Public Health Assessment for

PETITIONED PUBLIC HEALTH ASSESSMENT
YAWORSKI LANDFILL
(ALIASES: YAWORSKI DUMP AND PACKER ROAD LANDFILL)
CANTERBURY, WINDHAM COUNTY, CONNECTICUT
APRIL 7, 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

PETITIONED PUBLIC HEALTH ASSESSMENT

YAWORSKI LANDFILL
(ALIASES: YAWORSKI DUMP AND PACKER ROAD LANDFILL)

CANTERBURY, WINDHAM COUNTY, CONNECTICUT

Prepared by:

Petition Response Section
Exposure Investigation and Consultation Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

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Summary

Residents of Canterbury, Connecticut petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) to determine whether air emissions from the Yaworski Landfill (a/k/a Yaworski Dump/Packer Road Landfill) represents a public health hazard. The site will be referred to as the Yaworski Landfill site. This 44 acres site in Canterbury Township, Windham County, eastern Connecticut is owned by Yaworski Incorporated. The landfill is regulated under the authority of the State of Connecticut and has not been added to the Environmental Protection Agency National Priority List. Residents were concerned with a perceived increase in the incidence of cancer, asthma, odors, dust, and contaminated private wells resulting from activities at the landfill. ATSDR attended public meetings with citizens, local health department and environmental agency representatives, and conducted site visits.

In this health assessment, ATSDR reviewed the available environmental data which included; 1994 soil gas sampling data collected at various on-site locations around the Yaworski Landfill, soil gas sampling conducted at the riser pipes and at random sites on the former "active" landfill area in December 1995 to 1996, and air dispersion modeling to predict off-site emissions. Limited environmental data were available for ATSDR to evaluate on-site contamination at the Yaworski Landfill and potential off-site emissions. The highest concentrations of landfill soil gas detected at the former "active" section of the landfill were closest to the recycling area and near residential areas along Packer Road. The potential exists for intermittent off-site emissions from leaks and during excavation activities occurring at the landfill. Ambient air monitoring data are needed to determine if nearby residents are exposed to these gaseous contaminants.

The Yaworski Landfill site represents a potential health hazard on site to workers and people who use the recycling area where high concentrations of volatile organic compounds and methane were detected in soil gas samples. The health hazard for off-site emissions to residential areas along Packer Road is unknown since ambient air data are not available. ATSDR recommends that perimeter ambient air sampling at the former "active" landfill be conducted for methane and non-methane organic compounds to determine whether residents and workers are potentially exposed through inhalation of contaminants released from the landfill. In particular, ambient air sampling should be conducted at the perimeter where the highest concentrations of methane and non-methane organic compounds were detected, closest to the recycling area and off-site residential areas, especially during periods of excavation activities. Until the soil migration of methane is better characterized, methane should be monitored in the basements of residences adjacent to the landfill. In addition, the landfill caps and gas collection system should be properly maintained, actions levels set for air monitoring, and a site safety plan be implemented for the landfill. ATSDR will review air sampling data that become available in the future for public health implications. ATSDR classifies the Yaworski Landfill site as a potential public health hazard.

Purpose and Health Issues

ATSDR was petitioned by residents of Canterbury, Connecticut to determine if air emissions from the Yaworski Landfill (a/k/a Yaworski Dump/ Packer Road Landfill) represent a public health hazard to the community. This site will be referred to in the document as the Yaworski Landfill site. Petitioners expressed concerns about a perceived increased incidence of cancer, asthma, odors, dust, and contaminated private wells resulting from activities at the landfill. Residents formed a community group called the People's Rights in a Clean Environment (PRICE). Previous documents provided by ATSDR to the community that have addressed health concerns regarding the Yaworski Lagoon and Landfill include; Public Health Assessment, Yaworski Lagoon NPL Site (April 5, 1988) (1), Site Review and Update, Yaworski Lagoon (September 30, 1993) (2), Health Consultation Yaworski Landfill and Lagoon (March 16, 1994) (3), and Public Health Assessment Gallup's Quarry (September 30, 1998)(4). Groundwater below the Yaworski Lagoon and the Gallup's Quarry sites was determined to be contaminated but did not pose a public health threat since it was not being used as a source of drinking water. In this health assessment, ATSDR will review the air data available from soil gas sampling conducted at the Yaworski Landfill and make recommendations to address public health concerns. Ambient air data are not available and represents a data gap. While soil gas concentrations do not represent the level of contaminants that people would likely be exposed to, they identify contaminants present that may be emitted during leaks, improper operation of the gas collection and flare system, during excavation operations, and from soil gas migration off-site to residential areas.

Community Health Concerns

Residents live within one-half mile of the site with the nearest residence approximately 800 feet from the former "active" landfill. Reports of illness include cancer, respiratory difficulties, and dizziness. This landfill has been cited by the CT DEP for excessive odors in the past (7). People are also concerned with exposure to fugitive dust during truck traffic.

Background

The Yaworski Landfill (also called the Yaworski Dump or Packer Road Landfill) site consists of 44 acres located in Canterbury Township, Windham County, eastern Connecticut and is owned by Yaworski Incorporated. The landfill is not listed as an EPA NPL site but is regulated under State authority. This site is located approximately 2,000 feet from the Yaworski Lagoon (CTD009774969), an EPA NPL site (6). The landfill accepted waste from 1950 to 1995 under a permit by the Connecticut Department of Environmental Protection (CT DEP) (5). Materials accepted for disposal included municipal, residential, and solid waste. The landfill lies within the flood plain of the Quinebaug River and the river borders the site on the north, south, and west sides (Figure 1, Appendix A).

Yaworski Landfill currently consists of three sections; the closed landfill, bulky waste landfill, and the former "active" landfill (Figure 2, Appendix A) (6). The closed landfill is approximately eight acres in size and located east of Packer Road. The landfill opened in 1950, accepting an unknown quantity and thickness of residential and municipal waste. This section of the landfill was closed and capped with an earthen cover in 1970. Located east of Packer Road and south of the closed landfill, the bulky waste landfill consists of approximately four acres (6). Opened in 1960, solid waste such as wood, brush, stumps, and other demolition debris was deposited in this area. It is reported that approximately 20 feet of waste is buried in this area. The former "active" landfill was opened in 1950 and is located west of Packer Road (6). This 32 acre section accepted mixed solid waste under a CT DEP permit. The western portion of the former "active" landfill is closed (May 1995) and covered with an earthen cover material. To date, activities are being conducted to close the former "active" section of the landfill. The former "active" landfill is surrounded by the Quinebaug River on the north, west, and southwest borders, and by residences and light industry on the east and southeast borders. Soil cover material from the Gallup's Quarry site (CTD 108960972), another NPL site located approximately three miles to the east in Plainfield Connecticut, was reported to have been placed in this section of the landfill (6). A recycling station is currently operating next to the entrance to the former "active" landfill area and is proposed to continue to operate after the landfill is completely closed and capped. Additionally, a trash-transfer station was proposed to operate at this location but was denied in 1994 in part due to a reported history of non-compliance (5, 6). A subsequent petition is currently being considered.

In response to complaints of odors and potential harmful emissions by residents, the CT DEP issued an order on March 8, 1993 (7), requiring Yaworski, Inc. to conduct a series of ambient air monitoring studies around the landfill. A final consent order was issued on May 10, 1994, requiring air sampling, analysis, and air dispersion modeling to be performed to assess potential health impacts of emissions from landfill activities.

Site Visits

September and October 1992, ATSDR attended public meetings and conducted site visits. April 16 and 17, 1996, ATSDR staff met with CT DOH and CT DEP representatives, private citizens, and used Global Positioning System equipment to collect geographic data of the landfill area. Observations made during this visit included: distinct odors emanating from the former "active" landfill area, the location of 11 gas monitoring wells, a trench system with three soil gas vents, proposed monitoring well sites, and a flare system at the rear of the landfill. Waste water was observed leaching from the top and sides of the landfill. Another site visit was conducted in November 1996 to tour the landfill, meet with concerned residents, state and local officials, and to obtain additional site information.

Review of the Air Modeling Proposal

ATSDR was asked by CT DEP to review (8) the proposed air impact study, "Air Impact Scope of Study, Yaworski, Inc., Canterbury, CT, June 1994" (9). This study proposed using soil gas data to generate air contaminant emission rates to be used in dispersion modeling. This model will be used to predict potential short term air impacts to populations living within one-half mile of the Yaworski Landfill.

Evaluation of Ambient Air Sampling Plan

ATSDR reviewed (10) air sampling plans submitted by the CT DEP Bureau of Air Management (11) and made the following recommendations (11): 1) The health based guidance for mercury in air is 0.3 $\mu g/m^3$, 2) Conduct real-time sampling down-wind of excavation activities, 3) Conduct ambient air monitoring to include; time-weighted samples for all pollutants of concern on a daily basis, place sampling locations at the nearest fence line so that a worst case exposure to residences is measured, determine the number of worse case samples to be collected, establish at least one upwind meteorological station, clarify the number of time-weighted samples to be collected, carefully monitor holding times for time-weighted samples, document handling procedures for time-weighted samples (record canister pressure immediately after sample collection and again before sample analysis), and discuss the collection of non-methane VOCs in the sampling plan.

Off-site Indoor Air Consultation

On October 19, 1993, the CT DPH under a cooperative agreement with ATSDR conducted a limited indoor and outdoor dust wipe sampling at one residence located on Packer Road near the former "active" landfill (3). The resident was concerned with exposures to dust from the former "active" landfill, the access road to the landfill, and the recycling area operating at the landfill. Dust samples were analyzed for lead and polychlorinated biphenyls (PCBs).

Sixteen indoor dust swipe samples obtained from window sills and floors, and seven outdoor samples taken from all sides of the house were analyzed for contaminants. Lead was not detected in indoor and outdoor samples at levels of health concern. PCBs were not detected in indoor samples. The consultation concluded, however, that dust may have adverse health effects depending on the particle size, chemical constituents, and duration of exposure. The following recommendations were made; 1) implement dust control measures at the landfill, landfill access road, and Packer Road, 2) review surface soil data taken from the landfill, access road, and residential property to identify potential contaminants of health concern, 3) implement damp dusting and wet mopping techniques in the home to reduce potential exposure to dust. No further dust sampling was recommended at the time.

