

INTEROFFICE CORRESPONDENCE

Company Mines Development, Inc.

Date May 11, 1959

To: H. B. Webb

From: G. F. Richards

Subject: Operations - Milling - RADIATION

Following are the results of the first airborne dust survey. The filter paper was assayed using the procedure recommended in Min 111, pages 39 and 40. The level of radioactivity was calculated by the following formula:

$$\text{Microcuries (UC)/ml} = \text{g U}_3\text{O}_8/\text{liter} \times 0.555 \times 10^{-3}$$

$$\text{Maximum permissible concentration} = 5 \times 10^{-11} \text{ UC/ml}$$

Sample #1

General air sample taken in the concentrate packaging section. Sampler was placed on the south table opposite the scale. During the sample period, the Productman was filling and sampling barrels. The sample time was 10 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 20, 1959.

U<sub>3</sub>O<sub>8</sub> collected on filter paper 0.630 g  
Liters of air sampled 200  
Radiation level  $1.84 \times 10^{-12}$  UC/ml

Sample #2

Same as Sample #1 except sampling time was 20 minutes.

U<sub>3</sub>O<sub>8</sub> collected on filter paper 1.650  
Liters of air sampled 400  
Radiation level  $2.44 \times 10^{-12}$  UC/ml

Sample #3

General air sample taken in the sample preparation room. Sampler was placed on table in the center of the room. During the sample period, the sampler was pulverizing, blending and packaging pulp samples. The sample time was 30 minutes at a flow rate of 3 liters of air a minute. This sample was taken April 27, 1959.

U<sub>3</sub>O<sub>8</sub> collected on filter paper 0.227  
Liters of air sampled 60  
Radiation level  $2.38 \times 10^{-13}$  UC/ml

Sample #4

Same as Sample #3 except the sampler was on the desk in the north.

U<sub>3</sub>O<sub>8</sub> collected on filter paper 0.088  
Liters of air sampled 60  
Radiation level  $1.19 \times 10^{-13}$  UC/ml

9612240249 590506  
PDR ADOCK 04001341  
PDR

9612240249 82AP

Sample #5

General air sample taken in the crusher building. Sampler was placed on top of the Control Panel east of the primary crusher on the 3rd deck. During the sample period, dusty, hard ore was being crushed. The sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 27, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	0.083
Liters of air sampled	600
Radiation level	$5.95 \times 10^{-14}$ $\mu$ C/ml

Sample #6

General air sample taken in the bucking room. Sampler was placed on table next to west wall. During the sample period, the sampler was blending, splitting and grinding samples. The sample time was 15 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 27, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	0.165
Liters of air sampled	300
Radiation level	$3.55 \times 10^{-13}$ $\mu$ C/ml

Sample #7

Same as Sample #6 except sampler was placed on desk in southeast corner.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	0.148
Liters of air sampled	300
Radiation level	$2.98 \times 10^{-13}$ $\mu$ C/ml

Sample #8

Same as Sample #6 except sampler was placed on Eberbach grinder in northeast corner.

U <sub>3</sub> O <sub>8</sub> on filter paper	0.127
Liters of air sampled	300
Radiation level	$2.38 \times 10^{-13}$ $\mu$ C/ml

Sample #9

General air sample taken above #1 Leach Tank. Sampler was placed on the belt guard above the agitator. The sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 28, 1959.

U <sub>3</sub> O <sub>8</sub> on filter paper	0.019
Liters of air sampled	600
Radiation level	$1.79 \times 10^{-14}$ $\mu$ C/ml

Sample #10

General air sample taken at the southwest corner of #7 R.I.P. bank on the second deck. Sampler was placed on the floor. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 28, 1959.

U<sub>3</sub>O<sub>8</sub> on filter paper 0.028  
Liters of air sampled 600  
Radiation level  $2.98 \times 10^{-14}$   $\mu$ C/ml

Sample #11

General air sample taken in the utility room. The sampler was placed in the opening above the bench on the north wall. The sample time was 30 minutes at 20 liters of air per minute. This sample was taken April 28, 1959.

\ U<sub>3</sub>O<sub>8</sub> on filter paper 0.150  
Liters of air sampled 600  
Radiation level  $1.79 \times 10^{-13}$   $\mu$ C/ml

Sample #12

General air sample taken at the rod mill. The sampler was placed on the desk at the northeast wall next to the Control Panel. The rod mill was running-- sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 28, 1959.

\ U<sub>3</sub>O<sub>8</sub> on filter paper 0.023  
Liters of air sampled 600  
Radiation level  $2.38 \times 10^{-14}$   $\mu$ C/ml

Sample #13

General air sample taken on the 3rd deck of the mill. The sampler was placed on the steps leading to the slurry weir north of the R.I.P. distribution wheel. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 30, 1959.

\ U<sub>3</sub>O<sub>8</sub> on filter paper 0.025  
Liters of air sampled 600  
Radiation level  $2.38 \times 10^{-14}$   $\mu$ C/ml

Sample #14

General air sample taken on the 2nd deck of the mill. The sampler was placed on top of P-2 tank. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was taken April 30, 1959.

\ U<sub>3</sub>O<sub>8</sub> on filter paper 0.038  
Liters of air sampled 600  
Radiation level  $3.57 \times 10^{-14}$   $\mu$ C/ml

All radiation levels during this survey are well below maximum permissible concentration.

---

G. F. Richards

gfr/cn

cc to: E. L. Hazen  
A. D. Gray

September 2, 1959

H. D. Webb

G. F. Richards

Operations Milling - RADIATION

Following are partial results of the second airborne dust survey now underway. The filter paper was assayed using the procedure recommended in WIN III, pages 39 and 40. The level of radioactivity was calculated by the following formula:

$$\text{Microcuries (}\mu\text{C)/ml} = \text{g U}_3\text{O}_8/\text{liter} \times 0.595 \times 10^{-3}$$

$$\text{Maximum Permissible Concentration (MPC)} = 5 \times 10^{-11} \mu\text{C/ml}$$

Sample #1

General air sample taken by #2 conveyor, half way between magnetic head pulley and the door where trash wood and mud balls are removed. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Ore was average, neither too wet nor too dry. Sample taken July 15, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	44.62	<i>44.62 = 27.44 μC/ml</i>
Liters of air sampled	600	
Radiation level	$4.42 \times 10^{-11}$	μC/ml

Sample #2

General air sample taken by #2 conveyor at stool where man removing trash wood and mud balls sits. Sample time was 15 minutes at a flow rate of 20 liters of air per minute. Ore was average. Sample collected July 15, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	15.38
Liters of air sampled	300
Radiation level	$3.09 \times 10^{-11}$ μC/ml

Sample #3

General air sample taken in the sample preparation room on table in center of room. The sampler was blending, cutting, pulverizing and packaging samples. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Windows were open to allow ventilation and all hoods were on. Sample collected July 16, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	104.62
Liters of air sampled	600
Radiation level	$1.04 \times 10^{-10}$ μC/ml



September 2, 1959

Sample #4

General air sample taken at sampler's desk in the North. All other data same as sample #3.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	13.83
Liters of air sampled	600
Radiation level	$7.32 \times 10^{-11}$ $\mu$ C/ml

Sample #5

General air sample taken between the two pulverizers in the east. All other data same as sample #3.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	47.83
Liters of air sampled	600
Radiation level	$4.74 \times 10^{-11}$ $\mu$ C/ml

Sample #6

General air sample taken in the concentrate packaging section, sampler on top of barrel storage next to south wall opposite barrel filling operation. Barrels were being filled during the sampling period. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Sample taken July 16, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	7323.2
Liters of air sampled	600
Radiation level	$7.76 \times 10^{-9}$ $\mu$ C/ml

Sample #7

General air sample taken on table next to south wall opposite scale. All other data same as sample #6.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	10147.0
Liters of air sampled	600
Radiation level	$1.01 \times 10^{-8}$ $\mu$ C/ml

Notes: After collecting the two above samples, I noted a large amount of dust in the air in this section. Upon investigation, I found the high pressure hose from the barrel jolter to the exhaust line leading to the outside of the building was loose and was blowing directly into spill where two fully-loaded barrels had been sitting during collection of the above samples. Messrs. Cobb and McGuire were notified of this condition immediately. Although these samples are unusually high and are not the rule, I have reported them to show what can happen when personnel do not report abnormal conditions. Upon questioning the productman, he told me that this hose had been loose for a considerable length of time.

Sample #8

General air sample collected in the crushing building, east of the vibrating grizzly and west of the control panel, on the third deck of the crushing building.

September 2, 1959

Dry ore was being sampled during this period. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was taken August 10, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	82.61
Liters of air sampled	600
Radiation level	$8.19 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

Sample #9

General air sample collected in the crusher building between the #1 and #2 chain and bucket samplers on the third deck of the crusher building. All other data is the same as Sample #8.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	143.55
Liters of air sampled	600
Radiation level	$1.42 \times 10^{-10}$ $\mu\text{C}/\text{ml}$

Sample #10

General air sample collected in the crusher building near the west wall next to #2 chain and bucket sampler. All other data the same as Sample #8.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	143.55
Liters of air sampled	600
Radiation level	$1.25 \times 10^{-10}$ $\mu\text{C}/\text{ml}$

Sample #11

General air sample collected in the crusher building along the west wall in between #1 and #2 chain and bucket samplers. All other data the same as sample #8.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	509.68
Liters of air sampled	600
Radiation level	$6.05 \times 10^{-10}$ $\mu\text{C}/\text{ml}$

Sample #12

General air sample collected in the sample room in the crusher building along the north wall facing the Anglebach grinders. During this period, the sampler was blending, splitting, and placing ore samples in sacks. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Sample collected August 10, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	529.03
Liters of air sampled	600
Radiation level	$5.25 \times 10^{-10}$ $\mu\text{C}/\text{ml}$

Sample #13

The same as sample #12 except the sampler was placed by the door on the south wall next to the 5 cubic foot blender.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	422.95
Liters of air sampled	600
Radiation level	$4.19 \times 10^{-10}$ $\mu\text{C}/\text{ml}$

September 2, 1959

Sample #14

Same as sample #12 except sampler placed on table west of 5 cubic foot blender.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	373.77
Liters of air sampled	600
Radiation level	$3.71 \times 10^{-10}$ $\mu$ C/ml

Sample #15

This sample was lost during assaying and will be repeated and reported in the next set of dust samples.

Sample #16

Same as sample #8 except the sampler was placed between the vibrating grizzly and the vibrating screen for the 10 x 16 jaw crusher on the second floor of the crushing building. Sample time was 15 minutes at a flow rate of 20 liters of air per minute. Sample taken August 10, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	26.23
Liters of air sampled	300
Radiation level	$5.20 \times 10^{-11}$ $\mu$ C/ml

Sample #17

Data same as sample #8 except sampler was placed on the second deck of the crusher building south of the 10 x 16 crusher jaws in the middle of the building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	62.90
Liters of air sampled	300
Radiation level	$1.25 \times 10^{-10}$ $\mu$ C/ml

Sample #18

Same as sample #8 except the sampler was placed on the first deck of the crusher building east of #7 conveyor belt and north of the #2 chain and bucket sampler.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	43.55
Liters of air sampled	300
Radiation level	$8.64 \times 10^{-10}$ $\mu$ C/ml

Sample #19

Same as sample #8 except wet ore was being sampled. The sampler was placed on the west side of the #7 conveyor belt near the west door that leads into the sample preparation room in the crushing building. The sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was collected August 11, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	51.61
Liters of air sampled	600
Radiation level	$5.12 \times 10^{-11}$ $\mu$ C/ml

September 2, 1959

Sample #20

Same as sample #19 except the sampler was placed south of #1 chain and bucket sampler and west of conveyor belt #7. Sample time was 15 minutes at a flow rate of 20 liters of air per minute.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	20.97
Liters of air sampled	300
Radiation level	$4.16 \times 10^{-11}$ $\mu$ C/ml

Sample #21

Source sample collected in crusher building of feed into #1 chain and bucket sampler. Wet ore was being sampled during this period. Sample time was 10 minutes at a flow rate of 20 liters of air per minute. Sample taken August 11, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	25.93
Liters of air sampled	200
Radiation level	$7.71 \times 10^{-11}$ $\mu$ C/ml

Sample #22

Same as sample #21 except a source sample of the feed to #2 chain and bucket sampler.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	29.63
Liters of air sampled	200
Radiation level	$8.81 \times 10^{-11}$ $\mu$ C/ml

Sample #23

Same as sample #21 except source sample at the 10 x 16 jaw crusher on the second deck of the crusher building. Dry ore was being sampled during this period.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	24.07
Liters of air sampled	200
Radiation level	$7.16 \times 10^{-11}$ $\mu$ C/ml

Sample #24

Same as sample #21 except the source sample of the 5 x 6 jaw crusher on the second deck of the crusher building. Dry ore was being sampled during this period.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	25.93
Liters of air sampled	200
Radiation level	$7.71 \times 10^{-11}$ $\mu$ C/ml

Sample #25

Same as sample #21 except source sample of primary crusher on the second deck of the crusher building. Dry ore was being sampled during this period. Sample time was 5 minutes at a flow rate of 20 liters of air per minute.

September 2, 1959

U <sub>3</sub> O <sub>8</sub> collected on filter paper	53.23
Liters of air sampled	100
Radiation level	$3.17 \times 10^{-10}$ $\mu\text{C/ml}$

Note: Although this crusher has been enclosed, the dust that was caught on this filter paper came from the conveyor belt directly below the 18 x 24 jaw crusher and the 3 x 8 vibrating grizzly.

