APPENDIX E

BASELINE MODELING RESULTS

Table E.1 Two Parameter High-End Analysis Results for On-Site Landfills

Waste Stream	Constituent	HBN Total [1] (mg/L)	1995 Back. Docu.	Mean TCLP (mg/l)	Revised Receptor Well Conc. (mg/L)	Two High-End Parameters from Sensitivity Analysis		Revised Results [2] in Response to Comments	Revised Results [2] w/Indirect Risk [1]	Two High-End Parameters from TC Capped Sensitivity Analysis		TC Rule Capped Revised Conc. [3]	TC Capped Revised Total Risk [3]
CSO sludge	Benzene #	6.23E-03	0.6	5.90E-02	1.9E-02	X-Well	Waste Vol.	**1.9**	**3.1**	NA	NA	NA	NA
Hydrotreating Catalyst [4]	Benzene #	6.23E-03	**28.6**	7.89E+00	0.51	Waste Conc.	X-Well	**51.3**	**82.4**	X-Well	Infiltration	2.5E-02	**4.1**
	Nickel	1.00E+00	0.1	1.46E+02	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Arsenic #	3.00E-04	**20.1**	1.10E+00	1.9E-02	Waste Vol.	Waste Conc.	**63.3**	**63.3**	NA	NA	NA	NA
	Toluene	1.00E+01	2.2E-02	7.68E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur complex sludge [5]	Benzene #	6.23E-03	1.6E-03	2.60E-02	2.2E-05	NA	NA	2.2E-03	3.5E-03	NA	NA	NA	NA
	Arsenic #	3.00E-04	0.1	1.38E-01	3.3E-05	NA	NA	0.1	0.1	NA	NA	NA	NA
Off-spec products and fines [6]	Benz(a)anthracene #	2.00E-05	0.3	1.30E-02	4.2E-04	Waste Vol.	X-Well	**21.2**	**21.2**	NA	NA	NA	NA
	Benzo(a)pyrene #	6.00E-05	0.0E+00	1.00E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
Off-spec products and fines [7]	Benz(a)anthracene #	2.00E-05	0.3	1.30E-02	6.72E-05	Infiltration	TCLP	**3.4**	**3.4**	NA	NA	NA	NA
Hydrorefining catalyst [4]	Benzene #	6.23E-03	**20.1**	1.49E+00	0.25	X-well	Waste Vol.	**25.4**	**40.8**	Infiltration	X-Well	3.2E-02	**5.1**
	Arsenic #	3.00E-04	**67.0**	1.37E+01	1.2E-01	X-Well	Waste Vol.	**413.3**	**413.3**	X-Well	Waste Vol.	7.7E-03	**25.7**
	Nickel	1.00E+00	0.1	2.82E+01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unleaded gasoline tank sl. [5]	Benzene #	6.23E-03	0.6	7.52E-01	1.1E-02	NA	NA	**1.1**	**1.7**	NA	NA	7.4E-02	**11.9**
	Nickel	1.00E+00	6.4E-04	2.92E+01	1.3E-03	NA	NA	1.3E-03	1.3E-03	NA	NA	NA	NA
FCC catalyst and fines	Nickel	1.00E+00	0.5	2.20E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA
SCOT catalyst	Cadmium	3.00E-02	NA	8.00E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vanadium	4.00E-01	NA	1.18E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFalkylation sludge	Benzene #	6.23E-03	0.8	7.60E-02	3.6E-02	Infiltration	X-Well	**3.6**	**5.8**	NA	NA	NA	NA
	Nickel	1.00E+00	3.2E-03	2.80E-01	NA	NA	NA	NA	NA	NA	NA	NA	NA

