Section 6.0

Consultation

Section 6.0 Consultation

6.1 Introduction

According to The Nova Scotia Department of Environment and Labour's **Proponent Guide to Environmental Assessment,** February 2001, there are no specific guidelines for the conduct of consultation programs related to a proposed undertaking. Of note is the commentary; "Proponents are not required to involve the public during the pre-registration stage … Proponents can chose to involve the public early in the project planning stage to inform them about the development." (Page 9)

In view of its long standing relationship with the local communities and its civic leaders, Envirosoil Limited and its parent company, the Municipal Group of Companies has chosen to proactively engage in dialogue with the aforementioned individuals. We note that the nearby Tidewater Operation of the Municipal Group of Companies has a Community Liaison Committee (CLC) and thus maintains dialogue with the nearby communities. The intent of proactively engaging in dialogue with regard to the proposed PERC operations of Envirosoil is consistent with the 'open line of communications' the company has established.

The consultation planning and program related to the proposed PERC operation of Envirosoil commenced in November, 2002. It consisted of the following activities:

- *Refinement of the preliminary plans of Envirosoil related to PERC:* An initial project plan was developed such that refinements could be considered and possibly accommodated by way of dialogue with the community and leaders.
- *Defining of the key stakeholders:* This included a review of previous stakeholders contacted as part of the 1996 consultation related to the testing of equipment for PAH's. At this time, the Department of Environment requested that the company conduct a public consultation. Some of these groups have changed in identity and composition.
- *Property owners:* The adjacent property owner(s) to Envirosoil is the Municipal Group of Companies. This is actually the parent company of Envirosoil. Envirosoil is located within the Municipal quarry. From the center of the Envirosoil site the nearest private home owners would be approximately 1.1 kilometers directly. These homes are in the direction of least prevailing winds. (See Appendix H) These owners will be informed by way of public notice of this undertaking in local newspaper(s).
- *Scheduling of meeting:* This included contingencies for additional meetings that could be recommended by some of the stakeholder groups.

- *Preparation of presentation materials:* This included a formal overhead presentation suitable for meetings. Also, this included preparation of a one page hand-out.

At the time of the filing of this Registration Document, the preliminary consultation program is now complete. However, the company looks forward to additional information requests through the formal registration period. Additionally, it looks forward to following through with the activation and ensuing dialogue through its Envirosoil PERC related Community Liaison Committee (CLC). Envirosoil formally requests that this commitment to a CLC be noted as a stipulation to the permit as per the proposed terms of operation. (See Section 6.6 of this document.)

6.2 Purpose of the Consultation

The purpose of the consultation was several fold: To provide individuals of notice and information about the undertaking, to promote dialogue with these individuals and organizations, to learn of issues and concerns, and attempt to satisfy or mitigate these concerns by way of provision of more detailed information or the changing of project plans

6.3 Method of Consultation

The consultation approach initially commenced with elected persons whose constituencies are in or near to the Envirosoil site. This is a useful contact in that elected representatives are sometimes contacted by their constituents and are expected to be knowledgeable about local projects. Thereafter, we contacted a number of local civic leaders.

Individuals were first contacted by telephone, given an initial project briefing, followed with a request for meeting. Meetings were set-up and participants include representatives of William Alexander and Associates Limited and/or Envirosoil.

Individuals were provided with an initial briefing of the company and the intent of the PERC filing. Also, individuals were left with the attached Q&A sheet relating to the company and the PERC project. (See Appendix J: Handout: Envirosoil and PERC)

If we were unable to answer a specific question we either (a); contacted the appropriate representative of the Envirosoil consulting team to provide the answer, or (b) sent additional information (via email or mail) to the individual.

6.4 Issues, Raised Responses, Suggestions & Commitments

Envirosoil has noted and been able to provide responses to a number of questions.

→ *Issue:* What is the rational for the treatment of PERC by Envirosoil?
Response: The identification of PERC as a contaminant has only recently occurred. There are an increasing number of sites within Halifax Regional Municipality and Nova Scotia that have been identified as PERC contaminated and in need of remediation.

→ *Issue:* What is being currently done with PERC contaminated soils?
Response: Some of the sites are being abandoned or held in abeyance until there is a remediation option within the province. In other cases, the material is being sent to landfills or incineration equipment in Ontario or Quebec. In other cases contaminated soil is being 'managed' at the effected site.

→ *Issue:* What is the background of Envirosoil and its relationship to its parent company, The Municipal Group of Companies.
Response: Envirosoil was established in 1992 and is a part of the Municipal Group of Companies. The Municipal Group of Companies is a Nova Scotia company and is a large quarrying, construction, and resource company with more than 1,000 employees

→ *Issue:* What is the permitting history of Envirosoil and has there been any breaches of its permits or regulations?
Response: The Company was first permitted in 1992 as a bio-remediation facility. Through a series of amendments to permits, it has evolved into a soil remediation facility using the Low Temperature Thermal Desorption process. It has successfully operated within its permit designations and regulations.

→ *Issue:* What is the difference between bioremediation and LTTD?
Response: Bioremediation is a biological process that has limitations with respect to the type of petroleum hydrocarbon present, as well as the treatment standards to be achieved. Our experience has been that 50 – 90% of the total contaminant present at the start, can be removed through bioremediation. The degree of success will depend on the molecular weights of the petroleum hydrocarbons but, in all cases, the possibility of treating to 100 ppm is very poor. The LTTD process will easily remove all the contaminant leaving a clean soil that is acceptable for any re-use. Unlike bioremediation, LTTD treatment allows full recycling of the soil. The LTTD process separates the contaminants from the soil in the primary treatment phase. Temperatures in excess of the contaminant boiling points, but lower than their auto-ignition

temperatures which would cause them to ignite, are used. The second phase of the treatment process uses higher temperatures to combust the contaminants, resulting in a chemical conversion of the petroleum hydrocarbons (in the case of hydro-carbon contaminated soils) to carbon dioxide and water vapour.

→ *Issue:* What are the types of materials treated at the site and the particular treatment process for each material?

Response: The company treats several types of contaminated soils. These are TPH's and PAH's. The handling and treatment process slightly varies for each one of these however, the basis is the Low Temperature Thermal Desorption process. The company also treats drilling muds from the offshore oil and gas industry. These are blended with soil and thus treated as a contaminated soil.

→ *Issue:* What is the normal use of these materials prior to their need for remediation.

Response: TPH' refers to such hydrocarbons as gasoline, diesels and similar fuels. PAH's refers to such items as coal or coal tar. Drilling muds are used in the offshore oil and gas industry as a down-hole lubricant and pressure control mechanism. In some cases, these drilling muds contain hydrocarbons.

→ *Issue:* What is the process of determining the need for treatment of impact soils including the measurement process and criteria.

Response: Contaminated sites are tested for PERC prior to these soils being removed and trucked to Envirosoil. This testing is done by an independent laboratory.

→ *Issue:* What is the general location in Nova Scotia of sources of PERC contaminated soils?

Response: There are a number of contaminated sites in metro. Others have been identified in Truro and Bridgewater. It is expected that other sites will be identified at some point in the future.

→ *Issue:* What is the alternate methods of treating or disposing of these impacted soils?

Response: The options are to bio-remediate, to leave a site as-is, or to ship material for treatment to Ontario or Quebec.

→ *Issue:* What is the background of the increased need to treat soils within Nova Scotia and HRM?

Response: Bank and purchasers of property are increasingly demanding analysis of soils at site. This is prior to construction or sale. Sites are now being identified as contaminated.

→ *Issue:* What is the management program for impact soils at the Envirosoil site commencing at the time of arrival?

Response: The trucking manifest is checked to ensure the specification of the load. The material is then directed to a designated control section of the clay-line/ water monitored site at the Envirosoil site. Then, the soils are scheduled for treatment by the LTTD unit.

