Health Consultation

Contaminant Migration from the Former Imperial Cleaners Facility
Minden, LA

Evaluation of Potential Soil Vapor Intrusion Issues in the Surrounding Community

LDEQ AI# 1813

July 11, 2024

Louisiana Department of Health
Office of Public Health
Section of Environmental Epidemiology and Toxicology
New Orleans, Louisiana 70112

Health Consultation: A Note of Explanation

The Louisiana Department of Health (LDH)/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDH/SEET) prepared this Health Consultation for the community around the former Imperial Cleaners, which is located in Minden, Webster Parish, LA. This publication was made possible by a cooperative agreement [Program # TS-23-0001] from the Agency for Toxic Substances Disease Registry (ATSDR). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the ATSDR, or the U.S. Department of Health and Human Services.

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Abbreviations

ADAF	age-dependent adjustment factor
ATSDR	Agency for Toxic Substances and Disease Registry
CREG	Cancer Risk Evaluation Guide
EDMS	Electronic Document Management System (LDEQ database)
EJI	Environmental Justice Index
EPA	Environmental Protection Agency
GW1	Groundwater 1 classification for aquifers
LDEQ	Louisiana Department of Environmental Quality
LDH	Louisiana Department of Health
ND	not detected
OPH	Office of Public Health
PERC	perchloroethylene (tetrachloroethylene)
PCE	tetrachloroethylene or tetrachloroethene
RECAP	Risk Evaluation/Corrective Action Program
RMEG	Reference Dose Media Evaluation Guide
RSL	Regional Screening Level
SEET	Section of Environmental Epidemiology and Toxicology
SDWP	Safe Drinking Water Program
SVOC	semi-volatile organic compound
TCE	trichloroethylene or trichloroethene
VOC	volatile organic compound
µg/m3	micrograms per cubic meter

1. Summary

In August 2021, the Louisiana Department of Environmental Quality (LDEQ) requested that the Louisiana Department of Health/Section of Environmental Epidemiology and Toxicology (LDH/SEET) review indoor air samples collected from offices located at the former Imperial Cleaners dry cleaners site. LDH/SEET compared concentrations of tetrachloroethylene (PCE) and trichloroethylene (TCE) in the indoor air samples to ATSDR's health-based comparison values and subsequently recommended that the employees of a real estate office at the site be relocated until the area could be investigated and remediated.

In April 2022, the investigation of the Imperial Cleaners site expanded to assess potential migration of vapors from contaminated soils into other buildings around the facility. LDH/SEET has reviewed indoor and ambient air samples collected from businesses around the facility and has made the following conclusions:

Conclusion 1	Chemical releases at the former Imperial Cleaners site may not be the source of contaminants detected in indoor air in the surrounding community.
Basis for Decision	• LDEQ's historical records indicate the dry-cleaning facility used PCE as a solvent in its operations. Records of the use of other solvents, such as Stoddard solvent, are not currently available. • PCE and its breakdown products (TCE, 1,2-dichloroethene, and vinyl chloride) were not detected in the air samples at levels suggesting that vapor intrusion from groundwater contaminated with these dry cleaning solvents might be a concern. • Other potential sources of the VOCs detected include paint, commercial solvents, bathroom deodorizers, automotive shops, gas stations, and the former locations of gasoline underground storage tanks near the site.
Conclusion 2	Levels of indoor air vapors similar to those detected within the community would not be expected to pose noncancer health issues.
Basis for Decision	• At all of the sampled locations except for the bathroom at Office 1, the levels of indoor air vapors detected are below levels that would be expected to cause noncancer health effects. In the Office 1 bathroom, toilet block deodorizers

	(known to contain 1,4-dichlorobenzene) were reportedly used to combat odors related to sewer gases. Vapors from these deodorizers may have contributed to contaminant levels detected in indoor air sampled from this bathroom. • LDH/SEET is unable to make definitive health conclusions for long-term exposure to these vapors based on the small number of air samples collected at each location.
Next Steps	• DEQ plans to do further soil and groundwater sampling at the former Imperial Cleaners site. The sampling should include additional attempts to determine whether other dry cleaning agents, such as Stoddard solvent or carbon tetrachloride, were used as part of the dry cleaning operations. • Source removal and groundwater remediation should be performed at the former Imperial Cleaners site, if warranted. This will prevent future movement of contaminants from the site into the community. • Staff at locations at which solvents, adhesives, and other compounds containing VOCs are stored should be encouraged to follow proper storage and usage practices to minimize exposures. • LDH will remain engaged at this site and collaborate with DEQ, when requested, while site investigation and remediation continues.
For More Information	**Contact LDH/SEET at (888) 293-7020.**

2. Background

2.1. Statement of Issue and Purpose

On August 26, 2021, the Louisiana Department of Environmental Quality (DEQ) contacted the Louisiana Department of Health (LDH) to request that the Section of Environmental Epidemiology and Toxicology (SEET) review two indoor air samples collected from a real estate office located at the former Imperial Cleaners dry cleaners site in Minden, LA. One sample was from the real estate office, and one sample was from an adjacent warehouse at the site. Chlorinated solvents common to dry cleaning use were identified as the contaminants of concern. The employees at the real estate office included women of childbearing age, which posed a particular concern as a sensitive population.

LDH/SEET's responded to the request with the following assessment:

> "Our assessment is based on two indoor air samples collected at an occupied real estate office earlier this month.. The property is a former dry cleaner Tetrachloroethylene (PCE) in the real estate office is 4-5 times higher than ATSDR's acute and chronic non cancer comparison values for PCE. Trichloroethylene (TCE) levels are 4-5 times higher than ATSDR's chronic non cancer comparison value (Note: An acute comparison value for TCE does not exist.). The PCE and TCE levels are roughly 50-75 times higher than cancer-based screening values which assumes lifetime exposures. It should be noted that ATSDR's comparison values are based on a residential exposure scenario. Even though this is a place of business and not a residence, **the levels of TCE and PCE are concerning. Employees of this real estate office should be relocated until the area is investigated and remediated and the indoor air concentrations are mitigated.**"

In April 2022, DEQ informed LDH/SEET that the investigation at the Imperial Cleaners site was expanding to assess vapor intrusion off-site, the potential migration of vapors from contaminated soils and groundwater into other buildings around the facility. LDH/SEET reviewed indoor and ambient air sample results collected in tiered sampling events from businesses in the community surrounding the former Imperial Cleaners site. The review was performed to identify whether vapor intrusion of chemicals associated with historical dry cleaning activities is a concern in these buildings and to determine whether any vapors present pose health risks to people working at or using these businesses.

