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January 28, 2014

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Anthony Zona, Esq, Hearing Representative
Final Adjudication Branch
U.S. Department of Labor (DEEOIC)
1001 Lakeside Avenue, Suite 350
Cleveland, Ohio 44114

Re.: Employee: [redacted]
Claimant:
File No.:

Re.: Additional evidence after Hearing of December 11, 2013

Dear Mr. Zona,

We write this letter with supporting evidence in relation to [redacted]'s part B claim based on her late husband [redacted] cancer of the colon and multiple myeloma.

A dose reconstruction was performed for [redacted] He received a Probability of Causation (POC) of 36.52%. We object to different aspects of the Dose Reconstruction. One objection involves the assigned doses for [redacted] The Report states on page 5 that [redacted] was "intermittently monitored between 1949 and 1957. Gaps in monitoring during this period were addressed by assignment of on-site ambient dose, as described later in this report." See Dose Reconstruction Report (attached as exhibit 1). The Dose Reconstruction at page 7 under on-site Ambient Dose states: "On-site ambient dose was assessed as part of this Dose Reconstruction in accordance with the External Dose Reconstruction Implementation Guideline" (see attached exhibit 2). This guideline OCUS 1-IG-001, p. 5 states under 1.1.2 Not Monitored:

> Many of the Atomic Weapons Employees (AWE) workers were not individually monitored for radiation exposure. At some facilities, radiation surveys were conducted and this data is available for a facility, scientifically reasonable estimates of exposure should be developed based on the source term or quantity of radioactive material handled by the facility (see attached exhibit 3).

This assignment guidance is based on someone who was not monitored at all during their employment. There are only gaps in [redacted] dosemitry records. We believe that his monitoring records are missing.

On page 6 of OCAS-IG-001 section 1.1.4 Monitoring records incomplete or missing states:

> When monitoring records are incomplete or missing, the monitoring data prior to and after the missing data can be used to interpolate the missing data. When only post monitoring data is available, extrapolation should be used with caution, accounting for engineering administrative changes that might have been instituted which reduced exposures. In addition, coworker data can be used to fill in missing or incomplete records (see attached exhibit 3).

[redacted] personal monitoring circumstances are governed by this guidance criteria. The gaps in his dosimeter file from 1949 and 1957 are likely from missing dosemity records not because he was not monitored. He did not change his labor category from fireman during this time and he would have traveled to any location site wide. There is historical information that supports the aspect that he and every other employee were monitored. Citation 11 (Argonne National Laboratory East external dose) on p.18 section 6.4.1 under the heading Badged Population states:

> "Information developed in a 1982 survey for a DOE health and mortality study (Storm, 1982) indicates that early on everyone was badged. By 1965, nearly all employees were still badged. By the early 1970's, the site health physicists assigned badges based on the exposure potential." (see attached exhibit 4).

This statement demonstrates that [redacted] was indeed monitored the entire period from 1949 through 1957. There should be no monitoring gaps in his dosimetry records.

[redacted] does have gaps in his external monitoring file. These gaps are from June 7, 1948 to August 15, 1948. [redacted] was monitored before and after these gaps. He was monitored from May 10, 1948 until June 6, 1948. During this monitoring period he did receive positive dosimetry results. See domemitry records (attached as exhibit 5). [redacted] also received positive dosimeter results when he was monitored from August 16, 1948 to February 2, 1949. See external dosimetry records (attached as exhibit 6). He also received positive dosimeter results from June 29, 1952 through his external dosimetry records to 1975. See external dosimetry results (attached as exhibit 7). The External dose implementation guideline OCUS-IG-001 p.24 at section 3.0 External Dose Reconstruction - Incomplete, missing or No monitoring Data.:

> Incomplete or missing personal monitoring usually occurs either between two periods of monitoring time period. When personal monitoring data is missing between two other periods of monitoring, interpolation between the two

monitoring periods may be reasonable. When the incomplete data is either before or after monitoring data, extrapolation may be reasonable, caution should be used properly to account for any trends that may exist. (see attached exhibit 8) [redacted] gaps are between periods for which he was monitored.

The External dosimetry guidelines implementation guidelines state that either Interpolation or Extrapolation can be used to assess any gaps in monitoring data. According to Interpolation from incomplete, personal monitoring data p.25:

> However, if the individual has sufficient monitoring data prior to and after [monitoring] the missing data, the dose can be interpolated by a simple average between the two monitoring periods. See attached exhibit 8.

As stated above, [redacted] has measured doses before and after the gaps in his external monitoring records. These dosimeter readings should be used to fill in the gaps of his missing dosimetry records. If this cannot be done, he should be assigned missed doses of one-half the limit of detection (LOD) for these gaps in his monitoring record as he was assigned for the years of his summery dosimetry records for the years 1965-1975.

We also object to the dosimeter badge exchange frequencies that account for the number of missed doses which were assigned to [redacted]. The Dose Reconstruction Report states on page 7 that "[a] potential missed dose was assigned to each actual or potential dosimeter cycle to maximize doses received by [redacted]" (see attached exhibit 2). These missed doses were treated as half the limit of detection (LOD). The Dose Reconstruction Report p.7. states: "For the years 1965 through 1975, a monthly badge exchange was assumed and a best estimate number of zeros was performed" (see attached exhibit 2). The default assigned badge exchanges were performed in accordance with table 6.3 of citation 11: TBD for Argonne National Laboratory- East- External dosimetry. Page19. States: table 6-3 provides the claimant-favorable default dosimetry exchange frequencies to be used for dose Reconstruction.

Table 6-3 Default dosimeter exchange frequencies:

Years	General Population	others
1945-1959	Weekly	
1960-1973	Biweekly	
1974	4-week (13 periods/yr)	
1975-2005	Monthly (12 periods/yr)	1994 APS quarterly

(see attached exhibit 9)

The dosimetry cycles (i.e. missed doses) for the time period from 1965-1973 conform to a biweekly exchange rate not a monthly badge exchange frequency as was assigned to [redacted]

[redacted] internal Dose Reconstruction report describes an incident that occurred October 17, 1972 where he responded to a plutonium fire. He had a Bio Assay conducted and the report states that his fecal sample was found to contain plutonium (see Dose Reconstruction Report p.8 attached as exhibit 10). [redacted] External Dosimetry Radiation Exposure summery sheet showed zeros for the year 1972 when this incident occurred (see attached exhibit 11). There is no mention of any external dose that was assigned for this incident. We believe that either his dose records are missing or that he wasn't monitored during this incident. Because his bioassay showed positive results, we believe that [redacted] was significantly exposed during this incident and that he should be assigned an external co-worker dose based on the dosimetry data of another person involved in this incident instead of only the missed dose which was assigned for that particular year and which was underestimated.

There is another incident report of [redacted] exposure to fumes from a uranium fire on May 23, 1951. A bioassay was conducted and revealed "exposure was less than harmful levels." See incident report (attached as exhibit 2). This incident and subsequent positive bioassay result was not referred to in the dose reconstruction report. A proper assignment of dose for this incident would have included at least a missed internal dose and would have added to his internal dose. The dose reconstruction report on page 9 states:

> "Employment records for [redacted] were reviewed and only records of the bioassay monitoring described below were found. Therefore to account for any internal dose that may have been received but not documented, additional internal dose that may have been received but not documented, additional internal dose was assigned based on reported environmental airborne radionuclide concentrations" (see attached exhibit 10).

There were no external dosimetry records for [redacted] during the time of this incident which occurred on May 23, 1951. As stated earlier, we believe that his Dose records have been lost. He was involved in fighting a uranium fire and the only external dose that he has received according to this dose reconstruction, is an ambient dose which was assigned for the missing dosimetry year of 1951. He should get an appropriate assigned internal and external dose. This incident also shows that [redacted] should have been monitored during the whole period of his employment. He should also receive an appropriate missed dose for this period.

In connection with [redacted] few bioassays, there is document number OCAS-PEP-017 Titled: Evaluation of incomplete Internal Dosimetry Records From Idaho, Argonne-East and Argonne national Laboratories dated 03/21/2007. This document lists the various problems involved in locating Industrial Hygiene (bioassay records from the facilities listed including Argonne (East) (see attached exhibit 13). As mentioned earlier, [redacted] Dose Reconstruction report stated that no other Bioassay results were contained in his file (see attached exhibit 10). However, we did find in [redacted] DOL file, the accident report of the uranium fire on 5/23/51 which indicated that a Bioassay was performed on him. This incident appears to have been overlooked for the Dose Reconstruction. This also supports the idea that, as referred to in the OCAS-PEP-017 document, there may be more of [redacted] internal dose records available.

