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ADVISORY BOARD ON RADIATION AND WORKER HEALTH

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

A REVIEW OF NIOSH'S PROGRAM EVALUATION REPORT OCAS-PER-005, "MISINTERPRETED APPLICATION OF THE EXTERNAL DOSE FACTOR FOR HANFORD DOSE RECONSTRUCTIONS"

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S. COHEN & ASSOCIATES: ***Technical Support for the Advisory Board on Radiation & Worker Health Review of NIOSH Dose Reconstruction Program***	Document No. SCA-TR-PR2013-0013 Effective Date: Draft – January 10, 2013
A Review of NIOSH's Program Evaluation Report OCAS-PER-005, "Misinterpreted Application of the External Dose Factor for Hanford Dose Reconstructions"	Page 2 of 17
Task Manager: _____ Date: _____ Steve Marschke	Supersedes: Rev. 0
Project Manager: _____ Date: _____ John Stiver, CHP	Reviewer(s): John Mauro John Stiver Steve Marschke Kathleen Behling

Record of Revisions

Revision Number	Effective Date	Description of Revision
0 (Draft)	12/19/2012	Initial issue
1 (Draft)	01/10/2013	Minor changes in the text were done for clarification purposes, minor typographical errors corrected, and updates were made to the case status column in Appendix B.

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ABBREVIATIONS AND ACRONYMS

Advisory Board	Advisory Board on Radiation and Worker Health
AEC	Atomic Energy Commission
DR	Dose Reconstruction
DOL	Department of Labor
EE	Energy Employee
IARC	International Agency for Research on Cancer
NIOSH	National Institute for Occupational Safety and Health
NOCTS	NIOSH OCAS Claims Tracking System
OCAS	Office of Compensation Analysis and Support
ORAUT	Oak Ridge Associated Universities Team
PEP	Program Evaluation Plan
PER	Program Evaluation Report
POC	Probability of Causation
Rem	Roentgen equivalent man
SC&A	S. Cohen and Associates (SC&A, Inc.)
SRDB	Site Research Database
TBD	Technical Basis Document
TLD	Thermoluminescent dosimeter

1.0 STATEMENT OF PURPOSE

To support dose reconstruction (DR), the National Institute for Occupational Safety and Health (NIOSH) and the Oak Ridge Associated Universities Team (ORAUT) have assembled a large body of guidance documents, workbooks, computer codes, and tools. In recognition of the fact that all of these supporting elements in DR may be subject to revisions, provisions exist for evaluating the effect of such programmatic revisions on the outcome of previously completed DRs. Such revisions may be prompted by document revisions due to new information, misinterpretation of guidance, changes in policy, and/or programmatic improvements.

The process for evaluating potential impacts of programmatic changes on previously completed DRs has been proceduralized in OCAS-PR-008, *Preparation of Program Evaluation Reports and Program Evaluation Plans* (OCAS 2006b). This procedure describes the format and methodology to be employed in preparing a Program Evaluation Report (PER) and a Program Evaluation Plan (PEP).

A PER provides a critical evaluation of the effect(s) that a given issue/programmatic change may have on previously completed DRs. This includes a qualitative and quantitative assessment of potential impacts. Most important in this assessment are the potential impacts on the Probability of Causation (POC) of previously completed DRs with POCs <50%.

As needed, a PEP may be issued that serves as a formal notification of an impending PER. The PEP provides a preliminary description of the issue(s) that will be addressed in the PER, and summarizes the likely scope of the effort required to complete the PER.

During an Advisory Board meeting on May 20, 2012, SC&A was tasked by the Advisory Board to conduct a review of OCAS-PER-005, *Misinterpreted Application of the External Dose Factor for Hanford Dose Reconstructions* (OCAS 2006a). In conducting a PER review, SC&A is committed to perform the following five subtasks, each of which is discussed in this report:

Subtask 1: Assess NIOSH's evaluation/characterization of the "issue" and its potential impacts on DR. Our assessment intends to ensure that the issue was fully understood and characterized in the PER.

