Indoor Air Quality Testing at the Middle River Complex
January 2014

Since the 1990s Lockheed Martin has been investigating the presence of contaminants in the soil and groundwater at the Middle River Complex and in the sediments of the adjacent Cow Pen Creek and Dark Head Cove. These contaminants are likely the byproduct of historic operations at the Complex. Results of these investigations are being used to plan for the cleanup of the site, which has already begun. More information on the investigations and cleanup can be found in the general site Fact Sheet (*note: a web link for more information is enclosed at the end of this update*).

What have the investigations determined? Sampling of soil and groundwater has revealed the presence of elevated levels of solvents (chlorinated hydrocarbons) and petroleum-related hydrocarbons, both of which are volatile organic compounds, as well as other contaminants. Volatile organic compounds have also been detected in the vapor beneath the Lockheed Martin and Middle River Aircraft Systems (MRAS) facilities.

What vapor testing has Lockheed Martin done to date? Underground volatile organic compounds have the potential to move into buildings through cracks in foundations and basement floors, and through sump and utility openings, in a process known as vapor intrusion. Since 2006, Lockheed Martin has conducted 15 rounds of tests of air quality inside Buildings A, B, and C, and of the vapor in soils directly beneath these buildings, to ensure that indoor air quality at the Middle River Complex is acceptable for workers.

Sampling is conducted generally twice a year to account for differences in conditions between summer and winter, when heating, ventilation and air conditioning can affect the rate at which soil vapors may be pulled into, be blocked from entering, or be pushed out of a building. Indoor air was sampled once inside the Vertical Launching System (VLS) building in 2006, and has not been sampled again, because no chemicals of concern were detected there. To confirm this determination, resampling is planned in February 2014 at the VLS building along with two additional buildings (Program building and the Engineering Lab) adjacent to the VLS building. Outside air was monitored at locations surrounding the Middle River Complex to measure chemicals in the outside air coming downwind. This helped identify whether chemicals found inside the facilities are from site operations, outside sources, or from underneath the buildings.

Initial monitoring inside the facilities focused on locations where volatile organic compounds were detected in underlying soil and groundwater, and were not focused on chemicals that are used currently in factory operations. (These latter compounds are regulated by the U.S. Occupational Safety and Health Act (OSHA) and its Maryland counterpart; some of the compounds in use at the factory today are included on the monitoring list because they were also used in the past). Later

rounds of monitoring expanded the number of indoor air and sub-slab sampling locations to provide a more detailed picture of what was occurring beneath the Complex. The current monitoring program analyzes 25 chemicals in 36 indoor air and 35 soil-vapor samples collected throughout Buildings A, B and C. *See figures on pages 5 and 6 for sampling locations*.

What was found? Based on monitoring results, chemical concentrations detected in the indoor air in the Middle River Complex do not exceed air quality standards established by the U.S Occupational Safety and Health Act and its Maryland counterpart, nor do they typically exceed the conservative (meaning, low), health risk-based screening levels established by the U.S. Environmental Protection Agency (EPA) and its Maryland counterpart, the Maryland Department of the Environment (MDE). Detections that exceed screening levels are very infrequent, and may or may not be related to releases or spills into the environment associated with historic operations at the Middle River Complex. Elevated concentrations of volatile organic compounds have been found in sub-slab vapor beneath the floor of the Plating Shop in Building A, and beneath the floor in the south end and eastern side of Building C.

What is being done? While indoor air sampling in the Plating Shop in Building A and in Building C did not indicate an unacceptable risk to workers, the possibility of it occurring in the future led Lockheed Martin to proactively install vapor mitigation systems in the Building A Plating Shop and the south side of Building C Basement in 2008. These sub-slab depressurization systems remove and treat volatile organic compounds from the air spaces beneath the buildings, and reduce their potential for moving inside. The vapor is collected through vacuum lines, treated in pressure vessels, and then clean air is discharged through an outside stack above the roofline.

In March 2013, the Building A system was shut down for maintenance. While it was down, Lockheed Martin sampled the indoor air in and around the Plating Shop. Results of this sampling indicated that the concentrations of volatile organic compounds remained below health risk-based screening levels even when the system was not running.

After installation of the sub-slab depressurization system at the south end of Building C Basement, concentrations of volatile organic compounds in the sub-slab vapor were reduced by over 95 percent. More recent monitoring in the Building C Basement identified an area in the east-central part of the basement where sub-slab vapors are also present. These vapors are believed to be associated with the former Patriot missile canister plating, painting and manufacturing operation. With the identification of this contamination, additional extraction points and piping were added to the Building C sub-slab depressurization system and the blower system was upgraded.

