Beryllium-Associated Worker Registry Summary

Through 2012

HSS
Office of Health, Safety and Security

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Beryllium-Associated Worker Registry Summary

Data Cumulative Through 2012

The U.S. Department of Energy (DOE) Beryllium-Associated Worker Registry (BAWR) is a collection of health and exposure information of individuals potentially at risk for chronic beryllium disease (CBD) due to their work at DOE-owned or leased facilities. The U.S. Code of Federal Regulations (CFR) Title 10, Part 850 Chronic Beryllium Disease Prevention Program (10 CFR 850) requires DOE sites to inventory and assess beryllium exposure hazards to determine whether employees are at risk for CBD. Subpart C—Specific Program Requirements, Section 850.39, requires that responsible employers must transmit all records generated as required by this rule, in a format that protects confidentiality of individuals, to the DOE Assistant Secretary for Environment, Safety and Health (now the DOE Assistant Secretary for Health, Safety and Security). To facilitate management of these data, a BAWR Data Center has been established at the Oak Ridge Institute for Science and Education, operated by ORAU, to receive and process the data and provide descriptive summaries that are included in the annual reports. The Registry includes, but is not limited to, a unique identifier, date of birth, gender, site, job history, medical screening test results, exposure measurements, and results of referrals for specialized medical evaluations.

Beryllium is a silver-gray metallic element found in approximately 30 minerals. It is a lightweight but strong, hard metal that has many industrial applications. The primary commercial use of beryllium is for hardening other metals, especially copper. Copper-beryllium alloys have many applications in electronic industries and other fields where strength and the ability to be fabricated into complex shapes and conduct electricity are desirable. The light weight and ability to dissipate heat of beryllium oxide ceramics have led to applications in the electronic, nuclear, and aerospace industries. Beryllium's transparency to x-rays and its ability to scatter and generate, but not absorb, neutrons when bombarded by protons have led to its use in nuclear weapons, experimental reactors, and accelerators.

HSS has taken the approach that summarization and periodic reporting of the results of ongoing data collection are within the Regulation's requirements to "…inventory and assess beryllium exposure hazards to determine whether employees are at risk for CBD." Annual reports organize the data into basic information with descriptive analyses in order to address 3 goals: (1) to perform basic data quality evaluation as part of continuous quality improvement, (2) to identify unusual patterns in a given year or over time that may warrant further evaluation, and (3) to provide feedback to site industrial hygienists, occupational medicine staff, management, and others with an interest in this aspect of worker safety and health.

The current annual report summarizes data cumulative through calendar year 2012 from sites that have determined that employees are at risk due to ongoing or past work. These sites have implemented CBD prevention programs that include the reporting of health and exposure data every 6 months to the DOE BAWR (see DOE-STD-1187-2007 for the operating protocol). Data summarized in this report include calendar 2012 data submitted or corrected by the end of April 2013. Health data were collected through the operation of current worker medical surveillance programs for all 29 sites and subcontractors submitting data. On page 14, the table showing *Number of Employees Exposure Monitored by Site and Year* reveals that there were no usable sampling data or no data submission at all for 5 sites. Exposure sampling data were submitted by 25 industrial hygiene programs for sites and subcontractors that have continuing beryllium operations or cleanup efforts due to a legacy of beryllium use from the past

The beryllium lymphocyte proliferation test (BeLPT) is a blood test that examines how lymphocytes (white blood cells in the immune system that fight disease) react to beryllium. A BeLPT is considered abnormal if a

person's lymphocytes are shown to proliferate more rapidly when exposed to beryllium. An abnormal BeLPT may indicate that a person is more likely than others with similar exposure to develop CBD in the future or may be an early sign of CBD. Individuals who have abnormal results are offered confirmatory testing that involves splitting blood samples, which are then tested in 2 laboratories. To be considered beryllium sensitized an individual must have 2 abnormal blood tests, 1 abnormal and 2 borderline blood tests, an abnormal bronchoalveolar lavage BeLPT, or a clinical evaluation with a diagnosis of beryllium sensitization. In this annual report, the "Number Sensitized" and "Number with CBD" are mutually exclusive categories; beryllium sensitized does not include individuals who have been diagnosed as having CBD.

The category "beryllium-associated worker" describes individuals who were screened for CBD or monitored for beryllium exposure while employed at a DOE site. The workers include both long-term employees who worked with beryllium years ago and workers exposed recently. Current workers who identify themselves or are identified by supervisors as beryllium-associated workers are offered screening for CBD but are not required to participate.

Individuals who have separated from employment at a DOE site are offered screening for CBD through programs operated by contract medical providers and cooperative agreement holders. The screening is performed at private clinics near the individual's current residence. These individuals are categorized as "former workers" and the results from these former worker programs are summarized in separate reports. For more information see http://www.hss.energy.gov/HealthSafety/FWSP/formerworkermed/.

The BAWR Summary Report for 2012 includes 2700 more workers than the 2011 report and reflects approximately 6900 additional BeLPT test results. The tables and figures included in the report provide brief comments to direct the reader to noteworthy observations. Overall, the data suggest that the prevention programs implemented by DOE sites have consistently provided a high level of compliance with the 10 CFR 850 action level of 0.2 $\mu g/m^3$ since 2004. We noted 11 additional beryllium sensitizations and 3 additional CBD diagnoses among the monitored population. Among craft workers, HVAC mechanics continue to show percentages exceeding the 0.2 $\mu g/m^3$ action level much higher than the percentages experienced by other craft workers. The exceedances observed in 2012 were primarily associated with waste operations at Pantex Plant, although it should be noted that the potential for these exceedances were generally identified by work planning processes and appropriate respiratory protection was in use.

The data at hand provide a basic evaluation of worker protection in beryllium work, both historical and current. Analyses in this report may indicate areas of substantial success and provide information that could be of use in identifying areas in which further work may be of benefit in the prevention of CBD.

29 Sites and Subcontractors Currently Submitting Data to BAWR

Advanced Mixed Waste Treatment Project (AMWTP)	LLNL Clean Harbors Environmental Services (LLNL CHES)
Ames Laboratory (AMES)	LLNL Envirocon, Inc. (LLNL ENVC)
Argonne National Laboratory (ANL)	Los Alamos National Laboratory (LANL)
Brookhaven National Laboratory (BNL)	Nevada National Security Site (NNSS)
DOE Oak Ridge Office (DOE-ORO)	Oak Ridge National Laboratory (ORNL)
East Tennessee Technology Park (ETTP)	Pacific Northwest National Laboratory (PNNL)
Fermi National Accelerator Laboratory (Fermi)	Pantex Plant (PTX)
Hanford Site (HAN)	Sandia National Laboratories (SNL)
Idaho National Laboratory (INL)	Savannah River Site (SRS)
Kansas City Plant (KCP)	Stanford Linear Accelerator Center (SLAC)
Knolls Atomic Power Laboratory (KAPL)	Wackenhut Security Services Inc. for ETTP, ORNL, and Y-12 (WSI)
LATA Environmental Services of Kentucky, LLC (PAD LATAKY)	Y-12 National Security Complex (Y-12)
Lawrence Berkeley National Laboratory (LBNL)	Y-12 Navarro Research and Engineering (Y-12 NRE)
Lawrence Livermore National Laboratory (LLNL)	Y-12 URS Corporation (Y-12 URS)
LLNL Boston University (LLNL BU)	

2 Inactive BAWR Sites

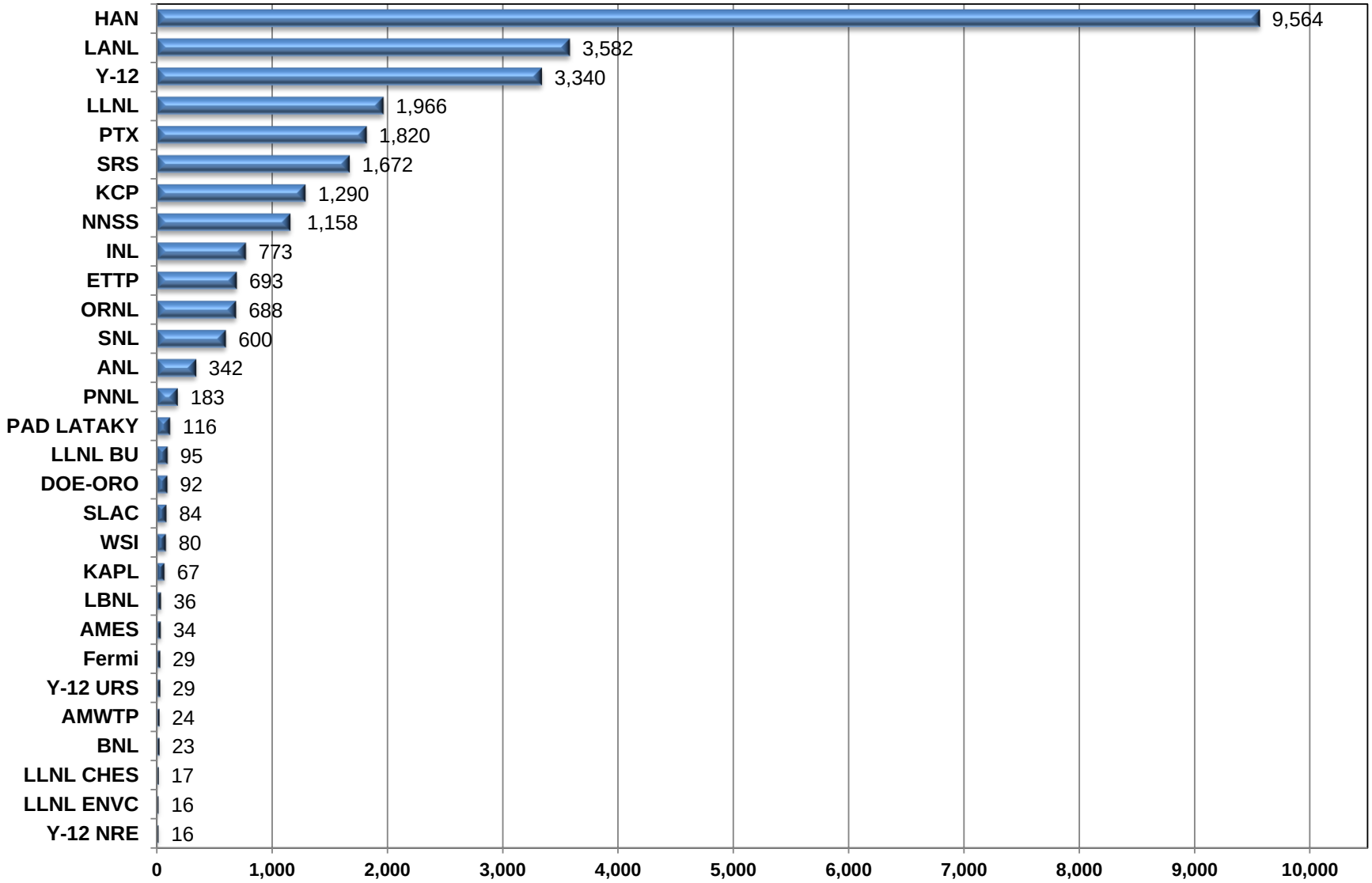
Rocky Flats Closure Project (RF)	Southwestern Power Administration (SWPA)

