

70-3073



**KERR-McGEE CORPORATION**

KERR-McGEE CENTER • OKLAHOMA CITY, OKLAHOMA 73125

March 6, 1992

CERTIFIED MAIL  
RETURN RECEIPT REQUESTED

Mr. Fenton R. Rood  
Solid Waste Management Service  
Oklahoma State Department of Health  
1000 N.E. 10th Street  
Oklahoma City, Oklahoma 73152

Dear Mr. Rood:

Pursuant to Section IX.2 of the Consent Order entered in State of Oklahoma v. Kerr-McGee Corporation, No. C-90-91-H, Kerr-McGee Corporation hereby submits the attached written progress report for the month of February, 1992.

If you have any questions or comments, please contact me at (405) 270-2694 (OKC) or (918) 225-7753 (Cushing).

Sincerely,

Jeff Lux  
Project Manager  
Kerr-McGee Technology Division

cc:

- Bill Fisher - U.S. NRC, Arlington, Texas
- William M. Kemp - Radiation Protection Service
- David N. Fauver - U.S. NRC, Washington, D.C.
- Kerr-McGee Citizens' Oversight Committee

JL/jl

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### RADIOLOGICAL INVESTIGATION AND REMEDIATION

Decontamination of the floor, ceiling, and beams of the uranium process building is complete, with the exception of some of the seams in the floor.

Radioactive contamination has been removed from Skull Creek, except for one small area east of the railroad bridge. Excavation of this area will commence when creek flow is significantly lower.

3" detector data is being correlated with gama spectrum analysis to identify "sort points" for segregation of soil into Option 1 and Option 2 criteria. This data has been collected, and a sort point of approximately 6000 counts/min will be used as a general guide for the lower limit of Option 2 soils.

The U.S. Nuclear Regulatory Commission (NRC) is still reviewing the license application submitted on October 17, 1991. NRC will notify Kerr-McGee of deficiencies in the license application and allow time for additional material to be submitted before issuing a license.

A soil boring program designed to investigate the potential of the site for location of a disposal cell for Option 2 soils has been conducted. Only one area, on land currently owned by ERW (in receivership?) shows potential as an acceptable site. A disposal cell located elsewhere on the property would probably require additional engineering because of shallow, groundwater-bearing sands.

A health physics program is being developed for submission to the NRC. The health physics program will consist of approved health physics procedures pertaining to radiation safety, instrumentation, and operating procedures.

### NON-RADIOLOGICAL ASSESSMENT AND REMEDIATION

The pH of Skull Creek at the property line has risen to above 6 on a regular basis since water began flowing in the new creek channel. However, what appears to be iron staining occurred downstream from the site, causing a red discoloration of the creek. Stover & Associates, of Stillwater, OK, was retained to determine the cause of the discoloration. Attachment 1 is a copy of their report.

Surface water that accumulated on the waste pits was transferred to holding ponds, neutralized, and discharged two times in February. The Oklahoma Water Resources Board (OWRB) was notified each time. Appropriate laboratory analyses were performed on upstream, holding

pond, and downstream water samples. Results were submitted to the OWRB when received.

Oil entering Skull Creek between pit 5 and the railroad bridge is being contained with absorbent booms. Absorbent pads are being used to pick up the oil for storage in drums. Samples will be collected for laboratory analysis prior to disposal.

Progress on the remedial investigation (RI) and risk assessment (RA) projects continues. Data has been transferred to Burns & McDonnell (B&McD). Aquifer tests on wells completed in the Vanoss shale and unconsolidated unconfined deposits will be run by B&McD. The RI and RA reports are scheduled to be submitted to the OSDH by May 29, 1992.

Evaluation of applicable technologies for waste pit remediation continues. This information will be used to prepare a feasibility study (FS) report. Attachment 2 is a list of the technologies that will be addressed in the Feasibility Study.

A french drain is being installed in the old Skull Creek channel to convey acid seepage from pit 5 to the holding pond for neutralization. Before pumping and treatment can begin, a NPDES permit modification must be submitted to the OWRB.

