ATTACHMENT 4.3-1A

Air Dust Concentrations in the Pilot Plant Thorium Process
N. W. Boback
November 19, 1970

WET AREA

Type Sample	Description	No. Samp.	a-d/m/m^3 High	Low	Avg.	X-NCG
BZ	[redacted]	3	4400	170	1890	19
BZ	[redacted]	3	3600	2500	2967	30
BZ	[redacted]	3	100,600	3000	29,300	293

DERBY BREAKOUT

BZ	[redacted]	1	126,200			1,262
BZ	Same as above with ventilation. (West wheelabrator in operation)	2	3900	230	2065	21
GA	Pump located three feet east of the doorway to the plazma spray booth. No ventilation.	2	30,300	1350	15,725	157
GA	Same location as above, with west wheelabrator in operation.	2	200	95	147	1.5
GA	Pump located three feet north of the doorway to the plazma spray booth. No ventilation.	1	6300	6300	6300	63
GA	Same location as above with west wheelabrator in operation.	2	100	29	64	0.6

SAWING THORIUM DERBY

BZ	[redacted]	3	45,570	630	15,910	159
	Saw area.	12	650.	13	190	

ATTACHMENT 4.3-1B

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SAMPLE PUMP LOCATION AND RESULTS (α - d/m/M^3)

Time Started	West Separation Booth Area	Behind #28 Remelt Furnace	In Front of #25 Remelt Furnace	Pump Behind #23 Remelt Furnace	Pump Behind #21 Remelt Furnace	Pump Behind #17 Remelt Furnace	Elec. Switch Area for West Remelts	West Breakout Canning Station	Avg. α d/m/M^3	X [illegible]
(30 min. Samples)										
0635	369	9000	63	4120	5946	1462	1549	820	2916	42
0705	64	532	45	2647	1726	1363	2386	288	1131	16
0735	26	330	17	29	25	47	201	51	91	1.3
0805	15	31	15	60	70	53	100	36	48	0.7
Contaminated canvas tarps hung from 6:25 A.M. until 7:35 A.M.										
Operations Started										
0835	42	92	51	420	412	312	256	122	213	3.0
0905	335	665	272	80000	1878	304	2238	Pump Burned Out	12200	174
0935	140102	600000	4586	200000	100000	40000	90000	20000	149300	2130
0950	3463	16000	2000	70000	30000	70000	170000	20000	47700	681
1007	390	2000	859	20000	9000	20000	50000	7800	13000	191
1037	413	13000	810	10000	5000	8000	30000	2814	8800	126
Break for lunch										
1219	200	1249	230	1184	5000	4000	4000	898	2100	30
1249	61	300	79	875	1000	1000	686	134	516	7.3
1319	359	3068	492	4000	5000	4000	4000	330	2700	39
1349	1576	20000	1547	60000	40000	30000	40000	417	24200	346
1419	4000	50000	1337	30000	20000	10000	10000	600	15700	224
Total	150961	706374	12163	476479	217290	187616	401180	53115		
Average α d/m/M^3 per 5 Hr. Period (During actual cleanout operations)										
	13729	64215	1105	43316	19571	17056	36470	5312		
MAC	197	917	16	618	280	244	521	76		
Average MAC for entire area = 859 MAC										

ATTACHMENT 4.3-1C

		Week of	No. of Samples	α d/m/M3 High	Low	Avg.	X MAC
BZ	Cleanout pit	3-7 to 3-14	8	75589	9100	26815	383
Z	Dump dust collector to furnace	2-20 to 2-27	5	4339	2018	8120	50
BZ	Beating bags	2-1 to 2-7	5	6000	38	1581	22
BZ	Repairing inside furnace	4-12 to 4-18	21	81470	43	7922	113
BZ	" " "	4-25 to 4-30	5	1804	57	504	7.2
BZ	" " "	5-1 to 5-7	7	55083	15	8250	117
BZ	Repairing inside T.H.	3-1 to 3-7	11	23167	17	2578	37
BZ	" " "	4-7 to 4-14	28	18629	126	2439	35
BZ	" " "	4-14 to 4-21	12	7876	120	1620	23
P	While repairing inside fur.	4-1 to 4-7	3	12787	268	7020	100
P	" " " "	4-23 to 4-30	12	5546	49	13-1	18
P	" " " "	5-1 to 5-7	11	92984	79	24853	355
P	" " " "	5-20 to 5-27	2	841	214	528	7.5
P	Rabble shaft opening	2-7 to 2-13	9	47	6	22	0.3
P	" " "	2-18 to 2-25	21	12653	3	2532	36
P	" " "	4-14 to 4-20	6	1467	13	395	7.1
P	Over front of furnace	2-1 to 2-7	5	28	0	15	0.2
P	" " " "	3-8 to 3-15	5	54167	2784	25676	366
P	" " " "	4-12 to 4-18	3	1683	29	656	9.3
P	" " " "	4-23 to 4-30	8	2704	21	654	9.5
P	" " " "	5-1 to 5-7	8	190	22	61	0.9
P	" " " "	5-13 to 5-20	3	441	17	210	3.0
	Empty sludge to fur.tray	5-6 to 5-13	3	286	51	134	1.9
	" " " " "	4-22 to 4-28	5	508	66	316	4.5
BZ	Feeding turnings	2-21 to 2-28	13	544	23	103	1.4
BZ	" "	3-6 to 3-12	18	5527	.6	503	7.1
BZ	" "	3-13 to 3-19	10	605	17	118	1.7
BZ	" "	3-20 to 3-26	4	348	33	117	1.7
BZ	" "	3-26 to 3-31	5	1167	16	308	4.4
BZ	" "	4-1 to 4-7	10	982	2	142	2
BZ	" "	4-8 to 4-14	20	482	3	113	1.6
BZ	" "	4-14 to 4-20	19	761	13	150	2.1
BZ	" "	4-20 to 4-27	17	1195	5	175	2.5
BZ	" "	4-28 to 4-30	14	1287	11	252	3.5
BZ	" "	5-1 to 5-7	48	2716	0	144	2.1
BZ	" "	5-8 to 5-14	12	2171	18	281	4
BZ	" "	5-14 to 5-21	20	409	8	105	1.5
BZ	Feeding turnings & sludge	3-23 to 3-30	3	1057	31	682	9.7
BZ	" " " "	4-8 to 4-14	8	16795	32	2220	31
BZ	" " " "	4-21 to 4-27	8	4853	49	750	10.7
BZ	" " " "	4-27 to 4-30	13	646	6	240	3.4
BZ	" " " "	5-1 to 5-7	14	5276	0	474	6.7

