Health Consultation

Vapor Intrusion at Properties Adjacent to
the Former Risdon Corporation Facility

RISDON CORPORATION

DANBURY, FAIRFIELD COUNTY, CONNECTICUT

EPA FACILITY ID: CTD001168558

SEPTEMBER 5, 2003

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

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

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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Prepared by:

Connecticut Department of Public Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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 ISSUE

The Connecticut Department of Public Health (CT DPH) was asked by the U.S. Environmental Protection Agency (EPA) to evaluate the public health implications of volatile organic compounds (VOCs) off gassing from contaminated groundwater near the Risdon Corporation and migrating into buildings in a residential/commercial neighborhood of Danbury, Connecticut. The data evaluated by CT DPH is from a groundwater and soil gas study conducted by Woodward & Curran, a contractor for the Risdon Company (Woodward & Curran, 2003b). The study involved two residential properties in a Danbury neighborhood. The properties are located near the intersection of Old Newtown Road and Broad Street, between the former Risdon Corporation facility and a small river. A map of the area, with sample locations shown, is included as Attachment A. There are no private drinking water wells on the Risdon site or at any of the nearby downgradient properties.

The residential sites were chosen for study because they are hydro- geologically down-gradient from the Risdon facility, and because a previous Health Consultation (ATSDR, 2002) had indicated that vapor intrusion may be occurring at the properties. As a result, indoor air, soil gas and groundwater sampling were conducted on these properties in March of 2003 by Woodward & Curran.

Risdon began operations on Old Newtown Road in 1956. The company's manufacturing process included electroplating (nickel, brass, chrome, silver, cyanide); stripping (nitric acid, methylene chloride, formic acid); painting (lacquers, enamels); buffing and polishing. Wastes generated at the site include 1,1,1-trichloroethane (TCA) and trichloroethylene (TCE), lacquers, thinners, enamels, petroleum distillates, methylene chloride, formic acid , degreasing filters, silver cyanide solution, nitric acid, and metal hydroxide sludge. The chlorinated solvents, TCA and TCE have contaminated groundwater at and near the Risdon facility. The breakdown products of TCE, 1,2-dichloroethene (1,2-DCE),1,1-dichlorethene (1,1-DCE) & vinyl chloride, have also been detected in groundwater.

Description of adjacent properties

On Broad Street , the single-family residence (built 1895) is one and one-half stories tall, and contains approximately 1200 square feet of floor space. A recent survey by Woodward & Curran indicates that two adults and two children reside at this address. On Old Newtown Road, the two-family residence (built about 1783) is two stories tall, and contains approximately 2100 square feet of floor space. A recent survey by Woodward & Curran indicates that three adults reside at

this address. Both residences are built on stone foundations and the basements are unfinished. Both have detached, single story, garages.

Site visit & community concerns
On February 21, 2002, representatives from CT DPH, ATSDR, EPA, Woodward & Curran (Risdon's Contractor), and the Danbury Health Department visited the area adjacent to the Risdon facility. Purposes of this visit were to inform public health officials of the goals of this Health Consultation, and to discuss any relevant community concerns. During the visit, the owner of one of the surveyed residential properties approached the group to ask for an explanation of the group's purpose. During our exchange, this individual did not ask about the possible health effects of vapor intrusion. At the completion of the last Risdon Health Consultation, CTDPH sent a copy and a cover letter explaining our conclusions to residents of the two homes. CTDPH did not hear back directly from any residents. However, CT DPH staff also advised local health department staff on the results/recommendations of this last consult and this information was transmitted directly to a concerned resident via communication with the local health department.

DISCUSSION

Assessment methodology
To evaluate public health implications of exposure to environmental contamination at these two residential properties, CTDPH considered the available environmental data and how people might become exposed to contaminants. If there is no potential for exposure, then it can be concluded that there is no threat to public health. In cases where exposure is possible (i.e., via vapor intrusion), CTDPH compared maximum concentrations of contaminants with health-protective comparison values. This is a conservative (health protective) screening step to rule out exposures that have little likelihood of causing adverse health impacts. When contaminant concentrations exceeded comparison values, exposures were evaluated further to determine the likelihood that the exposures would be significant enough to cause health effects.

