Thus, the present official estimate of unmeasured process losses is clearly wrong, perhaps by two or more orders of magnitude.

Finally, there were a number of non-point sources of releases from poorly operating equipment that was located outdoors. These may have resulted in enormous discharges to the air, and there is considerable evidence towards just such a conclusion. Yet such sources were not evaluated based on any evidence that relates to the history of FMPC operation in the Addendum to the Official History.

We cite a few examples from copious documentation. Consider the following statement in a 1959 document:

> "High levels of airborne contamination in Plant 8 are being reported by Health and Safety. The major sources of contamination are the various product drumming station and the outside crusher system."[8]

There are many other documents which show similar conditions, in the context of both uranium and thorium processing. Take for example the following from a 1968 document discussing possible thorium processing methods:

> "As you well know, most of our air dust problems at the FMPC over the years have resulted from drumming and dumping dry materials. Any time that we can eliminate either of these operations our air dust problems become greatly lessened."[9]

Or again in another 1970 document (which shows that such problems persisted over a long period):

> "Probably the worst housekeeping problem in the facility is the Ball Mill. The equipment leaks excessively at practically every joint. All horizontal surfaces have a thick covering of dust. In the operation dust becomes airborne and adds to the dust coming from the leaks. Since the ventilation is inadequate and there is no proper enclosure, a bucket was placed under the largest leak to help contain the spilled dust."[10]

Presumably, some improvements in conditions have been made by 1987 as a result of considerable public scrutiny.

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8 *Production Engineering Document, "Short Term Completion Report; Project Title: Air Contamination in Plant 8", document number 2225348, 2-17-59.*

9 *R.H. Starkey to C.R. Chapman, "Problems Associated with Thorium Processing - Plant 8", October 1, 1968.*

10 *K.N. Ross to J.E. Beckelheimer, "Thorium Metal Production Housekeeping", June 8 1970.*

We reject as unreasonably low the estimates of unmonitored sources, both from process sources and non-point sources, presented in Table 1 of the Addendum to the Official History, which is included in the documents appendix here for reference. We have not included any estimate of losses from the about 280 unmonitored emissions sources, particularly the non-point sources. As one illustration of the hypothesis that such releases may have been very large see the section below on working conditions and uranium releases.

We have made an estimate of about 60 metric tons from the 50 unmonitored sources discussed above. This is admittedly a low confidence estimate. It is impossible at this stage to produce an estimate of higher quality, given the poor monitoring practices at FMPC. However, we should note that while the expected variability of the year to year estimates will be high, the variability of the total is likely to be considerably lower. If additional documentation on estimates of unmeasured losses can be obtained from the period when these losses were actually occurring it would be possible to considerably improve both the estimate and the confidence one would have in it.

D. WORKING CONDITIONS AND RELEASE ESTIMATES

There is much documentation which shows that large amounts of uranium (and thorium during thorium processing) was prevalent in many working areas due to poor or sometimes non-existent ventilation. The following is typical of a large number of documents depicting inadequate ventilation:

> "High levels of airborne contamination exist in Plant 8, a large portion of which is attributed to inadequate air flow in the various ventilation systems which are served by dust collector G43-27 and the caustic scrubber."[11]

Uranium dust concentration hundreds of times the maximum allowable level of 70 alpha disintegrations per minute per cubic meter of air were present in some areas. In one case uranium concentration was 958 times the maximum allowable level, and the notation next to the measurement in the survey says "Nothing in Progress to improve." Interestingly, this same document indicates that work to reduce dust concentrations in areas where such efforts were being undertaken was stopped if an area had dust levels which were below three times the maximum allowable concentration.[12]

The highest level of dust that is mentioned in the documents that we have come across is as high as 1,261 times the maximum allowable concentration.[13] Some documents showing the existence of such conditions are appended to this addendum.

It is interesting to do some rough calculations on what such air dust level might mean for airborne contamination outside plant buildings. In the last mentioned document (appended), the levels of radioactivity in the air recorded were in the range of 3,185 to 88,277 alpha disintegrations per minute per cubic meter of air. Assuming an average wind speed of 10 kilometers per hour (6 miles per hour), and a value of 10,000 disintegrations per minute per cubic meter yields an estimate on the order of 1 metric ton of airborne dust per year per square meter of area across which the wind was blowing which contained the contamination level specified. The estimate would be proportional to operating time (we use the full year here for the purpose of illustration only). This indicates the possibility that non-point sources may have contributed significantly to airborne releases. In addition to data on outside non-point sources, a great deal of analytical and modelling work will be needed to get even rough estimates of this figure.

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11 *Construction Proposal Number CP--59-57, Additional Dust Collector Capacity - Plant 8, November 3, 1959; p.1.*

12 *R.H. Starkey to J.A. Quigley et al., "Compilation of High Air Dust Concentrations", October 27, 1960.*

13 *J.F. Wing to H.M. Sears, Air Dust Samples at the Outside Mill, Plant 3", August 1, 1958.*

High concentrations of uranium in working areas and the poor working conditions indicate several things:

- large sections of the FMPC were operated in violation of radiation standards, which indicates a substantial degree of technical negligence, especially as these problems persisted for considerable periods;

- poor ventilation and working conditions resulted in suspension of large quantities of uranium into the air which did not pass through any stack monitoring systems.

- due to the poor coverage of the site by environmental air monitors, it is quite possible that the air monitoring system picked up only a small fraction of such particles;

- an unknown quantity of such suspended particles might have made it offsite as airborne particles, while some may have been deposited onsite and made their way to surface or ground water.

Due to the poor record-keeping and lack of information it is not possible at the present time to arrive at estimates of the quantities of uranium and other radionuclides which might have been suspended due to poor ventilation. But as we have noted above, such releases over a period of more than three decades may well have been enormous. It is neither possible at the present time to estimate the figures, nor what fraction of such airborne uranium might have wound up offsite.

E. SCRUBBER LOSSES

In his recent deposition, Michael W. Boback, head of Industrial Hygiene and Radiation at FMPC during 1969-1982, admitted some startling things which cast doubt on the integrity of all stack data during 1969-1982 and of Plant 8 scrubber data during the entire period of operation.

He stated that he was not familiar with any of the documents regarding scrubber losses which are appended to this addendum, and which are crucial primary documentation in evaluating scrubber losses from Plant 8. He was not able to cite a single reference for the estimates of scrubber losses which he presented in the successive versions of the official History of FMPC Radionuclide Discharges. Nor was he able to provide any explanation of why the numbers were consistently so much lower than those clearly indicated by plant records.[14]

There is a great deal of evidence to suggest that the official estimates of losses from the five Plant 8 scrubbers are far below the actual releases. Further, the method of estimation of the losses was incorrect. The combination of optimistic estimates of scrubber efficiency with an incorrect approach to calculating scrubber losses from analytical data have resulted in systematically erroneous estimates for scrubber losses.

A memo from E.W. Randle to A.F. Pennak, March 12, 1971,[15] explains that the scrubber losses were estimated "by weighing and analyzing the liquor from the scrubber each time it is drained" and then assuming that the scrubber was operating at a constant efficiency of 83%. This figure is in the middle of the manufacturers suggested range of efficiencies of 70% to 95% expected from the equipment "under ordinary conditions."[16]

The situation can be depicted as follows:

Assume that the production level and conditions are such that 100 kilograms per week is being sent to the scrubber. If the scrubber operates at an efficiency of 83%, then 83 kilograms will be captured in the scrubber liquids and 17 kilograms will be exhausted to the atmosphere.

Now assume that the scrubber was operating at 50% efficiency due to a partial deterioration. The actual situation would be that 50 kilograms would be captured in the

14 *Deposition of Michael W. Boback, taken by the plaintiffs at the office of Waite, Schneider, Bayless and Chesley, April 18, 1989.*

15 *E.W. Randle memo to A.F. Pennak, "Investigation of Methods of Measuring and Reporting Uranium Losses to the Atmosphere," March 12, 1971.*

16 *Ibid.*

scrubber liquids and 50 kilograms would be exhausted to the atmosphere. That is, the release to the atmosphere would go up almost three-fold; due to the reduction in scrubber efficiency.

However, the calculational procedure used by NLO was such that it would show a reduction in emissions. The procedure was to measure the uranium captured in the liquids. This would be 50 kilograms in this example. Then, it was assumed that the scrubber was operating a design efficiency -- even though the efficiency was not measured. Thus the NLO calculation would proceed as follows. If 50 kgs. were in the liquid and the efficiency was 83%, the incoming uranium must have been 50/0.83 = 60.24 kilograms. Thus, the quantity released to the atmosphere would be calculated as the quantity going into the scrubber less the amount retained in the scrubber. In this case, the NLO estimate of release would be about 10 kilograms, a decrease from 17 kilograms.

Similarly, if the efficiency went down to 10%, for a severely deteriorated scrubber, the actual loss would be 90 kilograms, since only 10 kgs would be retained in the scrubber. However, NLO would proceed on the assumption that if 10 kgs were found in the scrubber then the incoming quantity would be only 10/.83 = 12.05 kgs. Thus the estimate of losses would be only about 2 kgs.

At the very extreme, if the scrubber were totally inoperative, as sometimes happened, all 100 kilograms of incoming uranium would be released to the atmosphere. But NLO, finding nothing in the scrubber liquids would assume that there was no incoming uranium (0/.83 = 0), and therefore no releases.

The approach is manifestly absurd and the results of the above examples summarized in Table 1 below show that in sharp relief:

Table 1

Scrubber Losses to the Atmosphere, Actual and NLO estimates
for an 100 kgs of uranium sent into the scrubber

Inlet Quantity Estimate kgs	Efficiency %	Actual Loss kgs	NLO kgs
100	83	17	17
100	70	30	14
100	50	50	10
100	10	90	2
100	0	100	0

Another way to illustrate the absurdity of this situation is to ask: what are the factors which determine the quantity of uranium which would be sent into the scrubber. Evidently this would depend on the quantity of materials being processed, and the efficiency with which uranium was being recovered, the ventilation conditions, and so on. The quantity of uranium being sent to the inlet of the scrubber has nothing to so with the efficiency of the scrubber. Yet that is how the NLO calculation was set up. If there was nothing in the scrubber, then it was assumed that there was no uranium at the inlet, even if large quantities of materials were being processed.

The 1971 NLO memo makes it clear that NLO was aware that this procedure was wrong, because it describes the estimates derived using it as "inherently deceptive, because a scrubber operating at a very low efficiency for a month would collect little uranium, thus showing a low loss." (p.2).

The memo also shows that NLO was aware that the amount of uranium going into the scrubber was dependent on the process conditions and not on the scrubber efficiency for the very next sentence says: "If it [the scrubber] were repaired and operated carefully for the next month, that calculations would show a high loss, provided the process conditions did not change." (Emphasis added.) Thus, Randle is clearly saying that the amount of uranium going into the scrubber depends on the process and not on the scrubber efficiency, and, further, that using scrubber efficiencies to estimate this would yield results which were exactly backwards from the true estimates.

Even with the assumption of an efficiency of 83%, which would presume good maintenance and condition of the equipment (often not a good assumption for FMPC), there is evidence that scrubber losses were far higher than reported. A June 4, 1964 memo on unaccounted for materials states:

> "Unmeasured Losses - We have long suspected that the stack and scrubber losses from Plant 8 are far greater than are reported by the Health and Safety Division and by the plant. The efficiency of the equipment claimed by the manufacturers would itself indicate a far greater loss than is being reported each month. Assuming the scrubbers operated at 83 percent efficiency, a loss of 1,340 uranium pounds per month might be expected. Losses as great as 1,000 pounds per month were reported by the Health and Safety Division in a special report dated September 26, 1961."[17]

These estimates would put 1961 scrubber losses at 5.4 metric tons and 1964 scrubber losses at 7.3 metric tons. Yet, the official estimates for these years as of May 1987 were far lower: 2.4 metric tons and 2.9 metric tons respectively. We are not able to explain these discrepancies. But they do clearly indicate that the present official estimates may be two to

17 *B. Gessiness to C.R.Chapman and S. Marshall, "Report on the Investigation of B-PID in Plant 8," June 4, 1964.*

three times lower than estimate based on even optimistic assumption about plant operating conditions.

Another document cites a typical monthly loss of 1,500 pounds from Plant 8 scrubbers based on an assumption of 83% efficiency and a uranium loading at the scrubber inlet of 12.3 pounds per hour.[18]

Yet another document shows that UAP furnace losses were a small proportion of the total Plant 8 scrubber losses. The losses from three of the five scrubbers during 1961 were estimated as 1,005 pounds per month. Of these the UAP furnace losses were about 15%.[19] Of course, UAP losses would be a smaller percentage, when the losses from the other two scrubbers are included in the total.

The above, and similar evidence in other documents, plus the failure of Michael Boback the principal author of the official History of FMPC Radionuclide Discharges to document even a single figure for scrubber losses or even to explain how documents such as the above-quoted ones were taken into account, leads us to discard all the official estimates of scrubber losses from Plant 8 scrubbers, and substitute them with our own, based on the above documentation.

We have used the figure of 1,340 pounds per month for 1964, or 7.3 metric tons for the whole year as the loss figure for 1964 based on an assumed operating efficiency of 83%, which is in the middle of the manufacturer specified range of efficiency of 70 to 95%.

Using the production data for Plant 8, we then recalculated the scrubber losses for all other years weighted according to production in that year. This procedure gives us a low estimate of scrubber losses, since there is considerable evidence that scrubber were operating well below design efficiency.

We have also calculated a set of values corresponding to the low end of manufacturer specified efficiencies of 70%. We chose not use the upper end of the manufacturer's specified efficiencies to make yet another estimate because plant documentation clearly shows that scrubbers were being operated in a manner they were not designed for. There is also evidence that at least one utterly deteriorated scrubber was in operation for some time.

18 *J.H. Noyes to C.L. Karl, "Request for Approved Inventory Write-offs, Normal and Enriched Scrubber Materials - Fiscal 1965", July 17, 1964.*

19 *C.R. Chapman to P.G. DeFazio, "Request for Feasibility Study - Re: Reduction of Scrubber Losses", January 25, 1965.*

In reality, we suspect that both of the sets of estimates we have made (assuming 83% and 70% efficiency) may yield serious underestimates of the actual releases, since scrubber operation was often very poor. Scrubbers frequently got plugged. On one scrubber, an emergency vent was installed and used with such frequency that releases were estimated 25 pounds of uranium every 24 hours during 1964.[20] While we have covered the emergency vent in the unmeasured losses, this document (attached) indicates that scrubbers were being operated in conditions and with materials for which they may not have been designed.

Further evidence indicates that for at least some of the period, scrubbers were in poor condition. For example, a 1970 document states:

> "Present scrubber is badly corroded and does not perform required scrubbing function of exhaust emitted from #2 Oxidation furnace, thus allowing product to be exhausted to the atmosphere."[21]

This document indicates that scrubber efficiency might have been zero, and that all the effluent from this oxidation furnace may have been exhausted to the atmosphere. We cannot at this time estimate the period or the number of scrubbers which might have operated at very low or even zero efficiencies. But clearly, such operation for any significant length of time would enormously increase loss estimates.

Estimates based on the actual inlet and scrubber fluid analysis data would yield much better estimates. We do not have any way of estimating scrubber efficiencies at present. We have only one document which shows actual analytical data - that is for the month of October 1959. However, an analysis of the data in the document and a comparison with other data an calculations yields information which is very difficult to interpret, implying efficiencies which range from anywhere near perfect (highly unlikely, given of the documentation) to below 50%.

The document from October 1959 (appended) shows a loss of 5,189 pounds per month based on scrubber liquid analysis. If October was a typical month, the annual loss would amount to 28.2 tons for 1959. Our recalculation based on an 83% scrubber loss efficiency, done as described above using 1964 information yields a loss estimate for Plant 8 scrubbers for 1959 as 5.3 tons. Thus, under the assumption (which may very well not be correct, and we make it here only for illustration) that 5,189 pounds was a typical monthly loss for 1959, we get a discrepancy of over five times in the loss estimates. If 28.2 tons was an actual loss

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20 *P.G. DeFazio to I.H. Noyes, "Idea Letter - Revisions to UAP Furnace Ventilation Systems - Plant 8", June 18, 1964.*

21 *Request for Engineering Services, 11-24-70, document number 2225077.*

figure, and 5.3 tons a loss figure using an assume deficiency of 83% , we could impute a a scrubber efficiency of only 48%.

However, this is a very speculative argument, and we have decided at this time not to use various lower estimates of scrubber efficiency to estimate losses. Such estimates based on actual operating information would enable considerably better estimates than we have made, and they may well be higher than the ones we have given here.

F. PLANT 2/3 GULPING LOSSES

In February 1989, FMPC released estimates of uranium losses from the gulping operation in Plant 2/3. Losses from these operations had not been included in previous official total because they had not been monitored. Three measurements in the scrubber system and three measurements on total emissions were performed. In each case one measurement was discarded as unsuitable, so that only two measurements remained. Making an estimate on the basis of only two measurements results in estimates of rather low confidence. Further, the measurements were obtained by using only one probe in the stack -- a procedure which is not recommended, since the representativeness of conditions at one point cannot be assessed. Finally, no account was taken of the possible variability introduced by varying acid concentrations. Thus poor procedures were used which yielded low confidence estimates of Plant 2/3 losses.

We have attempted to reanalyse the data. If one makes the questionable assumption of normal distribution of the measurements, a 95% upper confidence bound estimate for Plant 2/3 losses based on the measurements would be about 75 tons, even if we ignore the variability introduced by uncertainty in the acid concentrations.[22]

For these reasons we show two estimates of Plant 2/3 losses - the first being the official 38.6 metric tons estimate, the other being the 95% upper confidence bound estimate produced using the data provided in the official report. That estimate comes to about 75 metric tons, or about double the present official estimate.

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22 *Peter J. Bickel, personal communication, April 5, 1989.*

G. DUST COLLECTOR LOSSES

There is ample evidence that losses from dry dust collectors have been underestimated. We have discussed this in great detail in the report to which this is an addendum. There is considerable additional evidence about this in the new documentation, which confirms our original conclusion. As one example we cite the case where a portion of the Plant 5 operation were being carried out without any ventilation, while the dust collector was being serviced and was therefore disconnected. Workers inhaled uranium which was present in the air at levels up to a 100 times the maximum allowable concentration. The document also discusses the installation of an emergency ventilation system, similar to the one for scrubbers discussed above, which would have resulted in unfiltered uranium dust being discharged directly from the plant into the atmosphere.[23] We do not know whether such a system was eventually installed.

However, in the limited time available to study and analyze the new documents, we have not yet been able to come up with a way to use the scattered data to make new estimates for dust releases from the monitored dust collectors. The only changes that we have made are for the 1970-1982 period, as described in Section B above, where official figures have been replaced by estimates based on an earlier operating period (1957-1969). For the other years we have not adjusted the data, in spite of considerable evidence that the present official estimates are biased in the direction of underestimation. This is one of the reasons we recommend that considerable additional work must be done to revise the estimates we present here.

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23 *R.H. Starkey to C.R. Karr, "Operation of Plant 5 Burnout Without Ventilation", December 24, 1962.* PE 180 (NA)

H. RELEASE ESTIMATES AND AIR MONITORING DATA

In the report to which this is an addendum it was pointed out that there is little or no correlation between the official release estimates (as of May 1987) and air monitoring data. Further information both from the Plant 2/3 report and from the engineering documents indicates that, for various reasons, a large, but unknown proportion of the releases happened in short bursts or short periods compared to overall plant operating time. For example, the denitration and gulping process in Plant 2/3 lasted 7.5 hours, but the gulping process itself during which roughly half the dust releases occurred lasted for only 1 hour. If one includes the time between denitration pot loading and down time, then it is apparent that gulping releases, which are routine process releases (as distinct from accidental releases) occurred over roughly 15% of the time. This short period over which losses occurred makes the effect of such losses on uranium concentration in the air more comparable to that in accidents than to uniform releases over time.

Another example of frequent severe sudden releases is provided by the releases via the emergency system when the scrubber systems were plugged. Such vents released large quantities of uranium and possibly other radionuclides in sudden burst, with effects on air quality very much like accidents, even though the releases were in these cases deliberate.