We also object to the presumption there were no reported doses for [redacted] after 1967, as proclaimed on page 10 of the dose reconstruction report. [redacted] was exposed during the 1972 incident. Also, the statement in the Dose Reconstruction report:

> The record of the telephone interview was evaluated carefully by the dose Reconstructor. Information from the interview indicated that [redacted] reached his "time radiation limit" around 1970 (see attached exhibit 14).

There is no record of [redacted] being told that he had reached his lifetime radiation limit in the Department of Labor's file which we received. The idea that [redacted] did not have a recorded dose after 1967 but fought a plutonium fire in 1972 shows that he was in a position to and was, in fact, exposed to radiation after 1967. It would only be reasonable to assume that any of [redacted] dosimetry records would have been lost or that he should have been monitored. There is also an incident dated June 17, 1969 in which [redacted] hands were burned during a sodium fire. See Accident or Emergency Report (attached as exhibit 15). This incident demonstrates that [redacted] was actively involved in firefighting during this later time of his career at Argonne National Lab East.

There are significant deficiencies in [redacted] Dose Reconstruction. We believe that [redacted] dose for the gaps in his external dose history from the years 1949 through 1957 should not be assigned ambient dose but should be assigned a missed dose. We also showed that [redacted] was exposed to radiation after 1967 and would expect some kind of dosimeter records or a whole body scan after each incident. Either his dosimeter records were lost or he should have been monitored during this time and during his 3 recorded incidents.

The missed dose, which was based on monthly dosimeter badge exchange frequencies from the years 1965 to 1975 should be changed to bi-weekly frequencies as directed in TBD 0036-6 (Argonne Nat. Lab East external dosimetry).

[redacted] two recorded incidents that caused him to be acutely exposed to radiation were caused in the performance of his regular job duties; as it was his job to respond to radiological incidents and fires. The plutonium fire of October 17, 1972 in Bld. 205 must have exposed [redacted] to large amounts of radiation. He tested positive on his bioassay tests. Yet there is no external dose information on his exposure. His external assigned ambient dose for that whole year is not claimant favorable. Also, the incident of May 23, 1951 where [redacted] breathed in uranium smoke, afforded him no internal dose value whatsoever, because the bioassay concluded that his exposure "was less than harmful levels". No internal dose value for this incident was included in his file. An assigned internal environmental dose for this incident and for the whole time that [redacted] worked at Argonne as a firefighter excluding the October 18, 1971 incident is not claimant favorable. A missed internal dose should have been assigned for this incident and a co-workers or other assigned dose should have been assigned for the entire year.

Our objections do not pertain to the methodology used for the dose reconstruction. Our objection is that the proper methodology was not followed by the health physicist. The values are determined by the specific circumstances of [redacted] employment history at Argonne East.

We believe that [redacted] employment history was not evaluated correctly by NIOSH. We believe this claim should be returned to NIOSH for a new Dose Reconstruction.

Respectfully submitted,

R. Hugh Stephens

cc: [redacted]

NIOSH DCAS

NIOSH Report of Dose Reconstruction under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)

NIOSH ID:	DOL Case No.	DOL District Office
[redacted]	[redacted]	Cleveland

Energy Employee Name:	[redacted]	[redacted]	[redacted]	[redacted]
	Last	*First*	*Middle*	*Date of Birth*

Covered Employment:	04/28/48 – 11/01/76	Argonne National Laboratory-East Argonne, IL	
	Date	*Location*	
Cancer:	Colon, ascending mass, adenocarcinoma	153.6	10/19/2009
	Multiple myeloma	203.00	06/19/2012
	Site	*ICD-9 Code*	*Date of Diagnosis*

Calculations Performed By:	Lawrence A. Page, Jr.	06/27/13
	Name	*Date*
Peer Review Completed By:	Louise M. Buker, CHP	07/03/13
	Name	*Date*
Dose Reconstruction Approved By:	Beth M. Rolfes	07/12/13
	Name	*Date*

If the facts surrounding this dose reconstruction change (e.g., the date of diagnosis is modified, an additional covered cancer is diagnosed, or additional covered employment is identified), the efficiency measures used to reconstruct the dose may not be applicable. In this case, if the facts were to change, the doses reconstructed for the colon and the red bone marrow could be lower than those reported using the overestimating assumptions.

Information Used

During this dose reconstruction, the primary data source was the dosimetry records obtained from the Department of Energy (DOE). In addition, specific parameters were applied to the dosimetry records in order to assign organ dose based on information in the External Dose Reconstruction Implementation Guideline[4] and the Internal Dose Reconstruction Implementation Guideline.[5] ORAUT Technical Information Bulletins and Technical Basis Documents were also used in this dose reconstruction (see References).

In addition to the above information, the record of the computer assisted telephone interview was reviewed carefully by the dose reconstructor. The information provided was considered in the dose estimation process. Additional information on the evaluation of the interview is provided in subsequent sections of this report, as applicable.

Dose Estimate

External Dose

External dose is received from radiation originating outside the body and is typically measured by dosimetry worn on the body. Radiation dose measured on a film badge or a thermoluminescent dosimeter (TLD) may have been delivered quickly (acute exposure) or slowly over the period of time that the employee was exposed (chronic exposure). External dose records received from the Department of Energy were reviewed and evaluated for the external dose estimate. The external dose for the multiply myeloma was determined by using the dose calculated for the red bone marrow.[10]

In his work as a firefighter and fire chief, [redacted] would have been required to respond to any location on the site. He was potentially exposed to photons, neutrons, and electrons. However, external electron radiation was not considered in this dose reconstruction because it would not have added dose to the cancer sites.

He was intermittently monitored between 1949 and 1957. Gaps in monitoring during this period were addressed by assignment of on-site ambient dose, as described later in this report.

Between 1965 and 1975, only summary dosimetry data were available. Missed dose was applied in these years and is described later in this report.

For the purpose of estimating probability of causation, all photon and electron doses, except on-site ambient doses, are assumed to be acute and all neutron doses are assumed to be chronic.[4] All on-site ambient doses are assumed to be chronic.

EXHIBIT 2

NIOSH DCAS

NIOSH Report of Dose Reconstruction under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)

NIOSH ID:	DOL Case No.	DOL District Office
[redacted]	[redacted]	Cleveland

Energy Employee Name: [redacted] (Last) [redacted] (First) [redacted] (Middle) [redacted] (Date of Birth)

Covered Employment:	04/28/48 – 11/01/76	Argonne National Laboratory-East Argonne, IL	
	(Dates)	(Facility)	
Cancer:	Colon, ascending mass, adenocarcinoma	153.6	10/19/2009
	Multiple myeloma	203.00	06/19/2012
	(Site)	(ICD-9 Code)	(Date of Diagnosis)

Calculations Performed By:	Lawrence A. Page, Jr.	06/27/13
	(Name)	(Date)
Peer Review Completed By:	Louise M. Buker, CHP	07/03/13
	(Name)	(Date)
Dose Reconstruction Approved By:	[signature]	07/12/13
	(Name)	(Date)
	Beth M. Rolfes	

A potential missed dose was assigned to each actual or potential dosimeter cycle to maximize the potential external doses received by [redacted]. A missed dose represents the dose that could have been received but may not have been recorded due to the dosimeter detection limits or site reporting practices.

Based on information provided in the Technical Basis Document for Argonne National Laboratory East – Occupational External Dosimetry,[11] the total number of dosimeter cycles assigned was 423 for photons and 230 for neutrons. For the years 1948–1964 and 1976, the zeros assigned were based on the actual number of zeros reported by the site. For the years 1965 through 1975, a monthly badge exchange was assumed and a best estimate calculation of the zeros was performed. The best estimate of the number of zeros assigned was equal to the average of the maximum potential badge cycles and the number of reported zero badge cycles.

Missed dose assigned is provided in the table below.

Description	Diagnosis	Missed Photon Dose (rem)	Missed Neutron Dose (rem)
Colon, ascending mass, adenocarcinoma	10/19/2009	5.738	5.828
Multiple myeloma	6/19/2012	3.269	4.304

On-Site Ambient Dose

[redacted] was intermittently monitored for ionizing radiation doses during the early years of his employment at Argonne National Laboratory East. As stated above, gaps during this period were addressed by assessment of on-site ambient doses as part of this dose reconstruction. On-site ambient doses were assessed as part of this dose reconstruction in accordance with the External Dose Reconstruction Implementation Guideline.[4] This accounts for any external doses from stack releases or other radiation sources that may have been unmonitored at the site. The total on-site ambient dose for each cancer was calculated based on site-specific data[7] and was assigned as a best estimate in accordance with guidance in the Occupational On-Site Ambient Dose Reconstruction for DOE Sites procedure.[9] Total on-site ambient doses assigned are provided in the table below.