065965

ATTACHMENT 4.3-1D

2260757

NATIONAL LEAD COMPANY OF OHIO

CINCINNATI 39, OHIO

March 26, 1963

SUBJECT AIR DUST RE-EVALUATION OF THE THORIUM FURNACE - PLANT 6

TO C. R. Chapman

FROM R. H. Starkey

REFERENCE

On December 10 and 11, 1962 an air dust re-evaluation was conducted of the Thorium Furnace. Results of the air dust samples taken during this survey are shown below and they are compared with the results of samples collected during October, 1960 and January, 1961.

Operation or Location		X MAC* 1962	1961	1960
BZ	Raking excessive cold residue from edge of top hearth into furnace	1260	-	-
BZ	Unplugging furnace discharge line	417	4.0	4.0
BZ	Loading thorium metal into 5 gallon can from 55 gallon drums to be carried to furnace for charging	69	-	-
BZ	Raking thorium residue into Rotex sifter	27	31	33
BZ	Changing drum at product canning station	19	4.0	4.0
BZ	Charging furnace with pieces of metal	7	3.0	3.0
GA	Approximately 12 feet southeast of furnace	2.5	-	-
GA	1 foot west of furnace	1.8	-	-

* MAC - maximum allowable concentration (70 α d/m/M^3)
- Denotes operation or area did not exist or was included in another classification at the time of sampling.

Although the Thorium Furnace and Rotex sifter have ventilation, it is completely inadequate. In addition, a majority of the operations performed in conjunction with the furnace do not have local ventilation at all. It should be mentioned also that the plexiglass window in the product canning station is broken. This is reducing the ventilation efficiency of the station. The rabbeling arms in the top hearths of the furnace

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ATTACHMENT 4.3-1E

AUTHOR A. J. [redacted]

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R. L. PRIVATE

DECEMBER. 1955

COMPARABLE WEIGHTED EXPOSURE OF PLANT 9 PERSONNEL

TABLE I

Thorium

Job Description	No of Employees	Daily Weighted Exposures Multiples of MAC May 17 to Oct. 31	Nov. 4 to Nov. 23
WET AREA			
[redacted]	[redacted]	34.8	6.52
		215.1	2.74
		46.9	6.21
		7.3	3.34
REDUCTION AREA			
[redacted]	[redacted]	4.11	2.67
		233.71	3.49
		4.10	2.36
		4.11	2.67
		14.9	12.26
		6.21	5.41
		10.60	6.67
ARC FURNACE			
[redacted]	[redacted]	25.06	89.44
		8.83	27.45
		685.64	122.11
		473.03	23.26
		75.71	43.74
MACHINING			
[redacted]	[redacted]	12.87	4.91
		17.67	5.63
		20.60	10.09
		10.46	(Operations
		8.21	(not performed
		25.41	(during this (period.
MISCELLANEOUS			
[redacted]	[redacted]	9.66	5.23
		4.39	---
		4.23	(Operations
		4.91	(not performed
		4.91	(during this (period.
		9.66	5.31
		34.46	6.13
		9.44	5.17
		1.36	1.14
		1.59	1.25

R. L. [redacted]

316345

PE392

NOTICE: This document has been reviewed for Privacy Act information and has been edited accordingly.

NOTICE: This report is pre-decisional and has not been reviewed by the Advisory Board for factual accuracy or applicability within the requirements of 42 CFR 82.

Finding 4.3-2: Use of the 1,050 MAC-hours Per Year as a Default Value for a Bounding Intake of Thorium is Inappropriate

With the noted changes regarding NIOSH's intended approach for estimating thorium intakes, SC&A is uncertain whether NIOSH still intends to employ the default and bounding intake of 1,050 MAC-hours per year, as described in Section 5.2.3 of ORAUT-TKBS-0017-5. In the event of its use in dose reconstruction, SC&A firmly believes that the 1,050 MAC-hours per year is clearly **not** a ". . . default intake rate [that] applies to the most exposed craft personnel (e.g., chemical operators, process maintenance personnel, safety personnel, and first-line supervision/foremen) . . ."