Since the network of monitoring stations was inadequate to detect accidents[24], a large but unknown proportion of the routine releases which happened in bursts or over relatively short periods of time would also be likely to be undetected. Another way of stating the situation is that, over a long period, a fraction of the short-period releases would be picked up by the monitors, but a considerable proportion, which cannot be determined from the data that we have, would go undetected.

24 *Bernd Franke, Preliminary Assessment of Radiation Exposures Associated with Releases of Radioactive Materials from FMPC - 1951 to 1984, Institute for Energy and Environmental Research, Takoma Park, Md., May 1988.*

Discrepancy

Uranium
?(Stack) Emmissions
TBD-2 pg 81
1959 plant 8 — 2360.9 kg

```
   X 2.2046
   151654
   94436
  472180
 47218
 5204.94014 LB   whole year
```

Recovery Plant Scrubber Loss Report for Oct 1959 showed

5,189 lbs for month of Oct

(in PE 950d appendix

October

Recovery [illegible] ober Loss Report for the Month of ~~[illegible]~~ , 1959

	Date	Sample #	Volume	Assay U g/l	U Loss
C[illegible]	9/26	S-148	1200	87.7	800.70
	9/28	S-149	1200	45.[illegible]	418.15
	10/1	S-151	1200	10.6	105.53
	10/2	S-152	1200	22.5	204.18
	10/4	S-153	1200	36.6	362.54
	10/9	S-157	1200	5.2	51.79
	10/12	S-160	1200	30.6	304.78
	10/15	S-162	900	25.2	[illegible].24
	10/16	S-163	1200	18.4	183.26
	10/19	S-166	1200	32.4	322.46
			11,500		3,301.63
KILN	9/26	S-147	800	74.5	496.68
	10/13	S-161	800	26.4	175.30
	10/17	S-164	800	40.5	268.92
	10/23	S-168	800	46.5	308.76
			3,200		1,247.66
UAP	9/30	S-150	1200	13.8	137.45
	10/4	S-155	1000	10.9	90.47
	10/10	S-159	1000	5.1	42.33
	10/23	S-167	1200	13.4	133.46
			4,400		403.71
DIGESTER	10/4	S-154	1500	.015	.19
	10/10	S-158	1500	.11	1.37
	10/19	S-165	1500	.076	.95
			4,500		2.51
OXIDATION	10/9	S-156	700	5.8	33.70
			24,300		5,189.26

(5189)

cc: Accountability
File

J.E.Marshall

950d

U. S. Department of Commerce Sinclair Weeks, Secretary
National Bureau of Standards A. V. Astin, Director

Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water

National Bureau of Standards Handbook 52
Issued March 20, 1953

For sale by the Superintendent of Documents, Washington 25, D. C. - Price 20 cents

values should be more or less conservative, they can be adjusted before anyone has been unduly inconvenienced or before damage can be expected to result. In any case, because of the uncertainties involved in the present values and in determining the actual accumulation and potential hazard of radioisotopes in the human body, it is strongly recommended that exposure be kept at a minimum insofar as it is practicable. Bearing in mind that in the future it may become necessary to lower some permissible limits, it is suggested that a factor of safety that may be as large as ten be used in the design and operation of permanent installations where large quantities of radioactive material are involved. This is particularly important in cases in which provision of additional protection later would be very difficult and expensive.

The values of maximum permissible amounts of the various radioisotopes in the human body and of the maximum permissible concentrations of these radioisotopes in air and water as given in this report are chosen by this Subcommittee as the most acceptable values after considering a preliminary report to the Committee (giving values recommended by various radiation protection committees, as listed under section F of this report) and after making comparisons with values calculated by use of the data summarized in table 4. This report considers only a few radioisotopes, and particularly those that are of present-day interest. Other radioisotopes will be considered in subsequent reports when such information about them is needed and as data become available to serve as a basis of acceptance of safe recommended values. Likewise, values given in this report must be revised from time to time as more biological information is obtained.

Efforts should be made to prevent the accumulation of dangerous quantities of radioisotopes in the body. Radioisotopes may enter the body by way of food and water, in the air we breathe, through wounds and abrasions, and through pores of the skin. The physical state (liquid, solid, or gas) and the chemical form of the radioisotope help determine the type of radiation hazard and to some extent the degree of retention in the body and magnitude of hazard. Other important factors that determine the radiation hazard are the quantities of radioactive material involved, the facilities and equipment available for handling radioisotopes, the training and experience of those working with the radioactive material, and the respect they have for appropriate radiation protection standards and procedures.

Pores

B. Radioisotopes More Hazardous Inside the Body Than Outside

Radioisotopes when contained inside the body present greater hazards than when they are limited to external sources, for the following reasons:

1. They irradiate the body continuously until they are eliminated.
2. The biological half-life is very long for some radioisotopes, and in most cases it is difficult, if not impossible, to increase appreciably the elimination rate from the body.
3. Sources inside the body are in intimate contact with the body tissue. This enables alpha and low-energy beta radiation (which, because of limited range, do not present an external hazard) to reach radiosensitive tissue inside the body and to dissipate all their energy in a small volume of tissue inside a critical body organ.
4. It is very difficult to measure the amount and distribution of a radioisotope in the body, and even if such information is obtained, it is impossible to assess the hazard accurately. Methods of urine and fecal analysis have been developed for some radioisotopes, but most of these analyses are very tedious, time consuming, and expensive.

C. Methods of Estimating Maximum Permissible Amounts and Concentrations

There are various methods of estimating maximum permissible levels of radiation exposure, maximum permissible amounts of radioisotopes inside the body, and maximum permissible concentrations in air and water. Some of these methods are given in the following paragraphs.

1. Comparison with X-ray or γ-ray damage

We have had considerable experience for more than 50 years with these radiations, and the Subcommittee on Permissible Dose from External Sources of the National Committee on Radiation Protection has set the relative biological effectiveness (RBE) and the maximum permissible exposure to various types of radiation, as listed in table 1. The values in table 1 were accepted by the Chalk River, Canada, Conference (Sept. 29 and 30, 1949) and the International Commission on Radiological Protection meeting in London (July 1950).

KLO

2122232

UNITED STATES GOVERNMENT

Memorandum

TO : C. L. Karl, Area Manager
Cincinnati Area Office

DATE: July 15, 1964

FROM : Herman M. Roth, Director
Research and Development Division, ORO

SUBJECT: REPORT OF THE ANNUAL HEALTH PROTECTION REVIEW AT NATIONAL LEAD COMPANY OF OHIO - MAY 1964

ORB:RLH

Six copies of the subject report are enclosed for your information and action. The cooperation and assistance of your office and National Lead Company during the conduct of this review are appreciated.

It is suggested that your contractor be authorized and instructed to proceed with the implementation of the matters covered by the recommendations unless there exist sound reasons why a particular recommendation is not warranted in whole or part. In any event your comments and those of your contractor with regard to the conduct of the review, the general content of the report, and the detailed plans for implementing or otherwise handling the recommendations are requested by September 1, 1964.

Richard B. Martin
acting

Herman M. Roth

Enclosure:
Report (6)

CC: R. C. Armstrong
H. B. Mills, w/encl.
J. W. Ruch, w/encl.

PLAINTIFF'S EXHIBIT

HEALTH PROTECTION REVIEW OF NATIONAL LEAD COMPANY OF OHIO
MAY 19-21, 1964

I. Introduction and Summary

Representatives of the ORO Research and Development Division conducted the annual on-site health protection review of NLO during the period of May 19-21, 1964. This review gave detailed consideration to implementation of last year's recommendations, transportation of fissile materials, nuclear safety, monitoring programs, and the treatment and sampling of off-gas effluents.

It is the opinion of the reviewers that the health protection programs reviewed are effective and satisfactory to cope with the problems of NLO. Observations and recommendations for program improvement are included in the final sections of the report.

II. Implementation of Previous Recommendations

A. Recommendation that counting equipment for NAD and film badge components be made functional as expeditiously as possible.

Action: The recommendation has been satisfactorily implemented and is discussed in NLO's reply dated August 20, 1963, to last year's report. The counting equipment, now fully operational, is checked periodically for calibration. Two NAD's and a few film badges exposed at the ORNL Health Physics Reactor and counted in this equipment indicated deviations within 5% of appropriate values such as the Pu curve.

B. Recommendation that the 1290 high range gamma film be routinely calibrated to insure effective use in the evaluations of high personnel exposures.

Action: The recommendation has been satisfactorily implemented, and films exposed from 6 to 500 r at 100 r increments will be used for calibration purposes. Sets of calibration film are exchanged at six-month intervals.

III. General Information on Programs Reviewed

A. Industrial Hygiene and Radiation Department (IH&RD)

ORIAD No. 0500-3 concerning posting requirements was implemented by posting the "Notice to Employees" on the bulletin boards at the two main entrances and the main locker room. Information contained in the Appendix to AEC Manual Chapter 0524 is included as a Plant Manufacturing Standard. In addition, a letter concerning the directive was sent to all division directors and holders of the Plant Manufacturing Standards Manual and the Technical Procedures Manual. Some modifications were necessary to meet the requirements of OR-0525 concerning Occupational Radiation Exposure Information. The modifications involve the preparation of a form letter for notification of visitors with exposures exceeding 50 mrem, and the compilation of required information on those Area Office personnel whose recorded yearly exposures exceed 50 mrem.

Procedures concerning the sale of contaminated scrap and/or equipment are in accordance with Manual Chapters OR-5182 and 5170. Prior to any sale, a summary letter concerning the contents thereof and certifying that contamination levels are within the specified limits is sent to the Area Office for approval. Contaminated 55 gallon drums which are no longer useable and other scrap not meeting the limits are sold to a licensee such as the Knoxville Iron Company.

Although no overexposures have been observed at NLO during the past years, records indicate a continuing increase in both number and magnitude of exposures above one rem of penetrating radiation. Since 1960, incremental yearly increases of about 300% in the number of personnel receiving exposures above one rem were reported, (1960-12, 1961-33, 1962-120, 1963-331). The highest skin exposure for 1963 was reported as 22.9 rem which includes 4.4 rem of penetrating radiation. The beta plus gamma to gamma ratio for the plant population has decreased significantly since 1960 when the ratio was 20.7 to 1 as compared to a ratio of 5.4 to 1 for 1963. NLO feels that a partial explanation of the exposure problem would be the increase in the UX_1 and UX_2 daughter build up in the uranium "feed" and the increased storage of uranium in various areas.

The IH&RD annual report shows a significant increase in the general air levels for various operations in Plants 5, 9, and 4, and the surrounding area of the rod cooling bed in Plant 6. Modifications to various operations (e.g., breakout station Plant 5) are planned for improving the overall air levels throughout the plant. Although there was an increase in the general air levels, results of the bio-assay program show that no employee exceeded the NLO criteria (50 ug/l avg. in urine) for reporting internal exposures to the AEC.

Exposure not evident in urine data recorded.

All routine operations requiring ventilation are exhausted through sixty stacks throughout the various plants. Pretreatment prior to exhaust to the atmosphere is primarily through Hersey Reverse Jet type filters (40 units) and through Sly Flat Envelope type or Shaking Tube Wheelabrator type filters. Each of the stacks is sampled continuously using a type "S" pleated type filter for collection of the sample. About eight stacks serve operations which have an off-gas with a high heat and/or moisture content. These off-gas streams utilize primarily a S&K Venturi Wet Scrubber for clean up and some use a cyclone separator before the scrubber on furnace off-gas streams. These stacks are spot-checked on a periodic basis using a Greenburg Smith Impinger type sampler. Results from the stack monitoring system show levels to be within appropriate health protection limits and the results are primarily used for monthly estimates of the amounts of uranium lost via the stack system.

Follow-up of last year's report concerning the clean up of the storm sewer and ground contamination problems shows that considerable improvements have been made in 1963. The improvements are summarized in the "Minutes Ground Contamination Study Committee Meeting held on March 3, 1964, and March 10, 1964." Monthly reports entitled "Incidents Detected and Corrective Action Taken in Storm Sewer System" by the Engineering Division and "Comments on Ground Contamination in Process Areas" by IH&RD are submitted to appropriate supervisors for action. The emphasis by NLO has resulted in a fifty percent reduction in the amount of uranium (i.e., 1230 lbs/month 1962 to 660 lbs/month 1963) losses via the storm sewer system. However, results for the first part of 1964 show an increase by a factor of about two in the amount of uranium lost via the storm sewer system. This increase is due in part to a rather dry latter part of 1963 and a wet first quarter of 1964.

Routine usage of respiratory protection devices for various extended operations is recommended on a job evaluation basis by IH&RD. A detailed review of the respiratory protection program was not made as IH&RD is currently evaluating and revising their program in view of recent publications. The program will be based on the recently revised Title 30, Code of Federal Regulations, Part 14, concerning the Bureau of Mines requirements and a recent book published by the American Industrial Hygiene Association entitled "Respiratory Protective Devices Manual."

B. Nuclear Safety

The organization and staffing, committee activities, criteria and functions as related to nuclear safety are essentially unchanged from those indicated in previous reviews. However, a recent change was effected in the FMPC Manufacturing Standards Manual Format concerning the preparations and review of Standard Operating Procedures (SOP). In this regard, temporary SOP's will be eliminated, and a more general nuclear safety section included in SOP's will be prepared to give more latitude to line supervision. It will be the responsibility of operations to request nuclear safety evaluation for operational changes involving enriched material. This change gives more responsibility to line organization with the anticipation of markedly reducing time required for SOP modifications heretofore considered excessive.

Current in-plant nuclear safety problems of special interest include the design of a metal dissolver and preparations for handling a limited amount of 20% U-235 enriched metal in the Plant 6 Blooming Mill. Procedures for the latter have been submitted to ORO for review and concurrence.

C. Transportation of Fissile Materials

Most fissile materials shipped to and from NLO involve low assay uranium metal in a variety of forms consisting largely of ingots, billets, and fuel cores. The bulk of this material is normal and 0.95% U-235 enriched uranium with a limited amount of 1.25% material. The uranium is packed in wooden boxes of two basic designs, B of E No. 265 and

1091, for cores and larger units, respectively. Mass limits are used where applicable with intermixing of relatively non-reactive materials to effect maximum loading for shipping economy. Essentially, all transport is by truck and rail under controlled conditions. All shipments are covered by Standard Operating Procedures or by special approvals.

A recent shipping incident involving load shift and breakage of wooden shoring has necessitated a re-evaluation of basic shoring methods on trailers and a change in tie-down technique. The change involves the use of two 1¼" steel verticle bands wrapped around the boxes in a lengthwise direction. Additional horizontal bands are used to bind the boxes as a unit, and each vertical band passes through devices known as "brakeman plates" fastened to the truck floor. This type of shoring, known as meeting the controlled floating load principle, was recommended by the Signode Steel Strapping Company as being superior to wooden shoring. SOP's NLCO 828, Rev. 2 and NLCO 902 are being revised to reflect this change.

The mass limits imposed for criticality control are based upon enrichment, specific piece geometry (i.e., wall thickness, length, diameter, etc.) and optimum conditions of water moderation and reflection as could be postulated under severe accident conditions. In this regard, the lattice pitch or spacing of individual elements which determines the possible moderating ratios is a very sensitive parameter. To capitalize on this fact, NLO has recently modified the V-E shipping box by supplying two 1" thick plywood tube sheets to space individual elements (these being specifically Mark V-E fuel cores) out of the optimum region. The spacing is sufficient to assure a Volume Water/Volume Uranium Ratio of five which, for these particular elements, will prevent criticality if an unlimited number of boxes are flooded with water. Hence, although the individual mass per box will be reduced from about 1,000 lbs. to 300 lbs. by use of the internal tube sheets, the maximum load permitted will be increased from about 12,000 lbs. to the load limit of the railroad car or truck. The boxes have been shown to survive a 30' drop if 1¼" steel bands are used. However, fire tests described in NLCO 899 indicate that the boxes may not survive a standard hour fire test, although they will withstand a 10-30 minute fire if double lids are used.

Special off-site shipments of enriched material are authorized by use of NLO H&S Form 2043 requiring the signatures of representatives of the Transportation Department, Procurement Division, Nuclear Safety Department, and the Health and Safety Division. In addition, sign off by a nuclear safety representative is obtained on routine in-plant and out-of-plant transfers of enriched material. In-Plant transfers of enriched uranium are scheduled in advance where possible.

More detailed aspects of shipping philosophy and criteria are described in appropriate CRO-NLO correspondence and in minutes of Enriched Feed Materials Transportation Meeting, March 3, 1964, and are not reiterated herein.

IV. Observations

A. The health protection programs are well organized and receive adequate attention from upper management. The methods (e.g., summary reports of survey data, annual reports, etc.) used by IH&RD for documentation and informing operating groups of conditions throughout the plant are excellent. Liaison and cooperation between IH&RD and operating groups appear effective.

B. The plant tour of the facilities showed that the housekeeping of the general plant area was good. In particular, the storage pad in Area 1 was greatly improved over previous years. The only process considered unsatisfactory from a health protection standpoint was the re-drumming, screening and similar operations performed by the Project Labor Pool Operations. It will be necessary to have adequate procedures and equipment if such operations are to be continued on a routine basis.

C. The emphasis and actions by NLO management concerning the ground and storm sewer contamination have greatly improved the status of this problem. It is noted in the body of the report that the problem is still significant as evidenced by the quantities of recent uranium lost via the storm sewer. Hence, it is felt that the emphasis by NLO concerning the ground and storm sewer contamination should not be reduced in magnitude or scope.

D. Personnel exposures to external penetrating radiation have significantly increased in both number and magnitude as noted in Part III A of this report. Although current exposures are within recommended limits, it is felt that some exposures in excess of AEC manual chapter limits would occur if this trend continues for a few years. Also, such a continuing trend would indicate a need for modification of basic health physics controls for maintaining exposures as low as practical.

E. Considerable amounts of re-cycle material from GE-HAPO are being processed in several plant areas. This material may contain impurities (e.g., increase in alpha, beta and/or gamma emitters) which are not found in other feed materials processed at this facility. The concentrations of such impurities could change depending on the number of cycles and other considerations concerning the process at GE-HAPO. Therefore, criteria and/or limits currently used for air and/or water concentrations may not be applicable for processes involving re-cycle material.

F. The following items were not reviewed in detail but are considered worthy of NLO study:

1. Completion of a detailed survey of the Neutron Generator is needed for formulating adequate health and safety operational procedures prior to routine operations. The detailed survey should consider the need for additional personnel monitoring (e.g., neutron film, etc.), potential air contamination problems from tritium in target and control room, radiation levels in and around target room, interlocks, and similar matters unique to such a facility. The initial survey by IH&RD indicated health physics problems minimal and facility design excellent.

2. The bio-assay sampling frequency is important in obtaining good estimates of internal uranium deposition. Recent publications indicate that the quarterly sampling frequency may be inadequate for evaluating some exposure potentials. It is also noted that a method for estimating internal deposition of thorium is needed before thorium is again processed in significant quantities.

no method f estimating internal deposition of thorium (July 1964)

3. The method of spot air sampling on a periodic basis used for estimating the general and breathing zone air concentration is good. However, there are no continuous samples of the general air, and such samples could provide meaningful information for those areas of greater hazard potential.

Thorium emits gamma

G. The design and testing of shipping containers for V-E cores to effect improved safety and economical transport of fissile materials is considered highly important, and it would be of considerable value if similar principles for nuclear safety control could be applied to other materials with uneconomic mass restrictions.

H. The lack of experimental data for low U-235 enrichment and unit dimensions peculiar to NLO production operations has necessitated conservatism in the application of appropriate safety factors to calculated data. It may be advantageous for NLO to avail itself of computer facilities, such as that at the ORGDP, where personnel are available and experienced in the use of the latest codes for criticality calculations. The use of these codes may give trends, curve shape factors, etc., which could, by comparison with known experiments, justify relaxation of some parametric limits derived by straight line extrapolations. Hence, favorable results would offer, perhaps, economic gains in the application of less restrictive limits to the overall NLO production process.

V. Recommendations

A. An evaluation should be made to explain the recent trend of increased personnel exposures and to implement corrective action when practical to lower such exposures.