Description	Diagnosis	Total On-Site Ambient Dose (rem)
Colon, ascending mass, adenocarcinoma	10/19/2009	0.020
Multiple myeloma	6/19/2012	0.021

Occupational Medical Dose

In addition to the estimated dose received from site operations, the dose received from diagnostic X-ray procedures that were required as a condition of employment was also included in the overall doses to the colon and red bone marrow.

Based on information in Technical Basis Document for Argonne National Laboratory-East – Occupational Medical Dose,[13] the Technical Information Bulletin: Guidance on Assigning

EXHIBIT 3

Office of Compensation Analysis and Support (OCAS)	Document No. [redacted] Effective Date: 11/21/2007 Revision No. 3
EXTERNAL DOSE RECONSTRUCTION IMPLEMENTATION GUIDELINE	Page 1 of 77
Approval: Signature on file Date: 11/21/2007 *J. W. Neton, Associate Director for Science* Concurrence: Signature on file Date: 11/21/2007 *L. J. Elliott, Director*	Supersedes: Rev 2

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1.0 INTRODUCTION

The purpose of this document is to provide guidance on the components, standards, and methods of external radiation dose reconstruction for probability of causation calculations in support of the Energy Employees Occupational Illness Compensation Program Act (EEOICPA). It is to be used as a source to help provide specific guidance and methods which can be found in site profiles and other site-specific documents. External radiation dose results from exposure to a radiation source that is outside of the body. The photon or particle radiations travel through the air and are absorbed in a tissue of the body.

1.1 Dose Reconstruction Requirement

The first step in the photon dose reconstruction is to determine whether there was any potential for external radiation exposure at the facility. At most Department of Energy (DOE) facilities and Atomic Weapons Employers (AWE) there is a potential for radiation exposure. When no radioactive material was processed or stored, an external dose reconstruction is not necessary. The three groups of workers who require dose reconstruction are: 1) workers who were not monitored for radiation exposure; 2) workers who were monitored inadequately for radiation exposure; and, 3) workers whose monitoring records are incomplete or missing (42CFR82.3(a) 2002).

1.1.1 Adequately Monitored

In general, external monitoring data collected since the implementation of 10 CFR Part 835 could be considered adequately monitored. When a claimant has been monitored adequately using either film badge dosimetry or thermoluminescent dosimetry (TLD) in accordance with the Department of Energy Laboratory Accreditation Program (DOELAP), these data shall be used to compute the annual dose for the claimant. The associated uncertainty should be assumed to be normally distributed and should be obtained from the site dosimetry office.

1.1.2 Not Monitored

Many of the Atomic Weapons Employer (AWE) workers were not individually monitored for radiation exposure. At some facilities, radiation surveys were conducted and this data, in conjunction with frequency of exposure, should be used to estimate the annual dose. When no radiation monitoring data is available for a facility, scientifically reasonable estimates of exposure should be developed based on the source term or quantity of radioactive material handled at the facility.

1.1.3 Monitored Inadequately

At some facilities, only a small sample of the work force was monitored to ensure compliance with radiation exposure limits. As an example, although construction workers were often not monitored, it may be possible in some instances to use workers who received similar exposures, such as radiological control technicians who monitored the work activities, to estimate external dose. For workers at these sites, the highest recorded value for similar work group should be assigned to the unmonitored worker.

In addition to incomplete monitoring practices, most early workers at DOE facilities were monitored inadequately compared to modern standards. In most instances, the missed dose alone can exceed 500 mrem/year. At many facilities, routine monitoring for neutron exposures was not initiated until the late 1950s. In general, monitoring data prior to 1960 must be evaluated cautiously due to technological shortcomings and because monitoring programs were designed to ensure compliance with a 12 rem/year exposure limit compared to the 5 rem/year current standard. For these workers and others with uncertain dose information, an evaluation of their dosimetry (or monitoring) data in combination with estimates for missed dose, occupational medical exposures, and environmental on-site dose should be used to determine the total annual external dose.

1.1.4 Monitoring records incomplete or missing

When monitoring records are incomplete or missing, the monitoring data prior to and after the missing data can be used to interpolate the missing data. When only post monitoring data is available, extrapolation should be used with caution, accounting for engineering administrative changes that might have been instituted which reduced exposures. In addition, co-worker data can be used to fill in missing or incomplete records.

1.2 External Radiation Exposures

The absorbed dose is to be calculated for the organ where the primary cancer exists. Interactive RadioEpidemiological Program (IREP) is used to calculate the probability of causation for an individual worker. For external radiation, there are three types of exposure; photon, neutron, and electron. Photon exposures are divided into three energy categories (< 30 keV, 30-250 keV, and >250 keV). Neutrons are divided into 5 energy categories (< 10 keV, 10-100 keV, 100-2000 keV, 2-20 MeV, and >20 MeV). While there are two electron categories in IREP, only the > 15 keV is considered to be a source of external radiation. Electrons below 15 keV do not have sufficient energy to penetrate the epidermal layer of the skin and, therefore, are not considered an external radiation hazard. Typically, external electrons are primarily of interest in skin cancer claims, however, depending on the beta particle energy, the dose can be significant for the development of breast and testicular cancer as well.

1.2.1 Photon exposures

The four basic components of photon exposures are the individual's radiation monitoring data from dosimeters (D_D), the unrecorded or unmeasured dose commonly referred to as the missed dose (D_M), the occupational medical dose from medical monitoring x-rays (D_{OM}), and the environment dose primarily from stack emissions (D_{EN}). The sum of these doses in each calendar year comprises a worker's annual occupational photon dose ($D_{\ }$).

$$D_{\ } = D_D + D_M + D_{OM} + D_{EN}$$

EXHIBIT 4

Document Title:	Document Number: [redacted]
Argonne National Laboratory – East – External Dosimetry	Revision: 00
	Effective Date: 02/09/2006
	Type of Document: TBD
	Supersedes: None

Subject Expert: Eugene W. Potter

Document Owner

Approval:	Signature on File Norman D. Rohrig, TBD Team Leader	Approval Date:	02/02/2006
Approval:	Signature on File Judson L. Kenoyer, Task 3 Manager	Approval Date:	02/01/2006
Concurrence:	Signature on File Kate Kimpan, Project Director	Concurrence Date:	02/06/2006
Approval:	Signature on File Stuart L. Hinnefeld, Health Science Administrator	Approval Date:	02/09/2006

☒ New ☐ Total Rewrite ☐ Revision ☐ Page Change

FOR DOCUMENTS MARKED AS A TOTAL REWRITE, REVISION, OR PAGE CHANGE, REPLACE THE PRIOR REVISION AND DISCARD / DESTROY ALL COPIES OF THE PRIOR REVISION.

- Unanticipated and invalid doses required additional documentation.
- There also was a Level 2 evaluation, with four higher-level A, B, C, D types (900, 1,500, 3,000, 7,500 mrem/mo, respectively). No examples of the Level 2 evaluation were found.

Termination Occupational Exposure Report (1979 to unknown) – Hand Entered (Figure A-16)

- Form prepared when workers terminated employment during certain years.
- Provides the beginning and ending employment dates in blocks 8 and 9, respectively.
- The external dose in millirem is in block 11.

Explanations of invalid data were also sent to individual files. For example, the results for all but one group of badges worn between June 12 and July 9, 1964, were declared invalid due to exposure received in shipment. The individuals' detail cards were punched with code 89 and zero doses were recorded.

6.3.2 Observed Data Discrepancies

As can be seen from the descriptions in the previous section, some of the periods of use of the various forms overlap. Care should be taken to not double count the doses for these periods.

The claimant-favorable assumption is to include discrepant data in the annual total unless there is some explanation in the record as to why it should not be included.

6.4 HISTORICAL ADMINISTRATIVE PRACTICES

6.4.1 Badged Population

In 1956, the site *Radiation Safety Guide* (ANL 1956a) indicated that areas were posted and that individuals entering an active area were required to wear personnel monitoring devices found at the entrance. Areas spelled out as active included Building 330 (CP-5) and Building 211 (cyclotron and small Van de Graaff accelerator). Wing G of Building 203 (large Van de Graaff) was not an active area, but access was forbidden during operation and restricted at other times. In addition, permanent monitors for fast neutrons were installed. Wrist badges containing neutron film were required at CP-5 (ANL 1956a).

Information developed in a 1982 survey for a DOE health and mortality study (Strom 1982) indicates that early on everyone was badged. By 1965, nearly all employees were still badged. By the early 1970s, the site health physicists assigned badges based on the exposure potential. By 1982 it was noted that approximately one-third of the workers were badged.

