Health Consultation

Evaluation of Indoor Air Settlement Program Data on Tetrachloroethane

SCHLAGE LOCK COMPANY
SECURITY, EL PASO COUNTY, COLORADO

EPA FACILITY ID: COD082657420

DECEMBER 10, 2008

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

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

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

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Prepared By:

The Colorado Department of Public Health and Environment
Under cooperative agreement with the
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Foreword

The Colorado Department of Public Health and Environment's (CDPHE) Environmental Epidemiology Section has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the US Department of Health and Human Services and is the principal federal public health agency responsible for the health issues related to hazardous waste. This health consultation was prepared in accordance with the methodologies and guidelines developed by ATSDR.

The purpose of this health consultation is to identify and prevent harmful health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on health issues associated with specific exposures so that the state or local department of public health can respond quickly to requests from concerned citizens or agencies regarding health information on hazardous substances. The Colorado Cooperative Program for Environmental Health Assessments (CCPEHA) of the Environmental Epidemiology Section (EES) evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur in the future, reports any potential harmful effects, and then recommends actions to protect public health. The findings in this report are relevant to conditions at the site during the time this health consultation was conducted and should not necessarily be relied upon if site conditions or land use changes in the future.

For additional information or questions regarding the contents of this health consultation or the Environmental Epidemiology Section, please contact the author of this document:

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Summary and Statement of Issues

Schlage Lock Company (Schlage) operates a manufacturing facility in Security, Colorado. In the late 1980's, the organic solvent tetrachloroethene, or PCE, was discovered in the subsurface soil on their property. Further investigation revealed that PCE had migrated to the Widefield Aquifer, which is a source of drinking water for the surrounding communities of Security, Widefield, and Fountain. Schlage entered into a Compliance Order on Consent with the Hazardous Waste and Waste Management Division of the Colorado Department of Public Health and Environment (CDPHE) in June 1990, which was amended in August 1998, and a variety of remedial measures have occurred since that time to remove PCE from the Widefield Aquifer. Remedial actions appear to be working as marked decreases of PCE in the aquifer have been measured. Clean-up and removal of PCE is ongoing. On January 8, 2007, Schlage Lock entered into a class action settlement. As part of the settlement agreement, residents were offered the opportunity to have their indoor air tested for PCE. A total of 115 homeowners responded and requested an indoor air test. Two area schools were also evaluated as part of a separate agreement between Schlage Lock and the Widefield School District.

The Colorado Cooperative Program for Environmental Health Assessments of the CDPHE has performed a variety of health consultation activities on the Schlage site, including evaluations of the municipal water systems affected by PCE contamination in the Widefield Aquifer, an evaluation of exposures to PCE in indoor air based on 2000-2001 data, and two evaluations of exposures to PCE in Willow Springs Ponds (distal extent of the contaminant plume). This evaluation focuses on indoor air data that was collected as part of a 2007 settlement agreement between Schlage Lock and residents of the Security-Widefield community. The purpose of this evaluation is to identify any potential public health hazards associated with indoor air exposures to PCE based on the Settlement Program indoor air data.

After a thorough review of the available data, it was concluded that all current exposures to PCE in indoor air represents no apparent public health hazard for the buildings evaluated as part of the Schlage Lock Indoor Air Settlement Program based on the current concentrations and an assumed exposure duration of 30 years. Overall, the PCE concentrations in indoor air were very low in the buildings overlying the contaminant plume, and well below concentrations that could cause non-cancer adverse health effects. The estimated theoretical cancer risks of indoor air exposures were within the acceptable risk range for all properties except two. It appears that the source of PCE in the indoor air of these properties is domestic (i.e. household) and not related to contamination in the Widefield Aquifer. However, the actual source of PCE in indoor air at these properties is still unknown. It is recommended that these residents take further action to identify and remove domestic sources of PCE from their property since the estimated lifetime theoretical cancer risks are at the high-end of the acceptable risk range. In addition, it is recommended that Schlage Lock continue with the remedial actions outlined in the

Compliance Order on Consent and its implementing documents approved by the CDPHE, to further reduce theoretical cancer risks to the CPDHE target cancer risk level.

Background

Site Description and History

The Schlage Lock Company (Schlage), located at 3899 Hancock Expressway, Security, Colorado began operations manufacturing door locks and related hardware in August 1977. From late 1977 until mid 1992, Schlage used PCE as a metal cleaner and degreaser. In mid-July 1987, Schlage discovered PCE contamination in the subsurface soil on their property during an excavation for plant expansion. A preliminary investigation, conducted in 1987, revealed that the PCE had leached down to groundwater beneath the site. It was later found that the contaminant had migrated into the Widefield Aquifer, the primary source of drinking water for the surrounding communities.

The plume of PCE-contaminated groundwater currently extends from the Schlage Lock facility in a west-southwest direction below the Little Johnson Reservoir, then turns and proceeds south-southeast as it intersects with the Widefield Aquifer, just south of Bradley Road (Figure 1). The contaminant plume then travels within the Widefield Aquifer towards Willow Springs Ponds, which is the distal extent of the PCE plume. The shape of the contaminant plume is constrained by paleo-channels in bedrock and channel deposits in the Widefield Aquifer. The overall length of the plume is approximately four and a half miles.

Following the identification of subsurface PCE contamination, a variety of remedial measures have taken place to remove and control the migration of PCE through the environment. Soil Vapor Extraction (SVE) systems were installed in two source areas at the Schlage facility in 1989 and in a third source area in 2000. In 1990, Schlage installed an on-site groundwater recovery and treatment system to treat PCE-contaminated groundwater and in 1992, they began operation of an additional system between their property and the former Little Johnson Reservoir. The treated water is discharged under a permit to the Security Water and Sanitation District sanitary sewer. An upgraded groundwater remediation system, described as the Bradley Road/Little Johnson Reservoir Groundwater Recovery, Treatment, and Injection System, has been operating since 1999. The system is designed to halt any further movement of contaminated groundwater from the aquifer beneath the facility into the Widefield aquifer. In 2001, Schlage installed a boundary control system to upgrade and supplement the on-site groundwater recovery and treatment system. The combined systems consist of 40 wells, 4 of which are located in a trench drain. Remediation of the contaminant plume is ongoing through continued operation of the various treatment systems described above.

The levels of PCE in the Widefield Aquifer appear to be decreasing. In 1999, maximum concentrations of PCE within the plume were over 1,000 ppb in the vicinity of Little

Johnson Reservoir, less than 100 ppb south of Bradley Road, and less than 50 ppb south of Fountaine Boulevard. Maximum PCE concentrations detected during the 4th quarter of 2007 were generally below 800 ppb in the vicinity of Little Johnson Reservoir, less than 50 ppb south of Bradley Road, and less than 10 ppb south of Fountaine Boulevard.

