**Final Detail and Inventory of Material**

F. W. Bolzney  
September 23, 1961

**Type 207:** This material was made into the following lots. Some of the additional material came from type 206, 282 and 290 material. All of these lots are re-sale material after pickling and/or de-cladding.

<table>
<thead>
<tr>
<th>Lot</th>
<th>Box</th>
<th>Weight</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1X-207-0101</td>
<td>#1</td>
<td>812 lbs</td>
<td>Slugs with small amounts of residual clad</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>813</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>821</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#4</td>
<td>816</td>
<td></td>
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<tr>
<td></td>
<td>#5</td>
<td>826</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#6</td>
<td>837</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#7</td>
<td>805</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,733 lbs</td>
<td></td>
</tr>
<tr>
<td>1X-207-0102</td>
<td>#1</td>
<td>379 lbs</td>
<td>Slugs with large amounts of residual clad</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>389</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>352</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#4</td>
<td>357</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#5</td>
<td>363</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#6</td>
<td>387</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#7</td>
<td>380</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#8</td>
<td>412</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#9</td>
<td>398</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,484 lbs</td>
<td></td>
</tr>
<tr>
<td>1X-207-0103</td>
<td>#1</td>
<td>716 lbs</td>
<td>Slugs with thick aluminum clad</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>366</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>446</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,528 lbs</td>
<td></td>
</tr>
<tr>
<td>1X-207-0104</td>
<td>#1</td>
<td>494 lbs</td>
<td>Miscellaneous size slugs and pieces</td>
</tr>
<tr>
<td>1X-207-0201</td>
<td>#1</td>
<td>1,159 lbs</td>
<td>Duds</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>835</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>997</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,991 lbs</td>
<td></td>
</tr>
<tr>
<td>1X-207-0301</td>
<td>#1</td>
<td>988 lbs</td>
<td>Billets and billet pieces</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>900</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>849</td>
<td></td>
</tr>
<tr>
<td>Material Code</td>
<td>Drum #</td>
<td>Pounds</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>--------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>1X-77-0301</td>
<td>#1</td>
<td>1,036</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>1,031</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#4</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#5</td>
<td>341</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6,115</td>
<td></td>
</tr>
<tr>
<td>1X-207-0302</td>
<td>#1</td>
<td>761</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>122</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,683</td>
<td></td>
</tr>
<tr>
<td>1X-207-0401</td>
<td>#1</td>
<td>393</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1,824</td>
<td></td>
</tr>
<tr>
<td>1X-207-0501</td>
<td>#1</td>
<td>3,066</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>840</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>1,223</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#4</td>
<td>1,225</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#5</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>6,224</td>
<td></td>
</tr>
<tr>
<td>1X-207-0601</td>
<td>#1</td>
<td>394</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>630</td>
<td></td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>1,062</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,086</td>
<td></td>
</tr>
</tbody>
</table>

**Type 286:** This material was made into two lots. Both lots of material are good remelt metal after pickling.

<table>
<thead>
<tr>
<th>Material Code</th>
<th>Drum #</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1X-208-1001</td>
<td>#1</td>
<td>414</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>1,133</td>
</tr>
<tr>
<td></td>
<td>#3</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>#4</td>
<td>1,104</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,551</td>
</tr>
<tr>
<td>1X-208-2001</td>
<td>#1</td>
<td>1,227</td>
</tr>
<tr>
<td></td>
<td>#2</td>
<td>868</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,095</td>
</tr>
</tbody>
</table>

**Type 210:** These briquettes were left intact but they were recoded. They
<table>
<thead>
<tr>
<th>Drum</th>
<th>Pounds</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1K-211-0301</td>
<td>306</td>
<td>Large massive spotty, corroded pieces. (larger than a coconut)</td>
</tr>
<tr>
<td>#2</td>
<td>987</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>902</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>737</td>
<td></td>
</tr>
<tr>
<td>#5</td>
<td>760</td>
<td></td>
</tr>
<tr>
<td>#6</td>
<td>650</td>
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<tr>
<td>#7</td>
<td>857</td>
<td></td>
</tr>
<tr>
<td>#8</td>
<td>593</td>
<td></td>
</tr>
<tr>
<td>#9</td>
<td>645</td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>585</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7,673</td>
<td></td>
</tr>
<tr>
<td>1K-211-0401</td>
<td>826</td>
<td>Solid dense pieces</td>
</tr>
<tr>
<td>#2</td>
<td>723</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>783</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>801</td>
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</tr>
<tr>
<td>#5</td>
<td>892</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7,544</td>
<td></td>
</tr>
<tr>
<td>1K-211-0501</td>
<td>630</td>
<td>Clad pieces</td>
</tr>
<tr>
<td>#2</td>
<td>859</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>917</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>962</td>
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</tr>
<tr>
<td>#5</td>
<td>742</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3,510</td>
<td></td>
</tr>
<tr>
<td>1K-211-1001</td>
<td>1,046</td>
<td>Derby pieces slightly corroded and oxidized</td>
</tr>
<tr>
<td>#2</td>
<td>1,164</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>1,082</td>
<td></td>
</tr>
<tr>
<td>#4</td>
<td>1,102</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4,394</td>
<td></td>
</tr>
<tr>
<td>1K-211-1002</td>
<td>968</td>
<td>Derby pieces corroded and oxidized</td>
</tr>
<tr>
<td>#2</td>
<td>952</td>
<td></td>
</tr>
<tr>
<td>#3</td>
<td>919</td>
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<td>#4</td>
<td>1,070</td>
<td></td>
</tr>
<tr>
<td>#5</td>
<td>997</td>
<td></td>
</tr>
<tr>
<td>#6</td>
<td>1,278</td>
<td></td>
</tr>
<tr>
<td>#7</td>
<td>1,110</td>
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<td>#9</td>
<td>1,081</td>
<td></td>
</tr>
<tr>
<td>#10</td>
<td>961</td>
<td></td>
</tr>
<tr>
<td>#11</td>
<td>1,306</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11,832</td>
<td></td>
</tr>
</tbody>
</table>
FINAL SUMMARY AND INVENTORY OF EKROM

P. H. McCready
September 28, 1961

1X-211-1003  Drum #1  208 pounds  Dirty pieces high
              #2    70
              #3    437
              #4    565
              #5    933
              #6    945
              #7    1,061
              #8    1,058
              #9    588
              #10   1,147
              #11   933
              #12    744
              #13    1,129
              #14    769
              #15    759
              12,866 pounds

1X-210-2001  Drum #1  341 pounds  Corroded briquettes
              #2    1,076
              #3    735
              #4    824
              #5    953
              #6    677
              5,106 pounds

Type 210: This material was redrummed.

1X-211-1001  421 drums  134,763 pounds

I believe the assay of this material should be less than
stated on the tab run.

Type 215: This material was redrummed.

1X-216-1001  1,234 drums  370,069 pounds  Original sump cake

Type 224: This material is intact and consists of a number of sample
bottles in one drum. This drum was not weighed.

1X-224-1001  1 drum  Not weighed

Type 226:  Delete - This material was in an acid or organic solution
and was being neutralized with dolomite. Many of the stainless
steel drums were leaking and the material in these drums has
crystallized or salted out. There was a definite loss of weight on this material and approximately nine drums (35 gallons) of liquid TNT leaked out and was lost to the storm sewer. The material is being reboxed to IK-216-3001 and will be discarded to some off site burial area, there were 167 drums that were discarded.

**Type 236:** This material was left intact but redrummed into the following lots:

- **IK-236-1001** 24 drums 9,827 pounds Bad material
- **IK-236-2001** 13 drums 5,899 pounds Clean dry
- **IK-236-2002** 18 drums 8,764 pounds Clean damp

**Type 238:** All of this material is a product from Plant 9 and should be good metal grade material. Both remaining lots are intact.

**Type 242:** All of this material is a product from Plant 6 thorium oxidation furnace. I have the approximately spec and analyses of each lot.

**Type 243:** This material was sent to Plant 6 thorium furnace for oxidation. This material was quite corrosive and there was a large loss of this residue to the storm sewer.

**Type 249:** This material was redrummed, recoded and made into the following lots. This material can be remelted after pickling or de-cladding.

- **IK-249-0201** 1 drum 521 pounds Billets
- **380-IK-249-0201** Drum 1 459 pounds Glad slugs
  - #2 825
  - #3 826
  - 2,114 pounds

**Type 250:** This material was redrummed, recoded and made into the following lot. This material was left intact.

- **IK-250-1001** 10 drums 2,061 pounds
Type 253: This material was re-drummed, recalculated and made into the following lots. The material was left intact.

1K-253-001  1 drum  1,221 pounds  Heavy tubes
1K-253-0101 1 drum  310 pounds  Small tubes
1K-253-0201  1 drum  134 pounds  Small pieces
1K-253-0301  Drum #1  833 pounds  Blad slugs and pieces
#2  992
1,766 pounds

Type 254: Delete - This material was recalculated to type 285 material.

Type 256: This material was re-drummed and weighed.

1K-256-0101  1 box  438 pounds  Two pieces of 7" ingots

(Note - this material is being held for P.O. D-427 for a future shipment to G.E. Co. Hanford)

Type 258: This material was recalculated to type 276 material.

Type 263: This material was re-drummed, recalculated, and weighed. The weights are drained weights. This material should be oxidized. Some of the increase came from type 283 and 293 material.

1K-263-0201  48 drums  9,407 pounds  Flat type of turning and chips
1K-263-0401  1 drum  64 pounds  Foil and thin flats

Type 270: This material was re-drummed and weighed. This metal can be remelted after degreasing and pickling.

1K-270-1001  Drum #1  513 pounds  Skulls
#2  475
988 pounds

Type 271: This material was re-drummed and weighed. This metal can be remelted after degreasing and pickling.
<table>
<thead>
<tr>
<th>Drum</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>893</td>
</tr>
<tr>
<td>#2</td>
<td>893</td>
</tr>
<tr>
<td>#3</td>
<td>893</td>
</tr>
<tr>
<td>#4</td>
<td>893</td>
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<td>#5</td>
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<td>#6</td>
<td>894</td>
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<tr>
<td>#7</td>
<td>893</td>
</tr>
<tr>
<td>#8</td>
<td>772</td>
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</tbody>
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7,042 pounds

<table>
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<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>891</td>
</tr>
<tr>
<td>#2</td>
<td>203</td>
</tr>
</tbody>
</table>

1,094 pounds

<table>
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<tr>
<th>Drum</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1,218</td>
</tr>
</tbody>
</table>

Clean slugs

<table>
<thead>
<tr>
<th>Drum</th>
<th>Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>892</td>
</tr>
<tr>
<td>#2</td>
<td>892</td>
</tr>
<tr>
<td>#3</td>
<td>893</td>
</tr>
</tbody>
</table>

Clean "4" slugs
Drum #4 566 pounds

\[ \frac{3}{2} \text{ pounds} \]

(Note - These four boxes of slugs are being held at F.o. 3-127 for C.I. Co. Toronto. Shipment is to be made in near future.)

Type 284: These lots are intact and have not been reweighed.

Type 285: This material was reweighed and reweighed.

\[ \text{LX-285-1001 Drum #1 166 pounds Wet and Lumpy} \]
\[ \begin{array}{ccc}
\text{#2} & 585 \\
\text{#3} & 527 \\
\text{#4} & 528 \\
\end{array} \]
\[ \text{1,800 pounds} \]

Type 286: Delete - All of this type material was reweighed to type 211 or oxidation feed for Plant 6.

Type 287: Delete - All of this type material was reweighed to type 207 or 276 material.

Type 288: Delete - All of this type material was reweighed to type 207, 211, 216, 263, 276, pit material or oxidation feed for Plant 6.

Type 289: Delete - All of this type material was reweighed to type 211, 263, pit material or oxidation feed for Plant 6.

Type 290: Delete - All of this type material was reweighed to type 207, 211, 263, pit material or oxidation feed for Plant 6.

Type 291: Delete - All of this type material was oxidized at Plant 6 or pit material.

Type 292: Delete - All of this material was reweighed to 211, 263, pit material or oxidation feed for Plant 6.

Type 293: Delete - All of this material was reweighed to 211, 263, pit material or oxidation feed for Plant 6.

