



# Sandia National Laboratories - Albuquerque SEC-00188 Addendum 2

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# Summary of SEC-00188 Petition History

- Petition qualified (83.13) for evaluation: October 21, 2011
- Petitioner proposed class definition:  
All Security Inspectors, Security Clerks, Firemen, Non-regular Recurrent Security Inspectors, Security Officers, Security Police Officers I, Security Police Officers II, Security Police Officers III, and Central Alarm System Operators that worked in any area at SNL-A for the period from January 1, 1963 through May 21, 2011
- NIOSH proposed the following class to be added to the SEC on February 21, 2012:  
All personnel that worked in any area at Sandia National Laboratories in Albuquerque, New Mexico for the period from January 1, 1949 through December 31, 1994

# Basis for 1949-1994 SEC Class

- Insufficient monitoring data and information to reconstruct internal dose from January 1, 1949 through December 31, 1994:
  - Lack of internal monitoring program documentation
  - Lack of internal monitoring data
  - Lack of process information
- The Evaluation Report published 2/21/12 concluded that external doses, including medical X-rays performed onsite as a condition of employment can be reconstructed for the duration of the evaluation period January 1, 1949 through May 21, 2011
  - Continued evaluation since publication of the 2012 report has not identified any information which would contradict this conclusion regarding external dose

# Summary of SEC-00188 Addendum Petition History

- NIOSH proposed the following class to be added to the SEC on July 26, 2018:

All personnel that worked in any area at Sandia National Laboratories in Albuquerque, New Mexico for the period from January 1, 1995 through December 31, 1996

# Basis for 1995-1996 SEC Class

- Internal monitoring program concerns
- Air monitoring data deficiencies
  - Uncertainties and concerns associated with the transitional and developmental nature of SNL-A's internal monitoring program
  - The site was making several improvements in the internal monitoring program including an increase in the use of personal and area air monitoring
  - The program seemed to be lacking formalization in that NIOSH did not find adequate evidence that some key implementing procedures were fully in place until 1996 & 1997

# SEC-00188 Addendum 2 (Jan. 1, 1997 – May 21, 2011)

The focus of Addendum 2 is determining Internal Dose Reconstruction feasibility:

- Determine suitability of monitoring program and documentation
- Determine monitoring data sufficiency
- Address security guards' monitoring concerns

# Data Sources Reviewed

- 21 Interviews with 17 people
- 1 Site data capture effort/trip since last SEC designation
- 4 Written data capture requests
- Over 900 relevant documents captured and reviewed since SEC-0188 was issued in 2012 (NIOSH has over 5,500 total documents in its database pertaining to SNL-A):
  - Internal procedures and memos
  - 10 C.F.R. pt. 835 Compliance and self-assessment reports/memos
  - Facility and process information
  - Radiation Work Permits
  - Incident reports
  - Air monitoring data
  - Internal and external radiological program audits and assessments

# Data Sources Reviewed, cont.

- Extracts from SNL-A's "WebDose" database which the site uses for bioassay monitoring and as a reporting tool
- Internal/external monitoring records
- Breathing Zone (BZ) monitoring and air sample records
- Derived Air Concentration (DAC)-hour tracking

# Available Internal Monitoring WebDose Urine Bioassay

Year	Non-H3 Sample Results	Persons Sampled (Non-H3)	H3 Sample Results	Persons Sampled (H3)
1997	111	45	238	100
1998	144	59	375	126
1999	187	67	440	83
2000	119	46	375	50
2001	90	39	426	58
2002	111	46	575	78
2003	160	55	679	78
2004	158	51	677	70
2005	172	60	647	69
2006	128	40	500	51
2007	115	35	438	47
2008	101	33	424	40
2009	121	42	435	40
2010	138	48	446	39
2011	165	47	534	54
<b>Total</b>	2020	317	7209	362

# Available Internal Monitoring, cont.

## WebDose WB/Thyroid Count Data

Year	Measurements	Persons Monitored
1997	59	54
1998	66	55
1999	58	52
2000	265	40
2001	73	33
2002	54	43
2003	102	61
2004	60	46
2005	65	58
2006	61	54
2007	45	42
2008	29	28
2009	48	40
2010	40	39
2011	90	50
Total	1115	207

# Available Internal Monitoring, cont.

## Captured BZ Data Sheets

Year	BZ Sample Results
1997	367
1998	1583
1999	708
2000	336
2001	172
2002	585
2003	0
2004	274
2005	388
2006	208
2007	231
2008	445
2009	76
2010	26
2011	0
Total	5389