→ *Issue:* How is PERC soil stored?

Response: Soil stored on the Envirosoil site is contained and discharges from the site are monitored. The entire site is constructed above an 18-inch clay liner. All runoff from the soil storage piles is directed to a collecting pond, which is also contained by the clay liner.

→ *Issue:* What is the post-treatment uses of the soils?

Response: Following treatment by the LTTD unit the soils are used for re-claimation in the quarry.

→ *Issue:* What is the nature of the Environmental Registration Process for this application. This includes the options for review.

Response: This is a Class 1 Registration and ultimately the decision of the Minister of Environment and Labour. The Minster can approve the project, can turn it down, request more information, or recommend that it be given a higher level of environmental evaluation.

→ *Issues:* What is the direction of the prevailing winds in relation to the Envirosoil facility?

Response: Prevailing winds are in a northeasterly direction towards Waverley.

→ *Issues:* Are there side effects to the LTTD process that would be of concern to the Waverley community?

Response: There are no harmful air emissions from the PERC process. The soil exiting the plant will meet the quality criteria defined by the Canadian Council of Ministers of the Environment. All contaminants are first removed from the soil in what is called the Primary Treatment Unit (PTU). The contaminants, that make up less than 1.5% of the total volume of soil, are then treated in the Secondary Treatment Unit (STU). It is in the STU that the contaminants are chemically converted (using higher temperatures) to carbon dioxide and water vapour.

→ *Issues:* How can Envirosoil implement a meaningful monitoring process that would create a good relationship with the community?

Response: Envirosoil's agrees with the value of a Community Liaison Committee (CLC) in terms of PERC operation. This is a commitment as part of the process of Registration for the project. Envirosoil's operating policies emphasize the protection and safety of its employees, the community, the environment and its reputation.

→ Issue: What are the inputs into the registration and the timing of preparation and review.

Response: The inputs are public consultation, technical information related to the performance of the LTTD for PERC, and environmental considerations related to the local environment and any possible effects.

→ *Issue:* What is the future of the company regarding treatment of other types of contaminants.

Response: The company will go through the necessary requirements of the NSDEL for any other approvals.

→ *Issue:* What is the identity of the independent environmental consultants for Envirosoil.

Response: Envirosoil has hired two firms to assist it with this registration. Both are Nova Scotia firms; William Alexander and Associates Limited to handle the consultation and regulatory liaison, and Jacques Whitford to provided advice regarding the environmental aspects.

→ *Issue:* What is the nature of air emissions at testing (1997) and operations since that time and the process for that related to PERC.

Response: The equipment was not specifically tested for PERC in the 1997 test evaluation by the Department of Environment. However, this was a considerable test with other similar contaminants and there performance is transferable. There are a number of case studies of the same equipment on PERC.

→ *Issue:* What is the nature of the ground and surface water monitoring program at the site, including type of testing, frequency of collection and frequency of data analysis.

Response: The main quarry has long had an extensive water monitoring system, this designed to NSDEL specification. Related to the Envirosoil site within the quarry, there is particular testing on a monthly basis related to TPH's, PAH's and will be for PERC and its daughter products.

→ *Issue:* What is the nature of trucking at the site and the impact that PERC may have on future trucking requirements to the Envirosoil site?

Response: Currently there are approximate ten trucks per day related to the Envirosoil operation. It is estimated that the requirement for the PERC component of the operation would be an additional two trucks per day.

→ *Issue:* What is the employment at the site and the levels of employment should there be a PERC approval.

Response: Currently the operation has three full time employees and eight part-time employees. The addition of PERC would add marginally to the employment roster.

6.5 Organizations and Individuals Contacted

The following represents those organizations and/or individuals consulted with respect to the environmental registration for PERC. Some of the below listed individuals have been contacted on more than one occasion. Below is identified the background of the organizations/individuals contacted and their key issues and comments. Additional questions and information are outlined in Section 6.4.

- *Peter Christie MLA*: Envirosoil is located in Bedford/Fall River/Waverley. The Member of Legislature (MLA), Honorable Christie was first contacted and met with on November 25, 2002 with respect to the intended registration for the PERC process at Envirosoil. We have provided regular updates to Minister Christie with respect to the preparatory work for the Environmental Registration and in particular the contact with other civic leaders. Minister Christie was contacted as part of the 1996 consultation related to the test program for the LTTD equipment. He is a former Mayor of Bedford.
  Key Issues and Comments: Minister Christie commented on the industrial nature of the surrounding setting and the longstanding reputation of the Municipal Group of Companies. He suggested that the Waverley Rate Payers Group be contacted and briefed on the project. Minister Christie was encouraging of a broad consultation for this project and the suggestion of inclusion of the local public. He was provided with a definition of the term PERC and its usage and the general process of treatment by LTTD. This included reference to the use of a lime scrubber. He wished to be kept appraised of the progress for the filing and the intended date for filing. He was provided with a backgrounder hand-out as shown in Appendix J.
- *Mayor Peter Kelly:* Mayor Kelly is the Mayor of Halifax Regional Municipality (HRM). He is a past Mayor of the Town of Bedford and was consulted in the 1996 consultation related to the testing of the LTTD unit. At that time, he was a City

Councilor representing Bedford on the then newly amalgamated HRM Council. HRM Mayor Kelly toured the Envirosoil site in Spring of 2002. With respect to Envirosoil and the intended PERC operation we met with the Mayor on November 22, 2002. In the interim, we have provided a number of verbal updates to him.
Issues and Comments: The Mayor wanted to ensure that a number of civic leaders in the area were fully appraised of the proposed undertaking. He has a strong focus on the consultative aspects of the preparation for this environmental registration. He is concerned about the need to remediate sites that are currently contaminated within HRM. This is a need to remediate without resorting to exporting and trucking out of the province. The HRM Mayor advised of the need to brief HRM environmental officials on this project. This briefing was made to HRM environmental officials as noted below.

- *Councilor Gary Hines:* Envirosoil is located in the HRM constituency held by Councilor Hines. Councilor Hines toured the Envirosoil facility in the Spring of 2002. With respect to PERC, the first meeting with the Councilor occurred on November 13, 2002. The company and its consultants have regularly updated the Councilor. This in particular with respect to the progress on the proposed Community Liaison Committee (CLC).
  Issue and Comments: Councilor Hines suggested that we make contact with the Waverley Rate Payers Group. Prior to amalgamation of the Halifax Regional Municipality, Waverley was an incorporated Village. The Rate Payers Association has recently assumed some of the duties of the Village. Waverley was contacted in the 1996 consultation for Envirosoil. Another entity is Preserve Our Waters Group (POW) and it has a number of resource persons. This includes Dr. Wayne Stobo. Councilor Hines stated the need to brief him and get him to the site for detailed presentation. Air emissions were discussed with the Councilor and in particular the prevailing wind direction. Hand-out material was provided to the Councilor as noted in Appendix J.

- *Councilor Len Goucher:* Councilor Len Goucher is the HRM Councilor for Bedford. While the Envirosoil site is not located in his constituency, a part of the Municipal Group of Companies lands are located in the northern part of his riding. Councilor Goucher toured the Envirosoil site in spring of 2002. We met with Councilor Goucher on November 26th, 2002 at HRM City Hall. In the intervening period, we have met several times to provide updates and in particular discuss progress with the Community Liaison Committee and the possible composition of this CLC.
  Issues and Comments: The Envirosoil site was recognized as being in a large industrial setting with long standing industrial use. The closest residents are approximately one kilometer away and are technically located in the northern part of his Bedford constituency. The Councilor pointed out the need to have some form of community inclusion from the Bedford area. This is certainly the case with respect to the CLC. Councilor Goucher has provided some recommendations as to composition of the proposed CLC. The Councilor wanted to be kept appraised of the progress and intended timing of filing. Handout materials were provided to Councilor Goucher, as noted in Appendix J.