1. Risk results are presented as HBN exceedance or HBN/well conc.This ratio corresponds to a 1 x 10-6 risk.
   The HBN value for Benzene is 0.01 mg/l, which corresponds to a direct risk from drinking 1.4 l/day of water
   (1.0×10^{-4} risk per 1mg/l benzene). The total risk also includes an indirect risk from showering (6.05×10^{-5} risk per 1mg/l benzene).
2. With the noted exceptions (see 5 below) the revised analysis consists of a Two Parameter Sensitivity Analysis.
3. Input leaching rates were capped on TC Regulatory levels for maximum allowable TCLP values for disposal in Subtitle D landfills (0.5 mg/l for benzene, and 5.0 mg/l for arsenic)
4. For hydrotreating and hydrorefining, all waste quantities, except those managed in Subtitle C landfills, were modeled including reclaimed waste.
5. Sensitivity analyses were not performed on these waste streams. Revised results were calculated using the two-high end parameters from the 1995 sensitivity analysis and 20-year 50 perc. waste volumes were used rather than derived waste volumes.
6. "J" value assumed to represent mean or expected TCLP value (see section 2.3.5)
7. "J" value assumed to represent maximum or high-end TCLP value (see section 2.3.5)

NA : Modeling results not available or not applicable.

Table E.2 Monte Carlo Baseline Modeling Results for On-Site Landfills

Waste Stream	Constituent	HBN Total[1] (mg/L)	90th Percentile					95th Percentile					99th Percentile				
			Rec. Well Conc. (mg/L)	Total Risk	TC Capped Well concentration	TC Capped Direct Risk[3]	TC Capped Total Risk[3]	Rec. Well Conc. (mg/L)	Total Risk	TC Capped Well concentration	TC Capped Direct Risk[3]	TC Capped Total Risk[3]	Rec. Well Conc. (mg/L)	Total Risk	TC Capped Well concentration	TC Capped Direct Risk[3]	TC Capped Total Risk[3]
CSO sludge	Benzene #	6.23E-03	5.00E-04	0.1	5.0E-04	0.1	0.1	1.58E-03	0.3	1.6E-03	0.2	0.3	6.34E-03	**1.0**	6.3E-03	0.6	**1.0**
Hydrotreating Catalyst[4]	Benzene #	6.23E-03	8.30E-03	**1.3**	4.9E-03	0.5	0.8	4.77E-02	**7.7**	2.2E-02	**2.2**	**3.5**	5.38E-01	**86.5**	1.1E-01	**11.0**	**17.7**