Most Recent Submission Dates to BAWR by Site

Site	Roster	BeLPT	Work History	Activities and Exposures
AMES	01/31/2013	01/31/2013	01/31/2013	02/22/2012
AMWTP	08/25/2011	02/04/2013	08/25/2011	02/04/2013
ANL	07/31/2012	07/31/2012	02/02/2009	02/02/2009
BNL	02/19/2013	02/19/2013	02/19/2013	02/19/2013
DOE-ORO	01/08/2013	01/08/2013	Not Reported	Not Reported
ETTP	02/01/2013	02/01/2013	02/01/2013	02/01/2013
Fermi	07/31/2012	07/31/2012	01/17/2007	07/31/2007
HAN	01/30/2013	01/30/2013	01/30/2013	01/30/2013
INL	01/31/2013	01/31/2013	01/31/2013	01/31/2013
KAPL	01/20/2012	01/20/2012	01/25/2011	01/20/2012
KCP	04/25/2013	01/30/2013	01/30/2013	01/30/2013
LANL	01/29/2013	01/29/2013	01/29/2013	01/29/2013
LBNL	01/01/2013	07/26/2012	08/16/2012	07/27/2012
LLNL	01/31/2013	01/31/2013	03/07/2013	01/31/2013
LLNL BU	05/03/2010	05/03/2010	05/03/2010	05/03/2010
LLNL CHES	06/18/2012	06/18/2012	06/18/2012	06/18/2012
LLNL ENVC	03/01/2012	01/31/2012	03/01/2012	03/01/2012
NNSS	03/25/2013	02/21/2013	02/21/2013	02/21/2013
ORNL	01/28/2013	01/28/2013	01/28/2013	01/28/2013
PAD LATAKY	12/27/2012	12/27/2012	12/27/2012	12/27/2012
PNNL	01/29/2013	01/29/2013	01/29/2013	Not Reported
PTX	01/31/2013	01/31/2013	03/25/2013	01/31/2013
SLAC	01/23/2013	01/23/2013	01/23/2013	01/23/2013
SNL	01/22/2013	01/22/2013	01/24/2013	01/24/2013
SRS	02/11/2013	02/11/2013	02/11/2013	07/31/2012
WSI	01/22/2013	01/22/2013	Not Reported	Not Reported
Y-12	03/19/2013	01/15/2013	04/11/2013	02/19/2013
Y-12 NRE	05/05/2010	02/20/2013	05/05/2010	02/20/2013
Y-12 URS	07/06/2011	01/07/2013	07/06/2011	Not Reported

Total 28,429 Employees Reported to BAWR by Site

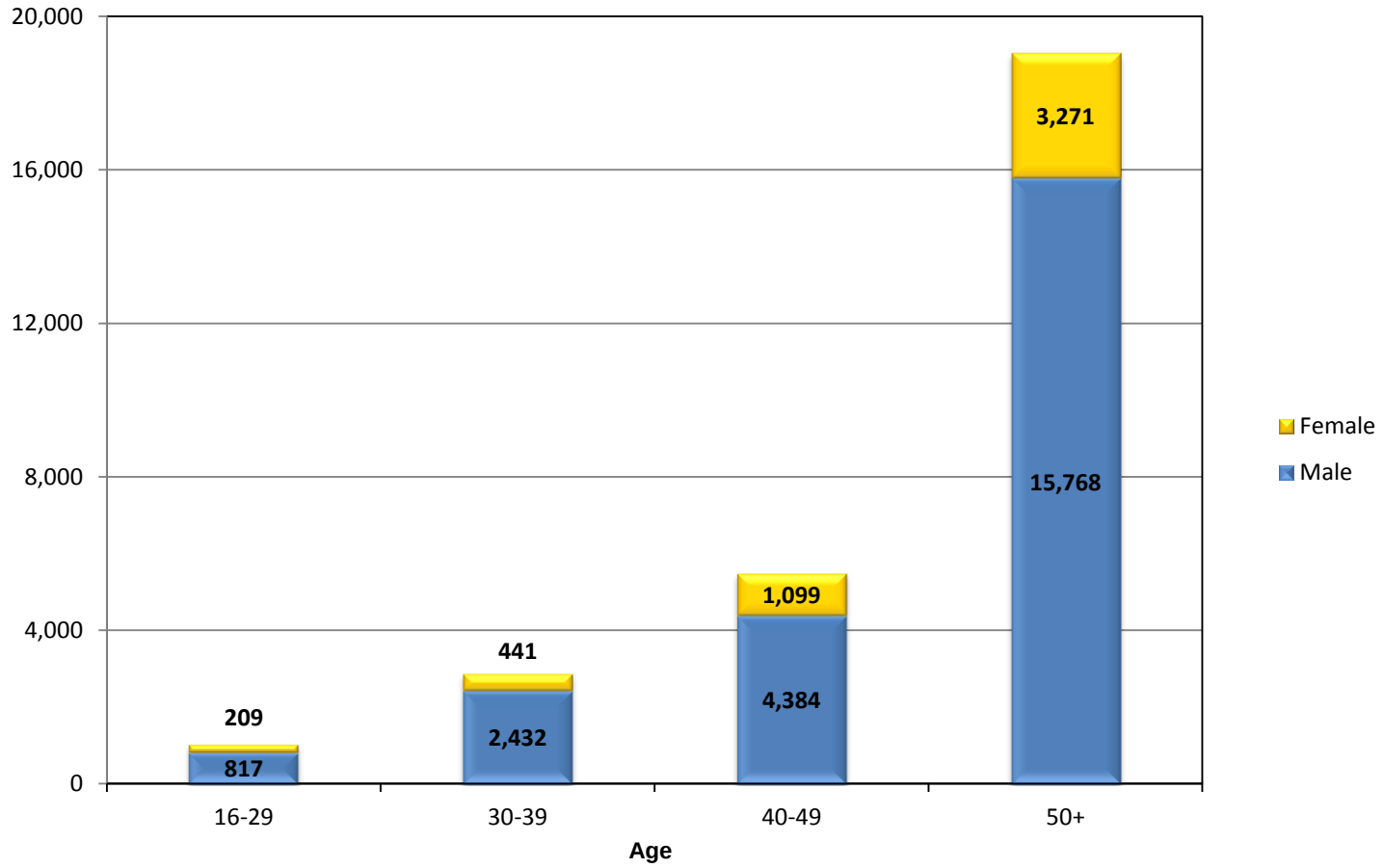
Data Cumulative Through 2012*



*Some sites provided data that predates the 2002 start date of the Registry.

Gender and Age Distribution of Employees Reported to BAWR

Data Cumulative Through 2012*



*Some sites provided data that predates the 2002 start date of the Registry.