2.2. Site Description

The Imperial Cleaners & Laundry Site, LDEQ Agency Interest No. (AI # 1813), is located on approximately 0.8 acres at 211 Pennsylvania Avenue in Minden, Louisiana (see Appendix A: Figures). The facility operated as a dry-cleaners between 1950-1962 to 2008-2013. Records reviewed in LDEQ's Electronic Document Management System (EDMS) indicate the dry-cleaning facility used perchloroethylene (tetrachloroethylene) as a solvent in its operations [1].

The northern portion of property, which operated as the former dry-cleaning facility, was recently used for woodworking/cabinet making and is currently used for storage [2]. The center portion of the property was formerly occupied by a realtor's office and is currently vacant [1].

LDEQ assessment of the history and conditions at the former dry-cleaning site suggests that solvents drained from the equipment formerly used in the facility to a concrete trench on the southwestern wall that empties to the alley between the warehouse and the office building. There is also an area on the west side along the alley where drums were stored.

2.2.1. Site Geology and Hydrology

Soil at the site consisted mostly of topsoil, asphalt, or concrete to a depth of approximately three inches, followed by layers of clays, sand, and gravels. Water saturated soil has been encountered at approximately 3.8-16.5 ft. below ground surface. The depth to the static water table has been observed at approximately 3.95-11 .60 ft. below ground surface [2].

The Upland Terrace is the aquifer that lies beneath the portion of the parish in which the facility and the associated community are located. The terrace deposits overlie the Sparta Aquifer System, which serves as a public supply aquifer (classified as Groundwater 1, or GW1). Although the regional groundwater flow in the Sparta Aquifer is generally toward the east-northeast, the shallow groundwater at the site flows toward the south/southeast. The nearest downgradient named surface water body is Mile Creek, located about 3,750 feet southwest of the site [2].

Water moves between the Upland Terrace Aquifer and the Sparta Aquifer; therefore, the groundwater under the site is conservatively classified as GW1, or groundwater currently being uses as a drinking water source. There is no evidence that the aquifers beneath the site have been impacted by chemicals released from the former Imperial Cleaners facility [2].

2.3. Off-Site Investigation

In February 2022, LDEQ conducted an investigation of soil in the alley between the warehouse that housed the former dry-cleaning operations and the office building located next door. PCE, TCE, cis-1,2-dichloroethene, bromomethane and methyl-tert-butyl-ether were found at elevated levels. Volatile organic compounds were also found in off-site soil gas samples collected to investigate potential off-site vapor impacts of tetrachloroethylene and its breakdown products (see Figure A-2) [3].

Previous groundwater investigations found elevated levels of PCE and TCE in the public right-of-way to the south. Sampling of groundwater in 2022 found PCE, TCE, cis-1,2-dichloroethene, and vinyl chloride, in groundwater at the southern corner of the site [3].

The investigation concluded that contaminants detected within soil and groundwater affected by releases from the former dry cleaning facility have the potential to impact indoor air [3]. Other potential offsite sources of contamination included nearby automotive shops and gas stations, as well as building suppliers (such as paints) located west of the facility. Underground storage tanks in the area, which have been removed, may also have contributed to soil or groundwater impacts [1, 3].

2.4. Off-site Impacts

DEQ requested that LDH/SEET provide guidance about sampling duration for buildings located near the former Imperial Cleaners site that host activities involving children (childcare and

dance lessons). LDH/SEET reached out to subject matter experts (SMEs) at ATSDR to discuss the issue and subsequently recommended the indoor air samplers be deployed for the duration of operating hours.

An April 2022 RECAP Evaluation Report, stated that "Because the upper water bearing unit may be connected to a drinking water aquifer, the groundwater can be classified as GW1." These statements suggest that a connection between the shallow aquifer at the site and the drinking water aquifer could not be ruled out. LDH/SEET updated LDH's Safe Drinking Water Program (SDWP) about potential groundwater concerns related to the site. DEQ subsequently informed us that permanent monitoring wells would be installed at the site but there were no plans to sample public wells or domestic wells.

SDWP informed LDH/SEET that the public supply wells associated with this site had been monitored in 2021; no exceedances for VOCs or SVOCs were found. Out of an abundance of caution, SDWP sampled all 9 public water supply wells and the corresponding points of entry. Going forward, the program will sample all 9 wells and points of entry on a quarterly basis.

In June 2022, Webster Parish Community Services hired consultants to conduct an investigation of indoor and ambient air at their office and the Head Start Administrative Offices in Minden. The independent investigation concluded that based on the results of the June 2022 indoor air sampling event, indoor air quality did not appear to be affected at concentrations above EPA's commercial Vapor Intrusion Screening Levels (VISLs) by dry cleaning or hydrocarbon-related chemicals of concern (COCs). Indoor air concentrations of COCs tended to be higher than concentrations in the outdoor air samples, suggesting that detections might be the result of cleaning and maintenance chemicals used inside the building rather than resulting from an environmental condition [4].

3. Community Description and Concerns

3.1. Community Demographics

Minden, Louisiana is a city with a population of 12,035 residents, according to the 2020 US Census. The residents of Minden are 53.2% Black, 43.1% White, 0.7% American Indian or Alaskan Native alone, 0.5% Asian, and 0.1% Native Hawaiian or other Pacific Islander. Two point four percent (2.4%) of residents identify as being of two or more races and 1% identify as Hispanic or Latino. Twenty-three point four percent (23.4%) of the population is under 18 years of age. Eighty-five point five percent (85.5%) of the population age 25 years+ has a high school diploma or higher. The mean income for all households in Minden in 2020 was $49,252 [5].

3.2. Health Equity Considerations

The Environmental Justice Index (EJI) Explorer is an online tool that measures the collective impacts of environment and vulnerability on communities. According to the EJI Explorer, the buildings sampled for potential vapor intrusion issues are located in a census tract that ranks high on the EJI due to the following factors [6]:

- minority populations;
- a high percentage of population age 65 and older and of civilians with a disability;
- low socioeconomic status due to multiple factors (lower-income households, poverty;
- persons without a high school diploma, low home ownership, persons living in group quarters or mobile homes, and a lack of internet access);
- lack of recreational parks and proximity of busy roadways, which are a potential source of air and noise pollution;
- high estimated prevalence of cancer associated with inhaling hazardous air pollutants;
- high estimated prevalence of asthma, high blood pressure, and poor mental health; and
- a high number of locations are within one mile of Toxics Release Inventory sites, which can affect the health of neighboring communities through routine chemical releases into air, soil, or water and can pose issues of noise and odor pollution.

