Appendix N

Public Health and Safety

Project Total **HAP Emissions Summary**

Hydrogen Energy International LLC *5/21/2009*
HECA Project

Compound	CAS #	Annual Rate (tons per year)
1,3-Butadiene	106-99-0	2.32E-04
Acetaldehyde	75-07-0	2.72E-01
Acrolein	107-02-8	7.36E-03
Ammonia*	7664-41-7	1.01E+02
Antimony	7440-36-0	1.11E-02
Arsenic	7440-38-2	2.44E-02
Barium	7440-39-3	5.67E-06
Benzene	71-43-2	4.01E-02
Beryllium	7440-41-7	2.64E-03
Cadmium	7440-43-9	9.75E-02
Carbon Disulfide	75-15-0	4.66E-01
Carbonyl Sulfide	463-58-1	7.10E+00
Chromium	7440-47-3	3.71E-04
Chromium, (hexavalent)	18540-29-9	1.55E-03
Chromium, Total	0-00-5	5.16E-03
Cobalt	7440-48-4	2.65E-03
Copper*	7440-50-8	2.39E-04
Cyanides	57-12-5	5.77E-02
Ethylbenzene	100-41-4	1.17E-01
Fluoride*		1.21E-03
Formaldehyde	50-00-0	9.30E-01
Hexane	110-54-3	8.45E-01
Hydrochloric Acid	7647-01-0	1.32E-01
Hydrogen Fluoride (hydrofluoric acid)	7664-39-3	5.06E-01
Hydrogen Sulfide	7783-06-4	1.30E+00
Lead	7439-92-1	5.70E-03
Manganese	7439-96-5	1.41E-02
Mercury	7439-97-6	1.22E-02
Methyl Bromide (Bromomethane)	74-83-9	4.83E-01
Methylene Chloride (Dichloromethane)	75-09-2	2.23E-02
Naphthalene	91-20-3	2.91E-02
n-Hexane	110-54-3	1.69E-03
Nickel	7440-02-0	4.50E-03
Phenol	108-95-2	3.73E-01
Propylene*	115-07-1	1.55E+00
Propylene Oxide	75-56-9	8.74E-02
Selenium	7782-49-2	5.73E-03
Sulfuric Acid and Sulfates*	7664-93-9	5.79E+00
Toluene	108-88-3	1.34E-01
Vanadium*	7440-62-2	6.09E-04
Xylenes	1330-20-7	4.94E-02
Zinc*	7440-66-6	1.76E-03
Diesel Particulate Matter*	DPM	8.94E-03
2-Methylnaphthalene	PAH	4.96E-06
3-Methylchloranthrene	PAH	3.72E-07
7,12-Dimethylbenz(a)anthracene	PAH	3.30E-06
Acenaphthene	PAH	3.72E-07
Acenaphthylene	PAH	3.72E-07
Anthracene	PAH	4.96E-07
Benz(a)anthracene	PAH	2.37E-05
Benzo(a)anthracene	PAH	4.14E-05
Benzo(a)pyrene	PAH	2.57E-05
Benzo(b)fluoranthene	PAH	2.10E-05
Benzo(g,h,i)perylene	PAH	2.48E-07
Benzo(k)fluoranthene	PAH	2.04E-05
Chrysene	PAH	4.64E-05
Dibenzo(a,h)anthracene	PAH	4.31E-05
Dichlorobenzene	PAH	1.55E-06
Ethane	PAH	3.99E-03
Fluoranthene	PAH	6.20E-07
Fluorene	PAH	5.78E-07
Indeno(1,2,3-cd)pyrene	PAH	4.32E-05
PAH (excluding Naphthalene)	PAH	1.75E-04
Phenanathrene	PAH	3.51E-06
Pyrene	PAH	1.03E-06
Total Combined HAPs and TACs		**121.80**
Total HAPs*		**13.15**

Notes:

* Denotes pollutants that are not listed as Federal HAPs. These pollutants are not included in the HAP total provided. As shown, combined annual HAP emissions are less than 25 tons per year. Additionally, individual HAP emissions are below 10 tons per year. As such, the source is not a major source of HAPs.

CTG/HRSG Stack - SynGas — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Annual emissions based on 100 percent load at annual average temperature (65°F)

HRSG Heat Input (Yearly Average - 65°F) =	2,159.40	10^6 Btu/hr (higher heating value)
Duct Burner Heat Input (Yearly Average - 65°F) =	273.76	10^6 Btu/hr ((higher heating value)
Total HRSG Heat Input (Yearly Average - 65°F) =	2,433.16	10^6 Btu/hr ((higher heating value)

Hourly emissions based on 100 percent load at winter minimum temperature (20°F)

HRSG Heat Input (Winter Minimum - 20°F) =	2,175.92	10^6 Btu/hr ((higher heating value)
Duct Burner Heat Input (Winter Minimum - 20°F) =	273.76	10^6 Btu/hr ((higher heating value)
Total HRSG Heat Input (Winter Minimum - 20°F) =	2,449.68	10^6 Btu/hr ((higher heating value)
HRSG (Firing Syngas) Operating Hours =	8,322.0	hr/yr

