HASL-RMDL-1

RAW MATERIALS DEVELOPMENT LABORATORY

WINCHESTER, MASSACHUSETTS

OCCUPATIONAL EXPOSURE TO AIRBORNE CONTAMINANTS

by

Industrial Hygiene Branch
Health and Safety Laboratory

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SCOPE

An air hygiene and contamination survey was conducted at the Raw Materials Development Laboratory (RMDL), Winchester, Massachusetts by Mr. Paul E. Alevin, Industrial Hygiene Branch, Health and Safety Laboratory in accordance with the recommendations stated in the Memo dated March 23, 1955 (from W. B. Harris, Chief, Industrial Hygiene Branch, RMDL to Mr. George Marvin, Director, Division of Raw Materials, Washington) re: "Visit to RMDL". This survey covered exposures to airborne uranium, radon and radiation during uranium ore assay, process development and experimental research operations.

PURPOSE

This survey was made with the following objectives in mind:

1. To measure the amounts of uranium dust, radon and mercury in the air at various operating laboratory areas.

2. To determine any sources of airborne contamination which must be controlled to reduce existing concentrations to an acceptable level.

3. To determine the extent and degree of radioactive contamination of building and equipment.

4. To train a member of the laboratory staff in the techniques of air sampling.

METHOD OF STUDY

A. Air Dust

Air dust samples were collected on 1 1/8 inches whatman number 41 filter paper using a universal air pump at 35. litres/minute. The collection period varied from 1.0 to 25 minutes depending on conditions of operations and dust loading. The dust samples were of two kinds:

1. General Air - those obtained from a general work area or room atmosphere.

2. Breathing Zone - those obtained in the breathing zone of an operator during the performance of a particular task or operation.

All uranium samples were counted for uranium alphas on an alpha scintillation counter.

Raw Materials Development Lab, Winchester, Mass

B. Radon

General air and breath radon samples were obtained in litre glass flasks as follows:

1. General air samples were collected by litre flask employing a universal air pump to move room atmosphere through a one litre flask. General air was passed through the flask for several minutes and then contained in the flask by closing both stopcocks discontinuing source of suction.

2. Breath radons, collected in one litre flask, were obtained from laboratory personnel in a low level radon area (office area) as follows:

   a. The subject breathed compressed air with a respirator for five minutes to flush the environmental air from his lungs.

   b. While the subject continues breathing compressed air, the one litre flask with both stopcocks opened is attached for a one minute period. The subject's exhaled air is contained in the flask by closing stopcocks.

The radon content in curies per litre of air were measured in a radon ionization chamber.

C. Mercury

Measurements of mercury concentrations were made using a General Electric vapor detector. The following two types of measurements were made:

1. General area measurements

2. Pin pointing and locating source of contamination.

D. Radiation

Area monitoring for radiation intensity at various laboratory operations and for general area contamination was performed using:

1. Beta gamma survey meter (sgm & D) geiger tube instrument used to detect beta and gamma emitting materials. This is a count rate meter reading intensity in millirontgens per hour (mr/hr). The instrument has three ranges (0.2, 2.0 and 20 mr/hr, full scale).

2. Samson SIC49A - Ionization chamber instrument for detection of alpha and gamma emitting radioactivity. The Samson measures intensity in three ranges (500, 2500, and 12,500 counts per minute, full scale).

Mr. G. L. Skillman, Administrative Assistant, RMDL, was given instructions in the techniques of air sampling, both area and breath radon sampling, and area radiation monitoring.

PROCEDURES

RMDL is responsible for some chemical engineering work toward process development of new and improved methods of recovering uranium from its ores. It also assays both foreign and domestic uranium ores. In the performance of the aforementioned responsibilities the operations performed by laboratory personnel vary from simple rountine chemical analysis to refined analytical methods and techniques and to process development working on a laboratory or pilot plant scale.

Because of the impossibility of obtaining a comprehensive dust study in this one day survey, a limited number of breathing zone samples were taken at several known dust producing operations. General air samples, however, were taken in all laboratory work areas and should serve the purpose of providing an indication of usual airborne contamination levels.

