
Draft

**ADVISORY BOARD ON
RADIATION AND WORKER HEALTH**

National Institute for Occupational Safety and Health

**REVIEW OF EXTERNAL DOSIMETRY RECORDS FOR
THE CHEMICAL PROCESSING PLANT 83.14 SEC
PERIOD (1975–1980)**

**Contract No. 211-2014-58081
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SC&A, INC.:

Technical Support for the Advisory Board on Radiation and Worker Health Review of NIOSH Dose Reconstruction Program

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ABBREVIATIONS AND ACRONYMS

Advisory Board or	
ABRWH	Advisory Board on Radiation and Worker Health
ANL-W	Argonne National Laboratory-West
CPP	Chemical Processing Plant
EE	energy employee
EBR-II	Experimental Breeder Reactor-II
HP	Health Physics
INL	Idaho National Laboratory
NIOSH	National Institute for Occupational Safety and Health
NRF	Naval Reactors Facility
ORAUT	Oak Ridge Associated Universities Team
SEC	Special Exposure Cohort
SRDB	Site Research Database
TLD	thermoluminescent dosimeter
V&V	verification and validation

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1 INTRODUCTION AND BACKGROUND

Based on its evaluation of Special Exposure Cohort (SEC) Petition 00219 for the Idaho National Laboratory (INL), the National Institute for Occupational Safety and Health (NIOSH) proposed that the following class be added to the SEC:

All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Idaho National Laboratory (INL) in Scoville, Idaho, and (a) who were monitored for external radiation at the Idaho Chemical Processing Plant (CPP) (e.g., at least one film badge or TLD dosimeter from CPP) between January 1, 1963 and February 28, 1970; or (b) who were monitored for external radiation at INL (e.g., at least one film badge or TLD dosimeter) between March 1, 1970 and December 31, 1974 for a number of work days aggregating at least 250 work days, occurring either solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort.

[NIOSH 2017a, page 1]

Although the end date for the recommended class was December 31, 1974, NIOSH indicated they were continuing to evaluate dose reconstruction feasibility for the period after 1974 at CPP via the 83.14 petition process. On July 20, 2017, NIOSH issued its evaluation of Petition-00238 (NIOSH 2017b) and recommended an additional class:

All employees of the Department of Energy, its predecessor agencies, and their contractors and subcontractors who worked at the Idaho National Laboratory (INL) in Scoville, Idaho, and who were monitored for external radiation at the Idaho Chemical Processing Plant (CPP) (e.g., at least one film badge or TLD dosimeter from CPP) between January 1, 1975 and December 31, 1980 for a number of work days aggregating at least 250 work days, occurring solely under this employment, or in combination with work days within the parameters established for one or more other classes of employees in the Special Exposure Cohort. [page 1]

This petition was presented to the Advisory Board on Radiation Worker Health (ABRWH) during Meeting Number 118 held on August 23, 2017, in Santa Fe, NM (ABRWH 2017). Based on previous deliberations concerning SEC-00219, NIOSH determined that some external dosimetry records (namely, temporary or visitor badges) had not been appropriately indexed and entered into the INL electronic dosimetry system. Consequently, these records were not properly included in individual dosimetry files and thus were not available for potential SEC determinations. An effort to properly code these additional dosimetry records is currently underway by the INL site.

In response to the coding effort undertaken by the site, the Advisory Board asked SC&A to evaluate the completeness of available dosimetry records and also propose potential test cases to validate that dosimetry records are being appropriately included in individual claimant files. This report presents SC&A's evaluation of the completeness of dosimetry records for the Chemical

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Processing Plant (1975–1980) in the context of individual SEC determinations. SC&A’s review is separated into four main areas of investigation:

- Evaluation of the completeness and availability of routine area exposure reports and construction exposure reports (see Section 2).
- Evaluation of the completeness and availability of temporary/visitor badges (see Section 3).
- Identification of claimants who could be used to verify and validate that dosimetry records have been correctly coded and identified with the individual worker to allow for SEC determinations (see Section 4).
- Review of a subset of claimant files to assess the practice of requiring a separate dosimetry badge for each area entered during a single monitoring cycle during the period of interest. This practice is often referred to as “multiple badges for multiple areas” (see Section 5).

The analysis in Sections 2 and 3 are to determine whether the currently available dosimetry records at INL are complete or, alternately, if it is apparent that there are missing records that may call the SEC badging requirement into question. Section 4 deals strictly with the issue related to whether the available records are being properly indexed and included in individual dosimetry requests. Finally, Section 5 investigates the important facet of the proposed definition in which it assumed that if you entered CPP, you received a CPP badge. Alternately, if one were allowed to enter CPP with a dosimetry badge obtained in another area (e.g., Test Area North, Central Facilities Area, Argonne National Laboratory-West), the class definition requirements would likely have to be expanded. Section 6 provides a brief overview of the findings and observations for each of these four areas of review and includes SC&A’s summary conclusions.

2 COMPLETENESS OF AREA EXPOSURE AND CONSTRUCTION EXPOSURE REPORTS

Dosimetry records for CPP most often come in a format known as “Area Exposure Reports” for most monitored workers;¹ these reports contain an electronic printout by site area and are sometimes organized by individual contractor. Characteristics and information contained on the area exposure reports include the following:

- Individual Health Physics badge number
- Name of individual
- Contractor
- Site area designation
- End date of exposure period

¹ “Construction Exposure Reports” are identical in format but were compiled separately for those workers strictly involved in construction projects.

Figure 2. Example of a Dosimetry Branch Activity Report for the Month of July 1975

Expected Number of Workers Monitored During Monthly Badging Cycle		MONTHLY AREA EXPOSURE RESUME						
		PERIOD COVERED 07/01/75 TO 07/31/75						
AREA	NUMBER OF INDIVIDUALS	FREQUENCY			TOTAL EXPOSURE		AVE. EXPOSURE MR	
		0-299	300-1199	1200+	BETA	GAMMA+NEUTRON		
34	35	35	0	0	0	50	1	
42	326	326	0	0	350	5260	16	
45	33	33	1	0	3645	2625	77	
53	527	519	8	0	29455	14115	26	
55	4	4	0	0	310	45	11	
113	14	13	1	0	0	1305	93	
115	64	59	5	0	8885	4275	66	
133	44	44	0	0	0	255	5	
135	2	2	0	0	25	20	10	
213	37	37	0	0	0	0	0	
244	10	10	0	0	0	30	3	
263	281	280	1	0	2385	7335	26	
265	14	14	0	0	0	325	23	
735	10	10	0	0	0	50	5	
754	46	45	1	0	445	840	18	
755	1	1	0	0	0	0	0	
772	77	77	0	0	510	1420	18	
775	4	4	0	0	30	20	5	
814	24	20	4	0	130	2900	120	
NRTS TOTALS	1554	1533	21	0	46170	40870	26	
TOTAL BADGES PROCESSED		1647						

NIOSH presented its comparison of the expected number of monitored workers contained in the summary reports to the available dosimetry logs in Figures 5-1 and 5-2 of the SEC-00238 evaluation report (NIOSH 2017b). These exact figures are not recreated here; however, SC&A obtained the data used in the comparison and reanalyzed it to show the numerical difference between the expected number of workers reported to have been monitored by month and the actual available records. In addition, SC&A presented the observed differences in the expected report totals and available records totals as a percentage of the expected report total per month. This analysis was done for both the regularly monitored workers contained in the area exposure reports (see Figures 3 and 4) and workers designated as construction workers found in the construction exposure reports (see Figures 5 and 6).

