



## MEMO

TO: TBD-6000 Work Group  
FROM: John Mauro and Bill Thurber, SC&A  
DATE: April 23, 2013  
SUBJECT: Baker Brothers Follow-Up: Review of Tomes White Paper of April 2, 2013

---

On February 18, 2013, SC&A was asked to read the National Institute for Occupational Safety and Health (NIOSH) Evaluation Report (ER) for Special Exposure Cohort (SEC) Petition-SEC-00204 concerning the Baker Brothers site in Toledo, Ohio (NIOSH 2012), and to be prepared to discuss any concerns we might have at the TBD-6000 meeting scheduled for February 21, 2013. In response to this request, SC&A prepared a number of talking points that could be used for the Work Group meeting (SC&A 2013).

Under talking points 8 and 9, SC&A expressed concern that chip fires during machining could affect assumed airborne dust loadings:

*(8) The story gets more complicated because of the numerous fires that occurred at the facility in 1943. Keep in mind that we are interested in the amount of surface contamination at the beginning of the residual period on January 1, 1945, and that NIOSH derived this value using the above-described dust loading, and that deposition occurred for a 30-day period (as prescribed in TBD-6000) without any removal activity just prior to the termination of AWE activities. Unless there was cleanup after every fire, the buildup of surface activity during operations might have been well in excess of the value derived in the PER as the starting point for this calculation. Without some evidence of cleanup after each fire, there is little reason to believe that there is any relationship between the airborne dust loadings reported in TBD-6000 (and by Harris and Kingsley) and the airborne dust loading used in the PER for the Baker Brothers facility.*

*(9) Given that there was cleanup after each fire, and we accept that 5,480 dpm/m<sup>3</sup> is a plausible bounding uranium dust loading for the types of operations that took place at the Baker Brothers facility, the assumption that deposition took place for a 30-day period seems rather arbitrary. It might be more appropriate to assume that the last fire occurred in 1943 (we might be able to confirm that this is, in fact, the case), and that dust accumulation occurred over the last year of AWE operations (i.e., 1944). Such an assumption might increase the derived dust loading on surfaces at the beginning of the residual period by about a factor of 10.*

In response to these talking points NIOSH prepared a white paper addressing SC&A's concerns (Tomes 2013). Tomes provided information describing clean-up procedures that were used at B&T Metals and Herring-Hall-Marvin Safe Company, which performed machining work contemporaneously with the work at Baker Brothers. Tomes notes the following:

*B&T Metals and Herring-Hall-Marvin Safe had specific cleanup requirement to complete prior to releasing the contractor from responsibilities. DuPont representatives were required to ensure the following steps were followed (summarized from list from Shinn, 1943):*

- (1) All machines inspected for cleanliness; wet residues and oxides shipped according to instructions.*
- (2) Floors cleanly swept and sweepings shipped as directed.*
- (3) Outside areas cleaned to satisfaction of inspectors.*

Although similar requirements were not uncovered for Baker Brothers from the NIOSH research, Tomes argues that Baker Brothers was operating under contract to DuPont, as were B&T Metals and Herring-Hall-Marvin, and it is reasonable to assume that contracts for the same work would have the same clean-up requirements. He further notes that sweepings were shipped from Baker Brothers on several occasions in 1943.

SC&A has reviewed the Tomes white paper and the cited references. The clean-up procedures at B&T Metals and Herring-Hall-Marvin Safe are clearly documented in Shinn 1943 and included sweeping the floors and shipping the sweepings off-site. In addition, the shipments of turnings and sweepings from Baker Brothers on August 16, 1943; September 14, 1943; and October 16, 1943 are documented in Clinton Engineering Works accountability reports for the period June 14 through December 1, 1943 (Accountability Reports 1943). The accountability records for that period show a net loss of 541 lb or 0.3% of the incoming material based on the difference in the weight of slugs received and the weight of machined slugs and scrap shipped. It could be argued that this loss remained on floors and building surfaces as residual contamination. However, for approximately the same period (April 2, 1943, to December 1, 1943), B&T Metals, which performed similar work, showed a net gain of 441 lbs or 0.13% of the material processed. Thus, it is possible that the observed loss at Baker Brothers was within the accuracy of the accounting procedures.

Based on the available information:

- Machining work began at Baker Brothers on June 8, 1943, and was completed on August 15, 1944.
- We have evidence that sweepings were shipped off-site from Baker Brothers as late as October 16, 1943.
- We do not know whether or not shipment of sweepings continued after October 16, 1943, because records for 1944 only mention turnings, scrap, and solid scrap (Accountability Reports 1944).
- We know that other DuPont sub-contractors (B&T Metals and Herring-Hall-Marvin Safe) had well-documented clean-up procedures required prior to contract termination.
- The fire hazards associated with uranium metal turnings were understood early in the slug machining program and precautionary and protective measures were established

(Daniels 1943). The extent to which these measures reduced the spread of surface contamination is not documented.

