SOIL MANAGEMENT PLAN

40 Marbledale Road
Tuckahoe, Westchester County, NY
NYSDEC Site #V00237-3

Prepared for:

Weissman Holdings, Inc.
formerly Kings Electronics Co., Inc.

Prepared by:

Environmental Management, Ltd.
41 Franck Road
Stony Point, New York 10980
Phone 845-429-1141

July 2009

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EXHIBITS

1.0 PURPOSE

The purpose of this Soil Management Plan (SMP) is to present measures for managing known or potentially contaminated soil remaining at 40 Marbledale Road, Tuckahoe, Westchester County, New York (the Site) in accordance with applicable regulatory requirements and a Deed Restriction for the 40 Marbledale Road property. It is not intended to supersede or replace any New York State Department of Environmental Conservation (NYSDEC) or Occupational Safety and Health Administration (OSHA) regulation and/or local and state construction code or regulation.

This SMP should be maintained on-site in the Operations, Monitoring & Maintenance Plan & Site Manual (the Site Manual). In July 2009, the Site operator was Storage Deluxe.

2.0 APPLICABILITY

This SMP shall apply to all activities that will disturb the existing on-site subsurface soil except that a NYSDEC-approved project specific Soil Management Plan and Construction Health and Safety Plan (CHASP) will be required if any person or entity is planning a construction or other project at the Site that involves the removal of a significant portion of any existing building foundation, concrete slab, asphalt pavement, or other engineered structure and/or sub-surface soil. NYSDEC approval may be obtained by contacting the NYSDEC Project Manager identified in Section 6.1 below; notice should be provided to Environmental Management, Ltd., also identified in Section 6.1.

The Site's current building foundations, concrete slabs, and asphalt pavements constitute a cover for residual soil contamination (the Soil Cover) at the Storage Deluxe facility. A Site Figure (attached as Exhibit 1) identifies the buildings, pavement, steeply sloping bedrock outcrop area, and the few exposed soil areas, which constitute the surface area of the property.

NOTE: A HEALTH AND SAFETY PLAN (HASP) HAS BEEN ESTABLISHED FOR THE SITE. IN ADDITION TO THIS SMP, YOU MUST REFER TO AND ALSO FOLLOW THE PROCEDURES SET FORTH IN THE HASP IF YOUR ACTIVITY INVOLVES DISTURBANCE OF SUBSURFACE SOIL OR SOIL COVER.

The provisions of this SMP apply to all persons and entities who are involved in covered soil disturbance activities, including, but not limited to: private contractors, utility workers, and subsurface equipment installers.

This SMP is not intended to apply to landscapers maintaining the exposed and vegetated surface soil areas of the Site along Marbledale Road. It is also not intended to apply to maintenance activities within the exposed steeply sloping bedrock outcrop along the eastern Site boundary.

3.0 SITE DESCRIPTION

3.1 HAZARD POTENTIAL/CONTAMINATION SOURCE AREAS

The Site was subject to cleanup pursuant to a Voluntary Cleanup Agreement (VCA) entered into between Kings Electronics Co., Inc. (Kings) and NYSDEC dated May 9, 2000 under NYSDEC's Voluntary Cleanup Program (VCP) to remediate contamination resulting from former manufacturing activities (i.e.; degreasing of metal parts) at the Site. Both volatile and semi-volatile compounds (primarily chlorinated volatile organic compounds - CVOCs) had been detected in both subsurface soils and the groundwater beneath the surface of the Site.

While contaminated soil was removed from the former degreasing area (i.e.; the source), some residual soil contamination remains. Site soil sampling has determined that residual CVOCs are below the restricted use commercial soil cleanup objectives for the protection of human health, although some are above the 6 NYCRR 375-6.3 "Unrestricted Use Soil Cleanup Objectives" (part 375 UUSCO). Exhibit 2 depicts the soil sampling results in a Figure entitled "Location, Depth and Summary of VOC Soil Sampling Results Conducted Pursuant to Voluntary Cleanup Agreement."

3.2 HAZARD EVALUATION

The most likely routes of exposure (to residual subsurface soil contamination) are breathing (of volatile organic compounds or particulate-laden air released during soil disturbance activities) and skin contact. Exhibit 3 includes specific chemical health effects from the known on-site contamination. A Site Health and Safety Plan (Site HASP – see Site Manual) addresses procedures (including training, air monitoring, work practices and emergency response) to reduce the potential for unnecessary and unacceptable exposure to these contaminants. Due to the above, a Safety Officer (SO) must be designated for all excavation work performed by any person or entity.

A preliminary evaluation of the site's characteristics shall also be performed by a qualified person prior to any subsurface soil disturbance beneath the Soil Cover in order to evaluate and select the appropriate engineering controls and personal protective equipment for the tasks to be performed. A preliminary evaluation also applies to contractors conducting soil excavation more than two feet deep within the uncapped areas of the Site. A qualified person is any individual working for the company or entity who understands the OSHA worker protection standards (at 29 CFR 1910) as well as the NYSDEC contaminated soil management requirements of 6 NYCRR.

4.0 INSTITUTIONAL AND ENGINEERING CONTROLS (IC/EC)

A Deed Restriction (see Site Manual) restricts the use of Site groundwater and refers to this SMP and the Site HASP, both of which are required to be implemented prior to any Site or building modifications that may result in the handling or movement of Site soils.

The Soil Cover will be inspected annually by Kings or its agent (or the owner/operator), in accordance with the Deed Restriction. Identified cracks or breaks will be evaluated by a geologist to ascertain if they would significantly impact the subsurface soil conditions within that area. If inspections indicate that the Site cover needs to be repaired, such repairs will be conducted by either the owner/operator or Kings. An IC/EC certification statement will be provided in an annual report to NYSDEC summarizing site activities.

5.0 SOIL MANAGEMENT PLAN (SMP)

5.1 EXCAVATION MANAGEMENT

As stated earlier, subsurface investigations identified that CVOC concentration levels (of trichloroethylene, 1,1,1 trichloroethane, cis-1,2 dichloroethene, and perchloroethylene) remain above the unrestricted use soil cleanup objectives of 6 NYCRR Part 375-6.3 (the Part 375 UUSCO). This SMP provides approved soil management procedures during excavation activities that do not involve significant removal of the Site cover and will involve excavation of subsurface soils. These procedures are consistent with regulatory requirements and ensure that contaminated soil is not used for backfill or re-grading purposes, and that two feet of clean material is placed in any uncapped areas.