A review of air sampling data clearly shows concentrations in the hundreds and even tens of thousands of MACs/NCG. For example, Attachments 4.3-1A, 4.3-1B, and 4.3-1D enclosed above under Finding 4.3-1 identify maximum air concentrations of 1,262 NCG (or 1,803 MAC), 8,571 MAC, and 1,260 MAC, respectively. Exposures to these air concentrations would exceed the default value of 1,050 MAC-hours per year in as little as eight minutes.

Finding 4.3-3: Limitations Associated with the Use of Job Task(s)/Job Location(s) for the Assignment of Intakes that are based on Air Sampling Data

The feasibility of assigning time-integrated air concentrations and/or lung burdens is severely limited for a sizeable fraction of FMPC workers. Numerous FMPC documents make reference to high-exposure environments/job tasks that were performed by members of the **Project Labor Pool**, **roving maintenance crew**, and **roving operators**.

Attachments 4.3-3A, 4.3-3B, 4.3-3C, and 4.3-3D verify the existence of such workers and their high exposure potential. The difficulty of tracking these and other individuals on the basis of "records" was fully recognized by FMPC Health and Safety personnel as opined in Attachments 4.3-3C and 4.3-3E and summarized below:

- From Attachment 4.3-3C in which the Director of FMPC's Health and Safety Division stated the following in 1953:

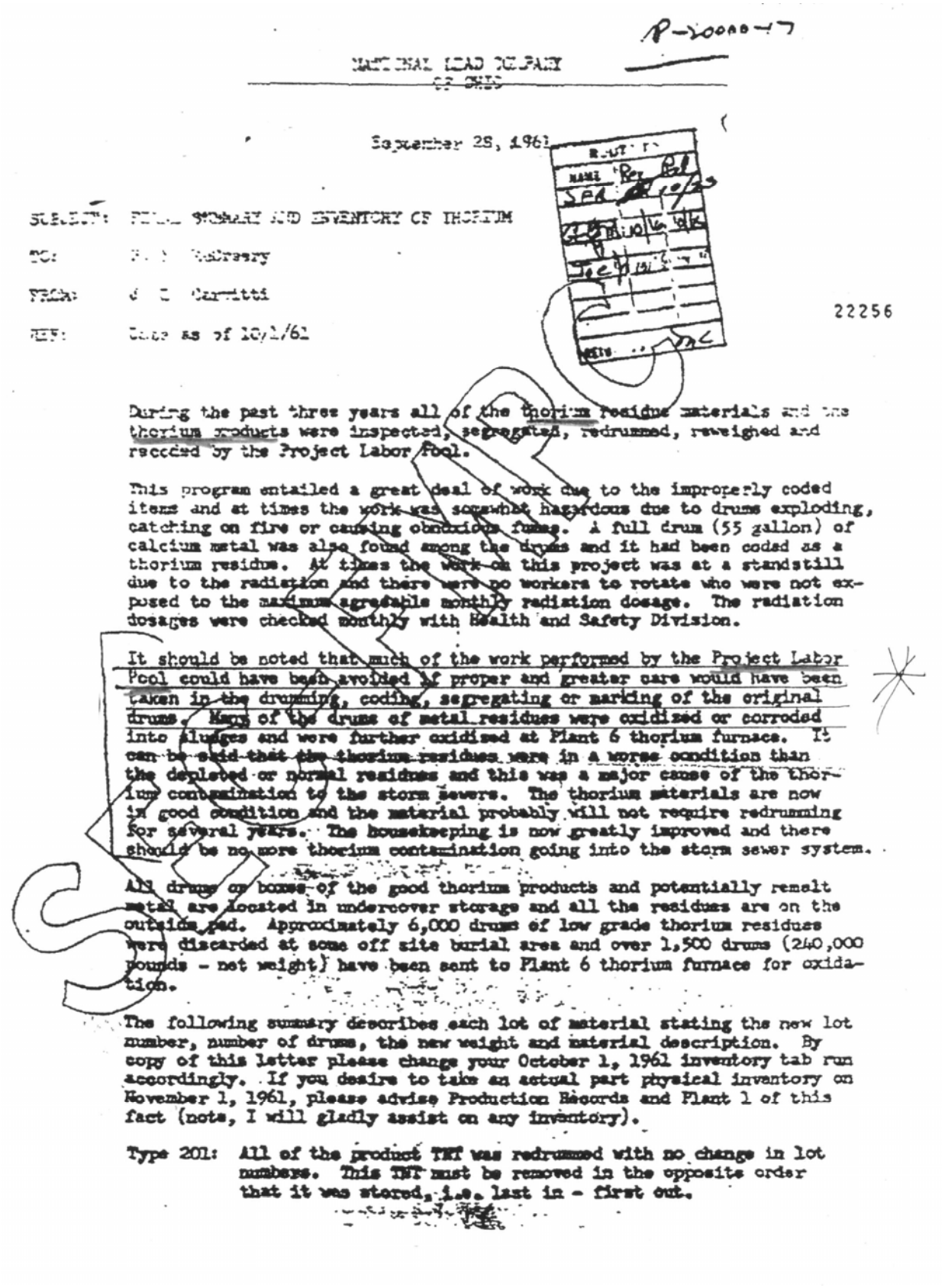
  > *This brief case study also afforded an opportunity to realize two major problems confronting this division. First, we often do not have a* ***complete work history****, especially of* ***roving maintenance men****, such as* [Name]. *However, there are men in other departments who are working in other areas or have been transferred, and our first knowledge at least in the Medical Department of their job locations is when they present themselves for medical care.* ***The man then reveals that he is working in a different area from the one noted on his medical records****. I cannot argue with anyone who says our records are not up to date, but often we are not notified of transfer to specific areas and we do not have the personnel to scout each man.* [Emphasis added.]

