UNITED STATES
ATOMIC ENERGY COMMISSION

DIVISION OF COMPLIANCE

REPORT

Vanadium Corporation of America
Durango, Colorado

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L. D. Low, Director, Division of Compliance,
AEC Headquarters

APR 27 1961

ORIGINAL SIGNED BY
DONALD I. WALKER

Donald I. Walker, Director, Licensee Compliance
Division, Idaho Operations Office

INTERIM INSPECTION REPORT - VANADIUM CORPORATION OF AMERICA, DURANGO, COLORADO - LICENSE NO. R-102

LC:AWH

On March 21-23, 1961, A. W. Holmes, Inspector of this office, visited the uranium ore processing facilities of the Vanadium Corporation of America, Durango, Colorado. The purpose of this visit was to determine the progress the licensee has made towards completion of the plant modifications proposed in the licensee's letter of August 19, 1960. The various proposed changes will be discussed in paragraphs that follow, using the licensee's outline of proposed changes as found, beginning with page 2, in the letter mentioned above.

Upon arriving at the plant site, the inspector contacted Mr. Fred Brinker, General Manager, Western Division, Vanadium Corporation of America. Although this was an unannounced visit, the visit was not in the least unexpected by the licensee; in fact, Mr. Brinker stated that he had expected someone from this office to visit the plant at an earlier date. The inspector verbally outlined the information he was seeking, and requested Mr. Brinker's permission to tour the plant for the purpose of viewing the progress made towards the completion of proposed modifications and changes. The inspector also requested and was granted, permission to take photographs at various locations throughout the mill. In the absence of Mr. Roland Vesper, Safety Director, the inspector was escorted on a tour of the mill by Mr. Pat Daniels, Mill Superintendent. Although Mr. Daniels pointed out all the modifications completed or now in progress, there were some questions pertinent to completion dates that Mr. Daniels perferred the inspector discuss with Mr. Vesper upon Mr. Vesper's return. Attached as Appendix A is an outline of the proposals listed in the letter of August 19, 1960.

Regarding the materials handling, crushing, drying and milling operations, (Paragraph A, Page 2, licensee's letter of proposals dated August 19, 1960) Mr. Brinker and Mr. Vesper stated that the proposed installations are complete but are not yet piped into the exhaust fan and dust collector. Mr. Brinker stated that the construction contractor anticipated completion of the installation by the week end of April 1, 1961. Mr. Brinker stated that it was anticipated that plant operations would be shut down

(continued)

for the two day week end of April 1 and 2, 1961, during which time the maintenance group will complete the piping installation to the exhaust fan. Photograph 1 of Appendix B is a view of the hoods over the discharge from the rod mills, with the piping leading from the hoods. Photograph 2 is a view of the hood enclosing the discharge from one of the ore driers. Photograph 3 is a view of the enclosure over the fine ore bin. According to Mr. Vesper, this installation was made prior to the beginning of negotiations that led to the proposals of August 19, 1960. Photograph 4 is a view of the fine ore discharge to the roaster, with the dust collector and exhaust piping. Each of the six ore roasters is so equipped.

In the final product area (Paragraph B, Page 2, letter of August 19, 1960) the steam drying pan has been enclosed with a hood exhausted to a wet collector. The air flow into the opening, through which the operator manipulates the drying final product, enters at a velocity of 150 FPM, as measured by the inspector. The screw conveyors from the drying pan to the product grinder and packaging area are completely covered. The final product grinding and barrelling operation has been covered with a hood exhausted to a bag collector. The air flow into the opening in this hood enters at a velocity of about 700 FPM, as measured by the inspector. Photograph 5 is a view of the bag house, where the exhaust from the final product grinding and barrelling operation is passed through the bag collectors. According to Mr. Vesper, this group of modifications was completed November 24, 1960.

In regards to the proposed hoods over the fusion furnace doors (Item C, Page 2, letter of August 19, 1960), Mr. Vesper stated that no action is contemplated at this time to complete these proposed modifications. Mr. Vesper stated that studies, thus far completed by the licensee, do not indicate a need for hoods over these doors as stated in the proposals.

Under the heading of "General Maintenance Housekeeping" (Paragraph D, Page 2, letter of August 19, 1960) the following items were observed and/or discussed.

(1) At the present time the roof of the main portion of the existing mill has been replaced with sheeting and an asphalt roofing material. According to Mr. Brinker, new additions will be added to the roof span to cover new construction and installations now in progress, but not proposed in the letter of August 19, 1960. These additional items will be discussed in a later paragraph. The sheeting enclosing the sides of the mill has not, as yet, been replaced. Work on this portion of the proposals is being deferred pending completion of the new construction

(continued)

and installations mentioned above. No specific date was given for completion of this portion of the proposed modifications. Photographs 6 and 7 are general views of the mill structure without the sheeting enclosing the mill structure.

(2) According to Mr. Vesper, inactive equipment is still being removed from the plant. Photograph 8 is a view of a fan with some of its associated piping that must still be removed. According to Mr. Brinker, other portions of the plant, now in operation, will be dismantled in the near future. These will be discussed in a later paragraph.

(3) According to Mr. Brinker, some of the substandard equipment has not been removed and is still being used. However, most of this equipment, such as the rod mills, driers and transfer equipment, will be removed when the plant changes over to upgraded ore, which will be sized for roasting and will be transferred directly from the stock piles to the roasters.

(4) The roadways and the walkways have been surfaced with gravel. Photograph 9 is a view of the ore receiving pad in front of the ore grizzlies. This pad has been covered with concrete, greatly improving conditions in this area.

Modifications and changes to the "Ore Roasters" (Paragraph E, Page 3, letter of August 19, 1960) have been, for the most part, completed. All the roasters have been shut down, as stated in the proposals, one at a time and renovated.

(1) New inspection doors and door frames have been installed. Leaks in the sides of the roasters, that contributed to the release of dust to working areas, have been sealed. New gaskets have been installed around the agitator shaft at the bottom of the roasters, an area where dusting from leakage was rather severe.

(2) As stated in a previous paragraph, some of the unorthodox piping must still be removed (see Photograph 8).

(3) All roasters had been fitted with exhaust fans prior to the August 19 proposals to maintain a constant negative pressure during the operation of the roasters.

(4) The following completion dates were listed by Mr. Brinker, as the dates when modifications to each roaster were accomplished:

(continued)

(a) November 1, 1960
(b) November 1, 1960
(c) January 1, 1961
(d) November 1, 1960
(e) February 1, 1961
(f) February 1, 1961

(5) According to Mr. Brinker, the roaster stack exhaust gas scrubbers have been completely rebuilt to eliminate the necessity for manually cleaning the stack scrubber. It will be, when in operation, a continuous operation that will not require manual cleaning as does the one now in operation.