#### ACTIVITIES PLANNED FOR MARCH, 1992

1. The french drain will be completed.
2. Sort Skull Creek soil stockpiles. Segregate Option 3 material for shipment.
3. Complete excavation of contaminated soil east of railroad bridge when water levels permit. Option 2 material will be stockpiled with other Option 2 creek sediment. Option 3 material will be drummed for shipment to Barnwell, South Carolina.
4. Begin release survey of uranium process building.
5. Perform aquifer tests on wells installed in the Vanoss shale and in the unconfined unconsolidated "aquifer".
6. Continue to search for a site acceptable for burial of Option 2 materials.

*ATTACHMENT 1  
STOVER & ASSOCIATES, INC.  
SURFACE WATER QUALITY EVALUATION REPORT*

# Stover & Associates, Inc.

Environmental Consulting  
Operations Management

1800 West Memorial Road  
Oklahoma City, Oklahoma 73134  
Phone: 405/749-8494  
Fax: 405/749-8497

P.O. Box 527  
Hackettstown, New Jersey 07840  
Phone: 908/813-2371

February 19, 1992

Mr. Jeff Lux  
Kerr-McGee Corporation  
P.O. Box 89  
Cushing, Oklahoma 74023

RE: Cushing Site Surface Water Quality Evaluation

Dear Mr. Lux:

On February 7, 1992, Marty Matlock and I visited the Kerr-McGee Cushing site to perform a site reconnaissance and collect surface water and sediment (soil) formation samples. The purpose of this visit and extensive sampling program was to define the water chemistry at the site relative to potential leaching of minerals from the various subsurface formations at the site and associated chemical precipitation reactions occurring in Skull Creek. The test results, conclusions, and recommendations from this study are presented in this letter report.

A simple schematic of the site with respective sampling locations is presented in the attached Figure 1. The sampling points are represented by numbers enclosed with a circle. The respective sample points are further described by location and sample type in the attached sampling log (Table 1). The test results from the analytical testing program are then presented in the attached Table 2. As you can see in Table 2, an extensive amount of analytical testing was required to define the source of the chemical precipitation reactions.

As observed in Table 2, the sediment formation (Samples No. 5A, 5B, and 5C) are high in natural minerals (especially aluminum (Al), iron (Fe), magnesium (Mg), manganese (Mn), calcium (Ca), potassium (K), and sulfate (SO<sub>4</sub>)). The new channel of Skull Creek exposed these formations and allowed the various formations to be sampled. The pH of the water in Skull Creek and the redox potential are such that these metals are not leached from the formation. However, the pH and redox potential of the leachate from the acid pits are such that these metals are very readily solubilized. Therefore, the acid pit leachate is very high in Al, Fe, Mg, Mn, Ca, and K. When the low pH water from the old stream bed (acid sludge pit leachate) combines with the higher pH water in the new stream bed, the combined pH and redox potential are such that these metals readily precipitate out of solution.

The primary precipitates appear to be Al hydroxides followed by Fe hydroxides and oxides, Mn hydroxides and oxides, and Mg oxides. The reaction chemistry and kinetics are such that the Al and Mg precipitate immediately, while the Fe precipitates much more slowly. Thus, significant Fe precipitate is not observed until well downstream of the mixing zone.

There was also observed significant bacterial activity, especially in the Fe precipitates. These appear to be Fe bacteria which can tolerate very low pH (3.0 to 3.5) and oxidize ferrous Fe to ferric Fe which also aids in precipitating the Fe out of solution. These Fe bacteria then become heavily encrusted with ferric oxide. Even though the bacteria contribute to the Fe precipitation, they are not the real problem. The real source of the problem is the heavy metals leached out of the natural formations from the acid sludge pit seepage.

