Department of Environmental Protection

Bureau of Air Quality

Ambient Air Monitoring Investigation Report

Chevron Appalachia Lanco 7H Well Pad Fire Monitoring– February 12 – 20, 2014

EXECUTIVE SUMMARY

Ambient air quality monitoring was conducted for nine days during a natural gas well fire at Lanco 7H well pad in Greene County, PA. The well is owned by Chevron Appalachia. Ambient air monitoring samples collected during the event were analyzed for 57 toxic air pollutants and none of those pollutants were detected at concentrations that would indicate a potential acute or short-term health concern for emergency responders or a "typical" local resident. The results did indicate higher concentrations of several pollutants (Propene, Heptane and 1, 2, 4-Trimethylbenzene) when compared to other areas of the Commonwealth where samples are systematically collected. These concentrations may be associated with the incident but that cannot be verified relative to the event.

BACKGROUND

The Pennsylvania Department of Environmental Protection (DEP) Southwest Regional Office (SWRO) in collaboration with the Bureau of Air Quality, conducted discreet ambient air sampling for toxic compounds in the vicinity of the fire at the Chevron Appalachia Lanco 7H well pad in Dunkard Township, Greene County, PA. The fire was initially reported on February 11, 2014. The SWRO employed the use of evacuated SUMMA® air sampling canisters to collect both instantaneous "grab" samples and 24-hour flow-metered samples in the attempts to characterize potential public exposure to toxic air pollution that could be emitted into the environment as a result of the incident.

Canister sampling began on Wednesday, February 12, 2014 and was terminated on February 20, 2014. Each day of sampling consisted of collecting 2 ambient air "grab" samples in the proximity of residences that were downwind under the visible plume of the gas well fire. The downwind samples were collected daily until the fire was extinguished and the well was capped. Likewise, a single daily upwind grab sample on the opposite side of the incident was also collected to help estimate background concentrations of air contaminants. Additionally one, 24-hour continuous sample was collected daily through the nine- day sampling period. The 24-hour sample was collected at one of the two locations where the daily downwind grab samples were taken.

Both the 24-hour and "grab" samples were collected at meteorologically forecasted downwind locations from the well pad fire but outside of the 500 meter exclusion zone established by the emergency management incident commander. Figures 1 and 2 respectively show the sampling locations for the 24-hour samples and the "grab" samples" collected for the duration of the sampling program. Samples were collected and analyzed using the EPA Toxics Organic Compendium Method 15 (TO-15). Analysis was performed by the Department's Bureau of Laboratories. A summary of this analytical method and the list of chemicals that this method can detect is provided in Attachment A.

The goal of this investigation was to estimate the mean 24-hr ambient air concentration of select toxic volatile organic compounds (VOC) observed through the nine day sampling period. These concentrations can then be compared to historic air toxics concentration data collected at three other air monitoring sites in the Commonwealth. A rural, urban (commercial), and urban (industrial) site will each be compared to the data collected from the incident. This comparison method can inform the Department

as to the nature and extent of the toxic pollution observed during the well fire in comparison to a generally un-impacted rural background location and two urban sites with differing toxic pollution sources.

The “grab” samples can be separated between upwind and downwind samples and can provide a second, though less reliable, method of estimating a mean ambient air toxics concentration during the event and help identify potential peak concentrations that might have acutely endangered public health. The “grab” sample results will also be compared to the data collected at the comparison sites referred to above.

Insufficient data was collected during this short-term investigation to perform any chronic ambient air toxics cancer risk or non-cancer hazard analysis. Ambient air inhalation risk analysis studies require at least one year of systematically collected data to be considered reliable.