In the 1973 to 1984 revisions of the site *Health and Safety Manual* (ANL 1973), a radiation area was defined as an area where the dose (equivalent) to an individual in any calendar quarter could exceed 300 mrem, where radioactive materials were stored in quantity, or where equipment producing ionizing radiation was operated. Each person entering a radiation area was required to wear a personal monitoring device. Assigned film badges and self-reading dosimeters were provided at the entrance to each area and were to be returned to the designated storage area at the end of the work shift (ANL 1973).

EXHIBIT 5

Form HP-1

Name: [redacted]

Week of	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Pocket Meter Total	Disc	Worn	Film Badge Shield	Window	1094
[illegible]											0	0	
[illegible]											0	0	
[illegible]											0	0	
[illegible]											0	0	
[illegible]											0	0	
[illegible]											0	0	
[illegible]											0	0	
[illegible]											0	0	
[illegible]											0	0	
3-29	0							0		1	0	0	
Total: [illegible] Thru [illegible]								0		1	0	0	

Form HP-1

Name: [redacted] 727

Week of	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Pocket Meter Total	Disc	Worn	Film Badge Shield	Window	1094
3-29													
4-5													
4-12													
4-19													
4-26													
5-3													
5-10		0	0	01	0			.01		4	0	0	
5-17		0		0	0	0		0		4	0	0	
5-24	0	0	0		0			0		4	0	0	
5-31		0		0				0		2	0	0	
Total: 3-29-48 5/10/48 Thru 6-6-48								.01		14	0	0	

Form HP-1

EXHIBIT 6

Name: [redacted]

Week of	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Pocket Meter Total	Pocket Meter Disc	Pocket Meter Worn	Film Badge Shield	Film Badge Window
8-16											0	0
8-23				01	0			.01		2	0	0
8-30											0	0
9-6											0	0
9-13											0	0
9-20	0							.01		1	0	0
9-27											0	0
10-4											0	0
10-11											0	0
10-18											0	0
Total:	8-16-48			Thru		10-24-48		.02		3	0	0

1094

Form HP-1

Withdrawn:

Issued:

PALOS PARK

YOUNG

Supervisor

Date

Date

Time

Right Wrist S W

Left Wrist S W

Spec. Body S W

Finger Tip S W

Head S W

Spec. Waters

% Air tolerance

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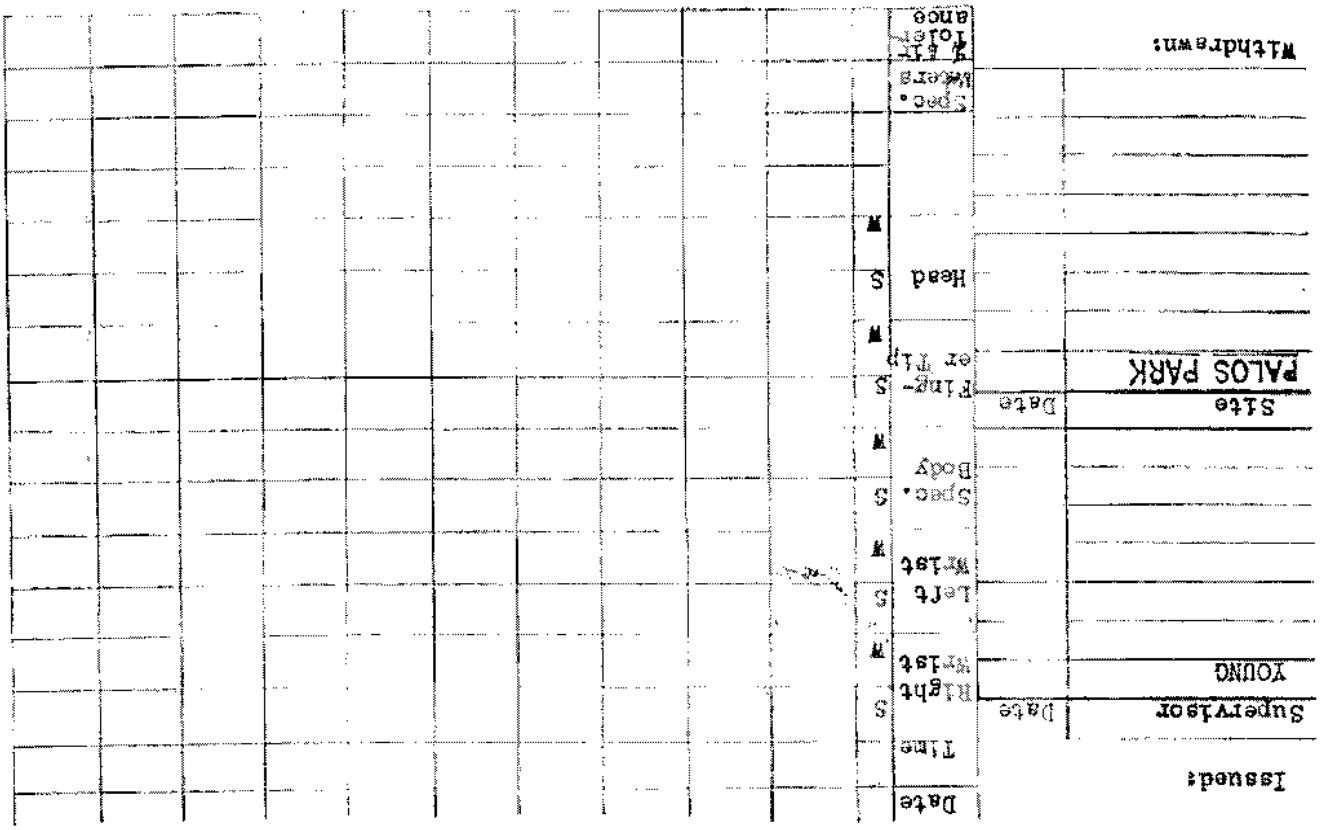

Name: [redacted] 1094

Week of	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Pocket Meter Total Disc	Worn	Film Badge Shield	Window
10-25										0	0
11-1										0	0
11-8										0	0
11-15										0	0
11-22										0	0
11-29										0	0
12-6										0	0
12-13										0	0
12-20										0	0
12-27										0	0
Total:										0	0

Form EP-1

Name: [redacted]

Week of	Mon	Tues	Wed	Thur	Fri	Sat	Sun	Pocket Meter Total	Pocket Meter Disc	Pocket Meter Worn	Film Badge Shield	Film Badge Window
1-3											0	0
1-10											0	0
1-17											0	0
1-24											0	0
1-31											0	0
2-7												
2-14												
2-21												
2-28												
3-7												
Total:	1-3-49				Thru	~~3-13-49~~ 2-7					0	0

Form HP-1

1094

EXHIBIT 7

CUMULATIVE EXPOSURE RECORD

DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.
6-30				
7-7				
7-14				
7-21				
7-28				
8-4				
8-11				
8-18				
8-25				
9-1				
9-8				
9-15				
9-22				
TOTAL				
9-29				
10-6				
10-13				
10-20				
10-27				
11-3				
11-10				
11-17				
11-24				
12-1	36	6		
12-8				
12-15				
12-22				
TOTAL		6		

DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.
12-29				
1-5				
1-12				
1-19				
1-26				
2-2				
2-9				
2-16				
2-23				
3-2				
3-9				
3-16				
3-23				
TOTAL				
3-30				
4-6				
4-13				
4-20				
4-27				
5-4				
5-11				
5-18				
5-25				
6-1				
6-8				
6-15				
6-22				
TOTAL				

[redacted] NAME

1952-1953 YEAR

977 PR #

HS-26A (4-54)

Official Use Only/Privacy Act Information

CUMULATIVE EXPOSURE RECORD

DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.
6-29				
7-6				
7-13				
7-20				
7-27				
8-3				
8-10				
8-17				
8-24				
8-31				
9-7				
9-14				
9-21				
TOTAL				
9-28				
10-5				
10-12				
10-19	301	0		
10-26				
11-2	205	0		
11-9				
11-16				
11-23	22	0		
11-30				
12-7	205	3		
12-14				
12-21				
TOTAL		3		

DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.
12-28				
1-4				
1-11				
1-18				
1-25				
2-1				
2-8				
2-15				
2-22				
3-1				
3-8				
3-15				
3-22				
TOTAL				
3-29				
4-5				
4-12				
4-19				
4-26				
5-3				
5-10				
5-17				
5-24				
5-31				
6-7				
6-14				
6-21				
TOTAL				

[redacted] NAME

1953-1954 YEAR

977 PR #

HS-26A (4-54)