- *Mr. Bill Lockhart:* Mr. Lockhart is a long time resident of the Waverley area and has been active in community issues. He is the past Chairman of the Waverley District HRM Planning Association. He is also Chairman of the Waverley Rate Payers Association with its eight person elected Board. He was contacted as part of the 1996 consultation associated with the testing of the LTTD unit. Over the past several months, a number of meetings (including one group meeting at the boardroom of Envirosoil) have been held with Mr. Lockhart, and with fellow Waverley resident, Dr. Wayne Stobo.
  Issues and Comments: The Municipal Group of Companies was noted as having quite good relations with himself and other local civic groups. Mr. Lockhart is a member of the Community Liaison Committee of the Tidewater Quarry project in Waverley that is now owned by the Municipal Group of Companies. The company was viewed as being quite forth coming with information and interested in the local community. Specific comments with respect to the proposed PERC operation of Envirosoil relate to the possibility of truck traffic increase, possible stack emissions and impact of run-off into local waterways if not properly mitigated. At the various meetings with Mr. Lockhart, Envirosoil was able to provide responses to these matters. Mr. Lockhart wanted to meet with the General Manager of Envirosoil, Mr. Dan Monk, and attend with Dr. Wayne Stobo also of the local area. This group meeting was held on December 12th, 2002 at Envirosoil. Of particular concern were the resources available by government authorities to properly monitor the PERC operation at Envirosoil. As a means to address this, the concept of a Community Liaison Committee was raised at this meeting and tabled for further review by Envirosoil. In the interim, representatives of the company have communicated acceptance of this concept and sought recommendations as to the composition of the group.

- *Mr. John Sibbard*: Pollution Prevention Coordinator HRM and Mr. Chris Major, Pollution Prevention HRM. At the suggestion of HRM Mayor Peter Kelly, Envirosoil and its consultants contacted the Pollution Prevention Division of HRM. A formal presentation was made December 3, 2002 to these two aforementioned HRM representatives.
  Issues and Comments: Whilst having a general interest in the project, HRM Pollution Prevention was specifically interested in the subject of any possibility of un-mitigated water run-off from the site. HRM does regulate the discharge of water into ditches, culverts and related water control mechanisms. Since Envirosoil has no intention of any discharges of hydrocarbon, sludge, or liquid waste, then HRM Pollution Prevention Division has no specific regulatory authority over this PERC application. The nature of the surface and groundwater control system at the Envirosoil was detailed for these two HRM officials. In closing, these individuals indicated that they, at the moment, have no specific issues or concerns related to the proposed Envirosoil operation as it relates to treatment of PERC contaminated soils.

- *Mr. Geoff Regan MP:* Envirosoil is located in the Federal Constituency Riding (Halifax West) of Mr. Regan. This includes all lands of the Municipal Group of

Companies and the 13 acre site of Envirosoil located within. It is noted that in the various preceding applications for regulatory approval, and this upcoming one for PERC there has been no federal jurisdictional review. We note that Mr. Regan was contacted in 1996 as part of the consultation program related to test of the LTTD equipment. At that time he was also a Member of Parliament MP for Halifax West constituency.
Issues and Comments: The nature of the emissions from the operation were discussed. The indication was that the emissions would be in the form of water vapor. The role of the LTTD is to separate components and with the addition of a lime scrubber to remove any chlorinated substances. The resulting soil would meet the standards established by the Canada Councilor Ministers of the Environment (CCME). The direction of prevailing winds was also discussed in the form of any possibility that emissions would go over Ridgevale Subdivision. It was noted that the prevailing direction is mostly southwest during the operational period for the equipment of May to November. Mr. Regan inquired as to the nature of the regulatory process. This was commented as a Provincial Class 1 Filing with little likelihood of Federal Review involved. Mr. Regan was provided with the one page summary sheet as per Appendix J.

- *Dr. Wayne Stobo:* Dr. Stobo is a member of the Waverley Water Advisory Group and the Preserve Our Waters group (POW). He has been a long standing member of the Waverley community and an active on community issues related to the environment. He was contacted during the 1996 round of consultations prior to the testing of the LTTD equipment. Representatives of Envirosoil first contact Dr. Stobo in November 2002. This was in relation to the proposed application of the company for treatment of PERC contaminated soils. Dr. Stobo and Mr. Bill Lockhart (aforementioned) agreed to participate in project briefing and discussion at Envirosoil, December 12, 2001. It is noted that company representatives have followed up on several occasions following this meeting. This follow up related to the agreement of Envirosoil to have a Community Liaison Committee as well as recommendations for members of the CLC.
  Issues and Comments: Dr. Stobo was concerned about a number of issues related to the proposed project. These were; nature of the treatment process, composition of soil once treated after exit from the LTTD equipment in particular the subject of CaCl, control process for stack emissions, role of regulatory authorities once equipment is operational, and mechanism for community involvement. Information was provided with respect to the above matters especially related to the technical operation of the facility and handling of soil prior to and after treatment. Central to these issues was community confidence that the processes are operating to specification. This would be over and above the role of regulatory authorities. The concept of a Community Liaison Committee was discussed as a means to address this concern, and it was agreed that management of Envirosoil would review this suggestion. In the interim, the concept has been accepted by Envirosoil. Additional follow-up has occurred with Dr. Stobo related to this CLC and composition of the group.

- *Soil Remediation Consultants:* We contact Mr. Scott Conrod, Manager of Environmental Services who works with Neil and Gunter, a regional engineering company with their head office located in Halifax. He works in the specialty field of environmental science and soil remediation. We interviewed Mr. Conrod on February 10, 2002.
  Issues and Comments: He viewed the potential of PERC contaminated soil treatment facility as a positive for the local HRM area. He viewed this as needed in the region and noted that in USA there is an increasing demand and subsequent supplier response to have these types of contaminated soils treated by LTTD process. In terms of suggestion for this specific project, he felt that there is a need to ensure that there is 'good science' detailing the mitigations to eliminate potential run-off of contaminants into the local waterways.
  We also contacted Mr. Robert Bekkers, Project Geologist associated with Maritime Testing an environmental testing firm in the province. We consulted with Mr. Bekkers on the need or lack of need for PERC treatment facilities by LTTD process.
  Issues and Comments: He indicated that the treatment is difficult to locally find PERC contaminated soils. He wanted to know what type of testing has been carried out to validate the LTTD process and its ability regarding PERC contaminated soils.

6.6 Commitments and Undertaking Resulting From Consultations

6.6.1 General Commitment

Envirosoil has established itself as willing to proactively communicate with elected and civic leaders in the neighboring areas of its Rock Lake operation. This is evidenced by way of the consultation it undertook in Fall of 1996 re its Department of Environment filing for testing of LTTD equipment.

In the case of this Registration Document, it believes that it has again followed its commitment to openly communicate with elected and civic leaders of the area. The company has committed to an 'open line of communication' for all its future activities.

6.6.2 Specific Commitments

The company has gone a significant step further by agreeing to establish a Community Liaison Commitment (for PERC) as per the published guidelines from the Department of Environment and Labour NSDEL. (See Appendix K: Guidelines for Community Liaison Committee.)

This commitment follows from a meeting held between Envirosoil officials, their consultants and Mr. Bill Lockhart (Waverley Rate Payers Association) and Dr. Wayne Stobo (Waverley Rate Payers Association). Further, it follows from discussions with elected and other civic representatives. Several concerns were expressed at the meeting, as follows:

- There was concern that government regulatory agencies may not have the full resources available at this time to monitor the success of the treatment of PERC at the Envirosoil site.
- There was concern that the local community would need a formal channel to observe and review the performance of the equipment, again related to PERC.
- It was felt that the community could provide valuable input into monitoring the equipment and its performance related to PERC.