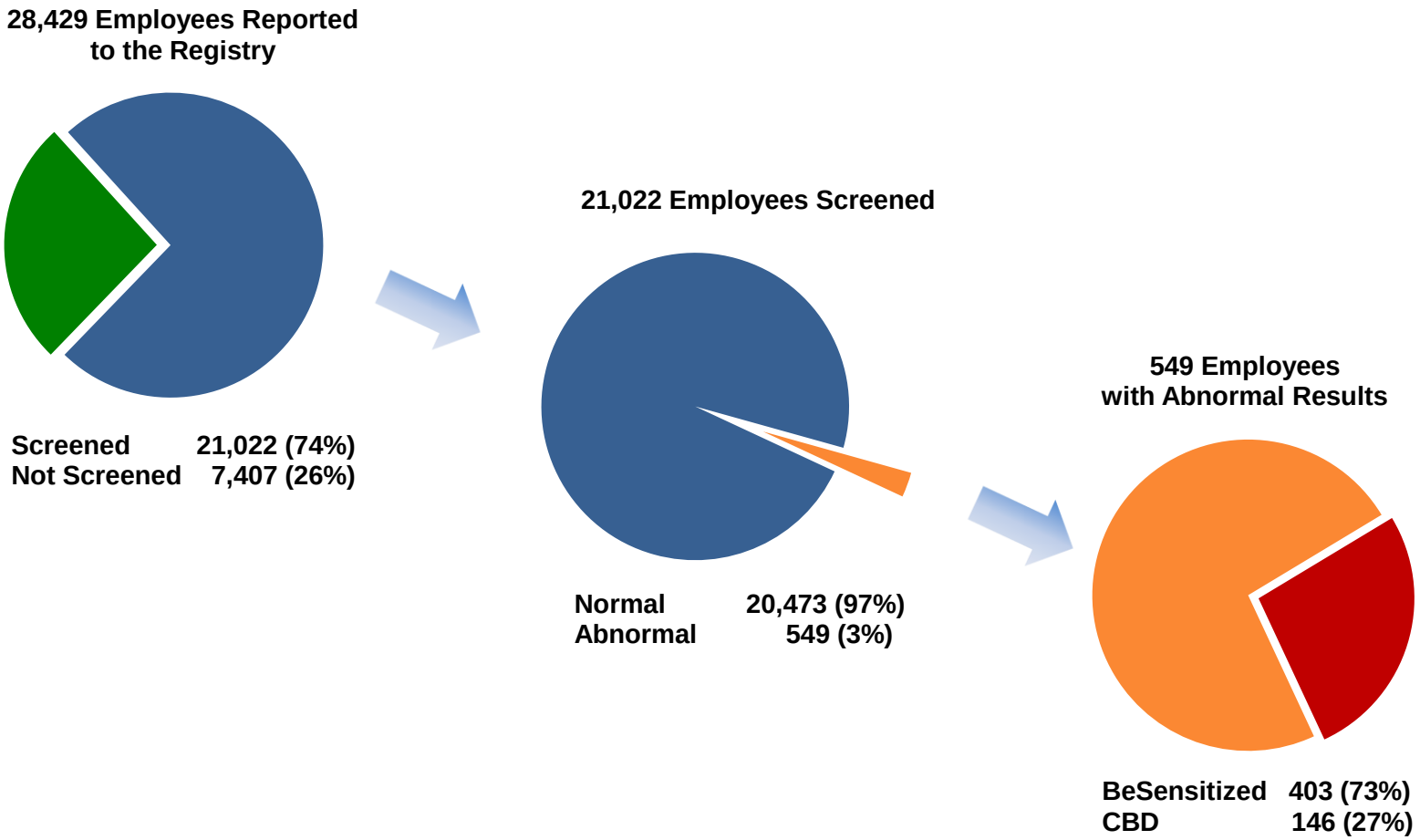
*Age and Gender by Site of 28,429 Employees Reported to BAWR Through 2012**

Site	16-29		30-39		40-49		50+		Not Reported
	M	F	M	F	M	F	M	F	
AMES	0	0	2	0	5	1	20	6	0
AMWTP	0	0	2	0	5	1	15	1	0
ANL	2	0	8	2	46	7	236	41	0
BNL	0	0	1	0	4	1	15	2	0
DOE-ORO	0	0	3	2	7	2	66	12	0
ETTP	19	5	59	8	115	18	422	47	0
Fermi	0	0	1	0	2	0	22	3	1
HAN	475	162	988	205	1,521	489	4,638	1,086	0
INL	30	7	118	11	174	40	341	52	0
KAPL	2	1	10	0	25	0	25	4	0
KCP	10	0	29	6	45	16	875	309	0
LANL	74	12	312	56	639	137	2,022	330	0
LBNL	0	1	0	0	5	1	27	2	0
LLNL	28	3	205	30	371	49	1,127	153	0
LLNL BU	1	0	8	1	18	1	52	11	3
LLNL CHES	8	0	1	1	2	0	4	1	0
LLNL ENVC	4	0	3	0	7	0	2	0	0
NNSS	11	4	88	29	128	50	585	263	0
ORNL	14	1	63	4	130	20	395	61	0
PAD LATAKY	5	2	13	6	36	6	45	3	0
PNNL	5	3	19	0	45	12	93	6	0
PTX	14	3	114	22	288	79	1,044	256	0
SLAC	2	0	3	0	6	0	72	1	0
SNL	4	0	49	7	87	6	391	52	4
SRS	29	2	75	17	279	68	967	235	0
WSI	0	0	3	0	9	1	61	6	0
Y-12	80	3	238	34	372	93	2,193	327	0
Y-12 NRE	0	0	8	0	5	1	1	1	0
Y-12 URS	0	0	9	0	8	0	12	0	0
Totals	**817**	**209**	**2,432**	**441**	**4,384**	**1,099**	**15,768**	**3,271**	**8**

*Some sites provided data that predates the 2002 start date of the Registry.

Progression from BeLPT Testing to "Sensitized" to CBD

Data Cumulative Through 2012*

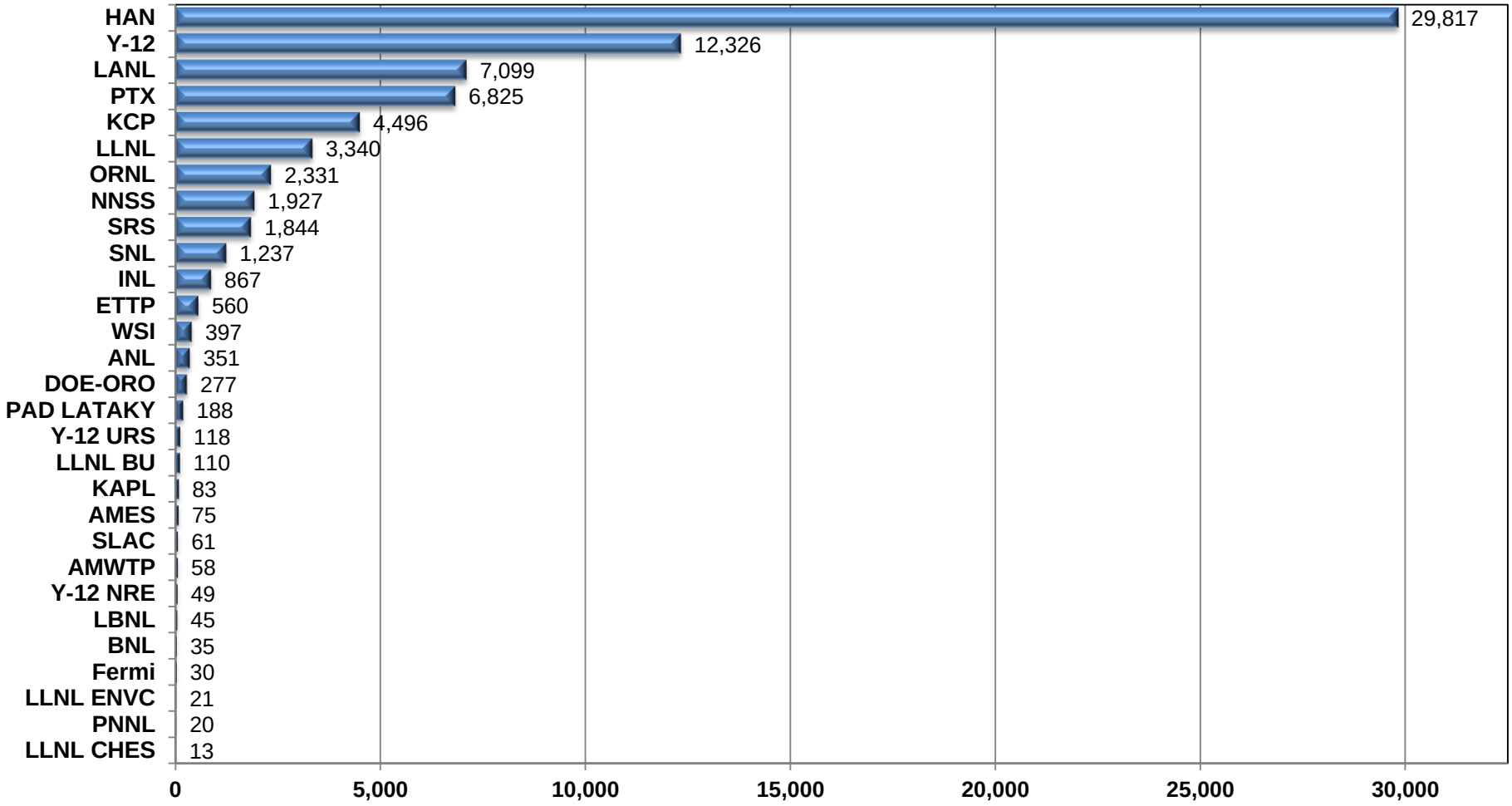


*Some sites provided data that predates the 2002 start date of the Registry.

From 2011 to 2012, sites reporting to the Registry identified 11 additional sensitized employees and 3 additional employees with CBD.

Total 74,600 BeLPT Results Reported to BAWR by Site

Data Cumulative Through 2012*



Number of BeLPT Results

*Some sites provided data that predates the 2002 start date of the Registry.

Number of Employees BeLPT Tested, "Sensitized," or CBD by Site

Data Cumulative Through 2012*

Site	Employees with BeLPT Results	"Sensitized" Employees	CBD Employees
HAN	7,260	88 (1.2 %)	34 (0.5 %)
Y-12	2,649	113 (4.3 %)	62 (2.3 %)
LANL	2,419	21 (0.9 %)	3 (0.1 %)
PTX	1,739	27 (1.6 %)	15 (0.9 %)
LLNL	1,298	39 (3.0 %)	3 (0.2 %)
KCP	1,202	41 (3.4 %)	14 (1.2 %)
NNSS	1013	22 (2.2 %)	4 (0.4 %)
SRS	705	15 (2.1 %)	6 (0.9 %)
ORNL	603	14 (2.3 %)	0
SNL	596	1 (0.2 %)	0
ETTP	396	6 (1.5 %)	4 (1.0 %)
INL	338	3 (0.9 %)	0
ANL	139	3 (2.2 %)	0
PAD LATAKY	111	1 (0.9 %)	0
LLNL BU	95	3 (3.2 %)	0
DOE-ORO	92	1 (1.1 %)	0
WSI	79	1 (1.3 %)	0
SLAC	46	0	1 (2.2 %)
AMES	34	2 (5.9 %)	0
KAPL	29	0	0
Y-12 URS	28	0	0
LBNL	25	1 (4.0 %)	0
AMWTP	21	0	0
BNL	20	1 (5.0 %)	0
Fermi	20	0	0
PNNL	20	0	0
LLNL ENVC	16	0	0
Y-12 NRE	16	0	0
LLNL CHES	13	0	0
Total	**21,022**	**403 (1.9 %)**	**146 (0.7 %)**

*Some sites provided data that predates the 2002 start date of the Registry.

