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### **Re: Somerville Public Safety Building**

On November 8, 2006, a walkthrough inspection and survey of the municipal headquarters for the Somerville Police and Fire Departments, respectively, was conducted. This facility is also known as the Public Safety Building and is located at 220 Washington Street, in Somerville, Mass. At the same time, a number of air samples were collected using Suma Canisters to determine the presence of Volatile Organic Compounds (VOCs) inside of the facility. In addition, wipe samples were collected in a variety of locations to determine the presence of lead and chromium in these areas. Finally, filters were collected from the ventilation ducts in some rooms to evaluate the presence of metals and semivolatile organic compounds, including Polycyclic Aromatic Hydrocarbons (PAHs) in these materials. (Note: References for all cited documents are found at the end of the document).

### **Methodology**

Samples for analysis of VOCs were collected using "Suma Canisters". This method required the opening of the inlet valve of the canister which, due to an inner negative pressure allowed air from the location being sampled to enter into the canister. The filling of the canister was determined to be complete once the sound of air rushing in was no longer detected. The canister valve was then tightly closed. Six locations were selected for sampling, based on reports from occupants of the building, as to locations where occupants had been working and air quality concerns had been raised. All canisters were taken to GeoLabs, Inc., in Braintree, Mass., for extraction and evaluation of the contents utilizing a combined Gas Chromatograph – Mass Spectrometer (GC/MS).

For the evaluation of semivolatile organic compounds, filters from various air ducts were collected, placed in separate sealed plastic bags, and once again taken to GeoLabs, Inc. for extraction and evaluation using a GC/MS. Samples were also extracted from the filters for evaluation of the presence of the following list of EPA designated Priority

Pollutant Metals (40 CFR Part 423, Appendix A): Antimony, Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Nickel, Selenium, Thallium, and Zinc. Metals were evaluated using Inductively Coupled Plasma Atomic Emissions (ICP).

In addition, sixteen wipe samples were collected on gauze pads and placed in individually labeled glass containers for the evaluation of lead and chromium. These metals were selected based on the presence of a firing range in the basement area of the building and also on the basis of previous indications that these metals had been found in locations throughout the building. Similar to the above, the extraction and analysis of these metals were performed by GeoLabs, Inc., of Braintree, Mass., using ICP.

Generally, the evaluation of samples using GC/MS for detection of either volatile or semivolatile organic compounds is based on the collection and evaluation of the chemicals observed. The presence of quantifiable elements results in the production of what is known as a peak in the range of the molecular weight of the chemical. The exact identity of the chemical is determined by comparison of the chemical peaks obtained with the library of chemicals contained within the GC/MS. It is possible to add chemicals to the library for comparison should an unknown or heretofore unexpected peak appear. The peaks of the chemicals that appear have not been predetermined. For accuracy, quality control and quality assurance is assured by the addition of unrelated chemicals at known quantities. The recovery of these materials provides assurance that the GC/MS evaluation has worked appropriately and within acceptable ranges.

The types of metals that were evaluated were predetermined, using either the EPA list of priority pollutant metals, or a predetermined work order to look for lead and chromium, as in the case of the wipe samples.

This study was conducted to determine which chemicals are present in the facility and what the potential health hazards associated with these chemicals are. The study did not determine eight hour time weighted average exposure levels for employees in the facility. Rather, the samples for volatile and semivolatile organic materials only determined that these materials were present. Determination of eight hour time weighted average exposure levels would require additional, and a different type of, testing. Therefore, the levels of the chemicals found on the day of the examination often did not reach the minimal allowable dose levels to which one could safely be exposed, as recommended by ATSDR or OSHA.

During the time frame on the day of the survey when samples were taken, there was not any activity of the diesel fire trucks. However, it should be pointed out that the recommended exposure levels, especially those promulgated by ATSDR, or more significantly, OSHA, are for occupational exposures. None of the individuals working in 220 Washington Street are working in an industry or occupation where these chemicals should be found.

#### Sample Collection Locations

The locations Suma Canisters were used to collect air samples: Professional Standards; Room 166; Former Auxiliary Officers Room; Stairs; Back Stairs; and the 9-1-1 operations center.

