HEALTH CONSULTATION

NORTHWEST 58TH STREET LANDFILL

MIAMI, DADE COUNTY, FLORIDA

CERCLIS NO. FLD980602643

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Prepared by

The Florida Department of Health and Rehabilitative Services
Under Cooperative Agreement With the
Agency for Toxic Substances and Disease Registry

Background and Statement of Issues

The Northwest 58th Street Landfill Superfund Site occupies a one square mile area near the western perimeters of the City of Miami Springs and the Town of Medley. The site is surrounded to the north, east and south by industrial and commercial areas, and to the west by an undeveloped area along the edge of the Everglades wetlands. The site is within two miles upgradient of two major public water supply wellfields serving over 750,000 people (Figure 1). From 1952 to 1982, the site operated as a municipal waste landfill, initially receiving approximately 60,000 tons of waste in 1952 and increasing to 1,000,000 tons per year in the 1980s. During its operation, the landfill likely received household hazardous wastes, such as paints, pesticides, and solvents. The shallow trenches dug for waste disposal resulted in disposal of refuse in the saturated zone of the Biscayne aquifer, two to three feet below ground surface. For a period after 1982, the landfill received only construction debris, quarry wastes, and water plant sludges (1, 2, 3).

The U.S. Environmental Protection Agency (EPA) placed the Northwest 58th Street Landfill on the National Priorities List (NPL) in 1981 because of past disposal activities and potential contamination of the Biscayne aquifer, the sole source of drinking water in southeastern Florida. EPA grouped the landfill with two other NPL sites, collectively referred to as the Biscayne Aquifer Superfund Study, to address the groundwater contamination caused by all three NPL sites (2, 3). EPA's 1985 area-wide ROD selected air stripping to remove volatile organic compounds (VOCs) from the contaminated groundwater (4, 5). In 1987, EPA finalized another ROD, specific to the Northwest 58th Street Landfill, that addressed properly closing the landfill and connecting nearby homes and businesses to municipal drinking water (5, 6). Miami-Dade Water and Sewer Department (MDWSD) completed construction of the air strippers in 1992 (7).

In 1986, the Agency for Toxic Substances and Disease Registry (ATSDR) published a public health assessment for the Northwest 58th Street Landfill Site. This assessment found the Biscayne aquifer contamination near the landfill posed a potential risk to human health. However, there were not enough data to identify the population at risk. Consequently, the public health assessment recommended nearby private wells be sampled and demographic information on private well users be provided (8). These recommendations were not carried out; however, Dade County completed the extension of municipal water supply lines to nearby private well users by the end of 1988 (3, 5). In 1992, the Florida Department of Health and Rehabilitative Services (FHRS) completed a Site Review and Update for the site. In this document, FHRS recommended a health consultation be performed on the emissions from the air strippers used to clean up the groundwater (5). The air strippers are located at the Preston and Hialeah drinking water treatment plants (9). Residents living near these plants are concerned that inhalation of chemicals from the air strippers plants may harm their health (10).

In this health consultation, we evaluate the potential for illness from inhalation exposure to the air stripping towers at the Preston and Hialeah drinking water plants, based on recent

data. There is insufficient information to evaluate the potential health effects from skin absorption of VOCs in air. Because area residents are connected to municipal water supplies, we did not evaluate the health effects from possible exposure to VOCs through drinking water use.

Site Visit

On June 21, 1994, FHRS staff performed a windshield survey of the air stripping system at the Preston and Hialeah drinking water treatment plants. There are 44 air stripping towers in operation at the Preston plant and 20 air stripping towers in operation at the Hialeah plant. The surrounding area is primarily residential, with a commercial area south of the Hialeah plant along U.S. 27 (Okeechobee Road) (Figure 2). In addition to the windshield survey, FHRS staff entered the Preston plant and discussed the air stripper operation with Mr. Keith Kieffer, the treatment plant supervisor. Mr. Kieffer told FHRS staff MDWSD planned to apply to the Florida Department of Environmental Protection (FDEP, formerly known as the Florida Department of Environmental Regulation) to modify the air pollution permits for the plants. He also explained how both plants blended water from different wellfields and used different treatment trains, as described below (9).

The primary purpose of the air strippers is removal of VOCs from water originating from the Hialeah, Preston, and Miami Springs Wellfields, also known as the Inner Wellfields (Figure 1). In order to meet demand, the Preston plant also draws water from the Northwest Wellfield (Figure 1), a water source that is not contaminated with VOCs, but has high color levels from natural tannins found in the decaying vegetation of native soils in the wellfield area. To disinfect the ground water prior to distribution to consumers, the Preston plants uses two different water treatment processes. One treatment train uses breakpoint chlorination, a process that reduces color but forms disinfection by-products known as trihalomethanes. Trihalomethanes are volatile and increase the VOC concentration emitted from the Preston plant's air strippers (9, 11). Because trihalomethanes have the potential to cause cancer, birth defects, and genetic mutations in animals (12-15), they are regulated under Florida's Safe Drinking Act (codified in Rule 17-550, Florida Statutes). The Preston plant's other treatment train uses chloramination, a process that does not reduce color or form trihalomethanes (11, 12). The Hialeah plant, which uses only Inner Wellfield water, employs only chloramination prior to air stripping, and trihalomethane formation is limited (9, 11).