Subtask 2: Assess NIOSH's specific methods for corrective action. In instances where the PER involves a technical issue that is supported by document(s) (e.g., white papers, technical information bulletins, procedures) that have not yet been subjected to a formal SC&A review, Subtask 2 will include a review of the scientific basis and/or sources of information to ensure the credibility of the corrective action and its consistency with current/consensus science. Conversely, if such technical documentation has been formalized and previously subjected to a review by SC&A, Subtask 2 will simply provide a brief summary/conclusion of this review process.

Subtask 3: Evaluate the PER's stated **approach** for identifying the universe of potentially affected DRs, and assess the **criteria** by which a subset of potentially affected DRs was selected for re-evaluation. The second step may have important implications in instances

where the universe of DRs is too large and, for reasons of practicality, NIOSH's re-evaluation is confined to a subset of DRs. In behalf of Subtask 3, SC&A will also evaluate the timeliness for the completion of the PER.

Subtask 4: Conduct audits of DRs affected by the PER under review. The number of DRs selected for audit for a given PER will vary. The selection of the DRs and the total number of DR audits per PER will be made by the Advisory Board.

Subtask 5: Prepare a comprehensive written report that contains the results of the above-stated subtasks, along with our review conclusions.

2.0 SUBTASK 1: IDENTIFY THE CIRCUMSTANCES THAT NECESSITATED OCAS-PER-005

In October 2003, Revision 00 of the Hanford Dose Reconstruction Technical Basis Document (TBD) ORAUT-TKBS-0006-6, *Hanford Site – Occupational External Dose* (ORAUT 2003), was issued. The document was subsequently revised in 2004 (ORAUT 2004). This revision (01) of the document indicates that the response of the dosimeter significantly changed depending on the energy spectra of the photons. This could potentially underestimate or overestimate true dose. Since the specifics of the exposure scenario would dictate either an over-response or an under-response, and since this information is generally not available, the OCAS TBD reviewers interpreted the Hanford External Dose TBD to conclude a claimant-neutral position that no bias factor that reduced the recorded dose would be applied.

ORAUT came to a different conclusion from the same information and implemented the bias correction factor methodology into the *Hanford Best Estimate Dose Reconstruction Tool/Template* [referred to herein as the Best-Estimate Tool (ORUAT 2005)] that was issued on May 3, 2005. This tool interpreted ORAUT-TKBS-0006-6 to indicate that an energy employee's recorded dose was overestimated from 1944–1994 by a bias ranging from 1.01 to 1.27, based on the dosimeter used at the time. These assumptions are summarized in Table 2-1, below.

Table 2-1. Hanford Bias Factors

Dosimeter	Period of Use	Bias	Estimated Range
Two-element film	1944–1957	1.27	1.13–1.60
Multi-element film	1958–1971	1.02	0.86–1.12
Hanford TLD	1972–1983	1.12	1.04–1.16
Hanford TLD	1984–1994	1.01	0.95–1.05
Commercial TLD	1995–2003	1.00	0.95–1.05

During a June 29, 2005, DR review, OCAS identified an error on the interpretation of the Hanford TBD (ORAUT-TKBS-0006-6) that caused an inconsistency in the treatment of external best-estimate doses and an underestimate in dose.

OCAS-PER-005, pg. 2, states:

> *It is important to note that not all Hanford cases completed to date have been affected by this misinterpretation. Only cases using the Hanford Best Estimate Dose Reconstruction Tool were affected.*

As discussed below, SC&A remains concerned that dose reconstructors that did not use the Best-Estimate Tool may have nonetheless reached the same conclusion as ORAUT and applied a dosimeter bias that reduced external dose.

2.1 SC&A'S COMMENTS ON TBD'S HANDLING OF BIAS

A formal review of the Hanford External Dose TBD is outside the scope of the PER process. However, because the language in the TBD regarding the dosimeter bias correction factor was shown to be subject to misinterpretation, SC&A examined the 2004 revision (Revision 01) of the TBD to identify how the initial misinterpretation occurred. SC&A found the following three tables in the TBD that help elucidate the source of confusion:

Table 2-2. Overall Bias and Uncertainty due to Variation and Uncertainties Regarding Energy Levels and Geometry in Recorded Dose as an Estimate of Deep Dose

