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Sent: Monday, February 07, 2011 9:51 AM
To: NIOSH Docket Office (CDC)
Cc: danmckeel2@aol.com; Katz, Ted (CDC/NIOSH/OD)
Subject: Fwd: GSI Docket 140 and Feb. 16 TBD-6000 wrk grp agenda items

NIOSH Docket 140 (GSI) office:

Please place the following comment on the General Steel Industries Docket #140. This slightly edited version supersedes the version I sent last night to Mr. Katz and the ABRWH. Thank you.

-- Dan McKeel Feb. 7, 2011

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Dr. Paul Ziemer, TBD-6000 work group chair
Ted Katz, ABRWH DFO
Current ABRWH board members (Ted Katz please distribute)
NIOSH GSI Docket #140

February 6, 2011

Dear Paul and Ted and members of the Board and Docket Office,

May I please request two important items be placed on the February 16, 2011, TBD-6000 work group meeting agenda? GSI-Landauer film badge sensitivity to 24-25 Mev Betatron photons was on one TBD-6000 work group agenda but was passed over due to time constraints. The question was whether these standard film badges, that used dental film packs apparently, accurately captured the full dose/energy range of photons related to operations of the two GSI 24 and 25 Mev Betatron particle accelerators? It is most important at this stage that this crucial question be answered definitively. The primary answer needs to come from NIOSH. To our knowledge, the agency to date has not addressed this key question in detail.

and I have been reviewing our notes including our 2008 through 2010 correspondence with Dr. , and former of the at the , and head of its program. like GSI, operated a 25 Mev Allis-Chalmers Betatron and used it to examine missile parts and other industrial/military castings at high resolution. , another physicist who addressed the Board about GSI Betatrons, did his fundamental research on metal activation and potential harmful exposures to Betatron operators under Dr. leadership as Department chairman.

I will highlight two key points that Dr. made in 2008 e-mails to Mr. and I regarding (1) the GSI Betatron control room door and (2) the GSI-Landauer 1964-73 film badge program for radiographers. We have Dr. Kobiske's permission to quote his remarks.

(1) The MSOE Betatron building shielding featured 6 foot thick concrete walls and a 70 ton, 30 inch thick steel door (attached photos from John Ramspott) to shield radiation from impinging on the surrounding classrooms. In contrast, the GSI control room door was only 1-2 inches wide and was (probably) wood covered by thin metal that provided, according to Dr. Kobiske, essentially no shielding from Betatron photons. To back this up, SC&A's computer modeling (no real data to validate) of GSI photon exposures showed highest doses in the control room, a seemingly anomalous finding that would actually be explained by Dr. observations on the inadequacy of the control room door design at GSI. Dr. indicated this minimal control room door shielding promoted "the radiation funneling effect." and I cannot remember hearing funneling effect or shielding inadequacy of the GSI Old and New Betatrons control room doors discussed on the record by NIOSH, the Board, the TBD-6000 work group or SC&A. We believe it should be addressed.

(2) It is unclear how effective the GSI-Landauer film badges were at measuring the very high energy 24-25 Mev Betatron photons. What percentage of total radiation dose and greater than 1 Mev photons did those badges actually capture: 10%, 20%, 30%, 50%, 75% or 90% or an even higher percentage? Quantitative "real data" analyses are needed to answer this question, not merely computer modeling, in the GSI co-petitioners opinion.

Here is what Dr. Kobiske had to say, in part (with his permission), in four excerpts:

[1]

" : Just an added comment on Energy (e.g., the 100 MeV Betatron). As the x-ray energy increases so does the resolution of the resulting radiographs. Smaller and smaller defects can be resolved. Also, one can look at thicker and thicker castings with higher energy (also with increased resolution.) Of course with these kind of energies, the secondary background radiation (due to pair production from the primary beam) would be extreme. Standard film badges worn in such area would probably not show much of an increase in control room radiation levels. Because the detection cross section would fall way off at the higher energies. I may be wrong here, because the radiation safety officer for the facility would probably have made certain that his badges were calibrated for the higher energies (0-100 MeV)."