Modeled Air Concentrations

Prior to air stripper construction, MDWSD hired a consultant to evaluate the effects of the proposed air stripping system on the ambient atmosphere around the Preston and Hialeah drinking water treatment plants. The 1987 final report evaluated the release of VOCs, including trihalomethanes formed by the disinfection processes. For the analysis, the

consultant used EPA's ISCST air dispersion model because it could incorporate point and area emission sources, a large number of receptors, and a year of representative hourly meteorological data collected from Miami International Airport. The model represented each field of strippers as an area emission source with an emission height equal to the height of the air strippers. Preliminary modeling indicated this approach was representative for the low flow condition, and the low flow condition resulted in higher maximum concentrations than the high flow condition. The ISCST model could not account for the effects of building downwash, the rapidly downward movement of an airborne contaminant plume in the turbulent mixing region directly downwind of a building, from an area source. Nevertheless, the consultant considered the downwash effect to be insignificant because of the low exit velocity of air from the stripping towers and because the tower heights were low enough for the model to consider them near the ground already.

The ISCST model predicted maximum concentrations for nine chemicals (Table 1). The model predicted the maximum off-site 8-hour average concentration from air stripping at the Preston plant would occur approximately 125 meters west-northwest of the center of the proposed air stripping field. The model predicted the maximum off-site 8-hour average concentration from air stripping at the Hialeah plant would occur approximately 400 meters north of the proposed Hialeah air stripping field. The consultant compared the maximum 8-hour average concentrations from the plants with the applicable reduced threshold limit values (RTLVs) (16). The reduced threshold limit values in the 1987 document were maximum workplace air standards known as threshold limit values, published by the American Conference of Governmental Industrial Hygienists and available from FDEP, reduced by a factor of 420 to account for continuous release and the increased sensitivity of the general population (11). In the report, RTLVs were not available for bromodichloromethane or chlorodibromomethane. The seven comparisons performed predicted vinyl chloride, chloroform, and 1,1-dichloroethene emissions from the plants would exceed the RTLV standards. The consultant stated a more realistic comparison to the RTLVs would be made by comparing these standards with the estimated maximum annual (continuous) average concentrations. The ISCST model predicted the maximum off-site annual average concentration from air stripping at the Preston plant would occur approximately 75 meters north-northwest of the proposed Preston air stripping field, and the maximum off-site annual average concentration from air stripping at the Hialeah plant would occur approximately 75 meters north-northwest of the proposed Hialeah air stripping field. The comparison of the predicted maximum annual average concentrations with the corresponding RTLVs indicated the emissions would be below the standards (16).

Since 1992, the air stripping towers have been operating under air pollution permits granted by FDEP. In 1994, MDWSD applied to modify their permit limits because of projected increases in customers served by the two water plants. In their permit application, MDWSD used EPA's ISCST2 model, incorporating five years (1985 - 1989) of meteorological data, to predict maximum emissions of 15 chemicals (Table 1) in a 24-hour period under worst-case, maximum daily flow conditions. The application then compared the maximum predicted contaminant concentrations emitted with the currently permitted RTLVs, called Acceptable

Ambient Concentrations in the FDEP permit. The Acceptable Ambient Concentrations are air standards based on the 1987 RTLVs and account for the gallon per minute flow rate as well as the height of the air stripper (S. Brooks, pers. comm.) None of the predicted 24-hour maximum concentrations exceeded the Acceptable Ambient Concentrations in the current permit (11).

Measured Air Concentrations

MDWSD's 1994 permit application discusses the analytical results of air samples collected since 1993 from nine locations near the plants. These are 8-hour samples collected in SUMMA canisters and analyzed for compounds known as the TO-14 group. MDWSD reports most samples have been below detection limits. Chloroform has been detected throughout the area, but in 8-hour concentrations lower than the 24-hour air standards, with one exception on October 29, 1993 (11). FHRS could not obtain these monitoring data for a separate analysis in this health consultation.

On July 7, 1993, MDWSD's consultant collected and analyzed seven air samples in the area surrounding the two drinking water treatment plants to evaluate ambient air quality for VOC compounds known as the TO-1 group (Table 1). In the final report, the consultant included the analytical results from the July 7 sampling, as well as analytical results from two sampling days in September 1991. The sample results from these three days were the only monitoring data we had for review.

