

Annual Fire Protection Program Summary

Calendar Year 2021



UNITED STATES DEPARTMENT OF ENERGY

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Summary Provided by:

DOE Office of ES&H Reporting and Analysis

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Executive Summary

The Department of Energy (DOE) Order 231.1B, *Environment, Safety, and Health Reporting*, requires organizations responsible for maintaining property under the stewardship of DOE to enter reportable fire and fire protection-related incidents into the DOE Fire Protection Reporting System (FPRS). This report examines calendar year (CY) 2021, and includes information submitted by 36 DOE elements representing approximately 99 percent of DOE's facility and property valuation.

Information reported by DOE elements into the FPRS documented a total of 95 fire protection-related (fire and non-fire) events in 2021, resulting in monetary losses of \$1,564,947. Compared to 2020 data, this represents a 12 percent increase in the number of events and a 15 percent increase in monetary losses. Of the 95 events, 64 resulted in monetary losses while 31 had no reported monetary losses.

There were 43 fire loss events (directly attributable to fire or smoke) in 2021, resulting in monetary losses of \$1,338,025. This represents a 12 percent decrease in the number of events, but a 0.7 percent increase in the monetary loss amounts from 2020. There were 21 non-fire loss events (leaks, spills, or inadvertent releases or actuations) related to fire protection systems in 2021, totaling \$226,922. This represents a 75 percent increase in the number of events, and a 735 percent increase in monetary losses from 2020.

In 2021, there were ten major fire losses at six sites costing \$10,000 or more, an 11 percent increase from the nine reported in 2020. Of these, six resulted in losses of \$50,000 or greater, compared with five in 2020. The single largest fire loss event was a fire in a heated oil tank at Y-12 that resulted in a \$530,260 loss, which alone represents 40 percent of all DOE fire losses reported in 2021.

Loss comparisons among DOE sites are performed by normalizing data against total facility and property valuation as reported in the Facility Information Management System (FIMS) and the Property Information Database System (PIDS). Total DOE valuation for sites reporting into the FPRS in 2021 was \$238.3 billion, a 4 percent increase from 2020. The calculated DOE 2020 fire loss rate was 0.06 cents per each \$100 in total site valuation, the same as in 2020. The highest fire loss rate was at National Renewable Energy Laboratory (NREL), at 2.30 cents per \$100 of valuation.

DOE elements are required to report costs associated with recurring fire protection activities into the FRPS annually. In 2021, recurring costs for fire protection activities were \$263,831,4486, a two percent decrease from 2020. As a ratio of cost to total valuation, DOE sites spent approximately 11 cents per \$100 of valuation for recurring fire protection activities in 2021, a 6 percent decrease from 2020. The Waste Isolation Pilot Plant (WIPP) had the highest rate at 92 cents per \$100 of valuation, followed by ETTP at 42 cents and ID at 30 cents.

DOE reported 6,343 Fire Department responses in 2021, a 45 percent increase over 2020. It should be noted that these wide swings may be attributable to operational changes resulting from the COVID-19 pandemic.

In calendar year 2021, DOE sites reported no fire or fire protection-related injuries or fatalities into the DOE Occurrence Reporting and Processing System (ORPS). There was one burn injury reported into the Computerized Accident/Illness Reporting System (CAIRS) by Brookhaven National Laboratory. There were 147 fire or fire protection-related occurrences reported into ORPS in 2021, an 86 percent increase over 2020. The vast majority of the increase was attributable to fire protection equipment degradation events which increased 155 percent in 2021. Of the 147 occurrences, 11 (8 percent) were rated High Level, 83 (57 percent) were rated Low Level, and 53 (36 percent) were rated Informational Level.

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Site/Facility Acronyms and Abbreviations

AMES	Ames Laboratory
ANL	Argonne National Laboratory
BNL	Brookhaven National Laboratory
DUF6	Depleted Uranium Hexafluoride
ETTP	East Tennessee Technology Park
FNAL	Fermi National Accelerator Laboratory
GJO	Grand Junction Office
HANF	Hanford Site
ICP	Idaho Cleanup Project
ID	Idaho (INL and ICP)
INL	Idaho National Laboratory
KAPL	Knolls Atomic Power Laboratory
KCNCS	Kansas City National Security Campus
LBNL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratory
LANL	Los Alamos National Laboratory
MOAB	Moab Uranium Mill Tailings Remedial Action Project
MSTS	Mission Support and Test Services
NBL	New Brunswick Laboratory
NREL	National Renewable Energy Laboratory
NNSS	Nevada National Security Site
NWS	North Wind Solutions
ORAU	Oak Ridge Associated Universities
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
ORP	Office of River Protection
OST	Office of Secure Transportation
PTX	Pantex Plant
PGDP	Paducah Gaseous Diffusion Plant
PNNL	Pacific Northwest National Laboratory
PORT	Portsmouth Gaseous Diffusion Plant
PPPL	Princeton Plasma Physics Laboratory
RL	Richland Operations Office
SLAC	SLAC National Accelerator Laboratory
SNL	Sandia National Laboratories, New Mexico
SRS	Savannah River Site
TJNAF	Thomas Jefferson National Accelerator Facility
TWPC	Transuranic Waste Processing Center
WIPP	Waste Isolation Pilot Plant
WVDP	West Valley Demonstration Project
Y-12	Y-12 National Security Complex

Definitions

Valuation Definitions

FIMS (Facility Information Management System): The DOE corporate database that maintains the inventory and property values for government owned real property and any permanently affixed structures such as buildings, trailers, fences, bridges, etc.

PIDS (Property Information Database System): The DOE corporate database that maintains the inventory and property values for government owned accountable personal property.

Property Value/Valuation: The approximate replacement value of all DOE-owned buildings/facilities and equipment. Included in the value are the cost of all DOE-owned supplies and average inventory of all source and special nuclear materials. Excluded from the value are the cost of land, land improvements (such as sidewalks or roads), and below ground facilities not susceptible to damage by fire or explosion (such as major water mains and ponds).

Total Valuation: The combined totals from FIMS and PIDS, DOE-wide and by site.

Loss Definitions

Estimated Loss: Monetary loss determination is based on all estimated or actual costs to restore DOE facility and equipment to pre-occurrence conditions irrespective of whether such restoration is performed. The estimate includes: (1) any necessary nuclear decontamination; (2) restoration in areas that received water or smoke damage; (3) any loss reductions for salvage value; and (4) any lost revenue experienced as a result of the accident. The estimate excludes: (1) down time; and (2) any outside agency payments. Losses sustained on private property are not reportable, even if DOE is liable for the damage and loss consequences resulting from the occurrence.

Fire Loss: All damage or loss sustained as a direct consequence of (and following the outbreak of) a fire shall be classified as a fire loss. Exception: the burnout of electric motors and other electrical equipment through overheating from electrical causes shall be considered a fire loss only if a self-sustained combustion exists after power is shut off.

Fire Loss Rate: Unit of comparison in cents loss per \$100 of valuation (facilities and equipment) as a consequence of fire events.

Fire Protection Loss: All damage or loss sustained as a consequence of fire events, or non-fire events involving fire protection systems; including leaks, spills, and inadvertent releases.

Non-Fire Loss: All damage sustained as a consequence of non-fire events involving fire protection systems; including leaks, spills, and inadvertent releases.

Introduction

The *Annual Fire Protection Summary Report*, required by the Department of Energy (DOE) Order 231.1B, *Environment, Safety and Health Reporting*, is the primary source for reporting fire and fire-related costs and monetary losses associated with facilities, property, and equipment across the DOE complex, including cost- and loss-to-valuation ratios to normalize the data for comparison purposes.