On January 8, 2007, Schlage Lock entered into a class action settlement approved by Judge Blackburn in Stalcup, et al. V. Schlage Lock Co., et al., Civil Action Number 1:02-cv-01188-REB-MEH, United States District Court. Under this agreement, individuals living within an area designated by Judge Blackburn could request one indoor air sample for PCE on their property. A letter was sent to all property owners within the settlement area (approximately 3,000 homes) notifying them of their ability to request an indoor air sample for PCE. This evaluation focuses on the indoor air data that was collected as part of the settlement agreement.

The purpose of this document is to analyze the settlement program indoor air data to determine what, if any, potential adverse health effects could be expected from vapor intrusion at the Schlage Lock site. This review was requested by the project manager of the environmental division at CDPHE and is also a follow-up activity of the previously published health consultation on the vapor intrusion pathway at the Schlage Lock site (CDPHE, 2006).

Demographics

Approximately 38,750 people live in the area of the PCE plume extending from the Schlage Lock facility to Willow Springs Ponds, which is the distal extent of the plume (Census 2000). This figure is an approximation and may over-or underestimate the actual number of people that could be exposed to PCE through the indoor air pathway due to a lack of a clear boundary of the plume and the use of old census data. No striking demographic features exist for this population when compared to national statistics.

Community Health Concerns

Community health concerns regarding the PCE contamination within the Widefield Aquifer were solicited and documented in the “Community Involvement and Health Issues Communication Plan” (CDPHE 2004). In addition, Schlage Lock and the Hazardous Waste and Waste Management Division (HWWMD) at CDPHE have also conducted public involvement activities in the affected communities. Their findings were documented in the “Community Involvement Plan for the Schlage Lock Company Site” (Schlage 2001). Community concerns from both documents are summarized below.

Previously Identified Community Concerns (Schlage 2001):

- Safety of the drinking water supply,
- Property Values,
- Progress on the Willow Springs Ponds remediation, and

- Testing of pumping wells west of U.S. Highways 85 and 87.

Current Community Concerns (CDPHE 2004):

- The possibility of PCE exposure causing brain cancer, lymphatic cancer, or other types of cancer,
- The possibility of PCE exposure resulting in respiratory problems, and
- The health of domestic dogs that have swam in Willow Springs Ponds.

The primary health concerns within the community from exposure to PCE appear to be cancer and other non-carcinogenic health effects, such as respiratory problems. The intent of this health consultation is to evaluate any potential adverse human health effects, including cancer, from inhalation of PCE vapors in indoor air. The drinking water quality of all municipal water systems that were affected by PCE contamination within the Widefield Aquifer has been evaluated in separate health consultations. Please see the "Public Health Action Plan" section of this document for a list of all other health consultations available on this site.

Discussion

Environmental Data

The data used in this evaluation was collected as part of the settlement agreement described above. Of approximately 3,000 eligible households, a total of 115 homeowners requested indoor air sampling and provided written access agreements. The indoor air of households that did not respond to the letter or failed to provide written access agreements was not sampled. Schlage also sampled PCE in the indoor air of two schools located within the settlement area because of a separate agreement made with the Widefield School District on November 6, 2006.

Indoor air sampling of the eligible homes was carried out in the lowest potential living space within the home, away from windows and vents. Prior to sampling, homeowners and tenants were asked to refrain from bringing dry-cleaned clothes into the homes for a two week period prior to sampling. A chemical survey and residential questionnaire was administered by field personnel prior to sampling to determine potential chemical interferences that might affect the sampling results. Indoor air samples were collected by EnviroGroup Limited of Centennial, Colorado with evacuated 6-liter SUMMA canisters equipped with flow regulators to collect air over a 24-hour period (or 8-hour period in the schools). Duplicate samples were collected at a rate of one duplicate per 20 indoor air samples. Air samples were then sent to Severn Trent Air Toxics Laboratory in the City of Industry, California for PCE analysis by EPA Method TO-15. PCE was the only compound tested for since historical data does not indicate that PCE is naturally degrading in the Widefield Aquifer. All data validation efforts appear to be well documented in the Indoor Air Report of the PCE Settlement Testing Program prepared by

EnviroGroup and there are no anomalies to report that created any significant amount of concern.

Of the 132 total samples collected (including duplicates), 58% (73/132) of the samples had non-detectable (ND) concentrations of PCE (Table 1). The concentration of PCE ranged from ND – 84 $\mu g/m^3$ with an average concentration of 5.8 $\mu g/m^3$ (Table 2). A surrogate value of ½ the reporting limit of the analytical method, or 0.34 $\mu g/m^3$, was used for indoor air samples reported as ND since the actual concentration of PCE lies somewhere between 0 and 0.68 $\mu g/m^3$ (reporting limit). The surrogate value for ND samples was not used in the calculation for the average concentration noted above.

Selection of Contaminants of Potential Concern

To screen the available indoor air data for contaminants of potential concern, the Colorado Cooperative Program for Environmental Health Assessment of the CDPHE uses the ATSDR Comparison Values (CVs) and the EPA's Region 3 Risk Based Concentrations (RBCs). These screening values are conservative values, which are based on health guidelines with built-in orders of protection. The appropriate CV is compared with the maximum detected concentration of the contaminant in indoor air to determine if further evaluation is necessary. Contaminant levels below the screening value are not likely to result in adverse or harmful health effects and are dropped from further analysis. Contaminants that exceed the screening values are evaluated further. However, exceeding the comparison value does not necessarily indicate that adverse health effects are likely to occur, only that more analysis is necessary.

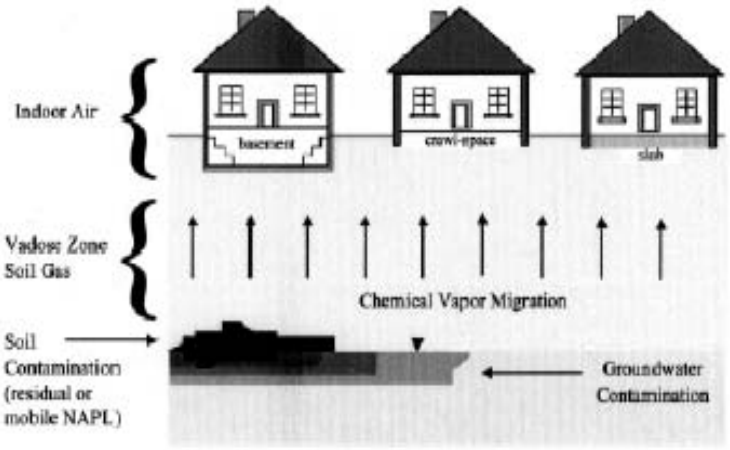
The ATSDR CV of 300 $\mu g/m^3$ is based on non-cancer health effects from chronic exposure to PCE in air. All indoor air samples collected for the settlement agreement were below 300 $\mu g/m^3$, indicating that non-cancer adverse health effects are not likely to occur from the levels of PCE in indoor air that were encountered in this evaluation. Therefore, non-cancer health effects were not considered further. The RBC of 0.31 $\mu g/m^3$ was used to screen the indoor air results for carcinogenic health effects. The RBC is based on an age-adjusted theoretical cancer risk equation, which accounts for exposure during childhood and as an adult over the course of a 30-year time period.