As a result, the meeting concluded with a recommendation from the community representatives that a Community Liaison Committee be formed as it relates to Envirosoil and its newly proposed PERC operation through the LTTD equipment.

Envirosoil has agreed with this recommendation and has communicated this to the aforementioned community leaders. By way of this document, the company communicates its desire to have the CLC be part of the stipulations to the Environmental Permit for this project.

The following are proposed as the terms of the Community Liaison Committee:

- *General Scope:* Scope of work would relate to Envirosoil. Further, this scope would address the PERC operation only of the company.
- *Specific Focus:* With respect to PERC operations the CLC would review matters related to; safe storage and acceptance of materials at site, surface and ground water monitoring related thereto, performance of the LTTD equipment and specific indices (temperature, liming, etc) including review of real time data related thereto, and handling and disposal of treated soils as it relates to the Envirosoil site. All other aspects of the CLC, as noted in the attached NSDEL Guideline (see Appendix K) would be applicable.
- *Timing:* The CLC would first meet within one month following the issue of the industrial/operational permit for the PERC operation at Envirosoil. Thereafter, the CLC would meet on a semi-annual basis.
- *Composition of the CLC:* The CLC would be formed as per the NSDEL Guidelines. It is noted that a number of community residents have been approached as of the writing of the Registration Document. These include civic leaders/residents of the Waverley, Bedford, and Lakeview area. These individuals have in principal agreed to sit on this CLC.

Envirosoil is pleased to have received this recommendation. It has wholeheartedly accepted the recommendation and looks forward to working with this Community Liaison Committee.

Appendix A

Guide to PERC

Appendix A A Guide to PERC

November 1999

Perchloroethylene

White Paper

EXECUTIVE SUMMARY

Perchloroethylene, also known as tetrachloroethylene or perc, has been used safely in industry for over 50 years. It is an effective, nonflammable solvent that does not contribute to the formation of smog (ground-level ozone) or to the depletion of stratospheric ozone. The U.S. Environmental Protection Agency (EPA) has approved the use of perchloroethylene as a replacement for stratospheric ozone-depleting solvents. Perchloroethylene is one of nearly 200 substances listed as hazardous air pollutants under the federal Clean Air Act. EPA has developed technology-based emissions standards for drycleaning, degreasing, and other sources of the solvent.

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. The available epidemiology studies show no consistent link between exposure to perchloroethylene and an increased risk of cancer in humans.

It is nevertheless important that workplace activities and user operations continue to be carried out in such a way as to keep exposure and environmental release as low as is reasonably practicable. Compliance with applicable regulations, using engineering controls and work practices, will enable perchloroethylene to be used in a safe and environmentally sound manner.

INTRODUCTION

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 manufactured by the Dow Chemical Company, PPG Industries, Inc., and Vulcan Materials Company. Total U.S. demand for the chemical in 1998 was estimated to be about 344 million pounds (156,000 metric tons), of which about 30 million pounds (13,600 metric tons) were imported. An additional 40 million pounds (18,100 metric tons) were exported.

Perchloroethylene is the primary solvent used in commercial and industrial dry cleaning. Since being introduced to the drycleaning industry in the late 1930s, it has replaced most other solvents because of its relatively low toxicity and nonflammability. Its other major uses are as a metal cleaning and degreasing solvent, as a solvent in automotive aerosols, and as a chemical intermediate in the production of several fluorinated compounds.

USES

For 1998, the use of perchloroethylene can be broken down into the following categories:

chemical intermediate	50%
drycleaning/textile processing	25%
automotive aerosols	10%
metal cleaning/degreasing	10%
miscellaneous	5%

Chemical Intermediate

Perchloroethylene is used as a basic raw material in the manufacture of hydrofluorocarbon (HFC) 134a, a popular alternative to chlorofluorocarbon (CFC) refrigerants. It also is used in the synthesis of hydrochlorofluorocarbon (HCFC) 123 and 124 and HFC 125.

Drycleaning

Perchloroethylene is used by more than 80 percent of commercial dry cleaners, as well as some industrial cleaning 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; 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 repellents.

Automotive Aerosols

Perchloroethylene has replaced 1,1,1-trichloroethane in aerosol formulations for the automotive aftermarket, particularly for brake cleaning. These formulations provide auto repair shops with highly effective, nonflammable products.

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, when used in compliance with applicable regulatory requirements. Its low vapor pressure contributes to reduced emissions from cold 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 a component of chemical maskant formulations used to protect surfaces from chemical etchants used in the aerospace and other industries.

HEALTH EFFECTS

General

Under certain conditions, overexposure to perchloroethylene may cause central nervous system (CNS) and liver effects. 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 exposures (>600 ppm) these symptoms are intensified. Prolonged exposure to extremely high levels (>1,500 ppm) may lead to unconsciousness due to anesthesia and, in extreme cases, death from respiratory depression.

Changes in the liver and kidney of laboratory animals have been observed following prolonged exposure to concentrations of 200 ppm or more. In humans, reversible effects in liver function have been noted in persons exposed to high levels of perchloroethylene vapor for extended periods of time. No effects on the liver or kidney were seen in human volunteers exposed to up to 150 ppm, 7.5 hours per day, 5 days per week for 11 weeks. For occupational exposures, there are reports of mild alterations of liver or kidney function in a few studies, but other studies have found no detectable effect.

Genotoxicity

The ability of perchloroethylene and its major metabolites to cause mutations or other damage to genetic material has been tested in a very large number of studies. These include bacterial systems, cell preparations (animal and human) and whole animal (in vivo) tests. Overall, these tests are considered to show an absence of genotoxicity.

Developmental and Reproductive Toxicity

A number of studies have been conducted of the effects of perchloroethylene on mammalian fetal development. The results of these studies in a variety of species indicate that perchloroethylene is not likely to be teratogenic. On the basis of the available data, EPA has concluded that there is no evidence suggesting that the fetus is uniquely susceptible to the effects of perchloroethylene.

Exposure of female Sprague-Dawley rats and Swiss-Webster mice to 300 ppm of perchloroethylene during gestation led to mild fetotoxicity in the presence of maternal toxicity. However, studies in CD rats and rabbits with exposure of mothers before and during pregnancy showed no maternal toxicity or fetotoxicity at 500 ppm. A further study in rats and rabbits showed no teratogenic effect at dose levels of 100 and 500 ppm.

An inhalation study of Long-Evans hooded female rats exposed to 1,000 ppm of perchloroethylene prior to and during gestation found a significant reduction in body weight and an increased incidence of variations 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.

HSIA sponsored a multigeneration reproduction study in rats, which was reported in 1995. The study involved the exposure of groups of rats (Wistar-derived strain) to three dose levels of perchloroethylene prior to mating, through pregnancy, followed by exposure of the offspring through a second mating cycle. Parents and offspring in each generation were evaluated against control animals. Parental toxicity was apparent as reduced body-weight gain at the top dose level of 1,000 ppm and, to a lesser extent, at 300 ppm. The high dose also induced histopathological changes in the kidney. Offspring growth and survival were reduced at 1,000 ppm, at least partially mediated through parental toxicity, and offspring growth alone was marginally affected at 300 ppm. There were no effects on fertility at any dose level. The no-effect level for general parental and offspring toxicity was 100 ppm and for reproductive effects was 300 ppm.

Studies of fertility rates among wives of dry cleaning workers exposed to perchloroethylene found a slight increase in fertility in comparison with national averages and no increase in miscarriages. The fertility of female dry cleaning workers is also not affected although one report suggests that time to become pregnant might be somewhat longer.

Recently, the Health and Safety Executive (HSE) of the United Kingdom sponsored a study of spontaneous abortion (miscarriages) in a limited number of drycleaning workers. The study showed that, of the different types of workers, only those operating the cleaning equipment experienced a higher rate of miscarriage than the general population. The UK Department of Health concluded that the observed increase in miscarriages could not be attributed specifically to perchloroethylene. Previous studies have found physical activity, such as the lifting of clothes associated with operating drycleaning machinery, to be a risk factor for miscarriage.

