

Public Health Assessment for

PETITIONED PUBLIC HEALTH ASSESSMENT
LOXAHATCHEE NURSERY
PALM CITY, MARTIN COUNTY, FLORIDA
CERCLIS NO. FL0001900091
SEPTEMBER 29, 1998

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



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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.

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.

Table of Contents

Summary	1
Background	3
A. Site Description and History	3
B. Previous ATSDR Actions	4
C. Site Visit	4
D. Demographics, Land Use, and Natural Resource Use	5
Community Health Concerns	6
Environmental Contamination and Other Hazards	7
A. Environmental Contamination	7
B. Physical and Other Hazards	13
Pathways Analyses	13
A. Completed Exposure Pathway	14
B. Potential Exposure Pathways	14
Public Health Implications	16
A. Toxicologic Evaluation	16
B. Health Outcome Data Evaluation	23
C. Community Health Concerns Evaluation	24
ATSDR Child Health Initiative	27
Conclusions	29
Recommendations	30
Public Health Action Plan	30
Preparers of Report	31
References	32
APPENDIX A -- ACRONYMS	36
APPENDIX B -- FIGURES	37
Figure 1: March 1998 Sampling Event Location Map -- Draft	38
Figure 2: Demographic Information	39

APPENDIX C -- TABLES	40
Table 1: Completed Exposure Pathways	41
Table 2: Potential Exposure Pathways	41
Table 3: On-Site Groundwater Sampling Results	42
Table 4: Private Well and Off-Site Temporary Well Sampling Results	45
Table 5: On-Site Soil Sampling Results - Soil Depth Unspecified	49
Table 6: On-Site Surface Soil Sampling Results - 1998	50
Table 7: Off-Site Surface Soil Sampling Results - 1998	56
Table 8: Sediment Sampling Results - 1998	58
Table 9: Tank Pull Sampling Results	63
 APPENDIX D -- COMPARISON VALUES	 64
 APPENDIX E -- ATSDR METHODOLOGY	 68
 APPENDIX F -- ATSDR HEALTH CONSULTATION	 71
 APPENDIX G -- ATSDR RESPONSE TO COMMENTS	 72

Summary

The Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned in 1996 for a public health assessment of the Loxahatchee Nursery site in Palm City, Florida. The main health concern of the community is contamination of private wells by pesticides leaching into the groundwater from the nursery site. Other concerns include the potential contamination of residential soils; the potential contamination of surface waters flowing from the site through drainage ditches; the potential contamination of the site and surrounding area by the chemicals, benlate and flusilazole; the incidence of cancer in the residential community surrounding the nursery site; the dangers to children playing on the site near the ponds and buildings; and the future development of the site for residential housing.

The Loxahatchee Nursery site began operating as a flower farm in the 1940's. In 1972, the flower farm converted to a nursery and began to grow specialty and long-term growth plants. Throughout the nursery's history, normal operations at the site included the use of pesticides. In January 1992, the nursery site ceased operations and was cleared of all plants in an agreement between the operators and Dupont (ATSDR, 1996a). Environmental sampling of monitoring wells, private wells, soils, and sediments was conducted.

The Loxahatchee Nursery site is not currently fenced. One pond is located on site. During ATSDR's site visit, the staff noted that the remaining structures on site were in a state of disrepair. ATSDR concludes that the on-site pond and dilapidated structures could pose a potential physical hazard to area residents, especially children, who trespass on site.

Based on a review of available environmental and toxicologic data, ATSDR determined that the Loxahatchee Nursery site in Palm City, Florida poses *no apparent public health hazard* from chemical contamination. ATSDR identified a completed exposure pathway to groundwater through the use of private wells in the area; however, the contaminants in drinking water from private wells in the area surrounding the Loxahatchee Nursery site are not at levels of health

concern. Potential exposures to soil and sediment, both on site and off site, have also been identified. ATSDR concludes that, under site-specific conditions of exposure, none of the contaminants detected in soil or sediment are likely to pose a hazard to public health. Given that only low levels of contaminants were detected in on-site soils and drainage ditch sediments, it is unlikely that the on-site pond contains elevated levels of contaminants. However, because no chemical-specific environmental sampling of the on-site pond has occurred, ATSDR has identified this as a data gap.

Based on the information reviewed for this public health assessment, ATSDR has made the following recommendations: (1) sample private well water on a periodic basis to ensure that residents will not be exposed in the future to constituents in groundwater at levels of health concern; (2) restrict access to the on-site pond and dilapidated structures as they could pose a physical hazard to individuals, especially children, who trespass on site; and (3) characterize on-site pond water and sediment to determine the presence or absence of contamination at levels of health concern.

Background

A. Site Description and History

The Loxahatchee Nursery site began operating as a flower farm in the 1940's. In 1972, the flower farm converted to a nursery and began to grow specialty and long-term growth plants. After the nursery site ceased operations in January 1992, the nursery was cleared of all plants in an agreement between the operators and Dupont (ATSDR, 1996a). An environmental audit in early 1992 discovered petroleum and chlorinated pesticide constituents in the soil and groundwater at the nursery site (HRS, 1996a).

Throughout the nursery's history, pesticides were routinely stored in the pesticide storage building and fertilizers were delivered to the plants through the nursery's irrigation system. In March 1992, after an abandoned underground storage tank was discovered and removed, low levels of pesticides were found in soil and groundwater samples collected near the tank (EPA, 1998a). In 1994, another storage tank was discovered at the site and its contents were removed (EPA, 1998a). From 1993 to 1998, several rounds of hydrocarbon and pesticide testing of private wells occurred. In July 1996, one private well contained concentrations of 1,2-dichloropropane as high as 150 parts per billion (ppb) which exceeds the United States Environmental Protection Agency's (EPA) maximum contaminant level (MCL) of 5 ppb. This well was fitted with a carbon filter in August 1996 which removes the contaminant from the water (EPA, 1998a). Methyl bromide, a nematocide, and benomyl (trade name Benlate), a Dupont fungicide, were reportedly used at the site.

EPA is currently investigating the site under the authority of the Superfund program to determine if any further action is necessary (EPA, 1998a). Groundwater, soil, and sediment samples were collected and tested for various chemicals including pesticides, metals, and organic compounds in March 1998 (EPA, 1998a). During the March 1998 EPA sampling event, the Florida Department

of Environmental Protection (FDEP) was also on site and collected split samples at the same locations as the EPA.

B. Previous ATSDR Actions

Since ATSDR was petitioned in 1996, ATSDR site activities have included the development of a health consultation, a petition scoping report, and a draft public health assessment. In September 1996, ATSDR reviewed available data and information for the Loxahatchee Nursery site in a health consultation. This review was initiated to determine if adequate sampling had been conducted and to determine if additional environmental sampling was needed to define the extent of contamination at the site (ATSDR, 1996a). Based on the information provided to ATSDR, recommendations were made to further characterize several media. A copy of this health consultation is contained in Appendix F.

In October 1996, the ATSDR Petition Screening Committee determined that there was a reasonable basis for conducting additional public health activities at the nursery site. ATSDR forwarded the recommendations from the health consultation (which focused on the need for additional sampling data) to the EPA. The EPA and FDEP conducted sampling activities in March 1998. ATSDR released a draft of the public health assessment for public comment in July 1998. Appendix G contains the specific comments ATSDR received during the public comment period and the agency's response to those comments.

C. Site Visit

ATSDR staff visited the site in March 1998. ATSDR staff met with the petitioner and another concerned resident to provide an update of the Agency's efforts with relation to the nursery site. ATSDR staff met with the Martin County Health Department (MCHD) to gather additional information about current site activities. Lastly, ATSDR staff toured the site with the petitioner

and representatives from the EPA and FDEP. During the tour, ATSDR staff identified areas of potential contamination and requested samples be collected in these areas.

ATSDR staff visited the site again in August 1998. During this site visit, ATSDR staff held public availability sessions and a public meeting to address health concerns the resident's expressed and answer any questions the residents had about the draft public health assessment. EPA, FDEP, and MCHD staff participated in the public availability sessions and the public meeting.

D. Demographics, Land Use, and Natural Resource Use

Demographics

The 1990 Census of Population and Housing demographic statistics for locations within 1 mile of the site indicated that 4,201 persons reside in 2,583 households. Of the 4,201 persons, 98.7 % are white; 0.45 % are black; 0.071 % are American Indian, Eskimo, Aleut; 0.62 % are Asian or Pacific Islander; and 0.095 % are members of other ethnic groups. There are 281 children aged 6 or younger and 1,357 adults aged 65 and older (US Bureau of the Census, 1991). Please refer to Figure 2, Appendix B, for additional demographic statistics.

Land use

The Loxahatchee Nursery site is located in Palm City, Martin County, Florida. The approximately 10-acre site is bounded by SW Mapp Road (to the south and west), SW Mockingbird Lane (to the north), and SW Mooring Drive (to the east). A residence is located on site. The area surrounding the nursery site contains residential homes and a county park. The Gull Harbor residential area is located to the east and the Pelican Cove residential area is located to the north of the nursery. The South Fork of the St. Lucie River is to the east of the nursery and Gull Harbor. Martin County Park is located directly west and south of the site, just across SW Mapp Road. The park contains ball fields and jogging/nature trails (ABB-ES, 1998). The future use of the site is intended to be residential.

Natural Resource Use

The residents surrounding the Loxahatchee Nursery site receive their drinking water from private wells. Most of the private wells range from 80 to 120 feet deep (ATSDR, 1998b). One pond is located on the western section of the site. The site topography slopes to the east and surface water runoff flows into the drainage canals that drain into Gull Harbor (ATSDR, 1996a). The South Fork of the St. Lucie River, located to the east of the nursery, is not used as a drinking water source; however, the river is used for recreation such as swimming, boating and fishing (ATSDR, 1998b). Because the entire area is a wetland, low lying areas flood during heavy rains. In this area, the water table is encountered at 8 feet, or less, below ground surface (ATSDR, 1998c). A septic system exists on site, but its location and use are not known (ATSDR, 1998a).