Number of Years Since Year of Hire for Employees that Are "Sensitized" or CBD

Number of Years Since Year of Hire	Employees in Roster	Employees with BeLPT Results	"Sensitized" Employees	CBD Employees
0-4	1,496	1,032	3	1
5-9	2,428	1,654	25	3
10-14	2,945	2,199	49	5
15-19	1,492	1,130	19	1
20-24	2,491	1,700	46	11
25-29	2,135	1,546	30	10
>=30	5,810	4,433	143	81
Not Reported	9,632	7,328	88	34
Totals	**28,429**	**21,022**	**403**	**146**

Year of First Positive or Abnormal BeLPT Result for Employees that Are "Sensitized" or CBD

Year of BeLPT Result	Employees Tested	"Sensitized" Employees	CBD Employees
<2000	708	35	10
2000	1,630	29	17
2001	3,238	43	17
2002	3,986	41	15
2003	3,967	13	5
2004	3,837	13	3
2005	5,138	27	6
2006	4,906	42	9
2007	4,602	40	5
2008	5,203	26	7
2009	6,186	36	2
2010	6,932	26	1
2011	7,964	15	0
2012	6,149	4	0
Not Reported	0	13	49

Work History Activity for Employees that Are "Sensitized" or CBD

Data Cumulative Through 2012*

Work History Activity	Employees with BeLPT Results	"Sensitized" Employees	CBD Employees
Management	1,471	30	10
Administrative Support	980	32	10
In-House Professionals	1,365	29	14
Field Professionals	1,934	42	7
Technical Support	2,853	54	13
Service	1,297	30	12
Security and Fire	1,390	18	7
Crafts	3,636	74	35
Line Operators	2,423	67	23
Guests	54	0	0
Unknown	732	12	11
Not Reported	2,887	15	4
Totals	**21,022**	**403**	**146**

*Some sites provided data that predates the 2002 start date of the Registry.

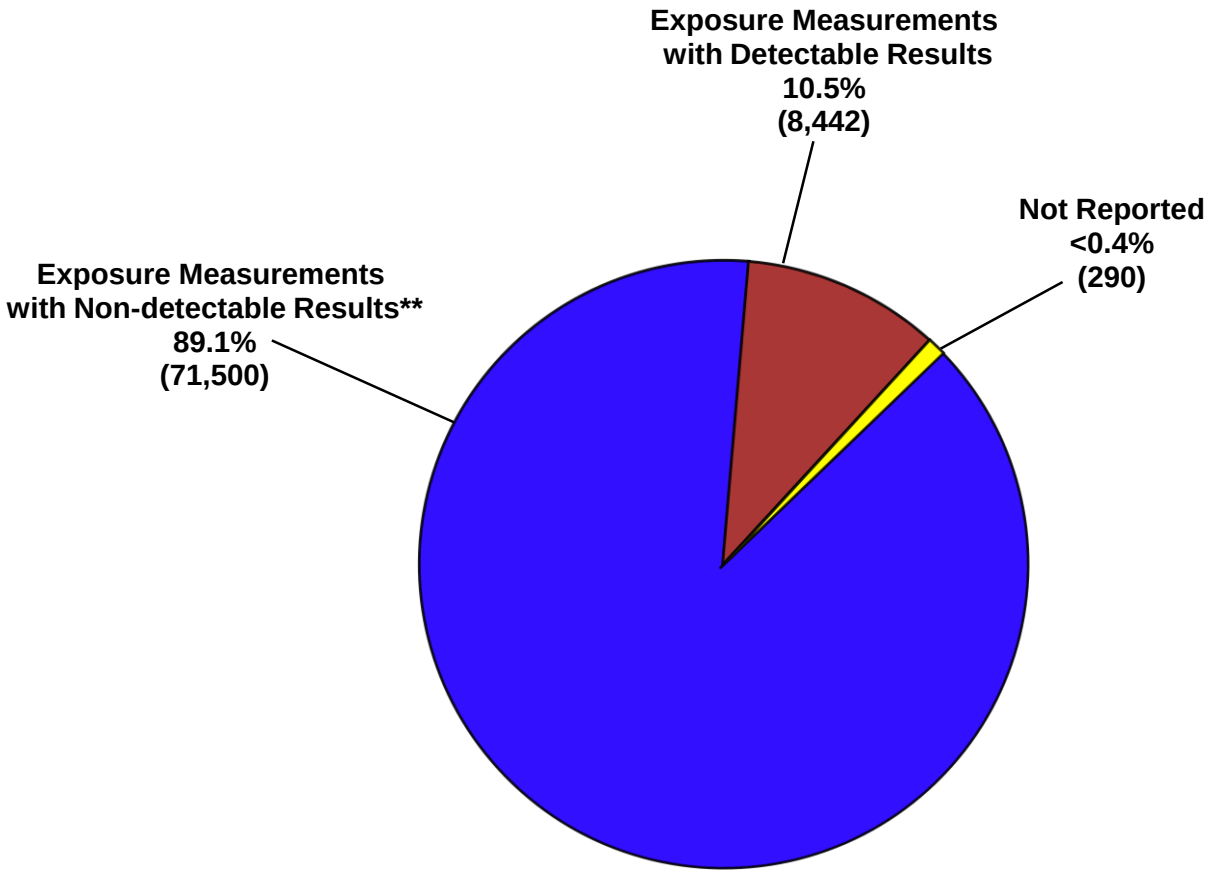
Number of Employees Exposure Monitored by Site and Year

Site	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
AMES								6	1	2	
AMWTP			2	10	5	4	4	4	2	2	2
ANL	14				8	3	1				
BNL				1		2			4		3
DOE-ORO											
ETTP	32	27	34	79	64	38		19	42	30	3
Fermi		2	2	2	1						
HAN	8	7	96	70	149	103	163	135	297	354	212
INL	3	4	3	53	76	81	49	57	44	39	4
KAPL	2	2		1		5	5	5	5	4	
KCP	14	20	11	13	24	24	18	15	18	17	43
LANL	88	67	69	123	101	60	36	61	42	32	27
LBNL			1	1			1			2	
LLNL	17	34	25	51	36	74	77	100	79	63	59
LLNL BU											
LLNL CHES										1	
LLNL ENVC									10	13	3
NNSS	66	45	33	26	26	14	43	18	18	19	22
ORNL	22	21	50	38	59	53	46	48	44	39	39
PAD LATAKY								9	47	3	5
PNNL											
PTX	58	30	17	26	38	50	38	35	30	42	51
SLAC	1	6	6	9	1	2	2			2	
SNL	7	5	38	21	17	7		5	16	19	17
SRS	22	13	34	35	6	18	34	28	19	2	10
WSI											
Y-12	124	129	85	101	160	223	215	304	426	359	238
Y-12 NRE						3	4	10	8	5	4
Y-12 URS											

The figure above shows the numbers of individuals by site whose exposures were monitored by an industrial hygienist at least once in each year. Seventeen sites provided exposure monitoring results with monitoring dates in 2012. Site-specific totals for a given year may change from totals in previous annual reports due to late reporting and/or corrections.

Total 80,232 Reported Exposure Levels

Data Cumulative Through 2012*

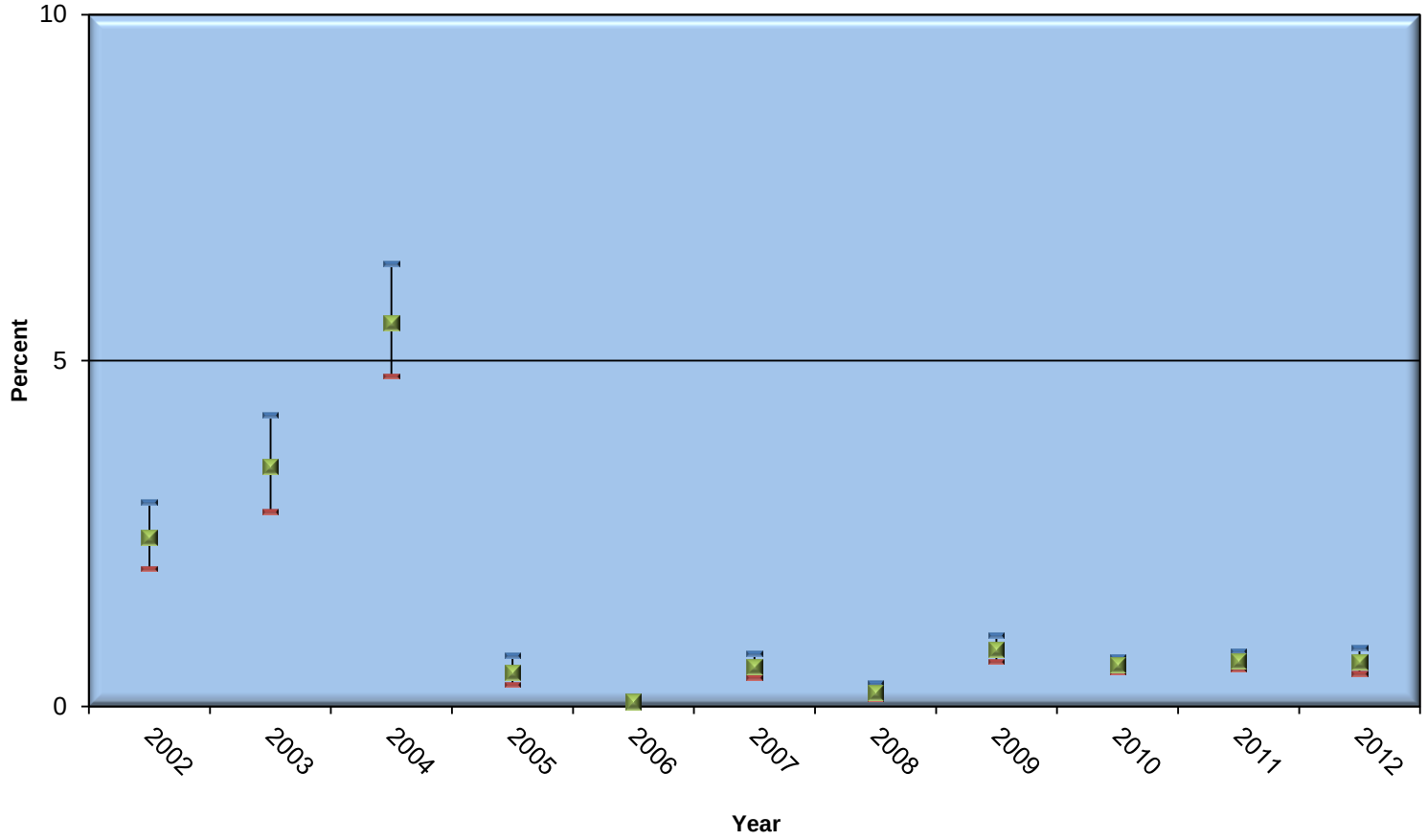


*Some sites provided data that predates the 2002 start date of the Registry.
**Non-detectable indicates that analysis results were reported as less than the laboratory's reporting limit.

