



Department of Energy

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

OCT 5 1988

Mr. Edward F. Hawkins
U.S. Nuclear Regulatory Commission
Region IV
Uranium Recovery Field Office
P.O. Box 25325
Denver, CO 80225

Dear Mr. Hawkins:

On September 30, 1988, DOE submitted additional information to your office justifying the use of Pepperling bedding material at the Lakeview UMTRA disposal cell. The DOE has concluded that every effort, considering all costs and risks associated with obtaining a higher quality material, has been made, and therefore, requests that NRC reconsider the use of Pepperling bedding material.

The DOE recommendation to utilize the Pepperling material is clearly presented in the DOE position paper or Record of Agreement, and previously submitted documents and summaries (copies enclosed), which reflect associated preliminary investigations, geological investigations, costs, risks, etc. The DOE position is that the Pepperling bedding material will provide the quality of rock necessary to fulfill the design requirements of the six-inch filter bedding layer, while meeting the intent of the standards promulgated by EPA under 40 CFR-192.

Additionally, per your request, a summary of estimated additional costs associated with each option for extraction of bedding material is as follows:

Pepperling	= \$117,000	
Choate	= \$691,000 to \$720,000	(6 x recommended cost)
Sheer	= \$635,000 to \$820,000	(7 x recommended cost)

The costs do not include any winterization costs.

Several meetings have been held with NRC to show that the Pepperling bedding material is well within the requirements of the specifications when the NUREG Guidelines (NUREG/CR-4620) maximum scoring criteria has been applied. The DOE contends that the original specification may not reasonably be met (i.e., without distance).

To obtain a "slightly" higher quality material, the Sheer Quarry has been investigated and blasted to a depth of forty feet. The upper material

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OCT 5 1988

Edward F. Hawkins

- 2 -

will only be suitable for use in supplementing the gradations for the rip rap, previously stockpiled in 1987. This material is seamed with clay and geologic investigation shows that the risk of not meeting the original specification or the proposed modified specification is great (without scoring), and associated costs and delays are not warranted.

The NRC and State of Oregon have signed a "relaxed" specification agreement (enclosed), which is appreciated, however, the specification modification is not attainable or necessary to meet the intent of the EPA standards. When the NUREG scoring criteria is applied to the Pepperling bedding, the material meets the intent of the design and EPA standards based on the original specification. The average score for the bedding was equal to 71%, which exceeds the requirement for frequently saturated areas.

Per our October 3, 1988 discussion with the State of Oregon, it was stated that Oregon's concurrence in use of the Pepperling bedding material is contingent only upon NRC concurrence. Your concurrence is requested in the use of the Pepperling bedding material with the application of the NUREG maximum scoring criteria (as currently being implemented in the design phases of other UMTRA sites, such as Tuba City and Green River). A signed formal letter of concurrence or disagreement is requested by facsimile (FTS 846-4023) by 10:00 a.m., October 6, 1988. If appropriate I will be glad to have one of our Project personnel meet with your staff to discuss. Thank you for your cooperation in this matter.

Sincerely,



W. John Arthur, III
Project Manager
Uranium Mill Tailings Project Office

Enclosure

cc w/enclosure:
S. Mann, NE-22, HQ
P. Lohaus, NRC

SUPPLEMENT TO APPENDIX B - COST ESTIMATES FOR ALTERNATIVES
REPORT FOR "EROSION PROTECTION FOR LAKEVIEW DISPOSAL SITE"

Cost production and placement of bedding from Pepperling Quarry, based on the Subcontract unit prices, would be \$117,000: 13,000 cy x \$9.00/cy = \$117,000

There are geologic indications that bedding meeting the quality limits of the specifications could be obtained from unweathered rock below the upper 40 feet in Sheer's Pit. Estimated costs for this alternative are:

Minimum cost to provide 13,000 cy of bedding	\$534,000
Minimum cost of winterization	<u>258,000</u>
Subtotal	\$792,000
Allowance for contingencies	<u>205,000</u>
Total	<u>\$997,000</u>

*not used
Conc*

Details of the estimate for providing the bedding are presented in Attachment 1. The ranges of cost shown are based on an estimate provided by the Subcontractor, with adjustments based on experience for similar construction.

