DOCKET NO. 40-1376
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TEXAS-ZINC MINERALS CORPORATION
MEXICAN HAT, UTAH

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July 25, 1961

Mr. Lyall Johnson
Chief, Licensing Branch
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, District of Columbia

Dear Mr. Johnson:

Enclosed is our progress report that describes the radiation surveys made by Texas-Zinc Minerals Corporation during the second quarter of 1961. These surveys were made in compliance with the Atomic Energy Commission "Standards for Protection Against Radiation, Part 20, Title 10, Code of Federal Regulations", dated January 29, 1957, amended September 7, 1960 and December 30, 1960, effective January 1, 1961.

This report describes radiation surveys made in the Mexican Hat mill area and environs, progress made on recent radiological safety programs and present and future projects which are designed to achieve compliance.

Very truly yours,

J. E. Nelson

J. E. Nelson
Plant Superintendent

GHCrouch/jmt

cc: W. Spencer Hutchinson, Jr., Director
Source Materials Procurement Division
United States Atomic Energy Commission
Grand Junction Operations Office
Grand Junction, Colorado

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RESTRICTED AREA A - Ore Yard

Previous data have indicated that no radiation hazards exist in this area. It is presently scheduled to be surveyed twice yearly.

RESTRICTED AREA B - Sample Plant and Fine Ore Bins

A random survey of airborne radioactive dust concentrations was taken in this area during the quarter. Although some readings were obtained in excess of MAC, the average uranium concentration was less that 2.5×10^{-11} microcuries of uranium per milliliter of air. Another survey to include all sampling stations is planned for the third quarter.

RESTRICTED AREA C - Grinding, Flotation, Leaching

RESTRICTED AREA D - Thickener Tanks

RESTRICTED AREA E - Solvent Extraction

Previous data have indicated that no radiation hazards present themselves in these areas. They are presently scheduled to be surveyed twice yearly.

RESTRICTED AREA F - Yellow Cake Section

Results of film badge exposures of operators in this area are shown in Table IV and are well below the maximum permissible dose for a calendar quarter.

Previous surveys of airborne radioactive dust concentrations in the yellow cake section have indicated that above average concentrations of uranium-bearing dust emanated from the drum-packaging zone. During the latter part of May a hooded enclosure with a high volume exhaust fan was installed around the drum-filling and packaging zone to decrease air contamination in the operating area. The plywood enclosure is approximately 5 ft. square by 6 ft. high, open on the north side for access and is topped by a pyramidal metal hood. The system is exhausted by a 24 inch Diehl belt-driven duct fan powered by a 3 hp 1800 rpm 3 phase motor. The fan has a 9300 cfm capacity and exhausts to atmosphere through a 24 inch ID stack 30 feet above ground level. This stack effluent will be sampled during the coming quarter. After this system was put into operation, a dust survey was taken in and around the drum packaging zone. Results of this survey are shown in Table I and are compared with results of two separate special surveys taken in the packaging zone prior to installation of the exhaust system.

TABLE I Special Dust Surveys of Drum Packaging Zone - Restricted Area F

Station	Average Dust Concentrations - Microcuries of Uranium per milliliter x 10^{-11}		
	3rd Quarter, 1960	3rd Quarter, 1960	2nd Quarter, 1961
3	4.2	3.0	0.3
4	4.6	15.3	0.6
5	1.3	3.3	0.2
6	3.4	2.8	0.4
7	5.0	18.3	2.1
8	5.1	16.5	3.1

These data show that the installation of the new exhaust system has greatly reduced the concentrations of airborne radioactive dust in and around the drum packaging zone. Figure 1. shows the location of the new assembly and the stations sampled for this survey. Supplementary data will be collected during the coming quarter.

RESTRICTED AREA G - Mill Offices

RESTRICTED AREA H - Shop Area and Plant Office

RESTRICTED AREA I - Tailings Pond Area

Previous data have indicated that no radiation hazards present themselves in these areas. They are presently scheduled to be surveyed twice yearly.

BY-PRODUCT SOURCE MATERIAL

On June 22, 1961, a wipe test was made on the fifty millicurie Cesium source stored in our vault (By-Products Materials License Number 43-2666-1). No leakage or contamination was noted. Gamma radiation measured from 0.19 to 0.21 milliroentgens per hour approximately one foot outside the lead box in which the container is stored.