Comparison Values
The comparison values are taken from the Connecticut Department of Environmental Protection's (CT DEP) Remediation Standards for residential exposure (RSR). The "Target Air Concentrations" (TAC), listed under the RSRs, have been revised since the last Risdon Health Consultation was released, and the revised (proposed) TAC values are used in this Health Consultation for comparison values.

Environmental Sampling and Results

At each of the two residences, samples were taken from indoor air, soil gas[1], and groundwater. Sampling was done on March 21, 2003. Sample locations are shown on Attachment A. To sample groundwater, a stainless steel groundwater probe was installed at the desired depth below grade at a location near the foundation. A sample of groundwater is then pumped up from inside the probe casing. The groundwater sample was collected in a vial and transported to the laboratory for analysis. Groundwater samples were analyzed using an EPA-approved method (#8260B). To sample soil gas, a stainless steel soil gas probe was installed at the desired depth below the basement grade level, within the basement. A soil gas sample was then pumped up from the inside of the probe casing. The gas was collected in a 1 liter canister for transport to the analytical laboratory. Soil gas samples were analyzed using an EPA-approved method (#TO-14/15). To sample indoor air (and ambient air), gas was collected in a vacuum canister over an eight-hour period of time and transported to the analytical laboratory. Indoor air samples were analyzed using an EPA-approved method (#TO-14/15). The following compounds were analyzed for:

1. Acetone
2. benzene
3. bromomethane
4. 1,3-butadiene
5. 2-buananone (MEK)
6. carbon Tetrachloride
7. chloroethane
8. chloroform
9. chloromethane
10. 1,4-dichlorobenzene
11. 1,1-dichloroethane
12. 1,2-dichloroethane
13. 1,1-dichloroethene
14. cis-1,2-dichloroethene
15. ethylbenzene
16. 4-ethyltoluene
17. freon 11
18. freon 12
19. freon 113
20. methylene chloride
21. methyl tertiary butyl ether (MTBE)
22. styrene
23. tetrachloroethene
24. toluene
25. 1,1,1-trichloroethane
26. trichloroethylene
27. 1,2,4-trimethylbenzene
28. 1,3,5-trimethylbenzene
29. vinyl chloride
30. m,p-xylene
31. o-xylene

The data summarized in this Health Consultation indicates that trichloroethylene, carbon tetrachloride, methylene chloride, 1,2-dichloroethane, benzene, and chloroform were detected in concentrations greater than the comparison value at both residences. Indoor air data and comparison values for all detections above comparison values are shown in Tables 1 and 2. As shown in the Tables, the source of trichloroethylene is groundwater. (Refer to the "Exposure Pathways" section for a discussion.) The sources of the other chemicals listed in the Tables is less

[1]Soil gas is a term describing gas that fills the tiny voids between soil particles. Usually the voids between soil particles are filled with water, however; when groundwater is contaminated with volatile organic chemicals, the chemicals can separate into the gas phase and move into the voids. High levels of contaminants in soil gas can enter confined building spaces such as basements through crawl spaces, plumbing holes, other floor holes such as sumps and foundation cracks, and can contaminate indoor air.

certain or unknown. Concentrations of TCE's breakdown product, 1,1-DCE, were below comparison values and are therefore not shown in the Tables.

Table 1: Data and comparison values for indoor air data from the Broad Street residence.