# Internal Dose Monitoring Program Overview

- SNL-A shifted the emphasis of the Internal Monitoring Program from reliance on bioassay to the use of breathing zone sampling as a primary method of monitoring
- It was SNL-A's position that no individual was likely to receive an internal exposure of 100 mrem
  - This is stated both in the Internal Technical Basis documentation and in external assessments performed in 1996 and 1999
- SNL-A used a confirmatory bioassay monitoring program
  - BZ monitoring was the primary method of internal dose monitoring
  - The site did not rely solely on bioassay monitoring to assess potential exposure to SNL-A personnel

# Changes to Monitoring Program

- Personal air sampling (PAS) indicated as the primary indicator of intakes at SNL-A
- Described as a philosophical change in the internal dosimetry program. Change of emphasis from internal dosimetry to internal radiation protection and reliance on other types of monitoring to be indicative of the need for bioassay.
- Procedures on entering dose from PAS samples into dose tracking system
- Personal air sample results and dose records included in the Internal Dosimetry recordkeeping and retention requirements

# Internal Dose Monitoring Program Evidence of Field Implementation

- February 3, 1998 summary of Radiological and Mixed Waste Management Facility (RMWWMF) safety committee discussion on need for routine bioassay
  - *“The RCTs at the RMWWMF are on routine bioassay. If a trend developed indicating internal doses, RMWWMF personnel would undoubtedly [sic] be asked to submit special bioassay samples to determine the scope of the problem.”*
  - *“If trends developed indicating elevated air concentrations or increased surface contamination levels, special bioassay samples would be requested from appropriate facility personnel.”*
  - *“Job specific RWPs require bioassay, as appropriate, for those workers involved with tasks where significant levels of radionuclides, or certain specific radionuclides (e.g.,  $^3\text{H}$ ) are handled.”*

# Internal Dose Monitoring Program Evidence of Field Implementation, cont.

- May 30, 2001 memo documenting the routine bioassay program for RCTs at TA-V
  - *“The current schedule calls for annual whole body counting and semi-annual urinalysis samples for U, Th, Am, and Pu.”*
  - *“The SNL bioassay program is confirmatory in nature. The bioassay program confirms the results and effectiveness of contamination control and other personnel protection activities.”*
  - *“Since Radiological Control technicians (RCTs) must be present in all work activities where the possibility of meaningful intakes is credible, their bioassay serves as a good proxy indicator for potentially exposure line personnel...”*

# Internal Dose Monitoring Program Evidence of Field Implementation, cont.

- Captured RWPs and work planning documents were reviewed for indication of airborne radioactive material, respiratory protection, personal/area air monitoring requirements, and bioassay
- Indications of surface and airborne radioactive materials were noted as was the use of respiratory protection, personal and/or area air monitoring requirements, and bioassay requested
- Review of RWPs supports Rad Program adherence to contemporary procedures

# Internal Dose Monitoring Program Evidence of Field Implementation, cont.

Date	Triggering Event	Summary	Follow-up
02/07/97	Puncture wound	[Incident description redacted]	Bioassay Sampling
03/20/97	Area survey	Unexpected surface contamination detected during post-job survey.	Bioassay Sampling
04/16/97	Odor during opening drum	Upon opening drum, a strange odor was detected. Tritium contamination detected.	Bioassay Sampling
05/29/97	Area monitor alarm	Tritium monitor alarmed during work.	Bioassay Sampling
02/12/98	Area survey	Unexpected surface contamination detected during post job survey.	Bioassay Sampling
07/23/98	Personnel contamination monitoring	Unexpected levels of contamination detected during work process. Work stopped, follow- up survey identified unexpected high levels of surface contamination.	Bioassay Sampling
10/30/98	BZ air sample	Unexpectedly high air sample result during work.	WBC and Bioassay Sampling
01/19/99	BZ air sample	Unexpectedly high air sample result during work.	Bioassay Sampling
01/26/99	Area survey	Unexpected surface contamination detected during post-job survey.	Bioassay Sampling
03/19/99	BZ air sample	Unexpectedly high air sample result during work.	Bioassay Sampling