B. The health physics aspects of "re-cycle material" should be evaluated and adjustments to the personnel monitoring program made as necessary.

C. NLO should continue its efforts to test and develop containers offering improved safety with economic gains in the transport of fissile material as noted in Observation G.

D. The possibility of using computers and available criticality codes for checking basic nuclear safety parameters and limits, as noted in Observation H, should be explored.

Reviewers: R. L. Hervin — R. L. Hervin, Health Physicist

W. A. Johnson — W. A. Johnson, Nuclear Safety Specialist

UNITED STATES GOVERNMENT

Memorandum

TO : C. L. Karl, Area Manager
Cincinnati Area Office

DATE: June 16, 1965

FROM : Herman M. Roth, Director
Research and Development Division, ORO

SUBJECT: REPORT OF THE ANNUAL HEALTH PROTECTION REVIEW OF NATIONAL LEAD COMPANY OF OHIO - APRIL 1965

ORB:RLH

Six copies of the subject report are enclosed for your information and action. The cooperation and assistance of your office and National Lead Company during the conduct of this review are appreciated.

It is suggested that your contractor be authorized and instructed to proceed with the implementation of the matters covered by the recommendations unless there exist sound reasons why a particular recommendation is not warranted in whole or part. In any event your comments and those of your contractor with regard to the conduct of the review, the general content of the report, and the detailed plans for implementing or otherwise handling the recommendations are requested by August 1, 1965.

Herman M. Roth

Herman M. Roth

Enclosure:
Report (6)

CC: R. C. Armstrong
H. B. Mills, w/encl.
J. W. Ruch, w/encl.

HEALTH PROTECTION REVIEW
NATIONAL LEAD COMPANY OF OHIO
APRIL 1965

I. Introduction and Summary

The annual health protection review of the National Lead Company of Ohio was made April 20-23, 1965, by Messrs. R. L. Hervin and W. A. Johnson of the ORO Research and Development Division. Nuclear Safety and Health Physics were emphasized during the review which included plant tours of operating facilities and formal presentations by NLO on accountability and nuclear safety control. During the review, a nuclear safety problem concerning the UF_6 vaporization step of the Pilot Plant operations was observed and called to the attention of NLO and CAO personnel. The NLO Plant Manager ordered this phase of plant operations discontinued until corrective action is taken. A recommendation concerning this situation is contained in the final section of this report.

It is the opinion of the reviewers that the health protection programs reviewed are, in general, satisfactory. More detailed analyses of the programs are contained in the Observations section of this report.

II. Implementation of Previous Recommendations

A. Recommendation that an evaluation should be made to explain the recent trend of increased personnel exposures and to implement corrective action when practical to lower such exposures.

NLO has submitted a report, entitled "Gamma Radiation Exposures," which explains the recent trend of increased exposures. The major problem involves the build-up of UX_1 and UX_2 daughters due to the processing of aged material. Other than more frequent rotation of personnel on a few operations, no additional control measures were necessary to significantly reduce personnel exposures. Exposure results for 1964 show a 50% decrease in the number of personnel (1963-331, 1964-176) above 1 rem but less than 5 rem of penetrating radiation.

B. Recommendation that the health physics aspects of "re-cycle material" should be evaluated and adjustments to the personnel monitoring program made as necessary.

The NLO study shows that external radiation problems involved in processing recycle material are not significantly different from other feed materials. The controlling impurity from an internal standpoint appears to be Pu which has an upper limit of 10 PPB in the uranium. In air, this limit would represent about 1.5% of the recommended limit for Pu when the air concentration for uranium is at the plant allowable limit. The specific activities of the various product streams (e.g., UO_3, UF_4, etc.) are around 132% of virgin material. A few by-product streams will also be evaluated for additional information. The study indicates that the NLO processes do not significantly reconcentrate the impurities. Hence, adjustments to the personnel monitoring program are not necessary at this time.

C. Recommendation that NLO should continue its efforts to test and develop containers offering improved safety with economic gains in the transport of fissile material.

Considerable progress has been made in this area to effect economic transport of fissile material, particularly with regard to Hanford and RMI shipments. With the implementation of AEC and ORO 0529, containers and shipping methods have been evaluated, approved and documented.

D. Recommendation that NLO consider the possibility of using computers and available criticality codes for checking nuclear safety parameters and limits.

Staff personnel were sent to Oak Ridge to discuss criticality calculations with personnel at the Data Processing Center. The accuracy of such calculations will best be known following metal lattice experiments planned at the Oak Ridge Critical Experiments Facility this year. It is expected that computer facilities will be used to greater advantage following these experiments.

III. Observations

A. At the Pilot Plant, steam hoods are used for vaporizing UF_6 from 10-ton feed cylinders. In the event of a UF_6 release, the procedure calls for manual actuation by an operator of a water valve to "freeze-down" the cylinder whereupon the water, as well as the steam condensate under normal conditions, drains to the storm sewer system. It was observed, for the current U-235 enrichment involved, that unsafe collection geometries are available for accumulation of resultant uranium solution. It was also observed that no instrumentation exists for automatic release detection and/or control.

B. In general, the approach to Nuclear Safety at NLO appears to be changing in that greater emphasis is being given to eliminating unnecessary or overly-restrictive conditions or limits. During the past year, economic gains without sacrifice of criticality control have been made with regard to in-plant storage and process limits and to off-plant shipment limits.

C. The formal NLO presentations during the review on criticality and accountability control are being documented at Fernald and, hence, will not be included in this report. The presentations were considered excellent and did clearly indicate good management support for the health protection programs, an awareness and respect for the problems involved and a continuing emphasis on education and training.

D. Although information obtained from the study of current recycle materials may not be valid for material from other sources, such as Nuclear Fuel Services, the information may be of value in identifying future potential problem areas. Both U-235 enrichment and impurities in material from other sources could be markedly higher than that presently handled. This could necessitate plant modifications based upon health protection considerations. These potential problem areas need consideration in an early stage of planning. Hence, NLO's continued awareness and understanding of the overall problem is important, particularly if and when commercially reprocessed material is handled at NLO.

E. The staff of the Industrial Hygiene and Radiation Department (IH&RD) was reduced by two employees since the last review. This has resulted in an increased degree of introspection and self-evaluation of various programs (e.g., film badge, air sampling, etc.) over that noted in previous years. Changes may be proposed in certain programs to provide for more efficient surveillance activities with the reduced staff.

F. The loss of uranium via the storm sewer increased from an average of 660 pounds per month for 1963 to 800 pounds per month for 1964. NLO is continuing its emphasis of the last few years concerning the ground and storm sewer contamination problem.

G. The daily job weighted air sample results for Plant 8 were reported as 1.7 times the Plant Allowable Limit (PAL) for 1963 and increased to 4.2 PAL for 1964. Respiratory protection is required for most of those operations exceeding 1 PAL.

H. New operations at NLO include the routine processing of thorium in the Pilot Plant on a production schedule. IH&RD has increased its surveillance activities of the thorium process over similar uranium operations due to the greater hazard of thorium and the difficulty in evaluating internal exposures. It is noted that analysis of urine, and/or feces is time consuming and in-vivo monitoring may be as practicable and would give more reliable results. The whole body counter at Y-12 is routinely used for monitoring thorium exposures. IH&RD is evaluating whether improved methods of thorium internal dose determination other than occasional spot air samples are desirable at NLO.

recommendation

I. The plant tour of a few facilities show that the housekeeping of the general plant area is good. However, as noted in last year's review, the Project Labor Pool Operations continue to be unsatisfactory as personnel are not following recommendations of IH&RD concerning health protection precautions. The facilities and equipment involved in the thorium operations resemble a pilot plant type operation with accompanying spills, leaks, etc., rather than a tighter routine production operation. NLO management is aware of these conditions and feels that corrective action will be taken as necessary.

IV. Recommendations

A. It is recommended that corrective measures be taken to eliminate the potential hazards arising out of the use of water for UF_6 release control at the Pilot Plant cylinder feed unit as pointed out in Observation "A".

B. NLO should evaluate the need for better control of the increasing uranium air concentrations in Plant 8, and for increased study and control of thorium operation.

Reviewers: R. L. Hervin
Health Physicist

W. A. Johnson
Nuclear Safety Specialist

NATIONAL LEAD COMPANY OF OHIO

P. O. BOX 39158 — CINCINNATI 39, OHIO

JUL 16 1965

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Mr. C. L. Karl, Area Manager
U. S. Atomic Energy Commission
P. O. Box 39188
Cincinnati, Ohio 45239

SUBJECT: REPORT ON HEALTH PROTECTION REVIEW - NATIONAL LEAD COMPANY OF OHIO - APRIL, 1965

Dear Mr. Karl:

We have reviewed the report on the Health Protection Program Review conducted by ORO Health & Safety representatives on April 20-23, 1965. As in the past, this year's survey was quite thorough on the topics covered, and we feel that the two recommendations made are appropriate. We have taken corrective measures on each of these and the status is as follows:

A. An investigating committee was formed to study the problem and to make recommendations to correct unsatisfactory conditions. This committee issued a report on 5/14/65 entitled "Interim Report: Investigation of Pilot Plant UF_6 Vaporization Facility" outlining improvements which were made prior to restarting the unit on June 1. Short range requirements given in the report have been considered and a status report submitted. A more complete final report is to be submitted for NLO management consideration after the plant vacation shutdown.

B. Starting shortly after the completion of the 1964 Plant 8 air dust survey and before issuance of the final survey report, a series of meetings was held concerning the rise in Plant 8 air dust levels. These meetings, the first of which was held on 11/11/64, were attended by the Plant 8 Superintendent and representatives of Maintenance, Engineering and Health & Safety. Definite plans were made for correcting undesirable conditions at the first meeting. Progress in specific areas was reported on at each of the subsequent meetings. After four such meetings, the last held on 2/24/65, it was decided that conditions had been improved to the point where no further formal meetings were required.

[redacted]

The overall improvement in Plant 8 conditions cannot be completely evaluated, as our 1965 air dust survey has not been completed. However, the air dust samples taken to date indicate significant improvement has been made. For instance, the operators having the three highest Daily Weighted Exposures (DWE) showed reductions from 19 NCG* to 1.5 NCG, 13 NCG to 2.5 NCG, and 9.6 NCG to 1.9 NCG. Also the plant-wide average of general air samples shows a significant reduction from 1.8 NCG in 1964 to approximately 1.0 NCG in 1965.

*NCG - National Lead Company of Ohio Concentration Guide

There appears to be a slight difference in philosophy pertaining to the hazards associated with the handling of thorium. We do not consider one isotope any more hazardous than another as long as an acceptable NCG can be established and we can control exposures below that limit. We agree that some sites consider thorium to have approximately the same toxicity as plutonium; however, both NBS Handbook 69 and AEC Manual Chapter 0524 list the maximum permissible concentration for thorium as 3×10^{-11} μc/cc (133 α d/m/m³). We have established an NCG for thorium at 100 α d/m/m³, the same as for uranium. We realize this does not give us as much leeway as our uranium NCG; however, the nature of the thorium operation, in our opinion, gives our operating personnel more than adequate protection. A DWE of 0.3 NCG was calculated for the thorium operator and this assumes that one operator is assigned to this job on a permanent basis. This we know is not the case as the Pilot Plant operators are rotated from day to day and often from hour to hour. With the existing conditions and this rigid job assignment assumption, this exposure level approximates the worst conditions.

On this basis we do not feel that any increased evaluation of our thorium exposures is required at this time. There is no suitable urinalysis procedure for thorium available and at this time we see no need for whole-body counting. We will continue a close surveillance of the operation both by routine visual checks and by air dust surveys. If exposures seem to be increasing, we can evaluate the advisability of whole-body counting at that time. If a suitable urinalysis procedure is developed, it too will be evaluated.

Sincerely yours,
Original Signed By
J. H. NOYES
J. H. Noyes
Manager

RHS/mjs/mb

cc: C. L. Karl
J. A. Quigley, M. D. ✓
R. H. Starkey

Hostile Response
reject recommendation

2280490

HEALTH PROTECTION APPRAISAL
NATIONAL LEAD COMPANY OF OHIO

SEPTEMBER 1968

I. Purpose and Scope

The annual health protection appraisal of the National Lead Company of Ohio was conducted September 10-11, 1968, by members of the ORO Safety Division, Health and Nuclear Safety Branch. The appraisal covered the NLO health protection programs in general and emphasized the implementation of previous recommendations, nuclear safety and personnel exposure data evaluation.

II. Summary

It is concluded from this appraisal that NLO continues to be operated in a safe manner with a health protection program consistent with the hazard potential of the operation. Satisfactory action has been initiated toward the implementation of last year's recommendations and should be pursued to completion at the earliest practical time. No new recommendations are made in this report. The findings of the appraisal were discussed with M. S. Nelson of NLO and W. T. Warner of AEC-CAO.

III. Recommendations

A. Implementation of Previous Recommendations, October 1967 Appraisal

1. Recommendation that material above 5% U-235 enrichment be placed in storage rather than be processed through the refinery on a batch basis.

   As reported in a letter from J. H. Noyes, NLO Manager, to C. L. Karl, CAO Manager, on December 26, 1967, a moratorium on the digestion of materials above 5% U-235 enrichment was declared by NLO management on October 20, 1967. In addition, an ad hoc committee, consisting of representatives for the Technical, Engineering and Health and Safety Divisions, was appointed to recommend and/or design a method for processing this material. Additional information on results of this committee is contained in Section IV-A.1 of this report.

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2. Recommendation that the training program for production supervisors and operators, particularly in the refinery, be strengthened emphasizing the importance of following nuclear safety controls.

On November 16, 1967, a full-time "Training Coordinator" was appointed for the purpose of establishing a formalized training program at NLO. As reported in a letter from J. H. Noyes, NLO, to C. L. Karl, CAO, on January 18, 1968, a training program was scheduled to begin January 22, 1968, for refinery personnel, emphasizing nuclear safety. Further, in a memorandum dated June 21, 1968, from C. L. Karl, CAO, to J. A. Lenhard, Director, Safety Division, ORO, it was reported that a review of 8 programmed instruction courses was performed by refinery foremen. An additional course was completed on a pre-test basis. Other training sessions have been held for the Maintenance Department on nuclear safety.

3. Recommendation that all noise areas be surveyed and necessary corrective measures be implemented.

The noise survey has been completed. Evaluation of the survey data in conjunction with previous audiometric data is underway. A report of this evaluation will be compiled and the satisfactory implementation of the recommendation will be contingent on the successful resolution of problems and recommendations resulting from the NLO evaluation. The jolters in the Metals Plant and the Ball Mill operation in Building 55 are currently recognized as potential problem areas.

A new audiometric booth has been installed and should improve the quality of audiometric examinations.

4. Recommendation regarding emergency planning and readiness.

Two high range radiation instruments are now available for use. It appears that some definite procedure for periodically verifying the workability and quasi-calibration of the high range scale was yet to be firmly established.

Initial steps were being taken at the time of the appraisal to develop the NLO program of off-shift supervision and emergency planning. Meetings of the newly appointed NLO shift supervisor with the Y-12 Plant shift supervisor and emergency coordinator are planned. It is anticipated that the influence and impact of this planning at the higher levels of supervision at NLO will be felt in emergency training throughout the NLO organization.

5. Recommendation that corrective action should be taken to eliminate the refinery fume problem.

   This problem has received a high priority at NLO, and conceptual engineering for correcting the problem appears to be adequate. Preliminary measures have been taken which have reduced the excessive fuming frequency somewhat; however, it was noted during the inspection tour that inattention to proper procedure continues to permit higher than desired fume concentrations, particularly at Digester D1-7.

B. Recommendation - September 1968 Appraisal

   None.

IV. Findings

A. Nuclear Safety

1. Safe Digester

   As noted in Part III-A.1 of this report, action has been initiated for handling U-235 enrichments above 5%. Current plans include the installation in Plant 1 of a geometrically safe continuous digester for enrichments to 10%. It is expected that this facility will be operational by March 1969. The installation of this equipment outside the Refinery is considered desirable and in keeping with recommendations of the NLO Health and Safety Division.

2. Current Refinery and General Plant Operation with Enriched Materials

Production requirements are somewhat lower than that observed in previous appraisals. Currently, the Refinery is processing normal enrichment uranium while only a small production campaign of 2.1% U-235 metal is in progress in other plant areas. Inventories of pads and general storage areas are significantly reduced from that observed in former reviews. Hence, with the implementation of previous recommendations and the status of current operations, the criticality potential is considered lower than that observed in past appraisals.

3. Projected and Anticipated U-235 Enrichment Processing

Discussions with CAO and NLO personnel have indicated that Fernald will probably reprocess cold fuel from several reactor sites including Hallam, BONUS, EGCR, Piqua, and perhaps from SRO. Significant portions of the fuel will range from 3% to 7% U-235 enrichment. In this regard, a campaign is scheduled to begin in February 1969. To upgrade the safety and economy for processing these materials, studies are underway for equipment modification in Plant 4 and in the Refinery Denitration Area. With regard to the latter, the ORO, NLO, and CAO staffs have been working together in statistical studies and computational efforts for establishing an upper safe enrichment limit for operating the 500-gallon denitration units without batch restrictions. Since water must be excluded from the denitration pots to utilize the "nitrogen poison-moderation control" principle under consideration, further studies are underway regarding the use of scrubbers, water cooling systems, etc., which could become sources of water inleakage into the units. Detailed discussions and plant inspections with NLO engineering and operating personnel were held on these aspects during the appraisal.

4. General

The nuclear safety staff functions and responsibilities are essentially unchanged from that previously noted. A significant portion of the staff time is devoted to field observation and inspection of the potential hazard locations, such as the refinery. As evidenced by the low frequency of nuclear safety violations, about three minor ones being reported during the year, operator personnel are more cognizant of nuclear safety procedure. This may be in part attributable to the formalized training program initiated since the last appraisal.

B. Transportation

All fissile materials are being transported in DOT approved containers which have OR-0529 approval. One future shipping problem has arisen which will require container(s) outside those currently used. This involves the transport of 3.85% U-235 enriched 2.6" diameter x 30" metal rods from NLO to the 9213 Critical Experiments Facility. Plans are in effect to provide the ORGDP Unirradiated BONUS Fuel Shipping Container on a loan basis for this use. This container has OR-0529 approval for BONUS fuel with a DOT Special Permit pending. This permit will need to be modified to cover NLO as a shipper and the new package contents. The package as now approved meets all requirements as a Fissile Class I package.

C. Internal Exposure Evaluation

Recent in vivo monitoring of NLO employees utilizing the IVRML indicated eight employees apparently sustaining from 70 to 100% of a permissible lung burden of uranium. These employees were continuing in their regular work assignments at the time of the appraisal. Four of these employees were from the Metals Plant; including the highest, two are from the Scrap Plant and two from Plant 9. NLO appears to recognize the need to expedite the verification of these lung burden levels and to take appropriate restrictive action as needed to insure that none of the employees exceeds the lung exposure guide. A serious question has been raised regarding the validity of the job weighted air dust sampling approach long used by NLO,

Revrewers are questioning the validity

since that data would not suggest lung exposure for these employees at the in vivo indicated level. It is understood that further in vivo measurements will be made, and increased surveillance of work areas involved will be effected.

No significant thorium exposures were found by the IVRML program.

TBD states it is an inadequate monitoring method for thorium

D. Thorium Operations

Inspection of Plant 8 revealed generally poorly-contained and makeshift-type operations. For the most part, it appears that the thorium materials when handled in dumping or shoveling operations are wet sludges and present a minimal potential for increased air activity levels. However, some such operations were noted to be left with gross amounts of material deposited in an unkempt fashion which lead to significantly elevated thorium air levels, particularly at the feed station for the rotary kiln. It is understood that thorium operations at NLO may be increasing and that planning for improved facilities will be required.

E. Raffinate Storage Area

The raffinate pits were visited, and the previously noted problem of leaching of liquid through the west levy was discussed. NLO postulated that the leach had stopped by some self-plugging effect from the shifting pit residue. The water level in Pit 3 was within one foot of the top of the west levy pointing up the rather urgent need for the new pit. The construction status of the new pit was observed. A line connecting the new pit to the clear well was laid in the top of the west levy of Pit 3, and at the time of the appraisal no ground cover existed atop this levy. NLO agreed to the need to reestablish ground cover and to assure the stability of the levy especially in view of the high water level in the pit.

