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HEALTH AND BIOLOGY

I

UNITED STATES ATOMIC ENERGY COMMISSION

INDUSTRIAL HYGIENE SURVEY OF THORIUM
ROLLING AT SIMONDS SAW AND STEEL
COMPANY

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December 14, 1953

Photostat Price \$ 3.70
Microfilm Price \$ 2.40
Available from the
Office of Technical Services
Department of Commerce
Washington 25, D. C.

National Lead Company of Ohio
Cincinnati, Ohio

Technical Information Service Extension, Oak Ridge, Tenn.

This document is
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**INDUSTRIAL HYGIENE SURVEY
OF THORIUM ROLLING
AT SIMONDS SAW AND STEEL COMPANY**

By Charles E. Schumann

ABSTRACT

The information contained in this report consists of personnel exposures to radioactive dust resulting from a thorium rolling operation.

SCOPE & PURPOSE:

On Friday, December 4, 1953, an industrial hygiene study was made of the thorium rolling operations at Simonds Saw & Steel Company, Lockport, New York. The purpose of this study was to evaluate the exposures of Simonds personnel to airborne radioactive dust and to determine any necessary physical or procedural changes in the event of future thorium rollings.

ROLLING PROCEDURE:

Thorium ingots were rolled during a three-day period on the ventilated 16" bar mill. The following is an outline of the rolling procedure.

A. Ingots were heated in a gas-fired furnace to a rolling temperature.

B. Ingots were removed from the furnace and carried to the roughing rolls by means of a large pair of tongs suspended by an overhead monorail.

C. Seven to nine passes were made on the roughing rolls until a rough dimension billet was attained.

D. The rough billets were then passed to the finishing rolls where they were rolled down to rods of one and one-fourth inch diameter.

E. The rods were then dragged with tongs on a horizontal slide to the west end of the cooling grate where they were stamped and allowed to cool.

F. After cooling, rod ends were cropped and the rods sent by dolly to the rod straightener for final processing.

G. When straightened the rods were loaded into beams and made ready for shipment.

Three eight-hour shifts were required to complete the entire lot.

SUMMARY OF RESULTS:

The unofficial recommended MAC for thorium is $500 \mu\text{g}/\text{M}^3$. In this report, however, a lesser figure of $70 \text{ d}/\text{m}/\text{M}^3$ (the MAC for uranium) is used as a basis for exposure analysis. The reasons for using this lesser figure are (1) the higher figure has not yet been accepted and (2) some of the measured alpha activity may be from residual uranium contamination in the mill area.

The following table is a summary of individual average weighted thorium exposures based on an eight-hour shift according to individual jobs.

Weighted Average Dust Exposures

Job Description	Multiples of the Maximum Allowable Concentration	
	Below MAC	Above MAC
Heater & Heater Helper	0.29	
Ingot Dragdown Operator	0.24	
Roughers (East Side)	0.6	
Roughers (West Side)	0.3	
Finishers (East Side)	0.43	
Finishers (West Side)	0.34	
Rod Dragdown Operator	0.14	
Rod Stamper	0.19	
Shear Operator		3.8
Shear Helpers	0.41	
Rod Straightener Operator		2.2
Helpers - Rod Straightener		1.4

As shown in the table, only 3 of the 12 jobs studied indicated exposures in excess of the MAC. This was partly due to the relatively slow oxidation rate of thorium as compared to that of uranium rolled under similar conditions. Very little dust could be observed from any of the operations except the crop shear and rod straightener. Ingot surfaces appeared intact upon removal from the ingot furnace and only moderate amounts of dust were visible on the mill floor at the end of the shift.

CONCLUSION:

Assuming that the thorium rollings at Simonds will be confined to a few days per year, the exposures to the shear operator, the rod straightener operator, and the rod straightener helpers are not significant. However, if rollings were to be done under similar conditions in excess of 48 hours per month, it would be necessary to provide adequate ventilation for the shear operation. Further investigation would be necessary to determine the need for ventilating the rod straightener if the rolling schedule exceeds 48 hours per month.

