Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87115

OCT 2 - 1987

Mr. Paul Lohaus
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Springs, MD 20910

Dear Mr. Lohaus:

Per our recent discussion, DOE will meet with NRC on October 14, 1987, at 8:30 a.m. in Silver Springs, Maryland, to discuss current UMTRA status and issues including Title I and II areas, demolition criteria and UMTRA schedules. As you are aware the DOE has been reviewing differences in cost between the standard UMTRA cover using a radon barrier covered by durable rock and that of soil covers proposed by Title II applicants for approval of reclamation plans.

Attached as Tables 1, 2, and 3 are the summary data from this study. Basis of calculation can be discussed during our meeting. The quantities calculated were based on simplifying assumptions (i.e., all piles square, placed on flat ground) since it was not reasonable to try and do a new design for each site.

- o Table 1 lists the sites and the estimated cost and haul distance for rock and soil for which there was data available and the actual bid costs for Lakeview, Durango and Canonsburg. This table also shows the costs/cy/mile for each material type.

- o Table 2 shows the quantities for each material type, the area of each site, the proposed radon barrier thickness and the cost of the total proposed cover at each site.

- o Table 3 shows the additional material required if a 20 foot cover with no rock were required with 10:1 side slopes and the additional cost for this cover system. This table also gives the additional material for a cover system requiring an additional two feet to the top slope radon barrier and a minimum of 20 feet of soil at 10:1 slopes placed on the sides with no rock. This table also shows the difference in cost between the presently proposed cover and this modified cover.

Table 1 reflects that the estimated costs for each material is very close to the actual costs and that, if anything, they are conservative.

The results of these analysis show the following:

- For all UMTRA sites it would be extremely expensive to go to a design which had 10:1 side slopes with a minimum of 20' of soil on top of the radon barrier (see column 7 of Table 3).

- For a design requiring 10:1 side slopes with a minimum of 20' between the tailings and the top of the cover at the crest of the 10:2 slope, and a minimum of two feet addition on the top slope the average additional cost per site would be over $1 million. At a few sites there would be a small savings and this savings would be within the accuracy of these estimates (see column 11 of Table 3), with the exception of the Maybell site where there could be an estimated $800,000 savings.

In order to see the differences in cost for the various design options Table 4 was created using unit average cost/cy/mile figures from Table 1. From Table 4, Figure 1 was plotted which shows that, for example, a 3 foot radon barrier coming from within one mile (which is the average for most of the sites) and rock coming from four miles away, the cost of a modified soil cover would be approximately the same.

In order to further analyze the actual cost differences between the different cover systems the Green River site was analyzed for four options. Calculations were done for each design taking into account the change in footprint size and the amount of material required.

- The design presented in the DRAP which had 10:1 side slopes and rock,

- The modified soil cover with no rock

- The standard UMTRA design with 5:1 side slopes and good quality rock, and from 80 miles away, and

- The standard UMTRA design with 5:1 side slopes and poor quality rock from five miles away and doubling the amount of rock to account for weathering.

The results of this analysis are shown on Tables 5, 6 and 7. As shown on Table 6 under "Total Cost" the least expensive option would be using poor quality rock with a small increase for good quality rock. The most expensive option would be the modified soil cover with no rock.

Also with soil covers, no additional cost has been taken into consideration for the additional maintenance costs that would be incurred for repair from erosion of the side slopes.

We shall look forward to meeting with NRC on October 14, 1987. Please feel free to contact me if you wish to make any revision to the discussion items or have any questions regarding the enclosed data.

Sincerely,

ORIGINAL SIGNED B1

James R. Anderson,
Project Manager
Uranium Mill Tailings Project Office

Enclosure

cc w/enclosure:
D. Smith, NRC URFO
D. Dubois, JEG
J. Oldham, MK-F
J. Turi, NE-22, HQ

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W. Arthur, UMTRA
J. Anderson, UMTRA
DOE Project Engineers

We shall look forward to meeting with NRC on October 14, 1987. Please feel free to contact me if you wish to make any revision to the discussion items or have any questions regarding the enclosed data.