Compound	CAS #	Emission Factor ($lb/10^{12}$ Btu coal)	Hourly (lb/hr)	Annual (lb/yr)
Acetaldehyde	75-07-0	1.8	4.41E-03	3.64E+01
Ammonia	7664-41-7		1.84E+01	1.53E+05
Antimony	7440-36-0	1.1	2.69E-03	2.23E+01
Arsenic	7440-38-2	2.4	5.88E-03	4.86E+01
Benz[a]anthracene	56-55-3	0.0023	5.63E-06	4.66E-02
Benzene	71-43-2	2.4	5.88E-03	4.86E+01
Beryllium	7440-41-7	0.26	6.37E-04	5.26E+00
Cadmium	7440-43-9	9.6	2.35E-02	1.94E+02
Carbon disulfide	75-15-0	46	1.13E-01	9.31E+02
Chromium (hexavalent)	18540-29-9	0.15	3.75E-04	3.10E+00
Chromium, total	0-00-5	0.51	1.25E-03	1.03E+01
Cobalt	7440-48-4	0.26	6.37E-04	5.26E+00
Cyanides	57-12-5	5.7	1.40E-02	1.15E+02
Formaldehyde	50-00-0	17	4.16E-02	3.44E+02
Hydrochloric acid	7647-01-0	13	3.18E-02	2.63E+02
Hydrogen fluoride (Hydrofluoric acid)	7664-39-3	50	1.22E-01	1.01E+03
Lead	7439-92-1	0.56	1.37E-03	1.13E+01
Manganese	7439-96-5	1.0	2.55E-03	2.11E+01
Mercury	7439-97-6	1.2	2.94E-03	2.43E+01
Methyl bromide (Bromomethane)	74-83-9	47.7	1.17E-01	9.66E+02
Methylene chloride (Dichloromethane)	75-09-2	2.2	5.39E-03	4.45E+01
Naphthalene	91-20-3	2.5	6.12E-03	5.06E+01
Nickel	7440-02-0	0.39	9.55E-04	7.90E+00
Phenol	108-95-2	36.8	9.01E-02	7.45E+02
Selenium	7782-49-2	0.56	1.37E-03	1.13E+01
Sulfuric acid and sulfates	7664-93-9	572	1.40E+00	1.16E+04
Toluene	108-88-3	0.033	8.08E-05	6.68E-01

Notes:

Under a mature operating scenario, the unit will primarily fire syngas.

1) HRSG (firing syngas) operating hours = 8,322 hour per year
2) Hourly emissions based on 100 percent load at winter minimum temperature (20°F)
3) Annual emissions based on 100 percent load at annual average temperature (65°F)
4) Emission rates are taken from Wabash River test data and the National Energy Technology Laboratory, U.S. Dept of Energy, Major Environmental Aspects of Gasification-based Power Generation Technologies, Final Report, December 2002.
5) Ammonia slip from the SCR (5 parts per million volume dry @ 15 percent O_2) - provided by Fluor - see Criteria Pollutant emission spreadsheet for details

Btu = British thermal units

Auxiliary CTG — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Total CTG Heat Input (Yearly Average - 65°F) = 911 10^6 Btu/hr (higher heating value)
Auxiliary CTG Operating Hours = 4,110 hours per year

Compound	CAS #	Emission Factor (lb/10^6 Btu coal)	Hourly (lb/hr)	Annual (lb/yr)
1,3-Butadiene	106-99-0	1.24E-07	1.13E-04	4.64E-01
Acetaldehyde	75-07-0	1.34E-04	1.22E-01	5.02E+02
Acrolein	107-02-8	3.62E-06	3.30E-03	1.36E+01
Ammonia	7664-41-7		1.20E+01	4.95E+04
Benzene	71-43-2	3.26E-06	2.97E-03	1.22E+01
Ethylbenzene	100-41-4	1.75E-05	1.59E-02	6.55E+01
Formaldehyde	50-00-0	3.60E-04	3.28E-01	1.35E+03
Hexane	110-54-3	2.53E-04	2.30E-01	9.47E+02
Propylene	115-07-1	7.53E-04	6.86E-01	2.82E+03
Propylene Oxide	75-56-9	4.67E-05	4.25E-02	1.75E+02
Toluene	108-88-3	6.93E-05	6.31E-02	2.59E+02
Xylenes	1330-20-7	2.55E-05	2.32E-02	9.55E+01
Benzo(a)anthracene	PAH	2.21E-08	2.01E-05	8.27E-02
Benzo(a)pyrene	PAH	1.36E-08	1.24E-05	5.09E-02
Benzo(b)fluoranthene	PAH	1.10E-08	1.00E-05	4.12E-02
Benzo(k)fluoranthene	PAH	1.07E-08	9.75E-06	4.01E-02
Chrysene	PAH	2.46E-08	2.24E-05	9.21E-02
Dibenz(a,h)anthracene	PAH	2.29E-08	2.09E-05	8.57E-02
Indeno(1,2,3-cd)pyrene	PAH	2.29E-08	2.09E-05	8.57E-02
Naphthalene	PAH	1.62E-06	1.48E-03	6.06E+00

Notes:

1) Auxiliary CTG operating hours = 4,110 hours per year
2) Hourly and annual emissions based on 100 percent load at annual average temperature (65°F) with evaporative cooling. This scenario represents worst-case heat input for both averaging periods.
3) Emission factors obtained from the CATEF database for natural-gas–fired combustion turbines. Formaldehyde, Benzene, and Acrolein emission factors are from the Background document for AP-42, Section 3.1, Table 3.4-1.
4) Ammonia emission rate based on an exhaust ammonia limit of 10 parts per million by volume at 15 percent oxygen.