Hanford dosimetry system	Bias magnitude and range		Uncertainty factors	
	Overall bias [a]	Range in bias [b]	Systematic [c]	Random [d]
Two-element film (1944–1956)	1.27	1.13–1.60	1.2	1.8
Multi-element film (1957–1971)	1.02	0.86–1.12	1.1	1.4
Multi-element thermoluminescent (1972–1983)	1.12	1.04–1.16	1.05	1.2
Multi-element thermoluminescent (1984–1993)	1.01	0.95–1.05	1.05	1.2

a. Based on the distribution of energy levels and geometry judged most likely. Divide recorded dose by the table's bias value to calculate deep dose. Note that this use of bias factor does not apply to plutonium facilities.
b. Range of overall bias factors based on alternative distributions of energy levels and geometry.
c. Systematic uncertainty resulting from lack of knowledge regarding actual distributions of energy levels and geometry.
d. Random uncertainty resulting from variation among workers in energy levels and geometry.

Source: ORAUT 2004, Table 6-12, pg. 28.

Table 2-3. Overall Estimates of Uncertainty for Photon Dose in Hanford Non-Plutonium Facilities

Hanford dosimetry system	Period of Use	Bias magnitude and range		Uncertainty factors	
		Overall bias [a]	Range in bias [b]	Systematic [c]	Random [d]
Non-plutonium facilities					
Two-element film	1944–1957	1.27	1.23–1.60	1.2	1.8
Multi-element film	1958–1971	1.02	0.86–1.12	1.1	1.4
Hanford TLD	1972–1983	1.12	1.04–1.16	1.05	1.2
Hanford TLD	1984–1994	1.01	0.95–1.05	1.05	1.2
Commercial TLD[e]	1995–2003	1.00	0.95–1.05	1.05	1.2

a. Based on the distribution of energy levels and geometry judged most likely. Divide recorded dose by the table's bias value to calculate Hp(10) dose.
b. Range of overall bias factors based on alternative distributions of energy levels and geometry.
c. Systematic uncertainty resulting from lack of knowledge regarding actual distributions of energy levels and geometry.
d. Random uncertainty resulting from variation among workers in energy levels and geometry.
e. Performance equal to or better than previous Hanford dosimeter.

Source: ORAUT 2004, Table 6-32, pg. 51.

Table 2-4. Overall Estimates of Uncertainty for Photon Dose in Hanford Plutonium Facilities

Dosimeter	Period of use	Bias magnitude and range	
		Overall bias [a]	Range in bias [b]
Beta/photon dosimeters – plutonium facilities [c]			
Two-element film	1944–1957	~1	0.25–2
Multi-element film	1957–1971	~1	0.5–1
Hanford TLD	1972–1983	~1	0.7–1.7
Hanford TLD	1984–1994	~1	0.7–1.7
Commercial TLD	1995–2003	~1	0.7–1.7

a. Divide recorded dose by the table's bias value to calculate Hp(10) dose. (However, no adjustment in recorded penetrating dose recommended.)
b. Range of overall bias factors based on alternative distributions of energy levels and geometry.
c. Estimated range in bias assuming factor of 2 increase in uncertainty
Source: ORAUT 2004, Table 6-33, pp. 51–52.

Additionally, the following sentence appears in Attachment 6E of the TBD (ORAUT-TKBS-0006-6):

> *No adjustment in the recorded photon dose is recommended for multi-element or thermoluminescent dosimeter recorded penetrating or gamma dose with the exception of the penetrating dose (i.e., identified as S dose in the early years) recorded for the two-element film dosimeter used prior to April 1957.*

Other than the above quoted tables and sentence, the TBD provided no guidance to dose reconstructors on how to apply dosimeter bias. Based on the excerpts above, SC&A believes that it is **not** unreasonable that a dose reconstructor could assume that a bias factor should be applied. The footnotes of Tables 2.2 and 2.3 clearly instruct the dose reconstructor to "[d]ivide recorded dose by the table's bias value to calculate deep dose."

If the TBD's intent was to have dose reconstructors take a "claimant neutral position that no bias factor that reduced the recorded dose would be applied," the Revision 01 of the TBD did not provide adequate guidance on the issue. In fact, other than the sentence in Attachment 6E and the footnote in Table 2.4 (Table 6-33 in the TBD) that states, "no adjustment in recorded penetrating dose is recommended," the Revision 01 offers conflicting guidance at best on how to assess external photon dose.