Figure 1: Location of 24-hr Canister Sampling Locations and Day(s) Sampled

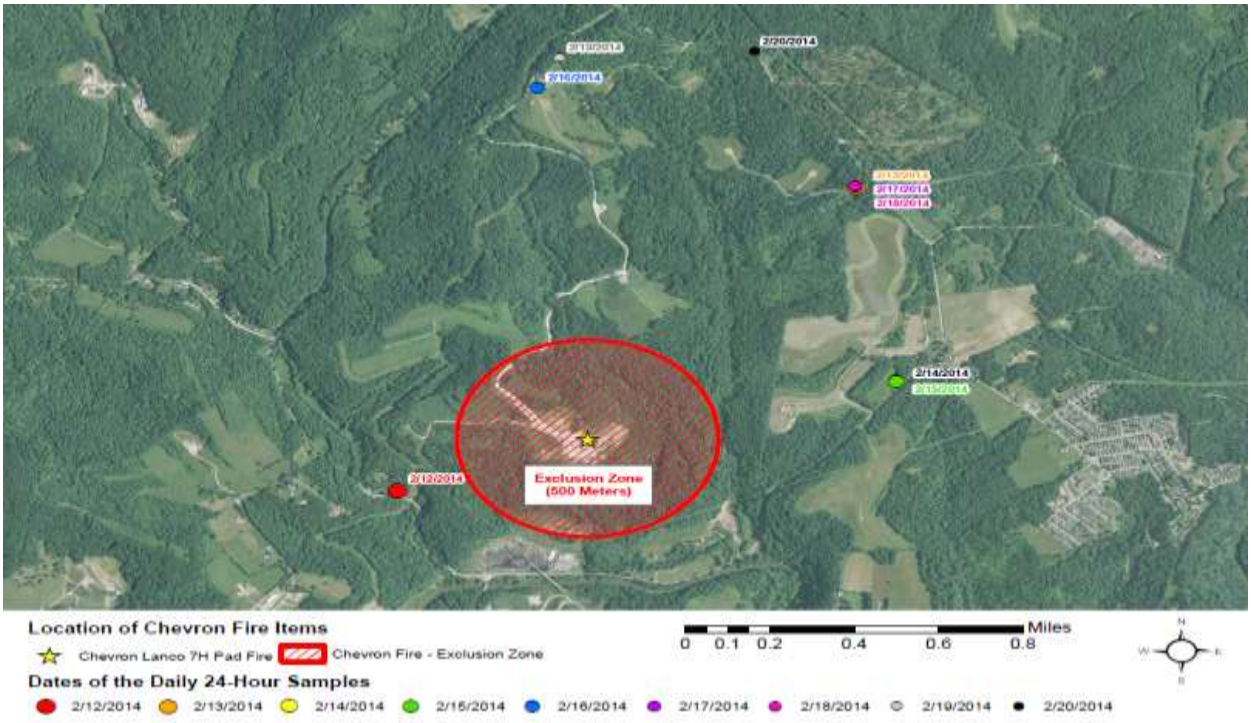
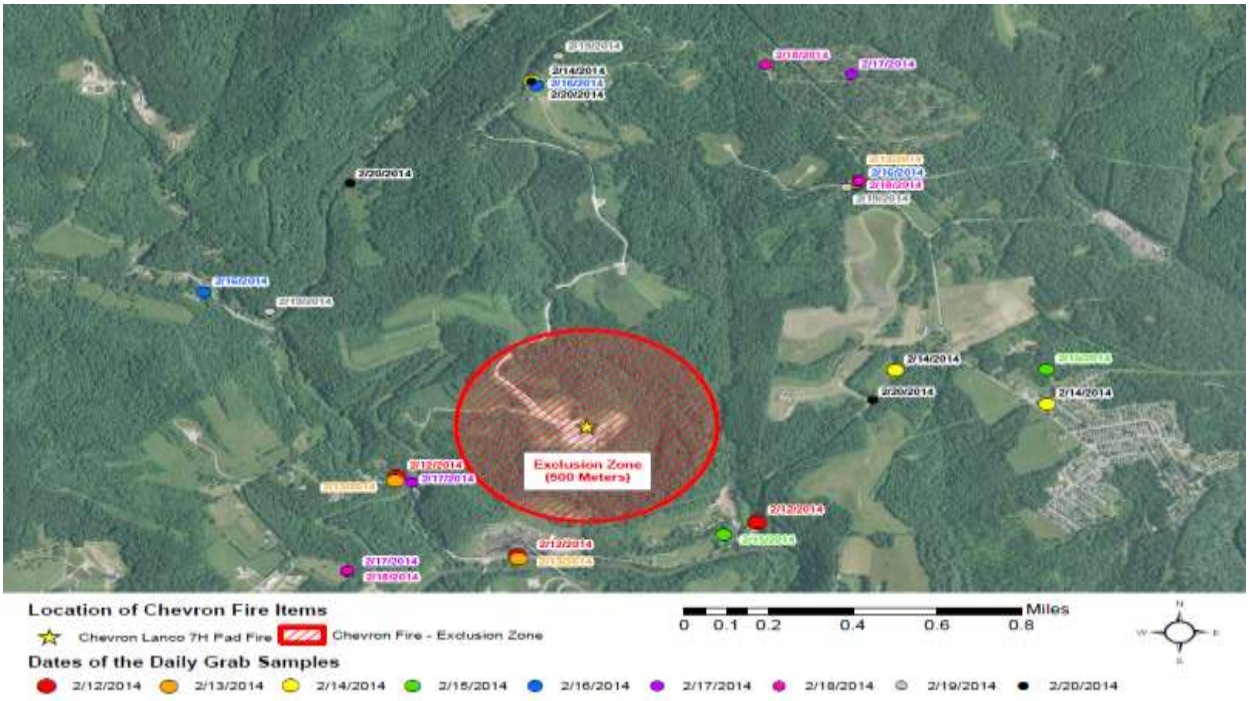


Figure 2: Location of "Grab" Canister Sampling Locations and Day(s) Sampled



RESULTS

24-hr Sampling Period

One 24-hour sample was collected on each day of the sampling period resulting in nine samples. Two of these samples (2/13 and 2/17) were voided as the samplers collected less than the minimum amount of sample required for reliable analysis. However, even with seven valid samples, enough data exists to make a reasonable estimate of the 24-hr mean (arithmetic average) of toxic pollutant concentrations over the nine-day sampling period. A summary of this data is included in Table 1.

