67	SNPO–C–O	A laboratory technician was found dead inside a core leaching furnace. Evidence indicates the employee climbed down into the furnace to retrieve a brush. Death was due to resultant asphyxiation from fumes.
272	6- 9-67	SAN–O	A fireman was helping to unload a firefighting vehicle from a trailer. It is not known what happened; however, evidence indicated that he jumped from the trailer truck, crashing into the windshield of a passing police car. The fatal injuries were a fracture of the base of the skull and a broken neck.
273 274	6-30-67	NV–C	Two miners were working at the bottom of a 3,200-foot hole when, without warning, a strong surge of muck and water flowed into their working area. One miner drowned immediately; the other was found alive, buried up to his neck in the muck and water, but drowned before he could be extricated.

See footnotes at end of table.

No.	Date	Field Office [1] & Facility [2]	Remarks
275	7- 8-67	NV-C	An employee was steadying a row of 21 stored doors while another employee removed two of them. The doors suddenly shifted and fell over on the first man, crushing his head against shelving behind him. He was pronounced dead at the scene. The cause of death was multiple skull fractures with severe intracerebral hemorrhages causing central respiratory paralysis.
276	7-17-67	ID-C	A carpenter fell more than 13' when he attempted to climb down on the forms inside a containment vessel under construction. He was found conscious, although paralyzed completely from the neck down. He suffered severe neck, back, and leg injuries, in addition to shock, and he died the next day.
277	8-17-68	OR-C	A road grader operator was crushed to death when a road roller overturned and rolled over him.
278	8-19-68	RL-C	A driller's helper was buried in a cave-in which occurred during a hole-digging operation.
279	11-14-68	NV-C	An aftercooler on an air compressor ruptured violently, resulting in the death of a mechanic who was struck by flying debris.
280	3-13-69	NV-C	An electrician was electrocuted while working on a 4160-volt line.
281	6-10-69	NV-C	One of four cables supporting a platform became detached, allowing two workers on the platform to fall. One of the workers was seriously injured and died two days later.
282	6-16-69	CH-C	A carpenter was fatally injured when he fell through a floor opening at the site of a proposed stairwell from which a temporary covering had been removed.
283	10-23-69	NV-C	An employee was killed while standing at the bottom of an elevator shaft when a section of pipe fell down the shaft and struck him.
284	12-10-69	NV-C	An employee was electrocuted when the boom of a crane struck overhead wires.
285	1-23-70	NV-C	A miner was fatally injured when he attempted to leave an elevator cage while it was descending. He was struck by the cage before it could be stopped.
286	2- 2-70	NV-C	An employee was killed when a pipe rolled off a truck, crushing him.
287 288	3-10-70	AL-G -G	Two government employees were killed in the crash of a private airplane which they were using for official business.
289	3-23-70	NV-C	While responding to a call, an ambulance aidman was killed when he fell from the side door of the vehicle, which was traveling over 60 m.p.h.
290	4- 8-70	CH-C	An employee was fatally injured due to a fall through an opening between floor joists.
291	6-11-70	NV-C	An engineer drowned while scuba diving alone.
292	7- 2-70	NV-C	An employee was killed when the pickup truck he was driving left the road at a high rate of speed, rolled over, and threw him from the vehicle.
293 294 295	11-25-70	WASH/-NV-G -G -C	An AEC Commissioner and his aide, as well as a contractor employee, were killed in a small aircraft as it crashed into Lake Mead and disintegrated.

[1] Field Offices:
ALA—Alabama Ordnance Works
AL—Albuquerque Operations Office
BH—Brookhaven Office
CH—Chicago Operations Office
CL—Clinton Engineer Works
DE—Decatur Area
GJ—Grand Junction Office
HA—Hanford Operations Office
ID—Idaho Operations Office
IO—Iowa Area
NV—Nevada Operations Office
NY—New York Operations Office
OR—Oak Ridge Operations Office
PNR—Pittsburgh Naval Reactors Office
RL—Richland Operations Office (Formerly HA)
SAN—San Francisco Operations Office
SF—Santa Fe Operations Office
SNPO-C-Space Nuclear Propulsion Office—Cleveland
SNPO-N-Space Nuclear Propulsion Nevada
SNR—Schenectady Naval Reactors Office
SR—Savannah River Operations Office
WASH—Washington Headquarters
WR—Wabash River Ordnance Works.
[2] Facilities: C—Construction G—Government O—Operation.

APPENDIX B

RADIATION EXPOSURES OVER 15 REM

(Whole-Body)

Atomic Energy Commission 1947–1970

FATAL RADIATION EXPOSURE ACCOMPANIES CRITICALITY ACCIDENT

Los Alamos, N. Mex., Dec. 30, 1958—12,000 (±50%), 134, and 53 rem

After placing emulsion in a tank, the operator was believed to have added a dilute plutonium solution from a second tank. Solids containing plutonium were probably washed from the bottom of the second tank with nitric acid and the resultant mixture of nitric acid and plutonium-bearing solids added to the tank containing the emulsion. Shortly after starting the stirrer motor to initiate an expected mild nonnuclear reaction between the emulsion and the acid, the operator observed a "blue flash", also observed by an employee in an adjoining room.

The employee died 35 hours later from the effects of a radiation exposure tentatively estimated at 12,000 rem (±50%).

Two other employees received radiation exposures of 134 rem and 53 rem, respectively. Property damage was reported as negligible. (See TID–5360, Suppl. 2, p. 30; *USAEC Serious Accidents Issue* #143, 1–22–59.)

RADIATION EXPOSURES ACCOMPANY CRITICALITY ACCIDENT

Oak Ridge, Tenn., June 16, 1958—461, 428, 413, 341, 298, 86, 86, and 29 rem

A nuclear accident occurred in a 55-gallon stainless steel drum in a processing area in which enriched uranium is recovered from various materials by chemical methods in a complex of equipment. This recovery process was being remodeled at the time of the accident.

The incident occurred while they were draining material thought to be water from safe 5-inch storage pipes into an unsafe drum.

Eight employees were in the vicinity of the drum carrying out routine plant operations and maintenance. A chemical operator was participating in the leak testing which inadvertently set off the reaction. He was within three to six feet of the drum, while the other seven employees were from 15 to 50 feet away.

Using special post hoc methods for determining the neutron and gamma exposures of the employees involved, it was estimated that the eight men received: 461 rem, 428 rem, 413 rem, 341 rem, 298 rem, 86 rem, 86 rem, and 29 rem.

Area contamination was slight, with decontamination costs amounting to less than $1,000.

During this incident 1.3×10^{18} fissions occurred (*See* TID–5360, Suppl. 2, p. 25; *USAEC Serious Accidents Issue* #136, 8–25–59; *USAEC Health and Safety Information* Issue #82, 9–5–58; 1959 *Nuclear Safety*, Vol. 1, #2, p. 59.)

SUDDEN INCREASE IN REACTIVITY DURING CONTROL ROD TESTS

Lemont, Ill., June 2, 1952—190, 160, and 70 rem

Manual withdrawal of a control rod from a critical assembly caused an accidental supercriticality.

The operation being conducted was the comparison of a series of newly-manufactured control rods. The assembly had been operated with the standard control rod. It was then shut down by inserting all control rods and draining the water moderator, a standard safe method of shutting down the assembly when core changes are to be made. The standard rod was removed and the first of a series of control rods to be tested was inserted.

The reactor was filled with water with the test control rod fully in and the standard type control rods fully inserted. Withdrawal of one of the standard control rods 32 centimeters caused the assembly to become critical and the power was leveled off while the desired measurements were made. The control rod was then reinserted into the original "in" position.

With the water still in the assembly, the four members of the crew then went into the assembly room for the purpose of replacing the control rod which they had just tested. The group leader went up on the platform, reached out with his right hand and started to pull out the tested rod. As soon as he had withdrawn it about one foot, the center of the assembly emitted a bluish glow and a large bubble formed. Simultaneously, there was a muffled explosive noise. The group leader let go of the control rod which he was removoing and it fell back into position. The crew left the assembly room immediately and went to the control room.

Four employees received radiation exposures ranging from 12 to 190 rem. (*See* TID–5360, p. 23.)

SUSPECT RADIATION EXPOSURE

Stanford, Calif., May–June 1966—150 rem

An employee's badge indicated a radiation exposure had occurred over a period of several weeks while he was engaged in his routine duties at a linear accelerator.

Investigation indicated that the film badge did receive an estimated radiation exposure of 150 rem; however, there was no evidence that the employee had actually received the exposure.

RADIATION EXPOSURES ACCOMPANY NUCLEAR EXCURSION

Richland, Wash., Apr. 7, 1962—110, 43 and 19 rem

An unplanned nuclear excursion occurred in a plutonium processing facility due to the inadvertent accumulation of approximately 1500 grams of plutonium in 45–50 liters of dilute nitric acid solution in a 69-liter glass transfer tank. The sequence of events which led to the accumulation of the plutonium in the tank cannot be stated positively. However, it is believed that, when a tank valve was opened, the solution from another vessel overflowed to a sump and was drawn into the transfer tank through a temporary line between this tank and the sump.

When the excursion occurred, radiation and evacuation alarms sounded. All but three employees left the building immediately, according to well-prepared and -rehearsed evacuation plans. Fortunately, they were not in close proximity to the involved system nor in a high radiation field.

Of the 22 persons in the building at the time, only four employees, those who were in the room with the system, were hospitalized for observation. Three of them were the system operators, who were in close proximity to the excursion, and who received estimated radiation doses of 110, 43 and 19 rem. None of them showed symptoms definitely referable to their radiation exposures. The fourth was sent to the hospital only because he was in the room at the time of the incident.

Some fission product activity, airborne via the vent system and the exhaust stack, was detected in the atmosphere for a brief period after the accident.

The physical damage amounted to less than $1,000. (*See* TID–5360, Suppl. 4, p. 17.)

IRRADIATED FUEL INCIDENT

Puerto Rico, July 24, 1962—100, 58, 24, 18 and 18 rem

Seven employees were accidentally exposed to radiation from irradiated fuel elements when a crane operator mistakenly thought he had been given the all-clear signal to move a rack of hot fuel elements into a position against the aluminum window which separates the exposure room from the reactor pool. The room was to be vacated and the shield door closed before positioning the fuel elements against the window. The gamma room door could not be seen from the crane operator's position.

When the crane operator began moving the fuel elements into the window position, the 10-millirem monitor near the gamma room door tripped an alarm. The reactor supervisor immediately ordered the fuel elements moved away from the window, terminating the incident.

The estimated exposure time of the individuals was 1¼ seconds. The seven employees' exposures were 100 rem, 58 rem, 24 rem, 18 rem, 18 rem, 8 rem, and 4 rem. There were no radiation injuries as a result of the accident. (*See* TID–5360, Suppl. 4, p. 21.)

ACCIDENTAL EXPOSURE

Oak Ridge, Tenn., Oct. 4, 1957—63 rem

An employee received an exposure to radiation for less than one minute when he mistakenly entered a room containing tanks of radioactive residues used in processing irradiated fuel elements.

The exposure was first discovered when a pocket dosimeter was examined at the end of the day's shift and was confirmed when the employee's film badge was processed. He apparently suffered no ill effects and continued working; however, he was transferred to other duties. (*See* TID–5360, Suppl. 2, p. 23.)

SUSPECT RADIATION EXPOSURE

Minneapolis, Minn., June 6–19, 1966—50 rem

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

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.

ELECTRON ACCELERATOR EXPOSURE

Livermore, Calif., Jan. 6, 1959—41 rem

A physicist was exposed while a series of adjustments were being made on beam-defining plates in a new electron linear accelerator. Radiation surveys were made with negative results when personnel entered the cell after the first three adjustment runs. No survey was made after the fourth and fifth runs. A survey made after the sixth run showed a 1,000 rem/hr level.

During all entries to the cell, the key which was designed to lock all controls in the "OFF" position was removed from the control panel. It was determined that the film badges had been exposed to about 200 Kev energy gamma radiation. An exposure dose of 41 rem was assigned to physicist "A". This dose was received in a period of about one minute, which was the established time he worked alone on plates 3 and 4 and entered the cell to measure very high radiation levels. The next highest reading of 400 millirem was received by physicist "B". All others received less than 50 millirem. (*See* TID–5360, Suppl. 3, p. 8.)

INADVERTENT EXPOSURE

Mercury, Nev., Mar. 1, 1955—39 rem

A security guard was to accompany the radiation safety monitors into the exclusion area after a weapons test and establish surveillance of equipment. The guard had his own vehicle.

When he arrived at the place where he was to meet the monitors, the guard found that they had already left and started out after them. Somehow, he lost his way and drove beyond the established safety point. When it became apparent that he could not find the radiation safety monitors, he contacted his headquarters by radio and notified them of his position. He was immediately ordered out of the area.

The guard's film badge indicated he had received a dose of 39 rem. (*See* TID–5360, p. 72.)

RADIATION EXPOSURE

Las Vegas, Nev., Jan. 18, 1956—28 and 19 rem

When the prescribed time after a shot had elapsed, four employees, dressed in the proper protective clothing, were recovering samples from a nuclear test area.

It had been prearranged to have a monitor enter the area in advance of the men; however, they entered the area to redeem the samples without the monitor.

The four men received external radiation exposures of 28, 19, 14 and 4 rem, respectively. Upon medical examination, the men showed no signs of ill effects. (*See* TID–5360, Suppl. 1, p. 4.)

CONTAMINATED EQUIPMENT CAUSES EXPOSURE

Mercury, Nev., 1954—27.8 rem

An employee unknowingly worked and slept in close proximity to highly contaminated equipment while it was in transport between testing sites. He received a 24 rem whole-body exposure in 24 hours; his total yearly exposure was 27.8 rem.

SL–1 EXCURSION

Idaho Falls, Idaho, Jan. 3, 1961—27, 27, 25, 23, 21, 18, 16 and 15 rem

A nuclear excursion occurred within the reactor vessel, resulting in extensive damage of the reactor core and room, and in high radiation levels (approximately 500–1000 rem/hr) within the reactor room.

At the time of the accident, a three-man crew was on the top of the reactor assembling the control rod drive mechanisms and housing. The nuclear excursion, which resulted in an explosion, was caused by manual withdrawal, by one or more of the maintenance crew, of the central control rod blade from the core considerably beyond the limit specified in the maintenance procedure.

Two members of the crew were killed instantly by the force of the explosion and the third man died within two hours following the incident as a result of an injury to the head. Of the several hundred people engaged in recovery operations, 22 persons received radiation exposures in the range of three to 27 rem gamma radiation total-body exposure. The maximum whole-body beta radiation was 120 rem.

Some gaseous fission products, including radioactive iodine, escaped to the atmosphere outside the building and were carried downwind in a narrow plume. Particulate fission material

was largely confined to the reactor building, with slight radioactivity in the immediate vicinity of the building.

The total property loss was $4,350,000. (*See* TID–5360, Suppl. 4, p. 8; 1962 *Nuclear Safety*, Vol. 3, #3, p. 64.)

COBALT 60 EXPOSURE

Mercury, Nev., Oct. 4, 1960—18 rem

Two employees were following through the routine involved in the calibration of photocell detectors. The detectors were placed in the radiation beam area, 30″ in front of the 340-curie cobalt 60 source unit. Currents were being recorded for each detector with the source exposed. Three detectors had previously been calibrated; the fourth was placed in position; both employees returned to the console; the source was exposed and the current output of the detector was recorded. After recording the current value, employee "A" noted that the warning lights were out and assumed that the source was no longer exposed. He approached the detector located in front of the source, without making a precautionary radiation survey, and started making mechanical adjustments on the photodiode. Employee "B" followed "A" and aided him in the adjustments.

"A" received a total-body dose of 18 rem as determined by film badge reading. "B" received a total whole-body dose of 5 rem. (*See* TID–5360, Suppl. 3, p. 23.)

EXPOSURE DURING REACTOR SHUTDOWN

Idaho Falls, Idaho, July 23, 1956—21.5 rem

During a shutdown operation for scheduled refueling, six employees were working on the reactor top adjacent to the reactor tank opening, while two men were present as observers and advisors. All were exposed to radiation when a highly radioactive reactor component was placed in a position where it was not adequately shielded because of lowered water level in the reactor tank. The moving of the component and the coincident lowering of the water level were done to facilitate insertion and removal of experiments in the reactor.

The eight employees received radiation exposures ranging from 2.5 rem to 21.5 rem. (*See* TID–5360, Suppl. 1, p. 18.)

EXPOSURES RESULT FROM HANDLING FISSION SAMPLES

Eniwetok, May 14, 1948—17 rem

Four employees, who were handling fission samples improperly, received whole-body exposures ranging from 1.7 rem to 17 rem.

GAMMA EXPOSURE

Mercury, Nev., 1954—15.1 rem

While handling 55-gallon drums, whose greasy surfaces had trapped considerable amounts of radioactive fallout, an employee received 13 rem whole-body exposure during one working day. His total yearly exposure was 15.14 rem.

RADIOGRAPHY INCIDENT

Richland, Wash., May 16, 1963—15.2 rem

Construction employees, who wore no dosimeters, were inadvertently exposed to a lost 27-curie iridium 192 radiography source during the construction of a new production reactor. Exposures were estimated based upon radiation surveys and interviews with the personnel involved. The exposures ranged from 3.9 rem to 15.2 rem.

X-RAY TECHNICIAN EXPOSURE

Middletown, Conn., October 1958—15 rem (±40%)

An employee was in a shielded X-ray room using a portable X-ray unit. The circumstances indicated that the employee was not exposed to the radiation shown by his film badge. However, investigation could not prove this; therefore, it was assumed that the employee was exposed.

