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KERR-McGEE OIL INDUSTRIES, INC.

Kerr-McGee Building • Oklahoma City 2, Oklahoma

April 12, 1961

Mr. Robert Lowenstein, Acting Director
Division of Licensing and Regulation
U. S. Atomic Energy Commission
Washington 25, D. C.

Dear Mr. Lowenstein:

Your Reference
DLR:CGW 40-2038 (see rpts folder)

The attached letter and report from our Mr. John A. Maxwell covers the information requested in your letter of March 16, 1961 addressed to Dean A. McGee regarding the August 22, 1960 tailings pond dam failure at the Shiprock, New Mexico uranium mill. We trust that the attached information adequately covers this situation.

We appreciate your assistance in the renewal of our license.

Very truly yours,

George H. Cobb
Vice President, Minerals

GHC/az
attachments

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Report to U.S. Atomic Energy Commission
Division of Licensing & Regulations
Attn: Robert Lowenstein, Acting Director

Relative to your Report of March 16, 1961
KERR-McGEE OIL INDUSTRIES, INC.
(Shiprock)

See incoming letter
dated April 12, 1961

A. Heavy mechanical excavation equipment was used to build the earthen dikes. The material was placed in even lifts approximately 6 inches deep. The fill section was maintained as level as practical. Effective compaction of the dikes was realized by directing equipment travel over the dikes on each pass made. The layers of fill material were carried across the entire width of the embankments and the embankments were built to the required slope of 1-1/2 : 1, and were not widened with loose material from the top. The heighth was built as designated. The crown of the embankment was finished to be suitable for a roadway. The material used for the embankment construction was adobe, which was moistened by means of truck sprinklers to maintain consistent moisture content to insure maximum compaction . The material was distributed so that the compacted material was homogeneous and was free from streaks, pockets or other imperfections. The placing operations were directed so that the materials, when compacted, were blended sufficiently to secure the best applicable degree of compaction, impermeability, and stability. The embankments as completed are impervious. There are no leaks or seepage through any of these fills. See attached sheet for cross sections of dikes which are presently in use. These cross sections are also noted on the attached Mill and Storage map.

B. On hand here at the Shiprock mill is the following company equipment that can be used for emergency or for routine maintenance to retain dams of either tailings or raffinate ponds.

1	-	D-7 Caterpillar Dozer
2	-	1-1/2 yd. Michigan front end loaders
1	-	2 yd. Michigan front end loader
4	-	3-ton dump trucks
1	-	road maintainer

C. VX raffinate was discharged to Pond No. 7 from 1/1/61 through 3/22/61. From 3/23/61 to 4/3/61 (11 days), the pond depth has dropped 2.5 feet. The area of this pond is approximately 109,166 square feet. See below for distribution of gallons loss through seepage and evaporation.

a. Total gallons lost (11 days)	2,046,863	
b. Total gallons evaporated (.3 inches per day)	225,148	$\frac{18 \times 1.75}{109,166} = 16.7$ gal loss in 11 days
c. Total gallons lost to seepage (Seepage flow rate--115 GPM)	1,821,715	1.5 gpd/sq ft

Based upon the above figures, the following calculations are submitted to show that the barren tailings ponds are adequate to handle the mill liquid tailings.

Plant Output per Month to Ponds (155 GPM) 6,696,000 gallons

Seepage Output per Month (115 GPM) 4,968,000 "

a. $\frac{4,968,000}{109,160} = 45.5$ gal/ ft^2/month ✓

Evaporation Output per Month (.3 inches per day) 614,040 "

b. $\frac{614,040}{109,160} = 5.6$ gal/ft^2/month

Item C continued

a plus b = 45.5
5.6
51.1 gal/ft^2/month total output of seepage and evaporation based on Pond No. 7

$\therefore$

$\frac{6,696,000}{51.1}$ = 131,037 ft^2 of surface required to handle mill output

$\frac{655,000}{131,037}$ = 499.8% safety factor

D. Since the initiation of the November 28, 1960, report, it has been deemed more advantageous, for spillage control purposes, to install an auxiliary dam north of the barren liquor ponds within the plant site fence. This dam was put in place early in January of 1961, in lieu of the earlier proposed flood gate at the road culvert.