Table 1: Collected Data, Non-Detect Rate and 24-Hr Average Concentration by Detected Chemical

Sample Location	No Location	Bald Hill Church Rd	Bald Hill Church Rd	121 Rocky Run Rd	Watertank Rd	Titus Hill Rd	Watertank Rd	Well Fire Site	
Sample Date	2/12/14;	2/14/14;	2/15/14;	2/16/14;	2/18/14;	2/19/14;	2/20/14;		
Sample Type	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	24 hr	9 Day, 24-hr Mean	
Units	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	%ND[A]	Mean[B] (ppbv)
1,1,2-Trichlorotrifluoroethane	0.164	0.115	0.096	0.100	0.119	0.123	0.120	0	0.119
2-Butanone (MEK)	0.822	0.618	0.353	0.491	0.306	0.386	0.216	0	0.456
Acetone	5.800	3.419	2.608	3.467	3.018	3.202	2.210	0	3.389
Benzene	0.450	0.288	0.284	0.319	0.179	0.196	0.124	0	0.263
Carbon Tetrachloride	0.193	0.130	0.108	0.107	0.132	0.131	0.138	0	0.134
Methylene Chloride	0.146	0.262	0.109	0.183	0.120	0.106	0.097	0	0.146
n-Hexane	0.126	0.118	0.096	0.102	0.110	0.086	0.047	0	0.098
Propene	1.433	1.310	5.918	3.423	1.686	1.637	0.992	0	2.343
Toluene	0.224	0.182	0.134	0.147	0.089	0.115	0.075	0	0.138
Acrolein	0.273	0.178	0.258	0.254	0.154	0.132	ND	14	0.208
Chloromethane	1.228	0.627	0.558	0.815	ND	0.811	0.578	14	0.769
Dichlorodifluoromethane	0.996	0.628	0.566	0.706	ND	0.806	0.624	14	0.721
Trichlorofluoromethane	0.429	ND	0.298	0.284	0.355	0.377	ND	29	0.349
1,2-Dichlorotetrafluoroethane	0.067	0.026	ND	ND	ND	0.029	0.023	43	0.036
Cyclohexane	ND	ND	0.043	0.048	0.050	ND	ND	57	0.047
n-Heptane	0.066	0.064	ND	ND	0.058	ND	ND	57	0.063
1,2,4-Trimethylbenzene	0.019	ND	ND	ND	0.021	ND	ND	71	0.020
2-Hexanone	ND	ND	ND	ND	ND	0.035	ND	86	0.035
4-Methyl-2-pentanone (MIBK)	0.034	ND	ND	ND	ND	ND	ND	86	0.034
Carbon Disulfide	ND	ND	ND	ND	ND	0.060	ND	86	0.060
Chloroform	ND	ND	ND	ND	ND	0.039	ND	86	0.039

Compounds in Red are discussed in text. ND = Compound not Detected

A: %ND = Percent of total samples reported as a non-detect

B: Mean (ppbv) = Arithmetic average of detected concentrations in parts per billion by volume

Color shading in % ND column reflects magnitude of detection frequency

>85% % ND | Between 25% and 85% ND | <25% % ND

All other TO-15 chemicals not included in Table 1 were not detected during the sampling period. Only detected data were included in the mean concentration estimation calculation (i.e. no assumed very low-concentration value was substituted for non-detects). The mean 24-hour concentration of detected chemicals was estimated using an arithmetic average of the measurements of the detected compounds. Chemicals that were detected over 75% of the time (ND %< 25) are considered estimates with reasonable certainty. Chemicals detected between 25% and 75% of the time during a sampling period have less certainty associated with their average estimates.

In all cases the estimates of the mean concentration where the chemical is detected in 25% or less of the total number of samples, the mean concentration is assumed to be the detected concentration. For the purpose of comparison to historical sites, this assumption provides a comparative concentration to the other sites, but the confidence in the value reflecting the true mean concentration is very low.

Table 2 shows the calculated average concentration estimates and non-detect rates compared to three historical ambient air toxics monitoring network stations. Additionally, a maximum and minimum value detected at the monitoring network stations in 2013 were included to demonstrate the typical ranges of concentrations of toxic chemicals observed. DEP's Arendtsville site is a background site at a rural location. The Charleroi site is an urban mixed residential/commercial/industrial site at a location predominated by mobile vehicle sources and industry related more to metals and glass manufacture, while the Marcus Hook site is located in an urban industrial area largely influenced by petrochemical operations and mobile sources.