Type 295: This material is being held for historical purposes and consists of thorium metal and some non-metallic samples. The
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>201</td>
<td>TNT (solid)</td>
</tr>
<tr>
<td>202</td>
<td>ThF₄, white salt</td>
</tr>
<tr>
<td>203</td>
<td>Derbies, dezinced</td>
</tr>
<tr>
<td>204</td>
<td>Ingots, induction melt</td>
</tr>
<tr>
<td>205</td>
<td>Rods, induction melt</td>
</tr>
<tr>
<td>206</td>
<td>Slugs, induction melt</td>
</tr>
<tr>
<td>207</td>
<td>Solid scrap - induction melt</td>
</tr>
<tr>
<td>208</td>
<td>Ingot crops</td>
</tr>
<tr>
<td>209</td>
<td>Turnings, induction melt, (nonbriquettable)</td>
</tr>
<tr>
<td>210</td>
<td>Briquettes, arc melt</td>
</tr>
<tr>
<td>211</td>
<td>Metal high in impurities, induction melt</td>
</tr>
<tr>
<td>212</td>
<td>Graphite - carbon scrap</td>
</tr>
<tr>
<td>213</td>
<td>Ceramics</td>
</tr>
<tr>
<td>214</td>
<td>Sweepings</td>
</tr>
<tr>
<td>215</td>
<td>Contam. cloth</td>
</tr>
<tr>
<td>216</td>
<td>Sump cake plus F or Cl</td>
</tr>
<tr>
<td>217</td>
<td>Sawdust, induction melt, from areas L, or F</td>
</tr>
<tr>
<td>218</td>
<td>C-liner</td>
</tr>
<tr>
<td>219</td>
<td>Contam. zinc</td>
</tr>
<tr>
<td>220</td>
<td>Grinder sludge - reacted - sludge only</td>
</tr>
<tr>
<td>221</td>
<td>Eggs</td>
</tr>
<tr>
<td>222</td>
<td>Oil - soluble - coolant</td>
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<tr>
<td>223</td>
<td>Brazilian sludge</td>
</tr>
<tr>
<td>224</td>
<td>Sump cake, no F or Cl</td>
</tr>
<tr>
<td>225</td>
<td>TNT (liquid)</td>
</tr>
<tr>
<td>226</td>
<td>Contam. wood and paper</td>
</tr>
<tr>
<td>227</td>
<td>Rolling sludge</td>
</tr>
<tr>
<td>228</td>
<td>Contam. HzO</td>
</tr>
<tr>
<td>229</td>
<td>Contam. steel, equipment</td>
</tr>
<tr>
<td>230</td>
<td>Contam. soil, sand, rock, etc.</td>
</tr>
<tr>
<td>231</td>
<td>Contam. glass</td>
</tr>
<tr>
<td>232</td>
<td>Furnace salt and sludge</td>
</tr>
<tr>
<td>233</td>
<td>Briquettable turnings, arc melt</td>
</tr>
<tr>
<td>234</td>
<td>Th(C₂O₄)₂ oxalate</td>
</tr>
<tr>
<td>235</td>
<td>ThF₄ scrap</td>
</tr>
<tr>
<td>236</td>
<td>Cu and By contam. fines, chips and turnings</td>
</tr>
<tr>
<td>237</td>
<td>ThO₂ - Finished</td>
</tr>
<tr>
<td>238</td>
<td>Contam. solvents</td>
</tr>
<tr>
<td>239</td>
<td>Briquettable turnings - induction melt</td>
</tr>
<tr>
<td>240</td>
<td>ThO₂ scrap</td>
</tr>
<tr>
<td>241</td>
<td>Th(C₂O₄)₂ oxalate scrap</td>
</tr>
<tr>
<td>242</td>
<td>Straighten sludge</td>
</tr>
<tr>
<td>243</td>
<td>Derby scalps, dezinced</td>
</tr>
<tr>
<td>244</td>
<td>Partially oxidized metal + metal X</td>
</tr>
<tr>
<td>245</td>
<td>Contam. lime</td>
</tr>
<tr>
<td>246</td>
<td>Solid scrap - arc melt</td>
</tr>
<tr>
<td>247</td>
<td>High Th C-liner - bad reduction</td>
</tr>
<tr>
<td>251</td>
<td>Contam. ZnCl</td>
</tr>
<tr>
<td>252</td>
<td>Sawdust, arc melt from areas L, or F</td>
</tr>
<tr>
<td>253</td>
<td>Solid scrap - arc melt from rolling and extrusion</td>
</tr>
<tr>
<td>254</td>
<td>ThCl₄, thorium tetrachloride</td>
</tr>
<tr>
<td>255</td>
<td>Briquettes, induction melt</td>
</tr>
<tr>
<td>256</td>
<td>Ingots, arc melt</td>
</tr>
<tr>
<td>257</td>
<td>Rods, arc melt</td>
</tr>
<tr>
<td>258</td>
<td>Slugs, arc melt</td>
</tr>
<tr>
<td>259</td>
<td>Sledge, pickling bath</td>
</tr>
<tr>
<td>260</td>
<td>Contam. furnace salt</td>
</tr>
<tr>
<td>261</td>
<td>Contam. K-nit oil, etc.</td>
</tr>
<tr>
<td>262</td>
<td>Derby sawdust before dezincling</td>
</tr>
<tr>
<td>263</td>
<td>Turnings, arc melt, nonbriquettable</td>
</tr>
<tr>
<td>264</td>
<td>Metal high in impurities, arc melt</td>
</tr>
<tr>
<td>265</td>
<td>Metal samples, induction melt; ingot and rods</td>
</tr>
<tr>
<td>266</td>
<td>Metal samples, arc melt, ingots, rods</td>
</tr>
<tr>
<td>267</td>
<td>Derby metal samples, dezinced</td>
</tr>
<tr>
<td>268</td>
<td>Derby metal samples, non-dezinced</td>
</tr>
<tr>
<td>269</td>
<td>Incinerator residue</td>
</tr>
<tr>
<td>270</td>
<td>Ingot crops, arc melt, primary</td>
</tr>
<tr>
<td>271</td>
<td>Ingot crops, arc melt, secondary</td>
</tr>
<tr>
<td>272</td>
<td>Scrubber liquors</td>
</tr>
<tr>
<td>273</td>
<td>Dezinced derby pieces, remeltable</td>
</tr>
</tbody>
</table>

**AREAS**

- Arc Melt Casting
- Reduction
- Machining
- Induction Melt Casting
- Fluoride (ThF₄)
Thorium metal can be removed only by the approval of Mr. F. L. Albright or J. E. Carvitti.

IL-285-1001 1 box 2,561 pounds Thorium metal
IL-295-1001 4 drums 274 pounds on-metal supplies

After all of the thorium material was compound, segregated, recorded, and weighed, the area was thoroughly cleaned. There were 22 drums of floor sweepings generated which were coded IL-200-2001. This material was discarded to an off-site burial ground.

The above information completes the entire thorium inventory. An attempt was made to properly code all the residues in order that they go into the proper class code. Data and typical analyses are available upon request. If any questions should arise about the thorium, please contact me.

Joseph E. Quinn
J. E. Carvitti

JEC/mc

cc: A. N. Carver - J. L. Padgett
C. R. Chapman - S. F. Andia
J. J. Costa - W. J. Strattman
F. C. Christen
P. C. Reist - E. B. Compf
J. C. Scott
A. Z. Maryan
R. J. Bilsky
J. H. Myers
D. A. Chung - D. L. Flowers
J. E. Tye

Central Files
NATIONAL LEAD COMPANY OF OHIO

March 19, 1968

Mr. C. L. Karl, Area Manager
Cincinnati Area Office
P. O. Box 39188
Cincinnati, Ohio 45239

Subject: Request for Authorization to Remove Thorium Residues from Inventory to Burial Ground

References: 1. Letter, Hayes to Karl, 1/16/68, Same Subject.
2. Letter, Karl to Hayes, 2/15/68, Disposal of Low-Grade Thorium Residues.

Dear Mr. Karl:

Request No. 115 for Commission approval to remove a number of low-grade thorium residues from our inventory to a suitable burial ground has been revised to include additional drums of contaminated non-burnables and floor sweepings. The corrected request form is attached. The total quantity of thorium to be discarded is 2,773 pounds. The number of drums of thorium residues requiring on-site disposal now totals 349; however, it has been estimated that 25 to 50% of these drums require redrumming because of their highly deteriorated condition.

In response to your letter of February 13 (reference 2), our Health and Safety Division reviewed the possibilities for on-site burial as an alternate to off-site disposal. It was determined that there is sufficient radium-226 in these residues to contaminate the Miami River from surface runoff or the ground water from seepage to levels 1,000 times the MPC level for drinking water. It was calculated that the Miami River could become contaminated for periods of up to three years. Similarly, calculations were made to show that our own water supply, or supply from a larger well located near the river, could be contaminated to the MPC level for periods up to 10 years. It was therefore reasoned that on-site disposal at this time would be risky and that off-site burial is preferable.

Inasmuch as the ORNL burial grounds are not available to us for this purpose, the possibility of disposal in other Commission facilities located a greater distance from Fermi and than the Oak Ridge burial grounds was eliminated because of the problems involved in transporting these radioactive materials over the
road. It has been determined that burial at the Nuclear Engineering Corporation facility at Morehead, Kentucky, offers the best possible solution to the problem. The cost of burial has been determined to be approximately $2,500. Shipment would be made in Nuclear Engineering Corporation trucks, using their drivers, at an estimated cost of $615.

The problem of redrumming the thorium residues is of particular concern to us. The redrumming operation is slow and tedious; the possible health hazard must be considered. It has been estimated that redrumming can proceed at a rate of one to two drums per hour, using teams of two laborers and one industrial truck operator. However, one truck operator could provide service for a number of two-man labor teams. Although reconditioned drums presently on site would be used, it is apparent that the redrumming cost will be extensive; the out-of-pocket cost has been calculated as $1,600.

In view of our current financial position, we are reluctant to allocate funds estimated at a total of about $5,000 for the burial, shipment, and redrumming operations. Nevertheless, from a health and safety standpoint, it appears to be highly desirable to dispose of these radioactive materials as expeditiously as possible.

Sincerely yours,

J. H. Royce
Manager

cc: C. L. Karl (w/request form)
    J. E. Farviti
    C. R. Chapek-S. A. Auwa
    S. Marshall-J. H. Cavendish
    J. L. Kitchen
    G. A. Seaman-B. Gessiness (w/request form)
    W. A. Smith
    Central Pile

\[ \frac{2500}{6.05} = 9.93 \text{ drums} \]
\[ \frac{3.113}{3.49 \text{ drums}} = \]
This is to confirm our discussion with R. G. Heatherton concerning a NCG for thorium. This came about by increased processing of thorium at the FPC with proposals for further increases.

NBS Handbook #69 - "Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupational Exposure" contains two maximum permissible concentrations for thorium, one in the table (2x10^{-12} μc/cc) along with other radionuclides, and one in the subscript (3x10^{-11} μc/cc). The following statement is included in the subscript:

"Provisional values for Th^{232} and Th-nat. Although calculations and animal experiments suggest that Th-nat is perhaps as hazardous as Pu and indicate the values listed above, industrial experience to date has suggested that the hazard of Th-nat is not much greater than that of U-nat. The NCGP has recognized that a certain period of time may be required for adjustment of operations to comply with new recommendations. Therefore, pending further investigation the values (MPC)_{0}=3x10^{-11} μc/cc for the 40-hour week and (MPC)_{c}=10^{-11} μc/cc for continuous occupational exposure (168 hr/wk) are recommended as permissible levels. These values are essentially those that have been generally used in this country (Federal Register 1957). However, the values given in Table 1 are listed to indicate the possibility that further evidence may require lower values and to urge especially that exposure levels of Th-nat be kept as low as is operationally possible. The exception indicated here applies only to the (MPC)_{c} values for Th-nat and Th^{232}."

The 3x10^{-11} μc/cc value for a 40-hour week is equivalent to 133 μ d/m/M3. For a 48-hour week this would be 110 μ d/m/M3 and for a 56-hour week it would be 95 μ d/m/M3. The 2x10^{-12} μc/cc listed in the table would be only 9 μ d/m/M3. This MPC would be virtually impossible to achieve in an operation of the type being carried out and proposed at the FPC. Also the above statement recommends the 3x10^{-11} μc/cc value on the basis that industrial experience to date suggests that it is still a safe concentration for a 40-hour work week.
Thorium NCG
J. A. Quigley, M.D.
July 6, 1964.

For the previously mentioned reasons we decided that a practical NCG for thorium is 100 c d/m^3. We plan to use it in our thorium airdust surveys.

R. H. Sturkey

RHS/mjs

cc: J. H. Noyes
    R. C. Heatherton
    J. F. Wing
SUBJECT: HEALTH PROTECTION ASPECTS OF THORIUM PRODUCTION

TO: R. C. Heatherton

FROM: M. W. Boback

Consideration of future thorium production work in the Pilot Plant has led to questions directed to the Health & Safety Division about health protection and the need for control equipment to be included in the budget submissions. This is a review of thorium work in the recent past and comments about what is needed for future work.

In order to determine if the health protection aspects of a thorium operation are acceptable or not we are required to start with the Concentration Guides given in Manual Chapter ERDAN-0524. The most recent revision, dated April 8, 1975, in Table 1 of Annex A, gives an airborne limit of 133 d/m². Concentrations in this table were selected on the basis that 40 years of continuous exposure, at these concentrations, would not produce a quantity of radionuclides in the body which would have any adverse health effects. Therefore, there would be compliance with ERDA's Table I regulation if all daily time-weighted thorium exposures did not exceed this level. The National Lead Company of Ohio Concentration Guide (NCG) for both thorium and uranium has been set at 100 d/m² to insure that the Manual Chapter limit was not exceeded. All recommendations for respirator use, clean-up, equipment changes, etc. have been based on the NCG of 100 d/m².

In addition to considering the Table I limit, ERDA contractors must also consider the requirements of Part V, ERDAN-0524. This section, titled "Guidance On Maintaining Exposures To As Low As Practicable," notes that adherence to exposure limits is, in itself, insufficient because it is ERDA policy that "operations shall be conducted in a manner to assure that radiation exposure to individuals and population groups is limited to the lowest practical levels technically and economically practicable."
Although this ALAP (as low as practicable) philosophy has been around several years, it has not been emphasised until recently and we can expect greater emphasis by ERDA in the future. Part V contains several pages of ALAP guidance. It is clear that ERDA will expect visible thorium dusts in the workplace to be eliminated, even though the time-weighted thorium exposures are within the Table I limit.

Finally, after making sure that the Table I limit is not exceeded and exposures have been made ALAP, a contractor must make use of whatever means are available to determine how much of a thorium intake his operators received. For NLO, this means using the in vivo (whole-body) counter. In fact, we are fortunate that this counter is available for assessing thorium lung burdens. Assessment by any other means is almost impossible.

There are, then, three questions to be answered in determining if a thorium operation meets ERDA requirements and is acceptable from a health protection standpoint:

1. Is the time-weighted thorium exposure less than 100 d/m/m²?
2. Have the obvious and easily controlled sources of exposure been eliminated?
3. What are the operators' lung burdens? Are they within the ERDA-6524 limits for internally deposited thorium?

In order to speculate about the acceptability of future thorium operations we should answer these questions for the most recent thorium operation, production of thorium oxalate for the Bettis plant.

Air sampling showed, many times, that high dust levels existed from the opening of the filter press to the canning operation. To stay within a time-weighted exposure of 100 d/m/m² it was recommended that respirators be worn. They were worn regularly. It was also recommended that full use be made of the filter press hood to control dust. Except for equipment or procedure changes, these are the only two methods available to reduce thorium deposition in the lung—use control features properly and use respirators when recommended. In my opinion, these two methods, when fully utilized, were capable of keeping the operators' time-weighted exposures within 100 d/m/m².
(2) During the Bettis operation, the concept of keeping exposures as low as possible was not given high priority. Clean-up occurred when the production schedule permitted and, as a result, there were times when the filter press area and canning hood were coated with dust. You may recall that at one point, Bettis representatives questioned if health control problems would interfere with the production schedule. They did not ask that question because of a knowledge of thorium intakes—it was asked because the area looked dirty.

(3) According to the in vivo data, operators who worked on the Bettis job did not suffer any observable increase in lung burden. It is likely that the thorium workers did have some deposition of thorium in lung tissue but the counter sensitivity is about 30% of a permissible burden and a small increase would not have been detected. However, if there were increases in lung burdens, the increases were well under the ARAR-0524 limit. It's worth repeating that this limit is the quantity a worker could have in the lung for 40 years without having any adverse health effects. As we all know, there is a comfortable degree of "safety" in all of the 0524 limits.

In summary, the filtering and canning of Bettis thorium looked dirty at times and could have been cleaner with improved attention to housekeeping and the use of controls. Actual deposition of thorium in lung tissue was within limits.

What should be done for future thorium work? Control equipment should be put in good order. Procedures should be improved if needed, so that operators will not improvise steps or movements which increase their exposure. Health & Safety should monitor, as we intend to do. And an adequate schedule of in vivo monitoring be carried out as the final determination of deposition levels.

Some reduction in exposure levels could be made by having Engineering design equipment improvements for that purpose. However, reductions are not guaranteed by such changes because of the tendency to use equipment in a manner other than that intended by the designer.
We should not overlook ERDA's seriousness in regard to their ALAP philosophy. Since we know that certain parts of the thorium operation can easily become dusty, the production schedule should make allowances for frequent, specified cleanup.

cc: W. J. Adams
    J. E. Beckelheimer
    G. G. Briggs
    J. H. Cavendish
    L. M. Levy
    C. E. Poison
    K. N. Ross
    R. M. Spenceley
    S. F. Audia
    J. F. Schiltz
Radiation Levels of More Than 0.05% Thorium Residues

J. E. Carvitti
R. H. Starkey

Following are the radiation levels found upon contact with the outside of the drums containing thorium residues, with the exception of those marked with an asterisk which indicates contact readings of the material.