New air cleaning equipment has been and is being installed as No. 1 Scrubber and No. 2 Scrubber, both serving the ore handling facilities, including the ore roasters. As stated previously, the licensee has installed a wet scrubber and a bag house collector serving the final product area. Photographs 10 and 11 are two views of Scrubber No. 2 system. Photograph 10 is a view of the fan and a portion of the exhaust stack after the fan and scrubbers. Photograph 11 is a view of the scrubber tank, the "demister" tank, the fan and the exhaust stack. According to Mr. Vesper, this system, when activated, will impound the dust collected from the raw ore handling facilities from the primary crushers to the top of the roasters. Mr. Vesper explained that the air from the various dust collectors will be drawn through the second tank immediately behind the fan. This tank will be the air scrubber, collecting the particulate matter carried in the air stream. The air then passes through the "demister" tank, seen immediately behind the fan, where the larger portion of the liquid carried from the scrubber by the air stream will be removed before the air passes through the fan and up the stack. It is estimated that this scrubber system will require approximately 750 gallons of liquid per minute. The under flow from this scrubber will be pumped to a thickener tank, seen as the tank on the right in Photograph 12. The under flow from this thickener will be filtered, salt added and pumped as a slurry to the top of the roasters, and fed to the roasters with ore from the crushing circuit now in operation, but with upgraded ore at a later date. The overflow will be returned to the scrubber sprays. Thus the operation will be continuous. Mr. Brinker stated that the anticipated schedule calls for the licensee to make the final connections into this system during the week end of April 1 and 2, 1961, when a shutdown is scheduled. Photograph 13 is a view of the installation replacing the presently operating Scrubber No. 1, shown in Photograph 14. Mr. Brinker stated that this new installation was not originally included in the proposed modifications. The roaster exhaust gas scrubber may be seen as

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the tank to the right in Photograph 13. Mr. Vesper informed the inspector that a plastic stack, 40 feet in height, will be placed on top of the scrubber tank. The material removed from the roaster off-gases will be run into the thickener tank seem to the left of the scrubber tank. The under flow from this thickener will be pumped as a slurry to the top of the roasters. The overflow from the tank will be pumped to the acid leach circuit. Mr. Brinker estimated that this unit will be in operation sometime during the last week in April..This continuous operation of the scrubber system will eliminate the present batch operation now being used.

In addition to the above-reported modifications, Mr. Brinker advised the inspector that the old ore roaster off-gas scrubber system, including the wood-stave exhaust stack (Photograph 14) would be removed. He stated further that the old Cottrell unit, formerly used to cool roaster off-gases and collect the dust in the off-gas, would be removed. This unit is over the present maintenance shop area, and it is anticipated that a new shop will be constructed in this area. The removal of this Cottrell unit (Photograph 15) will require new roofing and enclosure of the mill proper, which will delay the final completion of D-1, Page 2, letter of August 19, 1960. In Photograph 6, right center, may be seen the new filter section containing four large drum filters. This is a new addition to the mill circuit and was not mentioned in the proposals. As may be seen from Photograph 6, this will require additional new roofing and siding, also adding to the delay in completion of this specifically proposed item (D-1, Page 2).

In addition to the items listed in the proposals of August 19, 1960, the inspector inquired concerning sampling procedures in effect at the licensee's mill. Mr. Vesper stated that the sampling for determinations of concentrations of airborne uranium is conducted by Mr. Robert Brown and Mr. Donald Prior under the direction of Mr. Vesper. Mr. Vesper stated that Mr. Edward Bronson does the counting of the samples and makes the calculations. The above are all employees on the staff of the licensee.

Mr. Vesper informed the inspector that occupational samples are collected in two ways. The breathing zone sample, taken on any operation that "will take the operator out of the normal environment (general air)" is collected using a Gast low volume air sampler operating at about 9 liters per minute. The sample is collected on a millipore membrane filter, the time of sampling dependent upon visual inspection of the membrane, and counted for gross alpha emissions. For general air samples, Mr. Vesper stated that an impinger sampler is used. The sample is collected in water at the rate of one cubic foot per minute, operating continuously for seven hours per location. This sample is then

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treated with HNO_3, $HClO_4$, and if necessary, HF. This sample is then made up to a volume of 50 ml., a 0.25 ml aliquot is removed to a planchet, dried under a heat lamp, and counted for gross alpha emission. Mr. Vesper stated that the counting time is dependent upon the concentration. The size of the aliquot withdrawn is adjusted to permit a count rate of at least 10 times background. These samples, according to Mr. Vesper, are periodically checked by spectrophotometry. The gross alpha counting is made using an Eberline, SAC-1, Scintillation Alpha Counter. Mr. Vesper also stated that environmental samples, representing the unrestricted environs, are collected using a Staplex High Volume air sampler operating at 35 cubic feet per minute, for a period of 30 minutes. He also stated that samples are collected at five points outside the mill area. Mr. Vesper stated that 1 to 3 samples are taken per location every three months. Mr. Vesper stated that scrubber stacks have been sampled, but no samples have as yet been taken representing effluent air from the final product area. However, samples will be collected from this area now that collection systems are in use.

Mr. Brinker stated that the present schedule should allow the licensee to make the first thorough survey of concentrations of airborne uranium between April 15 and April 30, 1961. He stated that sampling and studies of concentrations would be done under the direction of Dr. Robert F. Bell and Mr. James Gilliland, Department of Industrial Hygiene, University of Colorado Medical Center. Mr. Brinker stated that studies would be made to correct deficiencies that may appear as the new systems are put into operation.

Mr. Brinker also informed the inspector that much of the present ore handling facilities will not be required after August 1, 1961. It is anticipated that at that time, all crushing and grinding of ore will be accomplished at the licensee's two upgrader facilities. One of these units is now located in Monument Valley in Utah, while another unit is being constructed in Naturita, Colorado. Mr. Brinker expressed the opinion that this change will materially affect the conditions at the Durango plant, reducing and even eliminating much of the dust being generated by the ore handling process now in use. Photograph 16 is a view of a portion of the upgraded ore handling facility installed at the Durango site, together with a portion of the upgraded ore now stockpiled at Durango. It is planned to load the upgraded ore into the rear compartment of this device, salt will be placed in the forward compartment and a mixture of the two will feed through the drum in the foreground, into a truck that will be located down the ramp under the screen. From here the mixture will be transported to the roaster feed belt and directly to the roaster, bypassing the crushing, grinding and drying circuit now being used.

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Regarding the mill liquid effluent situation, Mr. Vesper stated that samples are still being taken on a routine schedule. The effluent liquors to the river are being sampled daily and composited for monthly analysis. The Animas River is being sampled three days per week upstream, and downstream at the state line. Separate composite samples are made of these grab samples, and they are analyzed once per month. Each of these above composites is analyzed for concentrations of Ra^{226} and Th^{230}. Mr. Brinker stated that the licensee's analyses indicated that the downstream concentrations of these nuclides were at background levels. He stated that the U. S. Public Health Service would be requested to make another study of the river in the near future. Photograph 17 is a view of a new settling pond now in use by the licensee. This pond impounds the effluent stream from the vanadium circuit, allowing the solids, formerly dumped directly into the Animas River, to settle prior to the liquid entering the river. Mr. Vesper stated that during the regular shutdown periods, the sludge, thus collected, is returned to the mill circuit. Mr. Brinker stated that with regard to the liquid effluent situation, several changes will be evidenced when the mill operates on upgraded ore. Among these changes will be:

1. Discontinuation of the acid leach,
2. Discontinuation of the solvent extraction,
3. Reduction in the volume of soda leach,
4. Discontinuation of the acid leach settling ponds and Barite treatment.