In addition, as part of this PER review, SC&A read the transcript from the December 1, 2006, Hanford Work Group teleconference meeting (NIOSH 2006), where the bias factor issue was discussed. During this meeting, SC&A raised concerns over the lack of guidance provided in the Hanford TBD regarding how to handle the bias correction factor, and NIOSH agreed that the TBD was confusing. SC&A also reviewed the findings matrix that resulted from this meeting, where NIOSH indicated that the use of corrections, uncertainty, and bias factors would be clarified in the revised TBD. Therefore, SC&A reviewed the subsequent revisions to ORAUT-TKBS-0006-6 to assess when the bias factor clarification was introduced into the TBD.

A review of Revisions 2 and 3 to the Hanford Occupational External Dosimetry TBD (ORAUT 2006, ORAUT 2007) revealed that no changes were made regarding the use of the bias factor. In

the most recent revision (ORAUT 2010), Table 6-32 from Revision 1 (Table 2.3 above), appears as Table 6-25 unedited. Revision 4 does, however, contain the following paragraph:

> ***6.5.1 Photon Dose Adjustments***
> *No adjustment in the recorded* ***neutron*** *dose is considered necessary. The 1972 AEC study stated that the photon dose of record was reasonably comparable between the film and thermoluminescent dosimeters (Biles 1972). The IARC study (Theirry-Chef et al. 2002) and Wilson et al (1990) studies have shown reasonable comparison in the recorded photon dose with the historical Hanford dosimeters with the general observation that generally earlier doses measured with the two-element film dosimeter were likely too high. Hanford did incorporate practices to account for the potential underestimate of the deep dose with the two-element from the low-energy photon dose component in Hanford plutonium facilities…*
> [Emphasis added.]

Assuming that the word "neutron" in this paragraph was intended to be the word "photon," this is the only guidance provided to DRs that the bias factor should not be assigned. Therefore, until Revision 04 was issued, SC&A finds it reasonable to conclude that, if a dose reconstructor did not use the Best-Estimate Tool, there is a potential the dosimeter bias was applied.

Our review of TBD revisions indicated that an attempt to clarify the use of a dosimeter bias correction factor was not addressed until Revision 4 of the Hanford TBD. Even with this modification, SC&A is unclear whether the bias factor finding identified in the Hanford Work Group meeting (NIOSH 2006) was adequately resolved in Revision 4 and verified by SC&A and the Work Group.

Finding #1: The Dosimeter Bias May have been Applied if the Best-Estimate Tool was Not Used.

Based on the above assessment, SC&A believes that it is not unreasonable to conclude that dose reconstructors who did not use the Best-Estimate Tool may have reached the same conclusion as the ORAUT Dose Reconstruction Team and applied a dosimeter bias that reduced external dose. (It should be noted that SC&A has included this finding to help ensure that it is fully investigated and resolved.)

3.0 SUBTASK 2: ASSESS NIOSH'S APPROACH AND METHODS FOR CORRECTIVE ACTION

With the realization in June 2005 that this tool misinterpreted the intent of the TBD, NIOSH pursued the following corrective steps, in order to determine the universe (or maximum potential number) of claims that could have been impacted by misinterpretation of the external dose TBD.

- Determined the total number of claims. As of August 3, 2005, there were 1,184 claims submitted from Hanford.
- Eliminated claims that did not use the Best-Estimate Tool. As of August 3, 2005, only 115 claims used the Best-Estimate Tool, which was roughly 10% of the total Hanford claims at the time.
- Eliminated claims that required no further evaluation. Of the claims that used the Best-Estimate Tool, 14 were compensable and thus did not require further evaluation, 3 claims were modified to remove the bias factor in the early stages of identifying the misinterpretation problem, and 18 claims only used a bias correction factor of 1.0 and therefore were unaffected by the misinterpretation.
- Determined claims not yet submitted to the Department of Labor (DOL). On August 3, 2005, 49 claims that used the Best-Estimate Tool were completed, but had not yet been sent to DOL. These claims were returned to the original dose reconstructor to remove the bias factor and recalculate final dose.
- Determined claims requiring re-evaluation. The remaining 31 claims were found to require re-evaluation.