The best solution to the present precipitation of heavy metals in Skull Creek would therefore be to remove the source of the acid sludge pit leachate into the old stream bed. Your approach of putting a French Drain into the old stream bed, collecting the leachate and treating it should resolve this problem. As you will note in Table 2, the heavy metals in the new Skull Creek stream bed (Sample No. 2) and the Tributary Creek (Sample No. 3) are very low and do not appear to be contributing to the problem. There did appear to be a significant amount of Fe precipitate in the stream bed of the Tributary Creek (Sample No. 3). However, the water sample at the time of sampling only had 0.57 ppm of Fe. The excessive Fe precipitation in this stream appeared to be enhanced by Fe bacteria. Either the Fe had already been precipitated out by the time the flow reached Skull Creek or there was very little Fe getting into the water at the time of sampling.

I would highly recommend that after you install the French Drain and collect and treat the Acid Sludge Pit leachate, that an additional round of water quality sampling be performed to confirm that these measures have solved the problem. I estimate that this effort would cost between \$3,500 to \$4,000.

If you have any questions, please contact me at (405) 624-0018.

Sincerely,

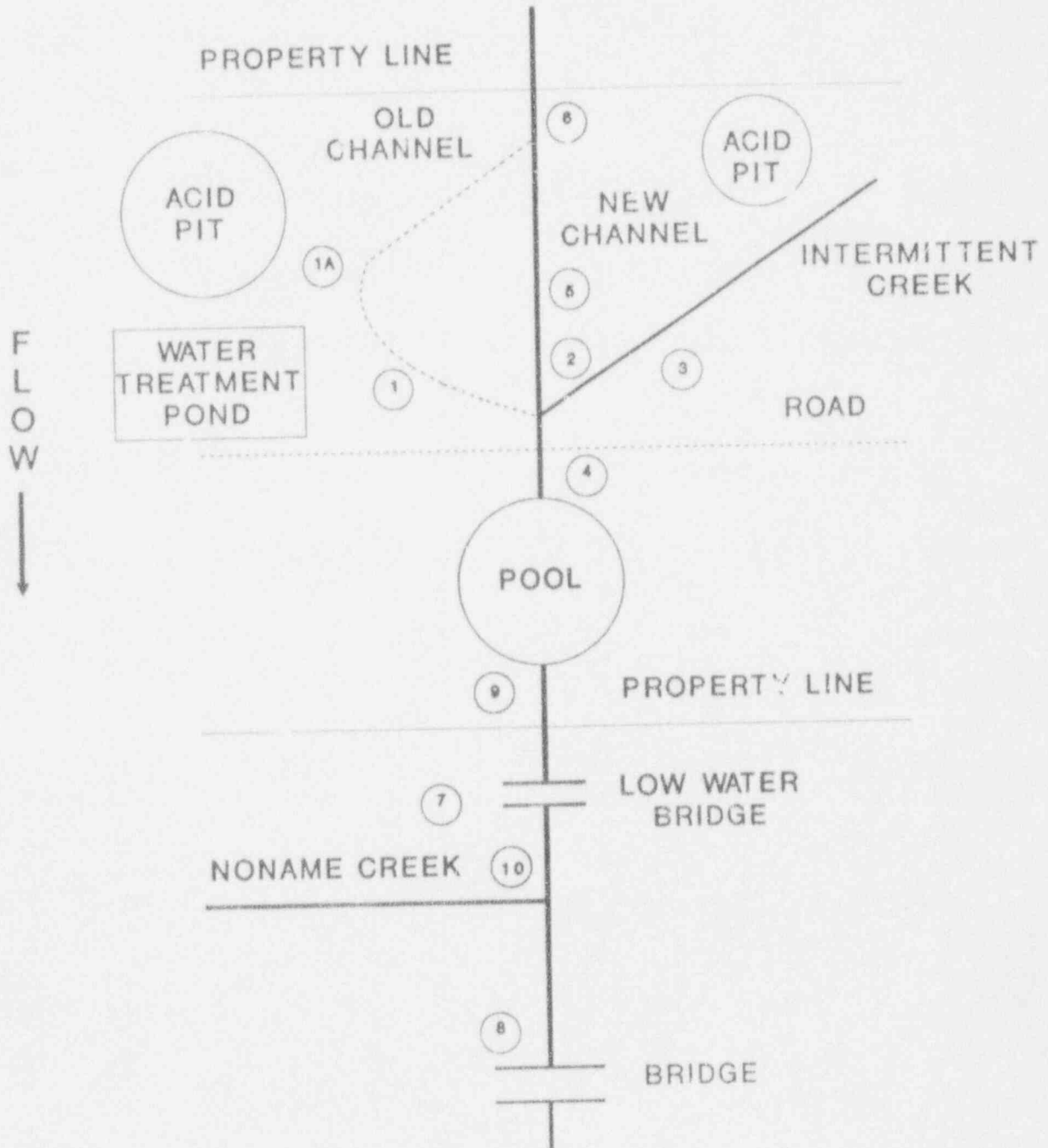


Enos L. Stover, Ph.D., P.E.  
President

ELS:mb



FIGURE 1  
 KERR-McGEE  
 CUSHING, OKLAHOMA  
 SAMPLING POINTS  
 SKULL CREEK



NOTE: MAP IS NOT TO SCALE.

TABLE 1  
KERR MCGEE  
CUSHING, OKLAHOMA  
SAMPLING LOCATIONS

SAMPLE NO.	SAMPLE DESCRIPTION	SAMPLE TYPE
#6	Skull Creek, upstream at property line	Water
#5A	Brown shale mixed with opaque crystals, top layer in new Skull Creek channel	Sediment
#5B	Gray shale beneath #5A	Sediment
#5C	Red clay, below shale layer #5B	Sediment
#2	New channel of Skull Creek	Water
#1	Old channel of Skull Creek	Water
#1A	Scum, near pipeline	Sediment
#3	Intermittent stream, run off from small acid pit	Water
#3A	Red sediment from #3	Sediment
#4	Skull Creek, down stream from acid pits, mixing area for #1, #2, #3	Water
#4A	Precipitate of mixing area	Slurry
#9	Skull Creek, down stream of property line	Water
#7	Skull Creek, at low water bridge	Water
#7A	Red precipitate from #7	Sediment
#10	Noname Creek, above convergence with Skull Creek	Water
#8	Skull Creek, below convergence with Noname creek, at bridge	Water

Note: All results reported in parts per million (ppm) which is approximately equivalent to mg/l for water sample and mg/kg for sediment samples.