Community Health Concerns

As part of the petition process, ATSDR staff have gathered health concerns from the local community. These concerns are summarized below and addressed in the Community Health Concerns Evaluation section of this public health assessment. These concerns include:

- contamination of private wells by pesticides leaching into the groundwater from the nursery site;
- contamination of residential soil and contamination of surface water flowing from the site through the drainage ditches within the community;
- contamination of the site and surrounding area by the chemicals, benlate and flusilazole;
- incidence of cancer in the residential community surrounding the nursery;
- dangers to children playing on the site near the ponds and buildings; and
- future development of the site for residential housing.

Environmental Contamination and Other Hazards

ATSDR evaluates contaminants detected in environmental media at the site and determines whether an exposure to them has public health significance. Please refer to Appendix D for information on health-based comparison values and Appendix E for information on ATSDR's methodology. For this public health assessment, ATSDR staff obtained and evaluated environmental data for groundwater, soil, and sediment.

A. Environmental Contamination

Groundwater, On-Site Sampling Events

Several on-site groundwater sampling events occurred between 1992 and 1998. In January 1992, on-site groundwater sampling was conducted from temporary well number 1 and temporary well number 2 (McGinnes Laboratories, 1992). Samples were tested for organophosphate pesticides and polychlorinated biphenyls (PCBs). In October 1995 and February 1996, samples were again collected and tested for pesticides and PCBs from on-site wells (ATSDR, 1996a; Evergreen Engineering, 1996). Historical sampling results were compiled by Evergreen Engineering for the Florida Department of Environmental Protection (Evergreen Engineering, 1996).

Chlordane was the only contaminant detected in the temporary wells more than one time, in the past, at levels above ATSDR comparison values. Benzene; beta BHC; 4,4' - DDD; 4,4' - DDE; and diazinon were all detected in one location at levels above ATSDR comparison values. Please refer to Table 3, Appendix C, for the results of these groundwater sampling events.

In a review of site file information, ATSDR obtained a letter indicating that Dupont had sampled an irrigation well (FDEP, 1995). Unfortunately, ATSDR was not able to find any other information on this irrigation well, including the sampling data.

In March 1998, the EPA and FDEP collected groundwater samples from three temporary on-site wells (EPA, 1998c). Please refer to Figure 1, Appendix B, for the sampling locations. The samples were analyzed for metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and pesticides. The samples were also analyzed for benlate as carbendazim. The benlate is converted to carbendazim in the laboratory analysis procedure, so this procedure measures both benlate and carbendazim in the sample (ATSDR, 1998d). During this March 1998 sampling event, only arsenic was detected at a level that was above ATSDR comparison values in one location. The EPA data indicated that carbendazim was not detected. Please refer to Table 3, Appendix C, for the results of this on site groundwater sampling event.

Samples were also collected from the one on-site private well in August 1993 and March 1998. In 1993, the sample was analyzed for VOCs and SVOCs (HRS, 1996b). In March 1998, the sample was analyzed for metals, VOCs, SVOCs, pesticides, and carbendazim. No VOCs, SVOCs, or pesticides were detected. The EPA data indicated that carbendazim was also not detected. However, several metals were detected. The sampling data for this private well are included in Table 4, Appendix C.

Groundwater, Off-site Sampling Events

During the period from 1993 to December 1996, the Martin County Health Department tested 36 private wells around the Loxahatchee Nursery site (EPA, 1998a). The samples were analyzed for VOCs, SVOCs, and pesticides (HRS, 1996b). In July 1996, the contaminant 1,2-dichloropropane was detected at a maximum level of 150 ppb in a private well. This private well was fitted with a carbon filter in August 1996 which removes the contaminant from the water (EPA, 1998a).

The private well that contained elevated levels of 1,2-dichloropropane in July 1996 was retested on several occasions. This private well contained 1,2-dichloropropane at a maximum level of 330 ppb in November 1996. Of note, the November 1996 sample was collected from raw, unfiltered water (ATSDR, 1998c). These levels of 1,2-dichloropropane are above EPA's MCL of 5 ppb, but below ATSDR's chronic child EMEG of 900 ppb. In addition, three VOCs (bromodichloromethane, chloroform, and dibromochloromethane) were detected in this same private well in raw, unfiltered water at levels above ATSDR cancer risk evaluation guides (CREGs); however, all three chemicals were below detection limits after treatment from the carbon filter.

In March 1998, the EPA and FDEP collected groundwater samples from four off site private wells (EPA, 1998c). One off site temporary well was also sampled as a part of this sampling event. This temporary well, TW01, was sampled to establish background conditions; however, for the purpose of this public health assessment, ATSDR did not consider the sampling results from this well as indicative of background conditions of the area groundwater. ATSDR's rationale for this decision is based on the location of the well (just across the street from the site) and the Agency's inability to obtain any documentation indicating that groundwater flow beneath the site is not toward this well.

The March 1998 samples were analyzed for metals, VOCs, SVOCs, pesticides, and carbendazim. Arsenic was detected in the temporary well (TW01) above ATSDR comparison values. Arsenic was not detected in any private wells. The EPA data indicated that carbendazim was not detected in private or temporary monitoring wells. Please refer to Table 4, Appendix C, for the results of the March 1998 sampling event.

Soil, On-Site Sampling Events

Several on-site soil sampling events have occurred between 1992 and 1998. In January 1992, two on-site soil samples were collected from an unspecified depth (Evergreen Engineering, 1996). In April 1992, a sample was collected from the soil stockpile at an unspecified depth (Evergreen Engineering, 1996). In February 1996, four soil samples within, and adjacent to, the soil stockpile were collected from an unspecified depth (ATSDR, 1996a). For the previously described sampling events, all the samples were tested for pesticides and PCBs. Chlordane was detected in all of the samples. Please refer to Table 5, Appendix C, for the results of the 1992 and 1996 on-site soil sampling events.

In March 1998, the EPA and FDEP sampled on-site soils throughout the nursery site to determine the presence or absence of contamination. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and carbendazim. At each sampling location, two depths intervals were collected. One surface soil sample was collected from a depth of 0–3 inches below land surface (bls) except for the portion for volatile analysis, which was collected at a depth of 6–12 inches bls (EPA, 1998c). A second sample at each location was collected from a depth of 1.0–1.5 feet bls (ABB-ES, 1998). Soil samples were also obtained from the two depth intervals from the yard of the on-site residence (SS05). Please refer to Figure 1, Appendix B, for the sampling locations. Deep subsurface soil samples were not collected as initially proposed in the work plan because of the shallow depth-to-groundwater at the site, which is approximately 1.5–2.0 feet bls (ABB-ES, 1998). The groundwater table in this area fluctuates depending on the season.

No contaminants from the on-site residence exceeded ATSDR comparison values. Gamma chlordane in sample SS03A, cadmium in sample SS10A, and benzo(a)pyrene in sample SS09A exceeded ATSDR comparison values on the nursery property. Arsenic, chromium, manganese, and chlordane exceeded ATSDR comparison values on the nursery property in several sampling

locations. The EPA data indicated that carbendazim was not detected. Please refer to Table 6, Appendix C, for the results of this on-site surface soil sampling event.

Soil, Off-Site Sampling Events

In March 1998, the EPA and FDEP sampled off-site soils at two locations. One location (SS08) was sampled to determine the presence or absence of contamination. The other location (SS01) was sampled to establish background conditions; however, for the purpose of this public health assessment, ATSDR did not consider the sampling results from SS01 as indicative of background conditions. ATSDR's rationale for this decision is based on the location of the sample (just across the street from the site) and the agency's inability to obtain any documentation indicating that this area has not been impacted by site activities.

The samples were analyzed for metals, VOCs, SVOCs, pesticides, and carbendazim. At each sampling location, two depths intervals were collected. One surface soil sample was collected from a depth of 0–3 inches bls, except for the portion for volatile analysis which was collected at a depth of 6–12 inches bls (EPA, 1998c). A second sample at each location was collected from a depth of 1.0–1.5 feet bls (ABB-ES, 1998). Please refer to Figure 1, Appendix B, for the sampling locations labeled as SS01 and SS08. Subsurface soil samples were not collected as initially proposed in the work plan because of the shallow depth-to-groundwater at the site, which is approximately 1.5–2.0 feet bls (ABB-ES, 1998). Arsenic, chromium, and manganese exceeded ATSDR comparison values. The EPA data indicated that carbendazim was not detected. Please refer to Table 7, Appendix C, for the results of this off-site surface soil sampling event.

Sediment Sampling Events

For the March 1998 sampling event, the EPA and FDEP had planned to collect a sediment sample from the on-site ponds to determine the presence or absence of contamination. However, a

sample could not be obtained from the smaller pond because it had been filled in. The site team attempted to sample the sediment from the second pond, but could not obtain a representative sample with the standard sampling equipment (ABB-ES, 1998; ATSDR, 1998e).

During this March 1998 sampling event, the EPA and FDEP were able to collect sediment samples from the shallow drainage ditches bordering the site, as well as from the South Fork of the St. Lucie River. One sediment location (SD01) was sampled to establish background conditions; however, for the purpose of this public health assessment, ATSDR did not consider the sampling results from SD01 as indicative of background conditions. ATSDR's rationale for this decision is based on the location of the sample (just across the street from the site) and the agency's inability to obtain any documentation indicating that this area has not been impacted by site activities.

The samples were analyzed for metals, VOCs, SVOCs, pesticides, and carbendazim. The sediment samples were collected below water (EPA, 1998c). Manganese was detected above comparison values in the drainage ditches and the South Fork of the St. Lucie River sample. Arsenic, chromium and vanadium exceeded ATSDR comparison values only in the drainage ditches. The EPA data indicated that carbendazim was not detected. Please refer to Table 8, Appendix C, for the results of this sediment sampling event.

Water, On-Site Tank Pull Sampling Event

During removal of an abandoned underground storage tank in 1992, water samples were collected from the bottom of the tank (ATSDR, 1996a). The water samples were analyzed for pesticides and gasoline constituents. Several contaminants exceeded ATSDR drinking water comparison values; however, this water from the underground tank was not used as a drinking water source. Please refer to Table 9, Appendix C, for the results of this sampling event.