APPENDIX C

REPORTABLE* ACCIDENTS, INCIDENTS, AND RADIATION EXPOSURES

USAEC FACILITIES
1959-1970

*Requirements for a "reportable" incident have varied slightly since 1959. See Appendix D for current requirements as set forth in AEC Manual Chapter 0502.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
59-1	1-4-59	SR–E. I. du Pont de Nemours & Co.	0	$7,000
	Gasket on head of secondary condenser in unit failed, allowing hydrogen sulfide gas to flow into water side of heat exchanger. Relief valve vented open due to overpressure. 4-5 T of gas released to atmosphere.			
59-2	1-15-59	AL–Reynolds Electrical & Engr. Co.	0	$20,000
	Booms buckled on two 50-T cranes while lifting 65-ft tower weighing 38 T.			
59-3	1-17-59	OR–Union Carbide Nuclear Co.	0	$86,020
	Multiple circuit breaker failure led to severe electrical fire.			
59-4	2-1-59	AL–Bendix Aviation Corp.	0	$22,197
	Dispatch oven failed when a power relay came loose from side of control box and dropped to bottom of unit. Weight of relay held armature and contacts in closed position, energizing oven heaters.			
59-5	2-24-59	AL–University of California (LASL)	2 fatalities	$27,000
	Detonation of explosives instantly killed 2 employees.			
59-6	3-25-59	SR–E. I. du Pont de Nemours & Co.	0	$20,000
	Leaking compression fitting.			
59-7	3-31-59	HA–General Electric Co.	1-1st degree burns–face	$9,518
	Plutonium glovebox explosion.			
59-8	4-2-59	SR–E. I. du Pont de Nemours & Co.	0	$8,700
	Solvent transfer truck en route from 200-H Area to plant burial ground suddenly applied brakes at a railroad crossing, causing organic solvent containing intermediate level fission product to overflow into the shallow reservoir on top of truck tank, then radiation solvent dripped onto road surface (0.9 mile).			
59-9	4-2-59	OR–Union Carbide Nuclear Co.	0	$7,485
	During removal of obsolete ventilation ducts, a duct was dropped and snapped off a valve on the pump discharge side of coolant cooler.			
59-10	4-10-59	HA–General Electric Co.	1 fatality	0
	Workman straddling 4-in. pipe fell 59 ft.			
59-11	4-17-59	OR–Union Carbide Nuclear Co.	0	$9,886
	Electric motor failure.			