E. At present, the lead operator makes an inspection of the dikes and the ponds every two hours. This is done on an around-the-clock basis.

F. The barren raffinate carrying line, at the time the rupture occurred in September, 1960, was not suitable for this duty due to the decomposition of the line caused by organic solvent entrained in the raffinate. At present, this carrying line is made up of 4 inch diameter PVC Schedule 40 pipe. The carrying line is laid in a 6-inch V-shaped wooden trough which offers maximum support and minimum movement of the pipe, thereby lessening the chances of a pipe break. This line shall also be inspected on an around-the-clock basis by lead operators.

At the time of the rupture, no liquid effluent was discharged to an unrestricted area. The rupture was in the pipe on the side parallel to the tailings pond and the effluent was discharged into the pond.

V. Liquid Effluent Survey Program

Liquid effluents are discharged from the mill process and retained in appropriate ponds. These effluents are designated as follows:

I. VX Raffinate

a. Description--this effluent is discharged from the solvent extraction circuit. It is pumped to and retained in ponds as described in Item 4 of our November 25, 1960, report.

Continue Item V

b. Sampling procedure--this effluent is continuously sampled over a 24-hour period, utilizing an automatic sampler. These daily samples shall be combined to make a monthly composite.

c. Analysis--the monthly composite shall be analyzed for uranium, Radium-226 and Thorium-230. The monthly composites shall be analyzed until such time representative concentrations of radionuclides are realized.

d. Volume--the volume of this effluent is constantly metered(GPM) before discharging into the ponds. A daily record of this volume is maintained.

II. Sand-Slime Tails Pulp

a. Description--this is the waste material discharged from the acid leach circuit. It consists of solids and liquid, and is pumped in pulp form to and retained in the pond as described in Item 4 of our November 25, 1960, report.

b. Sampling Procedure--this effluent is continuously sampled over a 24-hour period, utilizing an automatic sampler. These daily samples shall be combined to make a monthly composite. Only the liquid effluent portion shall be composited and analyzed.

c. Analysis--the monthly composite of this liquid effluent shall be analyzed for uranium, Radium-226 and Thorium-230. The monthly composites shall be analyzed until such time representative concentrations of radionuclides are realized.

d. Volume--the volume of this liquid effluent may be calculated from daily records maintained on the solids-liquid weight ratios.

The volume of all seepage and mill effluent streams shall be determined and records maintained of same. The seepage samples shall be determined on a weekly basis.

To determine the sub-surface movement of seepage liquids, a series of test holes have been drilled and pits dug in the vicinity of our tailings areas. These test holes have been drilled to the Mancos shale. The location and depth of these test holes and pits are spotted on the attached Mill and Storage map. Samples of these test holes have been taken and shall be continued to be taken for analysis of Radium-226. Further work of this type shall be continued in the area north of our present sand tailings pond. Detailed evaluation of these test holes shall be submitted at a later date.

The cooling water stream which was discharging to an unrestricted area was being contaminated with liquid effluent discharging from the barometric leg of our vacuum system. At present, both of these effluents are being fed

back into the mill process. In addition to the above precautionary measure, an earthen dam has been constructed across the gully, inside the plant-site to retain any effluent that may escape from the mill process. Any effluent discharging into this gully would not be excessive to the point of breaking the dam. This would allow sufficient time to stop any effluent escapes and pump the effluent retained by the dam to our present tailings pond. This measure would prevent escape of any effluent, down this gully, to an unrestricted area.

7. Dust Collection and Ventilation Equipment

Ore Crushing and Sampling Plant. The ore crushing and sampling plant is ventilated by two exhaust vents situated in the roof of the building. These vents are 2 feet in diameter and are covered with louvered spherical cowls. The dust generated in this building is vented to the atmosphere by movement of convection currents through these vents.