Reviewers: W. T. Thornton
W. T. Thornton
Health Physicist

W. A. Johnson
W. A. Johnson
Nuclear Safety Specialist

H W Hibbitts
H. W. Hibbitts
Health Physicist

2280487

HEALTH PROTECTION APPRAISAL

NATIONAL LEAD COMPANY OF OHIO

BY

WILLIAM T. THORNTON

RICHARD D. SMITH

WILLIAM A. PRYOR

SEPTEMBER 1970

B. Forearm Exposures

NLO has performed a study of exposure to the forearms of some Plant 5 employees. The results of this study showed projected annual forearm exposures from about 14,000 to 46,000 mrem. In view of this, it is evident that AECM 0524 monitoring requirements have not been met. According to NLO estimates, about 300 employees would require extremity monitoring because of potential exposure to the hands. It appears necessary that further attention be given by NLO to this matter. Extremity dosimeters should be provided as appropriate and an evaluation of involved operations should be made to assure compliance with 0524 guides.

The study does not indicate the level of hand exposure for these employees. From previous experience at other uranium facilities, it would be expected that the hand exposure could be 2-3 times the wrist exposure.

C. IVRML

The IVRML visited NLO on two occasions during CY 1970. It was on site for two weeks, beginning March 30, and again from early July through the end of September. During the first counting period, about 24 employees were counted and during the second period 103 employees (including the 24 previously counted) were monitored. On the basis of data generated during these monitoring periods, 23 employees are calculated to have average lung burdens for 1970 equal to or greater than one-half the AEC guide. It is estimated that about 200 employees are currently working in production areas and have a generally comparable potential for uranium lung exposure. It is therefore noted with concern that only about half of those potentially subject to exposure have been monitored by IVRML during this year. It is further noted that a substantial fraction (approximately 20-25 percent) of the production work force has not received at least one IVRML count since the counter first went to NLO in 1968.

What is this costing NLO?

Based on the above data, it would appear that about 15-20 percent of those counted in 1970 were found to have more than 50 percent of the AEC guide criterion. Of the number exceeding the 50 percent level, one-third was counted for only the first time during the July-September IVRML visit.

F-1-3

May 13, 1955

URINARY URANIUM INVESTIGATIONS

2132431

R. C. Heatherton

W. S. Shurkin

The following urinary uranium results were investigated first because there were no apparent reasons for the high uranium results.

The investigations failed to show why these urinesamples were high in uranium.

Following are the results of the investigations:

(1) works for as a She never gets into any area that would result in an exposure. There is no reason for the result of 0.072 mg U/l given by the analysis on 4/27/55.

(2) works for , office where he is working to the present time. I could find no reason for the high uranium result of 0.466 mg U/l given by the urine sample of 4/29/55.

(3) worked as Radiochemistry Lab, in the Laboratory Building. Her principle job was Possibility of her getting an exposure which would result in 0.543 mg U/l is very remote.

(4) , is a Her duties occasionally take her to the reproduction room in the Laboratory Building. I could find no reason for the urinary result of 0.053 mg U/l given by the sample of 5/2/55.

WSS:bg

W. S. Shurkin

cc: J. A. Quigley
R. Hoover
W. S. Shurkin
Central Files ✓

[redacted]

01239

2117069

NATIONAL LEAD COMPANY OF OHIO

P. O. BOX 39158 CINCINNATI, OHIO 45239

[redacted]

MAR 6 1972

Mr. C. L. Karl, Area Manager
U. S. Atomic Energy Commission
P. O. Box 39188
Cincinnati, Ohio 45239

Subject: REPORTING REQUIREMENT FOR INTERNAL EXPOSURES

Reference: 1. Letter, C. L. Karl to M. S. Nelson, dated 2/28/72, same subject

2. Letter, J. A. Lenhard to C. L. Karl, dated 2/24/72, same subject

Dear Mr. Karl:

Following is information requested in the reference letters:

As we have pointed out on previous occasions, we have little confidence in the reliability of any method for assessing dose to the lung from depleted, normal, or slightly enriched uranium at the expressed levels of interest, 25% to 50% of the annual standard. We believe urine assay results are of no value for this purpose. Assessments based on single in vivo counts for an individual are subject to considerable error. If we choose to overlook this difficulty we can, by additional in vivo monitoring, report individuals whose in vivo counts can be equated to 25% of a lung burden. This would be accomplished at some additional expense in both money spent and time lost from production and other endeavors.

It must be assumed that anyone who works in the production area has the potential for acquiring 25% of a permissible lung burden. At present there are 353 wage employees working in the production area. Also, there are about 50 salaried employees who have the potential for acquiring 25% of a permissible lung burden. Consequently, approximately 400 employees would require routine in vivo monitoring in order to determine which employees have a lung burden of 25% or more of the permissible amount.

002308

We assume that it might be sufficient to count those groups of employees, some of whom might show lung burdens of 25 to 50%, only once a year. Those groups in which lung burdens of 50% or greater occur would be counted two or more times per year. Such a program would involve making about 600 body counts a year. It would require that we have use of the mobile body counter at least six months a year. The cost of this counting program, including $35 per count counter charge, wages of NLO Health and Safety personnel, and lost working time of those being counted, would be about $36,000. This is more than twice the cost of approximately $15,000 for the counting program planned for 1972.

The above estimate of the economic impact is conservative. Several factors could have the effect of greatly increasing the cost of the body counting program. One of these factors would be the need to count those in the 25 to 50% lung burden groups more than once a year. Also, it may be necessary to impose the "at least two days away from exposure" criteria to all body counting in order to obtain satisfactory data at the 25% lung burden level. Such factors could lead to the necessity of having body counting facilities available on a full-time basis.

Since uranium and thorium both have long biological half-lives of at least 100 days, our program for annual in vivo monitoring, together with the urine assay program for exposure control, has been sufficient to assure our meeting the quarterly dose standard. No difficulties are expected with this in the future.

Sincerely yours,

Original Signed By
M. S. NELSON
Manager

M. S. Nelson
Manager

RCH:TAD/fb:vvs

cc: C. L. Karl
J. A. Quigley, M.D. ✓

Central Files

002309

NATIONAL LEAD COMPANY OF OHIO

A SUBSIDIARY OF N L INDUSTRIES, INC.

2159291

P. O. BOX 39158

CINCINNATI, OHIO 45239

PHONE: AREA CODE: 513-738-1151

AUG 1 1979

Mr. W. H. Travis, Director
Safety & Environmental Control Division
Oak Ridge Operations
Department of Energy
P. O. Box E
Oak Ridge, Tennessee 37830

Dear Mr. Travis:

INTERNAL RADIATION EXPOSURE EVALUATION

Ref: Letter, W. H. Travis to Multiple Addressees, same subject, dated July 12, 1979

Uranium urinalysis results are not used to evaluate internal radiation exposure at the FMPC. In order to do so, an employee would have to be removed from all exposure until transient uranium was eliminated from the upper respiratory tract and the gut. Only when all urinary uranium was due to the deposit in the organ of interest, usually the lung, could an estimate be made of organ burden and internal radiation exposure. Removal of employees from regular work duties for this purpose would not be practical.

All estimates of uranium lung burdens are provided by in vivo counting. Urinalysis results are only used as an indication of the adequacy of basic exposure control measures. We assume that uranium in urine will generally not exceed 0.040 mg/l when airborne uranium is within the concentration guide limit. This assumption is based on many years of air sampling and urinalysis data. When a urinalysis result exceeds 0.040 mg/l, the employee is immediately requested to submit additional urine samples at the start of shift on three consecutive work days. An investigation of the work area is made if the high concentrations persist.

PLAINTIFF'S
PE765

For chronic uranium exposures, we consider the lung as the critical organ and base the permissible burden on radiotoxicity. Chemical toxicity would be the controlling factor, and kidney the critical organ, if there was an acute intake of a large amount of soluble uranium.

Sincerely yours,
Original Signed By
R. M. SPINCELEY
Assistant Manager

S. F. Audia
Manager

MWB/vvs

cc: M. W. Boback
T. A. Dugan
W. J. Grannen
R. C. Heatherton
H. D. Hickman
Central Files

jal MWB 10/20

October 19, 1972

OCCUPATIONAL SAFETY & HEALTH STANDARDS, PART 1910.96, IONIZING RADIATION

D. L. Dunaway

R. C. Heatherton

Paragraph (p) (2) of this part relates to AEC contractors. Although it states that such contractors shall be deemed to be in compliance with respect to possession and use of source materials, we do not comply with many of the requirements. Major areas of noncompliance are in posting of signs, labeling of containers, and exposure to airborne radioactive materials.

Strict compliance with the sign posting regulations would require a "Radiation Area" sign in each area accessible to personnel where they could receive radiation of 5 mrems in one hour or 100 mremsin any five consecutive days. Also, each area or room in which 34 pounds or more of natural uranium, 100 pounds or more of thorium, or any quantity of enriched uranium is used or stored would require posting with a "Caution - Radioactive Materials" sign. Each area or room in which airborne radioactivity exceeds for any time the concentrations given in the guide for industrially exposed people or any area in which the concentration for time spent by an individual in one week averages 25% of the guide value requires a "Caution - Airborne Radioactivity Area" sign.

There is nothing in the regulation regarding one sign taking precedence or the frequency for use in large areas. It is conceivable that our process areas would require all three types of signs in each area and each production building would require several of each type of sign.

In addition to posting the areas, strict compliance with the regulations would require that each container in which enriched uranium in any quantity, natural uranium in excess of 3.3 pounds, or natural thorium in excess of 10 pounds is processed, stored, or transported would require a label bearing the radiation symbol and these words, "Caution - Radioactive Materials."

Most likely these requirements for labels and signs were intended for small users whose work with radioactive material is a small part of their total work and where there is a need to constantly remind those coming into the area of the presence of radioactive material. Such requirements seem out of place for this plant where work with source materials is the principal work.

Paragraph (c) (3) of this part does not allow application of particle size data or use of respirators in determination of exposure to airborne radioactivity. Thus, the only means of control are reduction of the airborne concentration to which workers are exposed or reduction of their time of exposure so that the average concentration for 40 hours does not exceed the concentration guide. It can be concluded that bioassay and in vivo monitoring data are not acceptable evidence of compliance with exposure criteria.

Because of the impracticality of these requirements for operation of this plant and evidence of many years of operation with adequate radiation exposure control, we should ask for a variance in these matters unless we are considered to be in compliance.

Original Signed By
R. C. HEATHERTON
Asst. Dir. of Health & Safety

R. C. Heatherton

RCH/fb

cc: J. A. Quigley, M.D. - M. W. Boback

F3-6-2
no card

PRODUCTION DIVISION SAFETY MEETING MINUTES

The July meeting was held on Wednesday, the 18th, and began at 8:15 a.m., with A. Stewart, Jr. presiding. Others present were: S. Audia, M. Nelson, M. Cawdrey, R. Coates, C. Chapman, H. Eberle, L. Dooley and M. Wittman. The Union representative and the Mechanical representatives were not present.

A discussion was held concerning the Semi-Annual Safety Report of the Mechanical Department, and the advisability of adapting it to the various other departments. A. Stewart suggested that C. Chapman and S. Audia give some consideration to the program and perhaps issue some literature for their departments regarding safety procedures. He stated that the Mechanical Department's program seemed to be achieving its purpose since a consistent reduction in the frequency rate was indicated.

Mr. Stewart also stated that since the Union has requested safety meetings among their own groups on Company time, a plan was suggested to the Plant Manager for a meeting once a month of representatives of each plant for both management and the union. It is planned that the employees would be excused at 3:45, and the meeting would be held from 4:00 to 4:30 p.m.

1. Fire Brigade. Because of the poor attendance, it is necessary to repeat part of the training course; therefore, the training will not be completed before September 1. A letter will be sent to all supervisors noting the changes made in the Fire Brigade procedure.

2. Rolling Mill Heat Problem. Nothing accomplished to date. It was stated that the results of the Health and Safety survey would be useful to this committee in their study of the problem.

3. Zirconium Hazard. It was pointed out that the potentially hazardous forms have not been converted to a more stable state as was recorded in the minutes of June 20, 1956. An S.O.P. is being prepared by Production Engineering. The problem of mislabeled material was also discussed, and will be brought to the attention of the plants involved.

4. Hazard Photos. The advisability of purchasing a camera was discussed. It was suggested that Health and Safety purchase a camera which would take both colored and black and white pictures and would be simple enough for the average person to operate.

5. Fork Truck Identification. To date, the numbers have not been painted on the fork trucks; and if a letter is not issued to the Procurement Division from Dr. Quigley by Friday, July 20, it will be written by the Production Safety Committee.

NOV 25 1981 J2-1

Mr. William H. Travis, Director
Safety & Environmental Control Division
Department of Energy
Oak Ridge Operations
P. O. Box E
Oak Ridge, Tennessee 37830

2154338

Dear Mr. Travis:

GOALS FOR CY-1982

Reference: Letter, W. H. Travis to Multiple Addressees, 10/14/81, "Health Physics ALARA Goal Program" J2-1

Both internal and external radiation exposures are encountered in FMPC operations:

Airborne uranium may be inhaled and deposited in the lung. If insoluble, there may be a gradual buildup and long-term retention.

Vacuum remelting of uranium metal causes a separation of impurities which concentrate on ingot surfaces. Beta-emitting daughter products also separate and are present in above-equilibrium amounts. During ingot handling, this enhanced radioactivity can produce significant doses to the skin of the whole body. Remelt crucibles and other remelt equipment also become exposure sources because of the accumulation of daughter products.

Above-equilibrium daughter products will also cause significant hand and forearm exposures in remelt operations and subsequent ingot machining.

Moderate whole body (gamma) exposures may occur in remelt operations. Low exposures occur in other uranium processes.

0188697

11-25-81

In response to your request (ref.), the following goals are proposed for CY-1982:

Initiate the reporting of person-rem totals and averages by cost center. This information would be reported to enable individual supervisors to follow the results of their own ALARA efforts. Data would be reported for whole body, skin of the whole body and hand exposures.

Initiate the reporting to supervisors of lung burden in vivo results as a percentage of the maximum permissible level. Many lung counts are made for screening purposes and are made under circumstances which require interpretation of the count result by someone familiar with the vagaries of in vivo measurements. While all count data are retained in the employees' files, not all results are useful as an expression of the true lung burden.

Initiate the reporting to supervisors of all urine uranium results above 0.025 mg U/ℓ. For many years we have considered this level as an indication that work conditions could be improved.

Conclude all testing to determine if ingot cleaning, by acid pickling or other means, should be pursued as a means of reducing beta exposures in remelt operations.

Please inform me or members of my staff if these draft goals meet the objectives of the ALARA goal program.

Sincerely yours,

Original Signed by
R. M. SPENCELEY
R. M. Spenceley
Manager

MWB/fb

cc: M. W. Boback
V. J. D'Amico
R. C. Heatherton
N. R. Leist
M. R. Theisen

Central Files

0188698

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : R. L. Kirk, Director, Production Division

DATE:

FROM : W. B. Harris, Chief, Industrial Hygiene Branch, Health and Safety Laboratory

2185130

SUBJECT: HEALTH HAZARDS INVOLVED IN PROCESSING THORIUM MATERIALS

SYMBOL: HSH:WBH

INTRODUCTION

Despite the fact that thorium is very similar to uranium in its radioactivity and not too different in its possible chemical toxicity, there are certain inherent features of the material which make the health hazards involved in its processing somewhat different. The purpose of this memorandum is to attempt to define these differences in order that plant and process design may be directly compared with those for uranium processing with specific exceptions. These exceptions, I shall attempt to clarify so that modifications may be made in the design to permit safe handling throughout.

1. Radioactivity

Unlike uranium, the extent of the direct radiation and radioactive dust hazards of thorium processing depend in large measure on the history of the thorium being handled. This is because of the complexity of the decay characteristics of the thorium chain. When one takes these characteristics into account, it becomes obvious that it is difficult to predict expected activity with the same degree of assuredness and accuracy as can be done for uranium and its compounds.

In order to simplify considerations of activity, it can be said that whereas in uranium processing the uranium is in equilibrium with its daughters only in the raw ore, thorium must be considered to be in radioactive equilibrium throughout the processing. Therefore, the same type of precautions must be followed in all steps of the thorium plant as are observed in the initial processing areas of uranium.

As a result of the above consideration, it can be seen that the thorium sludge materials and raffinates, as well as the condensed ash from the remelt operations, are both similar in activity content to the K-65 material resulting from uranium refining.

PLAINTIFF'S EXHIBIT 535b

2. Air Dust

The air dust hazard from thorium processing is somewhat more than it is from uranium. This, however, should not necessitate any basic change in handling procedures. As far as we have been able to determine the only area where dust hazards are significantly different is in the metal recasting step.

3. Radioactive Gas

thoron gas

Because the thorium daughters build up so rapidly after separation, there is no area in a thorium processing plant where thoron gas would not be expected to exist. Predictable exposure to this gas differs from exposure to radon in the uranium plants in that none of the thorium process areas can be expected to be thoron free, whereas once the radium has been removed from uranium, radon no longer is a problem. What this means in uranium processing is that operations involving concentrates only never result in any significant radon concentrations. This cannot be expected in a thorium plant.

4. Fire

Because thorium is much less pyrophoric than uranium, the metal finishing procedures can be operated with much less concern. The main difficulty with such operations as machining of uranium lies in the fact that chips readily burn. The fumes from these chips are apt to create a nasty inhalation hazard. This type of hazard is much less severe with thorium.

SPECIFIC OPERATIONS

1. Ore Handling

The general procedures for handling ore will not differ significantly from those employed in the processing of pitchblende ores. If the initial operations up to the sulfating step are treated in a manner similar to the treatment of Q-11 at Fernald, no unusual hazards would result.

2. Wet Processing

After the ground sand has been mixed with sulfuric acid, and through solvent extraction, the only unusual hazards will come from the gangue material or the raffinate. Whether this occurs as a single residue or as two separate residues, it can be expected to have a fairly high radioactivity. This activity is comparable to that encountered from the K-65 material. It should be pointed out, therefore, that throughout the areas where this material is stored or handled high levels of gamma activity may be expected. These levels will be similar to those found in the Mallinckrodt plant in the vicinity of the Feinc filters.

3. Dry Processing

Here again, the direct radiation from in-process and stored material is significantly more severe than that encountered from uranium operation. However, these radiation levels are not so high that they cannot be met by interposing distance between the operator and the material.

4. Casting Operation

The present furnace in use at Fernald creates excessive radiation exposures to personnel and a high degree of contamination throughout the area when used with the present operating procedures. It should be pointed out, however, that the activities which have been measured recently at FMPC are higher than would be found in normal processing. The reason for this is that the operations which have been seen at FMPC have involved the use of scrap metal which always will produce higher levels of radiation than derby material (this has also been found to be true for uranium, but not to the same extent). It will be necessary either that a furnace be designed which will permit more remote operation, or if the present furnace must be used, operating procedures will be necessary which will insure that the operator not enter the furnace enclosure. Measurement which were taken at the vacuum casting furnace at Fernald show some areas which would exceed the weekly beta tolerance dose in 1 hour, and the weekly gamma tolerance dose in 4 hours. It was found that the present method of charging scrap into the furnace gave the operators in 7 minutes about 10% of the weekly gamma dose, and 25% of the weekly beta dose. In addition, the disassembly of the molds and the removal of the ingot created very high dust exposures.

5. Metal Fabrication

If carried out in a manner similar to the handling of uranium, these operations should create no unusual problem. As a matter of fact, the most serious hazard in metal fabrication of uranium arises from the burning of the material. This would be largely eliminated because of the lesser pyrophoricity of thorium. It should be pointed out that with the exception of centerless grinding these operations are being satisfactorily carried out at Fernald.

6. Inspection

We are not yet in a position to define inspection procedures. Radiation exposures to the hands will undoubtedly be more severe from the inspection of thorium slugs than the present uranium practices would show. It may be possible to handle this either with more mechanical operation or with time. Samples are being obtained for surface dose measurement. After the evaluation of the metal, more definitive information will be presented.

