Dragon, Karen E. (CDC/NIOSH/EID)

From:	DanMcKeel
Sent:	Saturday, November 10, 2012 9:16 AM
To:	NIOSH Docket Office (CDC)
Cc:	danmckeel'
Subject:	Fwd: McKeel Comment on Allen Nov 2012 GSI Discussion Paper
Attachments:	McKeel Comment on Allen Nov 2012 GSI Discussion Paper

To the NIOSH Docket Office:

Attachment: <McKeel_Comment_AllenNov2012.pdf> 1.1 MB

Please accept the attached PDF file as my comment on David Allen's DCAS/NIOSH latest Discussion paper on the General Steel Industries (GSI) site. The Allen paper was prepared for the TBD-6000 work group at its scheduled Nov. 28, 2012 next meeting. The Allen paper analyzes additional surrogate data sources to be used in a future revision to Appendix BB to account for uranium intakes at GSI. I wasn't sure whether or not Ted Katz, DFO, forwarded your office a copy of the attachment. Thank you.

-- Dan McKeel 11/10/12

In a message dated 11/9/12 12:40:44 PM, ____________ writes:

Paul Ziemer, Chair, and members of the TBD-6000 work group
Ted Katz, ABRWH DFO
Members of the ABRWH full Board
NIOSH Docket 140 (GSI) Office

November 9, 2012

Attachment: <McKeel_Comment_AllenNov2012.pdf> 1.1MB

Dear Dr. Ziemer,

I have attached as a PDF file my comment related to the latest David Allen and DCAS/NIOSH Discussion paper that was posted on the DCAS website on 11/8/12.

Ted Katz, please distribute this Discussion comment paper to the full Board membership.

NIOSH Docket 140 Office, please consider posting this message and the attached PDF file to the DCAS website as a discussion paper for the Nov. 8, 2012, TBD-6000 work group meeting.

Thank you -- Dan McKeel 11/9/12

Daniel W. McKeel, Jr., MD
GSI SEC-105 co-petitioner

Daniel W. McKeel, Jr., MD

Daniel W. McKeel, Jr., GSI SEC-105 Co-petitioner Comment on David Allen DCAS White Paper "Evaluation of Additional Air Sample Data Applicable to GSI" Received Nov. 6, 2012

Page 1

Background

On July 16, 2012, SC&A submitted a review of NIOSH's use of surrogate data at GSI to the TBD_6000 work group (Anigstein 2012). NOSH responded to that review in a white paper dated August 2012 (Allen 2012). Both papers were discussed during a work group meeting held on August 28, 2012. As a result of this discussion, the work group asked NIOSH to locate and review additional air sampling data associated with the movement of cold uranium metal[1]. This paper presents the data collected in response to that request; and provides an analysis of the applicability of the data to bounding the inhalation of uranium at GSI.

MCKEEL: The background should include the facts that on August 28 SC&A reported the NIOSH TBD-6000 intake model for GSI was invalid and failed to meet 4 of 5 Board surrogate data criteria. The work group did not accept the "new" surrogate data from LeBlond and two other AWE sites two of which handled uranium slugs and the other uranium billets. None handled dingots or ingots of the type sent by MCW Destrehan Street and Weldon Spring site to GSI. None of the three "new" surrogate data sites were stringently justified as being similar in scope of operations and source terms to GSI. The intake data offered were very scant and did not include breathing zone, general air and process sampling as recommended by HASL. There is no uranium urine bioassay data for any worker at GSI. Only 3% of the work force in a single job category, radiography, were ever badged.

Data Collected

Pursuant to the working group's request, NOISH broadened its search for data related to the handling of cold uranium metal. Difficulties associated with finding this type of data are pointed out in the NIOSH white paper issued in August 2012. In summary, the difficulties include:

a) The operation is not normally a source of high airborne activity so few samples were taken; and,

b) When the metal is moved, it is normally for the purpose of performing some mechanical operation. These mechanical operations often cause high airborne activity in the vicinity, thereby positively skewing the results.

In searching the NIOSH site research database, some air samples were found in which it was difficult to determine if they were representative of the movement of cold uranium metal. An example is the general area air samples found for an ingot storage area at Fernald. The sample descriptions contained no indication of what, if any, work was occurring in the area, therefore, the samples were not used. Other samples that were located also may have been interfered with by nearby airborne activity generating operations. Finally, if the metal was heated, samples associated with additional steps soon after were assumed to be associated with heated metal and were not used. The intent of our data

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FILE: DM_reply_Allen_Nov2012.doc

Cold uranium metal, as used in this white paper, refers to uranium that has not been physically heated.

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search was to find samples related to handling cold uranium metal and elevated temperatures can have a great effect on the production of oxides on the surface. An example of this can be seen at the Weldon Springs Site. In an outgassing procedure, 60 slugs were loaded into wire baskets and 8 baskets were loaded into a "boat" which was placed into a furnace. When the slugs were placed in the basket, the airborne level was 25 dpm/m^3. When the slugs came out of the furnace, they had to be handled to read the numbers stamped in the slug. The measured airborne level from this handling operation was 1530 dpm/m^3.

MCKEEL: The correct site name is Weldon Spring (singular). GSI did not handle uranium slugs. They did handle uranium dingots from the Weldon Spring site 1957-66. Uranium dingot data are the relevant data that are needed to assess and bound intakes at GSI with sufficient accuracy.

As a result of the expanded data search, a few additional samples were, however, located that have little or no influence from nearby operations. The samples include data collected at several facilities and cover the years 1956 through 1968. The data also cover operations involving four forms of uranium metal: slugs, derbies, billets and dingots.

MCKEEL: All of the "additional sample" sites listed later in this white paper are not new. For example, LeBlond was a site introduced by NIOSH at the August 2012 TBD-6000 work group meeting.

<u>Forms of Uranium</u>

Slugs were typically 8 inches long and approximately 1 inch diameter weighing approximately 4 pounds. They were intended to be used as fuel in plutonium production reactors. Operations associated with the selected samples primarily involved moving slugs into or out of a container.