It is also anticipated that the total volume flow of effluent liquid from the plant will be appreciably reduced. During the past seven months, members of the staff of this office have, when the opportunity was available, collected samples from the licensee's effluent streams. The following table reports the date obtained from analyses of these samples:

Date of Collection	Sample From	Ra^{226} $\mu c/ml \times 10^{8}$	Th^{230} $\mu c/ml \times 10^{8}$
9/2/60*	Vanadium circuit discharge	45.9	37.5
9/2/60*	Soda leach tailings discharge	344.0	120.0
10/12/60	Vanadium circuit discharge	75.0	16.0
10/12/60	Soda leach tailings discharge	74.0	470.0

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Date of Collection	Sample From	Ra^{226} µc/ml x 10^{9}	Th^{230} µc/ml x 10^{8}
1/24/61*	Vanadium circuit discharge	185.0	3.0
1/24/61*	Soda leach tailings discharge	158.0	145.0
3/27/61	Vanadium circuit discharge	166.0	123.0
3/27/61	Soda leach tailings discharge	75.0	715.0

* Qualitative Barium determination negative.

The appearances in and around the mill have changed, indeed, for the better. While it is true that quite a considerable amount of work yet remains to be done toward closing in the mill building, the inspector was conscious of walking around the roaster area without the usual discomfort noted on previous visits. Efforts towards better housekeeping in and around the mill have improved the general appearance of the mill. The large pendant masses of ore hanging from the structures above the roaster quench tanks have been removed. As reported previously much of the unused and unorthodox piping has been removed. The roadway and walkways were passable, even though the Durango area had experienced a heavy snow storm, all of which had melted, a few days prior to the arrival of the inspector. While there remains much to be done to complete the project now in progress, the modifications appear to have made vast improvements in the licensee's operations. As to the status of compliance with the provisions of 10 CFR 20, this remains to be indicated by further studies by the licensee and by the ID Licensee Compliance Division.

Enclosure:
Appendix A
Appendix B

CC: W. B. Carlson, GJ w/enc.

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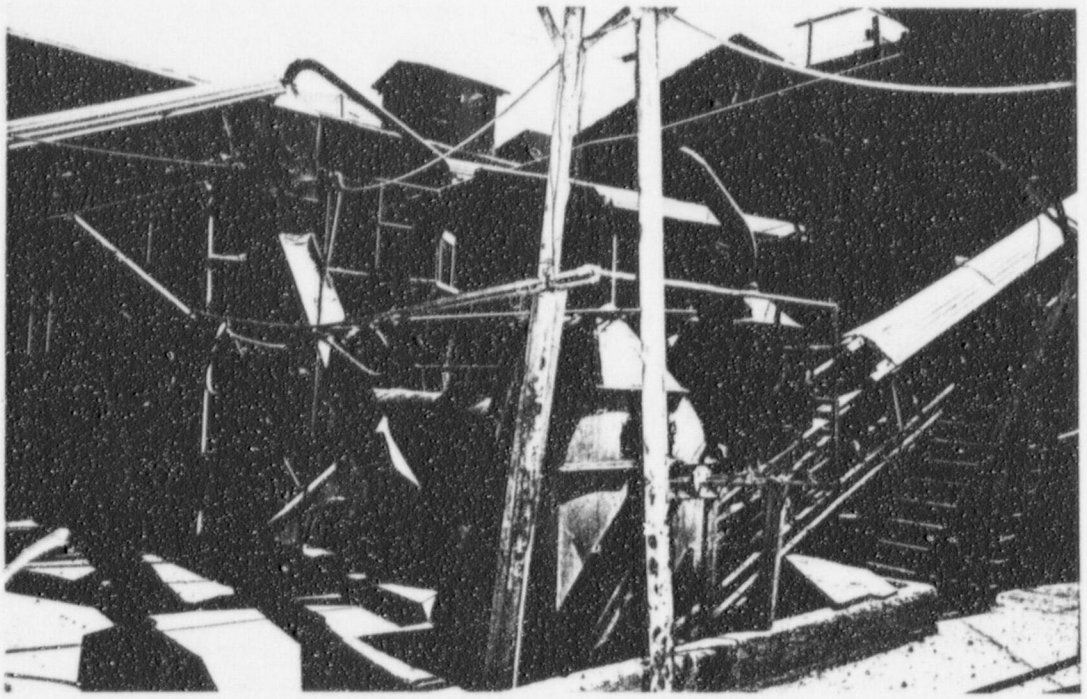
CHECK LIST ON VCA, AUGUST 19, 1960, PROPOSAL

		Installed	Date	Operating
A 1	Hoods, piping and accessories	Yes	2/9/61	See
2	Enclosures for rod mills, driers and transfer points	Yes	2/9/61	Report
B 1	Final product enclosure and steam drier vent	Yes	11/24/60	Yes
2	Screw conveyor to crusher, crusher enclosure	Yes	11/24/60	Yes
C	Hoods for discharge from fusion furnaces	See	Report	
D 1	Roofing and Sheeting	Yes	See	Report
2	Inactive equipment	Some	See	Report
3	Sub-standard equipment	To Be	Removed	Later
4	Roadways and walkways	See Yes	Report May-Aug	
E 1	Overhaul roasters	Yess	See	Below
2	Unothodox piping	Some	See	Report
3	Exhaust fans	Prior to	8/19/60	
4	(a) Rehab. #1	Yes	11/1/60	Yes
	(b) Rehab. #2	Yes	11/1/60	Yes
	(c) Rehab. #3	Yes	1/1/61	Yes
	(d) Rehab. #4	Yes	11/1/60	Yes
	(e) Rehab. #5	Yes	2/1/61	Yes
	(f) Rehab. #6	Yes	2/24/61	Yes
5	Operating schedule for cleaning scrubber	See	Report	
F	Omitted			
G 1	Modify scrubber #1 and #2	Yes	#2 2/1/61	See Report
2	Return of material to process	Yes	See	Report
3	Dust collector for final product station	Yes	11/24/61	Yes