There are data gaps and irregularities in the latter report. There was no information about background samples or wind direction in the report, although the July 7, 1993 results have one sample marked "downwind" (location #4). It is not known if this downwind sample, located at the Preston plant's south fence line, represents the point of maximum contaminant exposure. Indeed, the highest concentrations for five contaminants occurred at the meteorological station at the Hialeah plant (location #1), and for 3 samples occurred at the "utility building" (location # 3) on this date. There is no map showing sample locations in the report. The July 7, 1993 data included detection limits, but the September 1991 data did not. The July 7 sample collection times varied between 4 hours 55 minutes and 5 hours 33 minutes; the September 1991 data did not include sample collection times (17).

Selecting Contaminants of Concern

Because of the different modeling and sampling timeframes used in the reports reviewed, we selected and evaluated contaminants of concern for acute and chronic exposure periods separately. For this health consultation, we defined acute exposure as the exposure to the maximum modeled or measured contaminant concentration for a time period of 8 hours or less. For measured data reported as below the detection limit, we used the detection limit value as the measured concentration when available. For acute exposures, we evaluated only

the increased risk of noncancer health effects because the calculations estimating increased cancer risk are based on lifetime exposure (18). Furthermore, we defined chronic exposure as the annual exposure to the maximum contaminant concentration modeled. If annual data were not available for a contaminant, we used 24-hour modeled data since the ATSDR screening values for chronic exposures are based on a daily exposure scenario (18). For chronic exposures, we evaluated the increased risk for both cancer and noncancer illnesses.

To select contaminants of concern for acute health effects, we identified the maximum air concentration for each contaminant and compared this value to ATSDR's noncancer screening values (19, 20) and to FDEP's no threat levels for air toxics (21) (Table 2). If a maximum air concentration was greater than its screening or no threat value, or if there were no values available for screening the data, we identified the contaminant as a contaminant of concern. Note that screening values do not represent health threat levels; they are simply used to select contaminants for further evaluation (19-21). As a result of these comparisons, we selected the following four contaminants as contaminants of concern: vinyl chloride, chloroform, bromodichloromethane, and chlorodibromomethane.

To select contaminants of concern for chronic health effects, we first considered the cancer-causing potential of each contaminant. Initially, we compared the maximum modeled air concentrations to ATSDR's cancer screening values (Table 3). If a maximum contaminant value was greater than its cancer screening value, we identified the contaminant as a contaminant of concern. If an ATSDR cancer screening value was not available for a particular contaminant, we next considered the contaminant's EPA or NTP (National Toxicology Program) cancer classification, and selected a contaminant for further evaluation if it was a known or suspected cancer-causing agent and the predicted maximum concentration was greater than zero (22). For substances with either unknown or no evidence of cancer-causing potential, we made comparisons to ATSDR noncancer screening values and to FDEP's no threat levels for air toxics, as described above. As a result of these comparisons, we selected the following eight contaminants as contaminants of concern: vinyl chloride, 1,1-dichloroethene, 1,1-dichloroethane, chloroform, bromodichloromethane, 1,1,2,2-tetrachoroethane, chlorodibromomethane, and trichloroethene.

Acute Health Effects Evaluation

To evaluate the four contaminants of concern for noncancer acute health effects, we compared the maximum air concentrations to health-based, acute Minimal Risk Levels (MRLs). An acute MRL is an estimate of the daily dose of a contaminant below which non-cancer illnesses are unlikely to occur after an exposure period of 14 days or less. ATSDR develops MRLs from scientific studies found in the toxicological literature, and publishes them in a series of chemical-specific documents called toxicological profiles (18, 19). These documents contain not only MRLs, but also information on possible health effects, environmental transport, human exposure, and regulatory status of contaminants. If there were no MRLs for comparison, we estimated the risk of developing a noncancer illness by

comparing the maximum air concentration to experimental concentrations associated with illnesses in published human or animal studies, as summarized in the ATSDR toxicological profiles. The conclusions from these latter comparisons are judgements based on what is known about the quality of the study, natural disease rates in the test organisms, and how close the air concentrations were to experimental concentrations at which health effects were found. These judgements always contain some uncertainty because of natural variation within human and animal populations, and because of species differences among humans and animals.

As a result of these comparisons to health-based criteria, we found the increased risk of developing noncancer illnesses from inhalation of chloroform or vinyl chloride to be negligible. Although neither of these two compounds are known to increase their toxicity by interacting together, people who drink alcohol may be more susceptible to the toxic effects of these substances (15, 23). We could not evaluate the increased risk of illness from inhalation of bromodichloromethane or chlorodibromomethane because there were no appropriate human or animal noncancer studies available for review (13, 14).