Of the 80,232 exposure monitoring records submitted to the Registry, over 89 percent have “non-detectable” results, indicating the sample analysis results were less than the laboratory’s reporting limit. The reporting limit can vary from sample to sample because of differing flow rates of the sampling equipment used and because of the presence of other materials on the sample that can interfere with the analysis. Reporting limits typically vary from 0.01 to 0.05 µg/m^3, which is one-twentieth to one-quarter of the action level of 0.2 µg/m^3.

DOE-wide Exposure Trend for 2002 – 2012

Percent Exceeding 0.2 µg/m^3 Based on a 95 Percent Confidence Limit



This figure is a DOE-wide rollup of 8-hour time weighted average personal exposure monitoring results. Detailed data are presented on the following page. Totals for an individual year may vary from previous reports due to late reporting and/or corrections. These data indicate that the CBD prevention programs being operated at DOE sites have achieved a high level of compliance with the 10 CFR 850 action level of 0.2 µg/m^3 since 2004.

The metrics are distribution-free product limit estimates of percent exceeding, which are used to accommodate the high percentage of non-detect results in these data sets. Non-detected values greater than 0.2 µg/m^3 were excluded from this analysis. For details see "Statistical Methods and Software for the Analysis of Occupational Exposure Data with Non-detectable Values," Frome EL and Wambach PF, ORNL/TM-2005/52, http://www.hss.doe.gov/HealthSafety/IIPP/hservices/statmethods.pdf.

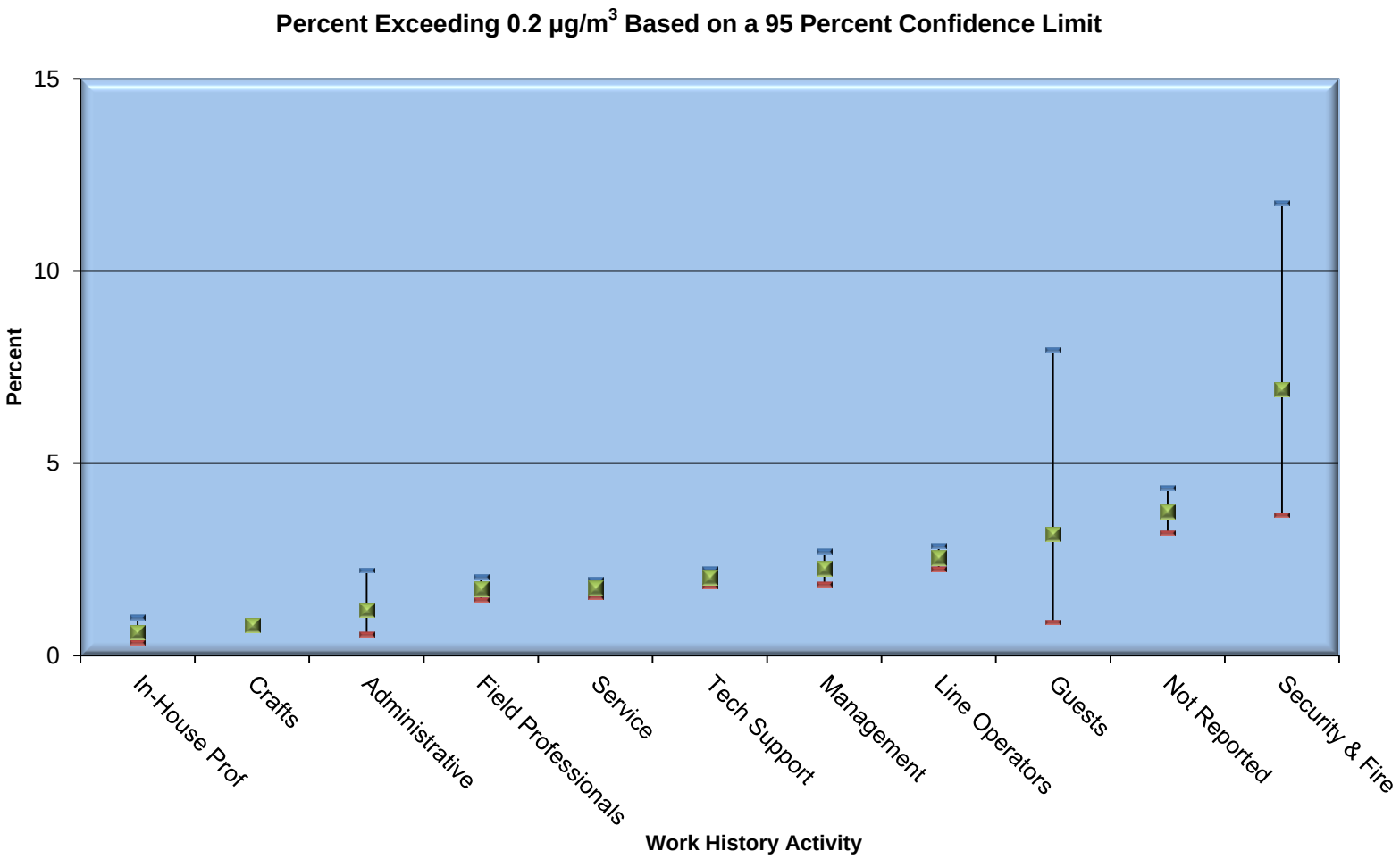
Summary Statistics for 2002 – 2012 8-Hour Time Weighted Average Exposure Monitoring Results

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	All Years
Number of reported monitoring results	2,997	1,992	2,256	3,444	6,081	5,771	5,109	6,578	13,740	11,099	5,318	64,385
Number of detected values	1,187	406	558	131	233	318	148	239	628	529	203	4,580
Percent non-detects	60.4	79.6	75.3	96.2	96.2	94.5	97.1	96.4	95.4	95.2	96.2	92.9
Number of individuals monitored	466	406	503	628	761	763	732	858	1,150	1,049	742	4,361*
Arithmetic mean (EX) ($\mu g/m^3$)	0.036	0.027	0.058	0.008	0.002	0.010	0.003	0.009	0.018	0.013	0.007	0.014
Lower confidence limit of EX ($\mu g/m^3$)	0.028	0.023	0.046	0.004	0.002	0.006	0.002	0.006	0.007	0.008	0.004	0.011
Upper confidence limit of EX ($\mu g/m^3$)	0.044	0.032	0.069	0.011	0.002	0.014	0.003	0.012	0.030	0.017	0.009	0.016
Observed 95th percentile of data ($\mu g/m^3$)	0.095	0.133	0.228	0.009	0.007	0.011	< 0.001	0.001	0.008	0.006	0.006	0.018
95% upper tolerance limit of the 95th percentile ($\mu g/m^3$)	0.119	0.180	0.267	0.100	0.051	0.035	0.028	0.021	0.020	0.019	0.017	0.041
Largest value ($\mu g/m^3$)	7.423	3.041	8.420	5.133	0.310	12.513	1.774	11.762	79.330	18.023	4.013	79.330
Percent exceeding 0.2 $\mu g/m^3$ (F)	2.4	3.5	5.5	0.5	0.1	0.6	0.2	0.8	0.6	0.7	0.6	0.9
Lower confidence limit for F	2.0	2.8	4.8	0.3	< 0.1	0.4	0.1	0.6	0.5	0.5	0.5	0.8
Upper confidence limit for F	3.0	4.2	6.4	0.7	0.2	0.8	0.3	1.0	0.7	0.8	0.9	1.0

*Many individuals were monitored in more than 1 year. The total number of individuals measured at least once in the 11-year period from 2002 through 2012 is 4,361.

This table provides additional summary statistics for the DOE-wide rollup of 8-hour time weighted average personal exposure monitoring results. Arithmetic mean, 95th percentile, and percent exceeding metrics are Kaplan-Meier product limit estimates. The very high percent of non-detected results from workplaces compliant with the 0.2 $\mu g/m^3$ action level points to the need to develop more sensitive exposure monitoring methods to support estimates of individuals' actual exposure levels.