Sample #26

General air sample collected beneath the two 50-ton coarse ore bins. Dry ore was being dumped into and fed from Bin #2. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample was collected August 11, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	108.06
Liters of air sampled	600
Radiation level	$1.07 \times 10^{-10}$ $\mu\text{C/ml}$

Sample #27

Same as sample #21 except dry ore was being sampled at this period. This is a source sample of the feed in #1 chain and bucket sampler. Sample time was 5 minutes at a flow rate of 20 liters of air per minute.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	46.77
Liters of air sampled	100
Radiation level	$2.78 \times 10^{-10}$ $\mu\text{C/ml}$

Sample #28

Same as sample #22 except dry ore was being sampled. Sample time was 5 minutes at a flow rate of 20 liters of air per minute.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	37.10
Liters of air sampled	100
Radiation level	$2.21 \times 10^{-10}$ $\mu\text{C/ml}$

Sample #29

General air sample collected in concentrate enclosure in the northeast corner. During this period, drums were being loaded and sampled. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Sample collected August 11, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	126.79
Liters of air sampled	600
Radiation level	$1.26 \times 10^{-10}$ $\mu\text{C/ml}$

Sample #30

Same as sample #29 except the sampler was placed next to the gate in this area.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	92.86
Liters of air sampled	600
Radiation level	$3.21 \times 10^{-11}$ $\mu\text{C/ml}$

September 2, 1959

Sample #31

Same as sample #29 Except the sampler was placed along the west wall about equal distance between the fence and the south wall.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	371.43
Liters of air sampled	600
Radiation level	$3.68 \times 10^{-10}$ $\mu$ C/ml

Sample #32

General air sample collected in the new machine shop. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. This sample taken August 11, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	13.04
Liters of air sampled	600
Radiation level	$1.29 \times 10^{-11}$ $\mu$ C/ml

Sample #33

Same as sample #29 except sampler placed in southwest corner on the table next to the west wall in the yellow-cake enclosure.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	430.00
Liters of air sampled	600
Radiation level	$4.26 \times 10^{-10}$ $\mu$ C/ml

Sample #34

General air sample collected in the electrician's shop on the south bench. Sample time was 30 minutes at a flow rate of 20 liters of air per minutes. This sample was collected on August 12, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	8.00
Liters of air sampled	600
Radiation level	$7.93 \times 10^{-12}$ $\mu$ C/ml

Sample #35

General air sample taken in the mill building on top of the barren organic storage tank. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Sample taken August 12, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	6.83
Liters of air sampled	600
Radiation level	$6.77 \times 10^{-12}$ $\mu$ C/ml

Sample #36

Same as sample #35 except sampler was placed on a stool on top of #1 carbonate settler.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	7.17
Liters of air sampled	600
Radiation level	$7.11 \times 10^{-12}$ $\mu$ C/ml



September 2, 1959

Sample #37

Same as sample #35 except the sampler was placed on a stool next to the solvent extraction control panel on the second deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	28.07
Liters of air sampled	600
Radiation level	$2.78 \times 10^{-11}$ $\mu$ C/ml

Sample #38

Same as sample #35 except the sampler was placed over the slime tailings neutralization tank.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	10.88
Liters of air sampled	600
Radiation level	$1.08 \times 10^{-11}$ $\mu$ C/ml

Sample #39

Same as sample #35 except the sampler was placed between P-1 and P-2 tanks.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	26.32
Liters of air sampled	600
Radiation level	$2.61 \times 10^{-11}$ $\mu$ C/ml

Sample #40

Same as sample #35 except the sampler was placed between R.I.P. banks #9 and #10 and precip tank #3.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	96.49
Liters of air sampled	600
Radiation level	$9.57 \times 10^{-11}$ $\mu$ C/ml

Sample #41

Same as sample #29 except the sampler was placed on the south table opposite the scale in the yellow-cake area.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	2330.0
Liters of air sampled	600
Radiation level	$2.31 \times 10^{-9}$ $\mu$ C/ml

Sample #42

Same as sample #29 except the sampler was placed near the jolter along the south wall in the yellow-cake area.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	65.00
Liters of air sampled	600
Radiation level	$6.45 \times 10^{-11}$ $\mu$ C/ml



September 2, 1959

Sample #43

Same as sample #35 except sampler was placed between E-3 tank and the yellow-cake press.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	26.67
Liters of air sampled	600
Radiation level	$2.64 \times 10^{-11}$ $\mu$ C/ml

Sample #44

Same as sample #35 except sampler was placed between E-2 and E-3 tanks on a stool next to the soda ash platform on the first floor. Sample collected August 13, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	21.67
Liters of air sampled	600
Radiation level	$2.15 \times 10^{-11}$ $\mu$ C/ml

Sample #45

Same as sample #35 except the sampler was placed on a stool next to #8 R.I.P. pump on the first floor of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	28.07
Liters of air sampled	600
Radiation level	$2.78 \times 10^{-11}$ $\mu$ C/ml

Sample #46

This sample lost during assaying and will be repeated and reported in the next set of dust samples.

Sample #47

The same as sample #35 except the sampler was placed directly below R.I.P. bank #14.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	6.14
Liters of air sampled	600
Radiation level	$6.09 \times 10^{-12}$ $\mu$ C/ml

Sample #48

Same as sample #35 except the sampler was directly below #4 R.I.P. bank.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	92.98
Liters of air sampled	600
Radiation level	$9.22 \times 10^{-11}$ $\mu$ C/ml

Sample #49

Same as sample #35 except the sampler was placed just inside the door of the utility shop leading from the mill building.

September 2, 1959

U <sub>3</sub> O <sub>8</sub> collected on filter paper	201.71
Liters of air sampled	600
Radiation level	$2.00 \times 10^{-10}$ $\mu$ C/ml

Sample #50

Same as sample #29 except the sampler was placed near the sump in the yellow-cake area. This sample collected August 13, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	29.06
Liters of air sampled	600
Radiation level	$2.80 \times 10^{-11}$ $\mu$ C/ml

Sample #51

Same as sample #35 except the sampler was on the second deck of the mill building west of the north yellow-cake press. This sample collected August 13, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	35.90
Liters of air sampled	600
Radiation level	$3.56 \times 10^{-11}$ $\mu$ C/ml

Sample #52

Same as sample #35 except the sampler was placed west of the south yellow-cake press on the second deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	176.07
Liters of air sampled	600
Radiation level	$1.75 \times 10^{-10}$ $\mu$ C/ml

Sample #53

Same as sample #35 except the sampler was placed on the second deck of the mill building south of the yellow-cake dryer.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	94.64
Liters of air sampled	600
Radiation level	$9.39 \times 10^{-11}$ $\mu$ C/ml

Sample #54

Same as sample #35 except the sampler was placed north of the yellow-cake dryer next to the stairways leading to the third deck and the first deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	114.29
Liters of air sampled	600
Radiation level	$1.42 \times 10^{-10}$ $\mu$ C/ml

Sample #55

Same as sample #35 except the sampler was placed on the second deck of the mill building between R.I.P. banks #6, 7, 8, and 9. Sample collected August 14, 1959.

September 2, 1959

U <sub>3</sub> O <sub>8</sub> collected on filter paper	14.64
Liters of air sampled	600
Radiation level	$1.45 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

Sample #56

Same as sample #35 except the sampler was placed between R.I.P. banks #4 and #5.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	21.43
Liters of air sampled	600
Radiation level	$2.13 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

Sample #57

Same as sample #35 except the sampler was placed between R.I.P. banks #2 and #3.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	11.72
Liters of air sampled	600
Radiation level	$1.16 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

Sample #58

Same as sample #35 except sampler placed between R.I.P. bank #1 and #5 washing classifier.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	36.20
Liters of air sampled	600
Radiation level	$3.99 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

Sample #59

Same as sample #35 except the sampler was placed on the productman's desk next to F-1 tank.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	50.00
Liters of air sampled	600
Radiation level	$4.96 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

Sample #60

Same as sample #35 except the sampler was placed on the second deck of the mill building north of the washing classifiers.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	20.09
Liters of air sampled	600
Radiation level	$2.0 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

Sample #61

Same as sample #35 except the sampler was placed on the platform by #1 cyclone and the pump box to #1 cyclone.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	50.33
Liters of air sampled	600
Radiation level	$5.78 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

September 2, 1959

Sample #62

Same as sample #35 except the sampler was placed next to the acid steady head platform on the third deck of the mill building next to the sodium chlorate feeder immediately above the #2 leach tank.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	18.03
Liters of air sampled	600
Radiation level	$1.79 \times 10^{-11}$ $\mu$ C/ml

Sample #63

General air sample same as sample #35 except the sample was collected between #1 and #2 leach agitators west of the pH controllers and recorders on the third deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	3.33
Liters of air sampled	600
Radiation level	$3.30 \times 10^{-12}$ $\mu$ C/ml

Sample #64

Same as sample #35 except the sample was collected in the Operation Foremen's office.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	1.67
Liters of air sampled	600
Radiation level	$1.66 \times 10^{-12}$ $\mu$ C/ml

Sample #65

Same as sample #35 except the sample was collected in the laboratory on the third floor of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	2.42
Liters of air sampled	600
Radiation level	$2.40 \times 10^{-12}$ $\mu$ C/ml

Sample #66

Same as sample #35 except the sample was collected above the holding tank on the third deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	10.00
Liters of air sampled	600
Radiation level	$9.92 \times 10^{-11}$ $\mu$ C/ml

Sample #67

Same as sample #35 except the sample was collected north of the yellow-oxide dust collector on the third deck of the mill building. This sample was collected August 17, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	11209.00
Liters of air sampled	600
Radiation level	$1.11 \times 10^{-8}$ $\mu$ C/ml

September 2, 1959

Sample #68

Same as sample #35 except the sample was collected south of the yellow-sake dust collector on the third deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	51.52
Liters of air sampled	600
Radiation level	$5.11 \times 10^{-11}$ $\mu$ C/ml

Sample #69

Same as sample #35 except the sample was collected on the third deck of the mill building in front of control center #9.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	46.97
Liters of air sampled	600
Radiation level	$4.66 \times 10^{-11}$ $\mu$ C/ml

Sample #70

Same as sample #35 except the sample was collected by the pulp density scale at the R.I.P. exhaustion weir box on the third and one-half deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	89.39
Liters of air sampled	600
Radiation level	$8.86 \times 10^{-11}$ $\mu$ C/ml

Sample #71

Same as sample #35 except the sample was collected on the third deck of the mill building at the R.I.P. central distribution wheel.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	75.00
Liters of air sampled	600
Radiation level	$7.44 \times 10^{-11}$ $\mu$ C/ml

Sample #72

Same as sample #35 except the sample was collected in front of the control center #6 on the third deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	150.00
Liters of air sampled	600
Radiation level	$1.49 \times 10^{-10}$ $\mu$ C/ml

Sample #73

Same as sample #35 except the sample was collected between R.I.P. basket drives #11 and #12 on the third deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	163.33
Liters of air sampled	600
Radiation level	$1.62 \times 10^{-10}$ $\mu$ C/ml

September 2, 1959

Sample #74

Same as sample #35 except the sample was taken in front of control center #7 on the third deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	140.00
Liters of air sampled	600
Radiation level	$1.39 \times 10^{-10}$ $\mu$ C/ml

Sample #75

Same as sample #35 except the sample was collected on the first deck of the mill building below R.I.P. banks #11 and #12.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	330.43
Liters of air sampled	600
Radiation level	$3.28 \times 10^{-10}$ $\mu$ C/ml

Sample #76

General air sample collected in the laboratory on the west bench north of the refrigerator. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Sample taken August 17, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	17.39
Liters of air sampled	600
Radiation level	$1.72 \times 10^{-11}$ $\mu$ C/ml

Sample #77

Same as sample #35 except the sample was taken on the first floor of the mill building along the north wall below the sample window into the laboratory. This sample collected August 18, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	57.97
Liters of air sampled	600
Radiation level	$5.75 \times 10^{-11}$ $\mu$ C/ml

Sample #78

Same as sample #35 except the sample was collected on the soda ash storage platform on the first deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	13.91
Liters of air sampled	400
Radiation level	$1.10 \times 10^{-10}$ $\mu$ C/ml

Sample #79

Same as sample #35 except this sample was taken in front of the time clock on the first deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	50.4
Liters of air sampled	450
Radiation level	$6.01 \times 10^{-11}$ $\mu$ C/ml

September 2, 1959

Sample #80

Same as sample #35 except the sample was taken on the first deck of the mill building by the lathe in the mechanics department.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	53.03
Liters of air sampled	450
Radiation level	$7.01 \times 10^{-11}$ $\mu$ C/ml

Sample #81

General air sample collected in the crusher building in the sample room, between the Jones Splitter and the oven. Sample time was 15 minutes at a flow rate of 15 liters of air per minute. Sample collected August 18, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	315.15
Liters of air sampled	225
Radiation level	$8.33 \times 10^{-10}$ $\mu$ C/ml

Sample #82

General air sample collected in the mill building in the locker room along the west wall. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample taken August 18, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	30.30
Liters of air sampled	450
Radiation level	$4.01 \times 10^{-11}$ $\mu$ C/ml

Sample #83

Same as sample #35 except the sample was taken between the lime tank and the slime tails tank on the first deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	13.33
Liters of air sampled	450
Radiation level	$1.76 \times 10^{-11}$ $\mu$ C/ml

Sample #84

Same as sample #35 except the sampler was placed on the welder's bench in the mechanics shop.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	13.33
Liters of air sampled	450
Radiation level	$1.76 \times 10^{-11}$ $\mu$ C/ml

Sample #85

Same as sample #35 except the sampler was placed in the center of the mechanic shop.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	11.82
Liters of air sampled	450
Radiation level	$1.56 \times 10^{-11}$ $\mu$ C/ml



September 2, 1959

Sample #86

Same as sample #35 except the sampler was placed between the vari-drives from A and B bin. Sample taken August 19, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	22.73
Liters of air sampled	450
Radiation level	$3.01 \times 10^{-11}$ $\mu$ C/ml

Sample #87

Same as sample #35 except the sampler was placed on top of the weightometer above #8 conveyor belt.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	20.31
Liters of air sampled	450
Radiation level	$2.69 \times 10^{-11}$ $\mu$ C/ml

Sample #88

Same as sample #35 except the sampler was placed on the table immediately in front of the tonnage recorder.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	6.25
Liters of air sampled	450
Radiation level	$8.26 \times 10^{-12}$ $\mu$ C/ml

Sample #89

Same as sample #35 except the sampler was placed south of the 42" DeECO screen on the first deck of the mill building on the platform where iron is added to the Ion Exchange Feed.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	15.63
Liters of air sampled	450
Radiation level	$2.07 \times 10^{-11}$ $\mu$ C/ml

Sample #90

Same as sample #35 except the sampler was on the first deck of the mill building directly beneath #4 classifier.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	20.31
Liters of air sampled	450
Radiation level	$2.69 \times 10^{-11}$ $\mu$ C/ml

Sample #91

Same as sample #35 except the sampler was placed by the east pump from the Ion Exchange Feed holding tank on the first deck of the mill building.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	25.00
Liters of air sampled	450
Radiation level	$3.21 \times 10^{-11}$ $\mu$ C/ml

Sample #92

General air sample collected in the warehouse office. The sampler was placed on top of the desk. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. This sample collected August 19, 1959.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	15.63
Liters of air sampled	450
Radiation level	$2.07 \times 10^{-11}$ $\mu$ C/ml

Sample #93

Same as sample #35 except the sampler was on the first deck of the mill building beneath the leach tanks.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	18.75
Liters of air sampled	450
Radiation level	$2.48 \times 10^{-11}$ $\mu$ C/ml

Sample #94

Same as sample #35 except the sampler was placed next to the Calisher pump from the rod mill to the #1 leach tank.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	7.81
Liters of air sampled	450
Radiation level	$1.03 \times 10^{-11}$ $\mu$ C/ml

Sample #95

Same as sample #5 except the sampler was placed next to the feed end of the rod mill north of #8 conveyor belt.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	421.21
Liters of air sampled	450
Radiation level	$5.57 \times 10^{-10}$ $\mu$ C/ml

Sample #96

Same as sample #35 except the sampler was placed next to the weightometer.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	178.79
Liters of air sampled	450
Radiation level	$2.36 \times 10^{-10}$ $\mu$ C/ml

September 2, 1959

Sample #97

Same as sample #35 except the sampler was placed between the east side of the holding tank and the small lime tank.