B. Physical and Other Hazards

The Loxahatchee Nursery site is not currently fenced. Therefore, community members, including children, have unlimited access. During ATSDR's site visit, the staff noted that most of the site was overgrown with tall weeds, and the on-site pond was not viewable from the nursery's dirt road. The remaining structures on site were in a state of disrepair, and there was evidence of trespassing (i.e., graffiti on the structures); therefore, ATSDR concludes that the on-site ponds and dilapidated structures pose a potential physical hazard to area residents, especially children, who trespass on site.

Pathways Analyses

To determine whether people were, or continue to be, exposed to contaminants originating from Loxahatchee Nursery site, ATSDR evaluated the factors that lead to human exposure. These factors, or elements, include (1) a source of contamination, (2) transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) an exposed population. Exposure pathways fall into one of three categories:

- *Completed Exposure Pathway.* ATSDR calls a pathway "complete" if it is certain that people are exposed to contaminated media. Completed pathways require that the five elements exist and indicate that exposure to the contaminant has occurred, is occurring, or will occur.
- *Potential Exposure Pathway.* Potential pathways are those in which at least one of the five elements is missing but could exist. Potential pathways indicate that exposure to a contaminant could have occurred, could be occurring, or could occur in the future. Potential exposure pathways refer to those pathways where (1) exposure is documented, but there is not enough information available to determine whether the environmental medium is contaminated, or (2) an environmental medium has been documented as contaminated, but it is unknown whether people have been, or may be, exposed to the medium.

- **Eliminated Exposure Pathway.** In an eliminated exposure pathway, at least one of the five elements is missing and will never be present. From a human health perspective, pathways can be eliminated from further consideration if ATSDR is able to show that (1) an environmental medium is not contaminated, or (2) no one is exposed to contaminated media.

ATSDR has identified a completed exposure pathway to off-site groundwater through private wells surrounding the nursery site. ATSDR has determined the exposures to on- and off-site soil, and on- and off-site sediment constitute potential exposure pathways. The specific elements associated with the completed exposure pathway and each potential exposure pathway are summarized in Table 1 and Table 2 (Appendix C), respectively. The following text also describes both the completed and potential exposure pathways identified for this site.

A. Completed Exposure Pathway

Groundwater

The residential homes surrounding the Loxahatchee Nursery site use private well water. Samples were collected and analyzed from nearby private wells from 1992 to 1998, and the contaminant 1,2-dichloropropane was detected in a private well at levels above the EPA's MCL. This private well is currently using a carbon filter which removes the contaminant from the water. Past, current, and future exposures exist from drinking, bathing, and irrigating with private well water. The routes of exposure include ingestion, inhalation, and dermal contact.

B. Potential Exposure Pathways

On-Site Soil

One residence is located on the nursery site. Adults and children living at this residence, as well as other nearby adults and children trespassing on the nursery site, may come into contact with on-

site surface soil. When the nursery site was operational, pesticides and other chemicals were used. No contaminants were detected at levels exceeding ATSDR comparison values from the on-site residence. Gamma chlordane, chlordane, benzo(a)pyrene, arsenic, cadmium, chromium, and manganese were detected on the nursery property at levels exceeding ATSDR comparison values. Of note, cadmium, benzo(a)pyrene, and gamma chlordane were each detected above comparison values in only one sample of on-site soil. On-site residents and trespassers may have been, and may continue to be, exposed to on-site surface soil.

Off-Site Soil

Nursery soil may have blown to off-site locations, or been carried to off-site locations, during flood events. Routes of potential exposure include dermal contact and incidental ingestion of off-site surface soil. While no VOCs, SVOCs, or pesticides were detected at levels exceeding ATSDR comparison values, three metals (arsenic, chromium, and manganese) were detected at levels that exceeded ATSDR comparison values. Of note, only two samples were collected from off-site locations by the EPA and FDEP in March 1998, and the levels detected may not be indicative of the levels of contaminants in soil throughout the surrounding residential area.

Sediment

In March 1998, the EPA and FDEP collected sediment samples from the drainage ditches bordering the nursery site, as well as from the South Fork of the St. Lucie River. On-site pond sediment has not been characterized. Several metals (arsenic, chromium, manganese and vanadium) were detected above ATSDR comparison values in the drainage ditches and one metal (manganese) was detected above ATSDR comparison values in the South Fork of the St. Lucie River sediment sample. Children might play in the on-site pond and drainage ditches bordering the site, and individuals who use the South Fork of the St. Lucie River for recreational activities, including boating and swimming, might come into contact with sediment. Exposures to

contaminants in sediment could occur during these activities, and both direct skin contact and incidental ingestion could be routes of exposure.

Public Health Implications

A. Toxicologic Evaluation

In this section, ATSDR addresses the likelihood that exposure to contaminants at the maximum concentrations detected would result in adverse health effects. While the relative toxicity of a chemical is important, the response of the human body to a chemical exposure is determined by several additional factors, including the concentration (how much); the duration of exposure (how long); and the route of exposure (breathing, eating, drinking, or skin contact). Lifestyle factors (i.e., occupation and personal habits) have a major impact on the likelihood, magnitude, and duration of exposure. Individual characteristics such as age, sex, nutritional status, overall health, and genetic constitution affect how a human body absorbs, distributes, metabolizes, and eliminates a contaminant. A unique combination of all these factors will determine the individual's physiologic response to a chemical contaminant and any adverse health effects the individual may suffer as a result of the chemical exposure.

ATSDR has determined levels of chemicals that can reasonably (and conservatively) be regarded as harmless, based on the scientific data the agency has collected in its toxicological profiles. The resulting comparison values and health guidelines, which include ample safety factors to ensure protection of sensitive populations, are used to screen contaminant concentrations at a site and to select substances ("chemicals of concern") that warrant closer scrutiny by agency health assessors and toxicologists.

It is a point of key importance that ATSDR's (and EPA's) comparison values and health guidelines represent conservative levels of safety and not thresholds of toxicity. Thus, although

concentrations at or below a comparison value may reasonably be considered safe, it does not automatically follow that any concentration above a comparison value will necessarily produce toxic effects. To the contrary, ATSDR's (and EPA's) comparison values are intentionally designed to be much lower, usually by orders of magnitude, than the corresponding no-effect levels (or lowest-effect levels) determined in laboratory studies. ATSDR uses comparison values (regardless of source) solely for the purpose of screening individual contaminants. In this highly conservative procedure, ATSDR considers that a compound warrants further evaluation if the highest single recorded concentration of that contaminant in the medium in question exceeds that compound's lowest available comparison value (e.g., cancer risk evaluation guides or other chronic exposure values) for the most sensitive, potentially exposed individuals (e.g., children or pica children). This highly conservative process results in the selection of many contaminants as "chemicals of concern" that will not, upon closer scrutiny, be judged to pose any hazard to human health. However, ATSDR judges it prudent to use a screen that "lets through" many harmless contaminants rather than one that overlooks even a single potential hazard to public health. Even those contaminants of concern that are ultimately labeled in the toxicologic evaluation as potential public health hazards are so identified solely on the basis of the maximum concentration detected. The reader should keep in mind the protectiveness of this approach when considering the potential health implications of ATSDR's toxicologic evaluations.

Because a contaminant must first enter the body before it can produce any effect, adverse or otherwise, on the body, the toxicologic evaluation in public health assessments focuses primarily on completed pathways of exposure, i.e., contaminants in media to which people are known, or are reasonably expected to have been exposed, such as water that may be used for drinking water and air in the breathing zone.

A completed exposure pathway to groundwater was identified in one private well. ATSDR evaluated whether exposures to this private well water would pose a public health hazard. While

this toxicologic evaluation section focuses primarily on groundwater contaminants, the contaminants in soil and sediment are also discussed.

Contaminants in Private Well Water

Exposure to private well water represents the only completed pathway identified at this site—the only pathway by which exposure to contaminants is known, or may be reasonably expected to be occurring, or have occurred. The maximum detected concentration of 1,2-dichloropropane (330 ppb) in one well did exceed EPA's MCL of 5 ppb by a substantial margin, but it was well below ATSDR's chronic child environmental media evaluation guide (EMEG). Based on the best medical and toxicological data available, ATSDR concludes that exposures to the levels of 1,2-dichloropropane detected in private well water pose no hazard to public health (ATSDR, 1989).

The apparent discrepancy between ATSDR and EPA comparison values is due to the fact that EPA still classifies 1,2-dichloropropane as a B2 carcinogen, based on its judgement that a rodent bioassay conducted by the National Toxicology Program (NTP) provided "sufficient" evidence of carcinogenicity in animals. (No such data exists for humans.) EPA policy requires that the MCL for all class A and class B carcinogens be as close to zero as is technically feasible, which explains why the MCL for 1,2-dichloropropane is two orders of magnitude lower than ATSDR's lowest comparison values. ATSDR has no cancer-based comparison value (CREG) for 1,2-dichloropropane because it currently considers the animal evidence to be "equivocal" or "limited", at best, as do both the International Agency for Research on Cancer (IARC) and NTP, the agency that produced the data in the first place (NTP, 1986). NTP and IARC currently classify 1,2-dichloropropane as "not classifiable" with regard to its potential carcinogenicity in humans. An MCL based on the "not classifiable" cancer classification would be higher by one or more orders of magnitude.

However, the current MCL is still 5 ppb, and EPA's MCLs are legally enforceable drinking water standards, whereas the comparison values and cancer classifications of ATSDR, NTP and IARC are not. A carbon filter was provided to the well owner known to have more than 5 ppb 1,2-dichloropropane in the well water. While ATSDR does not consider even the highest concentrations of 1,2-dichloropropane detected in drinking water to represent a potential public health hazard, this agency nevertheless recognizes that the action of providing a carbon filter to the residence was based on prudent public health policy.