Table 2 – Site Average Concentration Comparison to Historical Air Toxics Data

Sample Location / Sample Date	Well Fire Site		Arendtsville COPAMS		Charleroi COPAMS		Marcus Hook COPAMS		3 SiteMax/Min	
Sample Type	9 Day, 24-hr Mean		2013 Annual Data		2013 Annual Data		2013 Annual Data			
Units	**%ND[A]**	**Mean[B] (ppbv)**	**%ND**	**Mean (ppbv)**	**%ND**	**Mean (ppbv)**	**%ND**	**Mean (ppbv)**	**Max (ppbv)**	**Min (ppbv)**
1,1,2-Trichlorotrifluoroethane	0	0.119	0	0.094	2	0.091	2	0.092	0.130	0.027
2-Butanone (MEK)	0	0.456	6	0.44	7	0.44	7	0.51	1.794	0.045
Acetone	0	3.389	0	4.7	0	4.3	0	5.7	16.057	1.230
Benzene	0	0.263	14	0.13	2	0.17	0	0.37	4.156	0.023
Carbon Tetrachloride	0	0.134	0	0.097	0	0.099	2	0.095	0.134	0.022
Methylene Chloride	0	0.146	38	0.081	25	0.11	13	0.11	0.563	0.038
n-Hexane	0	0.098	72	0.040	16	0.10	3	0.26	0.843	0.022
Propene	0	2.343	0	0.56	0	1.3	0	9.9	37.464	0.083
Toluene	0	0.138	0	0.13	4	0.38	0	0.52	2.758	0.020
Acrolein	14	0.208	0	0.35	6	0.29	5	0.37	1.210	0.027
Chloromethane	14	0.769	0	0.64	0	0.60	0	0.62	0.805	0.229
Dichlorodifluoromethane	14	0.721	0	0.58	0	0.57	0	0.57	0.766	0.132
Trichlorofluoromethane	29	0.349	0	0.27	2	0.26	2	0.26	0.387	0.027
1,2-Dichlorotetrafluoroethane	43	0.036	100	0.024	100	0.024	98	0.028	0.267	0.024
Cyclohexane	57	0.047	70	0.077	40	0.20	31	0.14	0.680	0.021
n-Heptane	57	0.063	74	0.032	38	0.051	17	0.11	0.349	0.021
1,2,4-Trimethylbenzene	71	0.020	100	0.023	96	0.024	69	0.038	0.107	0.023
2-Hexanone	86	0.035	100	0.034	100	0.034	100	0.034	0.034	0.034
4-Methyl-2-pentanone (MIBK)	86	0.034	100	0.031	100	0.031	97	0.033	0.110	0.031
Carbon Disulfide	86	0.060	10	0.21	96	0.040	100	0.038	0.485	0.038
Chloroform	86	0.039	100	0.019	98	0.019	100	0.019	0.069	0.019

Compounds in Red are discussed in text. ND = Compound not Detected

Color shading in % ND column reflects magnitude of detection frequency

>85% % ND | Betw een 25% and 85% ND | <25% % ND

A: %ND = Percent of total samples reported as a non-detect

B: Mean (ppbv) = Arithmetic average of **detected concentrations** in parts per billion by volume

In general, all concentrations of observed toxic pollutants were below ambient long-term toxic pollutant concentration levels that have been associated with unacceptable increase in population cancer risk or non-cancer hazard. It is important to note, though, that while observed mean concentrations of the samples collected were below chronic health impact levels, some pollutants were observed to be at frequencies and/or concentrations more akin to an urban site (e.g. Propene, n-Hexane, Heptane and

1,2,4-Trimethylbenzene) or were detected more frequently at low concentration than what has been observed at the historical comparison sites. Mean Methylene Chloride concentrations were slightly higher and at a more frequent detection rate than the Arendtsville (Background) and Charleroi (Urban/Mixed) sites. The observed mean concentration during the short-term sampling period, however, was still below concentrations associated with long term cancer risk or non-cancer hazard. The source of this was likely the combustion over time of various plastic materials on the site of the accident.

While the compounds described above are likely directly associated with the release and combustion of "wet" natural gas and the combustion of onsite equipment during the course of the fire, the detection of 1, 2-Dichlorotetrafluoroethane in more than ½ the study samples was unexpected. As this chemical (also known as R-114 or Halon 242) is a non-flammable refrigerant, it is rarely detected at other sites. The possibility exists that it may have been used by emergency responders to fight and contain the fire or had been contained on some on-site cooling or fire-suppression apparatus.

Downwind and Upwind "Grab" Samples

Table 3 gives the summary of the collected "grab sample" data from those locations downwind of the fire site. The list is sorted by the percent non-detect rate with the most frequent detections first. Table 4 shows the data collected from the upwind locations. Table 5 compares both the upwind and downwind data to the historical data collected at the three sites used for the 24-hour comparisons in Table 2.

Table 3 – Data Summary of Downwind "Grab" Samples and Estimate of Average Toxic Pollutant Concentration