Exposure by Work History Activity Through 2012 (Ranked by Percent Exceeding)*



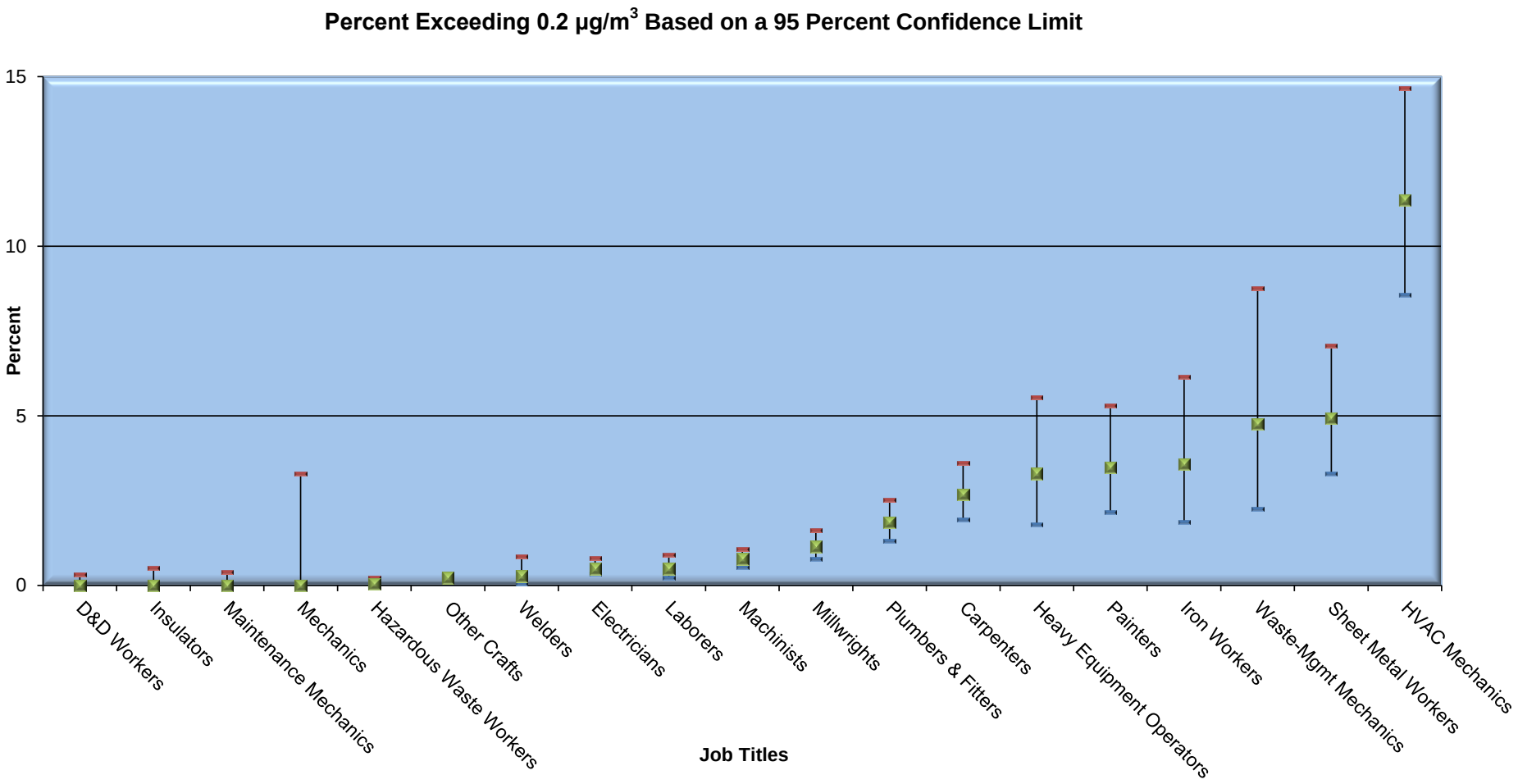
*Some sites provided data that predates the 2002 start date of the Registry.

Shown above are exposure data grouped by work activity for years 2002 through 2012. Detailed data are presented on the following page. The work activities are the high level rollup of job functions used in the table “Work History Activity for Employees that Are “Sensitized” or CBD.” Direct comparison with prior years’ reports may be problematic due to late reporting and/or corrections.

Summary Statistics for 8-Hour Time Weighted Average Exposure Monitoring Results by Work History Activity Through 2012

Work History Activity	Admin	Crafts	Field Prof	Guests	In-House Prof	Line Operators	Management	Security & Fire	Service	Tech Support	Not Reported	All Combined
Number of reported monitoring results	590	33,409	5,529	95	1,824	7,558	3,495	130	9,155	11,778	3,013	76,576
Number of detected values	57	1,588	802	28	122	839	637	11	755	1,757	1,211	7,807
Percent non-detects	90.3	95.2	85.5	70.5	93.3	88.9	81.8	91.5	91.8	85.1	59.8	89.8
Number of individuals monitored	61	1,624	481	7	215	836	220	50	458	912	206	5,070
Observed 95th percentile of data (ug/m^3)	0.022	0.008	0.066	0.029	0.018	0.099	0.060	1.045	0.030	0.066	0.159	0.039
95% upper tolerance limit of the 95th percentile (ug/m^3)	0.067	0.050	0.100	0.291	0.050	0.100	0.080	5.000	0.051	0.091	0.177	0.070
Largest value (ug/m^3)	2.600	51.895	26.678	0.313	7.500	575.930	11.762	11.700	84.933	29.852	7.670	575.930
Percent exceeding 0.2 ug/m^3 (F)	1.2	0.8	1.7	3.2	0.6	2.5	2.3	6.9	1.7	2.0	3.8	1.5
Lower confidence limit for F	0.6	0.7	1.5	0.9	0.3	2.2	1.9	3.7	1.5	1.8	3.2	1.5
Upper confidence limit for F	2.2	0.9	2.1	8.0	1.0	2.9	2.7	11.8	2.0	2.3	4.4	1.6

Exposure by Job Title for Craft Workers Through 2012 (Ranked by Percent Exceeding)*



*Some sites provided data that predates the 2002 start date of the Registry.

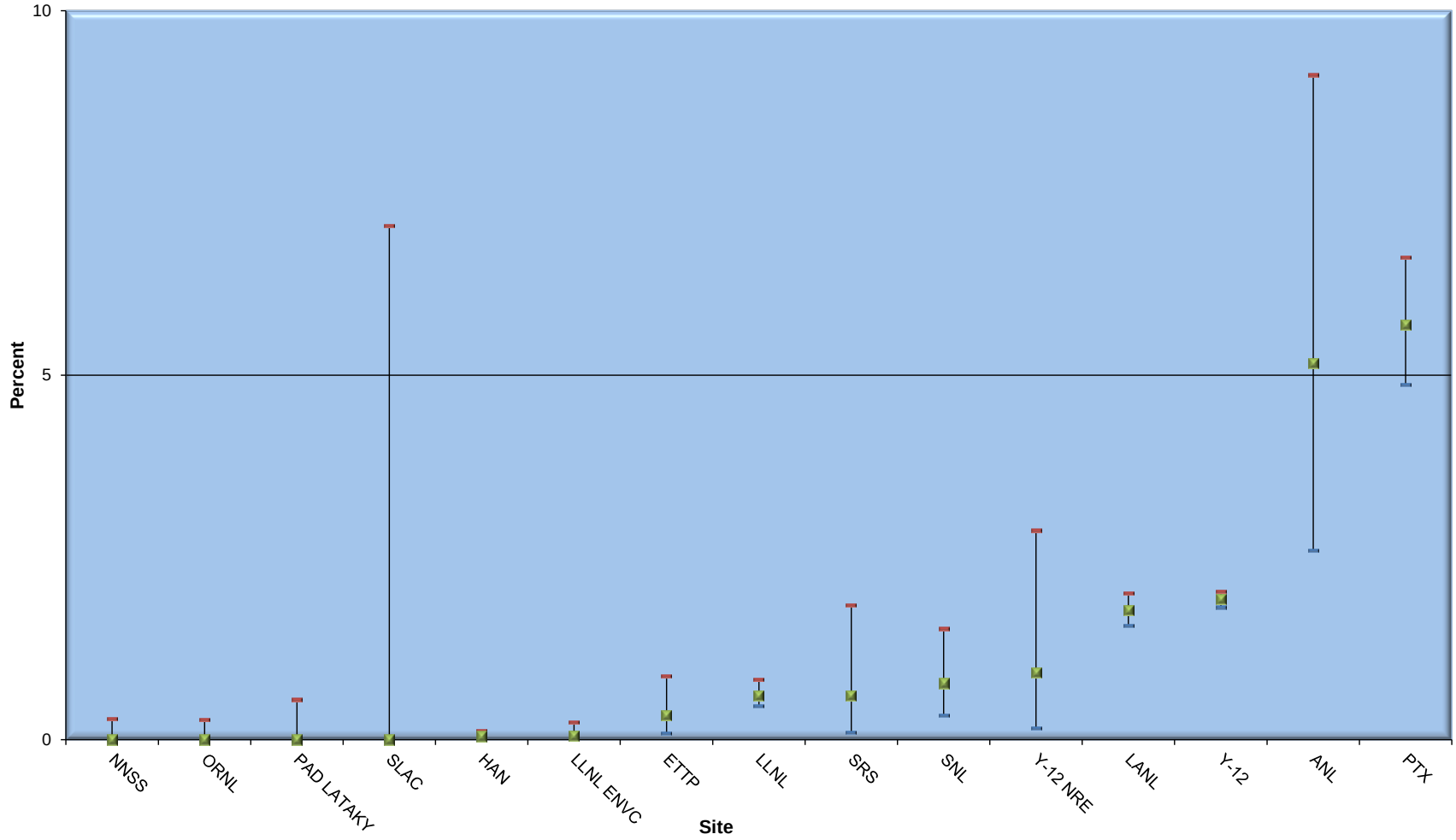
The figure above provides an indication of differences in exposure level for individuals with job titles that were grouped together in the Craft work activity category. Detailed data are presented on the following page. Millrights, Plumbers & Fitters, Carpenters, Heavy Equipment Operators, Painters, Iron Workers, Waste-Management Mechanics, Sheet Metal Workers, and HVAC Mechanics have exceedance rates significantly higher than all Crafts combined (0.8 µg/m^3, as shown in the table on page 21). Direct comparison with prior years' reports may be problematic due to late reporting and/or corrections.