# Analysis of Breathing Zone (BZ) Data

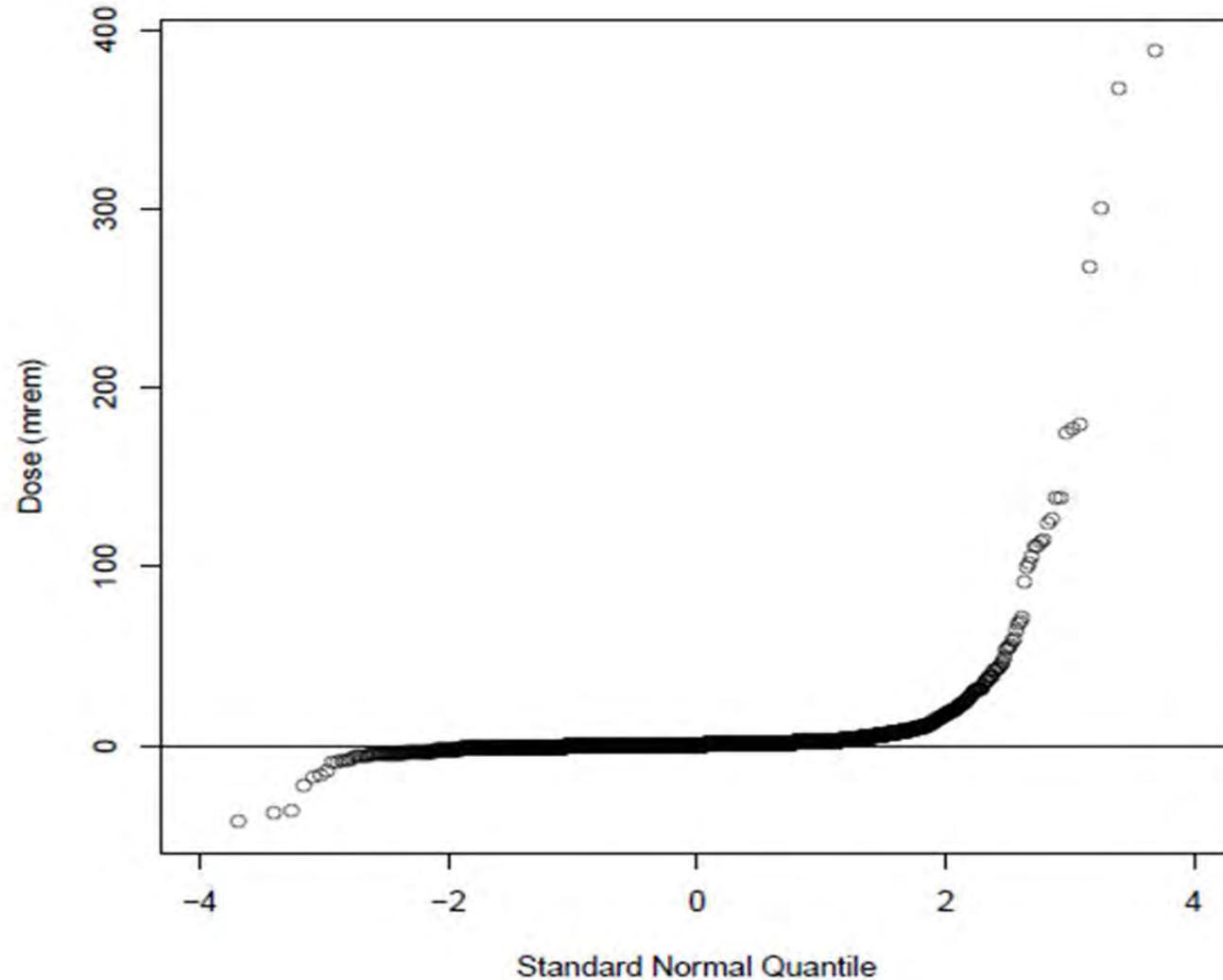
In order to evaluate the internal dose associated with BZ filters, the following steps were performed

- Intake quantity associated with each BZ filter were determined
- Committed Dose associated with the intake quantities were calculated and based on the stochastic ALI for the limiting nuclide for the analysis type (i.e., gross alpha, beta/gamma, tritium)
- Committed Dose analyzed to determine the distribution of the data grouped by event. An event is defined two ways: a radiological work task at a given location on a given day, and all radiological work on a given day

# Gross Alpha BZ Results

Year	Available Alpha BZ Results	Number of Individual Work Activities	Number of Work Days with a Sample
1997	357	148	130
1998	1581	368	211
1999	708	186	120
2000	334	84	78
2001	172	90	82
2002	553	296	155
2004	131	53	44
2005	177	77	65
2006	75	33	32
2007	111	42	39
2008	189	68	63
2009	38	16	16
2010	23	6	6