ATMOSPHERIC EFFLUENT

An environmental air survey including 16 samples from mill stacks and 24 random samples in the inhabited areas around the mill property was taken during the second quarter as groundwork for evaluating our atmospheric effluent. All air samples of the environs were taken for 2½ hour periods, each sample representing 3000 liters of air. In-stack samples were taken at sealed sampling stations located in the stack several feet from the discharge. Stack samples represent only 200 to 500 liters of air due to higher airborne concentrations.

Atmospheric Effluent (Cont.)

Concentration levels of airborne radioactive dust in inhabited areas surrounding the mill are shown in Table IV. Out of 24 samples, 23 were well below the maximum allowable concentrations for airborne dust released to unrestricted areas as specified in 10CFR20. One sample taken in the Texas-Zinc Minerals Corp. housing project was 1.98 times MAC. In view of the lower concentrations found in the rest of the townsite it is believed that this was a contaminated sample. However, additional samples will be collected at this location.

A summary of in-stack concentrations of airborne radioactive dust are shown in Table II. The maximum ground concentration, which may be caused by each stack is also shown. These calculations were made using equation 4.66, AECU 3066.

TABLE II. In-Stack Concentrations of Airborne Radioactive Dust and Maximum Ground Concentrations in Air Effluents

Stack	Microcuries of Uranium per milliliter $\times 10^{-13}$			
	In-Stack Concentration		χ max(1)	times MAC
	Maximum	Average		
Sample Plant Rotoclone	200	105	0.209	0.026
Torit Bag Filter	32.8	13.7	0.345	0.043
#6-10 Leach Tank Exhaust	686	499	0.411	0.051
North Yellow Cake Rotoclone	2180	1600	1.897	0.237
South Yellow Cake Rotoclone	340	188	0.227	0.028

(1) $\chi_{mas} = \frac{2Q}{e\pi\bar{u}h^2}$ = maximum ground concentration which can occur from any given stack

Q = In-stack concentration of airborne radioactive dust

$\bar{u}$ = mean wind velocity

h = stack height

Atmospheric Effluent (Cont.)

Because no wind measurements have been taken to date an arbitrary figure of 2 meters per second was used for mean wind velocity in all calculations. This is considered to be a very low estimate and represents, probably, the worst possible conditions in this area where strong winds prevail. Data show that even under these adverse conditions, the maximum ground concentrations are well below MAC for atmospheric effluents.

As this survey was nearing completion a new stack was added in restricted area F to exhaust dust from in and around the drum-packaging zone (see Restricted Area F - Yellow Cake Section). The stack will be included in the next atmospheric effluent survey.

In addition to further surveys of the types reported here, several 24 hour samples will be collected during the coming quarter in order to include both the daytime and nighttime meteorological conditions.

LIQUID EFFLUENTS

Results of Ra-226, Th-230 and uranium analyses on quarterly composites of the neutralized raffinate and the upstream and downstream river water are shown in Table III. When the concentrations shown for downstream river water are inserted in the proper formula taken from 10CFR20 it can be shown that the San Juan river waters dilute the neutralized raffinate to less than MAC by the following calculation:

distance? river flow ft/sec? intake stations? discharge rate?

$$\frac{\text{Conc. Ra-226}}{\text{MAC for Ra-226}} + \frac{\text{Conc. Th-230}}{\text{MAC for Th-230}} + \frac{\text{Conc. Uranium}}{\text{MAC for Uranium}}$$

$(1.05 \times 10^{-9}) \pm 0.64$ $(0.09 \times 10^{-8}) \pm .05$ $(.034 \times 10^{-5}) \pm .06$

$$= \frac{0.5 \times 10^{-9}}{1 \times 10^{-8}} + \frac{0.07 \times 10^{-8}}{2 \times 10^{-8}} + \frac{0}{2 \times 10^{-5}}$$

$= .105$ ✓ $= .0004$ ✓ $= .017$ ✓

$$= 0.05 + 0.0004 + 0$$

$= 0.05$ (Less than 1) Considering max SD = 0.2 (still less than 1) ✓

$= 0.12$ " to take into account analytical errors

A request for exemption to discharge the neutralized raffinate pursuant to section 20.106a has been submitted to the AEC.