U <sub>3</sub> O <sub>8</sub> collected on filter paper	94.32
Liters of air sampled	450
Radiation level	$1.25 \times 10^{-10}$ $\mu$ C/ml

---

G. F. Richards

gfr:cn

cc: A. D. Gray  
H. L. Hazen ✓

H. D. Webb

G. F. Richards

Operations Milling - RADIATION

This report completes the second airborne dust survey, the first part of which was reported September 2, 1959. The filter paper was assayed using the procedure recommended in WIM 111, pages 39 and 40. The level of radioactivity was calculated by the following formula:

$$\mu\text{C/ml} = \text{gas U}_3\text{O}_8/\text{liter} \times 0.595 \times 10^{-3}$$

$$\text{Maximum Permissible Concentration (MPC)} = 5 \times 10^{-11} \mu\text{C/ml}$$

Sample #98

General air sample collected in the Buying Station in the moisture determination room. The sampler was placed on the north wall west of the crusher. During the sample period, the crusher was operating, the bucking table was swept off, samples were being weighed and placed in the oven. Dry samples were taken from the oven, reweighed and dumped into the wheel-barrow in this room. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample taken August 20, 1959.

Micrograms $\text{U}_3\text{O}_8$ collected on filter paper	74.19
Liters of air sampled	450
Radiation level	$9.81 \times 10^{-11} \mu\text{C/ml}$

Sample #99

Same as sample #98 except the sampler was placed on the south wall.

Micrograms $\text{U}_3\text{O}_8$ collected on filter paper	46.97
Liters of air sampled	450
Radiation level	$6.21 \times 10^{-11} \mu\text{C/ml}$

Sample #100

Same as sample #98 except the sampler was placed next to the scale on the west wall in this room.

Micrograms $\text{U}_3\text{O}_8$ collected on filter paper	24.19
Liters of air sampled	450
Radiation level	$3.20 \times 10^{-11} \mu\text{C/ml}$

September 17, 1959

Sample #101

Same as sample #98 except the sampler was placed in the scale room on the desk in the northwest corner.

Micrograms $U_3O_8$ collected on filter paper	24.64
Liters of air sampled	450
Radiation level	$3.26 \times 10^{-11}$ $\mu C/ml$

Sample #102

Same as sample #3 except the sample was collected August 20, 1959.

Micrograms $U_3O_8$ collected on filter paper	27.54
Liters of air sampled	450
Radiation level	$3.64 \times 10^{-11}$ $\mu C/ml$

Sample #103

Breathing zone sample taken of sampler during the period of taking dry ore from the oven in the sample room in the crushing plant and placing these samples into the 2 cubic foot blender. Sample time was 15 minutes with a flow rate of 15 liters of air per minute. Sample collected August 20, 1959.

Micrograms $U_3O_8$ collected on filter paper	238.71
Liters of air sampled	225
Radiation level	$6.31 \times 10^{-10}$ $\mu C/ml$

Sample #104

Same as sample #103 except the sampler was grinding samples in the Anglebach grinder, emptied the five cubic foot blender and cleaned the Anglebach and some sample sacks with compressed air.

Micrograms $U_3O_8$ collected on filter paper	545.16
Liters of air sampled	150
Radiation level	$2.16 \times 10^{-9}$ $\mu C/ml$

Sample #105

Same as sample #103 except the sampler emptied both the small blender and the large blender, split samples through the Jones Splitter and refilled the blenders.

Micrograms $U_3O_8$ collected on filter paper	247.07
Liters of air sampled	150
Radiation level	$9.80 \times 10^{-10}$ $\mu C/ml$

Sample #106

This is a repeat of sample #103 with a sample time of 10 minutes at a flow rate of 15 liters of air per minute instead of the previous 15 minute sample period.

Micrograms $U_3O_8$ collected on filter paper	408.82
Liters of air sampled	150
Radiation level	$1.62 \times 10^{-9}$ $\mu C/ml$

September 17, 1959

Sample #107

Repeat of sample #104.

Micrograms $U_3O_8$ collected on filter paper	350.00
Liters of air sampled	150
Radiation level	$1.39 \times 10^{-9}$ $\mu C/ml$

Sample #108

Same as sample #105 except the sample time was 15 minutes instead of 10 minutes. Flow rate was 15 liters of air per minute.

Micrograms $U_3O_8$ collected on filter paper	350.00
Liters of air sampled	225
Radiation level	$9.26 \times 10^{-10}$ $\mu C/ml$

Sample #109

Same as sample #103 except the sample was taken during the splitting of two samples through the Jones Splitter. Sample time was 10 minutes at a flow rate of 15 liters of air per minute.

Micrograms $U_3O_8$ collected on filter paper	163.64
Liters of air sampled	150
Radiation level	$6.49 \times 10^{-10}$ $\mu C/ml$

Sample #110

Same as sample #103 except sample was taken during the time that the air hose was turned on to clean all equipment in the sample preparation room. Sample time was 10 minutes at a flow rate of 15 liters of air per minute.

Micrograms $U_3O_8$ collected on filter paper	360.60
Liters of air sampled	150
Radiation level	$1.43 \times 10^{-9}$ $\mu C/ml$

Sample #111

Breathing zone sample of the sampler taken in the sample preparation room in the Buying Station. This sample collected during the period the sampler took a sample from the oven and placed it in the small blender and blended the dry ore.

Micrograms $U_3O_8$ collected on filter paper	68.12
Liters of air sampled	225
Radiation level	$1.80 \times 10^{-10}$ $\mu C/ml$

Sample #112

Same as sample #111 except this sample was taken during the period that the air hose was turned on to clean the equipment.

Micrograms $U_3O_8$ collected on filter paper	30.44
Liters of air sampled	225
Radiation level	$8.07 \times 10^{-11}$ $\mu C/ml$

September 17, 1959

Sample #113

Same as sample #111 except blender was cleaned and blown out with compressed air.

Micrograms $U_3O_8$ collected on filter paper	59.68
Liters of air sampled	225
Radiation level	$1.58 \times 10^{-10}$ $\mu C/ml$

Sample #114

Same as sample #111 except the blender was running and ore was being pulverized in the Braun pulverizer.

Micrograms $U_3O_8$ collected on filter paper	22.58
Liters of air sampled	225
Radiation level	$5.97 \times 10^{-11}$ $\mu C/ml$

Sample #115

Same as sample #111 except the air hose was turned on to clean equipment again.

Micrograms $U_3O_8$ collected on filter paper	32.26
Liters of air sampled	225
Radiation level	$8.53 \times 10^{-11}$ $\mu C/ml$

Sample #116

Same as sample #111 except the blender was cleaned again with air. This completes one complete cycle from taking the sample out of the oven, blending it, splitting it, pulverizing it, blending it, and placing the pulverized sample in the 6-ounce packages.

Micrograms $U_3O_8$ collected on filter paper	41.94
Liters of air sampled	225
Radiation level	$1.11 \times 10^{-10}$ $\mu C/ml$

Sample #117

Same as sample #111 except the pulverizer and the screens were cleaned by brushing and then blowing out with compressed air.

Micrograms $U_3O_8$ collected on filter paper	81.81
Liters of air sampled	225
Radiation level	$2.16 \times 10^{-10}$ $\mu C/ml$

Sample #118

Same as sample #111 except all equipment was cleaned with the use of an air hose.

Micrograms $U_3O_8$ collected on filter paper	87.88
Liters of air sampled	225
Radiation level	$2.32 \times 10^{-10}$ $\mu C/ml$



September 17, 1959

Sample #119

Breathing zone sample taken of the productman during the period that a drum was placed under the hopper and the drum was being loaded. Sample time was 15 minutes at a flow rate of 15 liters of air per minute. Sample collected August 21, 1959.

Micrograms $U_3O_8$ collected on filter paper	2269.70
Liters of air sampled	225
Radiation level	$6.00 \times 10^{-9}$ $\mu C/ml$

Sample #120

Same as sample #119 except the sample was taken from the drum, the drum was sealed and the sample was placed in the sample bucket.

Micrograms $U_3O_8$ collected on filter paper	2269.70
liters of air sampled	225
Radiation level	$6.00 \times 10^{-9}$ $\mu C/ml$

Sample #121

Same as sample #111 except the sample was taken during the period that the weights were painted on the drums. During this period, a drum was also being loaded.

Micrograms $U_3O_8$ collected on filter paper	231.25
Liters of air sampled	225
Radiation level	$6.12 \times 10^{-10}$ $\mu C/ml$

Sample #122

Same as sample #119 except the sample was taken during the period that part of one barrel was transferred to another barrel in order to level the top. This transfer is taken care of by use of a scoop.

Micrograms $U_3O_8$ collected on filter paper	33317.00
Liters of air sampled	225
Radiation level	$8.81 \times 10^{-8}$ $\mu C/ml$

Sample #123

Same as sample #119 except yellow cake was being transferred from one drum to another.

Micrograms $U_3O_8$ collected on filter paper	13220.59
Liters of air sampled	225
Radiation level	$3.50 \times 10^{-8}$ $\mu C/ml$

Sample #124

Same as sample #119 except the composite yellow cake sample was blended, weighed, one sample placed in a jar and another sample placed in the oven for moisture determinations.

September 17, 1959

Micrograms $U_3O_8$ collected on filter paper	585.29
Liters of air sampled	225
Radiation level	$1.55 \times 10^{-9}$ $\mu$ C/ml

Sample #125

Same as sample #119 except the sample was taken during the time that the productman was washing down and cleaning the dryer.

Micrograms $U_3O_8$ collected on filter paper	8562.50
Liters of air sampled	225
Radiation level	$2.26 \times 10^{-8}$ $\mu$ C/ml

Sample #126

General air sample same as sample #7 except this sample was collected August 22, 1959. This sample was taken after the high pressure hose from barrel jolter to the exhaust line leading to the outside of the building was repaired.

Micrograms $U_3O_8$ collected on filter paper	18.75
Liters of air sampled	450
Radiation level	$2.48 \times 10^{-11}$ $\mu$ C/ml

Sample #127

Same as sample #6 and sample #126.

Micrograms $U_3O_8$ collected on filter paper	934.38
Liters of air sampled	450
Radiation level	$1.24 \times 10^{-9}$ $\mu$ C/ml

Sample #128

Source sample taken where the new rubber hose was placed on the exhaust line from the barrel jolter. Barrels were being loaded during this period. Sample time was 15 minutes at a flow rate of 15 liters of air per minute. This sample collected August 22, 1959.

Micrograms $U_3O_8$ collected on filter paper	300.00
Liters of air sampled	225
Radiation level	$7.93 \times 10^{-10}$ $\mu$ C/ml

Sample #129

General air sample collected in the concentrate section. The sampler was placed on the table along the west wall. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample collected August 22, 1959.

Micrograms $U_3O_8$ collected on filter paper	1467.65
Liters of air sampled	450
Radiation level	$1.94 \times 10^{-9}$ $\mu$ C/ml

Sample #130

Source sample same as #128. This is a recheck of #128. During the time that this source sample was taken, the drum was leaking at the seal along the top of the barrel.

Micrograms $U_3O_8$ collected on filter paper	2350.00
Liters of air sampled	225
Radiation level	$6.21 \times 10^{-9}$ $\mu$ C/ml

Sample #131

General air sample collected in the mill building on the second deck between P-3 and E-1 tanks. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample collected August 22, 1959.

Micrograms $U_3O_8$ collected on filter paper	31.82
Liters of air sampled	450
Radiation level	$4.21 \times 10^{-11}$ $\mu$ C/ml

Sample #132

General air sample same as sample #43. Sampler was placed between E-3 tank and the yellow cake press. Sample collected August 22, 1959.

Micrograms $U_3O_8$ collected on filter paper	56.06
Liters of air sampled	450
Radiation level	$7.41 \times 10^{-11}$ $\mu$ C/ml

Sample #133

General air sample collected in the mill building on the second deck between #1 and #2 yellow cake presses. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample collected August 22, 1959.

Micrograms $U_3O_8$ collected on filter paper	261.76
Liters of air sampled	450
Radiation level	$3.46 \times 10^{-10}$ $\mu$ C/ml

Sample #134

Same as sample #133 except the sampler was placed on the second deck above the yellow cake barrel loading section.

Micrograms $U_3O_8$ collected on filter paper	55.88
Liters of air sampled	450
Radiation level	$7.39 \times 10^{-11}$ $\mu$ C/ml

Sample #135

Same as sample #133 except the sampler was placed next to yellow cake dryer during the period that the dryer was being washed down and cleaned.

Micrograms $U_3O_8$ collected on filter paper	61.76
Liters of air sampled	450
Radiation level	$8.17 \times 10^{-11}$ $\mu$ C/ml

September 17, 1959

Sample #136

Same as sample #61 except the sample was collected August 23, 1959.

Micrograms $U_3O_8$ collected on filter paper	61.76
Liters of air sampled	450
Radiation level	$8.17 \times 10^{-11}$ $\mu C/ml$

Sample #137

Same as sample #49 except the sample was collected August 23, 1959.

Micrograms $U_3O_8$ collected on filter paper	67.14
Liters of air sampled	450
Radiation level	$8.88 \times 10^{-11}$ $\mu C/ml$

Sample #138

Same as sample #137 except the sampler was placed in the center of the Utility Shop.

Micrograms $U_3O_8$ collected on filter paper	35.71
Liters of air sampled	450
Radiation level	$4.72 \times 10^{-11}$ $\mu C/ml$

Sample #139

Same as sample #137 except the sampler was placed along the west end of the Utility Shop.

Micrograms $U_3O_8$ collected on filter paper	40.00
Liters of air sampled	450
Radiation level	$5.29 \times 10^{-11}$ $\mu C/ml$

Sample #140

Source sample taken when the 2 cubic foot ore blender in the sample preparation room in the crushing building was being dumped. Sample time was five minutes at a flow rate of 15 liters of air per minute. This sample collected August 13, 1959.

Micrograms $U_3O_8$ collected on filter paper	225.71
Liters of air sampled	75
Radiation level	$1.79 \times 10^{-9}$ $\mu C/ml$

Sample #141

Same as sample #140 except the source sample was taken of the Jones splitter during the time that ore was being split.

Micrograms $U_3O_8$ collected on filter paper	1097.14
Liters of air sampled	75
Radiation level	$8.70 \times 10^{-9}$ $\mu C/ml$

Sample #142

Breathing zone sample taken of the productman during the time that he was blending the composite yellow cake sample and weighing out the samples. Sample time was 10 minutes at a flow rate of 15 liters of air per minute. This sample collected August 23, 1959.

Micrograms $U_3O_8$ collected on filter paper	468.57
Liters of air sampled	150
Radiation level	$1.86 \times 10^{-9}$ $\mu$ C/ml

Sample #143

Same as sample #142 except the breathing zone sample was taken during the time that the productman was working at the scale weighing the barrels.

Micrograms $U_3O_8$ collected on filter paper	940.00
Liters of air sampled	150
Radiation level	$3.73 \times 10^{-9}$ $\mu$ C/ml

Sample #144

Source sample taken of the Jones Splitter in the sample preparation room in the Buying Station. During this period, dry ore was being split. Sample time was 5 minutes at a flow rate of 15 liters of air per minute. Sample collected August 24, 1959.

Micrograms $U_3O_8$ collected on filter paper	454.29
Liters of air sampled	75
Radiation level	$3.60 \times 10^{-9}$ $\mu$ C/ml

Sample #145

Same as sample #144 except this source sample was taken next to the pulverizer at the ore inlet chute.