Chronic Health Effects Evaluation

To evaluate the eight contaminants of concern for noncancer chronic health effects, we compared the maximum air concentrations to health-based chronic MRLs and to EPA's Reference Concentrations (RfCs) for inhalation exposure. A chronic MRL is an estimate of the daily dose of a contaminant below which non-cancer illnesses are unlikely to occur after an exposure period of 365 days or more; an RfC is an estimate of daily human exposure to a contaminant, generally for a year or more, likely to be without an appreciable risk of developing noncancer illnesses (18, 22). If there were no MRLs or RfCs for comparison, we estimated the risk of developing a noncancer illness by comparing the maximum air concentration to experimental concentrations associated with illnesses in published human or animal studies, as summarized in the ATSDR toxicological profiles. The conclusions from these latter comparisons use the judgements and have the uncertainty described above.

As a result of these comparisons to health-based criteria, we found the increased risk of developing noncancer illnesses from inhalation exposure to chloroform, vinyl chloride, 1,1-dichloroethene, 1,1-dichloroethane, 1,1,2,2-tetrachloroethane, or trichloroethene to be negligible. Although none of these six compounds are known to increase their toxicity by interacting together, people who drink alcohol may be more susceptible to the toxic effects of these substances (15, 23-27). We could not evaluate the increased risk of illness from inhalation of bromodichloromethane or chlorodibromomethane because there were no appropriate human or animal noncancer studies available for review (13, 14).

To evaluate the increased cancer risk for the eight contaminants of concern, we used the computer software, Risk*Assistant™ to estimate the increased cancer risk for each contaminant. These estimates use a formula based on EPA's cancer slope factor, a number

derived from experiments examining the potential for illness based on exposure to different concentrations of a chemical (28), as well as standard assumptions about body weight, inhalation rates, exposure time length, and other factors needed for the calculations (Table 4) (29). The estimated increased cancer risk is the number of excess cancer cases that could develop per unit of population if the exposure assumptions are met for a specific contaminant. Usually, an excess cancer risk of 1 in 10,000 to 1 in 1,000,000 is considered to be a low to negligible increase in cancer risk (30).

There are three things to consider when evaluating cancer risk. First, when examining the numeric cancer risk value, it is important to recognize there is a background cancer rate of around 25% in the United States (19). This means, for example, that in a group of 10,000 people, 2,500 people can be expected to develop cancer in their lifetime without exposure to contaminants at a particular site. If there is a low (1 in 10,000) increased cancer risk, about 2,501 people in this same group might develop cancer in their lifetime if they are exposed to that contaminant at the specified dose and exposure period. Because these cancer risk calculations are made for a lifetime, and because some cancers don't develop until many years after exposure, we did not calculate a separate cancer risk for children. Second, when interpreting the associated cancer information, it is important to note whether or not the associated cancers have been looked for and found to occur in humans. This is because a given test animal species can be more or less likely to develop cancer than humans. When only animal studies of cancer are available, we present the suggestive evidence from the animal studies, but do not necessarily conclude human exposure will be linked to cancer. Third, there is much scientific controversy about the validity of adding cancer risks from different exposure routes together. Some scientists believe exposure to a cancer-causing chemical via multiple pathways seems likely to increase the overall cancer risk. Other scientists believe cancer risks can be added only if the cancer-causing agent affects the same cell type within the same organ, and works through the same cellular mechanism within the common cell type. In this health consultation, we support the principle that a common mechanism is required. Often, cellular mechanisms of action are not known; in these cases, the suitability of adding estimated cancer risks together cannot be determined.

The increased cancer risk calculations indicate there could be a low increased risk of cancer from exposure to vinyl chloride, chloroform, or 1,1-dichloroethene if annual emissions meet worst-case modeled conditions. In humans, vinyl chloride inhalation has been linked to a rare form of cancer called angiosarcoma of the liver. This type of cancer has also been linked to the ingestion (eating or drinking) of vinyl chloride, indicating that the cancer risk might increase if people were exposed to significant amounts of vinyl chloride in their drinking water. However, because people living near the air stripping towers use municipal water, the possibility of significant ingestion exposure is likely to be remote. In addition, some human studies suggest vinyl chloride inhalation might be associated with cancers in other parts of the body, although this is not known with certainty (23). In contrast to vinyl chloride, there are no human or animal cancer studies concerning inhalation exposure to chloroform. However, animal studies suggest chloroform ingestion causes liver and kidney cancer in animals, and EPA's cancer slope factor for inhalation is based on an ingestion

study in mice. Additionally, there is some human evidence suggesting chloroform ingestion may be associated with bladder and colon cancer in people, but these studies are not certain. Therefore, it is not known if chloroform inhalation causes liver, kidney, bladder, or colon cancer in people (15). For 1,1-dichloroethene, there is one inhalation study suggesting this chemical may be associated with kidney cancer in one strain of mice, and EPA's cancer slope factor for inhalation is based on the study involving these mice. Available epidemiological studies of people breathing 1,1-dichloroethene at work are inadequate for determining if 1,1-dichloroethene is associated with cancer in humans (24).