VANADIUM CORPORATION OF AMERICA
Durango, Colorado

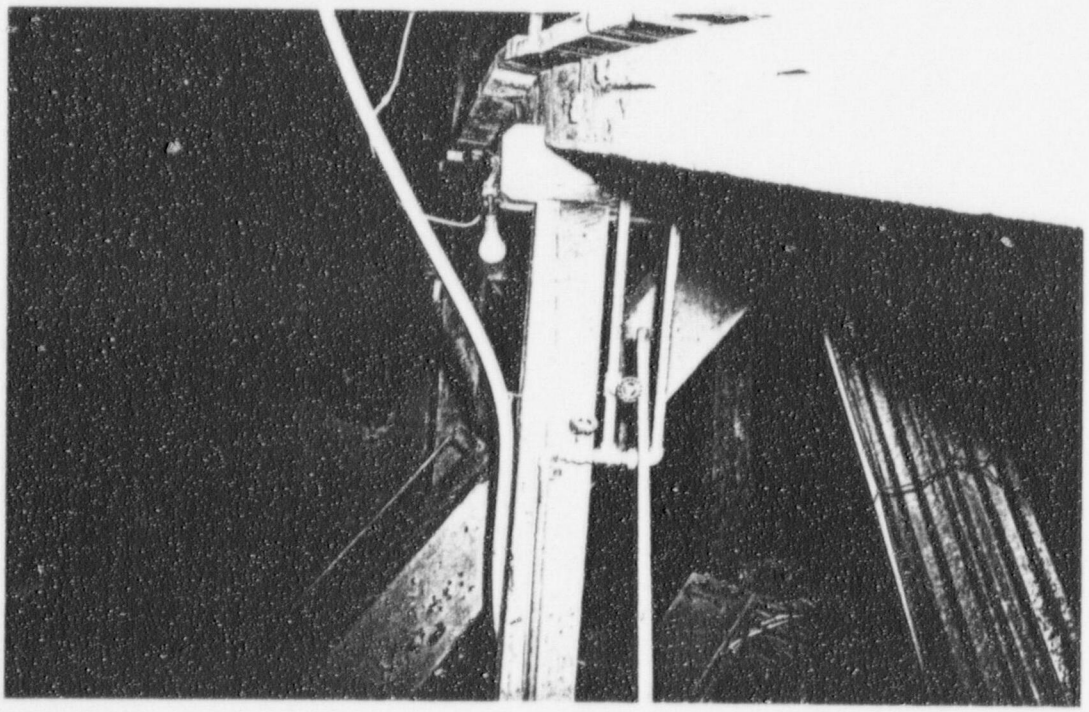
PHOTOGRAPHS
APPENDIX B

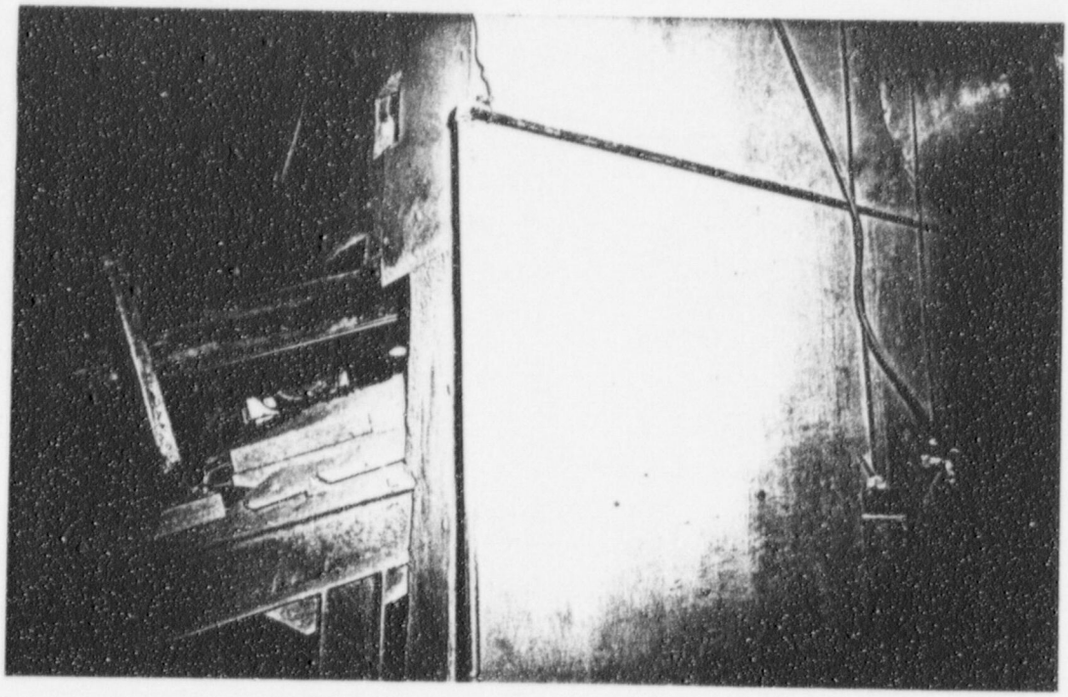
March 21-23, 1961



1. View of hoods over rod mill discharges.

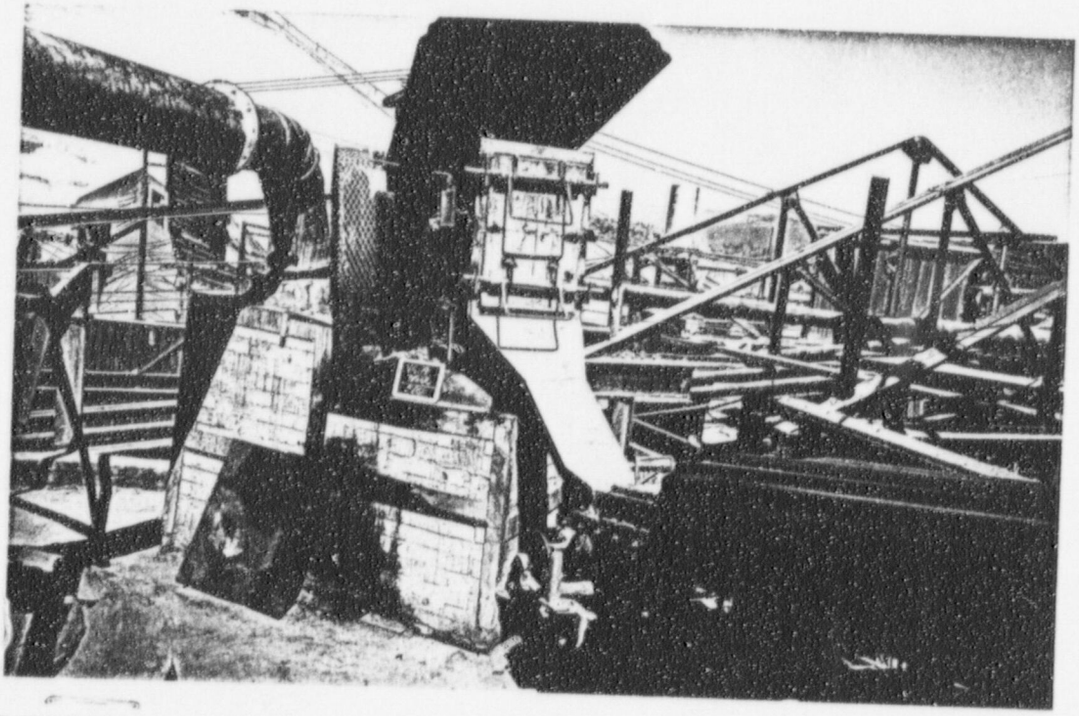
2. View of hood over ore drier discharge.