	Nickel	1.00E+00	5.43E-02	5.4E-02	NA	NA	NA	4.95E-01	0.5	NA	NA	NA	1.16E+01	**11.6**	NA	NA	NA
	Arsenic #	3.00E-04	4.57E-04	**1.5**	NA	NA	NA	2.15E-03	**7.2**	NA	NA	NA	1.24E-02	**41.2**	NA	NA	NA
	Toluene	1.00E+01	8.22E-03	8.2E-04	NA	NA	NA	3.61E-02	3.6E-03	NA	NA	NA	7.26E-01	7.3E-02	NA	NA	NA
Sulfur complex sludge	Benzene #	6.23E-03	8.93E-05	1.4E-02	NA	NA	NA	6.21E-04	0.1	NA	NA	NA	4.39E-03	0.7	NA	NA	NA
	Arsenic #	3.00E-04	4.10E-06	1.4E-02	NA	NA	NA	4.36E-05	0.1	NA	NA	NA	1.57E-03	**5.2**	NA	NA	NA
Off-spec products and fines[6]	Benz(a)anthracene #	2.00E-05	7.51E-08	3.8E-03	NA	NA	NA	2.74E-06	0.1	NA	NA	NA	8.42E-05	**4.2**	NA	NA	NA
	Benzo(a)pyrene #	6.00E-05	1.36E-12	2.3E-08	NA	NA	NA	1.26E-10	2.1E-06	NA	NA	NA	9.38E-07	1.6E-02	NA	NA	NA
Off-spec products and fines[7]	Benz(a)anthracene #	2.00E-05	6.98E-08	3.5E-03	NA	NA	NA	2.68E-06	0.1	NA	NA	NA	8.22E-05	**4.1**	NA	NA	NA
Hydrorefining catalyst[4]	Benzene #	6.23E-03	1.64E-02	**2.6**	1.2E-02	**1.2**	**2.0**	4.75E-02	**7.6**	3.6E-02	**3.6**	**5.8**	4.78E-01	**76.8**	0.1	**12.0**	**19.3**
	Arsenic #	3.00E-04	8.43E-03	**28.1**	8.1E-03	**27.1**	**27.1**	3.35E-02	**111.7**	3.3E-02	**109.0**	**109.0**	2.71E-01	**904.7**	0.2	**830.3**	**830.3**
	Nickel	1.00E+00	2.49E-02	2.5E-02	NA	NA	NA	3.36E-01	0.3	NA	NA	NA	7.07E+00	**7.1**	NA	NA	NA
Unleaded gasoline tank sludge	Benzene #	6.23E-03	6.84E-04	0.1	6.6E-04	0.1	0.1	3.84E-03	0.6	3.8E-03	0.4	0.6	2.43E-02	**3.9**	2.4E-02	**2.4**	**3.8**
	Nickel	1.00E+00	5.24E-05	5.2E-05	NA	NA	NA	7.68E-04	7.7E-04	NA	NA	NA	3.01E-02	3.0E-02	NA	NA	NA
FCC catalyst and fines	Nickel	1.00E+00	5.45E-03	5.5E-03	NA	NA	NA	6.56E-02	6.6E-02	NA	NA	NA	1.18E+00	**1.2**	NA	NA	NA
SCOT catalyst	Cadmium	3.00E-02	5.90E-06	2.0E-04	NA	NA	NA	4.86E-05	1.6E-03	NA	NA	NA	1.06E-03	3.5E-02	NA	NA	NA
	Vanadium	4.00E-01	3.68E-13	9.2E-13	NA	NA	NA	7.36E-11	1.8E-10	NA	NA	NA	5.76E-09	1.4E-08	NA	NA	NA
HFalkylation sludge	Benzene #	6.23E-03	2.79E-04	4.5E-02	2.8E-04	2.8E-02	4.5E-02	1.49E-03	0.2	1.5E-03	0.1	0.2	8.68E-03	**1.4**	8.7E-03	0.9	**1.4**
	Nickel	1.00E+00	2.82E-05	2.8E-05	NA	NA	NA	1.03E-03	1.0E-03	NA	NA	NA	3.06E-02	3.1E-02	NA	NA	NA