Cooling Towers — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Cooling Tower Operating Parameters

	Power Block	Process Area	ASU
Cooling water (CW) circulation rate, gpm =	175,000	42,300	40,200
CW circulation rate (million lb/hr) =	88	21	20
CW dissolved solids (ppmw) =	9,000	9,000	9,000
Drift, fraction of circulating CW =	0.0005%	0.0005%	0.0005%

Note: Assumed 9,000 ppm TDS in circulating cooling water. Circulating water could range from 1,200 to 90,000 ppm TDS depending on makeup water quality and tower operation. PM_{10} emissions would vary proportionately.

Cooling Tower Operating Hours = 8,322.0 hours per year

Power Block

Compound	CAS #	Emission Factor (ppm)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	0.026	1.13E-05	9.38E-02
Copper	7440-50-8	0.005	2.19E-06	1.82E-02
Fluoride		0.45	1.97E-04	1.64E+00
Manganese	7439-96-5	1.29	5.63E-04	4.68E+00
Selenium	7784-49-2	0.02	9.36E-06	7.79E-02
Zinc	7440-66-6	0.01	4.38E-06	3.64E-02

Notes:

1) Power block operating hours = 8,322 hours per year
2) Arsenic ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
3) Copper ppm value shown is one-half of stated detection limit
4) Fluoride ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Manganese ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Selenium ppm value shown taken as average of analytical test results (DWR)
7) Zinc ppm value shown is one-half of stated detection limit

Process Area

Compound	CAS #	Emission Factor (ppm)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	0.026	2.72E-06	2.27E-02
Copper	7440-50-8	0.005	5.29E-07	4.40E-03
Fluoride		0.45	4.76E-05	3.96E-01
Manganese	7439-96-5	1.29	1.36E-04	1.13E+00
Selenium	7784-49-2	0.02	2.26E-06	1.88E-02
Zinc	7440-66-6	0.01	1.06E-06	8.80E-03

Notes:

1) Process area operating hours = 8,322 hours per year
2) Arsenic ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
3) Copper ppm value shown is one-half of stated detection limit
4) Fluoride ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Manganese ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Selenium ppm value shown taken as average of analytical test results (DWR)
7) Zinc ppm value shown is one-half of stated detection limit

ASU

Compound	CAS #	Emission Factor (ppm)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	0.026	2.59E-06	2.15E-02
Copper	7440-50-8	0.005	5.03E-07	4.18E-03
Fluoride		0.45	4.52E-05	3.76E-01
Manganese	7439-96-5	1.29	1.29E-04	1.08E+00
Selenium	7784-49-2	0.02	2.15E-06	1.79E-02
Zinc	7440-66-6	0.01	1.01E-06	8.36E-03

Notes:

1) ASU operating hours = 8,322 hours per year
2) Arsenic ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
3) Copper ppm value shown is one-half of stated detection limit
4) Fluoride ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Manganese ppm value shown taken as average of analytical test results (Fruit Growers Laboratory)
5) Selenium ppm value shown taken as average of analytical test results (DWR)
7) Zinc ppm value shown is one-half of stated detection limit

Gasifier Refractory Heaters — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Gasifier Heat Input =	18	10^6 Btu/hr (HHV)
Reference HHV =	1,050	Btu/scf
=	0.017	10^6 scf/hr
Gasifier Heater Operating Hours =	1,800	hours per year

Please note that there are three gasifier heaters; however, the current assumption is that only one gasifier heater is expected to operate at any one time on an as-needed basis to pre-heat the gasifier.