Neurotoxicity

The major symptoms of acute overexposure to perchloroethylene are central nervous system effects typical of anesthesia, which generally disappear when the individual is removed from exposure. To test the potential for chronic (long-term) neurotoxic effects, HSIA sponsored testing in rats exposed to the solvent for up to 90 days. The techniques used in this study included sophisticated and sensitive neurophysiology plus extensive histopathology of the nervous system. The results showed no significant neurotoxicity after exposure to concentrations of up to 800 ppm, and established a no-observed-effect level of 200 ppm. While the HSIA study provides the most complete assessment of neurotoxicity, other studies have reported minor neurobehavioral effects in humans exposed to perchloroethylene. These studies are difficult to interpret, however, since the effects are small and the methodologies used have raised questions.

Carcinogenicity

Laboratory Animal Studies

Five studies of the carcinogenic potential of perchloroethylene in laboratory animals have been conducted. Three of the studies showed a significant increase in liver tumors in mice.

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, and 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.

In Japanese studies similar to the NTP bioassays, Fischer 344 rats were exposed to dose levels of 0 to 600 ppm, and Crj:BDF1 mice were exposed to doses of 0 to 250 ppm, for two years. The results were similar to those in the NTP bioassays except that no increase in kidney tumors was observed in the rat study.

Science Advisory Board Review of the NTP Study

After reviewing the results of the NTP study, the EPA Science Advisory Board concluded in 1987 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.

Significance of 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 mouse data to humans. This research indicates that perchloroethylene is not the proximal 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 or humans. Moreover, in vitro (test tube) 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 suggests that such a response is unlikely in humans.

Epidemiology

Several epidemiology studies have investigated cancer mortality among dry cleaning workers. For the most part, the workers studied were exposed to a variety of cleaning agents, including petroleum solvents. The tumor types observed in experimental animals did not occur with increased frequency among the drycleaning workers studied. Rates were approximately doubled for bladder and esophageal cancers, but were not clearly increased for other sites. With regard to bladder cancer, the limited data available suggest that the observed increased risk may be associated with exposure to dry cleaning solvents other than perchloroethylene.

Two epidemiology studies have been reported of small cohorts of individuals exposed predominantly to perchloroethylene. In one of these studies, overall cancer incidence was decreased in the exposed individuals, and there were no significant excess cancers at any site. The second study, conducted by the National Institute of Occupational Safety and Health (NIOSH) and last updated in 1994, found that dry cleaning workers employed in shops where perchloroethylene was the primary or only solvent used exhibited no excess cancers except for an increase in cancer of the esophagus observed in female subjects. This finding contrasts with the findings in the larger cohort of drycleaning workers exposed to mixed solvents, in which the increase in esophageal cancer occurred in a male (African-American) subgroup, and in a recent study of aerospace workers exposed to perchloroethylene that found no significant increase in esophageal cancer.

Interpretation of the NIOSH results is unclear, as no animal study has identified an elevated incidence of esophageal tumors and there is no plausible mechanism to explain it. Moreover, some of the highest exposed worker groups in the cohort studies did not

show an increased risk of esophageal cancer. Most significantly, the potential for confounding factors is great for esophageal cancer, given the strong association between the disease and the combination of cigarette smoking and alcohol consumption.

The available epidemiology studies show no consistent link between perchloroethylene exposure and cancer. Questions about esophageal cancer can only be answered with further studies. Fortunately, both of the perchloroethylene-only cohort studies are expected to be updated in the near future.

Carcinogenicity Classification

The International Agency for Research on Cancer (IARC) recently classified perchloroethylene in Group 2A, as a substance considered "probably carcinogenic to humans." IARC, following its own restrictive classification scheme, concluded that the combination of the results of some of the epidemiology studies provided "limited" evidence of carcinogenicity in humans. In addition, NTP listed perchloroethylene as "reasonably anticipated" to be a carcinogen based on a finding of "sufficient" evidence of carcinogenicity in experimental animals. The American Conference of Governmental Industrial Hygienists (ACGIH), however, classifies perchloroethylene in its Category A3 ("animal carcinogen"):

The agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic types(s), or by mechanism(s) that are not considered relevant to worker exposure. Available epidemiological studies do not confirm an increased risk of cancer in exposed humans. Available evidence suggests that the agent is not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.

EPA's Science Advisory Board has stated that the weight of the evidence for perchloroethylene does not support its classification as a probable human carcinogen (Category B2) under EPA's 1986 Guidelines for Carcinogen Risk Assessment. The Board concluded that "[t]he available scientific information does not suggest to us the same regulatory responses that would be appropriate for a chemical whose bioassay responses were clearly relevant to human cancer." Perchloroethylene currently is considered by EPA to be on a "continuum" between Categories B2 and C, and is expected to be reassessed under revised Guidelines proposed by the Agency in 1996. The Guidelines are being revised in part to provide for greater use of mechanistic data in assessing substances like perchloroethylene.

REGULATION

Environmental Exposure

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

achievable 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 generally 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 drycleaning, published in September 1993, was the first standard adopted under the revised Section 112. A standard for organic solvent cleaning (degreasing) with perchloroethylene and the other chlorinated solvents was adopted in December 1994. As a result, all degreasing sources using perchloroethylene will be required to obtain an operating permit from the state regulatory agency. In many states, permitting for small degreasing sources has been deferred.

Perchloroethylene does not contribute to stratospheric ozone depletion. EPA has determined, consequently, that perchloroethylene is an acceptable alternative in many applications for ozone depleting solvents whose production has been phased out by the federal Clean Air Act. Because perchloroethylene does not contribute appreciably to smog formation, EPA exempted the solvent from the federal definition of a reactive volatile organic compound (VOC) in 1996. At that time, the Agency indicated that it would no longer provide credit for reductions of perchloroethylene emissions in state control strategies for achieving the national ambient air quality standard for ground-level ozone. Perchloroethylene has now been exempted by most states that have VOC regulations, in accordance with federal guidelines.

In 1991, EPA established national primary drinking water regulations setting a maximum contaminant level, or MCL, of 5 micrograms per liter for perchloroethylene (equal to 5 parts per billion, or ppb), and a maximum contaminant level goal (MCLG) of zero. EPA has indicated that "[t]he establishment of an MCLG at zero does not imply that actual harm necessarily occurs to humans 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 several industry categories EPA has established effluent limitation guidelines, which may contain limitations for perchloroethylene. EPA also has published 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) and many state laws. Such waste must be stored, transported, and disposed of in accordance with applicable RCRA and state requirements.

The reportable quantity (RQ) for releases of perchloroethylene under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) is 100 pounds. Releases in excess of this amount must be reported to the National Response Center, the local emergency planning commission, and the state emergency

response commission. Some states have lower thresholds that trigger their notification requirements.

Perchloroethylene is one of several hundred chemicals subject to material safety data sheet (MSDS), inventory, and release reporting under the Emergency Planning and Community Right-to-Know Act (Title III of the Superfund Amendments and Reauthorization Act of 1986).

Occupational Exposure

The current permissible exposure limits (PELs) for perchloroethylene are 100 ppm as an 8-hour time weighted average (TWA), 200 ppm as a ceiling limit, and 300 ppm as a peak limit. In 1989, the Occupational Safety and Health Administration (OSHA) lowered the PEL for perchloroethylene from 100 ppm to 25 ppm for an 8-hour TWA, as part of an overall PEL update. This action was overturned by a federal court in 1993, however, and the PELs for perchloroethylene reverted to the former limits. OSHA has urged employers not to roll back measures they may have taken to comply with the lower limits that were overturned, and several states that adopted the lower 1989 limit have not adopted the higher limit. OSHA has recently indicated its intent to establish a workplace standard for perchloroethylene.