Analyses on the quarterly sample of tailings pond seepage are shown in Table III. If we apply these values to the formula, we find that the combined concentrations of Ra-226, Th-230 and uranium are less than MAC for liquid effluents being discharged to unrestricted areas.

Liquid Effluents (Cont.)

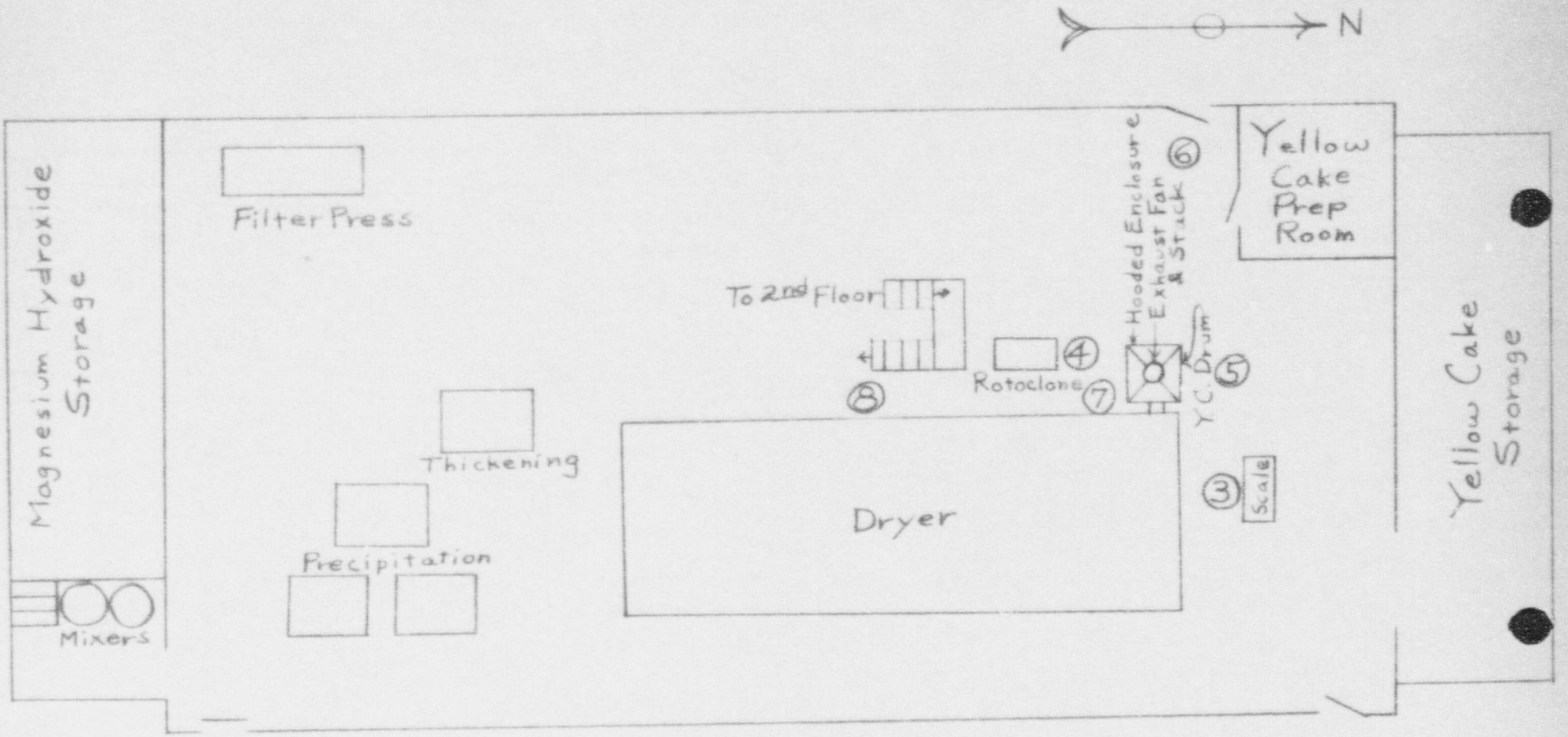
$$\frac{7.6 \times 10^{-9}}{1 \times 10^{-8}} + \frac{0.009 \times 10^{-8}}{2 \times 10^{-6}} + \frac{0.4 \times 10^{-6}}{2 \times 10^{-5}}$$

