Analysis of Additional Data Provided By Alpha Analytical

Summary

- In May 2019, the Massachusetts Department of Environmental Protection (MassDEP) obtained and made available revised laboratory reports received from Alpha Analytical, which is the laboratory MassDEP contracted with to conduct sample analysis for volatile organic compounds (VOCs) during July and August 2018 as part of the Fore River Health Impact Assessment (HIA).
- The revised reports include sample results for an additional 25 VOCs. The original report contained results for 40 VOCs.[1]
- The results show that 13 VOCs were not detected while 12 VOCs were detected at low levels:
    - Of the 12 VOCs detected, no results exceeded MassDEP's 24-hour air guidelines.
    - On 3 days, one VOC, 1,3-butadiene, was above annual air guidelines. 1,3-butadiene is commonly found in ambient air and is attributable to multiple sources, including car and truck emissions.
- MassDEP evaluated the new data and determined that the additional data does not change the findings or recommendations of the HIA, including the finding that estimated air emissions from the proposed compressor station in Weymouth are not likely to cause health effects through direct exposure because estimated air emissions do not exceed daily or annual health-protective standards or guidelines.
- The Massachusetts Department of Public Health (MDPH) and MassDEP consulted on the evaluation of the new data, and MDPH concluded that the revised Alpha Analytical Laboratory data does not change the baseline health profile or warrant review of additional health outcome data.

Background

In July 2017, Governor Baker directed MDPH and MassDEP to jointly prepare a health impact assessment related to the proposed compressor station in Weymouth. The goal of the assessment was to document current background air levels at the site and the current health status of the community, to consider the future air quality impacts of the proposed compressor station on public health, and to recommend actions to address concerns and potential impacts.

In 2018, MassDEP, MDPH, and the Metropolitan Area Planning Council, who served as the consultant for this effort, completed the HIA for the Fore River Area, which was published on January 4, 2019. The HIA focused on potential changes to community health that could occur due to the construction and operation of the proposed compressor station. Based on results of a public scoping process, the HIA prioritized three potential pathways for potential health impacts: air quality, noise and land use and natural resources. As part of the HIA, MassDEP conducted ambient air monitoring to better define existing levels of VOCs in the Fore River area. MassDEP also conducted an assessment of how emissions from the proposed compressor station might change exposure levels in the surrounding areas. Modeled

[1] For one VOC, 1,1,2,2-Tetrachloroethane, Alpha Analytical reported sample results in its original reports but not in the revised reports (due to different VOC target lists); however, the sample results in the original reports are valid.

concentrations of criteria pollutants were compared to EPA's National Ambient Air Quality Standards (NAAQS) and modeled concentrations of VOCs were compared to MassDEP's Allowable Ambient Limits (AALs) and Threshold Effects Exposure Limits (TELs), which are guidelines used by MassDEP to evaluate air emission sources.[2]

Air Quality Monitoring

To assess existing air quality conditions, MassDEP performed two phases of ambient air monitoring for VOCs in the Fore River area during the summer and fall of 2018.

The first phase of monitoring was from July 7, 2018 through August 13, 2018. MassDEP placed air sampling canisters that collected 24-hour samples at five locations on an every 6th day schedule for 7 weeks, which ensured that every day of the week was sampled. MassDEP contracted with Alpha Analytical to analyze the samples, using EPA Method TO-15. All sampling results received from Alpha Analytical, which included 40 VOCs, were posted on the HIA webpage on MAPC's website.

The sampling results showed that all of the 24-hour sample results were below MassDEP's 24-hour TEL guidelines, in many cases by orders of magnitude. While not directly comparable, some of the 24-hour levels (e.g., benzene, carbon tetrachloride, chloroform, 1,2-dichloroethane) were above MassDEP's annual AAL guidelines. As discussed in the HIA, overall, the levels of VOCs reported were consistent with levels measured in other developed areas (including in Lynn and Boston where MassDEP routinely conducts VOC air monitoring) and at levels that generally would be expected to be present in background.