Three additional contaminants (i.e., bromodichloromethane, chloroform, and dibromochloromethane) were detected in this same private well at levels that exceeded ATSDR's CREG comparison values (Table 4, Appendix C) in raw, unfiltered water; however, these same three contaminants were not detected after the water received treatment from the carbon filter. Because residents are drinking the filtered water rather than the raw, unfiltered water, they are not generally exposed to detectable levels of chloroform and the two by-products mentioned above. However, even the levels detected in raw, unfiltered water would pose no health hazard because, although these levels exceed ATSDR's CREGs by relatively slight margins, they are far below all other comparison values, including federal drinking water standards. (EPA's MCL for each of these three compounds is 100 ppb.) Recent drinking water studies in rodents have demonstrated that the actual carcinogenic potential of these compounds is much lower than the already low (i.e., < 0.0001) theoretical risk suggested by ATSDR's CREGs and the cancer risk assessments on which they are based. (The cancers on which these risk assessments and CREGs are based were produced in rodents force-fed high concentrations of the chemical in oil. However, these same cancers were not induced in animals treated ad libitum with the same chemicals in drinking water.)

No comparison values are available for calcium, magnesium, potassium and sodium (Table 4, Appendix C) because all of these elements are essential nutrients with low potential for toxicity (NRC, 1980). In fact, the estimated doses that would be associated with the highest detected concentrations of these elements in private well water surrounding the nursery site would be small

relative to their respective recommended daily allowances (NRC, 1980; FNB, 1989).

Hyperkalemia (potassium poisoning) is not even possible via dietary exposures alone, at least not in people with normal circulatory and renal function; it is usually a symptom of some pre-existing health problem such as Addison's disease or renal failure (NRC, 1980). In addition, high intake of potassium has a protective effect against the hypertensive effect of sodium. Sodium toxicity, on the other hand, is not generally associated with daily NaCl intakes less 30,000 milligrams/day (mg/day) (NRC, 1980).

Contaminants in On-Site Groundwater

Ingestion of on-site groundwater from monitoring wells has not occurred in the past and is not occurring currently. The maximum concentrations of benzene; beta BHC; chlordane; DDD; diazinon; and arsenic exceeded one or more of ATSDR's comparison values (Table 3, Appendix C). However, only chlordane was consistently detected in on-site temporary wells. The other compounds were each detected only once above ATSDR comparison values, and do not represent a potential public health concern.

The maximum detected concentration of chlordane of 200 ppb (Table 3, Appendix C) in a temporary well was an isolated value; all other detects were below all of ATSDR's noncancer comparison values, which incorporate a safety factor of 100 (ATSDR, 1994). In 1992, when the high of 200 ppb was detected in this on-site temporary well, no chlordane was detected in the other on-site temporary well. Chlordane was detected in two of three on-site wells tested in 1995, but at levels below 1 ppb. Chlordane has never been detected in private wells.

The contaminants listed in Table 9, Appendix C (Tank Pull Sampling Results–1992) were present at low concentrations, relative to most of ATSDR's noncancer comparison values. More importantly, these data only represent levels detected during a removal action. There was no

direct exposure to the contaminants in water inside this underground storage tank before or after its removal in 1992.

Contaminants in On- and Off-Site Soils/Sediments

Few of the soil/sediment contaminants listed in Tables 5 through 8, Appendix C, exceed ATSDR's comparison values. Generally speaking, those that do (e.g., chlordane, benzo(a)pyrene, cadmium, and chromium in on-site soils; chromium in off-site soils; and chromium and vanadium in sediment) only exceed CREGs and EMEGs/reference dose evaluation guides (RMEGs) for pica children. (The only exceptions, arsenic and manganese, are discussed below.) However, neither the duration nor the magnitude of actual exposures to on-site soils will be comparable to the default exposure assumptions on which ATSDR's CREGs and EMEGs/RMEGs for pica children are based. ATSDR therefore concludes that, under site-specific conditions of exposure, none of the contaminants detected in soil or sediment are likely to pose a hazard to public health.

The maximum concentration of arsenic detected off site was an estimated 43 parts per million (ppm) in an isolated, surface soil sample, which is about twice ATSDR's chronic child EMEG of 20 ppm. Using default assumptions of exposure rate (i.e., daily ingestion of 200 milligrams [mg] soil), this maximum detected concentration would correspond to less than 9 micrograms arsenic/day ($\mu\text{g}/\text{day}$). This is at least an order of magnitude lower than typical dietary exposures and is comparable to average arsenic exposures from US drinking water, which usually contains less than 5 micrograms per liter ($\mu\text{g}/\text{L}$). Assuming a child body weight of 10 kilograms, this level of exposure would be comparable to the estimated human *no observed adverse effect level* (NOAEL) of 0.8 micrograms per kilograms per day ($\mu\text{g}/\text{kg}/\text{day}$) on which ATSDR's chronic minimal risk level (MRL) is based (ATSDR, 1993). (The chronic oral MRL of 0.3 $\mu\text{g}/\text{kg}/\text{day}$, which is based on exposure to arsenic in drinking water, rather than soil, contains a safety factor of 3.) More importantly, (1) historical evidence suggests that the carcinogenic, as well as the noncarcinogenic, effects of arsenic may exhibit a threshold at 200–400 $\mu\text{g}/\text{day}$, and (2) virtually

all known cases of arsenical skin cancer have been associated with occupational exposure (Marcus and Rispin, 1988; Storher, 1991). Finally, because all 200 mg of the soil that a child might (hypothetically) ingest every day will not come exclusively from any single "hot spot," actual exposures to arsenic in soil are likely to be substantially less than the isolated, maximally-contaminated soil sample would imply. Therefore, ATSDR concludes that average, soil-related arsenic exposures surrounding the nursery site are unlikely to pose any hazard to public health.

Arsenic in on-site soils range from 0.7 to 2.3 ppm, and levels in sediment from off-site drainage ditches range from 0.7 to 1 ppm (Tables 6 and 8, Appendix C). None of the latter concentrations exceed ATSDR's child EMEG for chronic exposure. Therefore, ATSDR considers that, under site-specific conditions of exposure, the average doses of arsenic from the area surrounding the nursery site that might result from incidental or intentional soil ingestion are not likely to pose any hazard to public health.

The maximum detected concentration of manganese in on-site surface soil ranges from 2.1 to 650 ppm, which exceeds ATSDR's child RMEG (300 ppm) by a factor of 2.2 (Table 6, Appendix C). However, as mentioned previously, all of a child's soil-related exposure will not come from a single "hot spot". In particular, children's exposure to on-site soils and sediments are expected to be considerably less than to off-site soils. Manganese in off-site soils range from 15 to 68 ppm, and levels in sediment from off-site drainage ditches range from 2.4 to 110 ppm (Tables 7 and 8, Appendix C). None of the latter concentrations exceed ATSDR's child RMEG for chronic exposure. Therefore, ATSDR considers that, under site-specific conditions of exposure, the average doses of manganese from the area surrounding the nursery site that might result from incidental or intentional soil ingestion are not likely to pose any hazard to public health (ATSDR, 1997).

As stated above in the section on drinking water, ATSDR has no comparison values for many essential mineral nutrients because the potential for toxicity resulting from exposure to these

substances in environmental media is usually quite low. For example, the estimated doses that would be associated with the highest detected concentrations of calcium, magnesium, potassium, and sodium in soils in Palm City would be less (usually much less) than 2 % of the respective recommended daily allowances.

B. Health Outcome Data Evaluation

ATSDR evaluates the health of a community living near a potentially contaminated site by considering the toxicity of the identified chemicals, defining a plausible completed pathway of exposure, and addressing the community's health concerns. The types of health data that are collected by state agencies and then reviewed may include disease incidence, cancer statistics, low birth weights, and developmental conditions. Individual state cancer registries collect data on reported cancers identified in populations and classify these reported cancer cases into different categories, such as skin, liver, breast, colon, etc. Depending on the type of data available, the rate of specific cancers can be determined for certain populations.

Citizens living near the Loxahatchee Nursery site were concerned with cancer resulting from possible exposures to contaminants identified on and off the site. Environmental sampling for on- and off-site groundwater, private well water, soil, and sediment have not identified any chemicals that would likely result in adverse health effects, including cancer. Water sampling analysis has been conducted at selected private wells since 1992. The chemical, 1,2-dichloropropane, was identified in one private well above EPA's MCL but not ATSDR's comparison values. This one residence is currently using filtered water to eliminate exposure. The chemical, 1,2-dichloropropane, was also found in trace amounts in five other private wells, but not above health based comparison values. Therefore, no chemicals were identified at levels of health concern or increased risk for cancer.

Only health statistics data for Martin County for rates of “all-cancers” (not individual cancers) were available for review. Therefore, it was not possible to evaluate the incidence of cancers specific for the small community located around the site. While environmental contaminants may play a role in some types of cancers, other risk factors such as genetics, lifestyle, and socio-economic factors are known to have a profound influence on the development, diagnosis and treatment of disease. In the United States, the lifetime risk of developing cancer is approximately one in three, depending on the type of cancer (ACS, 1997). However, intervention activities including, improved diet, early detection, and better health care, have shown that individuals with certain types of cancers have remarkably improved survival rates today.

C. Community Health Concerns Evaluation

Community members expressed several concerns regarding the Loxahatchee Nursery site.

ATSDR addressed each of the community concerns as follows:

Concern: contamination of private wells by pesticides leaching into the groundwater from the nursery site

Response: Since 1992, private wells in the Gull Harbor and Pelican Cove area have been sampled for hydrocarbons and pesticides. To date, no pesticides have been detected in any of the private wells sampled. The pesticide, chlordane, was detected once in 1992 in an on-site monitoring well at a level exceeding the ATSDR EMEG comparison value. Low levels of chlordane, slightly exceeding the most protective comparison values (CREG and pica child EMEG), were detected in on-site soils. ATSDR would not expect the low levels of chlordane detected in on-site soil to have a major impact on area groundwater in the future.

Five private wells indicated trace levels of the organic compound 1,2-dichloropropane and one private well exceeded the recommended MCL for this contaminant on several occasions. The source of the 1,2-dichloropropane is not known; however, samples from monitoring wells, soils,

and sediments on site have not indicated this contaminant, which suggests the nursery is not the source. Regardless of the source of the 1,2-dichloropropane, the levels detected in private wells are not of health concern.

Overall, sampling of private well water indicates that the detected contaminants, including 1,2-dichloropropane, are currently not at levels of health concern. ATSDR recommends periodic sampling of private wells to ensure residents will not be exposed to constituents in the groundwater at levels of health concern in the future.