Location	Compound [1]	Detected Concentration (ppb)	Comparison Value (ppb) [2]	Ratio (Detected over comparison value)	Likely source of contamination
Basement	carbon tetrachloride	0.11	0.08	1.38	unknown
	1,2-dichloroethane	0.034	0.017	2	unknown
	methylene chloride	1.6	0.85	1.88	unknown
	trichloroethylene	0.26	0.18	1.44	groundwater
1st floor	carbon tetrachloride	0.11	0.08	1.38	unknown
	chloroform	0.15	0.1	1.5	unknown
	1,2-dichloroethane	0.083	0.017	4.88	unknown
2nd floor	benzene	38	1	38	unknown
	carbon tetrachloride	0.12	0.08	1.50	unknown
	chloroform	0.21	0.1	2.10	unknown
	1,2-dichloroethane	0.078	0.017	4.59	unknown
	trichloroethylene	0.2	0.18	1.11	groundwater
outdoors	carbon tetrachloride	0.098	0.08	1.23	unknown

[1] A compound is included in this column if the concentration is greater than the comparison value.
[2]Comparison values are CT DEP's proposed TACs (residential Target Air Concentrations)

Table 2: Data and comparison values for indoor air data from the Old Newtown Road residence.

Location	Compound [1]	Detected Concentration (ppb)	Comparison Value (ppb) [2]	Ratio (Detected over comparison value)	Likely source of contamination
Basement	carbon tetrachloride	0.12	0.08	1.50	unknown
	chloroform	0.12	0.1	1.20	unknown
	trichloroethylene	1	0.18	5.56	groundwater
1st floor	carbon tetrachloride	0.27	0.08	3.38	unknown
	chloroform	0.23	0.1	2.30	unknown
	1,2-dichloroethane	0.04	0.017	2.35	unknown
	trichloroethylene	0.4	0.18	2.22	groundwater
2nd floor	benzene	1.2	1	1.20	unknown
	carbon tetrachloride	0.18	0.08	2.25	unknown
	chloroform	3.7	0.1	37.00	unknown
	1,2-dichloroethane	0.16	0.017	9.4	unknown
	methylene chloride	3.5	0.85	4.12	unknown
	trichloroethylene	0.46	0.18	2.56	groundwater
outdoors	carbon tetrachloride	0.092	0.08	1.15	unknown

[1] A compound is included in this column if the concentration is greater than the comparison value.
[2]Comparison values are CT DEP's proposed TACs (residential Target Air Concentrations)

Exposure pathways

Indoor air concentrations of intruding vapors can be expected to vary considerably with time because intrusion is influenced by a variety of factors such as soil moisture and atmospheric pressure (inside relative to outside). The influence of these factors on intrusion is difficult to account for at any one time and location, and it is not possible (with only a single sampling event) to infer the range of possible concentrations. However, because specific steps were taken to limit the exchange of indoor with outdoor air, and because samples were taken during the cool weather season, the results are probably representative of the high-end of the spectrum of variability (Woodward & Curran, 2003a).

At the Old Newtown Road residence, the drop in TCE upstairs (about 40 % relative to the basement) parallels the drop in its breakdown product (1,1-DCE), strongly suggesting that the source of the contamination is groundwater. Furthermore, the ratio of TCE divided by 1,1-DCE stays nearly constant across different media (i.e.; the ratio in basement air is 8.33, while the ratio in soil gas and groundwater is 11.11 for each: Groundwater and soil gas data is from Woodward & Curran, 2003b). Though the TCE concentration in the air from the Broad Street residence is not as high, the results still suggest that vapor intrusion is occurring at this address. (TCE was detected in all media (air, soil gas, & groundwater), and its air concentration was highest in the basement.) As both residential addresses are served by public water, the vapor intrusion pathway would appear to be the primary means of exposure to TCE.

The general public can be exposed to TCE in many different ways, e.g., through outdoor air, drinking water, food, and at work. As about 3.5 million workers are exposed, it is clear that significant TCE exposure occurs in an occupational setting. The general public is also exposed to TCE through various consumer products, e.g., typewriter corrections fluids, paints and paint removers, glues, spot removers, rug cleaning fluids, and metal cleaners. TCE has also been detected in a variety of different foods (ATSDR, 1997).