This report includes data for calendar year (CY) 2021 from information submitted by 36 DOE elements representing approximately 99 percent of DOE's facility and property valuation. DOE facilities, with the exception of the Power Marketing Administrations and Headquarters offices, are required to report costs and losses associated with fire and fire protection activities into the DOE Fire Protection Reporting System (FPRS) annually by April 30 of the following year.

The data for this 2021 report were extracted from the FPRS, with the following organizations reporting:

Ames Laboratory	ORISE-ORAU
Argonne National Laboratory	ORNL/EM-Isotek
Brookhaven National Laboratory	ORNL/EM-Waster
DUF6 Paducah Site	ORNL-UT /Battelle
DUF6 Portsmouth Site	Pacific Northwest National Lab
East Tennessee Technology Park	Paducah Gaseous Diffusion Plant
Environmental Management Nevada Program	Pantex Plant
Fermi National Accelerator Laboratory	Portsmouth Gaseous Diffusion Plant
Hanford Site (Office of River Protection)	Princeton Plasma Physics Laboratory
Idaho Cleanup Project	Richland Operations Office
Idaho National Laboratory	Sandia National Laboratories
Kansas City National Security Campus	Savannah River Site
Lawrence Berkeley National Laboratory	SLAC National Accelerator Laboratory
Los Alamos National Laboratory	Strategic Petroleum Reserves
National Renewable Energy Laboratory	Thomas Jefferson National Accelerator Facility
Nevada National Security Site	Waste Isolation Pilot Plant
Office of Legacy Management	West Valley Demonstration Project
Office of Secure Transportation	Y-12 National Security Site

Because some nearby reporting elements share fire department resources, throughout this report they are grouped by site, e.g., Hanford (Office of River Protection/Richland Operations Office), Paducah (Paducah Gaseous Diffusion Plant/DUF6), Portsmouth (Portsmouth Gaseous Diffusion Plant/DUF6), Idaho (Idaho National Laboratory/Idaho Cleanup Project), NNSS (Nevada National Security Site/Environmental Management Nevada Program).

The Fire Protection Reporting System is located at: <http://energy.gov/ehss/policy-guidance-reports/databases/fire-protection-database> [password required]. EHSS continues to work with the DOE Fire Safety Committee to update and improve the data submission system and the content of the annual report to improve its utility to the DOE fire protection community and the Complex.

Note: GJO, KAPL, MOAB, NBL may have property valuations in FIMS and/or PIDS, but do not report into the Fire Protection Reporting System (FPRS). TJNAF reports into the FPRS, but there are no property valuations in PIDS and FIMS. Therefore, these sites are not included in the overall DOE fire protection calculations.

Fire and Fire Protection Losses

Fire Losses are events that involve fire, smoke, or both, that result in monetary losses. Figure 1 displays the 20-year trend of fire losses at DOE.

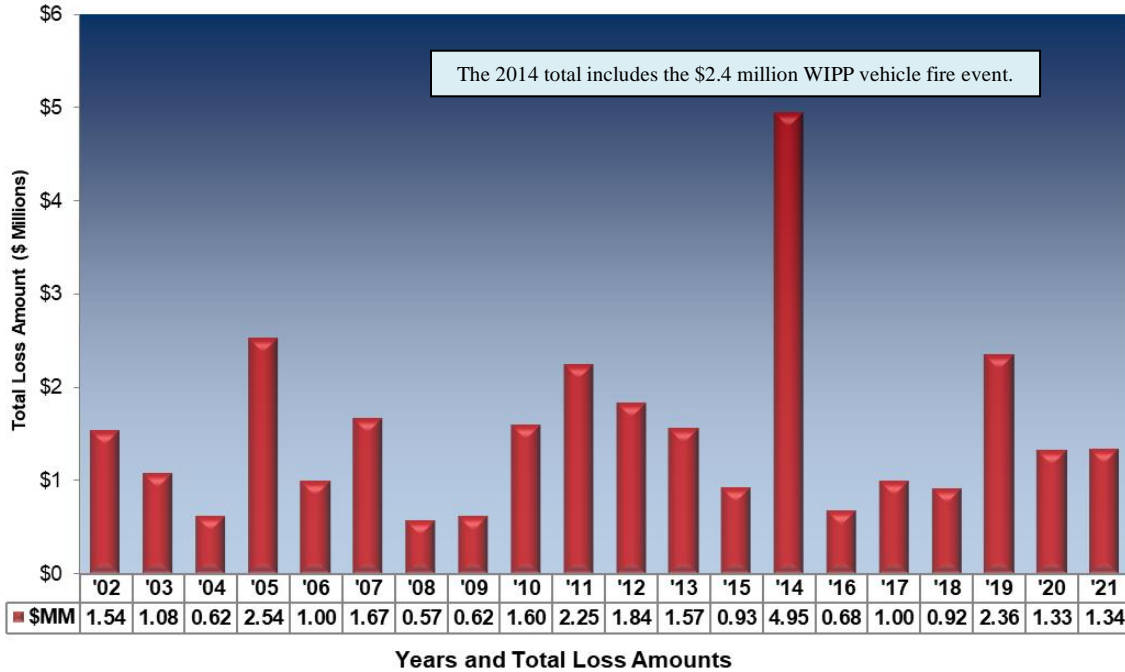


Figure 1: DOE Total Property and Facility Fire Losses 2002-2021

In 2021, DOE elements reported 43 fire loss events totaling \$1,338,025 in fire losses. When compared with 2020, this represents a 12 percent decrease in the number of events, but a 0.7 percent increase in loss amounts.

Note: In the Annual Fire Protection Summary reports from 2011-2014, Fire Protection Loss figures included both fire losses and non-fire losses, such as system leaks, spills, and unintentional releases. Prior to 2011 and from 2015 forward, the figures include only losses from actual fire events. Non-fire loss events are detailed in the Water-Based Fire Suppression System Actuations and Non-Water-Based Fire Suppression System Actuations sections of this report.

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Table 1 displays the 2021 loss category, loss type, and monetary losses associated with Fire Loss events (all damage or loss sustained as a direct consequence of a fire) and Non-Fire Loss events (all damage sustained as a consequence of non-fire events involving fire protection systems; including leaks, spills, and inadvertent releases) reported into the FPRS.

Table 1: Summary of Reported Fire and Fire Protection Events in FY 2021

Loss Category	Fire Loss Type	No. Events	Loss Amount
Fire Loss Events	Fire/Smoke Brush	3	\$1,100
	Fire/Smoke Vehicle	3	\$5,550
	Fire/Smoke Other	18	\$148,936
	Fire/Smoke Building	19	\$1,182,439
	Total Fire Loss Events	43	\$1,338,025
Non-Fire Loss Events	Leaks, Spills, Releases, Actuations	21	\$226,922
	Total Monetary Losses	64	\$1,564,947
No Reported Loss	Non-Monetary Events	31	\$0.00
	Total Fire Protection Events	95	\$1,564,947

In 2021 there were 95 total fire protection-related events reported into the FPRS, a 12 percent increase from 2020, resulting in \$1,564,947 in monetary losses, a 15 percent increase from 2020. Of the 95 total events, 64 resulted in monetary losses, a 5 percent increase from 2020. There were 31 events with no reported costs, a 29 percent increase from 2020. These events are typically small incidents that are resolved quickly by local staff, or events where all costs are absorbed by the Fire Department.

Of the 64 events resulting in monetary losses in 2021, 43 were fire loss events (directly attributable to fire or smoke), a 12 percent decrease from 2020; and 21 were non-fire loss events (leaks, spills, and inadvertent releases), a 75 percent increase over 2020.