Sample Bucking Room. The pulverizer in this room is enclosed on three sides with plywood and hooded to a 10-inch diameter exhaust pipe. Air is drawn from the hooded and enclosed pulverizer area utilizing a Buffalo Forge "Breezflo" fan. The rated output of this fan is 500 CFM. The fan and motor assembly is enclosed in a metal housing, with one louvered side open for exhaust discharge. This metal housing is situated directly above the pulverizer area, flush on the roof of the building.

Improvements to Control Dust Concentrations in the Product Packaging Area. At the time that the air samples were taken (your reference to August, 1959, and June, 1960, samples) the efficiency of the dust collector in this area was very low. In lieu of this problem, the dust collector was completely replaced with a new one to insure maximum dust collecting efficiency. Periodic operational and mechanical inspections of this dust collector and its ducts are made to insure maximum operating efficiency.

11. Respiratory Protective Equipment

Respirators are worn by operators while working in areas having airborne radioactive particulates in excess of MPC. These areas are posted as respirator areas and are worded, "Safety First, Wear Your Respirator."

Breathing zone samples indicate that these areas are in excess of MPC based on the fact that an operator works in said areas forty hours per week. However, in most instances, the operator remains in these areas for a short period of time each day. Time and motion studies are being surveyed and weighted exposure averages shall relate whether or not these operators are respiring airborne radioactive particulates in excess of MPC during their total forty hour working week. If this survey indicates that some operators are respiring airborne radioactive particulates in excess of MPC, then one of three actions shall be taken. These actions are as follows:

Item 11 continued

a. The operator shall be transferred to other duties in lower level areas. This immediate action will relieve the operator or operators of exposure to airborne radioactivity in excess of MPC until ventilation modifications can be utilized to lower the concentrations of radioactive particulates.

b. The ventilation problem shall be studied and proper measures shall be taken to lower dust levels.

c. If the above measures are inapplicable, then application shall be made to the Commission proper to compliance with Section 20.103 of 10 CFR 20.

12. Description of Mill Discharge Stacks.

No. 1 National Hydro Filter. The exhaust port of this dust collector is 8 inches in diameter and extends 6.5 feet above the roof of the building. It exhausts vertically to the atmosphere. See attached sheets for results of concentrations of radioactive particulates released to the atmosphere.

No. 2 National Hydro Filter. The exhaust port of this dust collector is 9 inches in diameter and extends 7 feet above the roof of the building. It exhausts vertically to the atmosphere. See attached sheets for results of concentrations of radioactive particulates released to the atmosphere.

Exhaust Port at Sample Bucking Room. The exhaust of the ventilating fan discharges to the atmosphere through a louvered port. This exhaust port extends 18 inches above the roof of the building. Samples of this exhaust port have not been taken at this time.

Exhaust Ports at the Ore Crushing and Sampling Plant. The ore crushing and sampling plant is vented to the atmosphere through two 24-inch diameter vents, covered with louvered spherical cowls. The spherical cowls are flush with the roof of the building. Samples of these vents have not been taken at this time.

See attached sheets for results of concentrations of radioactive particulates released to the atmosphere through stacks described in Item 12 of our November 25, 1960, report.

APPENDIX

1. Attach. sheet of cross sections of dikes (1)

2. Attach. Mill and Storage Map (1)

3. Attach. sheet of results of concentrations of radioactive particulates released to the atmosphere and through stacks described in Item 12 of our November 25, 1960, report (1)

STACK EFFLUENT SURVEY SAMPLES

Location Sampled	Date	Sampling Time	Ml of air ($\times 10^{2}$)	Total uc ($\times 10^{-6}$)	uc/ml ($\times 10^{-11}$)
Yellow Cake Dust Collector Stack	11/29/60	180 min.	12.60	3.22	3.22
Leaching Tank Stacks (8) ← averaged ?	12/19/60	240 min.	16.80	34.48	2.05
	1/31/61	360 min.	14.40	7.33	0.51
	3/1/61	480 min.	37.84	212.15	2.42
Uranium Precipitation Tank Stack	3/2/61	240 min.	31.20	33.21	1.00