MCKEEL: At the August 28 work group meeting SC&A introduced data that slugs were only 1/2 x 3/4 inch in size. Mr. Allen's figures are considerably different. What is his primary reference source? Is it different from Dr. Anigstein's and the SC&A reference source for slug dimensions? Despite Ms. Munn's comment that everything is known about uranium metal, there seems to be considerable disagreement about fundamental facts such as the size of uranium slugs.

Derbies are approximately 12 inches in diameter and 4 inches high weighing approximately 300 pounds.

MCKEEL: What is the primary reference source for these measurement values?

They are created by a thermite process used to reduce uranium tetrafluoride to uranium metal.

MCKEEL. The details of the "thermite process" needs to be clarified and explained. What are the specifics of this process, and what is Mr. Allen's primary reference source for the thermite process he is referring to?

Once produced, the derby has to be "broken out" of a reduction pot and the excess magnesium fluoride cleaned off by mechanical means. The operations found associated with derbies include breaking the derby out of the pot, cleaning the magnesium fluoride from the derby and removing the derby from the table. The airborne contamination results in these steps may be interfered with by the mechanical removal of the derby from the pot and the mechanical removal of the magnesium fluoride from the derby. However, most of the dust created in those operations is from magnesium fluoride and though it is contaminated with uranium, the concentration is low and so the interference should be small.

MCKEEL emphasis added. The above description conforms to a one step Mallinckrodt patented dingot process. To produce ingots, several derbies were first produced and these were heat remelted and cast into uranium ingots in a heated "bomb."

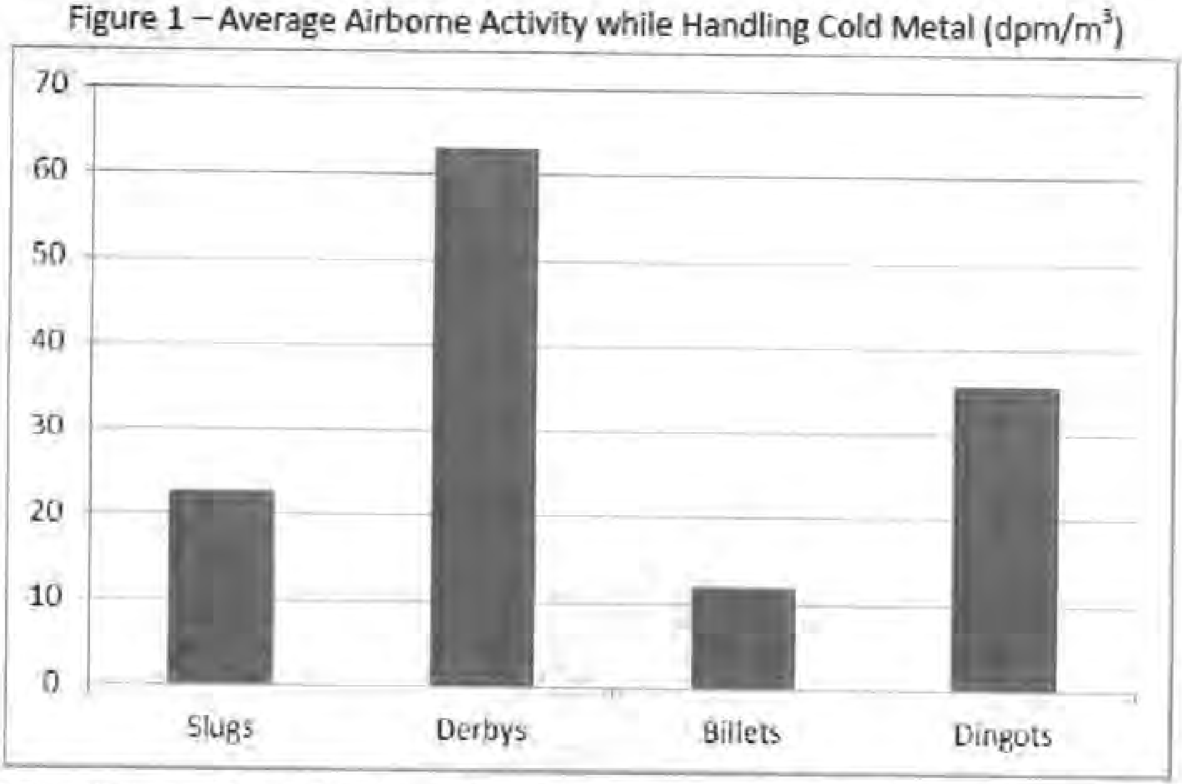
A billet is a generic metallurgical term used to describe a semi_finished piece of metal. In uranium fuel fabrication, it is a piece of uranium metal that was originally cast into an ingot and rolled into a smaller dimension using a blooming mill. The billet would later be further rolled to a finished product using a rolling mill. The billets associated with the data found for this report were approximately 7 inches in diameter and 20 inches long. This would result in a billet weighing approximately 525 pounds.
MCKEEL. The exact references need to be cited here: author, title, site, date published, agency report number, SRDB no., etc. The key question is not the dimensions of the billet in some other site, but rather the uranium billet dimensions that MCW Uranium Division supplied to GSI 1953-1966 for Betatron radiographic nondestructive testing (NDT) that induced both activation and photofission in the irradiated uranium. Those are the relevant comparison billet specifications that must be known and reported by NIOSH, if they assert the claim the "new" "additional" surrogate site/s are stringently justified to be comparable to MCW/GSI.

Page 3

A dingot (direct ingot) is a term used at Mallinckrodt to describe an ingot made directly from the metal reduction process. The alternative procedure was to remelt several derbies and cast them into ingots. The dingot is approximately 18 inches in diameter and 18 inches long weighing approximately 3300 pounds.
MCKEEL: *Uncropped* MCW dingots were not square as Mr. Allen states. As I show later Weldon Spring dingots came in several sizes and shapes. Mr. Allen needs to provide a solid literature citation to back up his recital of MCW uranium dingot dimensions. We agree the weight of an idealized MCW dingot was approximately 3300 pounds.

Analysis of Samples

Air samples were found related to handling cold uranium metal in each of the four forms described above. The sample results, along with the form associated with the sample, are provided in Attachment 1. Figure 1 graphically depicts the average airborne value associated with handling each form of uranium.