If soil needs to be excavated, either one of two excavation strategies will be employed.

If the excavation is small, such as a limited repair to a subsurface potable waterline servicing the Site, small volumes of soil will be excavated, the repair will be performed, the materials will be returned to the excavation and the overlying cap repaired.

In the event that a relatively large amount of soils will be excavated, such as replacing a stormwater line, soils may be stockpiled on-site. Stockpiled soils will be placed on and covered by secured plastic sheeting until testing is completed or the soils are properly disposed of off-site. A qualified technician will monitor ambient air quality with a hand-held instrument to screen for volatile organic compounds (VOCs) within both the excavation and the stockpiled soil. If VOCs are not detected, repair will be completed under the oversight of the SSO. If VOCs are measured in the ambient air, repair will be performed by workers with current OSHA HAZWOPER (i.e.; 29 CFR 1910.120) training. A representative composite sample of excavated soils will be taken from the soil stockpile. In addition, discrete post-excavation sampling will be performed at fifteen-foot intervals along each sidewall of the excavation. All post-excavation samples will be analyzed for volatile organic compounds by a NYSDOH ELAP certified laboratory. Analytical results should be provided to Kings, the Site owner/operator, and NYS DEC project manager.

After the subsurface soil disturbance work is completed, the excavation will be backfilled with clean fill and the cap repaired.

5.2 DUST CONTROL

To prevent the potential off-site transport of dust that may contain above-background levels of contaminants, the following dust control measures will be implemented during all earth-disturbing operations:

- In conjunction with the particulate air monitoring requirements under Hazardous Materials Contingencies – Section 6.0 of this Plan, water must be available on site to be used for dust suppression.
- Any haul truck will have effective tarp covers.
- Appropriate sediment management procedures will be employed prior to the vehicle/truck exit point of the site to prevent site soil from being tracked onto roads in the community.

All work that involves soil disturbance or otherwise generates dust will be performed utilizing methods to minimize dust generation to the extent practicable.

5.3 SOIL STOCKPILING

Known or potentially contaminated soils will be stockpiled based on their known or anticipated type and/or level of contamination [based on previous data, organic vapor monitor (OVM) readings, odor, staining, etc.] and whether such soils are intended for reuse on-site as backfill material or intended for off-site disposal. Soils will be stockpiled on approximately 8-mil polyethylene (or equivalent) sheeting. Any soil, expected to remain on-site overnight or longer, must be covered with similar poly sheeting and the cover be secured with appropriate weights, anticipating a strong wind at any time.

5.4 SOIL TESTING

During any subsurface soil disturbance activity, an OVM (preferably a photo ionization detector – PID) shall be used to monitor volatile air emissions on a routine basis (see Work Zone Air Monitoring under 6.3.2 Air Monitoring in Contaminated Areas).

Soils intended for off-site disposal will be characterized first, in accordance with the NYSDEC regulations (see 6 NYCRR Parts 360, 371 and Subpart 375-6). In addition, a representative sample must be tested in accordance with the requirements of the off-site receiving facility, if applicable.

5.5 TRANSPORTATION AND DISPOSAL

Transportation of material leaving the site for off-site disposal should be in accordance with federal, state and local requirements (including, but not limited to, 6 NYCRR Parts 364 and 372) covering licensing/permitting of haulers and trucks, hazmat communications, packaging, manifesting/bills of lading, etc.

Disposal and/or reuse will be in accordance with applicable federal, state and local requirements, including those for hazardous waste, industrial waste, petroleum-contaminated soil, construction and demolition debris, etc.

5.6 MANAGEMENT AND REUSE OF EXCAVATED SOILS

Soil and fill material excavated at the site may be tested for possible reuse as backfill beneath the Site cover. It will not be used as topsoil. Any areas excavated and not capped by buildings or asphalt/concrete will be filled with at least two feet of clean fill that meets the Part 375 USSCO. The upper six inches should be amended with peat moss.

6.0 HAZARDOUS MATERIALS CONTINGENCIES

6.1 HAZARDOUS MATERIALS CONTINGENCY RESPONSE

In the event that previously unidentified hazardous materials are discovered during excavation or the Work Zone Air Monitoring under Section 6.3 indicates a possible volatile organic exposure, the following contingency procedures will be followed. All excavation will be continuously monitored for the presence of buried tanks, drums or other containers, sludge, or soil which shows evidence of potential contamination, such as discoloration, staining, or odors. If any of these are detected, excavation in the area will be halted, and the SO will notify the following.

Current Site Operator Project Manager	Storage Deluxe Steve Novenstein @ Storage Deluxe (718)525-6950
Kings Environmental Consultant	Donald J. Wanamaker President Environmental Management, Ltd. (845)429-1141
New York State Department of Environmental Conservation Project Manager	Nicole M. Bonsteel @ NYSDEC (518)402-9813

The affected area will be cordoned off and no further work (except for safety reasons) will be performed at that location until a project specific CHASP and Soil Management Plan is approved by the NYSDEC Project Manager. All contingency response actions will be carried out in accordance with the Contingency Health and Safety procedures specified in Section 6.3.

6.2 SOIL CONTAMINATION CONTINGENCY PLAN

If any sludge or subsurface material (i.e.; soil, historic fill, etc.) shows evidence of potential contamination (such as discoloration, staining, or odor) during excavation activities or any air monitoring detects a VOC concentration above 10 ppm, the area will be cordoned off and the following procedures will be followed:

- The suspected soil will be sampled for laboratory analyses. All soil samples will be properly containerized. Each container will be properly labeled, sealed, and placed in a chilled cooler for shipment to the laboratory. A chain-of-custody will be maintained throughout the field sampling, transport of samples to the laboratory, and during lab analysis. Depending on field observations, soil samples may be analyzed for volatile and semi-volatile organic compounds, PCBs and RCRA metals [6 NYCRR 371.3(e)].
- If the suspect soil is contaminated based on sampling results, and it needs to be (or will be) excavated, it will be excavated and stockpiled on-site, either in a leak-proof container or in a stockpile placed on plastic sheeting and securely covered by plastic sheeting. Composite samples of the soil will be collected and analyzed for disposal. The excavated soil will then be disposed of off-site in accordance with all applicable regulations.
- Post excavation samples will be collected from the sides and bottom of the excavated area. A suitable location for a background sample will be determined by the SSO or other qualified person and approved by the NYSDEC Project Manager. All soil samples will be properly containerized, labeled, sealed, and placed in a chilled cooler for shipment to the laboratory. A chain-of-custody will be maintained throughout the field sampling, transport of samples to the laboratory, and during lab analysis. Analytical parameters for post excavation soil samples will be determined based on the original analysis of the contaminated soil. If post-excavation samples exceed the restricted use commercial soil cleanup objectives (see 6NYCRR Part 375), then additional excavation may be performed under a project specific CHASP and Soil Management Plan pre-approved by the NYSDEC Project Manager.