All readings were taken with a GS-3 survey meter without any regard of the background radiation level, which generally was 5.0 mreps/hr.

<table>
<thead>
<tr>
<th>Code</th>
<th>Material Description</th>
<th>Activity (mreps/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>203*</td>
<td>Derbies dezinced</td>
<td>30</td>
</tr>
<tr>
<td>204</td>
<td>Ingot - induction melt</td>
<td>30</td>
</tr>
<tr>
<td>205*</td>
<td>Rods - induction melt</td>
<td>35</td>
</tr>
<tr>
<td>206*</td>
<td>Slugs - induction melt</td>
<td>45</td>
</tr>
<tr>
<td>207</td>
<td>Solid scrap - induction melt</td>
<td>25</td>
</tr>
<tr>
<td>208</td>
<td>Ingot crops - induction melt</td>
<td>30</td>
</tr>
<tr>
<td>209</td>
<td>Turnings - induction melt - non-briquettable</td>
<td>10</td>
</tr>
<tr>
<td>210*</td>
<td>Briquettes - arc melt</td>
<td>30</td>
</tr>
<tr>
<td>211</td>
<td>Metal high in impurities - induction melt</td>
<td>25</td>
</tr>
<tr>
<td>221</td>
<td>Brazilian sludge</td>
<td>10</td>
</tr>
<tr>
<td>237</td>
<td>Cu and In contaminated fines, chips and turnings</td>
<td>10</td>
</tr>
<tr>
<td>238</td>
<td>ThO₂ - finished</td>
<td>15</td>
</tr>
<tr>
<td>245</td>
<td>Derby scalps, dezinced</td>
<td>25</td>
</tr>
<tr>
<td>246</td>
<td>ThCl₄</td>
<td>10</td>
</tr>
<tr>
<td>254</td>
<td>Rods - arc melt</td>
<td>20</td>
</tr>
<tr>
<td>257*</td>
<td>Slugs - arc melt</td>
<td>75</td>
</tr>
<tr>
<td>258*</td>
<td>Derby sawdust before dezincing</td>
<td>75</td>
</tr>
<tr>
<td>262</td>
<td>Metal samples</td>
<td>20</td>
</tr>
<tr>
<td>265</td>
<td>Metal samples</td>
<td>20</td>
</tr>
<tr>
<td>287</td>
<td>Ingot crops</td>
<td>20</td>
</tr>
<tr>
<td>276</td>
<td>Reject slugs</td>
<td>10</td>
</tr>
<tr>
<td>284</td>
<td>Th metal powder</td>
<td>15</td>
</tr>
</tbody>
</table>

Original Signed By
R. H. STARKEY
R. H. Starkey
AIR DUST CONCENTRATIONS IN THE PILOT PLANT THORIUM PROCESS

M. W. Boback

K. N. Ross

The attached table contains average air dust concentrations of all thorium metal production operations sampled during the 1970 campaign. The air dust concentration data has been arranged to follow the production flow where possible. A few air dust sample results included are new. These new results did not materially change the average air dust concentrations previously reported. The causes for these high air dust levels have been reported in previous studies.

The Pilot Plant is equipped with dust collectors and scrubbers. The total capacity of this ventilating equipment exceeds 40,000 cubic feet per minute. It appears that if this capacity were utilized to ventilate properly designed equipment through properly designed hoods, these air dust levels would be reduced.

<table>
<thead>
<tr>
<th>Type Sample</th>
<th>Description</th>
<th>No. Samp.</th>
<th>a-g/m³</th>
<th>Avg.</th>
<th>±</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA</td>
<td>Sampling pump located four feet south of ThF₄ precipitation tank on platform. The tank is ventilated to a scrubber. North door open.</td>
<td>3</td>
<td>150 30</td>
<td>93</td>
<td>.9</td>
</tr>
<tr>
<td></td>
<td>Sampling pump located four feet east of ThF₄ precipitation tank on platform. The tank is ventilated to a scrubber. North door open.</td>
<td>3</td>
<td>200 40</td>
<td>117</td>
<td>.2</td>
</tr>
<tr>
<td></td>
<td>Operator scoops ThF₄ from west filter box with a metal scoop and dumps it into the Fitzmill. After the pan is full, the operator removes the pan and places it on a portable cart to go to the drying ovens. An respirator worn. No ventilation. North door open.</td>
<td>3</td>
<td>9800 3300</td>
<td>6833</td>
<td>68</td>
</tr>
</tbody>
</table>
## WET AREA

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample</th>
<th>Description</th>
<th>No.</th>
<th>Sum</th>
<th>High</th>
<th>Low</th>
<th>Avg.</th>
<th>X-M</th>
<th>a/dm/m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA</td>
<td>Sampling, um, locate five feet east of the west filter box area.</td>
<td>3</td>
<td>302</td>
<td>111</td>
<td>507</td>
<td>2.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td>Sampling dump located two feet west of the west filter box area.</td>
<td>2</td>
<td>87</td>
<td>47</td>
<td>670</td>
<td>6.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BZ</td>
<td>Operator shovels wet thorium filtrate cake from filter box and dumps it into an empty 5-gallon drum which has a plastic liner inside. No ventilation. No respirator worn.</td>
<td>2</td>
<td>56</td>
<td>30</td>
<td>356</td>
<td>13.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td>Sampling, um, located 17' east of 3-W-2 tank while the above operation was being performed.</td>
<td>4</td>
<td>50</td>
<td>13</td>
<td>31</td>
<td>.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td>Sampling, pump located four feet west of the east wall while the above operation was being performed.</td>
<td>3</td>
<td>76</td>
<td>11</td>
<td>23</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BZ</td>
<td>Operator removes full pans of wet ThF₄ from portable cart and places it in drying oven. No respirator worn. No ventilation. North and west door open.</td>
<td>3</td>
<td>1,102</td>
<td>8</td>
<td>1250</td>
<td>13.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BZ</td>
<td>Operator removes full pans of ThF₄ from ovens and places them on portable cart and transports them to ventilated enclosure.</td>
<td>3</td>
<td>7260</td>
<td>560</td>
<td>1400</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td>Sampling, pump located six feet south of drying ovens 5 and 6. West door open. No ventilation.</td>
<td>2</td>
<td>22</td>
<td>5</td>
<td>110</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Air Dust Concentrations in the Pilot Plant Nitrogen Process

N. W. Boback
November 19, 1970

**NET AREA**

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample</th>
<th>Description</th>
<th>No. Samp.</th>
<th>High</th>
<th>Low</th>
<th>Avg.</th>
<th>X-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ</td>
<td></td>
<td>Operator removing ThP₅ from drying pans with a metal scoop and dumping into a retort pan inside a ventilated enclosure. <strong>No respirator worn. North door open.</strong></td>
<td>3</td>
<td>4400</td>
<td>170</td>
<td>1890</td>
<td>19</td>
</tr>
<tr>
<td>BZ</td>
<td></td>
<td>Operator removing ThP₅ from a 10-gallon can with a plastic scoop and dumps it into an empty retort pan inside the ventilated enclosure. Respirator worn. North door open.</td>
<td>3</td>
<td>3600</td>
<td>2500</td>
<td>2987</td>
<td>30</td>
</tr>
<tr>
<td>BZ</td>
<td></td>
<td>Operator takes full retort pans of ThP₅ from ventilated enclosure and places on retort pan holder. Respirator worn. North door open.</td>
<td>3</td>
<td>10000</td>
<td>3000</td>
<td>29300</td>
<td>293</td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Sampling pump located four feet south of the ventilated enclosure while removing ThP₅ from drying pans. North door open.</td>
<td>3</td>
<td>5800</td>
<td>4700</td>
<td>5166</td>
<td>51</td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Sampling pump located five feet north of ventilated enclosure while removing ThP₅ from drying pans. North door open.</td>
<td>3</td>
<td>4300</td>
<td>1900</td>
<td>2180</td>
<td>22</td>
</tr>
</tbody>
</table>

**PILOT PLANT ANNEX**

BZ  Operator removing retort pans from retort chamber which contains ThP₅ and dumping into Sturtevant Mill. Removing five-gallon can from under mill and dumping ThP₅ into twin shell blender. Average face velocity on tray above mill 1000 fpm. At the dropout of the mill, 350 fpm. Ventilation was not used at the blender. Respirator worn.
**PILOT PLANT ANNEX**

| Type | Sample | Description                                                                 | No. | High | Low | Avg | %
|------|--------|-----------------------------------------------------------------------------|-----|------|-----|-----|-----
| BZ   |        | Operator removes ThF₄ from blender by placing a five-gallon can under the blender and turns a valve. When the can gets half full, the operator removes it from under the blender and dumps it into a 10-gallon can located on the scale. Average face velocity at blender 300 fpm. The only ventilation at the scale is a Hoffman vacuum hose. Respirator worn. | 4   | 720  | 340 | 542 | 8.4

| GA   |        | Sampling pump located three feet west of the semicontinuous reduction enclosure. The retort pot holder and all the pots on it are lifted from the large furnace pot left standing in this location to cool off. South door open. | 3   | 2100 | 1200| 1633| 14.3

| GA   |        | Sampling pump located three feet east of the semicontinuous reduction enclosure. | 3   | 520  | 290 | 423 | 4.7

| GA   |        | Sampling pump located inside the semicontinuous reduction enclosure between the twin shell and the Sturdevant Mill. | 3   | 530  | 140 | 296 | 3

**REDUCTION AREA**

| BZ   |        | Operator putting empty furnace pot into jolter. Respirator worn. | 2   | 220  | 120 | 170 | 1.1

| BZ   |        | Operator removing mgF₂ from 55-gallon drum. Respirator worn. No ventilation. | 6   | 3150 | 450 | 1729| 1.1

| BZ   |        | Operator dumping five-gallon can of mgF₂ into furnace pot located in the jolter. Average face velocity 200 fpm. Respirator worn. | 4   | 5800 | 1190| 3022| 30
<table>
<thead>
<tr>
<th>Type Sample</th>
<th>Description</th>
<th>No. Samp.</th>
<th>a-d/m³</th>
<th>Avg. X-</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ</td>
<td>Operator removing furnace pot from jolter.</td>
<td>3</td>
<td>90</td>
<td>62</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator removing mandrel from furnace pot. Respirator worn. No ventilation.</td>
<td>3</td>
<td>670</td>
<td>333</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator charging ThF₄ and ZnF₂ into twin shell blender located on platform. Average face velocity 150 fpm. Respirator worn.</td>
<td>8</td>
<td>16,850</td>
<td>6970</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator charging calcium into twin shell blender. Average face velocity 150 fpm. Respirator worn.</td>
<td>3</td>
<td>1000</td>
<td>640</td>
</tr>
<tr>
<td>GA</td>
<td>Sampling pump located five feet north of dumping station on platform.</td>
<td>3</td>
<td>490</td>
<td>330</td>
</tr>
<tr>
<td>GA</td>
<td>Sampling pump located two feet south of dumping station on platform.</td>
<td>3</td>
<td>230</td>
<td>183</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator discharging ThF₄ and ZnF₂ and calcium into furnace pot from twin shell blender. Average face velocity 50 fpm. Respirator worn.</td>
<td>3</td>
<td>14,250</td>
<td>9050</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator packing or tamping charged furnace pot with a metal bar. Respirator worn. No ventilation.</td>
<td>3</td>
<td>21,400</td>
<td>14,353</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator capping furnace. Respirator worn. No ventilation.</td>
<td>4</td>
<td>1930</td>
<td>1255</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator lidding furnace pot. Respirator worn. No ventilation.</td>
<td>4</td>
<td>600</td>
<td>400</td>
</tr>
<tr>
<td>BZ</td>
<td>Operator putting furnace pot into Rockwell. No ventilation.</td>
<td>4</td>
<td>58</td>
<td>42</td>
</tr>
</tbody>
</table>
### REDUCTION AREA

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample</th>
<th>Description</th>
<th>No. Samp</th>
<th>a-d/m³/m³</th>
<th>High</th>
<th>Low</th>
<th>Avg.</th>
<th>X-N</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ</td>
<td></td>
<td>Operator removing furnace pot from Rockwell furnace.</td>
<td>1</td>
<td></td>
<td>53</td>
<td>53</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Reduction area.</td>
<td>9</td>
<td></td>
<td>430</td>
<td>10</td>
<td>129</td>
<td>1</td>
</tr>
<tr>
<td>BZ</td>
<td></td>
<td>Preparing liner material at Ball Mill.</td>
<td>2</td>
<td></td>
<td>790</td>
<td>240</td>
<td>515</td>
<td>5</td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Ball Mill area.</td>
<td>10</td>
<td></td>
<td>53</td>
<td>17</td>
<td>37</td>
<td>0</td>
</tr>
</tbody>
</table>

### DERBY BREAKOUT

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample</th>
<th>Description</th>
<th>No. Samp</th>
<th>a-d/m³/m³</th>
<th>High</th>
<th>Low</th>
<th>Avg.</th>
<th>X-N</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ</td>
<td></td>
<td>Operator turns graphite pot upside down on a metal skid and removes thorium derby. South door open. <em>No ventilation. No respirator worn.</em></td>
<td>1</td>
<td>126,200</td>
<td></td>
<td></td>
<td>1,262</td>
<td></td>
</tr>
<tr>
<td>BZ</td>
<td></td>
<td>Same as above with ventilation. (West wheelchair in operation)</td>
<td>2</td>
<td>3900</td>
<td>230</td>
<td>2065</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Pump located three feet east of the doorway to the plasma spray booth. <em>No ventilation.</em></td>
<td>2</td>
<td>30,300</td>
<td>1350</td>
<td>15,725</td>
<td>157</td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Same location as above, with wheelchair in operation.</td>
<td>2</td>
<td>200</td>
<td>95</td>
<td>147</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Pump located three feet north of the doorway to the plasma spray booth. <em>No ventilation.</em></td>
<td>1</td>
<td>6300</td>
<td>6300</td>
<td>6300</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Same location as above with wheelchair in operation.</td>
<td>2</td>
<td>100</td>
<td>29</td>
<td>64</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

### SAWING THORIUM DERBY

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample</th>
<th>Description</th>
<th>No. Samp</th>
<th>a-d/m³/m³</th>
<th>High</th>
<th>Low</th>
<th>Avg.</th>
<th>X-N</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ</td>
<td></td>
<td>Operator sawing derby pieces, loading and unloading saw, stamping derby pieces and samples. <em>Respirator worn. Ventilation at saw blade only.</em></td>
<td>3</td>
<td>45,570</td>
<td>630</td>
<td>15,910</td>
<td>157</td>
<td></td>
</tr>
<tr>
<td>GA</td>
<td></td>
<td>Saw area</td>
<td>12</td>
<td>650-</td>
<td>13</td>
<td>190</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plant</td>
<td>Collector Number</td>
<td>Remarks</td>
<td>Exhaust Airflow</td>
<td>Location</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>---------</td>
<td>-----------------</td>
<td>--------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.P.</td>
<td>037-5011</td>
<td></td>
<td>7,000 CFM</td>
<td>Outside, north side of plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.P.</td>
<td>735-13-7041</td>
<td></td>
<td>7,000 CFM</td>
<td>Outside, south side of plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.P.</td>
<td>735-13-7050</td>
<td></td>
<td>16,000 CFM</td>
<td>Outside, southeast corner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.P.</td>
<td>108843</td>
<td></td>
<td>7,200</td>
<td>Outside, northwest corner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.P.</td>
<td>06-93A</td>
<td>AAF Rotoclone</td>
<td>Unknown</td>
<td>Outside, southeast corner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.P.</td>
<td>4-20-20</td>
<td>Mikro</td>
<td>4,000</td>
<td>Inside 3620 area (not in use)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Signed By: K. W. Rosa

cc: P. G. DeFazio - A. Pennak - W. J. Adams
October 7, 1970

AIR DUST LEVELS AT THORIUM METAL OPERATIONS

M. W. Boback

K. M. Ross and C. E. Long

Letter, K. M. Ross to M. W. Boback, dated September 25, 1970,
Air Dust Evaluation of Various Operations During Thorium
Metal Production - Pilot Plant

The following is a compilation of air dust levels found in
the Pilot Plant thorium metal operations. Some of the sam-
ppling is yet to be completed and some of the air dust con-
centrations are high enough to deserve re-sampling. This is marked
where appropriate. Where the source of a particular air dust
level is known, it is mentioned. In many places, possible
remedies are suggested. The following is an early approxi-
mation of air dust concentrations in the Pilot Plant.