- From Attachment 4.3-3E in which the Director of FMPC's Health and Safety Division restated these concerns in 1963:

> *Another serious problem in determining internal exposure is the **difficulty in obtaining good work records**, which show how long an individual has worked in various jobs. Five of the jobs in the table are performed by employees with the job classification of "chemical operator." The other two are classified "chemical operator helper" and "laborer." We have records which tell us to which plants a person is assigned and in which job classification he worked however, these **records do not tell use the specific job operation he performed**.* [Emphasis added.]

SC&A concludes that, for a large fraction of workers, records that may define a claimant's job description/job location are unlikely to be accurate, complete, or sufficiently detailed to be of use in dose reconstruction. (SC&A notes that, while Attachment 4.3-3C and 4.3-3E pertain to uranium workers, it is reasonable to assume that this problem equally applies to thorium workers.)

ATTACHMENT 4.3-3A



NATIONAL LEAD COMPANY
OF OHIO

September 28, 1961

SUBJECT: FINAL SCRAP AND INVENTORY OF THORIUM

TO: P. J. Mahoney

FROM: J. C. Carritti

REF: Date as of 10/1/61

22256

During the past three years all of the thorium residue materials and the thorium products were inspected, segregated, redrummed, reweighed and recoded by the Project Labor Pool.

This program entailed a great deal of work due to the improperly coded items and at times the work was somewhat hazardous due to drums exploding, catching on fire or causing obnoxious fumes. A full drum (55 gallon) of calcium metal was also found among the drums and it had been coded as a thorium residue. At times the work on this project was at a standstill due to the radiation and there were no workers to rotate who were not exposed to the maximum agreeable monthly radiation dosage. The radiation dosages were checked monthly with Health and Safety Division.

It should be noted that much of the work performed by the Project Labor Pool could have been avoided if proper and greater care would have been taken in the drumming, coding, segregating or marking of the original drums. Many of the drums of metal residues were oxidized or corroded into sludges and were further oxidized at Plant 6 thorium furnace. It can be said that the thorium residues were in a worse condition than the depleted or normal residues and this was a major cause of the thorium contamination to the storm sewers. The thorium materials are now in good condition and the material probably will not require redrumming for several years. The housekeeping is now greatly improved and there should be no more thorium contamination going into the storm sewer system.

All drums or boxes of the good thorium products and potentially remelt metal are located in undercover storage and all the residues are on the outside pad. Approximately 6,000 drums of low grade thorium residues were discarded at some off site burial area and over 1,500 drums (240,000 pounds - net weight) have been sent to Plant 6 thorium furnace for oxidation.

The following summary describes each lot of material stating the new lot number, number of drums, the new weight and material description. By copy of this letter please change your October 1, 1961 inventory tab run accordingly. If you desire to take an actual part physical inventory on November 1, 1961, please advise Production Records and Plant 1 of this fact (note, I will gladly assist on any inventory).

Type 201: All of the product THT was redrummed with no change in lot numbers. This THT must be removed in the opposite order that it was stored, i.e. last in - first out.

NOTICE: This document has been reviewed for Privacy Act information and has been edited accordingly.

NOTICE: This report is pre-decisional and has not been reviewed by the Advisory Board for factual accuracy or applicability within the requirements of 42 CFR 82.

ATTACHMENT 4.3-3B

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April 24, 1964

PROJECT LABOR POOL OPERATIONS

J. A. Quigley, M.D.

A. K. Starkey

We have now evaluated the more routine Project Labor Pool operations as it was agreed that we should in our meeting with [redacted] and [redacted] on February 13, 1964. Some of the PLP operations aren't too bad from an industrial hygiene standpoint; however, others are extremely bad, and still others are far from satisfactory. All of the PLP activities are routinely observed and when a specific operation looks to be unsatisfactory, air dust samples are taken. For example, we don't sample operations such as sorting lids and rings or blending organics. The duplicate copy of the work records that I receive daily have helped considerably in our follow-up on the PLP activities. A complete summary of the air dust sample results are included in Appendix I.

As you recall, the operation of screening and redrumming UF_4 in Plant 7 precipitated our 2/13/64 meeting at which time we had no air dust samples on the operation. Samples were taken and as we surmised, they are extremely high (up to 1100 MCG). There is no question that this operation should never again be performed until suitable facilities are provided. As you recall, considerable discussion concerning clean-up, and lack of facilities for doing so, took place at our 2/13/64 meeting. This time, a portable vacuum was available in Plant 7 but not used. Air dust levels of 39 MCG resulted from the "sweeping and shoveling" operation which was substituted for the vacuum cleaner. Respirators were worn during these operations; however, there was never a dust respirator built efficient enough to adequately protect workers in such atmospheres.