7. Storage

More shielding will have to be provided for the storage of completed material. As a matter of fact, all inplant storage should be shielded or at least adequately removed from operating areas.

In the event that specific information is desired on individual operations, I am enclosing a copy of a memorandum from Mr. P. B. Klevin to me which discusses each operation in detail and presents dust and thoron concentrations and radiation exposures which were actually measured at Ames, Lindsay and FMPC.

Enclosure:
Memo to Harris fr Klevin, dtd 3/5/54.

CC: C. L. Karl, Fernald (2)
D. C. Moore, NYOO
F. Huke, NYOO
M. C. Kells, NYOO (2)
P. B. Klevin, NYOO

2138200

Merril Eisenbud, Manager

April 17, 1956

W. B. Harris, Chief, Industrial Hygiene Branch, HASL

THORIUM AT FERNALD

SYMBOL: HSH:WBH

I talked to Joe Quigley this morning about the Fernald thorium exposures, and picked up the following facts.

The thorium plant which consists of a wet purifying step, a derby production, sawing the derbies into 2" squares, welding the squares into long electrodes, and arc melting with consumable electrodes is no longer in operation. Prior to last winter, the plant was operating at a low rate, but a large order for remelted thorium came in, and the production rate was stepped up very high. By December, however, the order had been substantially completed, and management shut down at Quigley's behest.

Prior to shutdown, during the period of high production rate, the exposures were very high, with several average exposures exceeding 15,000 micrograms per cubic meter, the highest being close to 50,000. Individual sample results ran up as high as 1/2 gram per cubic meter.

When this was determined, Joe persuaded them at least to reduce the production rate. Operating at the lower rate they were able to bring most of the exposures down below 200 micrograms per cubic meter, with some as high as 500, but the bad spots which previously had been at 50,000 were now reduced to an average exposure of 10,000.

At that point, as I mentioned before, the order was about completed, and George Wunder agreed that the only thing to do was to shut the plant down until the Commission was willing to support the approximately $250,000 improvement which had been recommended by National Lead.

Incidentally, it might interest you to know that National Lead has taken over the Monticello plant, and they called Joe out there to advise on health controls (I wonder who paid for his time). Also, National Lead is apparently seriously considering the construction of a MTR. They called Joe on this as well.

0114280

PE 528

STANDARD FORM NO. 64

4108

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

3727

SUBJECT: DISPOSAL OF FERNALD THORIUM PRODUCTION RESIDUES

SYMBOL: E:ELG

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 durms. 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

8-22-58

the Vitro uranium residues which were dumped into the Pennsylvania Railroad dump at Blairsville, Pennsylvania. The Vitro disposal was arranged by the Feed Materials Division after surveying several sites, and a total of 12,000,000 pounds of uranium residues were disposed of in the dump during 1956 and early 1957. This office contacted the railroad and sent representatives to the dump site to arrange for disposal of zero assay residues. As the Pennsylvania Railroad has no interest in obtaining an AEC license, the legal limitation of less than 0.05% SS content was placed on any disposal considered for this site. By agreement the radioactivity of the residues was limited to equal or less than the 10 mreps/hr (maximum) measured in the Vitro wastes. Residues with activities higher than 10 mreps/hr were held back for disposal with residues having thorium contents above 0.05%.

All arrangements with the railroad were thought to be complete. They had verbally instructed the FAO to load the cars with the residues which qualified under the agreements. The FAO initiated a rate request to the Chesapeake and Ohio Railroad and was ready to direct shipment as soon as the rate was established. The Chesapeake and Ohio Railroad requested the Pennsylvania to quote their part of the rate for the part of the shipment over the Pennsylvania system. This rate was never quoted as the Pennsylvania Traffic Manager at Pittsburg refused to quote a rate stating that the railroad would be unwilling to unload the residues at Blairsville. It developed that the Pennsylvania contact man had cleared the shipment with all of the departments of the railroad, but had failed to notify the Traffic Manager at Pittsburg of the intended disposal shipment. This department apparently had borne most of the railroad and private criticism for permitting the Vitro waste disposal in 1956 and 1957, and was determined to stop any future shipments and disposal on railroad property. The specific reasons for their action were never stated. The withdrawal of approval for shipment and disposal of these zero assay residues at Blairsville has forced the FAO to take immediate steps to locate other sites which can be used for the purpose.

The Feed Materials Division in their survey of 1956, had contacted a company in Hollidaysburg, Pennsylvania which had indicated an interest in burial of radioactive residues on their property. This company is actively engaged in strip mining for a high quality clay which is used for refractory purposes in steel production. As this high quality clay is in isolated pockets throughout the company property, a great amount of stripping is required to reach the clay. Once the pocket is worked out the pit is abandoned and a new stripping is started. These abandoned pits make an ideal site for burial of residues and are located so that control of access to them would be very simple. In addition, there is a track spur to the property which passes within 50 feet of several large pits and is within short trucking distance of several other very large pits.

AUG 22 1958

Representatives of the FAO visited this site at the same time they inspected the Pennsylvania Railroad dump at Blairsville. Contact was made with a Mr. John H. Stevens, Partner, of the Woodbury Clay Company. Mr. Stevens informed the group that he had applied for an AEC license early in 1956 and that it was not approved. Information developed latter was that Mr. Stevens' application was so general in its description of his proposal for burial of residues that the AEC could not approve it. Mr. Stevens is currently preparing a new proposal and has hired a consultant on health physics to advise him and to handle technical details of its preparation. He is very interested in the use of his property for disposal of FAO residues, and has visited Fernald with his consultant and lawyer to inspect the residues and to discuss details of a proposal to FAO for disposal of these residues. A proposal from the Woodbury Clay Company is expected before the end of August.

At the time the Pennsylvania Railroad withdrew its approval of the residue shipment to Blairsville, the Chesapeake and Ohio Railroad was approached with an inquiry on possible sites along their right-of-way. Their Industrial Development Division has contacted numerous private owners and state government officials in the search for new sites. A result of this search was a call from Mr. James H. Phalan, State Commissioner of Mines, State of Kentucky, who contacted the FAO and requested that representatives call on him for the purpose of discussing the disposal of radioactive residues in Kentucky. He stated that the new Strip Mining Law in Kentucky would create many sites where residues could be buried in the restorations required by the law. He feels that private mine owners will be interested because they will be able to recover part of the cost of the restorations by contract burial of residues before starting the restoration work. Representatives of FAO and the Feed Materials Division will visit Mr. Phalan during August to discuss details of the thorium residue disposal program.

The above history of the Fernald Area's activity in the program of thorium residue disposal is related for background purposes. The current status of the program and the limited success of efforts to locate disposal sites have caused the FAO to request staff assistance from appropriate ORO divisions. This assistance is needed to guide the disposal program along legal and acceptable channels to its conclusion. The Fernald Area has a definite requirement for the storage areas now occupied by the thorium residues, and considers their removal of prime importance to furnish much needed storage area for enriched product and residues generated in enriched production. The prospect of redrumming a large percent of the residues in outside storage and the associated costs form additional pressures which force the FAO to seek a permanent solution to the thorium residue problem.

The FAO proposes to invite bids from private companies for the disposal of these residues, subject to AEC licensing, on sites which are now or may be developed as disposal grounds. We are aware that such an invitation will create problems with state and local governments which will involve both the Oak Ridge and the Washington offices of the AEC. Before entering into this program this office desires to gain expressions from interested parties on the proper procedures and regulations which might be applicable.

C. L. Karl

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2117319

NATIONAL LEAD COMPANY OF OHIO
Cincinnati, Ohio 45239

August 17, 1965

SUBJECT: MPC VALUES FOR THORIUM

TO: J. A. Quigley, M.D. ✓

FROM: R. C. Heatherton and M. W. Boback

Recently, Dr. Marshall asked about the health and safety aspects of handling natural thorium which contained thorium-230 (ionium). As you know, his question was prompted by current AEC interest in some French-produced thorium nitrate tetrahydrate which is now stored at Middlesex. The ionium content of the TNT varies up to 5.5 parts per million.

We conclude that this material can be handled like natural thorium, and no special precautions are required. A Th-230 content of 5.5 ppm in aged natural thorium will increase the alpha activity by 16%. In freshly separated thorium the alpha activity will be increased by about 48%. Thus, the presence of Th-230 will not be reflected in a significant increase in the airborne alpha activity at any point in the process.

In the past, we never had reason to be concerned about the mpc for Th-230. However, Dr. Marshall's question changed that, and also resulted in an interesting situation. The mpc tables in Handbook 69 list 2×10^{-12} $\mu c/cc$ as the mpc for a 40-hour work week for natural thorium, Th-232, and Th-230. However, a footnote gives a provisional value of 3×10^{-11} $\mu c/cc$ for Th-232 and natural thorium. Thorium-230 is not mentioned in the footnote. These mpcs are listed below in the more familiar units of disintegrations per minute per cubic meter ($d/m/m^3$). The special curie allowance has been applied to the mpc for natural thorium.

Nuclide	mpc, HB tables	mpc, HB footnote
Th-natural	8.8 dpm/m^3	132 dpm/m^3
Th-232	4.4 "	66 "
Th-230	4.4 "	(none given)

The mpc values given in the Handbook seemed unrealistic. The half-life and decay scheme of Th-230 indicates that Th-230 would probably be less hazardous than Th-232 or Th-natural. This perturbing situation prompted

MPC-T-65

a phone call to Dr. Walter S. Snyder, ORNL, who works with Dr. K. Z. Morgan, Chairman of the NCRP subcommittee on Permissible Internal Dose.

After a few minutes of consideration, Dr. Snyder returned the call and said that the footnote in NBS Handbook 69 also applied to Th-230. R. Heatherton later discussed this by phone with Joe Lenhardt, OROO, who then discussed the matter, by phone, with Carl Welty and Don Ross in Washington, D. C. The Washington AEC members agreed that the provisional values should apply to Th-230 and their comment was relayed to us by a return call from Joe Lenhardt.

Joe asked that we request written confirmation of the Th-230 provisional value when we are certain that we will be processing the TNT now at Middlesex. Joe indicated that this request will be used as a vehicle to bring about a correction in the Th-230 mpc given in AEC Manual Chapter 0524. In the Chapter tables, Th-natural and Th-232 have the same mpc that is given as a provisional mpc in the HB-69 footnote. Th-230, in the Chapter tables, has the same mpc that is given in the HB-69 tables. The correction of Chapter 0524 would change the Th-230 mpc to the same limit as that now given for Th-natural and Th-232.

These phone calls cleared the uncertainty surrounding the provisional values for Th-230. However, Dr. Snyder presented us with a new problem with his comments on future thorium mpc values. The problem is worthy of our attention if we are to continue thorium operations with reasonable mpc values. His story goes like this:

> At one time, the mpc values for thorium were those values which are now given in the HB-69 footnote. Then, the University of Rochester found a few dogs which were left from a thorium inhalation study which was conducted seven years previously. The dogs were sacrificed and their organs analyzed for thorium. By comparing these results with results from dogs sacrificed seven years previously, the University of Rochester investigators concluded that the inhaled Th stayed in the lungs and that only a small fraction had been removed during the seven years. Members of the International Committee on Radiological Protection took this data and assigned to Th a biological half-life of four years, as compared to the previously assigned half-life of 120 days. This increased biological half-life, when used in the ICRP calculations, resulted in a lowering of the thorium mpc in air. The ICRP members realized that industry would have a difficult time adjusting to the lower mpc values. For this reason, the ICRP added the provisional values for Th-232 and Th-natural with the idea that the provisional values

could be used while industry took five years to adjust to the table values. The five years were up several years ago but the ICRP Committee did not care to make an issue of the matter. A new table of mpc values is now being considered by the ICRP and they may be published in about two years. The mpcs for Th-230, Th-232 and Th-natural will not be changed in the tables. However, the provisional values will be dropped or made more restrictive.

Dr. Snyder seemed certain that the University of Rochester had undertaken new inhalation studies after the long biological half-life of thorium was noted. He indicated that this new work yielded findings which were the basis for the ICRP decision to stick with the lower mpc values.

This matter was discussed with Bob Thomas of the Lovelace Foundation who previously worked at the University of Rochester and is a recognized authority on thorium deposition and toxicology. Bob was not aware of any new work at the University of Rochester. He said that work at other places, such as the University of Utah, was primarily concerned with animal studies using injections of soluble thorium. He pointed out that these injections of large amounts of soluble thorium were causing tumors but that this could not be compared to the inhalation of small amounts of thorium under industrial conditions. Bob said that he had discussed this matter with Dr. Snyder many times but that Dr. Snyder would not acknowledge the difference between laboratory injection studies and industrial inhalation exposures.

The Lovelace Foundation and the Sandia Corporation are sponsoring the next meeting on Bio-assay and Analytical Chemistry, which will be held in Albuquerque, October 7-8, 1965. Bob Thomas is willing to add the subject of thorium mpcs to the program. Dr. John Hursh of the University of Rochester was told of these plans. He is in sympathy with our argument and has agreed to help if he can. We cannot present any data on thorium studies but we can discuss the problem, and try to show why the lower thorium mpc values are not realistic.

R. C. Heatherton

R. C. Heatherton

M. W. Boback

M. W. Boback

2131898

October 26, 1954

CONTAMINATION OF PLANT 3 HEATER TUBES

W. C. Hill - Maintenance

R. C. Heatherton

On the morning of Monday, October 25, an inspection was made of the KC-2 Area where the Brown Fin Tube Company heater tubes were moved from the Plant 3 Combined Raffinate Area. The inspection revealed that the area is extremely contaminated. This resulted from the equipment not being cleaned before it left the Combined Raffinate Area.

A phone call to you by E. V. Barry of this department revealed that according to you someone from this department had monitored the equipment and instructed J. Wallace that no cleaning was necessary. An investigation by E. Barry revealed that the technician who monitored had given J. Wallace verbal instructions and written instructions as well. These instructions were that since the equipment had a tremendous amount of loose material, it should be cleaned before removal from the Plant 3 area. The persons doing the cleaning would wear respirators. A visit to the KC-2 Area revealed that several pieces of this equipment are still tagged with these instructions on the tag. It is evident that this equipment was moved without any cleaning. Therefore, we suggest that this situation be investigated in order to prevent recurrence of such discrepancies.

With regard to the present situation, the following recommendations are made:

(1) Rope off the area that is contaminated. This area will be pointed out to you or a member of your department by an Industrial Hygienist.

(2) The equipment should be cleaned before any further moving.

(3) The area where the equipment is stored at present should be cleaned so that no contamination remains.

R. C. HEA...

R. C. Heatherton

EVB/mb
cc: H. Martin
...gley
...pman
...e

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[redacted]

NATIONAL LEAD COMPANY OF OHIO

CINCINNATI, OHIO 45239

April 10, 1968

SUBJECT INCIDENT INVOLVING URANYL NITRATE BURN

TO J. A. Quigley, M.D.

FROM Bio-Assay Committee

REFERENCE

On March 29, 1968, a Refinery employee received an acid burn when he was sprayed with a uranium solution. Two urine samples were collected during the shift; follow-up samples were collected several days later, after an intervening weekend. The information is documented here because of our interest in exposure incidents.

The following information was taken from the "Supervisor's Report of Injury," sent to the Fire & Safety Department:
Name of injured -
Badge number -
Date of injury -

What happened? "A portable dumpster containing decoppering solution from Plant 9 was unloading from the 1st shift into the NE storage tank. ? ad checked the progress of this periodically and at 5:45 PM he stated only air was coming out of the unloading line. He then unhooked the air line which was padding the dumpster, bled the air off, and then removed the wire securing the Chicago fitting on the unloading hose. The unloading hose had a twist in it and when the wire was removed the hose twisted from the coupling and the acid material sprayed him in the face. He was wearing his chemical goggles and he stated that either the acid got in behind his goggles or he moved the goggles with his hands when it sprayed him on reflex. He washed himself off at the shower station in the Metal Dissolver building, and then we washed him again in the Digestion area."

The Medical Department supplied the following information: Second-degree burns covered a 2" x 2" area under the right eye and a 2" x 2" area along the right side of the neck. Material also caused a burn of the right eye. Some material was swallowed.

[redacted]

Analysis of urine for uranium:

3/29/68	5:45 pm	Injury occurred
3/29/68	8:30 pm	Urine sample, 0.190 mg U/1, 120 ml
3/29/68	11:20 pm	Urine sample, 0.220 mg U/1, 140 ml
4/ 1/68	8:00 pm	Urine sample, 0.010 mg U/1
4/ 1/68	12:00 pm	Urine sample, 0.009 mg U/1
4/ 2/68	9:00 pm	Urine sample, 0.018 mg U/1
4/ 2/68	12:00 pm	Urine sample, 0.013 mg U/1

According to Refinery personnel, the solution in the portable dumpster contained 88.4 grams U/liter, and was 5.04 N nitric acid.

M. W. Boback

M. W. Boback
(for) The Bio-Assay Committee

MWB/vvs

cc: R. C. Heatherton
T. C. Mick, M.D.
M. H. Regan
R. H. Starkey

SEC notation:
If the urine test hadn't been done immediately the exposure wouldn't have been detected 3 days later.

OFFICIAL USE ONLY

April 19, 1972

? Plant 2

REFINERY URANIUM EXPOSURES

S. F. Audia

J. A. Quigley, M.D.

During January, Refinery personnel were scheduled to submit a quarterly urine sample for uranium analysis. When the first samples were analyzed it became clear that there had been prolonged exposures to high concentrations of airborne uranium. In the attached summary, conclusions are given regarding the sources. Recommendations are made to avoid the recurrence of such unacceptable exposures.

The exposure conditions have continued despite abatement efforts made so far. During the week of April 10, fresh layers of dust were noted around the north side screw conveyor and one drum dumper operator was observed without a respirator. In view of anticipated Refinery operations, these exposures and possible corrective measures are matters of major concern.

Original signed by
J. A. QUIGLEY, M.D./RCH
Dir. of Health & Safety

J. A. Quigley, M.D.

MWB
MWB/vvs

attach.

cc: W. J. Adams
J. E. Beckelheimer
P. G. DeFazio - w/o printout
A. F. Pennak - w/o printout

Routed to Bill Hill 5/4/72
returned by him on 5/5/72.

OFFICIAL USE ONLY

[redacted]

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REFINERY URANIUM EXPOSURES

Since the revision of the urinalysis schedule in 1970, Refinery workers have submitted samples for uranium analysis on a quarterly schedule. In October, 1971, results were acceptable. In January, 1972, results indicated that excessive exposures had occurred. The problem was discussed with Refinery supervision and efforts were made to reduce the exposures.

Conclusions

1. Refinery workers have been exposed to unusually high concentrations of airborne uranium. The exposures began between the quarterly urinalysis samples analyzed in October, 1971, and this January.

2. The greater-than-usual exposures resulted from the greater-than-usual production rate in December, January, and February.

3. Measures taken to reduce the exposures, while worthwhile, are not enough to prevent excessive exposures when the Refinery returns to the production rate maintained during December to February.

4. Major exposure sources were:

   a. Excessive dust levels in the drum dumper building.
   b. Leaks around the screw conveyor.
   c. Rodding out jammed conveyor and plugged feed lines.
   d. Dust and residues from (b), (c), leaking valves and flanges, and tank spillage is spread all through the Digestion Area and provides a constant supply for air entrainment.
   e. Leaks from the UO_3 mills.
   f. General spills around the UO_3 drumming station and the denitration pots.

Recommendations

1. Initiate a request for the Engineering Division to determine equipment changes required to properly feed the digest tanks at the desired rate. The survey should include the system from drum dumping to digest tanks, including associated dust collectors, scrubbers, and quick draft.

2. Revise SOP 2-C-102, "Continuous Digestion System," to specify that the door of the drum dumping enclosure be lowered before the drum grabs are closed for dumping. Also, specify that the dumper operator wear a respirator continuously while in the building. This would include any waiting period after the first drum is dumped.

3. Thoroughly remove the uranium dust and residues which have been deposited on the floors and overhead structures such as girders, ducts, pipes, and walls.