All samples exceeded the RBC including indoor air samples that were reported as ND, since the surrogate value of ½ the reporting limit also exceeds the RBC. Thus, all samples were selected for further evaluation.

Exposure Evaluation

The exposure assessment involves examining the way that individuals could come into contact with site-related contamination. This health consultation focuses solely on inhalation of contaminated indoor air as a result of the vapor intrusion pathway in residential properties and two school buildings. PCE belongs to a class of organic

compounds called Volatile Organic Compounds or VOCs. VOCs have high vapor pressure, which means the vapors of these contaminants readily enter the atmosphere. Vapor intrusion refers to the migration of VOC vapors from a subsurface source, through the soil, and into overlying homes and buildings where people can be exposed. Subsurface sources may include contaminated groundwater and/or soils. The figure below is a generalized schematic of how vapor intrusion works.



(Source: EPA 2002)

Environmental contamination is not the only source of VOCs in indoor air. VOCs are present in a number of household sources including building materials, cleaners, furniture treatments, paint, plastics, sealants, and cosmetics. In fact, studies have found that the levels of VOCs in indoor air may be as high as five times the levels found in outdoor air regardless of if the building was located in industrialized, urban areas or rural settings (EPA 2006b). Background concentrations of PCE documented at other sites in Colorado will be discussed in more detail later in this document. Once VOCs are present within the building or dwelling, occupants inhale them during regular indoor activities.

Public Health Implications

This section focuses on the public health implications of PCE in indoor air. To determine if the levels of PCE in indoor air are harmful to the individuals living, or attending school, in the area defined in the settlement agreement, the amount of PCE a person might take into the body and the toxic potential of PCE are taken into consideration.

Exposure to PCE can result in non-carcinogenic and carcinogenic adverse health effects. Carcinogenic adverse health effects are the most sensitive endpoint with non-cancer adverse health effects occurring at much higher levels. The main health outcome of concern amongst the Security-Widefield community related to PCE exposure appears to be cancer. At the current time, the International Agency for Cancer Research (IARC) has classified PCE as a Group 2a carcinogen (IARC 1995). This category indicates that the

substance is “probably carcinogenic to humans” based on sufficient experimental animal data and a limited amount of human data. The U.S. Environmental Protection Agency (EPA) is currently reviewing toxicity information on PCE and no cancer classification is available in the Integrated Risk Information System (IRIS) (EPA IRIS 1998). In the absence of relevant values in IRIS, the USEPA Office of Solid Waste and Emergency Response (OSWER) recommends using the California EPA’s carcinogenic inhalation cancer slope factor or toxicity factor per mg/kg/day of PCE (EPA, 2003, OSWER Directive No. 9285.7-75). CDPHE also adopted the Cal EPA inhalation cancer slope factor. In general, acute and chronic neurological changes, and liver and kidney toxicity, have been observed in humans and animals exposed to PCE (See Appendix C for PCE health effect fact sheet). It is important to note that estimates of human health risks may be based on evidence of health effects in humans and/or animals depending upon the availability of data.

The maximum detected concentration of PCE in indoor air of each building was used to estimate lifetime theoretical cancer risks. As mentioned previously, non-cancer adverse health effects of PCE are not expected to occur at this site since the maximum detected concentration of PCE found in indoor air is well below the noncancer health-based guideline. Thus, the remaining discussion focuses only on theoretical cancer risks. The derivation of the theoretical cancer risk estimates accounts for childhood and adult exposures over the default exposure duration for residential exposures. The estimated theoretical excess cancer risk for residents of each household is shown in Table 1. Theoretical cancer risk estimates for students at each school is shown in Table 3.

PCE was only detected in one of the three samples collected at School 2 at a concentration of 1.1 $\mu g/m^3$. This corresponds to a theoretical cancer risk of 3.55 excess cancer cases per one million exposed individuals, based on residential exposure scenario, which may overestimate the actual cancer risk since children do not attend school 24 hours per day for a 30 year period. Even under these conservative assumptions, the highest theoretical cancer risk estimate for schoolchildren are at the low end of the acceptable cancer risk range. It should also be noted that School 2 was also sampled in 2001 and a maximum detected PCE concentration of 0.86 $\mu g/m^3$ was found. PCE was not detected in all samples collected from School 1. It does not appear that children attending either school are at an increased risk of developing cancer based on the available indoor air data.

In general, CDPHE strives to achieve a target cancer risk level of $1 * 10^{-6}$ or no more than 1 excess cancer case out of a million people for all site-related environmental exposures. The USEPA considers a risk level of $1 * 10^{-6}$ to $1 * 10^{-4}$ as the acceptable range of cancer risk (1 to 100 excess cancer cases per 1,000,000 exposed individuals). The theoretical cancer risks in this evaluation range from $1.1 * 10^{-6}$ to $2.7 * 10^{-4}$. All of the theoretical cancer risks estimated in this evaluation were at the low end of the acceptable cancer risk range with the exception of 2 properties, House 19 and House 53. The estimated theoretical cancer risks for residents of House 19 and House 53 were initially $2.71 * 10^{-4}$

and 9.35 * 10^{-5}, respectively. Both of these values are above the CDPHE risk management action level of 5 * 10^{-5} for PCE in the residential indoor air.

House 19 was initially sampled on February 13, 2007 and the concentration of PCE in indoor air at that time was 84 $\mu g/m^3$. No obvious indoor air sources were noted on the questionnaire or the chemical survey for this property, although it was noted that an attached garage was not inspected for possible sources of PCE. The crawl space of House 19 was monitored with a handheld VOC detector to determine any potential background sources prior to resampling with SUMMA canisters and no VOCs were detected (Detection limit of the handheld device was not noted). One 20-minute grab sample and one 24-hour indoor air sample were collected in a different room on March 13-14th, 2007 and returned results of 40 $\mu g/m^3$ and 31 $\mu g/m^3$, respectively. Again, these results are above the CDPHE action level. Under the terms of the settlement agreement and the CDPHE Indoor Air Guidance, a vapor mitigation system was installed at the property on May 15, 2007. It should be noted that a vapor mitigation system is not likely to remove domestic sources of PCE from the indoor air since the system is designed to pull vapors from beneath the home prior to entering the indoor air space.