Discussion

ATSDR obtains the community's concerns, and other medical, toxicological, demographic, and environmental factors that may affect the health of a community exposed to hazardous substances. To determine if health effects are likely to occur within the community, ATSDR health professionals consider the toxicity of the contaminant, the concentration (how much), the time of exposure (how long), and how the chemical gets into the body (breathing, eating, drinking, or skin contact). In addition, other factors are considered; occupation, personal habits, age, nutritional status, general health, and genetics. These factors affect how a contaminant is absorbed, distributed, metabolized, and eliminated from the body. Contaminants are evaluated in a health assessment to determine whether exposure to them has public health significance. ATSDR selects and compares on- and off-site concentrations of contaminants with ATSDR comparison values for noncarcinogenic and carcinogenic effects. Comparison values are concentrations of contaminants in specific environmental media (air, soil, drinking water) that are not expected to produce an adverse health effect in people who are exposed. These values are used only as screening values, listing a contaminant in a table of "chemicals of concern" does not mean that it will necessarily cause adverse health effects if exposure occurs at that specified concentration. When the concentration of a contaminant detected on or off the site is above the comparison value it is further evaluated to determine the potential for adverse health effects. The focus of the evaluation is on health effects that could plausibly result from exposures to site related contaminants. ATSDR considers both adults and children when developing comparison values. The potential health effect on children is considered separately since in certain situations children may be more sensitive and more exposed to contaminants. Finally, ATSDR presents its conclusions and recommends appropriate actions.

On-site Air Sampling

Limited air sampling data are available for the Yaworski Landfill site. No ambient air data were available to review for this site evaluation. ATSDR reviewed the available environmental data which included 1994 soil gas sampling data collected at various on-site locations around the Yaworski Landfill, and soil gas sampling conducted at the riser pipes and at random sites on the former "active" landfill area in December 1995 to 1996.

Landfill Soil Gas Sampling Data (1994)

Limited landfill gas sampling was conducted at the Yaworski Landfill on four occasions from November thru December 1994 (12). The first air sampling was conducted on November 21, 1994; three samples were taken at the bulky waste and six at the closed municipal solid waste sections of the landfill. Because all samples exceeded the nitrogen concentration, they were considered invalid due to intrusion of ambient air and not analyzed further for organic compounds. Therefore, these samples were invalidated when the quality assurance/quality control procedures were applied. Ten samples (A-1 to A-10) were obtained from the former "active" landfill section on November 30,

1994. The third sampling event occurred on December 12, 1994; three samples (A-4, A-7, and A-8) were taken at the former "active" section, six samples (C-1 to C-6) were taken at the closed section, and one sample (B-3) was taken at the bulky waste section of the landfill. The last sampling event occurred on December 22, 1994. Three samples (A-11 to A-13) were taken at the former "active" section and three samples (B-1, B-2, and B-4) were taken at the bulky waste section of the landfill.

Random samples were also analyzed for methane and carbon dioxide. Methane gas was not detected at the bulky waste section of the landfill. Methane concentrations detected at the closed section varied with a maximum detection of 57.4% by volume (C-3 #2). Five samples taken at the former "active" section of the landfill demonstrated the presence of methane production where concentrations ranged from 49.7% (A-12) to 62.7% (A-5) by volume. Methane forms explosive mixtures in air and the hazard range for explosions is 5 to 14% methane with 8.5 to 9.5% methane the most dangerous (13). Air that contains above 14% methane by volume, burns without noise when ignited. Methane is a tasteless, odorless, colorless liquid that can be produced naturally during anaerobic fermentation processes that occur in some landfills. It is extremely flammable and may be ignited by heat, sparks, or flames. Depending on weather conditions, areas where methane production has been detected above the upper explosive limit have the potential to rapidly drop into the potentially explosive limit (5 to 14%). Methane may replace available oxygen particularly in low lying areas on-site and presents a potential health hazard to workers and other persons visiting the site. In addition, methane migration was known to be moving toward the residential areas in the past, potential also exists for accumulation of methane in the confined areas of basements. Therefore, ATSDR recommends ambient air sampling onsite and in the basements of residents living near the active landfill to better characterize methane migration.

Table 1 provides a list of contaminants, detected in soil gas samples collected in 1994 at the Yaworski landfill site, which are above ATSDR's comparison values and the odor detection threshold range established for specific contaminants by the American Conference of Governmental Industrial Hygienists (ACGIH) (14, 15). The odor detection threshold range is the best estimate of the concentration range of a specific chemical where the odor is recognizable and is determined by a number of physical and chemical factors. ATSDR provided a consultation regarding this data to CT DEP in April 1996 (12). There was some question regarding the sampling method/shipment and the accuracy of the contaminant concentrations reported. Samples from the bulk waste section and closed section of the landfill demonstrated similar contaminants. In general, the former "active" section of the landfill had the highest contaminant concentrations. Fourteen chemicals were detected (Table 1) in gas samples obtained on-site in 1994 that were above health comparison values and odor detection threshold values including aromatic hydrocarbons (benzene, toluene, ethylbenzene, trimethylbenzene, and xylenes), chlorinated aliphatic hydrocarbons (1,1-dichloroethyne, 1,4-dichlorobenzene, fluorotrichloromethane, methylene chloride, tetrachloroethylene, trichloroethane, and vinyl chloride), hydrogen sulfide and methyl ethyl ketone. The highest concentrations were detected in sampling sections A-1, A-2, A-5, and A-10, along the north and northeastern section of

the open landfill, nearest to Packer Road. It is unlikely that people would be exposed to contaminant levels detected from soil gas samples collected several feet below the surface of the landfill. However, the former "active" section of the landfill remains uncapped and during periods of excavation activities, workers on-site and persons frequenting the recycling area of the landfill would be potentially exposed to these contaminants (Table 4, Appendix A). Residents may potentially be exposed to these contaminants during wind shifts and during seasonal weather changes (Table 5, Appendix A). Ambient air sampling data are not available and represents a data gap to evaluate potential on site and off site exposures.

Data Gaps

In the April 1996 consultation (12), ATSDR identified data gaps needed to make a determination of whether landfill gas exposures to residents living near the landfill would likely result in ill health effects. The following recommendations to obtain air sampling were made: 1) Conduct perimeter ambient air sampling to determine if residents and off-site workers are exposed through inhalation of contaminants released from the landfill. Initially, additional sampling should include EPA priority pollutants, VOCs, volatile sulfur compounds, ammonia/amines from the landfill vents, the gas migration interceptor trench, and leachate. 2) Perimeter sampling should be conducted for a representative and/or worst case time period/conditions, to include meteorological data, and sampling locations closest to the residential areas. 3) Until soil migration is better characterized, ATSDR recommends that methane monitoring be conducted in the basements of residents living adjacent to the former "active" landfill. Initially, conduct a screening survey to identify an immediate problem, if identified, continuous sampling for a year is recommended to ensure that methane concentrations do not fluctuate to significant levels with seasonal weather changes.

Since a landfill matrix consists of a wide range of heterogenous waste streams, the air sampling data collected in 1994 may not represent the contents of the area to be excavated. Excavation activities may have adverse health effects to off-site residents or on-site workers, especially because of the levels of hydrogen sulfide and other contaminants identified on site may cause odors from air emissions, fires, explosions, and cave-ins. The following sampling is recommended to address these issues; 1) On-site air monitoring and continuous sampling should occur in addition to perimeter sampling when any excavation occurs. 2) Time-weighted air sampling should occur at the perimeter to ensure that excavation activities are not releasing significant contamination to off-site areas. 3) Establish action levels for air monitoring equipment, if the action level is exceeded on-site, a work slowdown or shutdown procedure should be employed to avoid reaching potential levels of health concern off-site. 4) Provide a site safety plan that defines worker protective devices, air monitoring, air sampling, and a contingency plan for an emergency situation to include a notification plan for nearby populations.

Table [illegible] Yaworski Landfill - On-site Soil Gas Sampling Results [illegible] December [illegible]

Contaminant	Concentration Range (μg/m³)[b]	Location of Maximum Concentration	Odor Detection Threshold Range[c] (μg/m³)	Comparison Value	
				Value (μg/m³)	Source
Benzene	ND-7,347.8	A-10	2,492-511,084	0.1	CREG[d]
				12.8	iEMEG[e]
1,1-Dichloroethyne(DCA)	ND-86,016.9	A-10	49-1,359	520	RBC[f]
1,4-Dichlorobenzene	ND-22,848.2	A-2	<15	1202.5	iEMEG
Ethylbenzene	ND-35,169.6	A-1	399-2,605	868.4	iEMEG
Fluorotrichloromethane	ND-241,644	A-10	NA	73	RBC
Hydrogen Sulfide	ND-68,410.9	A-2	0.001-0.18	125.5	iEMEG
Methylene Chloride	ND-39,603.9	A-5	4,168-1,528,000	3.0	CREG
				1042.1	iEMEG
Methyl Ethyl Ketone (MEK)	ND-13,564.8	A-5	2-85	1000	RBC
Tetrachloroethylene (PCE)	ND-949.6	A-10	2-71	2.0	CREG
				271.3	cEMEG
Toluene	ND-56,144.7	A-5	0.79-259,999	1809.4	cEMEG
1,1,1-Trichloroethane	ND-192,626.8	A-10	87,310-3,896,191	3819.8	iEMEG
Trimethylbenzenes	ND-24,185.5	A-1	0.006-2.4	6.2	RBC
Vinyl Chloride	ND-409	C-1 #2	10-20	76.7	iEMEG
Total Xylenes	ND-54,708	A-1	353-173,677	3,039.4	iEMEG

[a] Landfill gas sampling was conducted four times; November 21 and 30, December 12 and 22, 1994. The former "active" landfill was sampled all dates except November 21, 1994. (Fuss and O'Neill Inc.)

[b] μg/m³ = microgram per cubic meter

[c] American Conference of Governmental Industrial Hygienists (ACGIH)

[d] CREG = ATSDR Cancer Risk Evaluation Guide (see Appendix B)

[e] iEMEG = ATSDR Intermediate Environmental Media Evaluation Guide

[r] RBC = EPA Risk Based Concentration.

Air Modeling

To determine if residents living near the landfill were exposed to contaminants from air emissions, the CT DEP proposed collecting gas samples from the landfill to develop a database of landfill emission rates. These values would then be used to model the predicted off-site air emissions. Air Modeling at the Yaworski Landfill was a two-phased project. The initial phase consisted of obtaining data using an air sampling program to measure soil gas emissions. Samples were collected and tested for volatile organic compounds (VOCs), semi-volatile organic compounds (sVOCs), methane, and sulfur compounds. These data were used with established air emission and dispersion models (16) to predict emissions from the closed, bulky waste, and the former "active" landfill sections. The model was used to predict the concentrations and location of contaminants that are likely to be emitted from the landfill and impact the surrounding community.

Landfill Air Sampling Data (1996)

Soil Gas Core Samples

Soil gas samples were taken from 13 locations (A-1 to A-13) (Figure 3, Appendix A) within the former "active" section of the landfill during the winter of 1995 to 1996 (17, 18). These 13 areas were selected to better represent individual multiple-area sources for the landfill emission model. Three locations were sampled within each of the 13 areas. A stainless steel gas probe was driven to a depth of approximately three feet below the landfill cap for closed areas and five feet below the surface for open areas. Summa canisters collected gas samples which were subsequently tested for non-methane VOCs by gas chromatography/mass spectrometry. Table 2 lists the adjusted concentration of the contaminants detected from these samples. Twenty-three of the thirty contaminants detected were above health based comparison values. The location of the maximum contaminant concentrations were near the recycling area and the north/northeast section of the former "active" landfill near Packer Road.