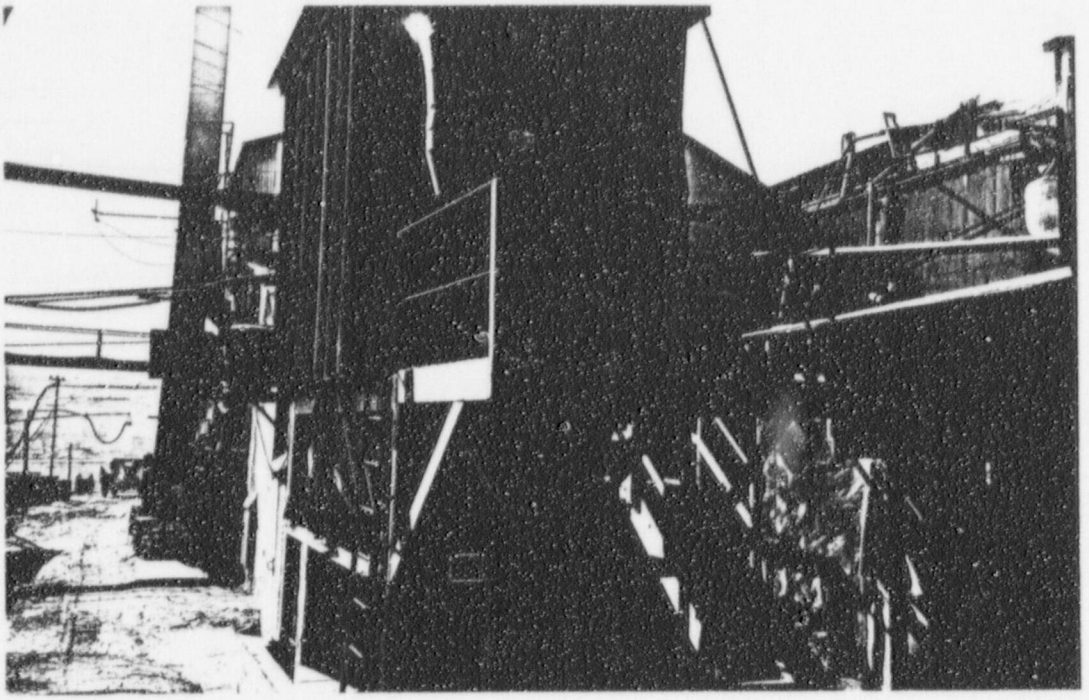




3. View of enclosure over fine ore bin.

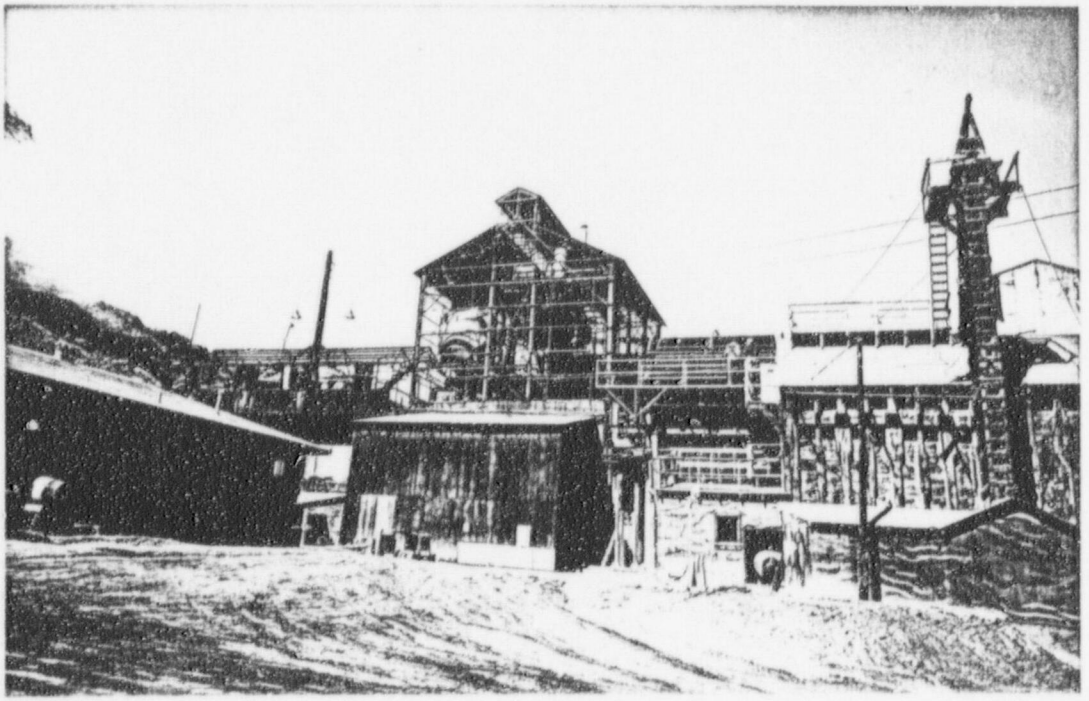
4. View of enclosure of fine ore discharge to ore roaster.