1. Risk results are presented as HBN exceedance or HBN/well conc.This ratio corresponds to a 1 x 10-6 risk.
   The HBN value for Benzene is 0.01 mg/l, which corresponds to a direct risk from drinking 1.4 l/day of water
   (1.0×10^{-4} risk per 1mg/l benzene). The total risk also includes an indirect risk from showering (6.05×10^{-5} risk per 1mg/l benzene).
2. With the noted exceptions (see 5 below) the revised analysis consists of a Two Parameter Sensitivity Analysis.
3. Input leaching rates were capped on TC Regulatory levels for maximum allowable TCLP values for disposal in Subtitle D landfills (0.5 mg/l for benzene, and 5.0 mg/l for arsenic)
4. For hydrotreating and hydrorefining, all waste quantities, except those managed in Subtitle C landfills, were modeled including reclaimed waste.
5. Sensitivity analyses were not performed on these waste streams. Revised results were calculated using the two-high end parameters from the 1995 sensitivity analysis and 20-year 50 perc. waste volumes were used rather than derived waste volumes.
6. "J" value assumed to represent mean or expected TCLP value (see section 2.3.5)
7. "J" value assumed to represent maximum or high-end TCLP value (see section 2.3.5)

NA : Modeling results not available or not applicable.

Table E.3 Two Parameter High-End Analysis Results for Off-Site Landfills

Waste Stream	Constituent	HBN Total[1] (mg/L)	1995 Back. Docu.	Mean TCLP (mg/l)	Revised Receptor Well Conc. (mg/L)	Two High-End Parameters from Sensitivity Analysis		Revised Results [2] in Response to Comments	Revised Results [2] w/Indirect Risk [1]	Two High-End Parameters from TC Capped Sensitivity Analysis		TC Rule Capped Revised Conc. [3]	TC Capped Revised Total Risk [3]
CSO sludge	Benzene #	6.23E-03	0.6	5.90E-02	1.55E-02	Area	Waste Vol.	**1.6**	**2.5**	NA	NA	NA	NA
Crude Oil Tank Sludge	Benzene #	6.23E-03	0.5	6.98E-01	1.71E-01	Area	Waste Vol.	**17.1**	**27.5**	Area	Waste Vol.	1.3E-01	**21.5**
Hydrotreating Catalyst [4]	Benzene #	6.23E-03	**35.7**	7.89E+00	3.38E-01	Y-Well	TCLP	**33.8**	**54.3**	Area	Waste Vol.	8.9E-02	**14.2**
	Nickel	1.00E+00	0.2	1.46E+02	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Arsenic *	3.00E-04	**31.6**	1.10E+00	2.11E-02	Waste Conc.	Y-Well	70.3	70.3	NA	NA	NA	NA
	Toluene	1.00E+01	3.7E-02	7.68E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfur complex sludge [5]	Benzene #	6.23E-03	1.6E-02	2.60E-02	1.99E-05	NA	NA	2.0E-03	3.2E-03	NA	NA	NA	NA
	Arsenic *	3.00E-04	0.5	1.38E-01	3.01E-05	NA	NA	0.1	0.1	NA	NA	NA	NA
Off-spec products and fines [6]	Benz(a)anthracene *	2.00E-05	**13.5**	1.30E-02	3.85E-04	Y-Well	Infiltration	**19.3**	**19.3**	NA	NA	NA	NA
	Benzo(a)pyrene *	6.00E-05	2.0E-04	1.00E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
Off-spec products and fines [7]	Benz(a)anthracene *	2.00E-05	**13.5**	1.30E-02	9.29E-05	Infiltration	TCLP	**4.6**	**4.6**	NA	NA	NA	NA
Hydrorefining catalyst [4]	Benzene #	6.23E-03	**34.6**	1.49E+00	2.26E-01	Area	Waste Vol.	**22.6**	**36.3**	Area	Waste Vol.	1.2E-01	**19.1**
	Arsenic *	3.00E-04	**126.7**	1.37E+01	2.04E-01	Y-Well	Waste Vol.	**680.0**	**680.0**	Y-Well	Waste Vol.	1.2E-01	**393.3**
	Nickel	1.00E+00	0.2	2.82E+01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Unleaded gasoline tank sl. [5]	Benzene #	6.23E-03	4.1	7.52E-01	2.90E-02	NA	NA	**2.9**	**4.7**	NA	NA	1.9E-02	**3.0**
	Nickel	1.00E+00	4.3E-03	2.92E+01	NA	NA	NA	NA	NA	NA	NA	NA	NA
FCC catalyst and fines	Nickel	1.00E+00	NA	2.20E+00	NA	NA	NA	NA	NA			NA	NA
SCOT catalyst	Cadmium	3.00E-02	8.9E-03	8.00E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Vanadium	4.00E-01	NA	1.18E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA
HFalkylation sludge	Benzene #	6.23E-03	3.1	7.60E-02	3.98E-02	Area	TCLP	**4.0**	**6.4**	NA	NA	NA	NA
	3/4-Methylphenol	3.00E-01	0.4	2.80E-01	NA	NA	NA	NA	NA	NA	NA	NA	NA

