



Agency for Toxic Substances & Disease Registry

Public Health
Assessments &Health Consultations

HEALTH CONSULTATION

Public Health Evaluation of Indoor Air Data

STRATFORD ARMY ENGINE PLANT
(a/k/a ARMY ENGINE PLANT/STRATFORD)
STRATFORD, FAIRFIELD COUNTY, CONNECTICUT

The conclusions and recommendations in this health consultation are based on the data and information made available to the Connecticut Department of Public Health and the Agency for Toxic Substances and Disease Registry. The Connecticut Department of Public Health and the Agency for Toxic Substances and Disease Registry will review additional information when received. The review of additional data could change the conclusions and recommendations listed in this document.

BACKGROUND AND STATEMENT OF ISSUES

The Connecticut Department of Public Health (CTDPH) was asked by the Stratford Health Department to review volatile organic chemical (VOC) levels in indoor air data from the Stratford Army Engine Plant (SAEP) for the purpose of determining the suitability, from a public health perspective, of leasing portions of the plant to the Town of Stratford.

The SAEP is a complex of 49 buildings that was formerly used for heavy industry and supporting administrative, research and development activities by the US Department of Defense. The SAEP is being remediated by the Army with oversight of the Connecticut Department of Environmental Protection (CTDEP) and the US Environmental Protection Agency (EPA).

The Town of Stratford is interested in leasing buildings or portions of buildings at the SAEP for light industrial/commercial activities and asked the CTDPH for advice regarding which buildings or portions of buildings were suitable for leasing, given the levels of VOCs in indoor air and likely exposures that would occur.

The Army has stated that air standards established by the Occupational Health and Safety Administration (OSHA) are suitable occupancy standards for buildings at the SAEP (FOSL2002). In other words, if levels of VOCs in indoor air are below OSHA standards, the Army considers the buildings suitable for any worker without the need for further remediation or controls. CT DPH disagrees with this approach as OSHA standards were designed primarily for industries which use VOCs in industrial production and thus involve workers who are unavoidably exposed. To protect those workers, OSHA requires that employers provide appropriate training and information regarding exposure, exposure control and potential health effects from the hazardous chemicals they are exposed to in their workplace. It would not be reasonable to expect employers to provide such information and protections to their non-industrial workers (for example, a pregnant female office worker).

Given these factors, the OSHA standards are not appropriate for the non-industrial workplace. Moreover, OSHA standards are not strictly health-based. For most chemicals, OSHA standards are a compromise between health-based values and levels that are technically feasible for industry to achieve.

Since there are no federal standards for indoor air quality in non-industrial environments, states such as Connecticut have derived Target Indoor Air Concentrations (TACs) to guide remediation stemming from subsurface contamination in both occupational and residential settings. These TACs are health-based and so are appropriate levels for basing decisions about the suitability of leasing buildings at the SAEP. CTDPH has evaluated VOC data from indoor air in buildings at the SAEP using the TACs as screening levels. CTDPH's evaluation is summarized in these sections that follow.

Environmental Data

There is significant groundwater contamination with VOCs that underlies much of the SAEP site. Data collected by the Army indicate exceedances of the Connecticut volatilization criteria for soil and groundwater beneath several buildings at the SAEP site (FOSL 2002). Vapors from the VOCs in groundwater have migrated into indoor air of several buildings.

Indoor air data were provided to CTDPH for review by the Town. The indoor air sampling occurred during the period September 1999 to May 2002 by the Army and focused on buildings that are above the highest groundwater and soil gas concentrations and buildings the Town identified as likely candidates for leasing. Indoor air samples were collected in the breathing zone over an eight-hour time period using passivated SUMMA canisters and were analyzed for VOCs using EPA Method TO-15. This is a standard procedure for sampling ambient air. In some buildings, only a single location was sampled. In other buildings, data are available for multiple locations within that building. The indoor air sampling data was collected by the Army as part of its ongoing monthly indoor air monitoring program. Not every location is sampled each month. Some locations have as few as one or two rounds (months) of data while other locations have as many as 26 rounds (months) of data. There are no readily apparent seasonal trends in indoor air concentrations or trends toward decreasing or increasing concentrations over time.

DISCUSSION

Exposure Pathways and Public Health Implications

This health consultation focuses on public health implications of exposures to future tenants of the SAEP. If the Town of Stratford leases buildings at the SAEP, future workers could be exposed to contaminants by breathing indoor air. There are no other exposure pathways for future tenants. Potential current exposures were not evaluated in this health consultation because: (1) the majority of the buildings at the plant are unoccupied; (2) the Army evaluates indoor air data for locations where their security workers are stationed; and (3) CTDPH was asked by the town of Stratford to focus on potential exposures to future tenants.