6.3 CONTINGENCY HEALTH AND SAFETY PROCEDURES

6.3.1 Site Work Zones Within Potentially Contaminated Areas

During any activities involving disturbance of subsurface areas, work within a known contaminated area (see attached site map or as determined under Section 6.2) must be divided into various zones to prevent the spread of possible contamination, ensure that proper protective equipment is donned, and provide an area for decontamination. All personnel must be adequately trained in accordance with 29 CFR 1910.120 (OSHA HAZWOPER) requirements. A Health and Safety Officer (HSO) will be designated.

The Exclusion Zone is defined as the area where potentially contaminated materials are located. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support Zone is the zone area where support facilities, such as vehicles, a field phone, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. These zones shall be designated daily, depending on that day's activities and weather conditions. All field personnel will be informed of the location of these zones before work begins.

6.3.2 Air Monitoring in Contaminated Areas

An OVM, preferably a PID, will be used to perform air monitoring during sampling and excavation work in areas where volatile organic compounds (VOCs) have been detected (see Site Map and as determined under Section 6.2). A Dust Trak® dust monitor or equivalent will be used to measure concentration of total particulate matter during initial excavation activities. The purpose of the air monitoring program is to avoid or minimize exposure of the field personnel and the public to potential environmental hazards in the soil. Results of the air monitoring will be used to determine the appropriate response action, if needed.

Work Zone Air Monitoring – Volatile Organic Compounds (VOCs)

Real time air monitoring for VOCs will be done with the OVM/PID whenever soil removal or sampling is performed in areas found to be contaminated with VOCs. Measurements will be taken prior to commencement of work and for at least twenty seconds per sample location every 60 minutes during the work. The OVM will be calibrated with isobutylene in accordance with the manufacturer's recommendations. These measurements will be made as close to the workers as practicable and at the breathing height of the workers. The HSO shall confirm the equipment is working properly. His/her designee may oversee the air measurements during the day. The initial measurement for the day will be performed before the start of work and will establish the background level for that day. The final measurement for the day will be performed after the end of work. The action levels and required responses are listed in the table below.

Action Levels and Required Response Action

Instrument	Action Level (Note 1)	Response Action
OVM	Less than 10 ppm in breathing zone at excavation work area	**Level D or D-Modified** (Requires coveralls and steel toe boots) (As applicable: Chemical resistant gloves, chemical resistant boot covers, hard hat, safety glasses, face shield, or escape mask)
	Between 10 and 20 ppm	**Level C** (Requires full face or half face respirator, hooded chemical resistant two piece Tyvek suit or overalls, chemical resistant inner and outer gloves, chemical resistant boot covers, steel toe and shank boots) (As applicable: hard hat, face shield or escape mask)
	More than 20 ppm	**Stop Work.** Resume work when source of vapors is abated and readings are less than 20 ppm above background.
Particulate monitor	Less than 5 mcg/m³	**Level D**
	Between 5/mcg/m³ and 125 mcg/m³	**Level C.** Apply dust suppression measures. If less than 2.5 mcg/m³, see above. Otherwise, upgrade Level C.
	Above 125 mcg/m³	**Stop Work.** Apply additional dust suppression measures. Resume work when less than 125 mcg/m³ and maintain **Level C.** Call DEC project manager.
Notes: ppm = parts per million mcg/m³ = micrograms per cubic meter		

6.3.3 Community Air Monitoring

Perimeter community air monitoring for VOCs (and, depending upon the nature of the work to be performed, dust particulate levels) may be conducted during soil disturbance activities. At the start of work, perimeter air monitoring stations will be established upwind and downwind of the work activities. Monitoring for VOCs (and dust particulate levels, if applicable) at the upwind and downwind stations may be conducted at the start of each workday, and every time the wind changes direction to establish background conditions.

If, during the continuous Work Zone air monitoring detailed in Section 6.3.2, any air monitoring readings in the work zone approach Community Action Levels as specified in the table below, then monitoring at the downwind property perimeter station will be conducted. If no exceedances of the Community Action Levels are noted at the downwind property perimeter station, then excavation activities will continue.

If exceedances in the Community Action Levels at the downwind property perimeter station are noted and cannot be controlled by the prescribed control measures outlined in this SMP, all work must stop and the Site secured. **A site and project specific Community Air Monitoring Plan must be developed, approved by NYS DEC project manager (call 518-402-9813) and**

immediately implemented. Continuous monitoring at the downwind perimeter station will be conducted until any exceedance is corrected and air monitoring levels are re-established at the background conditions.

Community Action Levels and Required Actions

Instrument	Task to be Monitored	Action Level	Response Action
PID	All soil disturbance tasks	VOC - more than 5ppm above background at downwind perimeter.	**Stop Work.** Continue Monitoring. Resume work when source of vapors is abated and readings are less than 5 ppm above background.
		Between 10 and 25 ppm	**Stop Work.** Determine source of vapors and take corrective measures, see above.
		More than 25 ppm	**Stop Work.** Shut down. Call NYSDEC project manager.
Particulate monitor (PM-10)	All soil disturbance tasks	Particulates greater than 100 mcg/m³	Apply dust suppression measures. Continue monitoring.
		Above 150 mcg/m³	Apply dust suppression measures. Continue monitoring. Resume work when < 100 mcg/m³ .
Notes: ppm = parts per million mcg/m³ = micrograms per cubic meter			

7.0 EMERGENCY RESPONSE

Any person or entity performing soil disturbance activities at the Site should be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In case of a medical emergency, someone should immediately call for an ambulance, if needed. If the nature of the injury is not serious (i.e.; the person can be moved without expert emergency medical personnel), he/she should be driven to a hospital by on-site personnel.