Official Use Only/Privacy Act information

CUMULATIVE EXPOSURE RECORD

DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.
6-28				
7-5				
7-12				
7-19				
7-26				
8-2				
8-9				
8-16				
8-23				
8-30				
9-6				
9-13				
9-20				
TOTAL				
9-27				
10-4				
10-11				
10-18				
10-25				
11-1				
11-8				
11-15				
11-22				
11-29				
12-6				
12-13				
12-20				
TOTAL				

DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.
12-27				
1-3				
1-10				
1-17				
1-24				
1-31				
2-7				
2-14				
2-21				
2-28				
3-7				
3-14				
3-21				
TOTAL				
3-28				
4-4				
4-11				
4-18				
4-25				
5-2				
5-9				
5-16				
5-23				
5-30				
6-6				
6-13				
6-20				
TOTAL				

[redacted] NAME

1954-1955 YEAR

977 PR #

HS-26A (4-54)

CUMULATIVE EXPOSURE RECORD

DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.	DATE	SITE	DOSIMETER mr	FILM mr	FILM a.u.
6-27					12-26				
7-4					1-2				
7-11					1-9				
7-18					1-16				
7-25					1-23	205	17		
8-1					1-30				
8-8					2-6				
8-15					2-13				
8-22					2-20				
8-29					2-27				
9-5					3-5				
9-12					3-12				
9-19					3-19				
TOTAL					TOTAL		17		
9-26					3-26				
10-3					4-2				
10-10					4-9				
10-17					4-16				
10-24					4-23				
10-31					4-30				
11-7					5-7	D15	5		
11-14					5-14				
11-21					5-21				
11-28					5-28				
12-5					6-4				
12-12					6-11				
12-19					6-18				
TOTAL					TOTAL				

[redacted] NAME

1955-1956 YEAR

277 PR #

IS-26A (4-54)

CUMULATIVE EXPOSURE RECORD

1956

DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.
1-2				
1-9				
1-16				
1-23	205	17		
1-30				
2-6				
2-13				
2-20				
2-27				
3-5				
3-12				
3-19				
3-26				
TOTAL		17		
4-2				
4-9				
4-16				
4-23				
4-30				
5-7	D15	5		
5-14				
5-21				
5-28				
6-4				
6-11				
6-18				
6-25	36	0		
TOTAL		5		

DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.
7-2				
7-9				
7-16	211	0		
7-23				
7-30	205	22		
8-6	D19	0		
8-13	301	1		
8-20	330 East	2		
8-27				
9-3	205	0		
9-10				
9-17				
9-24				
TOTAL		26		
10-1				
10-8				
10-15	D17	5		
10-22				
10-29				
11-5				
11-12				
11-19				
11-26	D36	2		
12-3				
12-10	D36	0		
12-17				
12-24				
12-31				
TOTAL		7		

[redacted] NAME

1956 YEAR

977 PR #

IS. 26A (3-58)

CUMULATIVE EXPOSURE RECORD

1957

DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.	DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.
1–7					7–8				
1–14					7–15				
1–21					7–22	301	10		
1–28					7–29				
2–4					8–5				
2–11					8–12				
2–18					8–19				
2–25					8–26				
3–4					9–2				
3–11	205 T Eas St	15			9–9				
3–18					9–16				
3–25					9–23				
4–1					9–30				
TOTAL		15			TOTAL		10		
4–8					10–7				
4–15					10–14				
4–22					10–21				
4–29					10–28				
5–6					11–4				
5–13					11–11	423	5		
5–20					11–18				
5–27					11–25				
6–3					12–2				
6–10					12–9				
6–17					12–16				
6–24					12–23				
7–1					12–30				
TOTAL					TOTAL		5		

[redacted] NAME

1957 YEAR

977 PR #

1-264 (3-58)

CUMULATIVE EXPOSURE RECORD

1958

DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.
1 – 6	D15	2		
1 – 13				
1 – 20				
1 – 27				
2 – 3				
2 – 10				
2 – 17				
2 – 24				
3 – 3				
3 – 10				
3 – 17				
3 – 24				
3 – 31				
TOTAL		2		
4 – 7				
4 – 14				
4 – 21				
4 – 28				
5 – 5				
5 – 12				
5 – 19				
5 – 26				
6 – 2				
6 – 9				
6 – 16				
6 – 23				
6 – 30				
TOTAL				

DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.
7 – 7	36	5		
7 – 14	4 5-8		0	0
7 – 21	"		0	0
7 – 28	"		0	0
8 – 4	"		0	0
8 – 11	"		0	0
8 – 18	"		0	0
8 – 25	"		0	0
9 – 1	"		0	0
9 – 8	"		0	0
9 – 15	"		0	0
9 – 22	"		0	0
9 – 29	"		0	0
TOTAL		5	0	0
10 – 6	"		0	0
10 – 13	"		0	0
10 – 20	"		0	0
10 – 27	"		0	0
11 – 3	"		0	0
11 – 10	"		0	0
11 – 17	"		0	0
11 – 24	"		0	0
12 – 1	"		0	0
12 – 8	"		0	0
12 – 15	"		0	0
12 – 22	"		0	0
12 – 29	"		0	0
TOTAL			0	0

[redacted]
NAME

1958
YEAR

977
IHS #

IHS-28A (10-57)

CUMULATIVE EXPOSURE RECORD

1959

DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.	DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.
1 – 5	DS		0	0	7 – 6	DS		0	0
1 – 12	"		0	0	7 – 13	"		0	0
1 – 19	"		0	0	7 – 20	"		0	0
1 – 26	"	~~10~~	0	0	7 – 27	"		0	0
2 – 2	"	10	0	0	8 – 3	"		0	0
2 – 9	"		0	0	8 – 10	"		0	0
2 – 16	"		0	0	8 – 17	"		0	0
2 – 23	"		0	0	8 – 24	"		0	0
3 – 2	"		0	0	8 – 31	"		0	0
3 – 9	"		0	0	9 – 7	"		0	0
3 – 16	"		0	0	9 – 14	"		0	0
3 – 23	"		0	0	9 – 21	"		0	0
3 – 30	"		0	0	9 – 28	"		0	0
TOTAL		10	0	0	TOTAL			0	0
4 – 6	"		0	0	10 – 5	"		0	0
4 – 13	"		0	0	10 – 12	"		0	0
4 – 20	"		0	0	10 – 19	"		0	0
4 – 27	"		0	0	10 – 26	"		0	0
5 – 4	"		0	0	11 – 2	"		0	0
5 – 11	"		0	0	11 – 9	"		0	0
5 – 18	"		0	0	11 – 16	"		0	0
5 – 25	"		0	0	11 – 23	"		0	0
6 – 1	"		0	0	11 – 30	"		0	0
6 – 8	"		0	0	12 – 7	"		0	0
6 – 15	"		0	0	12 – 14	"		0	0
6 – 22	"		0	0	12 – 21	"		0	0
6 – 29	"		0	0	12 – 28	"		0	0
TOTAL			0	0	TOTAL			0	0

[redacted]
NAME

1959
YEAR

977
HHS #

CUMULATIVE EXPOSURE RECORD

1960

DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.	DATE	AREA	DOSIMETER mr	FILM mr	FILM a.u.
1–4	D8		0	0	7–4	D8		0	0
1–11	"		0	0	7–11	"		—	—
1–18	"		0	0	7–18	"		0	0
1–25	"		0	0	7–25	"		—	—
2–1	"		0	0	8–1	"		0	0
2–8	"		0	0	8–8	"		—	—
2–15	"		0	0	8–15	"		0	0
2–22	"		0	0	8–22	"		—	—
2–29	"		0	0	8–29	"		0	0
3–7	"		0	0	9–5	"		—	—
3–14	"		0	0	9–12	"		0	0
3–21	"		8 0*		9–19	"		—	—
3–28	"		0	0	9–26	"		0	0
TOTAL			* Report HP-33 # 60-135 0 Surveys		TOTAL			0	0
4–4	"		0	0	10–3			—	—
4–11	"		0	0	10–10			0	0
4–18	"		0	0	10–17			—	—
4–25	"		0	0	10–24			0	0
5–2	"		0	0	10–31			—	—
5–9	"		0	0	11–7			0	0
5–16	"		0	0	11–14			—	—
5–23	"		0	0	11–21			0	0
5–30	"		0	0	11–28			—	—
6–6	"		0	0	12–5			0	0
6–13	"		0	0	12–12			—	—
6–20	"		0	0	12–19			0	0
6–27	"		0	0	12–26			—	—
TOTAL			0	0	TOTAL			0	0

[redacted] NAME

1960 YEAR

977 IHS #

IHS-25A (10-59)