Riser Pipe Stack Samples

The migration of landfill gas was reported to be moving toward the residential area. A gas collection system was installed and the eastern side of the landfill (closest to residential areas) was excavated and regraded. This portion of the landfill had previously been overfilled. In 1990, CT DEP required Yaworski Inc., to recover and burn gasses emitted from the former "active" landfill. The flare was constructed and went into operation in June 1993. Seven methane extraction wells were placed in this area with more to be added at a later date. The system was shut down temporarily in April 1994 due to diminished performance. Another gas flare system was installed in January 1996.

A 500 foot (ft) long trench was excavated to intercept the horizontal migration of landfill gas through the soil. Three passive perforated pipes were placed vertically at 75 ft intervals along this trench and the trench was backfilled. Air samples were taken from each of these riser pipe stacks (stacks 1 to 3 or south, center, and north pipe) in the winter of 1995 to 1996 (17, 18) and analyzed for non-methane VOCs. Table 3 lists the organic contaminants detected in these samples. These concentrations were used in the landfill emissions model as stack emission rates from point sources. Twenty-one of the fifty-eight contaminants detected were above comparison values.

Contaminant	Concentration Range ($\mu g/m^3$)[b]	Location of Maximum Concentration	Comparison Value ($\mu g/m^3$)	Comparison Value Source
Acrylonitrile	21.7-368.8	A-1	2.0	RFC[c]
			0.01	CREG[d]
Benzene	63.9-8,210.3	A-10	0.1	CREG
			12.8	iEMEG[e]
Carbon Tetrachloride	62.9-818	A-2	0.07	CREG
			314.6	iEMEG
Chloroform	48.8-634.7	A-2	0.04	CREG
			244.1	iEMEG
1,1-Dichloroethane	40.5-96,177	A-10	520	MRL[f]
1,2-Dichloropropane	46.2-600.8	A-2	32.3	iEMEG
1,2 Dichlorobenzene	60.1-781.6	A-2	3.3	RBC[g]
1,4-Dichlorobenzene	60.1-29,221.6	A-2	1,202.5	i EMEG
Ethylbenzene	43.4-40,059.6	A-1	868.4	iEMEG
Fluorotrichloromethane	56.2-270,134.2	A-10	73	RBC

Table 2 Soil Gas Sampling Results[a]

Contaminant	Concentration Range ($\mu g/m^3$)[b]	Location of Maximum Concentration	Comparison Value[c]	
			Value ($\mu g/m^3$)	Source
Hydrogen Sulfide	69.7-87,423.2	A-2	125.5	iEMEG
Methylene Chloride	34.7-45,544.5	A-5	3.0	CREG
			1042.1	iEMEG
Methyl Ethyl Ketone (MEK)	29.5-25,390	A-11	1,000	RFC
Naphthalene	52.4-681.4	A-2	10.5	cEMEG[h]
Tetrachloroethylene (PCE)	67.8-1,695.7	A-6	271.3	cEMEG
Toluene	37.7-64,585.2	A-5	1809.4	cEMEG
1,1,1-Trichloroethane	54.6-215,381.9	A-10	3,819.8	iEMEG
1,1,2-Trichloroethane	54.6-709.4	A-2	0.06	CREG
			0.11	RBC
Trichloroethylene	53.7-967.4	A-13	0.6	CREG
			537.4	iEMEG
Trimethylbenzenes	98.3-43,602.7	A-12	6.2	RBC
Vinyl Chloride	25.6-332.3	A-2	76.7	iEMEG
Xylenes (total)	43.4-625,671	A-1	3,039.4	iEMEG

[a] Soil gas sampling results obtained 1995 to 1996 from the former "active" landfill section of the Yaworski Landfill. (Anchor Engineering Services, Inc.).
[b] $\mu g/m^3$ = microgram per cubic meter
[c] RFC= Environmental Protection Agency (EPA) Reference Concentration
[d] CREG = ATSDR Cancer Risk Evaluation Guide (see Appendix B)
[e] iEMEG =ATSDR Intermediate Environmental Media Evaluation Guide
[f] MRL = ATSDR Minimal Risk Level
[g] RBC = EPA Risk Based Concentration.
[h] cEMEG = ATSDR Chronic Environmental Media Evaluation Guide

high levels of contaminants in these riser pipes, combined with the likelihood that these gasses will enter on-site ambient air whenever the flames are not lit, is sufficient justification for strongly recommending that useful ambient air data be collected and evaluated.

The maximum recorded concentrations, inside the pipe, of many of the contaminants listed in Tables 1 and 2 (e.g., benzene, fluorotrichloromethane, hydrogen sulfide, methylene chloride, and trimethylbenzenes) exceed relevant comparison values (e.g., intermediate EMEGs and noncancer-based RBCs) by factors of hundreds or even thousands. Therefore, some of these maximum concentrations inside the pipe exceed not only ATSDR's comparison values, but the incorporated safety factors as well. These concentrations might not be of health concern if the landfill gases were being effectively burned off. Even if they were not, they might be substantially diluted soon after entering the atmosphere, perhaps even to concentrations below comparison values, some distance from the pipe. However without ambient air data available to review this remains speculation. It is therefore essential that ambient air data both on- and off-site be collected so that ATSDR can determine the public health implications of potential emissions from the Yaworski Landfill.

Discussion of Community Health Concerns

Citizens were concerned about a perceived increase in the incidence of cancer within their community. The Connecticut Department of Health evaluated cancer rates in Canterbury, Plainfield, and two other surrounding towns in Connecticut compared to expected rates for cancers occurring within populations of similar size in the United States (2). Cancer incidence rates for reported cancer cases occurring over a twenty year period (1971 to 1990) were obtained. The analysis demonstrated that no differences were observed in the number of cancer cases reported in the populations in Connecticut compared to the number of cases that would be expected. Therefore, no increase from the expected cancer rates were observed.

Respiratory difficulties and irritations of the eyes, nose, sinuses, and throat were reported. Since these types of conditions are not consistently reported to hospitals and community health clinics, the incidence of these conditions can not be evaluated. Other nuisances reported by members of the community included; odors, dust, and truck traffic. The off-site air sampling conducted in 1993, suggested that dust may create a nuisance and recommendations were made that dust abatement activities related to the site should be implemented. The Yaworski Landfill site represents a potential health hazard on site to workers and people using the recycling area, however, there are no ambient air data available. Data does not exist to evaluate the off-site emissions and exposures to residential areas along Packer Road. Therefore, ATSDR could not determine the public health implication of these exposures.

emissions from the Yaworski Landfill (21). Emission rates from the 13 source areas and the three point sources (stack) were used to calculate ambient concentrations from the center of the landfill and to predict concentrations at receptor points. These receptor points were defined at the landfill property line and within a radius of 1000 meters with receptors located at 100, 200, 500, 600, 700, 800, and 1000 meter intervals. The receptors were selected based on the worst-case wind direction for landfill emissions and should include areas of nearby residences. In addition, three nearby residences were specifically selected as receptor points.

ATSDR reviewed the non-methane organic compound emissions and dispersion modeling procedures for the Yaworki landfill in September 1998 (21). The 1995 to 1996 landfill gas and the stack sampling data were reviewed along with the assumptions and predictions of the emission and dispersion models. Please refer to Appendix C for specific technical issues discussed.

In summary, ATSDR concludes that the methods used for evaluating the impact of air emissions of non-methane organic compounds from the Yaworski Landfill is sufficient as a screening evaluation of long-term and short-term impact, however, refined methods for sampling and modeling is recommended. The annual and one-hour average concentrations of contaminants, predicted by the ISCST3 model at the maximum receptor and at the three residential areas, were not at levels of health concern. However, these contaminants were predicted from a source located in the center of the landfill and not at the location of the maximum contaminant concentrations detected from previous on-site sampling, which was identified near the recycling area and close to residential areas on Packer Road. Due to limitations in the sampling, analysis, and modeling described above, these predicted values may not give a realistic evaluation of potential maximum exposures received by on-site workers, residents who may frequent the site for recycling activities, and residents who live near the landfill. Ambient air data should be obtained for more than one sampling event, in the section of the former "active" landfill where the highest concentrations of non-methane organic compounds were identified and these concentrations modeled for emissions using at least five years of meteorological data. Due to limited environmental data and limitations of the model, ATSDR could not evaluate the health hazard for on-site workers and people who frequent the on-site recycling area. Environmental data are not available to determine potential off-site emissions and exposures to nearby residential areas. Therefore, ATSDR could not determine the public health impact of these exposures.

Toxicological Evaluation

The data currently available to ATSDR are insufficient to form the basis of a health call, at this time. The soil gas measurements in Tables 1 and 2 do not represent concentrations that anyone is likely to be exposed to; they represent concentrations inside pipes driven several feet into the ground for extracting subterranean VOCs to be burned off at the surface. The only way to assess the extent to which nearby residents are exposed to these gaseous contaminants is by evaluating ambient air monitoring data. Such data are not available at this time. However, ATSDR considers that the very

Contaminant	Concentration (µg/m³)[b]			Comparison Value	
	South Pipe	Center Pipe	North Pipe	Value (µg/m³)	Source
p-Isopropyltoluene	6,899.0	2,197.4	2,231.6	NA	
Methylene Chloride	464.5	481.3	489.0	3.0	CREG
				1042.1	iEMEG
Naphthalene	308.1	0	0	10.5	cEMEG[g]
N-Propylbenzene	3,884.5	1,074.8	1,091.5	NA	
Styrene	1,027.7	258.0	262.0	255.6	cEMEG
Toluene	16,894.0	3,059.7	3,107.2	1809.4	cEMEG
1,1,1-Trichloroethane	2,168.4	0	0	3,819.8	iEMEG
Xylenes (total)	85,820.9	31,492.6	31,981.8	3039.4	iEMEG

[a] Riser pipe (stack) gas sampling results obtained 1995 to 1996 from the former "active" section of the Yaworski Landfill. (Anchor Engineering Services, Inc.).
[b] $\mu g/m^3$ = microgram per cubic meter
[c] CREG = ATSDR Cancer Risk Evaluation Guide (see Appendix B)
[d] iEMEG =ATSDR Intermediate Environmental Media Evaluation Guide
[e] RFC= EPA Reference Concentration
[f] MRL = ATSDR Minimal Risk Level
[g] cEMEG = ATSDR Chronic Environmental Media Evaluation Guide