[*McKeel comment: The 100 Mev Betatron was a hypothetical; both the MSOE and GSI Allis-Chalmers industrial Betatrons operated in the 24-25 Mev range.*]

[2]

"I can recall that one time we set up the Betatron to aim directly at a 6 foot wall, perhaps a few feet away. The radiation levels that were measured on the other side of the wall, using calibrated ion chamber detectors was higher than were allowed by the standards. e.g. A person would not be allowed to work a 40 hour work week in such an area. (Faculty offices were on the other side of the Wall). However, it was decided that this geometry was really never in place in practice. e.g. that castings were usually far from the walls, and that the walls were never actually in the direct beam. Usually the sample being x-rayed scattered the direct beam by quite a bit and thereby reduced the concentrated direct beam." [*McKeel comment: At GSI, large castings were often radiographed with the Betatron head pointed at a concrete wall that itself must have been activated. Workers walked directly outside the Old and New Betatron buildings. A sign on the Old Betatron building stated "Do not approach this building within 100 feet" indicating that elevated radiation levels must have been known about by GSI management.]*

[3]

"I have a few more comments on the survey instrument calibration for high energy Betatron radiation. These survey meters, film badges, and ion chambers, etc. were usually calibrated with (perhaps) Ra226, or Cs 137, or Co 60. which are all relatively low energy gamma emitters (in the neighborhood of a half to one MeV or so. A 5-25 MeV X-ray is not so easily detected by such a device because the detection cross section depends upon energy and falls off. Even the survey instruments that we used were not calibrated for these higher energies. Its not clear how one would do such a calibration. Perhaps some way with attenuator blocks to first lower the energy it would be possible. But I feel that this was not done at the time (in general). I can recall that we had a set of large diameter Victoreen ion chamber probes (some as large as 5 or 6 inches diameter or larger; but I do not really know about the calibration. I do not recall that they were ever used.) Ron"

[*McKeel comment: To our knowledge, NIOSH has no information about how the GSI-Landauer film badges were calibrated. I have seen no data indicating they were calibrated to account for 24-25 Mev Betatron photons.*]

[4]
[*McKeel comment: The following passage comes after a detailed explanation of how photons interact with matter by the photoelectric and Compton effects, pair production, and Bremstrahlung*]
"I do not know how significant this funnel effect is, but it might be very large. Because the energy is potentially so high, standard film badges which are usually calibrated with ? (perhaps Cs 137 or Co 60) would give a much lower reading than the actual radiation dose. For example, what is the probablity of capturing completely the energy from a 10 mev photon that interacts by pair production within the film badge? **Probably almost zero.** Yet, such a photon can ionize a lot of biological tissue when it is incident upon a person."

In summary, there exists abundant knowledge of fundamental physics and film badge technology that casts doubt on the accuracy of radiation dosimetry measurements represented by the 108 Landauer GGSI male-only radiographer film badges (FB) that NIOSH and SC&A have in their possession as a result of initial inquiries in 2006 by the GSI co-petitioner. This is a tiny non-representative sample (one job, no females) of the GSI workforce who were badged out of 3,000 workers/year in the workforce. Of course, given turnover, the total workers at GSI during the covered period of 1953 to 1966 was much higher and the fraction badged was therefore far lower than 108/3000 = 3.6%.
a) Nothing is known of how the GSI FB were calibrated.
b) There is no information about the quality control procedures for FB handling that were used at GSI. c) There is no explanation why no FB personal monitoring data was done or exists presently for the remaining 2900 GSI workers.
d) No FB data exists for female GSI workers.
e) Most important are the facts addressed in this request by question 2. That is, what was the sensitivity of the GSI-Landauer FB for the full spectrum of photon energies the GSI Betatron operators and Co-60, Ir-192 and Ra-226 radiographers were exposed to? Dr. Kobiske's commentaries suggest the photons with energies between 1 Mev to 25 Mev from the two Betatrons may have been most severely underestimated. The petitioners and GSI site experts express doubt the GSI FB were calibrated in this range. There is no evidence this calibration was done. GSI petitioners, site experts and former workers have pointed out in other Board and Docket 140 comments that (1) GSI radiographers racked their FB when working outside the Betatron facilities, (2) the GSI FBs were not configured to measure neutrons, and (3) there were several known NDT radiography accidents below criticality that nevertheless resulted in workers being hospitalized or suspended from their jobs. The accuracy of the facts of these incidents as portrayed by NIOSH and SC&A are challenged by the petitioners. We do not consider the facts have been full validated, nor has all the evidence been fully disclosed to the petitioners by RS Landauer. The reasons behind this censorship is not clear.

Submitted by,

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MSOE door (above); GSI door (right)