CUMULATIVE EXPOSURE RECORD

1961

DATE	AREA	DOSIMETER mr	FILM mr	FILM Beta G.U.	DATE	AREA	DOSIMETER mr	FILM mr	FILM Beta G.U.
1-2	28		0	0	7-3			0	0
1-9			-	-	7-10			-	-
1-16			0	0	7-17			0	0
1-23			-	-	7-24			-	-
1-30			0	0	7-31			0	0
2-6			-	-	8-7			-	-
2-13			0	0	8-14			no (e/w)	0
2-20			-	-	8-21			[redacted]	[redacted]
2-27			0	0	8-28			0	0
3-6			-	-	9-4			-	-
3-13			0	0	9-11			0	0
3-20			-	-	9-18			-	-
3-27			0	0	9-25			0	0
TOTAL			0	0	TOTAL			0	0
4-3			-	-	10-2			-	-
4-10			0	0	10-9			0	0
4-17			-	-	10-16			-	-
4-24			0	0	10-23			0	0
5-1			-	-	10-30			-	-
5-8			0	0	11-6			0	0
5-15			-	-	11-13			-	-
5-22			0	0	11-20			0	0
5-29			-	-	11-27			-	-
6-5			0	0	12-4			0	0
6-12			-	-	12-11			-	-
6-19			0	0	12-18			0	0
6-26			-	-	12-25			-	-
TOTAL			0	0	TOTAL			0	0

[redacted]
NAME

1961
YEAR

977
IHS #

EXHIBIT 8

Office of Compensation Analysis and Support (OCAS)	Document No. [redacted] Effective Date: 11/21/2007 Revision No. 3
EXTERNAL DOSE RECONSTRUCTION IMPLEMENTATION GUIDELINE	Page 1 of 77
Approval: Signature on file Date: 11/21/2007 *J. W. Neton, Associate Director for Science* Concurrence: Signature on file Date: 11/21/2007 *L. J. Elliott, Director*	Supersedes: Rev 2

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2.3.3 Skin Contamination

2.3.3.1 Background

Skin contamination can result in significant exposures. While frisking out of contamination areas, some workers might have triggered alarm levels such that decontamination of the skin was necessary. These skin contamination incidents have typically been recorded in the individual's radiological exposure records.

2.3.3.2 Method

2.3.3.2.1 Location of Contamination

To be included in the skin dose, the contamination must have occurred on a body part where the skin cancer originated.

2.3.3.2.2 Dose Calculation

For calculating the dose from skin contamination, a program such as VARSKIN[1] can be used to estimate the skin dose. The default skin depth should be 0.07 mm. If the area of the skin cancer is known, the dose should be calculated for that surface area. If the skin cancer area is unknown, the contamination area, if known, should be assumed to be the surface area of the skin cancer, however the surface area should not be less than 1 cm^2. The shielding effect of any personal protective equipment such as coveralls, gloves, plastics, etc. worn should be considered if known.

2.3.3.3 Uncertainty

When conducting dose reconstruction for skin cancer, there are multiple parameters which must be taken into consideration such as the activity, average area of the measurement probe, average area of the actual contamination, etc. Professional judgment should be used to determine the most probable exposure parameters in arriving at the central tendency of the log normal distribution of the dose. The maximum or 95% dose limit should be calculated assuming the most reasonable claimant friendly assumptions such as a minimum surface area of 1 cm^2, no protective clothing, negligible distance between contamination and skin, etc.

3.0 External Dose Reconstruction – Incomplete, Missing or No Monitoring Data

Incomplete or missing personal monitoring usually occurs either between two periods of monitoring data or at the beginning or end of a monitoring time period. When personal monitoring data is missing between two other periods of monitoring, interpolation between the two-monitored time periods may be reasonable. When the incomplete data is either before or after monitoring data, extrapolation may be reasonable, however caution should be used to properly account for any trends that may exist.

[1] This is not an endorsement of the VARSKIN program, and is presented as one example of a typical program that could assist in skin dose computations.

3.0.1 Interpolation of Missing Personal Monitoring Data

In some instances, dosimetry records might be missing for a portion of an individual's work history. However if the individual has sufficient monitoring data prior to and after the missing data, the dose can be interpolated by a simple average between the two monitoring periods. The interpolation would be considered reasonable providing the work practices, radiological protection measures, and the administrative and engineering controls did not change. In addition, interpolation may be conducted only if there is no indication, whether from the claimant or site radiological records, that a radiological incident resulting in a higher exposure occurred during the time period of missing data.

3.0.2 Extrapolation from Incomplete Personal Monitoring Data

At some sites, as the radiological monitoring practices were being developed, early dosimetry was rather crude and not all external radiation types were measured. As radiological monitoring programs became more sophisticated, more radiation types and energies were measured and recorded in personal monitoring records. Most programs started with measurements of high-energy photons and then added beta or electron measurements followed by neutrons. In order to reconstruct an individual's dose during these early time periods, some extrapolation from adjacent (near-by) time periods may be necessary. Caution must be used, however, to account for trends in exposure data resulting from differences in work practices, implementation of radiological, administrative, and/or engineering controls that might change the exposure pattern.

Uncertainty from either interpolation or extrapolation could be very difficult to accurately determine. Therefore claimant friendly upper bounds should be used.

3.0.3 No Personal Monitoring Data

When no personal monitoring data is available, the external radiation dose should be reconstructed based on 1) co-worker data, 2) radiation survey data or 3) source term information. As noted in section 1.4, Dose Reconstruction - Hierarchy of Data, co-worker data should be used prior to radiation surveys and survey data should be used before source term information. It should be recognized that dose reconstructions based on survey data will probably be biased, since monitoring practices tended to be recorded at the highest level to ensure compliance, but this is an acceptable bias in a claimant friendly compensation program. If no survey data is available, the dose should be estimated based on the activity of the source term, engineering and administrative controls, and work history.

3.1 Photon Exposures

3.1.1 Photon Dose Reconstruction – Co-worker Data

At some facilities, only a subset of workers was monitored for radiation exposure to demonstrate compliance with orders or regulations. In these instances, the claimant has been asked during the CATI for a list of co-workers who worked with the claimant. Data from the claimant's co-worker(s) should be used when monitoring data is incomplete or missing. In some instances, multiple co-workers were monitored and an average was reported for the remainder of the group. The benefit of the doubt should be given to the

EXHIBIT 9

Document Title:	Document Number: [redacted]
Argonne National Laboratory – East – External Dosimetry	Revision: 00
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Concurrence:	Signature on File Kate Kimpan, Project Director	Concurrence Date:	02/06/2006
Approval:	Signature on File Stuart L. Hinnefeld, Health Science Administrator	Approval Date:	02/09/2006

☒ New ☐ Total Rewrite ☐ Revision ☐ Page Change

FOR DOCUMENTS MARKED AS A TOTAL REWRITE, REVISION, OR PAGE CHANGE, REPLACE THE PRIOR REVISION AND DISCARD / DESTROY ALL COPIES OF THE PRIOR REVISION.

6.4.2 Badge Exchange Frequency

At first there were weekly film badge exchanges. On April 16, 1951, the badge exchange frequency was changed from weekly to biweekly for Site D and West Stands personnel. Although not stated, this change probably included Site A personnel. The only film badges still being developed weekly were for reclamation personnel (i.e., the site decontamination group) and twenty special cases at the new Chemistry Building at the University of Chicago (Rose 1951).

The 1961 specifications (scope of work) for film badge services indicated that the exchange frequency was to be biweekly (Strom 1982). During 1967 to 1974, badges were exchanged approximately biweekly (26 exchanges/yr) (Bleiler 1968a, 1968b, 1970, 1973a, 1974).

Due to a work force reduction in the Personal Monitoring Group biweekly exchanges were eliminated and all film badges were placed on a 4-wk exchange schedule as soon as possible (Bleiler 1973b). It appears that this change was made starting with the first exchange in 1974, which covered December 28, 1973, to January 24, 1974 (Bleiler 1975a). Starting in 1975, exchanges were monthly according to Bleiler (1975b). This does not agree with "Information concerning NIOSH Requests" (Luck 2002), which states that monthly exchanges started in October 1965. This may indicate that some groups were on a monthly exchange at least temporarily in the mid-1960s.

In 1981 and 1982, the exchange frequency was monthly (Strom 1982). A summer 1981 study done at ANL-E indicated that a quarterly TLD badge exchange was anticipated (Strom 1982). There is no evidence that this was implemented for the general population.

The *Advanced Photon Source* [APS] *Accelerator Systems Safety Assessment Document* states that personnel monitors are exchanged quarterly at that facility (ANL 1994).

Table 6-3 provides the claimant-favorable default dosimetry exchange frequencies to be used for dose reconstructions.

Table 6-3. Default dosimeter exchange frequencies.