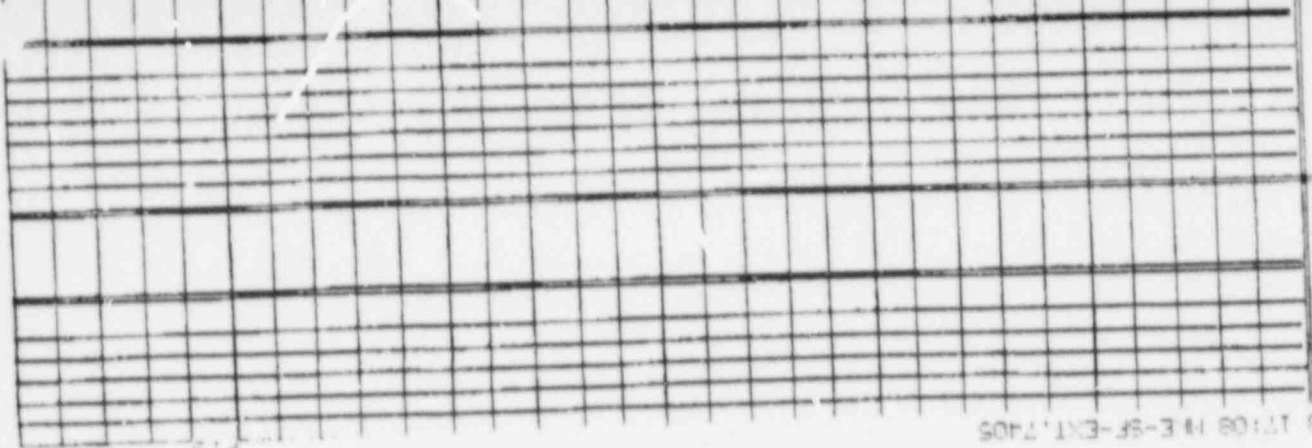
The allowance for contingencies includes the difference between upper and lower bound estimates as shown on Attachment 1. Contingency costs are primarily based on uncertainties regarding location of disposal for overburden and possible surcharge for use of access into Sheer's.

The above cost can be compared to the cost of providing bedding from Pepperling Quarry. By comparison, clearly both the minimum cost and the cost including allowance for contingencies indicate that material meeting the original specifications is not reasonably available.

ATTACHMENT:

Bedding Cost Analysis - Sheer's Quarry

4005-LKY-R-01-02820-00
6412U/0171U



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SUMMARY OF LAKEVIEW ROCK DECISIONS

The purpose of this summary is to point out specifically the Lakeview design specifications that are affected by the August 30, 1988 agreement between the U.S. NRC, U.S. DOE and Oregon. All rock placed on the disposal cell will, as a minimum, meet the durability requirements that were deemed acceptable for the stockpiled riprap sampled in May, 1987. The results of this sampling, as provided by MK-E, are provided in Table I.

The individual samples labeled "Bad", referred to rock that was of poor durability quality and is not acceptable for placement. Samples labeled "Good", and those that are unlabeled represent rock quality tests that were acceptable to all three parties. This set of analysis provides the basis for minimum durability requirements that the contractor needs to provide for the Lakeview project.

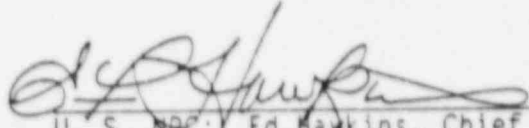
1. Specific Gravity - Remains unchanged at greater than 2.65.
2. Absorption - Test results for (Good) and intermediate samples indicate that an acceptable specification is 1.0 and less.
3. Soundness - Test results for (Good) and intermediate samples indicate that an acceptable specification is not more than 10% loss.
4. LA Abrasion - It was previously agreed that less than 25% loss after 500 cycles was acceptable.