Air Modeling Results-Predicted Landfill Emissions

Environmental sampling data obtained from landfill gas core samples (estimates of area source emissions) and landfill vent (stack) emissions (estimates of point source emissions) were used along with other landfill factors (waste quantity, age, topography, and other physical features), and meteorological data to estimate landfill contaminant emission rates (19, 20). Meteorological data used for the model were obtained from the National Weather Service Station at Bradley Airport for the years 1970 and 1972. Not all the same contaminants were sampled for during the gas core sampling and the stack sampling events. The model may under predict these contaminant concentrations. Estimated emission rates were placed in a database of an air dispersion computer model and used to predict one-hour average and annual average contaminant concentrations. Patterns of air dispersion to receptor locations surrounding the landfill site were also predicted by this model. The Industrial Source Complex Model (16) was used to evaluate contaminant concentrations from a variety of sources. ATSDR evaluated the use of this model for predicting

Contaminant	Concentration (ug/m³)			Risk-based Concentration	
	South Trip[a]	Center Trip[b]	North Trip[a]	Value (ug/m³)	Source
Benzene	1,663.9	544.3	552.8	0.1	CREG[c]
				12.8	iEMEG[d]
Bromomethane	348.6	410.5	416.9	194.2	iEMEG
Carbon Tetrachloride	541.2	0	0	0.07	CREG
				314.6	iEMEG
Chlorbenzene	26,372.1	10,074	10,230.5	21	iEMEG
Chloroethane	18,918.6	2,527.0	2,566.3	10,000	RFC[e]
Chloromethane	859.3	650.7	660.8	413	iEMEG
1,2-Dibromo-3-Chloropropane	397.7	0	0	1.9	iEMEG
1,1-Dichloroethane	8,962.1	1,279.5	1,299.4	520	MRL[f]
cis-1,2-Dichloroethene	114.9	0	0	37	iEMEG
Dichlorfluoromethane	3,269	944	958.7	NA	
1,4-Dichlorobenzene	4,126.5	1,561.2	1,585.5	1202.5	iEMEG
Ethylbenzene	47,332.3	18,317.9	18,602.5	868.4	iEMEG
Isopropylbenzene	3,479.9	1,014.2	262.0	NA	

Conclusions

1. Limited environmental data were available for ATSDR to evaluate on-site contamination at the Yaworski Landfill and potential off-site emissions. Only on-site soil gas data were available for review and the landfill has an incomplete documented history of the type, amount, and location of waste deposited for 37 years prior to 1987. While people may not be exposed to the concentration of volatile organic compounds detected in these samples, the potential exists for exposure to gases released during leaks, excavation activity, or when the gas is not effectively burned off. While the collection of ambient air data on-site and within residential basements would not identify past exposures that have occurred, it would further identify contaminants that may be emitted near the recycling area, site perimeter, and in residential basements due to soil gas migration.

2. Landfill soil gas sampling data obtained in 1994 demonstrated that non-methane organic compounds were detected at high levels on site at the bulky waste, closed, and former "active" sections of the landfill.

3. Methane gas was detected in soil gas samples collected in 1994 at the closed and former "active" sections of the landfill and may represent a hazard to on-site workers and persons who frequent the recycling area. The highest concentration of methane gas was detected at the former "active" section at 63% by volume and may represent a fire hazard. Potential exists for the migration of methane to basements and other confined spaces within residences adjacent to the landfill.

4. Landfill air sampling data were obtained from on-site soil gas core samples and riser pipe stacks in 1995 to 1996 and used for modeling potential off-site emissions. Twenty-three of the thirty contaminants detected were identified as contaminants of concern to be sampled for in ambient air on and off site.

5. The highest concentration of landfill soil gas detected at the former "active" section of the landfill were closest to the recycling area and near residential areas along Packer Road. Previous sampling indicated that soil gas was reported to be migrating toward the residential area The potential exists for intermittent off-site emissions from leaks and excavation activities occurring on the landfill as well as migration of soil gas to off site residences located near the landfill.

6. Air modeling results predicted that landfill emissions would not adversely impact the health of residents within a one-half mile area. However the model was based on limited environmental data (one sampling period, limited meteorological data, and no landfill pressure measurements to determine gas emission fluctuations). In addition, the same contaminants were not sampled for during both the gas core sampling and the stack sampling events.

7. The model used the middle of the former "active" landfill as the source of maximum exposure instead of the area (north and northeast section near the recycling area and closest to Packer Road) where the highest levels of contamination was detected by on-site sampling.

8. Due to limitations in the sampling, analysis, and modeling described above, these predicted landfill emissions may not represent a realistic evaluation of potential maximum exposures received by on-site workers, residents who may frequent the site for recycling activities, and residents who live near the landfill.

9. The Yaworski Landfill site is classified as a potential health hazard to workers and people using the recycling area on site due to high levels of volatile organic compounds measured in soil gas samples on site and the concentration of methane above safe levels. Since no ambient air data were available for review, ATSDR could not evaluate the potential health hazard for off-site emissions to residential areas along Packer Road.

Recommendations

1. Conduct on-site perimeter air sampling at the former "active" landfill for methane and non-methane organic compounds to determine whether residents and workers are potentially exposed through inhalation of contaminants released from the landfill. In particular, air sampling should be conducted at the perimeter where the highest concentrations of methane and non-methane organic compounds were detected, closest to the recycling area and off-site residential areas.

2. Monitor for methane in the basements of residences adjacent to the landfill until the soil migration of methane is better characterized.

3. Conduct continuous air sampling on-site in areas where excavation activities are occurring and at the perimeter to monitor for potential off-site emissions.

4. Establish action levels for air monitoring equipment and if the action level is exceeded, employ a work slow-down or shut-down procedure to prevent off-site exposures.

5. Establish a site safety plan for the Yaworski Landfill that provides for worker safety, monitoring and sampling plans, and to include a contingency plan for emergency situations.

6. Properly maintain the existing landfill caps and gas collection and venting systems on site.

Public Health Action Plan

Actions Completed

1. Site visits and meetings with the community, state and local health and government agencies.

2. Release of ATSDR Public Health Assessment (1988) evaluating the Yaworski Lagoon.

3. Release of ATSDR Health Consultation (1994) evaluating Yaworski Landfill and Lagoon)

4. Release of ATSDR Health Assessment (1998) evaluating the Gallup's Quarry site.

Actions Planned

1. ATSDR will review air sampling data that become available in the future.

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Exposure Investigations and Consultation Branch

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APPENDIX A

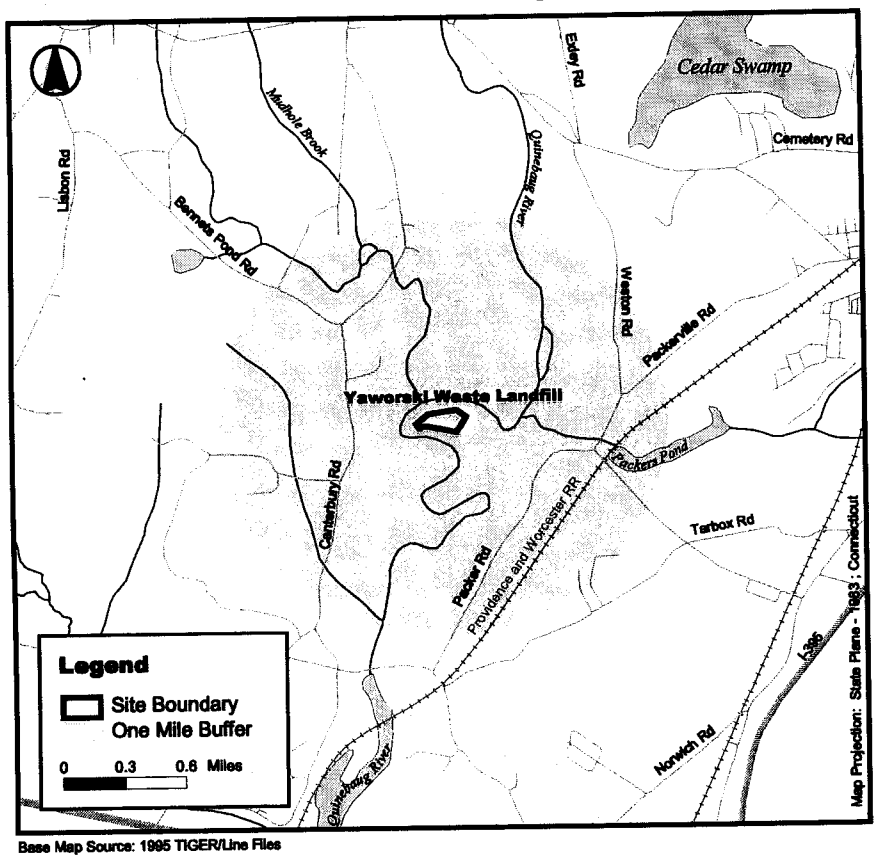
Maps and Figures

Yaworski Waste Landfill

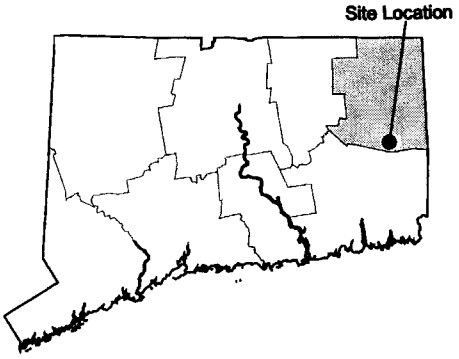
INTRO MAP

Canterbury, Connecticut

AKA: Yaworski Dump



Base Map Source: 1995 TIGER/Line Files



Windham County, Connecticut

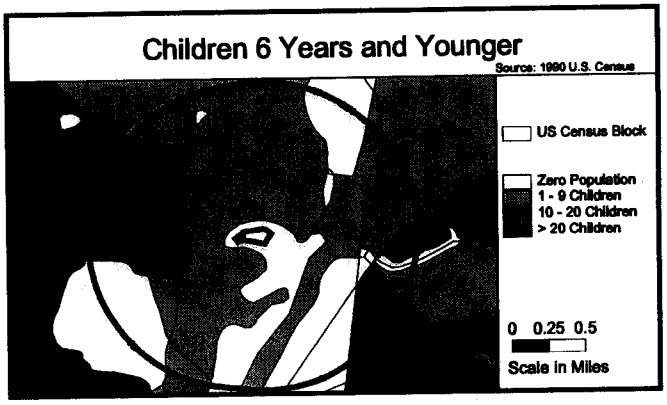
Demographic Statistics
Within One Mile of Site*

Total Population	409
White	402
Black	0
American Indian, Eskimo, Aleut	2
Asian or Pacific Islander	3
Other Race	1
Hispanic Origin	2
Children Aged 6 and Younger	30
Adults Aged 65 and Older	46
Females Aged 15 - 44	98
Total Housing Units	140

