

URANIUM REDUCTION COMPANY

P. O. BOX 488
MOAB, UTAH
August 12, 1960

Ref. to Comp. 111

Mr. H. L. Price
Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Price:

In the letter to you from this company of August 10, 1959, we outlined the radiation control program to be followed by Uranium Reduction Company. On the basis of our experience with this program, we are submitting a new, revised program which we feel to be more than adequate for monitoring and control of radiation at the Moab mill. The new program, which follows, will become effective on October 1, 1960.

A. External Radiation.

1) All employees of the Uranium Reduction Company have been film badged for a period of one calendar quarter. Film badges were furnished by Tracerlab, Inc., and were their Type "A" Twin Window badges. The initial program began on July 20, 1959, and terminated October 16, 1959. The Inspection Division of the USAEC also film badged all employees of Uranium Reduction Company for a four month survey during the same period. The results of the USAEC survey were in excellent agreement with the results of the URECO survey.

2) Since the film badging of all employees showed an average exposure of less than 50 mrem for 40 hours, or a total of 650 mrem for the 13 weeks, the program has been discontinued as we outlined in the program submitted to you on August 10, 1959. A mean level of exposure for each job classification was assigned.

9612200348 600812
PDR ADOCK 04003453
C PDR

URANIUM REDUCTION COMPANY

P. O. BOX 450
MOAB, UTAH
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App. H
Ref IV Comp Div

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The mean level of exposure for each job classification will remain the same as determined unless a process change is inaugurated or the duties of the particular job are significantly changed. In cases where new job classifications are created or significant changes are made in an existing job classification, the individuals on these jobs will be film badged for a suitable period and a new mean level of exposure established.

3) The Personnel Department will be responsible for the film badge program.

4) Each supervisor will be responsible for the issuance, collection, and storage of the film badges for the employees in his particular department.

5) Film badges will be provided by Tracerlab, Inc. or some other acceptable film badge supply company.

6) The Personnel Department will keep current records of all personnel whose average exposure level is between 150 and 250 mrem per 40 hours. These records will be kept on AEC Form 20-2. Records of all employees will be preserved until December 31, 1965, or until a date five years after termination of employment, whichever is later. The Personnel Department will make an annual written report to each individual who falls within the range mentioned above. The method of reporting used will be as described in Section 20.404, of the proposed revision to Title 10, Part 20.

7) All personnel whose average film badge exposure shows in excess of 250 mrem per 40 hours will be continuously monitored. Personnel whose exposure is in excess of 250 mrem and below 300 mrem per 40 hours will not be removed from their jobs until their maximum accumulated occupational dose has been reached. Annual reports will be made to these individuals as described above in Section 6. If any employee has an exposure in excess of 300 mrem per 40 hours, the employee will be transferred to another job. Such job transfers will continue to insure that no employee receives in excess of the maximum allowable exposure.

8) The Metallurgical Department will make an extensive external radiation survey during each calendar quarter. These surveys will be made by means of a Model 111B Scintillator, AEC No. SBX-11A or a similar instrument of equal sensitivity. The results of the scintillator survey will be compared with the mean levels of exposure for each job classification, as established by the film badge survey. All individuals whose levels, as determined by scintillator survey indicate significantly higher exposure than those determined by the film badges will be further investigated.

B. Airborne Radiation.

1) Breathing zone surveys (Restricted Areas). A breathing zone air sample survey will be made for those job classifications listed in Table I. All samples will be taken in triplicate. The sampling technique will follow the Multiple Sample Time Weighted Average Exposure method. Sample time in each location will be proportional to the percentage of an operating shift the individual actually spends in the location as set forth in his job description. All breathing zone samples will be taken with a Millipore Type AA filter discs or some similar paper having a pore size of approximately .80 microns.

2) In any area in which the air concentrations, as determined by the Multiple Sample Time Weighted Average Technique is found to be above the maximum allowable concentration, corrective action will be taken. Additional samples will be taken after each corrective step or series of steps are completed in order to evaluate the effects of the corrective actions. Surveys will continue to be made in this manner until the area in question shows airborne radiation concentrations below the maximum allowable concentration. When this occurs the sampling schedule in this area will revert to a quarterly basis.