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COVER COST VS COVER THICKNESS

TITLE I VS TITLE II

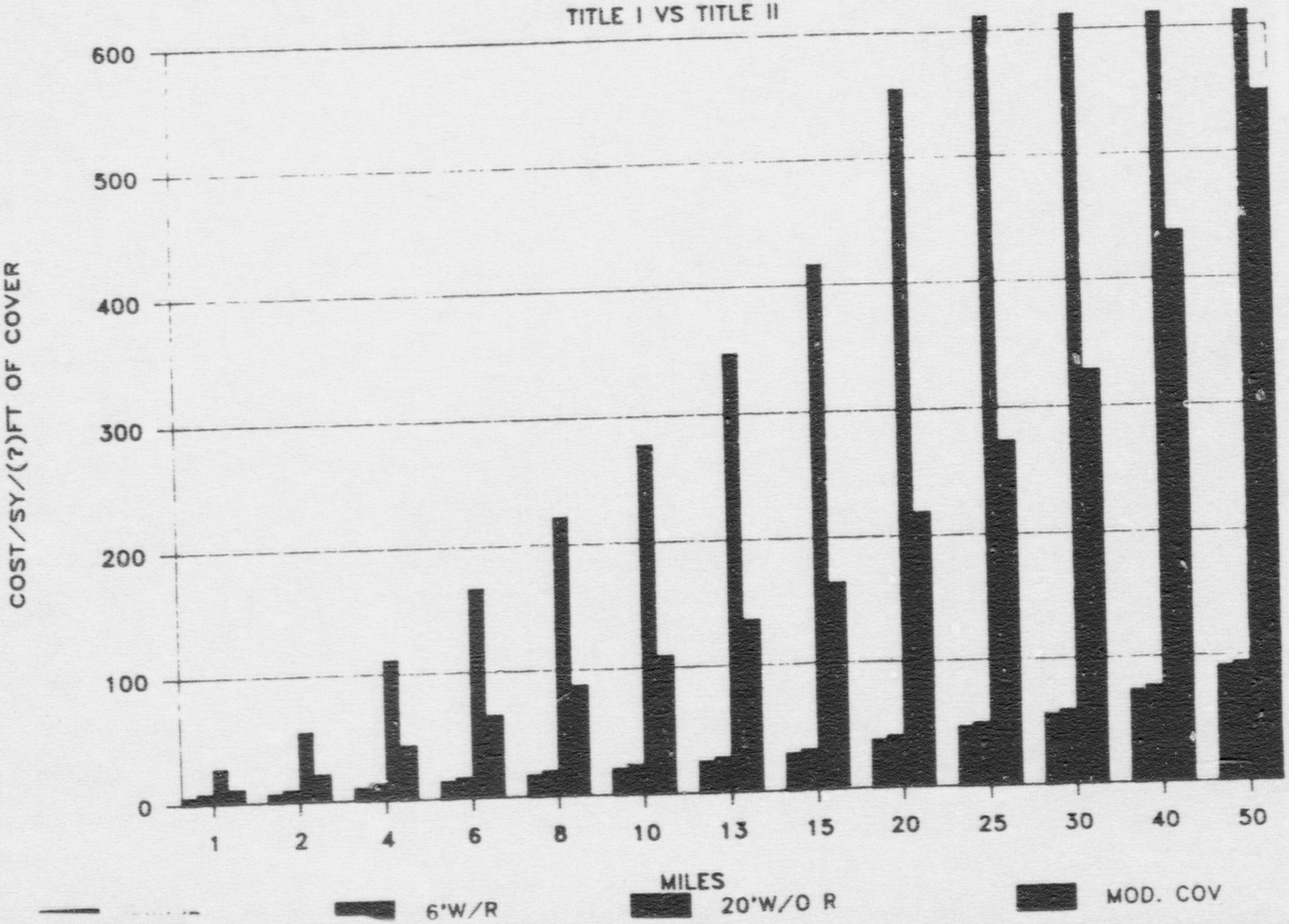

TABLE 1

PROJECT	MATERIAL COST/CY COVER	BEDDING	ROCK	RIPRAP	ROCK HAUL DIST.	COVER HAUL DIST.	RIPRAP HAUL DIST.	BEDDING HAUL DIST.	ROCK COST/CY/MI	COVER COST/CY/MI	RIPRAP COST/CY/MI	BEDDING COST/CY/MI
AMBROSIA	4.54	7.74		23.23		0.9	21.0	21.00		5.04	1.11	0.37
BEL-BOW	1.58		10.26		5.0	0.5			2.05	3.16		
FALLS CITY	2.51		9.06		3.0	2.0			3.02	1.26		
GRAND. JUCT.	3.25		11.57		2.0	0.5			5.79	6.50		
GREEN RIVER(DR)	9.15		31.31	31.31	80.0	3.5	80.0		0.39	2.61	0.39	
GUNNISON	3.97		12.28	11.38	3.6	2.0	3.6		3.41	1.99	3.16	
LOWMAN	2.57		13.10	11.60	15.0	0.5	6.0		0.87	5.14	1.93	
MAYBELL	1.55		13.88	18.59	6.0	0.5	15.0		2.31	3.10	1.24	
MONUMENT	4.73		17.80		20.0	2.4			0.89	1.97		
MEX. HAT	6.29	11.10		17.04		3.0	14.0	14.00		2.10	1.22	0.79
NATURITA(C.O.)	1.63		13.01		7.0	0.5			1.86	3.26		