TABLE 2  
KERR-McGEE  
CUSHING, OKLAHOMA

Parameter	SAMPLE LOCATION																
	SC Up Stream (#5)	Brown Shale (#5A)	Crystal only (#5A)	Gay Shale (#5B)	Red City (#5C)	SC N Channel (#2)	SC O Channel (#1)	Scum Pipeline (#1A)	Tributary Creek (#3)	Red Sediment (#3A)	Using Area (#4)	Ppt At Area (#4A)	Property Line (#6)	Lowwater Bridge (#7)	Red Ppt (#7A)	Noname Creek (#10)	SC DIS (#8)
pH, s.u.	7.6					8.2	3.4		7		6.2		6.3		7.3	7.6	
Radio Potential, Volts	0.107					0.065	0.334		0.040		0.040		0.015		0.188	0.212	
CO <sub>2</sub> , ppm	85					100	820		100		130		130		130	130	
BOG, ppm	<5.0					<5.0	<5.0		<5.0		<5.0		<5.0		<5.0	<5.0	
Total Solids, ppm	900					1020	18000		1530		1720		1810		1300	1300	
Total Dissolved Solids, ppm	900					1010	15700		1300		1560		1670		1300	1465	
Total Suspended Solids, ppm	2					16	332		4		162		36		1	5	
Visible Suspended Solids, ppm	1					10	56		4		48		12		1	3	
Total Kjeldahl Nitrogen, ppm	1.4					1.4	9.8		<1.0		1.4		1.4		1.4	1.4	
Ammonia Nitrogen, ppm	0.6					0.3	**		0.8		0.8		1.1		0.8	0.8	
Nitrate Nitrogen, ppm	0.800					0.040	**		0.040		0.085		<0.001		<0.001	0.070	
Total Phosphorus, ppm	252					278	311		278		280		280		530	530	
Chloride, ppm	180					80	4360		480		384		440		110	284	
Sulfate, ppm	<0.2					278	**		200		25		<0.2		198	215	
Total Alkalinity, m/eqCaCO <sub>3</sub>	0					0	0		0		0		0		0	0	
p. Alkalinity, mgCaCO <sub>3</sub>	0					0	0		0		0		0		0	0	
Hydroxide Alkalinity, mgCaCO <sub>3</sub>	0					0	0		0		0		0		0	0	
Carbonate Alkalinity, mgCaCO <sub>3</sub>	278					278	**		200		25		55		186	215	
Bicarbonate Alkalinity, mgCaCO <sub>3</sub>	1574					1700	9590		2150		2150		2190		2500	2540	
Conductivity, microhm/cm	432					408	2508		805		612		625		481	515	
Total Hardness, mgCaCO <sub>3</sub>	228					238	3465		420		282		282		238	270	
Calcium Hardness, mgCaCO <sub>3</sub>	228					218	2011		384		319		330		224	245	
Magnesium Hardness, mgCaCO <sub>3</sub>																	
METALS																	
T. Aluminum, ppm	0.3	5380	1940	7300	5500	0.3	505	124	0.3	6474	34.8	2170	3.2	0.5	172	0.3	0.3
S. Aluminum, ppm	0.2					0.2	532		0.2		0.4		0.5		0.2	0.2	0.2
T. Barium, ppm	<0.1	<0.1	0.1	0.1	0.1	<0.1	<0.1	1.2	<0.1	0.3	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
S. Barium, ppm	<0.1					<0.1	<0.1		<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1
T. Calcium, ppm	91.2	72500	58900	27370	3854	85	235	340	174	2808	117	0.82	124	123	121	97.5	114
S. Calcium, ppm	90.5					85	234		198		117		117		94.5	108	
T. Iron, ppm	0.26	31400.00	4820.00	43800.00	12900.00	0.26	850.00	1110.00	0.57	10700.00	53.00	848.00	36.00	37.00	245.00	0.41	0.15
S. Iron, ppm	0.17					0.17	848.00		0.15		50.50		9.50	15.00	0.19	0.15	0.15
T. Magnesium, ppm	26.5	2050	338	6700	4670	56	460	121	83.5	1290	81	81	81.8	79.3	79.5	80	59.5
S. Magnesium, ppm	54.8					53	468		83.3		77.5		80.8	77.5	54.4	59.5	
T. Manganese, ppm	0.28	208.00	258.00	487.00	140.00	0.14	20.00	28.00	5.05	204.00	6.15	7.30	5.85	10.50	6.20	0.05	1.90
S. Manganese, ppm	0.22					0.07	19.50		4.75		8.05		5.80		0.05	1.87	
T. Potassium, ppm	5.08	295.00	834.00	1550.00	1025.00	5.83	110.00	17.30	8.08	852.00	11.75	11.20	10.00	11.80	10.80	8.26	8.70
S. Potassium, ppm	4.70					4.91	108.00		8.09		11.20		9.70		5.41	7.62	
T. Sodium, ppm	130	280	140	290	328	143	304	130	130	730	154	158	167	150	189	289	218
S. Sodium, ppm	130					138	300		130		153		178		289	214	

\* Could not determine because of interferences.  
 \*\* Insufficient sample.  
 # Acidity - initial pH < 4.5

*ATTACHMENT 2*  
*KERR-McGEE TREATABILITY STUDY*  
*CUSHING WASTE TREATMENT OPTIONS*

No Action- "No Action" is clearly not an acceptable solution for waste pit remediation. It is simply one of the options stipulated for consideration by the EPA in feasibility studies. It does not reduce toxicity or mobility, is not permanent, and has no public acceptance.

Institutional Controls- "Institutional Controls" is another name for "fence it off and keep people out". It is essentially as unacceptable as "No Action" for all the same reasons.