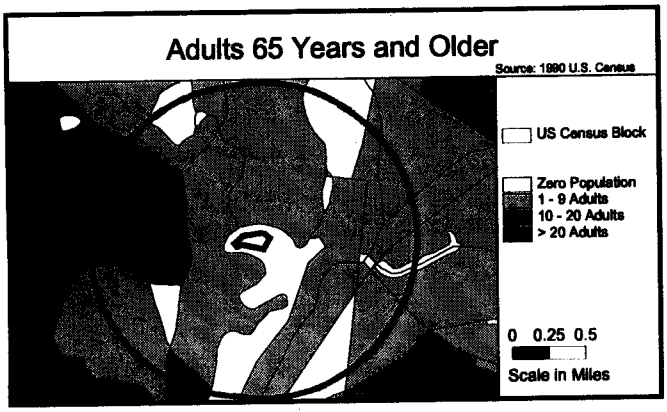
Demographics Statistics Source: 1990 US Census
*Calculated using an area-proportion spatial analysis technique

Population Density

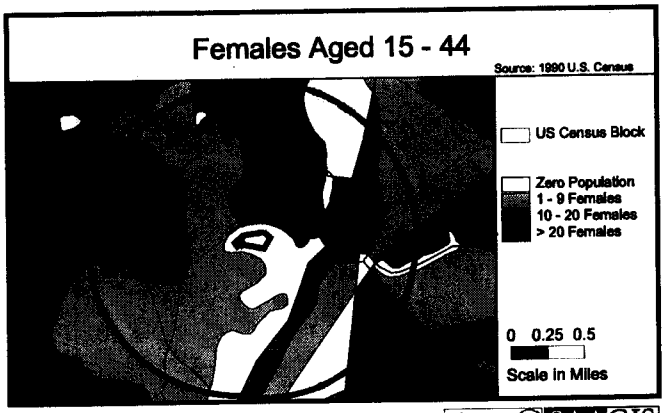
Children 6 Years and Younger



Adults 65 Years and Older



Females Aged 15 - 44



SAAGIS

JVA091699

Yaworski
Site Features Map

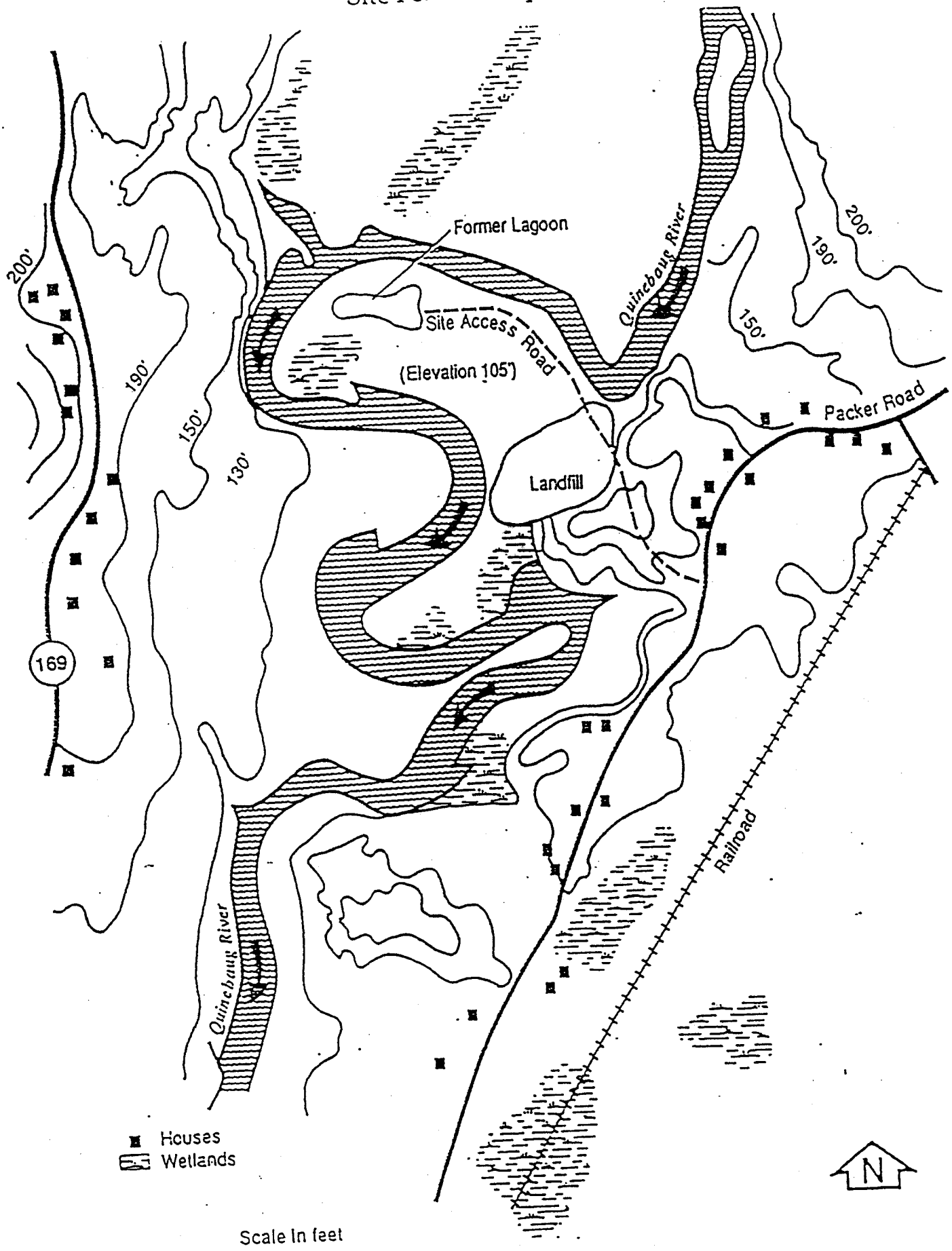


Figure 1

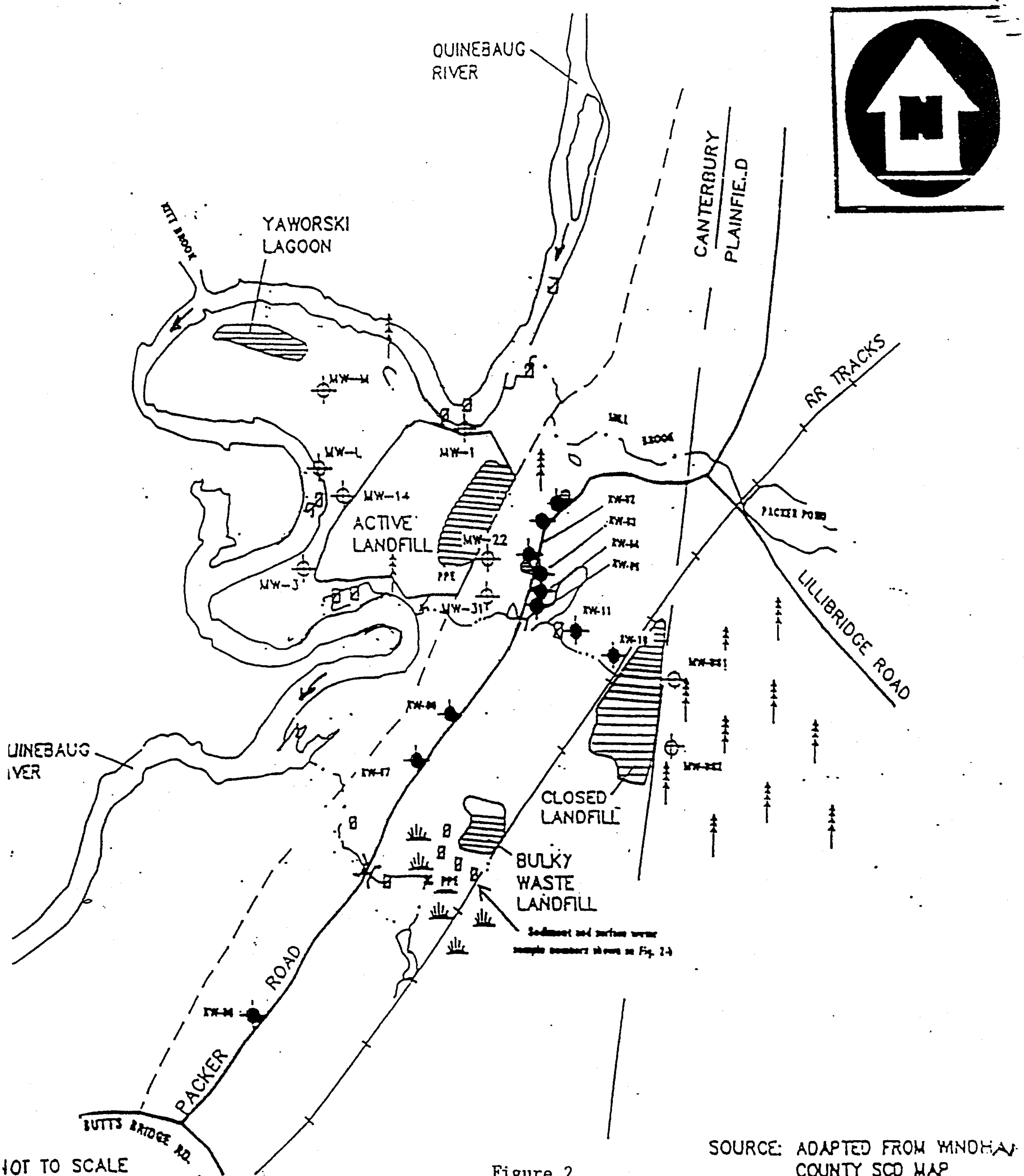


Figure 2

SITE MAP
YAWORSKI SITES
PACKER ROAD, CANTERBURY, CT

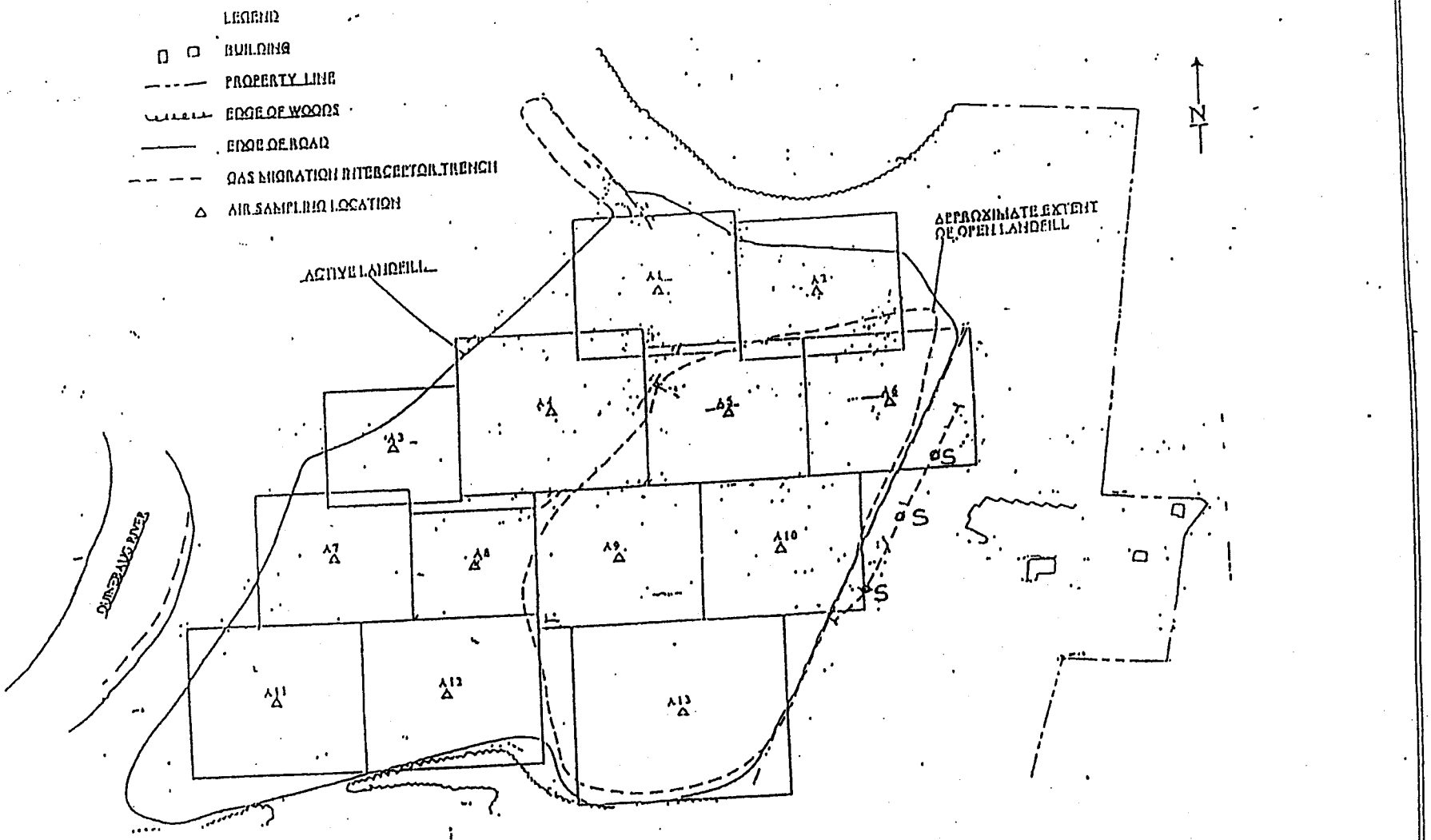

LEGEND
BUILDING
PROPERTY LINE
EDGE OF WOODS
EDGE OF ROAD
GAS MIGRATION INTERCEPTOR TRENCH
AIR SAMPLING LOCATION
ACTIVE LANDFILL
APPROXIMATE EXTENT OF OPEN LANDFILL
N
A1
A2
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Figure 3

Table 4 : Potential Exposure Pathway - ON SITE

Medium	Exposure Route	Time of Exposure	Exposure Activities	Estimated Exposed*		Chemicals	Public Health Concern
				Total	Children (<18 yr)		
Air	Inhalation	Past, Current, Future	Workers, recycling	50	unknown	Volatile Organic Compounds	Yes

Table 5 : Potential Exposure Pathway - OFF SITE

Medium	Exposure Route	Time of Exposure	Exposure Activities	Estimated Number Exposed*		Chemicals	Public Health Concern
				Total	Children (<18 yr)		
Air	Inhalation	Past, Current, Future	Outdoor, Inside	50	unknown	Volatile Organic Compounds	Yes

APPENDIX B

Comparison Values

ATSDR's Comparison Values

ATSDR comparison values are media-specific concentrations that are considered to be "safe" under default conditions of exposure. They are used as screening values in the preliminary identification of "contaminants of concern" at a site. The latter is, perhaps, an unfortunate term since the word "concern" may be misinterpreted as an implication of "hazard." As ATSDR uses the phrase, however, a "contaminant of concern" is merely a site-specific chemical substance that the health assessor has selected for further evaluation of potential health effects.

Generally, a chemical is selected as a contaminant of concern because its maximum concentration in air, water, or soil at the site exceeds one of ATSDR's comparison values. However, it cannot be emphasized strongly enough that comparison values are not thresholds of toxicity. While concentrations at or below the relevant comparison value may reasonably be considered safe, it does not automatically follow that any environmental concentration that exceeds a comparison value would be expected to produce adverse health effects. Indeed, the whole purpose behind highly conservative, health-based standards and guidelines is to enable health professionals to recognize and resolve potential public health problems before they become actual health hazards. The probability that adverse health outcomes will actually occur as a result of exposure to environmental contaminants depends on site specific conditions and individual lifestyle and genetic factors that affect the route, magnitude, and duration of actual exposure, and not on environmental concentrations alone.

Screening values based on noncancer effects are obtained by dividing NOAELs or LOAELs determined in animal or (less often) human studies by cumulative safety margins (variously called safety factors, uncertainty factors, and modifying factors) that typically range from 10 to 1,000 or more. By contrast, cancer-based screening values are usually derived by linear extrapolation from animal data obtained at high doses, because human cancer incidence data for very low levels of exposure simply do not exist, and probably never will. In neither case can the resulting screening values (i.e., EMEGs or CREGs) be used to make realistic predictions of health risk associated with low-level exposures in humans.

Listed and described below are the various comparison values that ATSDR uses to select chemicals for further evaluation, along with the abbreviations for the most common units of measure.

CREG =	Cancer Risk Evaluation Guide
MRL =	Minimal Risk Level
IMRL =	Intermediate Risk Level
CMRL=	Chronic Risk Level
EMEG=	Environmental Media Evaluation Guide
aEMEG=	Environmental Media Evaluation Guide based on acute Minimal Risk Level
IEMEG =	Intermediate Environmental Media Evaluation Guide

RMEG	=	Reference Dose Media Evaluation Guide
RfD	=	Reference Dose
RfC	=	Reference Dose Concentration
EPAIII	=	EPA Region III
DWEL	=	Drinking Water Equivalent Level
CLHA	=	Child Longer-Term Health Advisory
LTHA	=	Drinking Water Lifetime Health Advisory
MCL	=	Maximum Contaminant Level
MCLG	=	Maximum Contaminant Level Goal (μg/L)
MCLA	=	Maximum Contaminant Level Action
NAAQS	=	National Ambient Air Quality Standards
PEL	=	Permissible Exposure Limit (OSHA)