Sample Location	Pigeon Hill Rd	Bald Hill Chruch Rd (Downwind)	No Location	No Location	Bald Hill Church Rd	Duff Rd	Bald Hill Chruch Rd	875 Bald Hill Church Rd	121 Rocky Run Rd	Davis Town	Pigeon Hill Rd	Watertank Rd	Watertank Rd	Watertank Rd	Watertank Rd	Titus Hill Rd	Titus Hill Rd	Titus Hill Rd	Well Fire Site	
Sample Date; Time	2/12/2014; 15:35	2/12/2014; 15:17	2/13/14; 15:17	2/13/14; 15:30	2/14/14; 15:09	2/14/14; 15:28	2/15/14; 15:35	2/15/14; 15:58	2/16/14; 14:47	2/16/14; 16:32	2/17/14; 14:20	2/17/14; 14:41	2/18/14; 15:24	2/18/14; 16;18	2/19/14; 15:20	2/19/14; 16:05	2/20/14; 14:54	2/20/14; 1611	Downwind Grab (18)	
Sample Type	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	Downwind Grab	%ND[A]	Mean[B] (ppbv)
1,1,2-Trichlorotrifluoroethane	0.080	0.146	0.093	0.088	0.070	0.077	0.081	0.100	0.084	0.088	0.084	0.087	0.093	0.072	0.087	0.094	0.095	0.086	0	0.089
2-Butanone (MEK)	0.387	0.810	0.244	0.513	0.379	0.209	0.378	0.737	0.569	0.638	0.452	0.313	0.233	0.366	0.360	0.314	0.275	0.194	0	0.409
Acetone	2.199	4.900	2.263	3.043	2.077	2.150	2.930	4.929	2.949	4.846	3.136	2.226	2.741	1.847	3.525	2.223	3.774	2.331	0	3.005
Benzene	0.152	0.222	0.875	0.193	0.089	0.103	0.185	0.261	0.204	0.221	0.201	0.206	0.126	0.093	0.127	0.114	0.163	0.097	0	0.202
Carbon Tetrachloride	0.088	0.156	0.109	0.118	0.070	0.084	0.087	0.120	0.088	0.094	0.087	0.094	0.100	0.082	0.099	0.103	0.105	0.097	0	0.099
Chloromethane	0.605	1.345	0.875	0.813	0.495	0.589	0.564	0.654	0.650	0.686	0.684	0.700	0.720	0.584	0.474	0.526	0.622	0.432	0	0.668
Dichlorodifluoromethane	0.549	1.028	0.598	0.624	0.268	0.345	0.482	0.668	0.542	0.581	0.588	0.608	0.649	0.459	0.454	0.560	0.599	0.455	0	0.559
Propene	1.958	1.837	1.249	1.308	0.609	1.260	1.217	1.139	7.918	2.389	6.296	0.940	1.515	0.499	0.657	0.603	1.457	1.897	0	1.930
Trichlorofluoromethane	0.231	0.466	0.271	0.262	0.196	0.245	0.220	0.325	0.235	0.245	0.229	0.239	0.276	0.216	ND	0.297	0.278	0.263	6	0.264
Acrolein	0.086	0.200	0.176	0.096	0.113	0.086	ND	0.378	0.151	0.304	0.169	0.198	0.096	0.089	0.312	ND	0.246	0.102	11	0.175
Methylene Chloride	0.087	0.132	0.115	0.083	0.069	0.087	ND	0.141	0.092	0.083	0.091	0.091	0.103	0.074	ND	0.118	0.096	0.085	11	0.097
n-Hexane	0.071	0.104	0.121	0.086	ND	ND	0.074	0.088	0.201	0.123	0.055	0.046	0.044	ND	0.065	0.057	0.063	ND	22	0.086
Toluene	0.068	0.081	0.699	0.074	ND	ND	0.107	0.161	0.092	0.112	0.128	0.098	ND	ND	0.087	0.062	0.122	0.074	22	0.140
Cyclohexane	0.043	0.068	0.096	0.057	ND	ND	0.041	0.049	0.067	0.062	ND	ND	ND	ND	ND	ND	ND	ND	56	0.060
1,2-Dichlorotetrafluoroethane	ND	ND	ND	ND	ND	ND	ND	0.021	ND	ND	ND	ND	ND	ND	ND	ND	0.020	0.017	83	0.019
n-Heptane	ND	ND	0.057	ND	ND	ND	ND	ND	0.063	ND	ND	ND	ND	ND	ND	ND	ND	ND	89	0.060
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	94	0.005
1,2,4-Trimethylbenzene	ND	ND	0.029	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	0.029
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.019	94	0.019
1,3-Butadiene	ND	ND	0.195	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	0.195
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.007	94	0.007
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.019	ND	94	0.019
Ethylbenzene	ND	ND	0.050	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	0.050
m/p-Xylene	ND	ND	0.141	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	0.141
o-Xylene	ND	ND	0.045	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	0.045
Styrene	ND	ND	0.034	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	0.034

Compounds in Red are discussed in text. ND = Compound not Detected

Color shading in % ND column reflects magnitude of detection frequency

>85% % ND | Betw een 15% and 85% ND | <15% % ND

A: %ND = Percent of total samples reported as a non-detect

B: Mean (ppbv) = Arithmetic average of **detected concentrations** in parts per billion by volume

Table 4 - Data Summary of Upwind (Background) "Grab" Samples and Estimate of Average Toxic Pollutant Concentration

