

Office of Compensation Analysis and Support
Program Evaluation Report

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Revision No. 0

Evaluation of the Effect of Revision 2 of the Site Profile on Previously Completed Bethlehem Steel Cases Page 1 of 7

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RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
11/14/2006	11/14/2006	0	New document to evaluate the effect of revision 2 of the site profile on previously completed dose reconstructions from Bethlehem Steel

1.0 Description

On July 27, 2006, OCAS issued a revision to the Bethlehem Steel Corporation Technical Basis Document. The changes in this revision were based on the resolution of review comments made by Sanford Cohen & Associates, the contractor that supports the Advisory Board on Radiation and Worker Health (ABRWH). The significant changes made to the site profile include:

1. The air concentration values were reevaluated using the additional air samples that became available after the publication of revision 0. As a result, an era specific log-normal distribution of air samples was developed that replaced the previous single triangular distribution that was applied to all years of operation. Further, NIOSH selected the 95th percentile air concentration of these distributions as being representative of the exposure for all claimants.
2. In 1952, when air concentrations were no longer bounded by rolling operations, NIOSH selected the highest recorded air sample, which was taken during a grinding operation, as representative of the breathing zone concentration for all workers.
3. An exposure scenario for the torch cutting of uranium cobbles was added.
4. The uranium ingestion model was revised to better reflect the air concentration and contamination conditions that existed at BSC.

Office of Compensation Analysis and Support Program Evaluation Report	Document Number: OCAS-PER-007
Effective Date: (11/14/2006) Revision No. 0	Page 2 of 7

5. The resuspension model was revised to increase the plausible bounding value for exposure from this pathway,
6. The external exposure model was revised to allow for exposure to contaminated clothing for up to two weeks between washings. This increased the shallow dose to the skin to 1.8 rem per year from potential uranium contamination on clothing.

The purpose of this PER is to evaluate the magnitude of the effect these changes made on the probability of causation for previously reconstructed cases. That is, all cases reconstructed using the previous version of the site technical basis document were evaluated to determine if the magnitude of the change in dose is sufficient to move the probability of causation (PC) to greater than or equal to 50% at the 99% credibility interval. For completeness, NIOSH also evaluated if any cases that were previously found to be greater than 50% would now be less than 50% when the new models were applied.

As of the approval date for this PER, a total of 579 dose reconstructions for Bethlehem Steel have been completed and forwarded to the Department of Labor for adjudication. The distribution of the probabilities of causation for these cases is provided in Attachment 1. As described below, the approach taken in this evaluation did not rework the dose reconstruction for each of the 579 cases. Rather, a methodology was employed that identified the cases which were potentially affected by the changes in the TBD. For these cases, a full evaluation, including a new IREP analysis, was completed.

2.0 Issue Evaluation

Comparison of different revisions

The previous version of the Bethlehem Steel Technical Basis Document (TBD) estimated annual internal exposure to uranium by assuming the same inhalation intake for each year of employment during the covered period. In the revised version, the intake assumptions were divided into three distinct periods. Further, the intakes are assigned as a constant value, rather than the triangular distribution that was used in the previous revision. When the new constant values are compared to the median value of the triangular distribution, the assumed intakes are higher for the first two years of covered period and lower for the last two year. Also, the inhalation intake was divided into two types of workers, cobble cutters and all others. The intakes assigned to cobble cutters are higher than all others for the last two years of operation (1951 and 1952), but lower for the first two years. If someone was exposed the entire four years, the non-cobble cutting exposure is bounding. The change to internal dose is the primary change for all organs other than those that are surficially exposed to shallow dose (i.e., skin, testes and breast)

Office of Compensation Analysis and Support Program Evaluation Report	Document Number: OCAS-PER-007
Effective Date: (11/14/2006) Revision No. 0	Page 3 of 7

The shallow dose assumptions were changed to include external shallow dose from residual contamination as well as from contaminated clothing. These two sources of exposure are modeled as a constant value for each year of covered work. The new values are 1.78 rem/yr from residual contamination and 1.80 rem/yr from contaminated clothing. This is added to the triangular distribution that was previously included. This is the primary change in the estimated dose for the skin, the testes and the breast.