3.3. Community Concerns

In September 2022, the pastor of a church near the former Imperial Cleaners site contacted LDEQ with questions about the indoor air sampling results and what they might mean for church members LDH/SEET and LDEQ worked together to provide the pastor with answers to his questions, explanations of the sampling results, and suggestions for safe storage of the commercial chemicals found in the church basement. LDH/SEET has not received additional calls from the pastor.

4. Sampling Data

4.1. Chemicals of Interest

Air sampled from businesses in the community around the former dry cleaners was analyzed for VOCs based on a 2018 LDEQ Risk Evaluation/Corrective Action Program (RECAP) risk evaluation performed on the Imperial Cleaners property to determine if corrective action is necessary to protect the community and the environment [2]. The following contaminants, which are related to dry cleaning activities, were of particular concern:

> **PCE** (also known as PERC, or perchloroethylene) is a colorless, nonflammable liquid. PCE is used as a starting material in making other chemicals and is also used as a dry cleaning agent and metal degreaser. Spills of PCE evaporate quickly and then break down slowly in air [7].

The levels of PCE that were found in community air samples are far lower than levels studies have linked to noncancer health effects. The National Toxicology Program has determined that PCE can reasonably be anticipated to be a carcinogen. Studies in humans suggest that exposure to PCE might lead to a higher risk of developing cancers such as bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma [7].

It is not known whether children are more susceptible than adults to the effects of PCE.

PCE's breakdown products include TCE, 1,2-dichloroethene (1,2-dichoroethylene), and vinyl chloride.

TCE is a colorless, nonflammable, sweet-smelling liquid used by industries to remove grease from metal equipment. It is also used in dry cleaning and found in a number of household products like paint strippers, glues, and pesticides (bug sprays). **PCE** and breakdown products such as **cis- and trans-1,2-dichloroethene** and **vinyl chloride**, are commonly found with TCE in commercial uses. Other common sources of these compounds include dry cleaning and household products.

Spills of TCE evaporate and break down quickly in the presence of light and oxygen. TCE spilled into the soil may move into groundwater, where it breaks down very slowly and may remain for long periods of time. TCE in groundwater sources of drinking water can pose a threat to private and public drinking water wells [8].

Women in their first 8 weeks of pregnancy are sensitive to TCE exposures. TCE exposures may increase the risk of health problems in the developing fetus, like heart defects and problems with the immune system, which make the baby prone to infections.

It is not known whether children are more susceptible than adults to the effects of TCE. While the health effects for children and adults may be the same, children are smaller and breathe faster than adults and breathe more TCE for their body size than adults.

The levels of TCE that were found in community air samples are lower than levels studies have linked to noncancer health effects.

The National Toxicology Program within the U.S. Department of Health and Human Services has determined that TCE is a known human carcinogen, based on sufficient evidence from human studies. There is strong evidence that TCE can cause kidney cancer in people and some evidence for TCE-induced liver cancer and malignant lymphoma [8].

1,2-Dichloroethylene is a colorless, flammable liquid with a sharp odor. 1,2-Dichloroethylene is used as an industrial solvent. It is also one of the breakdown products of PCE and TCE [9].

The levels of 1,2-dichloroethylene that were found in community air samples are lower than levels studies have linked to noncancer health effects. The EPA has determined that the human cancer-causing potential of cis-1,2-dichloroethylene is not classifiable. No EPA cancer classification is available for trans-1,2-dichloroethylene [9].

Information about the health effects to children breathing 1,2-dichloroethylene is not available.

Vinyl chloride is a colorless, sweet-smelling gas. It is man-made and not found naturally in the environment. Levels of vinyl chloride that were found in community air samples are far lower than levels studies have linked to noncancer health effects. The National Toxicology Program classifies vinyl chloride as a known human carcinogen, based on sufficient evidence from human studies. Studies of work-related exposures present strong evidence that vinyl chloride can cause liver cancer in people; the strongest evidence comes from a greater-than-expected incidence of liver angiosarcoma, a very rare tumor type in humans. Scientific studies have not proven that vinyl chloride causes birth defects in humans, but studies in animals suggest that vinyl chloride might affect growth and development [10].

4.2. Indoor Air Sampling

Indoor air samples were collected from multiple buildings near the former dry cleaner to determine whether vapors from contaminants associated with dry cleaning activities at the former Imperial Cleaners facility were entering offsite buildings in the community. Ambient (outdoor) air samples were also collected near each building (see Appendix A: Figures, Figure 2). Air sampling was performed using a tiered approach based on nearness to the Imperial Cleaners property and presence of sensitive populations. **Table 1: Tiered Air Sampling Locations** describes the sampling locations included in each Tier. The number of samples collected from each location was based on building layout and usage. Sampling was performed on June 21, 2022 (Tier 1) and July 19, 2022 (Tier 2).

Table 1: Tiered Air Sampling Locations

Sampling Tier	Sampling Locations	Location Type
Tier 1, June 21, 2022	IA7, IA8, IA9, IA10, AA4	Extended Daycare
Tier 1, June 21, 2022	IA11, AA5	School services
Tier 1, June 21, 2022	IA12, IA13, AA6	Daycare
Tier 1, June 21, 2022	IA14, IA14Dup, IA15, IA16, AA7	Office 1
Tier 2, July 19, 2022	IA20, IA21, AA9	Office 2
Tier 2, July 19, 2022	IA22, IA23, AA10	Office 3
Tier 2, July 19, 2022	IA24, AA11	Storage Facility
Tier 2, July 19, 2022	IA25, IA25Dup, AA12	Office 4

Table 2: Placement of Air Sampling Canisters by Breathing Level or Location

Breathing Level Height/Location	Location Code, Tier 1	Location Code, Tier 2	Location Code, Tier 3
2-3 feet	IA7, IA8, IA9, IA10 (Extended Daycare)	N/A	N/A
3-4 feet	IA11 (School services) IA12, IA13 (Daycare)	N/A	IA11A, IA12A, IA13A
5 feet	IA14, IA15, IA16, IA17 (Office 1)	IA20, IA21 (Office 2) IA22, IA23 (Office 3) IA24 (Storage Facility) IA25 (Office 4)	IA25A
Ambient Air (Outside)	AA4, AA5, AA6, AA7	AA9, AA10, AA11, AA12, AA-Alley	AA5A, AA6A, AA12A
Crawlspace	N/A	N/A	CS1

An additional sampling event (Tier 3) was performed on January 11, 2023 due to the following quality assessment/quality control issues:

- During Tier 1 sampling, the pressure gauges on the flow controllers on sample IA11 and IA13 gave pressure readings inconsistent with normal sample collection. These samples were rejected by the third-party data validation. IA12 and AA6 (both from the same property as IA11 and IA13) were also resampled because construction had been occurring at this location during the Tier 1 sampling event.
- Sample IA25 and its duplicate IA25 DUP were collected from different heights at the same location, with the parent air sample closer to the ground than the duplicate air

sample. Results for the duplicate IA25 DUP included higher VOC levels than those detected in its parent IA25. LDEQ requested that this location be resampled.