The figure is arranged from left to right by the weight associated with each form of metal. No specific pattern can be seen that would indicate one form of metal creates higher airborne activity than another. Although it would seem intuitive that a large metal object would create more airborne activity than a small one, as shown in Figure 2, the data indicate the opposite. In Figure 2, the average airborne activity from handling each form of metal is normalized to the weight of the object.

MCKEEL: These data are uninterpretable because (a) the primary source of the weights are not provided by Mr. Allen, (b) It is not clear whether or not the dingots have 100% of the Mg-Fluoride outer crust removed by machining or not, (c) all of this is surrogate data in that none of these sites (which are not known up until this point in this report) has been stringently justified to be similar to the uranium products that MCW sent to GSI 1953-66.

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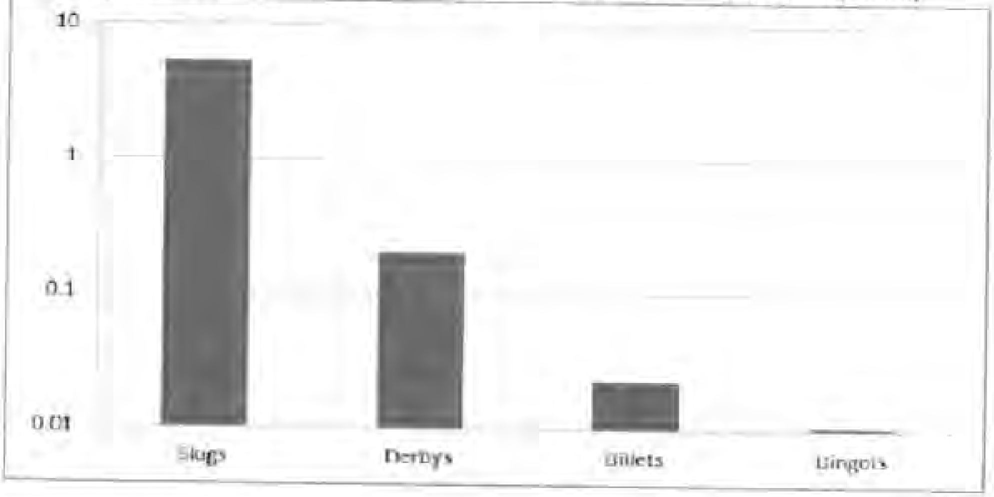
Figure 2 – Average Airborne Activity Created per Pound (dpm/m³/pound)



The figure shows clearly that more airborne activity per unit mass is created from smaller objects than from larger ones. Given that only the loose surface activity contributes to the airborne levels, it would be more relevant to normalize the airborne activity on a surface area basis rather than a mass basis. Figure 3 provides the results of normalizing the data in this manner. This figure is the same as Figure 2 except that the average airborne activity is divided by the surface area in square centimeters rather than the weight.

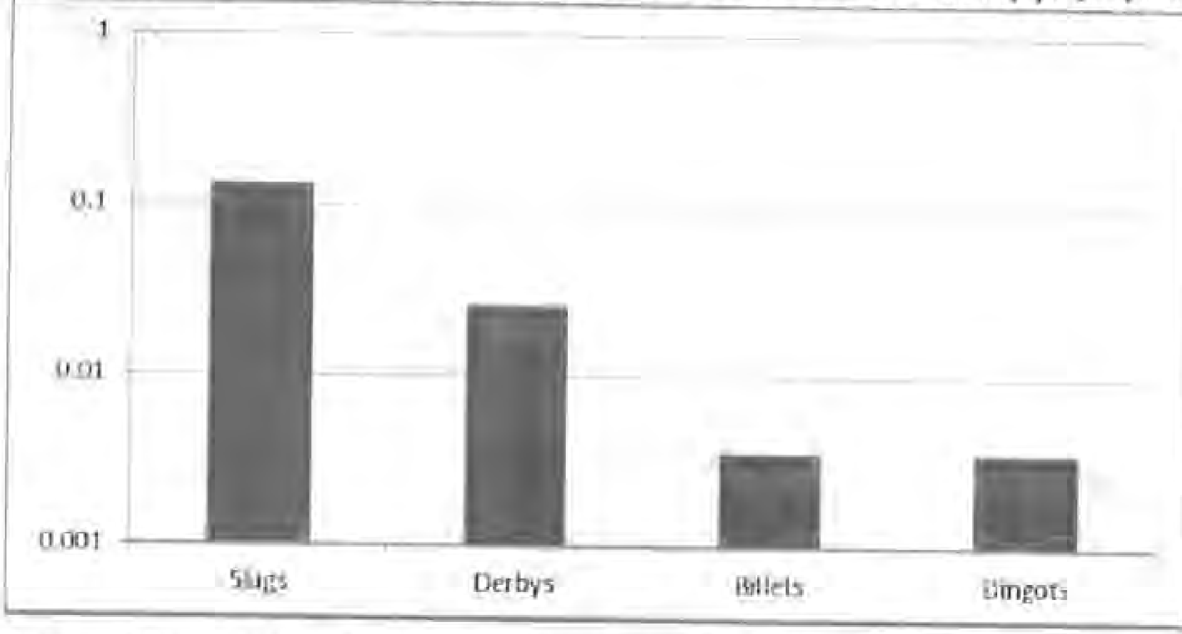
MCKEEL: The same caveats apply to this Figure as to Figure 1. Another caveat that applies equally to both figures is there is a very small "N" and no error bars indicating an SEM or Std. Dev. are given. The legend is further unclear as being labeled "Figure 2" and the legend stating "This figure is the same as Figure 2" when it should say "as Figure 1."

A new factor that must be brought into the equation, that has not been previously discussed by the work group, is the fact that at GSI, as opposed to these "new" and "additional" surrogate sites, 24-25 Mev Betatron irradiation could volatilize activated elements on the uranium surfaces and thereby release more airborne radioactivity.

Page 5

Figure 3 is on the following page.

Figure 3 – Average Airborne Activity per Square Centimeter of Surface Area ($dpm/m^3/cm^2$)



While Figure 3 shows that the airborne activity is indeed more closely related to surface area than weight, there is still a clear trend indicating that smaller objects produce higher levels of airborne activity per unit of surface area.

