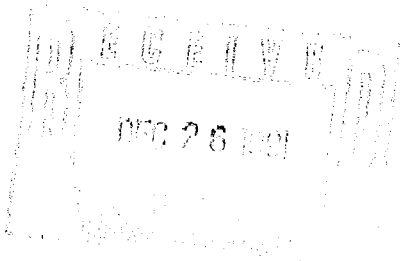
REPORT
OF
PHASE I ENVIRONMENTAL ASSESSMENT



TO
YAKIMA COUNTY PUBLIC WORKS DEPARTMENT
ROOM 408 COURTHOUSE
YAKIMA, WASHINGTON 98901

PHASE I
ENVIRONMENTAL SITE ASSESSMENT
CREST LINEN PROPERTY
YAKIMA, WASHINGTON
PROJECT NO. 190-1961

PREPARED
BY
CHEN-NORTHERN, INC.
CONSULTING ENGINEERS & SCIENTISTS

AUGUST 1990

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APPENDICES

August 28, 1990

Yakima County Public Works Department
Room 408 Courthouse
Yakima, WA 98901

Attention: Mr. Daniel L. Hesse, P.E.
Director of Public Works

Subject: Phase I Environmental Site Assessment of the Former Crest Linen Site, Yakima, Washington.

Gentlemen:

At your request and in accordance with our proposal dated May 17, 1990, we have conducted a Phase I environmental site assessment at the Crest Linen property in Yakima, Washington. The purpose of the assessment was to evaluate the potential presence of hazardous materials and/or petroleum products on site. The study was based solely on visual reconnaissance of the site and research of available land use history. The following is a summary of our activities to date:

1. A review of the site history was made to identify previous activities or land use which may have caused hazardous material to be on the property. Information reviewed included topographic maps, and a search of ownership history to evaluate previous land use indicated.

2. Appropriate public agencies were contacted to determine if there have been reported instances of hazardous materials released or encountered on site. The U. S. Environmental Protection Agency and the Washington State Department of Ecology site lists were reviewed to

determine if the site or adjacent sites were identified.

3. A visual reconnaissance of the site and surrounding land use was made in an attempt to detect environmental abnormalities, actual hazardous materials or conditions indicating that hazardous materials could be present.

4. The following report summarizes our activities, findings, and conclusions of this Phase I environmental site assessment. The report also presents recommendations for further investigation that appears to be necessary to address environmental concerns developed in the Phase I investigation.

BACKGROUND INFORMATION

Site Description

The Crest Linen site is located in the Yakima Central Business District in the NW 1/4 of Section 19, Township 13 North, Range 19 East, Yakima County, Washington (Appendix A: See Figure 1). A site sketch of the area is presented in Appendix A, Figure 2. The site presently consists of a single building and parking areas.

The subject site is in an area of commercial and government facilities. In the same block to the northeast is a former Safeway store. To the west are railroad tracks and sidings. To the south across B Street are Budget Rent-A-Car and the County Courthouse and Jail. To the east across First Street are several service stations, retail stores and a courthouse parking lot.

Land Ownership Records and Land Use

A record of ownership history and land use was obtained from

reviewing public records, City phone directories, the and Polk directories. A representative of the Yakima County assessors office indicated the ownership records were traceable on microfiche back to 1972. In 1972 the property was transferred to the Noel Investment Group from another Noel family member. Throughout the period from 1972 until 1988 the site was owned by various individuals and companies of the Noel Corporation. Reportedly, the ownership was transferred from the Noel Corporation to Yakima County in 1988. Apparently the property was leased to the Crest Linen by the Noel Corporation.

According to the Polk Directories the previous land use at the site included a retail gasoline service station operated from as early as 1942 until the late 1950's. From 1960 until the 1980's Crest Linen, formerly Peerless Laundry, was located at the site. In the 1930's until 1959 Crest Linen operated a store across 1st Street, to the east of the subject site.

Agency Inquiry

The Washington State Department of Ecology (DOE) was contacted by phone and in writing to determine if a release of hazardous materials had been reported for the site. Three sites were identified by the Department of Ecology within a one-half mile radius of the site. The letter provided by the DOE identified the following sites:

- Chevron Service Station - 15 West Yakima Avenue
- Yakima County Courthouse Parking Lot - N. First St. and B Street
- Yakima Fruit and Cold Storage - (Possibly an incorrect location given) N. First Avenue and B Street

The letter provided by the Department of Ecology is included in

Appendix B.

We also reviewed the DOE's current list of leaking underground storage tanks for sites in the area. In addition, the U.S. Environmental Protection Agency's lists of Superfund sites and RCRA handlers was reviewed for the area. The agencies contacted and the site lists reviewed did not indicate apparent problems with the subject site.

However, because of the numerous industrial and commercial businesses that have operated in the area for many years, the potential for subsurface contamination is relatively high. The site is near the northern edge of an area that is being investigated by the Washington Department of Ecology and the U.S. Environmental Protection Agency, known as the Railroad Study Area. A plume of groundwater contamination that is characteristic of dry cleaning fluids has been identified throughout west and south Yakima. Our discussions with representatives from the regulatory agencies indicate that the source of the contamination is unknown, however, suspect sources have been identified that need further investigation.

Additionally, within approximately a one-half mile radius, there are several sites on the EPA's Superfund, Comprehensive Environmental Response, Compensation and Liability Index System (CERCLIS) list. Included are Frank Wear Cleaners at 106 S. 3rd Ave., and Prestige Buick at 217 S. 2nd Street. Six sites on the U.S. EPA Superfund Program CERCLIS List, are within approximately 1/2 mile of the site. These sites are presented in Appendix B.

Review of the DOE's leaking underground storage list showed that there are four known sites within approximately one-half mile of the Crest Linen site. These include a Chevron station at 15 West Yakima, Yakima Fruit and Cold Storage at North First Avenue and

West "B" street, Brand's Truck Repair at 208 South 4th Avenue, and the Yakima County Courthouse parking lot at First and "B" Street. These sites are listed in Appendix B.

SITE VISIT

On June 29, 1990, a representative from Chen-Northern visited the site to observe conditions and features. Mr. Randy Wilbanks and Mr. Reginald Goforth, Yakima County representatives, accompanied our representative during the site visit. The surrounding land use was noted and agency contacts were completed subsequent to the site visit.

The interior of the building was examined during our site visit. The former laundry area is presently used for storage of county vehicles and stolen property. Within the interior of the building the slab was not continuous. Areas of soil were exposed below the slab grade and may have been part of an overflow drain system used by the laundry facility. A room in the northwest corner of the facility was locked and inaccessible during the visit. Signs were posted indicating pesticides were stored in the room.

Surrounding Land Use

As part of our Phase I investigation, a survey of the surrounding land use within one half mile radius of the site was noted. The surrounding land use includes industrial, commercial, residential and public property. Based on the visual survey of surrounding properties, several existing facilities could be a source of environmental problems. A list of these sites is included in Appendix C. Several dry cleaning and retail gasoline facilities are located near the site (Figure 2, Appendix A).

An aerial photograph of the site and the surrounding area taken

during the mid 1970's was available from the City of Yakima Engineering Department. The photograph appears to indicate pump blocks associated with the fueling area are present at the facility located directly north of the subject site. Older aerial photographs of the subject site were not readily available according to the City of Yakima representative. A representative of the Yakima County Public Works Department indicated that photos of the site were not available.

FINDINGS

The site visit, the review of ownership history, and our contact of public agencies during our Phase I investigation did not reveal a known release of petroleum products or hazardous materials at the site. Hazardous materials and/or petroleum products may have been stored or used because of present and previous site use. Apparently, a gasoline service station was once operated at the site which would have stored petroleum products on site. Additionally, a laundry cleaning facility was located at the site for over 20 years and potentially could have used cleaning solvents.

Our contact of public agencies indicated concerns with a contaminate plume characteristic of dry cleaning fluids, that may impact the site. Additionally, the surrounding land use which includes service stations, dry cleaners, and other industrial sites indicates a potential for the release of petroleum products or hazardous materials to the subsurface soils and groundwater.

CONCLUSIONS

Although, a release of petroleum products or hazardous materials was not identified at the site, the review of the previous site use and the surrounding land use suggests that subsurface conditions

may have been impacted.

Based on the previous use of the site, a subsurface investigation should be performed to determine specific conditions at the site. Laboratory analyses for petroleum hydrocarbon products and solvents associated with cleaning facilities appear to be appropriate.

Solvents, total petroleum hydrocarbons and volatile organic constituents will naturally biodegrade with time. However, numerous factors may influence the rate at which the materials will biodegrade including subsurface conditions, whether the groundwater has been impacted, man made materials covering the soil, climate and the chemical nature of the material.

Based on previous investigations in the Yakima Valley, the apparent groundwater flow direction is toward the southeast. If a subsurface investigation is initiated at the site, the subsurface borings or test pits should be located to sample the groundwater up and down gradient of the site activities.

RECOMMENDATIONS

A Phase II investigation of the property is recommended to sufficiently evaluate the subsurface conditions at the site. The Phase II investigation should include a subsurface investigation and laboratory analysis of soil and groundwater samples. A minimum of four locations should be used to collect samples. Borings or test pits can be used. Generally subsurface boringsare preferred because they provide better quality control for data collection. The advantage of test pits tend to be associated with lower initial expense. The specific site conditions including access to the site, the depth to groundwater and the potential size of an excavation must be considered. Based on the site location, the restricted access and the necessity for quality samples, we are

recommending borings be drilled at the site. Drilling may be difficult due to the expected subsurface conditions. Cable tool or rotary drilling method may be required.

One boring should be located west of the building near the area where pesticides or herbicides have been stored. Laboratory analysis should be completed for soil and groundwater samples collected from the subsurface.

A second and third boring should be located west and east of the building near the southern property boundary. The access to these areas is limited because of the existing building and streets. The locations of these borings will be useful in assessing the impact from previous land use. Therefore, soil and groundwater samples should be submitted for analysis of solvents, total petroleum hydrocarbons and volatile organic constituents. The analysis for solvents may provide information with regard to the Crest Linen facility. Although the gasoline facility operated at the site over 35 years ago, we were unable to establish if or when the underground storage tanks were removed. Samples from this area may indicate if the site was impacted by this activity. However, since hydrocarbons constituents biodegrade, it is expected that the data will be limited with regard to those constituents.

A fourth boring should be located north (up gradient) of the existing building. Soil and groundwater samples collected from this location should be submitted for laboratory analyses as recommended for each of the other borings. This information may provide information about the impact of the surrounding land use and may provide a baseline on which the other analyses can be compared.

The cost associated with a Phase II investigation of this scope is expected to range from $7000 to $10000. The associated expenses

are expected to include the following services.

Drilling	$ 2200 to 3400
Field engineer or scientist	$ 672 to 1260
Equipment and Vehicles	$ 630 to 945
Laboratory Analysis	$ 2900 to 3900
Reporting	$ 1115 to 1415

A specific proposal for a phase II investigation and an itemization of the anticipated costs can be provided if requested.

LIMITATIONS

The environmental assessment for this site was performed in accordance with generally accepted industry methods for the evaluation and appraisal of environmentally sound land use practices. Chen-Northern does not and cannot conclusively state that the site contains no hazardous material, petroleum products, or other latent conditions beyond that observed during the specified scope of services.

This study and report has been prepared on behalf of and for the exclusive use of Yakima County, solely for its use in an environmental evaluation of the site. This report and the findings herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party without the prior written consent of Chen-Northern. The report has been prepared in accordance with generally accepted hydrogeologic practices. No other warranty, expressed or implied, is made.

We trust that the report presented herein satisfies your current requirements. Should you have any questions or comments concerning the report, please contact us at your convenience. We have appreciated the opportunity to work with you on this project.

Respectfully submitted,

Gerald G. Harper, R.G.

Dee J. Burrie, P.E.
GGH:DJB/mlb

ENV\YCPWDCL.RPT

APPENDIX A
SITE MAPS

APPENDIX B
COMPILATION OF SITES FROM AGENCY LISTS

AUG. 1 3 1990

CHRISTINE GREGOIRE
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
3601 W. Washington • Yakima, Washington 98903-1164 • (509) 575-2800

August 7, 1990

Gerald G. Harper
Chen Northern, Inc.
2214 North 4th Avenue
P.O. Box 2601
Tri Cities, WA 99302

RE: Former Safeway Store, 8 East Lincoln Street, Yakima, WA and Former Crest Linen, 200 North First Street, Yakima, WA

Dear Mr. Harper:

As requested, I researched our records for information on known environmental contamination near (within a one-half mile radius) the following sites:

1) Former Safeway store, 8 East Lincoln.

2) Former Crest Linen, 200 North First Street.

These sites are within a generally industrial area with some residents to the east. These sites are in the vicinity (within one-half mile) of a number of operating and former gas stations, former dry cleaners and the railroad lines servicing Yakima.

I checked our waste management files and found the following sites which fit into your request:

WDOE has had three leaking underground storage tanks reported to us within one-half mile of either property. These sites have undergone, or are undergoing, independent cleanups and have not been investigated by the Washington Department of Ecology (WDOE). These sites are:

1.) Chevron Service Station
15 West Yakima Avenue

2.) Yakima County Courthouse
Intersection of North First Street and B Street

3.) Yakima Fruit and Cold Storage
North First Avenue and B Street

The research I did consisted of looking through our waste management files including our Leaking Underground Storage Tank information from November 1988 to present. I did not locate any record of pollution incidents on the sites that you gave me. The research of our records was very limited - no archived records or complaint files were reviewed. Although no records of your sites being contaminated were found, this does not mean the property is free of contamination or "clean". To determine if there is or is not contamination at these sites, full environmental assessments should occur with appropriate sampling plans for each site.

If you have any questions or would like to come and examine our files, please feel free to call me at (509) 454-7299. We ask two weeks notice if you would like to come examine our files.

Sincerely,

Mark Peterschmidt

Mark Peterschmidt
Toxics Cleanup Program

MP:vw

Enc: SMIS report: Affected Media and Contaminants Key

CERCLIS SITES

The CERCLIS List is a compilation by EPA of the sites which EPA has investigated or is currently investigating for a release or threatened release of hazardous substances pursuant to the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund Act).

The following sites are included on the CERCLIS List printed May 1, 1990, and are within approximately one-half mile of the subject site:

Crop King (Woods Warehouse)
709 N. First Ave.
Yakima, WA

Frank Wear Cleaners
106 S. 3rd Ave.
Yakima, WA

Prestige Buick
217 S. 2nd Street
Yakima, WA

Spratt's Metal Works
105 E. C Street (Also known as Lincoln Street)
Yakima, WA

NFA. At the conclusion of a preliminary assessment, no further action is anticipated for this site or no hazard was identified.

Sullivan's Cleaners & Shirt Laundry
610 W. Yakima Ave.
Yakima, WA

Yergen's Paint & Body
308 S. 3rd Ave.
Yakima, WA

RCRA HANDLERS LIST

The EPA's Resource Conservation and Recovery Act (RCRA) Program identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA List is a compilation by EPA of reporting facilities that generate, store, transport, treat, or dispose of hazardous waste. The following companies are located within approximately one-half mile of the subject site.

AT&T (US West Communications)
208 W. Yakima Ave.

Chevron Chemical Co.
521 S. 2nd Ave.

Del Monte Corp.
108 W. Walnut Street

FMC Corp. - Citrus Machine Division
215 N. 3rd Ave.

Frank Wear Cleaners
106 S. 3rd Ave.

Goodyear Auto Service Center
1 E. Lincoln

S & S Auto Body, Inc.
111 S. 4th Ave.

Scott Davis Transport Inc.
611 N. Front Street

Sun City Lincoln-Mercury
311 S. 1st Street

Toyota of Yakima
113 S. 3rd Ave.

USDOJ - DEA
402 E. Yakima Ave.

US West Communications
8 S. 2nd Ave.

Wikstrom Motors
217 S. 2nd Street

Yakima County Public Works Dept. - Materials
104 N. 1st Street

Yakima Valley Transportation Co.
104-1/2 W. Yakima Ave.

LEAKING UNDERGROUND STORAGE TANKS

The following sites (within approximately one-half mile of the subject property) are included in the Washington Department of Ecology's list of underground and above ground tank complaints from November, 1988, to July 5, 1990.

Chevron Service Station 15 West Yakima Yakima, WA	(5/23/89) Water in gasoline.
Yakima Fruit and Cold Storage N. 1st Ave. and West "B" Yakima, WA	(12/4/89) Gas-stained soil found during tank removal. Soil excavated.
Yakima County Courthouse Parking Lot 1st Street and "B" Street Yakima, WA	(2/15/90) Unleaded gas-contaminated soil.
Brand's Truck Repair 208 S. 4th Ave. Yakima, WA	(3/19/90) Contaminated soil found during UST removal. Independent cleanup.

APPENDIX C
SURROUNDING LAND USE

YAKIMA CITY CREST LINEN PROPERTY

SOUTH ON 1ST

1ST AND E STREET	SHELL SELF SERVE GAS
1ST AND EAST LINCOLN	ARCO GAS STATION CONOCO GAS STATION
1ST AND B STREET	BUDGET RENT-A-CAR (POSSIBLY OLD GAS STATION OR GARAGE)
1ST AND EAST CHESTNUT	OMNI MART (DID NOT OBSERVE ANY PUMPS) AAMCO TRANSMISSION
1ST AND EAST WALNUT	EXXON GAS STATION TEXACO GAS STATION FIRESTONE MASTER CARE CAR SERVICE
1ST AND EAST SPRUCE	MINIT LUBE

NORTH ON FRONT STREET STARTING @ E. SPRUCE

	INLAND PIPE AND SUPPLY CO. YAKIMA HARWARE CO.
FRONT AND EAST WALNUT	INLAND PIPE AND SUPPLY CO.
FRONT AND EAST CHESTNUT	SENSKE LAWN AND TREE CARE
FRONT AND EAST A	OLD TRAIN DEPOT
FRONT AND LINCOLN	GOODYEAR SERVICE CENTER WASHINGTON FRUIT AND PRODUCE STORAGE

SOUTH ON 2ND STREET @ F. STREET

2ND AND F. STREET - B STREET

2ND AND A STREET	B.F. GOODRICH TIRES AND GAS DRAGON INN GARAGE PRESTIGE AUTO (BUICK AND CADILLAC DEALERSHIP)

2ND AND EAST SPRUCE

NORTH ON 3RD STREET @ SPRUCE

GOODWILL DEPT. STORE

3RD AND WALNUT EAST LINCOLN

SOUTH ON 4TH STREET @ G. STREET

4TH AND G - B STREET

4TH AND A STREET MALL AUTOMOTIVE PARTS AND SERVICE

4TH AND EAST CHESTNUT - EAST SPRUCE

NORTH ON SOUTH NACHES @ SPRUCE

SOUTH NACHES AND SPRUCE - G STREET

SOUTH ON N. 1ST AVE. @ QUINCE

1ST AND QUINCE - WEST D STREET - PRODUCE WAREHOUSES

1ST AND WEST D STREET WARREN AND COMPANY (UNKOWN BUISNESS)

1ST AND WEST B STREET HELLIESON LUMBER

1ST AND WEST WALNUT

NORTH ON SOUTH 2ND AVE @ WEST WALNUT

PRECISION AUTO (VOLCKSWAGON SERVICE)
RED EAGLE AUTOMOTIVE

2ND AND WEST LINCOLN CENTRAL WASHINGTON RECYCLING

2ND AND WEST D STREET

SOUTH ON N. 3RD AVE @ WEST D

3RD AND WEST CHESNUT FRANK WEAR CLEANERS AND LAUNDRY

3RD AND WEST WALNUT

NORTH ON N. 4TH @ WEST WALNUT

WALNUT STREET TIRE CENTER
WALNUT STREET AUTOMTIVE
ACCURATE AUTO BODY AND PAINTING

4TH AND WEST CHESNUT - WEST LINCOLN

RING VIDEO (OLD GAS STATION ?)