As a first step in evaluating the indoor air data, CTDPH compared maximum VOC concentrations in each location with CTDEP industrial/commercial Target Air Concentrations (TACs). TACs are levels in indoor air that are not expected to pose a health threat, assuming long-term exposure. They are guidelines used to trigger the need for

remediation at hazardous waste sites. The TACs for two chemicals (1,1-DCE and TCE) have been updated recently by CTDPH to reflect toxicology reevaluations at both the federal and state level. These revised TACs have been used by CTDPH in recent evaluations of indoor air VOC data at another hazardous waste site in Stratford, the former Raymark facility site (ATSDR 2000, ATSDR2003).

Table 1 below provides the TACs used in this first step of the evaluation. There are three VOCs detected at SAEP at levels exceeding TACs in at least one sampled location (tetrachloroethylene [PCE], TCE and vinyl chloride). The Table also includes the maximum concentration of each VOC that was detected in any sampled location.

Table 1.

Maximum indoor air concentrations detected at the Stratford Army Engine Plant and Comparison Values (CTDEP Industrial/Commercial Target Air Concentrations) used to screen indoor air data.

Chemical	Target Air Concentration (ppb)	Maximum Concentration (ppb)
1,1,1-Trichloroethane	191	2.5
Trichloroethylene	0.19 [^]	11
Tetrachloroethylene	1.62	9.6 [@]
Vinyl Chloride	0.36	0.62
1,1-Dichloroethylene	2.5 [*]	1.1

[^] This value is background-based.

^{*} This value was developed for residential settings. A commercial/industrial value based on updated toxicity information has not yet been developed.

[@] A level of 20 ppb was detected in one building but it is likely not related to vapor intrusion but rather, new carpeting that had just been installed in the location where sampling occurred.

The next step in CTDPH's evaluation involved calculating theoretical cancer risks for each location which had an exceedance of a TAC. CTDPH calculated cancer risks associated with five years of exposure to the maximum VOC concentration detected at those locations. Exposure was assumed to occur 8 hours per day, 5 days per week, 50 weeks per year. CTDPH selected five years as the exposure period because it reflects the maximum anticipated term of a lease for the buildings. In addition, final remedial decisions on the site should be reached within a five-year period. For the reasons detailed below, CTDPH considers this exposure scenario to represent a conservative but not necessarily worst case estimate of potential exposure.

- Assumptions about exposure duration (8 hours per day, 5 days per week, 50 weeks per year) are realistic for a typical worker.
- For TCE risk calculations, CTDPH used the midpoint (rather than the upper end) of EPA's new range for cancer potency. Use of the midpoint provides a less conservative estimate of theoretical cancer risks than use of the upper end.
- While CTDPH's use of maximum concentrations is a conservative assumption, it is not necessarily worst case because in most locations, there are not enough rounds of data to adequately represent the large variability inherent in indoor air VOC concentrations.

Cancer potency values and other inputs to the risk calculations are provided in Attachment 1. Attachment 1 also contains the results of the risk calculations.

Attachment 1 shows that theoretical cancer risks from exposure to *maximum* concentrations range from a low of 7×10^{-9} to a high of 4×10^{-5} (d). For the purposes of this assessment, CTDPH has assumed that five years is the maximum amount of time prospective tenants will be exposed. For locations with five-year cancer risks less than 1×10^{-6} , CTDPH considered them to be insignificant and no further risk calculations were conducted for that location. In most cases, such locations are considered suitable to lease as long as periodic indoor air sampling occurs to ensure that conditions do not worsen in the future.

For those locations with five-year cancer risks (based upon the maximum detected concentration) greater than 1×10^{-5} , CTDPH considered those risks to be significantly elevated with such locations designated as "Do Not Lease."

For locations with five-year cancer risks between 1×10^{-6} and 1×10^{-5} , CTDPH calculated an average indoor air concentration to provide a central tendency estimate to compare with the maximum exposure. All 5-year cancer risks based on the average concentration were near or below 1×10^{-6} . CTDPH considered these locations suitable to lease, with more sampling.

Table 2 below summarizes CTDPH's conclusions regarding the suitability to lease for each location at the SAEP for which indoor air data was provided. Attachment 1 contains the full details of the evaluation. In making its decisions, CTDPH considered the magnitude of the risks as discussed above. CTDPH also considered whether there was sufficient data on which to base a decision and also the frequency of detections of VOCs above TACs. CTDPH notes that its recommendations are based on an assumed maximum occupancy period of five years. If buildings are occupied for a longer period, exposures and risks should be reassessed. In addition, CTDPH's evaluation did not include a thorough review of all of the quality control/quality assurance aspects of the Army's indoor air data. As stated previously, the Army did use standard sample collection and analysis protocols for ambient air. For purposes of this evaluation, CTDPH assumes that the Army's indoor air data are of good quality.

Table 2.