3) In the event major process changes are inaugurated, equipment is redesigned, or new equipment is added which may possibly result in an increase in airborne radioactive material concentrations, breathing zone air surveys and general air surveys will be conducted immediately until the

TABLE 1

Job Classification	Location	Duration	Per Cent
Scalesman	Scalehouse	20 min.	100%
Moisture Sample Buckar	Moisture Room	12 min.	60%
	Scalehouse	8 min.	40%
Lot Sample Buckar	Lot Room	18 min.	78%
	Scalehouse	5 min.	12%
Moisture Sampler	Ore Pad	28 min.	80%
	Scalehouse	7 min.	20%
Crusher Clean-Up Man	Ore Pad (Grizzly)	20 min.	50%
	#1 Belt Conveyor	10 min.	25%
	Ore Pad Control Rm.	10 min.	25%
Scoopmobile Operator	Scoopmobile Cab	28 min.	85%
	Ore Pad Control Rm.	5 min.	15%
Crusher Operator	MCC Deck	40 min.	61%
	2 & 3 Screens Deck	5 min.	8%
	#2 Conveyor	5 min.	8%
	#3 Conveyor	5 min.	8%
	Transfer Tower	5 min.	8%
	#1 Conveyor	5 min.	8%
Lot Sample Prep Man	Sample Tower	23 min.	70%
	Scalehouse	5 min.	15%
	Ore Pad Control Rm.	5 min.	15%
"A" Precipitation Operator	Precip. Deck	10 min.	50%
	Control Room	10 min.	50%
"B" Precipitation Operator	Precip. Deck	10 min.	50%
	"B" RIP Control Rm.	10 min.	50%
Packaging Operator	Packaging Area	10 min.	50%
	Control Room	10 min.	50%
Thickener Operator	Thickener Area	20 min.	80%
	Pump Area	5 min.	20%

not include

of time

dryer

empt

incubator

Job Classification	Location	Duration	Per Cent
Tailings Pond Man	Tailing Pond Dikes	10 min.	50%
	Mill Yard	10 min.	50%
Reagent Man	Pumphouse #2	10 min.	50%
	Pumphouse #3	10 min.	50%
Sample Tower Operator	Top of Fine Ore Bins	24 min.	51%
	4th Floor of Sample Tower	10 min.	21%
	# 4 Belt Conveyor	5 min.	11%
	3rd Floor of Sample Tower	8 min.	17%
Ball Mill Operator	Operating Deck	20 min.	80%
	Collecting Belt Gallery	5 min.	20%
Leach Operator	Leach Control Room	20 min.	66%
	Top of Leach Tanks	5 min.	17%
	Top of Autoclaves	5 min.	17%
Classifier Operator	Drags Deck	20 min.	57%
	Leach Control Room	15 min.	43%
"A" RIP Operator	"A" RIP Control Room	14 min.	67%
	"A" RIP Banks	7 min.	33%
"B" RIP Operator	"B" RIP Control Room	14 min.	67%
	"B" RIP Banks	7 min.	33%
RIP Helper	"A" & "B" Banks	10 min.	50%
	"A" Control Room	5 min.	25%
	"B" Control Room	5 min.	25%
RIP Crewman	RIP Banks	20 min.	80%
	"B" RIP Control Room	5 min.	20%

4) General Air Surveys (Restricted Areas). In addition to the breathing zone survey, a General Air Survey will be made each calendar quarter in the areas listed in Table 11. Samples will be taken in triplicate with a Staplex Hi Volume Air Sampler or a similar instrument with filter papers having a porosity equal to IFA No. 41 papers.