EAST ON EAST B TO NACHES

WEST ON E. LINCOLN @ NACHES - NORTH 1ST AVE

E. LINCOLN AND EAST 2ND SPRAITS MACHINE SHOP

EAST ON WEST D. STREET @ N. 1ST AVE - NACHES

WEST ON E. STREET @ NACHES - FRONT

WEST ON E. STREET TO 3RD

WEST ON SPRUCE @ NACHES

EAST ON WALNUT @ FRONT

ALAMO SERVICE GARAGE

WEST ON YAKIMA FROM NACHES

YAKIMA AND 1ST AVE TEXACO GAS STATION

EAST ON CHESNUT FROM 4TH AVE

WEST ON A STREET

A Report Prepared For:

Mr. Terry D. Austin
Mr. Lawrence A. Peterson
Yakima County Prosecuting Attorney
Civil Division
211 County Courthouse
Yakima, Washington 98901

REPORT REVIEW AND FORMER PROPERTY USE ASSESSMENT
CREST LINEN PROPERTY
200-210 NORTH 1ST STREET
YAKIMA, WASHINGTON

Kleinfelder Project Number 60-1196-01

Prepared By:

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April 17, 1992

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 General

This report presents Kleinfelder's findings upon review of two environmental site assessment reports prepared, by Chen-Northern Inc., for the subject property. Also presented in our report are the results of an independent assessment of historical property uses and our review of Tetrachloroethylene (PCE) use.

1.2 Background

The subject property is located at 200-210 North 1st Street in Yakima, Washington (Plate 1). Yakima County owns this property, which currently is undeveloped and used for building-construction equipment parking. Kleinfelder understands the site was previously owned by Mr. John J. Noel Sr., and later by the Noel Canning Corporation, prior to ownership transfer to Yakima County in March of 1987. Prior to County ownership, the property was the location of a gasoline service station and a laundry facility.

Kleinfelder understands that Yakima County Public Works Department retained Chen-Northern Incorporated (a consulting firm) in 1990 to perform an Environmental Site Assessment for the subject property. The findings of this assessment, and a subsequent drilling and sampling program, indicated that a release of tetrachloroethylene (to the subsurface soils and ground water) may have occurred on the property. This was indicated by the reported presence of very low concentrations of tetrachloroethylene in two ground-water samples and in one soil sample. The assessment findings also indicated that if a release had occurred on the property, the former laundry-business activities on the property was the likely cause of the release.

Kleinfelder also understands that the site assessment reports were submitted to the Washington Department of Ecology (Ecology) for their review and notification. On the basis of the one soil sample which contained tetrachloroethylene at a concentration of 0.001 mg/kg, and the current County ownership of the subject property, Ecology subsequently named Yakima County a Potentially Liable Party (PLP) for the cleanup of this property. The PLP notification letter from Ecology, dated September 30, 1991, also indicated Yakima County was jointly and severally liable for the cleanup of a larger, approximately two-square mile "site" located in southeast Yakima. This larger area, which Ecology identifies as the Railroad Study Area, includes the subject property.

1.3 Scope of Services

Kleinfelder, Inc. was retained by the Yakima County Prosecuting Attorney - Civil Division, to review and comment on the two reports prepared by Chen-Northern. Kleinfelder also was requested to perform an independent review of the site's environmental history.

The intent of this work was threefold: 1) identify data gaps in the Chen-Northern reports, 2) collect additional site information to supplement the report information, and 3) identify possible causes of the indicated tetrachloroethylene release. Our services included the following work items:

- Review of the Chen-Northern reports
- Performance of a reconnaissance of the site
- Review of readily available site documented information
- Review of aerial photography and chain-of-title information
- Personal interviews
- Review of PCE use
- Preparation of this report

2.0 ASSESSMENT ACTIVITIES

2.1 Chen-Northern Report Review

The two Chen-Northern reports were furnished to Kleinfelder by Mr. Larry Peterson of Yakima County. These reports are identified as follows:

Phase I Environmental Site Assessment
Crest Linen Property
Yakima, Washington
Project Number 190-1961 by Chen-Northern, Inc., dated August 28, 1990

Phase II Environmental Site Assessment
Former Crest Linen Site
Yakima, Washington
Project Number 190-1961 by Chen-Northern, Inc., dated February 7, 1991

The findings of our report review are included in Section 3.1 of this report. Summary notations of our report review also are included in Appendix A of this report.

2.2 Site Reconnaissance

A reconnaissance of the site was conducted on January 9, 1992 and visual observations were recorded with regard to surface conditions and features located on the site. Present during this site visit were Mr. Rory Galloway representing Kleinfelder and Mr. Larry Peterson representing Yakima County. The findings from our on-site reconnaissance are presented in Section 3.2 of this report.

2.3 Record Review

Public, agency, and company records are sources of information that may be helpful in evaluating activities that may contribute to contamination of soil or ground water. The following agencies, companies, and individuals were contacted for available information regarding the subject property.

University of Washington, Suzzallo Library, Special Collections and Map Room, Sanborn Fire Insurance Maps, Historical Polk Reverse Telephone Directories

Walker and Associates, Aerial Photographs, Tukwila, Washington

Kroll Mapping Company, Seattle, Washington

Crest Linen Building Plan, prepared by the Yakima County Public Works Department

Schreiner Title Company, Yakima, Washington

Washington Department of Licensing, Business Licence Services, Olympia, Washington

City of Yakima, Licensing Department, Yakima, Washington

City of Yakima, Sewer Treatment Plant, Yakima, Washington

Washington Department of Revenue, Yakima, Washington

Washington Department of Ecology, Wastewater Discharge Program, Yakima, Washington

Office of the Secretary of the State, Olympia, Washington

Yakima County Building Department, Yakima, Washington

The results of our records review and agency contacts are presented in Section 3.0 of this report.

2.3.1 Property Ownership Information

Title reports prepared by licensed title companies generally provide chronological information on the individual(s) holding title to the property, either whole or in-part. Property ownership information, based on an ownership report prepared for Yakima County by Schreiner Title Company of Yakima, Washington, is presented in Section 3.3.1 of this report.

2.3.2 Property Use Information

Historical Sanborn Fire Insurance Company maps, Polk Reverse Directories, and Kroll Mapping Company (land use) maps provide information on previous on-site activities. Findings based on review of these resources are presented in Section 3.3.2 of this report.

2.3.3 Aerial Photography Review

Review of historical aerial photography provides a method of reviewing past activities at a property. Photographs may also identify past activities that may not be documented in agency or company files, or observed during a site visit. The effectiveness of this review depends on the scale of the available photography and the number of years in which photos are available.

Black and white aerial photographs for 1955 and 1968 were available for review from Walker & Associates, Inc. of Tukwila, Washington. These photographs were stereoscopically reviewed to assist in understanding the site's history. The following is a tabulation of the reviewed photography:

Date	Flight #	Scale
03-15-55	YAK-3-15	1" = 1,000'
03-19-68	YAK-68	1" = 1,000'

The results of our aerial photography review are presented in Section 3.3.3 of this report.

2.4 Personal Interviews

The following individuals were contacted by Kleinfelder by telephone. These individuals were asked to provide insight into the chronological history of the property and their recollection of historical site activities.

Individual	Relationship
Mr. Gerald Harper	Chen-Northern
Mr. Morgan Slaugh	Yakima County Noxious Weed Board
Mr. Walt Hanthorn	Former Manager of Crystal Linen
Ms. Sylvia Campbell	Manager of St. Elizabeth Hospital Laundry
Mr. Jack Barrett	Assistant to the President, Crystal Linen
Mr. Dan Haughton	Production Manager at Crystal
Mr. Greg Stoffers	Current owner of Frank Wear Cleaners
Mr. Bill Wier	Former co-owner of Frank Wear Cleaners

Mr. Dewey Frame	Former co-owner of City-Peerless
Mr. Bill Frame	Former co-owner of City-Peerless, current owner of Camelot Cleaners
Mr. Bruce Bates	Yakima City Sewer Treatment Plant
Mr. Pete Hobbs	Yakima City Sewer Treatment Plant

The following individuals were personally interviewed by Yakima County. These individuals also were asked to provide insight into the chronological history of the property and their recollection of historical site activities.

Individual	Relationship
Mr. Todd Smith	Former co-owner of Crest Linen, current co-owner of Crest Linen Rental, Inc., dba Crystal Linen
Mr. Richard Smith	Former co-owner of Crest Linen, current co-owner of Crest Linen Rental, Inc., dba Crystal Linen

The findings of these interviews are presented in Section 3.4 of this report.

2.5 PCE Use Review

Kleinfelder performed a review of the occurrence and common uses of PCE. The following sources of information were reviewed.

NIOSH Pocket Guide to Chemical Hazards, Publication No. 85-114, dated February 1987.

PCE White Paper, Halogenated Solvent Industry Alliance, dated June 1991, provided by Dow Chemical USA

Dry-cleaning and Laundry Plants information flyer, EPA, undated

Dow Chemical information flyer, undated

Dow Chemical information flyer, Form No. 100-272, undated

Dow Chemical information flyer, Form No. 100-61, undated

On-line search of the Hazardous Substances Data Bank, a division of the National Library of Medicine

Health Assessment Document for Tetrachloroethylene, US EPA, Document No. 600/8-82/005F, dated July 1985, Final Report

The findings of this information review are summarized in Section 3.5 of this report.

3.0 SUMMARY OF FINDINGS

The following is a summary of our findings pertaining to our review of the Chen-Northern Reports and our independent review of the environmental history of the site.

3.1 Chen-Northern Report Review

A summary of the findings of the Chen-Northern reports are presented below. Specific report comments are attached as Appendix A of this report.

Phase I Environmental Site Assessment, dated August 28, 1990

In 1990, Yakima County retained Chen-Northern Incorporated (a consulting firm) to perform a Phase I Environmental Site Assessment for the property (in preparation for planned government-facility construction on the property). The Phase I assessment identified former property uses which included a gasoline service station and a commercial laundry business.

At the time of Chen-Northern's site visit, the property buildings (former commercial laundry) were being used for storage of County vehicles and stolen property which had been recovered by the Police Department. A room in the northwest corner of the building was reported as containing pesticides, however the room was locked and the actual contents were not determined.

Based on the Phase I findings, further site-exploration work was recommended by Chen-Northern.

Phase II Environmental Site Assessment, dated February 7, 1991

Chen-Northern performed a Phase II Environmental Site Assessment of the property in late 1990 and early 1991. This work included the completion of three soil borings (DH-2, DH-3, and DH-6) on the property and one boring (DH-1) up-gradient of the property. This work also included the collection of soil and ground-water samples and laboratory analysis of submitted samples.

At the time of this Phase II work, the former commercial laundry buildings had been removed. One boring, DH-6, was located near the center of the former laundry building.

Tetrachloroethylene reportedly was detected only in soil and ground-water samples from DH-6 and in the ground-water sample from DH-3 (down-gradient from the former laundry building). The reported concentrations of tetrachloroethylene detected in these sample are summarized below.

Sample Location	Detected Concentration	Cleanup Level *
Ground-water from DH-3	0.0011 mg/L	0.005 mg/L
Soil from DH-6	0.0010 mg/kg	0.5 mg/kg
Ground-water from DH-6	0.0078 mg/L	0.005 mg/L

* MODEL TOXICS CONTROL ACT (MTCA) METHOD A CLEANUP LEVEL FOR GROUND WATER

Chloroform also was reportedly detected at low concentrations in ground-water samples from DH-2, DH-3, and DH-6.

Pesticides and herbicides were reportedly not found in the soil or ground-water samples from DH-6. Trace amounts of four pesticides were reportedly discovered in the ground-water sample from DH-1 (up-gradient of the property). Pesticides and herbicides were reportedly not analyzed for the soil or ground-water samples collected from DH-2 or DH-3, or for the soil sample from DH-1.

3.2 Site Reconnaissance

At the time of Kleinfelder's site reconnaissance (January 9, 1992), the site was undeveloped. Portions of the ground surface were covered with sections of floor slab (poured concrete) from the former laundry building. Other portions of the ground surface were covered with gravel. A fenced equipment storage area (temporary fence) was located in the eastern portion of the property and was apparently used for the storage of building-construction equipment (used at the County construction project at the southeast corner of North 1st Street and B Street).

3.3 Record Review

The following subsections present information obtained during the record review portion of this assessment.

3.3.1 Property Ownership Findings

Ownership Report

An ownership report prepared for Yakima County by Schreiner Title Company of Yakima, Washington, was reviewed to collect information on previous ownership of the property. The ownership report (attached as Appendix B of this report) indicated the following information:

- The legal description for the subject property is as follows:

  Lots 1 through 6, Block 8, Town of North Yakima, Volume E of Plats, Page 1.

- Current ownership of the property is reported to be Yakima County. The County ownership reportedly began on March 31, 1987.

- Previous owners of the property include the following:

  Noel Canning Corporation, from June 18, 1976 to March 31, 1987

  John J. Noel, Sr., from August 22, 1941 to June 18, 1976

  King County Building Company, from May 11, 1931 to August 22, 1941

Two "Received Notice of Leases" also were identified on the ownership report. These leases included the following:

- Sears, Roebuck & Company, from November 13, 1941 (for a two year term)
- Union Oil Company, from August 11, 1941 (for a ten year term)

3.3.2 Property Use Findings

Presented below are the summarized findings from our review of Historical Sanborn Fire Insurance Company maps, Polk Reverse Directories, and Kroll Map Company maps. Additionally, the findings of regulatory agency contacts are presented below.

Sanborn Fire Insurance Company Maps

Historic Sanborn Fire Insurance maps were reviewed in the University of Washington, Suzzallo Library, Special Collections and Map Room. Maps were available for review for 1920.

The map for year 1920 indicates that a two story building occupied the eastern half of the property and a building of unspecified height occupied the western half of the property (possibly an extension of the eastern building). The eastern building reportedly was used for automobile sales on the first floor, a Labor Temple on the second floor, and printing operations in the basement. The western building reportedly was used as a machine shop. The historical site improvements identified in the Sanborn Maps are presented on Plate 2 of this report.

Polk Reverse Telephone Directory

Polk Reverse Telephone Directories, spanning approximately five decades (1941-1991) were reviewed to gain information on historical land use. The 1941, 1951, 1953, 1954, and 1955 directories identified the following businesses at 202 North 1st Street:

- Union Service Garage
- Hertz "Drive-Ur-Self System"
- Automotive Engine Company

Reviewed directories after 1955 did not contain a listing for 202 North 1st Street. However, the following listing were found for 200 North 1st Street.

1961	City-Peerless Laundry and Dry Cleaning Company
1962	City-Peerless Laundry and Dry Cleaning Company
1965	City-Peerless Laundry and Dry Cleaning Company
1966	Crest Company Inc., Agents for Yakima Laundry
1967	Crest Company Inc., Agents for Yakima Laundry
1968	Crest Company Laundry
1971	Crest Company Laundry
1973	Crest Company Laundry
1975	Crest Company Laundry
1976	Crest Company Laundry
1977	Crest Linen Rental, Inc.
1978	Crest Linen Rental, Inc.
1979	Crest Linen Rental, Inc.
1981	Crest Linen Rental, Inc.
1982	Crest Linen Rental, Inc.
1983	Crest Linen Rental, Inc.
1984	Crest Linen Rental, Inc.
1985	Crest Linen Rental, Inc.

The 200 North 1st Street property was listed as vacant in the 1986 and 1989 directories.

Kroll Map Company

A map of the subject property and surrounding areas, prepared by the Kroll Map Company of Seattle, was reviewed. The date of this mapping was 1948 (base map date).

This map indicated that the southeastern quadrant of the property was occupied by a service station. The address of this station was not identified on this mapping. Remaining portions of the property were indicated as occupied by apartments. The address of the apartment was identified as 210 North 1st Street.

Crest Linen Building Plan

A plan of the former Crest Linen building, prepared in May of 1987 by the Yakima County Public Works Department as an "As Built" plan view, was reviewed for site features. This drawing was generated in conjunction with consideration of the possible conversion of the building to a minimum security jail. A copy of this plan is attached as Plate 6.

Several "recesses" and "voids" in the concrete floor of the Crest Linen building were identified on the drawing in the western portions of the building. One void was identified as "filled with concrete", while another was identified as having a "dirt floor". The purpose of the recesses and voids are not identified on this plan. This building was subsequently demolished in December of 1990.

Regulatory Agencies

The following is a summary of information from contacted agencies regarding former laundry business activities on the subject property.

- *Washington Department of Licensing, Business License Services, Olympia, Washington*

  Information on file at the Department of Licensing, Business Licence Services, indicates Crest Linen Rental, Inc., has been incorporated since 1957 through 1993. The registered agent for Crest is Mr. Jeff Tague at 918 North 5th Ave, Yakima, Washington, 98902. The tax identification number for Crest is 397014686 and their corporate file number is 21354360.

- *City of Yakima, Licensing Department*

  Information on file at the City of Yakima, Licensing Department, indicates Crest Linen Rental, Inc. dba (doing business as) Crystal Linen Company, has been incorporated since January 1, 1957.

- *Washington Department of Revenue, Yakima, Washington*

  File information was reported to be confidential and was not provided.

- *Washington Department of Ecology, Wastewater Discharge Program, Yakima, Washington*

  File information was not discovered as of the date of this report.

- *Office of the Secretary of the State, Olympia, Washington*

  File information indicated that the company name of Yakima Laundry and Supply Company, Inc. was changed to Crest Linen Rental Inc. on May 23, 1975.

- *Yakima County Building Department, Yakima, Washington*

  The reviewed files indicated a building permit was issued in August 19, 194[illegible] to Union Oil Company of California for the construction of four buildings on the property.

  On November 23, 1955, a permit for the demolition of the Union Oil buildings was issued. This permit included a notification requirement that the fire department be notified if underground piping or tanks were to be moved.

  A plumbing permit for the installation of one sump on the property was issued on October 23, 1967.

On November 27, 1990, a permit for the demolition of the site building was issued. The permit listed Yakima County as the owner.