The remaining changes to the TBD produce only small effects compared to these changes. Therefore, assuming that the more substantial changes were responsible for all the dose for a given case will overestimate the change in dose. This estimate of the change in dose has been used to determine a pool of cases in which the Probability of Causation (PC) could change from less than 50% to greater than 50% or visa versa. This pool of claims has been further evaluated by performing a dose estimate using revision 2 of the TBD.

Probability of Causation

The dose estimate is used to determine the Excess Relative Risk (ERR). The probability of Causation (PC) is determined directly from the ERR. The relationship is:

$$PC = ERR/(1+ERR)*100\%$$

From this equation it can be seen that an ERR of 1 is required to yield a PC of 50%. For a given scenario of time since exposure, age at diagnosis, type of cancer, type of radiation, etc., the ERR varies essentially linearly with the dose. Therefore, it is possible to assess the change in PC on a particular case if the change in dose is known and it is the same for all sources of dose. This, of course, is not exactly the case for the changes made in the TBD. Only one component of the dose (such as internal dose) will change. Therefore, in this evaluation, the changes will be assessed as if the primary source of exposure to an individual organ was the only source of exposure. This will overestimate the magnitude of the change and produce a larger than necessary group of claims to evaluate further. For the purposes of selecting cases for detailed analysis, four categories of cases were evaluated.

Category 1

The first category included cases that reconstructed the dose to organs in which the primary dose is from external shallow radiation. This includes skin cancer, as well as cancers of the breast and testes. In revision 2, the dose from contaminated clothing and from residual contamination was added to the median dose from the shallow dose triangular distribution. This newly added dose, was compared to the median dose from the previous triangular distribution in revision 0 of the TBD. Based on this comparison, it was determined that an original PC of 36.52% would now result in a PC of 50% (if **all** the dose for a claim was due to shallow dose). All claims with a skin, testicular or breast

Office of Compensation Analysis and Support Program Evaluation Report	Document Number: OCAS-PER-007
Effective Date: (11/14/2006) Revision No. 0	Page 4 of 7

cancer that were previously determined to be <50% PC were reviewed and the ones with a PC >30% were selected for further evaluation. This resulted in a pool of 3 claims.

Category 2

The second category included cases that worked the entire four year period and had organ doses that were primarily due to internal irradiation. To facilitate this comparison, the median internal dose was calculated for someone working during the entire covered period using the exposure scenarios described in revisions 0 and 2. Under revision 2, the non-cobble cutter intake was found to result in the largest overall increase in dose. The difference in annual organ doses for non-cobble cutters was found to be largest for the first two years then dropped significantly. This is due to the fact that the intakes in revision 2 are higher than revision 0 only for the first two years. It was decided to use the total dose for the first four years as a tool to select cases for further evaluation. This should give a conservatively high difference in doses without being so high that all cases are re-evaluated. Because the doses drop during the second two years, this was not a sufficient selection criterion for people with employment for only part of the covered period. These people were assessed with the additional criteria identified under category 3 below. Using the comparison of the four year total median dose for the most affected organ (the liver), it was determined that a PC as low as 41.49% could now result in a PC of 50%. Based on this selection criterion, all cases between 40% and 50% were selected for further evaluation. This resulted in 8 cases to be further evaluated.

Category 3

The third category evaluated claims in which employment ended prior to the end of the covered period. Since the newest revision results in intakes that are higher in the early period and lower in the later periods, it is possible that the second criteria above would underestimate the change to a person who worked primarily in the early period. The largest change to intakes would occur if the person worked entirely in the first two year of the covered period. In that case, a PC as low as 37.58% could now result in a PC of 50%. All cases with employment ending prior to the end of the four year covered period were reviewed for this criterion. Only one of these cases had an original PC greater than 30% and that case was a skin cancer already selected as part of the first selection category. Therefore, this category added no new cases for further evolution.

Category 4

The fourth category results from the fact that revision 2 results in a lower intakes in the last two years than the first two revisions. Therefore, it is possible for someone with a PC originally >50% to now be <50%. To assess this, the non-cobble cutting intakes were evaluated against the median intakes from the first revision. The original ERR was computed based on the original PC and the ERR was reduced by a percentage equal to

Office of Compensation Analysis and Support Program Evaluation Report	Document Number: OCAS-PER-007
Effective Date: (11/14/2006) Revision No. 0	Page 5 of 7

the reduction in inhalation intakes for the individual case. As with the other criteria, this produced a pool of claims for further evaluation. This criterion resulted in 9 claims to be further evaluated.