Sample Location	Bald Hill Church Rd (Upwind)	277 Watertank Rd	Titus Hill Rd	218 Titus Hill Rd	277 Watertank Rd	Highland Cemetery Rd	Highland Cemetery Rd	Steet Hill Rd/Pigeon Hill Rd	Titus Hill Rd	Well Fire Site	
Sample Type	2/12/2014; 15:25	2/13/14; 14:56	2/14/14; 13:59	2/15/14; 16:42	2/16/14; 15:33	2/17/14; 15:43	2/18/14; 13:41	2/19/14; 13:45	2/20/14; 16:32	Downwind Grab (18)	
Parameter	Bkgrd Grab	Bkgrd Grab	Bkgrd Grab	Bkgrd Grab	Bkgrd Grab	Bkgrd Grab	Bkgrd Grab	Bkgrd Grab	Bkgrd Grab	**%ND[A]**	**Mean[B] (ppbv)**
MEK	0.168	0.281	0.115	0.397	0.384	0.325	0.217	0.372	0.280	0	0.282
Acetone	1.852	2.752	1.037	2.846	1.945	2.178	1.660	2.735	2.474	0	2.164
Benzene	0.105	0.504	0.143	0.189	0.211	0.193	0.124	0.858	0.150	0	0.275
Chloromethane	0.736	0.774	0.330	0.663	0.694	0.723	0.650	0.604	0.732	0	0.656
Dichlorodifluoromethane	0.612	0.555	0.244	0.588	0.643	0.602	0.478	0.630	0.711	0	0.563
Propene	0.838	0.698	0.800	1.180	2.826	3.191	0.553	1.599	0.658	0	1.371
Toluene	0.049	0.277	0.071	0.085	0.098	0.085	0.051	0.177	0.173	0	0.119
Trichlorofluoromethane	0.271	0.253	0.102	0.234	0.247	0.246	0.274	0.312	0.330	0	0.252
1,1,2-Trichlorotrifluoroethane	0.086	0.085	ND	0.091	0.089	0.084	0.096	0.102	0.114	11	0.093
Methylene Chloride	0.080	0.102	ND	0.084	0.089	0.093	0.097	0.098	0.098	11	0.093
n-Hexane	0.051	0.097	0.061	0.072	0.155	ND	0.053	0.118	0.050	11	0.082
Acrolein	0.116	0.269	ND	0.168	ND	0.160	0.103	0.292	0.115	22	0.175
Carbon Tetrachloride	0.100	0.107	ND	0.089	0.094	0.091	0.102	0.114	ND	22	0.100
Cyclohexane	ND	ND	ND	ND	0.060	ND	ND	0.048	ND	78	0.054
1,2-Dichlorotetrafluoroethane	ND	ND	ND	ND	ND	ND	ND	0.019	ND	89	0.019
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	0.042	ND	89	0.042
Styrene	ND	ND	ND	ND	ND	ND	ND	0.060	ND	89	0.060

Compounds in Red are discussed in text. ND = Compound not Detected

Color shading in % ND column reflects magnitude of detection frequency

>85% % ND | Between 25% and 85% ND | <25% % ND

A: %ND = Percent of total samples reported as a non-detect

B: Mean (ppbv) = Arithmetic average of **detected concentrations** in parts per billion by volume

Table 5 shows the downwind grab sample results and compares them to the historical site data presented in Table 2. Table 6 follows with the upwind "grab" sample results and comparison.

Table 5 – Site Downwind "Grab" Sample Average Concentration Comparison to Historical Air Toxics Data

Sample Location	Well Fire Site		Arendtsville COPAMS		Charleroi COPAMS		Marcus Hook COPAMS		3 SiteMax/Min	
Sample Date; Time	Downwind Grab (18)		2013 Annual Data		2013 Annual Data		2013 Annual Data			
Sample Type	%ND[A]	Mean[B] (ppbv)	%ND	Mean (ppbv)	%ND	Mean (ppbv)	%ND	Mean (ppbv)	Max	Min
1,1,2-Trichlorotrifluoroethane	0	0.089	0	0.094	2	0.091	2	0.092	0.130	0.027
2-Butanone (MEK)	0	0.409	6	0.44	7	0.44	7	0.51	1.794	0.045
Acetone	0	3.005	0	4.7	0	4.3	0	5.7	16.057	1.230
Benzene	0	0.202	14	0.13	2	0.17	0	0.37	4.156	0.023
Carbon Tetrachloride	0	0.099	0	0.097	0	0.099	2	0.095	0.134	0.022
Chloromethane	0	0.668	0	0.64	0	0.60	0	0.62	0.805	0.229
Dichlorodifluoromethane	0	0.559	0	0.58	0	0.57	0	0.57	0.766	0.132
Propene	0	1.930	0	0.56	0	1.3	0	9.9	37.464	0.083
Trichlorofluoromethane	6	0.264	0	0.27	2	0.26	2	0.26	0.387	0.027
Acrolein	11	0.175	0	0.35	6	0.29	5	0.37	1.210	0.027
Methylene Chloride	11	0.097	38	0.081	25	0.11	13	0.11	0.563	0.038
n-Hexane	22	0.086	72	0.040	16	0.10	3	0.26	0.843	0.022
Toluene	22	0.140	0	0.13	4	0.38	0	0.52	2.758	0.020
Cyclohexane	56	0.060	70	0.077	40	0.20	31	0.14	0.680	0.021
1,2-Dichlorotetrafluoroethane	83	0.019	100	0.024	100	0.024	98	0.028	0.267	0.024
n-Heptane	89	0.060	74	0.032	38	0.051	17	0.11	0.349	0.021
1,1,1-Trichloroethane	94	0.005	100	0.022	100	0.022	100	0.022	0.022	0.022
1,2,4-Trimethylbenzene	94	0.029	100	0.023	96	0.024	69	0.038	0.107	0.023
1,2-Dichloroethane	94	0.019	100	0.018	100	0.018	98	0.018	0.038	0.018
1,3-Butadiene	94	0.195	100	0.046	100	0.046	100	0.046	0.046	0.046
Carbon Disulfide	94	0.007	10	0.21	96	0.040	100	0.038	0.485	0.038
Chloroform	94	0.019	100	0.019	98	0.019	100	0.019	0.069	0.019
Ethylbenzene	94	0.050	100	0.020	81	0.027	61	0.037	0.118	0.020
m/p-Xylene	94	0.141	98	0.036	63	0.077	36	0.12	0.490	0.034
o-Xylene	94	0.045	100	0.021	80	0.029	58	0.042	0.146	0.021
Styrene	94	0.034	100	0.021	98	0.022	100	0.021	0.059	0.021