As can be seen in Figures 4 and 6, report summaries detailing the number of monitored workers by month were available for 49 of the 72 months of interest (68.1%). The largest observed temporal gap occurred from October 1975 to September 1976 (11 months total), with the remaining temporal gaps spanning 3 months or less. These gaps are specifically discussed later in this section.

Observation 1: A comparison of the expected number of monitored workers listed in the Dosimetry Branch activity reports to those tabulated in the available dosimetry logbooks contained in area and construction exposure reports was only available for 49 of the 72 months of interest (~68%). The largest temporal gap observed was 11 months; all others were 3 months or less.

For the majority of months for which data are available for comparison, there are more monitored workers observed in the area/construction exposure report logbooks than were indicated in the corresponding Dosimetry Branch activity report totals (see Figures 3 and 5 for regular and construction workers, respectively). Some notable exceptions include August 1978

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for regularly monitored workers (20 additional workers were indicated to have been monitored than were found in the dosimetry lists). For workers designated as construction workers, the periods in August and September of 1978 as well as July 1979 indicated between 17 and 31 additional workers were monitored who were not located in the Construction Exposure Report listings.

Figures 4 and 6 put the observed differences in total workers into a percentage of the total expected monitored workforce as indicated by the Dosimetry Branch activity reports. For example, if the Dosimetry Branch activity reports indicated 100 workers were monitored externally and 90 were observed in the corresponding area exposure reports, then the available dosimetry records would represent 90% of the expected monitored workforce. Conversely, if there were 110 workers observed in the area exposure reports, then the available dosimetry records would represent 110% of the expected monitored workforce.

For the regular (non-construction) workers at CPP, the percent of the total monitored workforce found in available area exposure report logbooks generally fluctuated within $\pm 1\%$ of the expected total (this occurred in 39 of 49 months analyzed). As indicated in Figure 3, records indicate 20 additional workers were monitored in August 1978 than could be found in the area exposure reports. This indicates that 98.1% of the expected monitoring total was found in the dosimetry listings.

For construction workers at CPP, the fluctuations in total percentage were more pronounced, with only approximately 25% of the evaluated months falling within 1% of the expected total. The range of percentages ranged from a low of 85.3% in August 1978 to a high of 118.5% in November 1980.

Figure 3. A Comparison of the Number of Regular Monitored Workers Found in the Area Exposure Reports versus the Expected Number of Monitored Workers Reported in INL Dosimetry Branch Monthly Summaries

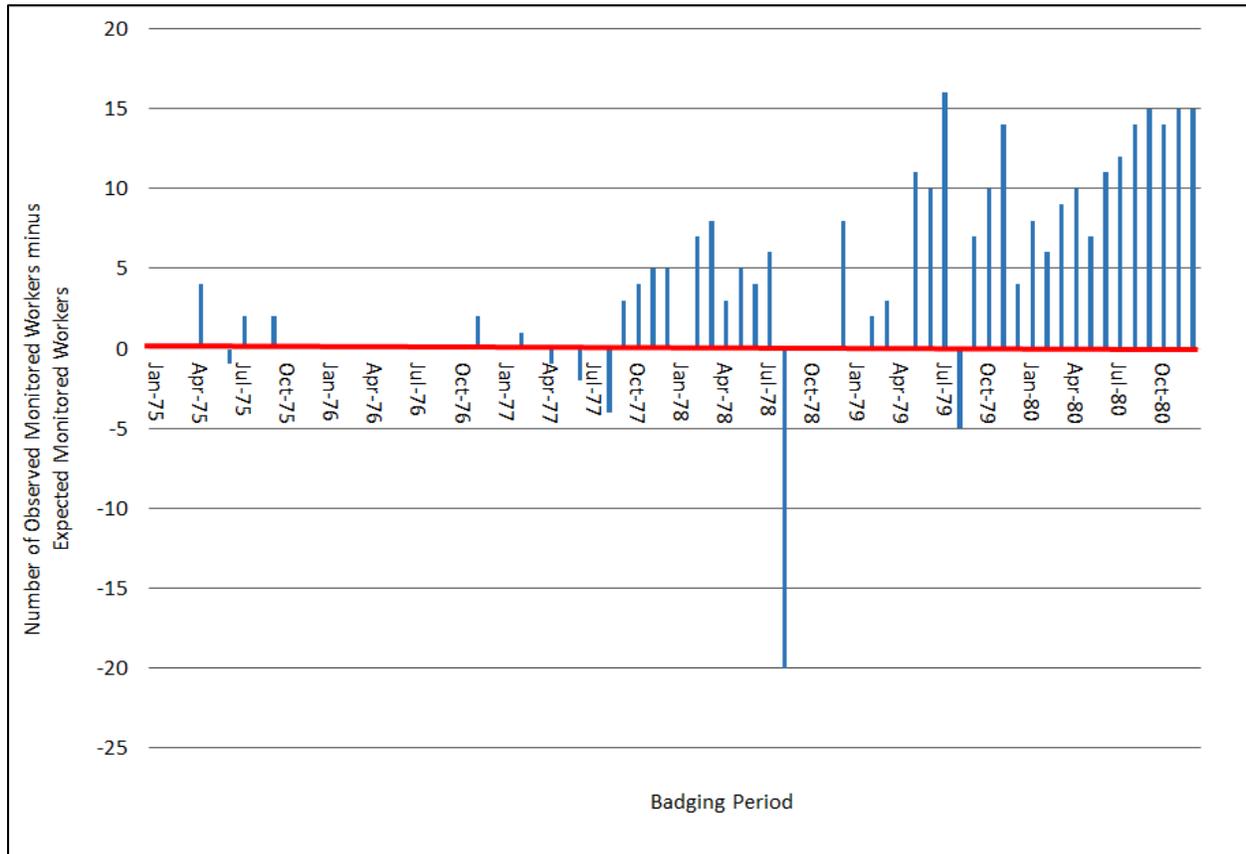


Figure 4. A Comparison of the Percentage of Regular Monitored Workers Found in the Area Exposure Reports versus the Expected Number of Monitored Workers Reported in INL Dosimetry Branch Monthly Summaries

