

Office of Compensation Analysis and Support
Program Evaluation Report

Document Number: OCAS-PER-003

Effective Date: (1/28/2005)

Revision No. 0

Evaluation of the Effect of Adding Ingestion Intakes to Bethlehem
Steel Cases

Page 1 of 3

Approval: Signature on file Date: _____ Supersedes: None
J.W. Neton, Associate Director for Science

RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
1/28/2005	1/28/2005	0	New document to evaluation the effect of adding ingestion intakes to previously finished claims from Bethlehem Steel

1.0 Description

On 3/31/2003 NIOSH completed a Technical Basis Document assessing exposures to uranium at the Bethlehem Steel Corporation facility. The original document did not assess intakes of uranium through an ingestion route. The document has since been revised on 6/29/2004 to include this exposure pathway. The purpose of this PER is to evaluate the effect on this additional intake on previously completed claims.

2.0 Evaluation

Intakes

The Bethlehem Steel Technical Basis Document (TBD) estimated annual exposures to uranium and prescribed using the same exposure for each year of employment. Intakes were originally determined for inhalation only, however, since that time, additional intakes via the ingestion pathway have been added. The additional intakes were based on the quantity of uranium estimated to be in the air. Therefore, the increased intake of uranium is a fixed percentage of the previously determined inhalation intake. Individual organ doses will also increase by a set percentage, however, this increase will vary for each organ.

Dose Evaluation

Since the exposure was estimated at a constant rate, the increased dose should be proportional to the original dose regardless of the exposure time. For this evaluation, organ doses were calculated for a hypothetical employee that worked at Bethlehem Steel during the entire contract period (1949 to 1952). Annual doses were calculated for various organs starting in 1949 and ending in 2002. These doses were compared with the

Office of Compensation Analysis and Support Program Evaluation Report	Document Number: OCAS-PER-003
Effective Date: (128/2005) Revision No. 0	Page 2 of 3

original (inhalation only) doses to determine the percentage increase in dose for each organ.

The f_1 value is the fraction of material absorbed into the body from the GI tract. The f_1 value for this evaluation was chosen to be consistent with the lung absorption type used in the Bethlehem Steel TBD. The TBD uses the most claimant favorable of the credible solubility types. This results in the use of type S material for respiratory tract doses and type M for all other organs.

The highest increase in dose occurred in the first year of exposure for all organs other than the respiratory tract. The difference in respiratory tract dose continued to increase through 2002, the largest difference being a 0.62% increase in the ET2 compartment. The increase was higher for all other organs in all years of exposure. The majority of organs had an increased dose of approximately 0.94% in the first year and quickly (within a few years) decreased to a 0.74% increase. The only remaining tissues with significantly different doses are the tissues associated with the GI tract. The largest difference in dose was found in the lower large intestine (LLI) tissue. The largest increase in dose to the LLI was 5.62%, occurred in the first year. Other tissues of the GI tract also exhibited the maximum increase in the first year.

Probability of Causation

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

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

From this equation it can be seen that an ERR of 1 is required to yield a POC 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, a 5.62% increase would be sufficient to raise the ERR from 0.947 to 1.0. An ERR of 0.947 would produce a POC of 48.6%. For non-GI tract cancers, an increase in dose of 0.94% would be sufficient to raise the ERR from 0.990 to 1.0. An ERR of 0.990 corresponds to a POC of 49.7%.

3.0 Results of Evaluation

A search of the existing claims in December 2004 indicated that 7 of the Bethlehem Steel claims submitted to the Department of Labor had a POC below between 40% and 50%. One of these claims included ingestion dose in the original version. Five of the remaining six did not exceed the POC threshold above that may cause the claim to exceed a POC of 50%. One however did exceed that threshold. However, the threshold is conservative in that it assumed the largest annual increase in dose occurred every year. All six claims were however, re-evaluated using the current version of the TBD. The

Office of Compensation Analysis and Support		Document Number: OCAS-PER-003
Program Evaluation Report		
Effective Date: (128/2005)	Revision No. 0	Page 3 of 3

new version of the TBD included changes to the medical x-ray doses as a result of additional information. Once the new dose values were entered, the POC calculation was run 30 times with a different random seed value each time. This was done in order to produce a more precise POC by minimizing minor fluctuations attributable to the computation rather than the actual uncertainty in the POC. The average of the 30 runs is reported in the table below.

Table 1

Claim	Cancer type	Original POC	New POC
A	Chronic Myelocytic Leukemia	44.90%	43.72%
B	Kidney	46.36%	45.72%
C	Rectum/ Kidney	49.42% combined	49.11% combined
D	Testis	47.53%	46.37%
E	Chronic & Acute Myelomonocytic Leukemia	48.32% combined	46.53% combined
F	Kidney	49.27%	47.11%

As a result of this evaluation, none of the six exceeded a POC of 50%. The reduction in the POC values can be attributed to the change in the x-ray dose estimate for these claims.

4.0 Summary

As a result of adding ingestion intakes, the POC of none of the previously completed Bethlehem Steel claims would increase to greater than 50%.

5.0 References

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