As indicated in Tables 1 & 2, the source of contaminants other than TCE is unknown. For some contaminants (e.g., benzene and chloroform) the exposure pathway may *not* involve vapor intrusion. Based on these data, it is not possible to explain why benzene was detected on the second floor of each residence; however, CTDPH suggests that the benzene was released from some petroleum product (e.g; a fuel or solvent), and that its presence may be transient. Chloroform is a byproduct of chlorine-based drinking water disinfection, and it is sometimes found in public water. Because chloroform is quite volatile, and because concentrations were low in ambient air, CTDPH suggests that the source of the chloroform is public water. These results do not provide evidence to suggest what the source of 1,2-dichloroethane, methylene chloride, and carbon tetrachloride contamination is, though it is clear that these compounds were not detected in groundwater or soil gas, and concentrations in basement air were (with the exception of methylene chloride at the Broad Street residence) at or below detection limits.

Public Health Implications of present and past exposures
The primary contaminant of concern for the vapor intrusion pathway is TCE. The TCE concentrations in the living spaces of the Old Newtown Road residence were 2-3 times above the comparison value. At the Broad Street residence, the TCE concentrations in the living spaces were about equal to the comparison value. In this instance the comparison value for TCE, which is taken from CTDEP's proposed Target Air Concentrations, is set at an estimate of the background indoor air concentration (CT DEP, 2003). The evidence that residents of the homes in the vicinity of the Risdon site are being exposed to 2-3 times the comparison value concentration of TCE through indoor air suggests that the residents are exposed to more TCE than the general population because recent studies (Kurtz & Folkes, 2002) have demonstrated that the TCE concentration in indoor air of homes unaffected by groundwater pollution is typically less than 25 percent of the comparison value.

For evaluations of TCE in indoor air at this and other sites, CTDPH has proposed a tiered system of action levels based on the proposed TAC of 0.18 ppb. The tiered system is outlined in Table 3. Above TCE indoor air concentrations of 1.8 ppb, immediate mitigation is needed. At levels between 0.18 and 1.8 ppb, mitigation is needed within several years. Below 0.18 ppb, no action is needed because the TCE detected could be due to background. Background (outdoor air) concentrations at this site were 0.14 and 0.13 ppb at the Old Newtown Road and the Broad Street residences respectively.

Table 3. Tiered Action Levels for Indoor Air and Recommended Actions for TCE*

TIER 1	TIER 2	TIER 3
>1.8 ppb: *Immediate mitigation needed. Cancer risks could be as high as 1 X 10^{-3} @*	**From 0.18 ppb to 1.8 ppb:** Mitigation needed within several years. Cancer risk is approximately 1 X 10^{-5} @	**<0.18 ppb:** No further action needed as TCE may be at background levels. More monitoring only if soil gas is elevated

* Risk estimates presented in this table assume continuous lifetime exposure. Calculations for the risk estimates are presented in Attachment B.

@ A cancer risk of 1 X 10^{-3} means a theoretical excess cancer of one in 1000 people exposed for a lifetime. A cancer risk of 1 X 10 -5 means a theoretical excess cancer of 1 in 100,000 people exposed for a lifetime.

Risk Calculations

Health concerns relevant to the residential indoor air exposure scenario (i.e.; continuous and long-term exposure to low concentrations of TCE) involve consideration of increased risk of cancer. For the purpose of estimating excess cancer risk, the Environmental Protection Agency (EPA) typically provides a potency factor for an environmental contaminant such as TCE. This potency factor (known as a slope factor or unit risk factor) is an upper-bound estimate of theoretical cancer risk for the general population for a lifetime's worth of exposure to account for the possibility that potency may vary between individuals. Though it can not be calculated, excess risk to an individual is likely to be less than the calculated risk.

EPA is currently evaluating the cancer potency of TCE and has proposed potency factors (unit risk values) in the range of 5.7 X 10^{-6} per ug/m^3 to 1.14 10^{-4} per ug/m^3 (EPA, 2001). Accordingly, risk associated with the comparison value (1 ug/m^3) is in the range of 5.7 in a million to 114 in a million. Theoretical risk associated with a lifetime's worth of exposure at the concentrations detected in air for this survey is proportionately higher. Risk calculations are shown in Attachment B.