RIFLE	2.69		9.26		9.0	0.5			1.03	5.38		
SLICK ROCK	9.76		7.03	7.03	1.0	9.0	1.0		7.03	1.08	7.03	
SPOOK	2.40		17.14		35.0	0.5			0.49	4.80		
TUBA CITY	5.63	6.05	21.28		25.0	2.5		1.00	0.85	2.25		6.05
RIVERTON(SIP)	7.56		10.61	16.47	1.0	13.0	27.0		10.61	0.58	0.61	
COUNT	16	3	14	8	14	16	8	3	14	16	8	3
AVERAGE	4.36	8.30	14.11	17.08	15.2	2.6	21.0	12.0	2.90	3.14	2.09	2.40
STD. DEV.	2.57	2.10	6.03	7.13	20.5	3.4	23.8	8.3	2.87	1.69	2.03	2.58

ACTUAL BID COSTS

PROJECT	MATERIAL COST/CY COVER	BEDDING	ROCK	RIPRAP	ROCK HAUL DIST.	COVER HAUL DIST.	RIPRAP HAUL DIST.	BEDDING HAUL DIST.	ROCK COST/CY/MI	COVER COST/CY/MI	RIPRAP COST/CY/MI	BEDDING COST/CY/MI
LAKEVIEW	2.00	9.00	12.00		5.0	0.5		5.0	2.40	4.00		1.80
CANNONSBURG	6.90	20.00	8.00	22.50	5.0	5.0	30.0	30.0	1.60	1.38	0.75	0.67
DURANGO	3.50	10.00	9.00	11.03	6.0	1.0	25.0	6.0	1.50	3.50	0.44	1.67
COUNT	19	6	17	10	17	19	10	6	17	19	10	6
AVERAGE	4.33	10.65	13.33	17.02	13.4	2.5	22.3	12.8	2.71	3.11	1.79	1.89