The 43 fire loss events in 2021 resulted in \$1,338,025 in fire losses, a 0.7 percent increase from 2021.

The 21 non-fire losses (leaks, spills, or inadvertent releases) resulted in \$226,922 in losses, a 735 percent increase from 2020.

Major Fire Loss Events (\$10,000 or greater)

A small proportion of the fire events constitute the majority of the total fire losses reported by DOE sites. In 2021, there were ten major fire losses at six sites costing \$10,000 or more, an 11 percent increase from 2020. The ten major loss events (23 percent of the 43 total events) represented \$1,315,159, or 98 percent of all reported fire losses in 2021. Of the ten events, six resulted in losses of \$50,000 or greater, compared with five in 2020. The single largest fire loss event was a fire in a heated oil tank at Y-12 that resulted in a \$530,260 loss, which alone represents 40 percent of all DOE fire losses reported in 2021.

Figure 2 displays the distribution of major (\$10,000+) fire loss events at DOE sites.

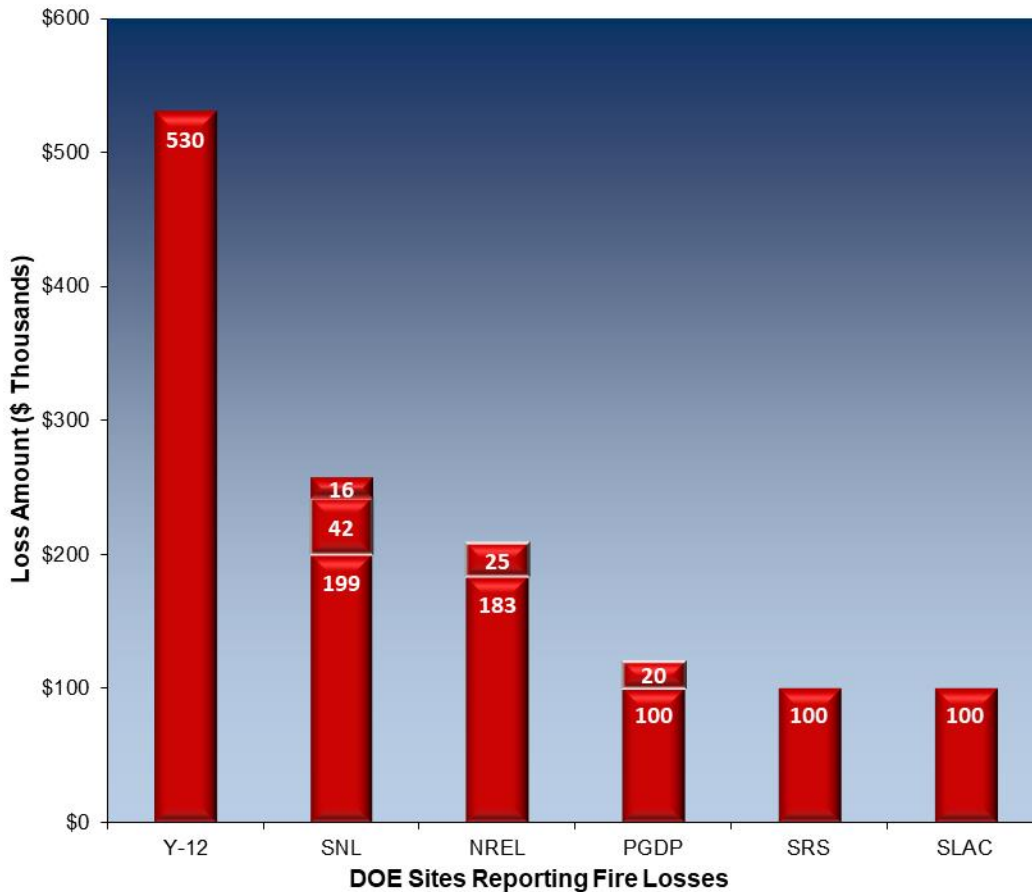


Figure 2: Major Fire Losses by Site

Ten major fire loss events were reported at six DOE sites resulting in losses of \$10,000 or greater in 2021. Sandia National Laboratory (SNL) reported three major losses, National Renewable Energy Laboratory (NREL) and Paducah Gaseous Diffusion Plant (PGDP) reported two each, and Y-12 National Security Complex (Y-12), Savannah River Site (SRS), and SLAC Accelerator Laboratory (SLAC) each reported one major fire loss. Of the ten major loss events, there were six losses of \$50,000 or greater.

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Table 2 provides information and site descriptions for the six costliest fire losses (\$50,000 or greater). These six events represent \$1,212,669, or 91 percent of all DOE fire protection losses for 2021.

Table 2: Summary of Fire Events with Losses of \$50,000 or Greater

Site	Loss Type	Cause	Description	Loss Amount
Y-12	Fire/Smoke (Building)	Design/Material Related	Mineral oil from a hot press operation was spilled from a pressure vessel and inadvertently saturated the insulation of a heated oil tank located beneath the process. When the process was operated the following day the elevated temperatures from the heated oil tank caused the mineral oil that absorbed into the tanks insulation to begin smoldering. Once the smoldering was able to reach an opening in the insulation flaming combustion began occurring on the outside surface of the tank's insulation. The Fire Department responded and ultimately extinguished the fire with a 1.75" handline.	\$530,260
SNL	Fire/Smoke (Building)	Procedure Related	Kirtland Fire Emergency Services, Protective Force, Facilities, High Voltage, Custodial, Sandia EMS, Fire Protection, ES&H, and Industrial Hygiene responded to smoke in the building. The fire alarm system was activated, followed by sprinkler flow. There were not any reported injuries. The cause of the fire was determined to be a lithium battery. The building was closed due to fire and water damage.	\$ 199,168
NREL	Fire/Smoke (Building)	Procedure Related	Fire within fume hood in Solar Energy Research Facility Lab C124. Fire originated in waste container containing activated carbon, ethanol wetted Kim wipes, a Palladium on carbon catalyst, and Nitric Acid.	\$ 183,241

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PGDP	Fire/Smoke (Building)	Electrical	<p>The C-532 Relay House facility was mostly already deactivated, thereby reducing/eliminating replacement costs. Five 14 kV feeder cables routed through the facility were not in the immediate vicinity of the fire and were not damaged. The other facility equipment that require functionality is the basement sump pump power that removes periodic groundwater accumulation, partial lighting that supports operator sump checks, and power to the adjacent public address speaker pole. Power to the sump pump and lighting was intended to be preserved according to the deactivation project; however, due to the fire, alternate conductors and lighting fixtures will likely be erected to avoid the need to restore the damaged cables. The estimated fire loss includes the cost to provide an alternate sump pump and lighting, waste disposal, and recovery; and is estimated to be \$100,000.</p>	\$ 100,000
SRS	Fire/Smoke (Other)	Unspecified	<p>SRSFD was dispatched to the Three Rivers Landfill for a reported trash and machinery fire. Units arrived to find a fire present in a trash pile that was contained. Facility personnel were utilized machinery to contain the fire and suppress fire with large amounts of dirt from the facility. SRSFD assisted facility personnel until the fire was extinguished. No injuries were reported.</p>	\$ 100,000

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SLAC	Fire/Smoke (Building)	Electrical	T20 dry transformer inside accelerator 10-2 modulator power cabinet shorted, overheated, and caught fire. Detected by in-cabinet heat detection wire. Equipment de-energized and fire extinguished and cooled with CO2 fire extinguishers. Cause of short determined and corrected in all modulator cabinets where it could occur. Entire modulator cabinet replaced with "spare" unit borrowed from less critical location on beamline. No programmatic schedule impact on FACET. Loss amount primarily represents cost to build new spare.	\$ 100,000
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NOTE: Major losses associated with leaks, spills, releases, and actuations are detailed in the Water-Based Fire Suppression System Actuations and Non-Water-Based Fire Suppression System Actuations sections of this report.