Health concerns relevant to the residential indoor air exposure scenario also involve consideration of potential non-cancer effects. TCE has been shown to cause adverse effects on the central nervous system, liver and endocrine systems of humans or laboratory animals (EPA, 2001). Typically, EPA evaluates the relevant toxicology literature and derives "reference concentrations" from observed effect or no-effect doses and an appropriate safety factor that accounts for inter-individual variability in response and other uncertainties. The reference dose (or reference concentration) is a daily exposure that is considered safe for the long term. For long term exposure to low doses of TCE, concerns about potential non-cancer effects are outweighed by concerns about potential cancer effects.

EPA is currently evaluating the trichlorethylene inhalation reference concentration (RfC) used to determine the Hazard Index (HI). The HI is the observed concentration divided by the RfC. Any value of HI less than or equal to 1 is considered safe for noncancer effects. Based on the data from this round of indoor air sampling, the maximum HI is 0.14 (1 ppb/ RfC), therefore adverse noncancer effects are not expected to occur.

Past exposures

Groundwater at the Risdon site has been actively remediated and groundwater concentrations are decreasing. This would suggest that exposures via indoor air were greater in the past. The last Risdon Health Consultation cited 12,000 ppb as a groundwater concentration representative of a historical maximum for TCE near the Old Newtown Road residence.[2] Assuming that the ratio of TCE in groundwater and indoor air was the same then as it is today, then this suggests that the air concentration in the first floor living space could have been as high as 9 ppb (12,000/540 * 0.4 ppb). Past groundwater data would indicate that the vapor intrusion pathway was significant for at least ten years. The actual number of years that the vapor intrusion pathway has existed is not known, but it is possible that the pathway has been present for as long as the Risdon facility has been operating (45 years).

To put the magnitude of past exposures in perspective with doses from the toxicology literature, CTDPH estimated the maximum possible lifetime averaged daily dose of TCE, and compared it to the doses derived from toxicology studies. These comparisons are presented in Table 4. The maximum lifetime average daily dose was derived by assuming continuous occupancy for 45 years, and a constant TCE concentration of 9 ppb. Even with this worst-case scenario, the maximum possible dose is 220 times less than the lowest lifetime average daily dose shown in Table 4 (1.98 mg/kg*day for a cohort of German workers at a cardboard manufacturing plant).

[2]Data from monitoring well 14 & 15 in 1992. See Table 2 of the previous Risdon Health Consultation

Table 4. Estimated exposure levels and doses for TCE: A comparison of lifetime average daily doses (LADD) between indoor air and the toxicology literature.

Estimated Exposure Level at the Site (mg/kg per day)*	Comment	Effect Level From Toxicology Literature (mg/kg per day)	Comment
0.0006 - 0.009	High number is "Worst case" estimate assuming 12,000 ppb in groundwater, while the low number is the estimate for present day.	1016	LADD causing increase of 26% in number of malignant liver tumors in male mice and increase of 7% in female mice (by inhalation).
		724	LADD causing increase of 50% in number of malignant liver tumors in male mice (by. gavage).
		714	LADD causing increase of 22% in number of malignant liver tumors in female mice (by gavage).
		21.6-348.9	Range of estimated LED_{10}[&] values based on mouse liver tumors. (Rhomberg, 2000)
		53-244	Range of estimated LED_{01}[&] values based on rat renal tumors. (EPA 2001)
		1.98	LADD associated with SIR[&] of 13.53 for kidney cancer in German cardboard workers exposed by inhalation. (EPA 2002)

* "Worst case" dose calculated from predicted maximum air concentration in the living space (9ppb- see text), assuming an inhalation rate of 20 m^3 per day for 365 days per year, and averaged for 45 years of a lifetime (70 yrs). Present day dose was derived assuming an indoor air concentration of 0.4 ppb (2 ug/m^3) and a 20 m^3/day inhalation rate.

& LED_{10} = Lower 95% confidence limit on the effective dose to 10% of the population.
LED_{01} = Lower 95% confidence limit on the effective dose to 1% of the population.
SIR = Standardized Incidence Ratio, ratio of the observed number of cancers in the exposed population and the expected number.

