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TECHNOLOGY DEPARTMENT
 ENGINEERING

Docket WM-34

*PDR
 RETURN TO
 D. CRAMER
 396 SS*

June 30, 1981

Mr. Albert J. Hazle, Director
 Radiation and Hazardous Wastes Control Division
 Colorado Department of Health
 4210 East 11th Avenue
 Denver, Colorado 80220



Subject: Plans for Reclamation - For Surety Purposes
 Radioactive Materials License No. Colo. SUA-673

Dear Mr. Hazle:

Attached are five (5) copies of "Proposed Plans and Estimated Costs for Tailings Reclamation, Mill Decommissioning and Pond Reclamation at the Uravan Mill - for Surety Purposes," Revision 2 dated June 29, 1981.

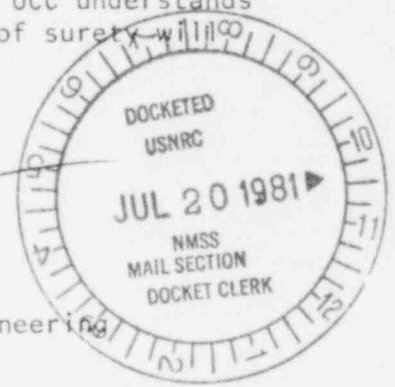
This document (Revision 2) presents for surety purposes UCC's reclamation plans and estimated costs in accordance with your letter to Mr. R. G. Beverly dated June 12, 1981. These plans required by the CDH represent the high cost alternatives.

It is Union Carbide Corporation's (UCC) understanding that the reclamation plans and costs submitted in Revision 1 on May 27, 1981 will be given due consideration after review of International Engineering Company, Inc.'s (IECO) "Uravan Tailings Reclamation Report - March 1981" submitted on March 25, 1981 and of IECO's "Uravan Ponds Reclamation Report" to be submitted as soon as completed. If IECO's findings are found acceptable to the CDH, UCC understands that the reclamation plans will be revised and that the amount of surety will be reduced consistent with the revised plans.

Yours very truly,

T. J. Kagetsu

T. J. Kagetsu
 Assistant Director-Engineering

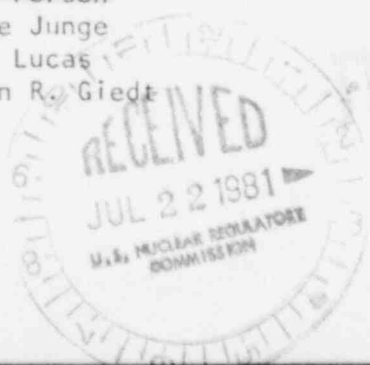


TJK/cap
 Enc.

- cc: Messrs.
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 Mr. Steve Spann
 Mr. Richard S. Dressel
 Mr. Robert Shukle
 Dr. Gonzalo Castro

- Mr. Charles Roberts
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Add Info

Proposed Plans and Estimated Costs for
Tailings Reclamation, Mill Decommissioning
and Pond Reclamation at the
Uravan Mill - for Surety Purposes

Revision 2

June 29, 1981

1.0 Introduction

The Colorado Department of Health (CDH) and Union Carbide Corporation (UCC) have been working towards a financial surety agreement for reclamation. On May 30, 1980, Union Carbide submitted a document titled "Proposed Plans and Estimated Costs for Tailings Reclamation, Mill Decommissioning and Pond Reclamation at the Uravan Mill - for Surety Purposes."

In a letter dated June 12, 1981 from Mr. A. J. Hazle to Mr. R. G. Beverly, the CDH stated the following:

"Union Carbide's May 30, 1980 "Proposed Plans and Estimated Costs for Tailings Reclamation, Mill Decommissioning and Pond Reclamation at the Uravan Mill for Surety Purposes" is acceptable as a basis for reclamation surety, if acceptably modified in conformance to:

- a. The U. S. Nuclear Regulatory Commission's April 9, 1981 "Assessment of the In-Place Tailings Reclamation Alternative for the Union Carbide Uravan Mill Site," the principal recommendations (minimum requirements) of which are summarized in Attachment A;
- b. The Inter-Office Communication (Attachment B) of June 4, 1981 from the Department's Water Quality Control Division to this Division, the recommendations of which were communicated to Union Carbide representatives at the prior meetings; and
- c. The Inter-Office Communication (Attachment C) of June 9, 1981, which records the meeting of June 3, 1981 and in particular the recommendations of the Colorado Geological Survey."