Containment- Containment is the process of surrounding waste with a material that prevents it from migrating. It does nothing to reduce the toxicity of the waste, but limits its mobility. The two primary methods of containment are:

Sheet Piles & Cover- Surrounding the waste material with sheet piles and covering the waste with a cap. Acids in the waste would corrode the sheet piling, resulting in a less-than-permanent solution.

Slurry Wall & Cover- A trench could be dug around the waste materials. The trench would then be backfilled with some impermeable material (bentonite grout, cement, concrete, etc.) A cover would then be placed over the waste. The acidity of the waste at Cushing would probably attack most backfill materials, destroying the effectiveness of the containment.

In-Situ Treatment- In-Situ Treatment includes methods of reducing the toxicity or mobility of the waste without removing it from the pits. Methods that will be evaluated include:

Hydrocarbon Extraction- Thermally or chemically removing a major portion of the hydrocarbon from the sludge, reducing the volume of waste material without removing it from the pit.

Neutralization- Neutralization agents could be injected or mixed into the sludge, raising the pH to where it is no longer hazardous. Kerr-McGee is evaluating methods for neutralizing the waste prior to removing it from the waste pits.

Neutralization & Stabilization- It may be necessary to add stabilizing agents to the waste, even after neutralization, to make it acceptable for landfilling or beneficial use. Kerr-McGee is evaluating methods for stabilizing the wastes.

Excavation, Treatment, Onsite Burial in Pits- Kerr-McGee is evaluating the possibility of excavating the acid wastes, treating them to reduce toxicity and mobility, and replacing them in the same pits they currently occupy.

Neutralization Only- It is possible that, using certain materials to neutralize the sludge, a stable product will be formed that is landfill-able without further treatment.

Neutralization and Stabilization- Using some neutralization agents, Kerr-McGee would definitely have to add other stabilizing materials to develop a product suitable for landfilling.

Neutralization, Biodegradation, Disposal- Kerr-McGee is evaluating the possibility of biologically reducing the amount of hydrocarbon in the sludge prior to landfilling. This would result in the burial of a material that is less hazardous than the asphalt placed on the roads going into the landfill.

Excavation, Treatment, Burial in Disposal Cell- Kerr-McGee is considering the possibility of excavating the sludge, treating it, and then burying the treated sludge both either in an on site disposal cell or in an off site permitted disposal cell.

On Site- Self-explanatory.

Off Site- Self-explanatory.

Excavation, Hydrocarbon Extraction, Landfill Residue- Kerr-McGee is also evaluating the possibility of excavating the sludge, removing the hydrocarbon through one of three processes, and then landfilling the neutralized residue.

Thermal Treatment- Removing only those hydrocarbons which would volatilize at "low" temperatures. As with the biodegradation option, this would result in disposal of only neutralized, very heavy hydrocarbons and clays.

Solvent Extraction- Essentially all the hydrocarbons could be removed through solvent extraction. Kerr-McGee is evaluating what the residue would be like, and what could be done with it after removing the hydrocarbon.

Supercritical Extraction- This is a highly technical, very thorough ( and expensive) method of hydrocarbon extraction.

Excavation, Treatment, Beneficial Use- Three possible uses for the sludge are being evaluated. Beneficial uses are appealing because they get rid of the waste and they convert a nuisance material to a product that does somebody some good.

Industrial Fuel- Cement kilns could lessen their fuel cost, but their intake would be low. A coal-fired power plant could use all the sludge in short order, but may not want the sulfur.

Coal Binder- The hydrocarbon in the material may make it acceptable as a coal binder for use in coal-fired power plants.

Road Construction- The material may be useful as a binder in road or roadbed construction.

#### Excavation, Treatment, Destruction

Bioremediation- Kerr-McGee is evaluating the potential for excavation and neutralization, followed by biodegradation of the sludges.

Incineration- Incineration would definitely destroy the hydrocarbon, but finding a place to take the waste and determining what the characteristics of the ash still needs to be done. Costs are very high.