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	2.00E-04	3.43E-06	6.17E-03
Benzene	71-43-2	2.10E-03	3.60E-05	6.48E-02
Beryllium	7440-41-7	1.20E-05	2.06E-07	3.70E-04
Cadmium	7440-43-9	1.10E-03	1.89E-05	3.39E-02
Chromium	7440-47-3	1.40E-03	2.40E-05	4.32E-02
Cobalt	7440-48-4	8.40E-05	1.44E-06	2.59E-03
Copper	7440-50-8	8.50E-04	1.46E-05	2.62E-02
Formaldehyde	50-00-0	7.50E-02	1.29E-03	2.31E+00
Hexane	110-54-3	1.80E+00	3.09E-02	5.55E+01
Manganese	7439-96-5	3.80E-04	6.51E-06	1.17E-02
Mercury	7439-97-6	2.60E-04	4.46E-06	8.02E-03
Naphthalene	91-20-3	6.10E-04	1.05E-05	1.88E-02
Nickel	7440-02-0	2.10E-03	3.60E-05	6.48E-02
Selenium	7782-49-2	2.40E-05	4.11E-07	7.41E-04
Toluene	108-88-3	3.40E-03	5.83E-05	1.05E-01
Vanadium	7440-62-2	2.30E-03	3.94E-05	7.10E-02
Benzo(a)pyrene	PAH	1.20E-06	2.06E-08	3.70E-05
Benz(a)anthracene	PAH	1.80E-06	3.09E-08	5.55E-05
Benzo(b)fluoranthene	PAH	1.80E-06	3.09E-08	5.55E-05
Chrysene	PAH	1.80E-06	3.09E-08	5.55E-05
Dibenzo(a,h)anthracene	PAH	1.20E-06	2.06E-08	3.70E-05
Indeno(1,2,3-cd)pyrene	PAH	1.80E-06	3.09E-08	5.55E-05
2-Methylnaphthalene	PAH	2.40E-05	4.11E-07	7.41E-04
3-Methylchloranthrene	PAH	1.80E-06	3.09E-08	5.55E-05
7,12-Dimethylbenz(a)anthracene	PAH	1.60E-05	2.74E-07	4.94E-04
Acenaphthene	PAH	1.80E-06	3.09E-08	5.55E-05
Acenaphthylene	PAH	1.80E-06	3.09E-08	5.55E-05
Anthracene	PAH	2.40E-06	4.11E-08	7.41E-05
Benzo(g,h,i)perylene	PAH	1.20E-06	2.06E-08	3.70E-05
Benzo(k)fluoranthene	PAH	1.80E-06	3.09E-08	5.55E-05
Fluoranthene	PAH	3.00E-06	5.14E-08	9.26E-05
Fluorene	PAH	2.80E-06	4.80E-08	8.64E-05
Phenanathrene	PAH	1.70E-05	2.91E-07	5.25E-04
Pyrene	PAH	5.00E-06	8.57E-08	1.54E-04

Notes:

1) Gasifier operating hours = 1,800 hours per year
2) Emission factor source is USEPA AP-42 Section 1.4
3) Calculation assumes fuel heating value, British thermal units/standard cubic foot, higher heating value 1,050
4) Please note that there are three gasifier heaters; however, the current assumption is that only one gasifier heater is expected to operate at any one time.

Auxiliary Boiler — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Auxiliary Boiler Heat Input =	142	10^6 Btu/hr (HHV)
=	1050	Btu/scf
=	0.135	10^6 scf/hr
Auxiliary Boiler Operating Hours =	2,190	hours per year

Compound	CAS #	Emission Factor (lb/10^6 scf)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	2.00E-04	2.70E-05	5.92E-02
Benzene	71-43-2	2.10E-03	2.84E-04	6.22E-01
Beryllium	7440-41-7	1.20E-05	1.62E-06	3.55E-03
Cadmium	7440-43-9	1.10E-03	1.49E-04	3.26E-01
Chromium	7440-47-3	1.40E-03	1.89E-04	4.15E-01
Cobalt	7440-48-4	8.40E-05	1.14E-05	2.49E-02
Copper	7440-50-8	8.50E-04	1.15E-04	2.52E-01
Formaldehyde	50-00-0	7.50E-02	1.01E-02	2.22E+01
Hexane	110-54-3	1.80E+00	2.43E-01	5.33E+02
Manganese	7439-96-5	3.80E-04	5.14E-05	1.13E-01
Mercury	7439-97-6	2.60E-04	3.52E-05	7.70E-02
Naphthalene	91-20-3	6.10E-04	8.25E-05	1.81E-01
Nickel	7440-02-0	2.10E-03	2.84E-04	6.22E-01
Selenium	7782-49-2	2.40E-05	3.25E-06	7.11E-03
Toluene	108-88-3	3.40E-03	4.60E-04	1.01E+00
Vanadium	7440-62-2	2.30E-03	3.11E-04	6.81E-01
Benzo(a)pyrene	PAH	1.20E-06	1.62E-07	3.55E-04
Benz(a)anthracene	PAH	1.80E-06	2.43E-07	5.33E-04
Benzo(b)fluoranthene	PAH	1.80E-06	2.43E-07	5.33E-04
Chrysene	PAH	1.80E-06	2.43E-07	5.33E-04
Dibenzo(a,h)anthracene	PAH	1.20E-06	1.62E-07	3.55E-04
Indeno(1,2,3-cd)pyrene	PAH	1.80E-06	2.43E-07	5.33E-04
2-Methylnaphthalene	PAH	2.40E-05	3.25E-06	7.11E-03
3-Methylchloranthrene	PAH	1.80E-06	2.43E-07	5.33E-04
7,12-Dimethylbenz(a)anthracene	PAH	1.60E-05	2.16E-06	4.74E-03
Acenaphthene	PAH	1.80E-06	2.43E-07	5.33E-04
Acenaphthylene	PAH	1.80E-06	2.43E-07	5.33E-04
Anthracene	PAH	2.40E-06	3.25E-07	7.11E-04
Benzo(g,h,i)perylene	PAH	1.20E-06	1.62E-07	3.55E-04
Benzo(k)fluoranthene	PAH	1.80E-06	2.43E-07	5.33E-04
Fluoranthene	PAH	3.00E-06	4.06E-07	8.89E-04
Fluorene	PAH	2.80E-06	3.79E-07	8.29E-04
Phenanathrene	PAH	1.70E-05	2.30E-06	5.03E-03
Pyrene	PAH	5.00E-06	6.76E-07	1.48E-03