3.3.3 Aerial Photography Findings

Two years of black-and-white aerial photographs, dated 1955 and 1968 were available for review from Walker & Associates, Inc. A summary of the aerial photography reviewed is presented below:

03/15/55 — The site is structurally improved with the service station and apartment buildings identified in the Kroll mapping review. Areas surrounding the service station appear to be paved.

The historical site improvements identified by the Kroll mapping, this photography, and the 1955 Polk Reverse Directory are presented on Plate 3 of this report.

03/19/68 — The site is structurally improved with the laundry building identified in the 1968 Polk Reverse Directory. Areas to the east of the building appear to be paved.

The historical site improvements identified by the this photography and the 1968 Polk Reverse Directory are presented on Plate 4 of this report.

3.4 Personal Interviews

The following subsections present information obtained during the personal interview portion of this assessment.

Mr. Gerald Harper, Chen-Northern

Mr. Gerald Harper of Chen-Northern was asked if he had additional information regarding the contents of the "pesticide" storage room, located in the northwest corner of the former laundry building. Mr. Harper indicated he did not have any addition information regarding the room contents.

Mr. Morgan Slaugh, Yakima County Noxious Weed Board

Mr. Morgan Slaugh of the Yakima County Noxious Weed Board was contacted regarding the contents of the "pesticide" storage room, located in the northwest corner of the former laundry building. Mr. Slaugh stated that he used this space for storage of herbicides only and that other pesticides (e.g., rodenticides, insecticides, etc.) were not stored in this room. Mr. Slaugh also stated that he used this space from 1989 to early 1991, that all herbicides were stored in their original containers (one-gallon liquid bottles), and the only herbicides stored consisted of 2,4-D and Banville (Note: Banville contains the herbicide dicamba. Small quantities of 2,4-D also may be present in Banville.).

Mr. Slaugh reported that no more than ten gallons of the herbicides were in this room at any one time and that mixing, rinsing, and container disposal occurred off property. Mr. Slaugh also stated that he did not believe that any spills or releases had occurred and that the floor of the storage room was concrete.

Mr. Walt Hanthorn, Former Manager Of Crystal Linen

Mr. Walt Hanthorn, the former manager of Crystal Linen, was contacted as to his knowledge of the subject property. Mr. Hanthorn stated he did not know anything about the property except that the laundry building had been built by the property owner and that Crest Linen had leased the building.

Ms. Sylvia Campbell, Manager of St. Elizabeth Hospital Laundry

Ms. Sylvia Campbell, currently the manager of St. Elizabeth Hospital Laundry, reported that she had been briefly employed at the former Crest Linen facility just prior to the facility closure in 1985 or 1986. Ms. Campbell stated that the Crest facility was a commercial laundry which laundered items such as uniforms, tablecloths, napkins, hospital linen, and hotel towels. Ms. Campbell also stated that she believed some dry cleaning was performed on-site, but she did not know what solvent had been used.

Mr. Jack Barrett, Assistant to the President, Crystal Linen

Mr. Jack Barrett, Assistant to the President of Crystal Linen, was contacted as to his knowledge of the subject property. Mr. Barrett stated that Mr. Todd Smith and Mr. Dick Smith were the owners of Crest Linen, that Messrs. Smith and Smith purchased the Crystal Linen business, and then subsequently consolidated both businesses at the current Crystal Linen property (918 North 5th Avenue, Yakima, Washington). Mr. Barrett stated that the Crest Linen facility was a commercial laundry and that a dry-cleaning machine also had been located at the Crest facility.

Mr. Barrett reported that Crystal Linen had been contacted by Mr. Don Schussler, an attorney with Halverson & Applegate in Yakima, Washington, regarding possible responsibility for cleanup of soil and ground-water contamination in the area, caused by the dry-cleaning solvent tetrachloroethylene. Mr. Barrett stated that he wrote a response to Mr. Schussler's inquiry which stated the former Crest-facility property was owned by Mr. John Noel, from whom they were leasing. Mr. Barrett also stated that, in his letter, he identified that a dry cleaning machine located at the Crest facility was located above ground and that any leaks from this machine would have been observed and corrective measures taken. Mr. Barrett also reported during the telephone interview that he had notified their insurance company, Pettit Morry of Seattle, Washington, of possible claims relating to cleanup of environmental contamination.

Mr. Dan Haughton, Production Manager at Crystal Linen

Mr. Dan Haughton, Production Manager at Crystal, was contacted as to his knowledge of the subject property. Mr. Haughton is currently the production manager at Crystal Linen. Mr. Haughton stated that he worked at the Crest Linen site form 1981 until they moved to the Crystal Linen site, in approximately 1985. During this period, Crest reportedly was only a laundry and did not perform dry-cleaning. Mr. Haughton also stated that subsurface

floor drains located in the west portion of the building were located beneath the laundry machines. These drains reportedly collected the wash water to a sump which then drained to the city sewer system. Mr. Haughton stated that these drains were lined with concrete and that no open bottom drains or dry wells were present in the building. Mr. Haughton also stated that tests on the wash-water effluent were performed in 1981 for discharge permit purposes.

Mr. Greg Stoffers, Current Owner of Frank Wear Cleaners

Mr. Stoffers said he moved to Washington in 1980 and bought a dry-cleaning business at that time. He said that in late 1980 or early 1981, Todd or Richard Smith offered to sell Mr. Stoffers a drum of PCE from their business (Crest Linen) at 200 North 1st Street. Mr. Stoffers stated that he understood the Smiths were no longer doing dry-cleaning and were removing their equipment. Also during this same period, Mr. Stoffers said an old dry-cleaning machine sat behind the Crest Linen Building (the alley west of the building) for several months. Mr. Stoffers stated that he believed Crest Linen had been using the machine and the PCE for the dry-cleaning of rental uniforms. Mr. Stoffers stated that he purchased the drum of PCE and subsequently found the PCE to be very dirty and oily.

Mr. Stoffers said that Tom Moore and Bill Wier, the two men that owned Frank Wear Cleaners prior to Mr. Stoffers' purchase, likely could provide additional information regarding site practices at the Crest Linen property.

Mr. Bill Wier, Former Co-owner of Frank Wear Cleaners

Mr. Wier stated that he and Mr. Tom Moore were owners of Frank Wear Cleaners prior to Mr. Stoffers' purchase of the business. Mr. Wier stated that he had been in the dry-cleaning business since 1937 and that he believed PCE became available in the mid 1940s.

Mr. Wier stated that to his knowledge, City-Peerless operated on the subject property and was owned by Mr. Dewey Frame and his son, Mr. Bill Frame. Mr. Wier stated that dry cleaning was performed on the property (did not know what solvent was used) and that the business was sold to the Smiths in approximately 1966. Mr. Wier also stated that the Smiths performed dry cleaning of rental uniforms (from auto garages) and that they used PCE.

Mr. Dewey Frame, Former Co-owner of City-Peerless

Mr. Frame was contacted as to his knowledge of the subject property. However Mr. Frame could not recall details of his former business or site practices.

Mr. Bill Frame, Former Co-owner of City-Peerless, Current Owner of Camelot Cleaners

Mr. Frame stated that he bought his interest in the City-Peerles business (at the subject property) from Mr. Wilber Hansen (reported passed away approximately 15 years ago). Mr. Frame stated that they performed dry cleaning on the property and that they used PCE. Mr. Frame also stated that the only waste that was generated was a spent filter cartridge, approximately one per week, which was disposed into their garbage dumpster.

Messrs. Todd and Richard Smith, Former Owners of Crest Linen, Current Owners of Crest Linen Rental, Inc., dba Crystal Linen

Messrs. Todd and Richard Smith were personally interviewed by Yakima County. The Smiths indicated that they purchased the business from City Peerless Laundry in 1966. They said that John Noel built the building for City Peerless in 1959-60. City Peerless was operated by a Hansen of Hansen Fruit Company and Dewey and William Frame. William Frame currently operates Camelot Cleaners.

They indicated that City Peerless used PCE for dry cleaning on the property during its tenancy. The dry cleaning machine utilized by the Smiths, a Permac 125, was purchased from City Peerless as part of the 1966 transaction.

The Smiths said that they dry cleaned on the property from 1966 until 1974-75 utilizing the Permac 125 machine. The machine was located in the southwest corner of the building on the 6 inch metal plate which is indicated on the building plans. Their PCE supplier was Van Waters and Rogers of Kent, Washington. They indicated that initially the PCE was delivered in drums but later on, the dry cleaning machine tanks were filled directly from a tank truck. Approximately two drums of PCE a month were utilized. The emptied drums were returned to the supplier.

Todd Smith indicates that the "still" on the dry cleaning machine was cleaned two or three times a week, although Richard Smith remembers it as being a daily process. Todd indicated that about "one-half of a shoe box full" of powder was removed at each cleaning. The powder was disposed of in the dumpster.

The Smiths indicated that they stopped dry cleaning and removed the dry cleaning machine in 1974-75. They cannot remember whether the machine was scrapped or sold. The Smiths indicated that the system of drains and the sump indicated on the building drawings were part of the laundry system. Dirty uniforms and linen were washed in that area. They indicated that rinse water from the laundry operation went into the sump and was ultimately discharged into the city sewer system. The discharge was apparently permitted by the City and test results may be available.

The Smiths indicate that their usage of PCE was in a closed system and that any that was accidentally spilled would have been contained by the "8 inch slab" floor in the dry cleaning area. They indicated that PCE is highly volatile and any spilled would have evaporated in a short period of time. They believe that the service station which operated on the site prior to the construction of the laundry facilities is a likely source of the contamination.

Mr. Bruce Bates, Yakima City Sewer Treatment Plant, Yakima, Washington

Mr. Bates was asked of they maintained records regarding waste-water discharge analyses for the former Crest Linen business. Mr. Bates stated that he would ask Pete Hobbs to review their files for this information.

Mr. Bates also stated that they had recently sampled the waste-water from the Crystal Linen business and had found this waste to be "a strong waste", described as having high biological oxygen demand (BOD) and suspended solids. Mr. Bates stated that the sewer treatment plant had collected two samples of waste-water from the Crystal Linen business and had the samples analyzed for priority pollutants. Mr. Bates also stated that Crystal Linen had subsequently dropped several of their accounts which included the washing of a solvent rags.

Mr. Pete Hobbs, Yakima City Sewer Treatment Plant, Yakima, Washington

Mr. Pete Hobbs stated that he was not able to discover records regarding waste-water discharge analyses for the former Crest Linen business. Mr. Hobbs stated that he did have the results of the priority pollutant scan for the two samples of waste-water from the Crystal Linen business. Mr. Hobbs stated that PCE was detected in the sample collected on 8-13-91 at a concentration of 5.9 ug/L (ppb). Mr. Hobbs also stated that PCE was detected in the sample collected on 9-9-91 at a concentration of 9.1 ug/L (ppb). Mr. Hobbs subsequently forwarded copies of this laboratory data, which are attached as Appendix D.

3.5 PCE Use Review

Kleinfelder performed a review of the occurrence and common uses of PCE. Copies of several reviewed documents are attached to this report as Appendix C. The following is a summary of the results of this review.

- Perchloroethylene, Chemical Abstract (CAS) Number 127-18-4, has numerous synonyms/acronyms which include the following:

  - Perchloroethylene
  - Perchlorethylene
  - Tetrachloroethylene
  - Tetrachlorethylene
  - Tetrachlorethene
  - 1,1,2,2-tetrachloroethylene
  - Carbon dichloride
  - Perk
  - Perc
  - PCE
  - Per

- PCE was introduced to the dry cleaning industry in the late 1930's.

- Use of PCE in the dry cleaning industry represented about 69 percent of 1974 consumption in the United States. In 1980, use of PCE in the dry cleaning industry was about 42 percent. In 1989, use of PCE in the dry cleaning industry was about 47 percent.

- The typical quantity of hazardous waste generated from the dry cleaning of 1,000 pounds of clothes ranges from 20 pounds (spent cartridge) to 40 pounds (cooked powder residue).

- Other major uses, as reported for 1989, include chemical intermediate (30 percent), metal cleaning/degreasing which includes vapor degreasing and cold cleaning (13 percent), and miscellaneous (10 percent).

- Miscellaneous former or current uses include the following:

  - Aerosol laundry-treatment products (stain, lipstick, and rust remover)
  - Textile scouring solvent

- Dried vegetable fumigant
- Rug and upholstery cleaner
- Leather treating (carrier for water proofing)
- Paint remover
- Heat transfer media ingredient
- Asphalt pavement additive
- Adhesives additive
- Paper coating additive
- Chemical intermediate

4.0 CONCLUSIONS

The following conclusions are based on Kleinfelder's knowledge of the subject property from our property observations and information gathered during our review. These conclusions are subject to the limitations presented at the end of this report and may change if additional information becomes available.

4.1 Chen-Northern Report

In general, our review found the Chen-Northern reports to be complete for the scope of work performed. Several of the data clarification issues, identified during our review of these reports, have been addressed in our subsequent site-history review.

4.2 Site History Review

Based on the information gathered to date, Kleinfelder has prepared the following site history interpretation for the 200-210 North 1st Street property in Yakima, Washington. A graphical interpretation of site ownership, land uses, and site activities has been prepared and is presented as Plate 5 of this report.

The subject property was owned by King Co. Building Company until 1941 when ownership was transferred to Mr John Noel. Ownership of the property changed in 1976 to the Noel Canning Corporation, and again in 1987 to Yakima County.

The subject property was occupied by a two story building on the eastern half of the property and a building of unspecified height on the western half of the property until 1941. The buildings were used for automobile sales, a Labor Temple, printing operations, and a machine shop.

From 1941 until approximately 1955, the property was occupied by a Union Oil Station, a Hertz car-rental business, and apartments.

From 1955 until approximately 1959, the property was vacant.

From approximately 1959 until approximately 1985, the property was occupied by a laundry business which periodically included linen and dry-cleaning operations. Laundry business names for this period are presented on Plate 5. PCE was the solvent used in the on-site dry-cleaning operation, from a period between 1959 and 1975.

Since approximately 1985, the property has been vacant with the laundry building demolished in approximately 1990.

From 1987 until 1990, Yakima County used the vacant laundry building for the storage of County vehicles and stolen property recovered by the police department. One room of the vacant laundry building was used for storage of small quantities of the herbicides 2,4-D and Banville (packaged in original containers).

Based on the presented information, we were not able to conclusively identify if, or when, a release of PCE occurred on the property. However, discovered information indicates that if an on-site release of PCE did occur, the former laundry-business activities on the property are the most likely cause of the release. This deduction is based on the use of the property as a dry-cleaning operation for approximately 16 years, the large quantity of PCE used in the dry-cleaning operation, the potential for the water-washing of solvent contaminated laundry and rags, and the probable use of laundry pre-treatment products (stain and spot removal) which likely contained PCE. Additionally, several "recesses" and "voids" in the concrete floor (western portions of the former Crest Linen building) were identified as former locations of the laundry machines. These voids reportedly performed as drains and collected the wash water to a sump which then drained to the city sewer system. Given information that PCE was detected in two recent samples of waste-water from the current Crystal Linen business, similar operating practices at the former Crest Linen site could have caused waste-water containing PCE to be discharged into the sub-floor drains and sump (at the Crest Linen site). This waste-water could then have leaked through the walls of the drains and sump and into the subsurface soils at the Crest Linen site.

5.0 LIMITATIONS

Report reviews and property use assessments are non-comprehensive by nature and are subject to many limitations, including those presented below. This report was not designed to identify all potential concerns or to eliminate all risk associated with the subject property. The scope of services performed was limited to reviewing the environmental history of the subject property.

All of the agencies and individuals contacted by Kleinfelder had only limited information concerning the property. Efforts were made to interview agency personnel and individuals with knowledge of the site, but information collected this way can be subject to many errors, including personal interpretation and memory.

Historical aerial photography can provide a record of activities at a particular point in time. Inherent limitations include the resolution of the photograph; the number, scale, and availability of photographs for stereoscopic review; the interpretation of features by the reviewer; and the lack of information between time periods of the photographs.

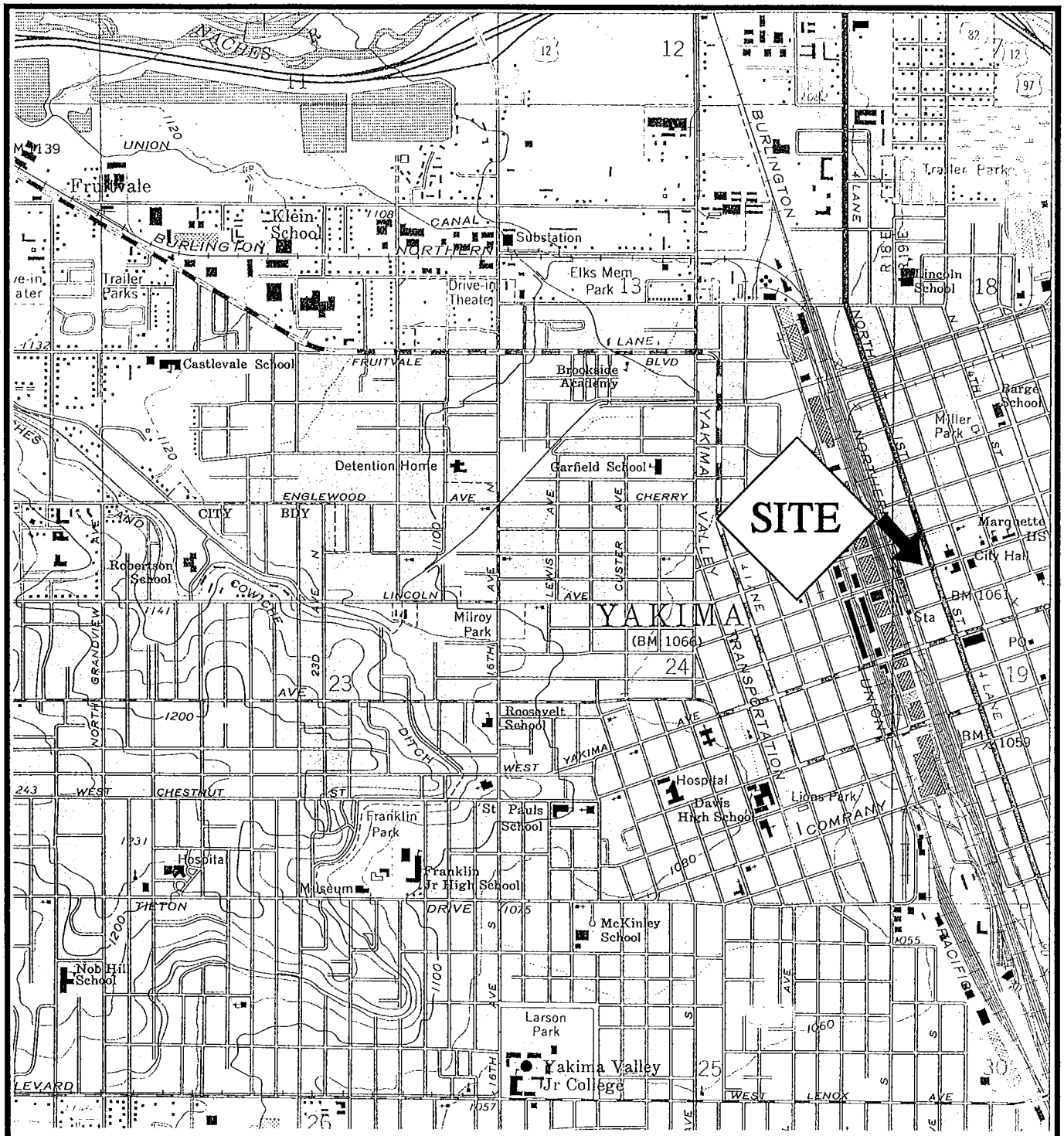
Historical site mapping can provide a record of activities at a particular point in time. Inherent limitations include the detail of the mapping; the availability of mapping; the interpretation of features by the reviewer; and the lack of information between time periods of the mapping.