There is no apparent increased risk of cancer from inhalation exposure to 1,1,2,2-tetrachloroethane, and there is no clear evidence that inhalation exposure to trichloroethene is linked to increased cancer risk (27). We could not determine the increased cancer risk from inhalation of bromodichloromethane, chlorodibromomethane, or 1,1-dichloroethane because there were no appropriate human or animal cancer studies available for review (13, 14, 25).

Conclusions

1. The maximum air concentrations for 4 of 15 contaminants exceeded acute, noncancer exposure screening guidelines. Acute inhalation exposure to vinyl chloride and chloroform from the air strippers, however, is unlikely to cause noncancer illnesses in area residents. The risk of developing noncancer illnesses from acute inhalation of bromodichloromethane or chlorodibromomethane is unknown because there are no appropriate human or animal noncancer studies available for review.

2. The maximum air concentrations for 8 of 15 contaminants exceeded chronic, noncancer exposure screening guidelines. Chronic inhalation exposure to vinyl chloride, 1,1-dichloroethene, 1,1-dichloroethane, chloroform, 1,1,2,2-tetrachloroethane, and trichloroethene, however, is unlikely to cause noncancer illnesses in area residents. The risk of developing noncancer illnesses from chronic inhalation of bromodichloromethane or chlorodibromomethane is unknown because there are no appropriate human or animal noncancer studies available for review.

3. Area residents may have a low increased risk of cancer from exposure to vinyl chloride, 1,1-dichloroethene, or chloroform if annual emissions meet worst-case modeled conditions. To date, the available data indicate the measured maximum air concentrations for these three contaminants are much smaller than the worst-case modeled air concentrations. Therefore, the estimated low increase in cancer risk seems unlikely to represent a significant public health threat. There is no apparent increased risk of cancer from inhalation exposure to 1,1,2,2-tetrachloroethane, and there is no clear evidence that inhalation exposure to trichloroethene is linked to increased cancer risk. The increased cancer risk from inhalation of bromodichloromethane, chlorodibromomethane, or 1,1-dichloroethane is unknown because there are no appropriate human or animal cancer studies available for review.

4. This health consultation evaluates, on a chemical-by-chemical basis, the health risk from inhalation of VOCs from the air strippers at the Preston and Hialeah water treatment plants. Although none of the contaminants of concern are known to increase their toxicity by interacting together, there is some evidence suggesting people who drink alcohol may be more susceptible to the toxic effects of these compounds. This health consultation does not evaluate the possible health effects from VOC exposure through residential drinking water use. Such exposure is likely to be limited because area residents are connected to municipal water which is regulated under Florida's Safe Drinking Water Act. There is insufficient information to evaluate the potential health effects from skin absorption of VOCs in air.

5. This health consultation is based on the maximum air concentrations modeled or measured in the three studies reviewed. If contaminant concentrations in future samples exceed these concentrations, the public health threat should be re-evaluated.

6. The interpretation, advice, and recommendations provided in this health consultation are based on the data and information referenced. Additional data could alter the conclusions and recommendations of this health consultation. ATSDR and/or FHRS will review additional data as it becomes available or respond to additional requests as necessary. The conclusions of this health consultation are site-specific and should not be considered applicable to any other site.

Recommendations

As long as air stripping is used to clean up the ground water, the potentially responsible parties should collect and analyze air samples in the area surrounding the Preston and Hialeah water treatment plants on a regular basis. In addition, the drinking water distributed from the plants should be monitored for the VOCs, including vinyl chloride and trihalomethanes, as regulated under Florida's Safe Drinking Water Act. Continued monitoring is necessary to ensure public health is protected and off-site air concentrations do not exceed those previously measured or predicted from the models.

CERTIFICATION

This NW 58th Street Landfill Health Consultation was prepared by the Florida Department of Health and Rehabilitative Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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

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Table 1. Air Contaminants Modeled or Measured in the Reports Reviewed

ISCST Air Stripper Model for 24 and 8 hours	ISCST2 Permit Application Model for 24 hours	MDWSD Ambient Data Measured for ~ 5 hours
Vinyl Chloride	Vinyl Chloride	Vinyl Chloride
1,1-Dichloroethene	1,1-Dichloroethene	1,1-Dichloroethene
Methylene Chloride	Methylene Chloride	Methylene Chloride
1,1-Dichloroethane	1,1-Dichloroethane	1,1-Dichloroethane
Chloroform	Chloroform	Chloroform
		1,2-Dichloroethane
		1,1,1-Trichloroethane
Bromodichloromethane	Bromodichloromethane	Bromodichloromethane
Bromoform	Bromoform	Bromoform
	o-Chlorotoluene	o-Chlorotoluene
	Chlorobenzene	Chlorobenzene
1,1,2,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane	1,1,2,2-Tetrachloroethane
	1,4-Dichlorobenzene	1,4-Dichlorobenzene
	1,2-Dichlorobenzene	1,2-Dichlorobenzene
Chlorodibromomethane	Chlorodibromomethane	
	1,2-Dichloroethene	
	Trichloroethene	