CA  ThF₄ Precipitation Platform

Since all operations on this platform concern
only slurries and solutions of thorium, it is
believed the general air dust levels are caused
by adjacent operations. These are: (1) preparing
CaF₂ liner in the Ball Mill area and (2) charg-
ing retort pots at the canning station.

BZ  Removing ThF₄ from the filter boxes and dumping it into Fitz Mill. Loading
drying trays from Fitz Mill.

CA  Filter box and Fitz Mill area

The ThF₄ in the filter boxes is almost dry
and is made airborne by the scooping and dumping
action as well as the mechanical action of the
Fitz Mill. The area is liberally sprinkled
with ThF₄ during this operation. The floor and
mill are hosed down after each operation. Hosing
will not clean the overhead and much of the
equipment is electric and cannot be hosed down.
This material dries and becomes airborne. It
has been noticed that thorium compounds are quite hard to remove from any surface by use of water alone. The drying pans which are filled contribute to the air dust levels at this operation since they are covered with a crust of dried ThF₄. This, of course, becomes airborne when the pans are moved.

BZ Loading drying trays from 30-gallon cans of ThF₄.

This operation is performed when there is more ThF₄ taken from the filters than there is drying room. Air dust levels and their causes are comparable to those mentioned previously.

(Only Partially Sampled)

BZ Loading drying pans of wet ThF₄ into dryers.

GA ThF₄ drying area.

BZ Removing pans of dry ThF₄ from dryer.

It is expected that completely sampling these operations will show they are not quite this high. The causes of air dust is again the ThF₄ crust on the drying pans, loose ThF₄ and crusted ThF₄ on the carts, and ThF₄ on and in the drying ovens. Keeping this equipment clean should aid in lowering these air dust levels, but the job of cleaning them will be another source of airborne dust.

BZ Dumping ThF₄ from drying pans into retort pots.

GA Canning station area.

BZ Removing retort pots from holder and dumping into Sturdevant Mill.

GA Outside west door of semicontinuous reduction enclosure.

GA Inside west door of semicontinuous reduction enclosure.

These operations were discussed previously.
Air Dust Levels at Thorium Metal Operations
K. W. Boback
October 7, 1970

(Only Partially Sampled)

BZ Preparing liner material at Ball Mill.

This operation involves using a sledgehammer on large pieces of material to reduce their size so they can go through a jaw crusher. It would be difficult to ventilate a sledgehammer operation. It is possible that slag liner could be reduced in size at the breakout station to make slogging unnecessary. Air dust levels will still be high, for although both the crusher and Ball Mill are ventilated, they both leak and cause high air dust levels. This equipment was not designed for work on radioactive toxic material. Dust escaping from these pieces of equipment has contaminated the area and the equipment itself. This is a source of secondary air pollution when air movement through or vibration of the equipment causes it to become airborne.

(Partial Sample Only)

BZ Dumping charge to blender.

GA Top deck of charge station area

The operator opens the cans of charge material (ThF₄-ZnF₂) outside the influence of the ventilation. This alone should not cause concentration levels of this size. It is probable that complete sampling of this operation will show a smaller air dust concentration or a reason for the larger one.

BZ Lining a pot with CaF₂.

BZ Charging pot with ThF₄, ZnF₂, and Ca

BZ Capping charged pot.

Air dust levels at these operations are caused by hand operations outside of ventilated enclosures. In the pot lining area, the operator scoops CaF₂ into a bucket from a 55-gallon drum, carries the bucket to the jolter and dumps it into the pot. The jolter...
is ventilated but the small amount of ventilation here is not enough to contain the dust generated by this action. The bucket loading and carrying is, of course, not ventilated.

The furnace pot is charged in a ventilated enclosure but the operator must pull the pot out of the enclosure into the open floor to tamp and compact the charge. This must be done at least once per charge or more, depending on the density of the charge.

The capping operation involves tamping the final addition of charge material, scooping a bucket of liner material from the drum, putting it on top of the charge and tamping it firmly in place. This is done in the open, east of the charge station. There is a ventilated booth on the west side of the charge station that might reduced the air dust levels.

EZ Removing dezinced derby from pot.

OA Outside Plasma spray booth.

The high air dust level during this operation is not surprising. The dezinced derby is dumped from the graphite pot to the floor. The inside of the pot is coated with ThO₂ and the outside of the derby is covered with oxide, carbides, and other compounds of Th. All of this becomes dust when the derby is dumped from the pot. The ventilation at this location is plentiful but probably the enclosure and hooding could be improved.

Air dust levels at this same operation when the ventilation was left off by mistake showed a EZ dust concentration of 1262 MCG and area concentrations of 157 MCG.

(Partial Sampling Only)

EZ Sawing derbies, loading and unloading saw, stamping derby pieces and samples.

OA Saw area.

159

3.7
Air Dust Levels at Thorium Metal Operations
M. W. Boback
October 7, 1970

This operation is ventilated only above the saw blade. High air dust concentrations are known to be caused by moving derbyes and pieces on the saw table and stamping derby pieces. Fines in the fines under the saw are also a source of air dust. The use of coolant at this operation would greatly reduce the air dust concentrations caused by it. Ventilation of the saw table and in particular the area where stamping is done would also reduce air dust.

Original Signed By

K. A. Ross

Original Signed By

K K

C. E. Long

cc: W. J. Adams
S. F. Audia
J. A. Quigley, M.D.
NATIONAL LEAD COMPANY
OF OHIO

JUL 1 1978

Mr. H. Doren Fletcher, Director
Uranium Enrichment Operations Division
Department of Energy
Oak Ridge Operations Office
P. O. Box E
Oak Ridge, Tennessee  37830

Dear Mr. Fletcher:

MONTHLY THORIUM INVENTORY POSITION AT HLO AS OF AUGUST 1, 1978

Attached is the monthly inventory position of thorium, in
metric tons, at HLO as of August 1, 1978.

Sincerely yours,

Original Signed By
S. F. Audia
Manager

S. F. Audia
Manager

RLE/mx

Distribution: W. J. Adams
J. H. Cavenhish
L. E. Harken
P. R. Haest
L. N. Levy
S. F. Schiltz
D. A. Tippenhauer
Central Files
## Monthly Thorium Inventory Position at NLO as of 8/1/78

**Reported in metric tons**

<table>
<thead>
<tr>
<th>Thorium</th>
<th>M-63-0105-732</th>
</tr>
</thead>
<tbody>
<tr>
<td>ThO₂ Dense (GR-Battis)</td>
<td>17.4</td>
</tr>
<tr>
<td>ThO₂ Sol Gel</td>
<td>11.7</td>
</tr>
</tbody>
</table>

**Pilot Plant - WIP:**

- TNT for Commercial (Pure) | 8.8 |
- Hanford Thorium Nitrate (Impure) | 58.1 |
- Misc. Scrap and Lab Samples | 8.2 |
- Impure Thoria Gel from Hanford TNT | 229.0 |
- Thorium Oxides in Plant 8 Silo  | 274.6 |
- Thorium Oxalate Cake | 2.1 |
- Thorium Nitrate Crystals | 0.3 |
- Off-Site Thorium Hydroxide | 10.8 |
- Off-Site Thorium Oxides | 57.3 |
- Thorium Nitrate Solution | 0.9 |
- ThF₄ | 0.8 |
- Metal | 72.5 |
- Clad Metal | 4.4 |
- Alloyed Metal | 0.8 |
- Material Held for Historical Purposes | 0.5 |
- High Grade Residues (30% Ta) | 38.2 |
- Low Grade Residues (30% Ta) | 7.9 |

**Total Inventory** | 711.3 |
Thorium processing was initiated at FMPC in mid-1954. The first operations consisted of precipitating ThF₄ from aqueous solution by adding HF solution to thorium nitrate solution. The ThF₄ was filtered and dried with hot air in a rotary kiln. The dried ThF₄ was mixed with purchased anhydrous ZnCl₂ and purchased calcium metal, both of special high purity, and the mixture fired in a refractory-lined steel vessel to give a thorium-zinc alloy regulus and a calcium fluoride slag. The regulus was dezincing by heating in a retort under vacuum, and then the pure thorium metal was melted in a zirconia crucible in an induction furnace under vacuum and poured into an ingot mold. The "wet" ThF₄ precipitation process was soon abandoned because of excessive corrosion. The ThF₄ was then made, starting in the fall of 1954, by (1) precipitating thorium oxalate by addition of oxalic acid to thorium nitrate solution, (2) filtering and drying the thorium oxalate, (3) roasting the oxalate in a rotary calciner at red heat in air to thorium oxide, (4) hydrofluorinating the thorium oxide to thorium fluoride (ThF₄) by contact with anhydrous HF in a ribbon-screw reactor.

The reduction to a Th-Zn regulus and dezincing continued as previously described. The vacuum-induction crucible melting and ingot casting process was replaced by a consumable electrode electric-arc melting process early in 1955. The dezinced thorium regulus was sawed into pieces which were welded together to make an electrode rod. Arc-melting this rod gave a
primary ingot which was rough machined to remove surface impurities and arc-melted a second time to give a secondary ingot which was surface-machined for clean-up. This product ingot was shipped off-site (Adrian, Mich.) for extrusion to rods and returned to FMPC for finish machining to product "slugs" which were shipped to DuPont, Savannah River, for canning and insertion in a nuclear reactor. This production operation was concluded in mid-1956.

The large volume of sawdust and machine turnings generated was stored in drums, some of which ignited spontaneously in storage and burnt up. In early 1960, 3-1/2 years after the thorium metal production was abruptly terminated, a campaign was initiated of roasting the thorium metal fines in a multiple-hearth furnace to avoid the hazard of spontaneous ignition. This operation continued for 3-1/2 years, to mid-1963, and produced an impure thorium oxide which was drummed and stored for later recovery.

In a five-month campaign, May to September 1964, some 30 tons of assorted thorium residues, mostly chips, powder and massive metal, were remelted in a vacuum furnace in an induction-heated, coated graphite crucible and bottom-poured into an ingot mold. The ingots were machined at FMPC and hot-extruded to rods at RMI, Ashtabula, Ohio and shipped to DuPont, Savannah River, for further fabrication and eventual reactor use.

The AEC supply of pure thorium nitrate was exhausted by January, 1965, so a thorium refining operation was started in existing solvent-extraction equipment in the FMPC Pilot Plant at that time. This operation has continued since then, with a variety of feed materials, mostly impure crystalline
thorium nitrate. Some of the thorium refinery feed has been thorium nitrate solution recovered from irradiated thorium reactor cores, and some has been metallic or oxide residues of process operations. The residue materials were dissolved in nitric acid prior to the refining operation. The refined thorium nitrate solution was either shipped off-site, principally to Mallinckrodt, Weldon Spring, Mo., during 1965 or Nuclear Fuel Services Erwin, Tenn., in 1966-1969, or used at FMPC for production of thorium oxide or metal. The solvent extraction refining process employs an organic phosphate solvent, diamyl amyl-phosphonate, at 30% concentration in an aromatic hydrocarbon diluent.

Thorium oxide needed for reactor use at Hanford, Washington was furnished starting in mid-1967 by a special process of ammonia-precipitation of thorium hydroxide, developed by NLO. The precipitate was dried to a glass gel, which was then ground to desired size distribution and fired to fully-dense thorium oxide at the General Electric Co., NSP Laboratories, at Evendale near Cincinnati, Ohio. The powder was shipped to Hanford for canning and reactor use. This operation continued a little over two years into the fall of 1969.

Production of thorium metal was resumed at the FMPC in mid-1969 at a lower-production rate than in 1955-56, but using a very similar process route. The aqueous precipitation of ThF₄ was revived, using plastic equipment to avoid corrosion. The partly dried ThF₄ is dehydrated at
THORIUM PROCESSING AT FMPC

elevated temperature in inconel batch retorts, and zinc fluoride is substituted for zinc chloride in the co-reduction with calcium to produce the Th-Zn alloy regulus. The dezinced regulus is sawed for a sample slice, packaged and shipped to the customer at Oak Ridge. Very high purity of the thorium metal has been achieved. The thorium refining and metal production operations continue at FMPC.
Mr. C. L. Karl, Area Manager  
USAEC, Cincinnati Area Office  
P. O. Box 39188  
Cincinnati, Ohio 45239

Subject: ANNUAL STORAGE INVENTORY OF NORMAL URANIUM CONCENTRATES AND THORIUM


2) Letter, C. L. Karl to J. H. Meyes, same subject, dated May 27, 1968

Dear Mr. Karl:

In response to your request, comments were obtained from the three-member team from Production, Production Recording and Nuclear Materials Control, who inventoried the normal uranium concentrates stockpile and the Thorium Storage Account. It is not practical to develop detailed records on the condition of individual lots in the closely packed stockpile. The following observations are an attempt to estimate the over-all condition of the drums based on observation from the top of the stockpile, overlooking the blocks of drums, and also from the ground, surveying the perimeter.

1) The drums of South African concentrate are the most weathered; up to 20% of the lids at the upper level of a single block of 1,080 drums may last another year. A few lids have rusted to the point where concentrate is visible within the drum. Many South African drums are rusting on the drum walls; this is more serious than corrosion of the lids since it may eventually affect the strength of the pile and future drum handling. Only a slight trace of material loss is visible between blocks of drums at this time.
2) The drums of domestic concentrate are in much better condition than the South African drums, while some light rusting is noticeable on the lids at the upper level, no significant rusting of the drum walls was observed.