The differences between the effect levels and maximum exposure levels suggested by indoor air and historical groundwater contamination data indicate that these exposure levels are well below the range where toxicity has been seen for TCE (Table 4). However, the calculated risk values fall above the *de minumus* level of 1 in a million to 10 in a million (Attachment B) due to the large size of the built-in safety factor. Regarding the acceptable size of the safety factor (*a.k.a.*;

margin of exposure), it is a matter of judgement and policy as to how to account for the possibility of incurring some risk even at very low doses. This is because with TCE, more than one possible mechanism of toxicity is apparent, and it is difficult to determine which mechanism is more relevant to estimating the carcinogenic effects of TCE, and what the shape of the resulting dose-response relationship might be. EPA's current draft risk assessment evaluates TCE carcinogenicity based upon the most recent cancer risk guidelines and presents a non-threshold approach to project cancer risk. This, more prudent, approach was used by CTDPH to develop the TCE cancer risk estimates shown in Attachment B.

CONCLUSIONS

Based on the data at or near the two residential properties, DPH has concluded that the vapor intrusion pathway is complete from groundwater to soil gas, and to indoor air. Residents of both homes have been and are being exposed to TCE in indoor air at concentrations in excess of the comparison value (Connecticut's proposed Target Air Concentration). Based on conservative estimates of exposure, CT DPH estimated cancer and non-cancer risks to residents living in homes with elevated VOCs in indoor air (Attachment B). The estimates represent a low to moderate added risk above the *de minimus* level. In addition, there is some concern among scientists that children may have increased risks of cancer when exposure to carcinogens occurs during early life. These factors have prompted CT DPH to conclude that a public health hazard exists and requires action (Attachment C). If action is taken to reduce or eliminate exposures to VOCs migrating from groundwater to indoor air, then the public health hazard will no longer exist. However, as comparison values represent exposures that are highly likely to be below the threshold for toxic effect (Table 4), CTDPH believes that it is very unlikely that present-day exposures could result in cancer or other adverse health effects. Consequently, CTDPH has categorized these TCE exposures as Tier 2 (Table 3), meaning that mitigation is needed; but, urgent action is not necessary.

In the previous Risdon Health Consultation, CTDPH stated that consideration will be given to sampling the commercial addresses if subsequent sampling of residential indoor air indicates that a public health hazard is present. Because the present-day extent of TCE intrusion is low, CTDPH does not conclude that sampling of the indoor air at commercial addresses is needed.

RECOMMENDATIONS

Because there is good evidence that the vapor intrusion pathway is complete, and because there is evidence that TCE concentrations are in the Tier 2 range, CTDPH recommends remediation at the Broad Street and Old Newtown Road residences.

PUBLIC HEALTH ACTION PLAN

Actions Planned

1. If EPA takes exposure reduction measures in any of the homes, CT DPH will work with EPA, CT DEP and the Danbury Health Department to evaluate alternatives and respond to public health questions and concerns.

2. CT DPH will continue to work with EPA, CT DEP and the Danbury Health Department to prepare a letter to the residents of 2 Broad Street and 2 Old Newtown Road which will: (1) summarize the results of the EPA Soil Gas and Indoor Air Study; (2) provide a public health interpretation of the results; (3) suggest how exposure to indoor air contaminants from sources other than vapor intrusion (e.g., benzene, etc.) may be reduced; and, (4) discuss next steps.

3. CT DPH will work with the Danbury Health Department in responding to public health concerns and questions

REFERENCES

ATSDR, 2002. Vapor Intrusion Potential at Properties Adjacent To Former Risdon Corporation Facility, Danbury, Fairfield County, Connecticut. Agency for Toxic Substances & Disease Registry, Health Consultation, June 12, 2002

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CERTIFICATION

The Health Consultation for Indoor Air Evaluation in Danbury Connecticut 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.