REL	=	Recommended Exposure Limit (NIOSH)
TLV	=	Threshold Limit Value (ACGIH)
FDA	=	Food and Drug Administration
ppm	=	parts per million, e.g., mg/L or mg/kg
ppb	=	parts per billion, e.g., μg/L or μg/kg
kg	=	kilogram (1,000 grams)
mg	=	milligram (0.001 grams)
μg	=	microgram (0.000001 grams)
L	=	liter
m^3	=	cubic meter (used in reference to a volume of air equal to 1,000 liters)

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations in water, soil, or air that would be expected to cause no more than one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors.

Minimal Risk Levels (MRLs) are estimates of daily human exposure to a chemical (i.e., doses expressed in mg/kg/day) that are unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. MRLs are derived for acute ($\leq$ 14 days), intermediate (15-364 days), and chronic ($\geq$ 365 days) exposures, and are published in ATSDR's Toxicological Profiles for specific chemicals.

Environmental Media Evaluation Guides (EMEGs) are concentrations of a contaminant in water, soil, or air that are unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. EMEGs are derived from ATSDR minimal risk levels by factoring in default body weights and ingestion rates. Separate EMEGS are computed for acute ($\leq$ 14 days), intermediate (15-364 days), and chronic ($\geq$365 days) exposures.

Intermediate Environmental Media Evaluation Guides (IEMEGs) are media-specific concentrations that correspond to a minimal risk level, factoring in body weight and ingestion rates for intermediate exposures (i.e., >14 days and <1 year).

Reference Dose Media Evaluation Guide (RMEG) is the concentration of a contaminant in air, water, or soil that corresponds to EPA's RfD of RfC for that contaminant when default values for body weight and intake rates are taken into account.

EPA's Reference Dose (RfD) is an estimate of the daily exposure to a contaminant unlikely to cause noncarcinogenic adverse health effects over a lifetime of exposure. Like ATSDR's MRL, EPA's RfD is a dose expressed in mg/kg/day.

Reference Concentration (RfC) is a concentration in air expected to be associated with no deleterious health effects over a lifetime of exposure, assuming default body weights and inhalation rates.

Environmental Protection Agency Region III (EPA III) values are similar to ATSDR's EMEGs in that they are risk-based concentrations derived for carcinogens and noncarcinogens from RfDs and Cancer Slope Factors, respectively, assuming default values for body weight, exposure duration and frequency, etc. Unlike EMEGs, however, they are available for fish, as well as for water, soil, and air.

Drinking Water Equivalent Levels (DWELs) are based on EPA's oral RfD and represent corresponding concentrations of a substance in drinking water that are estimated to have negligible deleterious effects in humans over a lifetime of exposure, at an intake rate of 2 L/day, and assuming that drinking water is the sole source of exposure to the contaminant. Similar to ATSDR's RMEG for drinking water.

Child Longer-Term Health Advisories (CLHAs) are contaminant concentrations in water that the Environmental Protection Agency (EPA) deems protective of public health (taking into consideration the availability and economics of water treatment technology) over a period of about 7 years, using a child's weight (10 Kg) and ingestion rate (1 L/day).

Lifetime Health Advisories (LTHAs) are calculated from the DWEL and represent the concentration of a substance in drinking water estimated to have negligible deleterious effects in humans over a lifetime of 70 years, assuming 2 L/day water consumption for a 70-kg adult, and taking into account other sources of exposure. In the absence of chemical-specific data, the assumed fraction of total intake from drinking water is 20%. Lifetime HAs are not derived for compounds that are potentially carcinogenic for humans.

Maximum Contaminant Levels (MCLs) represent contaminant concentrations in drinking water that EPA deems protective of public health (considering the availability and economics of water treatment technology) over a lifetime (70 years) at an exposure rate of 2 liters of water per day.

Maximum Contaminant Level Goals (MCLGs) are drinking water health goals set at levels at which no known or anticipated adverse effect on the health of persons occurs, and which allow an adequate margin of safety. Such levels consider the possible impact of synergistic effects, long-term and multi-stage exposures, and the existence of more susceptible groups in the population. When there is no safe threshold for a contaminant, the MCLG should be set at zero.