Notes:

1) Auxiliary boiler operating hours = 2,190 hours per year
2) Emission factor source is EPA AP-42 Section 1.4
3) Calculation assumes fuel heating value,British thermal units/standard cubic foot, higher heating value 1,050

Gasification Flare — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Reference HHV = 1,050 btu/scf

Gasification Flare - Normal Operating Emissions From Pilot

Total Hours of Pilot Operation = 8,760 hr/yr
Ground Flare Pilot Fuel Use = 0.5 10^6 Btu/hr

Gasification Flare - Operating Emissions During Gasifier Startup and Shutdown

Total Flare SU/SD Operation = 115,500 10^6 Btu/yr
Wet Unshifted Gas-Firing Rate = 1,195 10^6 Btu/hr - conservatively assuming maximum possible rate
Dry Shifted Gas-Firing Rate = 1,020 10^6 Btu/hr - conservatively assuming maximum possible rate

Startup and shutdown flared gas scenario

Cold plant startup =	30,000	10^6 Btu/yr (1 event)	(assume 20 percent unshifted)
Plant shutdown =	500	10^6 Btu/yr (1 event)	(assume 100 percent unshifted)
Gasifier outages =	60,000	10^6 Btu/yr (24 events)	(assume 100 percent unshifted)
Gasifier hot restarts =	25,000	10^6 Btu/yr (12 events)	(assume 100 percent unshifted)
Total	115,500	10^6 Btu/yr	(approx 75 percent unshifted)

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Emission ($lb/10^6$ Btu)	Hourly (lb/hr)	Annual (lb/yr)
Acetaldehyde	75-07-0	0.043	4.10E-05	9.07E-02	4.91E+00
Acrolein	107-02-8	0.01	9.52E-06	2.11E-02	1.14E+00
Benzene	71-43-2	0.159	1.51E-04	3.35E-01	1.82E+01
Ethyl Benzene	100-41-4	1.444	1.38E-03	3.05E+00	1.65E+02
Formaldehyde	50-00-0	1.169	1.11E-03	2.47E+00	1.33E+02
Naphthalene	91-20-3	0.011	1.05E-05	2.32E-02	1.26E+00
n-Hexane	110-54-3	0.029	2.76E-05	6.12E-02	3.31E+00
PAH (excluding Naphthalene)	PAH	0.003	2.86E-06	6.33E-03	3.43E-01
Propylene	115-07-1	2.44	2.32E-03	5.15E+00	2.79E+02
Toluene	108-88-3	0.058	5.52E-05	1.22E-01	6.62E+00
Xylene(s)	1330-20-7	0.029	2.76E-05	6.12E-02	3.31E+00
Arsenic	7440-38-2	2.00E-04	1.90E-07	4.22E-04	2.28E-02
Beryllium	7440-41-7	1.20E-05	1.14E-08	2.53E-05	1.37E-03
Cadmium	7440-43-9	1.10E-03	1.05E-06	2.32E-03	1.26E-01
Chromium	7440-47-3	1.40E-03	1.33E-06	2.95E-03	1.60E-01
Cobalt	7440-48-4	8.40E-05	8.00E-08	1.77E-04	9.59E-03
Copper	7440-50-8	8.50E-04	8.10E-07	1.79E-03	9.70E-02
Lead	7439-92-1	5.00E-04	4.76E-07	1.05E-03	5.71E-02
Manganese	7439-96-5	3.80E-04	3.62E-07	8.02E-04	4.34E-02
Mercury	7439-97-6	2.60E-04	2.48E-07	5.49E-04	2.97E-02
Nickel	7440-02-0	2.10E-03	2.00E-06	4.43E-03	2.40E-01
Selenium	7782-49-2	2.40E-05	2.29E-08	5.06E-05	2.74E-03
Vanadium	7440-62-2	2.30E-03	2.19E-06	4.85E-03	2.63E-01
Zinc	7440-66-6	2.90E-02	2.76E-05	6.12E-02	3.31E+00

Notes:

1) Annual operation assumes total pilot operation of 8,760 hr/yr and 115,500 10^6 Btu/yr during gasifier startup and shutdown.
2) Emission factors based on AP-42 Chpt. 1.4 (for metals) and VCAPCD AB2588 (for non-metals).
3) Calculation assumes fuel heating value, Btu/scf, higher heating value 1,050

SRU Flare — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Reference HHV = 1,050 btu/scf

SRU Flare - Normal Operating Emissions From Pilot

Total Hours of Pilot Operation = 8,760 hr/yr
Elevated Flare Pilot Fuel Use = 0.3 10^6 Btu/hr

SRU Flare - Operating Emissions During Gasifier Startup and Shutdown

Total Flare Operation During SU/SD = 6.0 hr/yr — assumes approximately 6 hours (2 events)
Natural Gas Heat Rate (assist gas) = 36.0 10^6 Btu/hr