Years	General population	Others
1945–1959	Weekly	
1960–1973	Biweekly	
1974	4-Week (13 periods/yr)	
1975–2005	Monthly (12 periods/yr)	1994 APS quarterly

6.4.3 Field-Specific Calibration Factors

No workplace-specific calibration factors have been found.

6.4.4 Minimum Reported Dose

The specifications for the multi-element film badge (Hanford type) indicated that the response range of the film badge was to be 0.025 R to 3,000 R (Strom 1982). In 1982, measured doses of less than 15 mR were reported as zero (Strom 1982).

The specifications for the Atomic Film Badge Corporation multi-element badge indicate that a lower limit of 25 mR was reported for X-ray, beta, and gamma. Amounts less than 25 mR were shown but not added to the cumulative total. Any neutron doses above zero were reported. Neutron tracks were counted in 25 random fields (Strom 1982). No information on minimum reported doses was recovered for the other early vendors.

EXHIBIT 10

NIOSH DCAS

NIOSH Report of Dose Reconstruction under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)

NIOSH ID:	DOL Case No.	DOL District Office
[redacted]	[redacted]	Cleveland

Energy Employee Name:	[redacted]	[redacted]	[redacted]	[redacted]
	Last	*First*	*Middle*	*Date of Birth*

Covered Employment:	04/28/48 – 11/01/76	Argonne National Laboratory-East Argonne, IL	
	Dates	*Facility*	
Cancer:	Colon, ascending mass, adenocarcinoma	153.6	10/19/2009
	Multiple myeloma	203.00	06/19/2012
	Site	*ICD-9 Code*	*Date of Diagnosis*

Calculations Performed By:	Lawrence A. Page, Jr.	06/27/13
	Name	*Date*
Peer Review Completed By:	Louise M. Buker, CHP	07/03/13
	Name	*Date*
Dose Reconstruction Approved By:	Beth M. Rolfes	07/12/13
	Name	*Date*

[redacted] [redacted] [redacted]

Occupational X-Ray Dose under EEOICPA for X-Rays Administered Off Site,[9] and the dates and types of X-ray procedures indicated in the site records, X-ray doses were assigned as indicated in the table below.

Description	Diagnosis	Total X-ray Dose (rem)
Colon, ascending mass, adenocarcinoma	10/19/2009	0.796
Multiple myeloma	6/19/2012	0.598

Internal Dose

Internal dose is caused by radioactive materials that are taken into the body. A chronic intake is an intake of radioactive material that occurs over an extended period of time (typically weeks or longer). An acute intake is an intake of radioactive material that occurs over a short period of time (typically minutes to hours). Regardless of the rate at which the intake occurs, the internal dose received from radioactive materials having long half-lives occurs over an extended period of time and is, therefore, considered chronic. The internal dose to the colon was determined by using the dose calculated for the upper large intestine (ULI) and the internal dose for the multiple myeloma was determined by calculating the dose to the red bone marrow.[10]

A computer code, the Integrated Modules for Bioassay Analysis (IMBA), was used to estimate intakes of radioactive material and the subsequent annual organ doses. The IMBA Expert ORAU-Edition was used for this dose reconstruction. The ICRP 66 lung model with default aerosol characteristics was assumed, in conjunction with ICRP 68 metabolic models. It should be emphasized that intake dates, scenarios, and intake levels were based upon mathematical models and do not necessarily prove that such intakes occurred on the given dates. These dates and scenarios provide an acceptable explanation of exposure and dose based upon the bioassay data provided. This approach is in accordance with the provisions of the Radiation Dose Reconstruction Rule (42 CFR 82)[1] and guidance in the NIOSH Internal Dose Reconstruction Implementation Guideline.[5]

Missed Dose

Internal dose monitoring records were reviewed. Between October 18 and December 11, 1972, [redacted] was monitored by urine and fecal sampling, three times each, apparently as part of an event which occurred in Site D. While the urine results were all below the stated minimum detectable activity[8] for the period, the fecal samples all showed positive results. All samples were evaluated as part of an acute intake, assumed to have happened 24 hours before the first set of samples, or October 17, 1972.

Fecal sample intakes were evaluated as fitted dose while the urine samples were evaluated as missed intakes. The missed intake (3.02E+05 dpm) resulted in a higher dose and was assigned as such. The intake was evaluated as 100% plutonium-239. Type Super S[13] solubility resulted in the highest dose for both cancers. Types M, S, and Super S[13] were considered.

Environmental Dose

Employment records for [redacted] were reviewed and only the records of the bioassay monitoring described above were found. Therefore, to account for any internal dose that may have been received but not documented, additional internal dose was assigned based on reported environmental airborne radionuclide concentrations.[9]

[redacted] worked in various locations during his employment at Argonne National Laboratory East, and it was assumed that he might have been occupationally exposed to environmental levels of radioactive material while working there. Environmental estimates of maximum annual intakes were derived from outdoor air concentrations at Argonne National Laboratory East.[7] These values likely represent the upper bound of potential intakes for individuals for whom monitoring was not required. It is assumed that these intakes occurred uniformly in the years listed and, therefore, for partial years of employment, credit for the entire year was given.

The highest values during [redacted] employment were used, as provided in Tables A-1 and A-2 of the Technical Basis Document for Argonne National Laboratory East – Occupational Environmental Dose.[7]

Some forms of plutonium exhibit longer lung clearance times than those used in the ICRP model for insoluble (Type S) plutonium. This can result in higher doses to some organs, so dose modification factors were developed as described in the Technical Information Bulletin: Estimating Doses for Plutonium Strongly Retained in the Lung.[13] [redacted] dose is estimated to the colon, part of the gastrointestinal (GI) tract, using measured air concentrations. The dose to the GI tract from an inhalation of plutonium is the result of plutonium that is deposited in and subsequently cleared from the lungs. Because Type Super S plutonium is retained in the lungs for a longer time than more soluble forms of plutonium (Types M and S), less is transferred to the GI tract, and hence the dose is lower than for an equal intake of Type M or Type S plutonium. Therefore, dose adjustments for plutonium (plutonium-239 and its mixtures) strongly retained in the lung (Type Super S) are not required for the dose to the colon.

In the case of the red bone marrow, a systemic organ (a portion of the body not included in the respiratory or gastrointestinal tracts), the dose to a systemic organ from an inhalation of plutonium is the result of plutonium that is absorbed into the bloodstream. Because Type Super S plutonium is retained in the lungs for a longer time than more soluble forms of plutonium (Types M and S), less is transferred to the blood, and hence the dose is lower than for an equal intake of Type M or Type S plutonium. Therefore, dose adjustments for plutonium (plutonium-239 and its mixtures) strongly retained in the lung (Type Super S) are not required for the dose to the red bone marrow.

The total internal dose assigned for each cancer in given in the table below.

Description	Diagnosis Date	Total Internal Dose (rem)
Colon, ascending mass, adenocarcinoma	10/19/2009	0.248
Multiple myeloma	6/19/2012	7.943

Dose from Radiological Incidents

EXHIBIT 11

WHOLE BODY EXTERNAL RADIATION EXPOSURE SUMMARY

for [redacted] PR # 977

EXPOSURE in mrem

Year	Rover Dosimeter	Film Badge			Penetrating Total
		Beta	Gamma	Neutron	
1964	10	0	0	0	10
1965	0	0	100	52	152
1966	3	0	150	0	153
1967	0	0	0	0	0
1968	0	0	0	0	0
1969	0	0	0	0	0
1970	0	0	0	0	0
1971	0	0	0	0	0
1972	0	0	0	0	0
1973	0	0	0	0	0
1974	0	0	0	0	0
1975	0	0	0	0	0

EXHIBIT 12

Argonne National Laboratory
HEALTH SERVICE

Name-Last	First	Middle	Unit No.
[redacted]	[redacted]		

Date	Division or Group	Site
9/19/51	ANL	

ACCIDENT OR EMERGENCY REPORT

Site D16 (Special Materials Shack) Department Fire Protection

Occupation _____ Supervisor _____

Address _____ Telephone _____

Date of Accident 5/23/51 Time _____ Age _____ S M W D Race _____

History of _____

Circumstances of accident or complaint. Physical findings, treatment and disability:

September 19, 1951:

Exposure to fumes of burning uranium on 5/23/51. No illness resulted. Bioassay studies revealed exposure was less than harmful levels. Not reported to insurance carrier; not considered an industrial illness.

This note is for record purposes only.

EAH:ol

Earl A. Hathaway, M.D.