3) About 1% of the 4,850 drums of French TNT crystals in Conset #1 are leaking. Many additional drums show signs of corrosion.

4) Several drums of TNT crystals in Building 74 are leaking, however, the number of leakers is not great.

5) More than 50% of the drums of thorium residues stored in the rad area west of Building 63 are leaking, and are in need of redrumming. Identification on many of the drums of thorium residues is badly faded and needs to be restenciled.

The total drum count obtained in the physical inventory agreed with the drum count as recorded in our book inventory.

Sincerely yours,

J. H. Noves
Manager

cc: C. L. Karl
     S. F. Audia - J. J. Costa
     C. R. Chapman
     G. A. Schum - E. Gestman
     Central Files

BEST COPY AVAILABLE

3100765
June 8, 1970

THORIUM METAL PRODUCTION HOUSEKEEPING

J. L. Beckelheimer
K. A. Ross

Inspection of the thorium metal production facilities during the past several weeks has pointed out some housekeeping problems that I wish to call to your attention.

1. Probably the worst housekeeping problem in the facility is the Ball Mill. This equipment leaks excessively at practically every joint. All horizontal surfaces have a thick covering of dust. In operation, this 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. This is not adequate. It is recommended that Engineering Division be requested to inspect the Ball Mill and associated equipment and recommend methods of improving both the dust problem and the housekeeping problem.

2. During the operation of removing the calcined ThF₄ and Ca₂⁺ from the retorts, the stack of trays is left standing on a skid near the south annex door. The door is left open to aid in cooling the trays. The wind coming through the door blows the loose powder from the trays and spreads it generously through the annex. Removing the trays from the support requires heavy effort and this dialogues more powder to be spread by the wind. It is recommended that this stack of trays be put inside the enclosure used for grinding, weighing, and blending their contents. If faster cooling is necessary, a ventilated enclosure could be built there. It is suggested that a method of removing the central pipe from the trays would use much less effort and cause less airborne dust.

General

Prompt cleanup of all soils is the keystone of good housekeeping. In every inspection, it has been noticed that thorium
containing material was spilled in many locations. Some of these repeated spill locations are the drying pan unloading station, the drying pan carts, the drying oven area, the bottom of the blending enclosure, the sals and saw area, the entrance to the furnace room when used to remove dezinced derbies from their holders, the top deck of the furnace room, the ThF₄ grinding enclosure and area surrounding it, and others. These spills are caused by human frailties and would be of no consequence if they were promptly and properly cleaned up. Vacuum cleaning and/or washdown with water is recommended.

All work stations should be cleaned before the operator moves to his next job. This method, when rigorously enforced, has been found to decrease the number of spills since more care is used to prevent a long tedious cleanup. Where the operator works at one station all shift, he is responsible for that area's cleanliness. Supervision must be alert and insist that each area be clean before the next operator or shift moves in.

Original Signed By

K. N. Ross

cc: W. J. Adams
     M. W. Boback
     J. A. Jigley, H.L.
SUBJECT: VENTILATION FOR REDRUMMING OF THORIUM RESIDUES

TO: S. F. Audia

FROM: P. G. DeFazio

REFERENCE: Request for Engineering Services dated October 20, 1965
Engineering Project 1-91

The thorium residue drums are disintegrating. Mr. Costa started redrumming these residues but was stopped by the IH&ER Department due to high levels of contamination arising from dust generated by the redrumming operation. Prior to the IH&ER shutdown of the redrumming operation, the sump cake had been redrummed in 900 drums and 100 drums of floor sweepings had been redrummed.

Upon the stoppage of the work, an Engineering Request was issued requesting design of ventilation to enable the redrumming to continue. A preliminary investigation of the problem revealed a number of facets involving IH&ER, Technical, and Production in several areas of the project. Accordingly, a meeting was called to gather all of the outstanding information on the problem of handling, storing and eventual disposal of the thorium residues.

About 30% of the drums are so corroded that they cannot be lifted off their pallets without falling apart. This is the fourth time that this material has been redrummed. There are approximately 2800 drums of this material. Originally, it was drummed separately under the following headings as: ThF₄, Metal Scrap, Sump Cake, ThO₂, Floor Sweepings, ThF₄ and Scrap, Miscellaneous Scrap, Material held for historical purposes and General Scrap. These drums were marked and stored on the outdoor pad.

Due to the corrosive nature of the material and exposure to the elements, the drums corroded and disintegrated on the pad with a resulting loss of marking on individual drums. Even though the general area of storage for separate lots is known there has been mixing of the drummed materials. The degree of mixture was increased as each redrumming of the material was accomplished. As a result, we have an increasing amount of general scrap and miscellaneous residues and scrap.

On November 10, 1965, a meeting was held to discuss this problem. In attendance were: W. Straitman, J. Costa, K. Boss, R. Bipes, J. Cavendish, J. Carvitti, A. F. Pennak and R. B. Boies. An attempt was made to delineate this problem of redrumming thorium residues. The following possible courses of action were established in the meeting:
1. We must redrum this material at its present location prior to any handling.

2. We should investigate burying it. (AEC, at the present time, believes that it is of sufficient value to be economically feasible to process.) Mr. Carvitti will investigate burying costs, which will include pickup at the site and burial at the Morehead, Kentucky site.

3. Mr. Costa will estimate the cost of crushing and drumming of the material at Plant 1 in order to provide better feed material of equal sized particles of material. The present drummed material has hardened into a solid mass.

4. Mr. Carvitti will investigate costs of processing the material to a neutral homogeneous slurry feed in Plant 2 so as to provide an improved feed material which is compatible with existing storage drums.

5. The Laboratory will run tests on drum samples to determine the types of chemicals causing this corrosion.

6. R. Boies will investigate procurement of a drum which will withstand the corrosion of this material for long periods of storage.

7. R. Boies will design and estimate the cost of a processing station to handle redrumming at the storage pad if it is deemed necessary.

8. Mr. Cavendish will investigate the cost of processing the various residues to determine economic feasibility.

On November 15, 1965, J. Cavendish, R. Leist, A. P. Pennak and R. B. Boies discussed the possibility of processing a homogeneous feed produced by mixing all of the thorium residues together. The reason for reviewing this approach was the mixing which has taken place between the stored residues. Mr. Carvitti has informed us that the only true analysis of this material would be by taking a core sample from each drum. This would be a time consuming operation and the cost would be prohibitive. Mr. Cavendish and Mr. Leist voiced strong objections to a homogeneous feed since the chemical separation process is made much more difficult and costly. They will investigate the oxalate process proposed for use in the Plant 8 winic and see if this program would handle this material as a homogeneous feed. At least 30 to 45 days will be involved to obtain the test samples and collect the necessary data.
VENTILATION FOR REDRUMMING OF THORIUM RESIDUES

S. P. Audia
November 17, 1965

A decision as to what will be done with these residues must be made prior to February or March of 1966, when the Pilot Plant will be out of thorium feed.

The Project Engineering Department has been in touch with the IH&R Department and they have agreed to allow the redrumming to continue at the present location of the residues on the following bases:

1. All personnel in the area shall wear an airline respirator, proper clothing, and all personnel shall be cleaned up by the use of a portable vacuum cleaner prior to removal of respirators.

2. A canvas wind break shall be installed around the work area.

3. Clean up of work area by vacuum cleaner shall be performed at the end of each shift.

Drums are available for this purpose. The use of polyethylene drum liners is recommended where wet material is encountered. Precautions should be exercised to prevent further mixing of residues during the redrumming operation.

Conclusions:

It is agreed by all concerned that regardless of whether we process the material and extract the thorium, or process it in Plants 1 or 8, or bury it in any burial site other than that of the licensee at Morehead, Kentucky (who would pick up as is and perform the redrumming) the material must be redrummed at the pad. It is recommended that the material be redrummed at once for greater ease in handling when the final decision is made on disposition of the residues.

After the investigations of the possible courses of action outlined heretofore are completed we will be able to determine whether processing is economically feasible. This information will be issued as a report with recommended solutions.

P. G. Defazio

RBB/APP/wfk

cc: H. M. Beers
    J. Carvitti
    J. Cavendish
    C. R. Chapman
    J. Costa

R. H. Starkey
W. J. Strattman
OFFICIAL USE ONLY

NATIONAL LEAD COMPANY OF OHIO

April 11, 1963

Mr. C. L. Earl, Area Manager
U. S. Atomic Energy Commission
P. O. Box 38188
Cincinnati, Ohio

SUBJECT: THORIUM OPERATIONS AT KLO - PRESENT AND FUTURE


Dear Mr. Earl:

In view of the recent request by Sylvania to ship a large quantity of thorium turnings to FNPC for oxidation in the Plant 6 facility, the entire thorium operation has been reviewed.

While developing the shipping information requested presents no major problem, continued operation of the thorium furnace in Plant 6 does. A basic problem exists and must be solved.

The solution decided upon with respect to the furnace can be used to determine just what should be done with the turnings at Sylvania. Summarized below are the principal considerations in this matter:

1. The current operation is unsatisfactory from both a hygiene and a fire and safety standpoint.

2. It is being continued only as terminal operation until July 1963. By that time the present inventory of thorium feed material is expected to be consumed.

3. Air dust levels in some operations now exceed 50 MAC; they range from 15-1000 MAC. Even the general air samples are 2-5 MAC. This stems from many deficiencies with the materials handling and ventilation systems.

4. To consume an additional 20,000 pounds of thorium turnings will add five months to the schedule. To continue an already unsatisfactory situation for an extended period, without major improvements, is intolerable.

5. Fire and safety hazards add to the problem. The roof over the furnace is not fire-proof, and should be.
July 17, 1964

SUBJECT
THORIUM OPERATION - PILOT PLANT

R. H. Starkey
J. F. Wing

TO
FROM
REFERENCE

We were given advance information in May that some thorium work was to be done in the Pilot Plant. This came to me from you from R. Heatherton from S. Marshall. The general work was outlined to us as was a tentative schedule. I personally discussed the proposed work with J. O. Davis by phone at that time (probably May 27 or 28). Their plans were still somewhat "fluid" so I told Jim I'd check back the next week. On Monday afternoon, June 1, I went to the Pilot Plant and talked with Jim Davis and Steve Cseplo in detail and at some length (at least an hour) about their proposed plans. Others from IHAR were there as were representatives of Fire & Safety.

There were no approved procedures; however, as "fluid" as things were, this was not pressed until June 4 and met with virtually no success. The matter of "no procedures" was passed on to you the same day and, as I understand, you passed this on to Dick Heatherton.

At no time do I recall anyone mentioning that the crucibles were to be BeO-coated. I did not ask. Neither did I ask if tri-cresyl-toluene, cyanide, or nerve gas was going to be used. In the face of the tin-can and bailing wire set-up that was visible, there was already enough to ask about. With the reputation that Be work has and with the background of the Pilot Plant supervisory force, I am surprised that they didn't mention it. I would expect that a supervisor of such an operation would have done so if he gave a damn for health and safety.

I did not learn of the use of BeO until the night of 7/14. Our investigation began the morning of 7/15. We learned that 7/15 was to be the last day for using the BeO-coated crucibles on this thorium run. We also learned from a Pilot Plant supervisor on 7/17 that "we've used BeO from the start." The first thorium metal arrived at the Laboratory Machine Shop on June 9 (3 ingots). This means that the metal was probably poured not much over two to three days before --- maybe as late as June 8. This would mean that the Pilot Plant supervisor responsible for the project was probably very aware of the possible or intended use of BeO at the outset (late May or early June).
Thorium Operation - Pilot Plant

R. E. Starkey
July 17, 1964

The limit for Be in air is 2 µg/M³ whereas our limit for uranium is approximately 67 µg/M³. The difference is more than simply one of numerical comparison. There is no positive evidence that anyone has died of exposure to natural uranium. The same cannot be said for beryllium.

JFW/mjs

J. F. Wang
SUBJECT  BeO AIR DUST EVALUATION OF PLASMA FLAME SPRAY FACILITY - PILOT PLANT

TO    R. H. Starkey

FROM   R. L. Bipes

REFERENCE

An air dust survey was conducted in March on the plasma flame spray facility while coating crucibles with BeO. The actual coating operation was accomplished in an inert atmosphere. There was a potential BeO exposure to the operator when placing BeO into the feeder, cleaning the interior of the spray chamber and conducting maintenance on the flame spray gun.

The following table summarizes the results of data which was collected.

<table>
<thead>
<tr>
<th>Date</th>
<th>Sample</th>
<th>No. of Samples Collected</th>
<th>Description</th>
<th>Results</th>
<th>X TLVx</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/21/66</td>
<td>GA</td>
<td>1</td>
<td>While coating crucibles in an inert atmosphere</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td>3/21/66</td>
<td>BZ</td>
<td>1</td>
<td>While loading feeder and cleaning interior of spray facility</td>
<td>13.8</td>
<td>6.9</td>
</tr>
<tr>
<td>3/22/66</td>
<td>GA</td>
<td>1</td>
<td>While cleaning interior of spray facility</td>
<td>0.55</td>
<td>0.26</td>
</tr>
<tr>
<td>3/22/66</td>
<td>BZ</td>
<td>2</td>
<td>While cleaning interior of spray facility and removing insulation from gun</td>
<td>11.8</td>
<td>5.9</td>
</tr>
<tr>
<td>3/24/66</td>
<td>GA</td>
<td>1</td>
<td>While cleaning plasma spray gun</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>3/26/66</td>
<td>BZ</td>
<td>1</td>
<td>While cleaning plasma spray gun</td>
<td>15.3</td>
<td>7.7</td>
</tr>
</tbody>
</table>

The results of the collected data indicate high Be air dust levels whenever performing any work inside of the enclosure after spraying BeO.

Since the air dust survey was conducted, a portable ventilation
BeO Air Dust Evaluation of Plasma Flame Spray Facility - Pilot Plant
R. H. Starkey
September 26, 1966

The hood has been designed to encompass the door of the plasma spray facility before opening. The construction and installation of this hood has gone out for subcontract bid. This hood should minimize spillage of material on the floor when the door is opened. The inner face of the door should be vacuumed clean as it is opened. Extensions should be obtained for the vacuum cleaner so that entire interior of the spray facility can be cleaned without having to lean into the facility.

Dust type respirators with ultra filters were worn by the operators when the survey was conducted. Until the effectiveness of the ventilated hood can be determined, the operators should continue to wear dust type respirators with ultra filters while conducting the following operations.

1. Preparing feed for the feeder
2. Cleaning the interior of the spray facility
3. Conducting maintenance on the spray gun.

* Recommended threshold limit value as established by the American Conference of Governmental Industrial Hygienists (2 µg/m³ of air).

