Letter Health Consultation

FORMER HEWLETT-PACKARD LOVELAND MANUFACTURING

LOVELAND, COLORADO

August 19, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

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LOVELAND, COLORADO

Prepared By:
Colorado Department of Public Health and Environment
Under Cooperative Agreement with the
The U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

LETTER HEALTH CONSULTATION

TO: ROB BEIERLE (HM&WMD/CDPHE)

FROM: SHANNON ROSSITER, MPH (CCPEHA/DCEED/CDPHE)

SUBJECT: AGILENT (FORMER HEWLETT PACKARD) - INDOOR AIR EVALUATION

DATE: 8/14/2008

CC: RAJ GOYAL, PHD (CCPEHA/DCEED/CDPHE)

The purpose of a health consultation is to identify and prevent harmful health effects resulting from exposure to hazardous substances in the environment. The Colorado Cooperative Program for Environmental Health Assessments (CCPEHA) of the Environmental Epidemiology Section (EES) evaluates sampling data collected by our partners, determines whether exposures have occurred or could occur in the future, reports any potential harmful effects, and then recommends actions to protect public health. The Hazardous Materials and Waste Management Division (HM&WMD) requested that CCEPHA evaluate any potential for public health implications to future employees resulting from exposures to volatile organic compound (VOC)-contaminated indoor air within Buildings A, B, C, and D of the Agilent Technologies, Inc. (Agilent) property. The property is currently planned for use as a warehouse and/or office.

Agilent currently owns the former Hewlett-Packard property in Loveland, Colorado. The property is approximately 331 acres and the majority of the property is currently zoned for industrial use with select tracts zoned as developing resource. The property was previously the subject of a Resource Conservation and Recovery Act (RCRA) Corrective Action to remediate impacted soil and groundwater resulting from manufacturing operations. Hewlett-Packard's investigation, remediation, and monitoring occurred from 1984 to 2007.[1]

The principle concern has been groundwater contaminated with solvents used in manufacturing processes during the 1960s and 1970s. The sources of contamination were removed by the early 1980s. Although residual contamination levels are expected to continue to decline through natural processes over time, the residual groundwater contamination persists in levels that exceed Colorado groundwater standards. In certain areas of the property,

[1] Essential Management Solutions, LLC (2008). *Materials Management Plan Former Hewlett-Packard Loveland Manufacturing Facility.*

these contaminants might still pose a threat to human health if activities on the property result in exposure to or direct contact with such contaminants.[2]

Discussion

This evaluation used the data collected by Essential Management Solutions, LLC as part of obligations imposed on Agilent Technologies, Inc. to remediate residual contamination per the terms of a CDPHE Environmental Covenant.[3]

To measure VOC concentrations, 36 total indoor air samples were taken from Buildings A, B, C, and D in April 2008; with 6 to 12 samples collected from inside of each building.[4] The collected data is summarized in Appendix A, Table 1.

All contaminants associated with the source of contamination were retained for further evaluation. These contaminants include acetone, benzene, 1, 1-dichloroethane, 1, 1-dichloroethene, cis-1, 2-dichloroethene, trans-1, 2-dichloroethene, 1, 4-dioxane, ethylbenzene, methylene chloride, methyl ethyl ketone (MEK), methylisobutyl ketone, tetrachloroethylene, toluene, total xylenes, 1,1,1-trichloroethane, trichloroethylene, and vinyl chloride.

The overall conceptual site model at the Agilent property is presented below. Incomplete exposure pathways include the drinking water pathway because the facility is connected to an established municipal water supply and therefore there is no risk of exposure to VOCs in the groundwater on-site through ingestion of water. The indoor air inhalation is considered a potential exposure pathway in this evaluation based on the future land use of the property.