3.1 SC&A'S COMMENTS

SC&A agrees with the methodology used by NIOSH to identify the 115 potentially affected claims. However, as discussed previously in Section 2.0, we question whether the 'Best-Estimate Tool' assumption accurately captures all potentially affected claims. If it is concluded that NIOSH has indeed captured the universe of potentially affected cases in this PER, SC&A can then concur with NIOSH's approach for identifying those cases and the methodology used for correcting the external doses associated with those cases.

4.0 SUBTASK 3: EVALUATE THE PER's STATED APPROACH FOR IDENTIFYING THE NUMBER OF DRs REQUIRING RE-EVALUATION OF DOSE

Section 1.0 of OCAS-PER-005 identified the following set of criteria for identifying those claims that required rework:

1. The case used the Best-Estimate Tool to calculate external dose.
2. All bias correction factors used in the Best-Estimate Tool were not equal to 1.00.

Using these criteria, NIOSH identified a total of 31 cases from among 1,184 total Hanford claims. Since there were only approximately 3% of the cases affected, NIOSH evaluated each claim individually.

During NIOSH's evaluation, a significant error was identified in the external DR of one claim's previous evaluation. This claim had not yet gone through the DOL's final adjudication process because of another unrelated error that was identified by DOL. Since at the time of the evaluation the case was in the process of being reworked, it was excluded from the PER evaluation. This reduced the total number of cases requiring re-evaluation to 30.

NIOSH re-analyzed 30 cases identified and found that, as expected, the calculated external dose for all 30 cases increased. This increase ranged from 78 to 4,698 mrem. None of the 30 cases had a POC increase to above 45%.

4.1 SC&A'S COMMENTS

SC&A reviewed data/information received from NIOSH with the objective of assessing the completeness of the criteria used to identify impacted cases. SC&A randomly selected 10 cases from the 84 remaining cases that NIOSH identified as not being impacted by PER-005. Of these cases, the following was found:

- (4) Used workbook free of photon bias correction
- (1) Used workbook with bias factor, but EE worked at plutonium facility where bias = 1
- (4) Used workbook with photon bias and had a POC >50%
- (1) Was revised and compensated under PER-012 and the original files removed

This distribution is consistent with the information contained in Figure 1 of PER-005. SC&A's review of the data found **no inconsistencies/errors** with the identification and selection of cases as specified in Section 2.0 of OCAS-PER-005.

Observation #1

SC&A also looked at the 30 cases identified as requiring re-evaluation as a result of the PER and found that, although NIOSH reassessed the doses and POC for these cases (see Appendix A of this report), no PER letter documenting this reassessment was included in the associated DR case files.

5.0 SUBTASK 4: CONDUCT AUDITS OF A SAMPLE-SET OF DRS AFFECTED BY OCAS-PER-005

SC&A contacted NIOSH in order to locate the 30 cases that were evaluated as a result of the PER. In addition to identifying claims 1–30 from PER-005, Table 2, NIOSH provided SC&A with the list of 115 potentially affected cases. Table 2 from PER-005 is reproduced in Appendix A. By means of the claims' ID numbers, SC&A independently assessed the current status of the 30 cases in the NOCTS database. (Note: Claim ID numbers are not identified in this document, but are referred to by the same random numbers used by NIOSH in Table 5 of the PER.) The current status for the 30 cases is shown in Figure 1 and Appendix B.