It appears that the source of PCE in the indoor air of House 19 is not related to the underlying groundwater contamination for 4 main reasons: 1) there is no spatial association between the groundwater concentration of PCE in that area and the indoor air concentration of PCE of House 19 (i.e. groundwater data for PCE is not high in this area); 2) nearby houses had very low levels of PCE (property next door had a PCE concentration of 1.1 $\mu g/m^3$); 3) No VOCs were detected in the crawl space of this property; and 4) the overall concentration of PCE in the indoor air of all homes surveyed was very low, indicating that vapor intrusion from the Widefield Aquifer may not be a commonly occurring pathway. Therefore, no further data has been collected from House 19 and it is assumed by the Settlement Program that the PCE concentration in the indoor air of this property is attributable to an unidentified household source. Regardless of the source, it is important to note that the theoretical cancer risks estimated for residents of this property are above the acceptable risk range assuming a 30 year exposure duration at the current indoor air concentrations of PCE. The available data indicates the source is domestic and not related to the groundwater contamination associated with Schlage Lock (i.e. the source is only affecting this property). It is recommended that the homeowners work to identify and remove the source of PCE from this property because the estimated residential cancer risks are above the acceptable risk range.

House 53 was initially sampled on February 28, 2007 and found a PCE concentration of 29 $\mu g/m^3$. Again, the theoretical cancer risks at this concentration correspond to 9.4 * 10^{-5} or 94 excess cancer cases per 1,000,000 exposed individuals. The chemical survey form of this property was reviewed and several potential household sources of PCE were identified. The property owner was advised to remove the potential household sources 2 weeks prior to resampling. On April 27, 2007, House 53 was resampled and the PCE concentration at this time was 7.9 $\mu g/m^3$, which corresponds to a theoretical cancer risk

of 2.5 * 10^{-5} (within acceptable range). It appears that household sources were contributing to the indoor air PCE concentration of House 53. Two homes were sampled in the immediate vicinity (across the street) of this property and the PCE concentration in indoor air was low (Not detected, 1.5 $\mu g/m^3$), which also seems to indicate a household source. It is recommended that the homeowners work to identify and remove all sources of PCE from this property since the source of PCE cannot be completely defined. Further air sampling by the homeowners would ensure that the residents are not being exposed to harmful levels of PCE in indoor air.

It should be noted that there is generally some uncertainty regarding the exact source of contamination in the indoor air environment because of the various sources of PCE in indoor and/or outdoor air. There may be other sources contributing to indoor air contamination and therefore the risks associated with this pathway may overestimate the groundwater/vapor intrusion contribution. As mentioned earlier, several domestic products contain PCE, which contribute to low background levels found almost ubiquitously in the ambient air. Other industrial sources such as dry-cleaning facilities also contribute small amounts of PCE to the ambient air. Background levels of PCE have been documented through indoor air sampling at two sites in Colorado (Redfield Rifle Scopes site and CDOT's Materials Testing Laboratory). The mean background concentration of PCE found in residential homes near these sites was 1.12 and 1.62 $\mu g/m^3$ with a 95% Upper Confidence Limit (UCL) of the mean of 2.22 and 2.23 $\mu g/m^3$, respectively (Kurtz and Folkes, 2002). More recent data from the CDOT site indicates that the background 95% UCL is closer to 5.5 $\mu g/m^3$. It must be noted that background data from other sites is only presented to roughly characterize the concentrations of PCE found in this assessment. Background data from other sites should not be used as the basis for determining if there is or is not a site-related impact. In fact, the Settlement Program data evaluated in this consultation indicates the site-specific background concentration of PCE could be as low as the detection limit of 0.68 $\mu g/m^3$ since the majority of sampled homes (60%) had non-detected concentrations of PCE. At the homes where PCE was detected, over 75% had indoor air concentrations of PCE less than 3.9 $\mu g/m^3$. Only two properties had an indoor air PCE concentration that would correspond to unacceptable theoretical cancer risks.

It is important to note that the theoretical cancer risks described in this document do not represent an exact risk. There are inherent uncertainties associated with any risk assessment and indoor air sampling. For instance, there is uncertainty with the interim EPA's cancer slope factor for PCE that is used to calculate cancer risks. Also, ATSDR's Cancer Risk Evaluation Guideline (CREG) that provides an estimated level of a contaminant that is associated with a 1 in a million excess risk for cancer is not available for PCE. Regarding the indoor air sampling uncertainties, the USEPA (2002) in the vapor intrusion guidance notes that concentrations of compounds found in indoor air are often subject to temporal and spatial variations, which may complicate estimates of exposure. For example, pressure differences between the inside and outside of a building can cause air to be drawn into the building. Thus the use of appliances that cause large pressure

differences such as exhaust fans, clothes dryers and furnaces be avoided during sampling. It is unknown if people actually followed the pre-sampling instructions. It is also unknown what the year round concentration of PCE is in the home. Thus, the conclusions stated in this document could be over or underestimations of actual risk to any one individual.

Overall, the concentration of PCE in the indoor air of all buildings included in this assessment represents no apparent public health hazard to residents or schoolchildren for all current exposures. These conclusions are consistent with the previous indoor air health consultation conducted in 2006. PCE was not detected in indoor air of nearly 60% of the 132 samples collected. In general, theoretical cancer risk estimates for all individuals considered in this evaluation are at the low end of the acceptable cancer risk range. The residential theoretical cancer risks were at the high-end of the acceptable range level at only 2 properties out of a total 116. The source of PCE contamination at these homes is unknown. It appears that a domestic (household) source could be affecting both properties. It is recommended that the homeowners of these properties work to remove all sources of PCE.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

The unique susceptibility of children to adverse health effects to PCE exposure was considered in this assessment. The Risk-Based Concentration that was utilized accounts for time-weighted early life exposures through the age of 30. No unique adverse health effects are expected to occur specifically for children.

Conclusions

After a thorough review of Schlage Lock Settlement Program's indoor air data, the following conclusions have been made regarding the indoor air quality and public health implications of exposure to PCE in the included homes and schools:

- The concentration of PCE in indoor air represents no apparent public health hazard to residents and/or school children for all current exposures in the buildings evaluated as part of the Schlage Lock Indoor Air Settlement Program based on an assumed 30 year exposure duration at the current concentrations of PCE.
- The theoretical cancer risk for residents of House 19 and House 53 were initially at the high-end of the acceptable cancer risk range. It appears that the major source(s) of PCE in indoor air of these properties may be in the home and not from groundwater.
- Noncancer hazards are below a level of concern for individuals occupying all homes and schools sampled in the settlement agreement program.
- All past and future exposures are considered indeterminate public health hazard because of data unavailability.