Micrograms $U_3O_8$ collected on filter paper	87.50
Liters of air sampled	450
Radiation level	$1.16 \times 10^{-10}$ $\mu$ C/ml

Sample #146

Same as sample #144 except this source sample was taken by the vibrating screens.

Micrograms $U_3O_8$ collected on filter paper	90.06
Liters of air sampled	450
Radiation level	$1.19 \times 10^{-10}$ $\mu$ C/ml

Sample #147

Same as sample #144 except this source sample was taken during the time that the small blender was being emptied and cleaned.

Micrograms $U_3O_8$ collected on filter paper	37.50
Liters of air sampled	450
Radiation level	$4.96 \times 10^{-11}$ $\mu$ C/ml

September 17, 1959

Sample #148

Same as sample #144 except this source sample was taken on the table in the center of the room next to the splitter. This is a recheck of sample #144.

Micrograms $U_3O_8$ collected on filter paper	156.25
Liters of air sampled	75
Radiation level	$1.24 \times 10^{-9}$ $\mu C/ml$

Sample #149

Source sample taken of the discharge hose from the barrel jolter to the exhaust line in the yellow cake packaging area. This is a recheck as there were some other adjustments made to the hose. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample collected August 24, 1959.

Micrograms $U_3O_8$ collected on filter paper	6057.58
Liters of air sampled	450
Radiation level	$8.01 \times 10^{-9}$ $\mu C/ml$

Sample #150

General air sample collected on the first deck of the mill building between R.I.P. baskets #6 and #7 east of the yellow-cake barreling section.

Micrograms $U_3O_8$ collected on filter paper	238.24
Liters of air sampled	450
Radiation level	$3.15 \times 10^{-10}$ $\mu C/ml$

Sample #151

General air sample collected on the first deck of the mill building between the two compressors along the south wall.

Micrograms $U_3O_8$ collected on filter paper	41.18
Liters of air sampled	450
Radiation level	$5.44 \times 10^{-11}$ $\mu C/ml$

Sample #152

General air sample collected between P-1 tank and the SX tank on the first deck of the mill building. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample collected August 24, 1959.

Micrograms $U_3O_8$ collected on filter paper	14.71
Liters of air sampled	450
Radiation level	$1.94 \times 10^{-11}$ $\mu C/ml$

Sample #153

General air sample collected on the first deck of the mill building north of and between P-3 and E-1 tanks, over the sump.

Micrograms $U_3O_8$ collected on filter paper	35.29
Liters of air sampled	213.75
Radiation level	$9.82 \times 10^{-11}$ $\mu C/ml$

September 17, 1959

Sample #154

General air sample collected above the hold tank on the third deck of the mill building.

Micrograms $U_3O_8$ collected on filter paper	81.25
Liters of air sampled	450
Radiation level	$1.07 \times 10^{-10}$ $\mu C/ml$

Sample #155

General air sample collected in the crusher plant west of the control panel and east of the vibrating grizzly. This is a re-run of sample #8.

Micrograms $U_3O_8$ collected on filter paper	86.77
Liters of air sampled	450
Radiation level	$1.14 \times 10^{-10}$ $\mu C/ml$

Sample #156

Same as sample #9 collected between #1 and #2 chain and bucket samplers on the third deck of the crusher building.

Micrograms $U_3O_8$ collected on filter paper	76.47
Liters of air sampled	450
Radiation level	$1.01 \times 10^{-10}$ $\mu C/ml$

Sample #157

General air sample collected in the crusher building north of the 5 x 6 jaw crusher on the second deck of the crusher building.

Micrograms $U_3O_8$ collected on filter paper	55.88
Liters of air sampled	450
Radiation level	$7.39 \times 10^{-11}$ $\mu C/ml$

Sample #158

Source sample collected at the south vent in the concentrate dryer on the second deck of the mill building. Sample time was 30 minutes at a flow rate of 15 liters of air per minute. Sample collected August 25, 1959.

Micrograms $U_3O_8$ collected on filter paper	100.00
Liters of air sampled	450
Radiation level	$1.32 \times 10^{-10}$ $\mu C/ml$

Sample #159

General air sample collected on top of the yellow-cake dryer on the second deck of the mill building.

Micrograms $U_3O_8$ collected on filter paper	47.06
Liters of air sampled	405
Radiation level	$6.91 \times 10^{-10}$ $\mu C/ml$



Operations Milling - RADIATION

-12-

September 17, 1959

The foregoing completes the Radiation report of dust samples.

---

C. F. Richards

gfr:cn

cc: A. D. Gray  
H. L. Haxen

H. L. HAZEN, INC.  
METALLURGICAL ENGINEERS  
777 GRANT STREET  
DENVER 3, COLORADO

SE 2-6

TELEPHONE AM 5 2554

### EXTERNAL RADIATION SURVEYS

These surveys were made between February 3, 1959 and October 20, 1959. They show that the "red cake" filter will occasionally emit more than MPC (6 mr/hr). This was corrected and is kept corrected by washing the outside of this filter with water. No employee stays near this filter more than an hour or so when it needs cleaning a couple of times a week. At no time did any employee receive more than MPC from this source.

  
\_\_\_\_\_  
H. L. Hazen

10/20/59

J. H. D. W.  
Krom & H. R.

A survey of the #3 red cake press today with the O. Keeline Rumbly meter revealed the following results.

High	Low	Avg
2.60 m/hr	0.90 m/hr	1.40 m/hr

There is very little evidence of salting on the cloths.

E. P. Richard

9/12/54

TO H DW  
FROM G FR

A check of the #3 press with the ebullient  
Survey meter reveals the following results:

H <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>
3.0 m/hr	1.5 m/hr	9.0 m/hr

*[Signature]*

TO HDW  
FROM GFR

8/12/59

A review of the #3 red oak pins revealed that the readings with the Eames runway meter are in the range of 2.00 to 1.00 m/yr with an average of 1.4 m/yr.

G. F. Nichols

## INTEROFFICE CORRESPONDENCE

RECV D.

32

Company Mines Development, Inc.

Date July 21, 1959

To: H. D. Webb

*Main Div.  
Radiation*

From: G. F. Richards

Subject: Operations - Milling  
Radiation

The following survey was made with the Sberline Meter for a check against readings to be received from the film badge survey. The Meter was held waist high and readings were taken about 1 foot from the equipment except where noted.

<u>Location</u>	<u>Milliroentgens/Hour</u>	
	<u>High</u>	<u>Low</u>
First Deck	0.6	0.1
Product Room	0.4	0.1
Second Deck	0.3	0.06
Y.C. Presses and Dryer	1.3	0.6
Third Deck	0.2	0.06
*Red Cake Press (before cleaning)	9.0	7.0
*Red Cake Press (after cleaning)	3.0	1.0
Crushing, Sampling & Buying Station	0.10	0.06
Laboratory	0.08	0.06
Sand Tails (3 ft above sand)	0.09	0.04
#1 Slime Tailings (3 ft above solution)	0.06	Nil
#2 Slime Tailings (Dry Slime along road to Mill)	0.15	0.10
#3 Slime Tailings (Dry Slime 8 ft above)	0.80	0.60
#3 " " (Solution 8 ft above)	0.06	0.04

\*The red cake press had considerable dry salt on the filter cloths outside of press. These cloths were soaked in acid and the frames scrubbed to remove all salts. The readings are now below maximum permissible concentration, which is 300 Mr per week. With a rubber glove held between the counter and the clean press, the readings are 1.0 Mr/Hour in place of 5.0 Mr/Hour two inches from the press without the glove. Thus, the wearing of gloves and aprons should give maximum protection during the hour/week that the press is cleaned.

G. F. Richards

gfr:cn

cc: A. D. Gray  
H. L. Hazen



# Radiation Report

Page 57

The following work concerning radiation has been completed to date

(1) Radiation signs have been placed on main entrances to the mill and the property

(2) Geiger Counter Surveys - Gamma Radiation

(a) Sand Tailings - <sup>above</sup> 0.00 to 0.10 MR/hour

(b) Slime Tailings

Surface above dry slime	1.00 MR/hour
Cracks about 2 ft from surface	0.40 MR/hour
Water covering slime	2.00 MR/hour

(c) Stone pile

Surface about 1 ft 0.04 to 0.08 MR/hour

(d) Concentrate

Open from - 10 ft	0.05 MR/hour
3 ft from - 10 ft	0.04 MR/hour
Bottom of pit below tank	0.30 MR/hour
8 ft from bottom of tank	0.00 MR/hour

(3) Film Badge Survey

Film ~~badge~~ badges were placed throughout the mill and property ~~the radiation was negligible for~~ and on selected personnel. The readings on personnel were negligible except for Richards - 12 mR, 30 mR <sup>on 10/1</sup> and 11 mR for a Mortimer at 10 mR. All signs were relatively free of radiation except ~~3 mR~~ <sup>3 mR</sup> on the slime tailings ~~was 2.00 MR/hour~~ 300 mR reading of Gamma rays for 168 hours exposure and 3 ft above slime tailings ~~was 2.00 MR/hour~~ <sup>on 10/1</sup> 200 mR of Gamma rays for 168 hours and 25 31 day old concentrate gave 195 mR of Gamma rays for 144 hours. Another film badge survey will be made in the near future



#### (4) Air Samples

At the present time we are exchanging the air pump we have for a calibrated air sampler ~~from the same~~  
com

#### (5) Urine samples

One urine sample was analyzed with a Doherty and assayed fluorimetrically. The result was 11.5  $\mu$ g/lit. assayed 11.5  $\mu$ g/lit. 0.0005 grams daily ~~liters~~ ~~liters~~ ~~liters~~ and 5.0 micrograms/liter. Assay fluorimetrically are not accurate below the above levels.

J. F. Pichard

H. L. HAZEN, INC.  
1000 UNIVERSITY BUILDING  
1000 UNIVERSITY STREET  
DENVER 3, COLORADO

SEP-7

TELEPHONE AM 6-2154

Urine Analyses - May 22, 1959 - June 22, 1959

No MPC was established in Part 20 for uranium in urine. Early in the program an effort was made to prove a direct relation between dust borne radiation and the amount of uranium in urine. This work showed no direct quantitative relation between the two although a qualitative relationship was shown.

None of these urine analyses were higher than a limit of 0.05 mg U/liter standard suggested by National Lead Company working under contract for the AEC.

H. L. Hazen  
H. L. Hazen

INTEROFFICE CORRESPONDENCE

2022-01-01

Company Mince Development, Inc.

Date June 3, 1959

To: H. D. Webb

From: G. F. Richards

Subject: Operations Milling - 2022-01-01

Following are the results of the urine samples taken the weekend of 5-22-59 - 5-25-59.

- |  |                  |
|--|------------------|
| (1) George Lord, Mechanic                  |                  |
| Sample #1 collected 9:25 PM 5-22-59        | 0.031 mg U/liter |
| Sample #2 collected 7:05 AM 5-25-59        | 2.033 mg U/liter |
| (2) Roy Davis, Sampler                     |                  |
| Sample #1 collected 10:00 PM 5-23-59       | 0.081 mg U/liter |
| Sample #2 collected 7:00 AM 5-25-59        | 0.055 mg U/liter |
| (3) Walter Ray, Rod Millman                |                  |
| Sample #1 collected 7:00 PM 5-23-59        | 0.079 mg U/liter |
| Sample #2 collected 7:00 AM 5-25-59        | 0.041 mg U/liter |
| (4) Clarence Christensen, Crusher Operator |                  |
| Sample #1 collected 1:30 PM 5-23-59        | 0.079 mg U/liter |
| Sample #2 collected 7:00 AM 5-25-59        | 0.041 mg U/liter |
| (5) John McKnight, Productman              |                  |
| Sample #1 collected 9:00 PM 5-23-59        | 0.086 mg U/liter |
| Sample #2 collected 5:30 AM 5-25-59        | 0.056 mg U/liter |

All of the samples were assayed and calculated by the procedures in IM 114, Appendix Section 7.

Only the sampler and productman are above the 0.05 mg U/liter standards set up by National Lead and they are on the borderline. This set backs up the results of the first set of dust samples which were all below maximum permissible concentration and certainly shows us that our dust is at a minimum and that these employees are following all good rules of personal health.

G. F. Richards

fr/cn

cc: Mr. L. Baker  
Mr. F. Gray

# INTEROFFICE CORRESPONDENCE

Company Mines Development, Inc.

Date July 4, 1959

To: H. D. Webb

From: G. F. Richards

Subject: Operations Milling - 1111 TON

Following are the results of the urine samples taken the weekend of 6-20-59 - 6-22-59:

1. Clarence Christensen, Crusher Operator  
 Sample #1, collected PM 6-20-59 0.043 mgU/liter  
 Sample #2, collected AM 6-22-59 0.022 mgU/liter
2. Floyd Schermer, Mill Operator (Gr Section)  
 Sample #1, collected PM 6-20-59 0.026 mgU/liter  
 Sample #2, collected AM 6-22-59 0.039 mgU/liter
3. John McKnight, Production  
 Sample #1, collected PM 6-20-59 0.039 mgU/liter  
 Sample #2, collected AM 6-22-59 0.015 mgU/liter
4. Roy Davis, Operator  
 Sample #1, collected PM 6-20-59 0.039 mgU/liter  
 Sample #2, collected AM 6-22-59 0.022 mgU/liter
5. Wray Martineau, Utility  
 Sample #1, collected PM 6-20-59 0.020 mgU/liter  
 Sample #2, collected AM 6-22-59 0.032 mgU/liter
6. Don McKinney, Equipment Operator  
 Sample #1, collected PM 6-20-59 0.010 mgU/liter  
 Sample #2, collected AM 6-22-59 0.011 mgU/liter
7. Don Wilson, Mill Operator (Gr Mill)  
 Sample #1, collected PM 6-20-59 0.030 mgU/liter  
 Sample #2, collected AM 6-22-59 0.030 mgU/liter
8. Marty Wilson, Mill Operator (Red Mill)  
 Sample #1, collected PM 6-20-59 0.035 mgU/liter  
 Sample #2, collected AM 6-22-59 0.032 mgU/liter

All of the samples were assayed and calculated by the procedures in 418 114, Appendix Section 7.

All samples assayed less than 0.05 mgU/liter.

G. F. Richards

Kinross Development, Inc.

January 28, 1960

H. D. Webb

LE-9

G. F. Richards

VARIATION - SURVEYS

Airborne - Radiation

Following are the results of the January, 1960 airborne dust survey. The filter paper was assayed using the procedure recommended in WIN III, pages 39 and 40. The level of radioactivity was calculated by the following formula:

$$\begin{aligned} \text{Microcuries (MC)/ml} &= \mu \text{ U}_3\text{O}_8/\text{liter} \times 0.595 \times 10^{-3} \\ \text{Maximum Permissible Concentration (MPC)} &= 5 \times 10^{-11} \text{ MC/ml} \end{aligned}$$

All samples were taken under normal operating conditions. The flow rate for all samples was 20 liters of air per minute.

*Wet ore*  
Dust samples taken specifically in the crushing plant were obtained while wet ore was being run, this is a normal condition for the winter months.

Samples one through sixty-eight are general air samples taken in the mill building. The sampling time was 30 minutes.

#### Sample #1

Sample was collected in front of the P.E. controllers above #1 and #2 leach tanks, January 4, 1960.