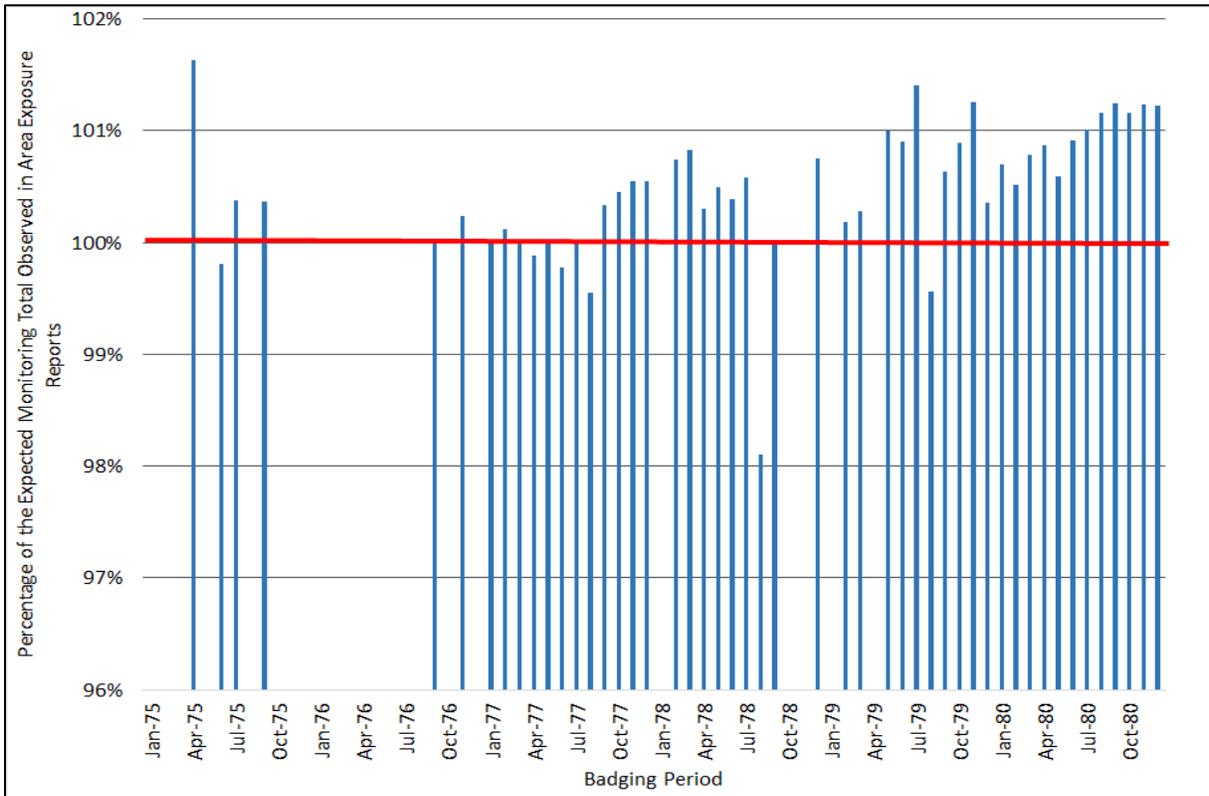


Figure 5. A Comparison of the Difference in the Number of Monitored Construction Workers Found in the Area Exposure Reports versus the Expected Number of Monitored Workers Reported in INL Dosimetry Branch Monthly Summaries

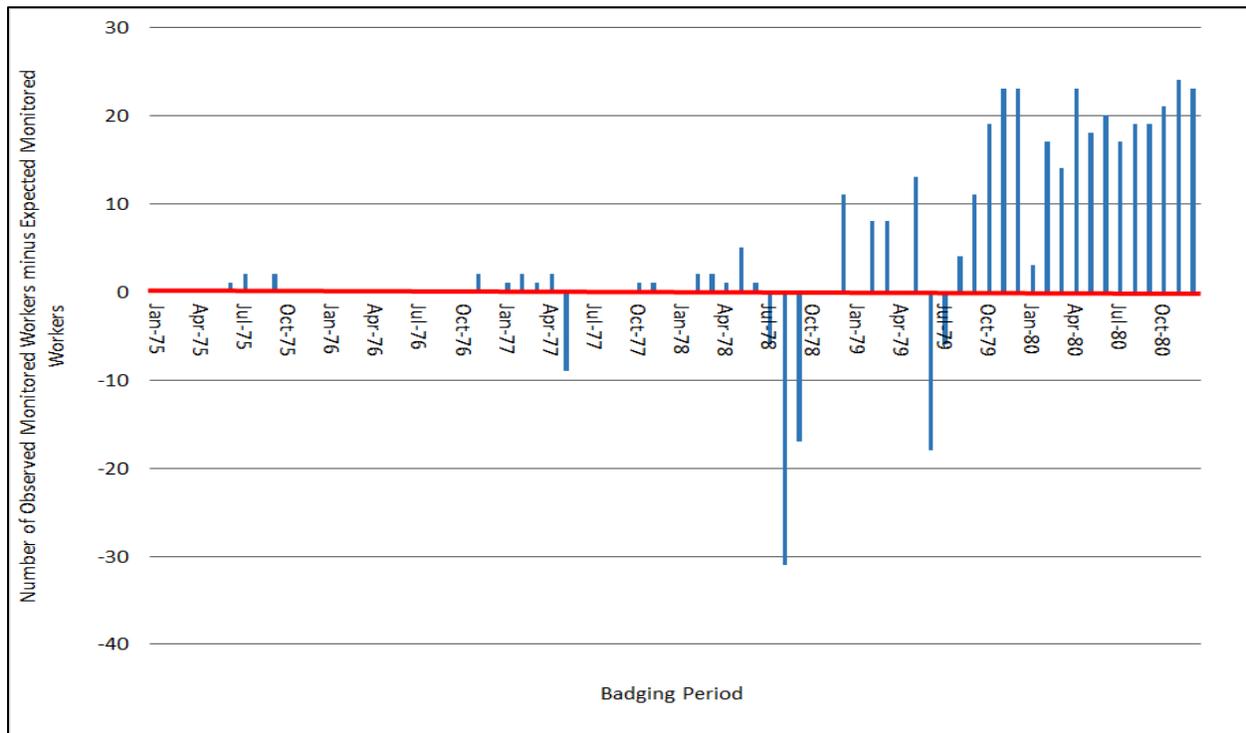
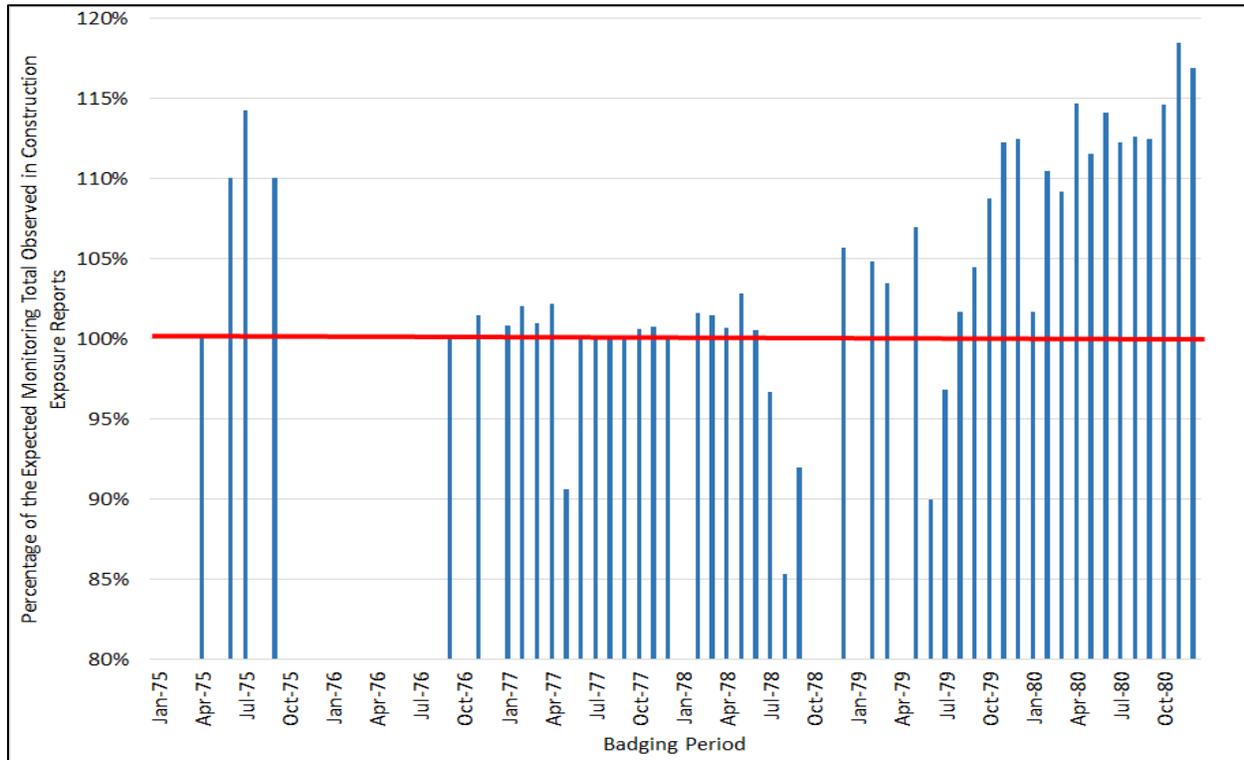


