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TO: Fernald Work Group – Brad Clawson, Chair

FROM: John Stiver and John Mauro, SC&A

SUBJECT: Data Demonstrating the High Degree of Variability and Uncertainty in Pre-1979 Thorium-232 Whole-Body Measurements Expressed in Terms of mg of Th-232

DATE: April 6, 2011

During the February 8th, 2011, Fernald Work Group Meeting, SC&A was directed to provide additional information on the variability and uncertainty in the pre-1979 Th-232 bioassay data at Fernald, which is being used to develop a coworker model for reconstructing internal doses to workers from inhaled Th-232. This memo is provided in response to that directive and is intended to help discussions on the variability and uncertainty in the pre-1979 data reported in units of mg. Sections 2.1, 2.2, and 2.3 of the SC&A White Paper titled, *Review of Thorium In-Vivo Coworker Study For FEMP – A Proposed Attachment FOR ORAUT-TKBS-0017-5, Rev. 1*, issued in June 2010, addresses this topic in detail. The SC&A White Paper is complete, and this memo is not an addendum to the SC&A White Paper. This memo is provided as an informal exchange of information, which complements the discussions held during the February 8, 2011, Fernald Work Group meeting that were truncated due to time restrictions.

The technical underpinning of the issue raised by SC&A in it's white paper has to do with the fact that thorium compounds are classified as either Type M (intermediate rates of absorption into blood from the respiratory tract) or Type S (relatively insoluble in the respiratory tract), and also that some workers were monitored for thorium repeatedly over a short period of time. When monitoring results taken in a short interval of time show a rapid decrease of Th-232 in the lung, they can not be used with confidence, because they contradict the biokinetics of Th-232 in the lung. This appears to be the case for the data reviewed by SC&A.

The lung measurement data provided below were obtained from a list of in-vivo measurements reported as mg of thorium, from various workers, as examined by SC&A. They are not a complete list of all potentially problematic measurement results and serve as examples to illustrate the uncertainty in Th-232 measurements in mg. Inspection of these data reveals a rate of change in the Th-232 body burdens that raise questions regarding the validity of the data.

Partial Listing of Thorium-232 Body Burdens for Fernald Workers

Worker*	Date	Result (mg)	Date	Result (mg)	Date	Result(mg)	Date	Result(mg)
1	03/07/68	5.9	03/19/68	6.1	04/01/68	2.3		
2	03/06/68	4.3	03/21/68	2.3				
3	03/05/68	10.2	04/15/68	0.2				
4	06/16/71	2.3	06/22/71	0.8				
5	04/19/76	3.9	05/10/76	0.8				
5	04/24/78	4.6	05/01/78	2.3				

Partial Listing of Thorium-232 Body Burdens for Fernald Workers

Worker*	Date	Result (mg)	Date	Result (mg)	Date	Result(mg)	Date	Result(mg)
6	03/27/78	4.1	05/01/78	0.2				
7	03/30/71	4.6	04/01/71	2.5	04/07/71	3.1	04/26/71	0.4
7	07/30/71	3.2	08/04/71	-0.6	08/06/71	5	09/01/71	2.6
8	04/17/74	4.7	04/23/74	1.8	04/29/74	-0.5		
8	05/07/74	4.8	5/8/1974	-0.9				
8	08/12/75	3.6	08/18/75	3.4	09/02/75	1.5		
9	04/12/71	2.3	04/14/71	-0.4				
10	08/02/70	5.8	09/18/70	0.7				
11	03/19/68	6.1	04/01/68	2.3	04/15/68	1.7		
12	03/22/71	4.8	05/03/71	0.4				
12	04/17/74	5.8	04/16/75	3.3				
13	03/29/76	6.2	07/13/76	-0.2				
14	04/12/72	2	04/17/72	0.2				
14	08/07/74	5.5	08/16/74	-1.3				
15	08/14/72	4.1	08/23/72	0.6				
16	04/20/71	3.6	04/26/71	0.9				
17	09/14/70	2.5	09/21/70	0.2				
18	07/28/75	3.6	09/02/75	-4.9				
19	03/05/68	10.5	04/15/68	0.2				
20	03/19/68	3.1	04/15/68	0.3				
21	02/25/71	4.6	03/01/71	0.9				
22	03/20/68	3.3	04/02/68	0.9				
23	08/13/74	2.6	08/26/74	1.3				
24	06/16/71	2.3	06/22/71	0.8				
25	03/18/68	4.6	03/22/68	1.1	03/25/68	0.7	04/02/68	0.7
26	03/07/68	6.8	03/19/68	2.9	04/02/68	1.8	04/15/68	0.7
27	02/16/71	4.8	02/18/71	2.5				
28	04/03/78	4.7	04/17/78	1.3				
29	08/07/73	3.6	08/20/73	-1.5				
30	02/23/71	2.8	02/24/71	0.6				

* Worker identification numbers are arbitrarily assigned.