Gradation requirements are to remain as set by the three parties in May, 1987 that takes into account oversizing requirements for riprap.

"Overthickening" is also limited by our agreement in 1987 to a maximum of 15%.

Signed By:

U. S. DOE: John Arthur, Manager


U. S. NRC: Ed Hawkins, Chief

 9/1/88
State of Oregon: Bill Dixon, Administrator

SEP 30 1988

UMTRA:PBC

GARCIA

9/ /88

UMTRA

BOSILJEVA

9/ /88

UMTRA

MATTHEWS

9/ /88

UMTRA

ARTHUR

9/ /88

Mr. Edward P. Hawkins
 Licensing Branch 1
 Uranium Recovery Field Office
 United Regulatory Commission, Region IV
 P.O. Box 2130
 Denver, CO 80225

Dear Sir,

enclosed is the final executive summary which leads to the conclusion that if the Pepparing Quarry bedding material is not utilized, Cascade's Quarry (located in Burns, Oregon) is the option to be pursued in obtaining bedding material for the Lakeview UMTRA site. It continues to be the DOE's position that the Pepparing bedding material will meet the intent of the 100 to 1000 year design criteria, and will provide the most economical and timely resolution to the successful completion of the Lakeview site.

Also enclosed, for reference, is a chronology of events which have taken place to date with regard to selection of rock and bedding for the Lakeview disposal site. This chronology also clearly displays that all efforts have been made to identify that better than Pepparing quality rock is not attainable on a reasonable and cost-effective basis.

Pursuant to our telephonic discussion yesterday, the UMTRA Project Office requests that you re-evaluate the option to utilize the Pepparing material. In comparison to the quality differential between Pepparing and the other proposed sources, and considering the associated significant cost increases, this is consistent with DOE/UMTRA and other agency policies currently being implemented on UMTRA project sites.

I request that your response or approval be verbally returned by 4:00 p.m. today in order for DOE to finalize construction plans immediately. DOE will then be given guidance by the DOE, in order to preclude any further time delays to the Lakeview UMTRA Schedule.

Sincerely,

Original Signed By

W. John Arthur, III
 Regional Manager
 Uranium Mill Tailings Project Office

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EXECUTIVE SUMMARY

1. INTRODUCTION

This report summarizes the facts leading to the recommendation to obtain riprap bedding for the Lakeview Disposal Site from Choate's Quarry near Burns, Oregon. Geologic information, test results and cost and schedule impacts are discussed for the Choate's, Sheer's and Pepperling sources, and the benefits, costs and risks associated with using each of the three proposed sources are compared.

2. BACKGROUND

The construction specifications have been found to be unachievable using local sources. Material meeting the specifications is not "reasonably available" in the context used by NRC.

The above situation was first encountered when riprap was produced from the Pepperling Quarry. (The quarry had been approved based on test results for pre-production samples.) As agreed to by NRC and the Oregon Department of Energy, the NRC requirements for cases where significantly better rock is not reasonably available were applied to the riprap; that is the riprap diameter and layer thickness requirements were increased to produce a design still meeting the 200- to 1000-year design life specified for the project, while using material from Pepperling Quarry.

Prior to production of bedding, additional samples were obtained from Pepperling quarry and subjected to specific gravity and absorption tests. The results for samples from the eastern two-thirds of the pit met specifications. Material to be crushed for bedding was taken primarily from the eastern two-thirds of Pepperling Quarry. Nevertheless the absorption values for samples of the crushed bedding failed to meet the specification requirements.

After review of new data, including the results of tests on samples recently obtained from another local source, Sheer's Pit, and information gathered in recent geologic investigations, drilling and blasting in that pit, it was re-confirmed that rock meeting the specification requirements could not be produced on a consistent basis from a local source.