The location of the nearest hospital is Lawrence Hospital, 55 Palmer Avenue, Bronxville, NY. Directions to this hospital have been attached as Exhibit 4.

7.1 PERTINENT EMERGENCY INFORMATION

Lawrence Hospital	(914) 787-1000
Ambulance, Fire and Police Departments	911
NYS DEC Spill Hotline	(800) 457-7362
National Response Center (all spills in "reportable quantities" as per USEPA)	(800) 424-8802

8.0 ACKNOWLEDGEMENT THAT ACCESS TO THIS SOIL MANAGEMENT PLAN (SMP) WAS OFFERED

Below is a listing of persons/entities who plan to perform subsurface soil activities and were directed to review this SMP as they entered the Site. A copy of the SMP must be on-site at all times at the office and a copy offered to the entity's SSO.

	Storage Deluxe Employee	Name of contractor/ company/utility	Date	Entity's SSO
Signed:				
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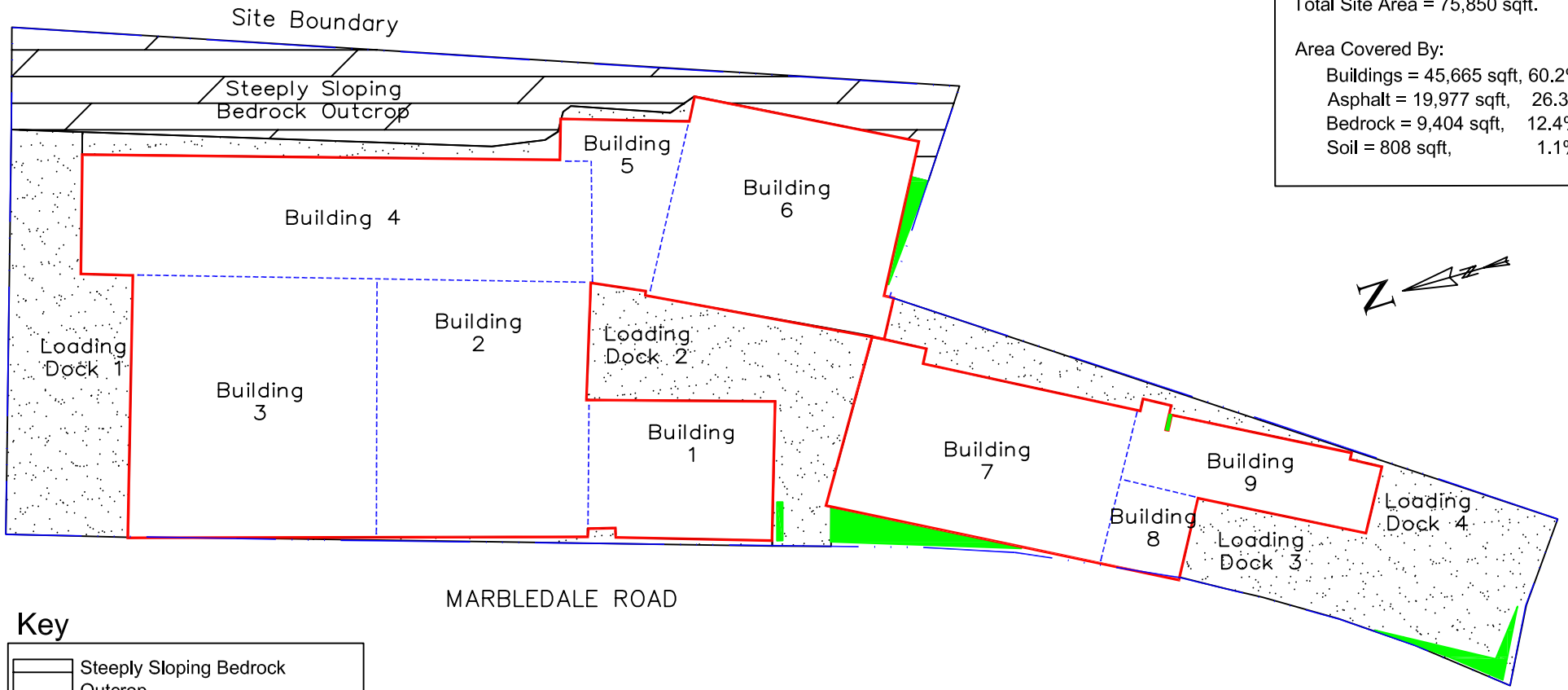
FIGURE 1

Area Calculations

Total Site Area = 75,850 sqft.

Area Covered By:

Buildings =	45,665 sqft,	60.2%
Asphalt =	19,977 sqft,	26.3%
Bedrock =	9,404 sqft,	12.4%
Soil =	808 sqft,	1.1%



Key

- Steeply Sloping Bedrock Outcrop
- Asphalt/Concrete
- Soil
- Outline of Storage Deluxe Facilty Buildings

Graphic Scale

0 50 100

feet

Location of site boundary line and site features approximate

Figure based on: 9/17/08 Survey Map Prepared by Arcadis reliant upon 9/21/2000 Survey of Lot 2 as shown on subdivision map prepared for Kings Electronics, Co., Inc., by Gabriel E. Senor, P.C., Drawing No. S-1,

