

APPENDIX E
SOIL REMEDIATION CALCULATIONS
AND BACKUP DOCUMENTATION

SOIL CONTAMINATION VOLUMES - REMEDIATION TO 29B WITH NO EXCEPTIONS
HENNING MANAGEMENT, LLC V CHEVRON USA, INC., ET AL; 31st JDC; DIV "C", DOCKET NO. 73318
HAYES FIELD, CALCASIEU AND JEFFERSON DAVIS PARISH, LA
PREPARED FOR MUDD, BRUCHAUS, & KEATING, LLC

SOIL EXCAVATION VOLUMES

Depth Interval (ft bgs)	Impacted Thickness (ft)	Surface Area of Soil Contamination (m ²)	Surface Area of Soil Contamination (ft ²)	Volume of Soil Contamination (ft ³)	Volume of Soil Contamination (BCY)
18-20'	2	848	9,128	18,256	676
6-8'	2	327	3,520	7,040	261
10-12'	2	860	9,257	18,514	686
6-20'	14	847	9,117	127,638	4,727
8-10'	2	746	8,030	16,060	595
4-32'	28	675	7,266	203,438	7,535
8-14'	6	576	6,200	37,200	1,378

15,857

CLEAN OVERBURDEN VOLUMES

Thickness of Overburden (ft)	Surface Area of Overburden (ft ²)	Volume of Overburden (ft ³)	Volume of Overburden (BCY)
12	9,128	109,536	4,057
6	3,520	21,120	782
4	7,266	29,064	1,076

5,916

SOIL AMENDMENT VOLUMES

Impacted Thickness (ft)	Surface Area of Soil Contamination (m ²)	Surface Area of Soil Contamination (ft ²)	Surface Area of Soil Contamination (acres)	Volume of Soil Contamination (ft ³)	Volume of Soil Contamination (BCY)	Gals of Amendment
6	860	9,257	0.21	55,542	2,057	14
5	847	9,117	0.21	45,585	1,688	11
6	746	8,030	0.18	48,179	1,784	12
2	576	6,200	0.14	12,400	459	3
2	848	9,128	0.21	18,256	676	5
6	266	2,863	0.07	17,179	636	4

44,595

1.02

197,141

7,302

49

CLEAN OVERBURDEN - AMENDMENT

Thickness (ft)	Surface Area of Overburden (ft ²)	Volume of Overburden (ft ³)	Volume of Overburden (BCY)
4	9,257	37,028	1,371
1	9,117	9,117	338
2	8,030	16,060	595
6	6,200	37,200	1,378
4	9,128	36,512	1,352

135,917

5,034

COST ESTIMATE FOR REMEDIATION OF SOIL CONTAMINATION TO 29B WITH NO EXCEPTIONS
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RS Means Reference Number	Quantity	Unit	Description	Unit Cost	Total
			<i>Excavation, Disposal, Backfilling</i>		
31 23 16.42 0300	21,773	yd ³	Excavation (equip & labor)	\$1.77	\$38,507
	20,773	yd ³	Transportation	\$33.00	\$685,508
	27,005	tons	Disposal	\$40.00	\$1,080,194
31 23 23.20 4112 31 23 23.15 6070	15,857	yd ³	Offsite backfill material and transportation	\$18.80	\$298,136
31 23 23.15 6070	21,773	yd ³	Backfilling of excavation	\$2.75	\$59,793
			<i>Chemical Amendment</i>		
31 23 16.42 0300	12,335	yd ³	Excavation (equipment & labor)	\$1.77	\$21,816
	49	gal	Liq. Chemical Amendment (material and transportation)	\$11.10	\$547
32 92 19.14 0100	197	MSF	Amendment application	\$10.99	\$2,166
31 29 13.26 6100	197	MSF	Soil Mixing	\$2.86	\$563
31 23 23.15 6070	12,335	yd ³	Backfilling of excavation (equipment & labor)	\$2.75	\$33,876
			<i>Confirmatory Sampling</i>		
	100	sample	Personnel and equipment	\$126	\$12,600
	100	sample	Laboratory analysis (includes 20% markup)	\$300	\$30,000
			<i>Project Management</i>		
	34,108	yd ³	Excavation oversight (geologist/engineer)	\$0.44	\$14,922
	34,108	yd ³	Backfilling oversight (geologist/engineer)	\$0.76	\$26,083