All of the above samples were taken utilizing the following equipment:

a. Air Sampler - Gelman Air Sampling Kit
b. Filtering Media - Distilled water in a 500 ml impinger

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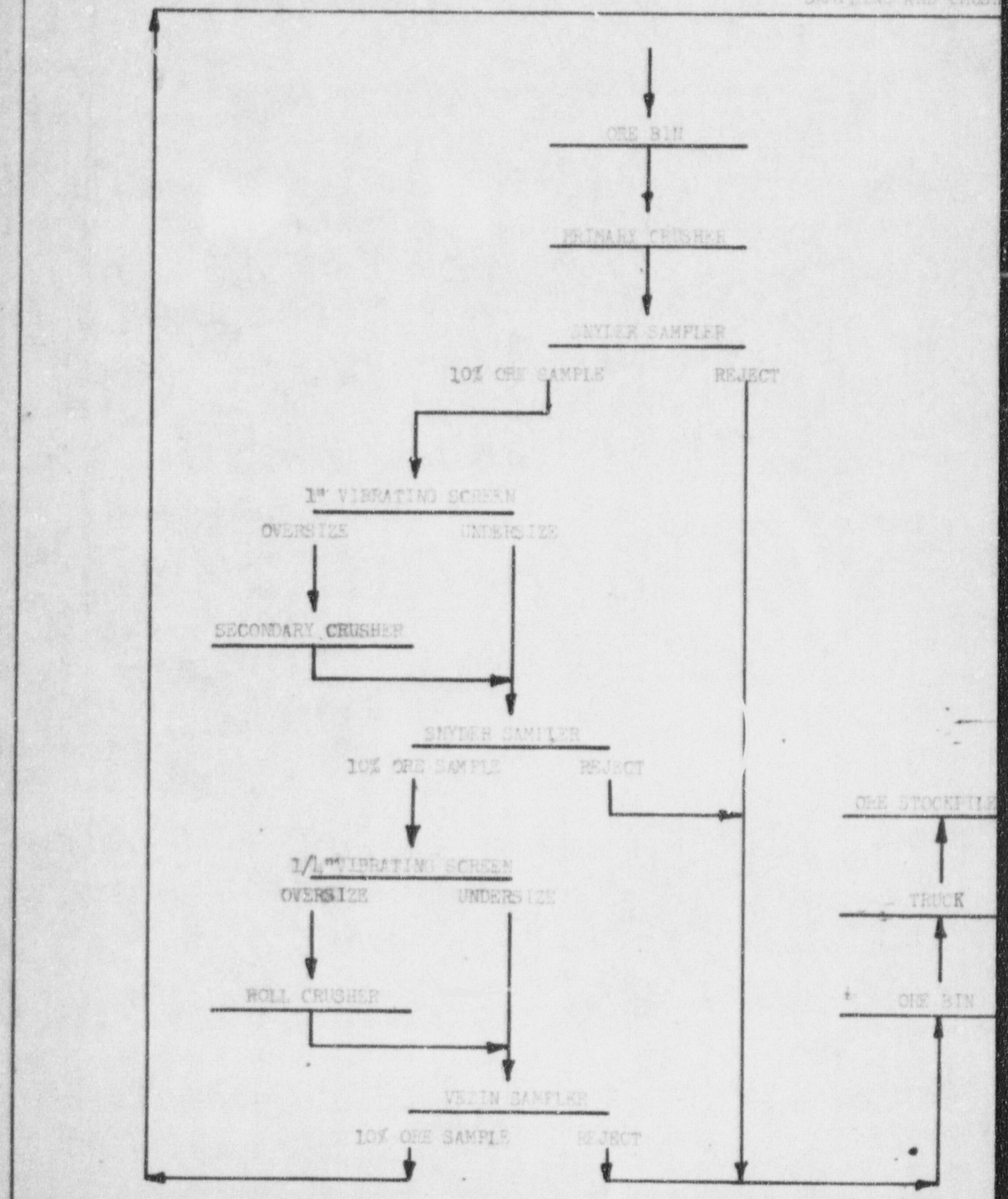
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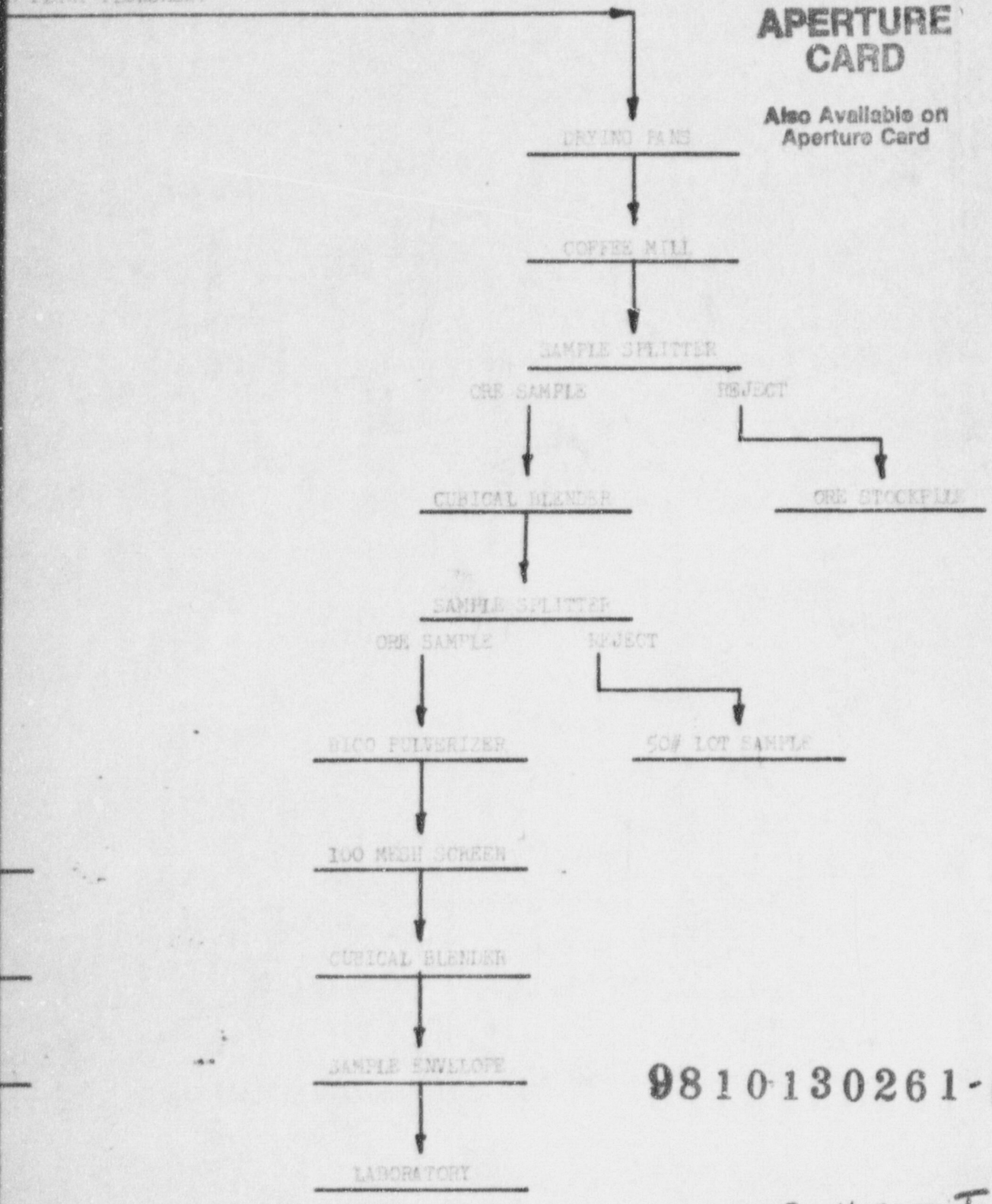