Pathway Name	Exposure Pathway Elements						
	Source	**Contaminated Envt'l. Medium**	**Point of Exposure**	**Potentially Exposed Population**	**Route of Exposure**	**Time Frame**	**Pathway Complete?**
Indoor Air	On-Site VOC Contamination	VOCs in groundwater	Indoor Air	Workers (e.g., office or warehouse)	Inhalation	Future	Potential

[2] SRK Consulting, TMSS Inc. and Burns, Figa & Will, P.C. (2007). *Remediation Completion Report Hewlett-Packard Company Loveland Manufacturing Center Loveland, Colorado.* November 8, 2007

[3] Essential Management Solutions, LLC (2008). *Materials Management Plan Former Hewlett-Packard Loveland Manufacturing Facility.*

[4] Essential Management Solutions, LLC (2008). *Materials Management Plan Former Hewlett-Packard Loveland Manufacturing Facility.*

To estimate theoretical cancer risks and non-cancer hazards, it is assumed that workers would perform different levels of activities; for example, warehouse workers with strenuous activities would have an inhalation rate of 20 cubic meters per day (m^3/day) and office workers with a low/moderate level of activity would have an inhalation rate of 9.3 m^3/day. The exposure duration for all workers is assumed to be 250 days/year for 25 years. The cumulative theoretical cancer risks for VOCs are well within the US Environmental Protection Agency's (EPA's) acceptable risk range of 1 in a million to 100 in a million (Appendix A, Tables 2-5). In addition, the estimated doses for non-cancer hazards are significantly below the health guidelines, i.e. hazard quotient (HQ) < 1 (Appendix A, Tables 2-5). The non-cancer hazard for 1,1-dichloroethene is higher in Building C than the other buildings, but still predominantly below the health guidelines (HQ= 0.31-0.66). Overall, the estimated cancer risks seem to be higher in Buildings A and B than in Buildings C and D.

Generally, benzene is also present in many indoor sources including building materials, cleaners, furniture treatments, paint, plastics, sealants, cosmetics, and glues. For example, according to the EPA Building Assessment Survey and Evaluation (BASE) study, the levels detected in Agilent buildings are fairly typically found in commercial buildings.[5] The BASE study was conducted over a five-year period from 1994-1998, to characterize determinants of indoor air quality (IAQ) in representative public and commercial office buildings across the US. In particular, the analytical results from the study indicate that the arithmetic mean of benzene and trichloroethylene were 4.2 and 0.76 micrograms per cubic meter of air (ug/m^3), respectively.

As a matter of prudent public health practice, CDPHE prefers that any exposures to potential carcinogens be reduced as much as possible and has established a policy goal of reducing potential long-term cancer risks to 1E-06. The theoretical estimated cancer risks for benzene, trichloroethylene and all VOCs combined are above the CDPHE long-term cancer risk goal (Appendix A, Tables 2-5).

Conclusions and Recommendations

In conclusion, indoor air quality inside the Building A-D constitutes no apparent public health hazard because levels detected in the buildings would result in potential exposures within the EPA acceptable cancer risk range. In addition, potential exposures to VOCs for all locations are not likely to result in noncancer health effects to workers because estimated doses are significantly below the health guidelines.

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[5] The United States Environmental Protection Agency (2008). *Building Assessment Survey and Evaluation (BASE) Study*. Available on the Internet at: http://www.epa.gov/iaq/base/, last accessed August 2008.

The estimated theoretical cumulative cancer risks for workers are above the CDPHE long-term cancer risk goal of 1E-06, with the highest cumulative cancer risk in Building A. As a matter of prudent public health practice remediation should continue so to reduce level of carcinogenic contamination in the buildings as much as possible.

To ensure a healthy environment inside the Buildings A-D on the Agilent property, the following recommendations should be implemented:

- Continue remediation of contaminated groundwater and soils.
- Reduce exposure to VOCs in buildings A-D, by implementing an air exchange system, or other types of mitigation.
- Collect and monitor indoor air samples of VOCs after remediation is complete.

Appendix A. Tables 1-5

Table 1. Summary of Data Collected in Buildings A, B, C, and D (36 Samples)