Table of Sample Results

Operation or Operating Area	Type	Concentration d/m/M ³			
		High	Low	Aver.	X MAC
Weigh-in and furnace area	GA (3)	18	9	12	0.17
Roughing Mill - East Side	GA (3)	58	12	38	0.54
Roughing Mill - West Side	GA (3)	32	16	25	0.36
Finishing Mill - East Side	GA (3)	22	12	15	0.21
Finishing Mill - West Side	GA (3)	6	1	3	0.04
Cooling grate & rod stamping area	GA (4)	7	3	6	0.09
Crop shear area	GA (3)	194	108	145	2.0
Rod straightener area	GA (3)	129	111	121	1.7
Heater and Helper	BZ (2)	75	49	62	0.89
Ingot dragdown operator	BZ (3)	60	16	40	0.57
Roughers - East side	BZ (3)	192	4	69	1.0
Roughers - West side	BZ (3)	27	13	20	0.29
Finishers - East side	BZ (3)	68	21	45	0.64
Finishers - West side	BZ (3)	61	14	38	0.54
Rod dragdown operator	BZ (3)	29	25	27	0.39
Rod stamper	BZ (3)	71	16	37	0.53
Shear operator	BZ (3)	2059	1416	1751	25.0
Rod Straightener operator	BZ (3)	627	343	508	7.3

Survey Period 12/4/53

PROCESS AREA 16" Bar Mill

2 men/shift   **1** shifts/day   **2** men/day

4 (TxC) 10390

MAC

612-8

NATIONAL LEAD OF OHIO

Survey Period 12/4/53

Job Exposure Evaluation

BUIL DING _____

PROCESS AREA 16" Bar Mill

OPERATOR Ingot Dragdown 1 men/shift 1 shifts/day 1 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Remove ingot from furnace & drag- down			75	3	60	16	40	3000
QA Furnace area			320	3	18	9	12	3840
QA Lunch & rest area			100	2	30	9	19	1900
QA Locker room			15	0	Assumed nil			----

LT 510

Σ (TxC) 8740

$$\frac{\sum (T \times C)}{\sum (T)}$$

17.1 d/m/M³

.24

MAC

AECD-3714

H.S.- 12-H-2

NATIONAL LEAD OF OHIO

Survey Period 12/4/53

Job Exposure Evaluation

BUILDING _____

PROCESS AREA 16" Bar MillOPERATOR Roughers -
East side2 men/shift1 shifts/day2 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Passing ingots through roughing rolls			150	3	192	4	69	10350
GA East side of roughing rolls			245	3	58	12	38	9310
GA Lunch & rest area			100	2	30	9	19	1900
GA Locker room			15	0	Assumed nil			-----

 ΣT 510 $\Sigma (T \times C)$ 21560

$$\frac{\Sigma (T \times C)}{\Sigma (T)} = \frac{21560}{510} = 42.3 \text{ d/m/M}^3$$

.6

MAC

612-10

Job Exposure Evaluation

BUILDING _____

PROCESS AREA 16" Bar MillOPERATOR Roughers -
West Side2 men/shift1 shifts/day2 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver. (C)			T X C
BZ Passing ingots through roughing rolls			150	5	27	13	20	3000
GA West side of roughing rolls			245	3	32	16	25	6125
GA Lunch & rest area			100	2	30	9	19	1900
GA Locker room			15	0	Assumed nil			-----

 ΣT 510 $\Sigma (T \times C)$ 11025

$$\frac{\Sigma (T \times C)}{\Sigma (T)} = \underline{21.6} \text{ d/m/M}^3 =$$

.3

MAC

612-11

NATIONAL LEAD OF OHIO

Survey Period 12/4/53

Job Exposure Evaluation

BUILDING _____

PROCESS AREA 16" Bar Mill

Finishers -

OPERATOR East Side2 men/shift1 shifts/day2 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Passing billets through finishing rolls			260	3	68	21	45	11700
GA East side of finishing rolls			135	3	22	12	15	2025
GA Lunch & rest area			100	2	30	9	19	1900
GA Locker room			15	0	Assumed nil			-----

 ΣT 510 $\Sigma (T \times C)$ 15625

$$\frac{\Sigma (T \times C)}{\Sigma (T)} = \underline{30.6} \text{ d/m/M}^3 =$$

.43

MAC

612-12

10

H S - 12-H-2

AECD-3714

NATIONAL LEAD OF OHIO

Survey Period 12/4/53

Job Exposure Evaluation

BUILDING _____

PROCESS AREA 16" Bar MillOPERATOR Finishers -
West Side2 men/shift 1 shifts/day 2 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Passing billets through finishing rolls			260	3	61	14	38	9880
GA West side of finishing rolls			135	3	6	1	3	405
GA Lunch & rest area			100	2	30	9	19	1900
GA Locker room			15	0	Assumed nil			----