$\text{U}_3\text{O}_8$ collected on filter paper	55.07
Liters of air sampled	600
Radiation level	$5.44 \times 10^{-11} \text{ MC/ml}$

#### Sample #2

Sample was taken above #4 leach tank west of the  $\text{NaClO}_3$  feeder, January 4, 1960.

$\text{U}_3\text{O}_8$ collected on filter paper	46.38
Liters of air sampled	600
Radiation level	$4.60 \times 10^{-11} \text{ MC/ml}$



January 28, 1960

Sample #3

Sample was collected on third deck near central control panel #3, January 4, 1960.

✓ U <sub>3</sub> O <sub>8</sub> collected on filter paper	42.03
Liters of air sampled	600
Radiation level	$4.17 \times 10^{-11}$ $\mu$ C/ml

Sample #4

Sample was collected on platform by #1 cyclone and pump box to #1 cyclone, January 4, 1960.

✓ U <sub>3</sub> O <sub>8</sub> collected on filter paper	69.37
Liters of air sampled	600
Radiation level	$6.90 \times 10^{-11}$ $\mu$ C/ml

Sample #5

Sample was collected from passage south of the filter by shift foreman's office, January 4, 1960.

✓ U <sub>3</sub> O <sub>8</sub> collected on the filter paper	70.59
Liters of air sampled	600
Radiation level	$6.96 \times 10^{-11}$ $\mu$ C/ml

Sample #6

Sample was taken at top of stairs north of the filter on 3rd deck by shift foreman's office, January 4, 1960.

✓ U <sub>3</sub> O <sub>8</sub> collected on the filter paper	186.76
Liters of air sampled	600
Radiation level	$1.85 \times 10^{-11}$ $\mu$ C/ml

Sample #7

Sample was collected above the hold tank, January 4, 1960.

✓ U <sub>3</sub> O <sub>8</sub> collected on the filter paper	66.18
Liters of air sampled	600
Radiation level	$6.55 \times 10^{-11}$ $\mu$ C/ml

Sample #8

Sample was collected near central control panel #7 north of shift foreman's office, January 4, 1960

✓ U <sub>3</sub> O <sub>8</sub> collected on the filter paper	38.24
Liters of air sampled	600
Radiation level	$3.79 \times 10^{-11}$ $\mu$ C/ml

January 28, 1960

Sample # 9

Sample was taken near control center #6 on third deck, January 4, 1960.

✓ $U_3O_8$ collected on the filter paper	13.87
Liters of air sampled	600
Radiation level	$1.57 \times 10^{-11}$ $\mu C/ml$

Sample # 10

Sample collected near RIF control distribution wheel on third deck, January 5, 1960.

✓ $U_3O_8$ collected on the filter paper	136.51
Liters of air sampled	600
Radiation level	$1.55 \times 10^{-11}$ $\mu C/ml$

Sample # 11Sample taken on third and  $\frac{1}{2}$  deck near RIF feed weir, January 5, 1960.

✓ $U_3O_8$ collected on the filter paper	788.89
Liters of air sampled	600
Radiation level	$7.79 \times 10^{-11}$ $\mu C/ml$

Sample # 12

Sample taken north of concentrate dust collector on third deck, January 5, 1960.

✓ $U_3O_8$ collected on the filter paper	42.86
Liters of air sampled	600
Radiation level	$4.22 \times 10^{-11}$ $\mu C/ml$

Sample # 13

Sample collected west of sack filter on third deck, January 5, 1960.

✓ $U_3O_8$ collected on the filter paper	84.13
Liters of air sampled	600
Radiation level	$8.53 \times 10^{-11}$ $\mu C/ml$

Sample # 14

Sample taken between holding tank and #2 classifier on second deck, January 5, 1960.

✓ $U_3O_8$ collected on the filter paper	30.16
Liters of air sampled	600
Radiation level	$2.99 \times 10^{-11}$ $\mu C/ml$

Sample # 15

Sample lost



January 16, 1960

Sample # 16

Sample was taken between #2 and #3 classifiers, January 5, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	28.57
Liters of air sampled	600
Radiation level	$2.83 \times 10^{-11}$ $\mu$ C/ml

Sample # 17

Sample was collected west of #3 classifier, January 5, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	1.64
Liters of air sampled	600
Radiation level	$1.61 \times 10^{-12}$ $\mu$ C/ml

Sample # 18

Sample was taken at the SA operators sink on second deck, January 5, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	85.25
Liters of air sampled	600
Radiation level	$8.45 \times 10^{-11}$ $\mu$ C/ml

Sample # 19

Sample collected between P-1 and P-2 tanks on second deck, January 5, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	42.62
Liters of air sampled	600
Radiation level	$4.22 \times 10^{-11}$ $\mu$ C/ml

Sample # 20

Sample taken between RIP tanks #13 and #12 on second deck, January 5, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	47.54
Liters of air sampled	600
Radiation level	$4.73 \times 10^{-11}$ $\mu$ C/ml

Sample # 21

Sample collected between RIP tanks #2 and #3 on second deck, January 5, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	27.69
Liters of air sampled	600
Radiation level	$2.74 \times 10^{-11}$ $\mu$ C/ml

January 28, 1960

Sample # 22

Sample taken between precip. tank #3 and eluate tank #1 on second deck,  
January 5, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

31.59

600

 $3.14 \times 10^{-11} \text{ } \mu\text{C/ml}$ Sample # 23

Sample collected on second deck between RIF baskets #8 and #9, January  
6, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

31.59

600

 $3.14 \times 10^{-11} \text{ } \mu\text{C/ml}$ Sample # 24

Sample taken on second deck between RIF tanks #6 and #7, January 6, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

2.31

600

 $2.29 \times 10^{-12} \text{ } \mu\text{C/ml}$ Sample # 25

Sample collected on second deck near west stairs between eluate tanks and  
the north yellow-oaks press, January 6, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

1.75

600

 $1.74 \times 10^{-12} \text{ } \mu\text{C/ml}$ Sample # 26

Sample taken on second deck west of the north yellow-oaks press, January  
6, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

3.51

600

 $3.48 \times 10^{-12} \text{ } \mu\text{C/ml}$ Sample # 27

Sample collected east of the north yellow-oaks press, January 6, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

1.75

600

 $1.74 \times 10^{-12} \text{ } \mu\text{C/ml}$

January 28, 1960

Sample # 28

Sample taken on second deck west of the south yellow-oaks press, January 6, 1960.

✓ $U_3O_8$ collected on the filter paper	3.51
Liters of air sampled	600
Radiation level	$3.48 \times 10^{-12}$ $\mu C/ml$

Sample # 29

Sample collected on second deck north of yellow-oaks dryer, January 6, 1960.

✓ $U_3O_8$ collected on the filter paper	2.54
Liters of air sampled	600
Radiation level	$2.52 \times 10^{-12}$ $\mu C/ml$

Sample # 30

Sample collected on second deck south of yellow-oaks dryer, January 6, 1960.

✓ $U_3O_8$ collected on the filter paper	1.69
Liters of air sampled	600
Radiation level	$1.67 \times 10^{-12}$ $\mu C/ml$

Sample # 31

Sample taken on third deck south of yellow-oaks dust collector, January 6, 1960.

✓ $U_3O_8$ collected on the filter paper	3.39
Liters of air sampled	600
Radiation level	$3.36 \times 10^{-12}$ $\mu C/ml$

Sample # 32

Sample taken on third deck near control control panel #9 south of yellow-oaks dust collector, January 6, 1960.

✓ $U_3O_8$ collected on the filter paper	2.34
Liters of air sampled	600
Radiation level	$2.51 \times 10^{-12}$ $\mu C/ml$

Sample # 33

Sample taken on second deck near the solvent extraction control panel, January 6, 1960.

✓ $U_3O_8$ collected on filter paper	3.28
Liters of air sampled	600
Radiation level	$3.25 \times 10^{-12}$ $\mu C/ml$

January 28, 1960

Sample # 34

Sample collected on second deck between #3 precip. tank and soda ash settlers, January 6, 1960.

✓  $U_3O_8$  collected on the filter paper  
 Liters of air sampled  
 Radiation level

4.28  
 600  
 $5.25 \times 10^{-12}$   $\mu C/ml$

Sample # 35

Sample taken on second deck west of soda ash settler tanks, January 6, 1960.

✓  $U_3O_8$  collected on the filter paper  
 Liters of air sampled  
 Radiation level

2.45  
 600  
 $2.44 \times 10^{-12}$   $\mu C/ml$

Sample # 36

Sample taken on second deck above soda ash holding tank, January 6, 1960.

✓  $U_3O_8$  collected on the filter paper  
 Liters of air sampled  
 Radiation level

1.64  
 600  
 $1.62 \times 10^{-12}$   $\mu C/ml$

Sample # 37

Sample collected on platform west of raffinate tank, January 7, 1960.

✓  $U_3O_8$  collected on the filter paper  
 Liters of air sampled  
 Radiation level

170.18  
 600  
 $1.69 \times 10^{-10}$   $\mu C/ml$

Sample # 38

Sample taken on first floor between raffinate tank and roller door, January 7, 1960.

✓  $U_3O_8$  collected on the filter paper  
 Liters of air sampled  
 Radiation level

2.38  
 600  
 $2.36 \times 10^{-12}$   $\mu C/ml$

Sample # 39

Sample collected west of #5 eluate tank and north of gate to yellow-sake area on first floor, January 7, 1960.

✓  $U_3O_8$  collected on the filter paper  
 Liters of air sampled  
 Radiation level

1.53  
 600  
 $1.58 \times 10^{-12}$   $\mu C/ml$

January 28, 1960

Sample # 40

Sample taken on soda ash storage platform on first deck, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	1.59
Liters of air sampled	600
Radiation level	$1.56 \times 10^{-12}$ #C/ml

Sample # 41

Sample collected on first floor, south of sample gate to the laboratory, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	12.90
Liters of air sampled	600
Radiation level	$1.28 \times 10^{-11}$ #C/ml

Sample # 42

Sample taken on first deck under soda ash settler tanks, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	4.84
Liters of air sampled	600
Radiation level	$4.80 \times 10^{-12}$ #C/ml

Sample # 43

Sample taken on first deck in front of time clock, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	1.61
Liters of air sampled	600
Radiation level	$1.59 \times 10^{-12}$ #C/ml

Sample # 44

Sample taken on first deck between five stage mixer settler tank and line tank, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	25.81
Liters of air sampled	600
Radiation level	$2.36 \times 10^{-11}$ #C/ml

Sample # 45

Sample collected on first deck east of #1 precip. tank, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	1.67
Liters of air sampled	600
Radiation level	$1.83 \times 10^{-12}$ #C/ml



January 28, 1960

Sample # 46

Sample taken in electrician's shop, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	1.67
Liters of air sampled	600
Radiation level	$1.55 \times 10^{-12}$ $\mu$ C/ml

Sample # 47

Sample taken in the center of the mechanic's shop, January 7, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	1.67
Liters of air sampled	600
Radiation level	$1.65 \times 10^{-12}$ $\mu$ C/ml

Sample # 48

Sample taken near the welder's bench in the mechanic shop, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	5.55
Liters of air sampled	600
Radiation level	$3.30 \times 10^{-12}$ $\mu$ C/ml

Sample # 49

Sample taken in the truck shop, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	1.64
Liters of air sampled	600
Radiation level	$1.62 \times 10^{-12}$ $\mu$ C/ml

Sample # 50

Sample taken in the northeast corner of the mechanic shop, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	16.39
Liters of air sampled	600
Radiation level	$1.62 \times 10^{-11}$ $\mu$ C/ml

Sample # 51

Sample was taken 10 feet north of the redmill, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	9.02
Liters of air sampled	600
Radiation level	$8.95 \times 10^{-12}$ $\mu$ C/ml

January 28, 1960

Sample # 52

Sample collected at rod mill operator's bench, north of feed into rod mill,  
January 8, 1960.

/  $U_3O_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

6.56  
600  
 $6.49 \times 10^{-12}$   $\mu C/ml$

Sample # 53

Sample collected in front of the weighometer for ore feed to rod mill,  
January 8, 1960.

/  $U_3O_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

14.30  
600  
 $1.42 \times 10^{-11}$   $\mu C/ml$

Sample # 54

Sample was taken under the fine ore bins, January 8, 1960.

/  $U_3O_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

15.87  
600  
 $1.57 \times 10^{-11}$   $\mu C/ml$

Sample # 55

Sample was taken on first deck under the leach tanks, January 8, 1960.

/  $U_3O_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

6.35  
600  
 $6.31 \times 10^{-12}$   $\mu C/ml$

Sample # 56

Sample Lost

Sample # 57

Sample was collected near the sand tails pump and box on first deck,  
January 8, 1960.

/  $U_3O_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

46.15  
600  
 $4.58 \times 10^{-11}$   $\mu C/ml$



January 28, 1960

Sample # 58

Sample was taken on first deck under RIF bank #1, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	10.77
Liters of air sampled	600
Radiation level	$1.07 \times 10^{-11}$ #G/ml

Sample # 59

Sample was collected on first deck under RIF bank #14, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	40.00
Liters of air sampled	600
Radiation level	$3.97 \times 10^{-11}$ #G/ml

Sample # 60

Sample taken on platform at the west end of the rod mill, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	15.38
Liters of air sampled	600
Radiation level	$1.52 \times 10^{-11}$ #G/ml

Sample # 61

Sample was taken on first deck between the air compressors and the pump, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	18.30
Liters of air sampled	600
Radiation level	$1.81 \times 10^{-11}$ #G/ml

Sample # 62

Sample was collected on first deck south of the holding tank, January 8, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	25.35
Liters of air sampled	600
Radiation level	$2.51 \times 10^{-11}$ #G/ml

Sample # 63

Sample was collected on first deck under RIF bank # 10, January 9, 1960.

U <sub>3</sub> O <sub>8</sub> collected on the filter paper	9.86
Liters of air sampled	600
Radiation level	$9.78 \times 10^{-12}$ #G/ml

January 11, 1960

Sample # 64

\* Sample was collected on first deck between # 3 presip. tank and #1 alkalis tank, January 11, 1960.

✓  $\text{U}_3\text{O}_8$  collected on filter paper  
Liters of air sampled  
Radiation level

193.96  
600  
 $1.92 \times 10^{-10}$   $\mu\text{C}/\text{ml}$

Sample # 65

Sample was taken on first deck under stairs east of yellow-oaks section, January 11, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

35.71  
600  
 $5.49 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

Sample # 66

Sample was collected in the east end of the carpenter shop, January 11, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

2.82  
600  
 $2.80 \times 10^{-12}$   $\mu\text{C}/\text{ml}$

Sample # 67

Sample taken in the west end of the carpenter shop, January 11, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

6.56  
600  
 $6.49 \times 10^{-12}$   $\mu\text{C}/\text{ml}$

Sample # 68

\* Sample was collected on third deck east of the sock filter, January 11, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

136.62  
600  
 $1.36 \times 10^{-10}$   $\mu\text{C}/\text{ml}$

Sample # 69

General air sample taken under the two, 50 ton coarser ore bins. Sample time was 30 minutes at a flow rate of 20 liters of air per minute. Sample taken January 11, 1960.