Figure 6. A Comparison of the Percentage of Monitored Construction Workers in the Area Exposure Reports versus the Expected Number of Monitored Workers Reported in INL Dosimetry Branch Monthly Summaries



As noted in Observation 1, direct comparisons between expected number of monitored workers and the actual number of monitored workers located in the area exposure report logbooks were available for 49 of 72 months during the period of interest. In addition, the largest observed gap in available comparisons was 11 months from October 1975 to September 1976. Although not as useful as comparing the number of monitored workers in a given period, comparing the total number of dosimeters reported to have been processed to the number available in the dosimetry logs would provide some indication of the completeness of available records during those months in which the total number of monitored workers is unknown. Accompanying the area exposure reports for each monthly monitoring cycle is a summary cover page listing the total number of badges serviced in a given period. An example of a summary cover page can be seen in Figure 7 in the next section (Section 3) for the badging period from January 1, 1975, to January 31, 1975.

Analyzing the number of dosimeters per period requires some additional considerations, such as:

- Is the dosimeter entry actually during the period of interest or some earlier period?
- Was the dosimeter actually processed and numerical results provided?
- Is the dosimeter actually from CPP or another area, such as the Experimental Breeder Reactor-II (EBR-II)?

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In addition, SC&A observed that some records were duplicated in the references cited in NIOSH 2017b and could result in double counting. The occurrence of duplicate records might also affect the comparisons of the total number of monitored workers presented above and is discussed later in this section.

The comparison between SC&A's tabulation of total dosimeters per period and the number of dosimeters reported to have been processed is shown in Tables 1 and 2 for regular workers and construction workers, respectively. As seen in these tables, the comparison between SC&A's manual tabulation and the number of dosimeters reported to have been processed generally showed reasonable agreement. Based on SC&A's analysis, 19 of the 24 analyzed monitoring periods either matched or showed a higher total than the number of reported badges processed for both regular and construction dosimeters.

Table 1. Comparison of Reported Total Regular Dosimeters Processed to SC&A's Tabulation of Dosimeter Entries for Months in which No Completeness Analysis Was Possible in NIOSH 2017b

Monitoring Period	SC&A Total Dosimeters*	Reported Number of Dosimeters Processed	Differential (Reported Total – SC&A Total)
January 1975	288	286	-2
February 1975	317	317	0
March 1975	312	309	-3
May 1975	289	288	-1
August 1975	604	599	-5
October 1975	610	610	0
November 1975	618	621	3
December 1975	678	675	-3
January 1976	810	808	-2
February 1976	921	921	0
March 1976	1,083	1,085	2
April 1976	1,033	1,034	1
May 1976	825	818	-7
June 1976	841	834	-7
July 1976	894	889	-5
August 1976	817	815	-2
October 1976	884	882	-2
December 1976	1,063	1,066	3
January 1978	1,154	1,142	-12
October 1978	1,172	1,157	-15
November 1978	1,081	1,078	-3
January 1979	1,069	1,066	-3
April 1979	1,211	1,200	-11

*Total includes only dosimeters that have numerical results reported, were in period, and identified as from CPP.

Table 2. Comparison of Reported Total Construction Dosimeters Processed to SC&A's Tabulation of Dosimeter Entries for Months in which No Completeness Analysis Was Possible in NIOSH 2017b

Monitoring Period	SC&A Total Dosimeters*	Reported Number of Dosimeters Processed	Differential (Reported Total – SC&A Total)
January 1975	74	72	-2
February 1975	49	49	0
March 1975	28	28	0
May 1975	11	9	-2
August 1975	15	14	-1
October 1975	6	3	-3
November 1975	7	4	-3
December 1975	10	10	0
January 1976	38	38	0
February 1976	63	62	-1
March 1976	139	145	6
April 1976	112	92	-20
May 1976	67	76	9
June 1976	109	95	-14
July 1976	95	102	7
August 1976	139	133	-6
October 1976	167	175	8
December 1976	313	311	-2
January 1978	121	107	-14
October 1978	304	299	-5
November 1978	144	138	-6
January 1979	142	141	-1
April 1979	205	201	-4

*Total includes only dosimeters that have numerical results reported, were in period, and identified as from CPP.