Summary of CTDPH Recommendations on Suitability to Lease Buildings at the SAEP.

Building/Location	CTDPH Recommendation
Building 1, Main Entrance	Do Not Lease
Building 1, 2nd Floor	OK to lease with more sampling
Building 1, 3rd Floor	OK to lease, no further sampling needed
Building 2, Boiler Room	Unlikely location for extensive exposure
Building 2, ground floor south end	OK to lease with more sampling
Building 2, ground floor, north end and center	Do Not Lease
Building 2, 2nd floor, north end	OK to lease with more sampling
Building 3, all locations	OK to lease with more sampling
Building 4	OK to lease with more sampling
Building 6, all locations	OK to lease with more sampling

Building 9, center	OK to lease with more sampling
Building 10, center	Do Not Lease
Building 12, Shop Area and Office Area	OK to lease with more sampling
Building 48, paint shop	OK to lease with more sampling
Building 65	OK to lease with more sampling
ML-01	OK to lease with more sampling
ML-02	OK to lease with more sampling

CONCLUSIONS AND RECOMMENDATIONS

In this Health Consultation, CTDPH has evaluated indoor air data at SAEP using realistic, yet health protective exposure assumptions and has made the above recommendations to the Town of Stratford regarding whether specific buildings and portions of buildings should be leased in the future. It should be stressed that these recommendations are based on data reflecting *current* indoor air conditions. Because we do not have data for future conditions, we cannot reach conclusions about exposures or potential health impacts to future occupants from VOCs in indoor air at the SAEP. As stated previously, current exposures were not evaluated as part of this Health Consultation.

CTDPH recommends additional sampling in the locations specified in the above table because there is uncertainty in the concentrations of VOCs to which future tenants may be exposed. In most locations, there are not enough rounds of data to adequately represent the large variability inherent in indoor air VOC concentrations. Additionally, the locations in the buildings that previously were sampled may not accurately represent the specific areas that will be occupied. Also, if modifications are made to interior spaces to accommodate future tenants, indoor air sampling will need to be done in the reconfigured spaces.

Future indoor air monitoring should commence once the spaces are reconfigured but prior to building occupancy and should continue periodically thereafter. CTDPH will assist the Town of Stratford, as needed, regarding development of a suitable sampling plan and evaluating future indoor air monitoring data.

Public Health Action Plan

Actions Taken:

1. CTDPH has provided technical assistance regarding the indoor air data from SAEP to the Town of Stratford by participating in conference calls and attending meetings with the Army and its consultants, CTDEP and EPA.
2. CTDPH has provided its evaluation and recommendations on the suitability to lease buildings at the SAEP to the Town of Stratford.

Actions Planned:

1. CTDPH will assist the Town of Stratford, as needed, regarding development of a suitable indoor air sampling plan for SAEP.

2. CTDPH will review future data and plans for building occupancy for the SAEP, as requested.
3. CTDPH will assist the Town of Stratford in preparing a fact sheet or other riskcommunication materials informing prospective tenants about indoor air quality.

REFERENCES

ATSDR 2000. Health Consultation: Residential Indoor Air Evaluation, Raymark Industries Incorporated, prepared by CT Department of Public Health, October 17, 2000.

ATSDR 2003. **DRAFT** Health Consultation: Residential Indoor Air and Soil Gas Evaluation, Phases 2 and 3, prepared by CT Department of Public Health, January, 2003.

Finding of Suitability to Lease (FOSL), Stratford Army Engine Plant, US Department of Defense, November 21, 2002.

CERTIFICATION

The Health Consultation for the Stratford Army Engine Plant was prepared by the Connecticut Department of Public Health 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 initiated.

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The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Health Consultation and concurs with its findings.

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ATTACHMENT 1: CANCER POTENCY VALUES AND RISK CALCULATIONS

[Click here to view Attachment 1 in PDF format](#) (PDF, 18KB)

¹ A cancer risk of 7×10^{-9} means 7 excess cancers in 1,000,000,000 (one billion) exposed people. A cancer risk of 4×10^{-5} means 4 excess cancers in 100,000 (one hundred thousand) exposed people.