Project Total: **\$2,304,710**

Notes

Heavy Construction Costs With RSMeans Data, 31st Edition, 2017

RS Means Location Factor for Lake Charles = 84.5

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SOIL EXCAVATION VOLUMES

Depth Interval (ft bgs)	Impacted Thickness (ft)	Surface Area of Soil Contamination (m ²)	Surface Area of Soil Contamination (ft ²)	Volume of Soil Contamination (ft ³)	Volume of Soil Contamination (BCY)
6-8'	2	327	3,520	7,040	261
10-12'	2	860	9,257	18,514	686
6-12'	4	847	9,117	36,468	1,351
8-10'	2	746	8,030	16,060	595
4-18'	14	675	7,266	101,719	3,767
8-12'	4	576	6,200	24,800	919

7,578

CLEAN OVERBURDEN VOLUMES

Thickness of Overburden (ft)	Surface Area of Overburden (ft ²)	Volume of Overburden (ft ³)	Volume of Overburden (BCY)
6	3,520	21,120	782
4	7,266	29,064	1,076

1,859

SOIL AMENDMENT VOLUMES

Impacted Thickness (ft)	Surface Area of Soil Contamination (m ²)	Surface Area of Soil Contamination (ft ²)	Surface Area of Soil Contamination (acres)	Volume of Soil Contamination (ft ³)	Volume of Soil Contamination (BCY)	Gals of Amendment
6	860	9,257	0.21	55,542	2,057	14
5	847	9,117	0.21	45,585	1,688	11
6	746	8,030	0.18	48,179	1,784	12
2	576	6,200	0.14	12,400	459	3
2	848	9,128	0.21	18,256	676	5

41,732 0.96 179,962 6,665 45

CLEAN OVERBURDEN - AMENDMENT

Thickness (ft)	Surface Area of Overburden (ft ²)	Volume of Overburden (ft ³)	Volume of Overburden (BCY)
4	9,257	37,028	1,371
1	9,117	9,117	338
2	8,030	16,060	595
6	6,200	37,200	1,378
4	9,128	36,512	1,352

135,917 5,034

COST ESTIMATE FOR REMEDIATION OF SOIL CONTAMINATION TO 29B WITH EXCEPTIONS
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RS Means Reference Number	Quantity	Unit	Description	Unit Cost	Total
			<i>Excavation, Disposal, Backfilling</i>		
31 23 16.42 0300	9,436	yd ³	Excavation (equip & labor)	\$1.77	\$16,689
	9,927	yd ³	Transportation	\$33.00	\$327,588
	12,905	tons	Disposal	\$40.00	\$516,199
31 23 23.20 4112 31 23 23.15 6070	2,734	yd ³	Offsite backfill material and transportation	\$18.80	\$51,402
31 23 23.15 6070	4,593	yd ³	Backfilling of excavation	\$2.75	\$12,613
			<i>Chemical Amendment</i>		
31 23 16.42 0300	11,699	yd ³	Excavation (equipment & labor)	\$1.77	\$20,691
	45	gal	Liq. Chemical Amendment (material and transportation)	\$11.10	\$499
32 92 19.14 0100	180	MSF	Amendment application	\$10.99	\$1,977
31 29 13.26 6100	180	MSF	Soil Mixing	\$2.86	\$514
31 23 23.15 6070	11,699	yd ³	Backfilling of excavation (equipment & labor)	\$2.75	\$32,129
			<i>Confirmatory Sampling</i>		
	75	sample	Personnel and equipment	\$126	\$9,450
	75	sample	Laboratory analysis (includes 20% markup)	\$300	\$22,500
			<i>Project Management</i>		
	21,136	yd ³	Excavation oversight (geologist/engineer)	\$0.44	\$9,247
	16,292	yd ³	Backfilling oversight (geologist/engineer)	\$0.76	\$12,458

Project Total: **\$1,033,956**

Notes

Heavy Construction Costs With RSMeans Data, 31st Edition, 2017

RS Means Location Factor for Lake Charles = 84.5



WASTE MANAGEMENT
7170 John Brannon Road
Sulphur LA 70665
(337) 583-3772

August 1, 2017

Icon
Wayne Prejean, P.E.
Sr. Engineer
Ph. 225-344-8490

RE: REQUEST FOR DISPOSAL QUOTE

Dear Sirs:

Waste Management is pleased to provide you with the disposal of approximately 300,000 barrels of material considered Non Hazardous Oil Field Waste (NOW) from oil field exploration and production, E&P Waste, from the oil field production pits located in Cameron Parish, LA. Based upon the information you provided, the following summarizes our quotation.