TABLE 2

PROJECT	COVER THICKNESS	AREA (ACRES)	COVER QUANT.(CY)	RIPRAP QUANT.(CY)	BEDDING QUANT.(CY)	ROCK QUANT.(CY)	TAILINGS THICKNESS	EROSION COST	COVER COST	TOTAL COST
AMBROSIA	3.5	80	450000	164700	69100		25	4360815	2043000	6403815
BEL-BOW	3.0	8	38000			25000	15	256500	60040	316540
FALLS CITY	4.0	137	887000			220000	30	1993200	2226370	4219570
GRAND. JUCT.	1.5	74	180000			236500	30	2736305	585000	3321305
GREEN RIVER(DR)	1.5	8	19000	9100		34900	20	1377640	173850	1551490
GUNNISON	3.5	37	210000	18000		71000	30	1076720	833700	1910420
LOWMAN	3.0	7	34000	17000		32000	15	616400	87380	703780
MAYBELL	5.0	81	650000	9000		150000	25	2249310	1007500	3256810
MONUMENT	2.0	11	34200			56700	15	1009260	161766	1171026
MEX. HAT	5.8	65	603000	128000	62000		30	2869320	3792870	6662190
NATURITA(C.O.)	5.0	14	111000			44000	23	572440	180930	753370
RIFLE	3.5	71	401000			230000	60	2129800	1078690	3208490
SLICK ROCK	2.0	13	42000	4300		41000	20	318459	409920	728379
SPOOK	3.0	5	23000			16000	15	274240	55200	329440
TUBA CITY	3.5	45	255000		49800	95600	20	2335658	1435650	3771308
RIVERTON(SIP)	6.0	80	770000	55000		120000	15	2179050	5821200	8000250
COUNT	16	16	16	8	3	14	16	16	16	16
AVERAGE	3.5	46	294200	50638	60300	98050	24	1647195	1247067	2894261
STD. DEV.	1.4	38	285536	57898	7970	77309	11	1121461	1542491	2352654

ACTUAL BID COST

PROJECT	COVER THICKNESS	AREA (ACRES)	COVER QUANT.(CY)	RIPRAP QUANT.(CY)	BEDDING QUANT.(CY)	ROCK QUANT.(CY)	TAILINGS THICKNESS	EROSION COST	COVER COST	TOTAL COST
LAKEVIEW	1.5	14	33400		13000	31000	10	489000	66800	555800
CANNONSBURG	3.0	12	59217	43500	16450	18800	12	1458150	408597	1866747
DURANGO	2.5	84	338400	65200	87600	32600	10	1888556	1184400	3072956
COUNT	19	19	19	10	6	17	19	19	19	19
AVERAGE	3.3	44	270432	51380	49658	85594	22	1588991	1137519	2726510

TABLE 3

PROJECT	ADDITIONAL SIDE CY	TOTAL CY 20' COVER	TOTAL COST 20' COVER	PERIMETER (FT)	TOP AREA(SF)	ADDITONAL COST 20' COVER	------- COVER PLUS 2', PLUS MIN. 20' ON SIDES ------- ADDITIONAL SIDE MATERIAL	TOTAL CY MOD. COVER	TOTAL COST MOD. COVER	ADDITIONAL COST MOD. COVER
AMBROSIA	2234260	4019014	18246322	7453	2409418	11842507	891737	1382545	6276752	-127063
BEL-BOW	460482	557867	881429	2339	131469	564889	137755	162101	256119	-60421
FALLS CITY	3483640	6686135	16782199	9788	4323368	12562629	1562382	2523130	6333057	2113487
GRAND. JUCT.	2671833	4231833	13753458	7200	2106000	10432153	1013500	1286500	4181125	859820
GREEN RIVER(DR)	592984	660045	6039415	2339	90533	4487925	179828	191564	1752811	201321
GUNNISON	1827989	2396307	9513338	5091	767229	7602918	793020	949308	3768752	1858332
LOWMAN	435572	514726	1322846	2213	106858	619066	130303	150091	385735	-318045
MAYBELL	2185749	3953083	6127278	7494	2385900	2870468	974220	1592786	2468819	-787991
MONUMENT	543840	714710	3380579	2718	230675	2209553	147222	181396	858002	-313024
MEX. HAT	2319594	3525777	22177140	6731	1628348	15514950	1167957	1635353	10286373	3624183
NATURITA(C.O.)	835573	958419	1562223	3097	165843	808853	3601[illegible]1	403147	657130	-96240
RIFLE	5711424	6348265	17076832	7035	859734	13868342	3304129	3479260	9359208	6150718
SLICK ROCK	757456	932036	9096671	3012	235683	8368292	239843	274758	2681643	1953264
SPOOK	358249	390256	936615	1820	43210	607175	107171	115173	276416	-53024
TUBA CITY	1375407	2344255	13198155	5610	1307945	9426847	494658	761091	4284944	513636
RIVERTON(SIP)	1385057	3372606	25496902	7446	2683191	17496652	552230	1347250	10185209	2184959
COUNT	16	16	16	16	16	16	16	16	16	16
AVERAGE	1698694	2600333	10349463	5087	1217213	7455201	753507	1027216	4000756	1106494
STD. DEV.	1380146	2015727	7754906	2477	1224322	5637364	785683	936475	3431605	1763906
ACTUAL BID COST										