Observation 2: SC&A's analysis of the total number of dosimeters in available records compared to the total number of dosimeters that were reported to have been processed during the observed temporal gaps showed reasonable agreement for both regular badges and construction badges. SC&A found no indication that available dosimetry logbooks for regular and construction badges are incomplete during these periods.

As stated previously, SC&A's review of the area/construction exposure reports noted that duplicate dosimetry results were included in the captured references for some monitoring periods. Specifically, a given dosimetry entry would appear in separate logbook locations but contained an identical name, date, result and sequential number (PSN number). This would be a cause for concern if not properly accounted for, as it would artificially inflate the total number of observed monitored workers used in comparison to the expected monitoring totals. SC&A identified duplicate records for the following monitoring periods:

- November 1975
- February–September 1976

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- April and October 1977
- January, February, April, and May 1980

SC&A independently tabulated the number of monitored workers in these months and accounted for any duplicate records (the exceptions are November 1975 and February through July of 1976³). SC&A’s total compared very well with NIOSH’s total, as shown in Table 3. Although the SC&A and NIOSH totals do not match exactly, it is clear that proper adjustments were made to account for duplicate records contained in the available references.

Table 3. Comparison of SC&A and NIOSH Totals of Monitored Workers during Period with Duplicate Records Observed

Monitoring Period	Total Duplicate Records Observed	Number of Monitored Workers (SC&A)	Number of Monitored Workers (NIOSH)
September 1976	173	787	786
April 1977	218	879	875
October 1977	136	893	895
January 1980	31	1,156	1,152
February 1980	204	1,167	1,167
April 1980	46	1,155	1,160
May 1980	256	1,183	1,181

Observation 3: SC&A noted that the available area exposure reports often contained duplicate entries for the same dosimetry badge entry, which would have the potential to artificially inflate the total number of monitored workers identified during a given period. However, SC&A’s independent analysis of those periods with duplicate records showed excellent agreement with NIOSH’s reported totals; therefore, it is evident that NIOSH had made appropriate adjustments to account for duplicate records.

3 REVIEW AND DISCUSSION OF AVAILABLE TEMPORARY BADGING RECORDS

The previous section concentrated on the area and construction exposure reports that were cited and analyzed in the SEC-00238 petition evaluation report (NIOSH 2017b). Figure 7 shows an example screenshot of the summary page from an area exposure report. Of particular note is the fact that Figure 7 indicates that zero “temporary badges” were processed during this period. However, as seen in Figure 1 (Section 2), there were badges designated with a “V” to indicate a visitor, so it is apparent that at least some temporary/visitor badges are included in the area/construction exposure reports. These visitor badges are likely included in the “special pulls” total shown in Figure 7. However, it is important to note that *all* summary cover pages for

³ These periods were omitted because no comparisons between the reported total of monitored workers and the number of monitored workers contained in the available records were possible, as noted in NIOSH 2017b. However, duplicate records were accounted for in the previous analysis comparing the number of dosimeters listed in the referenced logbooks to the number of dosimeters reported to have been processed.

reports during the period of interest (1975–1980) indicate that zero “temporary badges” were processed during their respective badging cycles.

Figure 7. Example of Monthly Area Exposure Report Summary Cover Page

CPP AREA EXPOSURE REPORT SUMMARY							02/10/75
CONTRACTOR AEROJET NUCLEAR COMPANY		147 PERIOD COVERED FROM 01/01/75 TO 01/31/75					
TABULATION OF ALL EXPOSURES CHARGED TO AREA							
	N-PEN	PENET	NEUTRON	TOTALS	DOSIMETERS PROCESSED	NEUTRON FILMS PROCESSED	
TEMPORARY BADGES	00	00	00	00	0	0	
SCHEDULED BADGE SERVICE	13140	13615	00	26755	220	0	
SPECIAL PULLS	24205	11010	00	35215	66	0	
TOTALS	37345	24625	00	61970	286	0	

FREQUENCY DISTRIBUTION OF EXPOSURES RECORDED IN CURRENT PERIOD							
(NUMBER OF INDIVIDUALS IN EACH EXPOSURE RANGE)							
MREM EXPOSURE RANGE (LT)	20	200	600	800	1000 (GE)	1000	
BETA	105	100	20	2	5	12	
GAMMA	85	121	30	5	2	1	
NEUTRON	244	0	0	0	0	0	

SC&A identified a set of temporary badge reports for the period of interest 1975–1980 (INL various dates-a, -b). However, it was apparent that the available captured temporary badge reports were likely not complete. SC&A requested clarification as to the disposition of any remaining temporary badge reports that might still be available at INL. NIOSH/Oak Ridge Associated Universities Team (ORAUT) indicated that those reports are likely available but had not been captured due to the focus of previous data capture efforts (Findley 2017).

Finding 1: SC&A located temporary badge reports during the period of interest; however, it is apparent that the currently available records are incomplete. Additional temporary badge reports are likely available at the site but have not been captured due to the focus of previous data capture efforts. It would be beneficial that such reports be obtained and reviewed to assure completeness of dosimetry records for use in potential SEC adjudication. Furthermore, capture of these records would allow for the expansion of available candidates for verification and validation reviews discussed in Section 4 of this report.

Figure 8 shows an example of a temporary badge report (names have been redacted). Note that this style of report also contains an entry column for a “Permanent Badge No.,” also known as an HP badge number. In the example report shown in Figure 8, the Permanent Badge No. entries are blank. To assess the extent to which the entries on the identified temporary badge reports are reflected in the official area exposure reports described in Section 2, SC&A compiled all temporary badge entries with zero recorded dose.⁴ SC&A identified 258 temporary badges in the available temporary badge reports that indicated zero recorded dose for the energy employee (EE). SC&A then compared these zero dose entries to the area/construction exposure reports covering the same time period to determine if these badging records had been appropriately included in the official dosimetry records. Of those 258 temporary badges reviewed, 219 (~85%)

⁴ As discussed previously, badges with zero recorded dose were selected due to previously identified problems with the coding of zero-dose visitor/temporary badges in the official INL dosimetry system.

could not be located in the corresponding area exposure reports. All of the remaining temporary badges (39 of 219) that had been migrated to the area/construction exposure reports had a “Permanent Badge No.” indicated on the original temporary badge report. This indicates that temporary badges indicating zero accrued dose were likely only migrated to CPP’s official dosimetry record if the EE already had a Health Physics badge number assigned.