As a solution to the problem of completing the isolation of the Lakeview tailings in a manner consistent with design requirements it was recommended that the bedding diameter and layer thickness requirements be increased, as needed, to utilize the material from Pepperling Quarry. This solution, which would have permitted meeting design requirement in a timely manner and at reasonable cost, was agreed to by NRC.



The Oregon Department of Energy chose to reject the solution recommended above for reasons which are not completely clear. As a result it will be necessary to obtain the required bedding from a different source. The two sources for which sufficient data are available to guide an intelligent choice are:

- 1) Sheer's Pit near Lakeview, Oregon
- 2) Choate's Quarry near Burns, Oregon

Pertinent facts concerning these sources as well as Pepperling Quarry are presented in the attached table.

3. DISCUSSION

Quarry locations, test results, rock quality scores, design adequacy, estimated costs, schedule impacts, benefits, risks and disadvantages for each of the three candidate rock sources are presented in the attached table.

The following key factors are shown:

- o Material from each source meets the design requirements for bedding for the Lakeview Disposal Site.
- o The estimated costs and schedule impact for obtaining the bedding from Sheer's and Choate's are essentially the same.
- o The risks of using Sheer's Pit include: possible need for extensive pit development and disposal of large volumes of waste, possible reduced quality of rock, and probable claims by the Subcontractor. Only the latter applies to Choate's.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the above information it is concluded:

- o The Oregon DOE does not approve of using bedding from Pepperling Quarry to complete the project.
- o Bedding to complete the project should be obtained from Choate's Quarry near Burns, Oregon.

TABLE 2
DETAILED COMPARISON OF CANDIDATE ROCK SOURCES

		Rock Source		
		Pepperling	Sheer's	Choate's
Location (Miles from Site)		2.5	10.5	137
PRE-PRODUCTION TESTS	Specific Gravity	2.76 to 2.86	2.81 to 2.90	2.77 to 2.79
	Absorption (%)	0.32 to 0.72	0.26 to 0.94	0.31 to 0.86
	Soundness (%)	1.04 to 7.83	0.6 to 8.1	
	L.A. Abras. (%)	14.88/	2.9 to 4.3b/	
PRODUCTION PERIOD TESTING (BEDDING ONLY)	Specific Gravity	2.72 to 2.78	-	-
	Absorption (%)	1.04 to 2.98	-	-
	Soundness (%)	6.70 to 17.3	-	-
	L.A. Abrasion (%)	3.5 to 3.9b/	-	-
ROCK QUALITY SCORES*	Pre-Production Tests	76 to 89	83 to 95	-
	Production Period Tests	61 to 75	-	-
	Acceptable Score	50/65**	50/65**	50/65**
Adequacy of Rock Quality for Current Bedding Design		Satisfactory	Satisfactory	Satisfactory ¹
Estimated Cost of Obtaining Required Bedding from this Source		\$117,000	\$893,000 ⁺ to \$1,300,000 ⁺	\$949,000 ⁺ to \$1,200,000 ⁺
Schedule Impacts of Obtaining Bedding from this Source		Probable Completion Date: 12/88 (No winterization required).	Probable Completion Date: 07/89 (Winterization required).	Probable Completion Date: 07/89 (Winterization required).
BENEFITS		Meet requirements in timely manner at reasonable cost.	Possibly slightly higher quality rock than Pepperling	Higher quality rock than Sheer's, with less risk of extensive pit development and reduced rock quality.
RISK AND DISADVANTAGES		None, product of known quality meeting design requirements.	Possible need for extensive pit development costs including disposal of large volumes of waste; possible reduced quality of rock; probable claims. Major cost and schedule impact.	Probable claims. Major cost and schedule impact ^x .

* See Ref. 2, Page 7 for scoring procedure details.