The cement mixer located in Plant 3 is now being operated on a two-shift basis. Air dust levels of 87 MCG were measured while MgF_2 was being dumped on the tray for loading into the mixer. All general air levels taken throughout the Denitration Area while the mixer is operating are above MCG. The mixer is located just inside the east door and the wind blows the contamination throughout the entire area. A report was written to [redacted] on March 31, 1964 outlining suggested revisions to the operating equipment and procedures which would result in lower air dust levels. [redacted] contacted me and told me that it wouldn't be possible to revise the operating procedure and he didn't feel he would be able to get money for other equipment for the operation. To

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ATTACHMENT 4.3-3C

NATIONAL LEAD COMPANY
OF OHIO

P. O. BOX 158
MT. HEALTHY STATION
CINCINNATI 31, OHIO

F7-2 211803

October 12, 1953

TO CHARLES DEES, INDUSTRIAL CASE STUDY

CENTRAL FILES

FROM DR. QUIGLEY

REFERENCE DR. DUNKIN

On Wednesday morning, noticed a worker enter the shower room shortly after nine o'clock. His body was covered with black dust, and the worker volunteered that this material was black oxide, U_3O_8, which he had encountered in cleaning the Bag House in the area of the Chip Burner. It was noted by both and I that the man's mouth and nose as well were filled with the black dust. Realizing that this offered an opportunity to initiate a case study, I asked the man to shower and report to the Medical Department.

The employee, , was examined and laboratory studies, such as routine urinalysis, blood count, and urinary level of uranium, were carried out. Both the employee and his immediate superior, were most helpful in securing a work history in regard to this man's activities.

is in the roving maintenance crew and during the period from worked on the third shift and spent approximately three to four hours nightly cleaning out the Bag House adjacent to the Chip Burner. After this man was transferred to the first shift and has spent approximately two hours once a week in cleaning out the Bag House adjacent to the Chip Burner. stated that he is aware of the Health and Safety recommendations as to time spent in cleaning the Bag House. He states that is the most familiar man with the operation and can do such a cleaning operation in two to three hours where another maintenance man may need six to eight hours to do the job. At the present time, however, he is breaking in two man to do the same job has been doing.

The following letters were sent from the Industrial Hygiene and Radiation Department in regard to recommendations concerning maintenance men in closed areas such as the Bag House. These letters are as follows:

PLAINTIFF'S EXHIBIT 330B

F/W 04

Attachment 4.3-3C (Continued)

Page 2
Industrial Case Study

In brief these letters limited the time allowed within the Bag House and also recommended that gloves and respirators be worn at all times.

supplied this man's radiation exposure record which was within normal limits except for the week of when he had an excessive exposure of while working in the Furnace area of 3005. I understand that this has been investigated by

On the afternoon of and I visited the Chip Burner area to survey the surroundings. In the shack-type office in the area, there were two Dust-Foe respirators hanging on hooks. Further comment on their condition will be seen in a later paragraph. There were no other unusual findings seen in the area at the time.

From the medical standpoint there were no unusual findings in regard to condition, and we shall not issue a further statement on this man unless there is a change in his status. However, and his group may desire to supplement this report or conduct further studies in regard to the dust exposure of men within the Bag House during these cleaning operations. stated he would be glad to cooperate in any way. He anticipates his next major cleaning operation will be the weekend of

This brief case study also afforded an opportunity to realize two major problems confronting this division. First, we often do not have a complete work history, especially of roving maintenance men, such as However there are men in other departments who are working in other areas or have been transferred, and our first knowledge at least in the Medical Department of their job locations is when they present themselves for medical care. The man then reveals that he is working in a different area from the one noted on his medical records. I cannot argue with anyone who says our records are not up to date, but often we are not notified of transfers to specific areas and we do not have the personnel to scout each man.

ATTACHMENT 4.3-3D

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NATIONAL LEAD COMPANY OF OHIO

CINCINNATI, OHIO 45239

October 5, 1967

SUBJECT EXPOSURE STUDY OF PLANT 8 PERSONNEL TO AIRBORNE RADIOACTIVE DUST

TO S. F. Audia

FROM H. M. Beers

REFERENCE Report issued by I H & R, dated July 1967, Same Subject

The Reference Report reflects an increase in (DWE) from 0.9 NCG in 1965 to 2.2 NCG in 1966. This report also indicates that 64% of the personnel exceeded the NCG in 1966 as compared to 21% in 1965. Thus in either comparison approximately a three fold increase.

Reviewing the specific assignments and/or specific operations the report indicates the major problems are related to only a few items.