LOSS OF TIME From _____ (Date) To _____ (Date)

FORM MD-8

Official Use Only/Privacy Act Information

EXHIBIT 13

Office of Compensation Analysis and Support Program Evaluation Report	Document Number: [redacted] Effective Date: 9/11/2007 Revision No. 0

Evaluation of Incomplete Internal Dosimetry Records from Idaho, Argonne – East and Argonne – West National Laboratories Page 1 of 3

Author: Signature on file Date: 9/11/2007 Supersedes: None
Dave Allen, HP Team Leader

Approval: Signature on file Date: 9/11/2007
Brant Ulsh, Research Health Scientist

RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
9/11/2007	9/11/2007	0	New document to determine which previously completed claims require revisions as a result of new dosimetry data at INL, ANL-E, and ANL-W.

1.0 Description

In April/May 2006, while reviewing dose reconstructions (DR) for an Idaho National Laboratory (INL) case and an Argonne National Laboratory – East (ANL-E) case, a particular notation ("no recordable dose") in the INL dosimetry response, as well as a similar notation ("no internal dose") in the ANL-E dosimetry response, was questioned. Both the INL and ANL-E points of contact (POC) were contacted and asked if this notation meant that the energy employee (EE) was not monitored. The INL POC responded that this notation meant that this particular EE may have been monitored but no internal dose was assigned. The ANL-E POC provided information that the EE had internal dose records for most years of his employment. [Although Argonne National Laboratory – West (ANL-W) requests are sent thru the Chicago Operations Office, the dosimetry records are provided by INL.]

In May/June 2006, it was determined that INL/ANL-W/ANL-E did not consistently include internal dose data in all of their individual dosimetry responses and that additional requests were needed for submitted/non-compensable cases. For a particular employee, INL/ANL-W/ANL-E either provided all or none of the EE's internal dosimetry records. The indication that there may be internal dosimetry data not submitted to NIOSH is that the OCAS-INT-004 (check-box form) has a hand-written note next to the internal dosimetry status section that says – "no internal dose" or "no recordable dose."

2.0 Issue Evaluation

In July/August 2006, all INL/ANL-W/ANL-E submitted/non-comp cases were reviewed to determine if additional requests were needed. At that time, there were 603 INL, 64 ANL-W and 56 ANL-E submitted/non-comp cases. Since the middle of 2006, several of the cases were submitted to DOL (either before or after the receipt of the additional response). As of 1/24/2007, there were 677 INL, 87 ANL-W and 69 ANL-E submitted/non-comp cases. Each case was reviewed to determine:

- how the internal dosimetry status section on the OCAS-INT-004 was completed (not marked; or marked as provided, not readily available, or does not exist),
- if a hand-written note was indicated on the form (no internal dose/exposure, no recordable dose, no monitoring required, not monitored, etc.), and
- if internal dose records (in-vivo or bioassay records) were provided within the response.

Based on the information resulting from this review, it was determined that additional requests were needed for INL/ANL-W/ANL-E cases that met one of the following criteria:

- the OCAS-INT-004 was marked as internal dosimetry records provided with or without a hand-written note stating "no internal or recordable dose," and there were no internal dose records in the response,
- the OCAS-INT-004 was marked as internal dosimetry records not readily available with or without a hand-written note stating "no internal or recordable dose," and there were no internal dose records in the response, or
- the OCAS-INT-004 had no markings or notations, and there were no internal dose records in the response.

For INL/ANL-W, some responses contained notes stating that the EE was not monitored or that the records show no record of the EE being monitored or receiving dose at INL/ANL-W. These notes may appear on either the OCAS-INT-004 or on a memo within the response. Additional requests were not generated for cases when this information was provided within the response.

For ANL-E, some responses contained additional notes on a memo within the response such as data was not available, minimal dose based on bioassays, no internal doses assessed, etc. Additional requests were generated when these notations occurred within the response. Also, some responses contained notes stating that the EE was not monitored, that no internal radiation exposure records were on file, or that no bioassay records were found. These notes may appear on either the OCAS-INT-004 or on a memo within the response. Additional requests were not generated for cases when this information was provided within the response.

3.0 Plan for Resolution or Corrective Action

Additional requests were sent in August/September 2006. By April of 2007 a response was received for each of the request. These requests resulted in receiving internal dose data for 83 claims, 62 from INL, 14 from ANL-W, 6 from ANL-E and one with additional records from both INL and ANL-W.

Some of these claims have already been returned to NIOSH for new dose reconstruction for various reasons. The new dose reconstructions will consider the new data received. NIOSH is requesting the remaining claims be returned for a new dose reconstruction. This consists of 68 individual claims. A list of these claims will be forwarded to the Department of Labor. A new dose reconstruction will be completed for each of the claims using the new data.

EXHIBIT 14

NIOSH DCAS

NIOSH Report of Dose Reconstruction under the Energy Employees Occupational Illness Compensation Program Act (EEOICPA)

NIOSH ID:	DOL Case No.	DOL District Office
[redacted]	[redacted]	Cleveland

Energy Employee Name:	[redacted]	[redacted]	[redacted]	11/02/26
	Last	*First*	*Middle*	*Date of Birth*

Covered Employment:	04/28/48 – 11/01/76	Argonne National Laboratory-East Argonne, IL	
	Type	*Location*	
Cancer:	Colon, ascending mass, adenocarcinoma	153.6	10/19/2009
	Multiple myeloma	203.00	06/19/2012
	Type	*ICD-9 Code*	*Date of Diagnosis*

Calculations Performed By:	Lawrence A. Page, Jr.	06/27/13
	Name	*Date*
Peer Review Completed By:	Louise M. Buker, CHP	07/03/13
	Name	*Date*
Dose Reconstruction Approved By:	Beth M. Rolfes	07/12/13
	Signature	*Date*
	Beth M. Rolfes	
	Name	

The record of the telephone interview was evaluated carefully by the dose reconstructor. Information from the interview indicated that [redacted] reached his "time radiation limit" around 1970. According to the records, [redacted] had no reported dose after 1967. It is possible that this comment refers to the potential internal exposure in 1972, which has been addressed as described above. There was no other information in the records or the interview to indicate that additional exposure potential exists beyond that determined by this best estimate of radiation dose.

Uncertainty

Uncertainties for all external doses, except for medical X-ray dose, were calculated using Monte Carlo methods,[12] as discussed above and applied as either a Weibull, normal, or lognormal distribution. Medical X-rays are assumed to have a normal distribution with a standard deviation of 30%.

Internal dose estimates based on missed dose were applied as a triangular distribution (minimum = zero, mode = dose calculated above, and maximum = twice the mode dose), whereas environmental doses were applied as a lognormal distribution with a geometric standard deviation.

Best Estimate of Radiation Dose

A best estimate of radiation dose was applied for each of the components considered in this dose reconstruction. In some instances in which information was lacking or incomplete, claimant-favorable assumptions were used.

Summary

[redacted] was exposed to various sources of radiation during his employment at Argonne National Laboratory East. The estimated doses to [redacted] are provided in the table below.

Description	Diagnosis Date	Dose (rem)
Colon, ascending mass, adenocarcinoma	10/19/2009	13.139
Multiple myeloma	6/19/2012	16.441

The reported dose is a best estimate of [redacted] occupational radiation dose which will support claim determination.

Attachment 1 contains the IREP dose reconstruction summary sheets that will be used by the Department of Labor to make the final probability of causation determination of the claim.

EXHIBIT 15

6-20-69

ARGONNE NATIONAL LABORATORY
HEALTH DIVISION

☐ CHECK HERE FOR COO-AEC

ACCIDENT OR EMERGENCY REPORT

NAME (LAST / FIRST / MIDDLE)	PAYROLL NO.	AGE	SEX
[redacted]	977	42	MALE

DIVISION OR DEPARTMENT	SUPERVISOR	JOB CLASSIFICATION
FPD	PANCNER	FIRE CHIEF

DATE OF INJURY	TIME	SCENE OF ACCIDENT OR EMERGENCY	DATE OF FIRST VISIT TO HEALTH DIVISION
6-17-69			6-17-69

INJURED PERSON'S EXPLANATION OF CAUSE OF INJURY: Some smoke from a sodium fire blew into his gloves.

DIAGNOSIS: Edema of both hands

DISPOSITION: Back to work

PROBABLE LOST TIME: None

(S) [signature] M.D.
F. W. Strehl, M.D.

HISTORY, PHYSICAL FINDINGS, TREATMENT:

June 17, 1969

On the dorsal aspect of both hands there is pitting edema 1 plus. The skin does not appear to be burned. He states that he has decontaminated the area thoroughly. To return in the morning for re-examination.

[signature]
F. W. Strehl, M.D.

FWS:dac

DISTRIBUTION: ORIGINAL - HEALTH DIVISION
DUPLICATE (2) - INDUSTRIAL SAFETY SECTION OF IHS

June 18, 1969

Edema involving the dorsal aspect of each hand has largely subsided.

A. J. Finkel, M.D.

AJF:mk/dac