Compounds in Red are discussed in text.

Color shading in % ND column reflects magnitude of detection frequency

>85% % ND | Between 25% and 85% ND | <25% % ND

A: %ND = Percent of total samples reported as a non-detect

B: Mean (ppbv) = Arithmetic average of **detected concentrations** in parts per billion by volume

Table 6 – Site Upwind "Grab" Sample Average Concentration Comparison to Historical Air Toxics Data

Sample Location	Well Fire Site		Arendtsville COPAMS		Charleroi COPAMS		Marcus Hook COPAMS		3 Site Max/Min	
Sample Type	Downwind Grab (18)		2013 Annual Data		2013 Annual Data		2013 Annual Data			
Parameter	%ND[A]	Mean[B] (ppbv)	%ND	Mean (ppbv)	%ND	Mean (ppbv)	%ND	Mean (ppbv)	Max	Min
MEK	0	0.282	6	0.44	7	0.44	7	0.51	1.794	0.045
Acetone	0	2.164	0	4.7	0	4.3	0	5.7	16.057	1.230
Benzene	0	0.275	14	0.13	2	0.17	0	0.37	4.156	0.023
Chloromethane	0	0.656	0	0.64	0	0.60	0	0.62	0.805	0.229
Dichlorodifluoromethane	0	0.563	0	0.58	0	0.57	0	0.57	0.766	0.132
Propene	0	1.371	0	0.56	0	1.3	0	9.9	37.464	0.083
Toluene	0	0.119	0	0.13	4	0.38	0	0.52	2.758	0.020
Trichlorofluoromethane	0	0.252	0	0.27	2	0.26	2	0.26	0.387	0.027
1,1,2-Trichlorotrifluoroethane	11	0.093	0	0.094	2	0.091	2	0.092	0.130	0.027
Methylene Chloride	11	0.093	38	0.081	25	0.11	13	0.11	0.563	0.038
n-Hexane	11	0.082	72	0.040	16	0.10	3	0.26	0.843	0.022
Acrolein	22	0.175	0	0.35	6	0.29	5	0.37	1.210	0.027
Carbon Tetrachloride	22	0.100	0	0.097	0	0.099	2	0.095	0.134	0.022
Cyclohexane	78	0.054	70	0.077	40	0.20	31	0.14	0.680	0.021
1,2-Dichlorotetrafluoroethane	89	0.019	100	0.024	100	0.024	98	0.028	0.267	0.024
Ethylbenzene	89	0.042	100	0.020	81	0.027	61	0.037	0.118	0.020
Styrene	89	0.060	100	0.021	98	0.022	100	0.021	0.059	0.021

Compounds in Red are discussed in text.

Color shading in % ND column reflects magnitude of detection frequency

>85% % ND | Between 25% and 85% ND | <25% % ND

A: %ND = Percent of total samples reported as a non-detect

B: Mean (ppbv) = Arithmetic average of **detected concentrations** in parts per billion by volume

Tables 5 and 6 show that most of the observed concentrations of toxic chemicals were consistent with the comparison sites when compared to the ranges of values observed at the comparison sites. While Benzene, Propene and Hexane concentrations in the downwind samples appear to be more similar to samples collected at a more urban site than a rural one, the upwind results did not vary significantly. This might imply that the pre-accident background concentrations might have been already slightly higher than the rural background comparison site at Arendtsville. More long-term ambient monitoring data from Greene County would be needed to help determine if background concentrations in the Greene County are elevated in comparison with the rural background site in Arendtsville.

Conclusions

Ambient monitoring samples collected during the Chevron Lanco 7H well pad fire were analyzed for 57 toxic air pollutants. The ground-level concentrations of those toxic air pollutants were not detected at levels in excess of concentrations that would indicate a potential acute or short-term health concern for emergency responders or a "typical" local resident. The results did indicate higher concentrations of several pollutants (Propene, Heptane and 1, 2, 4-Trimethylbenzene) when compared to other areas of the Commonwealth where samples are collected. These concentrations may be associated with the incident but that cannot be verified relative to the event. The presence of 1, 2-Dichlorotetrafluoroethanewhich has rarely been detected during other historical monitoring efforts is a potential fire suppressant or on-site refrigerant.