Concern: contamination of residential soil and contamination of surface water flowing from the site through the drainage ditches within the community

Response: In March 1998, EPA and FDEP performed limited sampling of residential soil and sediment from the drainage ditches. Low levels of VOCs were detected. The levels of these contaminants detected during this limited sampling event were all below ATSDR comparison values; therefore, ATSDR would not expect any adverse health effects from exposures to these contaminants in residential soil and the drainage ditches. Chlordane in sample SS03A and benzo(a)pyrene in sample SS09A were detected at a level that exceeded ATSDR comparison values; however, exposure to these contaminants is not expected to cause adverse health effects. Several metals (arsenic, cadmium, chromium, manganese, and vanadium) were also detected in soil and/or sediment samples on and off site; however, ATSDR would not expect any adverse health effects to occur from exposures to these metals in soil and/or sediment.

Concern: contamination of the site and surrounding area by the chemicals benlate and flusilazole

Response: On several occasions, the Martin County Health Department (MCHD) collected and analyzed private well water for the chemical, benlate (HRS, 1996c). On all occasions, benlate was not detected. During the March 1998 sampling event, both EPA and FDEP collected and analyzed groundwater, soil, and sediment samples for benlate. The EPA procedure tested for benlate as

carbendazim. The benlate is converted to carbendazim in the EPA laboratory analysis procedure, so this procedure measures both benlate and carbendazim in the sample (ATSDR, 1998d). Because carbendazim was not detected in any of the samples, benlate is considered nondetect also.

FDEP sampled for additional contaminants during the March 1998 sampling event. One of the contaminants in the samples analyzed by FDEP, but not by EPA, is flusilazole. Flusilazole was not detected in any of the groundwater, soil, or sediment samples. However, the community voiced concerns during a public meeting in August 1998 over the analyses. The community was concerned that the arbitrary holding times for the samples had expired. While FDEP and ATSDR do not believe that holding the samples in the laboratory for an extra week compromised the data, ATSDR acknowledges the community's concern. The community also does not believe that the flusilazole analytical procedure was validated. ATSDR plans to request the flusilazole validated analytical procedure from FDEP. ATSDR is considering sampling at the site and testing for flusilazole once the Agency has reviewed the validated analytical procedure.

Concern: the incidence of cancer in the residential community surrounding the nursery

Response: The community living near the Loxahatchee Nursery is concerned with a perceived increase in the incidence of cancer. Environmental data were reviewed; however, no association between the detected chemicals and increased risk of developing cancer was identified. Cancer data specific for the small community around the Loxahatchee Nursery were not available for review. If future sampling demonstrates levels of contaminants that are of health concern, ATSDR will reevaluate this health concern. Of note, the MCHD plans to investigate cancer incidence.

Concern: the dangers to children playing on the site near the ponds and buildings

Response: In the Physical Hazards section of this public health assessment, ATSDR identified the physical dangers associated with the site. As mentioned previously, the Loxahatchee Nursery site is not currently fenced, thus making it easy for children to trespass on site. While the on-site pond

is not viewable from the nursery's dirt road, children who realize it exists may gain access to this pond. The remaining structures on site are in a state of disrepair. ATSDR concludes that the on-site pond and dilapidated structures could pose a potential physical hazard to area residents, especially children, who trespass on site. Therefore, ATSDR recommends limiting site access to these hazards.

Concern: the future development of the site for residential housing

Response: The future use of the site has not been determined, although it is proposed to be residential. In addition to determining if the site is free of contamination, other logistical issues must be addressed before the area is developed. For instance, connections to the municipal water and sewer system must be resolved (ATSDR, 1998a). While ATSDR is aware of these issues, they are out of the purview of this public health assessment.

ATSDR Child Health Initiative

ATSDR recognizes that infants and children may be more vulnerable to exposures than adults in communities faced with contamination of their air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter, resulting in a greater likelihood to breathe dust, soil, and heavy vapors close to the ground.
- Children are smaller, resulting in higher doses of chemical exposure per body weight.
- The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

Because children depend completely on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at the Loxahatchee Nursery site, as part of the ATSDR Child Health Initiative.

Children who are the most likely to be exposed to environmental media at the Loxahatchee Nursery site include the children living in nearby homes. Exposures to media include:

- *Groundwater:* Children are exposed to area groundwater through the use of private well water.
- *Sediment:* Children could have been, and could continue to be, accessing the on-site pond and drainage ditches as well as the South Fork of the St. Lucie River.
- *On-Site Soil:* Children could have been, and could continue to be, exposed to nursery soil when trespassing on the site.
- *Off-Site Soil:* Children could have been, and could continue to be, exposed to nursery soil that was carried to off-site locations by the wind and during floods.

As indicated in the Toxicologic Evaluation section of this public health assessment, the concentrations of contaminants in private well water, sediment, and soil are not at levels of health concern for area residents, including children.

Conclusions

On the basis of available environmental and toxicologic information, ATSDR concludes that the Loxahatchee Nursery site in Palm City, Florida, poses *no apparent public health hazard*. This determination is based on the following:

- The levels of contaminants, including 1,2-dichloropropane, detected in private wells are unlikely to result in adverse health effects for residents consuming this well water.
- Under site-specific conditions of exposure, the levels of contaminants detected in soil and sediment are unlikely to result in adverse health effects.

The Loxahatchee Nursery site is not currently fenced. One pond is located on site. During ATSDR's site visit, the staff noted that the remaining on-site structures were in a state of disrepair. ATSDR determined that the on-site pond and dilapidated structures could pose a potential physical hazard to area residents, especially children, who trespass on-site.

The future use of the site has not yet been determined; however, it is presumed to be residential. To date, the on-site pond surface water and sediment have not been sampled. Given that only low levels of contaminants were detected in on-site soils and drainage ditch sediments, it is unlikely that the on-site pond contains elevated levels of contaminants. However, ATSDR cannot evaluate the public health implications resulting from exposure to this on-site pond without environmental data.

Recommendations

1. Periodically sample private well water to ensure that residents will not be exposed to constituents in groundwater at levels of health concern in the future.
2. Restrict access to the on-site ponds and dilapidated structures as they could pose a physical hazard to individuals, especially children, who trespass on site.
3. Characterize on-site pond water and sediment to determine the presence or absence of contamination at levels of health concern.

Public Health Action Plan

The actions described in this section are designed to ensure that this public health assessment identifies public health hazards and provides a plan of action to mitigate and prevent adverse health effects resulting from exposure to hazardous substances in the environment.

ATSDR includes a commitment to follow up on this plan and ensure that it is implemented. Public health actions to be implemented are as follows:

- ATSDR will request the validated analytical procedure for flusilazole from FDEP.
- ATSDR is considering sampling at the site and testing for the chemical flusilazole.
- ATSDR is considering sampling on-site pond water and sediment.
- ATSDR will continue to review environmental sampling data as it is made available.
- The Martin County Health Department (MCHD), formerly called the Martin County Public Health Unit (MCPHU), plans to periodically monitor the groundwater quality of private potable water sources in the Gull Harbor / Pelican Cove area (HRS, 1996a).
- The MCHD plans to review cancer incidence data in response to community concern.

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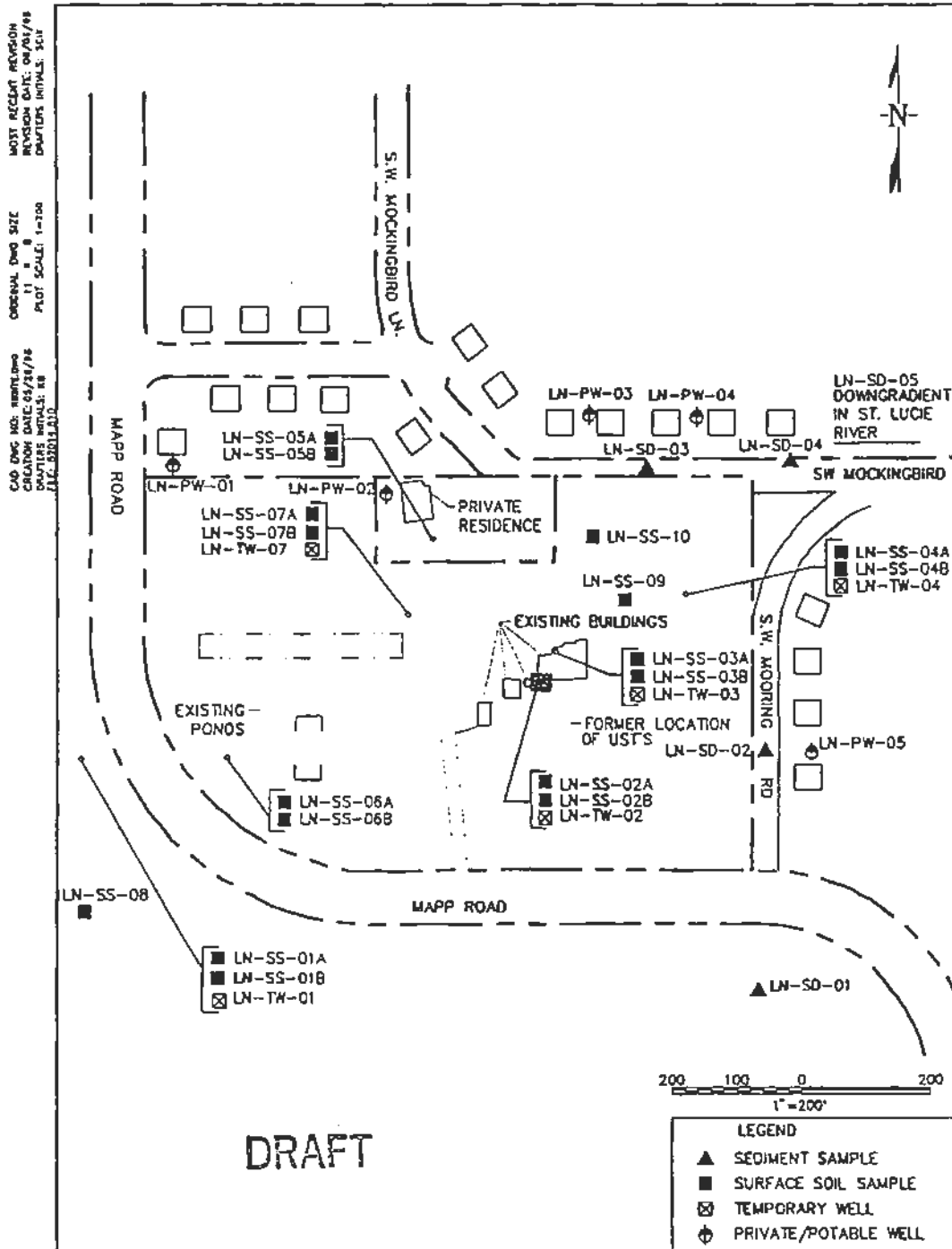
APPENDIX A -- ACRONYMS

The acronyms used in this public health assessment are listed below, in alphabetical order.