Recommendations

Based on the information and conclusions within this document, the CCPEHA makes the following recommendations to reduce or eliminate exposure to PCE from the indoor air pathway:

- The homeowners of House 19 and House 53 should work to identify and remove all sources of PCE from their property. The source of PCE in the indoor air of these homes is unknown, but appears to be related to domestic sources.

- Schlage Lock should continue with the remedial actions specified in the Compliance Order on Consent and its implementing documents to further reduce PCE concentrations in the Widefield Aquifer, and subsequently the impact on public health.

- In general, residents should limit or remove known household sources of PCE from the property or store in a well ventilated, preferably outdoor (unattached garage/shed), location. A list of household products containing PCE can be found on the Internet at: http://householdproducts.nlm.nih.gov/cgi-

bin/household/brands?tbl=chem&id=177. In addition, dry-cleaned clothing should not be stored in plastic bagging and should be kept in ventilated areas.

Public Health Action Plan

The public health action plan describes the actions designed to mitigate or prevent adverse human health effects that might result from exposure to hazardous substances associated with site-related contamination. The CCPEHA at CDPHE commits to do the following public health actions related to indoor air exposures to PCE in the Security-Widefield community:

- By request, CCPEHA will evaluate any additional indoor air data that may be collected in the future.
- CCPEHA will also make this document available to the public through the information repositories located in the Security-Widefield community along with a fact sheet summarizing the results of this consultation.

Other ATSDR health consultation documents currently available on the Schlage Lock site:

- Assessment of Drinking Water Quality, Fountain Municipal Water District, published in 2004.
- Assessment of Drinking Water Quality, Security Municipal Water District, published in 2005.
- Assessment of Drinking Water Quality, Widefield Water and Sanitation District, published in 2006.
- Evaluation of Tetrachloroethene Vapor Intrusion into Buildings Located Above a Contaminated Aquifer, published in 2006.
- Exposure and Health Effects Evaluation at Willow Springs Ponds following PCE Contamination of the Widefield Aquifer, published in 2006.
- Analysis of Untreated Residential Ground Water Wells in the Widefield Aquifer, published in 2007.
- Evaluation of Current and Future Fish Consumption from Willow Springs Ponds, published in 2007.

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Tables and Figures

Table 1. Schlage Lock Settlement Program's Residential Indoor Air Results

House Number	Sample Date	PCE Concentration (in μg/m^3)	Detected (Y/N)	Theoretical Cancer Risk*
1	2/7/2007	0.91	Y	2.94E-06
2	2/7/2007	1.1	Y	3.55E-06
3	2/7/2007	6.2	Y	2.00E-05
4	2/7/2007	1.7	Y	5.48E-06
5	2/7/2007	0.77	Y	2.48E-06
6	2/7/2007	1.4	Y	4.52E-06
7	2/7/2007	0.77	Y	2.48E-06
8	2/9/2007	0.68	N	1.10E-06
9	2/9/2007	1.3	Y	4.19E-06
10	2/9/2007	7.6	Y	2.45E-05
11	2/9/2007	1	Y	3.23E-06
12	2/9/2007	0.75	Y	2.42E-06
13	2/9/2007	0.94	Y	3.03E-06
14	2/9/2007	0.68	N	1.10E-06
15	2/13/2007	0.68	N	1.10E-06
15	2/13/2007	0.68	N	1.10E-06
16	2/22/2007	0.68	N	1.10E-06
17	2/13/2007	0.68	N	1.10E-06
18	2/28/2007	1.6	Y	5.16E-06
19	2/13/2007	84	Y	2.71E-04
19	3/14/2007	40	Y	1.29E-04
19	3/13/2007	31	Y	1.00E-04
20	2/13/2007	0.79	Y	2.55E-06
21	2/13/2007	1.2	Y	3.87E-06
22	2/13/2007	0.68	N	1.10E-06
23	2/15/2007	0.68	N	1.10E-06
24	2/15/2007	8.1	Y	2.61E-05
25	2/15/2007	0.68	N	1.10E-06
26	2/15/2007	0.68	N	1.10E-06
27	2/15/2007	0.68	N	1.10E-06
28	2/15/2007	0.68	N	1.10E-06
29	3/14/2007	0.68	N	1.10E-06
29	3/14/2007	0.68	N	1.10E-06
30	2/15/2007	0.68	N	1.10E-06
31	2/15/2007	0.68	N	1.10E-06
32	2/20/2007	3.4	Y	1.10E-05
33	2/20/2007	1.1	Y	3.55E-06
34	2/20/2007	0.68	N	1.10E-06
35	2/20/2007	0.68	N	1.10E-06
36	2/20/2007	9.7	Y	3.13E-05
37	2/20/2007	0.68	N	1.10E-06
38	2/20/2007	0.68	N	1.10E-06
39	2/20/2007	0.68	N	1.10E-06

39	2/20/2007	0.68	N	1.10E-06
40	2/28/2007	0.68	N	1.10E-06
41	2/22/2007	0.68	N	1.10E-06
42	2/22/2007	0.7	Y	2.26E-06
43	2/23/2007	0.68	N	1.10E-06
44	2/21/2007	0.68	N	1.10E-06
45	2/28/2007	0.68	N	1.10E-06
45	2/28/2007	0.68	N	1.10E-06
46	2/28/2007	0.68	N	1.10E-06
47	2/28/2007	0.68	N	1.10E-06
48	2/13/2007	1.4	Y	4.52E-06
49	2/13/2007	8.1	Y	2.61E-05
50	2/22/2007	2.5	Y	8.06E-06
51	2/28/2007	0.68	N	1.10E-06
52	2/28/2007	0.68	N	1.10E-06
53	2/28/2007	29	Y	9.35E-05
53	4/27/2007	7.9	Y	2.55E-05
54	2/23/2007	0.68	N	1.10E-06
55	3/6/2007	4.5	Y	1.45E-05
56	3/6/2007	0.68	N	1.10E-06
57	3/7/2007	1.4	Y	4.52E-06
58	3/8/2007	0.68	N	1.10E-06
59	3/7/2007	0.68	N	1.10E-06
60	3/6/2007	0.68	N	1.10E-06
61	3/6/2007	0.68	N	1.10E-06
62	3/6/2007	0.68	N	1.10E-06
64	3/14/2007	0.68	N	1.10E-06
71	3/23/2007	0.68	N	1.10E-06
72	3/27/2007	3.9	Y	1.26E-05
73	3/27/2007	1.1	Y	3.55E-06
74	3/27/2007	0.68	N	1.10E-06
75	4/3/2007	1.5	Y	4.84E-06
76	4/3/2007	1.2	Y	3.87E-06
77	4/3/2007	2.4	Y	7.74E-06
78	4/3/2007	0.68	N	1.10E-06
79	4/3/2007	1.1	Y	3.55E-06
80	4/19/2007	0.68	N	1.10E-06
80	4/19/2007	0.68	N	1.10E-06
81	4/19/2007	0.68	N	1.10E-06
82	4/19/2007	8.6	Y	2.77E-05
83	4/27/2007	2	Y	6.45E-06
85	4/27/2007	1	Y	3.23E-06
86	4/27/2007	0.68	N	1.10E-06
87	4/27/2007	0.68	N	1.10E-06
88	4/27/2007	0.68	N	1.10E-06
89	4/27/2007	0.68	N	1.10E-06
90	5/4/2007	0.68	N	1.10E-06
91	5/4/2007	0.68	N	1.10E-06
92	5/3/2007	0.68	N	1.10E-06
93	5/3/2007	0.68	N	1.10E-06