Attachment a – Summary of TO-15 Analytical Method

Source: U.S. Environmental Protection Agency – Air Toxics Monitoring Methods Webpage
http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-15r.pdf

Method Name: *Compendium Method TO-15: Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/Mass Spectrometry (GC/MS)*

Scope: This method documents sampling and analytical procedures for the measurement of subsets of the 97 volatile organic compounds (VOCs) that are included in the 189 hazardous air pollutants (HAPs) listed in Title III of the Clean Air Act Amendments of 1990. 57 of these 97 compounds are commonly monitored as they are largely the most likely to be actually detected in ambient air in samples taken in the United States.

Summary of Method:

The atmosphere is sampled by introduction of air into a specially-prepared six liter stainless steel (Summa) canister. The canister is evacuated to sub-ambient (< 1 Atmosphere) pressure. In the case of a long-duration sample, a sample of air is drawn through a sampling train comprised of components that regulate the rate and duration of sampling into the pre-evacuated canister. A "grab" sample is taken without the sampling train and is an instantaneous six liter air sample.

After the air sample is collected, the canister valve is closed, an identification tag is attached to the canister, and the canister is transported to the laboratory for analysis. Upon receipt at the laboratory, the canister tag data is recorded and the canister is stored until analysis. All samples must be analyzed within 30 days of collection to be considered valid for quality control/assurance purposes.

To analyze the sample, a known volume of sample is directed from the canister through a solid multisorbent concentrator. A portion of the water vapor in the sample breaks through the concentrator during sampling, to a degree depending on the multisorbent composition, duration of sampling, and other factors. Water content of the sample can be further reduced by dry purging the concentrator with helium while retaining target compounds. After the concentration and drying steps are completed, the VOCs are thermally desorbed, entrained in a carrier gas stream, and then focused in a small volume by trapping on a reduced temperature trap or small volume multisorbent trap. The sample is then released by thermal desorption and carried onto a gas chromatographic column for separation.

The analytical strategy for Compendium Method TO-15 involves using a high resolution gas chromatograph (GC) coupled to a mass spectrometer. Mass spectra for individual peaks in the total ion chromatogram are examined with respect to the fragmentation pattern of ions corresponding to various VOCs including the intensity of primary and secondary ions. The fragmentation pattern is compared with stored spectra taken under similar conditions, in order to identify the compound. For any given compound, the intensity of the primary fragment is compared with the system response to the primary fragment for known amounts of the compound. This establishes the compound concentration that exists in the sample.

For this investigation, the DEP analyzed for 57 of the toxic chemicals provided for in the TO-15 method. These are listed in Table A-1.

Table A-1: TO-15 Compound List by Chemical and Chemical Abstract Service (CAS) Number

Toxics Monitoring Analyte List by Analysis Type			
TO-15 Analyte List (Toxic VOC)			
Analyte	**CAS#**	**Analyte**	**CAS#**
1,1,1-Trichloroethane	71-55-6	Chloroethane	75-00-3
1,1,2,2-Tetrachloroethane	79-34-5	Chloroethene (vinyl chloride)	75-01-4
1,1,2-Trichloroethane	79-00-5	Chloroform	67-66-3
1,1,2-Trichlorotrifluoroethane	76-13-1	Chloromethane	74-87-3
1,1-Dichloroethane	75-34-3	cis-1,2-Dichloroethene	156-59-2
1,1-Dichloroethene	75-35-4	cis-1,3-Dichloropropene	10061-01-5
1,2,4-Trichlorobenzene	120-82-1	Cyclohexane	110-82-7
1,2,4-Trimethylbenzene	95-63-6	Dibromochloromethane	124-48-1
1,2-Dibromoethane	106-93-4	Dichlorodifluoromethane	75-71-8
1,2-Dichlorobenzene	95-50-1	Ethylbenzene	100-41-4
1,2-Dichloroethane	107-06-2	Hexachlorobutadiene	87-68-3
1,2-Dichloropropane	78-87-5	m/p-Xylene	108-38-3
1,2-Dichlorotetrafluoroethane	76-14-2	MEK	78-93-3
1,3,5-Trimethylbenzene	108-67-8	Methyl Tert-Butyl Ether	1634-04-4
1,3-Butadiene	106-99-0	Methylene Chloride	75-09-2
1,3-Dichlorobenzene	541-73-1	MIBK	108-10-1
1,4-Dichlorobenzene	106-46-7	n-Heptane	142-82-5
1-Bromopropane	106-94-5	n-Hexane	110-54-3
1-Ethyl-4-methylbenzene	622-96-8	o-Xylene	95-47-6
2-Hexanone	591-78-6	Propene	115-07-1
Acetone	67-64-1	Styrene	100-42-5
Acrolein	107-02-8	Tetrachloroethene	127-18-4
Benzene	71-43-2	Tetrahydrofuran	109-99-9
Bromodichloromethane	75-27-4	Toluene	108-88-3
Bromoform	75-25-2	trans-1,2-Dichloroethene	156-60-5
Bromomethane	74-83-9	trans-1,3-Dichloropropene	10061-02-6
Carbon Disulfide	75-15-0	Trichloroethene	79-01-6
Carbon Tetrachloride	56-23-5	Trichlorofluoromethane	75-69-4
Chlorobenzene	108-90-7		