Tier 3 also included samples collected in an alleyway and in a crawlspace under the building where IA25 was collected [2].

The sample collectors (Leaaf Environmental, LLC) and LDEQ coordinated with the property owners and tenants to minimize the chance that vapors detected were due to commercial products in use at each location [2].

To determine whether any contaminants detected in indoor air were due to outdoor sources rather than to vapor intrusion, ambient (outdoor) air samples were also collected near each building sampled.

Air samples were collected into evacuated 6-liter SUMMA® canisters over an 8- or 12-hour period, based on the operating time of the businesses being sampled. Sampling canisters were placed at breathing-level height; for locations predominantly serving children, this was 2-3 feet for children predominantly 4 years old or younger or 3-4 feet for older children. For locations predominantly serving adults, breathing level height was set at 5 feet [2]. **Table 2: Placement of Air Sampling Canisters by Breathing Level or Location** lists sample location codes by breathing level heights.

One duplicate sample was collected during each Tier sampling event for quality assurance/quality control. The duplicate samples were IA14 DUP, IA25 DUP, and IA25A DUP [2].

5. Scientific Evaluations

5.1. Exposure Pathway Analysis

To determine whether community members are being exposed to contaminants that have migrated from the former Imperial Cleaners site, LDH/SEET examined the exposure pathway between the source of the contaminant and the people who might be exposed. Completed exposure pathways have five required elements:

1. a source of contamination
2. a way for contamination to move through the environment from the source to
3. an exposure point (where someone gets exposed)
4. a route to human exposure (skin contact, eating or drinking, breathing) and
5. people who might be exposed.

For the community around the former Imperial Cleaners site, LDH/SEET considers exposures to contaminants in indoor and outdoor air to be completed pathways. LDH's Safe Drinking Water

Program, which monitors the municipal water supply, has found no evidence of site-related contamination in the public's drinking water supply.

5.2. Evaluation of Community Air Samples

5.2.1. Screening Analysis

The air sampling results were screened against established health-based comparison values to determine if further evaluation of air quality in the potentially affected buildings is recommended to protect public health. Health-based screening values originated from the following sources:

ATSDR's **Environmental Media Evaluation Guides (EMEGS)** are estimated contaminant concentrations below which humans exposed during a specific timeframe (acute [14 days or less], intermediate [15 to 364 days], or chronic [365 days or longer]) are not expected to experience noncarcinogenic health effects.

ATSDR's **Reference Dose Media Evaluation Guides (RMEGs)** represent the concentration in a specific medium (e.g., water, soil) at which daily human exposure for a chronic duration is unlikely to result in noncarcinogenic effects.

ATSDR's **Cancer Risk Evaluation Guides (CREGs)** are estimated contaminant concentrations that pose no concern for increased cancer risk (no more than one excess cancer in a million, or 1E-06, persons exposed during their lifetime of 78 years).

Where health-based screening values were not available, EPA's **Regional Screening Levels (RSLs)** for residential air were used. RSLs are derived from equations combining exposure assumptions with chemical-specific toxicity values.

All of the screening values used in this process are residential screening values. Further evaluation using appropriate exposure lengths for business hours is used to determine if exposures are high enough to pose potential harm to workers or the persons served by these businesses.

To be protective of human health, contaminants that were not detected in any samples but had laboratory detection limits that were higher than their carcinogenic screening values were held for further assessment.

Screening values were not available for dibromochloromethane, cis-1,2-Dichloroethylene, m-Dichlorobenzene [1, 3-], and Trichlorofluoromethane.

Table 3: Indoor and Ambient Air Sample Contaminants Held for Further Evaluation

Compound	Air SVs [*] (µg/m³)[†]	SV Source	Background (µg/m³) [11]	Maximum Detection (µg/m³)	Maximum Detection Location
Naphthalene	0.029	CREG[‡]	-	10.00	AA11
Naphthalene	3	RMEG[§]	-	-	-
C9- C12 Aliphatics (APH) Total Petroleum Hydrocarbons (Aliphatic Medium)	100	EPA[¶] Residential Air RSL[#] (Noncancer)	-	796.00	IA14Dup
C9- C10 Aromatics (APH) Total Petroleum Hydrocarbons (Aromatic Medium)	3.1	EPA Residential Air RSL (Noncancer)	-	29	IA15
Benzene	0.13	CREG	ND[**]-29	6.40	IA24
Benzene	9.6	Chronic EMEG[††]	-	-	-
Bromodichloro-methane	0.076	EPA Residential Air RSL (Carcinogenic)	-	0.66	IA10
Chloroform	0.043	CREG	ND-7.5	21.00	IA10
Chloroform	98	Chronic EMEG	-	-	-
Carbon tetrachloride	0.17	CREG	-	0.69	AA12A
Carbon tetrachloride	100	RMEG	-		
1,2-Dichloroethane	0.038	CREG	ND-0.2	23.00	IA24
cis-1,3-Dichloropropene	0.25	CREG	-	<0.28	ND
cis-1,3-Dichloropropene	20	RMEG	-	-	-
p-Dichlorobenzene [1, 4-]	60	Chronic EMEG	-	878.00	IA14Dup
trans-1,3-Dichloropropene	0.25	CREG [cis]	-	<0.45	ND
trans-1,3-Dichloropropene	20	RMEG	-	-	-
1,3-Dichloropropene (total)	0.25	CREG [cis]	-	<0.28	ND
1,3-Dichloropropene (total)	20	RMEG	-	-	-
1,1,2,2-Tetrachloroethane	0.048	EPA Residential Air RSL (Carcinogenic)	-	<0.33	ND
1,1,2-Trichloroethane	0.063	CREG	-	<0.21	ND