What about recent sampling? The most recent round of sampling of the Middle River Complex in August 2013 detected some volatile organic compounds in indoor air at concentrations above their health risk-based screening levels at a limited number of locations. Lockheed Martin is most interested in the fact that trichloroethene (TCE), a cleaning solvent, was detected in 38 of 42 indoor air samples, including at concentrations above the Environmental Protection Agency-established health risk-screening level of 8.8 micrograms per cubic meter at three locations. (The Maryland Department of the Environment has adopted the EPA health risk-screening level.) The locations are the southern part of Building A Basement, the Mission Systems and Training (MST) Machine Shop in

Building C, and east of the Bond-Layup Room in Building A. Detected concentrations ranged from 0.6 to 34 micrograms per cubic meter; and the facility-wide average for the areas sampled was 3.5 micrograms per cubic meter. To put this in perspective, over the course of the monitoring program from 2006 to 2013, trichloroethene has been detected at concentrations exceeding the current screening level in less than one percent of the indoor air samples—5 out of 568 samples. Prior to the August 2013 sampling, tricholorethene was detected at concentrations exceeding the current screening level at only two locations.

The two sub-slab depressurization systems are operating effectively and will likely reduce the highest concentrations of vapors found beneath the buildings. The August 2013 sampling, with results that exceed health-risk based screening levels, indicates a need for improved understanding of the potential sources of the contaminants. Whenever results exceed screening levels, further evaluation is undertaken as a precautionary measure; this does not necessarily indicate that unacceptable risks are present. Instead, further evaluation is being done before results reach a level of unacceptable risk, so that steps can be taken to address airborne concentrations before they become a problem.

What comes next? Three of the August 2013 results are inconsistent with previous air sampling results. Samples from two of the locations with elevated indoor air results were from areas where sub-slab vapor concentrations have historically been less than screening levels; and the third location has never had indoor air concentrations greater than screening levels in adjacent and surrounding areas. Additional testing is needed to determine potential sources, either sub-slab or possibly unrelated indoor sources.

Lockheed Martin's understanding of the levels of trichlorethene found beneath the building in each of the three locations where results exceeded screening levels, plus information from previous indoor air and sub-slab vapor samples, are insufficient to determine the cause of the elevated concentrations. For that reason, additional samples will be taken in those three areas during the next regularly scheduled round of sampling, which will take place in February 2014.

A number of questions need to be answered: Can the data indicating elevated concentrations of trichloroethene be reproduced or was the August sampling an exception? Are products containing trichloroethene being used in the workplace? Is the heating/cooling system air intake a problem? Are there additional cracks in the building foundation beyond those identified previously?

To help answer these questions, Lockheed Martin will also collect information on chemicals used at these locations in order to identify other possible sources of volatile organic compounds in the indoor air. Sub-slab samples will be collected from additional locations, as necessary, to better understand the extent of contamination at those locations where elevated concentrations of volatile organic compounds have been found during previous rounds of sampling. Additional indoor air samples will be collected in concert with any new sub-slab samples to see whether any volatile organic compounds found in the sub-slab are also present in indoor air.

Over the history of vapor intrusion investigations at the Middle River Complex, naphthalene has never been found to exceed screening levels in groundwater, therefore was not considered a

potential source for vapor intrusion. Naphthalene is widely found in motor vehicle emissions, tobacco smoke, solvents, lubricants and even from deodorizers. However, it has been found to exceed screening levels in soil vapor in recent years, causing the Lockheed Martin team to speculate what its source may be, and whether naphthalene found in indoor air could be the result of vapor intrusion. For example, an evaluation of the August 2013 data found nine out of 38 of the indoor air samples exceeded an indoor air health risk-screening level for naphthalene. Lockheed Martin intends to continue analyzing for naphthalene as part of its on-going vapor intrusion-monitoring program. It will collect information on chemicals used at locations where naphthalene was found in excess of indoor air screening levels during the August 2013 sampling in order to identify other possible sources of volatile organic compounds in indoor air.

What can employees do to help? Lockheed Martin will review existing inventories of chemicals found in the workplace. Employees are being asked to help identify all chemicals being used in the three areas where screening levels were exceeded. Local Lockheed Martin management supports this request. Some product containers may not cite ingredients such as trichloroethene on their labels; so, environmental experts need to evaluate all products present in the workplace during the inventory. A safe work environment is everyone's right and responsibility, and Lockheed Martin appreciates everyone's help.

Do employees need to be concerned? Currently available information indicates that employees do not need to be concerned about air quality resulting from historic environmental impacts. While sub-slab vapor concentrations may be elevated, indoor air concentrations are generally below conservative (meaning, low) health-risk based screening-levels, which indicates a safe work environment. Steps are being taken to understand and address those areas where indoor air contaminants recently exceeded screening levels. Employees are always encouraged to ask questions and bring up concerns and issues so that they may be promptly addressed.

Who do I contact if I have questions?