See footnotes at end of Appendix C.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
59-12	4-17-59	AL–Government-owned Property	0	$12,000
	Fire occurred in 1-story bedroom dwelling. The cause was combustible materials in the vicinity of the floor furnace.			
59-13	4-28-59	OR–Union Carbide Nuclear Co.	0	$6,500
	Lightning damaged transformer.			
59-14	5-13-59	ID–Wright-Cheney-Birch	1 fatality	0
	Employee was working on 60-ft scaffold when it toppled.			
59-15	5-13-59	LAR–Pratt & Whitney Aircraft (CANEL)	0	$30,000
	Electrical fire due to severe arcing on the line side of heater breakers.			
59-16	6-3-59	SR–E. I. du Pont de Nemours & Co.	0	$13,750
	Lightning damaged two 750-KVA transformers.			
59-17	7-1-59	AL–University of California (LASL)	2 injured	0
	¾-in. copper tubing separated from male section of disconnect when pressure was applied, loose end of tubing whipped around striking and injuring 2 men.			
59-18	7-3-59	SAN–University of California (LRL)	0	$32,400
	Overpressure helium system caused release and distribution of small quantity of curium 244, resulting in contamination of laboratory. No overexposures.			
59-19	7-17-59	AL–University of California (LASL)	0	$8,800[5]
	RA-Gas release.			
59-20	7-18-59	HA–General Electric Co.	0	$24,500
	Fire involving bakery and grocery store. Electrical short in junction box.			
59-21	7-27-59	LAR–General Electric Co.	0	$9,540
	Fire in construction contractor's material caused smoke and fire damage to building.			
59-22	7-31-59	HA–General Electric Co.	0	$4,000
	Autoclave explosion.			
59-23	8-1-59	NY–Princeton University	0	$12,000
	Disruption of water service to stellarator caused by overpressure in well pump supply line.			
59-24	8-6-59	AL–Monsanto Chemical Co.	0	$1,933
	Drybox explosion.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
59-25	8-7-59	OR–J. A. Jones Construction Co.	1 fatality	0
	Electrician electrocuted when contacting energized frame of welding machine.			
59-26	8-16-59	CH–Atomics International	0	$24,450
	Sodium storage tank exploded.			
59-27	8-21-59	SR–E. I. du Pont de Nemours & Co.	0	$129,324
	Solution leaked from the loosened flange during maintenance work on a waste evaporator in hot canyon, vaporized and contaminated a crane.			
59-28	9-4-59	LAR–General Electric Co.	0	$7,500
	Wind damage to aluminum side wall of building.			
59-29	9-23-59	SR–E. I. du Pont de Nemours & Co.	0	$14,000
	Product loss due to sudden leak at a high pressure valve.			
59-30	9-29-59	SR–E. I. du Pont de Nemours & Co.	0	$50,000
	Hurricane damaged water dam.			
59-31	10-3-59	SR–E. I. du Pont de Nemours & Co.	0	$9,750
	Overheating caused diesel engine damage.			
59-32	10-14-59	AL–University of California (LASL)	4 fatalities	$5,341
	Explosion occurred while disposing of scrap and waste explosives.			
59-33	10-16-59	ID–Phillips Petroleum Co.	0	$61,800
	Criticality incident, release of radioactive materials.			
59-34	10-30-59	AL–B & R Tub Co., subcontractor Holmes & Narver	0	$48,396
	Barge overturned carrying drill rig and core.			
59-35	10-30-59	SNR–General Electric Co.	1 fatility	$100,000
	Air-oil explosion occurred in air flask component of a 3,000-psi hydraulic oil system. Fatality was not chargeable to AEC.			
59-36	11-3-59	AL–Holmes & Narver	0	$7,919
	LST struck deep water pier during storm causing damage to pier.			
59-37	11-20-59	OR–Union Carbide Nuclear Co.	0	$350,000
	Chemical explosion in innercycle evaporator.			
59-38	11-23-59	OR–Mallinckrodt Chemical Co.	0	$6,000
	Overheated flue in gas stack. Incident was probably caused by improper combustion of propane gas or ignition of carbon which had accumulated in some of the stacks.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
59-39	12-2-59	AL–Reynolds Electrical & Engr. Co.	1 fatality	0
	An employee was killed instantly in head-on auto collision.			
59-40	12-12-59	SR–E. I. du Pont de Nemours & Co.	0	$5,200
	Loose contaminated particles on the lid of a waste burial box were scattered by the wind, contaminating the ground, locomotive and spacer car.			
59-41	12-18-59	CH–Atomics International	1 fatality	0
	Asphyxiation. Accident occurred at sodium pump loop when an inspector entered a pump casing which was 15 ft. deep and about 40 in. in diameter to inspect the collar near the bottom.			
59-42	12-23-59	AL–Petroleum Combustion & Engr. Co.	1 fatality	0
	Failure of a cable caused jib section of crane to fall and drop ¾ cu. yd. bucket of concrete on an employee.			
59-43	12-29-59	OR–National Lead Co. of Ohio	0	$10,000+
	An explosion occurred in digester.			
60-3	1-16-60	CH–Argonne National Laboratory	0	$35,000
	Two boilers in a reactor power house exploded due to buildup of fumes in firebox while an attempt was being made to start unit manually. Damage primarily to boiler and adjacent piping with minor building damage.			
60-4	1-29-60	AL–Holmes & Narver	1 fatality	0
	Professional skin diver drowned while performing assigned duties at the Pacific Proving Ground.			
60-5	2-12-60	CH–Argonne National Laboratory	0	$13,115
	A reactor vessel holddown plug assembly dropped when being lifted and moved by means of a hand winch. Two riggers were injured, each having a fractured leg. The plug was damaged.			
60-7	3-3-60	SAN–University of California (LRL)	0	$12,500
	During the pressing of an experimental high explosive, a detonation occurred.			
60-8	3-8-60	OR–Union Carbide Nuclear Co.	1 exposed	0
	An employee was exposed while cleaning up a cell due to the failure of the monitoring system to disclose the presence of radioactive cerium 144. The exposure was 5,550 rem to the hand (beta dose).			
60-9	1-29-60	OR–Union Carbide Nuclear Co.	0	$20,000
	Explosion occurred in a uranium sintering furnace located in a foundry. Major structural damage to furnace and buildings.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
60-10	3-18-60	SR–E. I. du Pont de Nemours & Co.	0	$135,300
	A hydrogen-sulfide gas release from a process equipment condenser caused a fire. The property damage was to the condenser.			
60-11	3-30-60	SR–E. I. du Pont de Nemours & Co.	0	$6,000
	During an electrical storm, lightning struck two 200-hp pump motors in an out-of-door pump pit. The cost was due to rewinding of the burned out motors.			
60-12	3-18-60	AL–Reynolds Elec. & Engr. Co.	1 fatality	0
	While helping to pour 15 gallons of hot soup stock into a steam kettle, a kitchen employee slipped, causing hot soup to spill on his body, resulting in first and second degree burns to chest and inside of thighs–20% of body. Employee died as a result of the burns.			
60-13	4-13-60	NY–Harvard University	1 fatality	0
	While an employee was standing on a 34-inch-wide ground level wall, straightening a reinforcing rod with a length of pipe, the rod broke, and the employee fell 20 ft. to a concrete subarea.			
60-14	4-17-60	HA–General Electric Co.	0	$250,443
	Fire and explosion in pyrophoric metal contents of a chemical dissolver caused high damage to dissolver, off-gas filter, and related process equipment. Contamination spread to cell, canyon, and crane. The cause or causes of the accident are not established.			
60-15	4-26-60	OR–Union Carbide Nuclear Co.	0	$39,500
	An irradiated graphite-clad reactor fuel element was being dry cut inside a hot cell with a remotely operated saw. A change in air pressure inside the cell forced contaminated graphite dust from the cell, and it dispersed into the rest of the building. There were no overexposures. The cost was due to cleanup of the area.			
60-16	4-5-60	SR–E. I. du Pont de Nemours & Co.	0	$216,285
	A leak in an outlet nozzle on a reactor necessitated a shutdown. The leak was caused by three cracks extending approximately 2½ in. around the circumference of the nozzle. The cost was chiefly due to the repairing of the nozzle and the loss of heavy water.			
60-18	6-15-60	AL–Reynolds Elec. & Engr. Corp.	0	$9,950
	A rigging crew was removing the astrodome from a 20-ft. camera tower with a crane. As the dome was being lowered, the sling broke, allowing the dome to fall approximately 10 ft.			
60-19	6-11-60	AL–General Electric Co.	0	$9,098
	Failure of overload switches to operate during severe electrical storm caused burnout of transformer.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
60-20	6-24-60	ID–Phillips Petroleum	1 injured	0
	Employee seriously injured when portion of a stud (concrete anchor nail) ricocheted, entering forehead over right eye and lodging in brain, while using a powder-actuated power tool.			
60-21	6-28-60	OR–Goodyear Atomic Corp.	0	$7,145
	The stainless steel lining of a new liquid nitrogen storage tank being installed collapsed when its contents were partly evacuated during an acceptance test.			
60-22	7-11-60	AL–Los Alamos Medical Center	0	$12,000
	A 15-KV switchgear located in a subbasement equipment room was damaged by fire.			
60-23	7-15-60	OR–Mallinckrodt Chemical Works	1 injured	$5,000
	Hydrogen gas explosion occurred in gas furnace enclosure in metal plant. One employee suffered serious injuries.			
60-24	7-6-60	AL–Mound Laboratory	0	$31,360
	The accidental discharge of radioactive material into a room occurred as a result of pressure buildup in a drybox. This was due to an inlet solenoid being locked in the open position and a venting solenoid being closed due to a malfunction. The pressure built up to a point that one of the drybox gloves blew out, thereby releasing radioactive particulate material into the room. Eleven persons received minor exposures.			
60-25	8-31-60	ID–Fluor Corp., Ltd.	1 fatality	0
	While an employee was painting the handrails around a silo, he suffered fatal injuries when he fell 69 ft.			
60-26	9-13-60	SR–E. I. du Pont de Nemours & Co.	0	$250,000
	Contaminated cooling water discharged from canyon onto floor. No overexposures. The large loss was due to decontamination.			
60-27	9-29-60	SR–E. I. du Pont de Nemours & Co.	0	$8,300
	Water leaking through roof during heavy rainstorm damaged transformer.			
60-28	6/2-6-60	SR–E. I. du Pont de Nemours & Co.	0	$24,000
	During shipment of irradiated fuel elements, 30 to 40 gallons of contaminated water leaked from the cask. The cost was due to decontamination of area.			
60-29	8-4-60	OR–Goodyear Atomic Corp.	0	$18,132
	During violent storm, severe power system disturbance caused oil circuit breaker failure.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
60-30	10-7-60	AL–Sandia Corp.	0	$16,500
	Beechcraft Drone Aircraft, which was to be used for air sampling, crashed when radio control was lost in desert.			
60-31	11-8-60	AL–Sandia Corp.	1 exposed 1 exposed/injured	0
	Employees were accidentally exposed to electron beam emanating from a Van de Graaff accelerator (12,340 & 1277 rem hands).			
60-32	9-13-60	LAR–General Electric Co.	0	$12,000
	During an electrical storm lightning damaged transformer.			
60-33	7-12-60	HA–Government–Hanford	0	$6,000
	15-mile per hour breeze spread a grass fire over 3,000 acres of AEC property.			
60-34	11-2-60	SR–E. I. du Pont de Nemours & Co.	0	$37,100
	Fire in a construction building.			
60-35	11-10-60	SAN–University of California (LRL)	0	$101,000
	Fire started in curium processing cave by an apparent overheating of oil bath in glovebox. Loss confined to one room, but all contents complete loss. No release of radioactive materials to environment.			
60-36	11-10-60	SR–E. I. du Pont de Nemours & Co.	0	$40,000
	Induced draft fan failed due to excessive vibration.			
60-37	11-14-60	AL–Sandia Corp.	0	$32,000
	Fire occurred in heat paper stored in dry room.			
60-38	12-7-60	OR–Union Carbide Nuclear Co.	0	$10,036
	A full, high pressure, 30-tube gas trailer overturned in the process of coupling to tractor.			
60-39	11-18-60	HA–General Electric Co.	1 injured	0
	Pipefitter slipped and fell 15 ft. down a shaft.			
60-40	12-21-60	HA–General Electric Co.	0	$12,294
	Buildup of pressure in a steam autoclave resulted in a blowoff which sent some material from the autoclave through the building roof. No radiation resulted.			
60-41	10-4-60	AL–Edgerton, Germeshausen & Grier	2 exposed	0
	Two employees were exposed to gamma radiation (18 & 5 rem wb).			
60-42	11-17-60	OR–Union Carbide Nuclear Co.	0	$103,260
	Ten-ton cylinder of UF_6 ruptured.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
60-43	11/8-28-60	OR–National Lead Co. of Ohio	0	$5,000+
	Slightly enriched uranium tetrafluoride lost through stack of dust collector located in the plant.			
61-1	1-3-61	ID–Combustion Engineering, Inc.	3 fatalities 9 exposed	$4,350,000
	Explosion within reactor vessel of SL-1 reactor plant. Two members of crew were killed instantly by explosion. Third died within about two hours as result of injury to head. Maximum overexposure to nine emergency crew members during emergency was 27 rem.			
61-2	1-9-61	AL–ACF Industries, Inc.	0	$27,060
	Fire in plating shop.			
61-3	1-11-61	AL–Reynolds Electrical & Engineering Co.	0	$8,000
	Test vehicle being towed from test bunker to disassembly building, prime mover accidentally uncoupled and vehicle car crashed into face of test bunker, damaging car and bunker.			
61-4	1-24-61	AL–Los Alamos Scientific Laboratory	1 fatality	0
	Employee fell from bunker 10-12′ to concrete pad.			
61-5	2-2-61	AL–ACF Industries, Inc.	1 fatality	$2,500
	Head-on motor vehicle collision.			
61-6	2-14-61	AL–Los Alamos Scientific Laboratory	1 fatality	0
	Employee overcome by solvent vapors while working in enclosure.			
61-7	1-25-61	ID–Phillips Petroleum Co.	0	$6,000
	Criticality accident occurred at chemical processing plant, when U235 solution accidentally surged from geometrically safe container to unsafe vessel leading to momentary occurrence of chain reaction. There were no overexposures.			
61-8	3-10-61	OR–Central Illinois Tower Maintenance Co.	2 fatalities	0
	Two employees fell 145′ when top section collapsed during erection of tower.			
61-9	3-16-61	PNR–Eichleay Corp.	1 fatality 3 injured	0
	Scaffold arrangement rigged for painting overhead structure and ceiling of shop collapsed, causing the death of one and injuries to three.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
61-10	5-11-61	AL–Monsanto Chemical Co. (Mound Laboratory)	1 exposed	$4,016
	Pressure buildup in closed caustic scrubber system forced airborne radioactive material into room. Employee received 71 rem exposure to bone. Area contaminated.			
61-11	1-10-61	SR–E. I. du Pont de Nemours & Co.	0	$7,750
	Overhead machine used to discharge reactor components struck aluminum I-beam used to support portable bridge.			
61-12	5-19-61	OR–Goodyear Atomic Corp.	0	$37,130
	Air circuit breaker failed resulting in shutdown of seven cells.			
61-13	7-11-61	SAN–University of California (LRL)	0	$13,500
	Fire occurred involving approximately 190 pounds of chemical explosive.			
61-14	7-18-61	HA–General Electric Co.	0	$5,900
	Two Hanford railroad locomotives collided head on.			
61-15	8-1-61	HA–Hanford Operations Office	0	$8,000
	Range fires burned approximately 4,300 acres, probably caused by sparks from defective muffler on railroad diesel locomotive.			
61-16	8-14-61	HA–General Electric Co.	1 fatality	0
	Employee fatally injured when tractor rolled backwards out of control while he was assisting in unloading it from a trailer.			
61-17	8-14-61	SNR–General Electric Co.	0	$5,700
	Fire burned approximately 3,000 square feet of newly laid roof, causing damage to building and ventilating equipment located on roof.			
61-18	8-29-61	AL–Sandia Corp.	0	$14,700
	Flash flood at deactivated base. Removal of 8-12 inches of silt majority of cost.			
61-19	9-2-61	ID–Phillips Petroleum Co.	0	$20,000
	Compressor malfunctioned, damaging insulation and wiring on stator and rotor.			
61-20	9-7-61	AL–Los Alamos Scientific Laboratory	1 fatality	0
	Employee killed in motor vehicle accident in which car skidded and turned over.			
61-21	8-14-61	HA–Hanford Operations Office	0	$69,865
	Series of brush fires caused by violent electrical storm.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
61-22	9-13-61	AL–Bendix Corp.	0	$449,200
	Flood following Hurricane Carla.			
61-23	10-2/24-61	SR–E. I. du Pont de Nemours & Co.	0	$400,000
	Series of flume failures occurred in SRP reactor cooling water effluent system.			
61-24	10-25-61	AL–Dow Chemical Co.	0	$7,000
	Explosion (considered to be of low order) occurred in boiler.			
61-25	10-26-61	AL–Sandia Corp.	1 fatality 3 injured	$131,210
	Fire in dry room.			
61-26	10-20-61	AL–Monsanto Chemical Co. (Mound Laboratory)	1 exposed	$590
	Employee received 1.4 body burden of polonium when glass apparatus containing polonium was dropped. Small amount of room contamination readily cleaned up. (22 rem to spleen)			
61-27	10-29-61	AL–Albuquerque Operations Office	0	$57,000
	Airplane struck 500-foot radio tower, collapsing tower. Wing torn from plane.			
61-28	11-7-61	AL–ACF Industries, Inc.	0	$34,450
	Gas explosion in portable metal shed housing reactor. Four employees received minor injuries. Shed badly damaged; piping and equipment exterior to reactor also damaged.			
61-29	10-27-61	OR–Oak Ridge National Laboratory	1 exposed	0
	Employee received beta burns to hands and fingers on at least two occasions while performing operations on fuel specimens. Dose estimates were 1,200 rem to fingers of left hand and 900 rem to fingers of right hand.			
61-30	10-15-61	ID–Phillips Petroleum Company	0	$10,000
	Contractor's bus collided with private car; 20 bus passengers received minor injuries. Private car driver killed.			
61-31	9-18-61	ID–Idaho Operations Office	0	$7,525
	Flood damage.			
61-33 (press release)	12-19-61	HA–General Electric Co.	0	0
	Superficial plutonium contamination puncture wound on finger when wire pierced glove while wiring inside of a hood.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
61-34	8-16-61	HA–J. A. Jones Construction Co.	0	$5,100
	Contamination spread occurred while dismantling old laboratory equipment in a process building. Five employees received some skin contamination.			
61-36	12-12-61	ID–Phillips Petroleum Co.	0	$16,360
	Reactor manually scrammed following fission break caused by restriction of primary coolant flow resulting from remnants of transparent acrylic resin sight box.			
61-37	12-4-61	BH–Brookhaven National Laboratory	0	$10,850
	Fire in biology laboratory. Major portion of loss was damaged equipment.			
61-38	4-20-61	HA–General Electric Co.	0	$13,000
	Uranyl nitrate (1,355 lbs. of depleted uranium) lost to ground when tank trailer was overfilled due to misunderstanding between regular operators and their lunch relief.			
61-39	4-13-61	HA–General Electric Co.	0	$12,900
	Approximately 30,000 gals. of nitric acid (100%) lost to chemical sewer as result of valves being left open.			
61-40	11-21-61	HA–General Electric Co.	0	$9,000
	Approximately 1,089 pounds of depleted uranium lost to chemical sewer in plant.			
62-1	1-22-62	SR–E. I. du Pont de Nemours & Co.	1 fatality	0
	Carpenter crushed beneath concrete form.			
62-2	2-15-62	SR–E. I. du Pont de Nemours & Co.	0	0
	Purging of stack gas sampling line released contaminated particulate material requiring washing of 163 vehicles for decontamination.			
62-3	2-14-62	NV–Reynolds Electrical & Engineering Co.	0	$7,000
	Tractor-trailer loaded with drill rig overturned.			
62-5	2-21-62	OR–National Lead Co. of Ohio	1 injured	$420
	Hydrogen explosion occurred in uranium casting pot while cover was being removed. One employee received severe laceration of head and eye injury.			
62-6	3-18-62	OR–Union Carbide Nuclear Co.	1 fatality 1 injured	$15,500
	Chemical explosion occurred during routine operations in metal reduction furnace. Two operators 35 feet from furnace were burned over 50% of body, one died 12 days later.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
62-7	3-29-62	CH–Argonne National Laboratory	1 fatality	0
	Pipefitter fell 25 feet.			
62-9	3-21-62	OR–Union Carbide Nuclear Co.	0	$24,700
	Fire occurred in ventilation system, probable cause electrical spark.			
62-10	3-23-62	OR–W. L. Hailey & Co., Inc.	1 fatality	0
	Pipefitter crushed by slide of shale from side of trench.			
62-11	4-7-62	HA–General Electric Co.	3 exposed	0
	Criticality incident with plutonium solution. Exposures were 110, 43, and 19 rem whole body.			
62-12	4-7-62	NV–Reynolds Electrical & Engineering Co.	0	$20,000
	Drill rig fell over when anchors pulled out to which guy wires were fastened.			
62-13	5-4-62	AL–Bendix Corp.	0	$20,430
	Electric oven overheated damaging channels in the oven.			
62-14	5-23-62	HA–General Electric Co.	0	$10,000
	Air ventilation equipment failure.			
62-15 (press release)	5-29-62	HA–General Electric Co.	0	0
	Employee received cut on right index finger while cleaning debris under pumps in loadout area. 70,000 d/m′ detected in excised tissue. Less than 10% maximum permissible body burden estimated to remain at wound site.			
62-16	4-29-62	GJ–Lucius Pitkin Co.	0	$9,728
	Boiler explosion occurred when electrician attempted to light oil fire.			
62-17 (press release)	6-2-62	HA–General Electric Co.	0	0
	Pipefitter received puncture wound in left index finger while performing maintenance work in hood. Initial radiation measurement of 250,000 d/m detected at wound site. Tissue excised. Estimate of 10-20% maximum permissible body burden remained at wound site.			
62-18	6-20-62	OR–Union Carbide Nuclear Co.	1 fatality	0
	While breaking bridge formation of coal in reclaim hopper, coal gave way, covering two employees. One suffocated.			
62-19	4-18-62	SR–E. I. du Pont de Nemours &Co.	0	$26,000[5]
	Gas release from stack.			
62-20	4-25-62	NV–Reynolds Electrical & Engineering Co.	0	$19,000
	Drill rig collapsed.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
62-21	Apr/ June-1962	PNR—Westinghouse Electric Corp.	1 exposed	0
	Employee received quarterly exposure of 8.1 rem during calibration of X-ray spectrometer.			
62-22	Mar/ July-1962	ID—General Electric Co.	1 exposed	0
	Employee received exposure of 3.2 rem one quarter and 3.9 rem another.			
62-23	7-24-62	OR—Puerto Rico Nuclear Center	7 exposed	0
	Crane operator thought he had been given all clear signal and moved rack of irradiated fuel elements into position against aluminum window which separates exposure room from reactor pool. Exposures received were 100 rem, 58 rem, 24 rem, 18 rem, 18 rem, 8 rem, and 4 rem. All were hospitalized for observation.			
62-24	7-26-62	AL—Monsanto Chemical Co. (Mound Laboratory)	3 exposed	$4,243
	Opening of calorimeter can accidentally discharged alpha contamination into room atmosphere, causing surface and personnel contamination. Cost was due to decontamination. Bone exposures resulted to three individuals (26, 24, & 23 rem).			
62-25	7-29-62	HA—General Electric Co.	0	$22,884
	Fire in climatizer room apparently caused by overheated electrical control ballast on one of the climatizers.			
62-26	7-12-62	AL—Albuquerque Operations Office	0	$13,000
	Fire in AEC-owned building.			
62-27	8-14-62	PNR—Pittsburgh Naval Reactors Office	1 injured	$15,000
	Train was rammed from rear by another freight train. Courier hurt but returned to work within 2 weeks. Damage was to Government railway car and contents.			
62-28	8-15-62	OR—Union Carbide Nuclear Co.	1 fatility	0
	Employee died from burns received when flash fire occurred during inspection of manhole port in side of oil circuit breaker tank in switchyard.			
62-29	10-7-62	NV—Reynolds Electrical & Engineering Co.	1 fatility	$1,179
	Power wagon overturned.			
62-30	Apr/ June-1962	AL—Dow Chemical Co.	3 exposed	0
	Chemical operators received 3.1 rem, 3.3 rem and 3.4 rem, respectively, while processing plutonium metal.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
62-31	June/ Aug- 1962	ID—General Electric Co.	1 exposed	0
	During cleanup of SL-1 incident, employee received 3.1 rem whole body exposure.			
62-32	8-24-62	ID—Phillips Petroleum Co. HA—General Electric Co.	0	$1,600
	Trailer and load (radioactive material shipping cask) were contaminated 5 rem/hour, due to iodine 131 leaking from the cask. Cost due to cleanup.			
62-33 (press release)	10-7-62	NY—Martin Co.	0	0
	Nuclear electric power plant, McMurdo Sound, Antarctica, damaged by fire. No AEC loss.			
62-34	10-19-62	OR—Union Carbide Nuclear Co.	0	0
	Private driver hit truck carrying cylinders of radioactive materials. No damage to truck.			
62-35	10-21-62	SR—E. I. du Pont de Nemours & Co.	0	$13,200
	Approximately 700 pounds of D_2O lost when rotameter sight glass ruptured.			
62-36	Sept/ Oct- 1962	SAN—Lawrence Radiation Laboratory	1 exposed	0
	Employee working weekend duties as roving health chemistry monitor, received 3.5 rem neutron exposure, as indicated by film badge.			
62-37 (press release)	11-13-62	ID—Phillips Petroleum Co.	0	0
	Slight increase in radioactivity levels caused temporary evacuation.			
62-38	12-3-62	AL—Albuquerque Operations Office	0	0
	Train involving courier coach and two ATMX cars containing weapons components (no high explosives) derailed. Shipment undamaged. Estimated $15,500 repairs to coach and cars acknowledged as railroad liability.			
62-40	9-14-62	OR—Oak Ridge Operations Office	0	0
	Fire in radioactive shipment by train. Shipment undamaged.			
62-41	12-13-62	OR—Union Carbide Nuclear Co.	0	$2,900,000
	Explosion and fire in cell.			
62-42	12-14-62	OR—Union Carbide Nuclear Co.	0	0
	Truck moving UF_6 in cylinders involved in accident with private car. No material released.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
62-43	Sept/ Dec- 1962	AL–Los Alamos Scientific Laboratory	1 exposed	0
	While handling residue in a recovery operation, an employee received a quarterly exposure of 6.4 rem.			
62-44	11-19-62	SR–E. I. du Pont de Nemours & Co.	0	$25,400[5]
	Gas release from a stack.			
62-45	11-26-62	SR–E. I. du Pont de Nemours & Co.	0	$21,500[5]
	Gas release from a stack.			
62-46	8-4-62	NV–Reynolds Electrical & Engineering Co.	0	$9,535
	While attempting to remove stuck pipe, drilling mast was damaged.			
62-47	2-28-62	SNR–United Nuclear Corp.	0	$16,310
	Slag from overhead cutting and welding fell on security curtains suspended across room from ceiling to floor, igniting curtains.			
63-1 A	1-1-63	ID–Phillips Petroleum Co.	0	0
	Truck transporting fuel elements involved in accident with private car. Shipment undamaged.			
63-2 A	1-5-63	CH–Atomics International	1 fatility	0
	Shift supervisor died of internal injuries and basal skull fracture resulting from 54' fall when he stepped backward into open shield plug hole while giving signals to crane operator.			
63-3 A	1-10-63	OR–Mallinckrodt Chemical Works	0	0
	Truck transporting radioactive material involved in accident with private car. Shipment undamaged.			
63-4 A	1-10-63	OR–National Lead Co. of Ohio	0	0
	Truck transporting uranium fuel slugs involved in accident with private car. Shipment undamaged.			
63-5 A	1-14-63	BH–NY–Nuclear Materials & Equipment Corp.	0	- $27,560
	One of eleven packages of contaminated precious metals found leaking upon arrival at destination. Decontamination of several vehicles and truck depots necessitated.			
63-6 B	1-24-63	OR–Government	0	$6,787
	Government-owned dwelling totally destroyed by fire believed started in defective heating system.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
63-7 B	1-26-63	PNR–Duquesne Light Co.	0	$33,455
	Fire (definite cause undetermined) occurred in contractor-owned office building. Government-owned office machines, furniture and other equipment damaged.			
63-11 A	2-16-63	NV–Camay Drilling Co.	1 fatility	0
	During excavation work, a construction worker was crushed by a tractor when the entire length of the tractor tread ran over his body, causing multiple internal injuries.			
63-12 A	2-12-63	RL–General Electric Co.	0	$8,650
	Promethium 147 contamination found in laboratory rooms; also tracked to other parts of building.			
63-13 B	2-10-63	AL–Sandia Corp.	0	$10,200
	During construction of laboratory, power outage resulted in deflation of "air structure," which was completely destroyed by high winds.			
63-14 B	2-3-63	RL–Government	0	$15,350
	Two small earth-fill dams washed out by melting snow.			
63-15 B	2-26-63	SR–E. I. du Pont de Nemours & Co.	0	$24,000
	Fuel element dropped into reactor, damaging element.			
63-16 B	3-14-63	SR–E. I. du Pont de Nemours & Co.	0	$22,000[5]
	Tritium release to atmosphere through stack.			
63-17 A	3-26-63	SAN–Lawrence Radiation Laboratory	0	$94,881
	Criticality occurred during subcritical experiment involving fissionable materials and small fire developed within enclosed concrete vault.			
63-18 B	3-16-63	AL–Dow Chemical Co.	0	$8,200
	High-velocity winds caused circuit breaker failure in substation, resulting in fire readily controlled by fire extinguisher.			
63-19 B	1-12-63	ID–C. F. Braun & Co.	0	$5,800
	During subzero weather, water in firewater header froze, damaging header.			
63-20 B	4-17-63	RL–General Electric Co.	1 exposed	0
	Maintenance employee received whole-body exposure of 5 rem while working on fuel tube of reactor.			
63-21 A	4-22-63	OR–Union Carbide Corp., Nuclear Div.	0	$25
	Tractor-trailer carrying interplant shipment of radioactive materials tipped over when forced off road by oncoming traffic. Shipment undamaged.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
63-22 B	4-20-63	NV–Sandia Corp.	0	$14,848
	Fire damaged aerodynamic balloon when gasoline overflowed from generator engine and was ignited by engine backfire. Later, on same day, high-velocity winds completely destroyed balloon.			
63-23 B	4-25-63	NV–Government	0	$12,000
	High-velocity winds damaged three balloons.			
63-24 A	4-30-63	OR–Union Carbide Corp., Nuclear Div.	1 fatility	0
	While testing an ion source, a physicist was electrocuted.			
63-25 B	5-16-63	RL–Kaiser Engineers	5 exposed	0
	During process of removing control cables from radiographic camera, 27-curie iridium 192 sealed source fell out of cable and remained unnoticed on cell floor for approximately five hours. During this period, approximately 76 workers were intermittently in area where exposed source was located. Five individuals exceeded 3.0 rem per quarter, (15.2, 9.6, 7.4, 4, 3.9 rem).			
63-26 A	6-6-63	NV–Reynolds Electrical & Engineering Co., Inc.	9 exposed	0
	Fifteen employees exposed during re-entry and recovery operation in tunnel, nine receiving in excess of 30 rem per year to thyroid. (593, 371, 350, 265, 200, 133, 37, 36, & 34 rem.)			
63-27 B	4-15/5-8	CH–Atomics International	1 exposed	0
	Employee received partial-body exposure of 11 rem while working on X-ray diffraction machine.			
63-28 B	6-19-63	NV–Reynolds Electrical & Engineering Co., Inc.	0	$17,000
	Drill rig toppled over while leveling adjustments were in process.			
63-29 A	6-25-63	SNR–Marley Corp.	1 fatality	0
	During construction of fan cylinder, carpenter fell 65'. Cause of death was compound fractured skull, broken neck and multiple injuries with massive hemorrhage.			
63-30 A	6-25-63	NY–Pratt & Whitney Aircraft Div., CANEL	1 fatality	0
	While operator's helper was kneeling on top of box, being moved by forklift truck, to counterbalance overhanging weight, box tipped forward and he fell to ground. He suffered fatal pulmonary embolus seventeen days later as result of injuries received in accident.			
63-31 B	4-23-63	AL–Dow Chemical Co.	0	$5,662
	Spill of contaminated nitric acid solution.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
63-32 B	6-20-63	AL–Dow Chemical Co.	0	$8,364
	Leak in line carrying high-level plutonium solution caused contamination of building and equipment.			
63-34 B	8-9-63	PNR–Westinghouse Electric Corp.	0	$9,400
	Severe winds during electrical storm damaged roofs, stacks, ventilation ducts, trees, shrubs and fences.			
63-35 B	6-28/7-8	SAN–Lawrence Radiation Laboratory	2 exposed	0
	Two employees received quarterly exposures to their right hands in excess of 25 rem, (calendar year exposures of ' 55 and 44 rem) while engaged in transferring radioactive materials into high vacuum chamber using short tongs.			
63-36A	7-23-63	OR–H. K. Ferguson Co.	1 fatality	0
	Apprentice pipefitter was asphyxiated while checking for inert gas leak in valve pit.			
63-37A	7-24-63	AL–Mason & Hanger-Silas Mason Co., Inc., San Antonio, Tex.	0	0
	Train derailed. Coach carrying radioactive materials remained upright. Shipment undamaged.			
63-38 B	Apr.-June 63	OR–General Electric Co.	2 exposed	0
	Two employees received quarterly external radiation exposures, one 3.9 rem whole body, 32 rem left hand, 14 rem right hand; the other, 2.1 rem whole body, 27 rem left hand, 25 rem right hand. Exposures occurred while making physical measurements of irradiated beryllium oxide samples.			
63-39 A	8-3-63	PNR–Westinghouse Electric Corp.	0	0
	Shipping cask dropped during transfer. Contamination removed from 1/2-square foot spot by removing 1/8-inch of wooden surface.			
63-40 B	8-6-63	OR–Union Carbide Corp. Nuclear Division	0	$43,400
	Fire (definite cause undetermined) originated in building exhaust system and was confined to laboratory hoods and exhaust system; however, smoke damaged building.			
63-41 A	8-1-63	OR–Union Carbide Corp. Paducah, Ky.	1 fatality	0
	While ironworker was climbing down rolling-type scaffold, scaffold began to swing and fold, finally toppling to floor. He held on until scaffold was about halfway down, then fell remaining distance (approximately 6') to concrete floor, dying five days later as result of skull fracture.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
63-43 B	7-23-63	SR—E. I. du Pont de Nemours & Co.	0	$10,000[5]
	Tritium release to atmosphere through stack.			
63-44 B	7-25-63	NY—Babcock & Wilcox Co.	1 exposed	0
	While engaged in routine radiography, employee received estimated exposure of 6 rem.			
63-45 A	7-10-63	NV—Reynolds Electrical & Engineering Co., Inc.	1 fatality	0
	A custodial employee suffered fatal pulmonary embolism as result of injuries received in automobile accident three months earlier.			
63-46 B	10-28-63	OR—Oak Ridge National Laboratory	1 exposed	0
	While work was being performed on infrared tritium cell, employee received tritium exposure of 12.5 rem to total body tissue.			
63-47 B	10-31-63	RL—General Electric Co.	0	$7,442
	Lightning ignited sage and grass at 18 locations.			
63-48 A	11-6-63	RL—General Electric Co.	0	$397,000
	Fire (definite cause undetermined) in plutonium purification facility. Plutonium contamination in immediate area of fire. Firemen received slight skin contamination, readily removed. Costs related directly to fire $85,400; decontamination costs $251,300; overhead related to direct losses $60,300.			
63-49 B	11-8-63	SNPO—N—Los Alamos Scientific Laboratory	0	$70,000
	Overpressurization of hydrogen feed lines to turbine pump resulted in destruction of turbine, shrapnel damaged pipes, conduits, etc.			
63-50 A	11-13-63	AL—Mason & Hanger-Silas Mason Co., Inc., San Antonio, Tex.	0	$92,568
	High explosives (120 lbs.) detonated in storage igloo.			
63-52 A	11-15-63	ID—Phillips Petroleum Co.	0	$25,451
	Low-level spread of plutonium contamination from glovebox.			
63-53 A	9-26-63	AL—The Zia Co.	1 fatality	0
	When truck backed over can of paint thinner, can ruptured, spraying contents on laborer's clothing. Flames from dump fire ignited his coveralls, and he died about six weeks later as result of chemical burns received.			
63-54 B	12-4-63	AL—Eagle-Picher Co.	1 injured	$58,507
	Flash fire (definite cause undetermined) in vault where heat-pad paper stored. One employee received first and second degree burns.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
63-55 B	12-9-63	OR—Goodyear Atomic Corp.	0	$51,500
	Compressor in cell debladed while on-stream, accompanied by small fire on exterior of compressor shell.			
63-56 A	12-12-63	ID—Phillips Petroleum Co.	0	0
	Truck transporting radioactive material jackknifed. Shipment undamaged.			
63-57 B	12-11-63	RL—Government	0	$23,500
	Fire, probably caused by cigarette, in Government-owned drug store.			
63-59 B	12-13-63	OR—Goodyear Atomic Corp.	0	$244,800
	Power transformer failed causing tank to rupture. Insulating oil ignited immediately.			
63-60 B	10-17-63	CH—Argonne National Laboratory	1 exposed	0
	While making adjustment on gradient synchrotron, an employee received whole-body exposure of 3.8 rem.			
63-61 B	12-21-63	AL—Monsanto Chemical Co.	0	$7,611
	During installation of copper tubing, plastic bag containing plutonium oxide was punctured, resulting in contamination of the area. Cost due to decontamination.			
63-62 B	Oct.-Dec. 63	AL—Los Alamos Scientific Laboratory	2 exposed	0
	Two men engaged in casting operations with normal uranium received whole-body skin doses of 15.2 rem and 17.3 rem, respectively.			
63-63 B	10-31-63	SNPO—N—Pan American World Airways	0	$5,883
	While in the process of loading collimator onto truck, crane began to tip. Operator dropped load onto truck in attempt to save crane. Damage to crane $5,483; damage to truck $400.			
64-1 A	1-20-64	AL—Government	0	0
	Empty AEC-owned 4-ton truck skidded on icy road, colliding with privately owned car carrying five passengers, three of whom were injured. The three truck couriers were bruised but otherwise uninjured.			
64-2 A	1-23-64	RL—General Electric Co.	0	$2,141
	Several employees received minor contamination while replacing equipment in waste storage facilities. They were readily decontaminated. Cost due to decontamination of equipment.			
64-3 A	2-3-64	OR—Union Carbide Corp. Nuclear Div.	0	0
	Interplant truck shipment of radioactive materials in accident with private car. Shipment undamaged.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
64-4 B	1-25-63	AL–The Bendix Corp.	0	$5,838
	Fire in air-conditioning system, believed to have been started by cutting torch.			
64-5 B	2-25-63	AL–Mason & Hanger-Silas Mason Co. Burlington, Iowa	0	$60,400
	Explosion (definite cause undetermined) during normal pressing operations of high explosives. No radioactive material involved.			
64-6 A	2-24-63	AL–Mason & Hanger-Silas Mason Co. Clarksville, Tenn.	0	0
	During routine disposal of high explosives waste, brush fire resulted, burning about 20 acres of no value. No radioactive material involved.			
64-7 A	2-24-63	ID–Phillips Petroleum Co.	0	0
	Truck carrying 1/2-ton shipping cask containing small quantity of radioactive material in collision. Shipment undamaged.			
64-8 B	2-4-63	NV–Holmes & Narver, Inc.	0	$14,000
	Fire (definite cause undetermined) in construction supplies in storage yard.			
64-9 A	3-11-63	SAN–Lawrence Radiation Laboratory	1 fatality	$1,600
	Electronics coordinator died as result of skull fracture received when car which he was driving overturned when he failed to manipulate a curve.			
64-10 B	2-12-63	RL–General Electric Co.	0	$14,400
	Pressurizer vessel of reactor loop damaged as result of operating heaters without water in system.			
64-11 B	3-11-63	RL–General Electric Co.	1 exposed	0
	When piece of irradiated wire pierced rubber glove of millwright and lay against his skin approximately three minutes, he received radiation exposure to his right thumb of 57 rem.			
64-12 A	3-15-63	NY–Materials & Equipment Corp.	0	0
	Truck carrying radioactive materials slid into ditch. Shipment undamaged.			
64-13 B	3-19-63	CH–Atomics International	0	$6,075
	Clean water, being used to test two new waste tanks, was contaminated by condensation from contaminated vent line connected to one tank. Water subsequently drained onto asphalt surface, contaminating it and drainage ditch.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
64-14 B	Jan.-Mar. 64	CH—Battelle Memorial Institute	1 exposed	0
	During routine handling of fission products in hot cell, technician received quarterly external whole-body gamma exposure of 3.2 rem.			
64-15 B	4-21-64	NV—Reynolds Electrical & Engineering Co., Inc.	1 fatality	0
	Driver of 8,000-gal. water tanker tried to jump clear of tanker when he lost control of it; however, he was uanble to do so, and it rolled over him, crushing him to death.			
64-16 B	4-19-64	AL—The Bendix Corp.	0	$5,143
	Lightning damaged switchgear.			
64-17 B	3-31-64	CH—Atomics International	0	$23,000
	Leak developed in sodium loop tubing; resultant vapors corroded emissivity coating of six banks of thermoelectric modules, rendering them unfit for further use.			
64-18 A	4-22-64	SAN—Advanced Technology Laboratories	0	0
	One drum of shipment of five, each drum containing five polyethylene bottles of radioactive materials, was damaged during transit. No contamination nor release of material resulted.			
64-19 B	5-10-64	ID—Phillips Petroleum Co.	0	$12,884
	During steam flushing to remove radioactive contamination from pipelines to permit tie-in to new lines, leak developed in hose coupling. Contaminated fluid and steam issuing from leak were rapidly dispersed by high wind over approximately ten acres. Majority of cost due to cleanup.			
64-20 B	2-15-64	SR—E. I. du Pont de Nemours & Co.	0	$10,460
	Plywood block left in reactor pipeline system following repairs disintegrated causing nonradioactive contamination of line.			
64-21 B	Jan.-Mar. 64	PNR—Duquesne Light Co.	2 exposed	0
	Due to error in adding doses, two employees received whole-body dose of 3.2 rem and 3.1 rem, respectively.			
64-22 B	4-23-64	SR—E. I. du Pont de Nemours & Co.	0	$19,800[5]
	Tritium release to atmosphere through stack.			
64-23 A	5-18-64	CH—Battelle Memorial Institute	0	0
	Cask, being shipped by truck, found at destination to be emitting 6 rem/hr (gamma). Investigation revealed cask had been dropped en route. Slight area contamination; no significant personnel radiation exposures.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
64-24 B	7-27-64	NY—Westinghouse Electric Corp.	0	$10,500
	When a junction box developed a short or ground, sparks ignited wooden crates nearby.			
64-25 B	6-12-64	AL—Dow Chemical Co.	1 exposed/injured	$56,400
	Chemical explosion caused by burning plutonium chips accidentally dropped into carbon tetrachloride bath. The thumb and index finger of the operator had to be amputated to effect decontamination because flying fragments of plutonium had become embedded in them.			
64-26 A	5-26-64	OR—Mallinckrodt Chemical Works	0	0
	Tractor-trailer hauling radioactive material involved in accident with private car. Shipment undamaged.			
64-27 B	6-10-64	NV—Reynolds Electrical & Engineering Co., Inc.	0	$5,000
	Vacuum unit, mounted on semitrailer, being towed by flat-bed truck, which jackknifed, causing semi-trailer to turn over, damaging vacuum unit.			
64-28 B	6-3-64	SR—E. I. du Pont de Nemours & Co.	0	$11,000[5]
	Tritium release to atmosphere through stack.			
64-29 B	6-14-64	SR—E. I. du Pont de Nemours & Co.	0	$8,400
	Loss of approximately 600 lbs. of heavy water through pipe left open inadvertently.			
64-30 B	6-18-64	CH—Notre Dame University	2 exposed	0
	Two employees received exposures of approximately 180 rem to the fingers, while working with 2000-curie cobalt 60 source.			
64-31 A	7-1-64	AL—Federal Roofing & Siding Co.	1 fatality	0
	Roofer died three days later from results of head and internal injuries sustained when he fell 22′ to the ground from the roof where he was working.			
64-32 B	7-2-64	AL—Los Alamos Scientific Laboratory	0	$11,597
	Explosion, attributed to accumulation of unburned gas in area of stagnant air movement in furnace upper passageways, damaged boiler furnace.			
64-33 B	6-28-64	SR—E. I. du Pont de Nemours & Co.	0	$11,000[5]
	Tritium release to atmosphere through stack.			
64-34 B	6-19-64	SR—E. I. du Pont de Nemours & Co.	0	$49,500[5]
	Tritium release to atmosphere through stack.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
64-35 A	7-10-64	OR—National Lead Co. of Ohio	0	0
	Drum of radioactive material and trailer transporting it slightly contaminated. Both readily decontaminated. No material release nor radiation exposures.			
64-36 B	4-27/ 5-11-64	AL—Monsanto Research Corp.	1 exposed	0
	During routine work with polonium in a laboratory, a chemist received a kidney dose of approximately 45 rem in ensuing year.			
64-37 B	7-10-64	RL—General Electric Co.	1 exposed	$75
	During pressing operations within glovebox, plutonium sample shattered. Ejected fragments caused deep laceration of employee's arm and minor contamination of adjacent working area (180 rem to bone).			
64-38 A	7-23-64	OR—National Lead Co. of Ohio	0	0
	When door of freight car broke open during switching operations, two drums containing radioactive material fell out. Part of contents of one drum spilled in yard area but was recovered.			
64-39 B	4-17-64	RL—General Electric Co.	0	$51,000
	Charging error made in loading reactor resulted in exceeding operating limits.			
64-40 B	7-22-64	ID—Phillips Petroleum Co.	1 exposed	0
	Employee received exposure of approximately 31 rem to one hand and 5 rem to the other while manually removing radioactive flux wires from stainless steel tubes.			
64-41 B	7-21-64	BH—Brookhaven National Laboratory	0	$11,613
	Explosion in hydrogen purifier in bubble changer expansion system when valve inadvertently left in closed position during purging operation. Precooler and adsorber coils torn open and containing dewar bulged.			
64-42 B	8-13-64	NV—Reynolds Electrical & Engineering Co., Inc.	0	$10,000
	Mobile drill rig developed excessive speed on downgrade, failed to negotiate curve, and turned over, damaging rig carriage.			
64-43 B	7-17/ 7-30-64	SR—E. I. du Pont de Nemours & Co.	0	$6,000
	Leaking nitric acid corroded canyon cell equipment beyond repair.			
64-44 A	8-22-64	SR—Sylcor Division of Sylvania Electric Products	0	$2,300
	Trailer-truck loaded with radioactive material collided with private car. Loss represents direct damage to fuel elements. Four non-AEC persons injured.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
64-45 B	9-2-64	RL—General Electric Co.	0	$8,800
	During normal operations, plastic impeller of exhaust fan disintegrated. Fragments penetrated housing of adjacent fan causing it to disintegrate. Nearby water line was broken and a third fan unit damaged by the flying pieces.			
64-46 B	Apr.-June 64	SAN—Lawrence Radiation Laboratory	1 exposed	0
	Chemist working in vicinity of cyclotron received whole-body dose of 3.4 rem.			
64-47 A	9-2-64	CH—Battelle Memorial Institute	0	0
	Truck-trailer arrived at destination with trailer bed slightly contaminated by gross fission products coming from surface of cask containing irradiated material. Truck-trailer decontaminated and returned to carrier.			
64-48 B	9-14-64	NV—Reynolds Electrical & Engineering Co., Inc.	0	$12,000
	Defective weld on drill rig leg caused leg to buckle inward and the mast to fall.			
64-49 A	9-19-64	NV—Reynolds Electrical & Engineering Co., Inc.	1 fatality 1 injured	$74,000
	Electrical cables were being lowered into underground complex when a wire rope from a hoist broke causing cable spools to be jerked from their racks. Four men were hit by the spools, one receiving extensive head and chest injuries from which he died, one being seriously injured, other two receiving lesser injuries. Four men were trapped underground but were rescued.			
64-50 A	9-23-64	SAN—Case Foundation Co.	1 fatality	0
	Employee electrocuted when he contacted a drill rig which struck overhead power lines.			
64-51 B	1-22/3-2	RL—Peter Kiewit Sons' Co.	0	$66,000
	1500 feet of disposal tunnel collapsed while backfilling operations were in progress. Six weeks later, another 50 feet collapsed.			
64-52 B	7-13-64	SAN—Lawrence Radiation Laboratory	0	$9,500
	High explosives accidentally exploded and burned during normal pressing operation. No radioactive material involved.			
64-53 B	7-24-64	SR—E. I. du Pont de Nemours & Co.	0	$102,000[5]
	Tritium release to atmosphere through stack.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
64-54 B	10-1-64	SR–E. I. du Pont de Nemours & Co.	0	$21,000
	Fire (definite cause undetermined) occurred around anion exchange column in hot canyon. Fire caused airborne contamination to crane used for remote maintenance. Water to quench fire damaged electric motors.			
64-55 B	10-27-64	AL–Monsanto Research Corp.	0	$34,922
	Chemical explosion in metal hood when methanol vapors reached flashpoint. Two sets of gloves were shredded by the explosion. Contamination spread in operating area. Three employees received slight contamination.			
64-56 A	11-3-64	RL–General Electric Co.	0	$318,000
	Roof fire (definite cause undetermined) resulted in extensive damage to biology building. All laboratory experiments and fish housed in building lost. Also some valuable records.			
64-57 A	11-11-64	CH–Argonne National Laboratory	0	0
	Broken valve on autoclave, housed in lead shipping cask, allowed contaminated water to seep out of cask during transit, contaminating container and truck floor.			
64-59 B	11-16-64	OR–Union Carbide Corp., Nuclear Div.	0	$16,000
	Explosion in first stage of nitrogen compressor resulting in shrapnel being thrown through roof and also damaging sides of building in which compressor was housed.			
64-60 B	Feb.-Mar. 64	SAN–Lawrence Radiation Laboratory	1 exposed	0
	During routine laboratory work, employee received quarterly exposure of 8.2 rem whole body.			
64-61 B	11-27-64	OR–General Electric Co.	0	$41,680
	Fire in 10,000 KVA transformer.			
64-63 A	12-15-64	NV–Reynolds Electrical & Engineering Co., Inc.	1 fatality 1 injured	$2,340
	When drill rig assembly failed, swivel assembly pipe fell. Rig operator killed instantly from crushing blow on head. Another employee received head injuries and broken arm.			
64-64 A	12-8-64	RL–General Electric Co.	1 fatality 1 injured	$504
	Head-on collision of interplant locomotive and maintenance car. One employee riding in maintenance car died two weeks later from injuries received; second employee seriously injured. Cost due to repair of maintenance car.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
64-65 B	12-22-64	ID—Phillips Petroleum Co.	0	$10,000
	High winds damaged movable test cell building.			
64-66 B	12-22-64	SR—E. I. du Pont de Nemours & Co.	0	$12,700[5]
	Tritium release to atmosphere through stack.			
64-67 B	10-28/ 11-2-64	NV—Holmes & Narver, Inc.	0	$30,000
	Crane damaged while aboard ship during high seas accompanied by gusty winds.			
64-68 B	12-17-64	NV—Reynolds Electrical & Engineering Co., Inc.	0	$17,500
	Failure of bridle line allowed crane mast to fall to derrick stand, causing excessive bending of mast members.			
64-69 B	Dec. 64	OR—Union Carbide Corp., Nuclear Div.	1 exposed	0
	While sampling, weighing, and grinding uranium oxides of varying assays in enclosed process system, operator received a lung burden of 0.021 μc. The employee will receive an estimated integrated lung dose of 20 rem during the first year.			
64-70 B	12-28-64	SAN—General Atomic—Division of General Dynamics Corp.	0	$20,000
	Five plutonium-fueled prototype generators were destroyed when malfunction of high temperature environmental test oven caused generators to be subject to ambient temperature of over 600°F. Generators are designed to withstand maximum ambient temperature of 165°F.			
65-1 A	1-15-65	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	1-20-65	SAN—Lawrence Radiation Laboratory, Livermore	0	$185,000[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.			
65-4 B	1-17-65	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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
65-5 A	1-28-65	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.			
65-6 B	2-5-65	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	2-23-65	NV–Reynolds Electrical and Engineering Co., Inc.	1 fatality	0
	A wireman foreman was electrocuted while working in a switchgear cabinet.			
65-8 A	2-20-65	OR–Government	0	0
	A truck, transporting 100 drums of thorium residues, overturned. Some decontamination was required.			
65-9 B	1-14-65	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.			
65-10 B	2-20-65	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 27rem, respectively, when gaseous radioiodine escaped from an "abandonment" valve opened in error.			
65-11 B	1-11-65	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.			
65-12 B	3-5/25-65	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.			
65-13 B	4-14-65	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			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
65-13 B—Cont.	5.2, 4.7, 4.3, 4.2, 4.1, and 4.1 rem, respectively; three USAF personnel 5.3, 4.7, and 4.4 rem, respectively.			
65-14 A	4-28-65	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.			
65-15 B	5-5-65	NV—Reynolds Electrical and Engineering Co., Inc.	0	$75,000
	A drill rig was damaged when it overturned.			
65-16 B	5-6-65	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	3-29/4-30-65	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.			
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.			
65-19 B	5-22-65	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.			
65-20 A	6-14-65	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.			
65-21 B	6-14-65	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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
65-22 A	6-21-65	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.			
65-23 A	6-24-65	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	7-5-65	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.			
65-25 B	4-8-64	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.			
65-26 B	5-6-65	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.			
65-27 B	5-10-65	SR—E. I. du Pont de Nemours & Co.	0	$33,600
	Process water (2400 lbs.) was lost when it leaked through an unseated sleeve.			
65-28 B	5-16-65	SR—E. I. du Pont de Nemours & Co.	0	$9,800
	Process water (700 lbs.) was lost when it leaked through an unseated sleeve.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
65-29 B	7-20-65	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	7-7-65	SAN—Lawrence Radiation Laboratory, Livermore	1 exposed/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.			
65-31 B	7-31-65	SNPO—N—Pan American World Airways, Inc.	1 exposed	0
	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.			
65-32 B	7-31-65	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	7-19/30-65	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.			
65-34 B	May 65	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 0.025 μc. (an accrued annual exposure of 25 rem)			
65-35 B	8-23-65	RL—Battelle-Northwest	0	$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.			
65-36 B	8-25-65	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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
65-37 B	8-27-65	CH–Argonne National Laboratory	0	$35,000
	Four transformers were damaged by lightning.			
65-38 A	9-9/13-65	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, 5.8, 3.3 and 1.9 rem, respectively.			
65-39 B	9-13-65	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.			
65-40 B	9-5-65	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	8-27-65	CH–Argonne National Laboratory	0	$8,000
	Lightning caused the destruction of a breaker and the burning of a cubicle.			
65-42 A	9-29-65	RL–Battelle Nrothwest	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 scrammed 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.			
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, 22, 21, 20, and 16 rem.			
65-44 A	9-15-65	RL–General Electric Co.	1 exposed/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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
65-45 B	10-13-65	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	5-8-65	RL--Battelle-Northwest	0	$7,000
	Failure, due to fatigue, of a 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	8-2-65	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	8-25-65	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	10-15-65	AL--Dow Chemical Co.	10 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. Ten employees received inhalation exposures from .017 to .119 microcuries of plutonium which produce an accrued annual dose to the lung of 112, 110, 83, 44, 42, 28, 21, 20, 16, & 16 rem.			
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.			
65-51 B	10-23-65	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	10-30-65	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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
65-53 B	9-30-65	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	11-9-65	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.			
65-56 B	Oct.-Dec. 65	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.			
65-57 A	12-23-65	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.			
65-58 B	12-26-65	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. 65	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.			
65-60 B	9-13 & 17-65	AL—Los Alamos Scientific Laboratory	0	$5,400
	Repeated lightning strikes damaged transformers.			
65-61 B	10-3-65	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.			