ACGIH currently recommends threshold limit values (TLVs) of 25 ppm for an 8-hour TWA and 100 ppm for a 15-minute short-term exposure limit, or STEL.

Regulatory (Federal) and Other Information for Perchloroethylene

Chemical Formula	C_2Cl_4
Molecular Weight	165.9
CAS Number	127184
Boiling Point	250 ^oF
Weight per Gallon (@60 ^oF)	13.6 pounds
Flash Point	none
Flammable Limits	none
Solubility	
perc in water	150 ppm
water in perc	105 ppm
OSHA PEL	
8hr TWA	100 ppm
Ceiling	200 ppm
Peak	300 ppm
ACGIH TLV	

8hr TWA	25 ppm
15min STEL	100 ppm
Cancer Classification	
ACGIH	A3 ("animal carcinogen")
IARC	2A ("probably carcinogenic to humans")
NTP	"reasonably anticipated to be a human carcinogen"
CERCLA Reportable Quantity (RQ)	100 pounds
Maximum Contaminant Level (MCL)	5 micrograms/liter (5 ppb)
RCRA Hazardous Waste No.	U 210
DOT Hazard Classification	6.1 (packing group III)
DOT ID No.	UN 1897

Halogenated Solvents Industry Alliance, Inc.
2001 L Street, N.W.
Suite 506
Washington, D.C. 20036
202 7750232 <> 888-594-4742 <> 202-833-0381 (fax)

Appendix B

A Citizens Guide to Thermal Desorption

United States Environmental Protection Agency
Solid Waste and Emergency Response (5102G)
EPA 542-F-96-005 April 1996

EPA

A Citizen's Guide to Thermal Desorption

Technology Innovation Office

Technology Fact Sheet

What is thermal desorption?

Thermal desorption is an innovative treatment technology that treats soils contaminated with hazardous wastes by heating soils to temperatures of 200-1,000°F so that contaminants with low boiling points will vaporize (turn into gas) and, consequently, separate from the soil. (The other soil contaminants, if any, are treated by other methods.) The vaporized contaminants are collected and treated, typically by an air emissions treatment system.

Thermal desorption is a different treatment process than incineration. Thermal desorption uses heat to physically separate the contaminants from the soil. The contaminants then require further treatment. Incineration uses heat to actually destroy the contaminants.

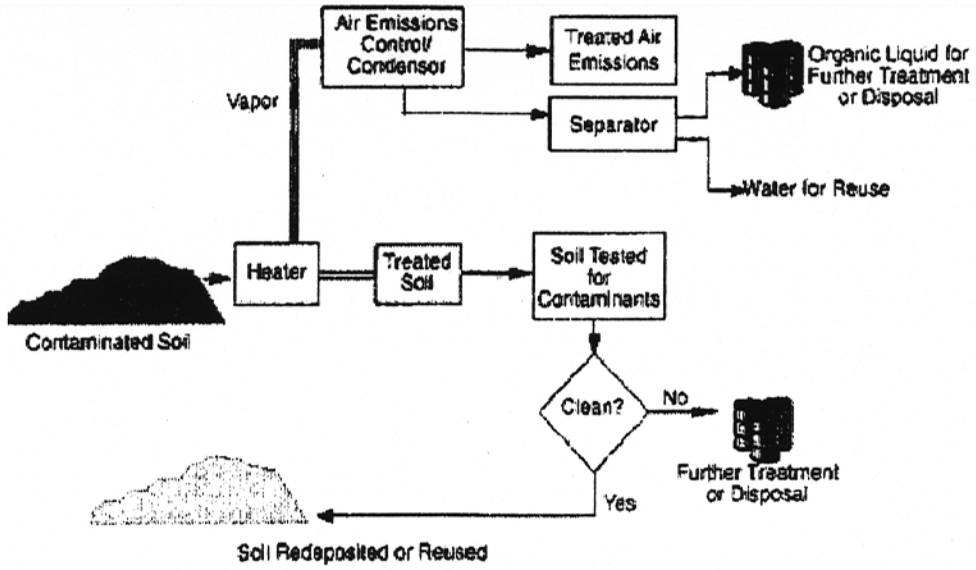
A Quick Look at Thermal Desorption

- Heats soil at relatively low temperatures to vaporize contaminants and remove them.
- Is most effective at treating volatile organic compounds, semi-volatile organic compounds and other organic contaminants, such as polychlorinated biphenyls (PCBs), and polyaromatic hydrocarbons (PAHs) and pesticides.
- Is useful for separating organic contaminants from refining wastes, coal tar wastes, wood-treatment wastes and paint waste.

How does thermal desorption work?

Typical thermal desorption systems (Figure 1) consist of three components: the pre-treatment and material handling system, the desorption unit, and the post-treatment system for both the gas (vaporized contaminants) and the solid (remaining soil).

Figure 1
The Thermal Desorption Process



Pretreatment and Material Handling System

Pretreatment of contaminated material involves sifting it to remove large clods and foreign debris. If the contaminated material is very wet or has a high level of contaminant, it may need to be blended with sand or dried to make it a more uniform mass for treatment in the desorption unit.

Desorption Unit

The function of the desorption unit is to heat the contaminated soil to a sufficient temperature for a sufficient period to dry it and vaporize the contaminants from the soil. A common design for the desorber unit is a *rotary desorber*, which consists of a rotating cylindrical metal drum. In a *direct-fired rotary desorber*, the material enters the rotating cylinder and is heated by direct contact with a flame or the hot gases coming off a flame. In an *indirect-fired rotary desorber*, the contaminated soil does not come into contact with a flame or combustion gases. Instead, the outside of the metal cylinder is heated and the hot metal indirectly heats the soil tumbling inside. As the waste is heated, the contaminants vaporize, and then become part of the gas stream of air and contaminated vapors flowing through the desorber towards the post-treatment system. An *inert*, or non-reactive gas, such as nitrogen, may be added to the gas stream to prevent the vaporized contaminants from catching fire in the desorption unit and to aid in vaporizing and removing the contaminants.

Post-treatment System

"Offgas" from the desorber is typically processed to remove particulates that remained in the gas stream after the desorption step. Vaporized contaminants in the offgas may be burned in an afterburner, collected on activated carbon, or recovered in condensation equipment. Depending on the contaminants and their concentrations, any or all of these methods may be used. All disposals must meet federal, state, and local standards.

Treated soil from the desorber is tested to measure how well the process removed the target contaminants. The performance of thermal desorption is typically measured by comparing the contaminant levels in treated soils with those of untreated soils. If the treated soil is non-hazardous, it is redeposited on-site or taken elsewhere to be used as backfill. If, however, the soil requires further treatment (for example, the soil contained contaminants that did not respond to this process), it may be treated with another technology or transported off-site for disposal.

Why consider thermal desorption?

Thermal desorption is effective at separating organics from refining wastes, coal tar wastes, waste from wood treatment, and paint wastes. It can separate solvents, pesticides, PCBs, dioxins and fuel oils from contaminated soil. The equipment available is capable of treating up to 10 tons of contaminated soil per hour. Finally, the lower temperatures require less fuel than other treatment methods.

Will it work at every site?

Thermal desorption is not applicable to most metals, although mercury can be removed by the process. Other metals will either remain in the treated soil, in which case the soil must be retreated, or vaporize, in which case they may complicate the offgas treatment. The presence of metals and their fate must be determined before the soil is processed.

Thermal desorption is not equally efficient at treating all types of soil. If the soil is wet, water will vaporize along with the contaminants. Because of the additional substance (water) being vaporized, more fuel is required to vaporize all of the contaminants in the wet soil. Soils with high silt and clay content are also more difficult to treat with thermal desorption. When heated, silt and clay emit dust, which can disrupt the air emission equipment used to treat the vaporized contaminants. In addition, tightly packed soil often does not permit the heat to make contact with all of the contaminants. Therefore, it is difficult for them to vaporize. Finally, thermal desorption would not be a good choice for treating contaminants such as heavy metals, since they do not separate easily from the soil, and strong acids, since they can corrode the treatment equipment.