ATSDR	Agency for Toxic Substances and Disease Registry
bls	below land surface
BHC	Hexachlorocyclohexane
DDD	1,1-dichloro-2,2- <i>bis</i> (<i>p</i> -chlorophenyl)ethane
DDE	1,1-dichloro-2,2- <i>bis</i> (<i>p</i> -chlorophenyl)ethylene
DDT	1,1,1-trichloro-2,2- <i>bis</i> (<i>p</i> -chlorophenyl)ethane
CLHA	Child Longer Term Health Advisory
CREG	Cancer Risk Evaluation Guide
EMEG	Environmental Media Evaluation Guide
EPA	Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
HRS	Department of Health and Rehabilitative Services
IARC	International Agency for Research on Cancer
kg	kilograms
L	liter
LTHA	Lifetime Health Advisory
MCHD	Martin County Health Department
MCL	Maximum Contaminant Level
MCPHU	Martin County Public Health Unit
mg	milligrams
MRL	Minimal Risk Level
NOAEL	No Observed Adverse Effect Level
NTP	National Toxicology Program
PCBs	Polychlorinated Biphenyls
ppb	parts per billion
ppm	parts per million
RBC _n	Risk-Based Concentration (noncancer)
RMEG	Reference Dose Media Evaluation Guide
SVOCs	Semi-Volatile Organic Compounds
µg	micrograms
VOCs	Volatile Organic Compounds

APPENDIX B -- FIGURES

Figure 1: March 1998 Sampling Event Location Map – Draft
 Loxahatchee Nursery, Palm City, Florida



Loxahatchee Nursery

Palm City, Florida

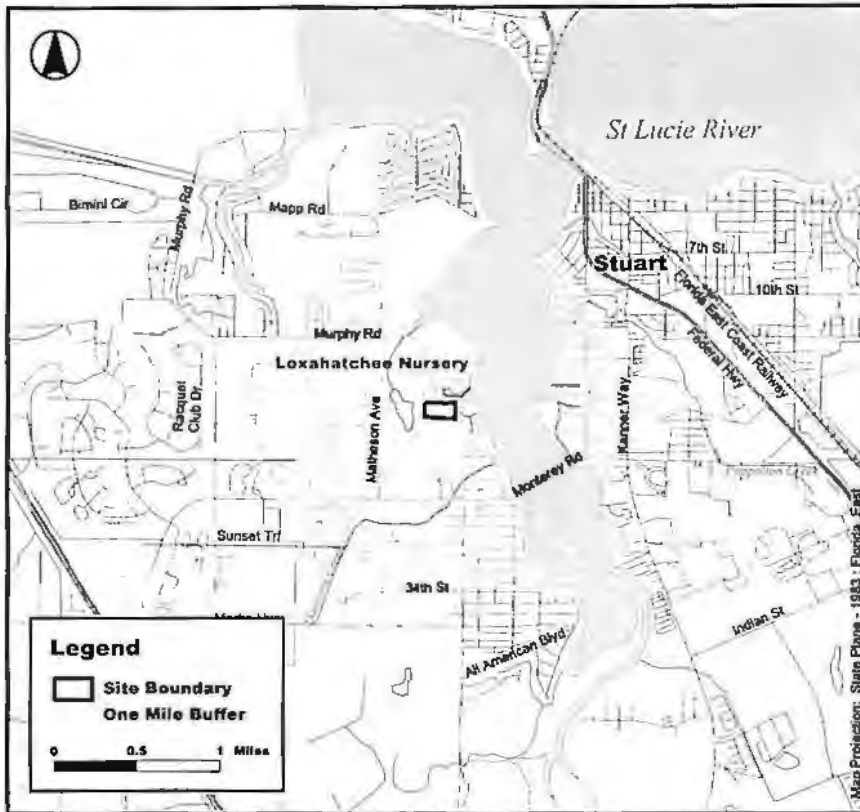
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INTRO MAP

Site Location



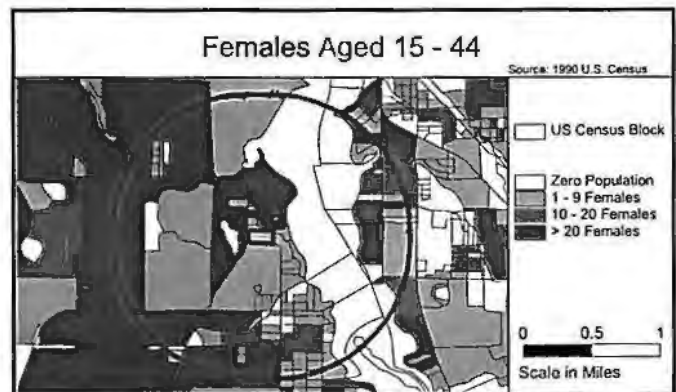
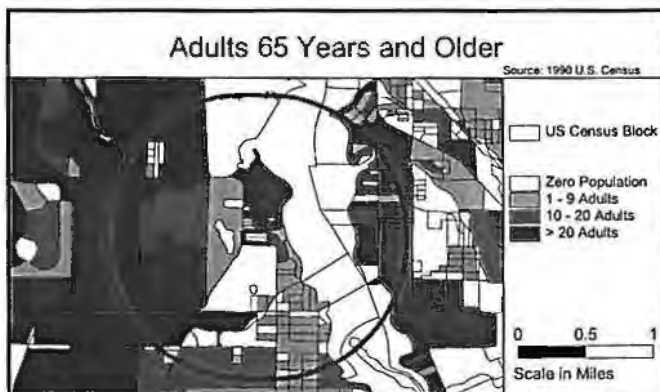
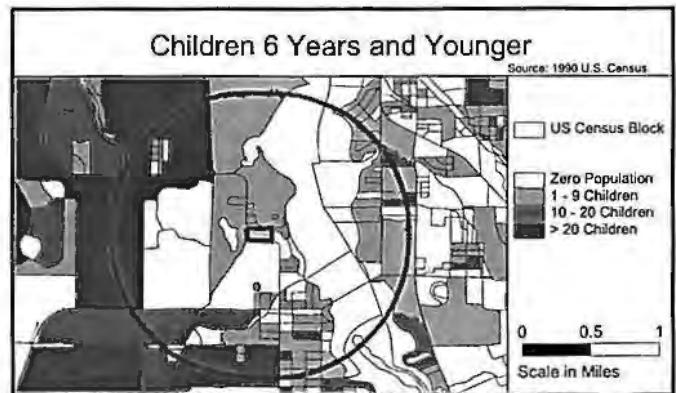
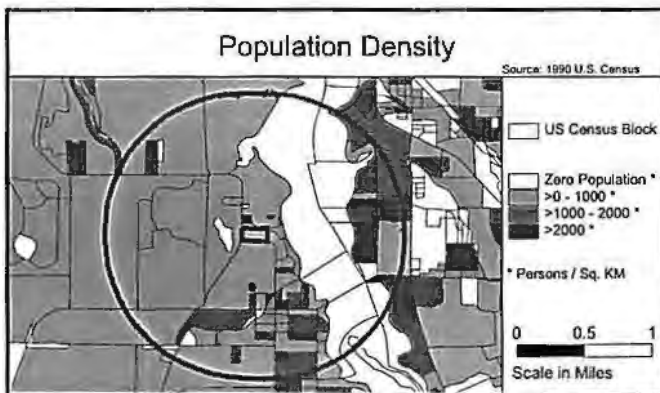
Martin County, Florida



Demographic Statistics Within One Mile of Site*	
Total Population	4201
White	4147
Black	19
American Indian, Eskimo, Aleut	3
Asian or Pacific Islander	26
Other Race	4
Hispanic Origin	88
Children Aged 6 and Younger	281
Adults Aged 65 and Older	1357
Females Aged 15 - 44	663
Total Housing Units	2583

Base Map Source: 1995 TIGER/Line Files

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



APPENDIX C -- TABLES

Table 1: Completed Exposure Pathways

Pathway Name	Source	Contaminants	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	Time Exposed
Groundwater	Potentially the Nursery	See Table 4 (private well data)	Off-Site Groundwater	Water from private drinking wells	Ingestion, Inhalation, Dermal	Residents with private drinking wells	Past, Current, Future

Table 2: Potential Exposure Pathways

Pathway Name	Source	Contaminants	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	Time Exposed
On-Site Soil	Nursery	See Tables 5 and 6	On-Site Soil	Direct contact with on-site soils	Dermal, Incidental Ingestion	Residents living on-site; Trespassers	Past, Current, Future
Off-Site Soil	Potentially the Nursery	See Table 7	Off-Site Soil	Direct contact with off-site soils	Dermal, Incidental Ingestion	Residents	Past, Current, Future
On-Site Sediment	Nursery	See Table 8	On-Site Sediment	Direct contact with on-site sediment in drainage ditches and the pond	Dermal, Incidental Ingestion	Trespassers	Past, Current, Future
Off-site Sediment	Potentially the Nursery	See Table 8	Off-Site Sediment	Direct contact with off-site sediment in drainage ditches and the South Fork of the St. Lucie River	Dermal, Incidental Ingestion	Residents	Past, Current, Future