MCKEEL: Major caveats for Figures 1 and 2 also apply to Figure 3: sites not identified, stringent comparability to GSI MCW uranium forms not justified (GSI never worked with slugs, for example), uranium form dimensions not backed up by proper primary source citations, no error bars, McKeel data challenges the dimensions of both slugs and dingots provided by David Allen.

This trend can be explained by considering that airborne activity is not solely related to the amount of oxide contamination on the surface of the metal. It is also necessary to have some force to dislodge the contamination and suspend it into the air. When handling cold uranium metal, that force will be associated with the mechanism used to move the metal. Movement of a four pound slug is most often accomplished by hand. A hand can easily wrap around a one inch diameter rod and can easily cover about half of the eight inch length. Thus, approximately half of the surface area of the slug could be disturbed by moving the slug. A dingot on the other hand weighs 3300 pounds and will not be moved by hand. The use of a chain hoist or fork truck or other means would have to be employed. If a one inch thick chain is wrapped around an eighteen inch diameter dingot, it would cover less than 4% of the surface area of the dingot. While a single chain may not be employed, it is very likely that whatever means is used, a small fraction of the surface area would be disturbed. So, it is possible that a larger fraction of the surface area of small objects is disturbed when compared to larger objects.

MCKEEL: The accuracy and comparability to GSI-MCW uranium forms of the measurement data from unnamed and uncharacterized surrogate sites presented as the basis for Figures 1, 2 and 3 has been challenged. Most refereed journals insist that Figure legends include full information to validate the information shown, including citations for the literature. NIOSH did not conform to these widely accepted standards, so these data and their interpretation must remain in limbo until these good science standards are met.

The entire rationale given in the preceding paragraph is also suspect. Of course it is true that *"airborne activity is not solely related to the amount of oxide contamination on the surface of the metal."* **Uranium ingots and dingots, and according to Mr. Allen derbies as well, must have the outer magnesium-fluoride and oxide crust removed. This coating was unevenly thick over the metal product surfaces, and data for the thickness of the crust of uranium derbies and dingots at the surrogate sites and at GSI are not known. For Betatron slices, which MCW sent to GSI apparently, the cut surfaces were presumably exposed bare uranium metal with some oxide accumulation, whereas the sides of the slices (~4 inch thick slabs cut from ingots and dingots) was coated with variable amounts of "bomb" crust. Extra handling of ALL MCW uranium sent to GSI was necessary for unloading from trucks and rail cars, weighing, and positioning associated with Betatron x-ray NDT radiography. These technical factors cannot and should not be dismissed as "trivial" or "negligible" or "insignificant" unless and until exacting measurement data are available that can be stringently justified as being comparable to the conditions that existed during Betatron X-ray radiography handling of MCW uranium forms at GSI 1953-1966.**

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While this may explain why more airborne contamination per unit surface area is created from small objects, it is also true that large objects contain more surface area overall. Given these two competing concepts, it is not obvious which form of metal will create more airborne contamination. Based on Figure 1, it appears as though the size of object being handled is not related to the amount of airborne contamination created. From Figures 2 and 3, it also appears that the airborne contamination created from the movement of cold uranium metal is independent of weight and surface area. Based on the data reviewed, however, the levels of airborne activity are relatively low and are can be represented by a fairly consistent quantity regardless of the form of the metal. Therefore, to establish the range of exposures associated with the movement of cold uranium metal, all the data in Table 1 were combined into a single distribution of airborne activity.

MCKEEL: Yes, <u>it is obvious</u> that <u>slugs create the highest airborne uranium values because they have the largest surface area per unit volume</u>. This is the basic principle that Mr. Allen, a health physicist, appears to have missed. There is no justification for combining these disparate uranium form samples to overcome a basic lack of relevant surrogate data. <u>Slugs were not used at GSI</u>, and billets are an undefined size, shape and weight. Moreover, the postulated GSI billets from MCW have not been adequately characterized as to shape, size, dimensions, or composition, or amount of radioactivity associated with their surfaces. <u>Uranium derbies were not handled at GSI</u>. Mr. Allen's surrogate intake data is weak and poorly characterized and is not similar to GSI-MCW uranium products, and there is no escaping or hiding this fact.

NIOSH and DCAS need to admit they lack sufficient air sampling (all three types), urine uranium bioassays, and film badge monitoring data at GSI to bound uranium intakes and activated steel casting radioactivity at GSI during either the operational AEC contract period of 1953-66 or during the 1967 to 1993 residual contamination period.

Attachment 1 contains the results for the samples utilized in this report. The attachment includes the Site Research Database document number and page number where the sample was located. It also includes the site from which the samples were collected as well as the type of metal and the date the sample was collected. A few of the values are listed as "nd" which represents a "none detectable" sample.

MCKEEL: This listing of sites and data sources by SRDB only, minus authors, report titles and numbers, years, sites, etc. is deceptive and scientifically unacceptable. Citing only SRDB numbers, as DCAS/NIOSH is well aware, will seriously impede and prevent the petitioners from acquiring these references in time for the December ABRWH meeting and give them time to prepare a proper rebuttal and defense of SEC-00105. The GSI petitioner and co-petitioner have no access to the SRDB, and have no way to know what specific documents SRDB numbers refer to. Dan McKeel today (Nov. 9, 2012) will submit a FOIA request for all of these SRDB documents to the CDC Atlanta FOIA office. However, based on hsi recent experience where a FOIA request for one such document (Harris-Kingsley 1958) where the authors and title and year were known took 2.5 months to fulfill. DOE had to supply the document, which is supposed to arrive at McKeel's home this morning (Nov. 9. 2012). This is another blatant example of censorship pure and simple.

• **<u>All of the information I seek should have been incorporated in full into this report.</u>**

The samples were analyzed assuming they can be represented as a lognormal distribution. The resulting distribution has a geometric mean of 21.2 dpm/m^3 with a geometric standard deviation of 2.6. This distribution results in a 95th percentile value of 104 dpm/m^3. This is the value NIOSH intends to use for the assessment of inhalation exposure to uranium at GSI.

MCKEEL: Statistically speaking, do the samples in fact have a log normal distribution?