Maximum Contaminant Level Action (MCLA) are levels set by EPA under Superfund that trigger a regulatory response when the contaminant concentration exceeds this value.

National Ambient Air Quality Standards (NAAQS) are established by the EPA, as mandated in the Clean Air Act, for six criteria pollutants (carbon monoxide, sulfur dioxide, nitrogen dioxide, ozone, particulate, and lead). NAAQS are classified as either primary, which define levels deemed protective of public health, or secondary, which in some instances establish lower levels to prevent adverse effects on vegetation, property, or other elements of the environment.

Permissible Exposure Limits (PELs) are air standards developed by the Occupational Safety and Health Administration (OSHA) for the workplace. They are time-weighted average concentrations of contaminants considered safe for healthy workers over the course of an 8-hr workday and a 40-hr workweek. A PEL may be exceeded for brief periods, but the sum of the exposure levels averaged over 8 hours must be equal to or below the PEL.

Recommended Exposure Limits (RELs) are established by the National Institute for Occupational Safety and Health (NIOSH) and are similar to OSHA's PELs. They are time-weighted average concentrations for the workplace deemed to be safe for up to 10 hours/day, for 40-hours/week.

Threshold Limit Values (TLVs) are established by the American Conference of Governmental Industrial Hygienists (ACGIH). The TLV is the time-weighted average concentrations for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. Many of ACGIH's TLVs were adopted by OSHA for use as PELs. TLVs and PELs, which were designed to protect healthy workers, are usually much higher than the health-based values of ATSDR and EPA, which were designed to protect the health of the general population, including the very young and the elderly. Although the ATSDR does not base any of its community health decisions on TLVs or PELs, it sometimes cites such values in Public Health Assessments merely as a means of putting concentrations of site-specific contaminants into a meaningful perspective for the reader.

The Food and Drug Administration (FDA) has recommended concentration levels for certain substances in food, including fish. Levels above the FDA levels mean the food may be unsafe for human consumption.

COMPARISON VALUE REFERENCES

1. Agency for Toxic Substances and Disease Registry. Health Assessment Guidance Manual. Atlanta: ATSDR, October 1992.

2. National Institute for Occupational Safety and Health. Pocket Guide to Chemical Hazards. Washington D.C.: U.S. Department of Health and Human Services, June 1994.

3. U.S. Environmental Protection Agency. New Interim Region IV Guidance for Toxicity Equivalent Factors Methodology for Carcinogenic PAHs. February 11, 1992.

APPENDIX C

Review of Air Modeling Procedure

ATSDR was requested in September 1998 to review the procedures provided in the Non-methane organic compound (NMOC) emissions and dispersion modeling that was completed for the Yaworski Landfill facility (21). The following conclusions and recommendations were made: The use of a one-time sampling event for the database may underestimate the actual emission values unless a sufficient number of samples are collected and an upper confidence limit is established. Leaks in the summa canisters during air sampling activities, introduce errors in the evaluation of flux emissions during the one-time sampling event, and the concentrations obtained for the VOCs needed to be adjusted. In addition, other software is available that may be used to predict optimal sampling periods for measuring peak emissions. Meteorological conditions may affect the flux rate and adjust the short term (observed) emission rates. Landfill pressure measurements would be useful in determining emission flux rates. Also, the conservative estimate within the model (80th percentile) may underestimate the actual emission rates due to the sampling time selected.

Sampling a 75 ft stack would require 275 Pascals of pressure to overcome gravity (21). In addition, a stack negates the buoyancy that is usually obtained by the sun heating the surface of the landfill and may not represent actual emissions. Since the stack diameter is less than 4 inches, variable gas flows may be measured by the anemometer which could result in an edge effect, especially with flow rates near the low end of its calibration range of 3 meters per second. A pito tube may be a more accurate instrument for measuring this variable gas flow, and landfill pressure measurements should be collected concurrently. This would also more accurately measure long-term flow rates.

The actual values for the decay rates (k and Lo) used in the model were not clearly identified, although the document stated that default values were used (21). The landfill model determines the mass fraction of daughter compounds that are formed by the decay of waste over time by reporting the time that the waste was put in the landfill cells. Estimating the age the waste was placed in the landfill, prior to 1987, may impact the reliability of the prediction of the more distal daughter compounds (ie; tichloroethane, dichloroethane, and vinyl chloride). Therefore, selecting a reasonable upper confidence level of decay (a conservative k and Lo) within the model, would account for the possible errors associated with estimating the age of the waste.

Use of the air dispersion ISCST3 model is sufficient, however, more recent meteorological data are available through EPA's Office of Air Quality Pollution Standards (21). Since predicted annual average concentrations may vary by a factor of three from one year to another at a given receptor, the inclusion of five years of meteorological data may predict more accurate weather conditions and emission rates.

APPENDIX D

Public Comments

Public Comments

ATSDR released the Yaworski Landfill Public Health Assessment for public review and comment during the period from September 29 through November 26, 1999. ATSDR appreciates the written comments provided. This section includes the comments received and ATSDR's response to these comments. General editorial comments were addressed, where appropriate, within the final document.

Comment 1
The "Note of Explanation" at the beginning of the report sites that this document was previously provided to EPA and the affected state in an initial release for review. By way of clarification EPA was NOT presented with an initial release version for review prior to this public comment version, and it appears that the various state agencies also did not receive an initial release. Given the nature of the following comments, much of the expected confusion form the public about this report probably could have been avoided had EPA been given the opportunity to review an earlier version.

Response 1
In most cases, ATSDR will provide the initial document for other federal and state agencies to review prior to being released to the public for comment. However, it is not unusual for ATSDR to release the document to other agencies and the public at the same time in situations where the community expresses concerns with this procedure. Due to controversies regarding the Yaworski site, ATSDR deem sending the document out for comment to everyone the most appropriate action. ATSDR explained during a site visit and meeting in May, 1999 that the document would be released to all interested persons at the same time for review and comment.

Comment 2
In general, the report does not adequately describe and distinguish between the Yaworski Lagoon Superfund Site and the Packer Road (Yaworski) Landfill. While the two sites are located very close to each other, the Landfill is NOT part of the Yaworski Lagoon Superfund Site, and the Landfill itself is not on the National Priorities List (NPL). The Landfill is currently regulated under State authority only.

Because the differences between the NPL and the non-NPL site is not outlined up front, the public is likely to have significant confusion regarding the appropriate regulatory agency. There are also related sections of the report that need to be addressed.

The foreword states that ATSDR is required to conduct a public health assessment at each of the sites on the EPA National Priorities List, and will also conduct a public health assessment when petitioned by concerned individuals. ATSDR should clarify the foreword to explain that this assessment is for a non-NPL site, and that the Superfund site was not included in this assessment.

Response 2
This document states in several sections that it will address concerns and issues regarding the Yaworski Landfill. Please refer to the title of the document, summary, page headers, the purpose and health issues, community concerns, and throughout the rest of the document. The document does not refer to the Landfill as a National Priorities List site, even though it was proposed for the NPL in the past. ATSDR's focus is advisory and does not routinely address regulatory issues. However, for clarification, the non-NPL status of the Yaworski Landfill site has been added to the summary and the background section.

Comment 3
The background section starting on page 4 should clearly describe the status of the Packer Road (Yaworski) Landfill as a State-regulated site and clearly that it is not a superfund site. This section should include a very brief description of the Yaworski Lagoon Superfund site and note it's proximity to the Landfill. Because the Purpose and Health Issues section on pages 3-4 also mentions the Gallup's Quarry Superfund Site, the Background should also briefly describe that site and its proximity to the Landfill.

Response 3
Please refer to the response to comment 3, above. In addition, a brief statement regarding the Yaworski Lagoon Superfund site and the Gallup's Quarry Superfund site, has been added where appropriate in the Background Section of the document.

Comment 4
The second paragraph in the Background section also describes the largest section of the Yaworski Landfill site as the "active landfill". This is inaccurate since the Landfill stopped accepting waste in 1995.

Most of the figures in Appendix A have references to the "open" or "active" portions of the landfill. These are inaccurate descriptions as the landfill stopped accepting waste in 1995.

Response 4
The word "active" or "open" has been changed in the document to the former "active" area of the landfill, when referring to the unclosed section of the landfill that stopped accepting waste in 1995.

Comment 5
Reference No.2 under the Public Health Action Plan-Actions Completed section is incorrect. The 1988 ATSDR Public Health Assessment did not evaluate the Yaworski Landfill.

The color "Intro Map" in Appendix A refers only to the Yaworski Lagoon and does not identify the Landfill. As presented, this map only serves to confuse the distinction between the Superfund site and the State-regulated Landfill.

Response 5
Thank you for your comments, the corrections have been made where appropriate.

Comment 6
On the cover page and throughout the report, the terms "Yaworski Dump." "Yaworski Landfill" and "Packer Road Landfill" are all used somewhat inconsistently. Although EPA has designated the area as the "Packer Road (Yaworski) Landfill," it is suggested that ATSDR clarify with the State of Connecticut how best to reference the site.

Response 6
The name "Yaworski Dump" appears on the cover page due to a database error which has been addressed. The name "Packer Road Landfill" appears as an alias only in the Summary and Purpose and Health Issues sections of the document. The name, "Yaworski Landfill is used throughout the document and will be identified in the final document as the official site name.

Comment 7
Thank you for the opportunity to review and comment upon the Public Health Assessment-Public Comment Release version of the "Petitioned Public Health Assessment-Public Comment on Yaworski Dump" dated September 26, 1999. This health assessment contains the recommendation that useful ambient air monitoring data be collected. The document further recommends that perimeter air sampling at the active landfill be conducted for methane and non-methane organic compounds and that methane should be monitored in the basements of residences adjacent to the landfill.