No.[1] · Type[2]	Date	Field Office[3] · Contractor	Injuries[4] · Exposures	AEC Property Damage
65-62 B	3-19-65	AL–Dow Chemical Co.	1 exposed	$1,306
	When a glove failed in a glovebox, releasing plutonium, an employee received a lung deposition of 0.042 μc of plutonium, from which is expected an accrued 12-month exposure of 36 rem. Cost was for decontamination of facilities.			
65-63 B	May 65	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.			
65-64 B	11-23-65	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.			
65-65 B	11-27-65	AL–Dow Chemical Co.	0	$47,000
	Roofing destroyed by high winds.			
66-1 B	1-5-66	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.			
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	1-12-66	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.			
66-4 A	1-11-66	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.			
66-5 B	1-21-66	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).			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
66-6 B	2-2-66	CH–Atomics International	1 exposed	0
	An employee picked up an irradiated fuel sample which fell from a transfer tunnel. The radiation exposure, estimated at 58 rem, occurred to the skin of the middle phalanx of the fingers of the left hand.			
66-7 A	2-14-66	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.			
66-8 B	3-18-66	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 & 3/28-66	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	3-15-66	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.			
66-11 B	Jan.-Mar. 66	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.			
66-12 B	4-1-66	SR–E. I. du Pont de Nemours & Co.	0	$20,049
	A forest fire destroyed 178 acres of pine and hardwood trees.			
66-13 B	1-24/ 2-24-66	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 plutonium processing.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
66-14 B	4-6-66	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	4-17-66	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. 66	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.			
66-17 A	5-1-66	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.			
66-18 B	4-14-66	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.			
66-20 A	5-26-66	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.			
66-21 B	6-6-66	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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
66-22 B	Apr.-June 66	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 28.5 rem to the left hand.			
66-23 B	5-20-66	SR–E. I. du Pont de Nemours & Co.	0	$22,600[5]
	A weld failure on a container in a gloveport hood permitted release of tritium gas through a stack to the atmosphere.			
66-24 A	6-24-66	SAN–Lawrence Radiation Laboratory, Berkeley (Halbach & Flynn, subcontractor)	1 fatality	0
	An employee was killed when the dirt loader he was operating overturned and crushed him.			
66-25 A	6-17-66	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.			
66-26 B	6-27-66	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	6-24-66	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	6-2-66	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.			
66-30 A	6-10-66	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.			
66-32 B	6-5-66	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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
66-33 B	Apr.-June 66	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.			
66-34 B	4-15-66	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.			
66-36 A	9-22-66	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.			
66-37 B	9-23-66	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.			
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	10-12-66	AL—J. R. Brennand Construction Co. (Triple A Electric Co., subcontractor)	1 fatality	0
	An electrician was electrocuted while working alone on a transformer.			
66-40 B	7-9-66	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	6-6/19-66	CH—University of Minnesota	1 exposed	0
	While working in a linear acceleration facility an employee's film badge indicated a reading of 50 rem whole body.			
66-42 B	7-21/10-18-66	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.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
66-43 B	10-21-66	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.			
66-44 B	10-12-66	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	12-20-66	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	12-9-66	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	11-17-66	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	10-26-66	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.			
67-1 B	2-16-67	AL–Monsanto Research Corp. Mound Laboratory, Miamisburg, Ohio	0	$16,465
	Abandoned storage vessels inside a stainless steel glovebox were being flushed with 7-9 N nitric acid to recover plutonium nitrate. During this operation, the air monitor alarmed, and the odor of nitric fumes was detected. Shortly thereafter, a puddle of dark liquid (plutonium nitrate solution) was seen on the floor under the glovebox. The solution had leaked from one of the storage vessels into the glovebox well and thence onto the floor of the room. Contaminated personnel (three) were readily decontaminated by showering; the cost was for decontamination of the storage vessel area.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] Exposures	AEC Property Damage
67-2 B	3-3-67	SR–E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$71,000