PROJECT	ADDITIONAL SIDE CY	TOTAL CY 20' COVER	TOTAL COST 20' COVER	PERIMETER (FT)	TOP AREA(SF)	ADDITONAL COST 20' COVER	------- COVER PLUS 2', PLUS MIN. 20' ON SIDES ------- ADDITIONAL SIDE MATERIAL	TOTAL CY MOD. COVER	TOTAL COST MOD. COVER	ADDITIONAL COST MOD. COVER
LAKEVIEW	478935	792168	1584336	3101	422865	1028536	97711	152527	305054	-250746
CANNONSBURG	492910	725459	5005670	2920	313942	3138923	132218	190355	1313450	-553297
DURANGO	1163855	3517031	12309609	7647	3176787	9236653	269236	798700	2795450	-277506
COUNT	19	19	19	19	19	19	19	19	19	19
AVERAGE	1542885	2454736	9710054	5003	1231000	6983544	660804	925107	3601371	874861

TABLE 4

MILES	COST/SY/ 3' COVER FROM 1 MI. W/ROCK	COST/SY/ 1.5' ROCK PER MILE	COST/SY/ 6' COVER FROM 1 MI. W/ROCK	COST/SY/ 20' COVER W/O ROCK	COST/SY/ 10' COVER W/O ROCK	COST/SY/ MOD. COVER W/O ROCK
1	4.91	1.77	8.05	27.74	17.90	10.96
2	6.68	3.54	9.82	55.49	35.80	21.92
4	10.22	7.08	13.35	110.98	71.61	43.84
6	13.75	10.62	16.89	166.47	107.41	65.76
8	17.29	14.15	20.43	221.96	143.22	87.68
10	20.83	17.69	23.97	277.45	179.02	109.60
13	25.25	22.11	28.39	346.81	223.78	137.00
15	29.68	26.54	32.82	416.17	268.54	164.40
20	38.52	35.38	41.66	554.89	358.05	219.20
25	47.37	44.23	50.51	693.62	447.56	274.00
30	56.21	53.08	59.35	832.34	537.07	328.80
40	73.91	70.77	77.05	1109.79	716.10	438.40
50	91.60	88.46	94.74	1387.23	895.12	548.00

THE AVERAGE PERCENT INCREASE IN MATERIAL FOR A 20 FT. COVER = 783.87 %

THE AVERAGE PERCENT INCREASE IN MATERIAL FOR THE MODIFIED COVER = 249.16 %

TABLE 5

PROJECT	MATERIAL COST/CY				ROCK	COVER	RIPRAP	BEDDING	ROCK	COVER	RIPRAP	BEDDING
	COVER	BEDDING	ROCK	RIPRAP	HAUL DIST.	HAUL DIST.	HAUL DIST.	HAUL DIST.	COST/CY/MI	COST/CY/MI	COST/CY/MI	COST/CY/MI
GREEN RIVER(DR)	9.15	6.80	31.31	31.31	80.0	3.5	80.0	80.00	0.39	2.61	0.39	0.08
soil/no rock	9.15					3.5				2.61		
5:1 good rock	9.15	6.80	31.31		80.0	3.5		80.00	0.39	2.61		0.08
5:1 poor rock	9.15	6.80	13.40		5.0	3.5		5.00	[illegible]	2.61		1.36
COUNT	4	3	3	1	4	4	1	3	3	4	1	3
AVERAGE	9.15	6.80	25.34	31.31	41.3	3.5	80.0	55.00	1.15	2.61	0.39	0.51

