STAR

DON'T SAY IT --- *Write It!*

DATE: October 21, 1992

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Dan Duncan - EPA

FROM: Cliff Clark SJ Skurla for
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SUBJECT: PAGE CHANGE INFORMATION - RD&D PERMIT APPLICATION

Attached is part of the information requested in your September 16, 1992 letter. The information includes:

- Modified Table 4-3 and accompanying revised text on Page 4-6
- A draft section of the portable berm foundation
- Portable berm calculations for the deflection of the asphalt by the tank trailer and the amount of deflection the berm liner can withstand.

Draft text revisions will be forwarded to you by the end of the week that will include information of the LERF ventilation system and load/unload areas pump secondary containment (catch basins). It is hoped that this information will provide you with the information you need to complete the draft permit. If you have any questions please call me or Steve Skurla at (509) 376-7957.

Table 4-3. Predicted Effectiveness of Ventilation System Activated Carbon with Spiked Liquid Effluent Retention Facility Feed. (sheet 1 of 2)

Volatile organic compound	Maximum feed concentration (ppm)(a)	Maximum pounds per batch (b)	Charcoal retentivity	Maximum charcoal required per batch (b)(c)
Acetone	101.0	0.842	15	~~1.12~~ 5.61
1-Butanol	200.0	1.667	36	~~0.93~~ 4.63
2-Butanone (MEK)	2.2	0.018	26	~~0.01~~ 0.07
Butraldehyde (butanal)	2.3	0.019	21	~~0.02~~ 0.09
Chloroform (trichloromethane)	0.8	0.007	32	~~0.00~~ 0.02
Ethyl alcohol (ethanol)	0.01	0.000	21	0.00
Methylene chloride (dichloromethane)	3.8	0.032	25	~~0.03~~ 0.13
Methyl n-propyl ketone (2-pentanone)	0.2	0.002	26	~~0.00~~ 0.01
Methyl n-butyl ketone (2-hexanone)	0.8	0.007	22	~~0.01~~ 0.03
Methyl isobutyl ketone (hexone)	1.7	0.014	30	~~0.01~~ 0.05
2-Propanol (isopropyl alcohol)	0.2	0.002	26	~~0.00~~ 0.01
Tetrahydrofuran	1.7	0.014	21	~~0.01~~ 0.07
1,1,1-Trichloroethane	1.0	0.008	35	~~0.00~~ 0.02
Acetonitrile	2.0	0.017	2	~~0.17~~ 0.83
Carbon disulfide	10.0	0.083	15	~~0.11~~ 0.56
Carbon tetrachloride	0.5	0.004	45	~~0.00~~ 0.01
Sodium cyanide	0.2	0.002	1(d)	~~0.03~~ 0.17
m-Dichlorobenzene	1.0	0.008	52	~~0.00~~ 0.02
Dichloroisopropyl ether	1.0	0.008	13	~~0.01~~ 0.06
Ethylene glycol monomethyl ether	1.0	0.008	31	~~0.01~~ 0.03
Ethyl methacrylate	2.0	0.017	23	~~0.01~~ 0.07
Formic acid	10.0	0.083	7	~~0.24~~ 1.19

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Table 4-3. Predicted Effectiveness of Ventilation System Activated Carbon with Spiked Liquid Effluent Retention Facility Feed. (sheet 2 of 2)

Volatile organic compound	Maximum feed concentration (ppm)(a)	Maximum pounds per batch (b)	Charcoal retentivity	Maximum charcoal required per batch (b)(c)
Methyl butyl ether	1.0	0.008	22	~~0.01~~ 0.04
Phenol	2.1	0.018	30	~~0.01~~ 0.06
Pyridine	10.5	0.088	25	~~0.07~~ 0.35
Toluene	1.0	0.008	29	~~0.01~~ 0.03
Trichloroethylene	0.5	0.004	30	~~0.00~~ 0.01
Totals	358.5	2.989		~~2.82~~ 14.16

(a) 90% C.I. feed concentration plus maximum spike concentration.
(b) Batch size assumed to be 1,000 gallons, refer to Section 4.1.3.2.
(c) Calculations assume 100% volatilization of the volatile organics.
(d) No retentivity data, assumed lowest value (compound has very low volatility).