Table 3: On-Site Groundwater Sampling Results

Contaminant	Concentration Range ¹ (ppb) ²	Year of Max, Sample ID	Comparison Value ³	
			Value (ppb)	Source
Benzene	8	1994, Temporary Well	5	MCL
beta-BHC	0.025 I ⁶ - 3.3	1995, MW#3	6	Intermediate EMEG (child)
			20	Intermediate EMEG (adult)
gamma-BHC	0.05	1995, MW#3	0.4	Intermediate EMEG (child)
			1	Intermediate EMEG (adult)
			0.2	MCL
delta-BHC	0.11 (2 hits)	1995, MW#3	None	
Chlordane	0.27 I - 200	1992, 1A#1A	6	Chronic EMEG (child)
			20	Chronic EMEG (adult)
Chloromethane	0.54 I	1998, TW03	3	LTHA
			400	CLHA
4,4 - DDD	0.031 I; 1.49	1992, 1A#1A	0.1	CREG
4,4 - DDE	0.12	1992, 1A#1A	0.1	CREG
Diazinon	4.9	1992, TW#2	2	Intermediate EMEG (child)
			7	Intermediate EMEG (adult)
			5	CLHA
Endosulfan I	0.12	1992, 1A#1A	20	Chronic EMEG (child) ⁵
			70	Chronic EMEG (adult) ⁵
Endosulfan Sulfate	1.46	1992, 1A#1A	20	Chronic EMEG (child) ⁵
			70	Chronic EMEG (adult) ⁵
Aluminum	220	1998, TW04	37,000	RBCn

Contaminant	Concentration Range ¹ (ppb) ²	Year of Max, Sample ID	Comparison Value ³	
			Value (ppb)	Source
Arsenic	3 I; 11.2	1998, TW04	3	Chronic EMEG (child)
			10	Chronic EMEG (adult)
			50	MCL
Barium	3.75 J ⁴ - 20	1998, TW04	700	RMEG (child)
			2,000	RMEG (adult)
Cadmium	0.05 I; 0.1 I	1998, TW03	7	Chronic EMEG (child)
			20	Chronic EMEG (adult)
Calcium	30,000 J - 85,000 J	1998, TW04	None	
Chromium	2 J - 5 I	1998, TW03	100	MCL
Copper	15 J - 25 J	1998, TW04	1,500	RBCn
Iron	91 - 1,600	1998, TW04	11,000	RBCn
Lead	0.58 - 4 J	1998, TW03	15	EPA Action Level
Magnesium	1,000 - 4,000	1998, TW04	None	
Manganese	15 J - 41	1998, TW03	50	RMEG (child)
			200	RMEG (adult)
Potassium	1,100 - 1,600	1998, TW04	None	
Sodium	3,000 - 30,000	1998, TW04	None	
Zinc	17 J - 33	1998, TW04	3,000	Chronic EMEG (child)
			10,000	Chronic EMEG (adult)

Sources: ATSDR, 1996a; EPA, 1998b; Evergreen Engineering, 1996; FDEP, 1998; and McGinnes Laboratories, 1992.

Table Notes:

1. The values listed in this column indicate the range of detected concentrations for each contaminant.

2. ppb = parts per billion.
3. Please refer to Appendix D for an explanation of the comparison values used in this public health assessment.
4. J = estimated value.
5. Comparison value is for Endosulfan.
6. I = value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.

Table 4: Private Well and Off-Site Temporary Well Sampling Results

Contaminant	Private Wells Concentration Range ¹ (ppb) ²	Private Wells Year of Max	Temporary Well Concentration in ppb (1998)	Comparison Value ³	
				Value (ppb)	Source
Benzene	0.31 - 1 J ⁴	1998	ND ⁵	1	CREG
				5	MCL
Bromodichloro- methane	1.3; 3.4	1996	ND	0.6	CREG
				200	Chronic EMEG (child)
				700	Chronic EMEG (adult)
Bromoform	1.2	1996	ND	4	CREG
				2,000	Chronic EMEG (child)
				7,000	Chronic EMEG (adult)
Chloroform	0.51; 9.9	1996	ND	6	CREG
				100	Chronic EMEG (child)
				400	Chronic EMEG (adult)
Chloromethane	0.13 - 0.82 I ⁶	1998	0.58 I	3	LTHA
				400	CLHA

Loxahatchee Nursery

Final Release

Contaminant	Private Wells Concentration Range ¹ (ppb) ²	Private Wells Year of Max	Temporary Well Concentration in ppb (1998)	Comparison Value ³	
				Value (ppb)	Source
Dibromochloro-methane	0.54; 2.8	1996	ND	0.4	CREG
				300	Chronic EMEG (child)
				1,000	Chronic EMEG (adult)
Di (2-ethylhexyl) phthalate	3.0	1996	ND	3	CREG
				200	RMEG (child)
				700	RMEG (adult)
1,1-Dichloroethane	0.21	1996	ND	810	RBCn
1,2-Dichloropropane	0.1 - 330	1996	ND	900	Chronic EMEG (child)
				3000	Chronic EMEG (adult)
				5	MCL
Naphthalene	0.22; 0.37	1996	ND	200	Intermediate EMEG (child)
				700	Intermediate EMEG (adult)
Styrene	0.23; 0.31	1996	ND	2,000	Intermediate EMEG (child)
				7,000	Intermediate EMEG (adult)
				100	MCL

Contaminant	Private Wells Concentration Range ¹ (ppb) ²	Private Wells Year of Max	Temporary Well Concentration in ppb (1998)	Comparison Value ³	
				Value (ppb)	Source
1,2,3-Trichloropropane	1.8 - 3.6	1996	ND	60	RMEG (child)
				200	RMEG (adult)
Aluminum	89	1998	ND	37,000	RBCn
Arsenic	ND	1998	27; 28.3	0.02	CREG
				3	Chronic EMEG (child)
				10	Chronic EMEG (adult)
Barium	15.6 - 23	1998	2.16 J	700	RMEG (child)
				2,000	RMEG (adult)
Calcium	1,500 J - 90,000 J	1998	68,000 J	None	
Chromium	3 J	1998	2 J	100	MCL
Copper	15 J, 25 J	1998	ND	1,500	RBCn
Iron	47 - 7,200	1998	380	11,000	RBCn
Lead	0.4 I - 3 J	1998	0.3 I	15	EPA Action Level
Magnesium	730 - 3,200	1998	16,000	None	
Manganese	6 J - 46	1998	16	50	RMEG (child)
				200	RMEG (adult)

Contaminant	Private Wells Concentration Range ¹ (ppb) ²	Private Wells Year of Max	Temporary Well Concentration in ppb (1998)	Comparison Value ³	
				Value (ppb)	Source
Potassium	210 - 1,400	1998	1,800	None	
Sodium	3,400 - 160,000	1998	15,000	None	
Vanadium	3 J	1998	ND	30	Intermediate EMEG (child)
				300	Intermediate EMEG (adult)
Zinc	38 - 210	1998	ND	3,000	Chronic EMEG (child)
				10,000	Chronic EMEG (adult)

Sources: EPA, 1998b; EPA, 1998f; FDEP, 1998; HRS, 1996b; and HRS, 1996c.

Table Notes:

1. The values listed in this column indicate the range of detected concentrations for each contaminant.
2. ppb = parts per billion.
3. Please refer to Appendix D for an explanation of the comparison values used in this public health assessment.
4. J = estimated value.
5. ND = material was analyzed for but not detected (value below the minimum quantitation limit).
6. I = value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.

Table 5: On-Site Soil Sampling Results - Soil Depth Unspecified

Contaminant	Concentration Range ¹ (ppm) ²	Year of Max. Sample ID	Comparison Value ³	
			Value (ppm)	Source
Chlordane	0.015 - >1.0	1992, #1Soil	1	Chronic EMEG (pica child)
			30	Chronic EMEG (child)
beta BHC	0.0052	1992, #1Soil	0.6	Intermediate EMEG (pica child)
			20	Intermediate EMEG (child)
gamma BHC	0.0038	1992, #1Soil	0.08	Intermediate EMEG (pica child)
			2	Intermediate EMEG (child)
delta BHC	0.0045	1992, #1Soil	None	
DDE	0.012 - 0.072	1996, West	2	CREG
DDD	0.015 - 0.030	1996, West	3	CREG
DDT	0.0062; 0.011	1996, West	1	RMEG (pica child)
			30	RMEG (child)
Dieldrin	0.013	1996, West	0.1	Chronic EMEG (pica child)
			3	Chronic EMEG (child)
Endosulfan II	0.0103	1992, #2Soil	4	Chronic EMEG (pica child) ⁴
			100	Chronic EMEG (child) ⁴
Endrin	0.037	1992, #1Soil	0.6	Chronic EMEG (pica child)
			20	Chronic EMEG (child)
Endrin Aldehyde	0.032	1992, #2Soil	None	
Heptachlor Epoxide	0.005	1992, #1Soil	0.08	CREG

Sources: ATSDR, 1996a; Evergreen Engineering, 1996; and McGinnes Laboratories, 1992.

Table Notes:

1. The values listed in this column indicate the range of detected concentrations for each contaminant.
2. ppm = parts per million.
3. Please refer to Appendix D for an explanation of the comparison values used in this public health assessment.
4. Comparison Value is for Endosulfan.