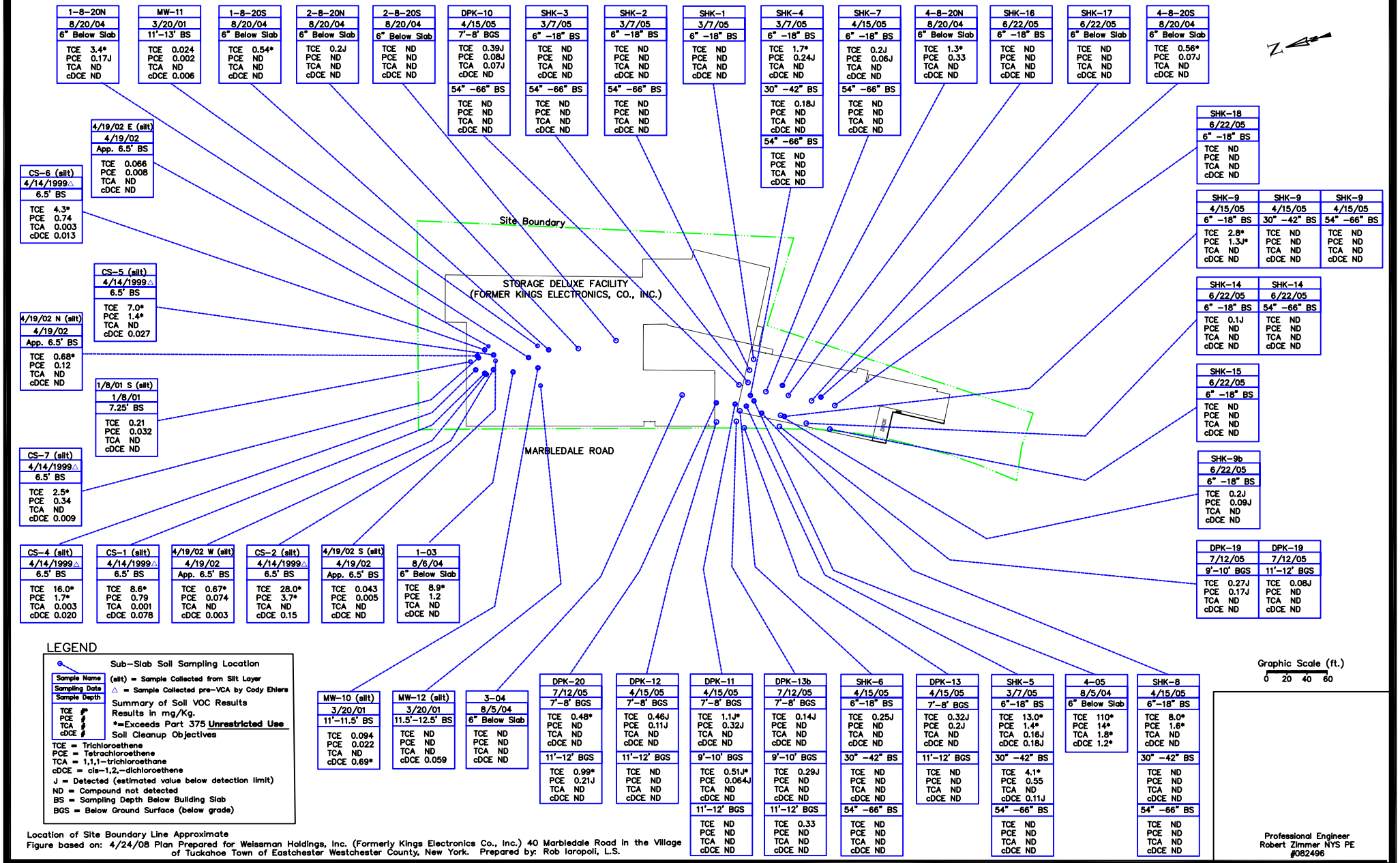
Professional Engineer
Robert Zimmer NYS PE
#082496

GEOVATION
Engineering, P.C.
Innovative Solutions to Environmental Problems
468 Rte. 17A, P.O. Box 293
Florida, New York 10921

Surface Area Showing Buildings, Asphalt/Concrete, Bedrock Outcrops and Soil. (Building Numbers also shown on Figure)

Storage Deluxe Facilty/Former Kings Electronics Co., Inc.
40 Marbledale Rd., Tuckahoe, NY

FIGURE 2



Location of Site Boundary Line Approximate
Figure based on: 4/24/08 Plan Prepared for Weissman Holdings, Inc. (Formerly Kings Electronics Co., Inc.) 40 Marbledale Road in the Village of Tuckahoe Town of Eastchester Westchester County, New York. Prepared by: Rob Iaropoli, L.S.

GEOVATION Engineering, P.C.
Innovative Solutions to Environmental Problems
468 Rte. 17A, P.O. Box 293
Florida, New York 10921

Location, Depth and Summary of VOC Soil Sampling Results Conducted Pursuant to Voluntary Cleanup Agreement

Storage Deluxe Facility – Former Kings Electronics Co., Inc.
40 Marbledale Rd. Tuckahoe, NY

FIGURE
2

FIGURE 3

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ **July 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

NPG Home | Introduction | Synonyms & Trade Names | Chemical Names | CAS Numbers | RTECS Numbers | Appendices | Search

Trichloroethylene

CAS 79-01-6

$ClCH=CCl_2$

RTECS KX4550000

Synonyms & Trade Names
Ethylene trichloride, TCE, Trichloroethene, Trilene

DOT ID & Guide
1710 160

Exposure Limits

NIOSH REL: Ca See Appendix A See Appendix C

OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)

IDLH Ca [1000 ppm] See: 79016

Conversion 1 ppm = 5.37 mg/m^3

Physical Description
Colorless liquid (unless dyed blue) with a chloroform-like odor.

MW: 131.4	BP: 189°F	FRZ: -99°F	Sol(77°F): 0.1%
VP: 58 mmHg	IP: 9.45 eV		Sp.Gr: 1.46
Fl.P: ?	UEL(77°F): 10.5%	LEL(77°F): 8%	

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities
Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Measurement Methods
NIOSH 1022, 3800; OSHA 1001
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system

Cancer Site [in animals: liver & kidney cancer]

See also: INTRODUCTION See ICSC CARD: 0081 See MEDICAL TESTS: 0236

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *trans*-) was not specified.

What is 1,2-dichloroethene?

(Pronounced 1,2-dī-klôr′ ō-ĕth′ēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- 1,2-Dichloroethene evaporates rapidly into air.
- In the air, it takes about 5-12 days for half of it to break down.
- Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- In groundwater, it takes about 13-48 weeks to break down.
- There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high

levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Fertility: Ability to reproduce.