4. Continue to emphasize the use of respirators and the need for prompt cleanup of material spilled on floors, walls, or equipment.

Discussion

Urine Results. Attached is a print-out of the 1972 urinalysis data for Refinery workers. Persistent results over 0.025 mg/ℓ indicate moderate exposures and results over 0.040 mg/ℓ are considered due to excessive exposures which require follow-up. During January and February, results above 0.100 mg/ℓ were common.

Action Taken. On January 19, the urine results were discussed with J. Beckelheimer. It first appeared that employees with high results had worked on the breaking of tubes containing UO_2 pellets. At that time the job had just been completed and it was agreed to see if the next results were lower. They were not. In addition, other men who did not work on the UO_2 job also had high results. On January 26, another discussion was held with W. J. Adams and Mr. Beckelheimer. No pattern could be seen in the urine data and it was agreed to have all Refinery workers submit daily samples until January 31.

A follow-up meeting was held February 1. Messrs. Adams, Beckelheimer, Ross, and Boback were present. At this time it was clear that most workers in the Digestion and Denitration Areas had high results. It was agreed that one man who had the highest urine results would be moved to the Extraction Area. He was moved one week later. Supervision was to stress the use of respirators at any dusty job and the prompt cleanup of spills. We were asked to bring to the attention of the Foreman or Superintendent any situation which might have a bearing on the exposure levels. In response, the Health and Safety Division submitted 13 reports to Mr. Adams between the period of February 4 and February 24, noting such items as leaks, abnormal dust collector conditions, and use or lack of use of respirators.

Observations. On only a few occasions did we actually find dusty conditions. However, enough residual dust has been seen to indicate that the system from the drum dumper to the digest tank is the major source of airborne uranium in the Digestion Area. Rodding out the screw conveyor and freeing blocked feed lines has scattered dust all over the upper levels of the NW corner of the Refinery.

The upper floors in the Digestion Area were cleaned several times during the period of concern. However, the dust remains on the overhead structure and does sift down to provide an exposure source. In February, gumpapers were placed in five locations. Results, given below, were as expected--the dust above tends to come down.

Location	Daily Dust Fall µg U/ft²
Near operator's desk, Digestion bottom level	1,160
Above D1-7, 2nd level, Digestion	25,600
Above screw conveyor, 3rd level, Digestion	11,250
On girders, 4th level, Digestion	750
North of center door, Denitration	7,500

As noted earlier, there were few actual dusty operations observed; the only one sampled was the drum dumping operation. Results, given below, show that a respirator is required during the entire dumping job, including any waiting periods after the dumping has started.

Location	Alpha Radioactivity d/m/m³	X NCG
GA. Drum Dumper Building	1950	20
BZ. Dumping 4 drums	6600	66
GA. Digestion, Operator's desk	170	1.7
GA. 607 Level	140	1.4
GA. At West Dust Collector	130	1.3
BZ. Drum Dumper Building	4500	45
GA. 596 Level. Hot side near digest tank west	240	2.4

In Vivo Counting Results. According to in vivo counts made this year, most Refinery workers have uranium lung burdens well below the permissible level. The employee who had the highest urine results during January and February also had the highest lung burden. His most recent count indicates that the uranium in his chest area is 78% of the maximum permissible lung burden (MPLB). Three other Refinery workers have MPLB's of 67%, 63%, and 55%. All others are less than 50% of the MPLB.

We see no immediate concern over any of these results. However, we would be concerned if the employees with the higher burdens continued to have the exposures they had earlier in the year.

CENTRAL FILES

August 17, 1955

R. C. Heatherton Plant 4 2132411

E. V. Barry

Occasionally maintenance and production work in Plant 4 is of such a nature that the personnel are grossly overexposed to airborne uranium materials, as well as to gases such as HF. The personnel of that plant use Dust-foe or Comfo type respirators and occasionally resort to the use of chemical type cannister masks.

Recent urinary levels have been of such a magnitude that I believe the installation of Air Line respirators in Plant 4 is urgently required to protect the personnel from the high concentrations of uranium. The reason that Air Line respirators have not been installed is that Plant 4 personnel believe that HF will back up into the air line system. This should be thoroughly investigated to see whether this statement is true or not. It may be advisable, if this is true, that a separate air line system be installed or that Plant 4 personnel resort to the use of bottled breathing air when doing jobs where the uranium concentrations are greatly in excess of the maximum allowable concentration.

E. V. Barry

EVB/bg

cc: A. J. Stefanec
J. A. Quigley
J. Ziegler
Central File

091325

[redacted]

March 27, 1975

HYDROGEN FLUORIDE IN PLANT 4

M. W. Boback

K. N. Ross

On 3/7/75 a Plant 4 employee reported to the Medical Department with a complaint of excess hydrogen fluoride in the Plant 4 Dust Collector Drumming area on the 619 level. An inspection of Plant 4 on this date indicated excess HF in the Reactor area on the 619 level. An attempt was made to obtain samples with Drager tubes but the tubes were unreadable.

Two days previously an all-plastic sample bubbler was used at the top of the stairwell to obtain a sample. The results of that sample and others taken during the period are on the attached table.

These results indicate that the air in the area around the dust collector drumming stations at the northeast of the 619 level frequently has more than the Threshold Limit Value (TLV) of HF. On some occasions the HF concentration is above the Excursion Limit (EL) of 4000 $\mu gm/M^3$.

It is recommended that:

1) All leaks be repaired promptly;

2) When a leak is discovered the area around the leak should be marked and no work should be done in the area without air-supplied respiratory protection.

Original Signed By

K. N. Ross

KNR/vvs

attach.

[redacted]

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Date	Location	Time Sample Taken	μgm/M³
3/5/75	In stairwell on top deck level NW corner of plant	1100 - 1400	1660
3/13/75	East of door to HF area outside wall of HF area about 10 feet NW of Dust Collector Drumming Station while leak is being repaired	1000 - 1100	10,370
3/14/75	Same location as above; no leaks	1000 - 1500	1750
3/17/75	(1) Center of Dust Collector Drumming area NE on 619 level	0900 - 1100	2740
	(2) On downcomer from Dust Collector G4-9 to Drumming Station	0900 - 1100	1560
3/18/75	(1) Same as (1) above	0930 - 1300	6020
	(2) Same as (2) above	0930 - 1300	5570

HF TLV = 2000 μgm/M³

GUMPAPER SAMPLING
RESULTS

BEST COPY AVAILABLE

[..]r/ Month	Production Area [..]anium µg/ft^2	Production Area Beta d/m/ft^2	Security Fence Uranium µg/ft^2	Security Fence Beta d/m/ft^2	[..]ect Area Ura[..] µg/ft^2	[..]ect Area Beta d/m/ft^2	FMIC Area Uranium µg/ft^2	FMIC Area Beta d/m/ft^2	Stack L[..]es
[..]59									
									602
									610
									1,195
									~~850~~
.	4,785	19,070	1,862	7,169	.794	6,756	.423	2,570	.339
[..]ne	14,994	19,256	1,314	3,463	761	3,819	3,386	3,449	482
[..]y	14,782	13,746	3,342	3,629	920	3,832	488	639	464
[..]:	12,335	19,335	12,290	3,640	900	3,821	2,089	1,371	267
[..]t	17,971	21,961	3,889	3,203	2,150	7,768	547	706	333
.	20,400	21,553	4,597	5,374	1,449	4,844	478	417	467
[..]r	12,112	14,264	1,691	3,069	994	3,058	272	316	556
[..]:	14,645	21,784	2,689	4,274	590	1,832	335	473	231
[..]al	112,024	150,969	31,674	33,821	8,558	35,730	8,018	9,941	6,416
[..].	14,003	18,871	3,959	4,228	1,070	4,466	1,002	1,243	535

r/ onth	oduction Area		Security Fence		[illegible] ct Area		FMPC Area		Stack Lo[illegible]es
	Uranium µg/ft²	Beta d/m/ft²	Uranium µg/ft²	Beta d/m/ft²	Uran[illegible] µg/ft²	Beta d/m/ft²	Uranium µg/ft²	Beta d/m/ft²	
960									
.	13,563	14,531	4,379	4,981	1,010	2,896	354	474	532
.	11,333	11,598	2,691	5,213	1,963	10,431	287	714	279
	28,917	12,901	1,574	2,147	945	450	244	208	329
	19,500	18,058	5,359	6,043	1,075	5,423	469	536	378
	15,667	13,526	3,369	3,660	1,092	3,122	422	422	357
e	13,333	12,932	4,097	3,680	1,463	2,892	625	534	265
y	31,833	28,714	6,125	6,013	2,871	4,925	672	534	199
	17,000	15,471	4,500	2,662	1,350	4,380	850	593	205
t	13,250	15,705	4,419	3,509	1,275	2,743	614	511	155
	27,583	19,647	3,344	4,610	1,825	2,929	1,768	479	122
,	38,500	17,832	12,625	7,142	3,125	2,082	1,082	625	1,662
:	22,333	9,798	5,086	4,112	1,783	2,224	900	669	265
al	252,812	190,731	57,568	53,772	19,777	44,497	8,287	6,299	4,748
J.	21,068	15,893	4,797	4,481	1,648	3,708	691	525	396

r/ onth	oduction Area Uranium µg/ft²	oduction Area Beta d/m/ft²	Security Fence Uranium µg/ft²	Security Fence Beta d/m/ft²	ct Area Uranium µg/ft²	ct Area Beta d/m/ft²	Area Uranium µg/ft²	Area Beta d/m/ft²	Stack Losses
961									
.	19,200	13,541	7,271	7,138	1,249	2,026	576	397	47
.	15,333	13,116	4,848	6,255	967	1,144	377	374	197
	14,917	13,092	4,781	3,637	1,246	1,775	493	407	195
	10,083	11,611	3,897	6,419	1,208	1,717	321	518	141
	3,000	4,040	1,434	2,267	716	1,872	411	501	171
e	3,000	9,374	5,538	6,644	1,450	1,658	586	506	258
y	10,083	12,306	2,731	4,409	1,071	1,558	657	647	285
	11,500	13,123	4,284	6,541	829	1,014	625	1,284	134
t	8,417	14,729	1,441	7,258	958	3,023	1,127	3,459	294
	6,583	15,140	3,153	9,264	592	6,059	310	3,805	161
	11,333	19,558	3,659	13,986	904	9,503	664	8,549	166
	6,333	20,038	1,548	8,563	493	5,579	381	4,978	224
al	119,782	159,668	44,585	82,381	11,683	36,928	6,528	25,425	2,273
	9,982	13,306	3,715	6,865	974	3,077	544	2,119	189

c/ onth	duction Area Uranium µg/ft²	Beta d/m/ft²	Security Fence Uranium µg/ft²	Beta d/m/ft²	Pl ct Area Uranium µg/ft²	Beta d/m/ft²	FMPC Area Uranium µg/ft²	Beta d/m/ft²	Stack Losses
962	✓		✓						
	8,583	17,329	2,250	9,686	679	7,603	532	7,281	751
	6,583	17,220	82,153	8,436	506	6,420	407	5,889	361
	14,917	13,092	4,781	3,637	1,246	1,775	493	407	414
	14,208	29,127	4,703	9,879	1,808	5,765	654	4,310	368
	26,917	32,374	3,091	13,133	1,196	9,613	1,832	9,154	167
e	36,250	46,400	5,580	15,340	1,550	12,310	940	11,990	179
y	2,988	15,131	1,956	7,642	627	4,573	251	5,624	285
	20,833	36,812	26,168	10,962	9,646	4,929	4,030	4,181	375
t	36,667	44,463	8,740	13,148	2,438	5,883	1,077	3,995	473
	16,250	27,905	4,704	13,429	1,230	8,655	712	7,508	325
	32,290	196,190	4,996	21,950	1,014	12,103	613	12,428	315
	32,916	168,305	5,950	35,650	1,573	14,041	1,523	9,382	634
al	249,402	644,348	155,072	162,892	23,513	93,760	13,064	82,149	4,647
	20,784	53,696	12,923	13,574	1,959	7,813	1,089	6,845	400

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r/ onth	..oduction Area Uranium µg/ft^2	Beta d/m/ft^2	Security F..nce Uranium µg/ft^2	Beta d/m/ft^2	P... ect Area Uranium µg/ft^2	Beta d/m/ft^2	FMPC Area Uranium µg/ft^2	Beta d/m/ft^2	Stack Losses
963	√								
	147,370	314,868	8,316	42,816	3,000	18,622	1,060	10,804	1,650
	14,574	37,096	1,946	10,692	6,542	9,480	418	3,489	418
	20,312	42,037	4,133	20,466	1,244	14,872	524	14,384	585
	21,563	34,820	7,531	20,122	1,802	10,983	979	10,737	908
	24,062	39,753	7,277	18,938	1,844	10,014	629	7,738	1,488
e	23,437	36,079	9,829	20,233	2,927	8,098	1,065	6,278	686
y	14,400	27,000	3,800	13,588	1,450	8,283	648	6,360	245
	18,450	35,140	6,187	12,375	1,800	6,066	1,020	4,040	472
t	30,625	37,100	8,113	14,263	1,877	3,933	684	1,700	332
	46,950	70,400	9,363	21,675	2,233	5,383	600	1,970	391
.	31,900	44,475	8,900	15,975	2,716	7,033	840	3,171	541
:	14,100	18,252	3,875	6,763	1,375	3,366	384	800	323
al	407,743	737,020	79,270	217,906	28,810	106,133	8,851	71,471	8,129
:	33,978	61,418	6,606	18,159	2,410	8,844	738	5,956	677

ır/ lonth	roduction Area Uranium µg/ft²	Beta d/m/ft²	Security Fence Uranium µg/ft²	Beta d/m/ft²	ject Area Uranium µg/ft²	Beta d/m/ft²	FMPC Area Uranium µg/ft²	Beta d/m/ft²	Stack Losses
.964									
m	24,525	39,850	6,800	10,787	2,433	4,116	757	1,714	437
)	51,750	59,575	11,350	17,413	3,983	6,450	1,456	3,014	402
	22,975	42,025	5,275	13,163	1,428	5,217	621	4,271	379
	25,950	52,975	4,306	16,887	1,342	7,083	539	5,529	350
	29,125	45,500	7,150	29,475	1,467	4,533	614	2,857	215
ıe	49,350	62,000	11,000	18,212	2,917	6,150	921	4,086	189
.y	13,650	19,700	4,194	9,000	1,147	2,817	620	1,660	404
:	25,500	42,250	6,706	12,300	1,282	2,000	558	851	255
ıt	32,975	41,750	6,450	10,087	1,933	2,683	711	1,541	197
	22,950	48,000	7,238	14,250	1,563	3,533	1,401	2,087	803
	13,750	40,750	5,413	23,575	1,857	4,717	487	1,652	948
:	8,850	60,750	2,788	19,488	718	6,038	210	830	326
al	321,350	555,125	78,670	194,637	22,070	55,337	8,895	30,092	4,805
:	26,779	46,260	6,556	16,219	1,839	4,611	741	2,508	387

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : W. B. Harris DATE: August 5, 1953

FROM : A. J. Breslin

SUBJECT: COMMENTS ON THE ATTITUDE OF FMPC PLANT #5 PERSONNEL TOWARD AIR HYGIENE

SYMBOL: HSH:AJB

In the course of the recent occupational exposure study conducted at Plant #5, many operating practices were observed which were of a nature to promote rather than to suppress dust dissemination and exposure. Typical of these aberrations, prevalent in nearly all production steps, were: (1) frequent entry of hoods without respiratory protection, (2) misuse of hoods, i.e., leaving doors open indefinitely or doing work outside of the hood provided, (3) performing dusty jobs without any ventilation, (4) careless handling of contaminated material.

Supervisory personnel admitted that these practices were undesirable but excused them on the basis that the large number of mechanical difficulties being met render the proper use of dust control facilities impossible. This excuse is invalid. It is true that the legendary "normal plant operation" in which all mechanical apparatus functions correctly is unattainable in the first few months after new plant start up. But this doesn't bestow an automatic blanket excuse for sloppy work habits. If employees are allowed to acquire an impudent attitude toward the handling of radioactive materials, it will be difficult later on to convince them that health rules must be heeded. Further, the concept of permissible limits of exposure does not allow for the temporary suspension of health standards due to operational failures. It has been our experience that if violations are permitted under these circumstances, a chronic disregard for safe operation can easily develop.

In the report on the Pilot Plant (FMPC-1) these same improper work habits were noted and it was predicted that these habits, if not corrected, would be carried into the production plants. The problem now exists in Plant #5.

It is essential that corrective action be initiated at the supervisory level. The present negligent attitude is a liability to clean operation.

Supervisory personnel must be made to understand that health is of equal importance to production and that overexposures to airborne dust, even if only of a transient, are to be avoided. They should personally enforce these rules: (1) In the event of equipment failure, available dust control equipment should be used to the best advantage. If the permanent

H&S
Breslin/gmt
6/5/53

0114231

PE 1716

NATIONAL LEAD COMPANY
OF OHIO
P. O. BOX 158, MT. HEALTHY STATION
CINCINNATI 31, OHIO

March 14, 1956

2119748

SUBJECT BERYLLIUM DUST - URANIUM ALLOY PROGRAM - PLANT 5

TO J. W. Mahaffey

FROM A. J. Stefanec

REFERENCE

Attached are results of air dust samples collected to determine the concentration of airborne beryllium resulting from its use in the alloy program.

Following is a summary of those operations which are above the MAC of 2 mc/M3, with comments and recommendations.

I. Operation: Removing mixer blade from beryllium compound mixture outside of dry box.

Type of Sample: Breathing Zone

Avg. Concentration: 6 times MAC

Comment: This operation was necessitated when the operator dropped the mixer blade into the can of beryllium compound.

Recommendation: Operators should be made aware that the ventilated hoods should be used for any similar incidents.

II. Operation: Mixing of the beryllium compound by hand inside the burnout coating station.

Type of Sample: Breathing Zone

Avg. Concentration: 5 times MAC

Recommendation: An electric mixer should be used inside the burnout enclosure to mix the beryllium compound.

III. Operation: Applying first and second coatings to the crucible inside the burnout coating station.

Type of Sample: Breathing Zone

Avg. Concentration: 1.5 times MAC

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[redacted]

	Recommendation:	More caution must be used by the operators performing this operation to keep the level below the MAC.
IV.	Operation:	Charging derbies and molybdenum to the crucible.
	Type of Sample:	Breathing Zone
	Avg. Concentration:	4.5 times MAC
	Recommendation:	Provide more ventilation to the charging station so the velocity over the crucible is adequate to prevent the escape of dust during the charging. (This will require the services of the Engineering Division Ventilation Engineer).
V.	Operation:	Changing residue drum at the Hoffman canning station.
	Type of Sample:	Breathing Zone
	Avg. Concentration:	5 times MAC
	Recommendation:	Extreme caution must be used for this operation, in addition to wearing an Air Line respirator.
VI.	Location:	General areas where the operations from I through V are performed.
	Type of Sample:	General Air
	Avg. Concentration:	Less than one-half MAC
	Comment:	These general air samples indicate the operations listed above are not contributing to the contamination of the general areas.

<u>General Comments</u>

In determing exposure of personnel to beryllium contamination no compensation is made for the respiratory protection used. It can be assumed that respirators will provide adequate protection if they are worn properly at all times. It would be presumptuous, however, to assume that all personnel working with beryllium are faithfully wearing respirators properly. For this reason, exposures are determined without compensating for respiratory protection.

In the short period of time that beryllium compound has been used as a coating for crucibles, it has presented a health problem to operating personnel. Although attempts have been made to make the use of beryllium safe, they have not been extensive enough to keep the levels of exposure below the MAC of 2 mc/M3. Serious consideration should be given to providing more extensive controls or to finding a less toxic substitute material for coating crucibles.

A. J. Stefanec

AJS:bg

cc: S. L. Reese
C. Lowery
R. C. Heatherton
Central File

Attach.