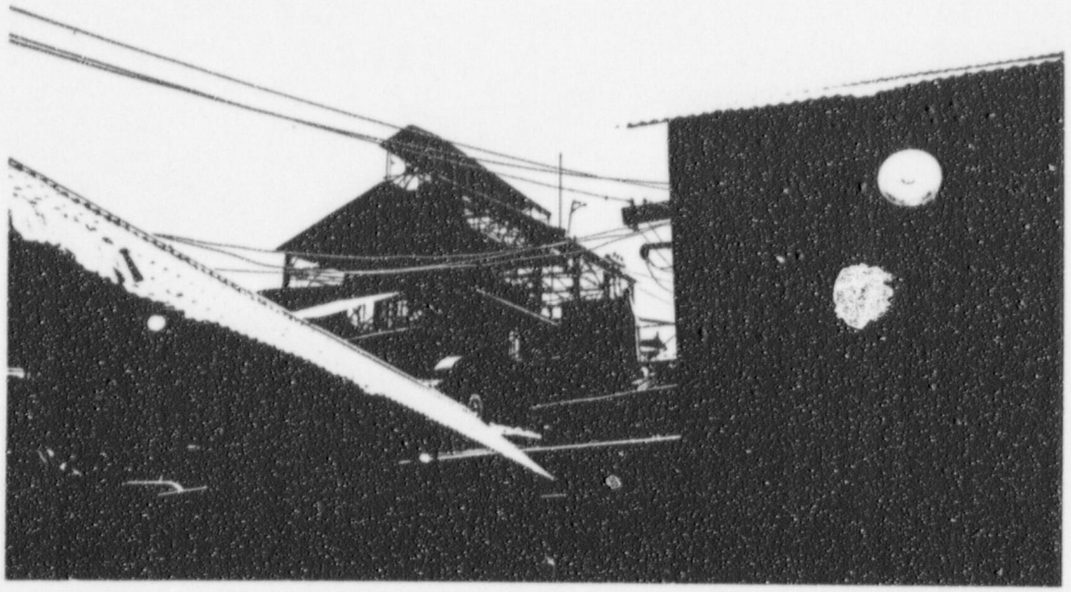




5. View of bag house, final product dust collector.

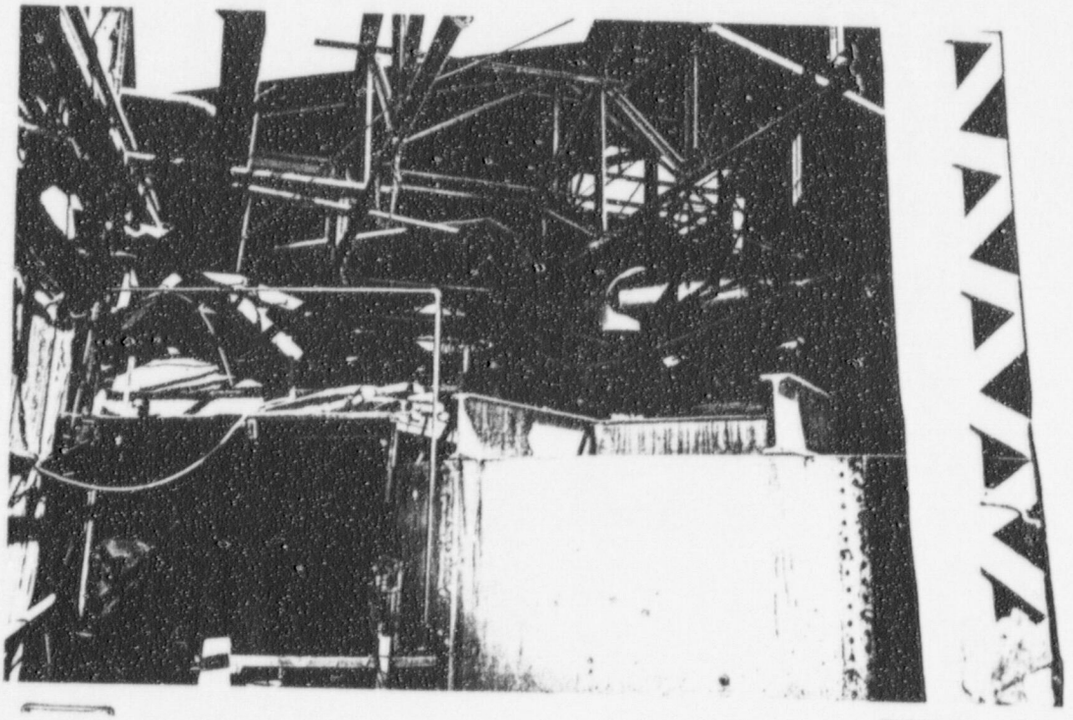
6. General view of east end of mill building with new construction right center.





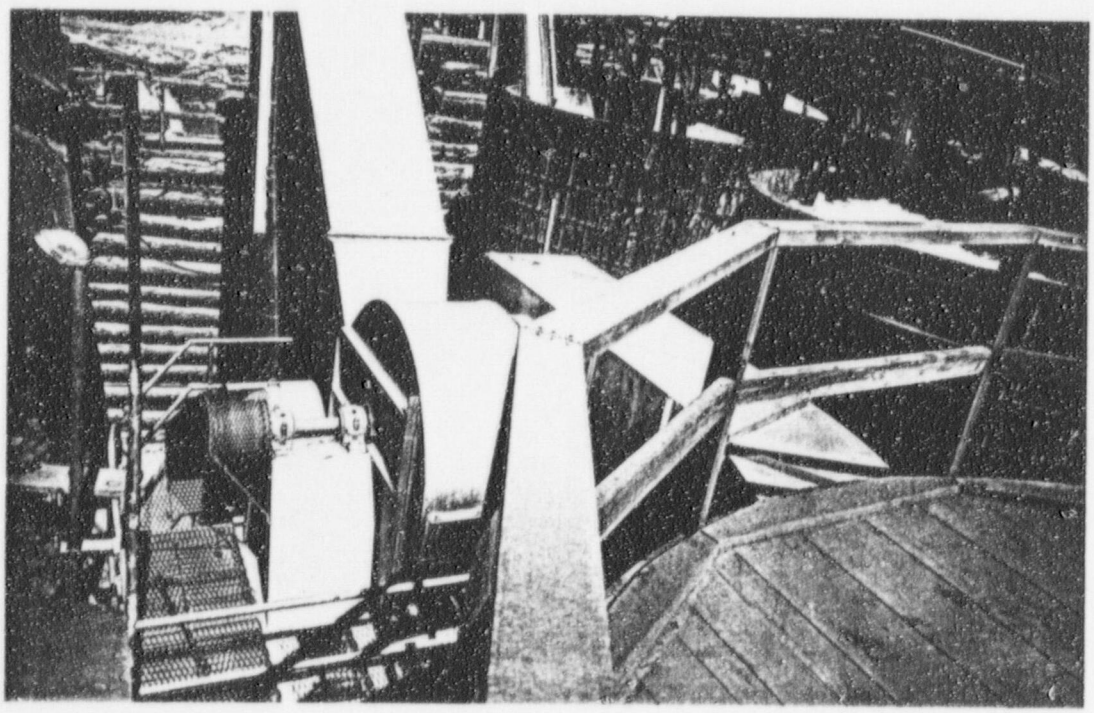
7. General view of west end of mill building.

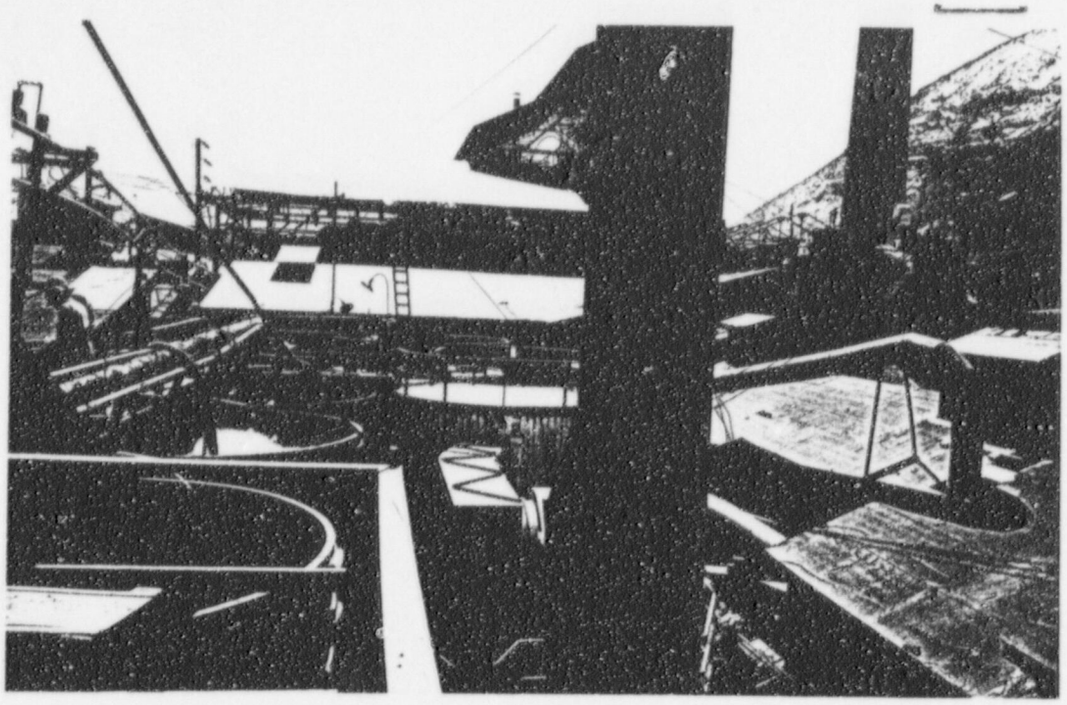
8. View of obsolete equipment and piping to be removed.