This document (Revision 2) presents for surety purposes UCC's plans and estimated costs for reclamation of the existing ponds and commingled tailings piles in conformance with the above requirements and for the decommissioning of the Uravan Mill. The alternatives required by the CDH in this plan represent the high cost case.

On July 9, 1980, a meeting was held with personnel representing CDH, NRC, GEI, BLM, UCC, and UCC consultants. It was stated by the NRC and CDH that in order for the tailings reclamation plan submitted on May 30, 1980 to be considered, additional field data and studies were required.

In August 1980, UCC selected International Engineering Company, Inc. (IECO) to study alternatives for the reclamation of the existing tailings piles. In conjunction with this study, IECO conducted field investigations and evaluated site specific geotechnical data, ground water impact, long-term stability, and cover materials to control radon emanations and to provide long-term erosion protection. IECO's "Uravan Tailings Reclamation Report - March 1981" was submitted to the CDH and NRC on March 25, 1981.

IECO is also preparing a report on ponds reclamation in which the evaluations are based on available data. This report will be submitted when completed.

On May 27, 1981, UCC submitted plans and estimated costs for reclamation of the existing ponds and commingled tailings piles based on IECO's recommendations and for the decommissioning of the Uravan Mill in Revision 1 of this document. It is UCC's understanding that these plans and IECO's reports will be reviewed by the CDH so that a more practical plan can be established and so that the amount of surety can be reduced.

2.0 Summary

This document presents a plan and estimated costs for surety purposes for reclamation of the Atkinson Creek Area, Club Ranch Ponds, River Ponds, Club Mesa Area, mill decommissioning, and reclamation of the existing commingled tailings piles. The estimated cost for these activities is \$23,692,000 in 1981 dollars. A summary of the costs is shown in Table I.

TABLE I
SUMMARY OF RECLAMATION COSTS FOR SURETY PURPOSES

<u>Item</u>	<u>Total Cost</u> <u>M\$</u>
Atkinson Creek Area	1,392
Club Ranch Ponds	4,409
River Ponds	1,546
Club Mesa Area	2,735
Mill Decommissioning	3,025
Tailings Pile 2	4,253
Tailings Pile 3	2,357
Fill Area	<u>3,975</u>
TOTAL COST	23,692

The contaminated materials from the Atkinson Creek Area, Club Ranch Ponds, River Ponds, and Club Mesa Area will be excavated, transported to and will be placed in the new fill area adjacent to tailings pile 2. These excavated areas will be graded, covered with one foot of random fill, and will be vegetated.

The mill decommissioning will provide for the removal of all structures and process area cleanup. All contaminated materials will be placed on top of the existing tailings piles.

The tailings piles 2 and 3 will be reclaimed by reducing the slopes to five horizontal to one vertical starting at the toe of the existing tailings, moving the excess to a new clay-lined fill area adjacent to tailings pile 2, and by placing a 3-meter cover which meets the NRC criteria over tailings piles 2 and 3 and the new fill area.

3.0 Reclamation of the Ponds

3.1 Atkinson Creek Area

A total of 270,000 cubic yards of contaminated materials will be excavated from the Atkinson Creek area, transported to and be placed in the new fill area adjacent to tailings pile 2. The excavated area will be graded, backfilled with one foot of random fill, and be vegetated. This site, shown in Figure 1, covers an area of 6.4 acres based on measurements off a topographic map. An average depth of 26 feet will be excavated.