Table 2. Maximum Air Concentrations and Comparison Values for Acute Health Effects

Contaminant	Maximum Modeled Concentration from Air Strippers (8 hour) in $\mu g/m^3$	Maximum Measured Concentration (8 hour) in $\mu g/m^3$	FDEP Air Toxics Working List No Threat Level (8 hr) in $\mu g/m^3$	ATSDR Screening Value (source) in $\mu g/m^3$
Vinyl Chloride	268.0	0.18 (estimated)	130	5.2 (EMEG - Intermed)
1,1-Dichloroethene	74.6	ND (0.1)	200	79.4 (EMEG - Intermed)
Methylene Chloride	21.7	3.45	1740	1412 (EMEG - Acute)
1,1-Dichloroethane	186.0	ND (0.05)	8100	Not Available
Chloroform	678.0	3.42	490	44.6 (EMEG - Acute)
1,2-Dichloroethane	Not Modeled	ND (0.05)	400	992 (EMEG - Acute)
1,1,1-Trichloroethane	Not Modeled	41.96	38200	10800 (EMEG - Acute)
Bromodichloromethane	119.0	0.9 (estimated)	Not Available	Not Available
Bromoform	10.7	ND (0.14)	52	Not Available
o-Chlorotoluene	Not Modeled	0.23 (estimated)	2590	Not Available
Chlorobenzene	Not Modeled	0.18 (estimated)	3450	Not Available
1,1,2,2-Tetrachloroethane	10.2	ND (0.14)	69	6980 (EMEG - Acute)
1,4-Dichlorobenzene	Not Modeled	0.69 (estimated)	4510	1202 (EMEG - Intermed)
1,2-Dichlorobenzene	Not Modeled	0.09 (estimated)	3010	Not Available
Chlorodibromomethane	40.5	ND	Not Available	Not Available
1,2-Dichloroethene	Not Modeled	ND	–	–
Trichloroethene	Not Modeled	Not Available	–	–

$\mu g/m^3$ - micrograms per cubic meter

FDEP Air Toxics Working List No Threat Level - FDEP nonregulatory guidelines for screening air concentrations. Air concentrations below FDEP guidelines are unlikely to harm health; air concentrations above FDEP guidelines will not necessarily harm health, but should be further analyzed.

ATSDR Screening Values - ATSDR estimates for screening air concentrations. Air concentrations below ATSDR screening values are unlikely to harm health; concentrations above ATSDR screening values will not necessarily harm health, but should be further analyzed.

ND - Not Detected (detection limit, if available)

EMEG - ATSDR's Environmental Media Evaluation Guide, derived from ATSDR's Minimal Risk Level, is an estimate of the daily human exposure to a chemical likely to be without an appreciable risk of noncancer illnesses. In this table, intermediate EMEGs (exposure periods between 15 and 364 days) are used when acute EMEGs (exposure periods of 14 days or less) are not available.

Table 3. Maximum Air Concentrations and Comparison Values for Chronic Health Effects

Contaminant	Maximum Modeled Concentration from Air Strippers in $\mu g/m^3$	FDEP Air Toxics Working List No Threat Level (annual or 24 hour) in $\mu g/m^3$	ATSDR/EPA Screening Value (value source) in $\mu g/m^3$
Vinyl Chloride	18.7 (annual average)	Not Available	Class A (WOE)
1,1-Dichloroethene	5.2 (annual average)	0.02	0.02 (CREG)
Methylene Chloride	1.52 (annual average)	2.1	2.0 (CREG)
1,1-Dichloroethane	13.0 (annual average)	Not Available	Class C (WOE)
Chloroform	47.3 (annual average)	0.043	0.04 (CREG)
1,2-Dichloroethane	Not Modeled	–	–
1,1,1-Trichloroethane	Not Modeled	–	–
Bromodichloromethane	8.32 (annual average)	Not Available	Class B2 (WOE)
Bromoform	0.743 (annual average)	0.91	0.9 (CREG)
o-Chlorotoluene	0 (24 hour)	621.6	Not Available
Chlorobenzene	0 (24 hour)	828.0	Not Available
1,1,2,2-Tetrachloroethane	0.714 (annual average)	0.017	0.02 (CREG)
1,4-Dichlorobenzene	0 (24 hour)	1082.4	RAC (NTP)
1,2-Dichlorobenzene	0 (24 hour)	722.4	Not Available
Chlorodibromomethane	3.28 (annual average)	Not Available	Class C (WOE)
1,2-Dichloroethene	3.0 (24 hour)	1903.2	792 (EMEG - Intermed)
Trichloroethene	1.0 (24 hour)	645.6	0.6 (CREG)

$\mu g/m^3$ - micrograms per cubic meter

FDEP Air Toxics Working List No Threat Level - FDEP nonregulatory guidelines for screening air concentrations. Air concentrations below FDEP guidelines are unlikely to harm health; air concentrations above FDEP guidelines will not necessarily harm health, but should be further analyzed.