R. L. Bipes
D. L. Elston
J. D. Davis
PROJECT PROPOSAL

A. PROPOSAL NUMBER
CP-59-79

B. TITLE OF PROJECT
Sludge Furnace Alterations for Oxidation of Thorium Residues - Plant 6

C. DATE
October 20, 1959

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

During the past four years there have been 30 known fires with these materials, some of which burned for several days. Clean up after these fires is a difficult job. In one case, the fire burned through a concrete storage pad. Storage of the drums on soil resulted in a worse situation, when a fire contaminated a considerable area, and much stone and dirt had to be removed. As long as these residues are in
the unoxidized state, the hazard and expensive housekeeping problems will exist. Corrosion from prolonged storage of the drums has resulted in oil leaks, and redrumming and clean up problems. Attempts to redrum these materials have resulted in violent reactions exposing personnel to possible serious injury. At present, because of limited outside pad storage space, it is necessary to store these residues without the desired spacing or isolation for preventing the spread of possible fires.

2. Solution
Use of the Plant 6 sludge furnace for the oxidation of these pyrophoric thorium residues is proposed. This will require alterations to the charging facilities and dust removal system.

The sludge furnace was originally installed for processing sludge from contour grinding operations. Production requirements have changed, and contour grinding of fuel elements is no longer done. The furnace is not now in use.

3. Justification
In recent correspondence from the Commission, National Lead Company of Ohio was requested to properly stockpile all thorium material not meeting the disposal criteria. The oxidation of these thorium residues will enable NLO to fulfill the Commission's request by safely storing all of these residues. The constant danger from pyrophoric materials will be eliminated.
The oxidation of these thorium residues will improve housekeeping conditions through the elimination of leaking oil used for covering chips, turnings, etc. Furthermore, the oxidation of this material will greatly reduce the individual drum inventory because the oxide is of higher density than are turnings, chips, and the like.

The reduction of drum inventory will release more storage pad area to the Special Products Plant for storage of enriched residues.

The thorium residues which will be processed in this furnace total approximately 80 tons, and consist of the following:

a. Turnings - approximately 65,000 pounds, net weight.

b. Grinder Sludge - approximately 14,000 pounds, net weight.

c. Saw Dust - approximately 63,000 pounds, net weight.

d. Misc. Solids - approximately 17,000 pounds, net weight.

Also, an unknown quantity of pyrophoric residues in 1,300 additional drums is now in storage.

Upon completion of the oxidation of the thorium residues, estimated to take about six months, this furnace will be cleaned and made available for the campaigning of other pyrophoric materials, particularly those which would require a special Accountability campaign.
E. PRELIMINARY DRAWING

<table>
<thead>
<tr>
<th>Drawing No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-4730</td>
<td>Oxidation of Thorium Residues - Proposed Equipment Installation</td>
</tr>
</tbody>
</table>

F. OUTLINE SPECIFICATIONS

Following is a brief description of the work required to modify the existing sludge oxidation furnace and supplementary facilities to make them suitable for thorium residue oxidation in compliance with Health & Safety, Accountability and housekeeping requirements.

1. Alterations to Existing Facilities:
   (a) The fire barrier trough shall be removed, decontaminated and stored for the duration of the thorium oxidation program.
   (b) The exhaust duct work connecting the furnace to the Acme ventilation system shall be removed.
   (c) The slide valve connecting the fire barrier trough to the furnace inlet shall be removed.
   (d) The power hack saw shall be relocated to the south portion of the east pad area.
   (e) The 8" diameter charge tube between the furnace valve and the second hearth shall be removed.

2. New Facilities:
   (a) Individual sludge collection trays shall be installed for each of the three clarifier units, replacing the fire barrier trough. The sludge will be scraped manually off the trays into drums.
(b) New dust collection facilities incorporating a wet scrubber shall be provided as a permanent installation. New duct work shall be installed from the furnace to the scrubber. A recirculating tank and pump shall be obtained from excess property and installed in conjunction with the scrubber.

(c) A single flapper type charge valve shall be provided for furnace charging. Valve operation will be controlled from the skip hoist.

(d) A power driven skip hoist shall be installed to mechanically transfer the packaged thorium charge from the work table to the point of discharge into the furnace. This hoist shall consist of two parallel strands of double pitch conveyor chain (to enable carrying the charge cradle in a vertical position) and shall be powered by a variable speed reversing drive. The hoist frame and supporting members shall be of structural steel construction.

The operator will manually place a packaged charge of approximately 30 pounds in the cradle of the hoist and press the start button. The hoist will carry the charge up to the furnace, actuate a limit switch, and stop with the charge in the charging station located above the valve opening. At the same time, the unloading air cylinder will be actuated to mechanically push the packaged charge from the cradle and simultaneously open the flapper of the charge valve. A time delay will
retract the unloading cylinder and close the valve as soon as the charge has fallen free of the valve onto the second hearth of the furnace. The hoist will then automatically return to the loading position.

An exhaust hood connected to the new ventilation system shall be installed over the charging station area to remove any possible flash-back or flame release occurring during the brief interval the valve is open.

(e) A steel work table (approximately 4' x 8') shall be provided for the purpose of dumping and mixing the thorium residues. A discharge opening complete with a loading funnel shall be located at the discharge end of the table. The working surface of the table shall be pitched to the loading end, and shall have a suitable oil discharge to permit drained oil to be collected into drums.

(f) A mechanical drum dumper shall be provided to pick up 30 gallon and 5 gallon drums from the floor and position them for dumping on the table. Suitable shovels, rakes, hoes, etc., shall be provided for handling the material on the table.

(g) The area used for the storage and handling of the thorium residues shall be temporarily enclosed by 6 ft. cyclone fencing to prevent cross-contamination of thorium and uranium materials. An access gate shall be provided for fork truck access.
(h) A new stainless steel charge tube, approximately 11" I.D., shall be installed between the furnace valve and the second hearth.

(i) The existing floor collection trench within the area enclosed for the thorium oxidation program shall be blanked off to prevent cross-contamination. A portable sump pump shall be provided to empty the trench as required.

3. Proposed Method of Handling Thorium Residues:
The residues consist of turnings, fines, sludge and miscellaneous solids. It is proposed to limit the unit furnace charge to 30 pounds of residue. It is further proposed to package each charge in a plain, unlined paper carton or tub approximately 8" dia. x 8" to 10" high. The container and material will be charged into the furnace, where the container will be reduced to ash, and the thorium charge will be reduced to a passivated oxide.

G. PRELIMINARY ESTIMATE OF COST
The estimated cost of the proposal is:
$29,000.

A breakdown of this estimate is shown on the attached estimate sheets.

H. ESTIMATED TIME REQUIREMENTS

<table>
<thead>
<tr>
<th>Start</th>
<th>Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 wks. after approval</td>
<td>12 wks. after approval</td>
</tr>
</tbody>
</table>

3358008
H. ESTIMATED TIME REQUIREMENTS (Cont'd)

2. Procurement (Purchase Orders) 5 wks. after approval 8 wks. after approval

3. Equipment Delivery 12 wks. after approval 16 wks. after approval

4. Installation 16 wks. after approval 24 wks. after approval

I. STATEMENT OF METHODS BY WHICH WORK WILL BE PERFORMED

1. The design and procurement will be by National Lead Company of Ohio.

2. The installation will be by a Subcontractor on a lump sum basis.

J. SPECIAL CONDITIONS

None.

K. BUDGET DATA

Funds are available in Activity 2900 and in the Operating Budget (Other Than Activity 2900). Costs will be charged as follows:

- Activity 2900 $23,000
- Operating Budget (Other Than Activity 2900) 6,000

Total $29,000
OFFICIAL USE ONLY

NATIONAL LEAD COMPANY
OF OHIO
Cincinnati 39, Ohio

November 14, 1960

SUBJECT  AIR DUST EVALUATION OF THERMIPHERC OperationS, PLANT 6

TO   J. E. Carvitti

FROM  K. N. Ross

The attached evaluation shows that most of the operations performed in the thermi oxidation area are greater than the MRC. This evaluation also shows the volume of ventilation to be 64 percent of the rated capacity. This should be sufficient ventilation to control the dust in this area. It is recommended that a ventilation survey of these operations be made to determine why the high air dust levels are not controlled. In addition, the results show that the dust controls on the sifting operation (not approved by the Pure & Dust Control Committee) are grossly inadequate and need correction.

A dust-type respirator should be worn while performing those operations until a new air dust evaluation shows the air dust levels to be less than the MRC.

K. N. Ross

cc: C. R. Chapman
    G. G. Leop
    R. M. Bausch
    J. A. Quigley, M.P.
    R. M. Sprandel
    R. H. Stotz
    J. L. Van
    Central Mic
November 14, 1960

SUBJECT AIR DUST EVALUATION OF THORIUM FURNACE OPERATIONS, PLANT 6

TO E. N. Ross

FROM R. N. Haicke

On October 18 and October 31, 1960, air dust samples were collected on all operations connected with the thorium furnace operation, east end of Plant 6. Results of the survey show that five of the six operations sampled exceeded the MAC of 70 alpha disintegrations per minute per cubic meter of air. These six operations are:

1. Sifting drums of thorium oxide - outside

2. Changing drums at product forming stations

3. Putting drum of thorium residue into outside dumping station and weighing controls

4. Unplugging furnace discharge line

5. Hand feeding thorium chips and turnings into second hearth - 2nd level

6. Raking thorium residue into paper buckets

The first four operations listed above are short-term operations; i.e., performed about three minutes each per shift, while the other two are performed from 60 to 90 minutes each per shift. The operation of sifting thorium oxide is performed once per week, usually on Monday morning while waiting for the furnace temperature to increase to the proper level.

However, it is recommended that a dust-type respirator be worn during those operations which exceed the MAC for airborne radioactive dust.

A 10-point traverse was taken on the exhaust stack on November 8, 1960. Results show that the fan is delivering a volume of 5400 cfm with a velocity of 1100 fps, which is an efficiency of 64 percent of the rated capacity of 6400 cfm. This indicates that the fan is therefore delivering near what it was designed to deliver.

In case the ventilation and/or scrubber systems are altered or any operational procedures are likewise altered, a re-evaluation will be conducted.
and a report submitted.

R. N. Halcroob

R. N. Halcroob
April 24, 1961

ATTACHED REPORT - AIR DUST EVALUATION OF THORIUM FURNACE OPERATIONS - PLANT 6
J. G. Cavallitti

Letter to J. G. Cavallitti, 11-24-60, subject: Air Dust Evaluation of Thorium Furnace Operation - Plant 6. 7-2-1-1

The attached air dust evaluation shows the air dust concentrations in the Thorium furnace operations to be above NAC. It is recommended that respiratory protection be worn while performing the operations listed in the attached evaluation.

From all appearances, air dust sources in this operation have not changed appreciably since the former evaluation (October, 1960). All recommendations made then are still valid and should be investigated.

ORIGINAL SIGNED BY
K. M. Ross

cc: C. W. Chapman
    A. M. Talcott
    R. H. Apperson
    G. A. Coon
    R. H. Deering
    J. A. Girdley
    W. N. King

Confidential File

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BEST COPY AVAILABLE
Mr. C. L. Karl, Area Manager  
U. S. Atomic Energy Commission  
P. O. Box 39188  
Cincinnati 39, Ohio  

SUBJECT: Thorium Turnings in Sylvania  

Dear Mr. Karl:  

This is in reference to your request of February 20, 1963 to supply Sylcor with instructions for shipping 20,000 pounds of thorium metal turnings to the FMPC.  

We should like to call to your attention that the furnace in Plant 6 used for the burning of thorium is not a satisfactory installation. Approximately two years ago the NLO Health and Safety group recommended that the facility be improved or shut down following the consumption of the thorium materials which were then on hand on the site.  

The furnace provides a fire hazard because of the type of roof over the furnace and because of its location near the center of a valuable building. It also provides a health hazard in exposure of operating personnel to airborne radioactive dust. The MAC which we have been using for thorium is approximately 20 times that presently recommended by the National Committee on Radiation Protection. The Committee in 1959 gave a provisional value of about two times the MAC but urged that the exposure of personnel to natural thorium be kept as low as operationally possible. Precautions, such as a low rate of burning, the use of respirators, and the rotation of personnel, have been taken by NLO in the processing to date. However we feel very strongly that it is unwise to process in the present facility beyond the time required for materials presently at hand. This will be about July 1, 1963. The Sylcor turnings cannot be included and meet this date.
We should appreciate your advice on the matter of a capital expenditure to provide a safe and efficient facility for future burning of thorium materials. We shall be pleased to submit a proposal if it is considered that there is a need for such a facility.

Sincerely yours,

J. H. Noyes
Plant Manager

CRC: mb

cc: C. L. Karl, lx
C. R. Chapman
P. G. DeFazio
S. Marshall - P. McCrery - B. Gessness
J. A. Quigley
W. A. Smith

Central Files
March 26, 1963

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

TO: C. R. Chapman

FROM: R. H. Starkey

REFERENCE

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

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

I MAC = maximum allowable concentration (70 &dgr;/m&sup3;)
- Denotes operation or area did not exist or was included in another classification at the time of sampling.

Although the Thorium Furnace and Rotex sifter have ventilation, it is completely inadequate. In addition, a majority of the operations performed in conjunction with the furnace do not have local ventilation at all. It should be mentioned also that the plexiglass window in the product canning station is broken. This is reducing the ventilation efficiency of the station. The rabbeting arms in the top hearths of the furnace
Air Dust Re-evaluation of the Thorium Furnace - Plant 6
C. R. Chapman
March 26, 1963

have been removed, thus the excessive cold residue on the edge of the hearths is raked into the furnace by hand (this operation is 1260 x MAC).

As was discussed in a meeting in your office this morning, this furnace should be shut down immediately after processing the thorium now on site. J. Carvitti estimates this should be completed by approximately July 1, 1963.

R. H. Starkey

RHS/NGS
cc: J. A. Quigley, M.D.
MEETING HELD ON MARCH 10, 1970, TO DISCUSS CUTTING UP OF THORIUM DERBIES IN PLANT 6

SUBJECT: Memo to Files

FROM: J. H. Cavendish

A meeting was held on March 10, 1970, to discuss the cutting up of thorium derbies in Plant 6. J. L. Burke, C. W. Baer, R. N. Mode, C. R. Armstrong, K. N. Ross, S. O. Samoriga, and J. H. Cavendish attended the meeting.

Items discussed were:

1. Health and Safety Considerations
   a. Airborne Contamination
      Keith Ross reported that the results of air samples taken during the test conducted March 2 indicated that the level of activity directly over the shear was 2000 d/m^3. At a distance of six feet from the shear, the level was 600 d/m^3. Since the maximum allowable concentration is 100 d/m^3, it is concluded that ventilation and/or wearing of respirators by personnel would be necessary.
   b. Mechanical Safety
      Armstrong indicated that it was Health and Safety's recommendation that a method be provided for mechanically holding the thorium pieces during the cutting operation. Holding of the pieces by the operator in his hand would not be permitted. It was felt that some form of tongs would be best for this purpose. He also indicated that better lighting in the area should be provided.