3.2 Club Ranch Ponds

A total of 800,000 cubic yards of contaminated material will be excavated from the Club Ranch Pond area, transported to and be placed in the new fill area adjacent to tailings pile 2. The excavated area will be graded, backfilled with one foot of random fill, and be vegetated.

This site, shown in Figure 1, covers an area of 62 acres based on measurements off a topographic map and includes the area from the shoulder of the road to the river. The excavation represents an average depth of 8 feet over the whole area, and in practice the depth of excavation will vary considerably due to the topography of the ponds. It is unknown where the "seasonal high water table" is located, if indeed there is one.

3.3 River Ponds

The River Ponds, shown in Figure 2, are located on both sides of the river and include the so-called "emergency ponds." A total of 200,000 cubic yards of contaminated material will be excavated, transported to and be placed in the new fill area adjacent to tailings pile 2. The excavated area will be graded, covered with one foot of random fill, and be vegetated.

The "emergency ponds" on the highway side of the river cover an area of 4.5 acres and the ponds adjacent to the mill cover 2.4 acres, for a total of 6.9 acres based on measurements off a topographic map. The excavation represents an average depth of about 18 feet.

3.4 Club Mesa Area

3.4.1 Neutralized Sludge

Neutralized sludge from the River Ponds dumped at locations on Club Mesa marked "S" in Figure 3, totals 75,000 cubic yards based on contractor haulage records at the Uravan Plant. It is expected that an equivalent amount of sludge will be deposited by the time the new facilities on Spring Creek Mesa are on-stream. A total of 150,000 cubic yards of neutralized sludge will be loaded, transported to and be placed in the new fill area adjacent to tailings pile 2. This is water insoluble material and it is not expected that ground in contact with this material is contaminated.

These piles will cover an area of 6.4 acres.

3.4.2 Ponds

A total of 40,000 cubic yards of contaminated material from the area labeled "Ponds" in Figure 3 will be excavated, transported to and be placed in the new fill area adjacent to tailings pile 2.

This pond area covers 6.2 acres based on measurements off a topographic map. The excavated material represents an average depth of about 4 feet, and in practice the depth of excavation will vary considerably due to the topography of the ponds.

3.4.3 Spray Area

A total of 390,000 cubic yards of contaminated material will be excavated, transported to and be placed in the new fill area adjacent to tailings pile 2.

The spray area covers 30.4 acres based on measurements off a topographic map. The depth of crystals over the spray area is about 4 to 5 feet. It is expected that the depth of crystals over the spray area will average 8 feet by the time the new facilities on Spring Creek Mesa are on-stream.

3.4.4 Fringe Areas

A total of 44,000 cubic yards of soil will be scraped from 27 acres of fringe area to a depth of one foot, transported to and be placed in the new fill area adjacent to tailings pile 2.

3.4.5 Total Area

The total impacted area on Club Mesa is 70 acres based on measurements off a topographic map. This area will be graded, covered with a foot of random fill, and be vegetated.

4.0 Decommissioning the Mill

1. All equipment including instrumentation, process piping, electrical controls and switchgear, and structures will be removed. Concrete foundations will be demolished and removed as required. Salvageable items will be decontaminated and removed from the site. The remaining items will be placed on the tailings piles prior to reclamation.
2. The process area will be cleaned up and all contaminated materials will be placed on the tailings piles prior to reclamation. This area will be backfilled and graded.