Facility/Property Valuation and Calculated Fire Loss Rates

Facility/property valuation is calculated by combining data from the Facility Information Management System (FIMS) and Property Information Database System (PIDS). The combined totals serve as a common denominator for calculating and normalizing Fire Loss Rates and Fire Protection Program Cost Rates (discussed later in this report). For historical context, Figure 3 displays the total DOE valuation trend over the past 20 years.

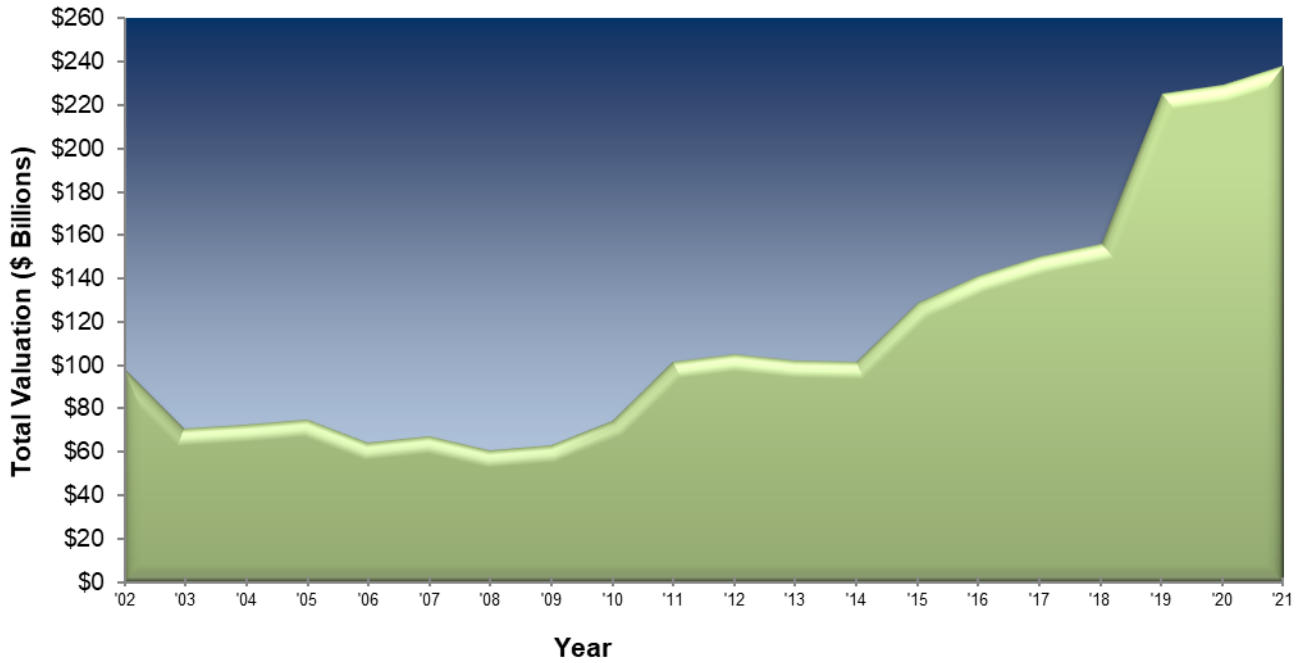


Figure 3: DOE Total Valuation from FIMS and PIDS 2002-2021

In 2021, total DOE valuation for sites reporting into the FPRS was \$238.3 billion, a 4 percent increase from 2020.

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Fire Loss Rates are calculated using monetary losses and total valuation. Figure 4 displays the DOE Fire Loss Rates over the past 20 years.

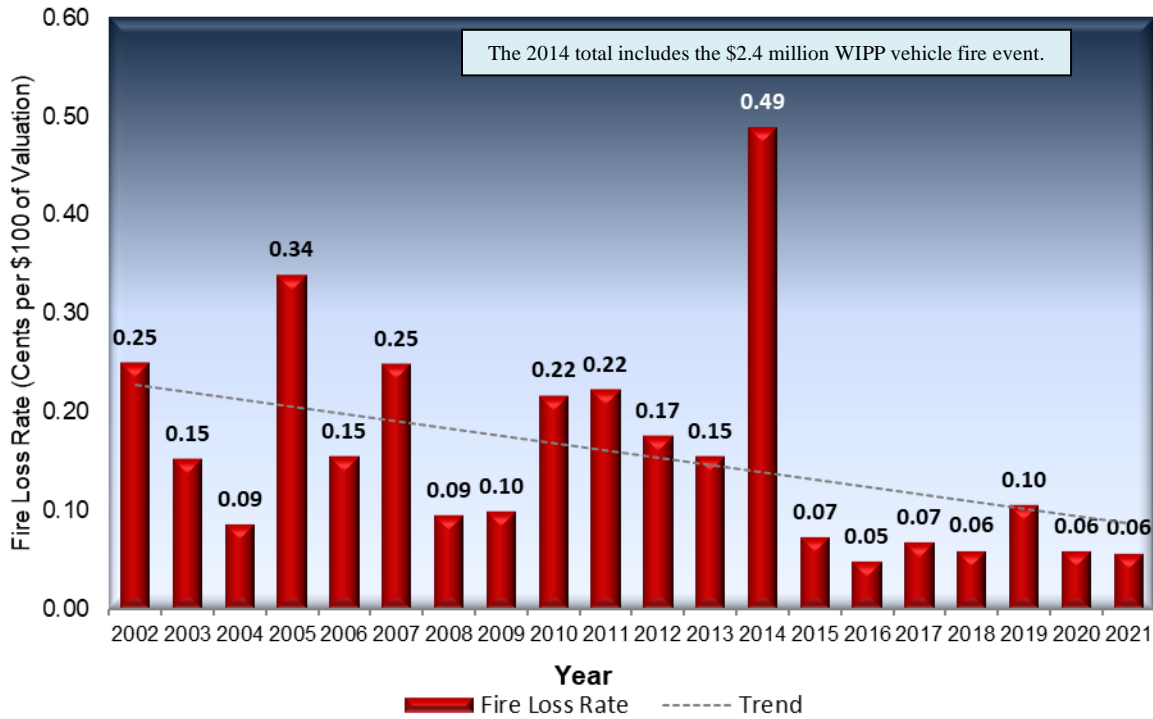


Figure 4: DOE Fire Loss Rates 2002-2021

DOE’s calculated 2021 Fire Loss Rate for sites reporting into FIMS, PIDS, and the FPRS was approximately 0.06 cents per \$100 of total valuation, the same as in 2020.

Figure 5 displays the Fire Loss Rates for sites that reported monetary fire losses into the FPRS in 2021.