Ingest: To eat or drink something.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

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1,2-Dichloroethylene

CAS 540-59-0

CICH=CHCl

RTECS KV9360000

Synonyms & Trade Names
Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene

DOT ID & Guide
1150 130P

Exposure Limits

NIOSH REL: TWA 200 ppm (790 mg/m^3)

OSHA PEL: TWA 200 ppm (790 mg/m^3)

IDLH 1000 ppm See: 540590

Conversion 1 ppm = 3.97 mg/m^3

Physical Description
Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

MW: 97.0	BP: 118-140°F	FRZ: -57 to -115°F	Sol: 0.4%
VP: 180-265 mmHg	IP: 9.65 eV		Sp.Gr(77°F): 1.27
Fl.P: 36-39°F	UEL: 12.8%	LEL: 5.6%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]

Measurement Methods
NIOSH 1003; OSHA 7
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 1000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode£
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)£
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, respiratory system; central nervous system depression

Target Organs Eyes, respiratory system, central nervous system

See also: INTRODUCTION See ICSC CARD: 0436

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

VINYL CHLORIDE

CAS # 75-01-4

Division of Toxicology and Environmental Medicine ToxFAQs™ **July 2006**

This fact sheet answers the most frequently asked health questions (FAQs) about vinyl chloride. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to vinyl chloride occurs mainly in the workplace. Breathing high levels of vinyl chloride for short periods of time can cause dizziness, sleepiness, unconsciousness, and at extremely high levels can cause death. Breathing vinyl chloride for long periods of time can result in permanent liver damage, immune reactions, nerve damage, and liver cancer. This substance has been found in at least 616 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is vinyl chloride?

Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, trichloroethylene, and tetrachloroethylene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials.

Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

What happens to vinyl chloride when it enters the environment?

❑ Liquid vinyl chloride evaporates easily. Vinyl chloride in water or soil evaporates rapidly if it is near the surface.
❑ Vinyl chloride in the air breaks down in a few days to other substances, some of which can be harmful.
❑ Small amounts of vinyl chloride can dissolve in water.
❑ Vinyl chloride is unlikely to build up in plants or animals that you might eat.

How might I be exposed to vinyl chloride?

❑ Breathing vinyl chloride that has been released from plastics industries, hazardous waste sites, and landfills.
❑ Breathing vinyl chloride in air or during contact with your skin or eyes in the workplace.
❑ Drinking water from contaminated wells.

How can vinyl chloride affect my health?

Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death.

Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold.

VINYL CHLORIDE
CAS # 75-01-4

The effects of drinking high levels of vinyl chloride are unknown. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

Animal studies have shown that long-term exposure to vinyl chloride can damage the sperm and testes.

How likely is vinyl chloride to cause cancer?

The U.S. Department of Health and Human Services has determined that vinyl chloride is a known carcinogen. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver, brain, lung cancer, and some cancers of the blood have also been observed in workers.

How can vinyl chloride affect children?

It has not been proven that vinyl chloride causes birth defects in humans, but studies in animals suggest that vinyl chloride might affect growth and development. Animal studies also suggest that infants and young children might be more susceptible than adults to vinyl chloride-induced cancer.

How can families reduce the risk of exposure to vinyl chloride?

Tobacco smoke contains low levels of vinyl chloride, so limiting your family's exposure to cigarette or cigar smoke may help reduce their exposure to vinyl chloride.

Is there a medical test to show whether I've been exposed to vinyl chloride?

The results of several tests can sometimes show if you have been exposed to vinyl chloride. Vinyl chloride can be measured in your breath, but the test must be done shortly after exposure. This is not helpful for measuring very low levels of vinyl chloride.

The amount of the major breakdown product of vinyl chloride, thiodiglycolic acid, in the urine may give some information about exposure. However, this test must be done shortly after exposure and does not reliably indicate the level of exposure.

Has the federal government made recommendations to protect human health?

Vinyl chloride is regulated in drinking water, food, and air. The EPA requires that the amount of vinyl chloride in drinking water not exceed 0.002 milligrams per liter (mg/L) of water.

The Occupational Safety and Health Administration (OSHA) has set a limit of 1 part vinyl chloride per 1 million parts of air (1 ppm) in the workplace.

The Food and Drug Administration (FDA) regulates the vinyl chloride content of various plastics. These include plastics that carry liquids and plastics that contact food. The limits for vinyl chloride content vary depending on the nature of the plastic and its use.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for Vinyl Chloride (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

NIOSH Publication 2005-149 September 2005

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Vinyl chloride

CAS 75-01-4

CH_2=CHCl

RTECS KU9625000

Synonyms & Trade Names
Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

DOT ID & Guide
1086 116P (inhibited)

Exposure Limits

NIOSH REL: Ca See Appendix A

OSHA PEL: [1910.1017] TWA 1 ppm C 5 ppm [15-minute]

IDLH Ca [N.D.] See: IDLH INDEX

Conversion 1 ppm = 2.56 mg/m^3

Physical Description
Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]

MW: 62.5	BP: 7°F	FRZ: -256°F	Sol(77°F): 0.1%
VP: 3.3 atm	IP: 9.99 eV	RGasD: 2.21	
Fl.P: NA (Gas)	UEL: 33.0%	LEL: 3.6%	

Flammable Gas

Incompatibilities & Reactivities
Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

Measurement Methods
NIOSH 1007; OSHA 4, 75
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Frostbite
Eyes: Frostbite
Wash skin: No recommendation
Remove: When wet (flammable)
Change: No recommendation
Provide: Frostbite wash

First Aid (See procedures)
Eye: Frostbite
Skin: Frostbite
Breathing: Respiratory support

Respirator Recommendations (See Appendix E) NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin, and/or eye contact (liquid)

Symptoms Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]

Target Organs Liver, central nervous system, blood, respiratory system, lymphatic system

Cancer Site [liver cancer]

See also: INTRODUCTION See ICSC CARD: 0082 See MEDICAL TESTS: 0241

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TETRACHLOROETHYLENE
CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

NIOSH Publication 2005-149 September 2005

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Tetrachloroethylene

CAS 127-18-4

$Cl_2C=CCl_2$

RTECS KX3850000

Synonyms & Trade Names
Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene

DOT ID & Guide
1897 160

Exposure Limits

NIOSH REL: Ca Minimize workplace exposure concentrations. See Appendix A

OSHA PEL†: †: TWA 100 ppm
C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm

IDLH Ca [150 ppm] See: 127184

Conversion 1 ppm = 6.78 mg/m^3

Physical Description
Colorless liquid with a mild, chloroform-like odor.