$$= 0.76 + 0.00065 + 0.02$$

$$= 0.78 \quad \text{(Less than 1)}$$

Data obtained during the fourth quarter of 1950 indicated that one of the components of the open drainage ditch, the solvent extraction sump waste, was the chief contributor to the excessive radium content of this stream. The major portion of the sump waste consisted of a small amount of organic scrub solution which was drained from the scrubbed organic storage tanks. A pump was installed during the first quarter of this year to return this solution to the circuit. It was thought that this would bring the open drainage ditch stream within limits for effluents being discharged to unrestricted areas. Since this revision, a scrub circuit has been installed to remove molybdenum from the feed nitrate. Aqueous scrub solution from this circuit, a stream of one-fourth to one liter per minute, was discarded to the solvent extraction sump and thence to the open drainage ditch. Analysis of the open drainage ditch for the second quarter show that the radium content of this stream has remained in excess of MAC (see Table III). Radium analyses on grab samples of solvent extraction sump waste and aqueous scrub solution from the molybdenum removal circuit, shown in Table III, are in excess of MAC for effluents being discharged to unrestricted areas. Upon receipt of these data, the solvent extraction sump discharge system was repiped to pump the entire amount of solvent extraction sump waste out with the raffinate for neutralization. This revision is definitely expected to bring the open drainage ditch stream within limits. A composite sample of the open drainage stream will be made early in the third quarter and submitted for radium analysis along with check composite samples of several stream components.

Yellow Cake Section



First Floor Plan

Figure 1

TABLE III Summary of Liquid Effluent Data

Type of Liquid	Date	Microcuries per milliliter Ra-226	Th-230	Uranium
Upstream River Water	October, 1960	Nil	Nil	Nil
	December, 1960	1.0×10^{-9}	0.1×10^{-8}	$<0.1 \times 10^{-6}$
	March, 1961	2.6×10^{-9}	0.1×10^{-8}	0.03×10^{-6}
	June, 1961	*	*	Nil
Downstream River Water	October, 1960	1.8×10^{-9}	Nil	Nil
	December, 1960	1.0×10^{-9}	0.1×10^{-8}	$<0.1 \times 10^{-6}$
	March, 1961	0.8×10^{-9}	0.2×10^{-8}	0.03×10^{-6}
	June, 1961	0.3×10^{-9}	0.07×10^{-8}	Nil
Neutralized Raffinate (Leaving Property)	October, 1960	12×10^{-9}	110×10^{-8}	1.8×10^{-6}
	December, 1960	90×10^{-9}	132×10^{-8}	1.8×10^{-6}
	March, 1961	260×10^{-9}	2500×10^{-8}	1.2×10^{-6}
	June, 1961	216×10^{-9}	3500×10^{-8}	1.2×10^{-6}
(Entering River)	December, 1960	65×10^{-9}	146×10^{-8}	1.8×10^{-6}
	March, 1961	110×10^{-9}	3200×10^{-8}	1.7×10^{-6}
	June, 1961	113×10^{-9}	3500×10^{-8}	1.7×10^{-6}
Open Drainage Ditch	October, 1960	43×10^{-9}		
(Acid Plant Blowdown)		0.3×10^{-9}		
(Potable Water Filter Backwash)		0.3×10^{-9}		
(Pregnant Liquor Filter Backwash)		Nil		
(Water Softener Backwash)		3.0×10^{-9}		
(Solvent Extraction Sump Waste)		126×10^{-9}		
(Sewage Plant Effluent)		No discharge in 1960		
Open Drainage	June, 1961	70×10^{-9}	0.1×10^{-8}	Nil
(Solvent Extraction Sump Waste)		72×10^{-9}	0.7×10^{-8}	2.0×10^{-6}
(Mo Circuit Scrub Solution)		47×10^{-9}	130×10^{-8}	
Tailings Pond Seepage	October, 1960	12×10^{-9}		
(Entering River)	October, 1960	12×10^{-9}		
(Entering River)	June, 1961	7.6×10^{-9}	0.009×10^{-8}	0.4×10^{-6}

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