Kleinfelder performed this report review and site assessment in accordance with the generally accepted standards of care that exist in the state of Washington at the time of this study. Judgements leading to conclusions and recommendations are made generally, with an incomplete knowledge of the subsurface and former conditions applicable to the site. More extensive studies, including soil or water sampling, hazardous material sampling, and chemical analysis, may reduce the uncertainties associated with this study. The assessment is subjective, qualitative, and based solely on the professional judgement, experience, and

observations of the Kleinfelder project team after review and consideration of available property information. Kleinfelder should be notified for additional consultation if Yakima County wishes to reduce uncertainties beyond the level associated with this study.

This report may be used only by Yakima County and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on-site and off-site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than Yakima County who wishes to use this report shall notify Kleinfelder of such intended use by executing the "Application for Authorization to Use" which follows this document in Appendix D. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by Yakima County or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

No warranty, express or implied, is made.



REFERENCE: USGS TOPOGRAPHIC MAP
YAKIMA WEST, WASHINGTON QUADRANGLE
1958 PHOTOREVISED 1985

APPROXIMATE SCALE
ONE INCH = 2000 FEET

0 1000 2000

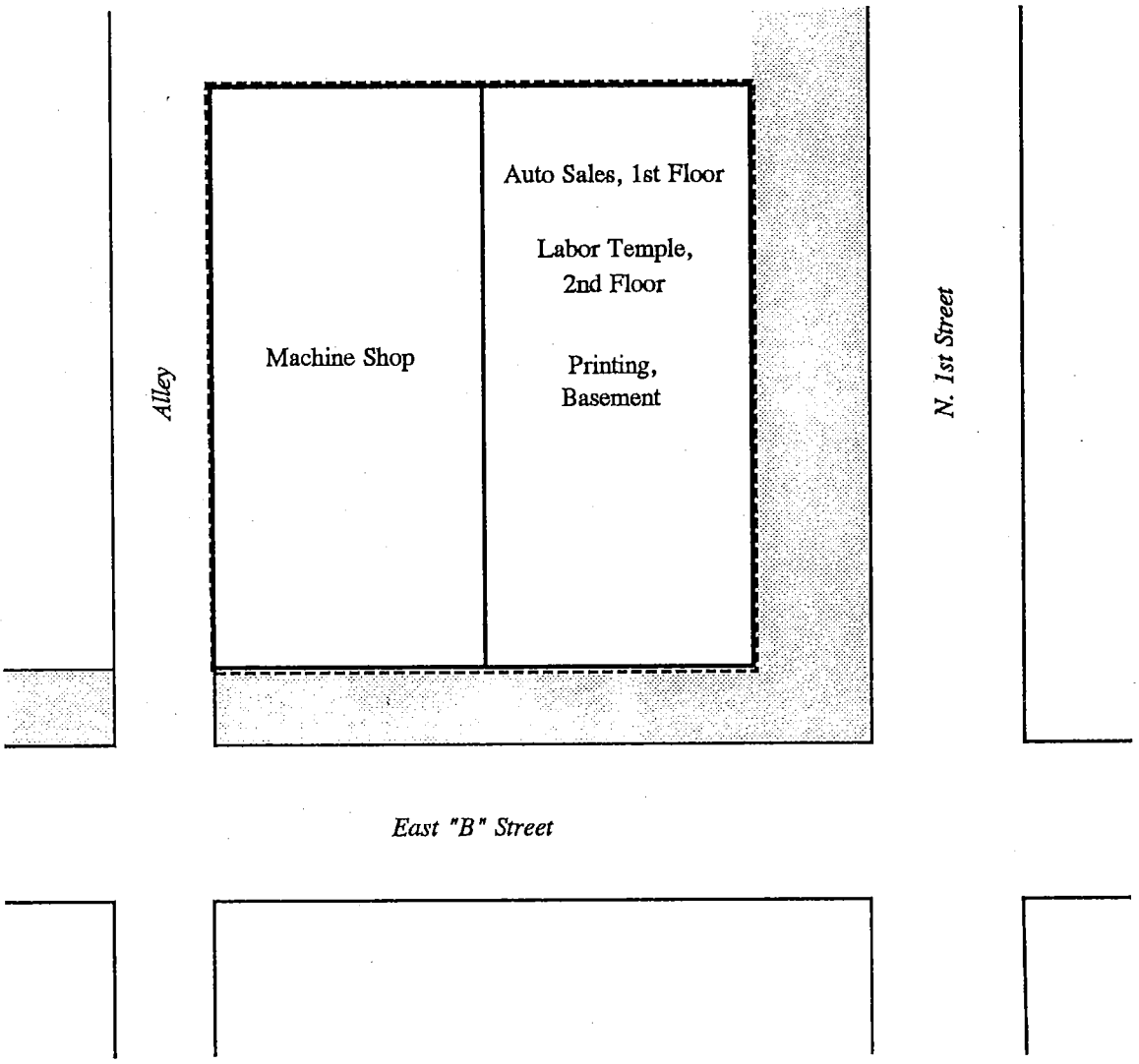
KLEINFELDER

SITE LOCATION MAP
200-210 N. 1ST STREET
YAKIMA, WASHINGTON

119601P1.DRW

Project # 60-1196-01

PLATE 1



LEGEND

Sidewalk

Property Boundary

*REFERENCE: Interpretation from 1920 Sanborn Fire Insurance Map

N

APPROXIMATE SCALE
ONE INCH = 50 FEET

0 25 50

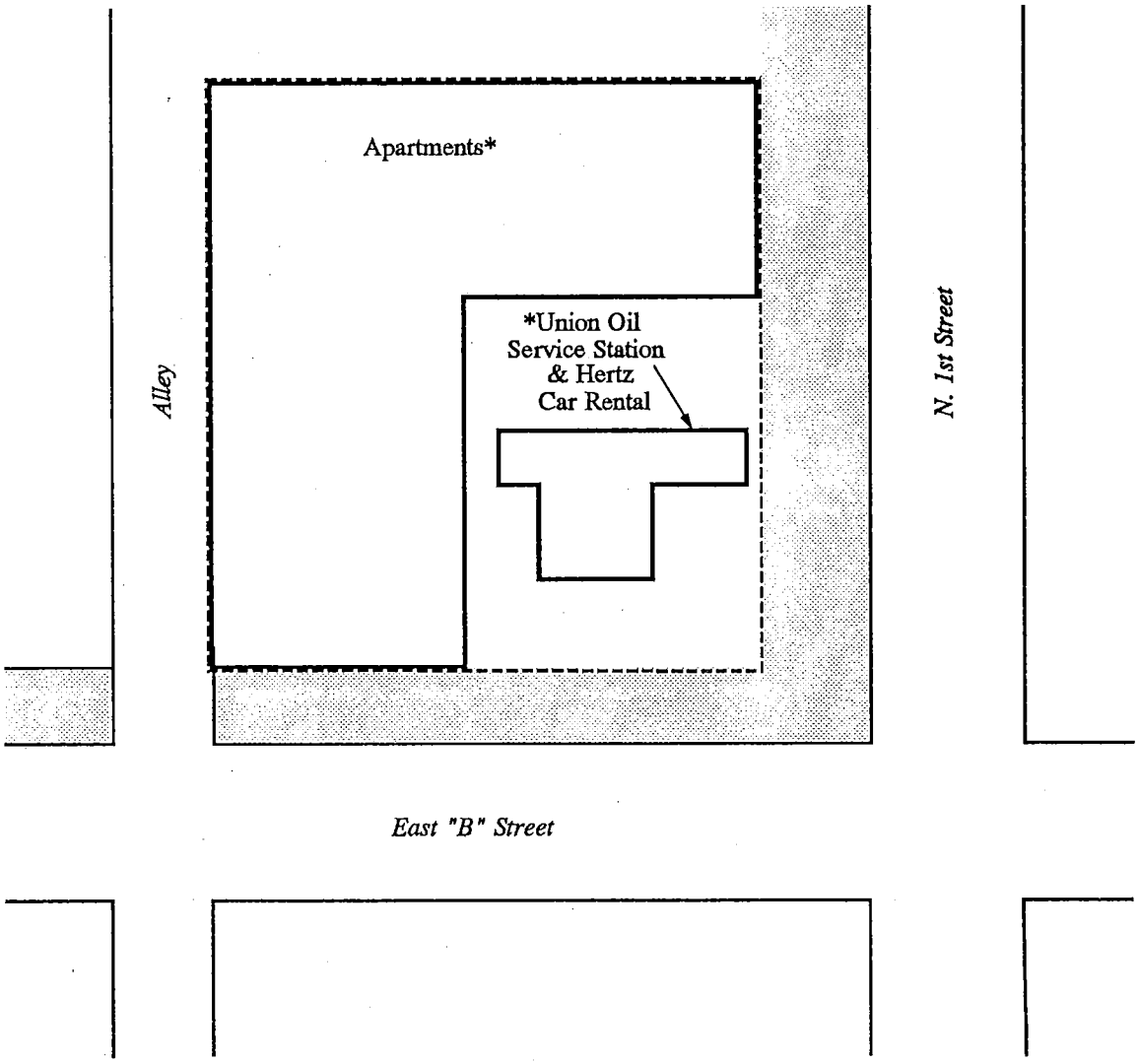
KLEINFELDER

119601P2.DRW

HISTORICAL SITE IMPROVEMENTS - 1920
200-210 N. 1ST STREET
YAKIMA, WASHINGTON

Project # 60-1196-01

PLATE 2



LEGEND

Sidewalk

Property Boundary

*REFERENCE: Interpretation from March 15, 1955, Aerial Photograph and 1955 Polk Reverse Directory

APPROXIMATE SCALE
ONE INCH = 50 FEET

0 25 50

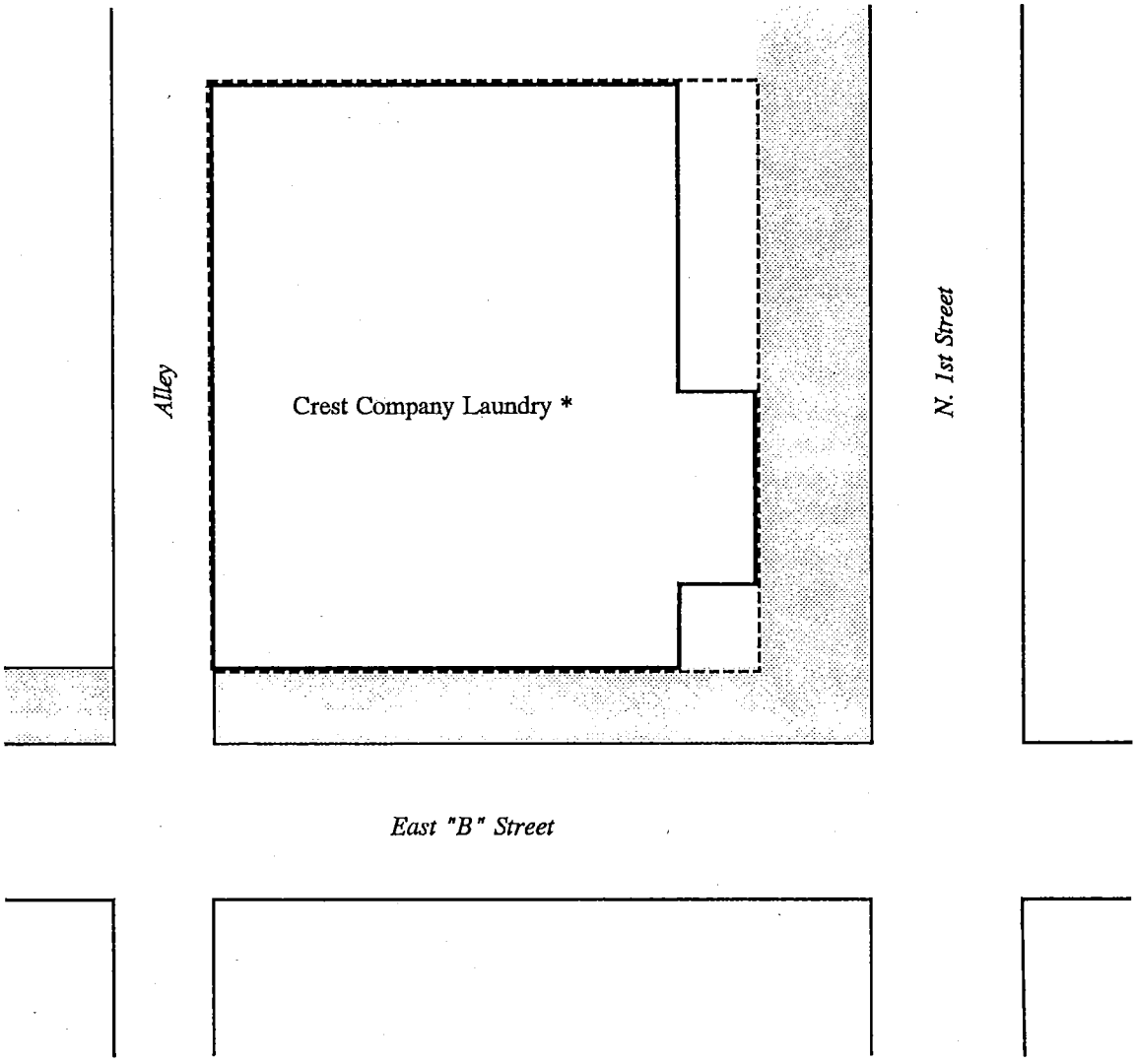
KLEINFELDER

119601P3.DRW

HISTORICAL SITE IMPROVEMENTS - 1955
200-210 N. 1ST STREET
YAKIMA, WASHINGTON

Project # 60-1196-01

PLATE 3



LEGEND

Sidewalk

Property Boundary

*REFERENCE: Interpretation from March 19, 1968, Aerial Photograph and 1971 Polk Reverse Directory

APPROXIMATE SCALE
ONE INCH = 50 FEET

0 25 50

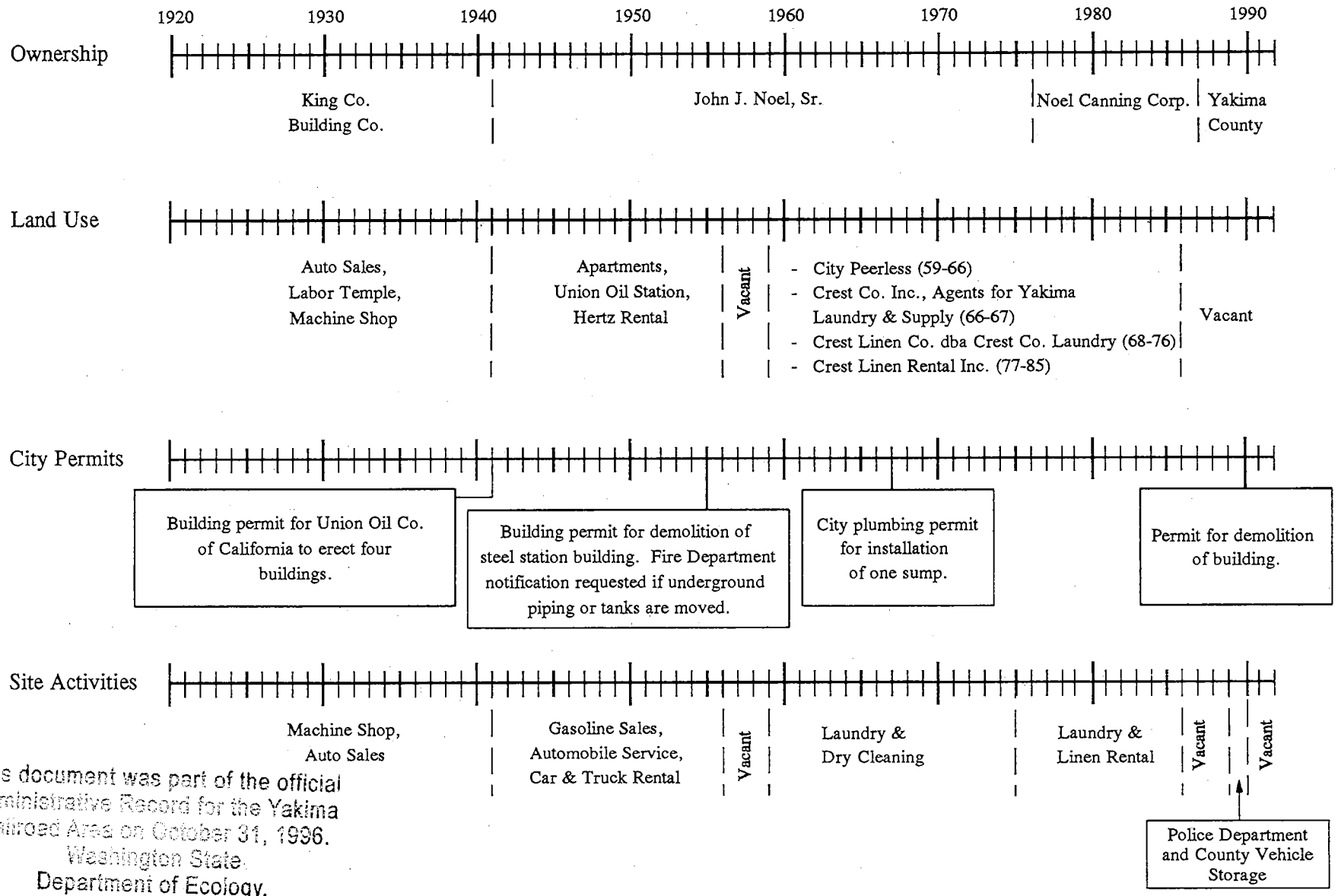
KLEINFELDER

119601P4.DRW

HISTORICAL SITE IMPROVEMENTS - 1968 & 1971
200-210 N. 1ST STREET
YAKIMA, WASHINGTON

Project # 60-1196-01

PLATE 4



Note: This chart presents an interpretation of information contained in the accompanying report, and should be reviewed in that context.