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ATTACHMENT 1

Location	Chemical	Max (ppb)	# samples above TAC-IC	5 Year Risk at Max	Annual Ave. (ppb)	5 Year Risk at Ave.	Area Recommendations
Bldg 10, center, B10-01	PCE	3.2	1/15	3.0E-06			Do Not Lease
	TCE	6	6/15	2.0E-05			
	VC	0.62	1/15	1.7E-07			
Bldg 1, main entrance, B1-01	TCE	3.2	9/26	1.1E-05			Do Not Lease
	PCE	9.6	1/26	9.1E-06			
Bldg 1, 2nd fl., B1-02	TCE	2.1	5/26	7.0E-06	0.169	5.6E-07	OK to Lease w/more sampling
Bldg 1, 3rd fl., B1-03	TCE	0.27	1/26	9.0E-07			OK to Lease
Bldg. 12 Shop Area B12-01	TCE	2.4 (J)	6/22	8.0E-06	0.280	9.4E-07	OK to Lease w/more sampling
	VC	0.067	0/22	1.8E-08			
Bldg. 12, Office Area, B12-02	TCE	0.56	3/26	1.9E-06			OK to Lease w/more sampling
	VC	0.12	0/26	3.2E-08			
Bldg 2 Boiler room, B2-01	TCE	0.87 (J)	19/26	2.9E-06			Low exposure / boiler room
Bldg. 2, S. end Gr. Fl. B2-03	TCE	0.71	3/3	2.4E-06	0.470	1.6E-06	OK to Lease w/more sampling
	VC	0.11	0/26	2.9E-08			
Bldg. 2, N. end, B2-1-01	TCE	11	3/3	3.7E-05			Do Not Lease
	VC	0.075	0/3	2.0E-08			
Bldg. 2, N. end 2nd fl. B2-2-01	TCE	0.7	3/4	2.3E-06	0.367	1.2E-06	OK to Lease w/more sampling
Bldg. 2, N. end 2nd fl. B2-2-02	TCE	0.88	2/2	2.9E-06	0.655	2.2E-06	OK to Lease w/more sampling
Bldg 2, center 99-01...05	TCE	11	10/10	3.7E-05			Do Not Lease
	VC	0.063	0/10	1.7E-08			
Bldg 3, E. side, B3-01	TCE	0.26	2/2	8.7E-07			OK to Lease w/more sampling
Bldg. 3, W. side, B3-02	TCE	0.27	1/1	9.0E-07			OK to Lease w/more sampling
Bldg 3, center, B3-03	TCE	0.31	4/5	1.0E-06			OK to Lease w/more sampling
Bldg. 3, SW end, B3-04	NO EXCEEDANCES - 2 ROUNDS						OK to Lease w/more sampling
Bldg. 3, SW end, 2nd fl. B3-2-01	TCE	0.31	1/2	1.0E-06			OK to Lease w/more sampling
Bldg 3, SE end, 2nd fl., B3-2-02	TCE	0.27	1/2	9.0E-07			OK to Lease w/more sampling
Bldg 3, SW end 3rd fl., B3-3-01	NO EXCEEDANCES - 2 ROUNDS						OK to Lease w/more sampling
Bldg. 3, SE side, 3rd fl., B3-3-02	NO EXCEEDANCES - 2 ROUNDS						OK to Lease w/more sampling
Bldg. 4, east corner, B4-01	NO EXCEEDANCES - 1 ROUND						OK to Lease w/more sampling
Bldg. 48, paint shop, B48-01	NO EXCEEDANCES - 1 ROUND						OK to Lease w/more sampling
Bldg 6, east corner, B6-01	TCE	1 (J)	1/8	3.3E-06			OK to Lease w/more sampling
Bldg. 6, center, B6-02	VC	0.062	0/5	1.7E-08			OK to Lease w/more sampling
Bldg 6, center, 2nd fl. B6-2-01	NO EXCEEDANCES - 2 ROUNDS						OK to Lease w/more sampling
Bldg 65, Index, B65-01	TCE	0.75	8/23	2.5E-06	0.198	6.6E-07	OK to Lease w/more sampling
	PCE	6	1/23	5.7E-06			
	VC	0.21	0/23	5.6E-08			
Bldg. 9, center, B9-01	TCE	0.35	3/17	1.2E-06	0.125	4.2E-07	OK to Lease w/more sampling
	VC	0.068	0/17	3.8E-08			
	PCE	3.2	2/17	3.0E-06			
ML - 01	TCE	1.3 (J)	4/16	4.3E-06	0.214	7.2E-07	OK to Lease w/more sampling
	PCE	20	1/16				
ML-02	TCE	1.5	3/26	5.0E-06	0.186	6.2E-07	OK to Lease w/more sampling
	VC	0.23	0/26	6.1E-08			

Cancer Risk Calculation Inputs

Inh. rate	10 m3/d
Body wt	70 kg
Exp. days	250 days per year - 5 day/wk * 50 wk/year
Avg. time	25550 days per 70 year lifespan
units conv	5.374 convert TCE ppb to ug/m3
units conv	6.78 convert PCE ppb to ug/m3
units conv	2.55 convert VC ppb to ug/m3
PCE CSF	2.00E-05 per ug/kg/d - Cal. unit risk converted to CSF
VC CSF	1.50E-05 per ug/kg/d - from IRIS inh. slope, adult only
TCE CSF	8.90E-05 per ug/kg/d - midpoint of new CSF range

CSF = Cancer slope factor, or cancer potency factor