Hazardous Air Pollutant (HAP) Scoping Study

- Estimated annual HAP emissions for select platforms, equipment, and HAPs
- 10 platforms selected based on total VOC and PM_{10} emission estimates
- Included combustion and non-combustion emission sources
- Emissions estimated for 14 HAPs using emission factors and speciation profiles

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HAP Scoping Study (cont.)

- Top-emitting VOC Platforms in 2014 Gulfwide Inventory:

Complex-Structure	2014 VOC Emissions (tpy)	% of Total Platform VOC Emissions	Platform Type
A	2,103	6.94%	Gas
B	1,053	3.48%	Gas
C	888	2.93%	Oil
D	724	2.39%	Oil
E	637	2.10%	Oil

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HAP Scoping Study (cont.)

- Top-emitting PM_{10} Platforms in 2014 Gulfwide Inventory:

Complex-Structure	2014 PM_{10} Emissions (tpy)	% of Total Platform PM_{10} Emissions	Platform Type
F	12.6	1.88%	Oil
G	10.4	1.55%	Oil
H	10.4	1.55%	Oil
I	9.4	1.42%	Oil
J	9.1	1.36%	Oil

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HAP Scoping Study (cont.)

HAP	Non-combustion Sources	Combustion Sources
Acetaldehyde		✓
Arsenic		✓
Benzene	✓	✓
Beryllium		✓
Cadmium		✓
Chromium		✓
Ethylbenzene	✓	✓
Formaldehyde		✓
Hexane	✓	✓
Mercury		✓
PAH		✓
Toluene	✓	✓
2,2,4 Trimethylpentane	✓	✓
Xylenes	✓	✓

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HAP Scoping Study (cont.)

- Estimated emissions using emission factors (boilers, turbines, engines, glycol dehydrators)

$$H = EF \times A$$

Where:

H = HAP emission estimate (lbs/yr)

EF = HAP emission factor (lbs/10^3 gallon, MMBtu)

A = Activity data (10^3 gallon, MMBtu)

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HAP Scoping Study (cont.)

- Estimated emissions using speciation profiles (fugitives, flashing, pneumatic devices, storage tanks, vents)

$$H = SP \times VOC$$

Where:

H = HAP emission estimate (lbs/yr)

SP = HAP speciation profile (%)

VOC = VOC emission estimate (lbs/yr)

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HAP Scoping Study (cont.)

- Total 2014 HAP Emissions for Selected Platforms:

Pollutant	Emissions (tpy)
2,2,4-Trimethylpentane	0.28
Acetaldehyde	2.57
Arsenic	2.80E-04
Benzene	11.00
Beryllium	8.18E-06
Cadmium	0.04
Chromium	0.08
Ethylbenzene	0.69
Formaldehyde	22.20
Hexane	222.00
Mercury	0.04
PAH	0.13
Toluene	7.56
Xylenes	6.63

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HAP Scoping Study (cont.)

- 2014 HAP Emission Estimates by Equipment Type:

Equipment Type	2,2,4-Trimethylpentane	Acetaldehyde	Arsenic	Benzene	Beryllium	Cadmium	Chromium	Ethyl-benzene	Formal-dehyde	Hexane	Mercury	PAH	Toluene	Xylenes
Boilers/ Heaters/ Burners	--	--	8.93E-06	9.38E-05	5.36E-07	4.91E-05	6.25E-05	--	3.35E-03	8.04E-02	1.16E-05	--	1.52E-04	--
Diesel Engines	--	5.24E-02	--	0.25	--	--	--	--	9.05E-02	--	9.22E-05	6.23E-02	9.37E-02	6.46E-02
Drilling Equipment	--	1.07E-03	--	3.29E-02	--	--	--		3.34E-03		1.27E-05	8.98E-03	1.19E-02	8.17E-03
Fugitives	1.89E-02	--	--	0.42	--	--	--	3.28E-02	--	4.43	--	--	0.11	2.90E-02
Glycol Dehydrators	--	--	--	2.29	--	--	--	0.12	--		--	--	1.21	4.52
Losses from Flashing	7.57E-04	--	--	1.42E-02	--	--	--	1.36E-03	--	1.43E-02	--	--	6.31E-04	7.89E-06
Natural Gas Engines	4.65E-02	2.27	--	0.52	--	--	--	1.60E-02	17.58	0.22	--	3.98E-02	0.25	9.25E-02
Turbines	--	0.25	2.71E-04	7.69E-02	7.64E-06	4.37E-02	8.40E-02	0.20	4.48		4.18E-02	1.48E-02	0.82	0.40
Pneumatic Pumps	6.35E-02	--	--	1.24	--	--	--	0.11	--	3.87	--	--	0.11	1.95E-02
Storage Tanks	3.41E-03	--	--	6.45E-02	--	--	--	6.12E-03	--	8.85E-02	--	--	3.39E-03	2.06E-04
Cold Vents	0.15	--	--	6.14	--	--	--	0.20	--	213.6	--	--	4.96	1.49
Total (tpy)	0.28	2.57	2.80E-04	11.0	8.18E-06	0.04	0.08	0.69	22.2	222	0.04	0.13	7.56	6.63