 ΣT 510 $\Sigma (T \times C)$ 12105 $\frac{\Sigma (T \times C)}{\Sigma (T)}$ - 23.9 d/m/M3.34

MAC

1612-13

H S.- 12-H-2

NATIONAL LEAD OF OHIO

Survey Period 12/4/53

Job Exposure Evaluation

BUILDING _____

PROCESS AREA 16" Bar Mill

OPERATOR Red Dragdown Operator

1 men/shift 1 shifts/day 1 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Dragging rods to cooling grate & return			75	3	29	25	27	8025
GA West side of finishing rolls			320	3	6	1	3	960
GA Lunch & rest area			100	2	30	9	19	1900
GA Locker room			15	0	Assumed nil			-----

ΣT 510

$\Sigma (T \times C)$ 4865

$\frac{\Sigma (T \times C)}{\Sigma (T)}$ 9.6 d/m/M3 =

.14

MAC

Job Exposure Evaluation

BUILDING _____

PROCESS AREA Stamping Area

OPERATOR Ed Stamber

1 men/shift 1 shifts/day 1 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Stamping rods			75	3	71	16	37	2775
GA Stamping area			320	4	7	3	6	1920
GA Lunch & rest area			100	2	30	9	19	1900
GA Locker room			15	0	Assumed nil			----

LT 510

4 (TxC) 6595

$$\frac{\sum (T \times C)}{\sum (T)} = \frac{12.9}{\quad} \text{ d/m/M}^3 =$$

19

MAC

612-15

H S.- 12-H-2

NATIONAL LEAD OF OHIO

13

Survey Period 12/4/53

Job Exposure Evaluation

BUILDING _____

PROCESS AREA Crop Shear Area

OPERATOR Shear Operator 1 men/shift 1 shifts/day 1 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Cropping rod ends on crop shear			75	3	2059	1416	1751	131325
GA Shear area			320	4	7	3	6	1920
GA Lunch & rest area			100	2	30	9	19	1900
GA Locker room			15	0	Assumed nil			-----

ΣT 510

$\Sigma (T \times C)$ 135145

$$\frac{\Sigma (T \times C)}{\Sigma (T)} = \frac{264.9}{100} \text{ d/m/M}^3 =$$

3.8

MAC

612-16

Job Exposure Evaluation

BUILDING _____

PROCESS AREA Crop Shear AreaOPERATOR Shear Helpers 2 men/shift 1 shifts/day 2 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Feeding & unloading shear			75	3	194	108	145	10875
QA Shear area			320	4	7	3	6	1920
QA Lunch & rest area			100	2	30	9	19	1900
QA Locker room			15	0	Assumed nil			----

 ΣT 510 $\Sigma (T \times C)$ 14075

$$\frac{\Sigma (T \times C)}{\Sigma (T)} = \frac{14075}{510} = 27.6 \text{ d/m/M}^3$$

.41

MAC

H.S.- 12-H-2

NATIONAL LEAD OF OHIO

Survey Period 12/4/53

Job Exposure Evaluation

BUILDING _____

PROCESS AREA Rod Straightener AreaOPERATOR StraightenerHelper1 men/shift1 shifts/day1 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)			T X C
BZ Straightening rods			75	3	627	343	508	38100
GA Straightener area			320	3	129	111	121	38720
GA Lunch & rest area			100	2	39	9	19	1900
GA Locker room			15	0	Assumed nil			----

 ΣT 510 $\Sigma (T \times C)$ 10,20

$$\frac{\Sigma (T \times C)}{\Sigma (T)} = \frac{104.3}{510} \text{ d/m/M}^3 =$$

2.2

MAC

612-18

Job Exposure Evaluation

BUILDING _____

PROCESS AREA Rod Straightener AreaOPERATOR Helpers-Rod
Straightener2 men/shift 1 shifts/day 2 men/day

OPERATION OR OPERATING AREA	TIME PER OPER.	OPER. PER SHIFT	TIME PER SHIFT (T)	NO. OF SAMPLES	CONCENTRATION d/m/M3 High Low Aver.(C)	T X C
GA Rod straightener area-loading & unloading rods			395	3	129 111 121	47795
GA Lunch & rest area			100	2	39 9 19	1900
GA Locker room			15	0	Assumed nil	----

 ΣT 510 $\Sigma (T \times C)$ 49695

$$\frac{\Sigma (T \times C)}{\Sigma (T)} = \frac{49695}{510} = 97.4 \text{ d/m/M}^3 =$$

1.4

MAC

6/2-14