Tom Blackman, Project Lead, (301) 548-2209, Cell (240) 460-7508, Tom.D.Blackman@lmco.com

Gary Cambre, Manager of Environmental Communications, (800) 449-4486, Gary.Cambre@lmco.com

Reports detailing the investigations and system expansion are available at www.LockheedMartin.com by using the following path:

www.lockheedmartin.com/us/who-we-are/eesh/remediation/middle-river.html

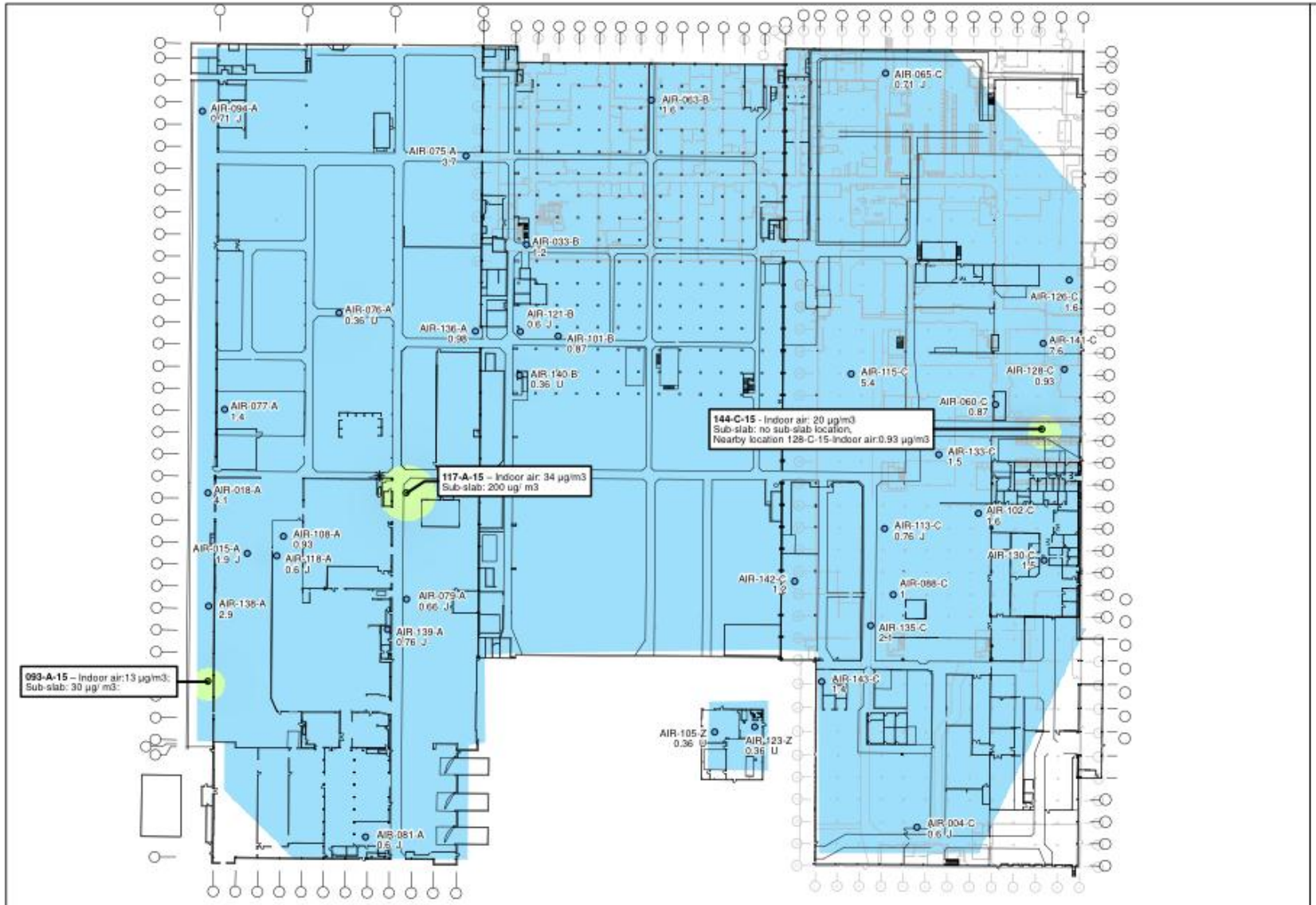

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Figure F-1
Trichloroethene
Isocontours for Indoor Air - August 2013
Building A, B, and C
Lockheed Martin Middle River Complex
Middle River, Maryland

Legend

Soil Vapor Sample Location

µg/m3

- < 10
- 10 - 100
- 100 - 1000
- 1000 - 10000
- > 10000

10000 µg/m3

1000 µg/m3

100 µg/m3

10 µg/m3

0.1 µg/m3

The current MDE screening level is 8.8 ug/m3.
The concentration circle sizes are approximate.