9. View of ore receiving pad in front of ore grizzley.

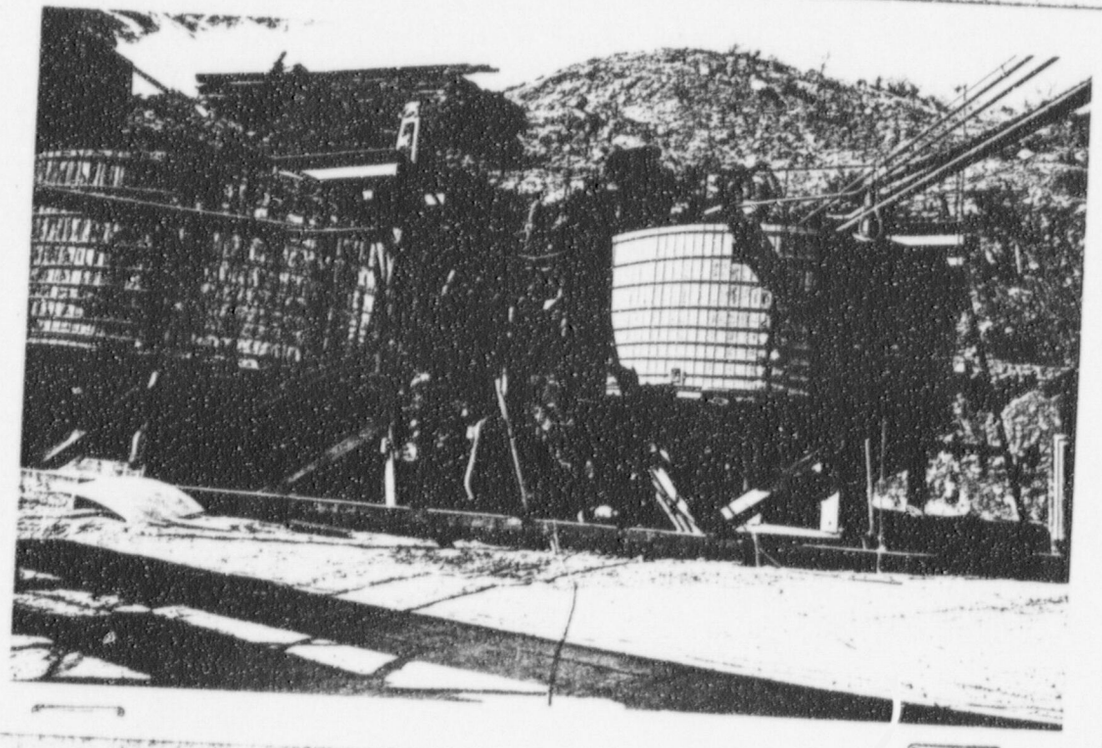
10. View of exhaust fan for scrubber unit #2.