Technical Project Officer, SPS,SSAB,DHAC

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

for RE

Chief, SSAB,DHAC,ATSDR

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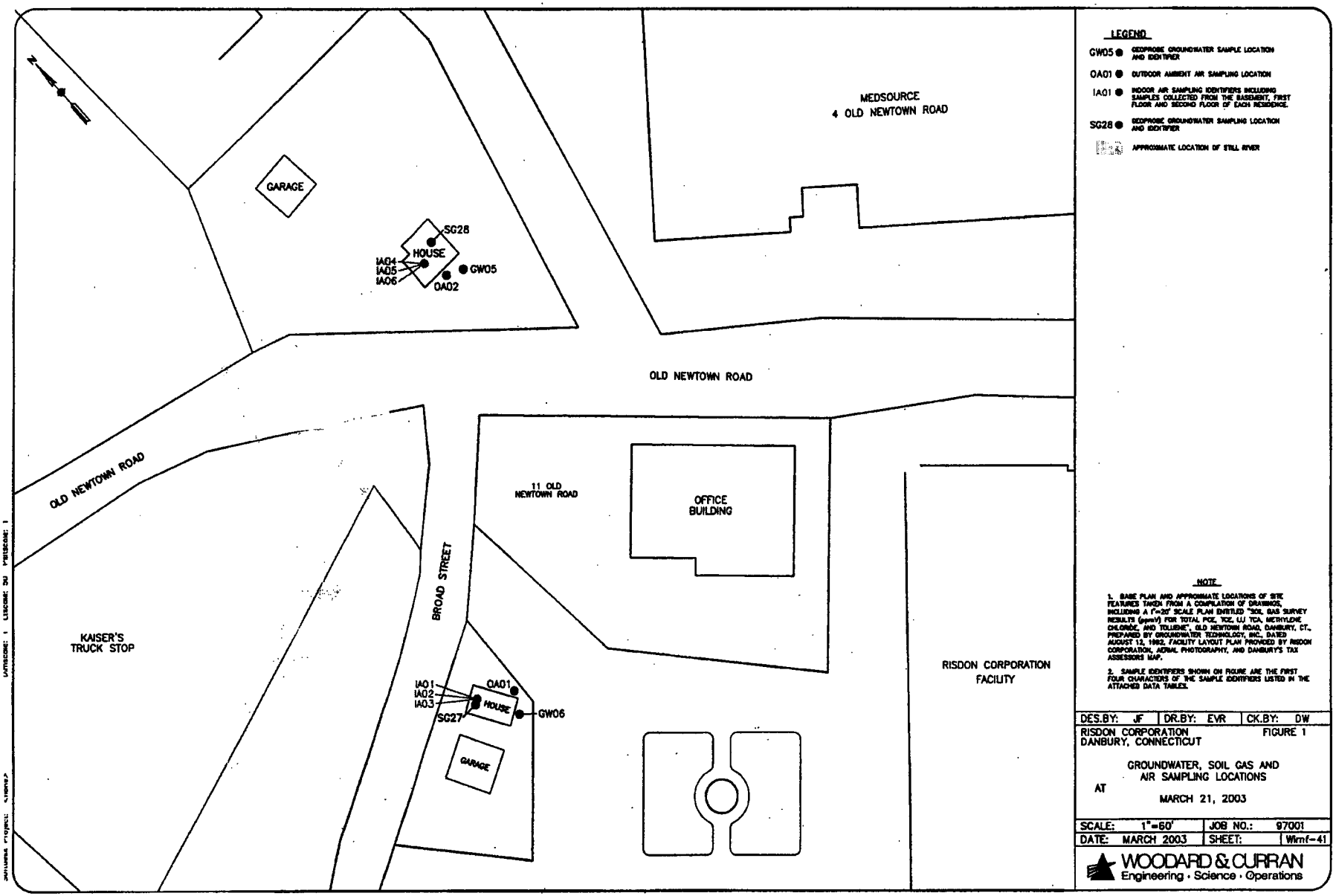
Attachment A: Diagram of the Risdon Facility with adjacent properties