1. Risk results are presented as HBN exceedance or HBN/well conc.This ratio corresponds to a 1 x 10-6 risk.
   The HBN value for Benzene is 0.01 mg/l, which corresponds to a direct risk from drinking 1.4 l/day of water
   (1.0×10^{-4} risk per 1mg/l benzene). The total risk also includes an indirect risk from showering (6.05×10^{5} risk per 1mg/l benzene).
2. With the noted exceptions (see 5 below) the revised analysis consists of a Two Parameter Sensitivity Analysis.
3. Input leaching rates were capped on TC Regulatory levels for maximum allowable TCLP values for disposal in Subtitle D landfills (0.5 mg/l for benzene, and 5.0 mg/l for arsenic)
4. For hydrotreating and hydrorefining, all waste quantities, except those managed in Subtitle C landfills, were modeled including reclaimed waste.
5. Sensitivity analyses were not performed on these waste streams. Revised results were calculated using the two-high end parameters from the 1995 sensitivity analysis and 20-year 50 perc. waste volumes were used rather than derived waste volumes.
6. "J" value assumed to represent mean or expected TCLP value (see section 2.3.5)
7. "J" value assumed to represent maximum or high-end TCLP value (see section 2.3.5)

NA : Modeling results not available or not applicable.

Table E.4 Monte Carlo Baseline Modeling Results for Off-Site Landfills

Waste Stream	Constituent	HBN Total[1] (mg/L)	90th Percentile					95th Percentile					99th Percentile				
			Rec. Well Conc. (mg/L)	Total Risk	TC Capped Well concentration	TC Capped Direct Risk[3]	TC Capped Total Risk[3]	Rec. Well Conc. (mg/L)	Total Risk	TC Capped Well concentration	TC Capped Direct Risk[3]	TC Capped Total Risk[3]	Rec. Well Conc. (mg/L)	Total Risk	TC Capped Well concentration	TC Capped Direct Risk[3]	TC Capped Total Risk[3]
CSO sludge	Benzene #	6.23E-03	1.76E-03	0.3	1.8E-03	0.2	0.3	6.84E-03	**1.1**	6.8E-03	0.7	**1.1**	2.14E-02	**3.4**	2.1E-02	**2.1**	**3.4**
Crude Oil Tank Sludge	Benzene #	6.23E-03	5.03E-03	0.8	3.9E-03	0.4	0.6	2.78E-02	**4.5**	2.1E-02	**2.1**	**3.3**	2.71E-01	**43.5**	0.1	**13.7**	**22.0**
Hydrotreating Catalyst[4]	Benzene #	6.23E-03	1.37E-02	**2.2**	7.3E-03	0.7	1.2	6.61E-02	**10.6**	2.7E-02	2.7	**4.4**	6.74E-01	**108.3**	0.1	**12.7**	**20.3**
	Nickel	1.00E+00	1.77E-01	1.8E-01	NA	NA	NA	1.33E+00	**1.3**	NA	NA	NA	1.83E+01	**18.3**	NA	NA	NA
	Arsenic *	3.00E-04	7.59E-04	**2.5**	NA	NA	NA	2.88E-03	**9.6**	NA	NA	NA	1.70E-02	**56.5**	NA	NA	NA
	Toluene	1.00E+01	1.16E-02	1.2E-03	NA	NA	NA	4.75E-02	4.8E-03	NA	NA	NA	6.16E-01	0.1	NA	NA	NA
Sulfur complex sludge	Benzene #	6.23E-03	4.41E-05	7.1E-03	NA	NA	NA	2.95E-04	4.7E-02	NA	NA	NA	4.64E-03	0.7	NA	NA	NA
	Arsenic *	3.00E-04	4.19E-06	1.4E-02	NA	NA	NA	4.65E-05	0.2	NA	NA	NA	1.48E-03	**4.9**	NA	NA	NA