Summary Statistics for 8-Hour Time Weighted Average Exposure Monitoring Results for Craft Job Titles Through 2012 (Ranked by Percent Exceeding)

Job Titles	Number of reported monitoring results	Number of detected values	Percent non-detects	Number of individuals monitored	Observed 95th percentile of data (ug/m^3)	95% upper tolerance limit of the 95th percentile (ug/m^3)	Largest value (ug/m^3)	Percent exceeding 0.2 ug/m^3 (F)	Lower confidence limit for F	Upper confidence limit for F
D&D Workers	914	40	95.6	100	0.012	0.037	0.095	0	0	0.3
Insulators	588	12	98.0	26	0.001	0.020	0.150	0	0	0.5
Maintenance Mechanics	750	16	97.9	76	0.001	0.053	0.158	0	0	0.4
Mechanics	89	9	89.9	30	0.017	0.091	0.091	0	0	3.3
Hazardous Waste Workers	2,010	23	98.9	27	0.002	0.009	0.432	< 0.1	< 0.1	0.2
Other Crafts	13,780	226	98.4	196	0	0.080	6.314	0.2	0.2	0.3
Welders	738	34	95.4	29	0.008	0.024	0.356	0.3	< 0.1	0.9
Electricians	3,306	263	92.0	258	0.022	0.050	1.999	0.5	0.4	0.8
Laborers	1,447	53	96.3	227	0.006	0.054	10.340	0.5	0.2	0.9
Machinists	3,338	129	96.1	77	0.009	0.050	51.895	0.8	0.5	1.1
Millwrights	1,920	149	92.2	138	0.021	0.050	20.176	1.1	0.8	1.6
Plumbers & Fitters	1,510	140	90.7	131	0.032	0.053	5.735	1.9	1.3	2.5
Carpenters	1,154	150	87.0	103	0.064	0.080	3.176	2.7	2.0	3.6
Heavy Equipment Operators	303	18	94.1	59	0.009	1.400	16.697	3.3	1.8	5.5
Painters	431	65	84.9	41	0.103	0.215	7.423	3.5	2.2	5.3
Iron Workers	252	27	89.3	29	0.096	0.263	1.006	3.6	1.9	6.1
Waste-Mgmt Mechanics	147	19	87.1	15	0.093	1.290	2.390	4.8	2.3	8.8
Sheet Metal Workers	406	56	86.2	39	0.168	0.440	4.872	4.9	3.3	7.1
HVAC Mechanics	326	159	51.2	23	0.554	0.949	6.404	11.3	8.6	14.7
All Combined	33,409	1,588	95.2	1,624	0.008	0.050	51.895	0.8	0.7	0.9

This table provides additional summary statistics for Craft job titles.

Percent of Exposure Monitoring Results Exceeding the Action Level by Site Through 2012 (Ranked by Percent Exceeding)*



*Some sites provided data that predates the 2002 start date of the Registry.

This figure summarizes 8-hour time weighted average exposure monitoring results by site. Detailed data are presented on the following page. Exceedance rates at ANL, LANL, PTX, and Y-12 were significantly higher than those for all sites combined.

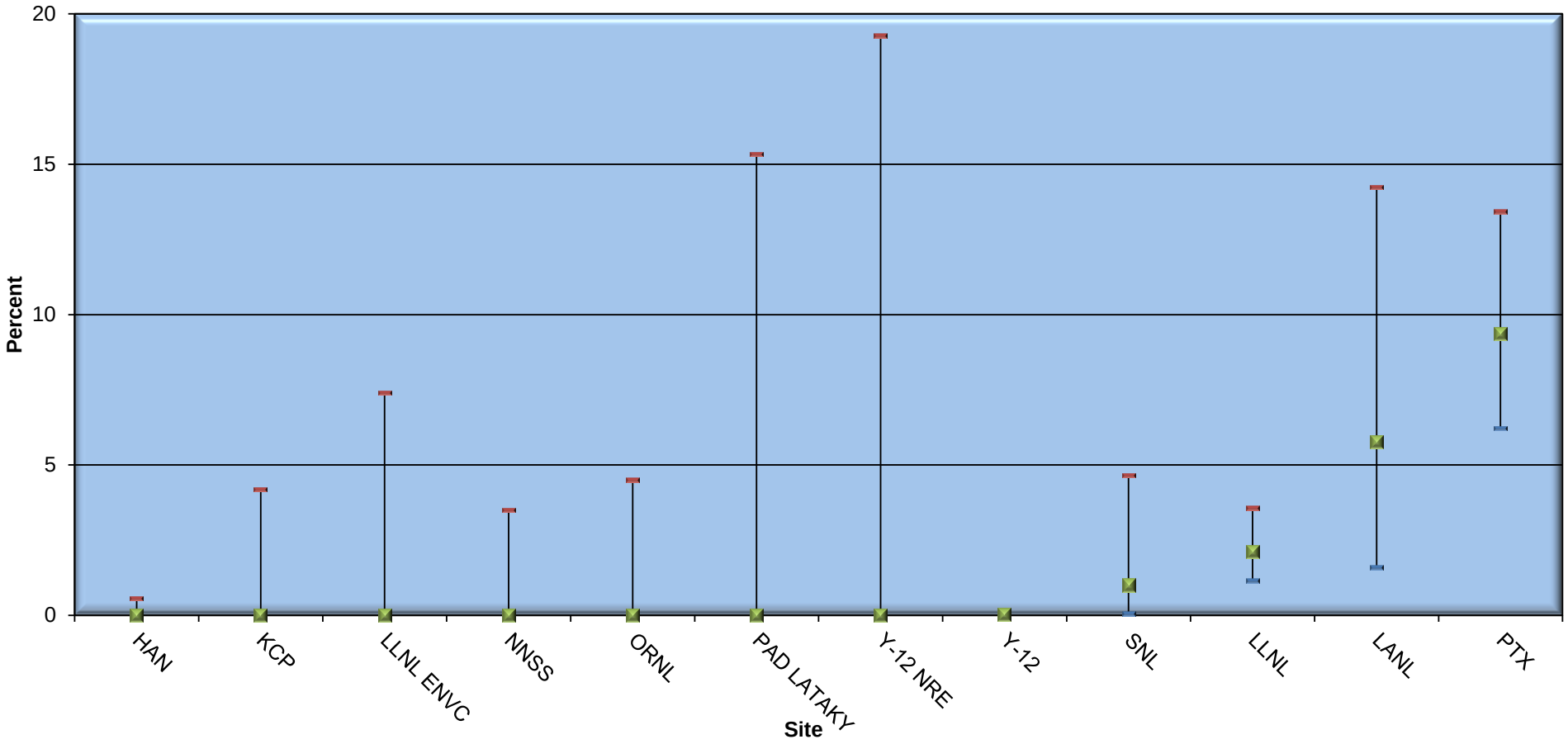
Results from AMES, AMWTP, BNL, Fermi, INL, KAPL, KPC, LBNL, and LLNL CHES were not included in this figure because of the small number of total samples or low percent exceeding the action level. Direct comparison with prior years' reports may be problematic due to late reporting and/or corrections.

Summary Statistics for 8-Hour Time Weighted Average Exposure Monitoring Results by Site Through 2012

Sites	Number of reported monitoring results	Number of detected values	Percent non-detects	Number of individuals monitored	Observed 95th percentile of data (ug/m^3)	95% upper tolerance limit of the 95th percentile (ug/m^3)	Largest value (ug/m^3)	Percent exceeding 0.2 ug/m^3 (F)	Lower confidence limit for F	Upper confidence limit for F
AMES	47	0	100	6	0	0	0.028	0	0	6.2
AMWTP	60	3	95.0	13	0.003	0.036	0.036	0	0	4.9
ANL	155	20	87.1	23	0.145	1.100	2.390	5.2	2.6	9.1
BNL	14	0	100	8	NA	NA	0.100	0	0	19.3
ETTP	889	31	96.5	283	0.007	0.080	2.264	0.3	0.1	0.9
Fermi	47	22	53.2	16	1.330	NA	4.800	17.0	8.8	28.6
HAN	6,367	251	96.1	1,142	0.004	0.025	12.513	< 0.1	< 0.1	0.1
INL	1,354	75	94.5	227	0.015	0.061	0.195	0	0	0.2
KAPL	154	2	98.7	32	0.007	0.150	0.200	0	0	1.9
KCP	1,507	17	98.9	164	0.002	0.151	0.196	0	0	0.2
LANL	9,944	2,325	76.6	420	0.050	0.060	26.678	1.8	1.6	2.0
LBNL	11	0	100	6	NA	NA	0.100	0	0	63.2
LLNL	5,920	251	95.8	272	0.013	0.035	5.133	0.6	0.5	0.8
LLNL CHES	3	0	100	1	NA	NA	0.042	0	0	63.2
LLNL ENVC	1,962	17	99.1	15	0.002	0.009	0.432	0.1	< 0.1	0.2
NNSS	1,029	56	94.6	262	0.008	0.052	0.197	0	0	0.3
ORNL	1,069	6	99.4	228	0.002	0.011	0.157	0	0	0.3
PAD LATAKY	543	4	99.3	55	0.004	0.011	0.019	0	0	0.6
PTX	2,020	259	87.2	450	0.328	0.747	575.930	5.7	4.9	6.6
SLAC	41	0	100	26	0.040	NA	0.150	0	0	7.0
SNL	774	239	69.1	112	0.048	0.083	2.800	0.8	0.3	1.5
SRS	339	16	95.3	189	0.013	0.072	0.320	0.6	0.1	1.8
Y-12	42,110	4,200	90.0	1,106	0.063	0.068	79.330	1.9	1.8	2.0
Y-12 NRE	217	13	94.0	14	0.016	0.059	1.111	0.9	0.2	2.9
All Combined	76,576	7,807	89.8	5,070	0.039	0.070	575.930	1.5	1.5	1.6

This table provides additional summary statistics for DOE sites reporting exposure data to the BAWR. While the majority of sites have acceptable sampling programs, these data show that some sites could revisit their sampling strategies and consider increasing the number of samples taken.