The malfunctioning of the plunger on the upper shield plug of a reactor caused the loss of 3,300 pounds (412 gallons) of heavy water. The plunger jammed and would not return to the latched position under normal spring pressure.

67-4 B & 67-11 B	Jan.– Mar. 67	AL–The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	3 exposed	0

A glovebox containing a fluorinator was located in an area enclosed by concrete and water-well neutron shielding. At times it was necessary for three process technicians to perform work of a routine nature inside the shielding area. During this period, an excessive accumulation of plutonium and americium residues contained within the glovebox required moving.

The three process technicians received estimated external whole-body quarterly radiation exposures of 3.4, 3.2, and 3.2 rem, respectively.

67-5 A	3-11-67	SR–E. I. du Pont de Nemours & Co. Aiken, South Carolina	1 fatality	0

A three-man plant railroad crew was engaged in routine car switching

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-7 B	3-15/20	SAN–University of California, Lawrence Radiation Laboratory, Livermore, California	0	0

An air-truck shipment of a depleted iridium 192 source (estimated at 6.5 curies) was found to have above-normal radiation levels upon arrival at its destination. A spring clip held the source in position in the container. Evidence indicates that a jolt during shipping caused the clip to disengage, permitting the source to be displaced to an unshielded position by normal vibrations while in transit.

67-8 A	4-5-67	AL–The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	1 fatality	0

An employee was servicing a tractor mounted on a lowboy, while standing on the tractor track. As he stepped back from checking the radiator, he fell approximately seven feet to the ground, without striking the tractor or the lowboy, and landed on his hands and left hip. He told another employee who came to his assistance that his "foot slipped off the track."

The employee was taken to the hospital where it was determined that he had sustained a fractured femur. Corrective surgery was performed and it appeared that he would have an uneventful recovery; however, his blood pressure began dropping and on the fifth day he died. The cause of death was pulmonary embolism secondary to injury causing fracture, neck of left femur.

67-9 B	4-10-67	SR–E. I. du Pont de Nemours & Co. Aiken, South Carolina	1 exposed	0

Steel wire was being irradiated to determine the flux pattern. The process was to introduce the wire into the reactor through stainless steel tubing. After irradiation, it was withdrawn by the drive mechanism and discharged through a tube ending six feet under the disassembly basin water level. On this occasion, malfunction of the drive mechanism resulted in a portion of the irradiated wire being caught in the discharge tube in such a way that it could be removed only by manually pulling it back through the drive mechanism box. The reactor foreman pulled the wire with one hand and coiled it with the other. His hands were protected from contamination by two pairs of rubber gloves.

The reactor foreman received an estimated radiation exposure of 250 rem to both hands. There were no clinical symptoms as a result of the exposure.

67-10 A	4-14-67	RL–J. A. Jones Construction Co. Richland, Washington	1 fatality	0

In the process of moving a motor crane, an equipment operator, with his back toward the clamshell bucket, was pulling the slack in the "closing line" through the bucket sheaves and roller. As the bucket assembly began to topple, another crew member yelled a warning; however, the equipment operator, instead of jumping aside, put his hand over his head and crouched down. The overturning assembly struck him on the neck and shoulder, driving him to the ground, the arm of the assembly coming to rest across his chest.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-10 A–Cont.	Although the victim was given mouth-to-mouth resuscitation and cardiac massage, closed chest, he was pronounced dead upon the arrival of a doctor. The cause of death was ruptured aorta at aortic arch, and pulmonary emphysema bilateral.			
67-12 B	Jan.-Mar. 67	AL–The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	1 exposed	0
	A process operator performed routine work in a plutonium fabrication foundry. Two factors created high exposure potentials: 1) an inoperative belt conveyor system was replaced by an improvised chain conveyor system, making it necessary for the employee to handpass massive plutonium charges and castings along a glovebox line, and 2) handling abnormally high amounts of material containing americium-241. The process operator received an estimated external whole-body quarterly radiation exposure of 3.2 rem.			
67-13 A	4-10-67	AL–Sandia Corp., Albuquerque, New Mexico	1 fatality	0
	A painter was applying clear wood sealer to the sloping plywood roof of a missile shelter. He had finished all but a small portion when he fell off the roof, which was 14 feet high at the eave edge. Apparently, he stepped onto a freshly sprayed area since there were footmarks smeared with sealer on the concrete floor slab which extended 30 inches beyond the eave line. Those coming to his assistance found him lying with his feet on the concrete and the remainder of his body on the ground. The painter died six days later of a fat embolism due to fractured pelvis and arm.			
67-14 B	4-4-67	SR–E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$11,000[5]
	During welding operations, an electric welder malfunctioned, causing the failure of a seal tube which resulted in the release of tritium gas through a stack to the atmosphere.			
67-15 B	3-12-67	NV–Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$65,000
	A fire occurred in an electronics equipment storage trailer, damaging both the equipment and the trailer. The fire is believed to have been caused by a heater overheating when a circulating fan stalled.			
67-16 B	5-5-67	AL–Mason & Hanger-Silas Mason Co., Inc. Amarillo, Texas	0	$594
	An AEC-owned truck, transporting 1,800 pounds of cargo, a part of which was radioactive material, was involved in an accident with a privately-owned passenger car. The two couriers in the truck were not injured. The driver of the privately-owned car, its sole passenger, was only slightly injured. There was no damage to the cargo. The cost was for truck repairs.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-17 B	6-14-67	BH—Brookhaven National Laboratory Upton, New York	0	$10,600

A Van de Graaff accelerating tube, in its positioning cradle, was to be moved. Four slings were attached and those on either side of the tube shackled together. Later, two employees, unaware that the shackled slings had not been lashed together, proceeded with the lift. The tube slid out of its cradle, fell 15 feet to the floor, and was damaged.

67-18 A	5-25-67	SNPO—C—Westinghouse Astronuclear Laboratory, Astronuclear Core Operations, Cheswick, Pennsylvania	1 fatality	0

A technician working on a leaching furnace platform requested another employee to throw him a brush to clean the platform, but he did not catch it. Later, he handed another employee a rod used for retrieving articles from the furnace. It was surmized from this that he tried to retrieve the brush with the rod and, this failing, that he climbed down into the furnace annulus and was overcome by the lack of oxygen (excluded by argon gas) before he could climb out.

Resuscitation efforts were made; however, there was no response. The coroner's office gave the cause of death as asphyxiation due to lack of oxygen.

67-19 B	6-2-67	AL—Mason & Hanger-Silas Mason Co., Inc. Burlington, Iowa	0	$50,000

During the remotely-controlled operation of a 20-inch hydrostatic press, 22 pounds of high explosives detonated, causing severe damage to the immediate area, with nearby areas receiving moderate superficial damage from the blast and/or flying missiles. The probable cause of the incident was the shearing or frictional action of high explosives particles between parts of the press.

67-20 A	6-9-67	SAN—University of California, Lawrence Radiation Laboratory, Livermore, California	1 fatality	0

Responding to the scene of a grass fire, a police officer, driving in the left lane as he passed a pickup truck, heard a crash and the shattering of glass, and felt an impact. He immediately stopped the police car and got out. He and a fireman, who had seen the police car stop and was going toward it to see what the policeman wanted, found a second fireman lying under the truck, badly injured.

It was not known what caused the second fireman to come into contact with the police car.

He died in the hospital about an hour later. His injuries were diagnosed as a basal skull fracture and a broken neck. Damage to the police car consisted only of a shattered windshield and minor dents.

67-21 B	5-14-67	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$49,179

Radioactive liquid waste was stored in an underground tank. The pipeline for the concentrate entered the storage tank through a shielded riser, extending from the top of the tank to approximately one foot

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-21 B—Cont.	aboveground. Access plugs were sealed with mastic compounds. The inlet pipe entered the riser horizontally below ground and terminated with a valve near the center of the riser. When the riser became plugged with concentrate crystals below the inlet line, the liquid flow reversed and forced its way through the access plugs. Approximately 13 curies of radioactive liquid waste, primarily cesium, were released to plant streams but sampling showed that radioactivity concentration standards were not exceeded in streams beyond the plant boundary. The cost was for decontamination of ground in the vicinity of the tank.			
67-22 B	6-8-67	SAN—Stanford Linear Accelerator Center Stanford, California	0	$17,211
	A spectrometer magnet was severely damaged by overheating of the coils when the unit was inadvertently connected to the wrong power supply.			
67-23 A	6-21-67	RL—General Electric Co., Richland, Washington	0	$185,000
	A fire occurred in the heat exchanger cell of a reactor when primary coolant pump lubricating oil, source of fuel for the fire, ignited after being inadvertently discharged into the cell equipment area when a normally open valve in the return line was not reopened after having been closed the previous day. The exact source of ignition was not determined, although several possibilities were considered. Damage was confined to a limited portion of the cell area, with some smoke damage to an adjoining pipe gallery.			
67-24 A	6-30-67	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	2 fatalities	$40,000
	During the preparation of a cavity at the bottom of a shaft 3,200 feet deep, an unexpected surge of water and muck (broken rock) entered the shaft in excessive volume. The men and equipment available were unable to stop or control the surge until it had run its course, burying and asphyxiating one miner. The excess muck covered the weep (drain) pipes with about four feet of material. Without being able to pump the water or drain it off, the rising water drowned a second miner.			
67-25 A	7-8-67	NV—Holmes & Narver, Inc., Johnston Atoll, Hawaii	1 fatality	0
	Two employees were retrieving the last two doors from a row of 23 doors which were stored vertically with the last door leaning against a wall. Employee A raised the doors to an upright position, one at a time, while Employee B steadied them. As Employee A started to remove the doors needed, the doors suddenly shifted off balance and toppled over onto Employee B, crushing his head against shelving behind him. He fell to the floor. His hard hat was found wedged between the doors and the shelving. The cause of death was anoxia, stagnant, due to intracerebral hemorrhage and multiple skull fractures.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-27 A	7-17-67	ID—Howard S. Wright & Associates, Idaho Falls, Idaho	1 fatality	0

The construction of a reactor ring (a concrete wall to encircle the reactor as a radiation shield) was in progress. Although an access ladder was provided, a carpenter elected to climb down into the ring, using the horizontal ribs, spaced 12 inches apart, as "ladder rungs," and the vertical walers as "handrails." He placed his hands on the top of the walers for support. His partner stated that he believed the carpenter's foot slipped on a rib. When this happened, the waler (not securely fastened) under his right hand moved. He instantly let go and fell, approximately 15 feet, landing face downward.