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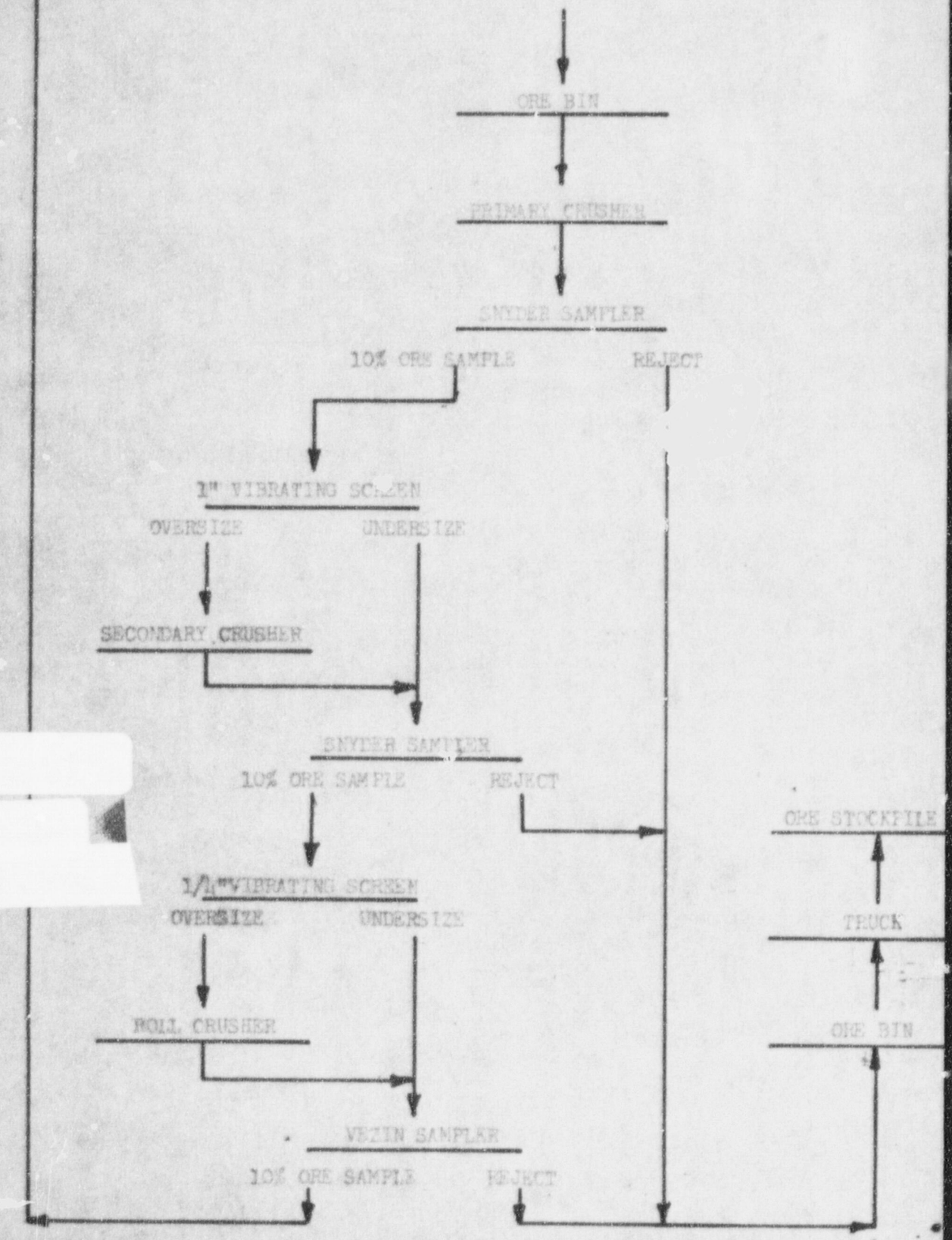