** See Ref. 1, Page 5 for acceptable scores (50 for occasionally saturated areas, 65 for frequently saturated areas).

+ Costs for Sheer's and Choate's include \$288,000 to \$460,000 for winterization.

a/ 500 Rev.

b/ 100 Rev.



JOB TITLE LAKEVIEW W.O. NO. _____
DESCRIPTION ROCK & BEDDING CHRONOLOGY
SHEET NO. 1
MADE BY BEL/PDL CHECKED BY _____ DATE 9/28/88

- Pre March 1986 - Auger Creek and Deadman's Canyon included as acceptable borrow sources for rock products. This was during design phase.
- June 19, 1986 - ICC provided test data including petrographic examination for Pepperling Quarry. Results met all specified requirements (See CMT Test results for sample 86-1088, Appendix E to "Rock Evaluation for Riprap at Lakeview" dated March 26, 1987)
- November 1986 - ICC began producing riprap from Pepperling material
- December 3, 1986 - MKF sent samples to STL in Medford, Oregon. Tests failed LA Abrasion ratio only. Results received in late December.
- December 29, 1986 - Results of an additional 6 test samples received. Samples failed in Absorption, Soundness and LA Abrasion ratio, with various failures from various samples.
- January 28, 1987 - Large samples taken from face of quarry by MKF. 3 samples taken, 2 failed Absorption, all failed ratio (Pepperling Quarry)
- March 13, 1987 - MKF took two type C and two type D stockpile samples. All samples failed LA Abrasion ratio only.



JOB TITLE _____ W.O. NO. _____
DESCRIPTION _____
SHEET NO. 2
MADE BY _____ CHECKED BY _____ DATE _____

- March 26, 1987 - MKE prepared the report entitled "Rock Evaluation for Riprap at Lakerview Disposal Site (PID 13-S-12). This PID proposed revisions to Soundness (5% to 10%) & Abrasion (to 10% and dropped ratio) for stockpiled Pepperling material. All other rock (to be produced) would have to meet the original specifications.
- April 1-2, 1987 - NRC, TAL, DOE, QDOE, MKF & MKE toured various quarries in the area to show that all material was relatively the same. Forest Service data was available for area quarries however testing data was incomplete.
- April 9, 1987 - MKF/MKE took additional samples from the Pepperling quarry face. Four (4) samples were taken from the best vein on the faces. All 4 samples failed the LA Abrasion ratio only.
- April 10, 1987 - MKE, based on marginal rock quality in the area, prepared a report proposing a riprap sampling & testing program for Pepperling stockpile, including PID 13-S-12.
- April 13, 87 - Sampling and testing program for Pepperling sent to USDOE by letter 87-3050-225 requesting comments by 4/27/87.
- May 11, 1987 - A meeting was held at Pepperling (MKF/MKE/TAL/NRC^{QDOE}) to discuss 4/10/87 plan. The intent was to determine if Pepperling stockpiled rock would be usable if oversizing or layer thickening was adopted.
- May 12-13, 1987 - It was agreed to sample each type of stockpiled material such that representative samples were taken. The sample for each type was quartered with 1/4 being separated into usually good and bad rock and weighed to determine percentages. Lab testing was performed on good, bad & composite. (See Appendix A to the June 1987 report "Evaluation of Sampled Riprap") Samples taken by (see Evaluation of Sails Table and Material Center)