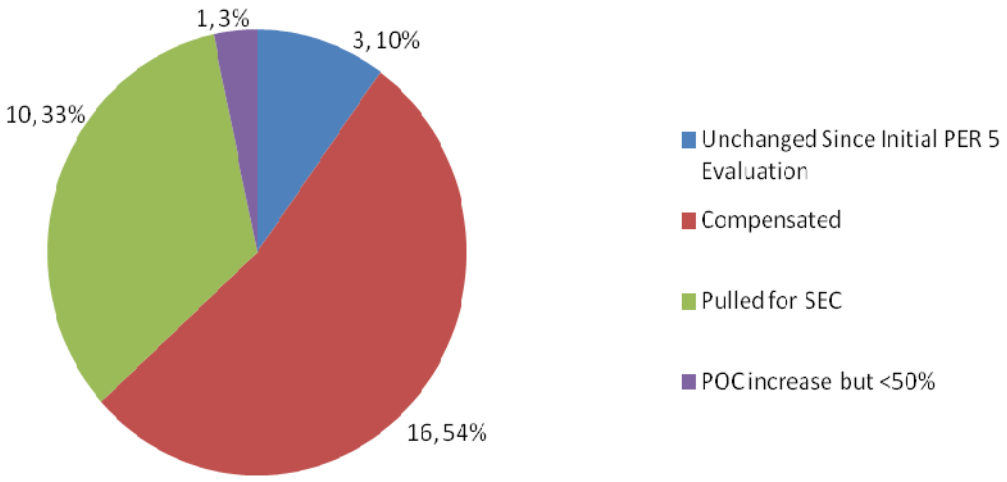

Figure 1. Current Status of PER-005 Impacted Cases

Selection of DRs for SC&A's audit by the Dose Reconstruction Subcommittee will be limited to completed DRs that have been adjudicated by the DOL. Based on the above evaluation, aside from the compensated cases, only 4 of the 30 cases are eligible for audit, and only 1 of those cases has (presumably) been updated to remove the bias correction factor. These cases are identified by the NIOSH-assigned random numbers in Appendix B.

Based on this evaluation, as well as the finding from Section 2.0 of this report (i.e., questioning whether the use of the Best-Estimate Tool is the only avenue for introducing the bias correction factor), SC&A believes at this time it is inappropriate to perform case audits. Pending the outcome of the resolution to SC&A's finding, a decision can be made regarding the selection of cases to audit under the PER-005 review.

6.0 SUMMARY CONCLUSIONS

In behalf of the four subtasks evaluated under OCAS-PER-005, SC&A identified one finding and one observation. Although SC&A is in agreement with the corrective actions taken by NIOSH, we believe there is a potential that the bias correction factor could have been introduced in DRs completed without the use of the Best-Estimate Tool. SC&A also questions whether the bias correction factor finding identified during the Hanford Work Group meeting was adequately addressed and resolved in Revision 4 of the TBD. Lastly, we observed that it does not appear that all appropriate paperwork (i.e., a PER letter) was included in the affected case history files.

7.0 REFERENCES

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APPENDIX A: SUMMARY OF CASES POTENTIALLY AFFECTED BY OCAS-PER-005
(reproduced from PER-005 Table 2)