DISCUSSION

A. Air Dust

The results of the air dust samples taken to determine the concentration of uranium airborne contamination are:

Location and Description	No. of Samples	Concentration (d/m/m³)* Aver	Max	Low
Room 140 Ion Exchange	2	13	25	1
Room 134-135 Sample Preparation Rm	3	9	22	<1
Room 133 Crushing Room	4	10	21	2
Room 136 Pilot Plant	2	7	8	6
Room 136-137 Fire Assay Area	2	2	3	1
Room 143 Mineral Dressing Lab	1	1	-	-

* d/m/m³ = Disintegration per minute per cubic meter of air
100 d/m/m³ = Mac = Maximum allowable concentration tentatively used by HASL

None of the fourteen samples were found to exceed more than 25% of the mac. The highest concentrations found in Room 140 (25 d/m/m³) Room 134-135 (22 d/m/m³) and Room 133 (21 d/m/m³) were obtained in unventilated bench areas on which low grade ores were being weighed, crushed or prepared.

Following are the results of breathing zone samples obtained during sample preparation in Rooms 134-135:

Operation	No. of Samples	Concentration (d/m/M3) Aver	High	Low
1. Pouring low grade ore from pan	2	2	5	<1
2. Weighing sample of low grade ore	2	16	20	11

The above operations are performed on unventilated laboratory table. Although none of BZ samples exceeded 20% of the mac, the GA concentration found in this room show evidence of some spread of the airborne contaminants.

B. Radon

The results of four samples taken to determine the concentration of radon in the major laboratory areas show the highest concentration to be 1/100 of the mac. The radon concentrations obtained are:

Location and Description	Radon Concentration c/l x 10^{-10} *
Room 134 - Sample Preparation Room	0.011
Room 133 - Crushing Room	0.002
Room 136-137 - Pilot Plant	0.008
Room 143 - Mineral Dressing Lab	0.003

* c/l = Curies per litre of air
1×10^{-10} c/l is the mac presently used by HASL

The results of breath radons obtained from four laboratory personnel revealed no one to exceed the mac. Following are the list of personnel and their exposure.

Name	Concentration c/l x 10^{-12} *
H. C. Greenlaw	0.2
J. C. Galipeau	0.4
O. A. Presle	0.5
T. L. Kurpiel	0.09

* 1×10^{-12} c/l is the mac presently used by HASL for breath radons.

C. Mercury

No detectable amounts of mercury were found in the general area survey made in Ion Exchange Lab (Room 140) Polorography Analysis Lab (Room 118) and Analytical Lab (Room 121).

Mercury concentrations obtained during pin point sampling to locate sources of contaminations are:

Location and Description	Concentration (Mg/M3)*
Room 140 - Mercury cleaning bench contact with drain	0.1
Room 118 - Spill on stainless steel tray bench	0.1
Floor under/to bench	0.05
Floor top	0.08
Sink	0.16
Room 121 - Mercury recovery hood	0.1

*Mg/M^3 = Milligrams per cubic meter of air
0.1 Mg/M^3 = Mac value adopted for mercury by American Conference of Governmental Industrial Hygienists

D. Direct Radiation

Negligible amounts of beta-gamma contamination measured at a 3 foot level and at contact, were found.

Visible amounts of removable alpha contamination was found in several of the laboratory areas. Following is a tabulation of the alpha contamination found at specific locations:

Location and Description	Radiation Measurement $d/m/100\ cm^2$	Remarks
Room 133 - Crushing Room	8000	Loose uranium bearing material in open waste basket
Room 136 - Pilot Plant -Floor area	3500-4000	Visible loose contamination
Hood S.W. Wall	5000	
Bench	1000	
Room 134 - Sample Preparation		
Stainless Steel Tables	400	Contamination fixed
Floor	400	
Top of Pulverizer Crusher	825	Loose contamination
Room 143 - Mineral Dressing -		
Floor, Walls, Ceiling	5000	Loose cake due to autoclave spill
Lab Bench	5000	Loose cake due to autoclave spill

CONCLUSIONS

The results found in this study indicate that no serious industrial hygiene hazards exist at the laboratory. In order to improve the contamination levels which were found, the following recommendations are made:

Rec. No. 1 - All laboratory operations concerned with handling radioactive or toxic materials should be performed in the adequately ventilated hoods.

Rec. No. 2 - Spillage of material should be immediately cleaned up to prevent the evolution of dust and the spread of airborne contamination. A vacuum cleaner should be employed to remove all visible loose radioactive contamination. For other toxic materials such as mercury a special roller device is available to clean up spillage.

Rec. No. 3 - Contaminated waste materials and ores should be stored or packaged in properly labeled closed containers.