Compound	Air SVs * (µg/m³)†	SV Source	Background (µg/m³) [11]	Maximum Detection (µg/m³)	Maximum Detection Location
1,1,2-Trichloroethane	11	Intermediate EMEG	-	-	-
Tetrachloroethylene	3.8	CREG	ND-9.5	11	AA-ALLEY
Tetrachloroethylene	41	Chronic EMEG, ambient air	-	-	-
Trichloroethylene	2.1	Chronic EMEG	ND-3.3	1.2	AA11
Trichloroethylene	0.21	CREG	-	-	-
Vinyl chloride	0.11	CREG	ND-0.09	<0.18	ND

*SV = screening value
†µg/m³ = micrograms per cubic meter
‡CREG = Cancer Risk Evaluation Guide
§RMEG = Reference Dose Media Evaluation Guide
¶EPA = Environmental Protection Agency
#RSL = Regional Screening Level
**ND = not detected
††EMEG = Environmental Media Evaluation Guide

Table *3*: Indoor and Ambient Air Sample Contaminants Held for Further Evaluation lists the contaminants requiring further evaluation. Where available, this table also includes background levels as compiled in EPA's "Background Indoor Air Concentrations of Volatile Organic Compounds in North American Residences (1990-2005)". Background levels are the levels of chemicals normally found in the environment without the influences of releases from a site. According to the EPA document,

> "Indoor sources that may emit VOCs include consumer products (e.g., cleaners, solvents, strippers, polish, adhesives, water repellants, lubricants, air fresheners, aerosols, mothballs, scented candles, insect repellants, plastic products); building materials (e.g., carpet, insulation, paint, wood finishing products); combustion processes (e.g., smoking, cooking, home heating); fuels in attached garages; dry-cleaned clothing or draperies; municipal tap water; or occupant activities (e.g., craft hobbies)." [11]

5.2.2. Exposure Calculations

LDH/SEET evaluated the chemicals that were present above the health-based comparison values to determine if long-term exposure to these levels of chemicals would pose health concerns. LDH/SEET performed this evaluation using ATSDR's Public Health Assessment Site Tool (PHAST) version 2.2.1.0, database rev 7.4.5 to calculate exposure doses to evaluate

potential noncancer and cancer- related health effects. The equations used by PHAST to estimate doses for exposures to the contaminants in air samples collected from businesses during open hours in the community around the Imperial Cleaners site are listed in Appendix B: Exposure Assessment Equations.

To calculate exposure doses, PHAST adjusts the levels of detected contaminants based on the standard length of time people are expected to be exposed at each location. Appendix B: Exposure Assessment Equations, **Table 6: Exposure Durations for Assessment of Air Samples** lists the lengths of exposure used to evaluate the businesses that were sampled, which included business providing services for children. Though no actual elementary or secondary schools were included in the sampling events, the "school" exposure substitutes as a maximum exposure time for non-childcare businesses primarily hosting activities for children.

The chemicals that were not detected were evaluated using the laboratory method detection limits (the lowest amount of each chemical that the laboratory's equipment was able to detect). Among these, total 1,3-dichloropropene was evaluated rather than separate evaluations for cis- and trans-1,3-dichloropropene because PHAST does not evaluate these isomers separately.

Chronic exposure to contaminants detected in sample CS1, the air sample from an office crawlspace, were not evaluated because it is unlikely anyone will stay in the crawlspace for an extended period of time.

5.2.3. Assessment of contaminants not listed in PHAST

Though the total petroleum hydrocarbons (TPHs) and bromodichloromethane were found in air samples at levels higher than their associated EPA residential air screening values, PHAST assessment was not available for these contaminants in air.

The elevated bromodichloromethane level was detected in one sample, IA10, collected from the extended daycare's basement.

TPHs are mixtures of chemicals that originally come from crude oil and can include chemicals such as benzene, toluene, xylene, and naphthalene; single ingredients from these mixtures are also evaluated as separate chemicals in the sampling results. **Table 4: Locations at which Total Petroleum Hydrocarbon (TPH) levels exceeded the EPA Regional Screening Levels** lists the locations at which TPH levels exceeded the EPA screening values for residential exposures.

Table 4: Locations at which Total Petroleum Hydrocarbon (TPH) levels exceeded the EPA Regional Screening Levels

Sample Location	TPH* (Aliphatic Medium) in µg/m³†, EPA RSL‡ = 100 µg/m³	TPH (Aromatic Medium) in µg/m³, EPA RSL = 3.1 µg/m³
IA10 (Extended daycare, Basement)	242	-
IA16 (Office 1, Lobby)	217	16
IA14 (Office 1, Bathroom)	281	-
IA14DUP (Office 1, Bathroom duplicate)	796	24
IA15 (Office 1, Back Office)	295	29
AA9 (Office 2, Outside air)	-	12
IA24 (Storage Facility, Lobby)	193	25

*TPH = total petroleum hydrocarbons

†µg/m³ = micrograms per cubic meter

‡EPA RSL = EPA Regional Screening Level (Residential)

5.2.4. Noncancer Health Assessment

LDH/SEET used ATSDR's PHAST version 2.2.1.0 (ATSDR, Atlanta, GA) to calculate exposure doses and chronic hazard quotients (HQs) for adults and for children, where appropriate. Hazard quotients evaluate the potential for noncancer health hazards to occur from exposure to a contaminant with available noncancer health guidelines. For air exposures, hazard quotients are calculated by dividing the adjusted exposure concentration for each chemical by the minimal risk level or reference concentration for that chemical. If an HQ is equal to or over 1.0, that exposure dose is further evaluated. If the HQ is less than 1.0, noncancer health effects are unlikely to occur.

Contaminants at all but one location were present at levels that are not expected to cause noncancer health effects. The HQs for levels of 1,4-dichlorobenzene detected at 1A14 (Office 1, Bathroom) were 1.6 for the parent sample and 3.5 for the duplicate sample (1A14Dup) collected at the same sampling location.

Due to lack of sufficient chemical information, PHAST did not calculate hazard quotients for 1,2-dichloroethane or 1,1,2-trichloroethane.

5.2.5. Cancer Risk Health Assessment

LDH/SEET used ATSDR's PHAST software to evaluate whether long-term exposure to the levels of contaminants detected in the indoor or ambient air samples would pose an increase in cancer risk. The cancer risks estimated by PHAST are theoretical estimates of the likelihood of developing cancer. These estimates do not represent an actual number of people exposed who would develop cancer.