KLEINFELDER

119601P5.DRW

CHRONOLOGICAL SITE HISTORY INTERPRETATION
200-210 N. 1ST STREET
YAKIMA, WASHINGTON

PROJECT # 60-1196-01

PLATE 5

APPENDIX A

APPENDIX A
CHEN-NORTHERN REPORT REVIEW COMMENTS

Phase I Environmental Site Assessment
Crest Linen Property
Yakima, Washington
Project Number 190-1961 by Chen-Northern, Inc., dated August 28, 1990

- This report identifies that the site used to be the former location on a gasoline service station during the 1940s and 1950s. The report does not identify where the tanks were located, whether the tanks were removed, what fuels may have been stored in these tanks, or who owned/operated this station.

- The report stated that the floor slab within the building interior was not continuous and that soils were exposed in several of these areas. The report stated these areas "may have been part of an overflow drain system used by the laundry facility". However, the actual reason for these area was not identified.

- The report states that in the northwest corner of the Crest Linen building, a locked closet reportedly contained pesticides. However, the actual room contents, quantity, and physical state (solid, liquid, or gas) was not identified.

- The report did not identify whether the Crest Linen facility ever performed dry cleaning and if so, whether tetrachloroethylene or what dry-cleaning solvent was used.

Phase II Environmental Site Assessment
Former Crest Linen Site
Yakima, Washington
Project Number 190-1961 by Chen-Northern, Inc., dated February 7, 1991

- Table 1 of this report states that the ground-water sample collected from boring 2 (DH-2) contained a concentration of toluene at 0.0007 mg/L. However, the attached laboratory results indicate that this concentration was 0.0012 mg/L.

- Page five, first paragraph of the report, states that the level of xylenes detected in the water sample from DH-2 approaches the MTCA Method A cleanup level of 5 parts per billion (ppb). This sentence should read cleanup level of 20 parts per billion.

- Table 2 of this report indicates a concentration of four pesticides in the ground-water sample collected from boring 1 (DH-1). However, the four listed concentrations are an order-of-magnitude greater than what is reported in the attached laboratory results. (Example: Dieldrin is identified at a concentration of 0.0008 mg/L. This should be written as 0.00008 mg/L.)

- The reported concentrations for these four pesticides are estimated values, which are below the practical quantification limit of the analytical method. Furthermore, endrin ketone was found in the laboratory blank sample, indicating these compounds may be present in this sample due to laboratory contamination or another type of sample compromise. These factors make the reported detection of these pesticides questionable.

- The report did not identify the soil or groundwater sampling or storage methods. Additionally, the report indicates groundwater samples were collected from the drilled soil borings. A groundwater sample collected in this manner is not considered to be "representative" of subsurface conditions. A sample should be collected from a properly installed and developed groundwater monitoring well, as per applicable Ecology guidance documents, to be considered representative. However, samples collected in this manner are considered by Ecology to be acceptable to document the presence of a release.

APPENDIX B

FOUNDED 1909

Schreiner Title Co. (AGENT FOR TRANSAMERICA TITLE INSURANCE CO.) Title Insurance - Escrows

NORTH SECOND STREET • YAKIMA, WASHINGTON 98901 • PHONE (509) 248-5801
FAX (509) 453-0798

YVONNE SCHREINER
PRESIDENT-MANAGER

OWNERSHIP REPORT

CHARGE:	100.00
Tax	7.80
Total	$107.80

Mr. Lawrence Petersen
Room 211
County Courthouse
Yakima, Wa 98901

RE: Crest Linen Property

5/11/31 to 8/22/41	King Co. Building Co.
8/22/41 to 6/18/76	John J. Noel, Sr.
6/18/76 to 3/31/87	Noel Canning Corp.
3-31-87 to Present	Yakima County

RECEIVED NOTICE OF LEASES

11-13-41	Sears, Roebuck & Co. (2 year term)
8-11-41	Union Oil Co. (10 year term)

Mark Quinn
Sr. Title Officer

MQ/mk

APPENDIX C

Perchloroethylene

White Paper

Executive Summary

Animal bioassays of perchloroethylene have shown an increased incidence of liver tumors in mice and marginal or equivocal results in rats. The relevance of these results to humans, however, has been questioned because of research indicating that the mechanism of liver tumor induction in mice does not apply to humans. Further, the results of an epidemiology study of 615 dry cleaner workers occupationally exposed only to perchloroethylene provided no evidence of an increased overall cancer mortality rate.

On the basis of the available evidence, perchloroethylene does not appear to pose a health hazard to humans under normal conditions of occupational exposure, and when equipment is used in accordance with manufacturers' instructions. It is nevertheless important that workplace activities and user operations should continue to be carried out in such a way as to keep exposure as low as is reasonably practicable.

Perchloroethylene is one of 189 substances listed as hazardous air pollutants under Section 112 of the Clean Air Act, as amended in 1990. The U.S. Environmental Protection Agency (EPA) is required to develop national emission standards for sources of these compounds over the next 10 years. Technology-based standards for dry cleaning and organic solvent cleaning (degreasing) with perchloroethylene are expected to be among the first standards issued.

Introduction

Perchloroethylene, also known as tetrachloroethylene, has been used safely in industry for almost 50 years, and is the primary solvent used in commercial and industrial dry cleaning. Since being introduced to the dry cleaning industry in the late 1930's, it has replaced carbon tetrachloride and most petroleum solvents because of its relatively low toxicity and nonflammability. Its other major uses are as a metal cleaning and degreasing solvent, and as a chemical intermediate in the production of several fluorinated compounds.

Perchloroethylene is a member of a family of aliphatic halogenated hydrocarbons. It is a colorless, volatile liquid that is essentially nonflammable and has no measurable flashpoint. In the United States, perchloroethylene is produced by Dow Chemical U.S.A., Occidental Chemical Corporation, PPG Industries, Inc., and Vulcan Materials Company. The 1989 production was about 473.7 million pounds (214,900 metric tons), of which 45.2 million pounds (20,500 metric tons) were exported. An additional 102.3 million pounds (46, 400 metric tons) were imported.

Uses

For 1989 the uses of perchloroethylene can be broken down into the following categories:

dry cleaning/textile processing	47%
chemical intermediate	30%
metal cleaning/degreasing	13%
miscellaneous	10%

■DRY CLEANING

Perchloroethylene is used by more than 75 percent of commercial dry cleaners, as well as many industrial and coin-operated establishments. It had replaced other synthetic solvents, such as carbon tetrachloride, by the late 1940's or early 1950's. A gradual shift from petroleum derivatives to perchloroethylene began in the late 1940's. This shift in solvents increased in the 1950's and early 1960's. However, in the period before 1960, petroleum derivatives were still the dominant solvents.

In addition to its nonflammability and relatively low toxicity, the popularity of perchloroethylene in the dry cleaning industry can be attributed to the following properties:

- safe to use on all common textiles, fibers, and dyes;
- effective at removing fats, oils, and greases;
- free of residual odor;
- chemically stable under all common use conditions;
- non-corrosive to the metals and other materials used in dry cleaning machinery;
- easily removed from clothes by rapid, safe drying; and
- energy- and cost-efficient (can be easily distilled and reused).

The textile industry uses perchloroethylene as a spotting agent for the removal of spinning oils and lubricants. It also is used in wool scouring and as a solvent carrier in dyes and water repellants.

■CHEMICAL INTERMEDIATE

Perchloroethylene is used as a basic raw material in the manufacture of chlorofluorocarbons (CFC's), principally trichlorotrifluoroethane (CFC-113), which is used in the electronics industry, in metal cleaning, and in dry cleaning. The chemical also is used in the synthesis of hydrofluorocarbon 134a (HFC-134a), and can be used for the synthesis of hydrochlorofluorocarbon (HCFC) 123, 142b, and 141b.

■METAL CLEANING/DEGREASING

Many industries, including aerospace, appliance, and automotive manufacturers, use perchloroethylene for vapor degreasing metal parts during various production stages. Its high boiling point and resultant longer cleaning cycle are advantageous in removing "difficult" soils such as waxes with high melting points. The ability of the chemical to remove water during vapor degreasing is useful to jewelry manufacturers and other metal finishers.

Perchloroethylene's nonflammability and low vapor pressure make it an effective cold (room temperature) metal cleaner, either alone or when blended with flammable solvents. Its low vapor pressure contributes to reduced emissions from cleaning operations where it is employed.

■MISCELLANEOUS

Perchloroethylene is used as an insulating fluid in some electrical transformers as a substitute for polychlorinated biphenyls (PCBs). Relatively small quantities of perchloroethylene are used in printing inks, aerosol specialty products, adhesive formulations, paper coatings, and silicones. In addition, perchloroethylene is used in chemical maskant formulations used to protect surfaces from chemical etchants in the aerospace and other industries.

Health Effects

■GENERAL

Overexposure to perchloroethylene can affect the central nervous system (CNS) and the liver. Prolonged exposure to concentrations of 200 parts per million (ppm) or more has been associated with dizziness, confusion, headache, nausea, and irritation of the eyes and mucous tissue. At higher level exposures (< 600 ppm) these symptoms are intensified. Prolonged exposure to sufficiently high levels (< 1500 ppm) may lead to unconsciousness due to anesthesia and, in extreme cases, death from respiratory depression.

Reversible changes in the liver and kidney of laboratory animals have been reported following prolonged exposure to concentrations of 200 ppm or more. In humans, reversible alterations in liver function also have been noted in persons exposed to high levels of perchloroethylene vapor for extended periods of time. No cause-effect relationship has been established between kidney effects and exposure to perchloroethylene in humans.

■GENOTOXICITY

The ability of perchloroethylene to cause genetic mutations has been tested in bacteria, laboratory animals, and human tissue. The preponderance of these data indicate that the chemical is not mutagenic. Commercial formulations of the chemical have elicited weakly positive responses in some yeast and bacterial assays, but only when toxic concentrations of perchloroethylene were used. Moreover, no dose-response relationships were established. In a study conducted using highly purified perchloroethylene, no evidence of mutagenic effect was observed in the bacteria tested.

■CARCINOGENCITY

Laboratory Animal Studies

Three studies of the carcinogenic potential of perchloroethylene in laboratory animals have been conducted. Two of the studies showed a significant increase in liver tumors in mice. The strain of mice used in these studies (B6C3F1), however, has a high and variable spontaneous incidence of liver tumors.

A study reported by the National Cancer Institute (NCI) in 1977 exposed (by gavage) Osborne-Mendel rats and B6C3F1 mice to up to 949 milligrams of perchloroethylene per kilogram (mg/kg) body weight and up to 1072 mg/kg body weight, respectively, each day, 5 days a week, for 78 weeks. The study showed a significant increase in liver tumors in both sexes of mice. Low survival in the rats tested, believed to result from exposure to doses higher than the maximum tolerated dose (MTD), compromised the study's ability to detect a carcinogenic effect in this species. Because of several significant limitations in its design and conduct, the results of this study should be interpreted with caution.

The Dow Chemical Company conducted an inhalation study of the carcinogenic effect of perchloroethylene on Sprague-Dawley rats. The Dow study exposed male and female rats to 0, 300, and 600 ppm of the chemical for 6 hours per day, 5 days per week, for 52 weeks (and observed them for another 52 weeks), and showed no significant differences between the exposed and control animals.

In 1986 the National Toxicology Program (NTP) reported the results of a 2-year inhalation study that found a significant increase in liver tumors in male and female B6C3F1 mice. The study exposed the mice and Fischer 344 rats to perchloroethylene concentrations of 0, 100, and 200 ppm and 0, 200, and 400 ppm, respectively, for 6 hours per day, 5 days a week, for the length of the study. NTP also reported an increased incidence in mononuclear cell leukemia in male and female rats and a marginal increase in kidney tumors in male rats. NTP concluded that these data demonstrated "clear evidence" of carcinogenicity in mice and male rats and "some evidence" of carcinogenicity in female rats.

Science Advisory Board Review of the NTP Study

After reviewing the results of the NTP study, the Science Advisory Board of the Environmental Protection Agency (EPA) concluded that the study does not provide a basis for associating either the leukemias or the kidney tumors observed in the rats with exposure to perchloroethylene. The Board's conclusion was based on the high spontaneous background rate of leukemia in concurrent and historical controls in this particular rat strain and the low incidence of rat kidney tumors in the NTP study. In addition, the Board stated that the mechanism responsible for the marginal increase in kidney tumors appears to be unique to male rats and is probably not operative in humans. The Board also indicated that the increase in the mouse liver tumors may have been due to the operation of a mechanism such as peroxisome proliferation (see below).

Significance of the Mouse Liver Data

Following the observation that perchloroethylene produces liver tumors in mice, but not in rats, studies were initiated to investigate the reasons for this species difference and to determine the significance of the mice data to humans. This research indicates that perchloroethylene is not the proximal (actual) carcinogen in the mouse bioassays, but that a metabolite of perchloroethylene, trichloroacetic acid (TCA), is the likely cause of the mouse liver tumor response. Tumor induction in rodent liver cells has been associated with TCA and the TCA-induced proliferation of enzyme-containing organelles (called peroxisomes) in the cells. Production of TCA occurs at a much higher rate in mice than in rats, which are genetically similar organisms, and at an even lower rate in humans than in mice or rats. Moreover, in vitro exposure of human liver cells to TCA did not result in peroxisome proliferation.

This research explains why liver tumors were seen in mice, but not rats, and strongly suggests that perchloroethylene is unlikely to cause liver cancer in humans.

Epidemiology Studies
A number of epidemiology studies have investigated the incidence of cancer mortality among dry cleaning workers. These studies, for the most part, cover workers who were exposed to a variety of cleaning agents, including petroleum solvents. A more recent epidemiology study of the dry cleaning industry sponsored by the National Institute for Occupational Safety and Health (NIOSH), however, has the potential to show a cause-effect relationship to perchloroethylene exposure. Significantly, this study shows no increased risk of cancer in a subgroup of dry cleaning workers exposed only to perchloroethylene.

The NIOSH study found the overall cancer mortality rate in dry cleaning workers to be higher than, but not significantly different from, that predicted using U.S. mortality rates. The relative number of cancer deaths among the workers studied was reduced when compared to the higher cancer mortality rates in the metropolitan areas investigated. Among the site-specific cancer mortalities, urinary tract cancer (particularly in the bladder) was the only one found to have a significant increase. Within the subgroup of workers exposed only to perchloroethylene, the incidence of mortality from urinary tract cancer (and from cancer, in general) was lower than that expected from overall U.S. mortality rates.

Carcinogenicity Classification
The International Agency for Research on Cancer (IARC) has classified perchloroethylene in Group 2B, as a substance considered "possibly carcinogenic to humans." In addition, NTP listed perchloroethylene as "reasonably anticipated" to be a carcinogen based on a finding of "sufficient" evidence for carcinogenicity in experimental animals. The American Conference of Governmental Industrial Hygienists (ACGIH) has not classified perchloroethylene as a carcinogen. A final decision has not been made by EPA as to the classification of perchloroethylene under its Guidelines for Carcinogen Risk Assessment.

■REPRODUCTIVE AND DEVELOPMENTAL TOXICITY

Several studies of the effects of perchloroethylene on mammalian reproduction have been performed on mice, rats, and rabbits. The results of these animal tests do not indicate any significant reproductive effects.

In studies of female Sprague-Dawley rats and Swiss-Webster mice exposed by inhalation to a perchloroethylene concentration of 300 ppm during gestation, no reproductive effects were observed. A similar result was observed in CD rats and New Zealand rabbits after females were exposed to 500 ppm of the chemical before and during gestation. An inhalation study of Long-Evans hooded female rats exposed to 1000 ppm of perchloroethylene prior to and during gestation found a significant reduction in body weight and excess variation in skeletal and soft tissue development. However, weight gain and survival of offspring followed up to 18 months of age were not influenced by exposure to perchloroethylene. Some changes in maternal body weight and liver and kidney weight were noted in these studies.

On the basis of these laboratory data, EPA concluded that there is no evidence suggesting that the fetus is uniquely susceptible to the effects of perchloroethylene. HSIA currently is conducting a multigeneration inhalation study in rats to further evaluate the potential for reproductive toxicity as a result of perchloroethylene exposure. The findings of this study will be available by 1994.

Regulation

Perchloroethylene is regulated as a volatile organic compound (VOC) under most state regulations implementing the national ambient air quality standards for ozone. Although EPA has recognized that perchloroethylene does not contribute appreciably to smog formation, it has not taken final action to allow the exemption of perchloroethylene from state VOC regulations.

The Clean Air Act Amendments of 1990 significantly revised the provisions of Section 112 relating to the regulation of emissions of hazardous air pollutants. Under the new law, EPA is required to develop national emission standards based on maximum available control technology, or MACT, for major sources (> 10 tons of emissions per year) of perchloroethylene and 188 other substances within 10 years. Emissions of sources emitting less than 10 tons/year also may be regulated, but can be subject to a lesser degree of control. The revised Section 112 also requires EPA to review the need for additional control of regulated sources within 8 years of the implementation of a MACT standard.

An emission standard for the use of perchloroethylene in dry cleaning is expected to be among the first standards proposed under the revised Section 112. The standard is expected to be based on available control equipment and to allow more than one option for compliance. A standard for organic solvent cleaning (degreasing) with perchloroethylene and the other chlorinated solvents is expected to be proposed thereafter.

In 1991, EPA established national primary drinking water regulations setting a maximum contaminant level, or MCL, of 5 micrograms per liter for perchloroethylene, and a maximum contaminant level goal (MCLG) of zero. The effective date of the regulations is July 30, 1992. EPA has indicated that "[t]he establishment of an MCLG at zero does not imply that actual harm necessarily occurs at a level somewhat above zero, but rather that zero is an aspirational goal, which includes a margin of safety, within the context of the Safe Drinking Water Act." Various states also may have drinking water regulations that apply to perchloroethylene.

For various industries EPA has established effluent limitation guidelines, which may contain effluent limitations for perchloroethylene. EPA also has published water quality criteria for perchloroethylene for use by states in developing water quality standards. Perchloroethylene waste is considered hazardous under the Resource Conservation and Recovery Act (RCRA).

The reportable quantity (RQ) for release of perchloroethylene under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) is 100 pounds. Perchloroethylene is one of several hundred chemicals subject to material safety data sheet (MSDS), inventory, and release reporting under Sections 311, 312, and 313 of the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986.)

The Occupational Safety and Health Administration (OSHA) recently lowered the permissible exposure limit (PEL) for perchloroethylene from 100 ppm to 25 ppm for an 8-hour time-weighted average (TWA), based on potential carcinogenicity. ACGIH currently recommends threshold limit values (TLVs) of 50 ppm (TWA) and 200 ppm (15-minute short-term exposure limit, or STEL) for workplace exposure.

Compliance with the new standard, using any combination of engineering controls, work practices, and personal protective equipment, was required by September 1, 1989 (October 1, 1989 for dry cleaners). Compliance with the new level through the use of administrative or engineering controls is required by December 31, 1992.