MassDEP also asked Alpha Analytical to report tentatively identified compounds (TICs) from each sample. As discussed in the HIA, a TIC is a non-target compound that can be detected by an analytical testing method, but the identity and concentration of the compound cannot be confirmed by the specific analytical testing method being used. No definitive conclusions can be drawn from the TICs reported data. The HIA did note that the only TIC that was reported above a TEL or AAL was methanol (methanol is not carcinogenic so the TEL and AAL are the same value) and explained that based on an updated EPA toxicity value, the methanol TEL would be well above the TIC levels reported.[3]

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[2] AALs and TELs are MassDEP's health-and science-based air guidelines used to evaluate potential human health risk from exposures to chemicals in air. AALs are based on known or suspected carcinogenic health effects and represent a concentration associated with a one in one million excess lifetime cancer risk over a lifetime of continuous exposure. TELs are based on non-cancer health effects. The TEL is a concentration intended to protect the general population, including sensitive populations such as children, from adverse health effects over a lifetime of continuous exposure. TELs are decreased by a factor of 5 (i.e., reduced to 20% of the limit) to take into account the fact that people may be exposed to a chemical from other sources, including indoor air, food, soil and water. Taken together, AALs and TELs are intended to protect sensitive members of the population from harmful effects assuming exposure to the same average concentration 24 hours each day for 70 years. MassDEP uses AALs and TELs primarily in its air pollution control permitting program as screening levels to ensure that a source's contribution to risk from air toxics is insignificant.

[3] The methanol TEL of 7.13 $\mu g/m^3$ was derived in 1990. In 2013, EPA published a new toxicity value for methanol indicating that it is much less toxic. An updated TEL based on that new information would be approximately 4,000 $\mu g/m^3$. The highest estimated concentration of methanol as a TIC was 60.1 $\mu g/m^3$. MassDEP has not updated the methanol TEL because it not emitted to a significant degree from Massachusetts sources. Acetaldehyde was also

The second phase of monitoring was conducted from August 1 through November 30, 2018 in which MassDEP operated a semi-continuous monitor with gas chromatograph located at the Weymouth MWRA pump station to collect samples of benzene, toluene, ethyl benzene and xylenes in order to obtain a larger set of data and to observe changes over time. MassDEP also collected 24-hour formaldehyde and acetaldehyde samples every 6 days at the same location. The semi-continuous monitoring showed levels of benzene below 24-hour TELs but above annual AALs, similar to some of the canister sampling from the first phase of monitoring as well as MassDEP monitoring in Boston and Lynn. The formaldehyde monitoring showed some 24-hour samples above the TEL and some below the TEL, and showed levels above annual AALs. These levels are similar to formaldehyde levels MassDEP has measured in Boston and Lynn. The acetaldehyde monitoring showed 24-hour samples below the TEL, but above the AAL. These levels are similar to acetaldehyde levels MassDEP has measured in Boston and Lynn.

To determine potential changes in air quality, MassDEP analyzed air dispersion modeling data submitted by Enbridge as part of the air permit application for the proposed compressor station. As part of its air quality permit application, Enbridge was required to do air dispersion modeling, using EPA's AERMOD air quality dispersion model, to estimate potential air emissions from the proposed compressor station, including VOCs. Modeling demonstrated that maximum modeled concentrations of all VOCs were below TELs and AALs. MassDEP's analysis as part of the HIA showed that the highest concentrations were at the compressor station site, and that concentrations decreased rapidly moving offsite and would contribute negligible additional concentrations to ambient air.[4]

Based on the analysis, the HIA found that the estimated air emissions from the proposed station are not likely to cause health effects through direct exposure because the emissions do not exceed daily or annual health-protective regulatory standards or guidelines. The HIA found that the facility could have potential health effects through other mechanisms, however, including increased stress among residents in surrounding areas and changes in perception about use of outdoor spaces and real estate property values.

May 2019 Revised Alpha Analytical Reports

In May 2019, based on a comparison of VOCs analyzed as part of the HIA and VOCs analyzed by the Rhode Island Health Laboratory[5], MassDEP requested that Alpha Analytical calculate and provide results

noted as a TIC at levels above the AAL. However, TO-15 is not the preferred method for acetaldehyde, so MassDEP conducted separate testing for acetaldehyde and formaldehyde using TO-11a as part of a second phase of monitoring.