#	Cancer Type(s)	Original POC (%)	Revised POC (%)	Change in POC (%)	Dose in DR Report (rem)	External% of Total Dose	Original External Dose (rem)	Revised External Dose (rem)	Change in Dose (rem)
1	Bladder	40.69	41.56	0.87	54.36	95.00	51.63	54.07	2.44
2	Bladder	37.79	38.46	0.67	40.75	99.30	40.46	41.84	1.38
3	Bladder &Prostate	37.76	37.93	0.17	21.88	72.70	15.90	16.08	0.18
4	Esophageal	41.00	42.07	1.07	37.75	80.40	30.34	32.63	2.29
5	Esophageal	36.00	36.86	0.86	31.74	95.80	30.40	31.60	1.20
6	Hodgkin's Disease	27.37	28.00	0.63	35.29	89.50	31.59	33.32	1.73
7	Kidney	43.33	43.49	0.16	43.95	95.60	42.01	42.58	0.57
8	Leukemia	36.01	36.13	0.12	14.14	66.50	9.40	9.48	0.08
9	Lung	43.14	43.30	0.16	89.88	19.10	17.16	17.92	0.76
10	Lung	41.09	41.15	0.06	82.53	24.40	20.15	20.91	0.75
11	Lung	42.61	42.82	0.21	49.62	37.80	18.73	19.71	0.98
12	Lung	43.47	43.78	0.31	63.88	38.50	24.58	25.60	1.02
13	Lymphosarcoma	34.89	36.43	1.54	71.25	97.70	69.62	74.32	4.70
14	Malign. Fib. Histiocytoma	29.68	29.84	0.16	15.60	86.50	13.49	13.63	0.14
15	Multiple Cancers	41.80	44.45	2.65	8.55	98.70	8.44	8.72	0.28
16	Multiple Myeloma	28.87	30.14	1.27	53.21	65.70	34.94	38.34	3.40
17	Multiple Myeloma	17.68	18.45	0.77	43.95	60.10	26.42	28.14	1.72
18	Pancreatic	40.89	42.20	1.31	84.99	88.80	75.51	79.82	4.30
19	Prostate	29.65	30.66	1.01	44.70	99.20	44.34	46.24	1.90
20	Prostate	43.34	43.48	0.14	59.43	63.70	37.83	38.25	0.42
21	Prostate	41.66	43.18	1.52	71.82	79.20	56.86	60.47	3.61
22	Prostate	37.64	38.53	0.89	58.09	97.80	56.80	59.00	2.20
23	Prostate & Lymphoma	40.41	41.70	1.29	36.32	97.70	35.48	37.62	2.14
24	Prostate & Renal	39.83	40.38	0.55	22.70	92.50	20.99	21.65	0.65
25	Prostate & Skin Cancers	40.82	40.96	0.14	11.54	98.60	11.38	11.65	0.27
26	Rectum	21.50	22.11	0.61	57.66	81.20	46.84	48.72	1.88
27	Renal	29.40	31.16	1.76	25.17	97.50	24.54	26.83	2.28
28	Stomach	27.35	28.40	1.05	29.90	97.40	29.14	30.83	1.69
29	Thyroid	41.86	44.45	2.59	10.87	78.20	8.49	9.43	0.94
30	Thyroid	42.67	43.01	0.34	5.51	66.10	3.64	3.76	0.11
			Average	0.83					

APPENDIX B: CURRENT STATUS OF PER-005 IMPACTED CASES

#	Cancer Type(s)	Original POC [c] (%)	PER Revised POC [c] (%)	Current POC (%)	Current Status
1	Bladder and Skin Cancers	40.69	41.56	61.93	Compensated
2	Bladder	37.79	38.46	37.79	SEC Pulled
3	Bladder, Prostate, & Ureter	37.76	37.93	44.70	SEC Pulled
4	Esophageal	41.00	42.07	53.15	Compensated
5	Esophageal	36.00	36.86	19.20	SEC
6	Hodgkin's Disease	27.37	28.00	53.15	Compensated
7	Kidney	43.33	43.49	43.33	SEC
8	Leukemia	36.01	36.13	NA	SEC Compensated
9	Lung	43.14	43.30	NA	SEC Compensated
10	Lung	41.09	41.15	NA	SEC Compensated
11	Lung	42.61	42.82	55.87	Compensated
12	Lung	43.47	43.78	51.76	Compensated
13	Lymphosarcoma	34.89	36.43	50.97	Compensated
14	Malign. Fib. Histiocytoma	29.68[b]	29.84	NA	SEC Compensation Eligible [a]
15	Colon	41.80[b]	44.45	23.77	Completed
16	Multiple Myeloma	28.87	30.14	28.87	Completed
17	Multiple Myeloma	17.68	18.45	16.05	SEC Pulled
18	Pancreatic	40.89	42.20	40.89	SEC Pulled
19	Prostate, Lung, & Pleura	29.65	30.66	58.68	Compensated
20	Prostate	43.34	43.48	44.34	SEC Pulled
21	Prostate	41.66	43.18	52.28	Compensated
22	Prostate	37.64	38.53	52.25	Compensated
23	Prostate & Lymphoma	40.41	41.70	60.29	Compensated
24	Prostate & Renal	39.83	40.38	NA	SEC Compensated
25	Prostate & Skin Cancers	40.82	40.96	40.82	SEC Pulled
26	Rectum	21.50	22.11	21.50	Completed
27	Renal & Bone	29.40	31.16	29.40	SEC Pulled
28	Stomach	27.35	28.40	27.35	Completed
29	Thyroid	41.86	44.45	NA	SEC Compensated
30	Thyroid	42.67	43.01	42.67	SEC Pulled

[a] Case has been pulled due to missing OCAS form
[b] Value not reflected in claimant file
[c] Values taken directly from PER-005