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DUST MONITORING AT ALGOMA STEEL CORPORATION LTD., SAULT STE. MARIE, ONT., JUNE 6, 1961

by

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MINERAL SCIENCES DIVISION

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SUMMARY OF RESULTS

Dust samples were collected during the tapping and pouring of three 100-ton heats of uranium-containing steel. The uranium concentrations in air that were found during these operations were considerably below those observed during the previous test and well below the maximum permissible value.

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INTRODUCTION

The second commercial heat of uranium-containing steel conducted by Algoma Steel Corporation Ltd. was made in their plant at Sault Ste. Marie on June 6, 1961. The writer attended these operations in order to obtain air dust samples in the area where this work was being carried out. Mr. D.R. Bell and Dr. G.J. Biefer of the Physical Metallurgy Division were also present to observe metallurgical aspects of the work.

The initial commercial heat of uranium-containing steel was made by Algoma Steel Corporation Ltd. in their Sault Ste. Marie plant on May 2, 1961. The writer attended these operations with Dr. Eichholz. Results from tests carried out on that occasion are covered in Mines Branch Investigation Report IR 61-53.

During the June 6 operations, the air monitoring was conducted only in the furnace and pouring platform areas, as results obtained from the previous tests in other areas, such as the rolling mill, soaking pits, deseamer, cooling beds, hand scarfing, etc, had failed to indicate the presence of appreciable radioactive dust concentration in the air.

Three heats, Nos. E-3373, E-3375 and E-3378, were made in which ferro-uranium was added to the melt, each being from 104 to 106 ton capacity heated in an oxygen converter furnace. The first heat (No. E-3373) was different from the two following:

the uranium was added only to No. 3 large ingot while pouring, other ingots being uranium-free. In heats No. E-3375 and No. E-3378 the uranium was added to the ladle during tapping. The additions were as follows:

Heat No. E-3373 - 104 to 106 tons

Ferromanganese - 150 lb, Al - 450 lb, zirconium silicate - 110 lb; 28 lb ferro-uranium added to No. 3 ingot (20,770 lb).

Heat No. E-3375 - 104 to 106 tons

Ferromanganese - 1600 lb, ferrosilicon - 1500 lb, Al - 150 lb, C - 250 lb; approx. 3 lb/ton of ferro-uranium as a ladle addition.

Heat No. 3378 - 104 to 106 tons

Ferromanganese - 1650 lb, ferrosilicon - 1500 lb, Al - 150 lb, C - 250 lb; approx. 3 lb/ton of ferro-uranium as a ladle addition.

Final uranium assays for representative ingots are given in Table 1.

TABLE 1

Uranium Assays
(determined by Eldorado Mining and Refining Ltd.)

Heat	Ingot	Per cent Uranium
E-3375	1	0.0071
"	8	0.0058
"	13	0.0048
"	14	0.0057
"	15	0.0052
E-3378	2	0.022
"	5	0.022
"	8	0.018
"	9	0.016

MONITORING PROCEDURE

Air dust samples were taken in the following positions:

(1) One Staplex sampler, mounted on a tripod base, was placed on the pouring platform approximately 12 ft from No. 3 ingot during pouring and addition of the uranium. (No. E-3373 heat - ingot addition). Later it was placed on the pouring platform in the area of operation. Samples were taken before, during and after the pouring of each heat.

(2) One Staplex sampler was used on the pulpit during tapping and additions. It was held at the door of the pulpit facing the ladle.

(3) Before and after tapping, two samplers were placed side by side on the pulpit floor. One was run for various short periods and the other for longer ones to check on the variation of uranium concentration in air with time and on the contribution of dust stirred up when the melting floor was swept.

It was noted that the ventilation in the neighbourhood of the pouring platform was much greater than during the previous test, so that fumes were carried away immediately. As a result, one would expect very low dust particle collection by samplers.

Fourteen air dust filters were used and were checked for beta activity in the Mines Branch laboratory on June 9, and again on June 12. Only two showed activity significantly above normal background fluctuation.