1. ASSIGNMENTS

	X NCG 1965	1966
1.1. Rotary Kiln and NPR Operators	0.9	7.1
1.2. Roving Operators	0.9	4.3

2. OPERATIONS

2.1. Charging Leach Tank	7.4	24.0
2.2. Changing drums at the Rotex oversize station	1.4	76.0
2.3. Changing drums at the Rotex packaging station	5.3	29.0
2.4. Charging Box Furnace	3.5	10.0
2.5. Changing drums at Rotary Kiln packaging station	6.1	9.2
2.6. Charging Rotary Kiln feed tray	1.6	41.0

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ATTACHMENT 4.3-3E

CENTRAL FILES

NATIONAL LEAD COMPANY OF OHIO

P. O. BOX 39158 CINCINNATI 39, OHIO

November 1, 1963

William T. Doran, M. D.
Division of Operational Safety
U. S. Atomic Energy Commission
Washington, D. C. 20545

2151983

Subject: Information on Forthcoming Feasibility Study on "Correlation of Lifetime Health and Mortality Experience of AEC and AEC contractor Employees with Occupational Radiation Exposure"

Dear Bill:

COPY

It was a pleasure to see you last week in Pittsburgh and to discuss with you the subject feasibility study. Prior to our meeting I had been somewhat concerned about the scope of the study. My doubts had been raised by references to "amounts of radiation" and the reference to NCRP standards regarding lifetime exposure to "penetrating" radiation. I had postponed answering the letter from Mr. Karl to our Manager, Mr. Noyes, pending some clarification of these points.

First of all I would like to say that I very much favor the proposal to undertake a feasibility study. I quite agree that radiation in its broad sense should encompass both exposure to external (penetrating) radiation and also to internal deposition of radioactive materials. The gathering of medical information should not be too difficult, though it certainly will be time-consuming and tedious work. Relating these findings to external or penetrating radiation will be relatively simple, since at all AEC contractor sites complete exposure data to penetrating radiation has been accumulated since the days of the Manhattan project. I am somewhat more concerned, however, with the adding of a factor or factors for internal emitters.

I would like to suggest that the portion of the feasibility study dealing with people exposed primarily to uranium be scheduled somewhat later and possibly after the completion of the "Epidemiological Study of Uranium Workers--Feasibility" presently being conducted at Mallinckrodt and here at National Lead of Ohio. I am still hopeful that our study may be of some assistance in handling estimates

0181504

Attachment 4.3-3E (Continued)

William J. Doran, M. D.
November 1, 1962

When the air dust concentration for a job results in exposures above a control level, we require the use of a respirator to perform the job. Thus the determination of the internal exposure becomes further complicated since we can never be sure of how much of the airborne dust is being removed from the air which is breathed.

Another serious problem in determining internal exposure is the difficulty in obtaining good work records, which show how long an individual has worked in various jobs. Five of the jobs in the table are performed by employees with the job classification of "chemical operator." The other two are classified "chemical operator helper" and "laborer." We have records which tell us to which plant a person is assigned and in which job classification he worked; however, these records do not tell us the specific job operation he performed. It is obvious from the table that all chemical operators in our metal production plant will not receive the same exposure to airborne uranium.

We use urinary uranium excretion information along with air survey information to be sure that we are controlling airborne exposures to amounts that will not be harmful. We do not consider the urinary uranium excretion measurement as an accurate method of estimating either body burden or exposure. We have assumed that the determination of internal exposure by any method or combination of methods is less precise that are estimations of exposure to external radiation.

We have wrestled with this problem of estimating internal exposure in the course of our Epidemiological Study of Uranium Workers here and at Mallinckrodt. It is my personal opinion, however, that because of the wearing of dust or airline respirators, the exposure to airborne radioactive material and hence internal emitters has not been in serious proportions either here or at Mallinckrodt. Our urinary uranium excretion records substantiate this opinion.

I will be happy--and I believe Mr. Mason will be also--to further discuss with you and your study committee the problems we have encountered and the experience we have gained in connection with estimating internal exposure.

Sincerely your,

J. A. Quigley, M. D.
Director of Health & Safety

JAQ:mm

cc: C. L. Dunham, M. D.
C. L. Karl, Ix
J. H. Noyes, Ix

218505

Finding 4.3-4: The Inability to Account for Internal Exposures Associated with Radiological Thorium Incidents

Section 5.3.5 of NIOSH's SEC Evaluation Report acknowledges the fact that:

> *. . . fires and small explosions resulted from working with uranium and thorium metal, especially when molten metal, stored un-oxidized metal turning or scraps, or phosphorus and magnesium compounds were involved. Interviews with former FMPC workers, including fork truck operators tasked with moving burning drums of uranium, reinforced that small fires and explosions occurred* ***frequently****, perhaps even daily at times. The majority of these incidents resulted in only local contamination. Other incidents mentioned by interviewees included ventilation exhaust system filter bag breaches, high dust levels from certain operations, and spills from drums of uranium ore.* [Emphasis added.]

Nevertheless, the ER dismisses these incidents and concludes with the following statement:

> *There were two serious incidents that had the potential to result in significant personnel exposure: a thorium blender incident and a uranium hexafluoride gas release.*

While SC&A concurs with the high frequency of incidents, SC&A rejects NIOSH's conclusion that only two incidents had significant potential for worker exposure.

Our review of FMPC's historical memoranda and numerous reports contained in the SEC Petition-00046 verifies the ubiquitous and serious nature of these radiological incidents (see Attachments 4.3-4A and 4.3-4B). Specifically of concern are thorium incidents that cannot be quantified by means of routine spot air sampling data.

Apparently, of interest to FMPC administrative personnel was the reduction of thorium compounds to thorium metal that was pioneered at the Ames Laboratory, as well as the need to respond to the pyrophoric/explosive nature of thorium materials (see Attachment 4.3-4C).