TABLE 6

PROJECT	COVER THICKNESS	AREA (ACRES)	COVER QUANT.(CY)	RIPRAP QUANT.(CY)	BEDDING QUANT.(CY)	ROCK QUANT.(CY)	TAILINGS THICKNESS	EROSION COST	COVER COST	TOTAL COST
GREEN RIVER(DR)	1.5	8	19000	9100	6000	34900	20	1418440	173850	1592290
soil/no rock	4.0	8	238000				20	0	2177700	2177700
5:1 good rock	1.5	8	15000		5000	26000	20	848060	137250	985310
5:1 poor rock	1.5	8	15000		5000	54000	20	757600	137250	894850
COUNT	4	4	4	1	3	3	4	4	4	4
AVERAGE	2.1	8	71750	9100	5333	38300	20	756025	656513	1412538

TABLE 7

PROJECT	ADDITIONAL SIDE CY	TOTAL CY 20' COVER	TOTAL COST 20' COVER	PERIMETER (FT)	TOP AREA(SF)	ADDITONAL COST 20' COVER	------ COVER PLUS 2', PLUS MIN. 20' ON SIDES ------ ADDITIONAL SIDE MATERIAL	TOTAL CY MOD. COVER	TOTAL COST MOD. COVER	ADDITIONAL COST MOD. COVER
GREEN RIVER(DR)	532340	564933	5169136	2100	44000	3576846	161438	167141	1529342	-62948
soil/no rock				3150	70000				2177700	585410
5:1 good rock	471501	550761	5039460	1860	107000	4054150	142988	156858	1435250	449940
5:1 poor rock	486711	565970	5178629	1920	107000	4283779	147600	161470	1477454	582604
COUNT	3	3	3	4	4	3	3	3	4	4
AVERAGE	496851	560555	5129075	2258	82000	3971592	150675	161823	1654936	388751

ALTERNATIVES FOR DISPOSITION OF CONTAMINATED
BUILDINGS AND FACILITIES AT UMTRA SITES

This report is based on experience at UMTRA sites, supplemented by additional considerations and cost estimates. The experience is summarized in Table 1, and includes demolition, placement of debris near the demolition location, and placement of debris in the tailings pile. Decontamination without demolition is also considered.

The four disposition options studied are listed in Table 2, along with the technical advantages and disadvantages of each. As indicated in the table, decontamination is the most advantageous, from a technical point of view, and has the least design problems. However, it can require more extensive characterization and verification effort than the demolition alternatives.

Comparing costs for the four alternatives is difficult because the cost differences are site dependent, varying with type of construction and size of the buildings, degree of contamination, haul distances and other local details. The normal industry practice in demolition assignments has been to leave the final disposition to the Subcontractor. This has always been the most cost effective. Unless cover requirements are trivial however - such as 6 inches of clean soil for debris having a low level of contamination - it will not be practical to give the Subcontractor freedom to choose his own disposal option.

The cost advantages and disadvantages of the four alternatives considered are presented in Table 3. Decontamination may be the most cost-effective method for facilities with relatively low contamination levels, provided characterization and verification costs are not excessive. This is confirmed in Table 4, which summarizes cost experience and estimates for UMTRA sites. The estimated cost to clean a standard block wall with a single soap and wash rinse is $2.00 per square foot, where as demolition of such a wall and disposition of the contaminated debris will cost at least $28.00/s.f.* This indicates that in this case decontamination will be the cheapest alternative. For all other cases it will be necessary to compare costs on a site specific basis, though Table 4 illustrates the general trends to be expected.

*$127/c.y x 8 in. thick

TABLE 1

EXPERIENCE IN HANDLING CONTAMINATED BUILDINGS AND FACILITIES AT UMTRA SITES

SITE	Experience
1. Canonsburg	Almost all debris was placed in a pit near the demolition location, formed by required excavation of contaminated material. A few very hot pieces of concrete were placed in the pile, along with some chemically-contaminated material. One deeply buried, clean, massive concrete foundation was broken through to prevent retention of water and then buried in place.
2. Durango	All contaminated steel components and other construction elements have been cut into short lengths, to be buried in the tailings pile.
3. Tuba City	All contaminated steel and concrete components have been reduced to short lengths, to be buried in the tailings pile.