# Gross Alpha BZ Results, cont.



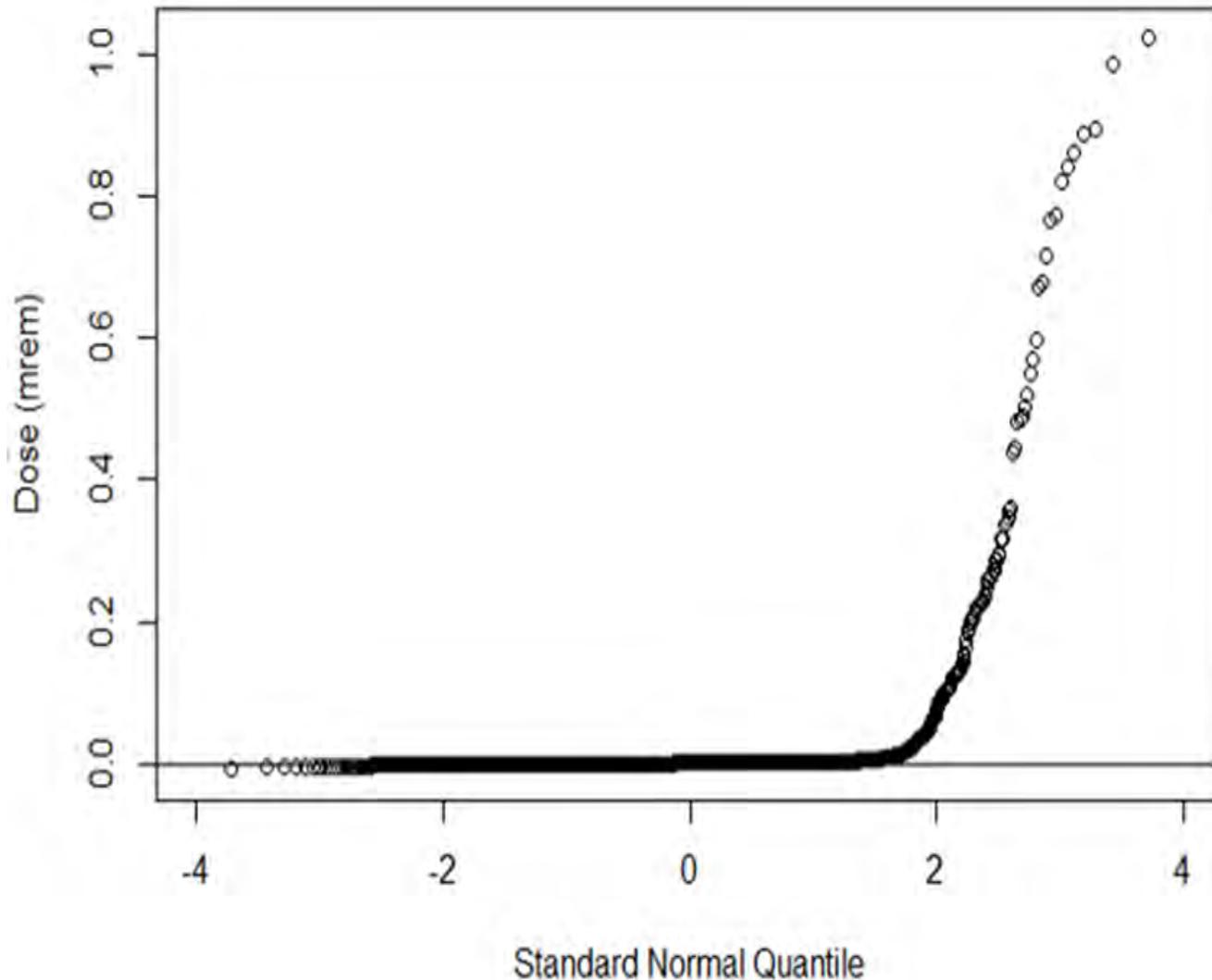
The median dose:

- 0.48 mrem with an associated geometric standard deviation of 5.8 for an event defined by particular area and time
- 0.51 mrem with a GSD of 5.2 for all individuals working on a particular day

# Gross Beta/Gamma BZ Results

Year	Available Beta/Gamma BZ Results	Number of Individual Work Activities	Number of Work Days with a Sample
1997	357	148	130
1998	1583	368	211
1999	708	186	120
2000	336	84	78
2001	172	90	82
2002	553	296	155
2004	137	53	44
2005	177	77	65
2006	72	32	32
2007	170	42	39
2008	358	68	63
2009	74	16	16
2010	26	6	6