Drawn By: S. PAXTON 10/29/12
Checked By: R. SAMUELS 11/13/13
Approved By:

Contract Number: 112IC04792

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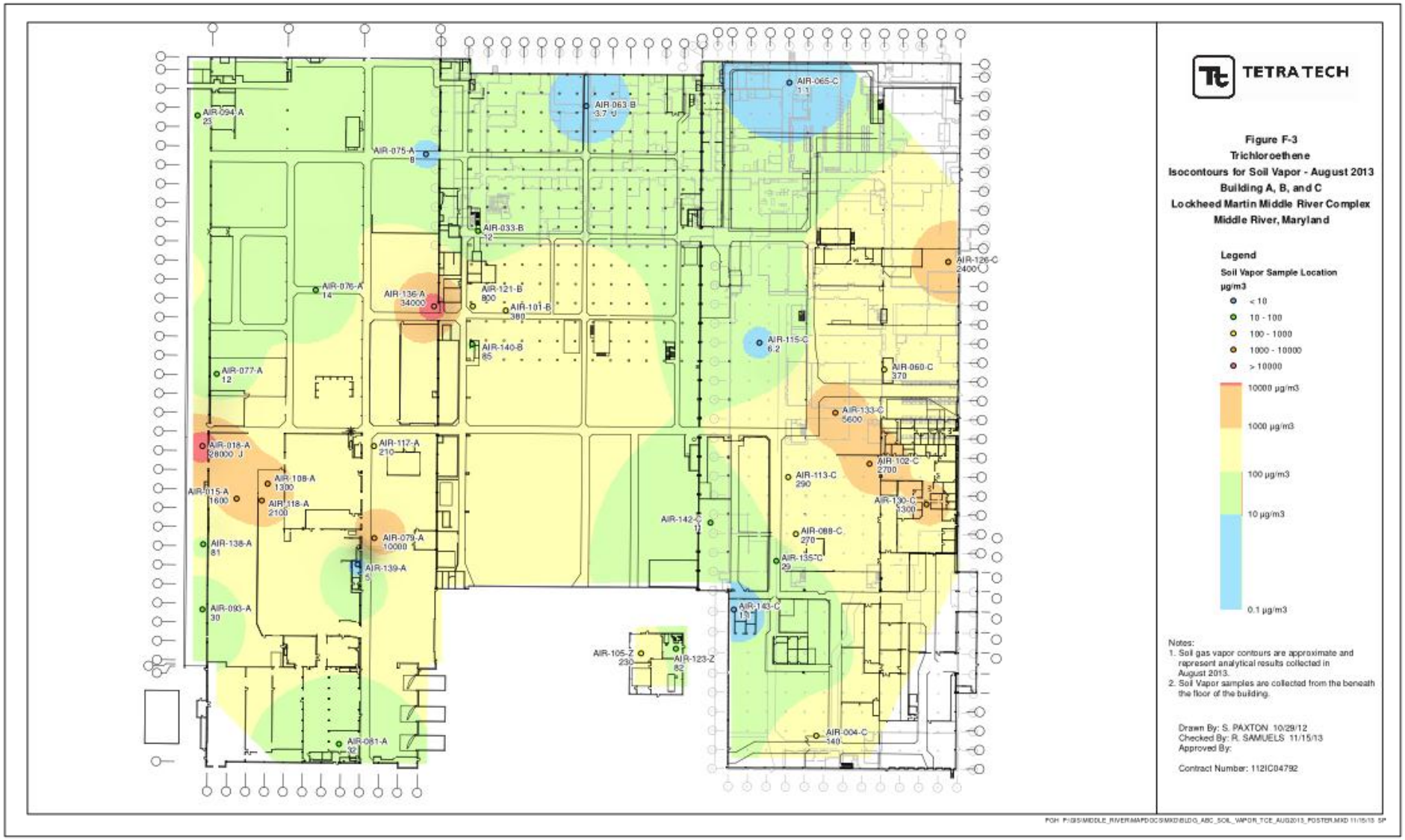
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TETRA TECH
Figure F-3
Trichloroethene
Isocontours for Soil Vapor - August 2013
Building A, B, and C
Lockheed Martin Middle River Complex
Middle River, Maryland
Legend
Soil Vapor Sample Location
µg/m3
< 10
10 - 100
100 - 1000
1000 - 10000
> 10000
10000 µg/m3
1000 µg/m3
100 µg/m3
10 µg/m3
0.1 µg/m3
Notes:
1. Soil gas vapor contours are approximate and represent analytical results collected in August 2013.
2. Soil Vapor samples are collected from the beneath the floor of the building.
Drawn By: S. PAXTON 10/29/12
Checked By: R. SAMUELS 11/15/13
Approved By:
Contract Number: 112IC04792
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