NATIONAL LEAD COMPANY OF OHIO

CINCINNATI, OHIO 45239

March 29, 1973

SUBJECT WRIST BADGE EXPOSURES USING ALL-PLASTIC BADGE IN PLANT 5 "B" AREA

TO M. W. Boback

FROM K. N. Ross

REFERENCE

Six of the all-plastic badges prepared in the Bioassay maintenance shop were used in a test to determine if contamination of the badges could be minimized. The results of this test are compared to two previous tests in Table I. The numbers in the table are the exposures indicated by the film exposed in the contaminated film badges and plastic badges after wearing.

It appears that use of the all-plastic badges does decrease the contamination of the wrist badges in most cases. It will be necessary to increase the number of tests and to make sure the badges are rinsed off twice a shift to see how much of a decrease we can get.

The wrist exposure for the people involved in the test is shown in Table II. It appears that 1623L badge was quite contaminated during the working exposure period. This exposure should be deleted.

Keith N Ross
K. N. Ross

KNR/vvs

attach.

cc: A. E. Abbott

[redacted]

TABLE I

Contamination of Badges Worn in Plant 5 "B" Area

ID	All Plastic Jan. 1973 mr/day	Soft Plastic and Cloth Nov. 1972 mr/day	Cloth Oct. 1972 mr/day
1427	7.5	66.5	41.4
	5.2	49.2	34.6
1679	17.2	71.5	31.1
	33.0	35.2	25.7
1623	17.2	40.5	37.9
	54.4	32.1	41.4
Total	134.5	294.5	212.1

TABLE II

WRIST EXPOSURE

January 1973

ID	mr/shift		mr/quarter	* mr/quarter - background	
1427R	24.0 × (13wks)(5d/wk)	=	1560	812	2
1427L	23.3		1515	774	3
1679R	59.3		3854	3113	12
1679L	81.3		5284	4543	18
1623R	96.6		6279	5538	22
1623L ~~mr/day~~	215.0		13975	13227	52

"Hanging background" mr/day

Test 1	10.0
Test 2	10.4

~741 mr/qt.

* Background subtracted was the background exposure while hung in the Plant 5 office. No correction has been made for contamination.

SEC → That represents exposure in a protected office area, an assumed exposure free area !!

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3439326

April 19, 1976

CHIP FIRES, PLANT 5 EAST INGOT SAW

J. P. Schiltz

R. C. Heatherton

At the Plant 5 east ingot saw, burning chippiles cause airborne uranium concentrations which exceed the permissible limit and add unnecessarily to the saw operator's lung burden. An engineering request should be submitted for alterations to reduce this source of exposure.

Despite the addition of a collection pan at this saw, chips continue to collect out of the coolant where they are easily ignited. During observations made 4/15/76, the operator removed chips from the pan after every two ingots. Chips in the pan began to appear above the coolant level midway through the second cut. Once ignited, the exposed chips burned steadily until removed at the end of the cut.

Chips also collect on a small ledge in the blade canyon. This ledge is not reached by the coolant spray during the final three minutes of each cut. Burning chips from the saw easily ignite the pile which then burns until drenched by coolant at the start of the next cut.

Original Signed By
R. C. HEATHERTON
Dir. of Health & Safety

R. C. Heatherton

MWB/vvs

cc: P. G. DeFazio
A. J. Mangold
K. N. Ross

[redacted]

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NATIONAL LEAD COMPANY OF OHIO CENTRAL FILES

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

August 11, 195[illegible]

SUBJECT

2132095

TO D. Nelson

FROM A. J. Stefanec

REFERENCE

Recently we have noticed a sudden increase in the number of overexposures to radiation as indicated by the film badge. It seems that the bulk of these overexposures are to operators of the burnout area. We have investigated and have noted the following.

> In the crucible disassemble section, the glass shield with arm ports is broken out allowing 100 mrep/hour of beta to irradiate the operator doing this work. In the crucible assemble section where the shield is usually raised there is emitted 20 mrep/hour to the operator.

Since our present limit of exposure is 300 mrep/week it can readily be seen why we have these overexposures to this particular group of men.

Having the above information it is therefore recommended that all shields be replaced and used properly.

Yours truly,

A. J. Stefanec

A. J. Stefanec

AJS:bg

cc: D. J. Blythe
W. Hill
J. A. Quigley, M. D.

090892

[redacted]

CENTRAL FILE 2132018

F

June 18, 1954

JUSTIFICATION OF BASIC NEED FOR VENTILATION SYSTEMS IN MACHINING AREA PLANT 6

P. G. DeFazio

S. F. Audia

Letter to S. F. Audia from J. A. Quigley Subj. "Exposures in Plannt 6", dated 4/1/54.✓

Letter to S. F. Audia from R. C. Heatherton, Subj. "Plant 6 Air survey" dated 3/4/54.✓

A recent survey conducted by the Industrial Hygiene Department disclosed many areas in the Machining Area of Plant 6 where exposures exceeded the presently accepted maximum allowable concentration (MAC) of seventy alpha disintegrations per minute per cubic centimeter. These locations and exposures recorded were as follows:

(1)	Acme Gridleys	up to 4½ MAC
(2)	Turret Lathes	up to 5 MAC
(3)	Centerless Grinders	up to 15 MAC
(4)	Medart Straighteners	up to 20 MAC
(5)	Peerless Saws	(no reading given but stated excessive in reference letter above).

During the same period of time, 459 urine samples were taken from employees working on and around these machines. 274, or 59% of these samples were above the maximum permissable level of uranium content.

This overexposure and resulting presence of excessive uranium in urine samples has been caused chiefly by lack of sufficient ventilation systems on machines in the machining area.

(1) Ventilation systems for Acme Gridleys are of insufficient capacity to draw off all dust carried by coolant mist and any additional fumes created by minor fires in bases of these machines. Hooding on Acme Gridleys is very inefficient.

090841

[redacted]

(2) No ventilation sustem has been installed for the turret lathes and for the future Heald facing and radiusing machine. Dust carried by coolant mist and fumes from minor fires are therefore allowed to disperse and mix into air in Machining Area.

(3) Present funnel-type ends of draft ducts above Centerless Grinders and splash guards for these same machines are very inefficient. A large amount of dust is being carried away via the coolant mist.

(4) No ventilation system has been installed for the Medart Bar straighteners or for the saws. Dust, oil fumes, and fumes from minor fires are dispersed into the air.

It is proposed to purchase and install ventilation equipment as follows and thereby eliminate the majority of causes for over-exposures of employees in the Machining Area of Plant 6:

(1) Aventilation system (or systems) of sufficient capacity and with properly designed hooding to insure almost 100% draw-off of dust and fumes from Acme Gridleys. This system (or systems) would replace present three (and fourth for 2 5/8 Acme Gridleys) which are now of insufficient capacity.

(2) A ventilation system above the turret lathes and the Heald facing and radiusing machine of sufficient capacity and with efficient hooding to carry off almost 100% of dust and fumes from these machines.

(3) One piece hoods for Centerless Grinders to replace present funnel-type ends of ducts and splash guards. Hoods are to be properly designed for quick removal or raising to facilitate set-up work and maintenance work on these machines.

(4) A ventilation system above or near the Medart Straighteners and Peerless Saws. System to be of sufficient capacity and to have efficient hooding to cary off dust and fumes created by the work in these machines.

ORIGINAL SIGNED BY
S. F. AUDIA
METALS PLANT SUPERINTENDENT

S. F. Audia

SFA/ec

cc: D. J. Blythe, M. J. Goebel, Office File, A. S. Yocco, R. Heatherton, Central Files, G. C. Coon, Dr. J. A. Quigley

090842

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FZ-1-1-1

NATIONAL LEAD COMPANY
OF OHIO
Cincinnati 39, Ohio

CENTRAL FILES

November 3, 1960

SUBJECT RE-EVALUATION OF SCRAP MELTING OPERATION - BUILDING 70 ? plant 6

TO J. A. Quigley, M.D.

FROM J. F. Wing

The attached Table I summarizes the results of air dust samples that were taken on November 2, 1960 to see if a lowered furnace temperature would adequately reduce the air dust levels as found on October 6, 1960. A copy of the October evaluation is attached as Appendix A.

The attached sample results seem to be somewhat higher than those of the previous evaluation. This was probably caused by the lack of air movement during the November 2 samples (colder weather - doors closed). Regardless, the results indicate that large sources of air contamination continue to exist.

In addition, process samples were taken at two suspected sources of contamination. Results of these samples indicate both sources are contributing to high air dust levels. As shown, one is a much larger source than the other; however, both require improved control.

Since the previous evaluation seems to be correct the recommendations therein will not be changed. However, it is further recommended that any steps to improve air dust levels in this area be immediate. The air dust levels indicated on the attached table are much too high to allow for any delay.

In addition, the urinary uranium levels of employees routinely working in this area appear to be steadily increasing. Some of the more recent results have been in the 100-200 μg/l range (control limit - 25 μg/l), further substantiating the magnitude of the personnel exposure levels found through air sampling.

* A perchlorethylene exposure problem also exists as evidenced by results shown in Appendix B. With the winter months almost upon us it can be expected that this aspect will worsen unless corrective action is taken. Already there have been complaints from some of the employees in this area of illness from the perchlorethylene exposure.

J. F. Wing
J. F. Wing

Sec
see atachmen

KNR:bg

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TABLE I

SUMMARY OF AIR DUST SAMPLE RESULTS

Type	Sample Description	Concentration-α d/m/M³ High	Low	Average	X MAC*
BZ	Dumping salt from mold on grated table.	-	-	1,951	28.0
BZ	Dumping billet from mold on grated table.	-	-	6,769	97.0
BZ	Operating hoist controls while quenching billet.	14,617	4,235	8,529	122.0
BZ	Operating furnace controls while charging chips into pot.	-	-	3,924	56.0
GA	Furnace area while heating pot. Doors closed.	3,358	1,020	1,967	28.0
GA	Furnace area while charging. Doors closed.	2,370	588	1,386	20.0
GA	Furnace area while pot is being charged and awaiting pour. Doors open. Strong draft.	1,150	661	905	13.0
GA	Furnace area while pouring salt and metal into molds. Doors open. Strong draft.	555	149	406	5.8
GA	Furnace area while scraping out pot after pour has been made. Doors open. Good draft.	719	171	432	6.2
P	Pump sitting on top of Cyclone drumming station. Leak in chip drying line 3' over head and slightly SE.	9,059	7,737	8,398	120.0
P	Pump sitting on rail above chip drumming station.	686	601	643	9.2

*MAC (Maximum Allowable Concentration) - 70 α d/m/M³

Type Sample: BZ - Breathing Zone
GA - General Air
P - Process

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HOW DOES PERCHLOROETHYLENE AFFECT HUMAN HEALTH AND THE ENVIRONMENT?

Effects of perchloroethylene on human health and the environment depend on the amount of PERC present and the length and frequency of exposure. Effects also depend on the health of a person or the condition of the environment when exposure occurs.

Breathing PERC for short periods of time can adversely affect the human nervous system. Effects range from dizziness, fatigue, headaches and sweating to incoordination and unconsciousness. Contact with PERC liquid or vapor irritates the skin, the eyes, the nose, and the throat. These effects are not likely to occur at levels of PERC that are normally found in the environment.

Breathing perchloroethylene over longer periods of time can cause liver and kidney damage in humans. Workers exposed repeatedly to large amounts of PERC in air can also experience memory loss and confusion. Laboratory studies show that PERC causes kidney and liver damage and cancer in animals exposed repeatedly by inhalation and by mouth. Repeat exposure to large amounts of PERC in air may likewise cause cancer in humans.

Perchloroethylene by itself is not likely to cause environmental harm at levels normally found in the environment. PERC can contribute to the formation of photochemical smog when it reacts with other volatile organic carbon substances in air. These reactions tend to eliminate PERC before it reaches the upper atmosphere in amounts sufficient to damage the ozone layer.

WHAT EPA PROGRAM OFFICES REGULATE PERCHLOROETHYLENE, AND UNDER WHAT LAWS IS IT REGULATED?

EPA OFFICE	LAW	PHONE NUMBER
Pollution Prevention & Toxics	Toxic Substances Control Act	(202) 554-1404
	Emergency Planning and Community Right-to-Know Act (EPCRA) Regulations (Sec. 313)	(800) 424-9346
	Toxics Release Inventory data	(202) 260-1531
Air	Clean Air Act	(919) 541-0888
Solid Waste & Emergency Response	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)/ Resource Conservation and Recovery Act / EPCRA (Sec. 304/311/312)	(800) 424-9346
Water	Clean Water Act	(202) 260-7588
	Safe Drinking Water Act (Drinking Water Standard: 0.005 mg/L)	(800) 426-4791

A technical support document can be requested from the TSCA Assistance Information Service, (202) 554-1404.

WHAT OTHER FEDERAL AGENCIES OR GROUPS CAN I CONTACT FOR INFORMATION ON PERCHLOROETHYLENE?

AGENCY/GROUP	PHONE NUMBER
Agency for Toxic Substances and Disease Registry	(404) 639-6000

CHEMICALS IN THE ENVIRONMENT: PERCHLOROETHYLENE (CAS NO. 127-18-4)

prepared by
OFFICE OF POLLUTION PREVENTION AND TOXICS
U.S. ENVIRONMENTAL PROTECTION AGENCY
August 1994

Chemicals can be released to the environment as a result of their manufacture, processing, and use. EPA has developed information summaries on selected chemicals to describe how you might be exposed to these chemicals, how exposure to them might affect you and the environment, what happens to them in the environment, who regulates them, and whom to contact for additional information. EPA is committed to reducing environmental releases of chemicals through source reduction and other practices that reduce creation of pollutants.

WHAT IS PERCHLOROETHYLENE, HOW IS IT USED, AND HOW MIGHT I BE EXPOSED?

Perchloroethylene (also called PERC) is a colorless, nonflammable liquid. It does not occur naturally but is produced in large amounts (310 million pounds in 1991) by three companies in the United States. US demand for PERC declined about 35% from 1989 to 1991, and is likely to continue to fall. Solvent recycling and reduced demand for chlorofluorocarbons are major reasons for this trend. The largest US user of PERC is the dry cleaning industry. It accounts for 80% to 85% of all dry cleaning fluid used. Textile mills, chlorofluorocarbon producers, vapor degreasing and metal cleaning operations, and makers of rubber coatings also use PERC. It can be added to aerosol formulations, solvent soaps, printing inks, adhesives, sealants, polishes, lubricants, and silicones. Typewriter correction fluid and shoe polish are among the consumer products that can contain PERC.

Exposure to perchloroethylene can occur in the workplace or in the environment following releases to air, water, land, or groundwater. Exposure can also occur when people:

* use products containing PERC,
* spend time in dry cleaning facilities that use PERC,
* live above or adjacent to these dry cleaning facilities, or
* bring dry cleaned garments into their home.

PERC enters the body when breathed in with contaminated air or when consumed with contaminated food or water. It is less likely to be absorbed through skin contact. Once in the body PERC can remain, stored in fat tissue.

WHAT HAPPENS TO PERCHLOROETHYLENE IN THE ENVIRONMENT?

Perchloroethylene evaporates when exposed to air. It dissolves only slightly when mixed with water. Most direct releases of PERC to the environment are to air. It also evaporates from water and soil exposed to air. Once in air, PERC breaks down to other chemicals over several weeks. Because it is a liquid that does not bind well to soil, PERC that makes its way into the ground can move through the ground and enter groundwater. Plants and animals living in environments contaminated with PERC can store small amounts of the chemical.

7

NATIONAL LEAD COMPANY
OF OHIO
P. O. BOX 158, MT. HEALTHY STATION
CINCINNATI 31, OHIO

September 16, 1957

SUBJECT AIRBORNE CONTAMINATION - PLANT 8

TO L. W. Kessler

FROM J. A. Huesing

REFERENCE

As per your request, attached is a copy of the comparison table of air dust samples taken in Plant 8 for 1956 and 1957. After September 17 any further information you may need on the subject may be obtained from J. Wing, Extension 691, who will be in charge of our survey section.

J A Huesing
J. A. Huesing

JAH:bg

Attach.

cc: Central File

Sec; note changes from 1yr to the next

[redacted]

NLO-GEN-653-1 (12-14-55)

Comparison of Plant 8 Air Dust Samples
1956 - 1957

Operation or Location	Type Sample	X MAC 1956	X MAC 1957
OUTSIDE			
1. Outside Williams Mill	GA		44.3
2. Breaking salt at outside mill	BZ		30.8
3. Shoveling onto conveyor at outside mill	BZ		137.8
4. Changing drums at outside mill	BZ		122.9
C-LINER FLOW			
1. Juice hopper area	GA		.45
2. Conveyor silo to calciner area	GA		1.48
3. Conveyor silo to bucket elevator	GA		3.48
4. Williams Mill, 2nd floor	GA		.65
5. Calciner furnace, drum dumping area	GA	2.67	1.56
6. Rotex dumping station area	GA		.65
7. Rotex drumming station area	GA		.74
8. Dumping drum of C-liner	BZ	3.21	13.2
9. Feeding material to Rotex	BZ	4.01	15.4
10. Changing drums at Rotex drumming station	BZ	6.90	9.14
11. Checking Rotex drum for fullness	BZ	3.74	5.40
BOX FURNACE			
1. Box furnace area	GA	3.07	.05
2. Feeding box furnace	BZ	.56	1.61
3. Checking drum for fullness	BZ	6.87	7.11
4. Changing drums at box furnace	BZ	6.11	3.79
OXIDATION FURNACE			
1. Oxidation furnace area, 2nd floor	GA	.53	.91
2. Smoking area, 1st floor	GA	1.83	1.13
3. Spreading material on feed tray & removing foreign objects	BZ		1.77
4. Feeding oxidation furnace	BZ	1.00	3.09
5. Checking drum for fullness	BZ	1.23	4.47
6. Changing drums at oxidation furnace	BZ	2.06	6.83
MUFFLE FURNACE			
1. Muffle furnace area, 1st floor	GA		1.03
2. Muffle furnace area, 2nd floor	GA	.86	.33
3. Charging muffle furnace	BZ	29.04	
4. Hoeing material in muffle furnace	BZ	1.99	3.96
5. Checking drum for fullness	BZ	5.89	58.20
6. Changing drums at canning station	BZ	15.43	227.07

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Operation or Location	Type Sample	X MAC 1956	1957
GRAPHITE FURNACE			
1. Graphite furnace area, 2nd floor	GA	.76	.92
2. Dumping feed material on tray	BZ		4.60
3. Charging (chips & turnings)	BZ	1.64	12.76
4. Pushing chips into furnace, south side	BZ		1.08
5. Hosing material in furnace	BZ	1.10	.73
6. Checking drums for fullness	BZ	1.36	
7. Changing drums	BZ	17.41	31.46
ROTARY KILN			
1. Rotary kiln area, 1st floor	GA	1.04	4.56
2. Smoking area by panel board for Kiln	GA	.97	.37
3. Feed tray area	GA		.18
4. Feeding kiln	BZ	.80	1.59
5. Checking drum for fullness at 'scalping' canning station	BZ	5.94	5.71
6. Changing drums at kiln scalping station	BZ	34.97	13.13
7. Checking drum for fullness at product canning station	BZ	13.00	6.80
8. Changing drums at product canning station	BZ	27.47	8.55
9. Dumping through kiln drum dumper	BZ	4.59	
GREEN SALT REVERTER			
1. Dumping area	GA	.71	2.94
2. Mezzanine area	GA	3.81	.14
3. Canning station area	GA	4.07	.27
4. Feeding at reverter dumping station	BZ	9.04	
5. Checking drum for fullness at canning station	BZ	47.79	17.23
6. Sampling oxide at canning station	BZ		12.43
7. Changing drums at reverter canning station	BZ	309.37	1.37
WET AREA, 1ST FLOOR			
1. Dump trailer area	GA	.14	.20
2. Foreman's office	GA	.11	.16
3. Control room	GA	.17	.07
4. Washroom	GA	.53	.09
5. Moyno pump area	GA	.56	.86
6. Denver crusher canning station area	GA		.17
7. Digester area, 1st floor	GA	.54	.10
8. Sampling dump trailer	BZ		.33

Operation or Location	Type Sample	X MAC 1956	X MAC 1957
WET AREA, 2ND FLOOR			
1. Surge & weigh hopper area	GA		.17
2. Conveyor area, surge hopper to digest tanks	GA	1.81	.13
3. Denver crusher area	GA		.34
4. Oliver filter area	GA	.73	.26
5. Rinco filter area	GA	.26	.07
6. Bucking areas:			
a. By weigh hopper	GA	1.81	.76
b. By Oliver filter	GA	.83	.56
c. In front of generator room	GA	.30	.11
7. Raking material on Oliver filter	BZ		.63
DIURANATE FURNACE			
1. Canning station area	GA	.70	.14
2. Bucking area by panel board	GA		.07
3. Second floor	GA	2.40	.30
4. Pushing material off top hearth	BZ		.63
5. Checking drum for fullness	BZ	4.73	2.94
6. Scoop sampling oxide at canning station	BZ	29.18	13.74
7. Changing drum	BZ	95.94	3.68
PLATE-FRAME FILTER PRESS			
1. General area, 1st floor	GA	.50	.10
2. Scraping cake from filter leaves	BZ	2.54	.50
3. Shoveling cake into drums	BZ	1.77	.74
4. Reassembling press	BZ	.27	.41
Maintenance Area, 2nd floor	GA		.09
Lime & Precoat Make-up Tank Area	GA		.11
CENTRIFUGE			
1. General area, 1st floor	GA		.47
2. Charging area, 2nd floor	GA		1.83
3. Charging with contaminated oil	BZ		5.81
4. Operating controls, 1st floor	BZ		
LEACHING TANK			
1. General area, 1st floor	GA		.17
2. General area, 2nd floor	GA	.13	.07
3. Charging leach tank	BZ	.31	
4. Drumming material	BZ		
5. Operating air hose to force material	BZ		

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April 11, 1961

CENTRAL FILES

HAND PICKING "ZY" MATERIAL - PLANT 8

K. N. Ross

A. D. Workum

On March 29, 1961, an air dust evaluation was conducted of the operation of hand picking "ZY" Material (partially fired derby charges). At that time the operation took place on the first floor, wet side, of Plant 8 near the old Denver crusher canning station. It includes the separation of tramp metal, "U" metal and contaminated trash from partially fired derby charges. Since that time, the operation has been moved outside. Attached are the results of the samples.