In the meantime, the former limits of 100 ppm for an 8-hour TWA, 200 ppm for an allowable (8-hour) ceiling, and 300 ppm for a maximum acceptable peak must be achieved by engineering controls.

REGULATORY (FEDERAL) AND OTHER INFORMATION FOR PERCHLOROETHYLENE

Chemical Formula	$CCl_2 = CCl_2$
Molecular Weight	165.9
CAS Number	127-18-4
OSHA PEL	
8-hr TWA	25 ppm
ACGIH TLV	
8-hr TWA	50 ppm
15-min STEL	200 ppm
IARC Classification	2B[a]
CERCLA Reportable Quantity	100 lbs
Maximum Contaminant Level (Drinking Water)	5 micrograms/liter
RCRA Hazardous Waste Number	U 210
DOT Hazard Class	ORM-A
DOT ID Number	UN 1897

a - A chemical in IARC Group 2B is considered "possibly carcinogenic to humans." This classification for perchloroethylene is based on IARC's finding of "sufficient" evidence for carcinogenicity in animals, and "inadequate" evidence of carcinogenicity in humans.

b - Equivalent to parts per billion.

HSIA

Halogenated Solvents Industry Alliance
1225 19th Street, N.W.
Suite 300
Washington, D.C. 20036
(202) 223-5890
1-800-332-HSIA

Drycleaning and Laundry Plants

RLG

INDUSTRY OVERVIEW

The establishments covered under Drycleaning and Laundry Plants include:

- Retail drycleaning stores
- Industrial and linen supply plants with drycleaning operations
- Leather and fur cleaning plants
- Self-service laundromats with drycleaning equipment
- Other establishments with drycleaning operations.

While not all of these facilities will produce hazardous waste, those facilities using hazardous solvents may be subject to new Resource Conservation and Recovery Act (RCRA) provisions regarding the treatment, storage, disposal, and transportation of small quantities of hazardous waste. These solvents include:

- **Perchloroethylene,** otherwise known as perc, PCE, or tetrachloroethylene
- **Valclene***, also known as fluorocarbon 113 or trichlorotrifluoroethane
- **Petroleum solvents,** such as Stoddard, quick-dry, low-odor and other solvents with a flash point less than 140°F ("140-F solvent" and other solvents with a flash point equal to or greater than 140°F are not considered hazardous under EPA RCRA designation. If you are unsure of the flash point, check with the distributor of the solvent.)

Table 1

TYPICAL QUANTITIES OF HAZARDOUS WASTE FROM DRYCLEANING

(Pounds of waste per 1,000 pounds of clothes cleaned)

WASTE TYPE	CLEANING METHOD		
	PERC	VALCLENE	PETROLEUM SOLVENTS
	Average Quantity of Hazardous Waste (pounds)		
Still Residues	25	10	20
Spent Cartridge Filters:			
Standard (carbon core)	20	15	*
Adsorptive (split)	30	20	*
Cooked Powder Residue	40	NA	NA
Drained Filter Muck	NA	NA	*

*Well drained filter cartridges or drained filter muck are solids and do not meet the criteria for classification as an ignitable solid; therefore, they are not hazardous wastes.

Table 2

WASTE DESCRIPTIONS*

WASTE	Information for Item 11 of the Manifest		
	DOT SHIPPING NAME	HAZARD CLASS	UN/NA ID NUMBER
Perc	Waste Perchloroethylene or Waste Tetrachloroethylene	ORM-A	UN 1897
Valclene	Hazardous Waste, NOS	ORM-E	UN 9189
Petroleum Solvents	Waste Petroleum Distillate	Combustible Liquid**	UN 1268
	Waste Petroleum Naphtha	Combustible Liquid**	UN 1255

*In certain situations, other DOT descriptions may be applicable to the wastes listed.

**If the flash point of the solvent or residue *as disposed of* is less than 100°F, the hazard class would be "flammable liquid." Although the flash point of petroleum drycleaning solvents is above 100°F, the presence of contaminants (such as printing inks) could lower the overall flash point to below 100°F.

HAZARDOUS WASTES FROM DRYCLEANING OPERATIONS

Perchloroethylene plants potentially produce three types of hazardous wastes:

- Still residues from solvent distillation (the entire weight)
- Spent filter cartridges (total weight of the cartridge and remaining solvent after draining)
- Cooked powder residue (the total weight of drained powder residues from diatomaceous or other powder filter systems after heating to remove excess solvent).

Valclene plants potentially produce two types of hazardous wastes:

- Still residues from solvent distillation (the entire weight)
- Spent filter cartridges (total weight of the cartridge and remaining solvent after draining).

Petroleum solvent plants potentially produce only one type of hazardous waste:

- Still residues from solvent distillation (the entire weight). However, if 140-F solvent is used, the still residue will *not* normally be a hazardous waste.

Well-drained filter cartridges or drained filter muck (powder residues from diatomaceous filter systems) are solids and do not meet the criteria for classification as an ignitable solid; therefore, they are not hazardous wastes.

WASTE QUANTITIES AND DESCRIPTIONS

If your plant produces 220 pounds or more of hazardous waste per month, you are subject to certain requirements, including the use of a Uniform Hazardous Waste Manifest when shipping hazardous waste off your premises.

To determine whether your plant qualifies as a regulated small quantity generator and to complete the Manifest, you will have to weigh the hazardous waste your plant generates. Table 1 lists common types and average quantities of hazardous waste produced per 1,000 pounds of clothes cleaned.

Item 11 on the Manifest is the Department of Transportation (DOT) description of the waste, which includes the proper shipping name, hazard class, and UN/NA identification number. This information is provided in Table 2 to aid in preparing the Manifest; other DOT descriptions and identification codes, however, may be applicable in some circumstances.

WASTE DISPOSAL METHODS

Generally there are three methods for proper disposal of hazardous wastes that are currently considered acceptable by both EPA and most state hazardous waste management agencies:

- Disposal in an authorized hazardous waste landfill
- Disposal at an authorized high-temperature incineration facility
- Disposal through an authorized recycler of hazardous wastes.

From an environmental perspective, recycling or incineration is generally preferable to land disposal.

BAN ON LAND DISPOSAL OF PERC AND VALCLENE WASTES

Under the new RCRA, EPA is required to issue, by November 8, 1986, new regulations that will ban the disposal on or into the land of hazardous waste containing certain solvents, including perchloroethylene and Valclene. In the near future, therefore, hazardous waste disposal options will be further restricted.

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ly 1985
l Report

Health Assessment Document for Tetrachloroethylene (Perchloroethylene)

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Research and Development
Office of Health and Environmental Assessment
Environmental Criteria and Assessment Office
Research Triangle Park, NC 27711

2. INTRODUCTION

Tetrachloroethylene (PCE) is one member of a family of unsaturated chlorinated aliphatic compounds. Other common names/acronyms are perchloroethylene, Perk, PER, and PERC. Its synonyms include carbon dichloride, tetrachloroethene, and 1,1,2,2-tetrachloroethylene.

PCE, though a water and solid waste contaminant, is primarily of interest in ambient air exposure situations. It is released into ambient air as a result of evaporative losses during production, storage, and/or use. It is not known to be generated from natural sources. It has negligible photochemical reactivity in the troposphere and is removed by scavenging mechanisms, principally via hydroxyl radicals.

The scientific data base is limited with reference to the effects of PCE on humans. Effects on humans have generally been ascertained from studies involving individuals occupationally or accidentally exposed. During such exposures, the concentrations associated with adverse effects on human health were either unknown or far in excess of concentrations found or expected in ambient air. Controlled PCE exposure studies have been directed toward elucidating the effects on the central nervous system, effects on clinical chemistries, and pharmacokinetic parameters of PCE exposure.

Since epidemiologic studies have not been able to assess adequately the overall impact of PCE on human health, it has been necessary to rely greatly on animal studies to derive indications of potential harmful effects. Although animal data cannot always be extrapolated to humans, indications of probable or likely effects among animal species increases the confidence that similar effects may occur in humans.

This document is intended to provide an evaluation of the scientific data base concerning PCE. The publications cited in this document represent a majority of the known scientific references to PCE. Reports which had little or no bearing upon the issues discussed were not cited.

The basic literature search that supports this assessment is current up to 1984. On-going literature searches have been conducted through 1985, resulting in the inclusion of selected references in all chapters of this document.

3. GENERAL BACKGROUND INFORMATION

3.1 PHYSICAL AND CHEMICAL PROPERTIES

Tetrachloroethylene, also called PCE (1,1,2,2-tetrachloroethylene or perchloroethylene), is a colorless, heavy liquid with a chloroform-like odor. It is used as a solvent for organic substances and is commercially important as a solvent in the dry cleaning of fabrics and in the degreasing of metals. It has a molecular weight of 165.85 and is relatively insoluble in water (150 mg/L) (Handbook of Chemistry and Physics, 1976; Chemical and Process Technology Encyclopedia, 1974). Its specific gravity at 20°C is 1.624. Its CAS registry number is 127-18-4. In air, at 25°C and standard pressure, 1 part per million (ppm) is equivalent to 6.78 mg/m^3.

PCE has negligible photochemical reactivity (Dimitriades et al., 1983) and, in the troposphere, is decomposed via free radical mechanisms. When in contact with water for prolonged periods, PCE slowly decomposes to yield trichloroacetic and hydrochloric acids. Upon prolonged storage in light, it was reported to decompose slowly to trichloroacetyl chloride and phosgene by autooxidation (Hardie, 1966). At 700°C, it decomposes, when in contact with activated charcoal, to hexachloroethane and hexachlorobenzene (Gonikberg, 1956). PCE has a boiling point of 121.1°C at 760 mm Hg and a vapor pressure of 14 torr at 20°C. MacKay et al. (1982) have calculated a vapor pressure of 19 torr at 25°C.

The chemical reactivity of PCE has been discussed by Bonse and Henschler (1976) in terms of the electron-inductive effect of the chlorine atoms, which reduce electron density about the ethylene bond. This effect, in combination with a steric protective effect afforded by the chlorine atoms, provides increased stability against electrophilic attack. This is exemplified in the reaction of PCE with ozone. Compared to ethylene and less-substituted chlorination hydrocarbons, PCE has a low rate of reaction (Williamson and Cvetanovik, 1968).

3.2 PRODUCTION

PCE may be produced by several processes:

1. Chlorination of trichloroethylene:

$$CHCl = CCl_2 + Cl_2 \xrightarrow[SbCl_3]{80°C} CHCl_2CCl_3$$

$$2CHCl_2CCl_3 + Ca(OH)_2 \xrightarrow{80°C} Cl_2C = CCl_2 + CaCl_2 + 2H_2O$$

2. Dehydrochlorination of S-tetrachloroethane:

$$CHCl_2\text{-}CHCl_2 + Cl_2 \longrightarrow CCl_2 = CCl_2 + 2HCl$$

3. Oxygenation of S-tetrachloroethane:

$$2CHCl_2CHCl_2 + O_2 \longrightarrow 2CCl_2 = CCl_2 + 2H_2O$$

4. Chlorination of acetylene:

$$CCl_2 = CCl_2 + Cl_2 \xrightarrow{200°C} CCl_3\text{-}CCl_3$$

$$CH \equiv CH + 3\ CCl_3CCl_3 \xrightarrow[\text{catalyst}]{200\text{-}400°C} 4CCl_2 = CCl_2 + 2HCl$$

5. Chlorination of hydrocarbons:

$$C_3H_8 + 8\ Cl_2 \longrightarrow CCl_2 = CCl_2 + CCl_4 + 8HCl$$

(propane)

$$2CCl_4 \longrightarrow CCl_2 = CCl_2 + 2Cl_2$$

6. Oxychlorination of 1,2-dichloroethane:

$$2C_2H_4Cl_2 + 5Cl_2 \longrightarrow C_2H_2Cl_4 + C_2HCl_5 + 5HCl$$

$$C_2H_2Cl_4 + C_2HCl_5 \longrightarrow C_2HCl_3 + 2HCl + CCl_2 = CCl_2$$

$$7HCl + 1.75\ O_2 \longrightarrow 3.5\ H_2O + 3.5\ Cl_2$$

$$2C_2H_4Cl_2 + 1.5\ Cl_2 + 1.75\ O_2 \longrightarrow C_2HCl_3 + CCl_2 = CCl_2 + 3.5\ H_2O$$

The majority of PCE produced in the United States is derived from the oxychlorination of 1,2-dichloroethane (reaction 6) or via chlorination of hydrocarbons (reaction 5) (Lowenheim and Moran, 1975).

In 1980, 329,000 metric tons of PCE were consumed in the United States (SRI, 1982). This figure represents production plus imports, minus exports. According to the U.S. International Trade Commission (1983), 265,770 metric tons were produced in the United States in 1982. Production in 1983 was estimated at 263,000 metric tons (Chemical and Engineering News, 1984).

TABLE 3-1. MAJOR U.S. PRODUCERS OF PCE[a]

Organization	Yearly 1981 capacity, MT[a]
Dow Chemical	145
PPG	91
Vulcan	91
Diamond Shamrock	75
Ethyl Corporation[b]	
E. I. du Pont de Nemours[c]	73
Stauffer Chemical	32

[a]Adapted from Chemical Economics Handbook (SRI, 1983). MT = Metric tons.
[b]Terminated production (Halogenated Solvents Industry Alliance, 1983).
[c]Output for captive use only.

3.3 USE

PCE has the following uses (Gosselin et al., 1976; Fishbein, 1977): (1) dry cleaning solvent; (2) textile scouring solvent; (3) dried vegetable fumigant; (4) rug and upholstery cleaner; (5) stain, spot, lipstick, and rust remover; (6) paint remover; (7) heat transfer media ingredient; (8) chemical intermediate in the production of other organic compounds; and (9) metal degreaser.

It is estimated that the use of PCE in the dry cleaning industry represents about 42 percent of 1980 consumption in the United States (SRI, 1982).

3.4 EMISSIONS

Emissions of PCE arise during its production, from its use as a chemical intermediate in industrial processes, from storage containers, during disposal, and from its use as a solvent. Because emissions are almost exclusively to the atmosphere, the information presented in this section focuses on air. Data available concerning discharges to water are discussed in Section 3.6.1.2. Emissions estimates reflect a diversity of sources throughout the country. Dry cleaning operations are located primarily in urban areas. Approximately

26,000 establishments are estimated to exist, according to Bureau of Census data (U.S. EPA, 1979). There are approximately 18,000 retail establishments plus much smaller numbers of industrial and coin-operated facilities (International Fabricare Institute, 1984).

In 1977, global emissions were estimated at 570,000 ± 285,000 metric tons (Singh et al., 1979). It was also estimated that emissions accounted for approximately 90 percent of the amount of PCE produced in the United States.

3.5 ENVIRONMENTAL FATE AND TRANSPORT

The potential for ambient air and water mixing ratios of PCE to pose a hazard to human health is influenced by many processes. Such factors include transformation into secondary pollutants of concern and degradation rates in air and water.

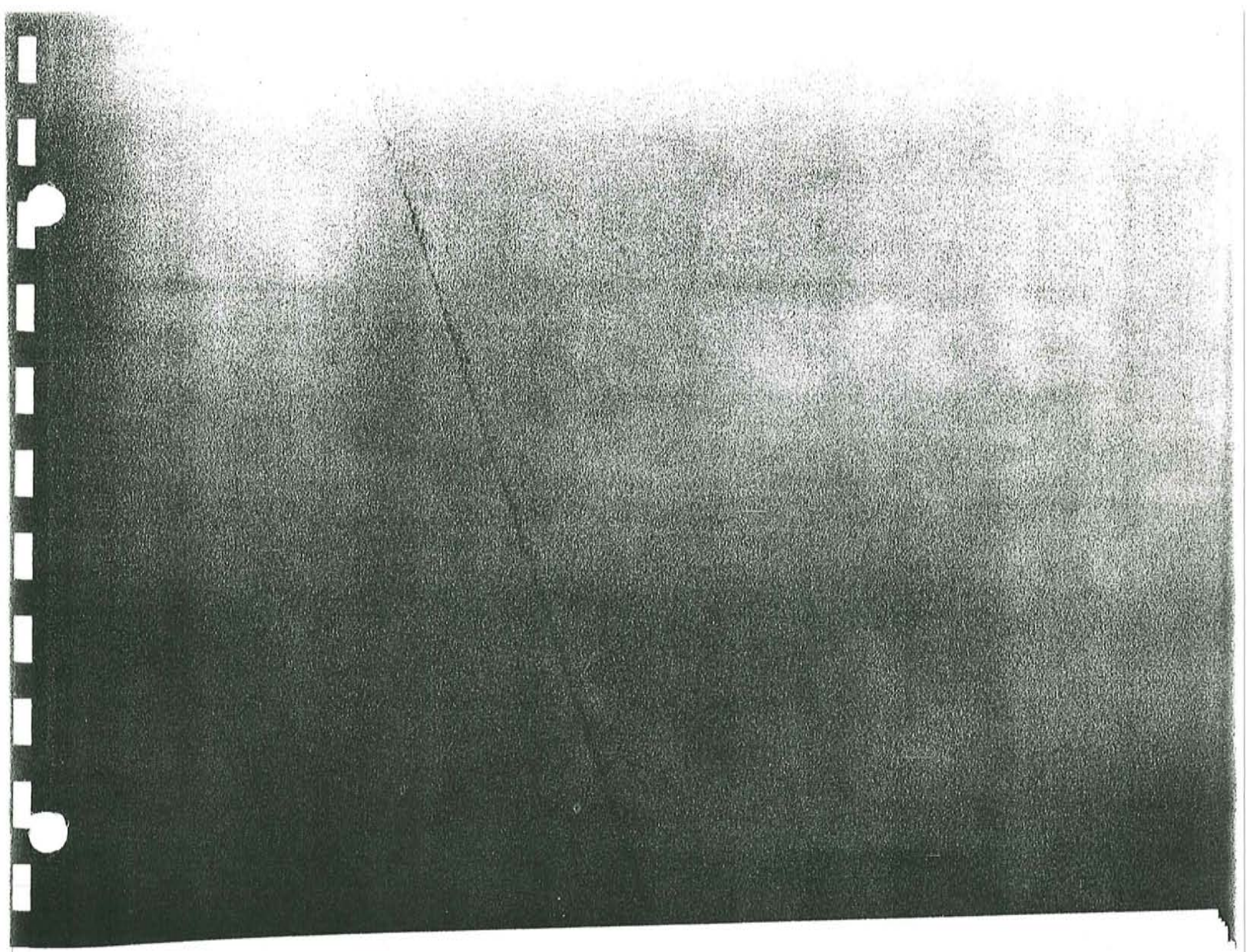
3.5.1 Ambient Air

3.5.1.1 Tropospheric Reactivity--Reaction with the hydroxyl radical (·OH) is the principal process by which many organic compounds, including PCE, are scavenged from the troposphere. Hydroxyl radicals are produced when O_3 is irradiated, resulting in excited atomic oxygen, which then reacts with water vapor. The tropospheric lifetime of a compound is related to the ·OH mixing ratio according to the expression:

$$\tau_{lifetime} = \frac{1}{k\,[OH]} \qquad (3\text{-}1)$$

where k is the rate constant of reaction.