The carpenter was conscious when reached by co-workers, although completely paralyzed from the neck down. He died in the hospital approximately 36 hours later as the result of the multiple fractures and spinal cord injury received.

67-28 B	6-22-67	AL—The Bendix Corp., Kansas City, Missouri	0	$11,575

A failure of voltage control equipment at the municipal power plant caused an overvoltage, resulting in the damage or destruction of electrical equipment at the contractor's plant.

67-29 B	6-9-67	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$17,700

The lower portion of the upper section of a drill rig mast collapsed while attempts were being made to free a drilling assembly lodged in a hole at a depth of 2,180 feet, with the top portion at approximately 1,730 feet.

67-30 B	7-1-67	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$7,500

A loose electrical connection, or similar fault, is believed to have resulted in an electrical arc, causing the wiring and control devices within an air dryer control cabinet to be charred and burned beyond use.

67-31 B	6-18-67	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$22,000

During a periodic inspection of a high-pressure tower in the heavy water plant, the bottom 21 trays were found to be damaged. Some were displaced completely and had fallen to the bottom of the tower. Others were in place but bent downward. The cause of the damage was not determined but it was known that several steps in the procedure preparatory to hydrostatic testing were performed out of normal sequence.

67-32 B	Apr.-June 67	AL—The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	3 exposed	0

While performing their routine duties, one on an americium line of a glovebox, one in a fluorinator area, and one in an oxide dissolving area, three employees received estimated external whole-body quarterly radiation exposures of 3.7, 3.4, and 3.1 rem, respectively.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-34 B	July-Aug. 67	AL–University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico	1 exposed	0
	An employee helped unload cobalt-60 sources (two 10-curie; two 100-curie) from a shipping cask. Although using remote-handling methods, because of inadequate shielding and distance, the employee received an estimated external quarterly radiation exposure to part of the trunk, head, and eyes of 5.9 rem. The bulk of the dose was received by the right shoulder and by the right side of the head.			
67-35 B	8-22-67	RL–Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	0	$9,800
	As a massive craneway door, hinged at the top, was being opened, it caught on a crane which had been parked too close. The cables from the door to the winch broke under the extra strain and, since there was no braking device, the heavy door slammed shut. The loss was limited to damage of the crane door and crane hoist motor.			
67-36 A	9-3-67	AL–Mason & Hanger-Silas Mason Co., Inc. Amarillo, Texas	0	$1,872,000
	A severe wind and hailstorm, with winds in the range of 80 to 100 miles per hour and hailstones the size of oranges, caused extensive roof and other structural damage to numerous buildings, disrupted utilities, demolished a warehouse wall, leveled security fencing, and caused severe vehicle damage.			
67-37 B	6-5-67	NV–Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$14,756
	Failure of a threaded brass fitting permitted oil to leak from a hydraulic line in a hoisthouse. The oil dropped onto a hotplate and/or portable heater and was ignited. The major portion of the damage was to the hoist operating and control system. Damage to the hoisthouse consisted principally of partially melted fiberglass insulation facing.			
67-38 B	9-15-67	AL–The Bendix Corp., Kansas City, Missouri	0	$13,590
	An electrical malfunction occurred while a special electronic testing apparatus was being tested, destroying the apparatus. Although numerous tests were run, no specific condition was found which could reliably account for the incident.			
67-40 B	July-Sept. 67	AL–The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	7 exposed	0
	A depleted uranium-plutonium-molybdenum alloy containing 28% plutonium was used in reactor fuel element fabrication. The plutonium contained 11.5% plutonium-240, 1.4% plutonium-241, and americium from decay of the latter. It was expected that the alloy could be processed in about the same manner as normal plutonium production; however, soon after volume production of castings was reached, monitors reported high gamma readings. Swipes taken from the glovebox bottom indicated the radioactivity had an americium content as high as 140,000			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-40 B—Cont.	parts per million. Investigation revealed that the high pouring temperature of 1275 degrees centigrade was selectively volatilizing americium which coalesced on molds and crucible surfaces. Subsequent operations, such as removing castings from molds, scattered americium-rich particulates throughout the glovebox. Because of this, six employees performing routine duties received unexpected amounts of radiation. The seventh exposure occurred in the fluorination area of the chemical recovery operations where the neutron background is normally high. The six employees received estimated whole-body quarterly radiation exposures of 3.8, 3.4, 3.3, 3.1, 3.1, and 3.1 rem, respectively, and the seventh 3.4 rem.			
67-41 B	8-10-67	NV—Holmes & Narver, Inc., Amchitka, Alaska	0	$6,500
	Strong winds demolished a house trailer.			
67-42 B	8-11-67	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$8,000
	While "walking" a backhoe up a hill, the operator lost control of it due to the malfunction of the braking mechanism. The backhoe, traveling backwards, rolled down a 50-foot embankment, turning over several times, and was demolished. The operator jumped off just before the backhoe went over the embankment.			
67-43 B	11-14-67	RL—Atlantic Richfield Hanford Co. Richland, Washington	1 exposed	0
	An employee, wearing protective clothing, used extension tools during most of the steps for taking a sample of highly radioactive liquid from a tank; however, he screwed the caps on the shielded sample carriers by hand. The presence of high-level contamination on the cuff of the right sleeve of the employee's coverall went undetected for 44 minutes. The exact manner in which the cuff became contaminated could not be determined. The employee received an estimated exposure of 370 rem to the right wrist.			
67-44 B	11-17-67	RL—ITT Federal Support Services, Inc. Richland, Washington	0	$5,124
	A diesel locomotive collided with a cask car during coupling operations, due to the inattention of the diesel's engineer. The cost was for repairing the locomotive; the cask car was not damaged. A switchman received a minor injury (knee cut) when he was thrown against the locomotive cab door at the time of impact.			
67-45 B	11-16-67	RL—Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	0	$25,000
	During a test to simulate sudden loss of reactor coolant, a 24-ton pressure vessel shifted, causing damage to structural supports, catwalks, instrumentation, and miscellaneous auxiliary equipment. The accident resulted from inadequate design of structural supports.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-46 B	9-29-67	AL—The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	0	$10,246
	Obsolete automatic stabilization process (ASP) equipment was being removed from a drybox system. Prior to a paint spraying procedure, all of the piping was to be removed, except the main supply headers leading to the various levels of the ASP box and the main drain line back to the storage tank. By mistake, a section of the supply line leading to the upper level of the box was removed. The end of the pipe was plugged with a rubber stopper and taped. When the spraying procedure began, the rubber plug blew out, releasing contaminated liquid into the adjacent area. Contamination was confined to the drybox area; the cost was for decontamination.			
67-47 B	10-1/11-15-67	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	1 exposed	0
	While performing routine maintenance duties, such as replacing jumpers in a diversion box, removing scaffolding from a "hot" shop, and replacing housing cable on a "hot" crane, a rigger received an exposure in excess of the quarterly limits. Since the rigger's duties took him into several areas where exposure was possible, its source could not be pinpointed. The rigger received an estimated quarterly skin exposure to the whole body of 10.8 rem.			
67-48 B	11-12-67	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$18,535
	Failure of a hydraulic lifting ram caused a drill rig mast to fall, damaging the mast and other parts of the drill rig.			
67-49 B	11-26-67	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$24,000
	Failure of a nylon tube (installed for test purposes on an instrumented shield plug in a reactor) led to a loss of 1,600 pounds of heavy water.			
67-50 B	12-24-67	BH—Brookhaven National Laboratory Upton, New York	0	$15,000
	A fire, probably originating in electric wiring, occurred in the compressor trailer of a 30-inch bubble chamber facility. The compressors and associated piping and wiring were damaged.			
67-51 B	12-9-67	SAN—Gulf General Atomic Inc., San Diego, California	0	$10,563
	A fire of electrical origin occurred in an instrumentation trailer. The fire was concentrated in the upper right hand area of the heating and cooling unit, although instrumentation and data acquisition equipment was subjected to heat and heavy smoke damage.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
67-52 B	Dec. 67	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	4 exposed	0
	Shortly after beginning curium solution processing, radiation levels became abnormally high at the glovebox containing the solvent recycle pumps and continued to rise. The next day, one of the pumps developed a leak and preventive maintenance was started. Supplemental shielding, containing two inches of lead, was installed at the face of the glovebox to reduce body exposure. Several hours after the defective pump was replaced, a leak was observed at a connector in the new pump. The line was replaced and the leak stopped. The greater portion of the hand exposures received by four employees was attributable to their taking part, unexpectedly, in the replacement and repair of the recycle pumps. The four employees received estimated hand exposures as follows: one 28 rem to the right hand and 75 rem to the left hand; one 39 rem to the right hand; two 39 rem to the left hand.		
67-53 B	12-14-67	NV—Government	0	$37,067
	Cargo (drilling equipment) on board a barge being towed through the Gulf of Alaska, was lost during a storm involving 75-miles-per-hour winds and 8-to-12-feet-high waves.			
67-56 B	10-15-67	SAN—Atomics International, Canoga Park, California	0	$8,478
	A series of offsite brush fires damaged materials in a salvage yard onsite.			
68-1 B	1-10-68	AL—Mason & Hanger-Silas Mason Co., Inc. Amarillo, Texas	0	$57,763
	Chemical high explosives (16.5 pounds) detonated during remotely-controlled pressing operations. The explosives were probably raised to ignition temperature either by being pinched between moving metal surfaces or by heat resulting from friction between metal surfaces. Light fixtures, hoists, air-conditioning ductwork, and walls and roof of building were damaged or blown away.			
68-2 B	1-11-68	SNPO—C—Westinghouse Astronuclear Laboratory, Pittsburgh, Pennsylvania	0	$48,810
	An electrical fault resulted in arcing and burnthrough of a test furnace spacer ring. This permitted the escape of hot gas which ignited adjacent combustible material in the test cell. Damage consisted of the total loss of the test cell expandable walls and roof beams, some loss of power, electrical control, and pneumatic transmission lines, and the loss of some pieces of various test support equipment.			
68-3 B	2-9-68	CH—Argonne National Laboratory, Idaho Falls, Idaho	0	$24,191
	During the replacement of a valve in the secondary sodium cooling system, a "freeze seal" failed, releasing approximately 80 gallons of sodium in a reactor facility boiler plant control room. The release occurred about 20 minutes after a fan, used to maintain a freeze seal between the open pipe and flowing sodium, had been turned off to			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
68-3 B–Cont.		permit welding the replacement valve. The sodium, initially under a pressure of approximately 13.5 pounds per square inch and at a temperature of 509 degrees Fahrenheit, streamed out of the open valve body, and almost immediately ignited. Portions of the equipment in the room were either destroyed or severely damaged by the fire. There was also smoke and heat damage to the remaining equipment, as well as to the ceiling and walls. The three men working on the replacement of the valve received minor burns. The cost was for cleaning, repairing, and replacing equipment.		
68-4 B	1-12/13-68	SR–E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$11,823
		A loss of 550 pounds of heavy water occurred because the cell jumper connection was not sufficiently tight for pressure operation.		
68-5 B	2-17-68	NV–Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$11,970
		During truck transportation, a vacuum circulation pump was damaged when the chains holding it came loose, allowing it to fall from the truck which was traveling over a rough road.		
68-6 B	1-25-68	NV–Holmes & Narver, Inc., Amchitka, Alaska	0	$14,428
		A crane was damaged when it overturned while lifting a load exceeding its 70-ton maximum capacity.		
68-7 B	3-4-68	ID–Idaho Nuclear Corp., Idaho Falls, Idaho	0	$1,300
		Equipment was removed from a railroad car and transferred onsite in two trucks to a warehouse. Almost four weeks later, it was discovered that the equipment was contaminated. The contamination (uranium oxide) was confined to the warehouse, the trackside unloading area, the railroad car washing site, and the two onsite trucks. The cost was for decontamination of these areas. There was no personnel contamination.		
68-8 B	3-13-68	RL–Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	0	$34,000
		An electrical short circuit and the resulting power arc in the main electrical switchgear damaged two breakers extensively. When the lights went out and the building ventilation stopped, all personnel evacuated the building, and the emergency crew went into action, taking the necessary steps to preclude any contamination spread. Operations were curtailed for two and one-half days while repairs were being made.		
68-9 B	3-24-68	SNR–General Electric Co., Knolls Atomic Power Laboratory, Schenectady, New York	0	$25,200
		Approximately 9,400 square feet of plastic covering equipment were damaged by ice formation and high winds.		

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
68-10 B	4-1-68	AL—Sandia Corp., Albuquerque, New Mexico	0	$9,707

An electrical fault occurred in a motor control center, causing spectacular arcing between the bus-bars and conductors inside the center, and resulting in the destruction of the 1,600-, 1,000-, and 300-ampere breaker sections of the center and heat and smoke damage to the remaining 19 sections.

68-11 B	4-3-68	AL—Monsanto Research Corp., Mound Laboratory, Miamisburg, Ohio	2 exposed	$41,881

A glovebox drying oven explosion blew out plastic shielding (up to four and one-half inches thick) on four gloveboxes, ruptured fronts of four others, and broke or displaced ceiling panels. Flying debris inflicted minor lacerations, abrasions, and contusions on three employees and knocked their respirators off or out of position. The cause of the explosion was the ignition of the flammable vapors emitted by gloves being dried within the oven, which overheated when the temperature control contacts stuck. The oven did not have a high-temperature safety cutoff.

The three injuried employees received plutonium-238 lung and systemic body burdens primarily through inhalation after their respirators has been knocked off or out of position by the explosion. However, only two received lung burdens in excess of .016 microcurie (.295 μc & .105 μc which was expected to produce an annual dose to the lung of 110 rem and 39 rem respectively).

68-12 B	Jan.-Mar. 68	SAN—University of California, Lawrence Radiation Laboratory, Berkeley, California	1 exposed	0

During a series of experiments involving an atomic beam machine, about five curies of cesium-137 were deposited in the machine interior. A group leader checked the machine's vacuum system and decontaminated the internal lead shield, which was replaced by a brass-clad lead shield to reduce outgassing from the lead. During a subsequent experiment, the group leader spent considerable time around the machine trying to locate and correct a small but persistent leak in the vacuum system.

He received an estimated external whole-body quarterly exposure of 3 rem, according to his film badges.