MW: 165.8	BP: 250°F	FRZ: -2°F	Sol: 0.02%
VP: 14 mmHg	IP: 9.32 eV		Sp.Gr: 1.62
Fl.P: NA	UEL: NA	LEL: NA	

Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Incompatibilities & Reactivities
Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Measurement Methods
NIOSH 1003; OSHA 1001
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, liver, kidneys, central nervous system

Cancer Site [in animals: liver tumors]

See also: INTRODUCTION See ICSC CARD: 0076 See MEDICAL TESTS: 0179

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

1,1,1-TRICHLOROETHANE

CAS # 71-55-6

Division of Toxicology and Environmental Medicine ToxFAQs™ July 2006

This fact sheet answers the most frequently asked health questions (FAQs) about 1,1,1-trichloroethane. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,1,1-trichloroethane usually occurs by breathing contaminated air. It is found in building materials, cleaning products, paints, and metal degreasing agents. You are not likely to be exposed to large enough amounts to cause adverse health effects. Inhaling high levels of 1,1,1-trichloroethane can cause you to become dizzy and lightheaded. Exposure to much higher levels can cause unconsciousness and other effects. This substance has been found in at least 823 of the 1,662 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is 1,1,1-trichloroethane?

1,1,1-Trichloroethane is a synthetic chemical that does not occur naturally in the environment. It also is known as methylchloroform, methyltrichloromethane, trichloromethylmethane, and α–trichloromethane. Its registered trade names are chloroethene NU® and Aerothene TT®.

No 1,1,1-trichloroethane is supposed to be manufactured for domestic use in the United States after January 1, 2002 because it affects the ozone layer. 1,1,1-Trichloroethane had many industrial and household uses, including use as a solvent to dissolve other substances, such as glues and paints; to remove oil or grease from manufactured metal parts; and as an ingredient of household products such as spot cleaners, glues, and aerosol sprays.

What happens to 1,1,1-trichloroethane when it enters the environment?

❑ Most of the 1,1,1-trichloroethane released into the environment enters the air, where it lasts for about 6 years.

❑ Once in the air, it can travel to the ozone layer where sunlight can break it down into chemicals that may reduce the ozone layer.

❑ Contaminated water from landfills and hazardous waste sites can contaminate surrounding soil and nearby surface water or groundwater.

❑ From lakes and rivers, most of the 1,1,1-trichloroethane evaporates quickly into the air.

❑ Water can carry 1,1,1-trichloroethane through the soil and into the groundwater where it can evaporate and pass through the soil as a gas, then be released to the air.

❑ Organisms living in soil or water may also break down 1,1,1-trichloroethane.

❑ It will not build up in plants or animals.

How might I be exposed to 1,1,1-trichloroethane?

❑ Breathing 1,1,1-trichloroethane in contaminated outdoor and indoor air. Because 1,1,1-trichloroethane was used so frequently in home and office products, you are likely to be exposed to higher levels indoors than outdoors or near hazardous waste sites. However, since 2002, 1,1,1-trichloroethane is not expected to be commonly used, and therefore, the likelihood of being exposed to it is remote.

❑ In the workplace, you could have been exposed to 1,1,1-trichloroethane while using some metal degreasing agents, paints, glues, and cleaning products.

❑ Ingesting contaminated drinking water and food.

How can 1,1,1-trichloroethane affect my health?

If you breathe air containing high levels of 1,1,1-trichloroethane for a short time, you may become dizzy and lightheaded and possibly lose your coordination. These effects rapidly disappear after you stop breathing contaminated air. If you breathe in much higher levels, you may become unconscious, your blood pressure may decrease, and your heart may stop beating. Whether breathing low levels of 1,1,1-trichloroethane for a long

time causes harmful effects is not known. Studies in animals show that breathing air that contains very high levels of 1,1,1-trichloroethane damages the breathing passages and causes mild effects in the liver, in addition to affecting the nervous system. There are no studies in humans that determine whether eating food or drinking water contaminated with 1,1,1-trichloroethane could harm health. Placing large amounts of 1,1,1-trichloroethane in the stomachs of animals has caused effects on the nervous system, mild liver damage, unconsciousness, and even death. If your skin contacts 1,1,1-trichloroethane, you might feel some irritation. Studies in animals suggest that repeated exposure of the skin might affect the liver and that very large amounts may cause death. These effects occurred only when evaporation was prevented.

How likely is 1,1,1-trichloroethane to cause cancer?

Available information does not indicate that 1,1,1-trichloroethane causes cancer. The International Agency for Research on Cancer (IARC) and the EPA have determined that 1,1,1-trichloroethane is not classifiable as to its carcinogenicity in humans.

How can 1,1,1-trichloroethane affect children?

Children exposed to large amounts of 1,1,1-trichloroethane probably would be affected in the same manner as adults. In animals, it has been shown that 1,1,1-trichloroethane can pass from the mother's blood into a fetus. When pregnant mice were exposed to high levels of 1,1,1-trichloroethane in air, their babies developed more slowly than normal and had some behavioral problems. However, whether similar effects occur in humans has not been demonstrated.

How can families reduce the risk of exposure to 1,1,1-trichloroethane?

Children can be exposed to 1,1,1-trichloroethane in household products, such as adhesives and cleaners. Parents should store household chemicals out of reach of young children to prevent accidental poisonings or skin irritation. Always store household chemicals in their original labeled containers. Never store household chemicals in containers that children would find attractive to eat or drink from, such as old soda bottles. Keep your Poison Control Center's number near the phone.

Sometimes older children sniff household chemicals in an attempt to get high. Your children may be exposed to 1,1,1-trichloroethane by inhaling products containing it. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to 1,1,1-trichloroethane?

Samples of your breath, blood, and urine can be tested to determine if you have recently been exposed to 1,1,1-trichloroethane. In some cases, these tests can estimate how much 1,1,1-trichloroethane has entered your body. To be of any value, samples of your breath or blood have to be taken within hours after exposure, and samples of urine have to be taken within 2 days after exposure. However, these tests will not tell you whether your health will be affected by exposure to 1,1,1-trichloroethane. The exposure tests are not routinely available in hospitals and clinics because they require special analytical equipment.

Has the federal government made recommendations to protect human health?

EPA regulates the levels of 1,1,1-trichloroethane that are allowable in drinking water. The highest level of 1,1,1-trichloroethane allowed in drinking water is 0.2 parts 1,1,1,-trichloroethane per 1 million parts of water (0.2 ppm).