[4] This analysis focused on benzene, formaldehyde, and acrolein because these VOCs had modeled maximum concentrations closest to their respective TELs or AALs.

[5] Outside the scope of the HIA, MassDEP took additional samples at a location at the Weymouth MWRA pump station between August 12 and November 30 on an every 12th day schedule, and sent those canisters, along with routine Lynn and Boston canisters, to the Rhode Island Health Laboratory for analysis. While there are some differences in the Rhode Island lab and Alpha Analytical lab analysis and in the suite of VOCs analyzed, the Rhode Island lab results are generally consistent with the Alpha lab results and the results from routine monitoring at Boston and Lynn stations.

for a broader suite of VOCs based on the original samples that had been taken in 2018. In response, Alpha Analytical Laboratory provided revised reports that included analysis for the additional 25 VOCs.

While the originally reported data covered 40 VOCs, the additional data provides analysis of an additional 25 compounds. Of the 25 additional VOCs analyzed, 12 VOCs were detected and 13 were reported as non-detect (i.e., not detected at or above the reporting limit for the sample). Of the 12 VOCs detected no result exceeded MassDEP's 24-hour TELs,[6] and only 1,3-butadiene exceeded the AAL in four samples out of 42.[7] These 1,3-butadiene samples were at three different locations on two different days (two of the four samples were at the same location on the same day in Quincy, which had sampling of two side-by-side canisters for quality control purposes). The levels of 1,3-butadiene detected are generally consistent with levels measured in Boston and Lynn and typical of background in developed areas. After reviewing the new data, MassDEP and MDPH determined that these additional results would not change the findings of the HIA since the HIA already noted that there are low levels of VOCs in the environment.[8]

The revised reports also included some changes to reported TICs. Several changes were due to the expansion of the list of VOCs being analyzed, since some of the VOCs which had appeared as TICs in Alpha Analytical's initial analysis became target VOCs in the revised reports. Other changes in TICs were minor and the result of revised estimates Alpha Analytical made when it developed the revised reports. As noted, a TIC is a non-target compound that can be detected by an analytical testing method, but the identity and concentration of the compound cannot be confirmed by the specific analytical testing method being used. No definitive conclusions can be drawn from the reported TICs.

Impact on HIA

As noted above, the only VOC sample results from the additional 25 VOCs that exceeded an AAL were four samples for 1,3-butadiene. The reported levels of 1,3-butadiene were well below the TEL. 1,3-butadiene is ubiquitous in ambient air in developed areas[9]. Sources of 1,3-butadiene released into the air include motor vehicle exhaust, manufacturing and processing facilities, forest fires or other combustion, and cigarette smoke (https://www.epa.gov/sites/production/files/2016-08/documents/13-

[6] One carbon disulfide value was reported above the TEL; however, this was from an invalid sample.

[7] AALs and TELs have not been developed for all VOCs. MassDEP has developed AALs and TELS for chemicals of most concern to MassDEP's air program, including ones for which toxicity information exists and ones that are known to be in the air in some areas or in emissions from some facilities at levels of potential concern. AAL and TEL values are not available for eight of the compounds reported as being detected in one or more samples in the new data set. However, EPA has published Regional Screening Levels for 5 of these compounds (Dichlorodifluoromethan, Chloromethane, n-hexane, 1,2,4- Trimethylbenzene, 1,3,5- Trimethylbenzene). RSLs are considered by EPA to be health protective for people, including sensitive subgroups, over a lifetime of exposure. Reported concentrations for these 5 compounds were below the RSLs.

[8] MassDEP notes that there were two minor changes in analysis results for the original 40 VOCs between the original and revised Alpha Analytical reports. The acetone result from the 7/26/18 sample at the Quincy Germantown 2 site was changedfrom 2.20 to 2.16 ppb, and the 1,2 dichloroethane result for the 8/13/18 sample at the Weymouth Fore River Energy Center (FREC) site was changed from .021 ppb to non-detect.