TABLE II

Plant Location	Dimensions of Location feet	Process Operations performed at Location	Approximate man hours per shift at Loc '00	No. of areas left in zone to be removed
Scalehouse	22 x 18	Weighing of trucks	16	1
Lot Sample Prep. Room	15 x 14	Prep. of Lot Samples	6	1
Moisture Det. Room	18 x 16	Ore Sample Moisture Det.	5	1
Ore Pad Control Room	12 x 12	Tool Storage & Rest Area	20	1
Open Grizzly Area	27 x 24	Raw Ore Dumped to Hopper	30	1
Crusher Feed Conveyor	205 x 8	Ore Fed to Crusher	8	3
Operating Deck	65 x 22	Ore Crushed and Screened	8	3
Inter. Mediate Deck East	22 x 14	Crusher Base and Chutes	1	1
Intermediate Deck West	20 x 17	Crusher Base and Chutes	1	1
2 & 3 Screen Deck, Bottom	37 x 33	Crushed Ore Screened	1	3
2 & 3 Screen Deck, Top	37 x 1	Crushed Ore Screened	1	3
#3 Belt Conveyor Ramp	106 x 8	Crushed Ore Conveyor Belt	1	3
Transfer Tower, Bottom	19 x 19	Ore Stream is Re-routed	1	1
Transfer Tower, Top	19 x 10	Ore Stream is Re-routed	1	1
#2 Belt Conveyor Ramp	106 x 8	Crushed Ore Conveyor Belt	1	3
Crushing Plant, Ground Floor	83 x 42	Equipment Bases & Conveyors	2	3
Sample Tower, 1st Floor	29 x 25	Sample Prepared for Assay	6	3
Sample Tower, 2nd Floor	29 x 25	Sample Crushed and Split	1	3
Sample Tower, 3rd Floor	29 x 25	Sample Crushed and Split	1	3
Sample Tower, 4th Floor	29 x 25	Ore Stream Sampled	2	3
#4 Belt Conveyor Ramp	86 x 8	Ore Conveyed to Tower	1	3
Pine Ore Bins, Top Gallery	268 x 15	Ore Dumped into Storage Bins	8	3
Ball Mill Gallery, Top	215 x 19	Ore Withdrawn from Bins	5	3
Ball Mill Gallery, Bottom	215 x 19	Ore Distributed	3	3
Ball Mill Operating Deck	120 x 50	Ball Mill Control Area	8	1
"A" Ball Mill Deck	60 x 50	Ore Milled and Pulped	1	1

Plant Location	Dimensions of Location	Process Operations performed at Location	Approximate hrs. per shift at Location	No. of Survey Points
"B" Ball Mill Deck	40 x 10	Ore Milled and Pulped	1	3
Regrind Cyclone Deck	4 x 10	Pulp is Classified	1	3
Leach Control Room	19 x 12	Leach Process Control	12	3
Sand Slime Drsg Deck	100 x 83	Leach Pulp is De-Sanded	3	3
"A" R.I.P. Bank Area	205 x 39	Resin Baskets are Jigged in Feed Solution	15	3
"B" R.I.P. Bank Area	205 x 39	Resin Baskets are Jigged in Feed Solution	15	3
R.I.P. Distribution Catwalk	205 x 10	Feed is Distributed	1	3
"A" R.I.P. Control Room	12 x 9	"A" Circuit Control	15	1
"B" R.I.P. Control Room	12 x 9	"B" Circuit Control	15	1
Yellow Cake Control Room	20 x 10	Drying Process Control	8	1
Top Hearth Deck	40 x 40	Cake Enters Dryer	1	3
Bottom Hearth Deck	19 x 15	Cake is Dried and Roasted	1	1
Packaging Area	55 x 41	Product is Packed into Barrels	4	3

5) A supplementary General Air Sample Survey will be made at 1 1/4 year intervals of the zones listed in Table III. Data obtained from previous surveys indicate an insignificant amount of airborne radioactive material concentration in these areas and it is felt that sampling at 1 1/4 year intervals in order to compensate for seasonal variations is sufficient. Samples will be taken in triplicate in the same manner as outlined in Section 4 above.

TABLE III

Location	(N) x 10 ⁻¹¹ uc/ml. Average Level Previous Surveys
Mill Office	0.63
Boiler Room	0.19
CO ₂ Removal Deck	0.636
Salvage Yard	0.0662

Pump House #1	0.010
Pump House #3	0.0142
Paint Shop	0.0328
Carpenter Shop	0.131
Laboratory	0.0158
Changahouse	0.0782
Administration Building	0.0375
Warehouse	0.0309
Machine Shop	0.0636
Garage	0.0262

6) As stated elsewhere in this letter, our fluorimetric procedure can detect the equivalent of 1.24×10^{-11} uc/ml on the basis of a 300 liter minimum sample within an error of $\pm 15\%$. The average exposures listed in Table III are considerably lower than this, but are merely indicated levels. Officially, the activity is recorded as less than 1.24×10^{-11} uc/ml.