✓  $\text{U}_3\text{O}_8$  collected on the filter paper  
Liters of air sampled  
Radiation level

6.72  
600  
 $5.66 \times 10^{-12}$   $\mu\text{C}/\text{ml}$

January 28, 1960

Sample # 70

General air sample taken by # 2 conveyor, below the magnetic head pulley. Sample time was 30 minutes. Sample taken January 11, 1960.

✓ $U_3O_8$ collected on the filter paper	19.40
Liters of air sampled	600
Radiation level	$1.92 \times 10^{-11}$ $\mu$ C/ml

Sample # 71

General air sample taken by # 2 conveyor at stool where men removing trash and mud balls etc. Sample time was 30 minutes. Sample taken January 11, 1960.

✓ $U_3O_8$ collected on the filter paper	14.73
Liters of air sampled	600
Radiation level	$1.48 \times 10^{-11}$ $\mu$ C/ml

Sample # 72

Source sample collected in the crusher building of feed into #1 bucket sampler. Sample time was 10 minutes. Sample collected January 11, 1960.

✓ $U_3O_8$ collected on the filter paper	20.90
Liters of air sampled	200
Radiation level	$6.25 \times 10^{-10}$ $\mu$ C/ml

Sample # 73

Source sample collected in the crusher building at the feed into #2 bucket sampler. Sample time was 10 minutes. Sample collected January 11, 1960.

✓ $U_3O_8$ collected on the filter paper	17.19
Liters of air sampled	200
Radiation level	$5.12 \times 10^{-10}$ $\mu$ C/ml

Sample # 74

Source sample taken in crusher building of vein sampler. Sample time was 10 minutes. Sample collected January 11, 1960.

✓ $U_3O_8$ collected on the filter paper	7.03
Liters of air sampled	200
Radiation level	$2.09 \times 10^{-11}$ $\mu$ C/ml

January 28, 1960

Sample # 75

General air sample taken at the control panel by the primary crusher on second and 3 deck of the crusher building. Sample time was 30 minutes. Sample taken January 17, 1960.

✓ U<sub>2</sub>O<sub>8</sub> collected on the filter paper 51.25  
Liters of air sampled 600  
Radiation level  $3.09 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

Sample # 76

Same as sample # 75 except taken on third deck by #2 bucket sampler. Sample time was 15 minutes.

✓ U<sub>2</sub>O<sub>8</sub> collected on the filter paper 9.38  
Liters of air sampled 600  
Radiation level  $1.86 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

Sample # 77

General air sample taken in the mill building on first deck 15 feet south of # 7 RIF pump. Sample time was 30 minutes. Sample taken January 17, 1960.

X ✓ U<sub>2</sub>O<sub>8</sub> collected on the filter paper 355.73  
Liters of air sampled 600  
Radiation level  $3.51 \times 10^{-10}$   $\mu\text{C}/\text{ml}$

Sample # 78

Same as sample # 77 except taken 8 feet west of #6 RIF pump.

X ✓ U<sub>2</sub>O<sub>8</sub> collected on the filter paper 144.70  
Liters of air sampled 600  
Radiation level  $1.43 \times 10^{-10}$   $\mu\text{C}/\text{ml}$

Sample # 79

General air sample taken in the center of the warehouse office. Sample time was 30 minutes. Sample taken January 17, 1960.

U<sub>2</sub>O<sub>8</sub> collected on the filter paper 14.93  
Liters of air sampled 600  
Radiation level  $1.48 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

Sample # 80

General air sample collected in the scaleroom at the buying station. Sample time was 30 minutes. Sample collected January 12, 1960.

✓ U<sub>2</sub>O<sub>8</sub> collected on the filter paper 26.67  
Liters of air sampled 600  
Radiation level  $2.67 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

January 28, 1960

Sample # 81

Same as sample # 80 except sample was collected in the moisture sampling room.

✓ $U_3O_8$ collected on the filter paper	38.81
Liters of air sampled	600
Radiation level	$3.85 \times 10^{-11}$ $\mu$ C/ml

Sample # 82

General air sample collected in the crusher building on second deck four feet north of the 5 x 6 jaw crusher. Sample time was 15 minutes. Sample taken January 17, 1960.

✓ $U_3O_8$ collected on the filter paper	17.91
Liters of air sampled	300
Radiation level	$3.55 \times 10^{-11}$ $\mu$ C/ml

Sample # 83

Same as sample # 82 except the sample was collected on first deck at the operator's bench.

✓ $U_3O_8$ collected on the filter paper	44.78
Liters of air sampled	300
Radiation level	$8.87 \times 10^{-11}$ $\mu$ C/ml

Sample # 84

Same as sample # 82 except the sample was taken on first deck east of the # 2 bucket sampler.

✓ $U_3O_8$ collected on the filter paper	74.63
Liters of air sampled	300
Radiation level	$1.48 \times 10^{-10}$ $\mu$ C/ml

Sample # 85

General air sample taken in the crusher building on first deck east of # 1 bucket sampler. Sample time was 15 minutes. Sample collected January 13, 1960.

✓ $U_3O_8$ collected on the filter paper	26.56
Liters of air sampled	300
Radiation level	$5.27 \times 10^{-11}$ $\mu$ C/ml

Sample # 86

Same as sample # 85 except sample was collected on second deck 4 feet west of # 2 crusher.

✓ $U_3O_8$ collected on the filter paper	3.13
Liters of air sampled	300
Radiation level	$6.19 \times 10^{-12}$ $\mu$ C/ml



January 28, 1960

Sample # 87

Same as sample # 85 except sample was collected on second deck 4 feet west of the primary crusher.

✓ $U_3O_8$ collected on the filter paper	1.56
Liters of air sampled	300
Radiation level	$3.09 \times 10^{-12}$ $\mu C$

Sample # 88

Same as sample # 85 except sample taken on third deck by # 2 belt.

✓ $U_3O_8$ collected on the filter paper	3.13
Liters of air sampled	300
Radiation level	$6.19 \times 10^{-12}$ $\mu C/ml$

Sample # 89

Same as sample # 85 except sample was taken on third deck near # 1 bucket sampler.

✓ $U_3O_8$ collected on the filter paper	46.03
Liters of air sampled	300
Radiation level	$9.10 \times 10^{-11}$ $\mu C/ml$

Sample # 90

Same as sample # 85 except sample was taken between control panel and #2 crusher on second deck.

✓ $U_3O_8$ collected on filter paper	41.27
Liters of air sampled	300
Radiation level	$8.21 \times 10^{-11}$ $\mu C/ml$

Sample # 91

General air sample taken in the filterometer room of the mill building. Sample time was 30 minutes. Sample taken January 14, 1960.

✓ $U_3O_8$ collected on the filter paper	53.33
Liters of air sampled	600
Radiation level	$3.31 \times 10^{-11}$ $\mu C/ml$

Sample # 92

General air sample collected at the large blender in the sample preparation room at the crushing plant. Sample time was 30 minutes. Sample taken January 14, 1960.

✓ $U_3O_8$ collected on the filter paper	33.33
Liters of air sampled	600
Radiation level	$3.31 \times 10^{-11}$ $\mu C/ml$

January 28, 1960

Sample # 91

Same as sample # 92 except sample was collected at the small blender.

✓ $U_3O_8$ collected on the filter paper	52.54
Liters of air sampled	600
Radiation level	$5.21 \times 10^{-11}$ $\mu C/ml$

Sample # 94

Same as sample # 92 except sample was taken near the large splitter.

✓ $U_3O_8$ collected on the filter paper	68.71
Liters of air sampled	600
Radiation level	$6.25 \times 10^{-11}$ $\mu C/ml$

Sample # 95

General air sample collected in the laboratory on the east bench south of the refrigerator. Sample time was 30 minutes. Sample taken January 15, 1960.

✓ $U_3O_8$ collected on the filter paper	1.69
Liters of air sampled	600
Radiation level	$1.68 \times 10^{-12}$ $\mu C/ml$

Sample # 96

Same as sample # 95 except sample was collected on east bench north of the refrigerator.

✓ $U_3O_8$ collected on the filter paper	1.69
Liters of air sampled	600
Radiation level	$1.68 \times 10^{-12}$ $\mu C/ml$

Sample # 97

General air sample collected near the jolter along the south wall in the yellow-cake area. Sample time was 15 minutes. Sample taken January 15, 1960.

✓ $U_3O_8$ collected on the filter paper	40.63
Liters of air sampled	300
Radiation level	$8.03 \times 10^{-11}$ $\mu C/ml$

Sample # 98

Same as sample # 97 except sample was taken near the scales.

✓ $U_3O_8$ collected on the filter paper	1.96
Liters of air sampled	300
Radiation level	$3.09 \times 10^{-12}$ $\mu C/ml$



January 28, 1960

Sample # 99

General air sample taken near the large splitter at the sample room in the crusher building. Sample time 30 minutes. Sample taken January 15, 1960.

X      ✓  $U_3O_8$  collected on the filter paper      892.19  
Liters of air sampled      600  
Radiation level       $2.90 \times 10^{-10}$   $\mu C/ml$

Sample # 100

Same as sample # 99 except sample was taken near the small splitter in the southeast corner of the room.

X      ✓  $U_3O_8$  collected on the filter paper      140.63  
Liters of air sampled      600  
Radiation level       $1.39 \times 10^{-10}$   $\mu C/ml$

Sample # 101

General air sample collected near barreled yellow-cake in the northwest corner of the yellow-cake area. Sample time was 15 minutes. Sample taken January 15, 1960.

X      ✓  $U_3O_8$  collected on the filter paper      123.58  
Liters of air sampled      300  
Radiation level       $2.45 \times 10^{-10}$   $\mu C/ml$

Sample # 102

General air sample taken near the door of the enclosure of the Magellbach grinder in the sample room at the crusher building. Sample time was 30 minutes. Sample taken January 21, 1960.

X      ✓  $U_3O_8$  collected on the filter paper      77.42  
Liters of air sampled      600  
Radiation level       $7.68 \times 10^{-11}$   $\mu C/ml$

Sample # 103

General air sample taken in the yellow-cake room near the pump. Sample taken January 20, 1960. Sample time was 15 minutes.

X      ✓  $U_3O_8$  collected on the filter paper      91.94  
Liters of air sampled      300  
Radiation level       $1.82 \times 10^{-10}$   $\mu C/ml$

Sample # 104

General air sample collected near the blender in the sample preparation room at the ore receiving building. Sample time was 30 minutes. Sample taken January 21, 1960.

✓  $U_3O_8$  collected on the filter paper 79.03  
Liters of air sampled 600  
Radiation level  $7.85 \times 10^{-11}$   $\mu C/ml$

Sample # 105

Same as sample # 104 except sample was taken near grinders along the west wall.

✓  $U_3O_8$  collected on the filter paper 5.09  
Liters of air sampled 600  
Radiation level  $3.05 \times 10^{-12}$   $\mu C/ml$

Sample # 106

Same as sample # 104 except sample was taken at the sampler's desk.

✓  $U_3O_8$  collected on the filter paper 8.47  
Liters of air sampled 600  
Radiation level  $8.39 \times 10^{-12}$   $\mu C/ml$

Sample # 107

General air sample taken in the yellow-slate area near the gate. Sample time was 15 minutes. Sample taken January 21, 1960.

✓  $U_3O_8$  collected on the filter paper 93.22  
Liters of air sampled 300  
Radiation level  $1.85 \times 10^{-10}$   $\mu C/ml$

Sample # 108

Same as sample # 107 except sample was collected in the northeast corner of the yellow-slate area.

✓  $U_3O_8$  collected on the filter paper 16.95  
Liters of air sampled 300  
Radiation level  $3.36 \times 10^{-11}$   $\mu C/ml$

Sample # 109

General air sample collected near the splitter in the sample preparation room of the ore receiving building. Sample time was 30 minutes. Sample taken January 23, 1960.

✓  $U_3O_8$  collected on the filter paper 14.04  
Liters of air sampled 600  
Radiation level  $1.39 \times 10^{-11}$   $\mu C/ml$

January 25, 1960

Sample 1112

Same as sample # 109 except sampler was placed on even in northwest corner of the room.

✓ $U_3O_8$ collected on the filter paper	7.02
Liters of air sampled	600
Radiation level	$6.96 \times 10^{-12}$ $\mu\text{Ci}/\text{ml}$

*E. A. Duffendaffer*  
E. A. Duffendaffer

Remarks:

In comparing this survey to the August, 1959 survey, a definite improvement in airborne radiation can be readily noted, especially in the product room, on the 2nd and 3rd decks above the product room, baking room, sample prep. room, and the crushing plant. This, of course, is due to the dust collection systems recently installed in these areas. Minor adjustments and changes are still required in these areas to bring the airborne dust below MPC and as soon as these are completed further surveys will be made to determine their effectiveness.

*G. F. Richards*  
G. F. Richards

md:hje

cc: A. D. Gray  
W. L. Mason  
File

# INTEROFFICE CORRESPONDENCE

Company. Mines Development, Inc.

Date February 22, 1960

To: E. D. Webb (File Copy)

LEB

From: S. A. Diffendaffer

Subject: Operations - Milling  
Radiation Dust Surveys

The radiation dust samples included in this report were taken in order to ascertain whether a rubber skirt, which had been placed around a Sweco screen, reduced the radiation level in the area around the filter on third deck by the shift foreman's office. The Sweco screen is located on second deck below and to the North of the area sampled.

The filter paper was assayed using the procedure recommended in Win III, Pages 39 and 40. The level of radioactivity was calculated by the following formula:

$$\begin{aligned}\text{Microcuries } (\mu\text{C})/\text{ml} &= \text{g U}_3\text{O}_8/\text{liter} \times 0.595 \times 10^{-3} \\ \text{Maximum permissible concentration (MPC)} &= 5 \times 10^{-11} \mu\text{C}/\text{ml}\end{aligned}$$

The results of the dust samples were as follows:

Sample #1 was a general air sample collected about four feet North of the filter press on third deck by the shift foreman's office, 2-11-60.

Micrograms $\text{U}_3\text{O}_8$ collected on the filter paper	85.71
Liters of air sampled	600
Radiation level	$8.51 \times 10^{-11} \mu\text{C}/\text{ml}$
Radiation level (Sample #6 taken 1-4-60)	$1.85 \times 10^{-10} \mu\text{C}/\text{ml}$

Sample #2 was a general air sample collected about four feet South of the filter press on third deck by the shift foreman's office, 2-11-60.

Micrograms $\text{U}_3\text{O}_8$ connected on the filter paper	10.00
Liters of air sampled	600
Radiation level	$9.94 \times 10^{-12} \mu\text{C}/\text{ml}$
Radiation level (sample #5 taken 1-4-60)	$6.96 \times 10^{-11} \mu\text{C}/\text{ml}$

## Interpretation:

The addition of the rubber skirt to the Sweco screen seems to have reduced the level of radioactivity slightly, but it appears that some of the radioactivity is coming from the hold and surge tanks.

cc: H. L. Hazen  
A. D. Gray  
H. J. Richards

S. A. Diffendaffer



INTEROFFICE CORRESPONDENCE

LE x 6

Company Mine Development, Inc.