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Emission Factor ($lb/10^6$ Btu)	Hourly (lb/hr)	Annual (lb/yr)
Acetaldehyde	75-07-0	0.043	4.10E-05	1.49E-03	1.16E-01
Acrolein	107-02-8	0.01	9.52E-06	3.46E-04	2.71E-02
Benzene	71-43-2	0.159	1.51E-04	5.50E-03	4.31E-01
Ethyl Benzene	100-41-4	1.444	1.38E-03	4.99E-02	3.91E+00
Formaldehyde	50-00-0	1.169	1.11E-03	4.04E-02	3.17E+00
Naphthalene	91-20-3	0.011	1.05E-05	3.80E-04	2.98E-02
n-Hexane	110-54-3	0.029	2.76E-05	1.00E-03	7.85E-02
PAH (excluding Naphthalene)	PAH	0.003	2.86E-06	1.04E-04	8.13E-03
Propylene	115-07-1	2.44	2.32E-03	8.44E-02	6.61E+00
Toluene	108-88-3	0.058	5.52E-05	2.01E-03	1.57E-01
Xylene(s)	1330-20-7	0.029	2.76E-05	1.00E-03	7.85E-02
Arsenic	7440-38-2	2.00E-04	1.90E-07	6.91E-06	5.42E-04
Beryllium	7440-41-7	1.20E-05	1.14E-08	4.15E-07	3.25E-05
Cadmium	7440-43-9	1.10E-03	1.05E-06	3.80E-05	2.98E-03
Chromium	7440-47-3	1.40E-03	1.33E-06	4.84E-05	3.79E-03
Cobalt	7440-48-4	8.40E-05	8.00E-08	2.90E-06	2.28E-04
Copper	7440-50-8	8.50E-04	8.10E-07	2.94E-05	2.30E-03
Lead	7439-92-1	5.00E-04	4.76E-07	1.73E-05	1.35E-03
Manganese	7439-96-5	3.80E-04	3.62E-07	1.31E-05	1.03E-03
Mercury	7439-97-6	2.60E-04	2.48E-07	8.99E-06	7.04E-04
Nickel	7440-02-0	2.10E-03	2.00E-06	7.26E-05	5.69E-03
Selenium	7782-49-2	2.40E-05	2.29E-08	8.30E-07	6.50E-05
Vanadium	7440-62-2	2.30E-03	2.19E-06	7.95E-05	6.23E-03
Zinc	7440-66-6	2.90E-02	2.76E-05	1.00E-03	7.85E-02

Notes:

1) Annual operation assumes total pilot operation of 8,760 hr/yr and 6 hr/yr during gasifier startup and shutdown with assist gas.
2) Emission factors based on AP-42 Chpt. 1.4 (for metals) and VCAPCD AB2588 (for non-metals).
3) Calculation assumes fuel heating value, Btu/scf, higher heating value 1,050

Hydrogen Energy International LLC *5/21/2009*
HECA Project

Operating Parameters - Normal Operating Emissions From Pilot

Rectisol Flare Pilot Firing Rate = 0.3 MMBtu/hr
Annual Operating Hours = 8,760 hr/yr