Toward these ends, this agency recommends that you develop a detailed monitoring plan. In the interest of obtaining the most relevant and scientifically defensible monitoring information for your health assessment and modeling evaluations, your plan, at a minimum, should include the following:

1. An identification of the exact chemicals to be sampled and analyzed (element and form),

2. Reference methodologies for sampling and analysis, including real time versus longer term ambient sampling, indoor air sampling, landfill vent sampling and leachate,

3. Acceptable holding times, handling procedures, chains of custody for samples,

4. Acceptable equipment and media to be used including pre and post sampling parameters to be measure and recorded (e.g. canister pressure),

5. Duration of frequency of sampling, including number of field and trip blanks,

6. Number of sampling sites along with site maps including exact locations of monitoring equipment (both on and off site) including collocated samplers for any compounds including methane,

7. Meteorological parameters and location for equipment,

8. Environmental or meteorological conditions under which sampling should occur,

9. Flow rates,

10. Time of day of sampling, including need for correlation with any potential excavation activities,

11. Specific landfill pressure

Response 7
We appreciate your comments to the Yaworski Landfill (Dump) Petitioned Public Health Assessment released for public comment in September, 1999. In your comments, you recommended that ATSDR develop a detailed air monitoring plan. While this activity is not within the purview of this health agency, ATSDR would be available to review any proposed air sampling plans. In the past, ATSDR has provided comments to the "Air Impact Scope of Study" for the Yaworski Landfill, develop by Fuss & O'Neill, Inc. for Yaworski, Inc., revised October 24, 1994 (8). These comments and recommendations were provided to the Connecticut Department of Environmental Protection by ATSDR in September 1994. ATSDR reviewed available landfill gas sampling results in April of 1996 and provided further comments and recommendations for ambient air sampling including target chemicals, sampling equipment, locations, and procedures. Additional reviews and recommendations were provided from 1996 to 1998 including recommendations for air sampling during excavation activities and air dispersion modeling (10, 11, 12). Additional copies of these reviews can be provided upon request. *EPA's NSPS New Source Air Emissions* guideline also provide a model for air sampling procedures at a landfill site. ATSDR will be available to review and comment on an updated sampling plan for ambient air emissions at the Yaworski Landfill and within residential areas.

Comment 8
Page 5 Review of Air Modeling Proposal The last sentence refers to the model in the future tense, "will be used to ...". Was this the model that was used and referred to in the Discussion section?

Page 5 Evaluation of Ambient Air Sampling Plan While this information appears to be provided to give the reader some historical perspective on ATSDR involvement, it is confusing in that the reader does not know if this work was ever done and if not why. Should be stated clearly that this ambient air sampling plan was not carried out and perhaps less information regarding what ATSDR recommended should be provided.

Response 8
ATSDR was requested by CTDEP to assist in determining air monitoring plans and sampling needs for the Yaworski landfill. Recommendations were provide by our air specialist to the CTDEP in April 22, 1996. It was recommended initially that additional sampling be conducted at the landfill vents, gas migration interceptor trench and leachate. EPA priority pollutants should be sampled for to include VOCs, volatile sulfur compounds, ammonia, and amines. Based on these results, it was further recommended that identified contaminants should be sampled for at the perimeter and ambient air sampling should be conducted for a representative and/worst case time period or conditions. It was also recommended that residences adjacent to the active landfill be sampled for until soil migration is better characterized. Additional air sampling was also recommended during excavation activities on site. To ATSDR's knowledge, the recommended air sampling activities have not occurred. However, air modeling was proposed using data collected from subsurface soil-gas samples in 1995/96. The model and ATSDR's evaluation is presented in the discussion section of this document.

Comment 9
Page 7 On-Site Air Sampling Title suggests that ambient sampling was done. Perhaps more appropriate title should indicate soil gas sampling. Clarification is very important since the assumptions that one can draw regarding potential exposure are very different for air sampling data versus soil gas sampling data.

Response 9
The title on page 7 is a general title but the accompanying paragraph has been modified to clarify that the data reviewed was from soil gas sampling. No ambient air data were available to review for this site.

Comment 10
Page 7 Landfill Gas Sampling Data Would help to provide a brief description of how these samples are collected to provide reader with a better understanding of soil gas, and what this data means.

Response 10
The sampling protocol for samples collected at the Yaworski Landfill during the winter of 1995/96 is described in the "Air impact scope of study" (Fuss & O'Neil, 1994).

Comment 11
Page 8 top of page Is it realistic that ambient levels of methane can present an asphyxiant hazard, "replace available oxygen..."? More information should be given to provide a better description of realistic methane hazards at this site, where and to whom. There is no discussion here regarding the potential for methane migration and potential build up in confined spaces, particularly homes. This seems to be one of the more significant public health issues but has not been presented.

Response 11
The migration of methane at the landfill has not been characterized and the potential for pockets of high levels of methane may represent a hazard to workers or people who frequent the recycling area which is in a low lying area. "Because of methane's low density it may accumulate in the upper strata of poorly ventilated areas to produce an asphyxiating atmosphere" (Patty, E. (ed.). in Industrial Hygiene and Toxicology: Volume II: Toxicology. 2nd ed. New York: Interscience Publishers, 1963. 1196) peer reviewed. In addition, methane migration was known to be moving toward the residential areas in the past, potential also exists for accumulation of methane in the confined areas of basements. Therefore, ATSDR recommends ambient air sampling onsite and in the basements of residents living near the active landfill.

Comment 12
Page 8 There is discussion about excavation activities. Some additional discussion about what these excavation activities entail, the duration of these activities and a description of how these activities may affect exposure potential would be helpful, since the excavation activities are identified as problematic.

Response 12
Air monitoring during excavation activities is recommended to identify the presence of volatile contaminants and odors released onsite during periods of activity where the landfill cap or soil is disturbed and to ensure that intermittent releases do not move offsite into residential areas. Action levels should be set to implement corrective action if emissions exceed health based levels. This information is provided on page 9, under the heading of data needs.

Comment 13
Page 8 Why is there extensive discussion about the April, 1996 ATSDR Health Consultation in the middle of the Discussion Section. To have sub-titles like Perimeter Air Sampling and Air Sampling During Excavation Activities suggests that these activities were performed and are in some way providing information that was evaluated for this health consultation. It is very confusing and would be more appropriate in the Background section. Recommendations that ATSDR made in 1996 have little or no relevance to the current discussion, which tries to use limited data to evaluate the health implications of air emissions from the landfill. It might also be more appropriate to restate some of these recommendations in the Recommendation Section of this document.

Response 13
The reference to the April 1996 ATSDR Health Consultation is presented in the discussion section to identify data gaps and recommendations to obtain data to characterize the site further and to identify air monitoring that is necessary during periods of landfill activity where volatilization of contaminants are more likely to occur. The headings may be misleading and that section of the discussion has been placed under a general "Data Gaps" heading.

Comment 14

Table 1 and 2. It is very inappropriate to cite comparison values in tables of data that have little relevance to actual exposure potential. While it is appropriate to use the comparison values to identify contaminants of concern, to present the comparison values in a table of soil gas or riser pipe concentrations is misleading and can easily be misinterpreted. Does anyone think someone may actually be exposed to 8,210 mg/m^3 of benzene or 39,603 mg/m^3 of methylene chloride? A more general discussion indicating that very high levels of volatile organic compounds were identified and a comparison with soil gas data found at other landfills could better make the case that this landfill is unique and higher concentrations of volatile organic compounds were identified than would be expected from a municipal waste landfill. This is essentially all you can conclude from this data. If ATSDR leaves the comparison values in they should be checked for accuracy, available CREGs were not cited for some chemicals. It is our understanding that CREGs are to be used first in the hierarchy of selected comparison values. In addition, the odor threshold for hydrogen sulfide is incorrect.

Response 14

The opening paragraph of the discussion section, " *ATSDR selects and compares on- and off-site concentrations of contaminants with ATSDR comparison values for noncarcinogenic and carcinogenic effects. Comparison values are concentrations of contaminants in specific environmental media (air, soil, drinking water) that are not expected to produce an adverse health effect in people who are exposed. These values are used only as screening values, listing a contaminant in a table of "chemicals of concern" does not mean that it will necessarily cause adverse health effects if exposure occurs at that specified concentration. When the concentration of a contaminant detected on or off the site is above the comparison value it is further evaluated to determine the potential for adverse health effects",* discusses this point. The comparison values were added to the tables of contaminants to identify the contaminants that are of concern according to ATSDR standards and should be sampled for during any future on-site ambient air sampling or off site residential air sampling. However to clarify the point, additional text has been added to the discussion section to make the point that potential exposures exist on-site to workers and people recycling as well as off site emissions are not clearly defined. Therefore ambient air data are necessary to evaluate these potential exposures to people who frequent the site and residents who live nearby.

The odor threshold range for hydrogen sulfide was obtained from Table 5.1, page 20 in the "Odor Thresholds for Chemicals with Established Occupational Health Standards. American Industrial Hygiene Association, 2700 Prosperity Avenue, Suite 250. Fairfax Virginia, 1997". This range is based on a technical critique of primary odor threshold values present in the literature and is the best estimate of odor thresholds for chemicals with experimental data available for evaluation using a standard set of criteria.

Comment 15
Page 16. This page is very technical and provides little assistance in interpreting the usefulness of the modeling exercise. The document should state the strengths and weaknesses of the model in terms that are understandable to the lay public. The modeled data should be provided with corresponding comparison values and ATSDR should qualitatively describe how they feel about that information given the strengths and weaknesses of the model. The paragraph on Page 17 starting with, " In conclusion," begins to do this. One of the clearer public health messages in this document "The annual and one-hour average concentrations.....were not at levels of health concern." is buried in this paragraph. The reader needs to be provided with a clearer discussion of how comfortable they should feel with that finding.

Response 15
Specific technical issues addressed in ATSDR's review of the NMOC emissions and dispersion modeling procedure, used to evaluate potential off-site contaminant emissions, are provided in Appendix C.

Comment 16
Page 17 Toxicological Evaluation The discussion regarding "data representing concentrations inside pipes driven several feet into the ground..." should also be stated in the Discussion sections where the types of available data are presented.

Response 16
Thank you for the comment, statements clarifying this issue have been added to the Discussion section.

Comment 17
Page 18 The top paragraph provides some perspective for the reader regarding the available data and should be repeated in the conclusion section. It also provides the foundation for the recommendation regarding the need for more data.

Response 17
Thank you for your comments, please refer to conclusions 6 through 8 in the Conclusion section and recommendations 1 and 2 in the Recommendation section of the document, which address these issues.

Comment 18
Conclusions Conclusion #2. It would be more appropriate to discuss the soil gas data in qualitative terms and not refer to comparison values. Conclusion #3 clarify that the highest concentration of methane was found in soil gas as opposed to ambient air. This same comment holds for all mention of landfill air sampling data. This conclusion should mention the potential for migration of methane into confined spaces since the second recommendation focuses on the need for monitoring in homes

but there is nothing in the text to support this. Conclusion #9 should provide more specifics on why this area is being recognized as a potential health hazard. Is it because of the methane, is it because the highest soil gas data were collected near this area, What?

Response 18
We appreciate your comments. Additional information has been provided in the sections of the text suggested above to further clarify this issue.

Comment 19
Recommendations Since ATSDR is recommending air sampling, the limitations of this approach should be outlined to illuminate the fact that ambient air sampling may not answer citizens' concerns about exposure in the past and that representative ambient air sampling is difficult to do and is reflective only of conditions of the landfill during the sampling. ATSDR should provide more detail with respect to an air sampling and monitoring plan that would provide useful data from a public health perspective particularly if ATSDR is going to be interpreting the results.

Response 19
Thank you for your comment, please see the response to Comment 7 above. ATSDR will be available to review and comment on any updated sampling plan for measuring ambient air emissions at the Yaworski Landfill and within residential areas.