<u>Surrogate Data Analysis</u>

Below is a comparison of the proposed approach to the Board's surrogate data criteria.

Hierarchy of Data

As discussed in the NIOSH white paper from August 2012, the only data available at GSI is FUSRAP data from 1993 and the use of the surrogate data presented in this paper would represent less uncertainty than back extrapolating the FUSRAP data over a 40 year period.

MCKEEL: None of the surrogate data produced by Mr. Allen satisfies this criteria.

SC&A also pointed out in its review that appropriate adjustments to the TBD_6000 data were not made. NIOSH believes the intent of that statement in the surrogate data criteria is intended to apply to adjustments necessary to make the data applicable to the site. This is not to be confused with other parameters used to estimate intakes from the data such as exposure time. Those parameters would be

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used even on measurements take at the site. They are therefore, not related to surrogate data. While it is agreed those parameters are subject to review, NIOSH disagrees that the surrogate data criteria would be relevant in that review.

MCKEEL: This is an arcane irrelevant argument by Mr. Allen. I agree with SC&A.

Exclusivity

This criterion requires that the use of surrogate data be stringently justified. SC&A pointed out in its review that the use was not justified in Appendix BB. NIOSH agreed in the white paper dated August 2012 and intends to include justification made here in the next revision to Appendix BB.

MCKEEL: Given that 20 of 37 samples came from complex DOE sites, this is impossible.

Site or Process Similarities

The airborne creating operations at GSI consisted only of the movement of cold uranium metal. The air sample results presented in this white paper consists of the movement of cold uranium metal in various forms with no or little interference from nearby operations. The various forms require different means of moving the metal. As discussed in this paper, all forms and means of movement appear to result in similar results and the data can therefore be considered to be from a similar process regardless of the size and shape of metal moved at GSI. **MCKEEL: This is a flawed analysis. The different sizes and shapes gave very different results as proven by Figures 1, 2 and 3 that Mr. Allen chooses to ignore to make his point.**

Temporal Considerations

No special controls or means of handling the uranium metal have ever been reported at GSI. Therefore the airborne activity at GSI is associated with the physical characteristics of uranium metal which doesn't change over time and no temporal considerations are relevant. However, the data was collected between 1956 and 1968 which is relatively contemporaneous to the GSI uranium work. **MCKEEL: Untrue: weighing, unload from trucks and trains, position of NDT Betatron radiography all at GSI.**

Plausibility

The data used was collected while moving cold uranium metal. The analysis in this paper indicates the results are relatively consistent regardless of size and shape of the metal or the means of movement. The data then represent real measurements associated with conducting comparable tasks on comparable material. Thus, the value is considered plausible.

MCKEEL: A succession of untrue statements: dimensions not authenticated by relevant literature, "relatively consistent" is not accurate, tasks are NOT comparable tasks and materials (no slugs or derbies at GSI), no uranium NDT radiography at any surrogate site.

Conclusion

NIOSH was able to find 37 air samples applicable to the movement of cold uranium metal. The results were consistent across various sizes and shapes of uranium as well as several sites and years. The 95^{th} percentile of the data resulted in an airborne contamination value of 104 dpm/m^3 which is what NIOSH intends to use at GSI. **MCKEEL: The values were not consistent as Mr. Allen claims.**

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References

Allen, D. 2012. "Use of Surrogate Data at GSI: Response to SC&A Review Dated July 16, 2012." http://www.cdc.gov/niosh/ocas/pdfs/dps/dc_gsisd_0812.pdf.

Anigstein, R. 2012. "Review of the Use of Surrogate Data for Estimating Intakes of Uranium at General Steel Industries." http://www.cdc.gov/niosh/ocas/pdfs/abrwh/scarpts/sca_gsisd_r0.pdf.

MCKEEL: These references are insufficient to back up Mr. Allen's key assertions. Where are the primary references for dimensions and weights of his four uranium forms?

Page 9. Attachment 1, part 1 follows on the next page.

Attachment 1 – Airborne Activity Samples

SRDB#	Pg#	Activity (dpm/m³)	Site	type	Date
10634	11	9	Leblond	billets	8/22/1961
10634	11	nd	Leblond	billets	8/22/1961
10634	11	nd	Leblond	billets	8/22/1961
10634	11	15	Leblond	billets	8/22/1961
10634	11	nd	Leblond	billets	8/22/1961
10634	11	nd	Leblond	billets	8/22/1961
43252	2	24	Chambersburg	slugs	3/21/1957
43252	2	5	Chambersburg	slugs	3/21/1957
43252	2	28	Chambersburg	slugs	3/21/1957
98533	129	53	Tocco	slugs	2/16/1968
98533	129	22	Tocco	slugs	2/16/1968
98533	124	5	Tocco	slugs	6/6/1968
98533	124	37	Tocco	slugs	6/6/1968
98533	124	5	Tocco	slugs	6/6/1968
98533	124	24	Tocco	slugs	6/6/1968
98533	124	nd	Tocco	slugs	6/6/1968
98533	124	19	Tocco	slugs	6/6/1968
34390	2	45 (1)	Fernald	derby	8/19/1963

34390	2	50 (1)	Fernald	derby	8/19/1963
34390	2	34 (1)	Fernald	derby	8/19/1963
34390	3	60 (1)	Fernald	derby	8/19/1963
34390	3	74 (1)	Fernald	derby	8/19/1963
34390	3	47 (1)	Fernald	derby	8/19/1963
34390	3	88 (1)	Fernald	derby	8/19/1963
34390	3	110 (1)	Fernald	derby	8/19/1963
34390	3	60 (1)	Fernald	derby	8/19/1963
12363	78	24	Weldon Springs	dingots	11/14/1960
12363	78	21	Weldon Springs	dingots	11/14/1960
12363	22	56.24 (1)(2)	Weldon Springs	dingots	7/26/1961
12363	22	66.6 (1)(2)	Weldon Springs	dingots	7/26/1961
12363	22	46.62 (1)(2)	Weldon Springs	dingots	7/26/1961
14956	4	25	Weldon Springs	slugs	3/30/1960
14956	4	25	Weldon Springs	slugs	3/30/1960
14956	4	25	Weldon Springs	slugs	3/30/1960
17254	6	11.8	Weldon Springs	dingots	12/10/1956
17254	6	nd	Weldon Springs	dingots	12/10/1956
17254	6	23.7	Weldon Springs	dingots	12/10/1956

MCKEEL COMMENT ON ATTACHMENT 1.