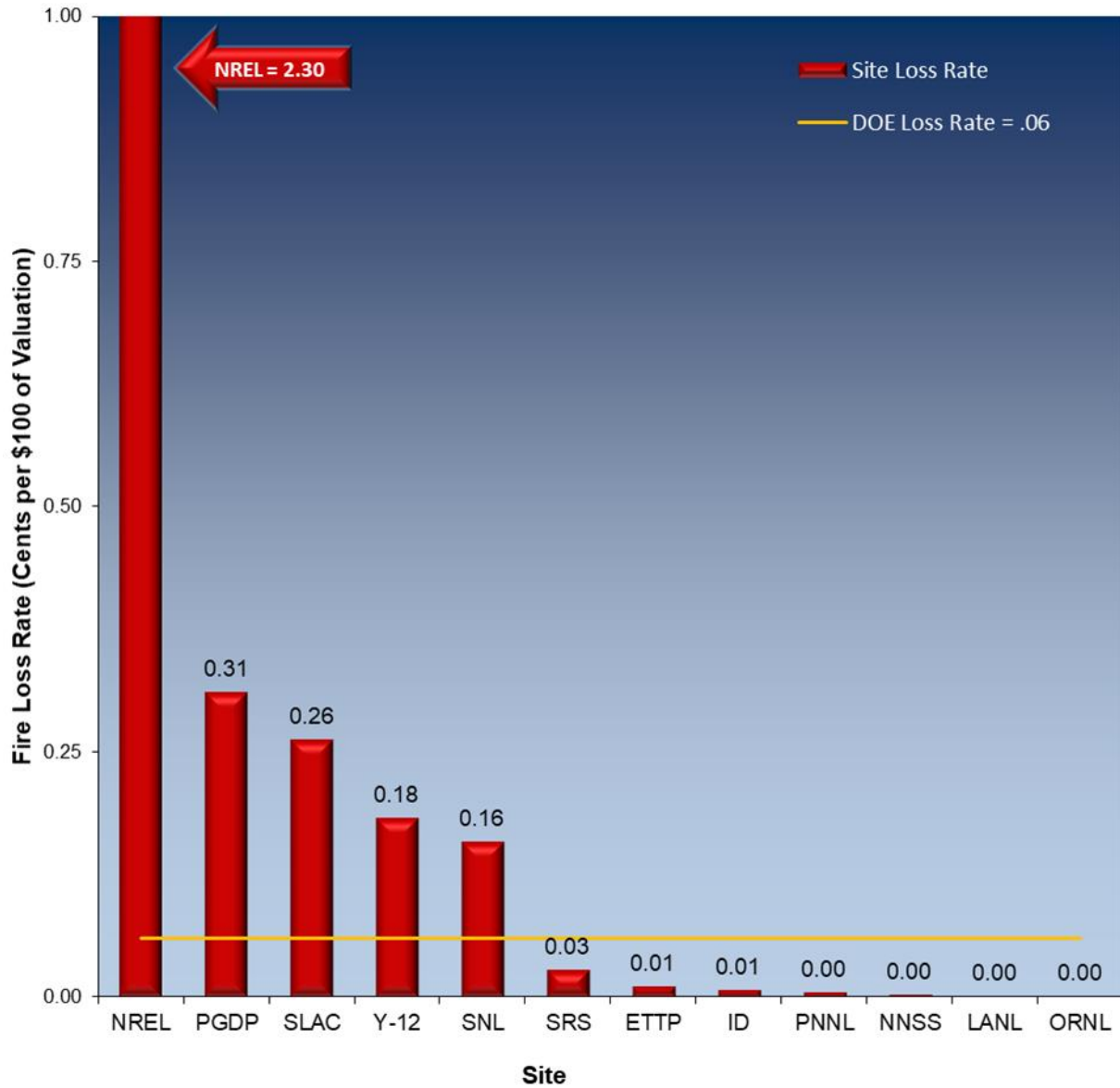


Figure 5: Fire Loss Rates by Site

Twelve sites reported fire losses in 2021, down one from 13 in 2020. The DOE-wide 2021 rate of 0.06 cents per \$100 was the same as in 2020 and is displayed as an orange line in the figure. NREL had the highest Fire Loss Rate of 2.30 cents per \$100 of valuation, followed by PGDP at 0.31, SLAC at 0.26, Y-12 at 0.18, and SNL at 0.16 cents. All other sites were below the DOE-wide rate.

DOE Fire Loss History

Table 3 displays DOE historical fire loss information, including valuations, monetary losses, and calculated Fire Loss Rates since 1950.

Table 3: DOE Fire Loss History

Year	Valuation (Millions)	Fire Loss (Dollars)	Fire Loss Rate (Cents per \$100 Valuation)	Previous 5-Year Average (Cents per \$100 Valuation)
1950	1,800.00	496,439	2.76	–
1951	2,177.10	356,115	1.64	–
1952	3,055.10	805,707	2.64	–
1953	4,081.00	575,572	1.41	–
1954	6,095.90	375,874	0.62	–
1955	6,954.20	455,788	0.66	1.81
1956	7,364.10	3,147,423	4.27	1.39
1957	7,973.20	1,476,599	1.85	1.92
1958	8,102.50	751,825	0.93	1.76
1959	10,301.80	1,197,901	1.16	1.67
1960	10,708.60	1,401,051	1.31	1.77
1961	11,929.90	5,856,055	4.91	1.91
1962	12,108.80	3,313,364	2.74	2.03
1963	13,288.90	1,376,054	1.04	2.21
1964	14,582.80	1,351,035	0.93	2.23
1965	15,679.30	3,850,069	2.46	2.18
1966	16,669.00	856,973	0.51	2.41
1967	17,450.90	2,782,934	1.59	1.53
1968	18,611.90	869,083	0.47	1.31
1969	20,068.30	28,054,334	13.98	1.19
1970	22,004.30	1,700,792	0.77	3.80
1971	24,155.80	1,936,049	0.80	3.47
1972	26,383.50	920,651	0.35	3.52
1973	27,166.70	2,375,688	0.87	3.27
1974	28,255.50	1,179,877	0.42	3.36
1975	31,658.30	5,252,349	1.66	0.64
1976	35,512.70	2,292,576	0.65	0.82
1977	39,856.10	3,613,984	0.91	0.79
1978	47,027.10	17,477,979	3.72	0.90
1979	50,340.80	2,541,023	0.50	1.47
1980	54,654.70	8,545,935	1.56	1.49
1981	59,988.80	4,643,488	0.77	1.47
1982	65,360.40	4,200,968	0.64	1.49
1983	70,484.40	10,497,062	1.49	1.44
1984	82,166.90	6,467,320	0.79	0.99

DOE Fire Loss History (continued)

Year	Valuation (Millions)	Fire Loss (Dollars)	Fire Loss Rate (Cents per \$100 Valuation)	Previous 5-Year Average (Cents per \$100 Valuation)
1985	86,321.84	4,129,297	0.48	1.05
1986	82,787.52	5,295,292	0.64	0.83
1987	91,927.20	3,010,829	0.33	0.81
1988	92,998.00	8,303,120	0.89	0.74
1989	107,948.00	7,505,551	0.70	0.63
1990	115,076.00	17,470,746	1.52	0.61
1991	118,868.68	2,428,805	0.20	0.81
1992	118,267.06	3,653,554	0.31	0.73
1993	119,826.25	3,018,534	0.25	0.72
1994	124,350.29	3,403,650	0.27	0.60
1995	120,321.68	1,632,466	0.14	0.51
1996	113,471.00	6,025,832	0.53	0.23
1997	102,947.24	6,112,887	0.59	0.30
1998	99,127.79	1,378,788	0.14	0.36
1999	110,858.47	2,911,040	0.26	0.33
2000	102,514.01	103,174,122	10.06	0.33
2001	103,215.56	505,586	0.05	2.32
2002	98,779.44	2,461,847	0.25	2.22
2003	70,812.80	1,075,309	0.15	2.15
2004	72,601.95	622,613	0.09	2.16
2005	74,951.25	2,537,565	0.34	2.12
2006	64,547.05	997,805	0.15	0.17
2007	67,382.01	1,674,515	0.25	0.20
2008	60,576.55	573,161	0.09	0.20
2009	63,569.89	623,299	0.10	0.18
2010	74,417.99	1,608,762	0.22	0.19
2011*	101,351.17	2,250,744	0.22	0.16
2012*	105,238.57	1,840,121	0.17	0.18
2013*	101,940.69	1,572,342	0.15	0.16
2014*	101,437.21	4,953,200	0.49	0.17
2015	129,041.10	929,879	0.07	0.25
2016	141,386.52	679,619	0.05	0.22
2017	150,206.75	1,008,295	0.07	0.19
2018	156,161.05	917,936	0.06	0.17
2019	225,242.45	2,360,843	0.10	0.15
2020	229,570.58	1,328,871	0.06	0.07
2021	238,336.95	1,336,492	0.06	0.07