GW: Location of groundwater well location. **SG:** Soil gas location. **IA**: Indoor air monitoring location



Attachment B:
Indoor Air Trichloroethylene Risks For a Cancer Potency Factor Range of 0.02/mg/kg/day to 0.4/mg/kg/day:

Part 1: Indoor Air Trichloroethylene Risks for CT DPH Tier 2 (Table 3)

Tier 2, high end: 10 ug/m^3 (1.8 ppb)

Low end potency (0.02/mg/kg/day):
[10 ug/m^3 * 20 m^3/day * 365 d/yr * 70 yr * mg/1000 ug / 70 kg * 25550 d] * 0.02/mg/kg/d = **5.7 E-5**

High end potency (0.4/mg/kg/day):
[10 ug/m^3 * 20 m^3/day * 365 d/yr * 70 yr * mg/1000 ug / 70 kg * 25550 d] * 0.4/mg/kg/d = **1.1 E-3**

Tier 2, low end: 1 ug/m^3 (0.18 ppb)

Low end potency (0.02/mg/kg/day):
[1 ug/m^3 * 20 m^3/day * 365 d/yr * 70 yr * mg/1000 ug / 70 kg * 25550 d] * 0.02/mg/kg/d = **5.7 E-6**

High end potency (0.4/mg/kg/day):
[1 ug/m^3 * 20 m^3/day * 365 d/yr * 70 yr * mg/1000 ug / 70 kg * 25550 d] * 0.4/mg/kg/d = **1.1 E-4**

Part 2: Site-Specific Indoor Air Trichloroethylene Risks for a lifetime's worth of exposure

Maximum detected concentration (basement of Old Newtown Road residence): 5.46 ug/m^3 (1 ppb)

Low end potency (0.02/mg/kg/day):
[5.46 ug/m^3 * 20 m^3/day * 365 d/yr * 70 yr * mg/1000 ug / 70 kg * 25550 d] * 0.02/mg/kg/d = **3.11 E-5**

High end potency (0.4/mg/kg/day):
[5.46 ug/m^3 * 20 m^3/day * 365 d/yr * 70 yr * mg/1000 ug / 70 kg * 25550 d] * 0.4/mg/kg/d = **6.00 E-4**

Attachment C: ATSDR Public Health Hazard Categories

Category	Definition	Criteria
A. Urgent public health hazard	This category is used for sites that pose an urgent public health hazard as the result of short-term exposures to hazardous substances.	evidence exists that exposures have occurred, are occurring, or are likely to occur in the future AND estimated exposures are to a substance(s) at concentrations in the environment that, upon short-term exposures, can cause adverse health effects to any segment of the receptor population AND/OR community-specific health outcome data indicate that the site has had an adverse impact on human health that requires rapid intervention AND/OR physical hazards at the site pose an imminent risk of physical injury
B. Public health hazard	This category is used for sites that pose a public health hazard as the result of long-term exposures to hazardous substances.	evidence exists that exposures have occurred, are occurring, or are likely to occur in the future AND estimated exposures are to a substance(s) at concentrations in the environment that, upon long-term exposures, can cause adverse health effects to any segment of the receptor population AND/OR community-specific health outcome data indicate that the site has had an adverse impact on human health that requires intervention
C. Indeterminate public health hazard	This category is used for sites with incomplete information.	limited available data do not indicate that humans are being or have been exposed to levels of contamination that would be expected to cause adverse health effects; data or information are not available for all environmental media to which humans may be exposed AND there are insufficient or no community-specific health outcome data to indicate that the site has had an adverse impact on human health
D. No apparent public health hazard	This category is used for sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.	exposures do not exceed an ATSDR chronic MRL or other comparable value AND data are available for all environmental media to which humans are being exposed AND there are no community-specific health outcome data to indicate that the site has had an adverse impact on human health
E. No public health hazard	This category is used for sites that do not pose a public health hazard.	no evidence of current or past human exposure to contaminated media AND future exposures to contaminated media are not likely to occur AND there are no community-specific health outcome data to indicate that the site has had an adverse impact on human health