Figure 8. Example of a Temporary Badge Report for CPP from March 1975

TEMPORARY BADGE REPORT

ID - 100
(R - 4 - 63)

Badging Area: CPP

Permanent HP Badge # (blank): _____

Report Date: 3/10/75

TEMP. BADGE NO.	NAME	EMPLOYER (SPELL OUT)	DATES USED	PERMANENT BADGE NO.	BETA	GAMMA	NEUTRON
	[REDACTED]	ANC	1/16-2/16/75		0	30	
	[REDACTED]	ANC	2/10-2/14/75		100	0	
	[REDACTED]	ANC	1/13-2/21/75		0	70	

Finding 2: Based on a review of the limited available temporary badge reports from 1975 and 1980, workers who accrued zero measured dose and did not have a permanent Health Physics badge indicated in the temporary badge report do not appear to be consistently migrated into the official area exposure reports for CPP. This does not necessarily indicate that such temporary badge entries are unavailable for dose reconstruction and/or SEC adjudication. However, it does indicate that determinations of the completeness of records using area exposure reports are likely based on incomplete data and information.

4 IDENTIFICATION OF VERIFICATION AND VALIDATION CASES

As discussed in the previous section, concerns remain for workers who were assigned temporary badges that did not measure a positive external dose and who had not been previously assigned a Health Physics number. While the site retained these temporary/visitor badges, the results do not appear to have been consistently migrated into the electronic dosimetry system used by the INL Dosimetry Branch. Current efforts are underway by INL to capture and code these additional data so they can be accurately and easily retrieved during records requests for an individual EE.

Verification that this coding and indexing effort is effective is important for all dose reconstructions performed by NIOSH, but it is especially important in the context of the proposed SEC because of the specific dosimetry requirements of the currently recommended definition. Previously, SC&A proposed a verification and validation approach to address an earlier SEC during the period 1963–1970 at CPP (SEC-00219). That proposal identified a subset of claimants that were identified in captured temporary badge records but whose previously transmitted monitoring files had not contained those temporary badges. Ideally, once the coding and indexing effort is completed by INL, any new records requests for these individuals would correctly include these temporary badges. The proposal for the earlier SEC period is detailed in

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the SC&A memorandum, *Update on Validation and Verification of INL CPP Temporary Badge Database – Expansion of Claimant Pool (1963–1970)* (SC&A 2017). As part of that effort, SC&A focused only on claimants who would still require a dose reconstruction because the individual either would not qualify for the SEC or would require adjudication of medical benefits for non-SEC cancers.

However, because only a portion of temporary badge records had previously been captured for the period of interest in this report (1975–1980), there were simply not enough data to focus only on claimants who would require a dose reconstruction. Therefore, SC&A considered any claimants included in the captured temporary badges as candidates for potential verification activities. Additionally, SC&A reviewed any “visitor” entries in the main area/construction exposure reports to potentially expand the pool of verification and validation (V&V) candidates. SC&A’s examination of these records identified the following dosimetry entries for further comparison with current claimant monitoring records:

1. Available Temporary Badge Reports: any claimant with a dosimeter reading of zero (22 claims identified covering 23 total badges)
2. Area Exposure Reports: any claimant with the “visitor” designation associated with their dosimetry entry (44 claims identified covering 63 total badges⁵)

From the first group of identified claimants (temporary badges), 11 of the badges were already contained in the claimant monitoring record, 11 were not currently contained in the claimant record, and 1 was unknown at this time.⁶ From the second group of identified claims (“visitors” in the area/construction exposure records), 56 of 63 records were already contained in the claimant monitoring file, 4 were not found, and 3 claimant files only contained annual summaries of external doses. Therefore, a total of 18 samples (11 temporary badges and 7 visitor badges) were identified as candidates for V&V records requests. These 18 candidates are described in Tables 4 and 5 for temporary badges and visitor entries, respectively.

⁵ To try to expand the group of available claimants, SC&A considered both zero and positive dosimeter readings.

⁶ The U.S. Department of Energy had not yet responded to a records request for this individual [REDACTED].

Table 4. Description of 11 Candidate Entries Identified in Limited Temporary Badge Records

[REDACTED]	End Date of Record	Employer on Record*	Dose Reconst. Required?	Additional Comments
[REDACTED]	1/17/1975	ANL-W	Yes	The claimant files did contain two other CPP temporary badges during the period of interest (August and July 1975).
[REDACTED]	4/1/1976	ANL-W	Yes	—
[REDACTED]	4/14/1976	ANL-W	Yes	The claimant had a positive CPP visitor badge included in their monitoring file from July 1976.
[REDACTED]	4/27/1976	ANL-W	Yes	—
[REDACTED]	11/4/1976	ANL-W	Yes	The claimant would currently require a dose reconstruction because covered employment at INL ends in 1962.
[REDACTED]	11/4/1976	ANL-W	Yes	The claimant would currently require a dose reconstruction because there is no covered employment currently identified at INL.
[REDACTED]	11/16/1976	ANL-W	No	The claimant has extensive dosimetry associated with CPP beginning in 1977 currently contained in their monitoring record.
[REDACTED]	12/1/1976	ANL-W	Yes	—
[REDACTED]	3/18/1977	Allied Chemical Co.	No	The EE had a permanent badge number entered on temporary badge records ([REDACTED]).
[REDACTED]	3/31/1977	Allied Chemical Co.	No	The Location File Card contained in the claimant monitoring record is reflective of visiting CPP during March 1977, but the temporary badge was not found.
[REDACTED]	11/11/1977	ANL-W	Yes	Though covered employment does not begin until 1989 for this claimant, evidence in Department of Labor files suggests the EE may have been employed at [REDACTED] during the period of interest.

*ANL-W = Argonne National Laboratory-West.

Table 5. Description of Seven Candidate Entries Identified as “Visitors” in Area Exposure Reports

	End Date of Record	Employer on Record	Dose Reconst. Required?	Additional Comments
	7/15/1976	Aerojet Nuclear Co.	No	The available claimant file only contains annual summaries covering this visitor badge.
	1/15/1975	Aerojet Nuclear Co.	Yes	The available claimant file only contains annual summaries covering 1975. In addition to the visitor badge, 8 regular badges associated with CPP were also issued during 1975.
	1/9/1975	Aerojet Nuclear Co.	No	The claimant had 7 different visitor badges at CPP during 1975; 5 of the 7 were already contained in the claimant’s monitoring record.
	1/29/1975	Aerojet Nuclear Co.	No	—
	9/29/1975	Aerojet Nuclear Co.	Yes	—
	1/21/1976	Aerojet Nuclear Co.	No	Note: this claimant was also included in the temporary badge records described in Table 4.
	2/16/1976	Aerojet Nuclear Co.	No	Note: this claimant was also included in the temporary badge records described in Table 4.

Observation 4: Based on its review of limited temporary badges and dosimetry entries designated as “visitor” in the main area/construction exposure reports, SC&A was able to identify just 18 external dosimetry entries from the claimant population that could be used for future verification and validation review. However, if the full set of temporary badge reports is captured at INL, the available population of V&V candidates would likely increase markedly.