* The Fire Loss Amounts from 2011-2014 (column 3 above) include both fire and non-fire losses such as system leaks, spills, and releases. The calculated Fire Loss Rate and the Previous 5-Year Average (columns 4 and 5 above) for 2011-2014 also include both fire and non-fire losses. Prior to 2011 and from 2015 forward, the figures reflect only actual fire losses.

Recurring Fire Protection Program Costs

DOE elements are required to report costs associated with recurring fire protection activities into the FRPS annually. Figure 6 displays the recurring cost distribution by Activity Type in 2021.

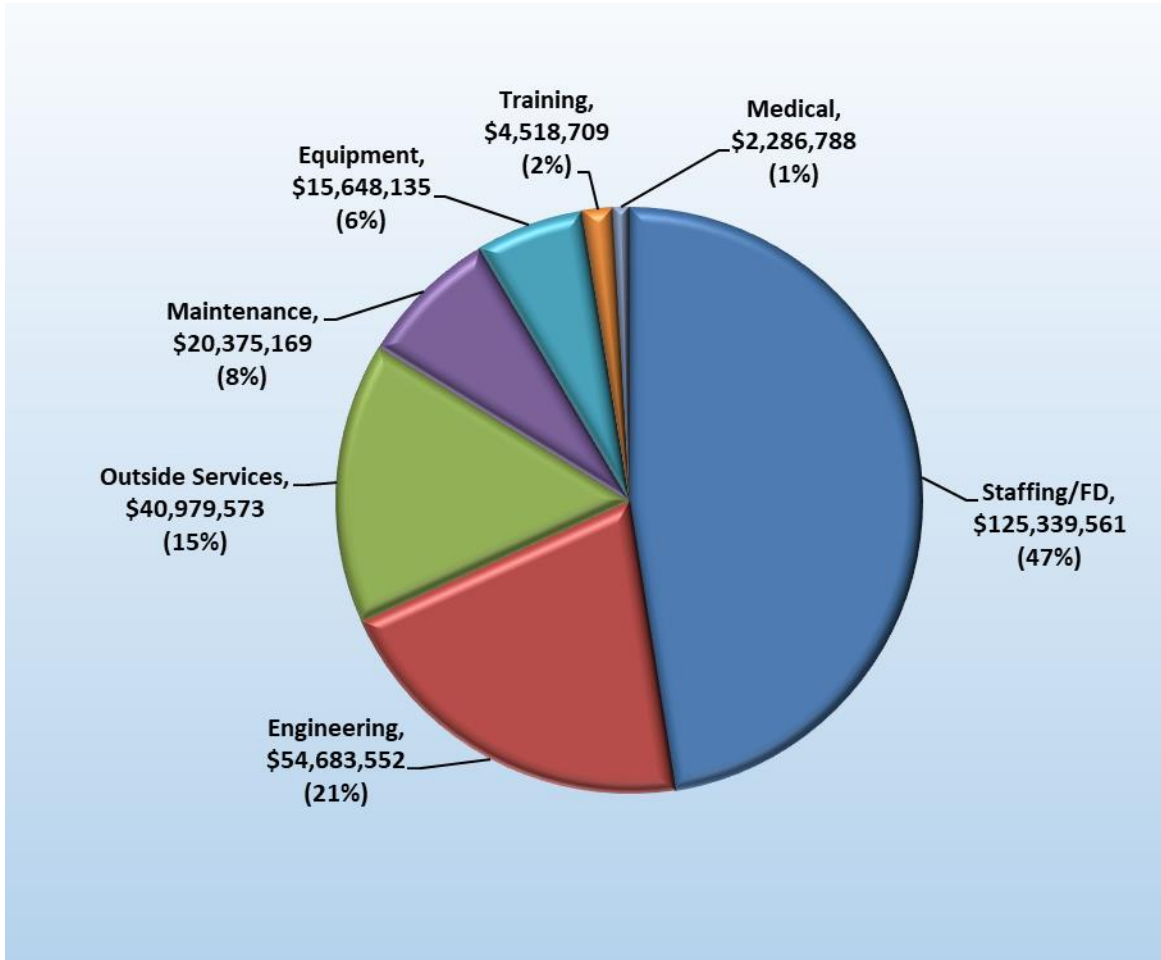


Figure 6: Fire Protection Program Costs by Activity

Total DOE recurring fire protection costs for 2021 were \$ \$263,831,486, a two percent decrease from 2020. Staffing/Fire Department Costs represented 47 percent of all fire protection costs, compared with 44 percent the prior year.

A Fire Protection Program Cost Rate may be calculated the same way as Fire Loss Rates, using facility and property valuations. Figure 7 displays the Fire Protection Program Cost Rates for the sites.

