Attachment No. 2

Screening Analysis for Other Constituents in 2,4,6-TBP Production Wastes

For this evaluation, the highest concentration was used when different values were available for the different TCLPs. Furthermore, risks were calculated based on a DAF of 100, consistent with the DAF used in the proposed rule. Health-based levels and carcinogenic risks were derived from reference does (RfDs) and carcinogenic slope factors (CSFs) obtained from IRIS, 1997 (Integrated Risk Information System. U.S. Environmental Protection Agency, National Center for Environmental Assessment, Cincinnati, OH; Internet URL: http://www.epa.gov/ngispgm3/iris/index.htm).

For the risk calculations, RfDs were first converted to Health-Based Limits (HBLs) assuming an ingestion rate of 1.4 L/day and a body weight of 70 kg [i.e., HBL = RfD (mg/kg/day) * (70 kg/1.4 L/day)]. The Hazard Quotient (HQ) was then calculated by dividing the concentration in the TCLP leachate by the HBL. No correction was made for an exposure duration of 30 years because this is considered a chronic duration. (Any human exposure of 7 years or more is considered chronic for the purposes of calculating noncancer risk.)

The carcinogenic risk was calculated assuming an ingestion rate of 1.4 L/day, an exposure duration of 30 years, and a body weight of 70 kg. Accordingly, the risk was calculated using the following equation: risk = (TCLP conc. in mg/L * 1.4 L/day * 30 yr * CSF)/(70 kg * 70 yr).

The concentration needed to yield a risk of 10-5 was calculated based on the same risk exposure assumptions above. Accordingly, the concentration for the 10-5 risk level was calculated with the following equation: TCLP conc. in mg/L = (10-5 * 70 kg * 70 yr)/(1.4 L/day * 30 yr * CSF). The risks presented by the chemicals other than 2,4,6-tribromophenol that are found in the wastes are summarized in the attached table.

A few inconsistencies in the TCLP analytical results were addressed as follows: Chromium is shown in the TCLP measurements only as total chromium, but the HBL differs for chromium (III) and chromium (VI). We calculated the risk both as if all of the chromium were present as chromium (III), and as if all were present as chromium (VI). The risk was not of concern under either condition. Finally, the risk calculations reflect the identification of the constituent 1,2-dibromoethane by the CAS number presented in parentheses in the data results (see Background Document to Support a Listing Determination for Wastes form the Organobromine Chemicals Manufacturing Industry, April 28, 1994, page 137). As confirmed by review of the analytical data reports, the substance reported as 1,2-dibromoethene, is actually 1,2-dibromoethane; this chemical is also known as ethylene dibromide (EDB), which may have caused the confusion.

Using the dilution factor of 100 used in the proposed Organobromines Listing rule (59 FR 24530, May ll, 1994), several chemicals (i.e., 1,2-dibromoethane, arsenic, and bromoform) have groundwater risks of potential concern (>10-5). Concerning arsenic, the analytical results are suspect due to known problems with measuring some metals in these type of waste matrices. (See Method 6020, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, third

edition, 1994; OSW/USEPA). EPA's contract lab experienced problems in some metal analyses, most notably for selenium and arsenic, using the method employed, ICP-MS (Inductively Coupled Plasma--Mass Spectrometry). EPA confirmed that the extremely high amount of bromine in the sample (due in part to 2,4,6-tribromophenol) resulted in false positive results for selenium; reanalysis using another method did not detect selenium. While arsenic was not reanalyzed using another method, it is likely that the high bromine content in these samples makes the ICP-MS results unreliable. (See Hinners, T.A., Heithmar, E., Rissmann, E., and Smith, D., Winter Conference on Plasma Spectrochemistry, Abstract THP18; p. 237, San Diego, CA (1994)). Furthermore, potential risks for 1,1,-dichloroethene were not evaluated due to significant concentration measured in the blank for this chemical.

The potential risks from EDB are extremely highly. Even after a dilution by a factor of 100, the risk calculated from the CSF would be in the 10-1 range. However, according to IRIS, the unit risk should not be used if the water concentration exceeds 0.004.0 mg/L, since above this concentration the unit risk may not be appropriate. Thus, the table presents the risk only as greater than 10-3. Using a DAF of 100, the risks from bromoform are marginally above the 10-5 level of concern.

Groundwater Risks Presented by Other Constituents in 2,4,6-Tribromophenol Production Wastes[1]

Chemical Name/Synonym	Conc. in TCLP (mg/L)	TCLP Value Used	RfD (mg/kg-day)	HBL (mg/L)	Oral CSF [(mg/kg)/day]-1	10-5 Risk Level (mg/L)	HQ (DAF=100)	Risk (DAF=100)
Chemicals with Risk >10-6								
1,2-Dibromoethane (Ethylene dibromide)	3.89e+01	GL-09/TCLP/DUP			8.50e+01	1.37e-05		>1e-03[2]
Arsenic	5.86e-01	GL-08/TCLP	3.00e-04	1.50e-02	1.50e+00	7.78e-04	3.91e-01	7.53e-05
Bromoform	1.72e+01	GL-09/TCLP/DUP	2.00e-02	1.00e+00	7.90e-03	1.48e-01	1.72e-01	1.16e-05
Chemicals with Risk <10-6								
Chromium(III), insoluble salts	1.12e-02	GL-09/TCLP	1.00e+00	5.00e+01			2.24e-06	
Barium	4.70e-03	GL-09/TCLP	7.00e-02	3.50e+00			1.34e-05	
Selenium	8.80e-03	GL-08/TCLP	5.00e-03	2.50e-01			3.52e-04	
Chromium(VI)	1.12e-02	GL-09/TCLP	5.00e-03	2.50e-01			4.48e-04	
Bromoform	1.31e-01	GL-08/TCLP	2.00e-02	1.00e+00	7.90e-03	1.48e-01	1.31e-03	8.84e-08
Dibromochloromethane	6.98e-03	GL-08/TCLP	2.00e-02	1.00e+00	8.40e-02	1.39e-02	6.98e-05	5.03e-08
Bromodichloromethane	1.04e-03	GL-08/TCLP	2.00e-02	1.00e+00	6.20e-02	1.88e-02	1.04e-05	5.53e-09
Methylene chloride	1.07e+00	GL-09/TCLP/DUP	6.00e-02	3.00e+00	7.50e-03	1.56e-01	3.56e-03	6.87e-07
Chemicals with no RfD or Oral CSF								
4-Bromophenol	1.20e+00	GL-08/TCLP						
2,4-Dibromophenol	2.05e+01	GL-08/TCLP						
2,6-Dibromophenol	9.73e-01	GL-08/TCLP						
Dibromomethane	1.13e+00	GL-09/TCLP						
1,1,2-Tribromoethane	1.32e+02	GL-09/TCLP/DUP						
Lead	2.77e-02	GL-09/TCLP						
Vinyl bromide	2.87e-01	GL-09/TCLP/DUP						

1 RfDs and CSFs are from IRIS, 1997 (Integrated Risk Information System. U.S. Environmental Protection Agency, National Center for Environmental Assessment, Cincinnati, OH). Internet web URL: http://www.epa.gov/ngispgm3/iris/index.html. Groundwater risks assume a dilution-attenuation factor (DAF) of 100. [2] According to IRIS, the unit risk for 1,2-dibromoethane should not be used if the water concentration exceeds 0.004.0 mg/L, since above this concentration the unit risk may not be appropriate. Thus, the table presents the risk only as greater than 1e-03.