Percent of Exposure Monitoring Results Exceeding the Action Level by Site for Calendar Year 2012 (Ranked by Percent Exceeding)



PTX reported the majority of results above the action level in 2012. Detailed data are presented on the following page. The upper confidence limit is above 5 percent at sites that reported fewer than 53 sampling results in 2012.

Results from AMWTP, BNL, ETTP, INL, and SRS were not included in this figure because of the small number of total samples.

Summary Statistics for 8-Hour Time Weighted Average Exposure Monitoring Results by Site for Calendar Year 2012

Sites	Number of reported monitoring results	Number of detected values	Percent non-detects	Number of individuals monitored	Observed 95th percentile of data (ug/m^3)	95% upper tolerance limit of the 95th percentile (ug/m^3)	Largest value (ug/m^3)	Percent exceeding 0.2 ug/m^3 (F)	Lower confidence limit for F	Upper confidence limit for F
AMWTP	7	1	85.7	2	NA	NA	0.009	0	0	34.8
BNL	5	0	100	3	NA	NA	0.020	0	0	54.9
ETTP	3	0	100	3	NA	0.005	0.100	0	0	63.2
HAN	526	23	97.2	212	0.003	0.019	0.140	0	0	0.6
INL	11	1	90.9	4	NA	NA	0.030	0	0	23.8
KCP	70	0	100	43	0.022	NA	0.025	0	0	4.2
LANL	52	18	65.4	27	0.138	NA	0.460	5.8	1.6	14.2
LLNL	473	51	89.2	59	0.032	0.133	2.075	2.1	1.2	3.6
LLNL ENVC	39	0	100	3	0.004	NA	0.004	0	0	7.4
NNSS	84	15	82.1	22	0.138	0.197	0.197	0	0	3.5
ORNL	65	2	96.9	39	0.003	0.015	0.015	0	0	4.5
PAD LATAKY	18	0	100	5	0.011	NA	0.013	0	0	15.3
PTX	203	57	71.9	51	0.693	1.553	4.013	9.4	6.2	13.4
SNL	100	8	92.0	17	0.012	0.194	0.208	1.0	0.1	4.7
SRS	11	0	100	10	NA	NA	0.050	0	0	23.8
Y-12	3,637	27	99.3	238	0.003	0.010	0.215	0.03	< 0.1	0.1
Y-12 NRE	14	0	100	4	NA	NA	0.055	0	0	19.3
All Combined	5,318	203	96.2	742	0.006	0.017	4.013	0.6	0.5	0.9

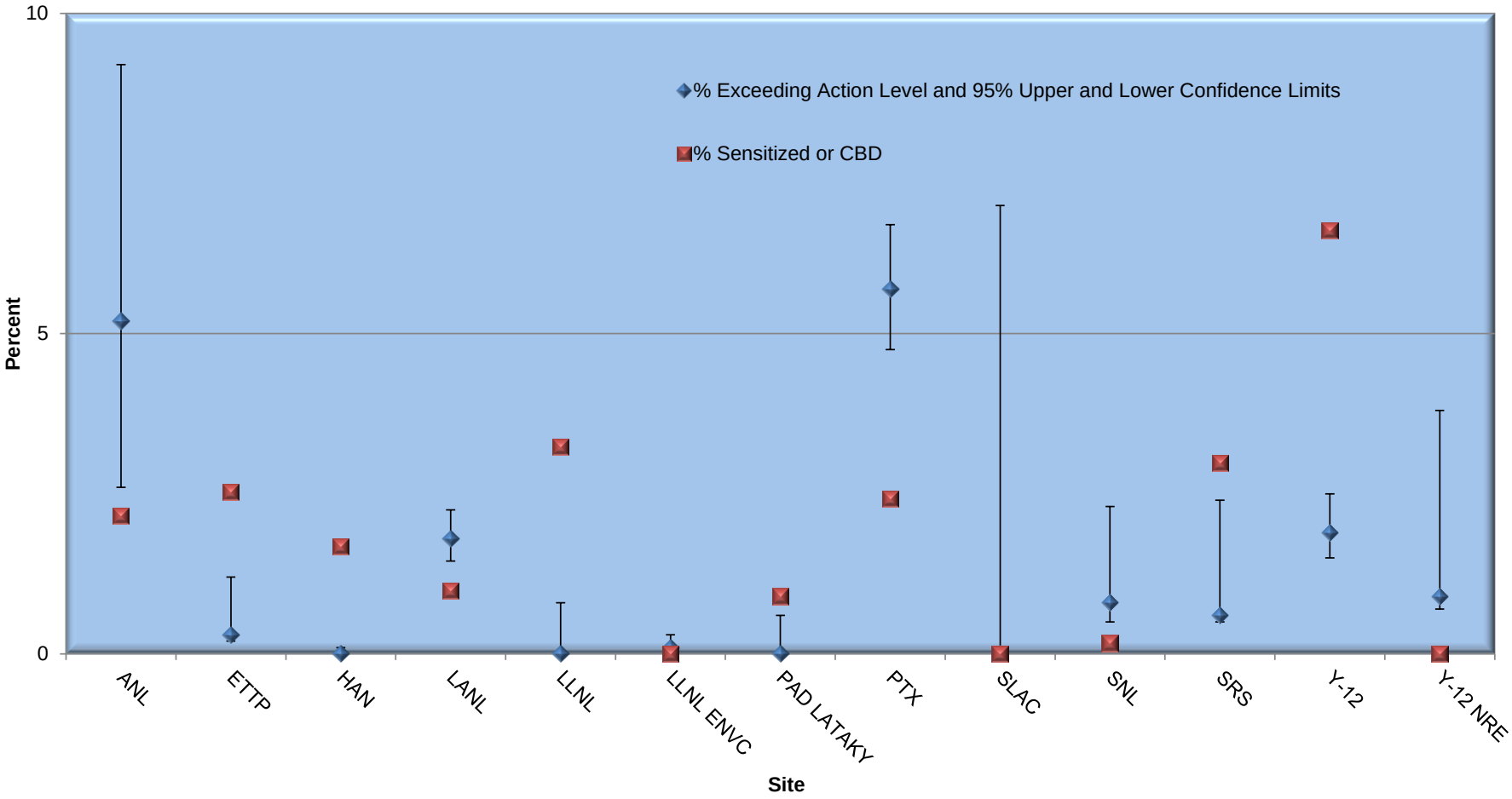
American Recovery Act funding for beryllium decontamination and decommissioning work at the Y-12 National Security Complex led to extensive exposure monitoring through 2012. Sites that did not report data for calendar year 2012 are not included in this table.

Exposure Monitoring Results Above the 0.2 µg/m^3 Action Level for Calendar Year 2012

Site	Process Description	Job Title	8-Hour Time Weighted Average, ug/m^3	Respirator Assigned Protection Factor
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	4.01	100
PTX	BERYLLIUM WORK	ENG TECH. II (WASTE OPER)	3.21	100
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	2.47	100
PTX	BERYLLIUM WORK	ASSOCIATE WASTE OPS TECH	2.25	100
LLNL	Not identified	Technologist - C/MS	2.08	1000
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	1.55	100
PTX	BERYLLIUM WORK	ASSOCIATE WASTE OPS TECH	1.35	100
PTX	BERYLLIUM WORK	ASSOCIATE WASTE OPS TECH	0.84	100
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.81	1
LLNL	Not identified	Technologist - C/MS	0.75	1000
PTX	BERYLLIUM WORK	ASSOCIATE WASTE OPS TECH	0.75	100
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.73	100
PTX	BERYLLIUM WORK	ASSOCIATE WASTE OPS TECH	0.73	100
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.49	100
LANL	R&D ENGINEER 4	TEAM LEADER	0.46	1000
LLNL	Not identified	Scientific Technician	0.43	1000
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.42	100
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.42	100
LLNL	Not identified	Sr. Technologist C/MS	0.40	1000
LANL	ENGINEERED SYSTEMS	EXPLOSIVES TEC 4	0.37	1000
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.36	100
PTX	BERYLLIUM WORK	ENG TECH (WASTE OPERATIONS) I	0.34	100
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.33	100
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.33	100
LLNL	Not identified	Sr. Technologist C/MS	0.30	1000
LLNL	Not identified	Sr. Technologist C/MS	0.29	1000
PTX	BERYLLIUM WORK	ASSOCIATE WASTE OPS TECH	0.27	100
LLNL	Not identified	Sr. Hydro Tech - S-300	0.27	1000
LANL	ENGINEERED SYSTEMS	EXPLOSIVES TEC 4	0.26	1000
LLNL	Not identified	Sr. Technologist C/MS	0.24	1000
PTX	BERYLLIUM WORK	ENG TECH. I (WASTE OPERATIONS)	0.23	100
LLNL	Not identified	Sr. Technologist C/MS	0.23	1000
Y-12	PRODUCTION	Other Crafts	0.22	100
SNL	WASTE TREATMENT	Technician	0.21	100
SNL	WASTE TREATMENT	Technician	0.21	1000

Exceedances in 2012 were fewer than in previous years (only 35 reported) and were primarily associated with waste operations work at Pantex Plant. In most cases, work planning processes identified the potential for beryllium exposure and workers were wearing appropriate respiratory protection.

*Cumulative Rates of Beryllium Sensitization or CBD versus Exposure Levels Through 2012**



*Some sites provided data that predates the 2002 start date of the Registry.

Medical monitoring results for beryllium sensitization or CBD and beryllium exposure monitoring results are weakly correlated (Pearson product moment correlation coefficient = 0.27). A likely explanation for this is that the sensitization or CBD being detected are due to past working conditions rather than those currently being monitored. However, it is also possible that monitoring programs are missing significant sources of exposure that are ongoing. Sites with low exposure monitoring results and high sensitization or CBD rates can investigate cases to determine if the possibility of ongoing exposure can be ruled out.