1. Part of Attachment 1. Chambersburg and LeBlond samples were in the August 2012 Allen white paper and thus are not "additional" sites.

2. I have never heard of a Tocco site and thus have no way to know how similar it may be to GSI.

3. This Attachment is further deliberately vague in not giving the exact number of samples that contributed the radioactivity values stated in column 3. Some values are averages.

4. Page numbers from documents identified only by SRDB numbers are meaningless.

5. These values are NOT REPRESENTATIVE of uranium forms used at GSI and do n ot include ingots and Betatron slices of ingots. GSI did not handle or do NDT radiography on uranium slugs or derbies *per se*.

6. Of the cells in column [5], 9 were derby, 6 were billets, 14 were slugs, and 8 were dingots from Weldon Springs (*sic*). Total n=37. Of those, only billets and dingots, total n=14, were possibly used at GSI. Thus 23 of 37 samples in Attachment 1, or <u>62.1% of total samples</u> cited by Mr. Allen, are <u>irrelevant</u> to work done at GSI under contract with the AEC 1953-1966.

7. <u>Twenty (20) of 37 (54%) total samples were from DOE sites</u> (Weldon Spring, Fernald) that differed markedly in scale and scope of activities from work done under contract for the SEC at the General Steel Industries (GSI) AWE site in Granite City, Illinois. Such large scale DOE site cannot reasonably or plausibly be justified stringently as being comparable to GSI in any way. To do so would be scientifically absurd and indefensible.

8. Petitioner records show that uranium dingot production did not develop at Weldon Spring site (WSS) until 1957. The 12/10/12 dates on the last three Weldon Spring dingot samples listed in the Attachment 1 table are therefore suspect, underlining the need for a specific supporting reference.

9. As I show again on the last pages of this report that follow, dingots at Weldon Spring came in several different shapes and sizes. The photos suggest that uncropped Weldon Spring dingots are taller than wide before cropping. Mr. Allen needs to characterize the sizes and shapes of his uranium samples, and the Attachment 1 dingot and billet air samples data, in much greater detail in order to make Figures 1, 2 and 3 more credible as being similar to those used at GSI. The slug and derby data is not credible because those uranium forms were not handled at GSI. And Betatron slices, that were used at GSI, to a large extent claimed in some SC&A reviews of GSI, are not represented in the Allen surrogate uranium samples.

<u>McKeel Summary Comment</u>: The sampling cited in ATTACHMENT 1 cannot possibly be interpreted without having the related primary technical documents. The attached photos

strongly suggest that Weldon Spring uranium dingots, before they were cropped, the form sent to GSI, were taller than they were wide. Mr. Allen gives the dimensions as 18 by 18 inches. This can only refer to dingots after cropping. Only uncropped dingots were supplied by MCW (both sites) to GSI.

From:
Subject: **Dingots / Ingots at GSI, "WHY"?**
Date: April 10. 2009 2:44:57 PM CDT
To:
4 Attachments, 822 KB Save Slideshow

The initial concept of the dingot process was to eliminate the vacuum casting by collecting the metal from a bomb reduction in a properly shaped cavity to permit direct rolling of the scalped regulus. The hot magnesium fluoride slag produced in the reaction would keep the upper portion of the metal molten longer than the bottom, and thus provide for directional solidification of the metal. Chemical analysis and Betatron examination of early dingots confirmed the expectation that the inner core of the dingot, under a contaminated surface layer, was sound metal of exceptional purity. Difficulty was experienced, however, in attempting to roll the scalped reguli in the existing rolling mill because of their short length. Reguli of greater length would result in greater scalping losses. The best solution to this problem seemed to be the adoption of a primary hot forming step prior to final fabrication by rolling or extrusion. This would provide an additional advantage in that it would permit the design of bomb shapes producing optimum metal yields.

components. In addition, the development of various types of power reactors required fuel elements of many different types, and special nondestructive tests were required. Consequently several of the Atomic Energy Commission contractors and subcontractors began rather extensive programs in nondestructive testing. The various contractors included the fuel manufacturers, Mallinckrodt Chemical Works, and the National Lead Co. at Fernald, and the various laboratories interested in fuel element manufacture including Knolls Atomic Power Laboratory, Hanford Atomic Products Operation, Savannah River Laboratory, Westinghouse Atomic Power Division, Atomics International (NAA), California Research and Development Co., Argonne National Laboratory, Oak Ridge National Laboratory, Los Alamos Scientific Laboratory, Battelle Memorial Inst., Sylvania Electric Products, Inc. and the New York Operations Office. An informal

Fuel Tests:

Uranium, like most metals, shrinks on solidifying and blowholes and pipes are formed in the ingots. The amount of metal to be removed by cropping in order to produce sound material for rolling is determined by the use of high-energy X-rays. This test has supplemented other work in aiding the development of improved casting techniques. Uranium alloys may be cast in rounds or flats so that very little if any machining is required for use. Such bars may be tested by ultrasonic techniques for soundness.

From: ·
Subject: **Dingots,**
Date: May 12, 2009 10:11:51 PM CDT
To: Dan McKeel ·
Cc: John Ramspott
4 Attachments, 784 KB Save Slideshow

Dan:
I am going to split this email into 2 sections just to make sure you get them .
These photos are in the "new' book that my Library got me.
(Amazingly they do not

Uranium production technology
By Charles D. Harrington, Archie E. Ruehle, Mallinckrodt Chemical Works. Uranium Division
Published by Van Nostrand, 1959
Original from the University of Michigan
Digitized Dec 14, 2007
579 pages
These are from Chapter 9