JOB TITLE _____ W.O. NO. _____
DESCRIPTION _____
SHEET NO. 3
MADE BY _____ CHECKED BY _____ DATE _____

- June 9, 1987 - MKE issued PID 13-S-12, Rev 1 which addressed usable stockpiled material based on layer thickening. Type B & D gradations were revised. The durability requirements were further revised (This PID was never approved.)
- June 15, 1987 - The MKE report "Evaluation of Stockpiled Riprap" with PID 13-S-12, R1 was transmitted to DOE by letter 87-3050-371
- June - July 10, 1987 - ICC continued investigation of bedding sources including Pefferling, Matchett, Maxwell and #70 Ranch Pit. All samples failed at least one specification requirement.
- July 10, 1987 - PID 13-S-12, Rev. 2 was issued changing gradation limits for overizing, layer thickening was added and the 90 Absorption was decreased from Rev. 1.
- July 16, 1987 - PID 13-S-12, Rev. 2 was approved by USDOE.
- July 31, 1987 - Messman #1 and Grizzley (~14 mi. west of Collins) were sampled and tested for interceptor drain and riprap bedding. (Conversations were to the effect that perhaps better material would be found for riprap and that the approval of PID 13-S-12, Rev 2 could be rescinded) Samples from both pits failed for various reasons.
- August 5, 1987 - Messman #2 sampled and tested. Sample failed specific gravity, absorption and abrasion further exemplifying marginal quality rock in the area.
- September 18, 1987 - Samples submitted by ICC from Sheer's Pit. All durability tests pass.



JOB TITLE _____ W.O. NO. _____
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SHEET NO. 4
MADE BY _____ CHECKED BY _____ DATE _____

- Sept 87 - Mar 88 - Sheers Constr. tried to produce bedding material for ICC from Sheers Pit. Initial durabilities were acceptable. Throughout this period, weather and broken equipment continually shut down production. Sheers was never able to obtain gradation and were dismissed by ICC. MKE representative present
- March 1988 - ICC elected to re-pursue Pepperling quarry for bedding
- April 15, 1988 - ICC submitted test results for Pepperling bedding material. Results failed SG & Absorption. ICC requested specification change which was denied by letter LXV-01-098.
- April 29, 1988 - ICC drilled for blast at Pepperling. With MKE geologist, six samples were taken prior to the blast from various areas. From visual MKE suggested ICC move blast location to the east. ICC elected to blast anyway mixing the apparent good material with unsuitable. Of the six tests, four passed. Of the blasted materials samples within gradation were retested and failed. ICC geologist also present.
- May 5, 1988 - ICC sampled and tested non-graded materials. These tests failed absorption.
- May 5 - June 3, 1988 - TAC working with MKE on cover redesign due to new proposed groundwater standards.
- June 3, 1988 - PID 13-6-19 issued to breakout bedding into B-1 and B-2 due to cover redesign. Approved by USDOE on June 6, 1988.
- June 8, 1988 - In gradation B-2 material was tested. Tests failed absorption and soundness.
- June 21, 1988 - Three additional in-gradation B-2 samples were tested and failed absorption and soundness.



JOB TITLE _____ W.O. NO. _____
DESCRIPTION _____
SHEET NO. 5
MADE BY _____ CHECKED BY _____ DATE _____

- July 1, 1988 - MKF/MKE had lab manufacture B-1 into gradation as ICC had not been able to produce this material in the field. Absorption failed.
- July 21, 1988 - MKE geologist took additional samples from the stockpile of material made by Sheers Const in Sept 87-Mar 88 and from the Pit face at Sheers to justify leaving Pepperling. Four samples were taken and mixed. The lab crushed into gradation, two each B-1 and two each B-2. Bot.'s B-1's failed absorption and both B-2's passed all requirements.
- July 21, 1988 - MKE prepared a report entitled "Options and Recommendations for Resolution of Erosion Protection Issues at Lakeview Oregon," based on all areas looked at confirming marginal quality rock in the area.
- July 26, 1988 - July 21, 1988 report transmitted to USDOE by letter 88-3060-525.
- July 28, 1988 - MKF requested additional B-1 tests. Three samples were taken, put in gradation by the lab and tested. All failed absorption and soundness.
- August 11, 1988 - Telecon between JGO and J. Arthur. Three scenarios 1) Use Sheers 2) Choute in Burns, Or 3) New Matchett Pit. Speed memo from MKF to DOE addressing latent defects clause (for use of Choute)
- August 12, 1988 - ICC prepare schedule and estimates for various scenarios
- August 13, 1988 - Letter to USDOE (88-3060-585) informing DOE that MKF having ICC proceed to develop Sheers for B-1 & B-2 per DOE recommendation. Also received MKE document "Recommended Source of Material for for Excavation and Additional Riprap for Disposal Site at Lakeview, Oregon".
- August 15, 1988 - Letter from DOE to ODOE suggesting use of MKF's ICC-4620, Brook Station. Addresses use of Sheers, Or materials vs. Brook Station materials.