[9] The average background concentration of 1,3-butadiene in the air in cities and suburban areas ranges from 0.1 to 2 $\mu g/m^3$ (0.04 – 1 ppb) with a mean concentration of 0.13 $\mu g/m^3$ (0.59 ppb). Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for 1,3-Butadiene. U.S. Department of Health and Human Services.

butadiene.pdf). The levels of 1,3-butadiene reported by Alpha Analytical are generally consistent with levels monitored at the Lynn and Boston sites and are lower than background concentrations measured in many urban and suburban areas in the United States.

Modeling of the potential emissions of 1,3 butadiene from the proposed compressor station estimated that the maximum annual ambient concentration would be 8.7% of the AAL, or ten times lower than the AAL. This maximum concentration would occur at the site of the proposed compressor station and decrease farther away from the site. The compressor station emissions of 1,3-butadiene are expected to contribute negligible levels to those existing in ambient air.

MassDEP evaluated the new data and determined that it does not change the overall findings or recommendations of the HIA, including the finding that estimated air emissions from the proposed compressor station are not likely to cause health effects through direct exposure because estimated air emissions do not exceed daily or annual health-protective standards or guidelines.[10] The HIA acknowledged that there already were existing background levels of common VOCs that exceed AALs and that the emissions from the compressor station would add negligible concentrations to this background. The results of the monitoring levels of VOCs, including the additional 25 VOCs, are consistent with results that would be expected in developed areas, and are generally consistent with results from MassDEP's routine VOC monitoring in Lynn and Boston. MDPH and MassDEP consulted on the evaluation of the new data, and MDPH concluded that the revised Alpha Analytical data does not change the baseline health profile or warrant review of additional health outcome data.

[10] Please note that in reviewing the original and revised Alpha Analytical Laboratory reports, MassDEP identified 6 transcription errors that occurred in the preparation of Figure 47 of the HIA, including: July 7- 8/Weymouth Enbridge for total xylene should be .634 instead of .22; July 13-14/Braintree BELD for Ethyl Benzene should be 0.087 instead of ND; July 19-20/Weymouth Enbridge for Ethyl Benzene should be 0.10 instead of ND; August 6-7/Braintree BELD for Tetrachloroethene should be 0.264 instead of ND and for Styrene should be 0.136. These values are below applicable AALs and TELs. In addition MassDEP notes that 1,2-Dichloroethane was detected at 0.105 in the July7- 8/Weymouth Enbridge sample, above the AAL.

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Additional VOCs Detected in Revised Alpha Analytical Reports