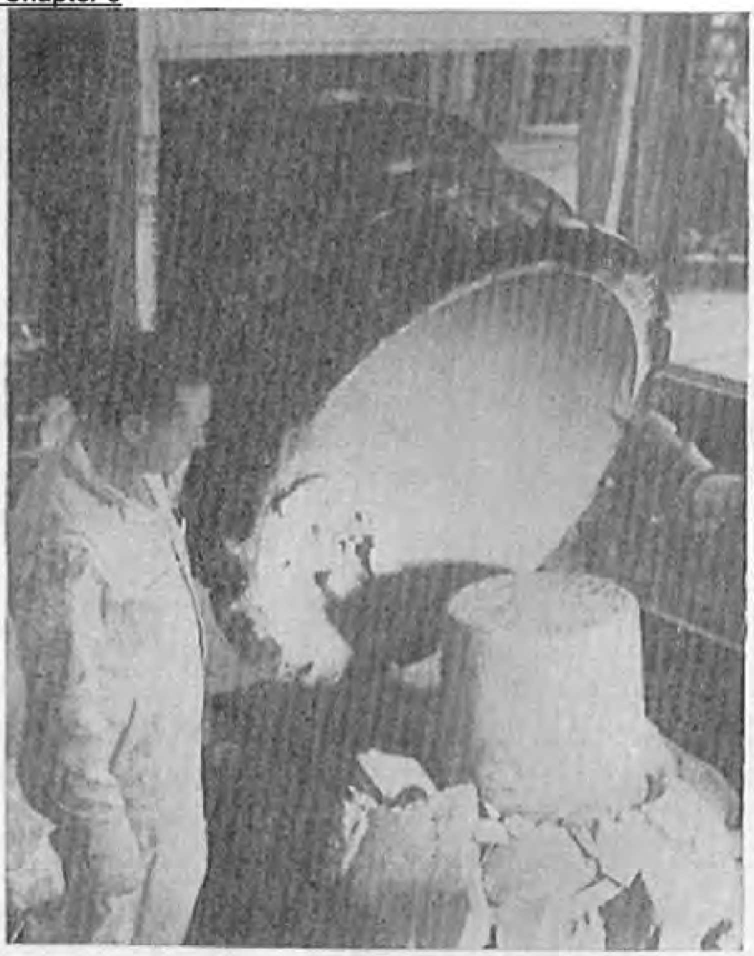


FIG. 9.10. Appearance of dingot and slag during the break-out.

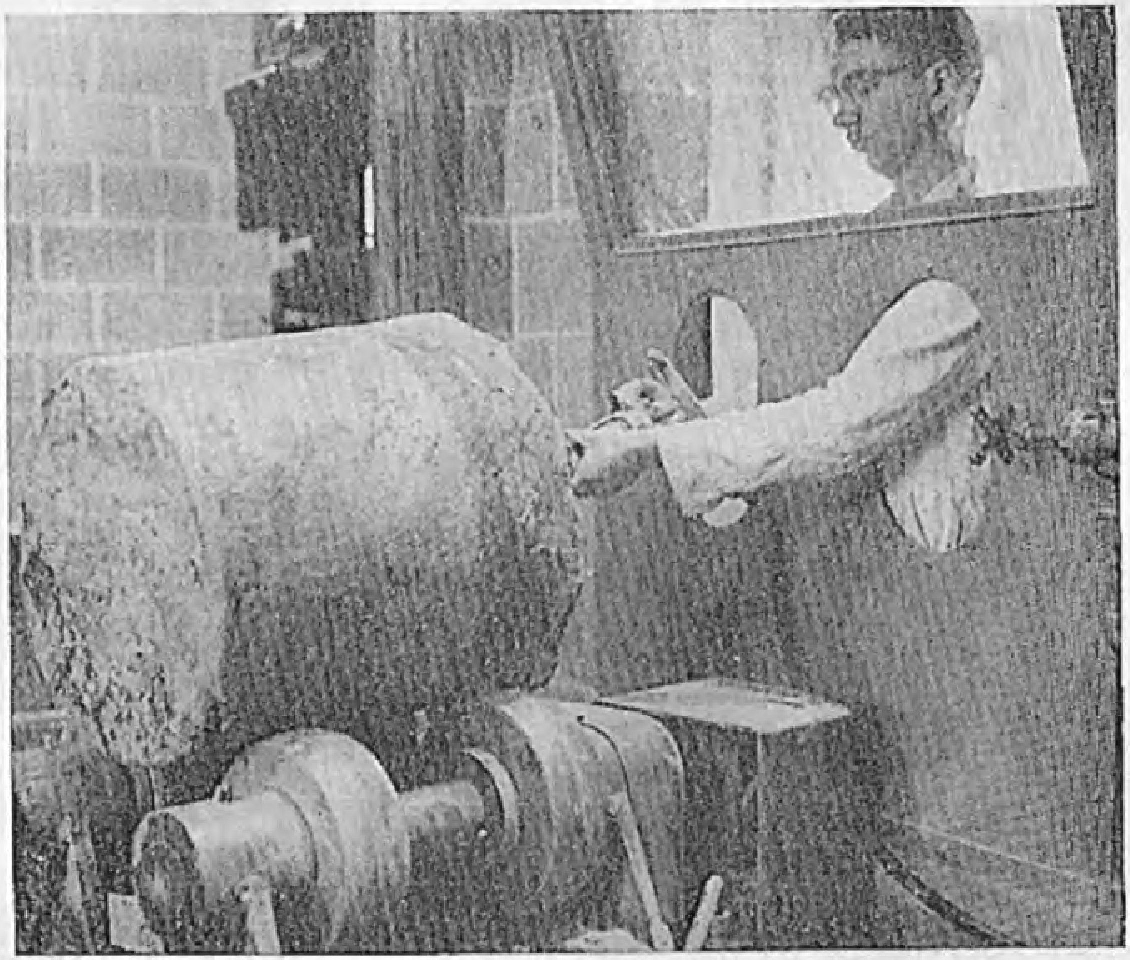
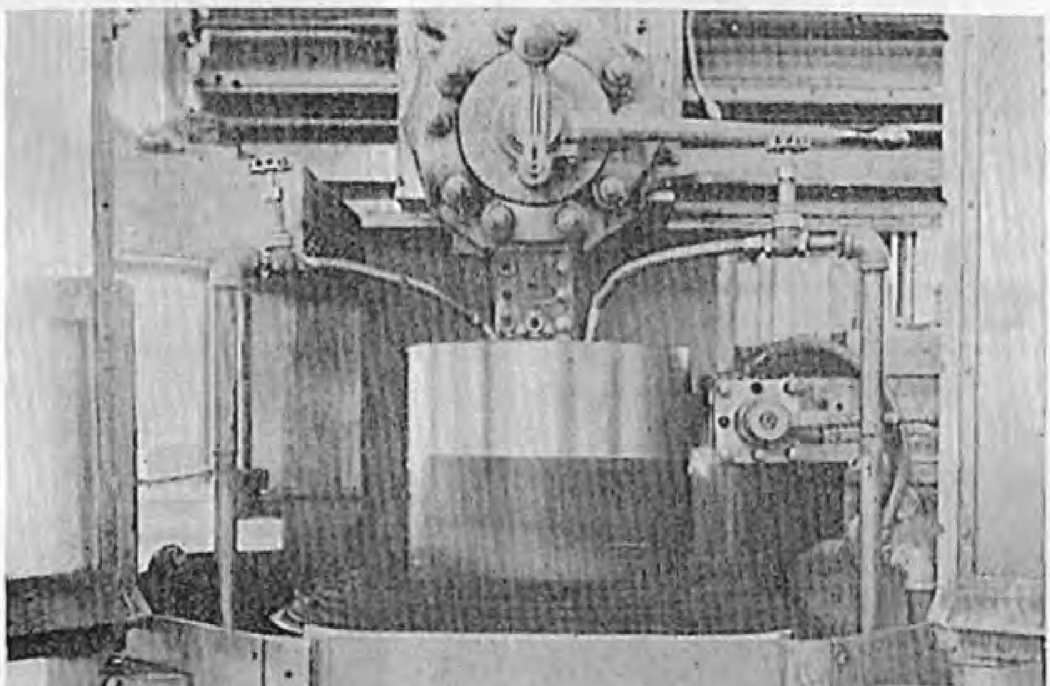