5 MULTIPLE BADGES FOR MULTIPLE AREAS – CLAIMANT STUDY

In addition to establishing the completeness of available dosimetry records and validating that they are correctly coded to the INL dosimetry system, another significant facet of the 83.14 class definition is the notion that the INL site transitioned from a “one badge-multiple area” policy to a “multiple badge-multiple area” policy. In the former situation, workers were able to take a badge from one major site area and use that badge for entrance into another area. In the latter situation, monitored workers would leave an area-specific badge when exiting that area and would be assigned a second badge if entering another area. This is especially important in the current 83.14 SEC class definition because it requires that a “CPP-specific” dosimetry badge be in evidence to prove potential exposure in the plant.

To assess the extent to which the site used a “multiple badge-multiple area” policy during the period of interest (January 1, 1975–December 31, 1980), SC&A examined a random sample of claimants and compiled data related to the number of different area badges observed for an individual during a given monthly badging cycle. At the time of its review, SC&A determined

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that there were 462 claimants with verified employment during the 83.14 SEC period. The goal of the study was to compile information on one quarter (~25% or 115 claimants) out of that group. However, during the random sampling of the 462 total claims, it became evident that several claims were not germane to the study and so were rejected as part of the reviewed subset of claimants. SC&A rejected claims from the study for the following reasons:

- General Lack of Monitoring: the claimants were not monitored at INL or were monitored outside the period of interest (36 randomly selected claims rejected).
- Quality of Monitoring Records: only annual or career summaries are available, making it impossible to determine individual badging practices (nine randomly selected claims rejected).
- Limited Work Duration: the EE only worked for a few weeks or months during the period of interest (five randomly selected claims rejected).
- Job Title/Description: the type of work performed would not likely pose the potential for movement among different areas (four randomly selected claims rejected, which included two [REDACTED] workers, a [REDACTED] instructor, and an [REDACTED]).

The rejected claims were replaced with additional randomly selected claimants. SC&A categorized each of the 115 claims used in the sampling analysis into nine generic job types, as shown in Figure 9. As seen in the figure, 40% of the sampled claimant population was classified as “Construction Trades/Maintenance” and 23% was classified as “Engineers/Technicians.” The remaining seven job categories individually contributed less than 10% of the total.

Figure 9. Distribution of Generic Job Types Included in the Claimant Sampling

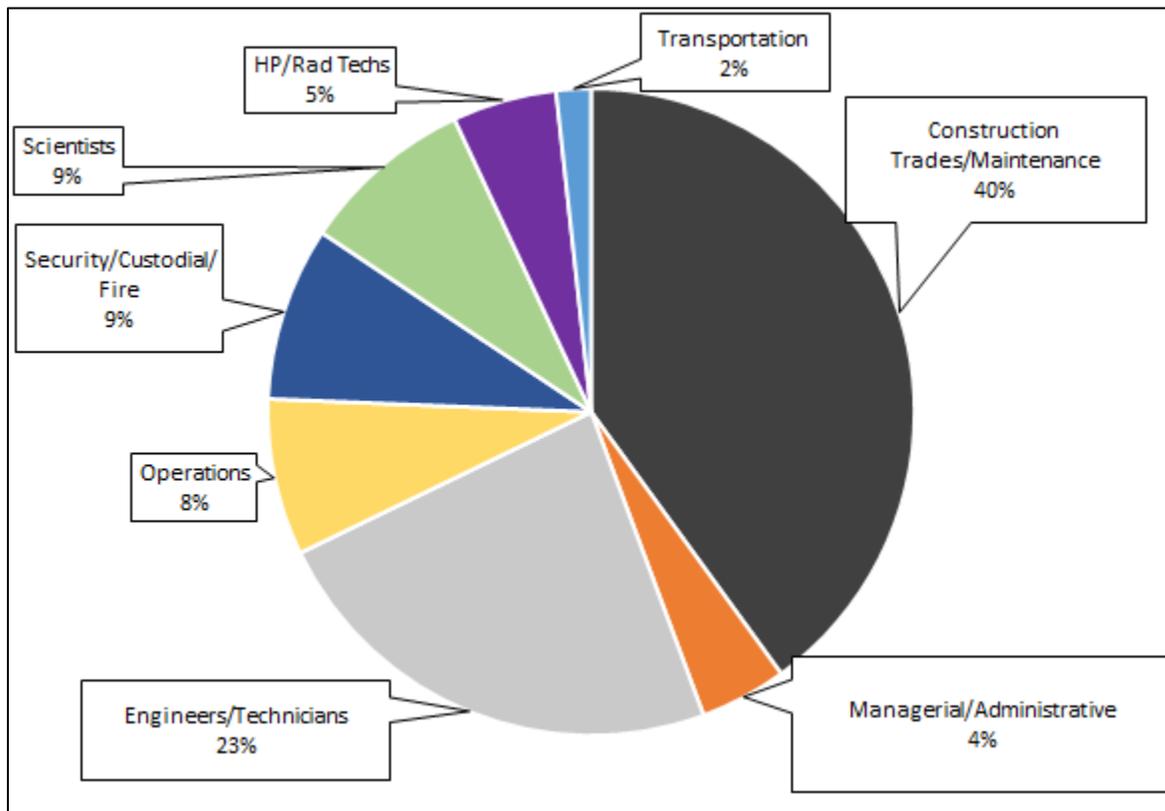


Table 6 summarizes the results of the job-specific analysis of multiple badging for multiple areas. Approximately 48% of the “Construction Trades/Maintenance” claims contained at least one badging cycle that included dosimeter results for multiple areas. On average, approximately 13% of the monitored dosimeter cycles per claim for this job category contained multiple badges. The average number of area badges per dosimeter cycle for this group was 1.27, which was only eclipsed by the 1.41 area badges per cycle for the five “Managerial/Administrative” claims surveyed. The highest number of area badges observed in a single cycle for any job category was six, which occurred for a “Construction Trades/Maintenance” worker.⁷

⁷ The claim had observed area badges in December 1975 at the [REDACTED].