A sample of floor sweepings from the area in front of the pulpit was checked for beta and gamma activity. The counts obtained were too close to background to indicate more than a possible trace of uranium. The sample was sent to the chemical laboratory for a chemical uranium assay. Results obtained from Geiger tests and chemical assays are presented in Table 2. Two film badges were issued to Algoma staff. No reportable exposures were found on development.

TABLE 2

Analysis of Air Dust Samples, June 6
(Heats No. E-3373, No. E-3375, No. E-3378)

Filter No.	Location	Sampling time	Approx. volume sampled (cu ft)	Net count rate (c/m) after 3 days	Net count rate (c/m) after 6 days	Total uranium (µg)	U concentration in air (µg/cu ft)
1	On pouring platform - 12 ft from E-3373 heat	11:23 - 11:31 am	384	1.54	0.77	-	-
2	Pouring platform, background control	11:36 - 12:06	1440	Bgd	Bgd	-	-
3	Door of pulpit during U addition and tapping E-3375	1:25 - 1:35 pm	480	1.92	Bgd	4 (chem)	0.008
4	On pouring platform pouring of No. E-3375 heat into moulds	1:36 - 1:56	960	7.17	5.18	205 (chem)	0.21
5	On pulpit stand following No. E-3375 heat pour	1:39 - 2:00	945	1.54	Bgd	-	-
6	On pulpit stand dust check	1:40 - 1:50	450	0.64	Bgd	-	-
7	On pulpit stand dust check	1:51 - 2:01	450	1.47	Bgd	-	-
8	On pulpit stand dust check	2:03 - 2:13	450	Bgd	Bgd	-	-
9	On pulpit stand dust check	2:02 - 2:32	1350	Bgd	1.73	-	-
10	On pouring platform following No. E-3375 pour	2:22 - 2:30	384	Bgd	0.90	-	-
11	At door of pulpit during U addition and tapping E-3378	4:42 - 4:56	630	Bgd	Bgd	-	-
12	On pulpit after ladle removed	5:00 - 5:30	1350	0.19	Bgd	-	-
13	On pouring platform during pouring of No. E-3378 heat into ingots	5:00 - 5:14	672	9.60	10.9	380 (chem)	0.57
14	On pouring platform after No. E-3378 pouring	5:16 - 6:30	3552	1.02	1.28	-	-
15	Pulpit floor dust sample						0.0009% U_3O_8

Notes: Beta background averaged 12 to 14.3 c/min
Chemical uranium determinations were obtained by fluorimeter by Mr. J.B. Zimmerman, Extraction Metallurgy Division, Mines Branch.

The slag was monitored with a portable radiation counter. The radiation level was similar to that measured during the previous test. In view of the low recovery of uranium in the metal, monitoring and safe handling of the slag are of prime importance. A small slag sample (heat No. E-3378) was brought back to Ottawa for assaying. It was found to contain 0.007% uranium.

CONCLUSIONS

Comparing the results from air dust sample tests taken during the June 6 operations with those of May 2 (Mines Branch Investigation Report IR 61-53) covering the same area of operations, on the pulpit and the pouring platform, samples taken on June 6, show a very remarkable decrease in uranium concentrations. The improvements in the ventilating system, combined with more favourable atmospheric conditions, no doubt were the main contributing factor in this reduction.

The chemical result for the pulpit floor dust sample showed a content (0.0009% U) of the same order as found in local sands and, therefore, could be considered negligible. In future tests it may be useful to take similar floor samples in the area where the ladle is situated during tapping, and also where the ingots are placed while pouring operations are being conducted. This would show if uranium dust was accumulating in these areas.

Appreciation is expressed to the following members of Algoma Steel Corporation Ltd., Mr. R.C. Madden, chief metallurgist, Mr. T.W. Crosta, works metallurgist,for their co-operation, and to Mr. K. Hermisten, chief observer, Metallurgical Department, and Mr. B. Douglas of the Research Laboratory for their assistance with the collection of samples.

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