Compound	CAS Number	Emission Factor ($lb/10^6$ scf)	Emission Factor (lb/MMBtu)	Hourly (lb/hr)	Annual (lb/yr)
2-Methylnaphthalene	91576	2.40E-05	2.35E-08	7.06E-09	6.18E-05
3-Methylchloranthrene	56495	1.80E-06	1.76E-09	5.29E-10	4.64E-06
7,12-Dimethylbenz(a)anthracene	57976	1.60E-05	1.57E-08	4.71E-09	4.12E-05
Acenaphthene	83329	1.80E-06	1.76E-09	5.29E-10	4.64E-06
Acenaphthylene	208968	1.80E-06	1.76E-09	5.29E-10	4.64E-06
Anthracene	120127	2.40E-06	2.35E-09	7.06E-10	6.18E-06
Benz(a)anthracene	56553	1.80E-06	1.76E-09	5.29E-10	4.64E-06
Benzene	71432	2.10E-03	2.06E-06	6.18E-07	5.41E-03
Benzo(a)pyrene	50328	1.20E-06	1.18E-09	3.53E-10	3.09E-06
Benzo(b)fluoranthene	205992	1.80E-06	1.76E-09	5.29E-10	4.64E-06
Benzo(g,h,i)perylene	191242	1.20E-06	1.18E-09	3.53E-10	3.09E-06
Benzo(k)fluoranthene	205823	1.80E-06	1.76E-09	5.29E-10	4.64E-06
Butane	106978	2.10E+00	2.06E-03	6.18E-04	5.41E+00
Chrysene	218019	1.80E-06	1.76E-09	5.29E-10	4.64E-06
Dibenzo(a,h)anthracene	53703	1.20E-06	1.18E-09	3.53E-10	3.09E-06
Dichlorobenzene	25321226	1.20E-03	1.18E-06	3.53E-07	3.09E-03
Ethane	74840	3.10E+00	3.04E-03	9.12E-04	7.99E+00
Fluoranthene	206440	3.00E-06	2.94E-09	8.82E-10	7.73E-06
Fluorene	86737	2.80E-06	2.75E-09	8.24E-10	7.21E-06
Formaldehyde	50000	7.50E-02	7.35E-05	2.21E-05	1.93E-01
Hexane	110543	1.80E+00	1.76E-03	5.29E-04	4.64E+00
Indeno(1,2,3-cd)pyrene	193395	1.80E-06	1.76E-09	5.29E-10	4.64E-06
Naphthalene	91203	6.10E-04	5.98E-07	1.79E-07	1.57E-03
Pentane	109660	2.60E+00	2.55E-03	7.65E-04	6.70E+00
Phenanthrene	85018	1.70E-05	1.67E-08	5.00E-09	4.38E-05
Propane	74986	1.60E+00	1.57E-03	4.71E-04	4.12E+00
Pyrene	129000	5.00E-06	4.90E-09	1.47E-09	1.29E-05
Toluene	108883	3.40E-03	3.33E-06	1.00E-06	8.76E-03
Arsenic	7440382	2.00E-04	1.96E-07	5.88E-08	5.15E-04
Barium	7440393	4.40E-03	4.31E-06	1.29E-06	1.13E-02
Beryllium	7440417	1.20E-05	1.18E-08	3.53E-09	3.09E-05
Cadmium	7440439	1.10E-03	1.08E-06	3.24E-07	2.83E-03
Chromium	7440473	1.40E-03	1.37E-06	4.12E-07	3.61E-03
Cobalt	7440484	8.40E-05	8.24E-08	2.47E-08	2.16E-04
Copper	7440508	8.50E-04	8.33E-07	2.50E-07	2.19E-03
Manganese	7439965	3.80E-04	3.73E-07	1.12E-07	9.79E-04
Mercury	7439976	2.60E-04	2.55E-07	7.65E-08	6.70E-04
Molybdenum	7439987	1.10E-03	1.08E-06	3.24E-07	2.83E-03
Nickel	7440020	2.10E-03	2.06E-06	6.18E-07	5.41E-03
Selenium	7782492	2.40E-05	2.35E-08	7.06E-09	6.18E-05
Vanadium	7440622	2.30E-03	2.25E-06	6.76E-07	5.93E-03
Zinc	7440666	2.90E-02	2.84E-05	8.53E-06	7.47E-02

Notes:

1) Emission factors ($lb/10^6$ scf) are from AP-42, Chapter 1.4, Table 1.4-3. Factors in pounds per 10E-06 scf were converted to factors in lb/MMBtu by dividing by 1,020.

Tail Gas Thermal Oxidizer — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Tail Gas Thermal Oxidizer Heat Input =	10	10^6 Btu/hr (HHV)
Reference HHV =	1,050	Btu/scf
=	0.010	10^6 scf/hr
Tail Gas Thermal Oxidizer Operating Hours =	8,760	hr/yr

Compound	CAS #	Emission Factor ($lb/10^6$ scf)	Hourly (lb/hr)	Annual (lb/yr)
Arsenic	7440-38-2	2.00E-04	1.90E-06	1.67E-02
Benzene	71-43-2	2.10E-03	2.00E-05	1.75E-01
Beryllium	7440-41-7	1.20E-05	1.14E-07	1.00E-03
Cadmium	7440-43-9	1.10E-03	1.05E-05	9.18E-02
Chromium	7440-47-3	1.40E-03	1.33E-05	1.17E-01
Cobalt	7440-48-4	8.40E-05	8.00E-07	7.01E-03
Copper	7440-50-8	8.50E-04	8.10E-06	7.09E-02
Formaldehyde	50-00-0	7.50E-02	7.14E-04	6.26E+00
Hexane	110-54-3	1.80E+00	1.71E-02	1.50E+02
Manganese	7439-96-5	3.80E-04	3.62E-06	3.17E-02
Mercury	7439-97-6	2.60E-04	2.48E-06	2.17E-02
Naphthalene	91-20-3	6.10E-04	5.81E-06	5.09E-02
Nickel	7440-02-0	2.10E-03	2.00E-05	1.75E-01
Selenium	7782-49-2	2.40E-05	2.29E-07	2.00E-03
Toluene	108-88-3	3.40E-03	3.24E-05	2.84E-01
Vanadium	7440-62-2	2.30E-03	2.19E-05	1.92E-01
Benzo(a)pyrene	PAH	1.20E-06	1.14E-08	1.00E-04
Benz(a)anthracene	PAH	1.80E-06	1.71E-08	1.50E-04
Benzo(b)fluoranthene	PAH	1.80E-06	1.71E-08	1.50E-04
Chrysene	PAH	1.80E-06	1.71E-08	1.50E-04
Dibenzo(a,h)anthracene	PAH	1.20E-06	1.14E-08	1.00E-04
Indeno(1,2,3-cd)pyrene	PAH	1.80E-06	1.71E-08	1.50E-04
2-Methylnaphthalene	PAH	2.40E-05	2.29E-07	2.00E-03
3-Methylchloranthrene	PAH	1.80E-06	1.71E-08	1.50E-04
7,12-Dimethylbenz(a)anthracene	PAH	1.60E-05	1.52E-07	1.33E-03
Acenaphthene	PAH	1.80E-06	1.71E-08	1.50E-04
Acenaphthylene	PAH	1.80E-06	1.71E-08	1.50E-04
Anthracene	PAH	2.40E-06	2.29E-08	2.00E-04
Benzo(g,h,i)perylene	PAH	1.20E-06	1.14E-08	1.00E-04
Benzo(k)fluoranthene	PAH	1.80E-06	1.71E-08	1.50E-04
Fluoranthene	PAH	3.00E-06	2.86E-08	2.50E-04
Fluorene	PAH	2.80E-06	2.67E-08	2.34E-04
Phenanathrene	PAH	1.70E-05	1.62E-07	1.42E-03
Pyrene	PAH	5.00E-06	4.76E-08	4.17E-04