94	5/4/2007	0.83	Y	2.68E-06
95	5/4/2007	0.98	Y	3.16E-06
96	5/18/2007	0.68	N	1.10E-06
97	6/26/2007	2	Y	6.45E-06
98	5/18/2007	0.68	N	1.10E-06
99	5/18/2007	0.68	N	1.10E-06
100	5/18/2007	0.68	N	1.10E-06
101	5/18/2007	0.69	Y	2.23E-06
102	5/31/2007	0.68	N	1.10E-06
103	5/31/2007	5.6	Y	1.81E-05
104	5/31/2007	0.68	N	1.10E-06
105	5/31/2007	1.1	Y	3.55E-06
106	5/31/2007	1.9	Y	6.13E-06
106	5/31/2007	2.2	Y	7.10E-06
107	6/26/2007	0.68	N	1.10E-06
108	6/26/2007	0.68	N	1.10E-06
109	6/26/2007	0.72	Y	2.32E-06
110	6/26/2007	2.9	Y	9.35E-06
112	6/26/2007	0.83	Y	2.68E-06
113	6/26/2007	0.68	N	1.10E-06
114	6/26/2007	3.6	Y	1.16E-05
115	6/26/2007	0.68	N	1.10E-06
116	6/26/2007	0.68	N	1.10E-06
117	7/13/2007	0.68	N	1.10E-06
118	7/13/2007	1.9	Y	6.13E-06
119	7/27/2007	0.68	N	1.10E-06
119	7/27/2007	0.68	N	1.10E-06
120	7/13/2007	0.68	N	1.10E-06
120	7/13/2007	0.68	N	1.10E-06
121	7/13/2007	0.97	Y	3.13E-06
122	7/13/2007	0.68	N	1.10E-06
123	7/13/2007	0.68	N	1.10E-06
124	7/27/2007	0.68	N	1.10E-06

* A surrogate value of ½ the detection limit of the analytical method (0.34 $\mu g/m^3$) was used to calculate theoretical cancer risks on non-detected samples.

Table 2. Settlement Program's Residential Indoor Air Summary Statistics

Contaminant	Detects	Non-Detects	Percent Non-Detects	Minimum Conc.	Maximum Conc.	Mean Conc.	Median Conc.
PCE	53	73	58%	0.69	84	5.8	1.5

All Concentration Units = $\mu g/m^3$

Table 3. Widefield School District Indoor Air Samples

School (Location)	Sample Date	PCE Concentration (in μg/m^3)	Detected (Y/N)	Theoretical Cancer Risk*
School 1	3/14/2007	0.68	N	1.10E-06
School 1	3/14/2007	0.68	N	1.10E-06
School 1	3/14/2007	0.68	N	1.10E-06
School 2	3/13/2007	0.68	N	1.10E-06
School 2	3/13/2007	0.68	N	1.10E-06
School 2	3/13/2007	1.1	Y	3.55E-06

* A surrogate value of ½ the detection limit of the analytical method (0.34 μg/m^3) was used to calculate theoretical cancer risks on non-detected samples.

Appendices

Appendix A. ATSDR Public Health Hazard Categories

Category / Definition	Data Sufficiency	Criteria
A. Urgent Public Health Hazard This category is used for sites where short-term exposures (< 1 yr) to hazardous substances or conditions could result in adverse health effects that require rapid intervention.	This determination represents a professional judgment based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that site-specific conditions or likely exposures have had, are having, or are likely to have in the future, an adverse impact on human health that requires immediate action or intervention. Such site-specific conditions or exposures may include the presence of serious physical or safety hazards.
B. Public Health Hazard This category is used for sites that pose a public health hazard due to the existence of long-term exposures (> 1 yr) to hazardous substance or conditions that could result in adverse health effects.	This determination represents a professional judgment based on critical data which ATSDR has judged sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* suggests that, under site-specific conditions of exposure, long-term exposures to site-specific contaminants (including radionuclides) have had, are having, or are likely to have in the future, an adverse impact on human health that requires one or more public health interventions. Such site-specific exposures may include the presence of serious physical or safety hazards.
C. Indeterminate Public Health Hazard This category is used for sites in which "*critical*" data are *insufficient* with regard to extent of exposure and/or toxicologic properties at estimated exposure levels.	This determination represents a professional judgment that critical data are missing and ATSDR has judged the data are insufficient to support a decision. This does not necessarily imply all data are incomplete; but that some additional data are required to support a decision.	The health assessor must determine, using professional judgment, the "criticality" of such data and the likelihood that the data can be obtained and will be obtained in a timely manner. Where some data are available, even limited data, the health assessor is encouraged to the extent possible to select other hazard categories and to support their decision with clear narrative that explains the limits of the data and the rationale for the decision.
D. No Apparent Public Health Hazard This category is used for sites where human exposure to contaminated media may be occurring, may have occurred in the past, and/or may occur in the future, but the exposure is not expected to cause any adverse health effects.	This determination represents a professional judgment based on critical data which ATSDR considers sufficient to support a decision. This does not necessarily imply that the available data are complete; in some cases additional data may be required to confirm or further support the decision made.	Evaluation of available relevant information* indicates that, under site-specific conditions of exposure, exposures to site-specific contaminants in the past, present, or future are not likely to result in any adverse impact on human health.
E: No Public Health Hazard This category is used for sites that, because of the absence of exposure, do NOT pose a public health hazard.	Sufficient evidence indicates that no human exposures to contaminated media have occurred, none are now occurring, and none are likely to occur in the future	

Appendix B. ATSDR Plain Language Glossary of Environmental Health Terms

Absorption: The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute: Occurring over a short time [compare with chronic].