TABLE 2

TECHNICAL ADVANTAGES AND DISADVANTAGES OF ALTERNATIVE SCHEMES FOR DISPOSITION OF CONTAMINATED BUILDINGS AND FACILITIES AT UMTRA SITES

Alternative	Advantages	Disadvantages
1. Decontamination	1. All buildings and facilities can be released for unrestricted use. 2. The property values of the facilities will be increased.	1. Requires verification effort to survey all the work performed.
2. Demolition and placement of debris in the tailings pile.	1. Usually, the tailings pile design will meet the radon release requirement for the debris; no additional design effort is required.	1. Because excessive settlement may damage the radon barrier cover, the debris requires excessive handling, cutting into small segments, and more rigid placement criteria.
3. Demolition and placement of debris in a pit adjacent to the tailings pile.	1. The debris only require moderate handling in cutting to reasonable segments, and less rigid placement criteria. 2. Hauling distance is reduced, compared to that of Alternative 2.	1. Some minor additional design effort may be required.
4. Demolition and placement of debris in a pit at the demolition location.	1. The debris only require moderate handling in cutting to reasonable segments, and less rigid placement crteriia. 2. Minimum or no hauling distance.	1. Some minor additional design effort may be required.

TABLE 3

COST ADVANTAGES AND DISADVANTAGES OF ALTERNATIVE SCHEMES FOR DISPOSITION OF CONTAMINATED BUILDINGS AND FACILITIES AT UMTRA SITES

Alternative	Advantages	Disadvantages
1. Decontamination	1. No demolition costs	1. May cost more than demolition if contamination is difficult to remove. 2. May require added costs to determine what can be decontaminated.
2. Demolition and placement of debris in the tailings pile.	1. Less cost for clearing and development of excavation. 2. No cost associated with determining degree of contamination.	1. Haul distance may cause cost of transportation to exceed cost of decontamination. 2. Extra cost require for cutting to specified lengths. 3. Added cost for placement to avoid settlement.
3. Demolition and placement of debris in a pit adjacent to the tailings pile.	1. No cost associated with determining degree of contamination. 2. Cutting of debris to small size is not required.	1. Requires slightly more land area than placement in tailings pile.
4. Demolition and placement of debris in a pit at the demolition location.	1. Lowest cost demolition option. 2. Minimum handling and hauling. 3. Minimizes cutting into small pieces.	1. May impact final land use of site.

TABLE 4

COST EXPERIENCE AND ESTIMATES FOR DISPOSITION OF CONTAMINATED BUILDINGS AND STRUCTURES AT UMTRA SITES

Alternative	Cost Experience or Estimate
1. Decontamination	1. Estimate $2.00/s.f. for single soap and wash rinse of standard block wall (sufficient for low contamination only). 2. Estimate 20.00/s.f. for steam cleaning of heavily contaminated block wall (extreme case).
2. Demolition and placement of debris in the tailings pile.	*1. Estimate $7,200,000 for Rifle Site.
3. Demolition and placement of debris in a pit adjacent to the tailings pile.	*1. Estimate $6,000,000 for Rifle site.
4. Demolition and placement of debris in a pit at demolition location.	*1. Estimate $2,000,000 for Rifle site.

*Initial Program Estimates

To: J.Williams
Fm: B.Meyer NRM
Subj: Building demolition
Date: 10 9 87 (revised)

Per your request:

1. When considering building demolition and methods of debris disposal, contamination on the surfaces of structures should, in general, be treated differently than contamination mixed with soil. The reason has to do with the final, as-buried concentrations of radium 226 in the materials. Contaminated soil (or tailings) is simply buried at its original concentration. Surface-contaminated structures are buried with the included volume of non-contaminated volumetric and structural debris (the "inside" of a concrete wall, for example). The inner mass of such a structure is, in general, not contaminated. Therefore, the final concentration of radium associated with the total mass of buried structure will generally be much lower than the initial, measured surface concentration.