The inability to account for exposures associated with thorium incidents is due to the following:

(1) Breathing zone air sampling at specific work locations was episodic at best

(2) When performed, air sampling was limited to sampling times as brief as 1 minute per sample

(3) With rare exception, air sampling data that assessed **radiological incidents** were never documented and are therefore unavailable

(4) Activity levels associated with fires, explosions, spills, etc. can raise air concentrations by several orders of magnitude

Attachment 4.3-4D contains isolated study data that document the dramatic rise in **general air** samples associated with derby fires. In the absence of a derby fire(s), the average "background" air concentration was recorded at 2.1 MAC; with one derby fire, the **average general air** concentration rose to 458 MAC, which is a 218-fold increase over the background level. The potential for even higher air levels must be expected if **breathing zone** air samples had been taken.

In behalf of Finding 4.3-4, SC&A concludes the following:

(1) Thorium incidents with potentially high internal exposure occurred frequently and likely affected a large pool of workers

(2) The failure to document and assess these incidents preclude both the identity of affected workers or the ability to quantify/bound internal thorium exposure

ATTACHMENT 4.3-4A

PROJECT PROPOSAL

A. PROPOSAL NUMBER

CP-59-79

B. TITLE OF PROJECT

Sludge Furnace Alterations for Oxidation of Thorium Residues - Plant 6

C. DATE

October 20, 1959

D. DISCUSSION AND JUSTIFICATION

1. Problem

The metal oxidation facilities at RMPC are not available, due to the lack of isolated dust removal syatems, for the processing of pyrophoric thorium residues such as sludges, chips or turnings. There is a considerable inventory of such material now being stored here, and more is received from time to time from other sites. Stockpiling of these pyrophoric residues creates handling and storage problems due to their hazardous nature.

During the past four years there have been 30 known fires with these materials, some of which burned for several days. Clean up after these fires is a difficult job. In one case, the fire burned through a concrete storage pad. Storage of the drums on soil resulted in a worse situation, when a fire contaminated a considerable area, and much stone and dirt had to be removed. As long as these residues are in

9368002

ATTACHMENT 4.3-4B

Office Memorandum • UNITED STATES GOVERNMENT

TO : S. R. Sapirie, Manager, Oak Ridge Operations DATE: AUG 22 1958

2185445

FROM : C. L. Karl, Area Manager, Fernald Area

SUBJECT: DISPOSAL OF FERNALD THORIUM PRODUCTION RESIDUES

SYMBOL: E:ELG

SUM. AUG 25 1958

In June 1956, all production of massive thorium metal at the Fernald site was terminated. Residues accumulated during the years of production have been stored in and adjacent to two storage buildings which are north of the thorium production plant. These residues are stored in 30 gallon and 55 gallon steel drums, and in 30 gallon cardboard barrels. Due to space limitations it was possible to store only the cardboard barrels inside the storage buildings, and the steel drums have been stored outside on concrete pads adjacent to the buildings. Many of the steel drums have been completely destroyed by the effects of weathering and the physical and chemical action of their contents. There are approximately 20,000 drums and barrels of these residues in the thorium storage area. The thorium content of the residues vary from 0% to 100%. The radioactivity range is 0-20+ mreps/hr and is essentially gamma radiation.

With the conversion of the thorium production plant to production of enriched uranium the storage of the thorium residues has become a very serious problem. The space occupied by the residues is needed for storage of enriched uranium production residues and product. The rapid deterioration of thorium residue drums in outside storage has resulted in continuous redrumming and some loss of residues to the storm sewers. In addition certain of the residues, due to their finely divided state, have a tendency to exhibit pyrophoric characteristics, and numerous small fires have resulted which, although damage was light, require the entire fire brigade to extinguish them and to prevent spreading to other drums. Since there appears to be no immediate future requirement for these residues, and since recent offers of the material to private industries have been only mildly successful, it is the desire of the Fernald Area Office to consider disposal of the thorium residues by burial in a government or private disposal area. It is concluded that the expense of disposal will be far less than the costs of redrumming, fighting fires, and the construction of new storage buildings.

In an effort to locate sites for disposal of the residues, the FAO contacted ORO Feed Materials Division and inquired about the disposal of

MATERIAL

NOTICE: This document has been reviewed for Privacy Act information and has been edited accordingly.

NOTICE: This report is pre-decisional and has not been reviewed by the Advisory Board for factual accuracy or applicability within the requirements of 42 CFR 82.

ATTACHMENT 4.3-4C

NATIONAL LEAD COMPANY
OF OHIO

P. O. BOX 158
MT. HEALTHY STATION
CINCINNATI 31, OHIO

NOV 6 1956

Mr. C. L. Karl, Area Manager
U. S. Atomic Energy Commission
P. O. Box 128, Mt. Healthy Station
Cincinnati 31, Ohio

SUBJECT: THORIUM INDUSTRIAL PARTICIPATION PROGRAM – C.A.P. RELEASE OF NLCO REPORTS

Dear Mr. Karl:

[redacted] on a recent visit, suggested to [redacted] that FMPC and NLCO Thorium reports, on special distribution, be reviewed for release to the Civilian Application Program, for possible inclusion in the proposed bibliography for the Thorium Industrial Participation Program.

Approximately seventy-five reports were reviewed for this program. Appendix I lists NLCO and FMPC reports recommended for C.A.P. release. Appendix II lists Catalytic reports which might be of interest to Thorium Program participants.