JOB TITLE _____ W.O. NO. _____
DESCRIPTION _____
SHEET NO. 6
MADE BY _____ CHECKED BY _____ DATE _____

- August 24, 1988 - Letter from DOE to MKF. OR feels mats at Pepperling not acceptable. Want to use Sheers. Do not want to accept scoring criteria for Pepperling
- August 24, 1988 - Evaluation of test holes drilled at Sheers. MKE geologist and ICC geologist agree that the quality of rock to be produced from Sheers may be marginal. The borings showed shear zones of weathered rock and clay strata. Recommend another source if sufficient material is to be obtained
- August 25, 1988 - MKE recommends all bedding and riprap stockpiled at Pepperling should be used to the extent possible using NUREG. Additional riprap from Sheers. This was based on cost and time of completion concerns.
- August 29, 1988 - DOE send letter to ODOE addressing problems encountered during test drilling at Sheers based on information provided by MKF/MKE. Request agreement on final decision for action by 8/30/88
- September 7, 1988 - MKF directs ICC to setup and screen bedding material from Sheers and to enhance Pepperling riprap with Sheers material.



JOB TITLE _____ W.O. NO. _____

DESCRIPTION _____

SHEET NO. 7

MADE BY _____ CHECKED BY _____ DATE _____

September 13, 1988 - MKF prepared report "Erosion Protection for LKV Disposal Site" suggesting rock scoring method

September 14, 1988 - After new blast at sheers, samples taken
B-1 in gradation (lab) - passed
B-2 in gradation (lab) - passed
4 1/2" - 0 for riprap - failed absorption

September 14, 1988 - Meeting @ NRC-URFO (NRC/DOE/TAC/MKE)
NRC requested cost data to support use of scoring system

September 19, 1988 - Letter BB-3050-671 to DOE with cost data requested by NRC

September 22, 1988 - TAC/DOE/MKE to Cheate Quarry in Burns, 130 miles from LKV to look at mats for bedding such that pile could be covered this year. Test results pending

September 23, 1988 - Meeting held in LKV w/ TAC/DOE/MKE/MKF/ODOE re: Bedding. Action to winterize, abandon Repairing, Pursue Cheate, Supplement Riprap w/ Sheers mats agreed to by all parties except ODOE who still insists on Durability requirements in specs

* Note: MKE geologist present during all sampling and testing done at all quarry work in 1988

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Journal of Child Psychology and Psychiatry 47:10 (2006), pp 1055–1064

J. C. Wright, 1/24 West 10th St., Weybridge, Surrey.

11. *Phragmites australis* (Cav.) Trin. ex Steud.

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doi:10.1111/j.1365-3113.2012.04711.x

doi:10.1017/S0022292412001617

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See Appendix Fig. 13-5 - 12, p. v

responsibly managing their A/R books.

Case	Age	Sex	Duration	Location	Outcome
1	18	M	2	USA	Recovered
2	25	F	1	USA	Recovered
3	32	M	3	USA	Recovered
4	45	F	4	USA	Recovered
5	58	M	5	USA	Recovered
6	65	F	6	USA	Recovered
7	72	M	7	USA	Recovered
8	80	F	8	USA	Recovered
9	88	M	9	USA	Recovered
10	95	F	10	USA	Recovered

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U.S. Department of Commerce, Bureau of Economic Analysis, 1997.