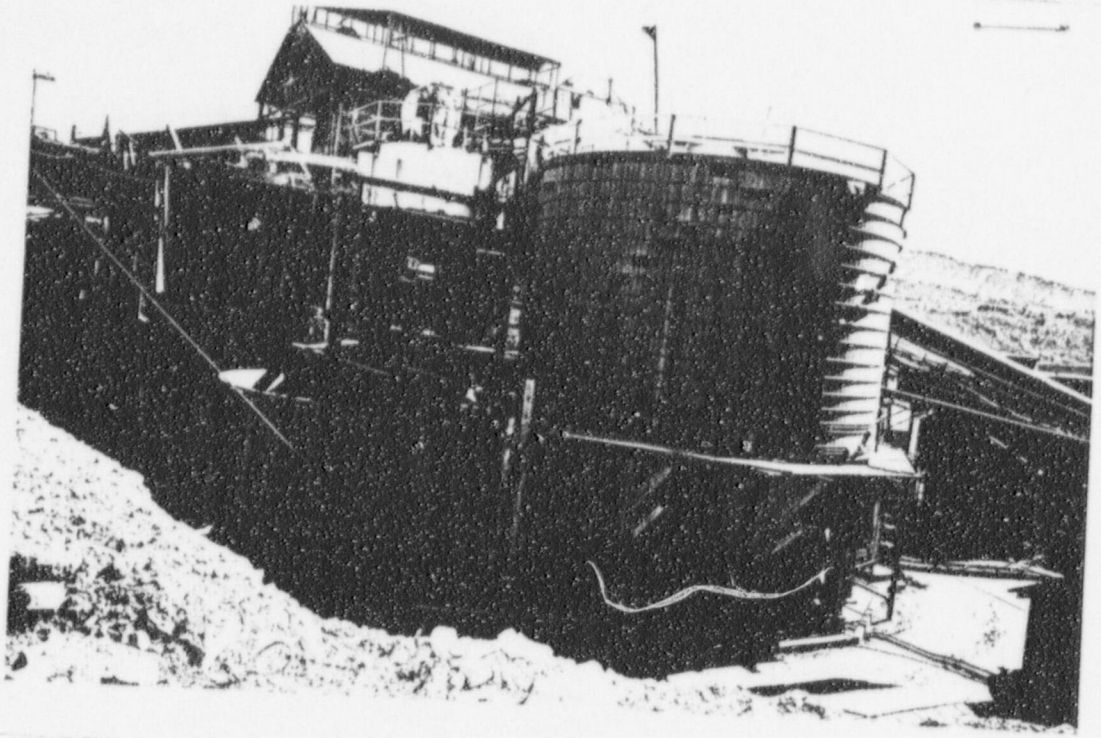




11. View of scrubber system #2, including scrubber tank, demister tank exhaust fan.

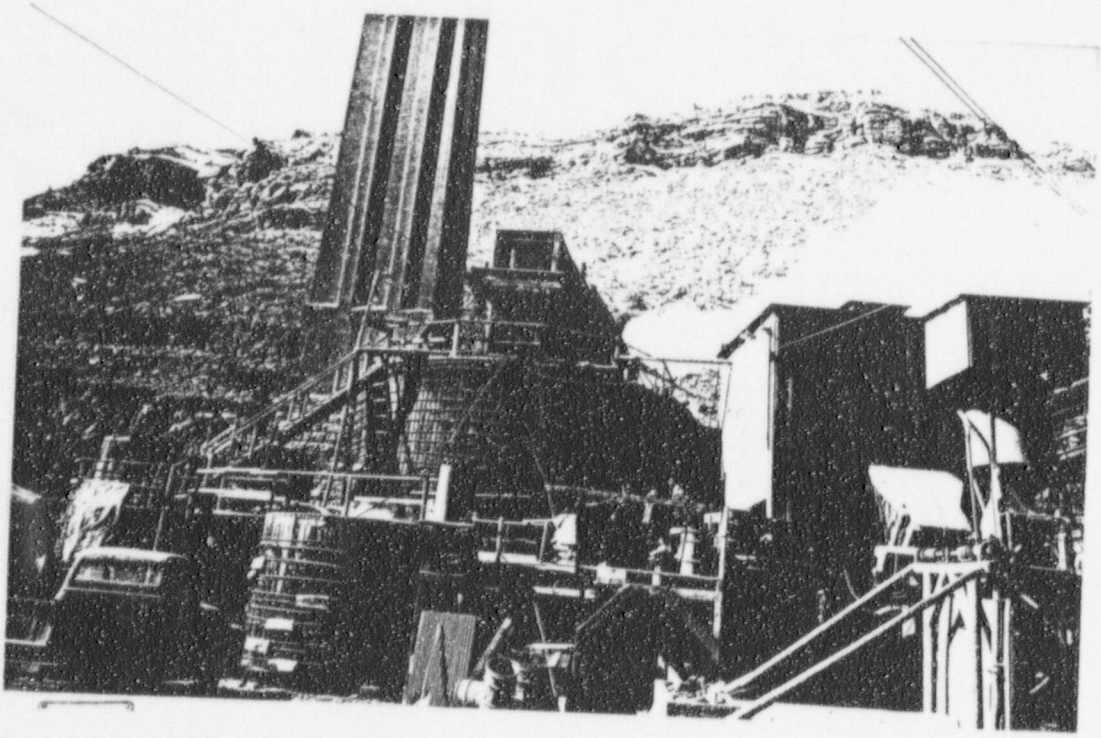
12. View of thickener tank (right) for scrubber system #2.

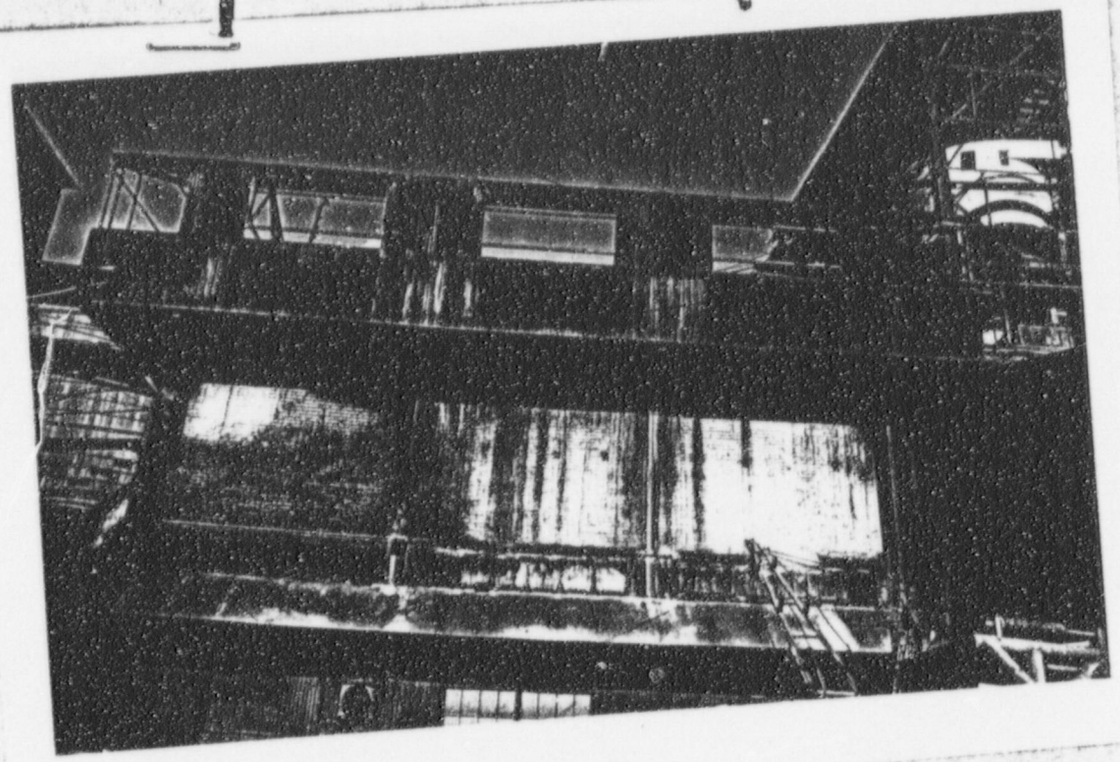




13. View of scrubber system #1 now under construction.

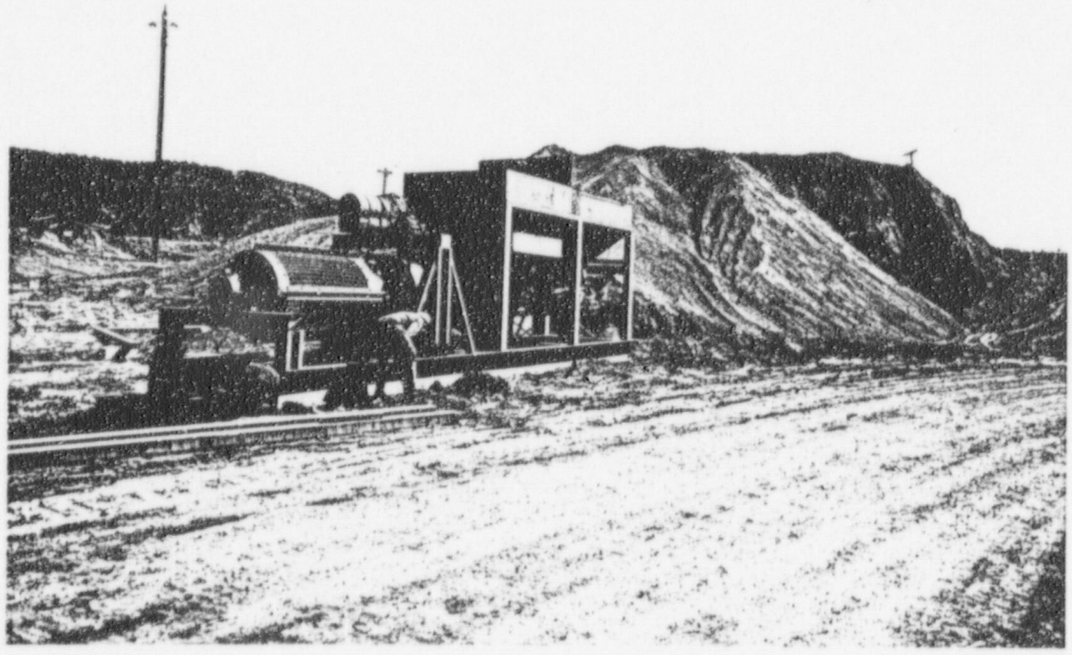
14. View of present scrubber system with exhaust stack.





15. View of old Cottrell building, now obsolete.

16. View of upgraded ore pile and ore-salt mixer in foreground.



17. Settling pond for vanadium circuit effluent discharge.