T4-3.2

55 gallon (208 liter) drum overpack for disposal. Location of the activated charcoal units is shown in the process flow diagram (Figure 4-2).

Table 4-2 shows the design requirements for the charcoal adsorption system. The volatile organics characterized in Table 3-1 were identified, along with expected concentrations. From this data, and the conservative assumption that 100% of the 90% confidence interval expected concentrations will be volatilized, it was calculated that 1.6 pounds (0.72 kilograms) of charcoal would be required to control the volatile organic emissions for each 5,000 gallon (18,927 liter) tanker. This would mean that a single drum of charcoal would be adequate to control over 60 tankers, not including spiking chemicals. The amount of waste water to be treated at the pilot plant facility will not approach 60 tankers. Also shown, for reference, in Table 4-2 is the maximum calculated emission rate for each volatile organic if there were no charcoal controls present.

Portions of the feed stream may be spiked with added organics to test the efficiency of the unit operations at higher concentrations and for different compounds than normally found in the feed as described in Section 3.2. The tests conducted with the spiked waste usually will be of smaller volume than the 5,000 gallon (18,927 liter) tankers, with 1,000 gallons (3,785 liters) being the typical volume. Table 4-3 lists the design requirements for the charcoal adsorbers for the spiked waste. The design calculations assume a 1,000 gallon (3,785 liter) batch spiked waste with the maximum concentrations of the volatile organics listed in Section 3.0, Table 3-4 "Operation Envelope Maximum Concentrations". Again, the conservative assumption was made that 100 percent of the compounds will be volatilized. The calculated charcoal required for a batch under these conditions is 14 ~~2.8~~ pounds (6.4 ~~1.28~~ kilograms). ~~If a 5,000 gallon (18,927 liter) batch were to be run, the charcoal requirement would become 14.1 pounds (6.4 kilograms).~~ Even with the very conservative assumptions, a single charcoal adsorber would have adequate capacity for over 7,800 ~~39,000~~ gallons (29,000 ~~148,000~~ liters) of maximally spiked waste.

A redundant charcoal adsorption system will be installed on the waste water pilot plant ventilation system. The charcoal units will be installed in series, so that if breakthrough occurs on the primary unit, a second unit will provide backup. A continuous organic vapor analyzer (Thermal Environmental Instruments Co. Model 52, or equivalent) will be used to sample the air stream after the first charcoal unit to detect any breakthrough of the charcoal. If breakthrough is detected, the primary charcoal unit will be removed and the secondary unit would become the primary unit. A fresh unit then would be installed as the secondary unit. Breakthrough of the first stage charcoal adsorber will be considered to be at 75 parts per million as shown on the organic vapor analyzer. The analyzer will be set to alarm at that point. Operations will be stopped within 24 hours of the alarm, and the adsorber changed out. Immediate shutdown is not necessary because of the redundant emission control provided by the second stage charcoal adsorber. Manufacturer's information on the organic vapor analyzer is presented in Appendix 4C.

4.1.3.3 Emission Monitoring Equipment. Stack effluent radionuclide content will be monitored with a particulate record sampler. These sampling systems

Induced Berm Liner Stress From Pavement Deflection Analysis

Purpose

The purpose of this analysis is to determine the amount of berm foundation settlement or 'deflection' that is tolerable before failure of the Seaman XR-5 geomembrane berm liner.

Assumptions

1. The mathematical model presented in Page A-16 of "Design and Construction of RCRA/CERCLA Final Covers" (EPA/625/4-91/025, May 1991) is applicable. This model was developed for the "Tensile Stresses in a Geomembrane Mobilized by Cover Soil and Caused by Subsidence."

2. The cover soil pressure term (density of the cover soil x height of the cover soil) can be represented by the trailer tire pressure. This is 125 pounds per square inch (psi).