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And: 1990-1995-1999

and applied, however, to these studies.

 $\sigma_{\text{H}_2}^{\text{H}}$ mol/L from before, see the first

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1. The first part of the paper is devoted to the study of the asymptotic behavior of the solutions of the system (1) as $t \rightarrow \infty$.

U.S. Department of Education

1997 September 15, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678

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RECORD OF AGREEMENT

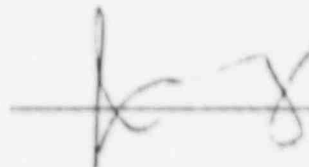
With regard to evaluation of the source of material to be utilized as filter bedding for use at the Lakeview disposal site, the technical position of the below signators is that the material available at the Pepperling Quarry is well within the intent of the Uranium Mill Tailings Radiation Control Act, PL 95-604, and the intent of EPA's standards for 200 to 1000 year design criteria. The preferred option to utilize the Pepperling material is based upon the following facts:


- 1) A thorough investigation, including evaluation of 173 known rock sources in the vicinity of Lakeview, Oregon, was performed resulting in a conclusion that the sources could not be shown to fully conform to the specification requirements. Similar to Pepperling, the Sheer Quarry material showed some test results meeting specification, while others did not.
- 2) A geologic investigation (by an MK-Engineering geologist and by a subcontractor-appointed geologist) of the area of interest, Sheer Quarry (Barry Pit), Pepperling Quarry, and Choate Quarry (Burns, Oregon) was performed in August of 1988. The geologists concurred that the material from Sheer Quarry would most likely provide slightly higher quality rock than that available at Pepperling, but would not meet the Lakeview specification. The geologists also concurred that the material at Pepperling was not considered a poor quality rock.
- 3) Exploratory Drilling took place at the sheer quarry to evaluate the extractability of the material. Exploratory data produced evidence that two blasts would be necessary to extract "sufficient" quantity. The characteristics of the material were such that the confidence of meeting the Lakeview specifications, or the proposed modification as assigned by the State of Oregon and Nuclear Regulatory Commission on September 1, and September 20, respectively, was minimal.
- 4) NRC permissible scoring criterion in accordance with NUREG/CR-4620, "Methodologies for Evaluating Long-Term Stabilization Design of Uranium Mill Tailings Impoundments", as modified in November of 1987, was applied to the Pepperling bedding material. The results ranged from 61% to 75% for seven tests, with an average score of 71%, which is above the minimum requirement for frequently saturated areas.

Signatures:

Joseph Long
Engineering and Design Manager
Morrison-Knudsen Engineers

Gerry Thiers
Technical Review Engineer
Morrison-Knudsen Engineers

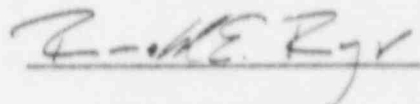
 9/20/88
Date

 9/20/88
Date


Jose Cercone
Geologist
Morrison-Knudsen Engineers


Date 9/30/88

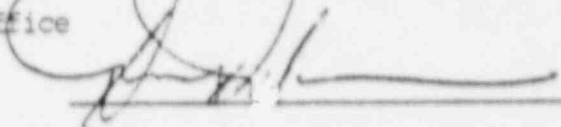
Ron Rager
Geotechnical Engineer
Jacobs Engineering Group


Date 9/29/88

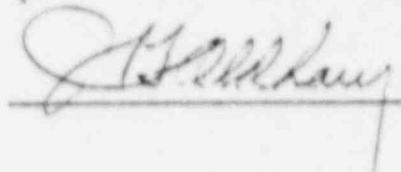
W. John Arthur, III
Project Manager
Uranium Mill Tailings Project Office


Date 9/29/88

Don Dubois
Manager, Albuquerque Operations
Jacobs Engineering Group


Date 9/29/88

Jim Oldham
Project Director
MK-Ferguson Company


Date 9/29/88