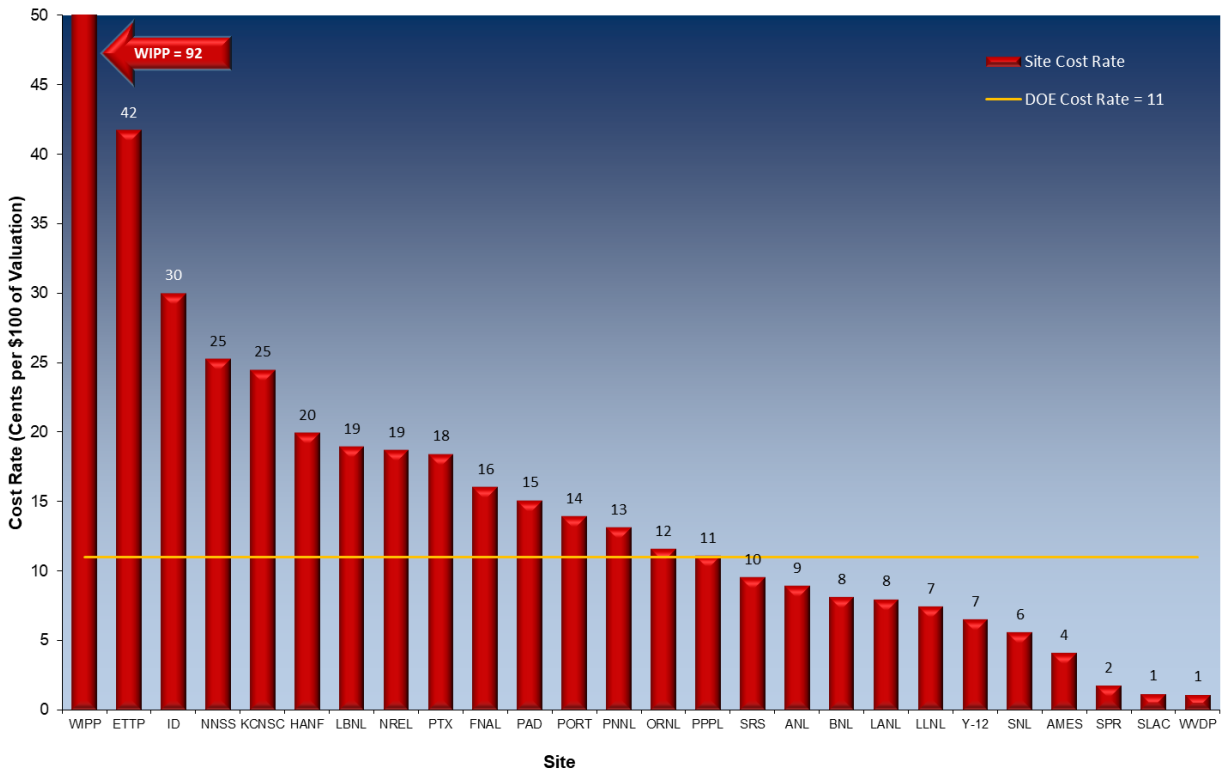


Figure 7: Fire Protection Program Cost Rates by Site

In 2021, the DOE Fire Protection Program Cost Rate was approximately 11 cents per \$100 (dollars) of property valuation for recurring fire protection activities, displayed as the orange line on the chart; an eight percent decrease from 2020.

The Waste Isolation Pilot Plant (WIPP) had the highest rate at 92 cents per \$100 of valuation, a 30 percent increase from 2020. This was followed by the East Tennessee Technology Park (ETTP) at 42 cents and Idaho (ID) at 30 cents. DOE-wide, 14 sites had cost rates higher than the DOE rate, while 12 sites were at or below the DOE rate.

It should be noted that recurring cost activities are not consistently reported across the Department, such as outside contracts and maintenance activities.

Water-Based Fire Suppression System Actuations

When a water-based fire suppression system is actuated, whether by fire, equipment malfunction, or human or environmental influence, there are costs associated with the event. These costs may include damage or loss of facilities and equipment, replacement or repair costs, fire department response costs, recharging fire suppression systems, cleanup costs, etc. Table 4 displays the distribution of Water-Based Fire Suppression System Actuations by cause.

Table 4: Water-Based Fire Suppression System Actuation Causes

Cause	No. of Events
Weather	6
Electrical	5
Other/Unspecified	5
Design/Material	3
Total	19

In 2021, DOE facilities reported actuations of 19 wet-pipe suppression systems, 18 of which resulted in financial losses totaling \$175,573, an 83 percent decrease from 2020.

Table 5 displays the three Water-Based Fire Suppression Actuation events resulting in costs of \$10,000 or greater. These three events represent 81 percent of the total costs associated with Water-Based Fire Suppression Actuations in 2021.

Table 5: Costliest Water-Based Fire Suppression System Actuations

Site	Loss Type/Cause	Cause	Description	Loss Amount
ID (INL)	Leaks, Spills, Releases	Weather	An electrical alarm malfunction caused pre-action sprinkler system to charge with water.	\$116,000
ID (ICP)	Leaks, Spills, Releases	Weather	An exterior sprinkler line froze causing the branch line piping to break, which resulted in waterflow on the system.	\$14,500
Y-12	Leaks, Spills, Releases	Electrical	A dry pipe system activated due to a failed air compressor.	\$11,180

Non-Water-Based Fire Suppression System Actuations

Non-water-based fire suppression system actuations includes wet chemical (including halon), dry chemical, and clean agent extinguishing systems. Chlorofluorocarbons (including halon) are regulated under the 1991 Clean Air Act due to their detrimental impact on the ozone layer. The Environmental Protection Agency has published regulations to: 1) prohibit halon production; 2) establish container labeling requirements; 3) impose Federal procurement restrictions and halon taxes; 4) issue requirements for the approval of alternative agents; and 5) identify essential areas where halon protection is considered acceptable.

DOE policy, as stated in Memorandum DOE F 132S.8, *Managed Phase Out of Halon Fixed Fire Suppression Systems*, prohibits the installation of any new halon systems. Field organizations have been requested to aggressively pursue alternative fire suppression agents to replace existing halon systems, and to effectively manage halon inventories. The Department’s long-term goal is the eventual elimination of all halon systems.

In 2021, 88 active halon systems were still in use at DOE sites, a 22 percent decrease from 2020. Eighty-three of the 88 active halon systems (94 percent) were at the Savannah River Site (SRS).

There were three events associated with Non-Water-Based Suppression Systems reported in 2021, resulting in losses of \$51,349, a 176 percent increase from 2020. All three events were reported at Idaho.

Table 6 provides information regarding the three events.

Table 6: Non-Water-Based Fire Suppression System Actuations

Site	Loss Type	Description	Loss Amount
ID (INL)	Leaks, Spills, Releases	Oil/refrigerant leaks from a compressor activated multiple smoke detectors causing the NOVEC system to discharge.	\$26,000
ID (INL)	Leaks, Spills, Releases	Cause identified as an active deficient O2 alarm, but no sign of fire or smoke. The O2 alarm was attributed to the dump of the FM-200 suppression system.	\$24,000
ID (ICP)	Leaks, Spills, Releases	Electrical switch malfunctioned causing the dry chemical system on a telehandler to discharge.	\$1,349

Fire Department Responses

Table 7 displays the distribution of 2021 fire department emergency and non-emergency responses at DOE sites by call category.

Table 7: Fire Department Responses

Site	Fire Calls	HazMat Calls	Other Emergency Calls	Non-Emergency Calls	Medical Calls	TOTAL SITE CALLS
AMES	1	0	0	0	0	1
ANL	19	36	159	256	75	545
BNL	13	30	28	109	71	251
ETTP	2	1	12	11	16	42
FNAL	187	0	0	0	24	211
HANF	23	0	123	391	210	747
INL	88	11	0	12	80	191
KCNSC	2	0	0	0	17	19
LBNL	3	9	6	49	9	76
LLNL	9	23	564	24	44	664
LANL	18	16	121	162	89	406
NREL	2	1	5	15	0	23
NNSS	6	4	22	78	73	183
OST	0	0	0	2	0	2
ORNL	10	15	55	320	87	487
PNNL	0	0	0	16	3	19
PGDP	4	0	65	22	31	122
PTX	2	43	140	209	103	497
PORT	10	8	143	6	88	255
PPPL	31	7	64	56	163	321
SNL	10	22	16	59	16	123
SRS	8	10	152	87	254	511
SLAC	1	0	0	2	5	8
SPR	0	2	0	0	17	19
TJNAF	9	1	1	0	5	16
WIPP	4	1	2	0	49	56
WVDP	2	0	3	0	3	8
Y-12	5	42	319	37	137	540
TOTAL	469	282	2000	1923	1669	6343

There were 6,343 Fire Department responses in 2021, a 45 percent increase, which followed a 38 percent decline in 2020. It should be noted that these wide swings may be attributable to operational changes resulting from the changing nature of the COVID-19 pandemic.

Fire Protection Occurrences Reported in ORPS

Fire and fire protection events that meet the reportability thresholds described in DOE O 232.2A, *Occurrence Reporting and Processing of Operations Information*, are required to be input into the Occurrence Reporting and Processing System (ORPS) database.

There were no ORPS-reportable fire or fire protection-related injuries or fatalities reported in 2021.

In 2021, there were 147 fire or fire protection-related occurrences reported in ORPS, an 86 percent increase from the 79 in 2020. Of the 147 reported events, 11 (8 percent) were rated *High Level*, 83 (57 percent) were *Low Level*, and 53 (36 percent) were *Informational Level*.

Table 8 displays the distribution of Fire Protection ORPS keywords. Note: The 147 fire protection occurrences resulted in 149 assigned keywords because two occurrences were assigned two keywords.