In these locations a variety of different volatile organic compounds were found. These VOCs included Benzene, a known leukemia causing agent, Xylenes, Toluene, Chloromethane, 1, 1, 1 Trichloroethane, Ethylbenzene, Bromomethane and Freon.

The air duct filters were taken from the ventilation ducts located in the Fire Prevention Office; the Bunk Room; and the Downstairs Room.

The semivolatile organic compounds and PAHs identified in the filters in these locations included:

Bis (2-ethylhexyl) Phthalate; Chrysene; Fluoranthene; Indeno (1,2,3-cd) Pyrene; Phenanthrene; Pyrene; and Di-n-Octyl Phthalate.

The metals detected in these air duct filters were: Beryllium; Lead; Zinc; Chromium; Copper; Nickel; Thallium; and Antimony.

Finally, wipe samples were collected for the evaluation of the presence of lead and chromium in the following locations:

The Gym (x2); the Gym Locker Room; Former Auxiliary Office; Academy (x2); Stairs to the Firing Range; Detail Office (x2); Room 195; 9-1-1 Operations Center, Traffic Operations(x2); Evidence Room 176; Evidence Room 179; and Fire Lieutenant's Room.

Lead was detected in every sample examined, ranging from a high of 1650 micrograms to a low of 2.84 micrograms. Chromium was not detected in each location sampled, but was found in: Former Auxiliary Office; the Gym Locker; the Stairs to the firing Range; Room 195; and Evidence Room 176.

### Summary of Toxins and Health Impact

These results indicate that there is widespread contamination throughout the building by a variety of toxic materials, many of which such as Benzene<sup>1,2</sup>, Bis (2-Ethylhexyl) Phthalate, Chrysene, Fluoranthene and Indeno(1,2,3-cd) Pyrene are potential carcinogens that affect a variety of organs, such as the Skin, Gastrointestinal Tract and Liver, to name a few<sup>3,4,5,6</sup>. Others of the toxic materials found are not carcinogenic in nature, but, like Pyrene<sup>7</sup>, are neurotoxins and, like Phenanthrene, are skin toxins.

The metals found have a number of possible health effects, for example<sup>8</sup>:

Lead is a known reproductive hazard, as well as known for causing learning disabilities in children. The same is true for the offspring of adults exposed to lead.

Beryllium is associated with lung disease, with symptoms demonstrated by shortness of breath on exertion.

Chromium Poisoning symptoms are manifested by skin and nasal ulcers or dermatitis.

Thallium affects the Heart, Liver, Lungs, and Nervous System. Symptoms such as Hair Loss and Vomiting may occur after exposure.

Copper, when high levels are inhaled, can cause irritation of eyes, nose and throat, as well as nausea, vomiting and diarrhea. Very high level exposure to copper can cause liver and kidney damage, as well as death.

The most common reaction in humans exposed to nickel is an allergic reaction.

Antimony can cause lung inflammation and irritation.

In summary, several grab samples were collected for the analysis of volatile and semivolatile organic compounds at the Somerville Police and Fire Headquarters. Samples were also collected for the determination of the presence of metals, like lead and chromium. A wide range of volatile and semivolatile organic compounds were found in various sites throughout the facility at 220 Washington Street. Many of these chemical compounds have the potential of causing various types of cancer after continuous, chronic exposure. Several metals, in addition to lead and chromium, were detected. These metals also have the ability to cause illness in humans, ranging from affecting reproduction to pulmonary irritation and other types of pulmonary disease.

The Public Safety Building located at 220 Washington Street in Somerville, at the very least, needs to be vacated and thoroughly cleaned and decontaminated. In addition, there appears to be a problem with the spread of contaminants related to diesel fuels when combusted in the fire trucks, contributing to further contamination of the air inside of the facility. A complete review of the HVAC system, the transport pathways and means of preventing the diesel fuels from entering the many spaces within the facility needs to be performed and put into action. Currently, the exhaust hoses that are attached to the exhaust pipes of the fire trucks do not appear to be effective, either because the system is not properly installed or because these exhaust hoses are not used consistently and correctly.