7) General Air Surveys (Unrestricted Areas). An annual General Air Survey will be conducted in the area surrounding the URECO mill and in the city of Moab, Utah. Equipment to be used is outlined in Section 4 above. The city of Moab will be divided into three sections and each section sampled separately. The sampler will be mounted in the back of a truck which will be driven slowly through each section with the sampler operating continuously. A minimum of 10,000 liters of air will be sampled in each section.

8) A simultaneous external radiation survey will also be made in these unrestricted areas using the equipment described in section 8 above. Unless an unusually high reading is obtained in an area, only the highest reading registered will be recorded.

C. Air Sampling Techniques and Analytical Procedure.

1) General air samples in both restricted and unrestricted areas will be taken as previously described in this letter. Breathing zone samples in restricted areas will be made using a Gast Manufacturing Company Model AD440 air pump or similar instrument with one inch AA Millipore filters or equivalent. Sampling rate will vary for some samples.

will be maintained. A minimum total sampling period of 30 minutes will be used. The approach used will be the Multiple Sample Time Weighted Average Exposure method as outlined in the report, Air Sample Procedures in Evaluating Exposures by H. Glasbeth and W. B. Harris of the Health and Safety Laboratory, U. S. Atomic Energy Commission. The filters from individual zone samples will be composited on a working time basis and the breathing zone exposure determined. All samples will be taken in triplicate. Samples will be placed in glassine envelopes and delivered to the analytical laboratory. The dust and papers will be digested in a mixture of nitric, perchloric, sulfuric, and hydrofluoric acids and the total weight of natural uranium in the resulting solution will be determined fluorimetrically in order to calculate the uranium content of the air. Calculation of the concentration of the daughter products of uranium in the air will be made on the assumption that the natural uranium is in secular equilibrium as has been indicated to be so for ores treated at the Moab mill by test work conducted by the Raw Materials Development Laboratory at Winchester, Massachusetts. Secular equilibrium of our ores will be checked annually by our analytical staff. A Nuclear Measurements Corporation proportional gas flow counter has been purchased for this purpose.

On the basis of a minimum 300 liter air sample, our fluorimetric procedure can detect the equivalent of 1.24×10^{-11} uc/ml within an error of $\pm 15\%$. All analytical results will be calculated and reported in terms of 1.24×10^{-11} uc/ml. Airborne radioactive concentration exposures for each job classification will be kept on file in our Personnel Department.

D. Employee Education and Instruction.

1) All new mill employees will be indoctrinated in general health precautions, the proper use of the respirator, what radiation is, why the standards or levels of exposure were set and by whom, and where the potential hazards of radiation exposure exist. Data for this educational program will be taken from the booklet, "Living with Radiation", Fundamentals I, published by the United States Atomic Energy Commission. Copies of this education data will be filed in the Personnel Department.

D. Wet Methods Housekeeping Program.

1) Periodic wet cleaning of all lower level areas, including the lower level areas, is required.

2) Periodic vacuum cleaning of all beams and dust settling areas in the front packaging area.

Note: These areas are the areas that are not cleaned in the normal operating procedure.

E. Continuous General Housekeeping Program.

1) The entire premises will be routinely cleaned to remove all dust from floors, equipment, etc.

2) Cleaning with brooms or compressed air will be eliminated as much as possible. A vacuum hose or wet cleaning methods will be adopted wherever practicable.

3) Until all ventilation problems are corrected, personnel will wear respirators whenever working in a dusty atmosphere.

G. Investigative and Corrective Work.

1) Investigative and corrective work will be done by the Metallurgical and Maintenance Departments to insure proper functioning and maximum utilization of our dust collector system.

2) A continuous daily inspection will be conducted by the Crushing Department to discover and repair any leaks or defects in the collecting system.

H. Liquid Effluents.

Our procedure with respect to the determination of concentrations of radioactive material discharge in liquid effluents has been to take, starting February 27, 1959, monthly samples of Colorado River water from a point one mile above the Moab mill, a point 5 miles downstream, and another 10 miles downstream from the mill, as well as monthly samples of the tailings pond overflow into the river.