2. Equipment Modifications
   a. Ventilation
      Provision for adequate ventilation to reduce the activity level below the 100 ppm maximum was felt to be required. This should preferably be vented outside.
   b. Improvement of Lighting in the Area
   c. Provision of an Argon Station
MEETING HELD ON MARCH 10, 1970, TO DISCUSS CUTTING
UP OF THORIUM DERBIES IN PLANT 6

Memo to Files
March 10, 1970

d. Provision of Screening Facilities for Removal of the
   Minus 1/4-inch Fraction

   Bob Mode was given the assignment to prepare a preliminary
design and estimate of cost and time involved in making
these modifications.

3. SOP Preparation

   It was agreed that C. Beer and S. Samorija would prepare the SOP
as soon as possible.

4. Training of Operators

   It was agreed that S. Samorija would spend the first two operating
days in the area training the operators for that shift.

JHC/blr

cc: W. J. Adams
    C. R. Armstrong
    S. F. Audia
    C. W. Beer
    J. L. Burke
    F. G. DePazic
    S. Marshall
    R. V. Mode
    M. S. Nelson
    O. R. Chapman
    F. A. Quigley
    K. N. Ross
    S. O. Samorija
    R. M. Spenceley

J. H. Cavendish

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March 6, 1963

DEPARTMENT MONTHLY REPORT FOR FEBRUARY, 1963

J. A. Quigley, M.D.

A. H. Starkey

Air Hygiene Studies

The 1963 complete in-plant air dust surveys of Plants 1 and 9 have been started.

Air dust samples of the general air at various locations in Plant 4 were taken in starting the Plant 4 survey. The results were higher than in the past, therefore sampling has been discontinued until the general-plant clean-up, started in February, is completed.

Evaluations:

Slug Degreaser - Plant 9:
An air dust evaluation of operations at the slug degreaser in Plant 9 showed no air dust levels greater than MAC. Respiratory protection was not recommended.

Whole Process - Plant 5:
An air dust evaluation of the Plant 5 Wino process showed air dust levels resulting from the changing of mobile hoppers to be 10 MAC. All other air dust levels were below MAC. Respiratory protection is recommended for this operation. It is understood that a CP is being prepared that includes provisions to control this dust source.

Enhanced Packaging Station - Plant 4:
An evaluation of the new enhanced packaging station, Bank 12, showed breathing zone air dust levels of 6 to 7 MAC. The probable cause of these high air dust levels is the incorrect use of equipment. Plant supervision indicated they would re-instruct the operating personnel and that they will request some revisions to the station.

Thorium Furnace - Plant 6:
Air dust samples taken during the operation of the thorium furnace show levels far exceeding the MAC for thorium. Breathing zone air dust levels of various operations range from 10 to 1,170 MAC. This is believed to be due to the decrease in ventilation (the fan is delivering less than 1/2 of its rated capacity) and to
lack of adequate maintenance. The exposure levels have exceeded acceptable values since at least as early as 1960; however, the current conditions are by far the worst on record. This problem was discussed with the general superintendent who agreed that minimum maintenance should be performed inasmuch as the unit should be shut down approximately July 1.

Special Radiation Studies

Instrument surveys of the external radiation levels at the Plant 9 remelt, ingot separation, charging, and burnout areas were conducted during the past three months. The purpose of these surveys was to point out problem areas to determine the cause of a gradual increase in monthly film badge exposures. It was found that under present operating conditions and design capacities, housekeeping problems have resulted in increases in the background radiation levels. Due to this relatively high "background" a more precise survey could not be made. Recommendations concerning housekeeping and other conditions affecting the radiation exposure in this area were sent to Plant 9 supervision. These conditions will be discussed with them in detail at a later date. A follow-up survey, after the preliminary improvements or revised procedures are accomplished, will then be initiated to determine additional radiation protection methods.

The semi-annual survey of the radiographic facility revealed that no radiation hazards exist during the use or storage of the source.

Miscellaneous Special Studies

A surplus electro-plating cleaner was checked to see if it could be safely used for general cleaning services. It was concluded that this material could safely be used with the protection of rubber gloves and splash goggles. This information was passed on to the plant labor pool foreman.

Pneum and Dermatitis Investigations

A Plant 5 melter area chemical operator became nauseated after spending approximately one hour without respiratory protection cleaning sump material from the base of the scrubber column. Measurements of the HF concentrations were found to be low but exceeding the threshold limit values. The operator returned to work the second shift after his exposure and sickness and was examined by a MC physician. It was determined that the gastrointestinal disturbance could not have been caused by the low HF level encountered during this exposure but rather was of non-occupational origin.
In the period from October 8 to October 12, a number of air dust samples were taken of the 3620 operations in the Pilot Plant. The results of these samples indicate that operators are exposed to breathing zone concentrations in the range from 2 to 35 times the maximum allowable concentration while performing the various operations. Process samples of the exhausts of the Lewyt and Invincible vacuum cleaners were about 1-1/2 times the maximum allowable concentration.

In addition to high air dust concentrations, there have been reports of skin irritations from HF which is carried on to the product receivers, and explosions in the Lewyt vacuum cleaners caused by an accumulation of hydrogen. One of the explosions was of sufficient force to blow the cleaner apart. In addition to being a safety hazard, it is almost certain that in explosions of this kind Industrial Hygiene problems are created by the sudden release of radioactive dust.

It is my opinion that high air dust concentrations, HF burns, and hydrogen explosions have resulted from the total inadequacy of the ventilation which is provided by the Lewyt vacuum cleaners. The prediction as to their inadequacy was made prior to their use and I now wish to state that they cannot serve the purpose for which they were intended in this operation. Aside from the fact that they do not have the capacity which is needed, the ones being used are installed in a manner that the maximum benefit from their use cannot be obtained.

It is also my opinion that if we are going to continue the operation we may be doing something that would seriously affect the health and safety of workers in the area. On the basis of this we would recommend that the operation be shut down until the ventilation which has been provided is installed.
SUBJECT: REPORT ON OVEREXPOSURES

TO: DR. J. A. QUIGLEY

FROM: DR. WM. A. McCLELLAN

REFERENCE

During August and September 1952, seventeen men were known to be directly exposed to uranium hexafluoride in varying amounts while working in the Pilot Plant. The exposures were uniformly of short duration. As closely as we can determine, flood conditions were not present, but in two instances there were relatively heavy acute exposures. In view of the toxicity found in the Rochester radiation experiments and chronic toxicity found at Harshaw, these men have been studied for possible renal damage. This was not a controlled condition but an actual on-the-job occurrence and consequently the findings will depend on the cooperation of the men and the necessity of going ahead with production without lowering of morale. The findings are open to criticism in several respects, in my estimation; one of the most serious being, rectal examinations to check for prostatitis have not been done on these men.

The criteria we have used:

1. Known exposures to uranium hexafluoride,
2. Urinary findings, in most instances possibly indicative of renal damage, and in some cases, certainly indicative of renal damage where no findings previously existed.
3. Recovery of uranium from the urine.

The men in the September exposure had a physical examination of their hearts, lungs, abdomen and mucus membranes within an hour after their exposure. Urinalysis were started on the day of exposure and have been continued as long as any renal damage has been shown. Of the seventeen men in the two exposures there has been only one man with any initial pathological urinary findings and all seventeen men have shown some abnormal urinary findings at some time within nine weeks following exposure.
Conclusion: There is possibly some degree of urinary damage associated with uranium hexafluoride inhalation. It occurs on very brief exposure and is apparently moderately persistent. Known exposures should be carefully observed for renal damage in all institutions using this compound. Careful records over a period of years should be kept on the men exposed to this compound since little is yet known of its human toxicity and its chronic effects.

Summary: Seventeen men were exposed to uranium hexafluoride. 100% showed urinary damage. There have been some suggestive findings in other organs, notably mucus membranes of the eyes, following uranium hexafluoride exposure, but no mention other than this was made in this report. Careful observation of known exposures should be carried out.
The following is a tabulation of some recently collected air dust samples in the Pilot Plant.

### 3013 Area

<table>
<thead>
<tr>
<th>Description</th>
<th>No. of Samples</th>
<th>Results (d/m³/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ Operator dumping ore to hopper</td>
<td>2</td>
<td>38,500 1,112 15,400</td>
</tr>
</tbody>
</table>

### 3680 Area

<table>
<thead>
<tr>
<th>Description</th>
<th>No. of Samples</th>
<th>Results (d/m³/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ Maintenance men removing micro dust collector bags</td>
<td>9</td>
<td>22,600 322 7,700</td>
</tr>
<tr>
<td>BZ Removing and breaking 4 up carbon rods</td>
<td>18,588 616 7,800</td>
<td>112</td>
</tr>
<tr>
<td>BZ Cleaning Adams filter 5 with wire brush and scraper.</td>
<td>16,500 306 2,840</td>
<td>41</td>
</tr>
<tr>
<td>BZ Removing UPA collector in off gas stream for sampling.</td>
<td>1</td>
<td>404 5.9</td>
</tr>
</tbody>
</table>

### 3037 Area

<table>
<thead>
<tr>
<th>Description</th>
<th>No. of Samples</th>
<th>Results (d/m³/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BZ Grinding metal sample up ventilation</td>
<td>7</td>
<td>30,500 23 3,890</td>
</tr>
<tr>
<td>BZ Removing QHD recovery station &amp; shipping slag from derby</td>
<td>1,123 113 358</td>
<td>8.4</td>
</tr>
</tbody>
</table>

While some of these operations were reported in the recently issued Pilot Plant Study #1 others were not included in that study. The results reported here are sufficiently high that action should be taken in order to reduce as much as possible air contamination at each source. This can possibly be achieved through more careful operation and improved housekeeping. Aasis is on clean up at the completion of each step of the
AIR DUST EVALUATION OF CLEANING AND REPAIRING ROCKWELL FURNACES, PILOT PLANT

K. K. Ross

F. J. Klein

December 13, 1963

On December 3, 1963, an air dust survey was made at the Pilot Plant while Maintenance Department personnel were making element repairs inside #1 Rockwell Furnace.

The furnace interior was cleaned of debris prior to sampling and entering. External radiation was measured in 10 mrad/hr beta plus gamma, using a GS-3 survey instrument.

Breathing zone air dust samples were collected while Maintenance Department personnel were making the necessary repairs. The repairs were done as the work was a full-time air-supplied respirator. The analytical results of the dust samples collected are as follows:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>Activity Description</th>
<th>X RAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>Maintenance man inside Rockwell Furnace removing center element ring and placing new insulators.</td>
<td>32</td>
</tr>
<tr>
<td>52</td>
<td>Maintenance man placing and adjusting insulators, locating roto, and placing new element in Rockwell Furnace.</td>
<td>32</td>
</tr>
</tbody>
</table>

RAC (Radiation Allowable Concentration) = 70 c rad/hr

The radiation dust concentration is well above the RAC and it is extremely doubtful that a dust-type respirator will provide adequate respiratory protection for anyone working in such air concentrations. Therefore, air line respiratory protection is recommended for anyone entering and/or working inside the Rockwell Furnace.

ORIGINAL SIGNED BY
F. J. Klein /s /

RE: 168

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2637815

3110893
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NATIONAL LEAD COMPANY
OF OHIO
CINCINNATI 39, OHIO
March 22, 1961

CENTRAL FILES

SUBJECT: ATTACHED REPORT—AIR DUST EVALUATION OF PILOT PLANT REDUCTION AND BREAKOUT OPERATIONS

TO: J. O. Davis

FROM: R. H. Starkey

The attached air dust evaluation shows most operations in the Pilot Plant Metallurgical Area are potential sources of air dust exposure. Recommendations for alleviating these conditions are included.

Because of the temporary nature of many Pilot Plant operations, ventilation and enclosures are often makeshift since time and economics do not allow proper design.

This is not the case in the Metallurgical Area. The equipment in this area appears to be at least semi-permanent and deserves properly designed enclosures and adequate ventilation. It is recommended that the Engineering Division and/or the Fume and Dust Control Committee be contacted in regard to this matter and permanent ventilation for these operations be procured with their assistance.

In this evaluation, it is mentioned that respirators are not worn while performing operations that require respirators according to NLCO 668 "SOP For Pilot Plant Metallurgical Area Reduction to Metal of Enriched UF6, Containing up to 3% U-235". It is recommended that these violations of SOP be investigated and the proper action taken by Pilot Plant supervision to prevent their future occurrence.

R. H. Starkey

cc: F. J. Klein
    J. F. Wing
    F. L. Cuthbert—W. E. Shaw
    C. E. Polson

Central Files

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3110799
DATE
February 14, 1966

TIME
8:40 a.m.

DEPARTMENT
Technical - Pilot Plant

LOCATION
UF₆ Vaporisation Facility, North side of Pilot Plant Building

INJURY
The inhalation of UF₆

EQUIPMENT INVOLVED
UF₆ Cylinder

TYPE OF ACCIDENT
Contact with noxious substances

DETAILS
A chemical operator was exposed to a serious release of UF₆ vapors while attempting to start up the UF₆ vaporisation system prior to the day's operation. The employee was given emergency treatment on site and then transferred to a local hospital. It is expected that he will be released from the hospital soon and will probably be able to report to work the week of February 20. A committee, selected by the A.E.C., has been directed to investigate the nature of this release.
SAFETY GUIDE

NATIONAL LEAD COMPANY
of OSMO

July 2, 1968
Major Injury #3 and #4

Date
June 28, 1968

Time
11:00 a.m.

Division
Technical

Location
PIT Operation - Pilot Plant

Equipment Involved
PIT Furnace

Injury
#3 - 1st, 2nd, and 3rd degree burns of back of head. 1st degree burns of both eyes.

#4 - 1st and 2nd degree burns of face, both eyes and both wrists.

Details
Two Technical Division employees, a Pilot Plant Chemical Operator (#3) and a Metallurgical Department co-op student (#4) were injured as the result of an explosion in the open furnace shell of the PIT furnace. The Pilot Plant employee was inside the open furnace removing the insulation pack and the co-op employee was standing on a ladder observing the operation when the explosion occurred. Both employees were treated on site and later transferred to an off site hospital. It is expected that they will be released to return to work in a week or more.

A committee has been formed to investigate the cause(s) of the accident.

check the rules - they're safety tools
NLO, Inc.
A SUBSIDIARY OF M.I. INDUSTRIES, INC.
CINCINNATI, OHIO 45239
November 6, 1984

SUBJECT   HEALTH, SAFETY, AND ENVIRONMENTAL MATTERS AT THE PILOT PLANT

TO        E. M. Nutter

FROM       R. M. Spenceley

REFERENCE Letter, R. B. Weidner to E. M. Nutter, Same Subject, November 1, 1984

We are in receipt of the reference letter which describes serious health, safety, and environmental problems in the Pilot Plant. These problems have apparently occurred as a result of design and construction defects in the new UF6 to UF4 reactor. Operations under such conditions cannot be tolerated. By receipt of this letter, my verbal instructions to you earlier this morning to shut the plant down, are confirmed. You are also instructed to begin and to expedite cleanup of the facility and, on completion to request monitoring by the Health and Safety Division to assure that the cleanup has been carried out in a completely satisfactory manner.

In the future, copies of letters describing situations of such importance are to be forwarded immediately to this office.