It should be noted that tests can be performed to determine the presence of many of these chemicals in people. Polycyclic aromatic hydrocarbon exposure can be determined in tests of urine, blood or body tissue. Lead and other metals can also be evaluated to determine levels of human exposure.

The chemicals determined as present either as volatile or semivolatile organic compounds were compared against lists produced by the Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor and the Agency for Toxic Substance and Disease Registry (ATSDR), an agency of the U.S. Department of Health

and Human Services. The latter was used for evaluation of potential health effects, which have been provided in the narrative above. The comparison is reproduced in the attached Appendix.

### Conclusions

The chemicals determined to be present in the Somerville Public Safety Building have the potential for causing various types of diseases. Benzene, for example is known to cause leukemia, while Chrysene is associated with lymphoma. The EPA has classified Indeno(1,2,3-cd) Pyrene as a probable human carcinogen, which, like many other polycyclic aromatic hydrocarbons, results in lung cancer. Other polycyclic aromatic hydrocarbons found at the site, like Fluoranthene, have also been shown to cause tumors in rodents, and are suspected of being human carcinogens.

The organic chemicals found are not the only materials that pose health hazards to humans. Lead, for example, poses a hazard to the reproductive system, the nervous system, and to the blood forming system. Long term studies in adults exposed to lead have shown a decline in the memory capabilities of exposed adults.

In the case at Somerville Public Safety Building, employees in this facility would not normally expect ongoing or continued exposure to these chemicals. In addition, the levels found on the day in question suggest that at various times higher levels of these chemicals will be found as, for example, when fire truck diesel engines are running in the basement of the building. It needs to be recognized that polycyclic aromatic hydrocarbons are produced by diesel engines. It must also be noted that the firing range located in the basement of the building has not been in use for several years, so the source of high lead levels needs further evaluation.

The chemicals and metals found at this site have been determined to be hazardous, and therefore many have occupational exposure limits. Although the extent of occupational exposure has not been determined, the personnel working in this facility should not be exposed to these chemicals on a chronic basis, as adverse health effects could still result. Unlike employees in industries with set occupational exposure limits, the occupants of the Public Safety Building do not share in the protections, regulations, and regular health monitoring of those in covered industries. This is particularly true because the employees here have no expectation of such exposures and may not even be aware of their exposure to these chemicals on a regular basis.

All of this information taken together leads to the conclusion that efforts need to be made to eliminate the presence of these chemicals from the facility or to eliminate employee exposure to these hazardous chemicals. This is particularly important because a number of the polycyclic aromatic hydrocarbons found in this facility, including Chrysene, Fluoranthene, Indeno (1,2,3-cd) Pyrene, have been classified as probable human carcinogens by the EPA. Employees in this facility should be protected from ongoing exposure. Ongoing cleaning the building without removing the source of the polycyclic aromatic hydrocarbons from the building is not effective. As long as sources of

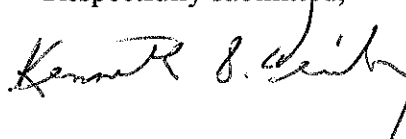
contaminates are allowed to continue to stream into the building, such as the diesel exhaust emitted from the engines of the fire trucks, employees in the building will continue to be exposed to these chemicals.

The protective methods need to involve administrative controls include:

- employee evacuation;
- engineering controls;
- cleanup of the facility;
- use of better filtration systems;
- re-design and installation of a different HVAC system.

Employees who work regularly in the building should consult with their physician and determine if their continued occupancy in the facility is safe and advisable.

Respectfully submitted,



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#### References

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2. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological profile for benzene. U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1997
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5. U.S. Environmental Protection Agency, Integrated Risk Information System, Chrysene, 1994
6. U.S. EPA, Risk Assessment Information System (RAIS) , Toxicity Profile for Fluoranthene, 1997
7. U.S. EPA, Risk Assessment Information System (RAIS) , Toxicity Profile for Pyrene, 1998
8. Casarett & Doull's Toxicology, 5<sup>th</sup> Edition, 1996, Curtis B. Klaassen, Ed., ch.23
9. Agency for Toxic Substances and Disease Registry (ATSDR), Minimal Risk Levels (MRLs) for Hazardous Substances, 2007
10. U.S. Department of Labor, Occupational Safety and Health Administration, 29, CFR 1910.1000, Table Z-1.