It is our intention to apply for exemption to the provisions of 20.103, relating to the radium and uranium limits in our tailings pond effluent. We believe that it is reasonable to apply for an exemption because of our isolated location, and because of the large volume of water flowing past the Moab mill in the Colorado River. However, in order to present adequate data to the United States Atomic Energy Commission with the application

for material. We originally planned to gather data for one year prior to the conversion. The reason for this extended test period was to be in possession of complete data before the conversion to cover the large seasonal variations in river flow so that a sensible and adequate data presentation could be made.

As stated in our letter to you of February 25, 1960, two conditions have developed which we feel warrant an extension of this testing program.

The first of these conditions is the conversion of our plant from an acid leach R.I.F. plant to a combined acid leach - alkaline leach - R.I.F. plant. This conversion has resulted in a substantial reduction in radium concentration in our tailings effluent.

The second condition is the revelation by A.E.C. personnel in January, 1960, that the modified Harwell analytical procedure for radium analysis which we have been using gave erroneously high results on tailings effluent samples due to co-precipitation of thorium. Since our analytical results on tailings effluent have been negated by this discovery, we have changed our analytical procedure to correspond with that recommended by A.E.C. personnel at the seminar held in Idaho Falls in January of this year.

For these reasons, we have made a one-year extension of our sampling and testing program to February, 1961.

1. Monthly Reports.

The Radiation Department will submit a monthly report to the Mill Superintendent. This report will cover the progress of all of the items described in our Radiation Control Program. This record will also be filed in the Plant Radiation File in the Personnel Department.

Yours very truly,

R. F. Hollis
Vice President and General Manager

1961 TABULATION OF AIR SAMPLES TAKEN IN AREAS FREQUENTED BY THE HEARTH OPERATOR
 Uranium Concentration in uc/ml x 10⁻¹¹

Platinum Concentration in $\mu\text{g}/\text{m}^3$																								
CALENDAR QUARTER	First						Second						Third						Fourth					
	"Breathing Zone" *																							
Date	2/23	2/27	3/1	3/28	3/29	3/30	6/5	6/6	6/7	6/8	6/13	6/14	8/4	8/14	8/15	9/22	9/23	9/25	9/27	9/28	9/29	12/13	12/21	12/29
Hearth Area (10 min.)	<1.2	<1.2	<1.2						<1.2		<1.2	<1.2			5.4			.60	.34			.55	nil	.17
Packaging Area (10 min.)																								
"General Air"																								
Hearth:																								
Top Deck				11.8	.07	.13		.16	.78	.73			1.8			.26				.70		.29	.16	.39
Bottom Deck	.11	.12	6.6						.31		.18	.14		1.3						.64	1.1	.39	.78	nil
Yellow Cake Room				1176.0	.13	.12	.57		.34	.22												.12	4.8	.26
Packaging				1.6	.10	.13		.31	.48	.19				.46				.69	.59					
Dog House														.14		.92	.13							

* "Breathing Zone" not purposely scheduled while persons were occupying the areas noted; samples were run in the two areas with the running time of the sample prorated in accordance with the percentage of time this operator actually spends in each area.

1962 TO DATE - TABULATION OF AIR SAMPLES TAKEN IN AREAS FREQUENTED BY THE HEARTH OPERATOR
 Uranium Concentration in uc/ml x 10⁻¹¹

CALENDAR	ARTER	First					Second				Third		
							"Breathing Zones"						
	Date	2/19	2/22	3/14	3/20	3/28	4/17	6/14	6/19	6/22	8/23	8/28	9/24
Hearth Area (10 min.)													
Packaging Area (10 min.)				.22	1.66	5.03	.506		.45	1.01	3.00	.365	.28
"General Air"													
Hearth:													
Top Deck		2.94	.27	.29			.597	.773	5.64		25.0	1.61	1.06
Middle Deck											18.0	1.66	.64
Bottom Deck			.290	.690	.964		.506	3.35	3.26				
Dog House		1.93	.276	.934			.212		3.03	.40	1.10	.459	nil
Yellow Cake Room													
Packaging Area				.373	.400				2.54	.397	6.35	.644	1.51