Contaminant	Building A Max Value (ug/m^3)	Building A Min Value (ug/m^3)	Building B Max Value (ug/m^3)	Building B Min Value (ug/m^3)	Building C Max Value (ug/m^3)	Building C Min Value (ug/m^3)	Building D Max Value (ug/m^3)	Building D Min Value (ug/m^3)
Acetone	48	6.9	20	ND	21	8.1	64	10
Benzene	0.67	0.51	0.8	0.51	1.1	0.48	0.64	0.45
1, 1-Dichloroethane	ND	ND	ND	ND	0.096	ND	ND	ND
1, 1-Dichloroethene	ND	ND	ND	ND	4.8	ND	0.17	ND
Cis-1, 2-Dichloroethene	0.36	ND	0.55	ND	0.44	ND	ND	ND
Trans-1, 2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
1, 4-Dioxane	ND	ND	ND	ND	ND	ND	1	ND
Ethylbenzene	0.82	0.13	0.29	0.15	2.5	0.18	0.61	0.17
Methylene Chloride	4.9	ND	ND	ND	2.8	ND	ND	ND
MEK	ND	ND	ND	ND	6.2	ND	10	ND
Methylisobutyl Ketone	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	0.55	ND	1.5	ND	0.16	ND	0.17	ND
Toluene	13	0.98	2.3	ND	10	1.4	10	1.1
Total Xylenes	3.367	ND	ND	ND	6	ND	3.4	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	1.2	ND	ND	ND
Trichloroethylene	0.86	0.18	0.24	ND	0.15	ND	ND	ND
Vinyl Chloride	0.11	ND	0.12	0.1	0.21	0.12	0.12	0.11

Note:

- ug/m^3 = Micrograms per Cubic Meter of Air
- ND = the contaminant was not detected via sampling in this location
- MEK = Methyl Ethyl Ketone
- Max = Maximum
- Min = Minimum

Table 2. Theoretical Cancer Risks and Noncancer Hazards for Contaminants Detected in Building A (6 Samples)

Contaminant	Air Max Value (ug/m^3)	Cancer Risk Low Exposure	Non-Cancer HQ Low Exposure	Cancer Risk High Exposure	Non-Cancer HQ High Exposure
Acetone	48		0.0048		0.010
Benzene	0.67	5.88E-07		1.26E-06	
1, 1-Dichloroethane	ND				
1, 1-Dichloroethene	ND				
Cis-1, 2-Dichloroethene	0.36		0.0033		0.0070
Trans-1, 2-Dichloroethene	ND				
1, 4-Dioxane	ND				
Ethylbenzene	0.82		0.00026		0.00055
Methylene Chloride	4.9	2.63E-07		5.65E-07	
MEK	ND				
Methylisobutyl Ketone	ND				
Tetrachloroethylene	0.55	3.57E-07		7.69E-07	
Toluene	13		0.00085		0.0018
Total Xylenes	3.367		0.010		0.022
1,1,1-Trichloroethane	ND				
Trichloroethylene	0.86	1.12E-05		2.40E-05	
Vinyl Chloride	0.11	5.37E-08		1.15E-07	
Cumulative Cancer Risk		**1.24E-05**		**2.67E-05**	

Note:

- ug/m^3 = Micrograms per Cubic Meter of Air
- m3/day = Cubic Meters per day
- ND = the contaminant was not detected via sampling in this location
- MEK = Methyl Ethyl Ketone
- Max = Maximum
- Min = Minimum
- HQ = hazard quotient
- High exposure = inhalation rate of 20 m^3/day
- Low exposure = inhalation rate of 9.3 m^3/day

Table 3. Theoretical Cancer Risks and Noncancer Hazards for Contaminants Detected in Building B (6 Samples)

Contaminant	Air Max Value (ug/m^3)	Cancer Risk Low Exposure	Non-Cancer HQ Low Exposure	Cancer Risk High Exposure	Non-Cancer HQ High Exposure
Acetone	20		0.0020		0.0043
Benzene	0.8	7.02E-07		1.51E-06	
1, 1-Dichloroethane	ND				
1, 1-Dichloroethene	ND				
Cis-1, 2-Dichloroethene	0.55		0.005		0.011
Trans-1, 2-Dichloroethene	ND				
1, 4-Dioxane	ND				
Ethylbenzene	0.29		9.09E-05		0.00020
Methylene Chloride	ND				
MEK	ND				
Methylisobutyl Ketone	ND				
Tetrachloroethylene	1.5	9.74E-07		2.10E-06	
Toluene	2.3		0.00015		0.00032
Total Xylenes	ND				
1,1,1-Trichloroethane	ND				
Trichloroethylene	0.24	3.12E-06		6.70E-06	
Vinyl Chloride	0.12	5.85E-08		1.26E-07	
Cumulative Cancer Risk		**4.86E-06**		**1.04E-05**	