FIG. 9.11. Procedure in pneumatic chipping of dingots prior to scalping.



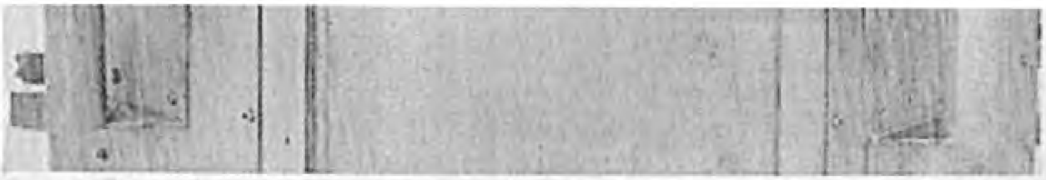


Fig. 9.14. Dingot undergoing scalping. The view shows two cuts being taken simultaneously in a vertical lathe, one across the top face and the other on the outside diameter.

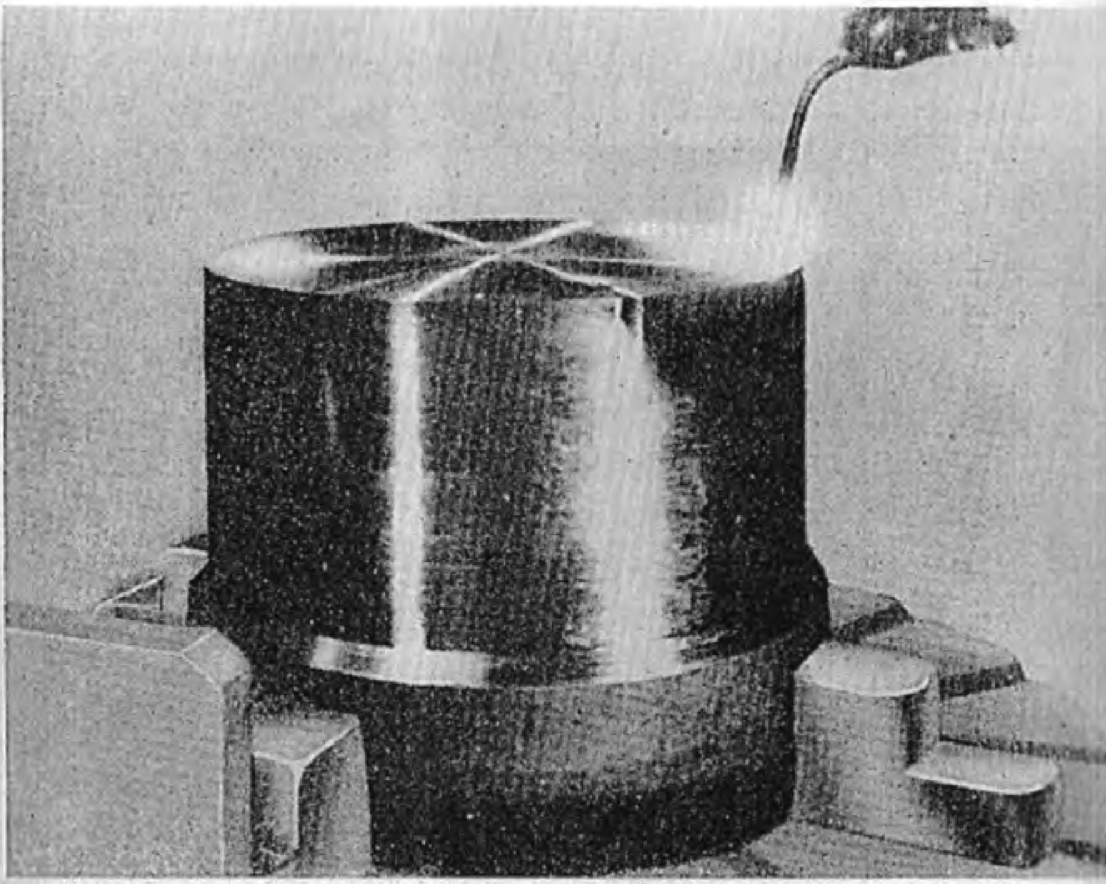


Fig. 9.15. The flame-etch test of dingot surface quality. The application of the torch to the spinning dingot heat-tints the surface and creates a sharp contrast between the metal and any slag inclusions that remain.