ATSDR/EPA Screening Values - ATSDR or EPA estimates for screening air concentrations. Air concentrations below numeric comparison values are unlikely to harm health; concentrations above numeric comparison values will not necessarily harm health, but should be further analyzed.

WOE - EPA's Weight of Evidence Classification, indicating the human cancer-causing potential of a chemical. Class A contaminants are considered known human cancer-causing agents; Classes B2 and C are considered suspected cancer-causing agents, based on animal studies.

CREG - ATSDR Cancer Risk Evaluation Guide, derived from EPA's cancer slope factors, is an estimate of the contaminant concentration that may result in one excess cancer in a million persons exposed over a lifetime.

RAC - Reasonably Anticipated to be a Carcinogen (cancer-causing agent) by the National Toxicology Program.

EMEG - ATSDR's Environmental Media Evaluation Guide, derived from ATSDR's Minimal Risk Level, is an estimate of the daily human exposure to a chemical likely to be without an appreciable risk of noncancer illnesses. In this table, intermediate EMEGs (exposure periods between 15 and 364 days) are used when chronic EMEGs (exposure periods of 365 days or more) are not available.

Table 4. Parameters Used for Exposure Calculations

Parameter	Hypothetical Adult
Inhalation Rate	0.83 cubic meters/hour
Inhalation Duration	24 hours
Exposure Frequency	350 days/year
Exposure Period	30 years
Body Weight	70 kilograms
Lifetime Expectancy	70 years