Singh et al. (1979, 1981) calculated a tropospheric residence of PCE of about 68 days. This calculation was based on an average 24-hour ·OH abundance of 10^6 molecules cm^{-3} in the boundary layer of a polluted atmosphere. Justification for this ·OH mixing ratio stems from the field studies of Calvert (1976) and from Singh and coworkers (1979a). Because this ·OH mixing ratio is more typical of summer months, Singh et al. (1981) suggested that a seasonally adjusted mixing ratio would result in a longer chemical residence time. If a seasonally averaged ·OH mixing ratio of 4×10^5 molecules cm^{-3} (a level supported by the field measurements of Campbell et al., 1979) and a weighted global



NIOSH POCKET GUIDE TO CHEMICAL HAZARDS

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

June 1990

For Sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

Chemical name, structure/formula, CAS and RTECS Nos., and DOT ID and guide Nos.	Synonyms, trade names, and conversion factors	Exposure limits (TWA unless noted otherwise)	IDLH	Physical description	Chemical and physical properties: MW, BP, SOL, FI.P, IP, Sp.Gr, flammability	Chemical and physical properties: VP, FRZ, UEL, LEL	Incompatibilities and reactivities	Measurement method (See Table 1)
1,1,2,2-Tetrachloroethane $CHCl_2CHCl_2$ 79-34-5 KI8575000 1702 55	Acetylene tetrachloride, Symmetrical tetrachloroethane 1 ppm = 7.00 mg/m³	NIOSH Ca See Appendix A 1 ppm (7 mg/m³) [skin] OSHA 1 ppm (7 mg/m³) [skin]	Ca [150 ppm]	Colorless to pale-yellow liquid with a pungent, chloroform-like odor.	MW: 167.9 BP: 296°F Sol: 0.3% FI.P: NA IP: 11.10 eV Sp.Gr(77°F): 1.59 Noncombustible Liquid	VP(86°F): 9 mm FRZ: -33°F UEL: NA LEL: NA	Chemically-active metals, strong caustics, fuming sulfuric acid [Note: Degrades slowly when exposed to air.]	Char(pet); CS_2; GC/FID; III [#1019]
Tetrachloroethylene $Cl_2C=CCl_2$ 127-18-4 KX3850000 1897 74	Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene 1 ppm = 6.89 mg/m³	NIOSH Ca See Appendix A Minimize workplace exposure concentrations; limit number of workers exposed. OSHA 25 ppm (170 mg/m³)	Ca [500 ppm]	Colorless liquid with a mild, chloroform-like odor.	MW: 165.8 BP: 250°F Sol(77°F): 0.02% FI.P: NA IP: 9.32 eV Sp.Gr: 1.62 Noncombustible Liquid	VP: 14 mm FRZ: -2°F UEL: NA LEL: NA	Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash	Char; CS_2; GC/FID; III [#1003, Halogenated Hydrocarbons]
Tetrachloronaphthalene $C_{10}H_4Cl_4$ 1335-88-2 QK3700000	Halowax®, Nibren wax, Seekay wax	NIOSH/OSHA 2 mg/m³ [skin]	Unknown	Colorless to pale-yellow solid with an aromatic odor.	MW: 265.9 BP: 593-680°F Sol: Insoluble FI.P(oc): 410°F IP: ? Sp.Gr: 1.59-1.65 Combustible Solid	VP: <1 mm FRZ: 360°F UEL: ? LEL: ?	Strong oxidizers	Filter/Bub; none; GC/FID; II(2) [#S130]
Tetraethyl lead (as Pb) $Pb(C_2H_5)_4$ 78-00-2 TP4550000 1649 56	Lead tetraethyl, TEL 1 ppm = 13.45 mg/m³	NIOSH/OSHA 0.075 mg/m³ [skin]	40 mg/m³	Colorless liquid (unless dyed red, orange, or blue) with a pleasant, sweet odor. [Note: Main usage is in anti-knock additives for gasoline.]	MW: 323.5 BP: 228°F (Decomposes) Sol: Insoluble FI.P: 200°F IP: 11.10 eV Sp.Gr: 1.65 Class IIIB Combustible Liquid	VP: 0.2 mm FRZ: -202°F UEL: ? LEL: 1.8%	Strong oxidizers, sulfuryl chloride, rust, potassium permanganate [Note: Decomposes slowly at room temperature and more rapidly at higher temperatures.]	XAD-2; Pentane; GC/PID; III [#2533]

Personal protection and sanitation (See Table 3)	Recommendations for respirator selection — maximum concentration for use (MUC) (See Table 4)	Health hazards: Route	Symptoms (See Table 5)	First aid (See Table 6)	Target organs (See Table 5)
Clothing: Any poss Goggles: Any poss Wash: Immed contam Change: N.R. Remove: Immed non-imperv contam Provide: Eyewash, quick drench	NIOSH ¥: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Abs Ing Con	Nau, vomit, abdom pain; tremor fingers; jaun, enlarged tend liver; derm; monocy; kidney damage	Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed	Liver, kidneys, CNS
Clothing: Repeat Goggles: Reason prob Wash: Prompt contam Change: N.R. Remove: Prompt non-imperv contam	NIOSH ¥: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Ing Con	Irrit eyes, nose, throat; nau; flush face, neck; verti, dizz, inco; head, som; skin eryt; liver damage; [carc]	Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed	Liver, kidneys, eyes, upper resp sys, CNS
Clothing: Any poss molt/Repeat liq-sol Goggles: Any poss molt/Reason prob liq-sol Wash: Prompt contam Change: After work if any poss contam Remove: Immed non-imperv contam molt/ Prompt non-imperv contam sol	NIOSH/OSHA 20 mg/m³: SCBAF/SAF §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOVHiE/SCBAE	Inh Abs Ing Con	Acne-form derm; head, ftg, anor, verti; jaun, liver inj	Eye: Irr immed Skin: Soap wash immed Breath: Resp support Swallow: Medical attention immed	Liver, skin
Clothing: Any poss >0.1% Goggles: Reason prob Wash: N.R. Change: After work if any poss contam >0.1% Remove: Immed non-imperv contam (>0.1%) Provide: Quick drench (>0.1%)	NIOSH/OSHA 0.75 mg/m³: SA/SCBA 1.875 mg/m³: SA:CF 3.75 mg/m³: SCBAF/SAF/SAT:CF 40 mg/m³: SA:PD,PP §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Abs Ing Con	Insom, lass, anxiety; tremor, hyper-reflexia, spastic; bradycardia, hypotension, hypothermia, pallor, nau, anor, low-wgt; disorientation, halu, psychosis, mania, convuls, coma; eye irrit	Eye: Irr immed Skin: Soap wash immed Breath: Resp support Swallow: Medical attention immed	CNS, CVS, kidneys, eyes

HSIA

Halogenated Solvents Industry Alliance

the safe handling of perchloroethylene dry cleaning solvent

Prepared as a Service to the Public and Industry

March 1989

the safe handling of perchloroethylene (tetrachloroethylene) dry cleaning solvent

The Halogenated Solvents Industry Alliance (HSIA) represents users and manufacturers of perchloroethylene ("perc"). HSIA is vitally interested in the safety and health of all customers, customer employees, and other individuals who may be associated directly or indirectly with the laundry and dry cleaning industry.

It is HSIA's purpose to address, on a unified and cooperative basis, important issues which affect all segments of the industry. The safe handling of perchloroethylene dry cleaning solvent is an issue which has top priority with HSIA members.

Toward that end, this booklet has been prepared to review the safe handling methods that have enabled both commercial and coin-operated dry cleaning establishments to achieve an outstanding and enviable safety record in the use of perchloroethylene as a dry cleaning solvent. This information also may be helpful to legislative groups, public health, labor, fire, and regulatory agencies charged with promulgating and enforcing dry cleaning industry codes and regulations.

The purpose of this booklet is to ensure that perc is safely handled and used. It is your responsibility to pass this information along to your employees. Copies of this booklet may be obtained free-of-charge from your supplier, trade association, or HSIA.

contents

introduction

Perchloroethylene (tetrachloroethylene), or perc as it is generally called, is the principal solvent of the dry cleaning industry. Its use for garment cleaning steadily expanded for almost four decades, but has leveled off in recent years.

purpose

This booklet has been prepared to acquaint owners, managers, and employees of perc dry cleaning establishments with the essential characteristics of the solvent, and to provide factual data for the guidance of public health, labor, fire, and other authorities.

it is provided as a service, for informational purposes only. The publishers of this booklet have not assumed, and do not assume, any duty to, or on behalf of, readers who might rely upon information contained in the booklet. The publishers do not guarantee the completeness or current accuracy of recommendations or the bibliography. The booklet is not intended to be the exclusive source of health or safety information regarding perchloroethylene. There is ongoing research and regulatory activity, and readers are encouraged to consult other sources. Compliance with the recommendations contained in this booklet does not give rise to any implied endorsement of health and safety conditions at any facility.

a long record of safe use

Extensive and successful use over such a long period of time has demonstrated that perchloroethylene can be stored, handled, and used safely in normal dry cleaning practice when proper safety precautions are observed. There are sound reasons for handling perc safely and minimizing perc vapors in the workplace:

- The U.S. Occupational Safety & Health Administration (OSHA), American Conference of Governmental Industrial Hygienists (ACGIH), and Canadian agencies have set maximum permissible Time-Weighted Average (TWA) exposure levels.
- Physiological effects such as irritation to the eyes and lack of coordination will result from prolonged exposure above acceptable levels.
- Massive overexposure may cause liver dysfunction, unconsciousness, respiratory failure, and even death.
- In a recent population study of the industry, dry cleaning workers whose solvent exposure was not known had some increase of certain cancers. However, those workers who were known to be exposed only to perc had no increase in cancer compared to the general population.
- Exposure to perc has produced cancer in some laboratory test animals; such information is viewed by regulatory agencies as indicating a possible risk in humans.
- Resources consumed in the production and use of perc should be conserved — and not wasted.

Perchloroethylene has made a substantial contribution to safety in the operation of dry cleaning establishments because it is nonflammable and non-explosive. It is used in dry cleaning units having dryers separate from the washer-extractor, and with combined washer-extractor-dryer machines. Its use has permitted the installation of dry cleaning establishments in locations more convenient for the public.

Perchloroethylene is chemically and thermally stable under normal conditions of use — but it does require proper handling for safety.

TABLE 1

properties of perchloroethylene

The American Industrial Hygiene Association (Hygienic Guide Series) describes perchloroethylene as a "clear, colorless, nonflammable liquid with a distinctive, somewhat ethereal odor." Typical chemical and physical properties of perchloroethylene are listed below:

Chemical formula	CCl_2:CCl_2
Physical state	Liquid at normal temp
Molecular weight	165.8
Weight per gallon (60 degrees F)	13.6 pounds
Specific gravity (60 degrees/60 degrees F)	1.63
Boiling point (760 mm mercury)	250 degrees F
Vapor density (air equals 1)	5.8
Vapor pressure (60 degrees F)	12 mm mercury
Freezing point	-9 degrees F
Flash point	none
Fire point	none

potential health hazards*

Perchloroethylene can be used safely when proper precautions are observed. The user must guard against certain hazardous properties of the solvent.

Users should avoid inhalation of excessive concentrations of perchloróethylene vapor, prolonged or repeated contact of the liquid with the skin, swallowing the liquid, and splashing into the eyes.

Manufacturers of dry cleaning equipment design and build their cleaning systems with these points in mind. When such equipment is operated and maintained in an appropriate manner, perchloroethylene should not be a health hazard.

inhalation of vapor

The initial effects of overexposure are as follows: nose and eye irritation, light-headedness, dizziness, mental dullness, and loss of coordination. The chief hazard associated with such overexposure lies with mental dullness and lack of muscular coordination that could result in an accident. Perchloroethylene is capable of producing an anesthetic effect if massive concentrations are inhaled. (See Table 2, page 5).

Exposure to continual and extremely high vapor concentrations can cause severe depression of mental functions, respiratory failure, and even death. Concentrations capable of causing serious acute effects such as unconsciousness may be expected only in exceptional circumstances, such as working in inadequately ventilated, confined areas or bending over a large pool of spilled solvent without the proper protective equipment. Upon removal of the person to open air, recovery is usually rapid and complete.

Daily overexposure, whether voluntary or accidental, to concentrations causing dizziness or other more serious side effects — that is, disregard of good practices or common sense — might produce some degree of liver injury in susceptible individuals. Although reports of cases are few in spite of extensive experience with the use of perchloroethylene, care must be taken to avoid overexposure.

skin

Prolonged and/or repeated contact with liquid perchloroethylene will produce rough and dry skin which is more susceptible to infection. Perchloroethylene can penetrate the human skin and be detected in the blood stream, although it is unlikely to penetrate the skin in harmful amounts. For these reasons, protective equipment must be worn to prevent skin contact with perc.

eyes

While the danger of serious injury if perchloroethylene is splashed into the eyes is small, a great deal of pain and redness may result. The eyes should always be flushed or rinsed with cool water immediately after contact and immediate medical attention sought.

internal

Perchloroethylene, if swallowed, may cause serious liver effects and possibly death.

*This section is a summary of results from various toxicological reports. See Bibliography for reference sources.

carcinogenicity

Results of laboratory tests of perchloroethylene, conducted by the National Cancer Institute (by tube feeding) and the National Toxicology Program (through inhalation exposure), have shown an increase in liver tumors in one strain of mouse. Although scientific questions have been raised as to the relevance of these particular liver tumors to human health, such information has traditionally been viewed by regulatory agencies as indicating the potential for risk in humans. While the authors of the NTP study also reported an increase in cancer in one strain of rat, the relevance to humans of this finding is uncertain. Additionally, other studies in rats have failed to induce cancer.

In a recent epidemiology (population) study of drycleaner workers by the National Institute for Occupational Safety & Health (NIOSH), workers whose solvent exposure was not known had some increases in certain cancers over the general U.S. population. However, those workers who were known to be exposed only to perc had no increase of cancer over the general population.

subjective responses to perchloroethylene

Table 2 presents a summary of responses to inhalation of perchloroethylene vapor at various concentrations.

It is important to note that responses may vary in different individuals, or even in the same individual depending upon his/her physical condition. Therefore, the values shown should serve only as an estimate of the consequences to be expected from exceeding acceptable levels of exposure.

TABLE 2

Average responses to inhalation of perchloroethylene vapor

1. 50 ppm*
   - Odor threshold (very faint) to unacclimated persons
   - No response — 8 hours
2. 100 ppm
   - Odor (faint) definitely apparent to unacclimated persons
     Very faint to not perceptible during exposure
   - No response — 8 hours
3. 200 ppm
   - Odor (definite) moderate to faint upon exposure
   - Faint to moderate eye irritation
   - Minimal light-headedness
   - (Eye irritation threshold — 100-200 ppm)
4. 400 ppm
   - Odor (strong) unpleasant
   - Definite eye irritation
   - Slight nose irritation
   - Definite incoordination (2 hours)
5. 600 ppm
   - Odor (strong) very unpleasant but tolerable
   - Definite eye and nose irritation
   - Dizziness, loss of inhibitions (10 minutes)
6. 1,000 ppm
   - Odor (very strong) intense, irritating
   - Markedly irritating to eyes and respiratory tract
   - Considerable dizziness, not likely to be tolerated voluntarily (2 minutes)
7. 1,500 ppm
   - Odor (almost intolerable) "gagging"
   - Irritation (almost intolerable) to eyes and nose
   - Complete incoordination within minutes to unconsciousness within 30 minutes

*parts per million

first aid and medical treatment

symptoms

Mild side effects due to brief overexposure may be manifested by light-headedness, incoordination, dizziness, headache, mental dullness, sleepiness, an appearance of being drunk, and possibly nausea. Massive overexposure may cause depression of mental functions, liver dysfunction, unconsciousness, respiratory failure, and even death.

inhalation

Most important is quick removal of the patient from the contaminated atmosphere into fresh air. If breathing has ceased, start artificial respiration. Oxygen may be administered by qualified personnel. Keep patient quiet and warm. Obtain medical attention at once. **Note to Physician:** Overexposure will cause symptoms of narcosis and, if accompanied by anoxia, may temporarily increase cardiac irritability. Maintain adequate oxygenation until recovery. Sympathomimetic amines, such as epinephrine, may precipitate arrhythmias. Use only after careful consideration.

skin contact

All contaminated clothing and footwear should be removed at once and not worn again until thoroughly dry. Wash affected skin area with large amounts of warm water and soap. Consult a physician if irritation persists.

contact with eyes

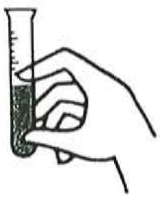
If liquid perchloroethylene has entered the eyes, wash them promptly with large quantities of water for at least 15 minutes. Consult a physician as soon as possible.

oral intake

If perchloroethylene has been swallowed, **do NOT induce vomiting.** Never give anything by mouth to an unconscious person. Seek medical attention immediately at the nearest hospital emergency room or from a physician.

diagnosis of perchloroethylene exposure

The diagnosis of perchloroethylene exposure can be established by breath or urine analysis up to several weeks after exposure depending on the amount absorbed. Analysis may allow estimation of the magnitude of the exposure, and the likelihood that poisoning will develop. The technique of breath analysis is rapid and easy to perform with the proper equipment.



prevention and control of potential hazards

The major potential hazard in the use of perchloroethylene in dry cleaning is the inhalation of vapors at concentrations above those prescribed for safe operation. Therefore, the most important single factor for safe operation is the adoption of effective means for limiting the concentration of perchloroethylene vapors in the atmosphere of the working area by proper maintenance and adequate ventilation.

Additionally, be certain that you have read — and understand — the handling precautions on the container label.

guidelines

These are six guidelines for prevention and control of perchloroethylene vapors:

1. Local building codes must be observed.
2. Equipment must be properly maintained to avoid leaks. A routine inspection program to detect leaks should be followed.
3. Spills and leaks must be cleaned up immediately. Cleanup personnel should be properly trained, and should wear proper protective equipment.
4. An adequate supply of fresh air should always be moving through the area.
5. All equipment ventilation, especially exhaust ventilation, should function properly and be kept in good condition. When the loading door of a washer or dryer is open, air should be drawn **into** the machine to prevent vapor from escaping.
6. An air analysis of the breathing zone around equipment should be conducted whenever doubt exists about vapor concentration. State and local public health agencies, insurance companies, consulting laboratories, and your trade association may be available to make such measurements. Personal sampling badges and/or sampling pumps are often used. Direct reading indicator tubes also may be used to detect perc leaks.

exposure to open flames

Exposure of perchloroethylene to high temperatures (above 700 degrees F), including those that occur in open flames of steam boilers, open electric heaters, gas-fired dryers, and gas-fired room heaters can cause the material to decompose and form toxic and corrosive gases. Those gases can lead to corrosion of heating elements or other parts of equipment used in dry cleaning operations and damage to fabrics. However, the gases are usually formed in trace amounts only, and not in sufficient quantities to be considered health hazards in the dry cleaning industry.

permissible concentration

Exposure to perchloroethylene, like exposure to other chemicals, should be kept as low as possible. The Occupational Safety and Health Administration (OSHA) acceptable 8-hr. TWA for exposure to perc is 25 ppm. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a maximum level of 50 ppm (8-hr. TWA). ACGIH and OSHA exposure limits are reproduced in Table 3.