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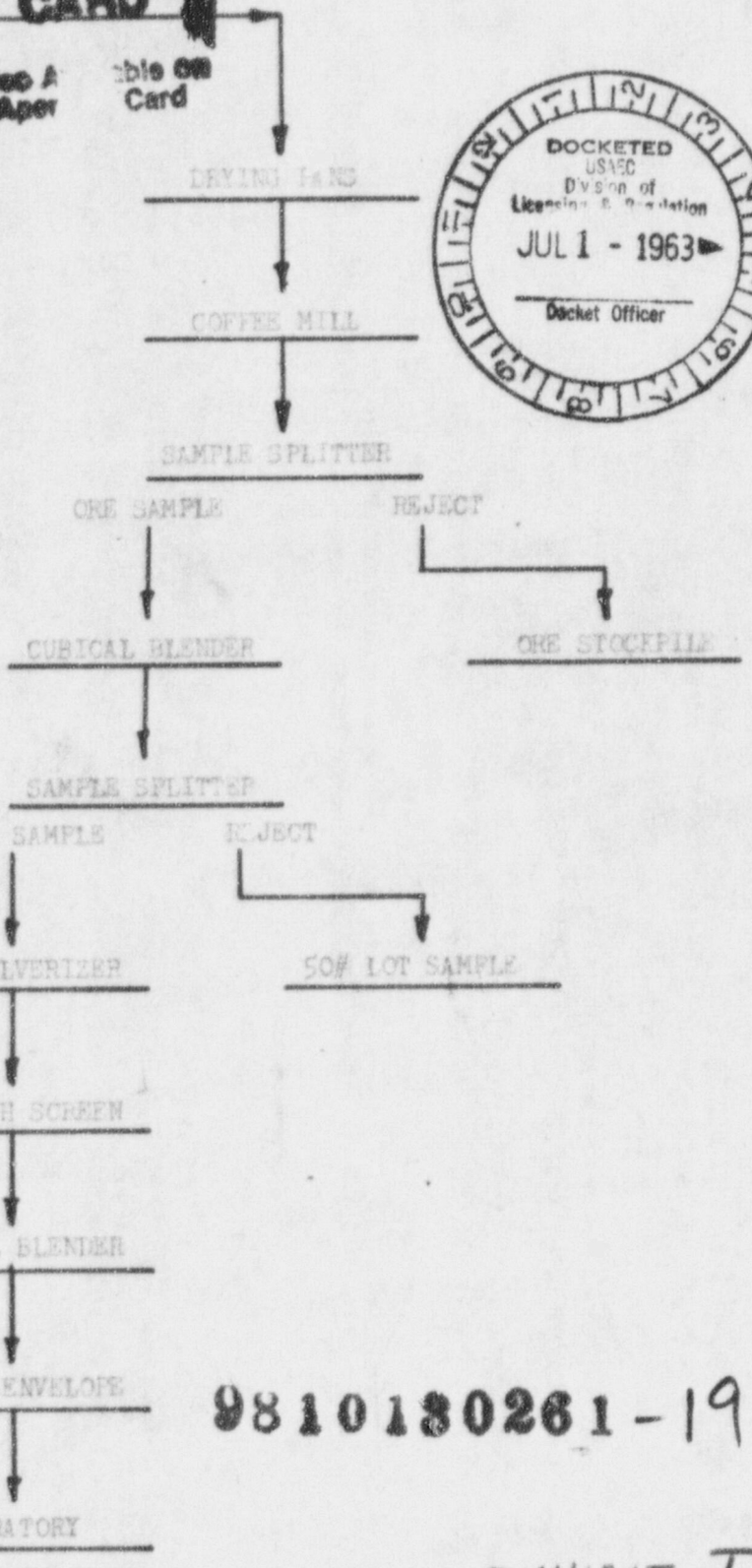

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