5.0 Reclamation of the Existing Commingled Tailings Piles

5.1 Overall Plan for Tailings Piles 2 and 3

1. The site for the new fill area adjacent to tailings pile 2 will be prepared and a one-foot thick compacted clay liner will be placed.
2. The required 450,000 cubic yards of rock fill and gravel from the stabilization berms on tailings piles 2 and 3 will be removed and stockpiled for later use as the rock cover. This Salt Wash sandstone is the most durable in the area and meets the requirements for the rock cover as determined by Professor Roger S. U. Smith in the report "Long Term Stability of Union Carbide's Tailings Piles at Uravan, Colorado" dated December 16, 1980.
3. The slopes of tailings piles 2 and 3 will be cut to 5 horizontal to 1 vertical (5H:1V). A total of 390,000 cubic yards of tailings from the slopes will be placed on top of tailings pile 2. A total of 240,000 cubic yards of tailings from the slopes will be placed on top of tailings pile 3. A total of 630,000 cubic yards of excess tailings from tailings piles 2 and 3 will be transported to and be placed in the new fill area adjacent to tailings pile 2.
4. The top of the tailings piles will be graded to a minimum slope of 3 percent for surface drainage.
5. A 3-meter thick reclamation cover will be placed over tailings piles 2 and 3 and over the new fill area. Based on the data in "Uravan Tailings Reclamation Report dated March 1981" by International Engineering Company, Incorporated (IECO), the cover will consist of 1 meter clay, 1.3 meters random fill, and 0.7 meter rock cover. This cover is more than adequate to reduce the radon emanation to less than $2 \text{ pCi/m}^2/\text{sec}$, the gamma radiation to background.
6. The same rock fill material used for the rock cover will be placed at the gully heads to divert any surface water away from the gullies northeast of tailings pile 2.
7. An approximately 1700-foot long interceptor ditch may be required for drainage control. This ditch has been included in this reclamation plan as shown in Figure 4. The natural topography is such that drainage control will not be needed during reclamation.

5.2 Basis for Quantities

The area of the new fill area shown in Figure 4 is 44 acres based on measurements off a topographic map. A total of 71,000 cubic yards of clay will be required for the 1-foot thick impermeable lining.

The quantity of tailings that will be removed when the slopes of tailings piles 2 and 3 are cut to a 5H:1V slope was calculated by drawing typical cross sections of the tailings piles based on topographic maps, drawing the reclamation 5H:1V slope starting at the toe of the existing tailings, calculating the fraction of the tailings removed in the total sloped cross section covered by the reclamation slope, and by multiplying the total weight of tailings in this section by this fraction. An average fraction of 0.3 was multiplied by the 4,200,000 cubic yards estimated to be in the section represented by the reclamation slope, to give 1,260,000 cubic yards of tailings that will have to be removed to establish the 5H:1V reclamation slope. Figure 5 shows that in going from a 3H:1V to a 5H:1V slope, the fraction removed from the cross section covered by the reclamation slope is 0.286 for this model. The quantity of excess tailings calculated for the May 30, 1980 reclamation plan was in error.

The volume of tailings placed on top of the existing tailings piles was calculated from the flat area remaining after cutting to a 5H:1V slope, adding 30 feet to the height and maintaining the 5H:1V slope around the outside perimeter.

The areas for the reclamation covers are 60 acres for tailings pile 2, 33 acres for tailings pile 3, and 44 acres for the new fill area. These areas were based on measurements off a topographic map.

6.0 Cost Estimates

6.1 Unit Costs

The unit costs used in calculating the cost of the reclamation plans dated February 1980 and May 1980 for surety purposes were based on the best 1980 cost data available at that time and reflected the input from contractors and consultants as well as actual cost experience. Since that time, additional site specific cost data have been accumulated from the UraVan tailings stabilization work, from contractors and from consultants. The unit costs used in the following cost estimates reflect the most recent cost experience and are based on 1981 dollars.

It should be noted that the unit costs used are generally significantly higher than the unit costs used by the Environmental Protection Agency in the "Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites" (40 CFR 192) dated December 1980.

6.2 Reclamation Costs

The cost estimates for the reclamation of ponds are given in Table II, for mill decommissioning in Table III, and for the reclamation of the existing commingled tailings in Table IV. The costs are given in 1981 dollars.