Notes:

1) Tail gas thermal oxidizer operating hours = 8,760 (accounting for both process vent and SRU startup)
2) Emission factor source is USEPA AP-42 Section 1.4
3) Calculation assumes fuel heating value, Btu/scf, HHV 1,050

Intermittent CO_2 Vent — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Total Days of Operation =	21	day/yr
Total Hours of Operation =	504	hr/yr
Total Flow =	656,000	lb/hr
Total Flow =	15,150	lbmol/hr
Molecular weight		
COS	60	lb/lbmol
H_2S	34	lb/lbmol

PLEASE NOTE THAT THIS EMISSIONS SOURCE WILL BE MODELED IN DEGADIS.

Compound	CAS #	Emission Factor (ppm)	Hourly (lb/hr)	Annual (lb/yr)
Carbonyl Sulfide	463-58-1	55	5.01E+01	2.52E+04
Hydrogen Sulfide	7783-06-4	10	5.15E+00	2.60E+03

Notes:

1) Emission rates based on plant design and 21 days per year full venting.

Emergency Diesel Generator — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Emergency Generator Specification = 2,800 Bhp
Emergency Generator Operating Hours = 50 hr/yr

PLEASE NOTE THAT THERE ARE TWO GENERATORS; EMISSION SHOWN IS FOR INDIVIDUAL GENERATORS.

Compound	CAS #	Emission Factor (g/Bhp/hr)	Hourly (lb/hr)	Annual (lb/yr)
Diesel Particulate Matter	DPM	0.03	1.60E-01	8.02E+00

Note:

1) Emergency generator operating hours = 50 hours per year per generator
2) Emissions factor shown is site-specific diesel emission rate based on vendor data
3) Emission rate shown is for individual generator

Emergency Diesel Firewater Pump — HAP Emissions Summary

Hydrogen Energy International LLC — *5/21/2009*
HECA Project

Operating Parameters

Fire Water Pump Specification = 556 Bhp
Fire Water Pump Operating Hours = 100 hr/yr

Compound	CAS #	Emission Factor (g/Bhp/hr)	Hourly (lb/hr)	Annual (lb/yr)
Diesel Particulate Matter	DPM	0.015	1.84E-02	1.84E+00

Note:

1) Fire water pump operating hours = 100 hours per year
2) Emission factor shown is from Tier 4 requirements

Hydrogen Energy International LLC *5/21/2009*
HECA Project

Data Supplied By Client				
	Onsite Petcoke and Coal Trucks (@ 10 mph)		Onsite Gasifier Solids Handling (@ 5 mph)	
Parameter	Running Emissions	Idling Emissions	Running Emissions	Idling Emissions
Distance Traveled (mile)	0.9659		0.568	
Per Truck Idle Time (hour)		0.117		0.083
No. Volume Sources	85		84	
Maximum number of trucks or loads				
1-hour	18	18	2	2
Annual average	35,500	35500	2,900	2900
EMFAC2007 Emission Factors (g/mi or g/idle-hour)				
PM_{10}	0.08	0.122	0.09	0.122

PM10 Emission Rates

	Onsite Petcoke and Coal Trucks (@ 10 mph)		Onsite Gasifier Solids Handling (@ 5 mph)	
Emission Rates for HARP	Running Emissions (0.84 mile route)	Idling Emissions (at each Idle Point)	Running Emissions (0.568 mile route)	Idling Emissions (at each Idle
1-hr PM_{10} (pounds per hour)	3.1E-03	5.6E-04	2.3E-04	4.5E-05
Annual PM_{10} (pounds per year)	6.2E+00	1.1E+00	3.3E-01	6.5E-02

HARP Inputs - Annual and Hourly Emission Rates per Volume Source

	Onsite Petcoke and Coal Trucks (@ 10 mph)		Onsite Gasifier Solids Handling (@ 5 mph)	
	Running Emissions (0.84 mile route)	Idling Emissions (at each Idle Point)	Running Emissions (0.568 mile route)	Idling Emissions (at each Idle
Max PM_{10} pounds per year per volume source	3.7E-05	6.6E-06	2.7E-06	5.3E-07
PM_{10} pounds per year per volume source	7.3E-02	1.3E-02	3.9E-03	7.7E-04