3.0 Probability of Causation Evaluation

The 22 cases selected above were re-evaluated by completing a new dose estimate for each of the claims. These dose estimates were performed in accordance with revision 2 of the TBD. The evaluation criteria above were intended to be conservative in order to obtain a pool of claims that could potentially change compensability. Therefore, it should be expected that not all of these claims will actually change compensability once the actual estimate of the dose is completed. The results of the new estimates are provided below. In accordance with OCAS practice, any case with a PC greater than 45% is reported as the average value of 30 IREP iterations using 10,000 trials. Since designating the employee as a cobble cutter could increase the PC if employment was not for the entire four years, cases in which this may have an affect were evaluated as both a cobble cutter and a non-cobble cutter.

Table 1 - New Estimate for cases from First Criteria

Case	Original PC	New PC
OCAS-PER-007-001	35.46%	48.11%
OCAS-PER-007-002	34.50% a	43.90% a
OCAS-PER-007-003	32.56%	41.47%

a = combination of all cancers

Table 2 - New Estimate for cases from Second Criteria

Case	Original PC	New PC
OCAS-PER-007-004	43.54%	48.56%
OCAS-PER-007-005	44.90%	21.65% (38.78% b)
OCAS-PER-007-006	46.36%	48.54%
OCAS-PER-007-007	42.06% a	44.08% a
OCAS-PER-007-008	48.04% a	53.04% a
OCAS-PER-007-009	47.53%	27.42%
OCAS-PER-007-010	42.49% a	54.57% a
OCAS-PER-007-011	43.86%	50.08%

a = combination of all cancers

b = PC if employee is assumed to be a cobble cutter

Table 3 - New Estimate for cases from Fourth Criteria

Case	Original PC	New PC
OCAS-PER-007-012	51.30%	48.82%

Office of Compensation Analysis and Support Program Evaluation Report	Document Number: OCAS-PER-007
Effective Date: (11/14/2006) Revision No. 0	Page 6 of 7

OCAS-PER-007-013	52.34%	47.30%
OCAS-PER-007-014	61.79%	28.27%
OCAS-PER-007-015	80.05%	55.08%
OCAS-PER-007-016	74.22%	38.33% (72.33% b)
OCAS-PER-007-017	64.46%	35.97%
OCAS-PER-007-018	51.74%	20.39%
OCAS-PER-007-019	51.73%	20.87% a
OCAS-PER-007-020	51.50% a	46.02% a

a = combination of all cancers

b = PC if employee is assumed to be a cobble cutter

4.0 Conclusions

As a result of revisions to the Bethlehem Steel TBD, three claims that were previously determined to have a PC of less than 50% would now have a PC greater than 50% (Table 1 and Table 2 above). One of these three cases, however, has new ICD 9 code information that the Department of Labor evaluated upon appeal by the claimant. If the new ICD code designation is adopted by the DOL, this claim would have a revised PC of less than 50%. The specific circumstances surrounding this case will be communicated to the DOL for further evaluation.

Eight cases that previously had a PC greater than 50% would now have a PC less than 50%. However, one of these claims would remain greater than 50% if the employee were determined to be a cobble cutter. The job title of this employee is listed as “unknown”.

This report along with detailed information on the specific cases and calculations will be provided to the Department of Labor for determination of further action.

5.0 References

1. ORAU Team (2003) *Technical Basis Document: Basis for Development of an Exposure Matrix for Bethlehem Steel Corporation*, ORAUT-TKBS-0001 Rev 00.
2. ORAU Team (2004) *Technical Basis Document: Basis for Development of an Exposure Matrix for Bethlehem Steel Corporation*, ORAUT-TKBS-0001 Rev 01.
3. OCAS (2006) *Technical Basis Document: Basis for Development of an Exposure Matrix for Bethlehem Steel Corporation*, OCAS-TKBS-0003 Rev 00.

Attachment 1

Distribution of PC for Bethlehem Steel Cases

(579 cases as of 10/17/2006)