For example, for a six inch thick concrete wall, surface contaminated to a depth of 0.1" at 50 pCi/g, the final concentration of the buried, demolished and mixed concrete mass would be (0.1/6)*50 = 0.8 pCi/g, much less than the allowable subsurface residual limit for UMTRAP (15 pCi/g).

A simple calculation will generally determine whether debris requires burial in a tailings disposal cell. Structures with surface contamination can often be demolished and buried, without any special consideration given to UMTRAP requirements concerning residual radium. Of course, there may be other factors, not involving radium, determining the handling of building debris (including asbestos, metals, and other hazardous materials). There may be additional requirements from other state or federal agencies concerning slightly contaminated debris being buried in uncontrolled land; if so, burial within the permanently fenced area (but not within the cell) on a site may be necessary, or waiver under specific circumstances for UMTRAP sites may be possible.

If such a waiver is sought, the following considerations may apply:

a. Exposure rate. Surface contaminated building debris was buried at the Canonsburg PA mill tailings site, after an evaluation similar to the above. The material was buried onsite, with a 2 foot cover, not in the tailings impoundment cell, with its carefully designed and engineered cover. To my knowledge, final radiation exposure rate measurements on top of the buried debris were not required or taken, although, based on the argument above, there should be no significant exposure related to the buried debris. Dr. Frank Petelka will be in the CAN area during October 1987, and could easily measure this final exposure rate if requested, to verify the results.

b. Radon emanation. Based on the above example, building debris as described could be demolished and buried if surface concentrations were of the order of several hundred pCi/g, based on the dilution effect of uncontaminated concrete and other mass. Again, a large quantity of contaminated debris is buried at CAN, and radon levels at the perimeter of that site are essentially background, including the contribution of the much larger quantity of radium in the cell itself. Because the EPA allows for vicinity property material not exceeding 15 pCi/g to be left in place in the environment of the general public, it would be reasonable to bury slightly contaminated building debris in an uncontrolled area, based on the EPA standards, as long as final concentration does not exceed 15 pCi/g.

c. Potential for disturbance of the debris at a later date. Again, the EPA standards allow material at 15 pCi/g to be left in place at UMTRAP vicinity properties, based on the minimal anticipated radon and gamma radiation levels from such material. Building debris, at similar or lower average concentration, should be treated in the same way, in a cost-effective project.

There are many examples of slightly contaminated materials being allowed as buried components in uncontrolled areas. For example, landfills are allowed to take sludge wastes containing university-released radionuclides meeting the 10CFR20 maximum allowable concentration limits. Landfills are also allowed to take discarded smoke detectors, containing significant quantities and concentrations of Am241, a relatively hazardous radionuclide (smoke detectors typically contain from less than 1, to 12 uCi Am241. Several thousand smoke detectors are probably buried by now in any moderate size landfill, with a total of at least 1 mCi Am241 buried per 1000 detectors. At 1 pCi/g, 10E9 grams, or 1,000 metric tons of debris, would be required to equal this buried radioactivity.

2. In addition, smooth surfaces (painted and metal, e.g.), can often be easily stripped of radioactive contamination through the use of water or steam sprays, or relatively quick mechanical methods. This can be checked in advance, on small representative sections of the structure in question. Because the free release limits for radioactively contaminated surfaces differ greatly, depending on whether the contamination is removable or not, surface cleaning can often be the most cost-effective method of dealing with such contamination. The hazard to workers performing radioactive contamination removal for radium and thorium on UMTRAP sites is generally very low (not considering hazards other than radiological), and this option should be considered whenever it is otherwise not necessary to demolish a structure. Equipment (motors, tractors, etc.) can also generally be cleaned by pressure spray to a free release condition, as long as rough or cracked surfaces are not present to retain the radioactive tailings. Monitoring of equipment for free release is relatively easy on UMTRAP (although time consuming for large pieces of equipment with complex surfaces).