Date March 17, 1960

To: H. D. Webb (File Copy)

*All excellent!  
Jan 18 3/19/60*

*10/18/60*

From: S. A. Diffendaffer

Subject: Operations - Milling - Radiation  
Dust Surveys

The following are results of airborne dust samples collected February 18, within the yellow-cake enclosure. These samples were collected to obtain the radiation level in this area. A dust collector has been placed at the barrel jolter and the blender has been enclosed with a hood since the January dust survey was completed.

The samples were assayed using the procedure recommended in Win III, Pages 39 and 40. The level of radiation was calculated by the following formula:

$$\begin{aligned} \text{Microcuries (}\mu\text{C)/ml} &= \text{g U}_3\text{O}_8/\text{liter} \times 0.595 \times 10^{-3} \\ \text{Maximum permissible concentration (MPC)} &= 5 \times 10^{-11} \mu\text{C/ml.} \end{aligned}$$

All samples were collected February 18, while barrels were being filled, weighed and sealed.

Sample #1

A general air sample taken in the northeast corner of the yellow-cake enclosure.  
Sample time was 30 minutes at a flow rate of 20 liters of air per minute.

Micrograms U <sub>3</sub> O <sub>8</sub> collected on filter paper.	11.11
Liters of air sampled.	600
Radiation level.	$1.10 \times 10^{-11} \mu\text{C/ml}$

Sample #2

A general air sample collected near the entrance to the yellow-cake enclosure.  
Sample time was 30 minutes at a flow rate of 20 liters of air per minute.

Micrograms U <sub>3</sub> O <sub>8</sub> collected on filter paper.	11.11
Liters of air sampled.	600
Radiation level.	$1.10 \times 10^{-11} \mu\text{C/ml}$

Sample #3

A general air sample collected near the pump in the yellow-cake enclosure.  
Sample time was 30 minutes at a flow rate of 20 liters of air per minute.

Micrograms U <sub>3</sub> O <sub>8</sub> collected on filter paper	11.11
Liters of air sampled.	600
Radiation level.	$1.10 \times 10^{-11} \mu\text{C/ml}$

Mar 17, 1960

Sample #4

A general air sample collected along the west wall near stored yellow-cake in the product enclosure. Sample time was 30 minutes at a flow rate of 20 liters of air per minute.

Micrograms  $U_3O_8$  collected on filter paper. 17.46  
Liters of air sampled. 600  
Radiation level.  $1.75 \times 10^{-11} \mu C/ml$

Sample #5

A general air sample collected near the scales in the yellow-cake enclosure. Sample time was 30 minutes at a flow rate of 20 liters of air per minute.

Micrograms  $U_3O_8$  collected on filter paper. 13.52  
Liters of air sampled. 600  
Radiation level.  $1.34 \times 10^{-11} \mu C/ml$

Sample #6

Lost

Sample #7

A general air sample taken near the bench along the south wall in the yellow-cake enclosure. Sample time was 30 minutes at a flow rate of 10 liters of air per minute.

Micrograms  $U_3O_8$  collected on filter paper. 4.84  
Liters of air sampled. 300  
Radiation level.  $9.58 \times 10^{-12} \mu C/ml$

Sample #8

A general air sample taken on south of the barrel jolter. Sample time was 30 minutes at a flow rate of 10 liters of air per minute.

Micrograms  $U_3O_8$  collected on filter paper. 8.06  
Liters of air sampled. 300  
Radiation level.  $1.60 \times 10^{-11} \mu C/ml$

Sample #9

A general air sample collected on north of the barrel jolter. Sample time was 30 minutes at a flow rate of 10 liters of air per minute.

Operations - Milling - Radiation  
Dust Surveys

-3-

March 17, 1960

Micrograms  $U_3O_8$  collected on filter paper, 19.05

Liters of air sampled, 300

Radiation level,  $3.78 \times 10^{-11}$   $\mu$ C/ml

  
E. A. Diffendaffer

sad:bw

cc: A. D. Gray  
H. L. Hasan



Location Box

Area

WATER SAMPLING DATA

DATE April 11, 1960

MD44

Location of all  
Samples

Micrograms of  
collected on  
filter paper

Saturation  
Level (M)

OFFICE

- 1 Engineering Room.
- 2 Center of main office.
- 3 In hall going to private offices.
- 4 West of Radiation Level

100
100
100

4.99
5.97
4.49

0.60
1.18
0.89

WATER SAMPLING

- 4 Center of water use office.
- 5 West of water use office.
- 6 Between East and West.
- 7 Walling room by office window.
- 8 Process chemical & release south side.
- 9 Process chemical & release north side.
- 10 West of Radiation Level

100
100
100
100
100
100
100

8.70
10.14
7.83
7.23
6.16
5.96

1.73
2.01
1.44
1.44
0.93
1.10

LIME PLANT

- 11 In North wall.
- 12 West side pump.
- 13 On platform beside lime tank.

100
100
100

1.92
7.08
7.35

0.38
1.29
1.45

Saturation Level 1.08

Remarks: All above areas below HPC.

## MISCELLANEOUS AREAS

DATE April, 1960

Sample No.	Area	Liters of air Sampled	Micrograms U308 Collected on Filter Paper	Radiation Level $\times 10^{-11}$ MC/ML
BOILER ROOM				
14	Between boiler and north wall.	300	5.26	1.04
15	Between boiler and south wall.	300	1.75	0.35
Average Radiation Level <u>0.70</u>				
TRUCK GARAGE				
16	Along west wall.	300	5.15	1.02
17	Along east wall.	300	7.35	1.46
Average Radiation Level <u>1.24</u>				
CHANGE ROOM				
18	By wash bowl.	300	7.14	1.42
19	By water fountain.	300	0.57	1.70
20	Along west wall.	300	13.24	2.62
Average Radiation Level <u>1.91</u>				
LABORATORY				
21	Metallurgical work bench.	300	0.83	1.75
22	Bench north of refrigerator.	300	14.81	2.84
23	Northwest bench in main laboratory.	300	12.71	2.52
24	Southwest bench in main laboratory.	300	7.27	1.44
25	Southwest bench in main laboratory.	300	7.87	1.64
26	Lot samples balance room.	300	7.87	1.64
27	Concentrate balance room.	300	3.28	0.65
28	Fluorometer room.	300	3.28	0.65
Average Radiation Level <u>1.60</u>				

Remarks: All above areas below MPC

Sample No.	Area	Liters of air Sampled	Micrograms U <sub>3</sub> O <sub>8</sub> Collected on Filter Paper	Radiation Level x 10 <sup>-11</sup> R/M.
<b>BOILING STATION</b>				
33	Boiler room by leak.	300	8.82	1.75
34	Boiler room by scales.	300	10.29	2.04
35	Moisture sampling room by crusher.	300	42.19	8.57
36	Moisture sampling room by moisture scale.	300	44.92	8.91
37	Boiler room by sampling room door.	300	10.14	2.01
38	Boiler room by west wall.	300	8.70	1.72
Average Radiation Level <u>4.14</u>				

## RAILROAD CAR UNLOADING

39	Top of car west of unloading chute.	150	12.16	4.83
40	Top of car east of unloading chute.	150	6.76	2.68
41	Above ventilator by control panel.	150	2.70	1.07
42	Near control panel.	150	4.05	1.61
43	Bottom of tunnel pit.	150	13.70	5.43
44	Bottom near bridge.	150	12.33	4.89
45	One-half way down tunnel.	150	4.11	1.63
46	Bottom of tunnel into tunnel.	150	4.11	1.63
Average Radiation Level <u>2.97</u>				

## COARSE ORE BINS AND BUILDING

47	Near top of #1 bin.	300	11.26	2.23
48	Below top of #1 bin.	300	14.08	2.79
49	Under #1 bin.	300	45.07	8.94
50	Under #2 bin.	300	18.31	3.63
51	Between walls between #1 and #2 bins	300	52.11	10.34

Average Radiation Level 5.59

Remarks: Samples 31 and 32 are due to the crusher in the Moisture Sampling Room. This crusher should be vented, also the wheelbarrow where dry samples are dumped. Samples 39 and 40 are in the pit where the operator seldom, if ever, present. Samples 45 and 47 were taken during periods where trucks were dumping ore in the bins. These two samples were taken during normal operating conditions, but during the time the operator is seldom, if ever, present. Also

April, 1960

Sample No.	Area	Liters of air Sampled	Micrograms U308 Collected on Filter Paper	Radiation Level $\times 10^{-11}$ W/cm <sup>2</sup> /hr.
CRUSHER BUILDING				
48	First deck by operators desk.	150	1.64	0.65
49	By west door going to sample room.	300	94.11	18.67
50	First deck north of control panel.	150	4.92	1.95
51	Sampling room by south door.	150	4.92	1.95
52	By steps leading to second deck.	150	1.64	0.65
53	First deck by #1 bucket sampler.	150	19.67	7.80
54	First deck by #2 bucket sampler.	150	16.39	6.50
55	Second deck north of primary crusher.	150	16.39	6.50
56	Second deck north of #2 crusher.	150	16.39	6.50
57	Second deck north of 6x6 crusher.	150	6.56	2.60
58	Second deck between bucket samplers along west wall.	150	9.84	3.90
59	Second deck south of primary crusher.	150	14.75	5.85
60	Second deck outside south door by dust collector.	150	21.31	8.45
61	Platform by primary crusher.	150	3.97	1.58
62	Third deck by #2 bucket sampler.	150	17.46	6.93
63	Third deck by #1 Bucket sampler.	150	2.30	0.91
64	Third deck between control panel and #2 crusher.	150	1.97	0.78
65	Third deck by #2 belt.	150	2.13	0.84

Average Radiation Level 4.61

Remarks: This area 1.1 times MPC

It is interesting to note that all areas, except sample #62, above MPC are on the first and second decks. In checking this area, Mr. Bennett and myself found that it was not airborne dust that was causing the area to be above MPC but large, wet particles of ore falling from the conveyor belts. The operator wears a respirator in the crusher building, thus the air he breathes is below MPC.



# MAINTENANCE DEPARTMENT

DATE April, 1960

Sample No.	Area	Liters of air Sampled	Micrograms U308 Collected on Filter Paper	Radiation Level $\times 10^{-11}$ WC/ML.
MECHANICS SHOP				
66	Electricians shop.	<u>300</u>	<u>7.69</u>	<u>1.52</u>
67	Truck shop.	<u>300</u>	<u>8.80</u>	<u>1.62</u>
68	Northwest corner of mechanics shop.	<u>300</u>	<u>6.56</u>	<u>1.30</u>
69	Near welders bench.	<u>300</u>	<u>18.03</u>	<u>3.58</u>
70	Center of mechanics shop.	<u>300</u>	<u>6.56</u>	<u>1.30</u>
Average Radiation Level <u>1.86</u>				

UTILITY SHOP				
71	West end of shop.	<u>300</u>	<u>17.14</u>	<u>3.40</u>
72	East end of shop.	<u>300</u>	<u>17.34</u>	<u>3.40</u>
73	South of power saw.	<u>300</u>	<u>14.28</u>	<u>2.83</u>
Average Radiation Level <u>3.21</u>				

Remarks: The above areas are below MPC.

Sample No.

Area

Liters of air  
Sampled

Microfines USM  
Collected  
Filter paper

Repetition  
10-11  
W/M.

BOILING TREATMENT ROOM

74 Next over in north west corner.  
75 Next sample splitter.  
76 By operator's seat.  
77 Next grinder along west wall.  
78 Near blender.  
Average Radiation Level 1.48

300  
300  
300  
300  
300

9.26  
5.70  
7.40  
7.40  
7.69

1.84  
1.10  
1.47  
1.47  
1.52

CRUSHER BUILDING SAMPLE ROOM

79 Next foot of conveyor grinders.  
80 Next small splitter in south west corner.  
81 North side of large splitter.  
82 Between large splitter and large blender.  
83 Near small blender.  
84 Near large blender.  
Average Radiation Level 4.76

300  
300  
300  
300  
300  
300

16.68  
46.67  
28.33  
28.33  
19.52  
5.56

3.21  
9.26  
5.62  
5.67  
3.67  
1.10

Remarks: The Boiling Station sample prep. room is below MPC. The Crusher Building sample Prep. Room is 1.1 times MPC.  
A better dust collection system is needed by the sample splitters to lower the level of this area to below MPC.  
The sampler wears a respirator during sample preparation, thus the air he breathes is below MPC.



## ORE PROCESSING

DATE April, 1960

Sample No.	Area	Liters of air Sampled	Micrograms U308 Collected on Filter Paper	Radiation Level $\times 10^{-11}$ WC/ML
RODMILL AREA				
85	Under A bin.	300	4.92	0.98
86	Under B bin.	300	11.48	2.28
87	On platform by #8 belt.	300	17.54	3.48
88	Front of weightometer.	300	21.05	4.18
89	South of operators bench.	300	7.02	1.38
90	West of #3 classifier.	300	21.05	4.18
91	Platform on west end of rockmill.	300	1.92	0.38
92	Ten feet north of rockmill.	300	5.77	1.14
93	Between #1 leach tank and rockmill.	300	7.69	1.52
94	Under leach tanks by east wall.	300	10.77	2.14
95	Between leach tanks and storage for acid.	300	20.90	4.15
96	On sweep screen platform.	300	21.88	4.74
97	Near sand tails pump.	300	15.94	3.16
98	First deck under #2 and #3 classifiers.	300	25.37	5.03
99	West of sand tails pump.	300	16.42	3.25
100	Second deck between hold tank and #3 classifier.	300	19.80	3.85
101	Second deck between #2 and #3 classifiers.	300	20.90	4.15
102	West of #5 classifier.	300	16.42	3.25
103	Near cyclone control center.	300	1.99	0.32
104	Platform by #1 cyclone and pump box.	300	6.15	1.22
105	Front of PH meters over #1 and #2 leach tanks.	300	15.87	3.15
106	Above #4 leach tank by oxidant feeder.	300	15.67	3.15
107	Near control panel #3.	300	15.87	3.15

Average Radiation Level 2.79

Remarks: This area is below MPC. Samples 88, 90, 96, and 98 are slightly above MPC. I feel that these samples are high due to air currents carrying dust from other sections.

DATE April, 1960

Sample No.

Area

Liters of oil  
collectedMicrograms DTC-  
collected on  
filter paperRotational  
(Lowel) 711  
WC/Ml.

## RIP SECTION

Sample No.	Area	Liters of oil collected	Micrograms DTC- collected on filter paper	Rotational (Lowel) 711 WC/Ml.
106	Sample between live tank and mixer settler tank.	300	8.20	1.62
109	Near alive tails pump.	300	16.39	3.75
110	First deck under RIP bank #1.	300	6.36	1.38
111	South of #7 RIP pump.	300	6.36	1.38
112	Under RIP bank #10.	300	23.73	4.71
113	South of hold tank.	300	16.94	3.36
114	Under RIP bank #14.	300	8.67	1.69
115	Between air compressors and surps.	300	22.03	4.37
116	West of #8 RIP pump.	300	18.64	3.69
117	Over wine tailing tank.	300	11.02	2.18
118	Between RIP banks #2 and #3.	300	16.18	3.21
119	Between RIP banks #6 and #7.	300	16.91	3.36
120	Between RIP banks #8 and #9 second deck.	300	18.43	3.64
121	Between RIP banks #12 and #13.	300	18.67	3.31
122	North of #3 press.	300	26.67	5.29
123	South of #3 press.	300	13.33	6.61
124	Above hold tank.	300	6.35	1.38
125	Upstairs laboratory.	300	3.17	0.63
126	Operations foreman's office.	300	4.76	0.95
127	Near control panel #7.	300	15.97	3.15
128	Near control panel #6.	300	3.33	0.64
129	Near RIP distribution wheel.	300	8.08	1.60
130	North of yellow-cake dust collector, second deck.	300	27.42	5.44
131	Near IX vent box.	300	14.52	2.99

Average Radiation Level. 2.69

Remarks: This area is below HVC. Samples 112, 115, 122, 125 and 130 are above HVC. I feel that these samples are above HVC due to air currents carrying dust from spills in the yellowcake area.