Note:

- ug/m^3 = Micrograms per Cubic Meter of Air
- m^3/day = Cubic Meters per day
- ND = the contaminant was not detected via sampling in this location
- MEK = Methyl Ethyl Ketone
- Max = Maximum
- Min = Minimum
- HQ = hazard quotient
- High exposure = inhalation rate of 20 m^3/day
- Low exposure = inhalation rate of 9.3 m^3/day

Table 4. Theoretical Cancer Risks and Noncancer Hazards for Contaminants Detected in Building C (12 Samples)

Contaminant	Air Max Value (ug/m^3)	Cancer Risk Low Exposure	Non-Cancer HQ Low Exposure	Cancer Risk High Exposure	Non-Cancer HQ High Exposure
Acetone	21		0.0021		0.0046
Benzene	1.1	9.65E-07		2.08E-06	
1, 1-Dichloroethane	0.096		6.23E-05		0.00013
1, 1-Dichloroethene	4.8		0.31		0.66
Cis-1, 2-Dichloroethene	0.44		0.004		0.0086
Trans-1, 2-Dichloroethene	ND				
1, 4-Dioxane	ND				
Ethylbenzene	2.5		0.00078		0.0017
Methylene Chloride	2.8	1.51E-07		3.23E-07	
MEK	6.2		0.00040		0.00087
Methylisobutyl Ketone	ND				
Tetrachloroethylene	0.16	1.04E-07		2.24E-07	
Toluene	10		0.00065		0.0014
Total Xylenes	6		0.018		0.039
1,1,1-Trichloroethane	1.2		0.00017		0.00037
Trichloroethylene	0.15	1.95E-06		4.19E-06	
Vinyl Chloride	0.21	1.02E-07		2.20E-07	
Cumulative Cancer Risk		**3.27E-06**		**7.03E-06**	

Note:

- ug/m^3 = Micrograms per Cubic Meter of Air
- m^3/day = Cubic Meters per day
- ND = the contaminant was not detected via sampling in this location
- MEK = Methyl Ethyl Ketone
- Max = Maximum
- Min = Minimum
- HQ = hazard quotient
- High exposure = inhalation rate of 20 m^3/day
- Low exposure = inhalation rate of 9.3 m^3/day

Table 5. Theoretical Cancer Risks and Noncancer Hazards for Contaminants Detected in Building D (12 Samples)

Contaminant	Air Max Value (ug/m^3)	Cancer Risk Low Exposure	Non-Cancer HQ Low Exposure	Cancer Risk High Exposure	Non-Cancer HQ High Exposure
Acetone	64		0.0065		0.014
Benzene	0.64	5.61E-07		1.21E-06	
1, 1-Dichloroethane	ND				
1, 1-Dichloroethene	0.17		0.011		0.023
Cis-1, 2-Dichloroethene	ND				
Trans-1, 2-Dichloroethene	ND				
1, 4-Dioxane	1	3.57E-07		7.69E-07	
Ethylbenzene	0.61		0.00019		0.00041
Methylene Chloride	ND				
MEK	10		0.00065		0.0014
Methylisobutyl Ketone	ND				
Tetrachloroethylene	0.17	1.10E-07		2.38E-07	
Toluene	10		0.00065		0.0014
Total Xylenes	3.4		0.010		0.022
1,1,1-Trichloroethane	ND				
Trichloroethylene	ND				
Vinyl Chloride	0.12	5.85E-08		1.26E-07	
Cumulative Cancer Risk		**1.09E-06**		**2.34E-06**	

Note:

- ug/m^3 = Micrograms per Cubic Meter of Air
- m^3/day = Cubic Meters per day
- ND = the contaminant was not detected via sampling in this location
- MEK = Methyl Ethyl Ketone
- Max = Maximum
- Min = Minimum
- HQ = hazard quotient
- High exposure = inhalation rate of 20 m^3/day
- Low exposure = inhalation rate of 9.3 m^3/day

CERTIFICATION

This Health Consultation was prepared by the Colorado Department of Public Health and Environment under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun. Editorial review was completed by the Cooperative Agreement partner.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this health consultation and concurs with its findings.

Alan Yarbrough
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CAT, SPAB, DHAC, ATSDR