The balance of the reviewed reports were rejected because of being outside the scope of the proposed program (i.e. machining, etc.), earlier versions of recommended reports, items of local interest, etc.

Yours very truly,
Original Signed By
G. W. WUNDER
Plant Manager

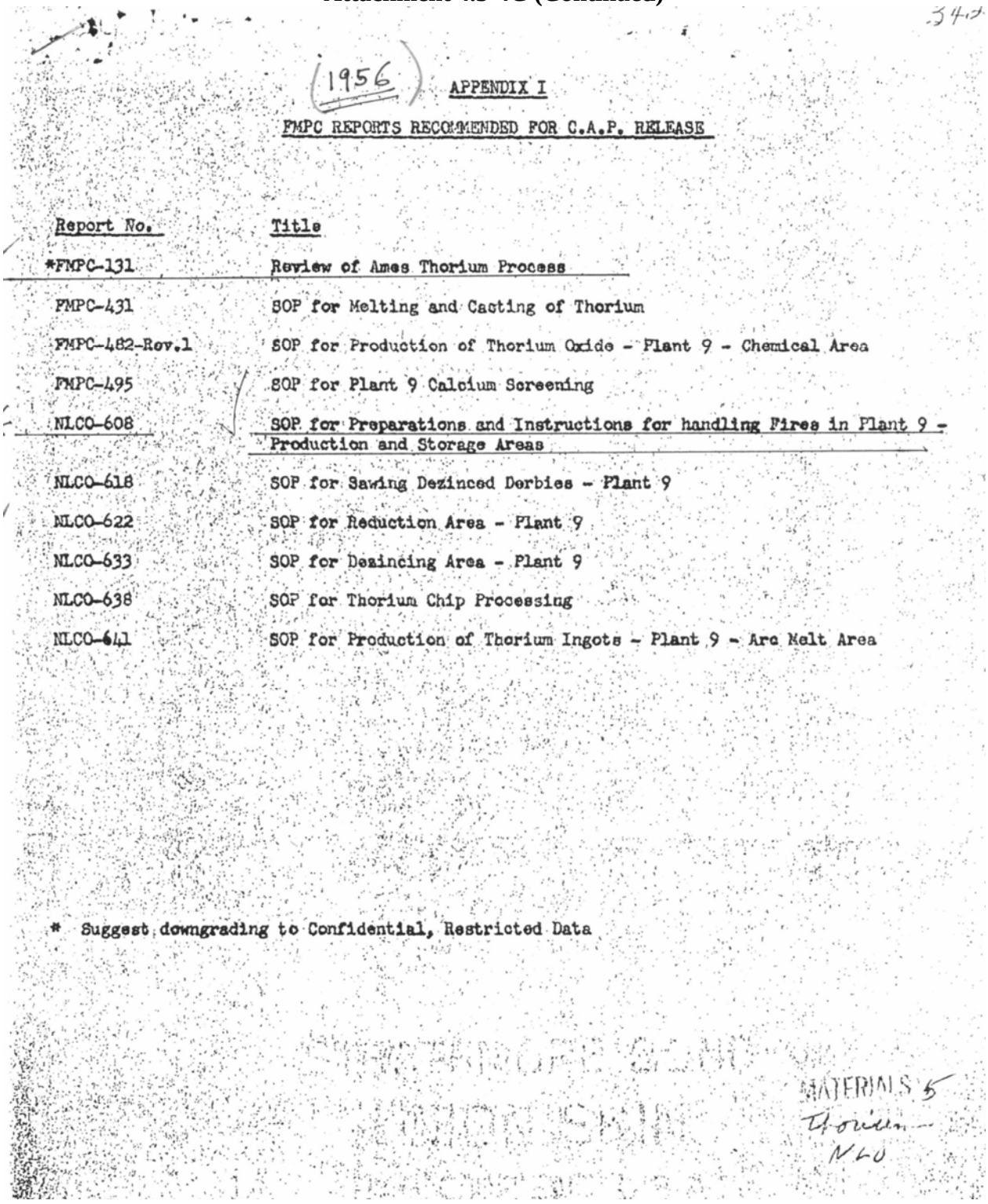
G. W. Wunder
Plant Manager

RAW:ew

cc: C. L. Karl (3x)
P. L. Cuthbert
C. H. Walden

MATERIALS 5
Holden
NLCO

Attachment 4.3-4C (Continued)



1956

APPENDIX I

FMPC REPORTS RECOMMENDED FOR C.A.P. RELEASE

Report No.	Title
*FMPC-131	Review of Ames Thorium Process
FMPC-431	SOP for Melting and Casting of Thorium
FMPC-482-Rev.1	SOP for Production of Thorium Oxide - Plant 9 - Chemical Area
FMPC-495	SOP for Plant 9 Calcium Screening
NLCO-608	SOP for Preparations and Instructions for handling Fires in Plant 9 - Production and Storage Areas
NLCO-618	SOP for Sawing Dezinced Derbies - Plant 9
NLCO-622	SOP for Reduction Area - Plant 9
NLCO-633	SOP for Dezincing Area - Plant 9
NLCO-638	SOP for Thorium Chip Processing
NLCO-641	SOP for Production of Thorium Ingots - Plant 9 - Arc Melt Area

* Suggest downgrading to Confidential, Restricted Data

MATERIALS 5
Thorium
NLO