Off-spec products and fines[6]	Benz(a)anthracene *	2.00E-05	1.34E-05	0.7	NA	NA	NA	1.09E-04	**5.4**	NA	NA	NA	1.48E-03	**73.8**	NA	NA	NA
	Benzo(a)pyrene *	6.00E-05	6.18E-07	1.0E-02	NA	NA	NA	9.43E-06	0.2	NA	NA	NA	2.48E-04	**4.1**	NA	NA	NA
Off-spec products and fines[7]	Benz(a)anthracene *	2.00E-05	1.17E-05	0.6	NA	NA	NA	8.86E-05	**4.4**	NA	NA	NA	1.05E-03	**52.6**	NA	NA	NA
Hydrorefining catalyst[4]	Benzene #	6.23E-03	2.06E-02	**3.3**	1.6E-02	**1.6**	**2.6**	5.14E-02	**8.3**	4.0E-02	**4.0**	**6.3**	5.30E-01	**85.1**	1.3E-01	**12.8**	**20.5**
	Arsenic *	3.00E-04	9.78E-03	**32.6**	9.4E-03	**31.3**	**31.3**	3.75E-02	**124.9**	3.7E-02	**123.0**	**123.0**	3.10E-01	**1034.0**	2.8E-01	**936.7**	**936.7**
	Nickel	1.00E+00	3.08E-02	3.1E-02	NA	NA	NA	3.58E-01	**0.4**	NA	NA	NA	6.36E+00	**6.4**	NA	NA	NA
Unleaded gasoline tank sl.	Benzene #	6.23E-03	1.99E-03	0.3	1.3E-03	0.1	0.2	1.09E-02	**1.7**	6.5E-03	0.6	**1.0**	8.22E-02	**13.2**	5.0E-02	**5.0**	**8.0**
	Nickel	1.00E+00	8.05E-05	8.0E-05	NA	NA	NA	2.01E-03	2.0E-03	NA	NA	NA	8.74E-02	0.1	NA	NA	NA
FCC catalyst and fines	Nickel	1.00E+00	4.69E-03	4.7E-03	NA	NA	NA	4.42E-02	4.4E-02	NA	NA	NA	5.57E-01	0.6	NA	NA	NA
SCOT catalyst	Cadmium	3.00E-02	2.75E-08	9.2E-07	NA	NA	NA	6.53E-06	2.2E-04	NA	NA	NA	4.27E-04	0.0	NA	NA	NA
	Vanadium	4.00E-01	4.41E-15	1.1E-14	NA	NA	NA	1.05E-11	2.6E-11	NA	NA	NA	3.92E-09	0.0	NA	NA	NA
HFalkylation sludge	Benzene #	6.23E-03	4.33E-03	0.7	4.3E-03	0.4	0.7	9.86E-03	**1.6**	9.9E-03	**1.0**	**1.6**	2.99E-02	**4.8**	3.0E-02	**3.0**	**4.8**
	3/4-Methylphenol	3.00E-01	4.70E-03	1.6E-02	NA	NA	NA	1.05E-02	3.5E-02	NA	NA	NA	3.09E-02	0.1	NA	NA	NA

1. Risk results are presented as HBN exceedance or HBN/well conc.This ratio corresponds to a 1 x 10-6 risk.
The HBN value for Benzene is 0.01 mg/l, which corresponds to a direct risk from drinking 1.4 l/day of water
(1.0×10^{-4} risk per 1mg/l benzene). The total risk also includes an indirect risk from showering (6.05×10^{-5} risk per 1mg/l benzene).
2. With the noted exceptions (see 5 below) the revised analysis consists of a Two Parameter Sensitivity Analysis.
3. Input leaching rates were capped on TC Regulatory levels for maximum allowable TCLP values for disposal in Subtitle D landfills (0.5 mg/l for benzene, and 5.0 mg/l for arsenic)
4. For hydrotreating and hydrorefining, all waste quantities, except those managed in Subtitle C landfills, were modeled including reclaimed waste.
5. Sensitivity analyses were not performed on these waste streams. Revised results were calculated using the two-high end parameters from the 1995 sensitivity analysis and 20-year 50 perc. waste volumes were used rather than derived waste volumes.
6. "J" value assumed to represent mean or expected TCLP value (see section 2.3.5)
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NA : Modeling results not available or not applicable.