# Gross Beta/Gamma BZ Results, cont.



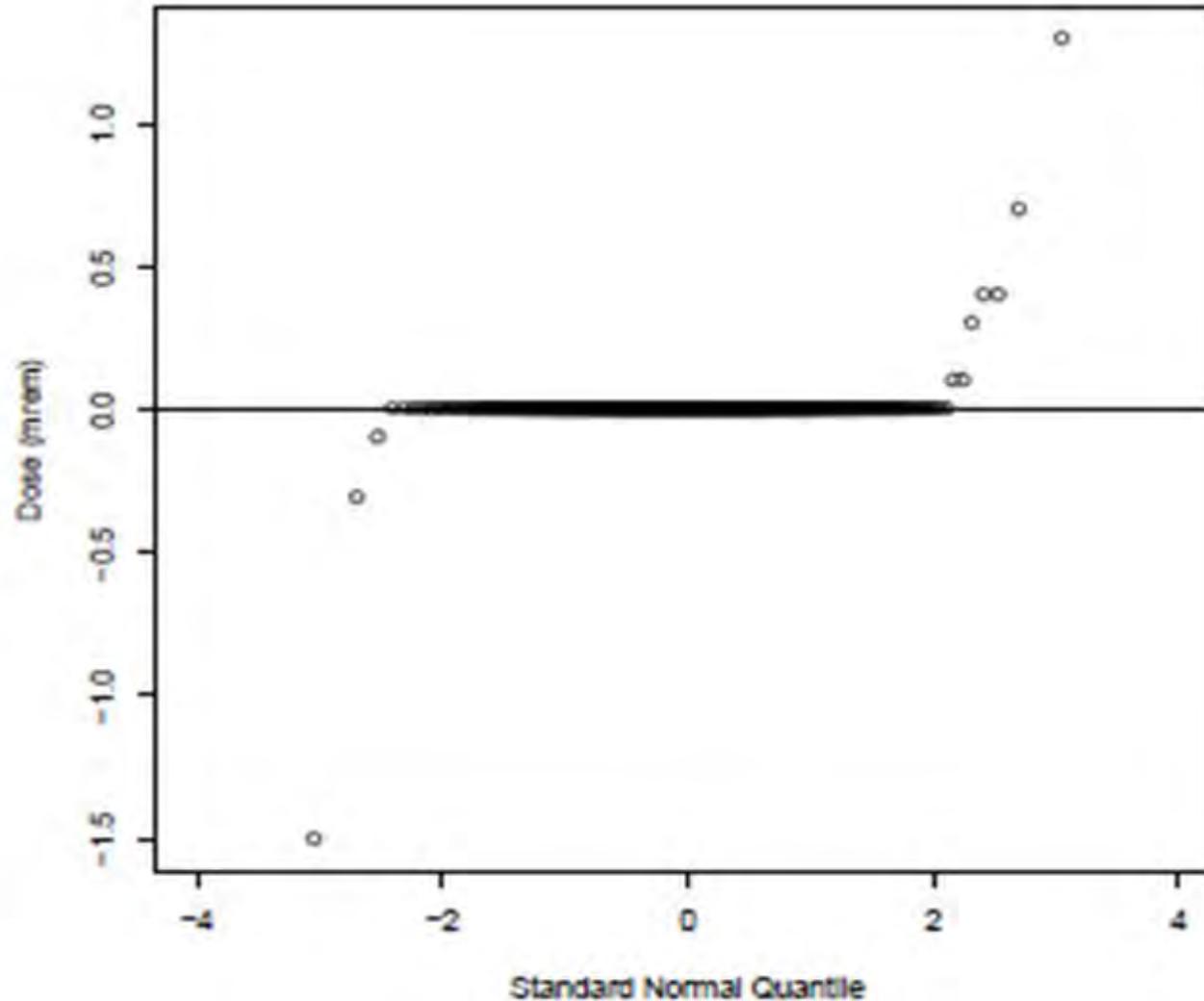
The median dose:

- 0.001 mrem with an associated geometric standard deviation of 8.0 for an event defined by particular area and time
- 0.001 mrem with a GSD of 7.0 for all individuals working on a particular day