Judging from the extremely high result, it is evident that this operation should not be conducted inside any building, unless it is absolutely necessary. If it is done inside, there should be some source of ventilation readily accessible. In either case, an air-supplied respirator should be worn.

SAMPLE RESULTS

Type	Sample Description	Concentration - d/m/M³ High	Low	Average	X MAC*
GA	Pump 4' west of operation	2,768	700	1,082	15
GA	Pump 5' east of operation	470	242	350	5
BZ	Shoveling material back into drum. Very little hand picking. Respirator worn.	23,260	313	7,402	106
BZ	Hand picking tramp metal material. Respirator worn.	5,145	5,111	5,128	73

Note: No ventilation source present

*MAC - 70 alpha disintegration per minute per cubic meter

ORIGINAL SIGNED BY

A. D. Workum

ADW/bw

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PLAINTIFF'S EXHIBIT

2637762

3110791

[redacted]

ME

UNITED STATES
ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS
CINCINNATI AREA
P. O. BOX 39188, CINCINNATI, OHIO 45239

File → ③ 7/17/64

CAS
CHH
HRW
LJZ file

IN REPLY REFER TO:

O:GJT

JUL 1 4 1964

DECLASSIFIED - PER AUTHORITY
W. J. NEYER, C.O. 5/4/92 (DATE)
BY: (SIGNATURE) 5/4/ (DATE)

Mr. J. H. Noyes, Manager
National Lead Company of Ohio
P. O. Box 39158
Cincinnati, Ohio 45239

Subject: UNACCOUNTED FOR LOW ENRICHED URANIUM - PLANT 8

Dear Mr. Noyes:

Enclosed herewith is one copy of a memorandum received from the Manager, Oak Ridge Operations Office, dated July 9, 1964, regarding the large quantity of material unaccounted for at the FMPC. The attached memorandum further emphasizes the concern of the Commission over the large quantities of material unaccounted for at the FMPC.

We suggest that the charter of the formal investigating committee which you have appointed be expanded to include the entire accountability complex at the FMPC due to the interaction of all material balances and enrichments. The memorandum should be studied by your investigating committee to see if there are any comments or suggestions contained therein which would assist in their activities.

We will be glad to assist you in any way possible. We would appreciate receiving reports of the progress of the committee for the use of this office and Oak Ridge.

Very truly yours,

Original Signed By
WILLIAM T. WARNER
Acting Area Manager
C. L. Karl
for Area Manager

Enclosure:
Cy ORO memo dtd 7-9-64

When committee report is in draft form we will have a meeting with CAO. From that mtg may come further direction as to extension of committee's activity (MSN 7/23).

[redacted]

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NATIONAL LEAD COMPANY OF OHIO

2215396

P. O. BOX 39158

CINCINNATI, OHIO 45239

DEC 1 2 1966

Mr. C. L. Karl, Area Manager
U. S. Atomic Energy Commission
P. O. Box 39188
Cincinnati, Ohio 45239

SUBJECT: IDEA LETTER - REVISIONS TO UAP FURNACE FACILITY - PLANT 8

Dear Mr. Karl:

PROBLEM

The UAP Furnace is in need of a major overhaul due to extensive corrosion damage to the furnace shell, hearths, burners, and rabble arms.

Because of the present inadequacy of the furnace's wet scrubber offgas system, frequent blow-backs of fumes and dust occur through the feed nozzle. These fumes attacked the dry collector which serviced the dumping station and made it inoperable. Since that time the dumping station has had no exhaust ventilation. High personnel air dust exposures have resulted from the routine dumping operation and from the furnace blow-backs.

Continued Refinery feed difficulties have effected further changes in Plant 8 processing so that at this time it is not clear if a calcium precipitate, a UAP or an ADU product will be fed to this furnace. In any case, due to the low grade halogen contaminated residues which Plant 8 is scheduled to process, the feed to the UAP Furnace is apt to be sticky or muddy in consistency. A redesigned feed and ventilation system is required to handle any type of material (wet or dry) that may be processed through the UAP Furnace.

SOLUTION

1. Rebuild the UAP Furnace by providing complete new steel shell including doors, new refractory and insulation, new gas burners, new rabble arms and rabble teeth.

2. Provide a new UAP Furnace feed system similar to the original design with the exception that the Moyno pump

[redacted]

PE323

NATIONAL LEAD COMPANY OF OHIO
HEALTH & SAFETY DIVISION

INCIDENT OBSERVATION REPORT

ROUTE TO
R. H. ?
K. N. K

2214098

To: E. D. Leininger E.V.L.

From: C. W. Zimber

Location: Plant 8

Subject: Emptying of Rotex Dust Collector No. 6018 Date: 9/10/68

The present method of emptying the rotex dust collector is not compati
with the objectives stressed by the Industrial Hygiene & Radiation Departme
During this operation the dust collector material is handled in a manner wh
promotes maximum employee exposure to harmful radioactive dust. The dust i
emptied from the collector on the second floor and falls down a chute to a
nonventilated drum on the first floor. The operator on the first floor sig
to the operator on the second floor that the drum is full by pounding on a
metal beam with a hammer. Because of the noisy conditions prevalent in the
plant, the second floor operator does not always hear the signal. This res
in an overflowing drum of dusty material causing a cloud of radioactive dus
to fill the area which also goes up the stairwell into the second floor. I
have observed this condition on September 9 and September 10, 1968. It is
a recurring problem and one which should be controlled.

I am aware that the air collector servicing the rotex unit is schedul
to be replaced and a more efficient unit installed; however, I feel that it
is necessary to provide temporary relief from the present unacceptable
situation. One possible solution would be to extend the downcomer from the
dust collector into the rotex drumming station, provide a blast gate so the
the first floor operator could shut off the flow, and use a Hoffman line to
supply temporary ventilation during filling of the drums. This should grea
improve the present situation at a cost which would not be prohibitive.

F/W0001161

[redacted]

COPY

NATIONAL LEAD COMPANY OF OHIO
HEALTH & SAFETY DIVISION
INCIDENT OBSERVATION REPORT

2215786

To F. Klein

From D. Jones

Location Plant 8

Subject NPR Dust Collector

Date 9/16/68

Tonight I found the NPR Drum Dumping Station filled to capacity with black oxide, part of which had spilled out over the roller conveyor and on to the floor. An operator who was covered with U_3O_8 told me that he had just rodded the material down from the NPR collector. His theory was that the recent heavy rains had caused the collector to allow water to moisturize the oxide material and cause it to cake up inside the ~~xxxxx~~ collector.

was with me and sent the operator to the Locker Room for clothing change. explained that the collector was not working right yesterday (Sunday) pm and that he had inspected the bags, pounding on them and causing two or three of them to pull loose at the top and ~~xxx~~ collapse.

showed me a newly installed section of downcomer from the dust collector. He said that apparently a fork truck had collided with the downcomer and ~~xxxx~~ caved it in on one side so badly that it severely restricted the flow of material through it. (The NPR dust collector canning station and the NPR drum dumping station are on the same enclosure.) At any rate, a piece of polyethylene was placed over the enclosure as best they could with the mounds of U_3O_8 lying in the way. Maintenance later checked the collector bags and found two of them with holes in them, so they were replaced.

rsiful estimates there to be 2,000 pounds of black oxide in the drumming . "There might be more." The material is .96% enriched. I had the nift superintendent check the rating of this system in regard to enrichm ad it to be rated for 1.25% of limited uranium compounds and at 1.95% nited category materials.

As 2,000 pounds is the maximum safe mass for uranium compounds, had this

A71-63

NATIONAL LEAD COMPANY OF OHIO

JOB ORDER REQUEST (NS-843) Job No. H-8519

Equipment Code 1316

Responsible Foreman R. WRIGHT Date 11-17-71 Accounting Charge 13000 (8A-12-72)

- [X] Safety
- [X] Emergency
- [ ] Urgent
- [ ] Routine
- [ ] Normal Maint.
- [ ] Extraordinary Maint.
- [ ] Alteration
- [ ] Operation
- [ ] Capital

Job Details:

Perform necessary repairs and/or modifications to increase exhaust velocity of the Quantometer fume exhaust (Lab C-35). Work performed on Minor Work Request A71-48 has not provided the necessary exhaust velocity. If necessary, replace blower with larger capacity unit.

Replace motor and blower sheaves and drive belt as follows:

Blower Sheave:	6.00" P.D. for "A" belt, 15/16" bore
Motor Sheave:	3.00" P.D. for "A" belt, 1/2" bore
Drive Belt:	#4L-320 Browning

ROOM C-35 FUME EXHAUST IN THE LAB.

NATIONAL LEAD CO. OF OHIO NOV 19 1971 MECHANICAL DEPARTMENT

NATIONAL LEAD CO. OF OHIO MAR 14 4 07 PM 1972 MECHANICAL DEPARTMENT

NUCLEAR SAFETY REVIEW NOT REQUIRED

SIGNED [signature] ENGINEER

Justification:

Exhaust velocity is not sufficient to remove corrosive vapors generated when U_3O_8 and ThO_2 samples are analyzed on the Quantometer. Personnel have been complaining of throat irritation during and after operating the Quantometer. Increased exhaust velocity is urgently needed to assure safe working conditions.

Engineering	$
Labor	$
Material	$
Contingency	$
TOTAL	$ Under $100.

1. G. R. Blank (WORK REQUESTED BY)

APPROVALS

1. [signature] (DEPT. HEAD OR SUPT.) 11/18/71
2. [signature] (DIVISION HEAD)
3. [signature] (MECH. SUPERVISOR) 3/10/72

Estimated By R. W. Mode - Proj. Eng.

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1	Mechanical Department (RECORD COPY)

NLO-ENG-183-1 (REV. 10/2/63)

[redacted]

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NATIONAL LEAD COMPANY OF OHIO
INTER-OFFICE ROUTING SLIP

Date ____________

TO: J. A. Quigley

FROM: G. Smith

The attached papers are referred for the purpose indicated by the check marks:

- [ ] Please prepare reply for my signature
- [ ] Submitted for signature or approval.
- [ ] Please note and file.
- [ ] Please note and return to me.
- [ ] Please answer, sending me a copy of your letter.
- [ ] Please follow up.
- [ ] For your information.
- [ ] Your comments, please.

Remarks:

Our Security Police sometimes report the existence of strong fumes in certain areas. They are not capable nor are their supervisors capable of evaluating whether the fumes were radio-active ~~in~~ and consequently do not know whether they should report to medical for urine sampling. -- Is there something in your procedure to cover this type of situation.

G

NLO-GEN-854 (5/25/56) IN LIEU OF PUR-2

[redacted]

2615497

3040717

HIGH AIR DUST EXPOSURE OPERATIONS

To Be Reviewed 3/23/61 January 23, 1961

PLANT 1

Operation	X MAC	Status
Riffling ore in Patterson Blending Room	3.3	Request for Production Engineering Services to be submitted for re-designing ventilation facilities where needed.
Washing sample drums	3.5	
Weighing reject drums	4.8	
Scooping ore from drum and placing into Patterson Blender	10.0	

PLANT 2

Operation	X MAC	Status
Dumping ore (Hot Side)	10.0	Ore Handling CP is being prepared and is to be submitted in the near future. All four of these operations should be either eliminated or improved with this CP.
Dumping ore (Cold Side)	6.7	
Loading crop ends at Metal Dissolver	8.0	
Emptying Hoffman vacuum cleaner	45.0	

PLANT 3

Operation	X MAC	Status
Operator changing sample jars	5.5	Idea Letter is being written by Production Engineering to enclose and ventilate this operation.
Operator raising chute from full hopper, etc. and disconnecting it.	4.6	
Operator removing lid from empty hopper and connecting it up.	6.5	

PLANT 4

Operation	X MAC	Status
Dumping reblend UF_4	5.9	Dropped from 8.2 x MAC. Other minor revisions have since been made. H&S will again re-evaluate early in 1961.

PLANT 5

Operation	X MAC	Status
Adjusting weights at the residue crib	3.0	Agreed that respiratory protection is most practical method for controlling exposures at this operation.
Jolter operation	11.0	Nothing in progress to improve.
Delidding furnace pots	10.0	Idea Letter for revision to breakout station should improve.
Operating breakout station	5.5	Idea Letter for revision to breakout station should improve.

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Operation	X MAC	Status
Loading pots into breakout station.	4.4	Idea Letter for revision to breakout station should imporve.
Rough cleaning derbies	6.5	Idea Letter for revision to breakout station should improve east station, however, nothing is in progress for improving the west station which is periodically used. Before completely satisfactory air dust levels can be realized, however, another method of derby cleaning and scaling must be found.
Scaling derbies	25.0	
Weighing and marking derbies	11.0	
Cleaning mold tank and setting in new mold and placing mold cup.	12.0	Respirator appears to be the best answer at this time although a permanent solution is highly desirable.
Removing molds from separation booth	42.0	CP-59-45 should improve this operation. Testing is now underway in an attempt to develop design criteria for spray coating MgO.
Cleaning molds with steel wool	13.0	Sketches and job order have been completed and approved by this committee for the redesign of the mold reconditioning table. This will include the use of the Sly dust collector on loan from Plant 8 as ventilation and dust collection.
Painting molds with MgO	4.0	
Removing drum from burnout canning station	10.0	CP-60-31 should greatly improve this operation.
Emptying Hoffman units - "A" Area	17.0	MCW has been contacted with no success. It appears as though we will have to start from scratch on this project again.
Emptying Hoffman units - "B" Area	42.0	
Crucible break-up area	6.8	Should be improved by CP-60-31.
Cleaning Rockwell furnaces	19.0	Respirator appears to be the most practical answer.
Removing crucible lids from burnout enclosure and placing into ventilated drum	465.0	CP-60-31 should improve, or if at all possible should eliminate this operation.
Dumping oversize liner material at East breakout "makeshift" dumping station	3.5	Nothing in progress to improve.

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Operation	X MAC	Status
PLANT 6		
Gag shear operation	15.0	Ventilation now being designed by Engineering.
Medart straightener operation	6.6	Nothing further in progress to improve. The transfer point is now being ventilated.
Shoving rods down rollers to scales	3.8	Nothing in progress to improve.
Loading rods into tote pans	3.0	Nothing in progress to improve.
Stamping rods	13.0	Spray quenching tests by Technical Division unsuccessful. More tests are planned.
Drumming crop ends	4.3	Nothing in progress to improve.
PLANT 8		
Removing and lidding drum from Rotex	6.0	New or reconditioned drums would reduce still further.
Feeding box furnace	4.9	Dropped from 88 x MAC largely by more operator care. CP-59-57 should improve still more.
Removing and lidding drum from muffle furnace	12.0	Appreciably reduced in new drumming station, but high level cleaning crew was working at the time these samples were taken and undoubtedly effected the results.
Removing and lidding drum from UAP furnace	22.0	Dropped from 43 x MAC largely by more operator care. Engineering Project 8-78 (UAP Furnace Off-Gas Revision) is awaiting electrostatic precipitator test before further work is done on it.
Drumming UAP cake	18.0	
Dumping MgF_2 into leach tank	1.7	Revisions to ventilation resulted in a drop from 21. x MAC. Will be dropped from list.
Feeding muffle furnace	8.5	Appreciably reduced, but impossible to tell just how much as high level cleaning effected samples.

Operation	X MAC	Status
Removing and lidding drum from box furnace	12.0	Dropped from 16 x MAC. Should be eliminated with completion of CP-59-57.
Removing and lidding drum from oxidation furnace	64.0	Up from 12 x MAC. Should be eliminated with completion of CP-59-57.
Feeding oxidation furnace	6.3	Up from 5 x MAC. Should be eliminated with completion of CP-59-57.
Feeding rotary kiln from feed tray	4.4	Dropped from 16 x MAC. CP-60-52 for new feed trays has been completed, but not being used for keeping dry feed wet as had been originally planned. Air dust problem will remain under present operating conditions. Engineering Project 8-69 will still need to be completed to provide more and better ventilation. This project is being held up awaiting electrostatic precipitator test.
Removing and lidding drum from rotary kiln	3.0	Dropped from 6.7 x MAC. Engineering Project 8-69 - also awaiting precipitator test.
Feeding oil centrifuge	14.0	Non-routine operation. Nothing in progress to improve.
Washing out drums	6.0	Non-routine operation. Nothing in progress to improve.
Raking material in box furnace	6.0	Dropped from 16 x MAC. Should be eliminated with completion of CP-59-57.
Dumping to silo	8.5	Nothing in progress to improve.
Changing drums at outside crusher	6.5	New drumming station has been installed. Health & Safety will re-evaluate.
PLANT 9		
Delidding furnace pots	.9	Dropped from 17 x MAC as a result of CP-59-28. Will be dropped from list.

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Operation	X MAC	Status
Charging UF4	13.0	Nothing in progress to improve.
Bottom reduction charging operation	4.4	Nothing in progress to improve.
Lowering "spent" crucible into burnout and removing it.	4.0	Nothing in progress to improve.
Installing new mold and bottom tank section	.6	Dropped from 3.0 x MAC. Will be dropped from list.
Unloading centrifugal dryer and loading magnetic separator	.2	Dropped from 8.2 x MAC. Will be dropped from list.
Transporting bottom mold tank section to separation booth	.8	Dropped from 3.0 x MAC. Will be dropped from list.
Hand cleaning furnace pots	3.0	Nothing in progress to improve.
Breaking brick and mortar from Remelt furnace coil	356.0	Nothing in progress to improve.
Shoveling brick and mortar from Remelt furnace coil	953.0	Nothing in progress to improve.
Knocking off and stamping sample	24.0	Design for ventilating this station complete, and is to be installed with Plant 9 major expansion.
Capping charged furnace pot	6.5	Up from .7 x MAC in 1959 - Nothing in progress to improve.
Separating mold from ingot	3.2	Up from 2.4 x MAC in 1959 - Entire separation to be remodelled in NPR and I&E Revisions.
DEVELOPMENT MACHINE SHOP		
Operating Bullard lathe	.3	Dropped from 23. x MAC as a result of minor enclosure modifications. Will be dropped from list.

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