Acute exposure: Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect: A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect: A change in body function or cell structure that might lead to disease or health problems

Ambient
Surrounding (for example, *ambient* air).

Analyte: A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Antagonistic effect: A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level: An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation: Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study: A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring: Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake: The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing: Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota: Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden: The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

Cancer: Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk: A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen: A substance that causes cancer.

Central nervous system: The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic: Occurring over a long time [compare with acute].

Chronic exposure: Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Comparison value (CV): Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA): CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration: The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant: A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect: A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal: Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact: Contact with (touching) the skin [see route of exposure].

Detection limit: The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention: Measures used to prevent a disease or reduce its severity.

Dose (for chemicals that are not radioactive): The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose-response relationship: The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media: Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism: Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA: United States Environmental Protection Agency.

Exposure: Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment: The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction: A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation: The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway: The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Feasibility study: A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS): A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Groundwater: Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Hazard: A source of potential harm from past, current, or future exposures.

Hazardous waste: Potentially harmful substances that have been released or discarded into the environment.

Health consultation: A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education: Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation: The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion: The process of enabling people to increase control over, and to improve, their health.

Indeterminate public health hazard: The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Ingestion: The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation: The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure: Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro: In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo: Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL): The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring: A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

mg/kg: Milligram per kilogram.

Migration: Moving from one location to another.

Minimal risk level (MRL): An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Mutagen: A substance that causes mutations (genetic damage).

Mutation: A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or **NPL)**: EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP): Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard: A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL): The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard: A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model): A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica: A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population: A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP): A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb: Parts per billion.

ppm: Parts per million.

Prevention: Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session: An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period: An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action: A list of steps to protect public health.

Public health advisory: A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA): An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard: A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories: Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement: The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting: A public forum with community members for communication about a site.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population: People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD): An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Remedial investigation: The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA): This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA: RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD [see reference dose]

Risk: The probability that something will cause injury or harm.

Risk reduction: Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication: The exchange of information to increase understanding of health risks.

Route of exposure: The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample: A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size (*n*): The number of units chosen from a population or an environment.

Source of contamination: The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations: People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder: A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics: A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance: A chemical.

Substance-specific applied research: A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Superfund Amendments and Reauthorization Act (SARA): In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance

exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water: Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Survey: A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect: A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen: A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent: Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile: An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology: The study of the harmful effects of substances on humans or animals.

Tumor: An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor: Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Appendix C. Tetrachloroethene Fact Sheet

ATSDR Tetrachloroethylene Public Health Statement

Public Health Statement
for
Tetrachloroethylene

CAS# 127-18-4

This Public Health Statement is the summary chapter from the Toxicological Profile for tetrachloroethylene. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs™, is also available. 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. For more information, call the ATSDR Information Center at 1-888-422-8737.

This public health statement tells you about tetrachloroethylene and the effects of exposure.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites make up the National Priorities List (NPL) and are the sites targeted for long-term federal cleanup. Tetrachloroethylene has been found in at least 771 of the 1,430 current or former NPL sites. However, it's unknown how many NPL sites have been evaluated for this substance. As more sites are evaluated, the sites with tetrachloroethylene may increase. This is important because exposure to this substance may harm you and because these sites may be sources of exposure.

When a substance is released from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. This release does not always lead to exposure. You are exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking the substance or by skin contact.

If you are exposed to tetrachloroethylene, many factors determine whether you'll be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider the other chemicals you're exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

What is tetrachloroethylene?

Tetrachloroethylene is a synthetic chemical that is widely used for dry cleaning of fabrics and for metal-degreasing operations. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products. Other names for tetrachloroethylene include perchloroethylene, PCE, perc, tetrachloroethene, perclene, and perchlor. 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 in 1 million parts of air (ppm) or more. In an experiment, some people could smell tetrachloroethylene in water at a level of 0.3 ppm.

What happens to tetrachloroethylene when it enters the environment?

Tetrachloroethylene enters the environment mostly by evaporating into the air during use. It can also get into water supplies and the soil during disposal of sewage sludge and factory waste and when leaking from underground storage tanks. Tetrachloroethylene may also get into the air, soil, or water by leaking or evaporating from storage and waste sites. It can stay in the air for several months before it is broken down into other chemicals or is brought back down to the soil and water by rain.

Much of the tetrachloroethylene that gets into water and soil will evaporate into the air. However, because tetrachloroethylene can travel through soils quite easily, it can get into underground drinking water supplies. If it gets into underground water, it may stay there for many months without being broken down. If conditions are right, bacteria will break down some of it and some of the chemicals formed may also be harmful. Under some conditions, tetrachloroethylene may stick to the soil and stay there. It does not seem to build up in animals that live in water, such as fish, clams, and oysters. We do not know if it builds up in plants grown on land.

How might I be exposed to tetrachloroethylene?

People can be exposed to tetrachloroethylene from environmental and occupational sources and from consumer products. Common environmental levels of tetrachloroethylene (called background levels) are several thousand times lower than levels found in some workplaces. Background levels are found in the air we breathe, in the water we drink, and in the food we eat. The chemical is found most frequently in air and, less often, in water. Tetrachloroethylene gets into air by evaporation from industrial or dry cleaning operations. It is also released from areas where chemical wastes containing it are stored. It is frequently found in water. For example, tetrachloroethylene was found in 38% of 9,232 surface water sampling sites throughout the United States. There is no similar information on how often the chemical is found in air samples, but we know it is widespread. We do not know how often it is found in soil, but in one study, it was found in 5% of 359 sediment samples.

In general, tetrachloroethylene levels in air are higher in cities or industrial areas where it is in use more than in more rural or remote areas. You can smell it at levels of 1 ppm in air. However, the background level of tetrachloroethylene in air is usually less than 1

part in 1 billion parts of air (ppb). The air close to dry cleaning shops and chemical waste sites has levels of tetrachloroethylene higher than background levels. These levels are usually less than 1 ppm, the level at which you can smell it. Water, both above and below ground, may contain tetrachloroethylene. Levels in water are also usually less than 1 ppb. Levels in contaminated water near disposal sites are higher than levels in water far away from those sites. Water polluted with this chemical may have levels greater than 1 ppm. In soil, background levels are probably 100–1,000 times lower than 1 ppm.