## ORE PROCESSING

DATE April, 1960

Sample No.

Area

Liters of air  
SampledMicrograms U308  
collected on  
Filter PaperRadiation<sup>11</sup>  
Level<sup>10</sup>  
MC/Ml.

## SX SECTION

132	First deck between raffinate tank and west door.	300	3.17	0.63
133	Between E-3 tank and gate to yellow-cake area.	300	11.11	2.20
134	Soda ash storage platform.	300	6.35	1.26
135	First deck below soda ash settlers.	300	4.78	0.93
136	Under stairs east of yellow-cake area.	300	13.11	2.60
137	First deck between P-3 and E-1 tanks.	300	16.99	3.23
138	First deck east of P-1 tanks.	300	29.30	5.83
139	First deck between mixer settler and lime tank.	300	8.20	1.62
140	First deck south of laboratory sample window.	300	9.83	1.93
141	First deck in front of time clock.	300	1.69	0.33
142	Platform west of raffinate tank.	300	11.86	2.35
143	West of north yellow-cake press.	300	25.42	5.04
144	East of north yellow-cake press.	300	16.95	3.36
145	West of south yellow-cake press.	300	66.13	13.14
146	South of yellow-cake dryer.	300	10.29	2.04
147	North of yellow-cake dryer.	300	22.06	4.37
148	Second deck between stairs and eluate tanks.	300	13.43	2.66
149	Between E-1 and P-1 tanks, second deck.	300	23.81	4.72
150	Second deck between P-1 and P-2 tanks.	300	25.40	5.04
151	Second deck near operators sink.	300	27.03	5.36
152	Near SX control panel.	300	21.62	4.29
153	Second deck between P-1 tank and soda ash settlers.	300	29.73	5.80
154	Second deck west of soda ash settlers.	300	5.41	1.07
155	Above soda ash holding tank.	300	36.90	7.24
156	East of #4 sock filter.	300	17.81	3.53
157	West of #4 sock filter.	300	26.03	5.16
158	South of yellow-cake dust collector, third floor.	300	21.92	4.35
159	Third deck near control panel #9.	300	21.29	4.22

Average Radiation Level 5.75

Remarks: This area below HPC.

Samples 138, 143, 145, 147, 149, 150, 152, 153 and 155 are apparently high due to air currents. Samples # 15 and # 157 are in areas where solution flows have a long, free drop. These are the Hold Tank and the Ramp Tank.



## ORE PROCESSING

DATE April, 1960

Sample No.

Area

Liters of air  
SampledMicrograms U308  
Collected on  
Filter PaperRadiation  
Level  $\times 10^{-11}$   
MC/ML.

## YELLOW-CAKE AREA

160	Near barrel jolter along south wall.	300	7.04	1.42
161	South of large yellow-cake scales.	300	9.86	1.98
162	Near yellow-cake sump.	300	25.75	5.09
163	Northwest corner of yellow-cake area.	300	26.24	5.11
164	Near yellow-cake area gate.	300	18.75	3.65
165	West of north yellow-cake press.	300	25.62	5.04
166	East of north yellow-cake press.	300	16.75	3.26
167	West of south yellow-cake press.	300	66.13	13.11
168	North of yellow-cake dryer.	300	22.86	4.37
169	South of yellow-cake dryer.	300	10.89	2.06
170	Third deck south of yellow-cake dust collector.	300	21.92	4.35
171	Third deck near control panel #9.	300	23.29	4.52

Average Radiation Level 4.64

Remarks: This area 1.1 times MPC or 4.12.

A re-check of sample #167 revealed that this level is correct. During this survey period the west window door was open due to the warm weather. Apparently the higher levels are not due to equipment but to air currents. The Production wears a respirator during product packaging, thus the air he inhales is below MPC.

# INTEROFFICE CORRESPONDENCE

FILE

Company Kines Development, Inc.

Date March 25

To: H. B. Webb (File Copy)

From: G. E. Richards

Subject: Operations - Milling -  
Surveys - Time Study

## Sampler

The following is a time study and average airborne radiation level for the area.  
The percentage of time is of one days observation using a stopwatch for each  
time in each area.

### % Time

3.4  
4.2  
37.0  
46.2  
8.4

### Area

Outside  
Change Room  
Sample Prep. Room at Crushing Plant  
Sample Prep. Room at Buying Station  
Buying Station Office

## Radiation Level

### Outside

Not Sampled

### Change Room

Sample # 14 Survey dated 1/21/60  
2.53x10<sup>-11</sup>  $\mu$ C/ml

### Sample Prep. Room at Crushing Plant

Sample # 98, 99, 94, 95, 100 & 102 Survey dated 1/28/60  
Sample # 98 3.51x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 99 5.21x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 94 6.25x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 99 29.00x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 100 13.90x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 102 7.60x10<sup>-11</sup>  $\mu$ C/ml  
Average 10.89x10<sup>-11</sup>  $\mu$ C/ml

### Sample Prep. Room at Buying Station

Sample # 104, 105, 106, 109 and 110 Survey dated 1/28/60  
Sample # 104 7.85x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 105 0.51x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 106 0.84x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 109 1.39x10<sup>-11</sup>  $\mu$ C/ml  
Sample # 110 0.70x10<sup>-11</sup>  $\mu$ C/ml  
Average 2.86x10<sup>-11</sup>  $\mu$ C/ml

Operations - Milling -  
Radiation - Surveys -  
Time Study

-2-

March 25, 1960

Barling Station Office

Sample # 80 Survey dated 1/28/60

$8.67 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

Weighted Average Exposure

3.4 % time	0	
4.2 %	$2.33 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	$= 0.10 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
57.6 %	$10.89 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	$= 4.12 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
46.2 %	$2.26 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	$= 1.04 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
8.4 %	$2.67 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	$= 0.22 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
		<u><math>5.48 \times 10^{-11}</math> <math>\mu\text{C}/\text{ml}</math></u>

MPC for a 48 hour week is  $4.17 \times 10^{-11}$   $\mu\text{C}/\text{ml}$ . The radiation level for this job classification is 1.3 times MPC. The Sampler wears a respirator at all times during sample preparation, thus the air he is breathing is below MPC.

---

G. F. Richards

gfr:bw

cc: A. D. Gray  
H. L. Hosen  
G. F. Richards



INTEROFFICE CORRESPONDENCE

Company Mines Development, Inc.

Date May 10, 1960

To: H. D. Webb

From: G. F. Richards

Subject: Operations - Milling - Radiation  
Surveys - Time Study

The Sampler for the time study dated 5/25/60 was J. LeRoy Davis. This would also include Thomas J. Bolts when he is covering this position in Mr. Davis's absence.

---

G. F. Richards

gfr:bw

cc: A. D. Gray  
R. L. Hazen  
G. F. Richards

# INTEROFFICE CORRESPONDENCE

Company Mines Development, Inc.

Date March 25, 1960

To: E. D. Webb (File Copy)

From: G. F. Richards

Subject: Operations - Milling - Radiation -  
Surveys - Time Study

## Crusher Plant Operator

The following is a time study and average airborne radiation level for the Crusher Plant Operator. The percentage of one days observation using a stopwatch for elapsed time in each area. Both stockpile ore and ore from the yard were crushed during this time study

### % Time

24.4

26.8

14.5

23.3

11.0

### Area

Outside

1st deck by operators bench

1st deck other than at operators bench

2nd deck

3rd deck

## Radiation Levels

### Outside

Not Sampled

### 1st deck by Operators' bench

Sample #83 Survey dated 1/28/60  
8.87x10<sup>-11</sup>  $\mu$ C/ml

### 1st deck other than by Operators' bench

Samples #84 & 85 Survey dated 1/28/60

Sample #84 14.80x10<sup>-11</sup>  $\mu$ C/ml

Sample #85 5.27x10<sup>-11</sup>  $\mu$ C/ml

Average 10.04x10<sup>-11</sup>  $\mu$ C/ml

### 2nd deck

Samples # 82, 86, 87 and 90 Survey dated 1/28/60

Sample #82 1.55x10<sup>-11</sup>  $\mu$ C/ml

Sample #86 0.62x10<sup>-11</sup>  $\mu$ C/ml

Sample #87 0.31x10<sup>-11</sup>  $\mu$ C/ml

Sample #90 8.21x10<sup>-11</sup>  $\mu$ C/ml

Average 3.17x10<sup>-11</sup>  $\mu$ C/ml

Mar 1 2 1960

3rd deck

Samples #75, 76, 88 and 89. Survey dated 1/28/60

Sample #75	$3.09 \times 10^{-11}$	µC/ml
Sample #76	$1.86 \times 10^{-11}$	µC/ml
Sample #88	$0.62 \times 10^{-11}$	µC/ml
Sample #89	$9.10 \times 10^{-11}$	µC/ml
Average	$3.67 \times 10^{-11}$	µC/ml

Weighted Average Exposure

24.4% times	0	
26.8% "	$5.87 \times 10^{-11}$	µC/ml = $2.38 \times 10^{-11}$ µC/ml
14.5% "	$0.6 \times 10^{-11}$	µC/ml = $1.26 \times 10^{-11}$ µC/ml
23.3% "	$5.4 \times 10^{-11}$	µC/ml = $0.74 \times 10^{-11}$ µC/ml
11.0% "	$1.67 \times 10^{-11}$	µC/ml = $0.40 \times 10^{-11}$ µC/ml
		<u><math>4.98 \times 10^{-11}</math> µC/ml</u>

MPC for a 48 hour week is  $1.17 \times 10^{-11}$  µC/ml. The radiation level for this job classification is 1.2 times MPC. The Crusher Operator wears a respirator at all times while in the crushing plant, thus the air he is breathing should be below MPC.

---

G. F. Richards

gfr:bw

cc: A. D. Gray  
H. L. Hazen  
G. F. Richards

# INTEROFFICE CORRESPONDENCE

Company Mines Development, Inc.

Date May 10, 1960

To H. D. Webb

From G. F. Richards

Subject Operations - Milling - Radiation  
Surveys - Time Study

The Crusher Plant Operator for the time study dated 5/25/60 was Clarence C. Christensen. This would also include Walter W. Plumb when he is covering this position in Mr. Christensen's absence.

---

G. F. Richards

gfr:bw

cc: A. D. Gray  
H. L. Hazen  
G. F. Richards



# INTEROFFICE CORRESPONDENCE

Company Minnas Development, Inc.

Date March 17, 1960

To: H. D. Webb (File Copy)

From: G. F. Richards

Subject: Operations Milling - Radiation  
Surveys - Time Study

## Product Man

The following is a time study and average airborne radiation level for the product man. The percentage of time for each area is an average of three days observation using a stop watch for elapsed time in each area over an eight hour shift.

<u>% Time</u>	<u>Area</u>
3.0	Third deck by product dust collector stack
2.1	Warehouse
6.2	Mill Lab.
18.8	Second deck product dryer
6.3	First deck stored, drummed product and susp
48.0	Benches along south wall during product pack- aging
4.1	Washing down product enclosure
9.3	Change room

## Radiation Levels

Third deck by product dust collector stack

Samples #31 & #32 Airborne Dust Survey report dated 1/28/60

Sample #31  $3.36 \times 10^{-12}$  pc/ml

Sample #32  $2.51 \times 10^{-12}$  pc/ml

Average  $2.94 \times 10^{-12}$  pc/ml

Warehouse

Sample #79 Survey dated 1/28/60  
 $1.48 \times 10^{-11}$  pc/ml

Mill Lab.

Sample #65 Survey dated 9/2/59  
 $2.40 \times 10^{-12}$  pc/ml

Second deck Product Dryer

Samples #29 & #30 Survey dated 1/28/60

Sample #29  $2.52 \times 10^{-12}$  pc/ml

Sample #30  $1.67 \times 10^{-12}$  pc/ml

Average  $2.10 \times 10^{-12}$  pc/ml

March 17, 1960

First Deck, Product Enclosure Etored, drummed Product and wump  
Samples #2, 3, & 4 Survey dated 3/17/60

Sample #2  $1.10 \times 10^{-11}$   $\mu\text{C}/\text{ml}$   
Sample #3  $1.10 \times 10^{-11}$   $\mu\text{C}/\text{ml}$   
Sample #4  $1.73 \times 10^{-11}$   $\mu\text{C}/\text{ml}$   
Average  $1.31 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

First Deck, Product Enclosure Benches along south wall during drumming operation  
Samples #5, 7, 8 & 9 Survey dated 3/17/60

Sample #5  $1.54 \times 10^{-11}$   $\mu\text{C}/\text{ml}$   
Sample #7  $2.58 \times 10^{-11}$   $\mu\text{C}/\text{ml}$   
Sample #8  $1.60 \times 10^{-11}$   $\mu\text{C}/\text{ml}$   
Sample #9  $3.79 \times 10^{-11}$   $\mu\text{C}/\text{ml}$   
Average  $1.92 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

First Deck, Product Enclosure washing down

Composite of the above two averages  
Average  $1.62 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

Change Room

Sample #82 Survey dated 9/2/59  
Sample #82  $4.01 \times 10^{-11}$   $\mu\text{C}/\text{ml}$

Weighted Average Exposure

4.2%	times	$0.29 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.01 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
3.1%	times	$1.48 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.05 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
6.2%	times	$0.24 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.01 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
18.8%	times	$0.21 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.24 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
6.3%	times	$1.31 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.08 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
48.0%	times	$1.92 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.92 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
4.1%	times	$1.62 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.07 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
9.3%	times	$4.01 \times 10^{-11}$ $\mu\text{C}/\text{ml}$	=	$0.37 \times 10^{-11}$ $\mu\text{C}/\text{ml}$
		Total Exposure		$1.55 \times 10^{-11}$ $\mu\text{C}/\text{ml}$

MPC for a 48 hour week is  $4.17 \times 10^{-11}$   $\mu\text{C}/\text{ml}$ . The Productman's exposure is well under this figure.

C. P. Richards

cc: H. L. Hazen

A. D. Gray

C. P. Richards



INTEROFFICE CORRESPONDENCE

Company: Kaiser Development, Inc.

Date: MAY 12, 1960

To: Mr. D. Webb

From: G. F. Richards

Subject: Operations - Milling - Registration  
Surveys - Time Study

The productionman for the time study dated 5/17/60 was John E. McKnight.

G. F. Richards

cc: to

cc: H. L. Hazen  
A. D. Gray  
G. F. Richards