TABLE II

COST ESTIMATE FOR RECLAMATION OF PONDS
(Costs in 1981 Dollars)

Area	Item No.	Description of Work	Quantity	Unit Costs (\$/Unit)	Estimated Costs (M\$)
Atkinson Creek	1	Excavate, load, haul and place contaminated materials in new fill area	270M yd ³	5.00	1,350
	2	Excavate, load, haul, and place random fill	10.3M yd ³	2.85	29
	3	Grade and vegetate	6.4 acres	2,000	13
	Total for Atkinson Creek Area				
Club Ranch Ponds	1	Excavate, load, haul, and place contaminated materials in new fill area	800M yd ³	5.00	4,000
	2	Excavate, load, haul, and place random fill	100M yd ³	2.85	285
	3	Grade and vegetate	62 acres	2,000	124
	Total for Club Ranch Ponds				
River Ponds	1	Excavate, load, haul and place contaminated materials in new fill area	200M yd ³	7.50	1,500
	2	Excavate, load, haul and place random fill	11.1M yd ³	2.85	32
	3	Grade and vegetate	6.9 acres	2,000	14
	Total for River Ponds				
Club Mesa	1	Excavate, load, haul and place neutralized sludge in new fill area	150M yd ³	2.85	428
	2	Excavate, load, haul and place contaminated pond materials in new fill area	40M yd ³	4.00	160
	3	Excavate, load, haul and place raffinate crystals in new fill area	390M yd ³	4.00	1560
	4	Scrape fringe areas, load, haul and place in new fill area	44M yd ³	2.85	125
	5	Excavate, load, haul and place random fill	113M yd ³	2.85	322
	6	Grade and vegetate	70 acres	2,000	140
	Total for Club Mesa Area				

TABLE III

COST ESTIMATE FOR DECOMMISSIONING THE URAVAN MILL
(Costs in 1981 Dollars)

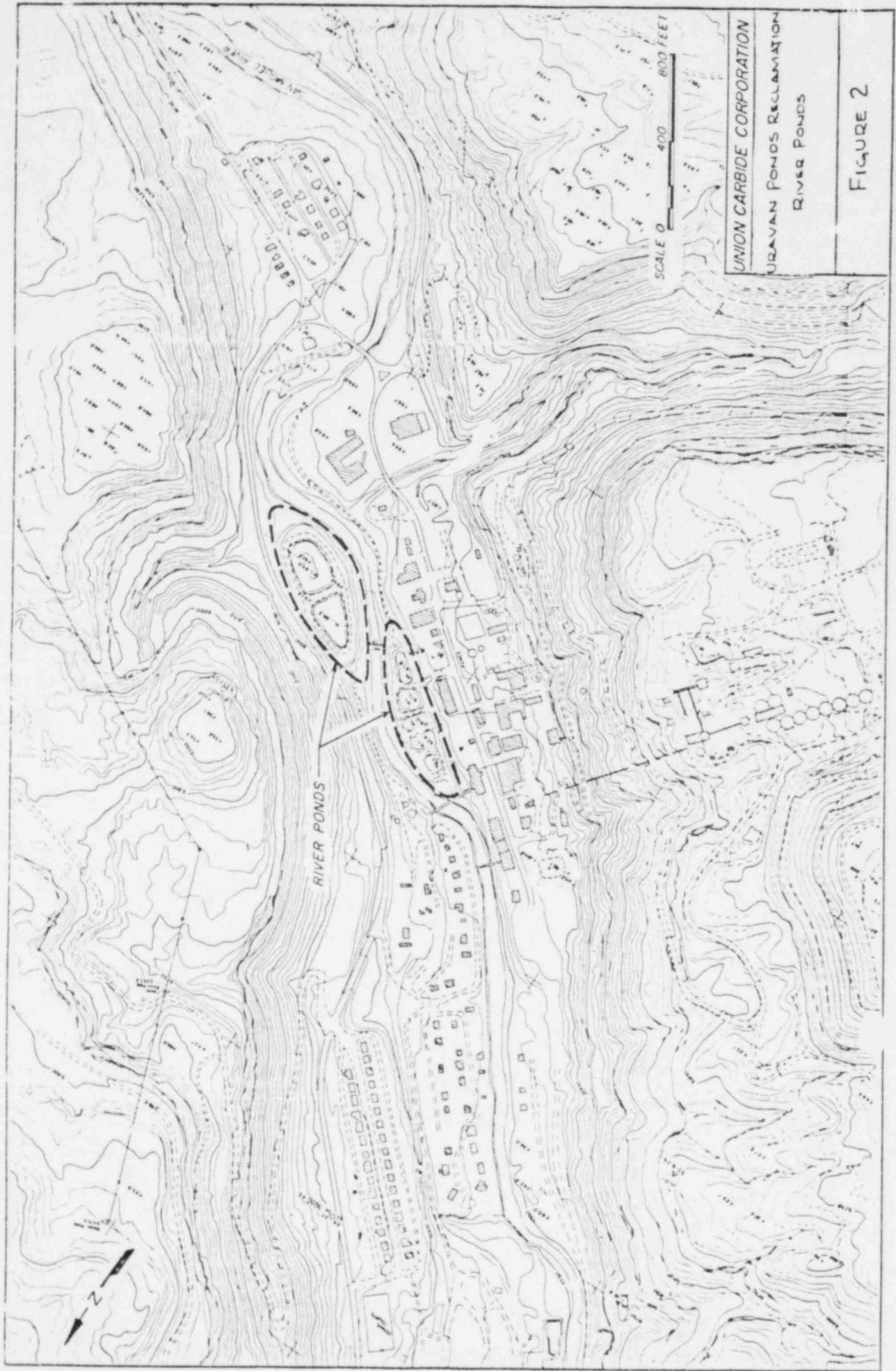
Item No.	Description of Work	Estimated Cost (M\$)
1	Removal of equipment, including piping, instrumentation, electrical controls and switchgear and hauling contaminated materials to the top of the existing tailing piles	1,820
2	Demolition of structures including buildings, storage bins, steel structures, and miscellaneous support facilities	420
3	Break up and remove concrete	675
4	Excavate contaminated process areas, haul contaminated materials to the top of the existing tailings piles, backfill, and regrade	110
	Total for Mill Decommissioning	<hr/> 3,025