R. M. Spenceley

cc: M. W. Boback - R. B. Weidner
N. R. Leist
National Lead Company of Ohio
P. O. Box 188
Mt. Healthy Station
Cincinnati 37, Ohio

August 25, 1953

SUBJECT
Control of Dust in the Sampling Plant

TO
D. J. Blythe

FROM
J. J. Costa

REFERENCE
Report: E. V. Barry to J. A. Quigley, "Industrial Hygiene and Radiation
Preliminary Report on the Sampling Plant" dated 8/19/53

Dust levels reported in the above survey are due to failures and poor
design on the part of the processing equipment. These failures have not
only increased air borne dust far above permissible safe working levels,
but have also caused completion of the evaluation program to fall far
behind schedule.

It will be noted that much of the dust is caused by the failure of both
the Q-11 and MgX deheaders. Attempts are being made by Richmond Machining Co.
in Philadelphia to rectify this situation.

The area around the MgX Drumming Station is dusty because of poor design.
A redesign study is presently being made by Engineering. Engineering, too, is
studying a redesign of hoods and ventilating systems in the laboratories to
decrease dust there.

It will be noted that the Honan-Crane conveyors on the Q-11 side have been
large contributors to the existing dust conditions. Conveyor G2-70 which feeds
Q-11 to the samplers has been non-functioning with frequent breakdowns and
under constant repairs. G2-75 has broken down several times causing Q-11 to
spill out of the tail end of the dryer. The conveyors are under study by Mr.
H. Neinke who is working with Honan-Crane in attempting to make these conveyors
work. G2-70 conveyor should and can be eliminated completely by elevating the
Hillman Mill sump to a position where it can discharge to the first sampler
by use of a vibratory conveyor. A "Request for Engineering Services" has
been made to accomplish this change in anticipation of complete failure on the
part of G2-70.

The magnetic separators and drum washers are now under study and will be
corrected. A recommendation has been made to enclose and ventilate the dis-
charge points of the Hoffman Collectors. The multiclone and gas cooler are
presently being studied for more efficient collection and discharging.

Very truly yours,

J. J. COSTA

J. J. Costa

cc: G. W. Vander
J. A. Quigley, M.D.
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NATIONAL LEAD COMPANY
of Ohio
P. O. Box 158
Cincinnati 39, Ohio

NOV '60

Mr. C. L. Karl, Area Manager
U. S. Atomic Energy Commission
P. O. Box 188
Cincinnati 39, Ohio

SUBJECT: IDEA LETTER - ORE HANDLING (PLANT 1 - PLANT 2)

REVISED 1

Dear Mr. Karl:

PROBLEM

Health and Safety Hazard

High levels of airborne contamination indicate that the existing ore handling ventilation systems in Plants 1 and 2 are inadequate from a Health and Safety standpoint.

The prime sources of radioactive dust are:

a. The ore sampling station in the Drum Reconditioning building.

b. The ore sampling station in Plant 1.

c. The ore dumping stations in Plant 2.

d. The ore conveying system in Plant 2 which includes both the bucket elevators and the horizontal-screw conveyors.

Results of the 1959 Plant 1 and Plant 2 air-dust surveys show that the airborne contamination exceeds the Maximum Allowable Concentration in both plants.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Location</th>
<th>Reading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Sampling</td>
<td>Drum Recond. Bldg. (Plant 1)</td>
<td>20 MAC</td>
</tr>
<tr>
<td>Auger Sampling</td>
<td>Drum Recond. Bldg. (Plant 1)</td>
<td>11 MAC</td>
</tr>
<tr>
<td>Auger Sampling</td>
<td>Plant 1</td>
<td>5 MAC</td>
</tr>
<tr>
<td>Ore Dumping</td>
<td>Hot Side Plant 2</td>
<td>15 MAC</td>
</tr>
<tr>
<td>Ore Dumping</td>
<td>Cold Side Plant 2</td>
<td>11 MAC</td>
</tr>
<tr>
<td>Metal Dumping</td>
<td>Metal Dissolver Plant 2</td>
<td>4 MAC</td>
</tr>
</tbody>
</table>

OFFICIAL USE ONLY
These high dust levels would result in Daily Weighted Exposures of 3.0 x MAC for sampling operators in Plant 1 and between 5.5 and 6.3 x MAC for ore handling operators in Plant 2, if respirators were not worn while performing the above operations.

Another serious source of airborne contamination is the Hoffman Vacuum drumming station in Plant 2. The dust collector is located on the fourth floor and the dust is emptied by opening a valve beneath the collector which allows the dust to drop to the first floor drumming station. This drumming station is of the old design which is inadequate because it allows copious quantities of dust to escape.

**Modernization**

Both Plant 1 and Plant 2 are currently handling ore with obsolescent equipment and attendant operating difficulties. The drummed ore is handled and rehandled many times before it is finally dumped and the empty drums must then be handled several times before rail shipment to the vendor.

**Sampling and Weighing**

The sampling and weighing of ore concentrates is presently accomplished in two separate areas of the Sampling Plant (Drum Reconditioning Building and Plant 1 Building). This requires a double sampling crew, extra material handling equipment and four scales.

A semi-automatic auger type sampler is used to handle the bulk of the ore concentrates; however, it is too light to handle all types of ore. Some ores require pipe sampling which is slower and more costly; others require the use of a ship's auger type sampler. The semi-automatic auger sampler mentioned above has been used extensively and is in need of replacement.

Although the drums of ore are gross weighed prior to sampling, the directive for payment cannot be made for any Canadian and some of the other shipments until a tare weight has been secured on the empty drums. Considerable bookkeeping and paper work are required since there is a decided time lag between receipt, weighing and sampling, dumping of the ore, and final tare weighing.

After the ore is dumped, the empty drums are transferred from Plant 2 to Plant 1 by tractor-trailers. They must be sorted by vendor and shipping lot and are then transferred to the tare weigh station at the southwest corner of Plant 1. This tare weigh station is remotely
Attached are the results of air dust samples collected at the Plant 3 dumping stations from 8/8/56 to 8/15/56, inclusive.

As indicated by these high sample results, these stations have recently been presenting a serious dust exposure problem. Several attempts have been made to reduce the air contamination, but none proved satisfactory. Some of these were: 1) slower dumping, 2) more careful handling of drums, 3) leaving the door on the dumping station closed for several seconds after dumping, 4) use of a vacuum hose to clear drum of dust before removing it from the enclosure, and 5) elimination of the ore crushers located in the pits beneath the dumping enclosures. Although a considerable reduction of dust was noted after the crushers were eliminated, air contamination was still several times the MAC during the dumping operations. Obviously there still exist several sources of dust which cannot be controlled by changes in operating procedure.

Additional ventilation is needed on all the enclosures. If possible, a ventilated tunnel should be installed in front of each enclosure so that drum dusting can be controlled. Faulty and leaky equipment in the pits beneath the dumpers are not only contributing to air contamination but are also causing additional personnel exposure by the frequent cleanouts which are required. During these cleanout periods operating personnel are being exposed to radioactive dust concentrations over 1800 times the MAC. Immediate action should be taken toward modification and/or repair of this equipment.

It has been noted that some operating personnel in these areas are using MSA Comfo and Dust-free respirators. Use of these mechanical filter respirators is not satisfactory and should be discontinued. Air line respirators should be used at all times until effective dust controls are provided.

C. E. Schumann

C. E. Schumann
May 17, 1960

RE-EVALUATION OF JUICE HOPPER FILLING STATIONS, DERMATITIS
AREA, PLANT 3
J. F. King
K. E. Ross and R. E. Leininger

On April 26, 1960, an air hygiene re-evaluation was conducted at the juice hopper filling stations, Dermatitis Area, Plant 3. This evaluation was made in order to determine if the new corrugated, rubber enclosed chutes recently installed at the filling stations had lowered the concentration of airborne dust.

The results of this evaluation show that the concentration of airborne dust has been lowered; however, the results also show that the air dust level is still well above the MAK.

A summary of the air dust samples from the current survey as compared to those taken in a previous survey is shown below:

PREVIOUS SURVEY (December, 1959)

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample Description</th>
<th>Concentration - d/s/m^3</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>Changing juice hoppers</td>
<td>2066</td>
<td>2435</td>
</tr>
<tr>
<td>09</td>
<td>First level in general vicinity of juice hoppers</td>
<td>131</td>
<td>22</td>
</tr>
</tbody>
</table>

CURRENT SURVEY (April, 1960)

<table>
<thead>
<tr>
<th>Type</th>
<th>Sample Description</th>
<th>Concentration - d/s/m^3</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>Operator changing sample jar (removing filled jar and replacing with an empty one)</td>
<td>2701</td>
<td>1811</td>
</tr>
<tr>
<td>02</td>
<td>Operator raising chute from full hopper, removing rubber gasket and vacuum line, and putting lid on hopper</td>
<td>3156</td>
<td>160</td>
</tr>
</tbody>
</table>
AIR DUST EVALUATION OF HOFFMAN DRUMMING STATION - PLANT II

G. A. Harr
K. N. Ross

The attached air dust evaluation was made because samples taken during the Plant 2 Complete In-Plant Air Dust Survey showed the air dust levels while operating this station to be 45 X MAC. It is thought that this level is of sufficient magnitude to be brought to your immediate attention. The installation of the new dumping station under the Idea Letter "Ore Handling (Plant 1 & 2)" should alleviate this high air dust level. Until this installation is complete and a re-evaluation shows the air dust levels to be considerably lower a full-face air supplied respirator is recommended.

ORIGINAL SIGNED BY
K. N. Ross

Attach:

cc: R. H. Starkey
    R. L. Ruehe
    J. F. Wing

Central File

EHR:mmh

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PE145E

3110887
SUBJECT: IDEA LETTER - DUST COLLECTION FACILITY FOR UO₂ MILLING AND LOADING STATIONS - PLANT 3

TO: J. H. Noyes
FROM: P. G. DeFazio

PROBLEM:

The UO₂ milling and loading stations are consistent sources of dust. The major contributors are the mills, rotary valves, filling chutes, and sample stations. Efforts to contain the dust from this equipment have not been successful. New gasketing, shaft seals, and other minor changes have reduced the amount of airborne contamination, but not to the degree required by the Health & Safety Division. To keep dust leakage at a minimum, continual maintenance is required.

These dust problems are intensified when the door on the east side of the Denitrification Area is open as the resulting draft creates air movements which spread the dust to adjacent areas. To control the contamination and to improve the housekeeping, the Fume and Dust Control Committee has recommended ventilation and/or enclosure of the various dust sources.

SOLUTION:

Procure and install a dust collector (2,000 CFM) plus the necessary duct work, hooding, and enclosures to contain dust from the following sources:

1. Hammer mills
2. Rotary valves
3. Sample jar stations

The dust collector is to be located on the second level, between columns 19 and 20. The oxide from the collector discharge is to be transferred by screw conveyor to surge hopper P3E-228.

To eliminate dusting from the hopper filling chutes it is proposed to install new control valves on the air lines activating the filling chutes and manual shut-off valves on the discharge ends of the chutes. At present, the chutes open and close very rapidly, creating a large amount of dust. Air control valves that will allow gradual lifting of the chutes and shut-off valves that will provide a positive seal on the chute discharges would reduce the air-dust levels to acceptable limits.
IDEA LETTER - DUST COLLECTION FACILITY FOR UO3
MILLING AND LOADING STATIONS - PLANT #3

J. H. Noyes, Plant Manager
November 16, 1961

JUSTIFICATION:

Reduction of the air-dust levels in the milling and loading areas is necessary to minimize exposure of the operating personnel. Listed are the results of two air-dust surveys conducted by the Health & Safety Division. The first survey was made just after the milling and loading equipment were put in the best possible operating condition by means of new gasketing and shaft seals. The second survey was conducted under normal operating conditions.

Results of Air-Dust Surveys

<table>
<thead>
<tr>
<th>Type</th>
<th>Operation or Area</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing Zone</td>
<td>Changing sample jar</td>
<td>X MAC</td>
<td>X MAC</td>
</tr>
<tr>
<td>Breathing Zone</td>
<td>Raising and lowering hopper filling chute</td>
<td>4.6 - 6.5</td>
<td>4.2 - 21.</td>
</tr>
<tr>
<td>General Air</td>
<td>Mill deck (second level)</td>
<td>2.8</td>
<td></td>
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</tbody>
</table>

Installation of the proposed dust collection system and filling chute revisions will improve the housekeeping in the hopper loading area in addition to reducing the airborne contamination to below the maximum allowable concentration.

STATUS OF PROPOSAL:

The cost of this project is estimated to be $17,300. Funds are available in Activity 02-01-99 FY 1962 Budget.

P. G. DeFazio, Chairman Engineering Committee

LWK:mc:1jm

cc: S. F. Audia
    C. R. Chapman
    G. R. Harr
    L. W. Kessler (P-22300-41)
    H. Martin
    W. J. Strattman

Central Files:/089625

APPROVED:

Original Signed By

J. H. NOYES
Plant Manager

J. H. Noyes, Plant Manager

DATE: NOV 20 1961

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SUBJECT: AIR DUST RESULTS OF DUMPING ORE CONCENTRATES

TO: W. J. Adams

FROM: R. C. Heatherton

REFERENCE: 1. Letter, R. C. Heatherton to W. J. Adams, dated 10/2/72, (2. 25) "Air Dust Sampling in the Refinery"

2. Letter, S. F. Audia to P. G. DeFazio, dated 11/3/72, "Dusting /2.3% Problems in the Ore Refinery and Capacity Requirements"

On 11/21/72 measurements were made of the airborne radioactivity resulting from the dumping of concentrates at the Refinery's north dumping station. Results which are summarized below nullify those previously reported to you in reference 1 and indicate a definite need for improved dust control for these operations. It is my opinion that Mr. Fisch, the chemical operator assigned to the dumping on 11/21, was doing the best he could with the existing equipment and the material he was dumping. In addition, he faithfully wore his respirator while doing this job.

In the time that I watched and sampled the operation, I did not observe airborne dust outside the dumping enclosure nor did I see any drums in which the material appeared to be wet. However, the material was apparently sufficiently damp to prevent it from flowing from the overturned drums. Usually the drum had to be struck several times on the sides with a hammer in order to start the material flow. The hammering had to be done with the door to the enclosure open. When flow started the door was closed and the drum was jogged to complete the dumping. At that point the enclosure would be filled with dust cloud.

The sample results from in front of the enclosure indicate there is probably adequate dust control with the door to the enclosure lowered, but leaving a small opening while dumping. The results of process samples collected at the small opening, while higher than the NIOSH of 100 d/m³, were still lower than other results. Most likely residual dust from other operations caused these results to be high.

With regard to items relating to the concentrate dumping in reference 2 I have these comments:

1. I agree the present operation is unsafe and improvements are needed to eliminate the need to climb over conveyors and mishandle the drums. A new means of cleaning the empty drums before removal from the enclosure would be desirable.
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April 19, 1972

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 analysed 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.

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

Forwarded to Bell Hall 6/14/72
Forwarded to RCH on 6/15/72

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