The Chemical Waste Management facility can accept the following waste E and P codes:
02 Oil Base Mud - 03 Waste Base Mud-05 Production Pit Sludges-06 Production Tank Sludges-07 Production Sands/Solids -12 Gas Plant Waste (solids only)-13 BS&W Wastes-15 Commercial Facility Waste-16 Oil Spill Waste 99 Other (as Specified by DNR)

The UIC 23 form must be sent to the State of Louisiana prior to waste approval and shipment. All E and P wastes must be shipped on UIC 28 form available from State of Louisiana. Waste Management will be glad to assist you in completion of the needed forms.

Disposal Facility:

Chemical Waste Management – Subtitle C Landfill

Disposal Cost:

\$40.00/Ton – Bulk Solid for Landfill (Disposal Fuel/Environmental Fees – included)
10 Ton Minimum Per Load

\$225.00/Ton – Bulk Sludge <50% liquids (Disposal Fuel/Environmental Fees – included)
10 Ton Minimum Per Load

Transportation:

\$495.00/Trip for 50 yard end dump capable of hauling 22 tons per load–Cameron Parish to CWM-Lake Charles

\$ 60.00/Liner

Due to the nature of the on-going project in the area, the availability of the larger end dump trailers is limited to 3 trucks up to 5 trucks per day

Transportation Fuel Surcharge – Varies based on National average price of Diesel fuel reported weekly by the Energy Information Administration of the U.S. Department of Energy.

Currently at 19% of the transportation price.

- If CWM arrives at the customer's facility for a scheduled pickup and is not able to load, a charge equal to the trip rate will be assessed and another schedule date will need to be arranged.
- Non-conforming loads being rejected at the disposal facility will be charged a fee, equal to the trip rate, for returning the load.
- If Generator sub-contracts transportation, transporters must comply with all CWM site rules including proper PPE.

Demurrage:

\$95.00/Hour after 1st hour

- CWM hauled loads held at the disposal facility due to customer manifest discrepancies and/or non-conforming loads are subject to demurrage charges at the rate above.
- CWM assumes no responsibility for demurrage incurred for unloading as a result of generator errors in manifesting, or other required documentation. Minor discrepancies that are easily resolved will not be cause for non-payment of demurrage.

Note: The pricing above assumes the following conditions:

All pricing is contingent upon the review of the Generator's Waste Profile Sheet and sample analysis (if required). An authorized signatory of the generator must complete the Waste Profile and all supporting documents. The profile may be completed on our website www.WMSolutions.com.

This quote is valid for a period of 60 days from the date hereof. This is only an offer, and shall not be deemed an acceptance of the waste. If we have not entered into a written agreement, or received written documentation from you or your company of award of this quote, within such 60 day period, the prices quoted shall automatically become null and void.

Should you have any questions, please contact me at 337-515-2855 or Allison at the Technical Service Center at 205-652-8150. Thank you again for allowing Waste Management this opportunity and we look forward to working with you.

Larry Cuppy
Senior Account Manager



LIQUID GYPSUM

Liquid Gypsum is a liquid formulation of calcium chloride, surfactants, penetrants, humectants, and a water soluble polymeric material.

Important: Water soluble polymer is not the same product as the superabsorbant polymer gels which swell up when in the presence of water. Water soluble polymer does not swell in the presence of water; it is dissolved in the water and is left behind attached to soil particles when the water evaporates.