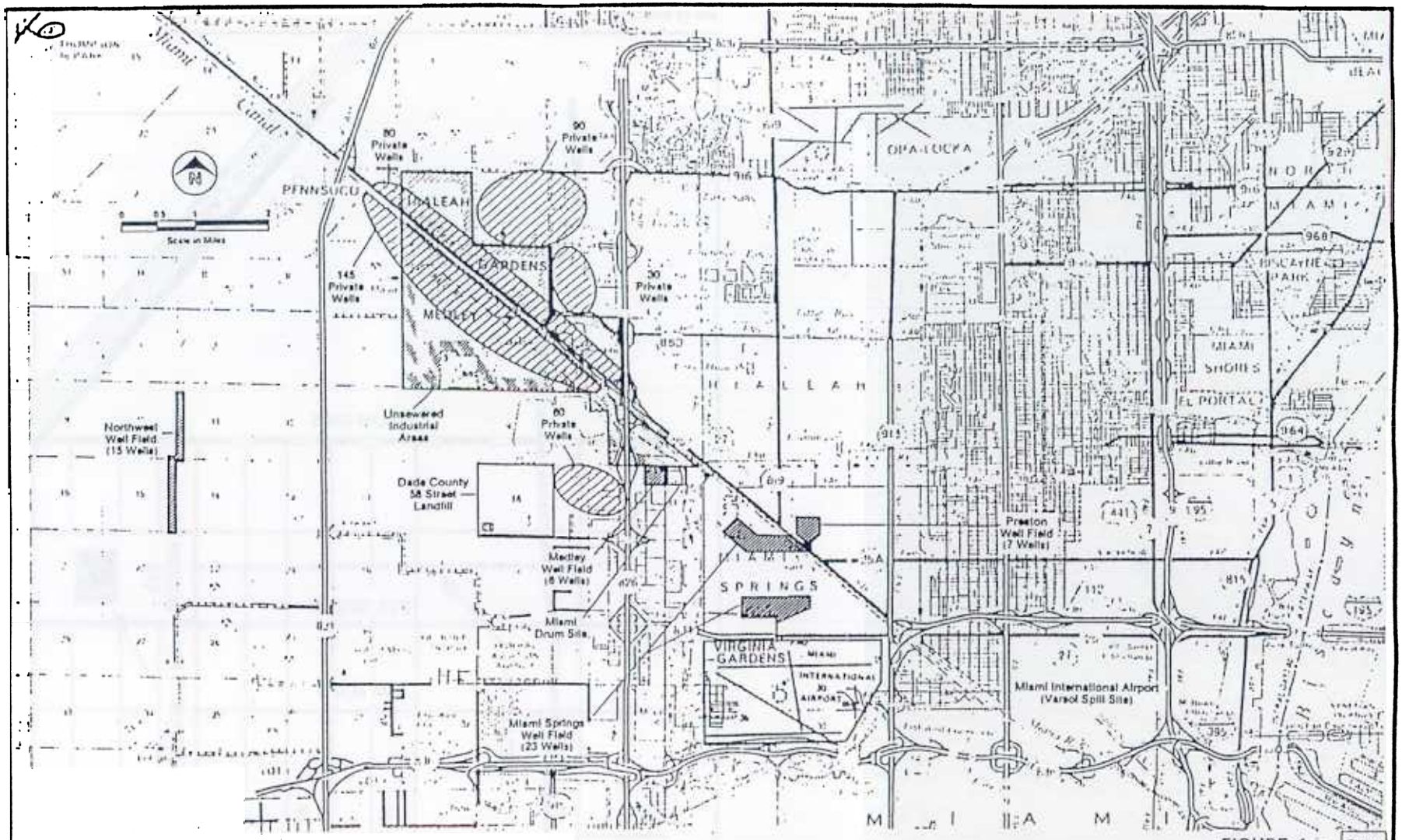

FIGURE 1
Location of Potential Contamination Sites, Public Well Fields, and Private Wells in Study Area.

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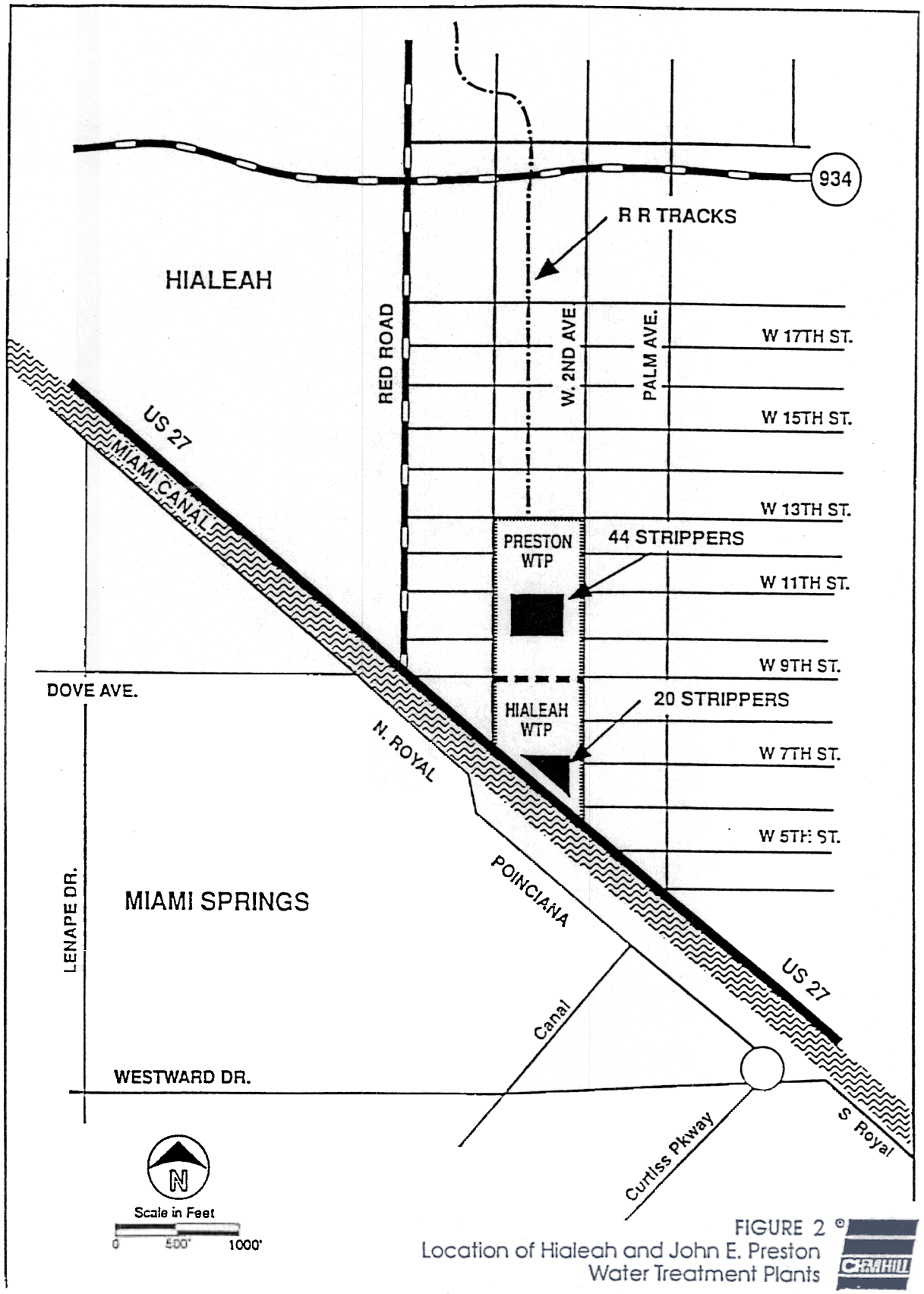

FIGURE 2
Location of Hialeah and John E. Preston Water Treatment Plants