Table 6. Summary of Job Title Analysis of Multiple Badging in Multiple Areas

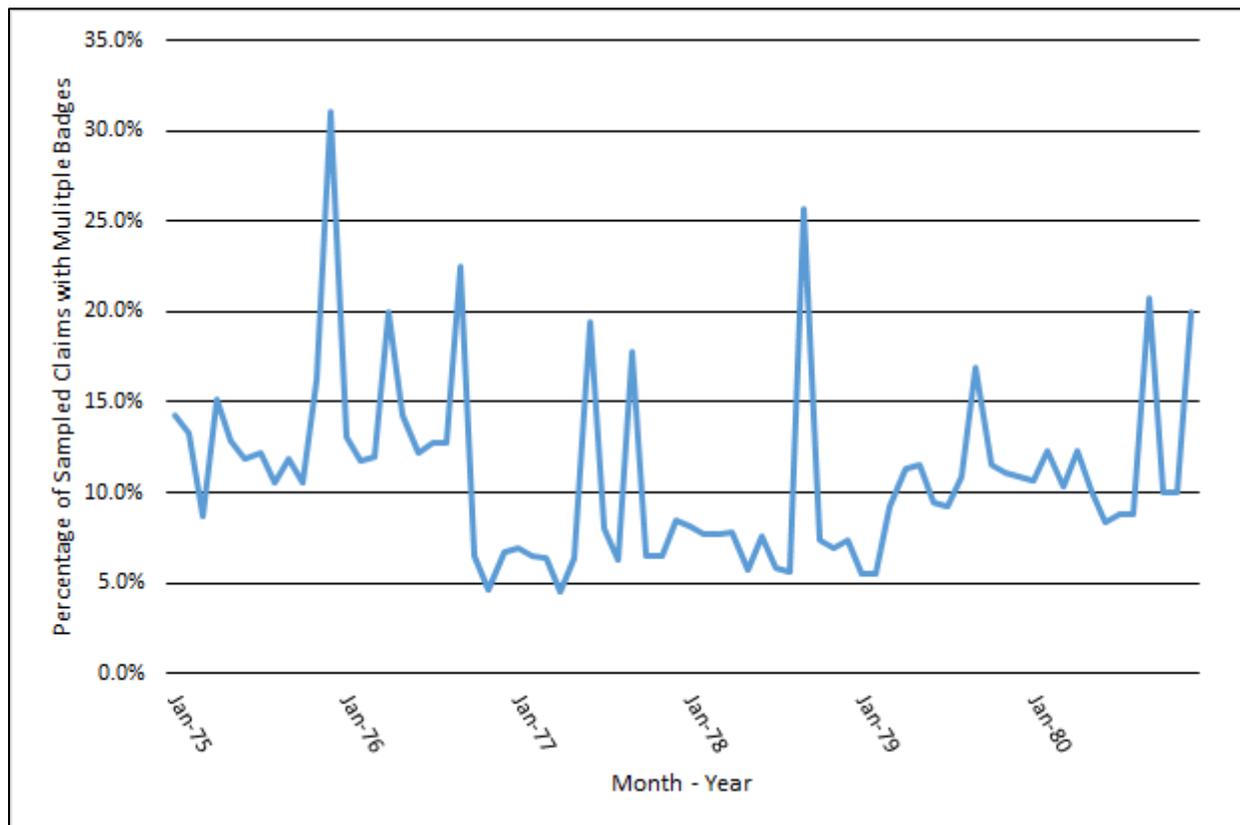
SC&A Work Designation	Total Claims Sampled	Percentage of Claims with Evidence of Multiple Badges	Average Percentage of Multiple Badge Cycles per Claim	Maximum Percentage of Multiple Badge Cycles per Claim	Average Number of Observed Badges per Cycle	Maximum Number of Badges per Cycle
Construction Trades/Maintenance	46	47.8%	13.3%	87.5%	1.27	6
Engineers/Technicians	27	40.7%	10.4%	100.0%	1.03	3
Scientists	10	20.0%	0.7%	4.3%	1.01	2
Security/Custodial/Fire	10	40.0%	16.9%	100.0%	1.20	5
Operations	9	33.3%	2.8%	12.1%	1.04	3
HP/Rad Techs	6	50.0%	16.2%	50.0%	1.10	4
Managerial/Administrative	5	40.0%	24.4%	100.0%	1.41	3
██████████	2	0.0%	0.0%	0.0%	1.00	1

Observation 5: With the exception of two ██████████, all sampled job categories showed evidence of multiple area badges during a single dosimetry cycle. The maximum number of observed area badges during a single dosimetry cycle was six, which occurred for a “Construction Trades/Maintenance” worker in December 1975.

In addition to the job-specific analysis, SC&A analyzed the sampled claimant population by monitoring cycle. The purpose of the temporal analysis was to identify any time periods in which the policy of multiple badges for multiple areas may not have been applied. Figure 10 shows the percentage of sampled claims who had multiple badges during a single dosimetry cycle by month. As seen in the figure, the percentage generally fluctuates between 5 and 20%, with a maximum of 31.1% in December 1975. The average for the entire period was 11%. There was no month in which instances of multiple badges for multiple areas was not observed. Finally, there does not appear to be a discernable temporal trend in the percentage of claims with multiple badges per dosimetry cycle during the period of interest.

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Figure 10. Percentage of Sampled Claims with Multiple Badges for Multiple Areas by Month



Observation 6: The practice of multiple area badges during a single dosimetry cycle was observed for at least some sampled claims during every month during the period of interest. Furthermore, there does not appear to be a discernable temporal trend in the percentage of claims exhibiting multiple area badges per dosimetry cycle; thus, the use of multiple area badges appears to be a consistent policy. The percentage of sampled claims with multiple badges per dosimetry cycle generally fluctuated from 5 to 20%.

6 SUMMARY AND CONCLUSIONS

As stated in Section 1, SC&A’s review of the 83.14 class definition included four main facets: evaluation of completeness of main area/construction exposure reports, review of available temporary badge reports, identification of potential verification and validation claims, and confirmation of the “multiple badges for multiple areas” policy at INL.

As detailed in Section 2, SC&A found no substantive reason to believe that the captured area and construction exposure reports are incomplete. Although there were temporal gaps in the ability to assess the completeness of these records by analyzing the number of monitored workers, comparisons of the total number of processed dosimeters do not indicate that completeness of the area/construction dosimetry logs is of concern. Furthermore, SC&A’s analysis established that appropriate adjustments had been made in NIOSH’s original completeness analysis to account for the existence of duplicate records in the captured references.

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SC&A’s examination of the available temporary badge records in Section 3 indicated that worker dosimetry results with zero accrued dose, and for which no permanent Health Physics badge had been previously assigned, were not generally migrated into the official area/construction exposure records. Additionally, SC&A determined that the captured temporary badge records available for analysis are currently incomplete. Evidence suggests that additional temporary badge records are available at the site. It would be beneficial to capture these additional temporary badge records, in particular when considering the limited number of V&V cases that were identified in Section 4 (18 total cases).

Finally, SC&A’s review of a substantial portion of the claimant population indicated that the practice of “multiple badges for multiple areas” was evident throughout the period of interest (January 1975 to December 1980). As expected, the analysis by job category indicated that more transient jobs, such as construction/maintenance workers, had the highest prevalence of multiple area badges during a given monitoring period. Additionally, temporal analysis of the multiple badging practice indicated no significant changes or gaps in policy.

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