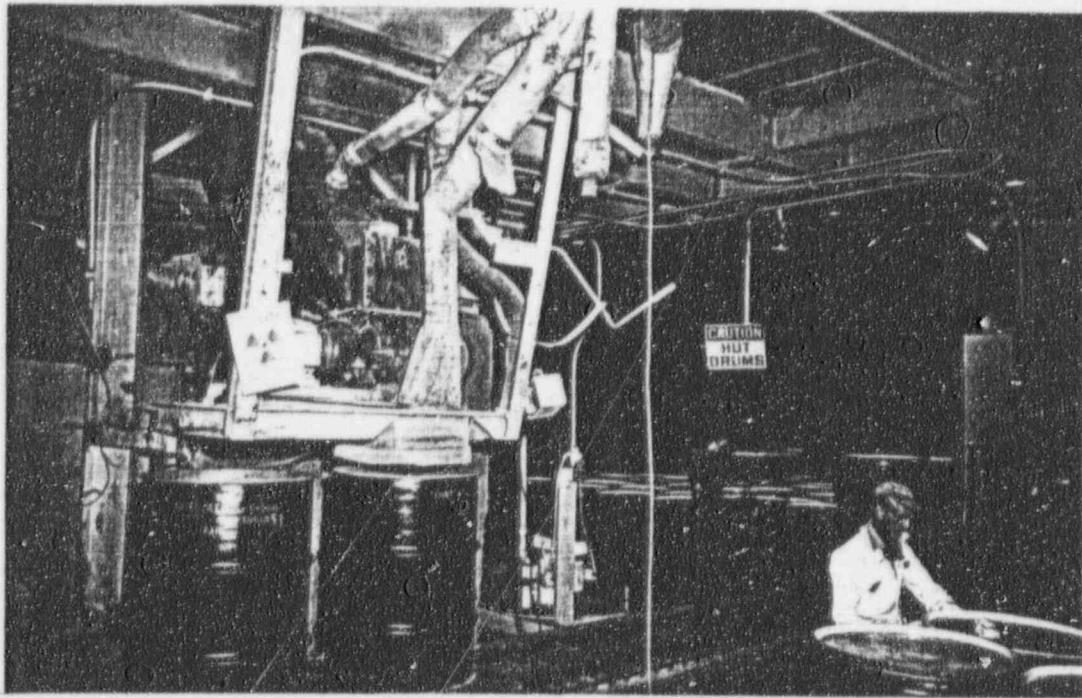


Photo No. 1 - Packaging Area and Packaging Operator

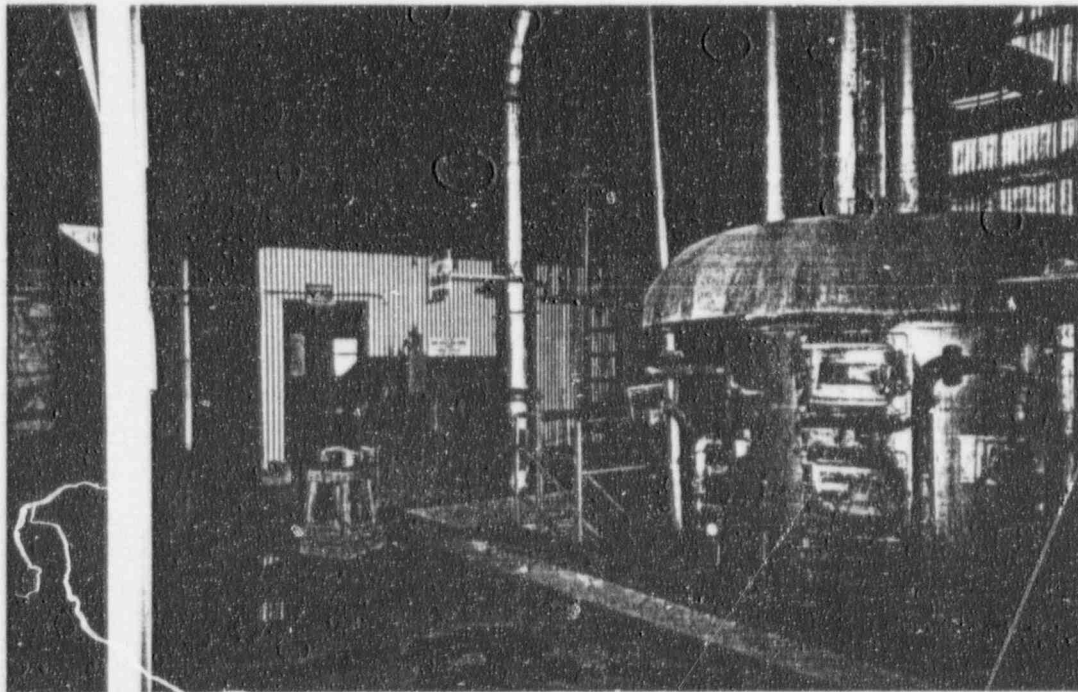


Photo No. 2 - Top of Hearth Drier

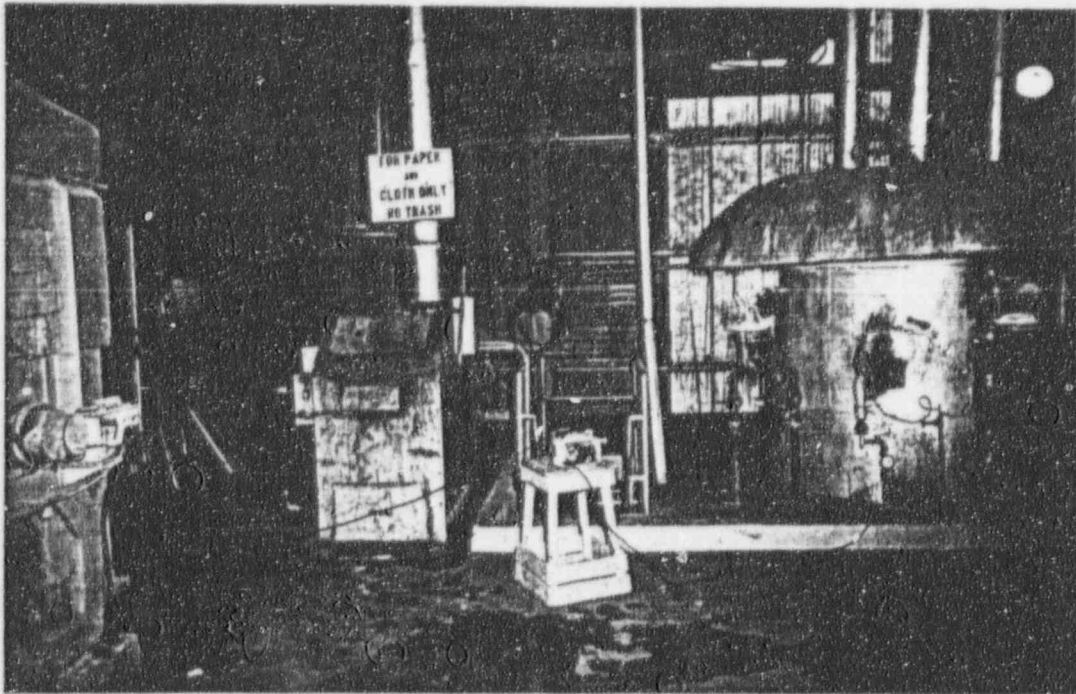


Photo No. 3 - Hearth Drier and Incinerator For Filter Papers and Cloths



Photo No. 4 - Barite Treatment Creek



Photo No. 5 - Measuring Weir - (Process Operator reads height gauge on a daily basis).