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HAP Scoping Study (cont.)

- 2014 HAP Emission Estimates by Platform:

Complex-Structure	2,2,4-Trimethylpentane	Acetaldehyde	Arsenic	Benzene	Beryllium	Cadmium	Chromium	Ethyl-benzene	Formal-dehyde	Hexane	Mercury	PAH	Toluene	Xylenes
A	0.10	0.36	N/A	3.94	N/A	1.09E-03	2.10E-03	0.11	2.32	147.09	1.05E-03	1.57E-03	3.44	1.05
B	0.04	0.19	N/A	2.06	N/A	N/A	N/A	0.05	1.38	73.10	2.54E-07	0.01	1.73	0.52
C	0.05	0.40	3.24E-06	0.84	1.94E-07	1.78E-05	2.27E-05	0.08	5.16	0.77	4.27E-06	3.81E-03	0.09	0.02
D	0.03	0.14	2.70E-06	0.68	1.62E-07	1.49E-05	1.89E-05	0.06	1.03	0.55	1.63E-05	0.02	0.06	0.02
E	0.03	0.31	N/A	3.01	N/A	5.65E-04	1.08E-03	0.18	2.31	0.50	5.40E-04	0.02	1.30	4.55
F	1.00E-03	0.08	2.99E-06	0.07	1.79E-07	0.01	0.02	0.06	1.25	0.04	0.01	0.01	0.24	0.12
G	0.03	0.90	2.21E-04	0.17	6.22E-06	1.36E-03	2.66E-03	0.01	5.70	0.13	1.28E-03	0.03	0.11	0.06
H	2.49E-03	0.08	5.04E-05	0.11	1.42E-06	0.01	0.02	0.06	1.28	0.04	0.01	0.01	0.25	0.12
I	1.45E-03	0.06	N/A	0.08	N/A	0.01	0.02	0.04	0.95	0.03	0.01	0.01	0.19	0.10
J	2.53E-03	0.05	N/A	0.09	N/A	0.01	0.01	0.04	0.76	0.04	0.01	0.01	0.15	0.08
Total	0.28	2.57	2.80E-04	11.0	8.18E-06	0.04	0.08	0.69	22.2	222	0.04	0.13	7.56	6.63

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HAP Scoping Study (cont.)

- Hexane is the highest emitted HAP of the pollutants included; driven by cold vents
- Formaldehyde is the second highest emitted HAP; driven by natural gas engines and natural gas, diesel, and dual fuel turbines
- Benzene, toluene, and xylene also contributed a significant amount to the estimated HAP emissions

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HAP Scoping Study (cont.)

- Metal HAPs (arsenic, beryllium, cadmium, chromium, and mercury) are driven by combustion equipment
- The organic HAPs are driven in large part by the cold vents, which is consistent with the cold vent contribution to the VOC emissions estimates in the 2014 Gulfwide Inventory

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HAP Scoping Study (cont.)

- BOEM plans to estimate HAP emissions for all platforms in the 2017 Gulfwide inventory
- BOEM will also estimate HAP emissions associated with non-platform sources for oil/gas related marine vessels

HAP Scoping Study (cont.)

- Recommended improvements include:
  - Expand the scope to include additional HAPs
  - Re-evaluate the speciation profiles used to estimate non-combustion HAP emissions
    - Profiles used were developed based on information from onshore sources
    - Research the available information to refine the profiles to be more specific to offshore sources
  - Continue to research the emission factors, so the latest available emission factors for all equipment types and pollutants are used

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ANY QUESTIONS?