What Is An Innovative Treatment Technology?

Treatment technologies are processes applied to hazardous waste or contaminated materials to permanently alter their condition through chemical, biological, or physical means. Treatment technologies are able to alter, by destroying or changing, contami-nated materials so they are less hazardous or are no longer hazardous. This may be done by reducing the amount of contaminated material, by recovering or removing a component that gives the material its hazardous properties or by immobilizing the waste. *Innovative treatment technologies* are those that have been tested, selected or used for treatment of hazardous waste or contaminated materials but lack well-docu-mented cost and performance data under a variety of operating conditions.

Although thermal desorption is widely used, innovative variations are continually being developed. It is still difficult to predict with certainty the time and cost to clean a site using thermal desorption. For these reasons, it retains its "innovative" label as EPA continues to track its performance.

Where is thermal desorption being used?

Thermal desorption has been selected as a treatment method at numerous Superfund sites. For example, thermal desorption was used at the TH Agriculture & Nutrition Company site in Albany, Georgia. Thermal desorption was used at the site to treat 4,300 tons of oil contaminated with pesticides (dieldren, toxaphene, DDT, lindane). The system ran from July to October 1993. Thermal desorption met the cleanup goals, removing over 98% of the pesticides in the treated soil. Table 1 lists some additional Superfund sites where thermal desorption has been used or selected for use.

Table 1

Examples of Superfund Sites Using Thermal Desorption (all projects completed)*

Name of Site	Type of Facility	Contaminants
Re-solve, MA	Chemical reclamation	Volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs)
Metaltec/Aerosystems, NJ	Metal manufacturing	VOCs
Reich Farms, NJ	Chemical drum storage/disposal	VOCs, semi-volatile organic compounds (SVOCs)
American Thermostat, NJ	Thermostat manufacturing	VOCs
U.S.A. Letterkenney SE Area, PA	Munitions manufacturing/storage	VOCs
Wamchem, SC	Dye manufacturing	Benzene, toluene, ethylbenzene & xylene (BTEX), VOCs, SVOCs
Jacksonville NAS, FL	Fire training site	Polyaromatic hydrocarbons (PAHs)
Outboard Marine/Waukegan Harbor, IL	Marine products manufacturing	PCBs
Pristine, OH	Industrial waste treatment facility	BTEX, pesticides, herbicides, VOCs
Sand Creek Industrial, CO	Pesticide manufacturing	Pesticides, herbicides

For a listing of Superfund sites at which innovative treatment technologies have been used or selected for use, contact NCEPI at the address in the box below for a copy of the document entitled ***Innovative Treatment Technologies: Annual Status Report (7th Ed.)*, EPA 542-R-95-008**. Additional information about the sites listed in the *Annual Status Report* is available in database format. The database can be downloaded free of charge from EPA's Cleanup Information bulletin board (CLU-IN). Call CLU-IN at 301-589-8366 (modem). CLU-IN's help line is 301-589-8368. The database also is available for purchase on diskettes. Contact NCEPI for details.

** Not all waste types and site conditions are comparable. Each site must be individually investigated and tested. Engineering and scientific judgment must be used to determine if a technology is appropriate for a site.*

For More Information

The publications listed below can be ordered free of charge by calling NCEPI at 513-489-8190 or faxing your request to 513-489-8695. If NCEPI is out of stock of a document, you may be directed to other sources. You may write to NCEPI at:

National Center for Environmental Publications and Information (NCEPI)
P.O. Box 42419
Cincinnati, OH 45242

- *Selected Alternative and Innovative Treatment Technologies for Corrective Action and Site Remediation: A Bibliography of EPA Resources*, EPA 542-B-95-001. **A bibliography of EPA publications about innovative treatment technologies.**

- *Physical/Chemical Treatment Technology Resource Guide*, September 1994, EPA 542-B-94-008. **A listing of publications and other sources of information about thermal desorption and other treatment technologies.**
- *Engineering Bulletin, Thermal Desorption*, February 1994, EPA 540-S-94-501.
- *Abstracts of Remediation Case Studies*, March 1995, EPA 542-R-95-001.
- *WASTECH ® Monograph on Thermal Desorption*, ISBN #1-883767-06-7. Available for $49.95 from the American Academy of Environmental Engineers, 130 Holiday Court, Annapolis, MD 21401. Telephone 410-266-3311.

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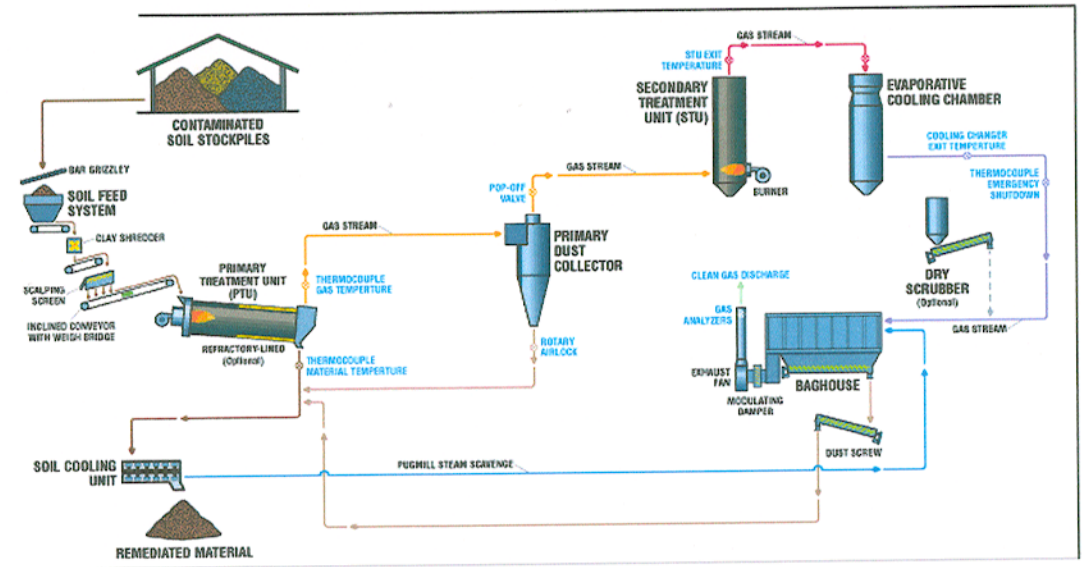
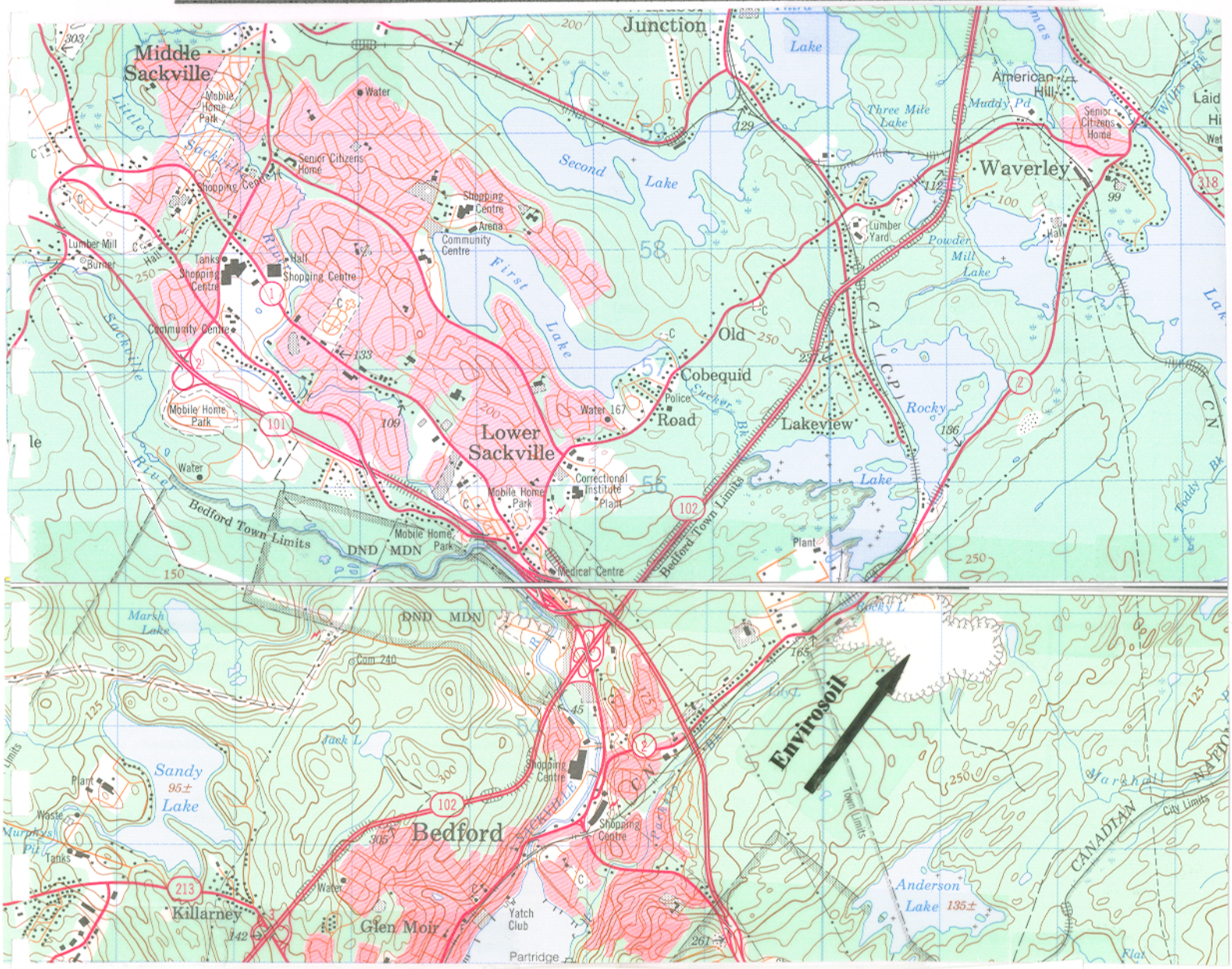