TABLE IV

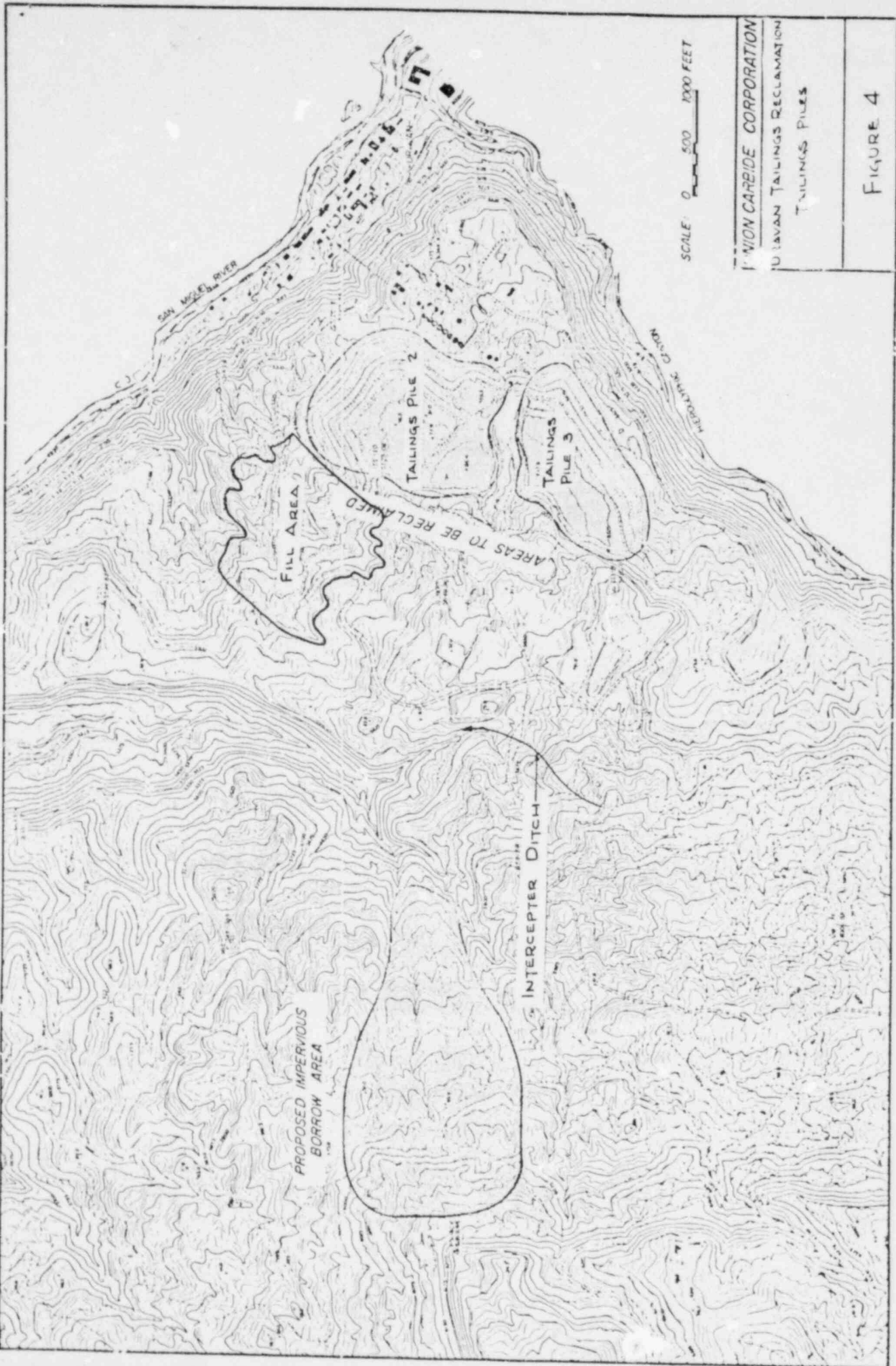
COST ESTIMATE FOR RECLAMATION OF EXISTING TAILINGS
(Costs in 1981 Dollars)

Area	Item No.	Description of Work	Quantity	Unit Costs (\$/Unit)	Estimated Costs (M\$)
New Fill Area	1	Site preparation	44 acres	400	18
	2	Excavate and stockpile material	145M yd ³	2.60	377
	3	Excavate, load, haul, place and compact clay liner	71M yd ³	2.85	202
	4	Excavate, load, haul and place excess tailings from tailings piles 2 and 3	630M yd ³	2.25	1,418
	5	Excavate, load, haul, place and compact clay cover	213M yd ³	2.85	607
	6	Excavate, load, haul and place fill for cover	355M yd ³	2.85	1,012
	7	Load, haul and place stockpiled rock for cover	142M yd ³	2.40	341
		Total for New Fill Area			3,975
Tailings Pile 2	1	Excavate, load, haul and stockpile rock and gravel from stabilization berm	294M yd ³	2.60	764
	2	Move tailings to top of tailings pile and grade slope and top	390M yd ³	2.00	780
	3	Excavate, load, haul, place and compact clay cover	290M yd ³	2.85	827
	4	Excavate, load, haul and place fill for cover	484M yd ³	2.85	1379
	5	Load, haul and place stockpiled rock for cover	194M yd ³	2.40	466
	6	Interceptor ditch excavation	2.3M yd ³	9.00	21
	7	Load, haul and place stockpiled rock for protection of gullies	6.7M yd ³	2.40	16
		Total for Tailings Pile 2			4,253
Tailings Pile 3	1	Excavate, load, haul and stockpile rock and gravel from stabilization berm	156M yd ³	2.60	406
	2	Move tailings to top of tailings pile and grade slope and top	240M yd ³	2.00	480
	3	Excavate, load, haul, place and compact clay cover	160M yd ³	2.85	456
	4	Excavate, load, haul and place fill for cover	266M yd ³	2.85	758
	5	Load, haul and place stockpiled rock for cover	107M yd ³	2.40	257
		Total for Tailings Pile 3			2,357