## APPENDIX

A compilation of chemicals and metals found, as well as their values:

<b><u>Volatile Organics</u></b>	<b><u>Value(s)<sup>*</sup> Found (<math>\mu\text{g}/\text{m}^3</math>)</u></b>	<b><u>ATSDR Min. Risk<sup>9</sup> Levels (selected)<sup>†</sup></u></b>
Benzene	2.33, 2.43, 2.52, 2.43, 5.81, 2.76	0.003ppm
Xylene (m, p, and o isomers)	5.98, 6.24, 6.59, 3.51	0.05 ppm
Toluene	9.94, 9.94, 8.36, 18.1, 6.82	1.0 ppm
Chloromethane	2.26, 1.84, 2.33, 2.13	
1, 1, 1 Trichloroethane	5.00	350 ppm(OSHA)
Bromomethane	3.26	
Freon 11	5.45, 6.19	
Freon 12	4.06	
<b><u>Semivolatile Organics</u></b>	<b><u>Value(s)<sup>‡</sup> (<math>\mu\text{g}/\text{Kg}</math>)</u></b>	<b><u>ATSDR Min. Risk Levels (selected)<sup>§</sup></u></b>
Bis(2-ethylhexyl) Phthalate	99,300; 17,100; 10,500	100 $\mu\text{g}/\text{kg}/\text{day}$
Butyl Benzyl Phthalate	4,000	
Chrysene	7,110	200 $\mu\text{g}/\text{m}^3$
Fluoranthene	6,720	40 $\mu\text{g}/\text{kg}/\text{day}$
Indeno (1,2,3-cd) Pyrene	2,610	
Phenanthrene	5,180	
Pyrene	16,900	30 $\mu\text{g}/\text{kg}/\text{day}$
Di-n-Octyl Phthalate	25,400; 148,000	3000 $\mu\text{g}/\text{kg}/\text{day}$
<b><u>Metals from Filters</u></b>	<b><u>Value(s)<sup>**</sup> (<math>\text{mg}/\text{Kg}</math>)</u></b>	<b><u>ATSDR Min. Risk Levels (selected)<sup>††</sup></u></b>
Antimony	1830, 1200	0.5 $\text{mg}/\text{m}^3$ (OSHA <sup>10</sup> )
Beryllium	0.444, 0.480, 0.461	0.002 $\text{mg}/\text{kg}/\text{day}$
Chromium	7.43, 7.91	0.5 $\text{mg}/\text{m}^3$ (OSHA)
Copper	10.5, 73.6, 47.9	1000 $\text{mg}/\text{m}^3$ (OSHA)
Lead	22, 44.8, 25.5	0.1 ppm (OSHA)
Nickel	39	0.0002 $\text{mg}/\text{m}^3$
Thallium	5.81, 6.62	0.1 $\text{mg}/\text{m}^3$ (OSHA)
Zinc	167, 322	300 $\text{mg}/\text{kg}/\text{day}$

\* Some chemicals were found in more than one location.

† Not all values have been determined.

‡ Some chemicals were found in more than one location.

§ Not all values have been determined.

\*\* Some chemicals were found in more than one location.

†† Not all values have been determined; OSHA values are 8 hour time weighted allowable exposures.

<b><u>Metals in Wipe Samples</u></b>	<b>Gross Values<sup>‡‡</sup> (µg)</b>	
Lead	8.22, 7.05, 17.8, 5.16, 1650, 83.5, 190, 13.4, 9.21, 51, 2.84, 9.25, 3.51, 30.4, 9.71, 291	
Chromium	6.4, 12, 17.7, 8.3, 18	

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<sup>‡‡</sup> Wipe samples could not be related to a volume of air, area or weight.