The available evidence regarding chip burning and the extent to which clean-up operations were conducted at the conclusion of the Baker Brothers slug machining program suggests, but does not conclusively demonstrate, that clean-up operations were done at the end of the program. However, we believe that this is a dose reconstruction issue rather than an SEC issue. For example, lack of clean-up can be taken into account by using a higher resuspension factor of  $10^{-4}$  to  $10^{-5}/m$  for the residual period.

The question of whether or not a geometric mean air concentration of 5,480 dpm/m<sup>3</sup> is bounding if chip fires occurred also must be addressed. It should be remembered that this value was for centerless grinding and was selected to bound exposure to all machining operators in Table 7.5 of TBD-6000. Operations more akin to machining activities at Baker Brothers ranged from 67 dpm/m<sup>3</sup> for a turret lathe operator to 245 dpm/m<sup>3</sup> for an automatic lathe operator (TBD-6000, Table 7.5)—values one to two orders of magnitude lower than for centerless grinding. It is not known to what extent, if any, these air concentration reflected chip fires but additional insight is provided in Harris and Kingsley (1959) which is the primary source document for the air concentrations in TBD-6000. Relevant information is included in their discussion of chip briquetting during scrap recovery, where they note that:

*The operator of the machine may receive an excessive exposure, primarily working at the discharge of briquetting machine. Here the concentration of uranium has been found to average 600 d/m/M<sup>3</sup>. The sources of contamination are the fume emanating from the burning edges of the briquette and that from burning chips which accompany the briquettes as they are ejected from the machine die. These fumes result from uranium ignited by the heat created in the press.*

This average exposure is well below that in Table 7.5 of TBD-6000 (DCAS 2011).

Adley et al. 1952 provides several measurements taken during various machining operations where either burning or fume generation are cited. These measurements are presented in Table 1.

**Table 1. Air Concentrations from Burning of Uranium during Machining**

Operation	Air Concentration	
	(10-5 µg/cc)	(dpm/m <sup>3</sup> )
Turning down deeply pitted billet. Sparks and burning metal.	27	410
Deep cut with dull tool. Heavy fume.	97	1,470
Same time and place as above sample.	20	304
Sampled during three cuts; dull saw much fume.	12	182
Sample at breathing level only; much fume from saw case vent.	154	2,340
Fume from vent of saw case – fume barely visible 20 minute sample.	122	1,850
Sawing large chunks of metal from crucible. Sample 15" above cut. Considerable fume observed.	127	1,930

In no instance did the air concentration approach the bounding concentration of 5,480 dpm/m<sup>3</sup>. Based on the available evidence, it appears that 5,480 dpm/m<sup>3</sup> is a bounding value for the air concentrations during uranium machining at Baker Brothers. If the weight of evidence leads to the conclusion that clean-up did occur at Baker Brothers prior to the beginning of the residual period, then it is reasonable to assume a resuspension factor of 10<sup>-6</sup>/m. If one cannot conclude that clean-up was done prior to the beginning of the residual period, then one would need to assume a higher resuspension factor (e.g., 10<sup>-5</sup>/m).

## REFERENCES

Accountability Reports 1943. *Shipping and receiving accountability reports*. Clinton Engineering Works. SRBD Ref ID 120593.

Accountability Reports 1944. *Shipping and receiving accountability reports*. Clinton Engineering Works. SRBD Ref ID 120591.

Adley, F.E., W.E. Gill, and R.H. Scott, 1952. *Study of Atmospheric Contamination in the Melt Plant Building*, U.S. Atomic Energy Commission Report HW-233352 (Rev.). April 4, 1952.

Daniels, C.E., 1943. Correspondence from C.E. Daniels (DuPont) to J.N. Tilley (DuPont), Subject: *Project 9536 Metal Turnings-Fire Hazards*. August 27, 1943. SRBD Ref ID 116470.

DCAS 2011. *Site Profiles for Atomic Weapons Employers that Worked Uranium Metals*. Battelle-TBD-6000. Rev. 1. National Institute for Occupational Health and Safety (NIOSH), Division of Compensation Analysis and Support (DCAS), Cincinnati, Ohio. June 17, 2011.

Harris, W.B., and I. Kingsley, 1959. "The Industrial Hygiene of Uranium Fabrication." *A.M.A. Archives of Industrial Health*, Vol. 19. May 1959. pp 76-101.

NIOSH 2012. *SEC Petition Evaluation Report, Petition SEC-00204*. Rev. 0. National Institute for Occupational Safety and Health, Cincinnati, Ohio. November 13, 2012.

Tomes, T.P., 2013. *Cleanup after Uranium Operations at Baker Brothers Toledo, Ohio*. Division of Compensation Analysis and Support, National Institute for Occupational Safety and Health, Cincinnati, Ohio. April 2, 2013.

SC&A 2013. *SC&A Talking Points on the SEC Petition Evaluation Report for the Baker Brothers Site in Toledo, OH (SEC-00204)*. SC&A, Inc., Vienna, Virginia. February 12, 2013.

Shinn, F.A., 1943. Letter from F.A. Shinn (War Department, United States Engineer Office, Manhattan District) to Steward Sturges (War Department, United States Engineer Office, Manhattan District). November 24, 1943. SRDB Ref ID 79035.