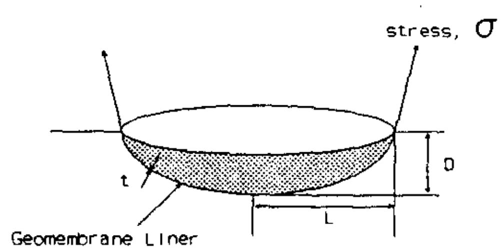
3. The radius of the subsidence, can be represented as the tire width for a dual tire system. This is 10 inches.

4. The XR-5 geomembrane thickness is 0.030 inches ("Technical Data and Specifications for XR-5 Geomembrane" included in Appendix 4E).

5. The XR-5 geomembrane tensile strength is 425 pounds per 4-inch wide test strip (grab tensile per ASTM-D-751) ("Technical Data and Specifications for XR-5 Geomembrane" included in Appendix 4E).

Analysis

The tensile stress induced in the geomembrane due to the deflection induced by subsidence is calculated with the following modified equation and is illustrated in the sketch.



SETTLEMENT SKETCH

$$\sigma = 2DL^2p/[3t(D^2 + L^2)]$$ (Equation 1)

where,

σ = geomembrane tensile stress
D = deflection in inches
L = radius of the depression in inches
p = pressure on the berm geomembrane in psi, and
t = thickness of the geomembrane in inches.

Induced Berm Liner Stress From Pavement Deflection Analysis (cont.)

The geomembrane tensile stress at failure, σ_F, can be calculated from the grab tensile strength as follows,

$$\sigma_F = 425 \text{ pounds}/(4 \text{ inches} \times 0.030 \text{ inches}) = 3{,}542 \text{ psi}$$

Assuming a safety factor of 2, the allowable tensile stress, σ_A, would be

$$\sigma_A = \sigma_F/2 = 1{,}771 \text{ psi}$$

By substituting this value (1,771 psi) for tensile stress in Equation 1 above, the allowable deflection, D_A, can be calculated, i.e.,

$$1{,}771 \text{ psi} = 2D_A(10 \text{ inches})^2(125 \text{ psi})/[3(0.030 \text{ inches})(D_A^2 + (10 \text{ inches})^2)]$$

By trial and error iteration, D_A is found to be 0.64 inches.

Conclusions

Assuming a safety factor of 2, the allowable defection of the berm geomembrane due to foundation settlement under the dual tires is 0.64 inches. The "Asphalt Pavement Analysis" in this appendix concluded that the maximum deflection under a dynamic load is 0.013 inches.

Analysis prepared by:

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Westinghouse Hanford Company
October 7, 1992

Asphalt Pavement Deflection Analysis

Purpose

The purpose of this analysis is to determine the deflection of the asphalt pavement berm foundation when under load. The load will consist of a 5 axle tractor-trailer. The trailer consists of a 5,000 gallon tank loaded with wastewater.

Assumptions

1. Trailer tire pressure is 125 pounds per square inch (psi).
2. The pavement is Class B asphalt concrete (per "1991 Standard Specifications for Road, Bridge, and Municipal Construction," M41-10, Section 9-03.8, Washington State Department of Transportation), 3 inches in depth, placed on a compacted base.
3. The pavement modulus of elasticity is 400,000 psi (Telecon 10/6/92 with Brian Wilson, Shannon & Wilson, Richland, Washington referring to information received from the Washington State Department of Transportation).
4. The pavement under the tire is assumed to be unrestrained from the sides (a conservative assumption).

Analysis

The compressive strain of the pavement under the tire, ϵ, is computed as follows:

$$\epsilon = \sigma/E = 125 \text{ psi}/400{,}000 \text{ psi} = 0.00031$$

where,

σ = the compressive stress = the tire pressure
E = the modulus of elasticity.

The deflection, x, under the tire is computed as follows:

$$x = \epsilon D = (0.00031)(4.2 \text{ inches}) = 0.0013 \text{ inches}$$

where,

D = the depth of the asphalt concrete pavement.

This analysis does not take credit for the considerable amount of load distribution provided by the pavement adjacent and integral to that directly under the tire.

Asphalt Pavement Deflection Analysis
(cont.)

Conclusions

Under a static load, the pavement deflection would be no more than 0.0013 inches. Assuming that a dynamic load could be 10 times as large, the maximum deflection would be no more than 0.013 inches.

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October 6, 1992