68-13 B	Jan.-Mar. 68	OR—Union Carbide Corp., Nuclear Division Paducah Gaseous Diffusion Plant Paducah, Kentucky	2 exposed	0

Shortly after the start of a program to wash 80 cylinders containing uranium residue, it became apparent that additional shielding was needed to prevent splashing and to reduce beta radiation from the surface of the drain pans. While installing the shielding, two mechanics came in close proximity to the residue and received estimated quarterly beta radiation doses to the skin of 36 rem and 24 rem, respectively.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
68-15 B	3-8-68	SNPO–N–University of California, Los Alamos Scientific Laboratory, Jackass Flats, Nevada	0	$9,911
	A 25-ton diesel electric locomotive lost braking traction while moving a flatcar carrying a 50-ton load. The locomotive was purposely derailed to avoid collision with another locomotive. The two operators, who jumped from the locomotive before it was derailed, received only minor injuries. The derailed locomotive, flatcar, and load sustained little damage; however, portions of the railroad track were severely damaged.			
68-16 B	1-24-68	OR–The Rust Engineering Co., Oak Ridge, Tennessee	0	$5,005
	When a hydraulically-controlled crane gantry was lowered into position, the anchor pin holes failed to align, although the indicator in the crane cab showed that the pins were in place. The boom was damaged when it fell about four feet onto a railroad track.			
68-17 B	4-29-68	NV–Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$30,000
	When two diagonal braces failed from overstress, a drill rig mast broke and fell, damaging the mast and the carrier.			
68-18 B	Mar. 68	NY–Government	1 exposed	0
	During a three-day period, an employee was engaged in experiments in which filter papers were electrostatically discharged by placement on a 50-millicurie strontium titanate source contained in a vertical pipe with a screwcap closure. With the cap removed, the source was below the top of the pipe at a position such that beta rays were emitted upward in a conical pattern. Periodically, the employee, using forceps, placed a filter paper on the source and, after a short interval, retrieved it. Each time he placed or retrieved a filter paper, the upper part of his body was within the radiation field for two or three seconds. The employee received an external beta ray exposure estimated at 13.4 rem, as indicated by his film badge.			
68-19 B	6-23-68	BH–Brookhaven National Laboratory Upton, New York	0	$12,000
	A defective transformer joint overheated, resulting in fire which damaged the power supply transformer and burned the insulation and varnish.			
68-20 B	6-20-68	AL–Sandia Corp., Albuquerque, New Mexico	0	$55,673
	A computer and electronic test equipment were loaded in the rear of a semitrailer van as a part of its cargo. En route, the right rear dual tires caught fire because of the excessive amount of braking necessary on a mountain road, igniting the wooden floor and plywood walls of the van. The computer and equipment were damaged; however, some of it was salvageable and is back in service.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
68-21 B	6-7-68	SR–E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$11,500[5]
	During welding operations, the failure of a seal tube resulted in the release of tritium gas through a stack to the atmosphere.			
68-22 B	6-22-68	RL–Douglas United Nuclear, Inc. Richland, Washington	0	$66,000
	A reactor was scrammed by a flow monitor which showed stoppage of the cooling water in one process tube. Subsequent investigation determined that a temperature sensing bulb from a temperature detector had become jammed in the throat of a venturi leading to a process tube containing slightly enriched uranium, and that cooling water flow had been completely blocked.			
68-23 A	8-17-68	OR–Mid-South Pavers, Inc., Oak Ridge, Tennessee	1 fatality	0
	When a road grader operator became conscious of a change in the sound from the exhaust of a road roller following at some distance, he looked back and saw the roller at the edge of the road tilted to an angle of approximately 45 degrees. The driver was standing up and then jumped into the path of the rotating machine, which rolled over and crushed him to death. The actual accident cause was not determined; however, it was known that the operator had been losing sleep because of sitting up nights with a hospitalized member of the family, and it was thought he may have dozed momentarily.			
68-24 A	8-19-68	RL–Hatch Drilling Co., Richland, Washington (subcontractor to J. A. Jones Construction Co.)	1 fatality	$1,720
	During a drilling operation, a cave-in began below ground and proceeded upward, carrying the driller's helper into the hole in an upright position. When the driller rushed to the hole, the helper had completely disappeared beneath a crater 15 deep wide and six feet deep. Rescue operations were started immediately. The body was located about eight hours later at the 22-foot level, head downward. An autopsy revealed death by asphyxia.			
68-25 B	8-16-68	RL–Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	0	$7,170
	Heavy water (approximately 5,500 pounds) leaked from a reactor primary system when, in returning the system's gas pressurizer to normal following repair work, an operator made an error in the sequence of valve adjustment. The water leaked out of an opening temporarily sealed with plastic while a permanent blank was being fabricated. Although 93% of the heavy water was recovered, it was degraded.			
68-26 B	7-22-68	AL–Monsanto Research Corp., Mound Laboratory, Miamisburg, Ohio	1 exposed	$350
	A senior research chemist inhaled airborne polonium when he removed a highly contaminated distillate container from a glovebox line. It was not determined how this occurred while he was wearing a respirator (half			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
68-26 B—Cont.	mask). The initial uptake was estimated as 2.1 microcuries, which was expected to produce an accrued 12-month dose to the kidney of 150 rem. Contamination was contained within the laboratory.			
68-27 B	8-5-68	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$6,445
	Because of a defective part in a railroad switch, a locomotive (with no cars attached) was derailed. After traveling 155 feet, it stopped in an upright position on the track bed. Both the locomotive and track were damaged.			
68-28 B	8-6-68	NV—EG&G, Inc., Weapons Test Division, Las Vegas, Nevada	0	$9,300
	During a rainstorm, water flooding into a bunker damaged electronic equipment.			
68-29 B	8-30-68	ID—Idaho Nuclear Corp., Idaho Falls, Idaho	0	$6,783
	A reactor diesel generator overheated when a cooling system malfunctioned. This was specifically due to the accumulation of debris in the coolant surge tank float control valve from corrosion and the subsequent failure of the valve. A contributory cause was the failure of the remote alarm system to indicate the overtemperature. The initial damage detected was warpage of the cylinder head valve seat inserts, and various gaskets and seals. On two later occasions, cracked cylinder heads were discovered.			
68-30 B	7-2-68	SAN—University of California, Lawrence Radiation Laboratory, Livermore, California	0	$5,904
	When a power supplier rectifier shorted, because of loosened lugs on the transformer tap change board, the insulation was ignited. The transfer tap change bolts and associated wires were destroyed, with extensive smoke damage and burned carbon deposits throughout the power supply interior.			
68-32 A	9-4-68	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	1 exposed	0
	Two health physics monitors received hand radiation exposures from a cobalt-60 container and its contents when they handled the container directly instead of using remote-handling tools as instructed. The first monitor received an exposure estimated at 655 rem ± 45% left hand, 54 rem right hand. The second monitor's exposure (23 rem left hand, 10 rem right hand) did not exceed reportable limits. No clinical evidence of injury has been observed.			
68-33 A	11-14-68	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	1 fatality	$23,160
	An air compressor booster aftercooler ruptured violently within nine minutes after the booster compressor was started and within seconds after the discharge pressure was purposely increased from 1,000 pounds			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage

68-33 A—Cont. per square inch to 1,200 pounds per square inch by the partial closing of a valve on the only discharge line. The rupture was caused by a pressure of about 7,000 pounds per square inch generated by a spontaneously ignited fire (explosion) occurring within the aftercooler. The fire (explosion) resulted from overlubrication of the booster compressor, caused primarily by an improperly adjusted lubricator, operating the aftercooler at temperature extremes, and overlubrication of the aftercooler.

A mechanic, standing nearby, was struck by a section of the aftercooler's protective grill, and a blast of high-pressure air. He was killed instantaneously.

68-34 A — 12-10-68 — OR—Union Carbide Corp., Nuclear Division, Y-12 Plant, Oak Ridge, Tennessee — 1 exposed — 0

A week prior to the exposure, the safety interlock circuit of an X-ray unit had been bypassed to facilitate an experiment, resulting in dependence on manual control. While performing a later experiment, the unit was turned on and off manually three times so that adjustments could be made; however, after turning it on the fourth time and making an adjustment, the unit, operating at 60 kvp and 50 milliamperes, was not turned off. Not realizing the unit was on, an experimenter positioned a collimator in the beam path and manipulated two metal shims. As he turned to restart the unit, he saw that it was still operating. He immediately shut it off and reported the incident.

By a timed observation of several repetitions of the collimator-positioning operations, the length of the exposure was estimated as no longer than five seconds; more likely three seconds. An accurate estimate of the exposure was precluded since the beam was extremely small and well collimated. Any movement of the fingers would have caused dose-rate changes of two or three orders of magnitude. Since, however, there was no clinical evidence of injury, the exposure was estimated to be less than 1,000 rem to the thumb and index finger.

68-35 B — 11-29-68 — SR—E. I. du Pont de Nemours & Co., Aiken, South Carolina — 1 exposed — 0

A maintenance mechanic accidentally punctured his right index finger with a sampler needle used for plutonium 238 nitrate solutions, resulting in a contaminated injury. The mechanic's plastic suit was immediately removed, a tourniquet was applied to his finger, and the wound flushed and surveyed. An estimated 90% of the deposited plutonium was excised by plant physicians and a program of chelation therapy was instituted.

The body burden in the employee is estimated at .033 microcuries. The annual bone exposure in 1969 was 27 rem.

68-36 B — 6-14-68 — ID—Idaho Nuclear Corp., Idaho Falls, Idaho — 0 — $20,200

An operation involving the burning of enriched fuel elements was shut down and examination revealed that a hole approximately three inches in diameter had been melted through the first-stage burner and the

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
68-36 B—Cont.		first-stage shroud surrounding the burner. This hole permitted escape of the burner contents, including uranium-235 and alumina bed material from the burner interior. Removal of insulation without contamination controls resulted in alpha contamination of the chemical engineering laboratory; costs consisted of $13,000 for the loss of the uranium-235 and $7,200 for decontamination. According to uranium inventory studies, 1311 grams of uranium-235 was unaccounted for following the incident and the subsequent dismantling and repair activity.		
68-37 B	10-14-68	AL—The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	1 exposed	0
		An employee inhaled plutonium oxide (.02 microcuries) from a fire in a "hot" waste drum. His estimated annual exposure to lung was 19 rem.		
69-1 A	3-13-69	NV—Wasatch Electric Co., Salt Lake City, Utah	1 fatality	0
		Two linemen were standing on an uninsulated aerial platform while working on a four-wire, three-phase, 4,160-volt system. Both were wearing rubber gloves rated for, and tested for, 10,000-volt use. Each of the three-phase conductors had rubber insulating hoses installed. One of the lineman reached under the crossarm with his right arm to place the tie wire on the conductor and the insulator when the tie wire came into contact with his right arm about three inches above his elbow, which was not protected by the glove. The other lineman knocked his arm loose, breaking the contact with the wire. The aerial platform was lowered to the ground immediately and mouth-to-mouth resuscitation and closed heart massage instituted. After the arrival of the ambulance and doctor, the heart-lung resuscitator was applied, and cardiac massage and artificial respiration with oxygen given for approximately ten minutes; however, there was no response.		
69-2 B	1-8-69	AL—Monsanto Research Corp., Mound Laboratory, Miamisburg, Ohio	1 exposed	0
		During maintenance work, a pipefitter (without protective equipment) disconnected a teflon line from a hydrogen fluoride valve, releasing argon purging gas, contaminated with plutonium 238. The adjacent areas, which became contaminated, were readily decontaminated. Three employees inhaled detectable amounts of plutonium 238, one of whom received an estimated annual lung exposure of 29 rem (.03 microcuries.)		
69-3 B	Jan.-Feb. 69	RL—Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	0	$51,000
		Earth-filled dams were washed out as the result of flooding during snow thaws.		

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
69-4 B	3-18-69	NV–EG&G, Las Vegas, Nevada	0	$35,000
		NV–Government	0	$11,200
		AL–University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico	0	$21,700
		A fire, occurring in an electronics laboratory and office trailer, was confined mainly to the trailer ceiling in the laboratory area; however, there was heat and smoke damage throughout the trailer. Damage to the trailer amounted to $11,200; the balance of the cost was due to damaged equipment.		
69-5 B	2-26-69	NV–Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$37,000
		A drill rig tipped over while the guylines were being tightened.		
69-6 B	4-23-69	AL–The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	1 exposed	0
		Following a minor incident, the body count for an employee indicated that he had a plutonium-239 lung burden. Additional bioassays and body counts showed that the exposure was not of recent origin. Although a detailed examination of the employee's work history was made, crossfiles for each contamination incident in which he had been involved were carefully examined, all persons who had worked with him were given a body count, and his supervisors questioned, there was no indication as to how or when the exposure was received. The estimated amount of Pu in the lung is .065 microcuries. The annual lung exposure is 61 rem.		
69-7 A	5-11-69	AL–The Dow Chemical Co., Rocky Flats Division, Golden, Colorado	1 exposed	$45,000,000
		A major fire occurred in a plant which produces plutonium parts for nuclear weapons. The origin of the fire, as indicated by available evidence, was a glovebox storage cabinet containing pyrophoric chips and lathe turnings of plutonium pressed into disks three inches in diameter and one inch thick. The heat from the burning plutonium metal evidently caused the storage cabinet, which was constructed mostly of cellulosic laminate material and plastic, to char and generate flammable gases which could have been ignited by burning plutonium. There were no lost-time injuries from the fire or the firefighting, although one firefighter inhaled .021 microcuries of plutonium, which was expected to produce an accumulative annual dose to the lung of 20 rem. His annual lung exposure is 20 rem.		
69-9 A	6-10-69	NV–Holmes & Narver, Inc., Las Vegas, Nevada	1 fatality	0
		Five men were performing survey services in a mined cavity 4,765' underground. They were working on a platform, suspended by four cables, within a 20' diameter by 36' high cavity, approximately 25' above the cavity bottom. One cable became detached, causing the platform to tip and two of the men to fall to the cavity bottom. They were taken to the hospital where one was released after examination. The other died		

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
69-9 A—Cont.	about 39 hours later from severe brain and brain stem injuries and compressed fracture of the skull.			
69-10 A	6-16-69	CH—Schless Construction Co., Batavia, Illinois (subcontractor to Daniel, Urbahn, Seelye, and Fuller)	1 fatality	0
	A carpenter was fatally injured when he fell 11 1/2 feet through a floor opening at the site of a proposed stairwell from which a temporary covering had been removed. No one saw the carpenter or anyone else remove the cover nor did anyone see the carpenter fall. He was found lying on the concrete floor of the basement beneath the opening. The cause of death was a basal skull fracture.			
69-11 B	6-19-69	RL—Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	1 exposed	0
	Because his attention was distracted, an operator entered an X-ray cubicle while the X-ray machine was on and was exposed to the primary beam. He received an estimated radiation exposure of 12 rem to the eyes and 8 rem to the whole body.			
69-12 A ("A" because of press release)	7-30-69	AL—The Dow Chemical Company, Rocky Flats Division, Golden, Colorado	0	$20,000
	Two chemical operators screened plutonium residues from a previous fire, separating the fine material from the larger pieces. The fine material was placed in a can and sealed with plastic tape. The can was then placed inside two plastic bags and transferred to the storage area about 6 p.m. Around 11 p.m., a fire occurred. Friction during the screening or transfer of the residues probably initiated oxidation resulting in the eventual ignition of unstable plutonium compounds and/or plutonium metal fines within the can. The smoke and flame were produced from ignition of the plastic bag containers, the source for the ignition of the bags being the heat from the can containing the the burning plutonium. The two chemical operators were found to have inhaled or ingested plutonium (estimated to be from 0.15 to 0.99 microgram*), which was expected to be eliminated by normal body mechanisms. *nonreportable			
69-13 A	8-8-69	RL—Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	1 exposed	0
	A scientist was accidentally exposed to 8 KeV X-rays from the primary beam of an X-ray diffraction unit when he went behind the machine, propped open the port with a piece of lead, and spent approximately fifteen minutes performing various measurements. When he returned to the front of the unit, he noticed X-rays were being counted by the proportional counter and realized the machine had been on when he was behind the unit. The scientist received an estimated dose of 1,700 rem to the fingers of the left hand, 50 rem to the right eye, and 2,400 rem to the skin of the upper left arm.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
69-14 B	8-9-69	ID—Government	0	$25

A truck transporting two casks of spent reactor fuels was struck by a privately-owned car. The right rear mudguard of the truck was damaged slightly; there was no damage to the shipment.

69-15 B	6-12-69	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$37,506

Approximately 20 millicuries of airborne radioactive contamination (mostly curium-244) were released via an exhaust stack and were spread by a northeasterly wind across the roof of a building and along a line leading from the main entrance of the building to a parking lot.

The level of radioactivity on the roof was 4×10^7 d/m/100 cm^2 and on vehicles inside the area fence 1.5×10^4 d/m/100 cm^2. The highest level of activity outside the area was approximately 5000 d/m/100 cm^2. All activity was contained within the plant's boundary.

There were no radiation exposures. The cost was for decontamination.

69-18 A	10-23-69	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	1 fatality	$3,500

The death of a radiation instrument technician resulted from the accidental release of a 120-foot section of pipe, which fell to the bottom of a 1,040-foot shaft, where it violently crumpled upon impact. As the 2-7/8"-diameter pipe crumpled, one large loop of it was forced out of the shaft enclosure and into a side station where two men were waiting for the shaft elevator. The loop of pipe struck the technician and knocked his head against an acetylene bottle with the result that he died instantly. The other man suffered a minor puncture wound in his right thigh from a piece of wire.

69-19 A	12-10-69	NV—Reynolds Electrical and Engineering Co., Inc., Las Vegas, Nevada	1 fatality	0

A drill rig helper was walking near a truck-mounted drill rig when he heard a noise which sounded like air escaping from a tire and saw what he thought was hydraulic fluid running out from beneath the truck. At the helper's signal, the truckdriver stopped the truck, dismounted, walked alongside the truck to where the helper was standing, and leaned over, ostensibly to look under the truck for the source of the leaking fluid. As he did so, he put his hand against or near a brace on the drill rig. At the same time, the helper heard a "pop," the left rear tires flashed and blazed, and the truckdriver fell over backward. Obviously, from their actions, neither man realized the boom had contacted a 34,500-volt powerline, clearly visible in the wide-open, isolated area in which they only were working.

After unsuccessfully attempting to resuscitate the truckdriver, the helper, having no radio, drove approximately one mile to where a radio was available, to summon help. The truckdriver was pronounced dead by an examining physician while en route to the hospital in an ambulance. The cause of death was cardiac arrest resulting from electrical shock.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
69-20 A	12-26-69	AL—EG&G, Amarillo, Texas	0	$200,000

Detonation of approximately 108 pounds of a plastic-bonded explosive occurred in a remotely-operated 20-inch diameter isostatic press. No radioactive materials were involved and no one was injured but extensive damage was sustained. The press and other equipment in the bay, hoists, pressurization equipment, and vacuum equipment were demolished, as well as the roof and blowout wall. The blowout walls and roofs of adjacent bays were extensively damaged. The roofs were damaged and other damage was sustained when fragments, some weighing hundreds of pounds, fell through the roofs.

The direct cause of the accident was that an operator left out a "mushroom plate," which seals the pressure vessel.

69-21 B	11-6/7-69	SR-E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$32,000

Acidic waste solution (approximately 8200 pounds), which was being processed for neptunium-237 and plutonium-238 recovery, was lost when inadvertently transferred to an underground waste system due to a leaking valve in the stream supply to a transfer jet.

70-1 A	1-23-70	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	1 fatality	0

An experienced miner and cage tender was assigned the duties of cage tender on a two-cage elevator, one cage of which was rigidly attached above the other. The cage tender had informed the top lander that the normal procedure would be followed and that personnel in the upper cage were to be unloaded first at the lower level and the lower cage was then to be raised to unload him and the material. According to witnesses who were waiting for the cage at the lower level, the cage tender was emerging from the descending lower cage when the top frame of the door opening struck his hard hat. The descending cage crushed him into a sitting-like position before the cage could be stopped. After stopping, the cage was then raised by signals to a point level with the landing and the cage tender was removed. The autopsy report states that death was due to crushing traumatic injuries.