Table 8: Distribution of Fire Protection ORPS Keywords

Code	Keyword Name	Occurrences
03A	Fire Protection Equip Degradation	115
03C	Facility Fire	24
03D	Explosives Safety Issue	3
03G	Wildland Fire	3
03E	National Fire Protection Assn. Issue	2
03B	Fire Suppression Actuation	1
03F	Explosion	1
TOTAL		149

In 2021, *Fire Protection Equipment Degradation* was identified in 78 percent of all fire protection ORPS reports, followed by *Facility Fires* at 16 percent. The vast majority of the increase was attributable to fire protection equipment degradation events which increased 155 percent in 2021.

Table 9 displays summaries of the 11 fire protection events rated as High Level ORPS occurrences.

Table 9: Summaries of High Level Fire Protection ORPS Occurrences

Site	Occurrence Description
ORNL	<p>Fire in Cubicle 4 Furnace in Building 7920 On February 20, 2021, Radiochemical Engineering Development Center (REDC) Operations personnel were heating 750 milliliters of anion resin to oxidize the resin prior to disposal, using an in-cell furnace. When the furnace was heated to 540 degrees Celsius, an unexpected amount of smoke was observed. The fire was and Fire Department personnel found no visual indication of fire damage beyond the furnace and associated equipment.</p>
NETL	<p>Building 28 Facility Fire On February 27, 2021, signs of smoke were found originating from Building 28. The fire department determined that the fire was isolated to the building's attic area and cut a hole in the roof for ventilation and access to the fire. Electrical service to the building was shut-off and fire suppression water was applied to the attic area by the fire department extinguishing the fire.</p>
PGDP	<p>Fire at the C-532 Facility On March 9, 2021, work to isolate two 48-Volt Direct Current (VDC) battery banks located in the facility basement resulted in an arc at the location where the cables were cut. The arcing cables created smoke that began encapsulating the basement and burned the insulation material on the nearby cables. PGDP Fire Services entered the building and after encountering heavy black smoke from the fire, multiple firefighting techniques were deployed to extinguish the fire.</p>
Y-12	<p>Fire in the inner insulation jacket of a hot oil tank supporting pressure vessel On April 7, 2021, after completing a hot oil run for Pressure Vessel PV4, chemical operators reported visible smoke coming from the PV4 area. Later, the Building Operations Manager reported fire in the pressure vessel area. The fire department responded, and an extinguisher was used, but the fire continued, and a fire attack line was used to knock down the flames. Smoke continued from the insulating jacket of the equipment. Asbestos was suspected of being the insulating material. The fire department pulled back the insulating jacket to extinguish all smoldering areas, then continued to remove enough of the insulating jacket from the equipment until no smoke or flames were present. The fire department requested Industrial Hygiene respond due to likely asbestos contact and dispersal.</p>
NREL	<p>Fire within fume hood in Solar Energy Research Facility Lab C-124 On April 19, 2021, an unanticipated reaction occurred in a Laboratory (lab) hood. After an activated graphite sample was placed into a yellow waste container located within the hood, ethanol Kim wipes and a pipe cleaner were disposed in the same yellow waste bin that also contained a waste palladium catalyst which caused a spontaneous combustion to occur. The Fire Department responded and extinguished the fire.</p>

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	Occurrence Description
LANL	<p>TSR Violation, Positive USQ, Safety Significant SSC Degradation: Fire Door Latch Failure</p> <p>On April 30, 2021, the Operations Manager (E1) for the Weapons Engineering Tritium Facility (WETF) discovered that a fire safety door latch failed when it became stuck, preventing the door from latching closed. The door is a Safety Class component per the WETF safety basis, and the failure is considered performance degradation of Safety Class equipment.</p>
NNSS	<p>Wildland Fire on the Nevada National Security Site</p> <p>On May 17, 2021, it was confirmed that there was a wildland fire on the Nevada National Security Site (NNSS) in the northwest corner of Area 18. The NNSS Fire and Rescue responded and continue to monitor the fire and assess the area for further hazards.</p>
Y-12	<p>Spark from Cutting Tool Produced a Flame</p> <p>On June 24, 2021, construction employees were removing metal piping from a high efficiency particulate air filter housing in Building 9225-3. As construction employees were making the second cut on a pipe, a spark generated and then ignited residual material inside the pipe. The flame was approximately 8-12 inches tall and did not travel down the pipe. Water was used to quickly extinguish the flame in less than one minute.</p>
NNSS	<p>Wildland Fire on the Nevada National Security Site #2</p> <p>On June 29, 2021, multiple wildland fires occurred on the Nevada National Security Site (NNSS) in the northwest corner of Area 16, Area 17, and Area 29. The NNSS Fire and Rescue responded and continue to monitor the fires and assess the area for further hazards.</p>
NNSS	<p>Wildland Fire on the Nevada National Security Site #3</p> <p>On July 18, 2021, smoke was reported in a remote area of the Nevada National Security Site (NNSS). NNSS Fire and Rescue responded and confirmed that there was a wildland fire in the southwest section of the Site (Areas 25 & 29). Named the Black Glass Canyon Wildfire, the fire was estimated at 300 acres. The next day, a second half-acre fire was also discovered burning in the remote unoccupied northern section of the NNSS (Area 30). RSL-N began water bucket drops and BLM aerial assets performed fire-retardant drops to contain this fire. Firefighting efforts continued on July 20 to address both fires.</p>
SNL	<p>Fire in Building 894</p> <p>On October 11, 2021, the fire alarm in Building 894, room 136D was activated by a smoke detector and sprinkler water flow indication. The building was evacuated, and first responders reported to the scene. Prior to the fire condition, a single lithium battery cell was found to have vented following a test. That single cell and three others in a common holder were placed in a fume hood while the remainder of lithium battery cells were placed on a cart that was next to a desk. After an initial assessment of the scene, the fire origin potentially points to an area under the desk in room 136D, not to the fume hood where the vented cell was placed.</p>

Key Observations

- In 2021, the number of fire loss events (directly attributable to fire or smoke) reported across the DOE Complex into the Fire Protection Reporting System (FPRS) declined 12 percent, while monetary losses increased by 0.6 percent. The number of major fire losses costing \$10,000 or more declined 11 percent.
- The number of non-fire losses (leaks, spills, releases, and actuations) increased 75 percent, while related monetary losses jumped 735 percent.
- Total DOE valuation for sites reporting into the FPRS in 2021 rose four percent, while the Fire Loss Rate (calculated ratio of fire losses to total valuation) remained the same as in 2020 at 0.06 cents per \$100 of total valuation.
- The highest fire loss rate was at NREL, at 2.30 cents per \$100 of valuation, over 7 times the next highest rate of 0.31 at PGDP and 38 times the DOE-wide loss rate of 0.06 cents per \$100 of valuation.
- Recurring fire protection costs DOE-wide declined two percent from 2020.
- The Fire Protection Program Cost Rate (calculated ratio of fire protection costs to total valuation) was 11 cents per \$100 of valuation, a six percent decline from 2020.
- The highest fire protection program cost rate was at WIPP, at 92 cents per \$100 of valuation.
- There were 6,343 Fire Department responses in 2021, a 45 percent increase, which followed a 38 percent decline in 2020. It should be noted that these wide swings may be attributable to operational changes resulting from the changing nature of the COVID-19 pandemic.
- There were 147 fire or fire protection-related occurrences reported into ORPS in 2021, an 86 percent increase over 2020. The vast majority of the increase was attributable to fire protection equipment degradation events, which increased 155 percent in 2021.

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