CONTAMINATED SOIL STOCKPILES
BAR GRIZZLEY
SOIL FEED SYSTEM
CLAY SHREDDER
SCALPING SCREEN
INCLINED CONVEYOR WITH WEIGH BRIDGE
PRIMARY TREATMENT UNIT (PTU)
REFRACTORY-LINED (Optional)
THERMOCOUPLE GAS TEMPERTURE
THERMOCOUPLE MATERIAL TEMPERTURE
GAS STREAM
POP-OFF VALVE
PRIMARY DUST COLLECTOR
ROTARY AIRLOCK
SOIL COOLING UNIT
REMEDIATED MATERIAL
PUGMILL STEAM SCAVENGE
GAS STREAM
STU EXIT TEMPERATURE
SECONDARY TREATMENT UNIT (STU)
BURNER
EVAPORATIVE COOLING CHAMBER
COOLING CHAMBER EXIT TEMPERTURE
THERMOCOUPLE EMERGENCY SHUTDOWN
DRY SCRUBBER (Optional)
GAS STREAM
CLEAN GAS DISCHARGE
GAS ANALYZERS
EXHAUST FAN
MODULATING DAMPER
BAGHOUSE
DUST SCREW

Appendix C

Site Topographical Detail

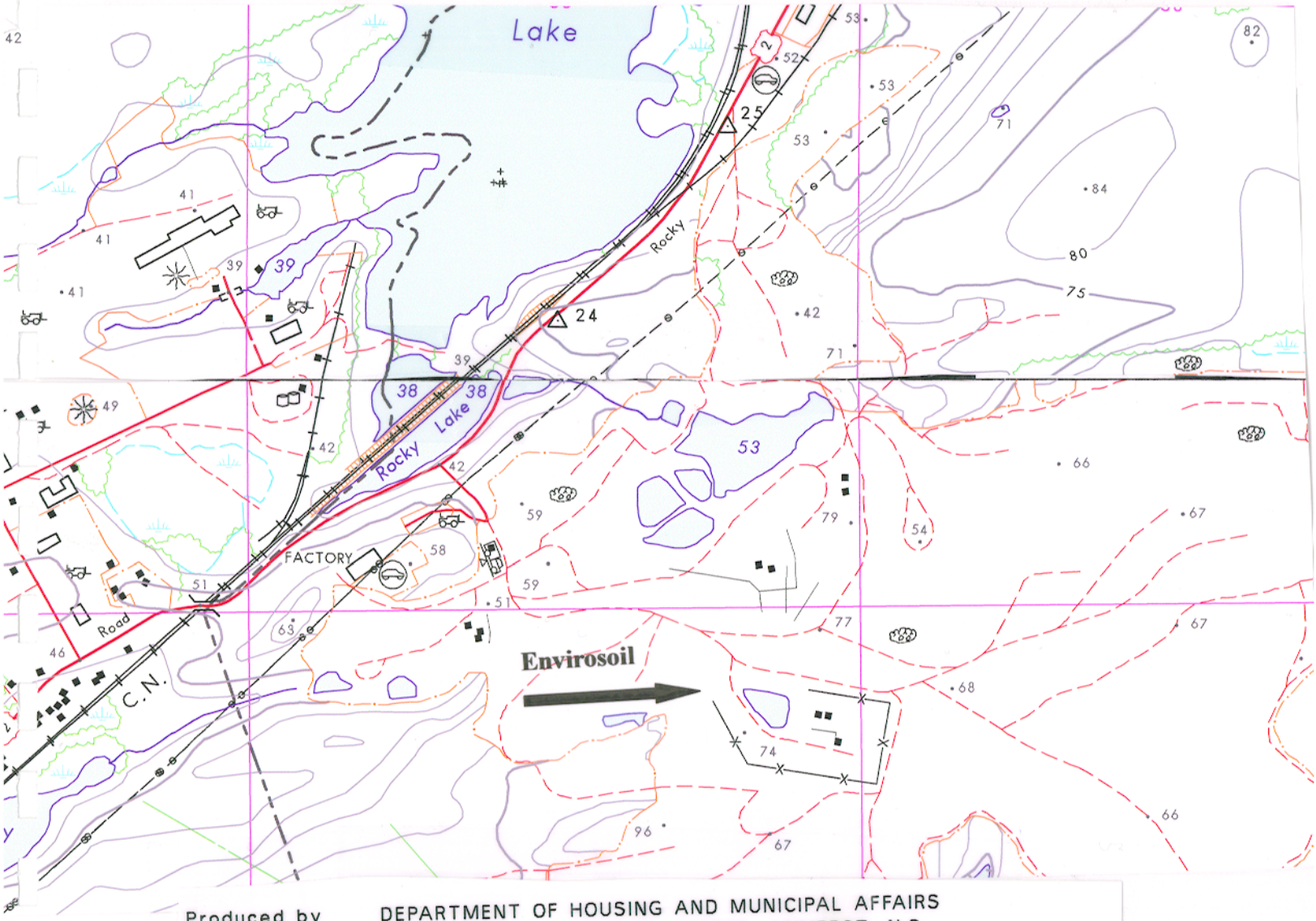
Appendix C Site Topographical Detail



Appendix D

Site: Land Use Detail

Appendix D Site: Land Use Detail



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