



# Report of TBD-6000 Work Group Concerning Appendix BB Rev. 1 Findings (General Steel Industries)

ABRWH Meeting 108, Oakland, California  
November 18, 2015

Presented by Paul L. Ziemer, Chair, TBD-6000 WG

# Work Group Members

- Josie Beach
- Wanda Munn
- John Poston
- Paul Ziemer, Chair

# Background Information

- Appendix BB, Rev. 1 dated June 6, 2014 was released on June 23, 2015.
  - Co-petitioner Dr. Daniel McKeel submitted a review and comments on July 21, 2014.
  - SC& A submitted their initial review and comments on Oct. 29, 2014 . It was replaced by a final version of record on December 10, 2015 (This included 10 Findings).
  - The Work Group met (by phone) on Feb. 5, 2015 to deal with the findings and concerns raised.
  - Six SC&A findings were resolved by the Work Group at the February meeting.
- NIOSH DCAS notified the Work Group on Feb. 20, 2015 that they would proceed to issue a PER for Appendix BB Rev 1
  - The resolution of the four open findings was expected to require more time than previously thought.
  - It was expected that resolution of the four open findings would lead to the issuance of Rev. 2 (and thus an additional PER).

# Background Information (continued)

- PER-057 was issued on March 11, 2015
  - The TBD-6000 Chair reported to the Board on March 25, 2015, that the PER had been issued and that the Work Group would continue to deal with the four unresolved findings as soon as NIOSH DECAS provided their responses to those findings.
  - Details on the PER and claims evaluations are not a part of this report.
- NIOSH DCAS issued their White Paper discussion of the four open Rev. 1 issues on July 10, 2015
  - Co-petitioner Dr. Daniel McKeel submitted a critique of the NIOSH document on July 19, 2015.
  - Site expert John Ramspott also provided a review of the NIOSH document on July 23, 2015
  - SC&A issued its review of the NIOSH document on September 15, 2011.
  - The Work Group met (by phone) on November 3, 2015 to deal with the open issues.

# Summary of Appendix BB Rev. 1 Issues

- An Issues Resolution Matrix for Appendix BB Rev. 1 has been provided by SC& A.
  - Copies of the Matrix, dated November 13, 2015, have been provided for the ABRWH for use in connection with the Oakland CA Board meeting on November 18, 2015.
  - Details on each issue, the NIOSH responses, the SC&A replies, and the Work Group actions are delineated in the Matrix.
  - Details on each issue will not be presented here, but Board members should refer to the Matrix for that information.
- Issues 1, 3, 4, 7, 8, and 9 were closed by the Work Group at the February 5, 2015 meeting.
- Issues 2, 5, 6, and 10 were closed by the Work Group at the November 3, 2015 meeting.
  - Since the final resolution of these actions are included in the Matrix, and since they were items that required more extended debate, I will summarize them here.

## Issue 2: Beta Dose to Skin of Betatron Operator

- Issue: (See Matrix) The issue deals with exposure scenarios relating to beta doses from irradiated uranium and steel, especially in terms of activation products produced as a result of short and long exposures of these metals.
- Skin doses from uranium
  - The NIOSH calculations were based on continuous irradiation of uranium.
  - The new SC&A analysis used the intermittent exposure model developed by NIOSH for irradiated steel.
  - SC&A created a more realistic MCNPX model of uranium disk to simulate photoactivation
- Skin dose from irradiated steel
  - SC&A verified the NIOSH model
  - SC&A estimates are slightly lower (0 - 1%) due to different calculations of betatron beam intensity
- NIOSH agreed to use the updated SC&A estimates; The WG concurred.

# Issue 5: Adding Betatron Operator Dose to Radium Radiography Dose

- Issue: (See Matrix) the Issue broadly deals with assumptions on times allocated for radiographic setups and exposures for both radium and betatron procedures
- NIOSH position:
  - Setup time: 15 minutes between shots— $15 \text{ min/shot} \times 10 \text{ shots/shift} = 150 \text{ min/shift} = 2.5 \text{ h/shift}$
  - Radiographic exposures:  $30\% \times 8 \text{ h} = 2.4 \text{ h/shift}$
  - Maximum time left for work in betatron:  $8 \text{ h} - 2.5 \text{ h} - 2.4 \text{ h} = 3.1 \text{ h}$   
 $\div 8 \text{ h} = 38.75\%$
  - Assumption that same radiographer performed all uranium radiography represents unjustified bias

# Issue 5 (continued)

- SC&A reply: recommended that the time assumed for betatron work be 60% rather than 38.75%.
- The Work Group recommended that a value of 50% be used. Both SC&A and NIOSH agreed
- NIOSH proposed adding the full-time betatron operator's doses, prorated for the fraction of the time spent in the betatron building, to the radium radiographer's dose.
  - SC&A proposed that the radium radiographer performed all of the uranium betatron radiography in a given year, with the remaining time in the betatron building spent radiographing steel
- The WG accepted the NIOSH recommendation; SC&A concurred

# Issue 6: Layout Man Beta Dose

- Issue: (See Matrix) The issue deals with assumptions relating to the times and distances involved to assess the skin doses from irradiated steel for workers setting up castings for radiography.
- NIOSH position:
  - All castings were irradiated intermittently
  - Layout man often spent 15 min on freshly irradiated casting—total 10% of shift (interrupting casting scenario)
  - Same amount of time on each casting, whether long or short shot
  - 90% of time on short shots—10% on long shots
- SC&A reply:
  - They accept NIOSH model as bounding and claimant favorable, except for the number of long vs. short shots
  - Model should consider more long shots to mark up
  - Proposed 25% of exposure time was to long shots and remainder to short shots
- NIOSH agreed to accept SC&A proposal. WG approved.

# Issue 10: Betatron Operator Gamma Dose

- Issue: NIOSH assumed hands and forearms shielded by torso 50% of time. SC&A recommends assuming a 100% value as a bounding value
- NIOSH response:
  - Betatron operator photon exposure scenario only used for doses to the skin of the hands and forearms—confirmed by SC&A
  - Plausible assumption that hands and forearms exposed to betatron only ½ time, remainder of time shielded by body
- SC&A reply:
  - Photograph from GSI shows betatron operator holding his left hand and forearm above his shoulders and his right arm at the side of his body
  - NIOSH should assume hands and forearms exposed to betatron full time
  - Recommended skin dose to hands/forearms: 10.225 rad (air kerma) × 0.654 rem/rad = 6.687 rem/y
- Resolution: WG voted to accept SC&A assumption. NIOSH agreed.

# Work Group Recommendation



- The TBD-6000 Work Group recommends that the ABRWH accept the resolution of Issues relating to Appendix BB, Rev. 1, and that NIOSH proceed to prepare Appendix BB, Rev. 2.