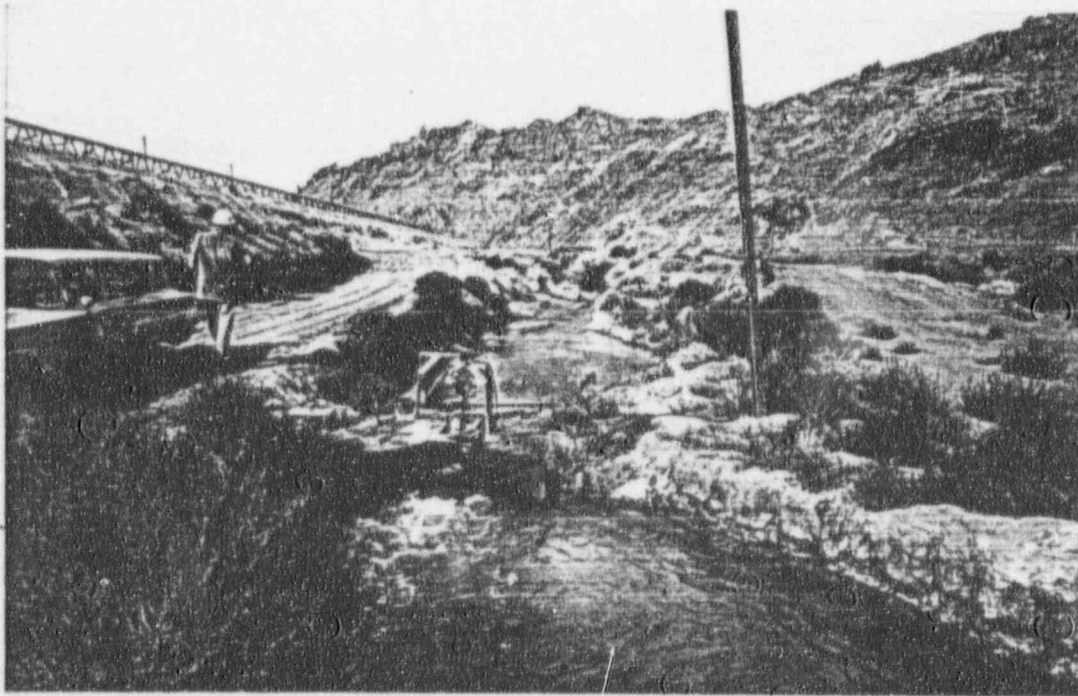


Photo No. 6 - Measuring Weir - (Process Operator reads height gauge on a daily basis).

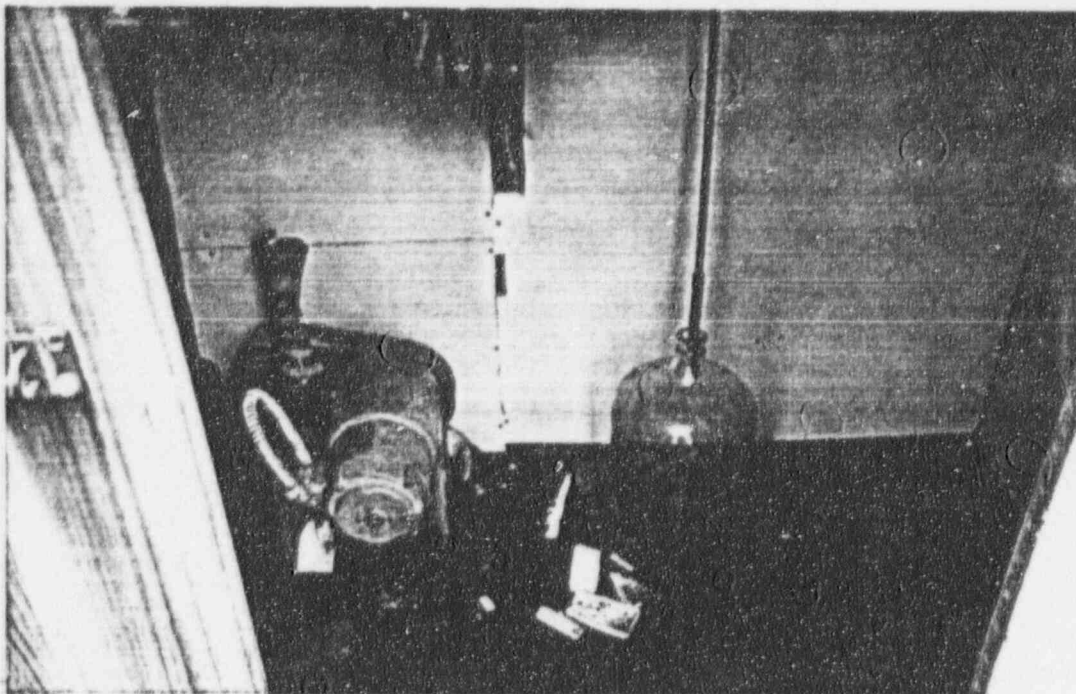


Photo No. 7 - Continuous effluent sampler. (Collects approximately 15 liters/day from the approximately 500 gpm flow returned to plant to be recycled).