70-2 B	1-16-70	AL—Zia Company, Los Alamos, New Mexico	0	$28,521

The 90′ boom on a mobile crane collapsed while being employed to lift and load a large concrete mass (44,775 lb.) upon a trailer. Besides damage to the boom, the trailer and the roof of a building upon which the boom fell were damaged. One person was slightly injured.

70-3 A	2-2-70	NV—Holmes & Narver, Subcontractor (McKenzie Construction, Inc.) Las Vegas, Nevada	1 fatality	0

While helping unchain a load of pipes from a flatbed trailer, a truckdriver was struck by one or more sections of pipe which rolled off the trailer when the last chain was released. Three co-workers immediately ran to assist the victim, throwing off the pieces of pipe that were lying on him.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
70-3 A—Cont.	They determined that he was seriously injured and summoned help. When the doctor arrived, he pronounced the victim dead of fatal head and chest injuries.			
70-4 B	1-8/11-70	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$38,200
	Water supply lines, drainlines and traps, water-jacketed equipment, heating and coiling coils, instruments, gages, and fire sprinkler lines froze in numerous plant locations during a period of extremely low temperatures, unusual and unexpected in the area.			
70-5 B	12-69/ 3-70	RL—Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	0	0
	During routine sampling of wildlife near the 100-K cooking water trench at Hanford, waterfowl were found to contain unusual amounts of phosphorous. Analyses indicated that the highest concentrations of material found in the waterfowl were 0.14 microcuries per gram. It has been determined that this resulted from food and water intake from reactor cooling water trenches on the project.			
70-6 A	3-10-70	AL—Government	2 fatalities	0
	While traveling on official business in a private airplane, two Government employees were killed when the plane crashed.			
70-7 A	3-28-70	NV—Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	1 fatality	0
	An ambulance was responding to an accident. The first aid technician was in the rear of the ambulance preparing equipment for treating patients. At a speed of over 70 m.p.h., the ambulance developed a severe shimmy. The driver glanced through the rearview mirror and saw the technician sitting on the jump seat. A short time later, the driver heard an unfamiliar noise. When he looked again into the rearview mirror, the technician was falling through the right, rear, side door. It is presumed that the technician inadvertently released the door lock or that the door sprung open due to vibration or mechanical failure. His head struck the pavement, killing him instantly.			
70-8 A	3-23-70	AL—Sandia Corp., Albuquerque, New Mexico	0 (fatality not AEC)	0
	A 13-year-old boy darted across a highway and was killed when struck by an automobile driven by a contractor employee.			
70-9 B	3-22-70	RL—Battelle Memorial Institute, Pacific Northwest Laboratory, Richland, Washington	0	$95,000
	An estimated 1,000-curie strontium 90 release occurred during an attempted measurement of the liquid level in a strontium 90 product storage tank. A portable manometer system (temporary instrumentation for liquid level measurement) was being used during a program of upgrading the normal tank instrumentation. A leak at or near the pipe gallery end of a tygon tube to the manometer allowed strontium			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
70-9 B—Cont.	90-bearing solution to be pumped from the storage tank out through the leak in the tygon tube by an airlift action created by tank purge air. This purge air, which is expelled through a line deep in the tank, bubbled up the adjacent line to which the manometer tube was connected. The solution entered the pipe gallery floor drain and the chemical sewer, which empties into an open ditch leading to an open 25-acre pond. Radiation levels of 500 rad/hour at three or four inches existed in the pipe gallery. Water samples taken from the pond reached a maximum strontium 90 concentration of 1.7×10^{-3} μCi/ml. The costs of stabilization and recovery efforts are estimated at $95,000.			
70-10 A	4-18-70	RL—Atlantic Richfield Hanford Co. Richland, Washington	1 exposed	0
	An employee was accidentally exposed to beta radiation (3 MeV-maximum) when he attempted to recap the cask from which radioactive waste (cerium-144 and promethium-144) was flowing. He received severe burns due to estimated doses of 2,500 rem to the fingers of the left hand and 2,000 rem to small areas of the right hand.			
70-11 A	6-11-70	NV—Holmes & Narver, Inc., Johnston Atoll	1 fatality	0
	An employee was found dead on the bottom of a lagoon in approximately 15 feet of water near the salt water intake of Johnston Atoll. He apparently drowned while scuba diving. Resuscitation efforts were unsuccessful.			
70-12 A	4-9-70	CH—National Accelerator Laboratory (Subcontractor - D & E Maintenance) Batavia, Illinois	1 fatality	0
	A barn was being converted into a storage space for materials and equipment. The second floor level consisted essentially of open floor joists, partially covered with loose lumber and plywood. A ceiling of Styrofoam panels had been installed on the underside of the joists. A carpenter fell from the second floor level through a portion of the Styrofoam ceiling to a concrete surface 9 feet below. He died approximately 11 hours later in the hospital, the cause of death was brain injuries and hemorrhage resulting from the fall.			
70-13 A	5-4-70	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$124,523
	A solution containing 20 grams of curium-244 and americium-243 was transferred by mistake to the waste system.			
70-14 B	3-10-70	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	1 exposed	0
	An operator inadvertently released airborne activity to the decontamination room environment while removing solid radioactive waste (curium-244) from the decontamination chamber. An alpha count rate meter alarmed and alerted him to the presence of alpha activity. He obtained assistance to remove his outer protective clothing and went to the personnel decontamination room. The operator received 6.5 body burdens of curium-244 (.6 microcuries, which was expected to produce an accumulative annual dose to the bone of 90 rem).			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
70-15 B	6-10-70	AL–Los Alamos Scientific Laboratory Los Alamos, New Mexico	0	0
	A trailer used to transport radioactive material was found to be contaminated (cobalt-60) in excess of 0.5 mrem/hour. Swipe surveys indicated levels up to 21,839 dpm/100 cm^2.			
70-16 B	4-9-70	CH–Argonne National Laboratory, Argonne, Illinois	0	$59,000
	When a reactor thru-hole (an experimental tube which passes through the reactor core) was overpressurized, the seal plug in the end of the tube was blown out and the loose contamination inside of the tube was distributed throughout the reactor building in the form of a finely-divided powder. The contamination was confined to the interior of the building, except for one small spot on the concrete just outside the front door, which was easily taped and cleaned.			
70-17 A	7-25-70	AL–Government	4 injured	*
	An AEC driver, in an attempt to avoid an unidentified, oncoming, skidding vehicle, lost control of his own vehicle during a rainstorm, and clipped a second oncoming vehicle. The AEC vehicle ran off the roadway while the clipped vehicle was struck broadside by a pickup truck. The AEC driver was not seriously injured but four others involved were hospitalized.			
	*estimate not received			
70-18 B	6-4-70	AL–Government	0	$10,000
	Two mechanics were working in an F-27 cockpit, revving up the engine in a checkout procedure. The wheels were in their chocks with the brakes set. In their operations, one of the mechanics inadvertently hit the brake release which caused the plane to jump the chocks. The right propeller and engine of the aircraft were seriously damaged.			
70-19 A	7-2-70	NV–Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	1 fatality	$1,575
	An employee was killed when he was thrown from the 1/2-ton pickup truck which he was driving. Apparently, he lost control of the vehicle at a high rate of speed and it left the highway and rolled over.			
70-20 A	8-24-70	CH–University of Wisconsin, Madison, Wisconsin	1 fatality (non-chargeable)	0
	A researcher at the University of Wisconsin was fatally injured when a bomb exploded at 3:42 a.m., CST, in the university's Sterling Hall. Low-energy physics equipment (AEC-owned) was damaged but the loss was covered by insurance. Licensed radioactive materials were on hand in the building at the time of the explosion, but there was no release of any radioactive material.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
70-21 B	9-8-70	NV–Reynolds Electrical & Engineering Co., Inc., Mercury, Nevada	0	$40,000
	A drilling rig was damaged when a bridle (wire line) used to raise and lower the drilling mast broke.			
70-22 A	8-6-70	SAN–Lawrence Radiation Laboratory Livermore, California	0	$165,000[5]
	An accidental release of tritium occurred when automatic safety devices discharged the gas through a 100-foot-high exhaust stack. Traces of radioactivity were found at locations on the site and at three locations on vegetation near Altamont, a few miles from the site. No activity has been found elsewhere offsite. There were no personnel exposures and the building was not contaminated.			
70-23 A (press release)	10-1-70	RL–Westinghouse Atomic Development Co. Richland, Washington	0	0
	Minor cerium-cesium contamination resulted from a routine change of a stack filter in the 300 area. Over 200 employees' shoes were checked and none were found to be contaminated. Walkways and roadways were washed down; no radioactivity was found in surveys beyond the 300 area.			
70-24 A	10-7-70	AL–Los Alamos Scientific Laboratory Los Alamos, New Mexico	0	(Loss is classified)
	A sample of radioactive tritiated salt, used as a calorimeter sample (or heat standard) in research, was lost at Los Alamos Scientific Laboratory (LASL). The sample capsule, enclosed in a plastic bag, was stored in a freezer with other similar-appearing capsules. It was in its proper place during an inventory on June 1, 1970, but was reported missing on September 29, 1970, after a routine inventory. An exhaustive search failed to turn up the missing sample. In addition, searches have been made of the commercial salvage yard, the commercial laundry facilities, and about 7,000 cubic feet of the radioactive disposal site, all without success. Despite the fact that the appropriate part of the radioactive disposal site was excavated and searched, the amount of overburden was so great compared to the size of the cylinder that absolute certification cannot be made that the sample is not in the area.			
70-25 B	9-9-70	SR–E. I. du Pont de Nemours & Co. Aiken, South Carolina	1 exposed	0
	An employee received a skin exposure of 34.5 rem probably while removing cell covers in a high-level caves section. The whole-body skin dose is probably too high since the technician's TLD badge fell from the normal chest location under his outer coveralls during this job, lodging in the taped leg near his ankle, very close to the highly-contaminated cell covers.			

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
70-26 B	9-12-70	NY–Plasma Physics Laboratory Princeton, New Jersey	0	$51,050

A scheduled power outage was conducted at the laboratory on Saturday, September 12, 1970. After completing the scheduled maintenance work, an attempt was made to restore normal power. Immediately after closing the main 138 kV circuit breaker, a short circuit occurred on the secondary side of the power system in the 4160-V circuit breaker cubicles. The fault was not cleared by the protective relays tripping the 138 kV circuit breaker, but rather remained on for approximately 30 seconds before the breaker was manually opened. The electrical flashover in the 4160-V switchgear cubicle caused the resulting fire and damage to three units of switchgear. This damage could probably have been less if the 138 kV circuit breaker on the incoming service line had properly tripped open to clear the fault condition. Roughly half of the $51,050 loss was due to replacement costs of the three switchgear units while the other half was labor cost.

70-27 A	11-20-70	ID–Arrington Construction Company (lump-sum) Idaho Falls, Idaho	1 fatality (non-chargeable)	0

An equipment operator was killed instantly when a crane boom which he was helping to disassemble dropped and struck him. The boom had been removed from the crane and half of it was on a truck bed, but was not lowered completely to a horizontal position; tielines were holding up the other end of the boom. The worker was removing pins which held the two boom sections together at the junction point. Upon removal of two of the four pins, the boom sections 'hinged' about the remaining two pins, due to the fact that the boom ends were being supported. This action caused the boom sections to drop suddenly and strike the worker.

70-28 A	11-25-70	HQ/NV–Government/Reynolds Electrical & Engineering Co., Inc.	3 fatalities	0

A U.S. Park Service plane (operated by a USPS pilot) was being used by two AEC personnel and a REECo employee to survey terrain around the Lake Mead, Nevada area. While flying at low altitude over the lake, the small aircraft was suddenly forced into the water by a strong down-draft air current, causing the plane to break up on impact and sink. The pilot was the only survivor.

70-29 A	11-17 - 11-18-70	SAN–Lawrence Radiation Laboratory (Sandia Laboratories employee) Livermore, California	1 exposed	0

A staff assistant received an accidental overexposure to small spots on 1) the left thumb (480 rem), 2) the left forefinger (370 rem), and 3) right little finger (150 rem) when he handled experimental Cu targets following exposure to 23- and 16-MeV alpha particles from the LRL 90-inch Cyclotron. No clinically observable damage was detected by the industrial physician.

No.[1] - Type[2]	Date	Field Office[3] - Contractor	Injuries[4] - Exposures	AEC Property Damage
70-30 A	11-9-70	SR—E. I. du Pont de Nemours & Co. Aiken, South Carolina	0	$511,833
		A reactor room became contaminated during a routine operational shutdown when an antimony-beryllium source rod separated as the assembly was being lifted out of the reactor by a crane. Some of the material dropped into a pan underneath the crane, releasing radioactivity to the room. Confinement filters contained the radioactivity and none was released through the building stack. The reactor confinement system functioned as designed and all radiation was contained within the reactor building. No personnel exposures resulted from the incident.		
70-31 B	June-Nov. 70	OR—Oak Ridge National Laboratory Oak Ridge, Tennessee	1 exposed	0
		An employee was assigned to the job of loading plutonium oxide sources during the period of June to November. Following a minor contamination spread in late June, urine samples taken from the employee showed high initial readings but then dropped to levels requiring only periodic sampling. When the urine levels commenced climbing again in mid-November, the employee was restricted from all radioactive work. It is estimated that he received approximately .072 microcuries of Pu-238 in his lung, resulting in a 75 rem exposure to this organ.		

[1] Division of Operational Safety, USAEC Headquarters, Reference Number
[2] See appendix D
[3] Abbreviations used for USAEC Field Offices:

AL	Albuquerque Operations Office
BH	Brookhaven Office
CH	Chicago Operations Office
GJ	Grand Junction Office
HA	Hanford Operations Office
ID	Idaho Operations Office
LAR	Lockland Aircraft Reactors Office
NV	Nevada Operations Office
NY	New York Operations Office
OR	Oak Ridge Operations Office
PNR	Pittsburgh Naval Reactors Office
RL	Richland Operations Office (Formerly HA)
SAN	San Francisco Operations Office
SNR	Schenectady Naval Reactors Office
SR	Savannah River Operations Office
SNPO-C	Space Nuclear Propulsion Office-Cleveland
SNPO-N	Space Nuclear Propulsion Office-Nevada

[4] Lost-time injury as defined in American National Standards Institute ANS Z16.1-1967 (Revision of Z16.1-1954-R1959)
[5] These property loss figures are based on a current commercial cost of about 55¢ per curie of tritium and therefore do not represent the actual classified loss figures.

* U. S. GOVERNMENT PRINTING OFFICE : 1971 483-024/114

APPENDIX D

CRITERIA FOR REPORTABLE INCIDENTS

APPENDIX D

CRITERIA

Criteria for the classification of radiation exposures and industrial accidents occurring through August 15, 1968, as Types A and B as contained 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.

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.

CRITERIA

Criteria for the classification of radiation exposures and industrial accidents occurring beginning August 16, 1968, as Types A and B are contained in revised AEC Chapter 0502, "Notification, Investigation, and Reporting of Occurrences."

"TYPE A"

1. Incident (Accident)

a. Any fatal or imminently fatal occupational injury or occupational illness involving an AEC or AEC contractor employee or a member of the public due to an accident or fire associated with an AEC or AEC contractor operation.

b. Any other disabling injury or occupational illness of five or more persons as a result of one occurrence in an AEC or AEC contractor operation.

c. Estimated loss or damage to AEC or other property amounting to $100,000 or more or estimated costs of $100,000 or more required for cleaning (including decontamination), renovating, replacing, or rehabilitating structures, equipment, or property.

d. Any occurrence involving a nuclear weapon or device (under jurisdiction of AEC) where there is personal injury or damage to private property.

2. Loss of Material. Any apparent loss or theft of byproduct or other radioactive material in such quantities and under such circumstances that it could constitute a hazard to the health and safety of individuals. Where this involves the possible theft of Government property, the FBI shall be notified (for a decision as to acceptance of investigation jurisdiction).

*N equals the age in years at last birthday.

3. Radiation Exposure

a. A single or annual accumulated whole body exposure of an individual to 25 rem or more of radiation, a single exposure of the skin of the whole body of an individual to 150 rem or more of radiation, or a single exposure of the feet, ankles, hands, or forearms of any individual to 375 rem or more of radiation.

b. Any 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 appendix 0524, II, B.

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 appendix 0524, II, B.

d. Any injury or occupational illness following 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.

4. Other

a. Any occurrence which is likely to give rise to an inquiry by members of the public or press, if the field office manager involved considers the inquiry to be of sufficient importance to notify Headquarters.

b. Any occurrence 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 allegation that persons previously employed by AEC or its contractors died from, or were injured as a result of, their duties in an AEC or AEC contractor operation.

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

e. Any radiological assistance occurrence. Notification and reporting of a radiological occurrence which is not also a Type A occurrence specified in 1., 2. or 3., above, shall be in accordance with the provisions of part V.

"TYPE B"

1. Incident (Accident)

a. Loss or damage to AEC or other property of $25,000 to $99,999 where loss or costs are incurred for cleaning (including decontamination), 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, on arrival at an AEC or AEC contractor facility, to be contaminated (internal surfaces of vehicle) above the limits specified in section 173.397, "Contamination Control," of the Department of Transportation Regulation, 49 CFR 173.

c. Any shipment of radioactive material that arrives at an AEC or AEC contractor facility damaged to the extent that there is substantial reduction in the effectiveness of the package.

2. Radiation Exposure

a. Any radiation exposure to an individual which in one calendar quarter exceeds the following:

(1) 5 rem to the whole body.

(2) 30 rem to skin of whole body or thyroid.

(3) 75 rem to the hands, forearms, feet, or ankles.

b. Any radiation exposure which causes an individual's cumulative dose to exceed 5(N-18)* rem whole-body radiation.

c. Any internal uptake of radioactive material which on the basis of a small number of early assay data will result in a dose or dose commitment in excess of the pertinent annual standard set forth in chapter 0524.

*N equals the age in years at last birthday.