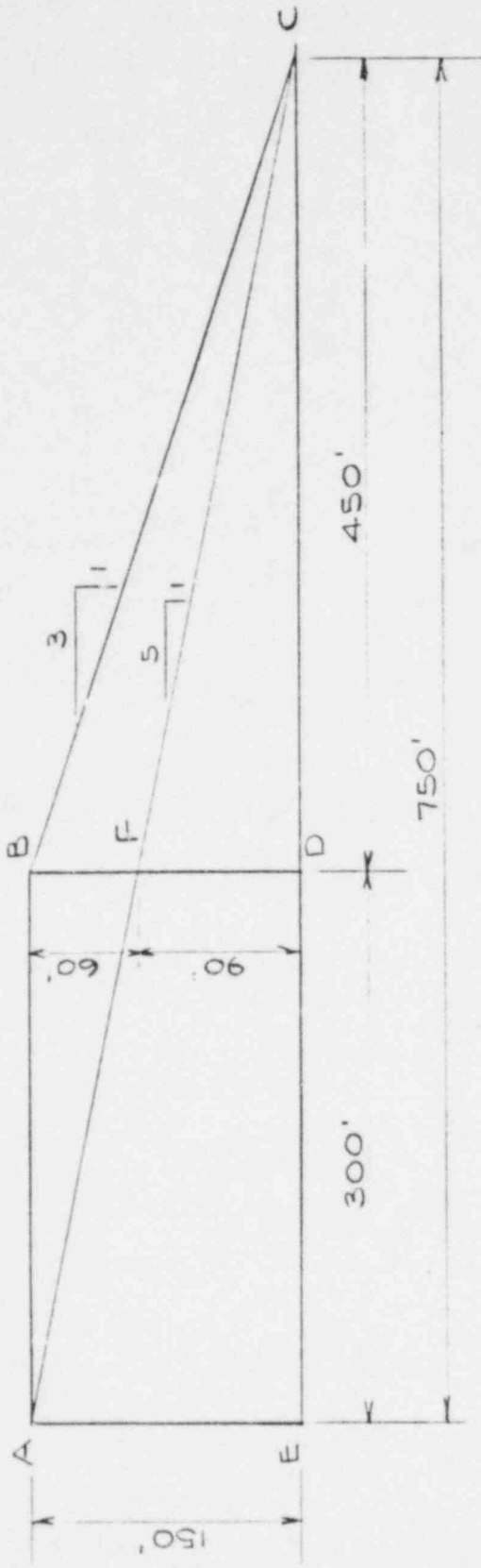






SCALE: 0 500 1000 FEET

UNION CARBIDE CORPORATION
ULAVAN TAILINGS RECLAMATION
TAILINGS PILES
FIGURE 4



AREA \square ABDE = $150 \times 300 = 45,000 \text{ FT.}^2$
 Δ BCD = $\frac{1}{2} \times 150 \times 450 = 33,750 \text{ FT.}^2$
 TOTAL AREA OF FIGURE ABCDE = $78,750 \text{ FT.}^2$ (TOTAL SLOPED CROSS SECTION)
 AREA Δ BCF = AREA Δ BCD - AREA Δ CDF
 = $33,750 - \frac{1}{2} \times 90 \times 450 = 13,500 \text{ FT.}^2$
 = $33,750 - 20,250 = 13,500 \text{ FT.}^2$
 AREA Δ ABF = $\frac{1}{2} \times 60 \times 300 = 9,000 \text{ FT.}^2$
 \therefore AREA TO BE REMOVED (Δ ABC)
 FRACTION TOTAL AREA TO BE REMOVED = $\frac{22,500}{78,750} = 0.286$

FIGURE 5

CALCULATION MODEL ILLUSTRATING FRACTION TAILINGS TO BE REMOVED FOR 5H:1V SLOPE FROM TOTAL SLOPED CROSS SECTION