Exposures to contaminants for which estimated cancer risks are less than or equal to one additional cancer case among one million people exposed ($1X10^{-6}$ or 1E-06) are considered to pose no increase in the risk of developing cancer. When estimated cancer risks are greater than 1 in 1 million, these estimations are further evaluation by the details of exposure, whether or not the chemical is a known human carcinogen, and the exposed population. **Table 5: Summary of cancer risk estimates greater than 1 in 1 million** lists the theoretical cancer risk estimates that were greater than 1 in 1 million.

Table 5: Summary of cancer risk estimates greater than 1 in 1 million

Location	Contaminant	Adjusted Concentration (in µg/m³*)	Exposure Group	Estimated Cancer Risk
IA10 (Extended daycare, Basement)	Chloroform	21.00	Children	**1E-05**
IA10 (Extended daycare, Basement)	Chloroform	21.00	Full time worker	**4E-05**
IA10 (Extended daycare, Basement)	Naphthalene	0.23	Full time worker	**2E-06**
IA22 (Office 3, Lobby)	Chloroform	2.10	Full time worker	**3E-06**
IA22 (Office 3, Lobby)	1,2-dichloroethane	0.46	Full time worker	**3E-06**
IA23 (Office 3, Back office)	Chloroform	2.20	Full time worker	**3E-06**
IA23 (Office 3, Back office)	1,2-dichloroethane	0.44	Full time worker	**3E-06**
IA24 (Storage Facility, Lobby)	Naphthalene	0.36	Full time worker	**3E-06**
IA24 (Storage Facility, Lobby)	Benzene	1.60	Full time worker	**3E-06**
IA24 (Storage Facility, Lobby)	1,2-dichloroethane	5.60	Full time worker	**4E-05**
AA11 (Storage Facility, Outside)	Naphthalene	2.40	Full time worker	**2E-05**
AA-ALLEY (Outside, Onsite)	Naphthalene	0.18	Full time worker	**2E-06**

*µg/m³ = micrograms per cubic meter

5.3. Discussion

LDEQ collected air samples from the businesses around the former Imperial Cleaners site to evaluate whether vapor intrusion of contaminants migrating from the site is occurring within the surrounding community. LDEQ's historical records indicate the dry-cleaning facility used PCE as a solvent in its operations. PCE and its breakdown products (TCE, 1,2-dichloroethene, and vinyl chloride) were not detected in the air samples at levels suggesting that vapor intrusion from contaminated groundwater might be a concern. The businesses at which PCE and TCE were initially detected at elevated levels were resampled due to technical issues with sample collection; PCE and TCE were not detected in the new samples. Additional environmental samples, including groundwater samples, would help to determine which vapors detected in community buildings are more likely due to historical releases from activities at the former Imperial Cleaners site rather than due to other sources.

A 2017 Site Investigation report for the former Imperial Cleaners property included a historical records review to determine potential sources of Total Petroleum Hydrocarbons (TPHs) detected in groundwater at the site. This report determined that three gasoline underground storage tanks were previously removed from properties near the former dry cleaning facility in 1990 and 1991 [2]. These potential sources of TPHs in the site's groundwater may also be the sources of TPH vapors detected within and outside of community businesses.

Benzene was found in all but one of the samples collected, the exceptions being two ambient air samples. Benzene can be linked to historic dry cleaning operations that used Stoddard solvent, a dry cleaning solvent used in the United States from the late 1920s until the 1950s [12, 13]. However, there is no documentation that Stoddard solvent was used at Imperial Cleaners. Benzene can also be present due to businesses such as gas stations or auto repair shops.

Naphthalene was found in five indoor locations (including one duplicate, though not detected in the parent air sample collected at the same time) and two outdoor locations. Naphthalenes, along with benzene, contribute to less than one percent (1%) of the mixture used for Stoddard solvent, and can likewise be linked to historic dry cleaning operations [14]. Naphthalene can also be linked to gasoline, deodorizers, repellants (mothballs), fumigants, and cigarette smoke [15].

Chloroform, which was found in four of the buildings sampled, can also be related to dry cleaning operations. Dry cleaners have used carbon tetrachloride as a cleaning chloroform is a breakdown product of carbon tetrachloride, which has historically been used as a dry cleaning agent [12]. There is no documentation that carbon tetrachloride was used at Imperial Cleaners. Chloroform also has uses as a commercial solvent.

1,2-Dichloroethane was found at four indoor locations and two outdoor locations. 1,2-Dichloroethane has historically been used in textile cleaning products; as an additive for leaded gasoline; as a solvent in household cleaning products; and as an insect and soil fumigant. The

current most common use of 1,2-dichloroethane is to make vinyl chloride, which is used in a variety of plastic and vinyl products [16].

The presence of other sources of VOC vapors can make it difficult to confirm the source of contaminants detected in indoor air. Additional potential sources identified during the sampling events include automotive fumes from traffic; art supplies (observed at the daycare center); paint and commercial solvents (observed at the facility offering extended daycare); drywall, joint compounds, and adhesives (observed at the storage facility); office supplies such as printer ink and degreaser; cleaners and deodorizers; and cigarette smoke (observed at multiple locations).

LDH/SEET is unable make predictions about health impacts based on a single sample collected at each location. The following discussions evaluate whether the indoor air data identifies any potential health concerns that should be considered while the investigation of the former dry cleaners continues.

5.3.1. Discussion of noncancer related risks

The HQs for levels of 1,4-dichlorobenzene detected at 1A14 (Office 1 bathroom) were 1.6 for the parent sample and 3.5 for the duplicate sample (1A14Dup). Office 1, at which samples IA14-IA17 were collected, had an issue involving sewer gases entering the building through the bathroom floor drain. Toilet blocks (deodorizers) were reportedly used to combat the odors affecting that bathroom, a garage, and related offices. 1,4-Dichlorobenzene is a known component of toilet blocks. The blocks were removed the day of sampling but lingering vapors may still have contributed to the levels detected in indoor air sampled from this location.

No other potential for noncancer health risks were identified at the locations sampled within the community.

5.3.2. Discussion of estimated theoretical cancer risks

Theoretical cancer risks estimated for long-term exposures to chloroform and naphthalene were above 1 in 1 million for IA10, the basement of the extended daycare services. This location is a storage room reported to contain paint and commercial solvents rather than a room that is constantly occupied by children or adults. Under its current usage, long-term exposures to contaminant vapors at this location would not occur. To minimize the release of vapors from chemicals being stored in this location, staff in charge of this basement should follow safe storage and usage practices.