General

Rec. No. 4 - Periodic air dust and direct radiation monitoring should be performed by R&L personnel to insure acceptable radiation and contamination levels.

Rec. No. 5 - All laboratory personnel who may come in frequent contact with radium bearing ores should be sampled for breath radon once every 6 months.

Rec. No. 6 - A urine sampling program should be initiated on an infrequent but periodic basis.

APPENDIX A

SAMPLE REQ. No. A [illegible]

ATOMIC ENERGY COMMISSION

FORM N.Y.-99
REV 2/4/52

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
HEALTH AND SAFETY DIVISION
P. O. BOX 30, ANSONIA STA.
NEW YORK 23, N. Y.

SAMPLE REQ. No. A 6429
DATE SENT
DATE RECEIVED 9-12-55
DATE REPORTED [illegible]

PLANT [illegible]
MAILING ADDRESS [illegible] Mass
ROUTE RESULTS TO [illegible]

TYPE OF SAMPLE Air Dust
METHOD OF DETERMINATION

ANALYZE FOR U

SAMPLE No.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING Rate	SAMPLING Time	SAMPLING TOTAL	SAMPLE TAKEN	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS d/m/m³	
B700	9/15	12:58	Lab Bench @ Wall ... Rm 140 ...	.035	25	0.875	0.4	15	30	0.1	.53	4.6
B701		12:53	Rm 140 West ... Lab Bench		25	0.875	0.4	145	22	6.2	25	3.5
B702		1:29	R134 Sample Prep Room ...		20	0.70	0.3	124	30	3.8	22	4.1
B703		1:29	Rm 135 ... Storage ...		20	0.70	0.4	12	30	0	0	3.8
B704		1:10	Rm 133 Sample Prep ...		21	0.735	0.2	34	30	0.9	5.0	4.1
B705			BZ - ... Scraping Planer		2	0.07	0.2	4	30	0	0	4.3
B706			BZ Same as B705		3	0.105	0.3	24	30	0.5	20	4.1
B707			BZ Weigh ... Sample ...		1	0.035	0.4	16	30	0.1	11	3.8
B708			BZ Same as B707		1	0.035	0.2	4	30	0	0	4.1
B709		...	Rm 133 - ... Dust Collector		21	0.735	0.2	111	30	3.5	20.4	4.3
B710			Rm 133 ...		21	0.735	0.3	[illegible]	30	[illegible]	21.2	4.1
B711			Rm 133 Drum weigh sta. West Center		20	0.70	0.4	34	30	.64	22	3.8
B712			Rm 133 In front of Crucible ... South ...		20	0.70	0.2	16	30	.33	19	4.1
B713			Control		—		0.2	8	30	.07	0.3 d/m	4.3

COLLECTED BY

ANALYZED BY

FORM N.Y.-89
REV. 2/4/52

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK OPERATIONS OFFICE
HEALTH AND SAFETY DIVISION
P. O. BOX 30, ANSONIA STA.
NEW YORK 23, N. Y.

SAMPLE REQ. No. A 6430
DATE SENT
DATE RECEIVED 9-12-55
DATE REPORTED

PLANT Knolls Res Lab
MAILING ADDRESS Windsor Vt
ROUTE RESULTS TO [illegible] Vin
ANALYZE FOR U

TYPE OF SAMPLE Air Dust
METHOD OF DETERMINATION

SAMPLE NO.	DATE	HOUR	SAMPLE DESCRIPTION	SAMPLING m³ RATE	TIME	TOTAL	SAMPLE TAKEN	TOTAL COUNT	COUNT TIME	COUNTS PER MIN.	RESULTS d/m/m³	
B710	9/	3	Rm 136 - [illegible] Next to [illegible]	C31	20	0.70	0.3	41	30	1.1	0.4	4.1
B711		3½	[illegible] Rm 136) [illegible]		20	0.70	0.4	54	30	1.5	.61	3.8
B716			Rm 136 West Corridor Front [illegible]		20	0.70	0.2	32	30	.53	.31	4.1
B717		3½	Rm 137 [illegible] Rad Lab Working Area		20	0.70	0.2	9	30	0.1	.41	4.3
B716		4	Rm 143 Mineral Dressing Lab South side near entrance		20	0.70	0.3	14	30	.16	0.9.4	4.1

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SURVEYOR TO RETAIN LAST COPY—RETURN ALL OTHERS TO HEALTH AND SAFETY DIVISION