# Tritium BZ Results

Year	Available Tritium BZ Results	Number of Individual Work Activities	Number of Work Days with a Sample
2004	119	45	39
2005	165	67	57
2006	88	41	39
2007	52	20	19
2008	8	5	5

# Tritium BZ Results, cont.



The median dose:

- 0.007 mrem with an associated geometric standard deviation of 4.4 for an event defined by particular area and time
- 0.007 mrem with a GSD of 4.3 for all individuals working on a particular day

# Assigned Committed Dose in WebDose: 1997 - 2011

Year	H3	BZ	Urine	Thyroid	Total
1997	0		0	0	0.000
1998	0	0.010	0	0	0.010
1999	0	0	0	0	0.000
2000	0	0	0	0.005	0.005
2001	0	0	0	0	0.000
2002	0	0	0	0	0.000
2003	0	0.012	0	0	0.012
2004	0	0	0	0	0.000
2005	0	0	0	0	0.000
2006	0	0	0	0	0.000
2007	0	0	0	0	0.000
2008	0	0	0	0	0.000
2009	0		0.023	0	0.023
2010	0	0.004	0.019	0	0.023
2011	0.004	0	0	0	0.004
<b>Total</b>	0.004	0.026	0	0	0.077

# Feasibility of Dose Reconstruction

- Based on its review of radioactive material use at Sandia-Albuquerque and the associated radiation protection programs, NIOSH has concluded that intakes for unmonitored workers with access to controlled areas were unlikely to have resulted in committed effective dose equivalents (CEDE) in excess of 0.1 rem per year.
- This conclusion is not wholly based upon the implementation of 10 C.F.R. § 835.402, but rather on a review of exposure monitoring records for individuals involved in radiological activities with the highest risks at the site during the period under evaluation.

# Feasibility of Dose Reconstruction 1/1/97 – 5/21/11

- Internal monitoring records from monitored individuals are available within the SNL-A WebDose Database
- SNL-A implemented 10 C.F.R. 835 with the requirements for monitoring of individuals with a potential for internal exposure >100 mrem by January 1, 1995
- Internal dose for unmonitored individuals or individuals monitored solely by breathing zone sampling can be bounded using a 100 mrem presumptive exposure

# Feasibility of Dose Reconstruction 1/1/97-5/21/11, cont.

- The total assigned internal dose (CEDE) for all employees combined for the 15-year period from 1997 through 2011 is 77 mrem
- A review of available breathing zone bioassay data indicates that the median quantity of radioactive material available for internal uptake to individuals located alongside personnel performing high-risk radiological work would correspond to an internal dose of 0.5 mrem per work event or per work day
  - Assumes the individual is present within the work area along side of worker
  - Assumes no respiratory protection/breathing same concentration of air as worker
- In either case, consistent with the recorded internal dose of 77 mrem above, it is not likely that an individual would be able to receive 100 mrem per year of internal exposure under these conditions
  - an individual would have to be present for 200 events, based on the median dose, to receive an exposure in excess of 100 mrem in a year

# Feasibility of Dose Reconstruction 1/1/97 – 5/21/11, cont.

- As previously identified in SEC-00188 Evaluation Report in 2012, NIOSH finds it is feasible to reconstruct occupational medical doses and principal sources of external radiation exposure including beta, gamma, and neutron radiation for Sandia National Lab-Albuquerque employees with sufficient accuracy
- As previously identified in SEC-00188 Evaluation Report, the principal sources of internal radiation for members of the proposed class included exposures to plutonium, tritium, uranium, americium, and fission and activation products
  - Potential exposure pathways could have involved the handling of these radionuclides during waste-burial operations or exposure to surface or air contamination associated with reactor and/or accelerator work
  - Considering the potential exposure scenarios, program policies, procedures, and monitoring data availability, NIOSH finds it able to estimate these internal doses with sufficient accuracy for the period

# Feasibility of Dose Reconstruction 1/1/97 – 5/21/11, cont.

- Based upon its analysis of the available resources, NIOSH found no part of the class under evaluation for which it cannot estimate radiation doses with sufficient accuracy

# Feasibility Findings

SEC-00188, Addendum 2 (January 1, 1997 – December 31, 2011)	
Source of Exposure	Dose Reconstruction is Feasible
Internal - All Radionuclides	Yes
External – Beta/Gamma	Yes
External – Neutron	Yes
External – Occupational Medical X-Ray	Yes

# Recommendation

Class	Feasibility	Health Endangerment
January 1, 1997 through October 21, 2011	Yes	N/A