Theoretical cancer risks estimated for long-term exposures to chloroform and 1,2-dichloroethane were above 1 in 1 million for air sampled from IA22 and IA23, the lobby and back office at Office 3. The available sample does not provide enough data to confirm long-term

exposures at these levels. Staff should be encouraged to follow the proper storage and usage instructions of any solvents or other chemicals in use at this office.

Theoretical cancer risks estimated for long-term exposures to naphthalene, benzene, and 1,2-dichloroethane were above 1 in 1 million for IA24, the storage facility lobby, and AA11, outside of the storage facility. This location is reported to be a self-storage operation consisting of storage units and a self-serve kiosk. Long-term exposures inside and outside of the facility are not expected to occur. Individuals using chemical products at this location should be encouraged to follow safe storage and usage practices to minimize the release of chemical vapors.

Theoretical cancer risks estimated for long-term exposures to naphthalene were above 1 in 1 million for air sampled from AA-ALLEY, an alleyway behind the back portion of the former dry cleaners. People are unlikely to linger in this alley for long periods of time. Long-term exposures are not expected to occur.

5.4. Summary of Limitations and Uncertainties

- LDH/SEET is unable to make definitive health calls based on the limited available data. A single indoor air sample was collected at each location. Each sample result represents a snapshot in time and may not be representative of general conditions at that location.
- Ambient air sampling results may also have been affected by outdoor activities that were reported during sampling, such as heavy traffic or lawn care activities.
- Contaminants detected in the air samples may not be related to historical activities at the Imperial Cleaners site but may originate from other defunct or currently active businesses in the area, which include a glass repair center and an automotive repair garage.
- Additional environmental samples, including groundwater samples, would be needed to evaluate the movement of contaminated groundwater from the former Imperial Cleaners site into the surrounding community.

6. Conclusions

Conclusion 1: Chemical releases at the former Imperial Cleaners site may not be the source of contaminants detected in indoor air in the surrounding community.

Basis for Decision:

- LDEQ's historical records indicate the dry-cleaning facility used PCE as a solvent in its operations. Records of the use of other solvents, such as Stoddard solvent, are not currently available.

- PCE and its breakdown products (TCE, 1,2-dichloroethene, and vinyl chloride) were not detected in the air samples at levels suggesting that vapor intrusion from groundwater contaminated with these dry cleaning solvents might be a concern.
- Other potential sources of the VOCs detected include paint, commercial solvents, bathroom deodorizers, automotive shops, gas stations, and the former locations of gasoline underground storage tanks near the site.

Conclusion 2: Levels of indoor air vapors similar to those detected within the community would not be expected to pose noncancer health issues.

Basis for Decision:

- At all of the sampled locations except for the bathroom at Office 1, the levels of indoor air vapors detected are below levels that would be expected to cause noncancer health effects. In the Office 1 bathroom, toilet block deodorizers (known to contain 1,4-dichlorobenzene) were reportedly used to combat odors related to sewer gases. Vapors from these deodorizers may have contributed to contaminant levels detected in indoor air sampled from this bathroom.
- LDH/SEET is unable to make definitive health conclusions for long-term exposure to these vapors based on the small number of air samples collected at each location.

7. Recommendations and Public Health Action Plan

- LDEQ plans to do further soil and groundwater sampling at the former Imperial Cleaners site. The sampling should include additional attempts to determine whether other dry cleaning agents, such as Stoddard solvent or carbon tetrachloride, were used as part of the dry cleaning operations.
- Source removal and groundwater remediation should be performed at the former Imperial Cleaners site, if warranted. This will prevent future movement of contaminants from the site into the community.
- Staff at locations at which solvents, adhesives, and other compounds containing VOCs are stored should be encouraged to follow proper storage and usage practices to minimize exposures.
- LDH will remain engaged at this site and collaborate with DEQ, when requested, while site investigation and remediation continues.

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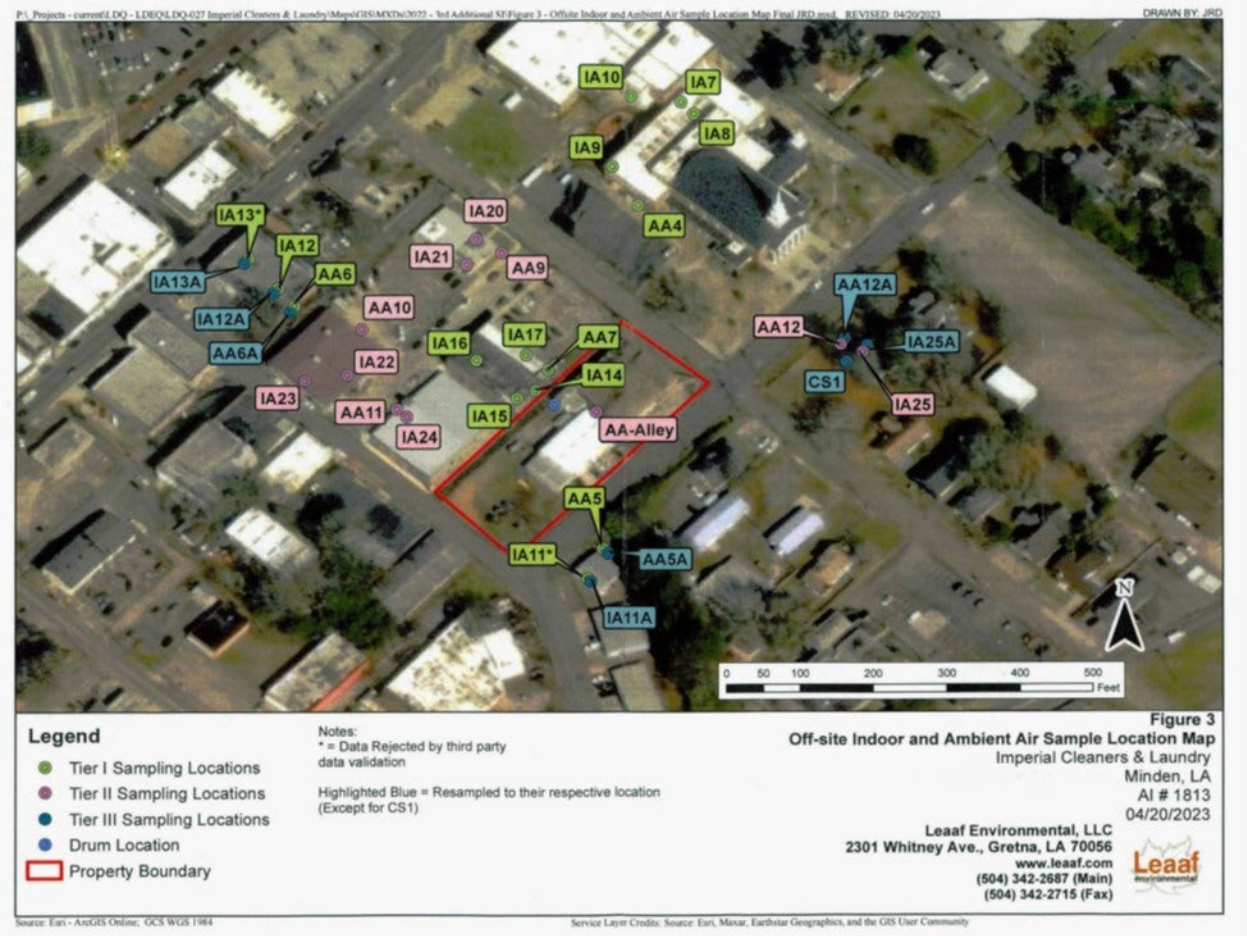
Appendix A: Figures