You can also be exposed to tetrachloroethylene by using certain consumer products. Products that may contain it include water repellents, silicone lubricants, fabric finishers, spot removers, adhesives, and wood cleaners. Although uncommon, small amounts of tetrachloroethylene have been found in food, especially food prepared near a dry cleaning shop. When you bring clothes home from the dry cleaners, the clothes may release small amounts of tetrachloroethylene into the air. The full significance to human health of these exposures to small amounts of tetrachloroethylene is unknown, but to date, they appear to be relatively harmless. Tetrachloroethylene can also be found in the breast milk of mothers who have been exposed to the chemical.

The people with the greatest chance of exposure to tetrachloroethylene are those who work with it. According to estimates from a survey conducted by the National Institute for Occupational Safety and Health (NIOSH), more than 650,000 U.S. workers may be exposed.

For the general population, the estimated amount that a person might breathe per day ranges from 0.08 to 0.2 milligrams. The estimated amount that most people might drink in water ranges from 0.0001 to 0.002 milligrams per day. These are very small amounts.

How can tetrachloroethylene enter and leave my body?

Tetrachloroethylene can enter your body when you breathe air containing it. How much enters your body in this way depends on how much of the chemical is in the air, how fast and deeply you are breathing, and how long you are exposed to it. Tetrachloroethylene may also enter your body when you drink water or eat food containing the chemical. How much enters your body in this way depends on how much of the chemical you drink or eat. These two exposure routes are the most likely ways people will take in tetrachloroethylene. These are also the most likely ways that people living near areas polluted with the chemical, such as hazardous waste sites, might be exposed to it. If tetrachloroethylene is trapped against your skin, a small amount of it can pass through into your body. Very little tetrachloroethylene in the air can pass through your skin into your body.

Most tetrachloroethylene leaves your body from your lungs when you breathe out. This is true whether you take in the chemical by breathing, drinking, eating, or touching it. A small amount of the tetrachloroethylene is changed by your body (especially your liver)

into other chemicals that are removed from your body in urine. Most of the changed tetrachloroethylene leaves your body in a few days. Some of it that you take in is found in your blood and other tissues, especially body fat. Part of the tetrachloroethylene that is stored in fat may stay in your body for several days or weeks before it is eliminated.

How can tetrachloroethylene affect my health?

To protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed, scientists use many tests.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, used, and released by the body; for some chemicals, animal testing may be necessary. Animal testing may also be used to identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method to get information needed to make wise decisions to protect public health. Scientists have the responsibility to treat research animals with care and compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines.

Tetrachloroethylene has been used safely as a general anesthetic agent, so at high concentrations, it is known to produce loss of consciousness. When concentrations in air are high—particularly in closed, poorly ventilated areas—single exposures 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 the chemical. As you might expect, these symptoms occur almost entirely in work (or hobby) environments when individuals have been accidentally exposed to high concentrations or have intentionally abused tetrachloroethylene to get a "high." In industry, most workers are exposed to levels lower than those causing dizziness, sleepiness, and other nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not definitely known. However, at levels found in the ambient air or drinking water, risk of adverse health effects is minimal. The effects of exposing babies to tetrachloroethylene through breast milk are unknown. Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethylene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known for sure 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 and liver and kidney cancers even though the relevance to people is unclear. Although it has not been shown to cause cancer in people, the U.S. Department of Health and Human Services has determined that tetrachloroethylene may reasonably be anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) has determined that tetrachloroethylene is probably carcinogenic to humans. 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. Rats that were given oral doses of tetrachloroethylene when they were very young, when their brains were still developing, were hyperactive when they became adults. How tetrachloroethylene may affect the developing brain in human babies is not known.

Is there a medical test to determine whether I have 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. This test has been used to measure levels of the chemical in people living in areas where the air is contaminated with tetrachloroethylene or those exposed to the chemical through their work. Because it is stored in the body's fat and is slowly released into the bloodstream, it can be detected in the breath for weeks following a heavy exposure. Tetrachloroethylene can be detected in the blood. Also, breakdown products of the chemical can be detected in the blood and urine of people exposed to tetrachloroethylene. Trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene can be detected for several days after exposure. These tests are relatively simple to perform. The breath, blood, or urine must be collected in special containers and then sent to a laboratory for testing. 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 only to tetrachloroethylene.

What recommendations has the federal government made to protect human health?

The federal government develops regulations and recommendations to protect public health. Regulations can be enforced by law. Federal agencies that develop regulations for toxic substances include the EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA). Recommendations provide valuable guidelines to protect public health but cannot be enforced by law. Federal organizations that develop recommendations for toxic substances include the Agency for Toxic Substances and Disease Registry (ATSDR) and NIOSH.

Regulations and recommendations can be expressed in not-to-exceed levels in air, water, soil, or food that are usually based on levels that affect animals; then they are adjusted to help protect people. Sometimes these not-to-exceed levels differ among federal organizations because of different exposure times (an 8-hour workday or a 24-hour day), the use of different animal studies, or other factors.

Recommendations and regulations are also periodically updated as more information becomes available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for

tetrachloroethylene include the following:

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 (mg/L) (0.005 ppm).

EPA has established regulations and procedures for dealing with tetrachloroethylene, which it considers a hazardous waste. Many regulations govern its disposal. If amounts greater than 100 pounds are released to the environment, the National Response Center of the federal government must be told immediately.

OSHA limits the amount of tetrachloroethylene that can be present in workroom air. This amount is limited to 100 ppm for an 8-hour workday over a 40-hour workweek. NIOSH recommends that tetrachloroethylene be handled as a chemical that might potentially cause cancer and states that levels of the chemical in workplace air should be as low as possible.

1.8 Where can I get more information?

For additional information on tetrachloroethylene, refer to the ATSDR Toxicological Profile at: http://www.atsdr.cdc.gov/toxprofiles/tp18.html

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological profile for tetrachloroethylene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

CERTIFICATION

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

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

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Date December 8, 2008

From Division of Health Assessment and Consultation, ATSDR

Subject Health Consultation
Schlage Lock Company

To Glenn Tucker
Senior Regional Representative, ATSDR, Region VIII

Enclosed please find 2 hard copies and 3 CDs of the December10, 2008 Health Consultation on the following site prepared by the Colorado Department of Public Health and Environment under cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Evaluation of Indoor Air Settlement Program Data on Tetrachloroethane

SCHLAGE LOCK COMPANY
SECURITY, EL PASO COUNTY, COLORADO

EPA FACILITY ID: COD082657420

The Division of Health Assessment and Consultation requires copies of all letters used to transmit this document to the agencies, departments, or individuals on your distribution list. The copy letters will be placed into the administrative record for the site and serve as the official record of distribution for this health consultation.

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