The Occupational Safety and Health Administration (OSHA) has set a limit of 350 parts 1,1,1-trichloroethane per 1 million parts of air (350 ppm) in the workplace.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for 1,1,1-Trichloroethane (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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NIOSH Pocket Guide to Chemical Hazards

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Methyl chloroform

CAS 71-55-6

CH_3CCl_3

RTECS KJ2975000

Synonyms & Trade Names
Chlorothene; 1,1,1-Trichloroethane; 1,1,1-Trichloroethane (stabilized)

DOT ID & Guide
2831 160

Exposure Limits

NIOSH REL: C 350 ppm (1900 mg/m^3) [15-minute] See Appendix C (Chloroethanes)

OSHA PEL†: TWA 350 ppm (1900 mg/m^3)

IDLH 700 ppm See: 71556

Conversion 1 ppm = 5.46 mg/m^3

Physical Description
Colorless liquid with a mild, chloroform-like odor.

MW: 133.4	BP: 165°F	FRZ: -23°F	Sol: 0.4%
VP: 100 mmHg	IP: 11.00 eV		Sp.Gr: 1.34
Fl.P: ?	UEL: 12.5%	LEL: 7.5%	

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities
Strong caustics; strong oxidizers; chemically-active metals such as zinc, aluminum, magnesium powders, sodium & potassium; water [Note: Reacts slowly with water to form hydrochloric acid.]

Measurement Methods
NIOSH 1003
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 700 ppm:
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, ingestion, skin and/or eye contact

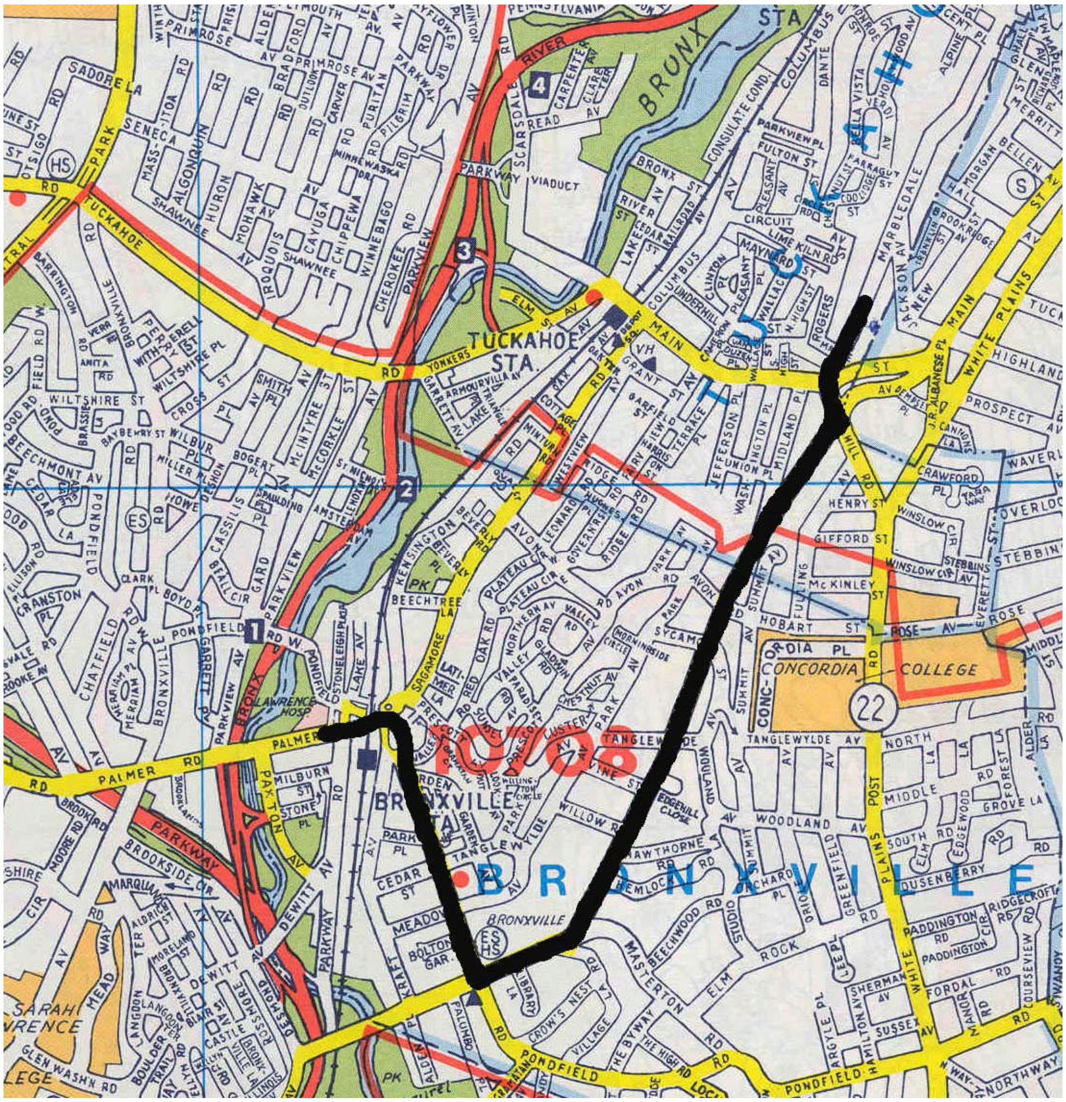
Symptoms Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage

Target Organs Eyes, skin, central nervous system, cardiovascular system, liver

See also: INTRODUCTION See ICSC CARD: 0079 See MEDICAL TESTS: 0141

FIGURE 4

Directions to Lawrence Hospital
55 Palmer Avenue, Bronxville, NY   (914) 787-1000



1 Start out going SOUTHWEST on MARBLEDALE RD towards MAIN ST. 0.1 mi

2 Turn LEFT onto WINTER HILL RD. 0.1 mi

3 Turn RIGHT onto MIDLAND AVENUE. 1.0 mi

4 Turn RIGHT onto PONDFIELD RD. 0.5 mi

5 Enter next roundabout and take 2nd exit onto PALMER AVE. 0.1 mi

6 End at 55 Palmer Avenue, Bronxville, NY 10708-3403, (914) 787-1000.