Units = ppb

Sample Date / VOC Detected	Hingham Stodder's Neck	Quincy Germantown-1	Quincy Germantown-2	Weymouth Enbridge	Weymouth FREC	Braintree BELD	TEL	AAL
July 7 to July 8, 2018								
Dichlorodiflouromethane	0.447	0.416	0.513	0.451	0.454	0.436		
Chloromethane	0.435	0.415	0.56	0.442	0.445	0.448		
1,3-Butadiene	ND	ND	ND	0.023	ND	0.021	0.54	0.002
Trichloroflouromethane	0.216	0.200	0.268	0.217	0.223	0.209		
Freon-113	0.062	0.061	0.091	0.071	0.064	0.064		
Vinyl Acetate	ND	ND	ND	0.248	0.388	ND	8.52	2.27
Tetrahydrofuran	0.904	ND	ND	ND	ND	ND	54.42	27.21
n-Hexane	ND	ND	ND	ND	0.302	ND		
Cyclohexane	ND	ND	ND	ND	0.211	ND	81.63	81.63
2,2,4-Trimethylpentane	ND	ND	ND	0.267	0.264	ND		
1,2,4-Trimethylbenzene	ND	0.045	ND	0.029	0.043	ND		
July 13 to July 14, 2018								
Dichlorodiflouromethane	0.458	0.439	0.419	0.451	0.442	0.45		
Chloromethane	0.435	0.388	0.373	0.413	0.382	0.407		
Trichloroflouromethane	0.216	0.217	0.206	0.218	0.217	0.227		
Freon-113	0.063	0.057	0.058	0.063	0.055	0.051		
Tetrahydrofuran	ND	ND	ND	ND	0.243	ND	54.42	27.21
n-Hexane	ND	ND	ND	ND	0.348	ND		
1,2,4-Trimethylbenzene	ND	ND	ND	ND	0.04	ND		
July 19 to July 20, 2018								
Dichlorodiflouromethane	0.364	0.37	0.382	0.37	0.374	0.37		
Chloromethane	0.454	0.458	0.467	0.459	0.449	0.466		
Trichloroflouromethane	0.17	0.171	0.174	0.175	0.17	0.176		
Freon-113	0.051	0.054	0.052	0.054	0.05	0.052		
Vinyl Acetate	ND	ND	0.296	0.207	0.272	0.221	8.52	2.27
n-Hexane	ND	ND	ND	ND	0.217	0.301		
1,2,4-Trimethylbenzene	ND	ND	ND	ND	0.031	0.024		
July 25 to July 26, 2018								
Dichlorodiflouromethane	0.4	0.389	0.39	0.372	0.395	0.399		
Chloromethane	0.518	0.48	0.483	0.479	0.487	0.503		
Trichloroflouromethane	0.178	0.171	0.171	0.171	0.173	0.175		
Freon-113	0.056	0.053	0.053	0.052	0.054	0.055		
July 31 to August 1, 2018								
Dichlorodiflouromethane	0.395	0.394	0.392	0.393	0.391	0.392		
Chloromethane	0.483	0.477	0.485	0.483	0.477	0.49		
Trichloroflouromethane	0.179	0.178	0.18	0.178	0.176	0.176		
Freon-113	0.056	0.054	0.055	0.054	0.052	0.053		
Vinyl Acetate	0.209	0.309	0.24	0.252	ND	ND	8.52	2.27
Tetrahydrofuran	0.832	ND	ND	ND	ND	ND	54.42	27.21
n-Hexane	0.584	0.547	ND	0.515	ND	ND		
Cyclohexane	ND	0.362	ND	ND	ND	ND	81.63	81.63
1,2,4-Trimethylbenzene	0.021	0.066	ND	0.097	ND	ND		
1,3,5-Trimethylbenzene	ND	ND	ND	0.03	ND	ND		
August 6 to August 7, 2018								
Dichlorodiflouromethane	0.406	0.379	0.411	0.36	0.393	0.389		
Chloromethane	0.512	0.485	0.503	0.509	0.539	0.48		
1,3-Butadiene	ND	0.02	0.021	ND	ND	ND	0.54	0.002
Trichloroflouromethane	0.194	0.187	0.191	0.186	0.194	0.184		
Freon-113	0.06	0.058	0.059	0.061	0.06	0.057		
Vinyl Acetate	0.398	0.48	0.484	0.592	0.664	0.681	8.52	2.27
n-Hexane	ND	ND	ND	ND	0.268	0.208		
Cyclohexane	ND	ND	ND	ND	0.216	0.589	81.63	81.63
1,2,4-Trimethylbenzene	ND	0.034	0.036	0.032	0.068	0.053		
August 12 to August 13, 2018								
Dichlorodiflouromethane	0.402	0.425	0.418	0.415	0.41	0.442		
Chloromethane	0.399	0.415	0.404	0.409	0.413	0.439		
Trichloroflouromethane	0.206	0.208	0.191	0.202	0.198	0.219		
Freon-113	0.065	0.064	0.065	0.061	0.063	ND		
Tetrahydrofuran	ND	ND	ND	ND	ND	1.62	54.42	27.21
n-Hexane	ND	ND	0.21	ND	ND	ND		

TEL = Threshold Effects Exposure Limit (24-Hour Average)
AAL = Allowable Ambient Limit (Annual Average)
ppb = parts per billion
ND = Not detected at the reporting limit for the sample
Concentrations are from 24 hour samples

Monitoring Sites

Stodder's Neck - MWRA Pump Station (Hingham)
Quincy-Germantown 1-Clement O'Brien Tower (Quincy) - Primary
Quincy-Germantown 2-Clement O'Brien Tower (Quincy) - Collocated
BELD - Braintree Electric (Braintree)
Embridge - Embridge Property site of proposed compressor (Weymouth)
FREC - Fore River Energy Center (Weymouth)