Benefits of Liquid Gypsum

1. *Liquid Gypsum* reacts with clay in soil with synergistic effects from organic matter in soil to give stable soil particles which do not form a crust on the surface after an irrigation. Water then runs into the soil (infiltration) instead of running off into streets and gutters. A larger percentage of rain water will penetrate the soil surface when it is treated with *Liquid Gypsum*.
2. Roots grow deeper into soil treated with *Liquid Gypsum* due to the creation of stable soil particles. The spaces between these soil particles (aggregates) are called pore spaces which store water, nutrients, and air. Roots move easily through these pore spaces.
3. A crumbly soil mulch, much like large grains of sand, become visible after the use of *Liquid Gypsum* and acts like other mulches to retain soil moisture below the surface.
4. Turf and other groundcovers grown in soil treated with *Liquid Gypsum* are less likely to form thatch. Improved pore structure in *Liquid Gypsum* treated soil allows roots to penetrate the soil much easier.
5. Treating soil and plant material already planted on slopes will permit applied water to penetrate the soil surface much easier eliminating most water runoff.
6. Where salts are a soil problem (saline) treatment of the soil with *Liquid Gypsum* will improve the ability of the soil to be irrigated to carry away (leach) salts away from the root zone.
7. Use of *Liquid Gypsum* makes it possible to more easily use reclaimed water for landscape irrigation without it causing compaction of clay soil. Damage to plant leaves from the salts in reclaimed water is also reduced.
8. Erosion of soil is reduced and the soil is stabilized.

Liquid Gypsum Safety: Liquid Gypsum leaves no toxic residues in soil or on plant leaves when it is applied and as it decomposes.

How Long Will a Treatment Last?: At the recommended application rate it is estimated that monthly treatments for 6 to 12 months will result in a flocculated soil capable of sustaining plant growth for about 5 years. This is, of course, dependent upon the initial condition of the soil when treatments began.

How Does Liquid Gypsum Compare to Regular Dry Gypsum? In order for dry gypsum to work properly it must be tilled into the soil. *Liquid Gypsum* can be sprayed over the top of bare soil or over the top of landscape plants and once it contacts soil it begins to work immediately. The response to an application of dry gypsum is counted in months and years. Dry gypsum, when spread over turf, groundcover, or ornamental plants is comparatively ineffective. The calcium content of a one quart bottle of LG is equivalent to the soluble content of gypsum in 4 – 50 pound bags of dry gypsum.

What problems will Liquid Gypsum solve? Sodium and/or saline problems, clay and compacted soils, soggy soils and water drainage issues, soil erosion, problems associated with poor or reclaimed water, and will reduce thatch.



LIQUID “GYPSUM” PRODUCT PERFORMANCE

Liquid Gypsum contains three primary ingredients intended to attack the monovalent sodium cations binding clay platelets together. The liquid calcium chloride in it contains 120,000 ppm of free exchangeable divalent calcium cations (compare to about 1,000 ppm in dry gypsum.) This cation exchange is based on the Law of Mass Action, which states that in order to drive this chemical reaction in a soil environment one must apply an overwhelming number of calcium cations to displace the large numbers of sodium cations attached to the negative exchange sites on clay platelets. This reaction is instantaneous, which is why Liquid Gypsum works quickly. It is also reversible, which means that if a water source is used for irrigation a constant source of sodium and other salts are constantly being reapplied. That is the reason there are two other ingredients.

To enhance this rapid reaction with sodium Liquid Gypsum also contains a high quality soil penetrant/humectant to help it penetrate resistant soils. The third ingredient is a water soluble mucilage which, after the soil aggregate structure is flocculated, imparts a permanent status to the new aggregates, similar to gluing tiny clay particles into larger sand-size particles. This permanent status will last one to two years and prevents the clay cation exchange sites from being made available to passing sodium ions. Eventually, microorganism activity decomposes this aggregate structure, so period applications should be made based on percolation rate testing.

When the soil aggregate structure is stabilized into a better condition sodium and other salts, especially where recycled irrigation water is used, are more easily moved through the soil profile and past the root zone. Air is more easily drawn into the soil matrix enhancing macro and microorganism activity. Soil matter is more easily decomposed and humus formation moves forward.

Prepared by:
Bill Nolde
Director of Research and Development
Global Aqua Science, LLC
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LIQUID GYPSUM CALCIUM EQUIVALENTS

LIQUID GYPSUM

vs.

DRY GYPSUM

1 GAL.

800 LBS.

2.5 GAL.

2000 LBS. (1 TON)

55 GAL.

44,000 LBS. (22 TONS)

Based on the amount of usable calcium

RATES AND COVERAGE

AMOUNT

AREA COVERED

1 GAL.

4000 sq.ft.

2.5 GAL.

10,000 sq.ft.

11 GAL.

1 acre

55 GAL.

5 acres

At the recommended application rate of 32 oz. / 1000 sq.ft. which is equivalent to 200 lbs. dry gypsum / 1000 sq.ft.

For faster results or severe sodium problems, the rate can be doubled or tripled without any harm to plants or soil.