Although the effective date for the 25-ppm level is March 1, 1989, the start-up date for actual compliance with the new OSHA limit is September 1, 1989. As of September 1, 1989, and until December 31, 1992, the new limit may be achieved by any reasonable combination of engineering controls, work practices, and personal protective equipment. In addition, during the entire period between March 1, 1989 and December 31, 1992, the *old* limits of 100 ppm TWA, 200 ppm ceiling, and 300 ppm peak continue to apply for perchloroethylene. These limits must be achieved by use of administrative or engineering controls whenever feasible.

As of December 31, 1992, employers must comply with the 25-ppm level by using administrative or engineering controls whenever feasible. When such controls are not feasible to achieve full compliance, protective equipment, or any other protective measures may be applied. The new standard provides that, if OSHA fails to revise the provisions of the standard concerning methods of compliance by December 31, 1991, the December 31, 1992 date that ends the transition period will be changed to December 31, 1993.

prevention and control of potential hazards

TABLE 3

Current Exposure Standards for Perchloroethylene Vapors

Type of Limit	Vapor Concentration	Notes
American Conference of Governmental Industrial Hygienists[1]		
• Threshold Limit Value (TLV) Time-Weighted Average (TWA)	50 ppm	8 hrs./day (40 hrs./week)
• Short-term Exposure Limit (STEL)	200 ppm	A 15-min. average which should not be exceeded, even if the 8 hr. TWA is less than 50 ppm. Exposures at the STEL should not be repeated more than four times per day.
Occupational Safety and Health Administration[2]		
• Permissible Exposure Limit (PEL) Time-Weighted Average (TWA)	25 ppm	8 hrs./day (40 hrs./week)

[1]The ACGIH values have been officially adopted by many Canadian provinces.

[2]The effective date of the 25-ppm PEL for perchloroethylene (lowered from 100 ppm) is March 1, 1989. Compliance with the new standard, using any reasonable combination of engineering controls, work practices, and personal protective equipment is required by September 1, 1989. Compliance with the new level through the use of administrative or engineering controls is required by December 31, 1992.

measurement of exposure

In order to evaluate the extent of exposure by inhalation, it is important to know not only the concentration of vapor in the air breathed by workers, but the duration and frequency of exposure to various concentrations as well. Monitoring of inhalation exposure is usually accomplished by air sampling, such as with a vapor badge, detector tube, or charcoal tubes. Agencies such as state and local public health groups, insurance companies, and consulting laboratories are available to make such measurements. You also may wish to contact your trade association or your perc distributor.

prevention and control of potential hazards

Several types of air sampling instruments can be used to measure the vapor concentrations of perchloroethylene in the work environment. They range in style and cost from inexpensive torch-type detectors or electronic leak detectors all the way up to automatic instruments costing several thousand dollars. Information on instruments and methods available for determining perchloroethylene vapors may be obtained from perchloroethylene producers, solvent distributors, trade associations, and others.

If leaks develop in the equipment or piping of a dry cleaning system, the perchloroethylene lost to the air can contribute to higher exposure levels. Electronic or torch-type leak detectors can be used to search for the sources of these leaks. With torch-type detectors, color changes in the flame give an approximate indication of the size of the vapor leak at the test point (see Table 4).

With electronic leak detectors, the instruments can be adjusted while standing at the call counter (or outside of the plant) so that they are just barely giving off an infrequent ticking sound. When searching for leaks, higher vapor levels will cause a very fast ticking, while a serious leak will usually produce a continuous squealing sound.

Direct reading color indicating tubes are available from several manufacturers. These tubes cost about a few dollars each and utilize a simple hand-operated pump. They also can be used for leak detection and workplace monitoring.

TABLE 4

interpreting halide torch flame colors

Color of Flame	Significance
Pale blue-pale green	No significant leak.
Intense green	Definite leak that must be corrected.
Intense blue	Serious leak requiring immediate corrective action.

use of protective equipment

It is recommended that the dry cleaning room or area contain emergency ventilation per NFPA* No. 32. Additionally, the operator should have available respiratory equipment approved by NIOSH/MSHA for use with organic vapors and protective clothing, including Viton gloves and apron. This protective equipment should be worn when changing filter cartridges and removing still or cooker residues. (For emergency situations, see "spills and leakage," below).

Protective gloves and/or aprons must be worn to prevent skin contact with perc during transfer operations. Any person doing a large number of transfers each day should wear an approved respirator during each transfer operation. Proper design of ventilation and transfer systems can significantly reduce the concentrations in the breathing zone during the transfer.

*National Fire Prevention Association

prevention and control of potential hazards

Vapor concentrations in the air can be kept at lower levels throughout the dry cleaning establishment by the use of equipment such as carbon adsorbers and proper ventilation techniques. Utilization of protective equipment will minimize the possibility of adverse side effects.

personnel selection

No one should be permitted to work in an area where a health hazard from exposure to perchloroethylene exists. Particular attention should be paid to individuals who are alcoholics, or who have diseases of the liver, kidney, or the nervous system. Their condition may be aggravated from perchloroethylene exposure.

If such individuals are already employed and any doubt exists concerning the degree of potentially hazardous exposure, periodic medical examinations are advisable. Any apparent deterioration in health should be the basis for either a temporary or permanent transfer to work involving reduced exposure to perc, based on the advice of a physician.

employee training

Safety in handling perchloroethylene requires instruction of employees. This is the responsibility of the plant owner. New employees should be thoroughly instructed and required to read available printed material on safe handling.

They should be shown how to perform their duties with minimum exposure. They should be cautioned not to remove perchloroethylene from the plant for personal uses.

Each employee should know the location of drinking fountains, faucets, or eyewash stations for flushing the eyes, and should be trained to report any suspected equipment leaks, signs of illness, or skin irritations.

Each employee should know what to do in an emergency and understand the importance of prompt administration of first aid in any overexposure.

Plant owners and managers may use this dry cleaning solvent booklet as part of their safety training program for employees.

An up-to-date Material Safety Data Sheet (MSDS) and container labels for perchloroethylene must be available and explained to exposed employees. A copy of the MSDS must be submitted to the local emergency planning committee, the state emergency response committee, and the local fire department.

Additional booklets for distribution to your employees are available from HSIA, many local solvent distributors and suppliers, and your dry cleaning trade association.

prevention and control of potential hazards

spills and leakage

Spills should be reported immediately by any employee observing them, but should be cleaned up only by employees properly equipped and instructed in safe procedures. Start as much air-flow through the spill area as possible without having vapors spread to other parts of the establishment. Each dry cleaning facility should develop an emergency spill clean-up plan so controls and ventilation procedures can be immediately implemented. In some states, formal emergency response plans are required under state right-to-know laws. Facilities must notify the local emergency planning committee and the state emergency response commission if there is a release of perchloroethylene that exceeds the reportable quantity.

The National Fire Protection Association standards for perc plants require manually operated emergency ventilation for spills or leaks so as to provide a complete air change every 5 minutes within 15 feet of the dry cleaning equipment.

A trained person, familiar with spill clean-up procedures and wearing gloves and a respirator approved for use with organic vapors, should throw a blanket, clothes, or rags over the spill to absorb solvent and to reduce the surface area available for evaporation.

The blankets, rags, and clothes should be thrown into an empty tumbler and the door closed. Continue cleaning until all liquid solvent has been picked up and the floor is dry. **Never stay in an area if the odor of perchloroethylene is detected through the respiratory protective equipment.** Leave the area immediately and use a new mask or fresh cartridges before re-entering.

A "buddy" system is imperative when cleaning up a spill. A back-up person, also wearing a respirator, should be standing by outside of the spill area, ready to assist immediately if the clean-up person is overcome.

In the case of a boil-over of a cooker or still, immediately leave the area until a respirator is worn. Turn off the steam line to the still or cooker from a remote location if possible. If it is not already on, start the cooling water through the coils.

storage, transfer, and disposal of solvent

Drums of perchloroethylene should be kept closed to avoid evaporation. They should be stored under cover to prevent rusting and should not be exposed to extreme heat or cold. Solvent should be transferred from a properly vented drum to the dry cleaning machine by pumping through piping connected directly to the small opening of the drum. Transferring by hand, using open buckets, should be avoided because of the possibility of overexposure to vapors. Disposal of all waste material and contaminated filters and equipment must be conducted in accordance with all applicable federal, state, and local health and environmental regulations. Follow all warnings on the container label.

BIBLIOGRAPHY

Brown, D.P., and Kaplan; S.D., Retrospective Cohort Mortality Study of Drycleaner Workers Using Perchloroethylene, J. Occup. Med. 29 (6):535-541 (1987).

Carpenter, C.P., The Chronic Toxicity of Tetrachloroethylene, J. Ind. Hyg.: 323-336 (1937).

Clayton, G.D., and Clayton, F.E., Patty's Industrial Hygiene and Toxicology, Third Edition, Vol. 2B, Wiley-Interscience Publishing Co., New York (1982).

Coler, H.R., and Rossmiller; H.R., Tetrachloroethylene Exposure in Small Industry, Arch. Ind. Hyg. and Occ. Med. 8:227-233 (1953).

Environmental Protection Agency, Health Assessment Document for Tetrachloroethylene (Perchloroethylene), Final Report (EPA/600/8-83/005F), Office of Health and Environmental Assessment, Washington, D.C. (1985).

Gosselin, R.E., Smith, R.P., and Hodge, H.C., Clinical Toxicology of Commercial Products, Fifth Edition, Williams and Wilkins Co., Baltimore (1984).

Meckler, L.C., and Phelps, D.K., Liver Diseases Secondary to Tetrachloroethylene Exposure: A Case Report, JAMA 197:622-663 (1963).

National Automatic Laundry and Cleaning Council, Facts about Perchloroethylene: A Solvent Used in Coin-Operated Commercial Drycleaning, Chicago, IL (1962).

National Toxicology Program (NTP), Technical Report on the Toxicology and Carcinogenesis Studies of Tetrachloroethylene (Perchloroethylene) in F344/N Rats and B6C3F1 Mice, NTP Board Draft, August, TR-311 (1985).

Rampy, L.W., Quast, J.F., Leong, B.K.J., and Gehring, P.J., Results of Long-Term Inhalation Toxicity Studies on Rats of 1,1,1-Trichloroethane and Perchloroethylene Formulations, Proceedings of the First International Conference on Toxicology: Toxicology as a Predictive Science, G.L. Plaa and W.A.M. Duncan, Editors, Academic Press, New York (1978).

Rowe, V.K., McCollister, D.D, Spencer, H.D., Adams, E.M., and Irish, D.D., Vapor Toxicity of Tetrachloroethylene for Laboratory Animals and Human Subjects, Arch. Ind. Hyg. and Occ. Med. 5:566-579 (1952).

Schwetz, B.A.. Leong, B.K.J., and Gehring, P.G., The Effect of Maternally Inhaled Trichloroethylene, Perchloroethylene, Methyl Chloroform, and Methylene Chloride on Embryonal and Fetal Development in Mice and Rats, Tox. and Appl. Pharm. 32:84-96 (1975).

Stewart, R.D., Gay, H.H., Erley, D.S., Hake, C.L., and Schaffer, A.W., Human Exposure to Tetrachloroethylene Vapor, Arch. Environ. Health 2:516-522 (1961).

Stewart, R.D., and Erley, D.S., Detection of Toxic Compounds in Humans and Animals by Rapid Infrared Techniques, J. Forensic Sciences 8:31-44 (1963).

Stewart, R.D., Dodd, H.C., Erley, D.S., and Holder, B.B., Diagnosis of Solvent Poisoning, JAMA 193:1097-1100 (1965).

Stewart, R.D., and Dodd, H.C., Absorption of Carbon Tetrachloride, Trichloroethylene, Methylene Chloride, and 1,1,1-Trichloroethane Through the Human Skin, J. Amer. Ind. Hyg. Assn. 25:439-466 (1964).

Stewart, R.D., Erley, D.S., Schaffer, A.W., and Gay, H.H., Accidental Vapor Exposure to Anesthetic Concentrations of a Solvent Containing Tetrachloroethylene, Ind. Med. and Surgery 30:327-330 (1961).

The Dow Chemical Company, Subjective Responses to Perchloroethylene, Trichloroethylene and 1,1,1-Trichloroethane, pp. 6-7 (1961).

APPENDIX D

GC/MS VOLATILES ORGANIC ANALYSIS REPORT

Sample No: 9101718 Batch No.: VM#46

Station: CRYSTAL Sample ID: YAKIMA Date Sampled: 09-10-91
Project: B40162 Inst. ID: 4500C Matrix: WATER
Amount: 5.0 ML Dilution: 1.0 % Solids: 0.00

Priority Pollutants	Wet DL (ppb)	Wet Conc (ppb)
CHLOROMETHANE	2.00	ND
VINYLCHLORIDE	2.00	ND
BROMOMETHANE	2.00	ND
CHLOROETHANE	2.00	ND
TRICHLOROFLUOROMETHANE	2.00	ND
ACROLEIN	10.00	ND
1,1-DICHLOROETHYLENE	2.00	ND
METHYLENE CHLORIDE	10.00	ND
ACRYLONITRILE	10.00	ND
TRANS-1,2-DICHLOROETHYLENE	2.00	ND
1,1-DICHLOROETHANE	2.00	ND
CHLOROFORM	2.00	11.00
1,1,1-TRICHLOROETHANE	2.00	ND
CARBON TETRACHLORIDE	2.00	ND
BENZENE	2.00	ND
1,2-DICHLOROETHANE	2.00	ND
1,1,2-TRICHLOROETHYLENE	2.00	ND
1,2-DICHLOROPROPANE	2.00	ND
BROMODICHLOROMETHANE	2.00	ND
2-CHLOROETHYLVINYLETHER	2.00	ND
TRANS-1,3-DICHLOROPROPENE	2.00	ND
TOLUENE	2.00	7.80
CIS-1,3-DICHLOROPROPENE	2.00	ND
1,1,2-TRICHLOROETHANE	2.00	ND
TETRACHLOROETHYLENE	2.00	9.10
CHLORODIBROMOMETHANE	2.00	ND
CHLOROBENZENE	2.00	ND
ETHYL BENZENE	2.00	5.50
BROMOFORM	2.00	ND
1,1,2,2-TETRACHLOROETHANE	2.00	ND
Additional Compounds	**Wet DL (ppb)**	**Wet Conc (ppb)**
ACETONE	10.00	28.00
CARBON DISULFIDE	2.00	ND
VINYL ACETATE	10.00	ND
2-BUTANONE (MEK)	10.00	5.40
4-METHYL-2-PENTANONE (MIBK)	10.00	ND
2-HEXANONE	10.00	ND
TOTAL XYLENE	2.00	54.00
STYRENE	2.00	ND

Note - DL means Sample Detection Limits (based on 100% recovery).
NA means Not Analyzed, ND means Not Detected.

GC/MS VOLATILES ORGANIC ANALYSIS REPORT

Sample No: 9101601 Batch No.: VM#43

Station: Sample ID: Date Sampled: 8-14-91
Project: Inst. ID: 4500C Matrix: WASTEWATER
Amount: 5.0 ML Dilution: 5.0 % Solids: 0.00

Priority Pollutants	Wet DL (ppb)	Wet Conc (ppb)
CHLOROMETHANE	10.00	ND
VINYLCHLORIDE	10.00	ND
BROMOMETHANE	10.00	ND
CHLOROETHANE	10.00	ND
TRICHLOROFLUOROMETHANE	10.00	ND
ACROLEIN	50.00	ND
1,1-DICHLOROETHYLENE	10.00	ND
METHYLENE CHLORIDE	50.00	ND
ACRYLONITRILE	50.00	ND
TRANS-1,2-DICHLOROETHYLENE	10.00	ND
1,1-DICHLOROETHANE	10.00	ND
CHLOROFORM	10.00	41.00
1,1,1-TRICHLOROETHANE	10.00	ND
CARBON TETRACHLORIDE	10.00	ND
BENZENE	10.00	ND
1,2-DICHLOROETHANE	10.00	ND
1,1,2-TRICHLOROETHYLENE	10.00	ND
1,2-DICHLOROPROPANE	10.00	ND
BROMODICHLOROMETHANE	10.00	ND
2-CHLOROETHYLVINYLETHER	10.00	ND
TRANS-1,3-DICHLOROPROPENE	10.00	ND
TOLUENE	10.00	14.00
CIS-1,3-DICHLOROPROPENE	10.00	ND
1,1,2-TRICHLOROETHANE	10.00	ND
TETRACHLOROETHYLENE	10.00	5.90
CHLORODIBROMOMETHANE	10.00	ND
CHLOROBENZENE	10.00	ND
ETHYL BENZENE	10.00	13.00
BROMOFORM	10.00	ND
1,1,2,2-TETRACHLOROETHANE	10.00	ND
Additional Compounds	**Wet DL (ppb)**	**Wet Conc (ppb)**
ACETONE	50.00	590.00
CARBON DISULFIDE	10.00	ND
VINYL ACETATE	50.00	ND
2-BUTANONE (MEK)	50.00	ND
4-METHYL-2-PENTANONE (MIBK)	50.00	ND
2-HEXANONE	50.00	ND
TOTAL XYLENE	10.00	91.00
STYRENE	10.00	ND

Note - DL means Sample Detection Limits (based on 100% recovery).
NA means Not Analyzed, ND means Not Detected.

APPENDIX E

APPENDIX E
APPLICATION FOR AUTHORIZATION TO USE

Report Review and Former Property Use Assessment
Crest Linen Property
200-210 North 1st Street
Yakima, Washington

TO: Kleinfelder, Inc.
1200 N.E. 112th Street
Suite C-226
Bellevue, Washington 98004

FROM:

(Please clearly identify name and address of persons/entity applying for permission to use or copy this document)

Gentlemen:
Applicant _____ hereby applies for permission to: (State here the use(s) contemplated)

for the purpose(s) of:
(State here why you wish to do what is contemplated as set forth above)

Applicant understands and agrees that the Report Review and Former Property Use Assessment, 200-210 North 1st Street, Yakima, Washington is a copyrighted document, that Kleinfelder, Inc. is the copyright owner and that unauthorized use or copying of said document is strictly prohibited without the express written permission of Kleinfelder, Inc. Applicant understands that Kleinfelder, Inc. may withhold such permission at its sole discretion, or grant such permission upon such terms and conditions as it deems acceptable, such as the payment of a re-use fee.

Date:_____ _____
Applicant

by_____
Name

_____
Title