Figure 1: Site Vicinity Map

Source: Leaaf Envirnomental, LLC. *Additional Site Investigation and RECAP Evaluation Report: Imperial Cleaners & Laundry.* Gretna, LA : Prepared for Louisiana Department of Environmental Quality, April 2022

Figure 2: Air Sampling Locations



Source: Leaaf Environmental, LLC, "Fourth Additional Site Investigation Report: Imperial Cleaners & Laundry.," Leaaf Environmental, LLC, Gretna, LA, 2023.

Appendix B: Exposure Assessment Equations

Exposure Assessment

Noncancer risks and cancer risks were calculated using ATSDR's Public Health Assessment Site Tool (PHAST) version 2.2.1.0, database rev 7.4.5. The PHAST exposure calculator uses the following equations

Air Inhalation Exposure Equation

Adjusted EPC = EPC x $EF_{noncancer}$ **Equation 1**

EPC = exposure point concentration, $EF_{noncancer}$ = exposure factor (unitless)

The EF is calculated based on the exposure time (hours per day, days per week, weeks per year, number of years) expected for each type of location (see Table 6**: Exposure Durations for Assessment of Air Samples**). The default EF=1. Non-residential EFs are therefore lower than 1; reflecting less time spent at these locations than at home. Therefore, Adjusted EPCs are lower than the contaminant levels detected in the air samples.

Exposure durations used in assessing contaminant concentrations are listed in Table 6. The default reasonable maximum exposure times were used for occupational exposures and school exposures. Exposures related to daycares used the defaults for all exposure durations except hours per day, which were instead based on the reported operating times of the facilities sampled.

Table 6: Exposure Durations for Assessment of Air Samples

	Hours/day	Days/week	weeks/year	years
Occupational	8.5	5	50	20
Daycare, birth to <1 year	8	5	52.14	1
Daycare, 1 to <2 years	8	5	52.14	1
Daycare, 2 to <6 years	8	5	52.14	4
Daycare, Child Total Years	-	-	-	6
Daycare, Full-time Adult Worker	8	5	52.14	20
School, Pre-Kindergarten	9.6	5	47	2
School, Kindergarten	9.6	5	47	1
School, 1st-5th grades	9	5	47	5
School, 6th-8th grades	9.3	5	47	3
School, 9th-12th grades	9.3	5	47	4
School, Child Total Years	-	-	-	15
School, Full-Time Adult Educator	9.6	5	47	20
Extended daycare birth to <1 year	12	5	52.14	1

	Hours/day	Days/week	weeks/year	years
Extended daycare 1 to <2 years	12	5	52.14	1
Extended daycare 2 to <6 years	12	5	52.14	4
Extended daycare Child Total Years	-	-	-	6
Extended daycare Full-Time Adult Worker	12	5	52.14	20

Hazard Quotient

HQ = Adjusted EPC ÷ HG **Equation 2**

HQ = hazard quotient, EPC = exposure point concentration (µg/m^3 or ppb), HG = health guideline (e.g., inhalation MRL, RfC)

Cancer Risk Equations

CR = Adjusted EPC x IUR x (ED ÷ LY) **Equation 3**

ADAF-adjusted CR = (Adjusted EPC x IUR) x (ED ÷ LY) x ADAF **Equation 4**

Total CR = Sum of the CR for all exposure groups **Equation 5**

CR = cancer risk (unitless), EPC = exposure point concentration (µg/m^3 or ppb), IUR = inhalation unit risk ((µg/m^3 or ppb)$^{-1}$),
ED = exposure duration (years), LY = lifetime years (78 years), ADAF = age-dependent adjustment factor (unitless),
EF (cancer) = exposure factor (cancer) calculated as follows: EF (noncancer; unitless) x exposure group specific exposure duration (years) ÷ lifetime of 78 years

TCE Cancer Risk Calculation

PHAST cancer risk calculations for TCE incorporate three cancer types: non-Hodgkin's lymphoma (NHL), liver, and kidney cancer. Cancer risks were calculated using the inhalation unit risks of 2.1E-06 [NHL], 1.0E-06 [liver], 1.0E-06 [kidney] (µg/m3)-1 and age-dependent adjustment factors. Because TCE is only considered to be mutagenic for kidney cancer, age-dependent adjustment factors (ADAFs) are only applied to the kidney cancer portion of the cancer slope factor (CSF) and inhalation unit risk (IUR).

Therefore, TCE cancer risk = [non-Hodgkin's lymphoma risk + liver cancer risk] + [kidney cancer risk with ADAFs applied]

- Total TCE CR = (NHL & liver CR) + (ADAF-adjusted kidney CR)

- NHL & liver CR = (C × (IUR for NHL + IUR for liver cancer)) × (ED/LY)
- ADAF-adjusted kidney CR = (C × IUR for kidney cancer) × ED/LY) × ADAF

where CR = Cancer Risk, C = Air Concentration (µg/m3), IUR = Inhalation Unit Risk ((µg/m3)-1), ED = Age-Specific Exposure Duration (years), LY = Lifetime in Years (78 years), ADAF = Age-Dependent Adjustment Factor (unitless), NHL = Non-Hodgkin's Lymphoma

The following ADAFs are applied for the evaluation of kidney cancer:

- ADAF of 10 for exposures occurring from birth to < 2 years
- ADAF of 3 for exposures occurring from 2 to < 16 years