Table 6: On-Site Surface Soil Sampling Results - 1998

Contaminant	Concentration Range ¹ (ppm) ²	Sample ID of Maximum Concentration	Concentration On-Site Residence (ppm)	Comparison Value ³	
				Value (ppm)	Source
Acenaphthylene	0.053 J ⁴	SS09A	ND ⁷	None	
Carbon Disulfide	0.004 J; 0.005 J	SS07B	0.003 J	200	RMEG (pica child)
				5,000	RMEG (child)
Alpha - Chlordane	0.0042 - 1	SS03A	ND	1	Chronic EMEG (pica child) ⁸
				30	Chronic EMEG (child) ⁸
Gamma - Chlordane	0.0044 - 1.1	SS03A	ND	1	Chronic EMEG (pica child) ⁸
				30	Chronic EMEG (child) ⁸
Chlordane	0.006 I ¹⁰ - 14	SS03A	ND	1	Chronic EMEG (pica child)
				30	Chronic EMEG (child)
Bis (2-ethylhexyl) phthalate	0.470 - 6.2 J	SS03A	ND	50	CREG
				40	RMEG (pica child)
				1000	RMEG (child)

Contaminant	Concentration Range ¹ (ppm) ²	Sample ID of Maximum Concentration	Concentration On-Site Residence (ppm)	Comparison Value ³	
				Value (ppm)	Source
Captan	0.003	SS03B	ND	300	RMEG (pica child)
				7,000	RMEG (child)
Chrysene	0.077 J - 0.19 J	SS09A	ND	88	RBCc
Flouranthene	0.041 J - 0.38	SS09A	ND	80	RMEG (pica child)
				2,000	RMEG (child)
Benzo (a) anthracene	0.065 J - 0.2 J	SS09A	ND	0.88	RBCc
Benzo (b and/or k) flouranthene	0.051 J - 0.24 J	SS09A	ND	0.88	RBCc [benzo(b)flouranthene]
				8.8	RBCc [benzo(k)flouranthene]
Benzo (g,h,i) perylene	0.046 J; 0.099 J	SS09A	ND	None	
Benzo (a) pyrene	0.050 J - 0.17 J	SS09A	ND	0.1	CREG
4,4' - DDE	0.0034 I - 0.36	SS09A	ND	2	CREG
4,4' - DDD	0.0013 I - 0.069 J	SS03A	ND	3	CREG
4,4' - DDT	0.0014 I - 0.33	SS03A	ND	1	RMEG (pica child)
				30	RMEG (child)
Indeno (1,2,3-cd) pyrene	0.055 J; 0.11 J	SS09A	ND	0.88	RBCc

Contaminant	Concentration Range ¹ (ppm) ²	Sample ID of Maximum Concentration	Concentration On-Site Residence (ppm)	Comparison Value ³	
				Value (ppm)	Source
PCB - 1260	0.050 - 0.79	SS02B	ND	1	RMEG (child) ⁹
Phenanthrene	0.23 J	SS09A	ND	None	
Pyrene	0.047 J - 0.47	SS09A	ND	60	RMEG (pica child)
				2,000	RMEG (child)
Total Xylenes	ND	--	0.002 J	400	Intermediate EMEG (pica child)
				10,000	Intermediate EMEG (child)
Aluminum	19 - 3,000	SS02A	510	78,000	RBCn
Arsenic	0.7 I - 2.3	SS09A	ND	0.5	CREG
				0.6	Chronic EMEG (pica child)
				20	Chronic EMEG (child)
Barium	0.45 I - 12	SS07A	6.9	100	RMEG (pica child)
				4,000	RMEG (child)
Cadmium	0.28 I - 1.1	SS10A	ND	0.4	Chronic EMEG (pica child)
				10	Chronic EMEG (child)
Calcium	220 - 66,000	SS06A	87,000	None	

Contaminant	Concentration Range ¹ (ppm) ²	Sample ID of Maximum Concentration	Concentration On-Site Residence (ppm)	Comparison Value ³	
				Value (ppm)	Source
Chromium	0.51 I - 96.7	SS10A	3.6	10	RMEG (pica child) ⁵
				300	RMEG (child) ⁵
Copper	3.7 J - 130 J	SS07A	7.6 J	3,100	RBCn
Iron	110 - 2,900	SS03A	460	23,000	RBCn
Lead	0.7 J - 31	SS03A	3.1 J	500	EPA Action Level
Magnesium	170 - 920	SS07A	330	None	
Manganese	2.1 J - 650 J	SS07A	4.7 J	10	RMEG (pica child)
				300	RMEG (child)
				4,000	RMEG (adult)
Total Mercury	0.19	SS09A	ND	4	Intermediate EMEG (pica child) ⁶
				100	Intermediate EMEG (child) ⁶
Potassium	18 - 150	SS07A	69	None	
Selenium	0.9 I; 1 I	SS02A	ND	10	Chronic EMEG (pica child)
				300	Chronic EMEG (child)

Contaminant	Concentration Range ¹ (ppm) ²	Sample ID of Maximum Concentration	Concentration On-Site Residence (ppm)	Comparison Value ³	
				Value (ppm)	Source
Silver	0.19 I - 1.3	SS06A	ND	10	RMEG (pica child)
				300	RMEG (child)
Sodium	500	SS06A	990	None	
Vanadium	1.1 J - 3 J	SS07A	2.5 J	6	Intermediate EMEG (pica child)
				200	Intermediate EMEG (child)
Zinc	4.6 J - 290 J	SS07A	12 J	600	Chronic EMEG (pica child)
				20,000	Chronic EMEG (child)
Cyanide	0.61 J (2 hits)	SS03B	ND	100	Intermediate EMEG (pica child)
				3,000	Intermediate EMEG (child)

Sources: EPA, 1998b; EPA, 1998d; EPA, 1998e; EPA, 1998f; and FDEP, 1998.

Table Notes:

1. The values listed in this column indicate the range of detected concentrations for each contaminant.
2. ppm = parts per million.
3. Please refer to Appendix D for an explanation of the comparison values used in this public health assessment.
4. J = estimated value.
5. Comparison value is for hexavalent chromium.
6. Comparison value is for inorganic mercury.
7. ND = material was analyzed for but not detected (value below the minimum quantitation limit).

8. Comparison value is for chlordane.
9. Comparison value is for PCB - 1254.
10. I = value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.

Table 7: Off-Site Surface Soil Sampling Results - 1998

Contaminant	Concentration Range ¹ (ppm) ²	Sample ID of Maximum Concentration	Comparison Value ³ Source	
			Value (ppm)	
Bis (2-ethylhexyl) phthalate	0.62 J ⁴	SS08	50	CREG
			40	RMEG (pica child)
			1000	RMEG (child)
Carbon Disulfide	0.015	SS01	200	RMEG (pica child)
			5,000	RMEG (child)
4,4' - DDD	0.00097 I ⁶	SS01	3	CREG
4,4' - DDE	0.0019 I	SS01	2	CREG
4,4' - DDT	0.0037	SS01	2	CREG
			1	RMEG (pica child)
			30	RMEG (child)
Aluminum	310; 640	SS01	78,000	RBCn
Arsenic	22.3; 43 J	SS01	0.5	CREG
			0.6	Chronic EMEG (pica child)
			20	Chronic EMEG (child)
			200	Chronic EMEG (adult)
Barium	4.24 - 6.4	SS08	100	RMEG (pica child)
			4,000	RMEG (child)
Calcium	1,800; 8,100	SS01	None	
Chromium	2.75 A ⁷ - 53	SS01	10	RMEG (pica child) ⁵
			300	RMEG (child) ⁵
Copper	21 J; 83 J	SS01	3,100	RBCn
Iron	220; 610	SS01	23,000	RBCn
Lead	2.1 A - 9.3	SS01	500	EPA Action Level
Magnesium	170	SS08	None	

Contaminant	Concentration Range ¹ (ppm) ²	Sample ID of Maximum Concentration	Comparison Value ³ Source	
			Value (ppm)	
Manganese	15 J; 68 J	SS08	10	RMEG (pica child)
			300	RMEG (child)
			4,000	RMEG (adult)
Potassium	34; 43	SS08	None	
Vanadium	0.48 J; 1.3 J	SS01	6	Intermediate EMEG (pica child)
			200	Intermediate EMEG (child)
Zinc	16; 57 J	SS08	600	Chronic EMEG (pica child)
			20,000	Chronic EMEG (child)

Sources: EPA, 1998b; EPA, 1998d; EPA, 1998f; and FDEP, 1998.

Table Notes:

1. The values listed in this column indicate the range of detected concentrations for each contaminant.
2. ppm = parts per million.
3. Please refer to Appendix D for an explanation of the comparison values used in this public health assessment.
4. J = estimated value.
5. Comparison value is for hexavalent chromium.
6. I = value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.
7. A = value reported is the mean of two or more determinations.

Table 8: Sediment Sampling Results - 1998

Contaminant	Sediment St. Lucie River Concentration Range (ppm) ²	Sediment Drainage Ditches Concentration Range ¹ (ppm)	Sediment Drainage Ditches Sample ID of Maximum Concentration	Comparison Value ³	
				Value (ppm)	Source
Atrazine	ND	0.0027 I ^p	SD01	70	RMEG (pica child)
				2,000	RMEG (child)
Alpha - Chlordane	ND ⁶	0.014	SD04	0.5	CREG ⁷
				1	Chronic EMEG (pica child) ⁷
				30	Chronic EMEG (child) ⁷
Gamma - Chlordane	ND	0.016	SD04	0.5	CREG ⁷
				1	Chronic EMEG (pica child) ⁷
				30	Chronic EMEG (child) ⁷
Chlordane	0.025 I	0.058 - 0.44	SD04	0.5	CREG
				1	Chronic EMEG (pica child)
				30	Chronic EMEG (child)
Bis (2-ethylhexyl) phthalate	1.3	4.8	SD01	50	CREG
				40	RMEG (pica child)
				1000	RMEG (child)
Chrysene	ND	0.071 J ⁴ - 0.120 I	SD04	88	RBCc

Loxahatchee Nursery

Final Release

Contaminant	Sediment St. Lucie River Concentration Range (ppm) ²	Sediment Drainage Ditches Concentration Range ¹ (ppm)	Sediment Drainage Ditches Sample ID of Maximum Concentration	Comparison Value ³	
				Value (ppm)	Source
Flouranthene	ND	0.13 J - 0.150 I	SD04	80	RMEG (pica child)
				2,000	RMEG (child)
Benzo (b and/or k) flouranthene	ND	0.13 - 0.22 I	SD04	0.88	RBCc [benzo(b)flouranthene]
				8.8	RBCc [benzo(k)flouranthene]
Benzo (a) pyrene	ND	0.063 J	SD03	0.1	CREG
4,4' - DDD	0.0014 I	0.0023 I - 0.0024 I	SD02	3	CREG
4,4' - DDE	0.0015 I	0.0096 - 0.030	SD02	2	CREG
4,4' - DDT	0.012	0.0042 J; 0.0092	SD02	2	CREG
				1	RMEG (pica child)
				30	RMEG (child)
(3 and/or 4) methylphenol	0.058 J	ND	--	100	RMEG (pica child) (3- methylphenol)
				3,000	RMEG (child) (3- methylphenol)
				390	RBCn (4-methylphenol)
PCB - 1242	0.039 J	ND	--	1	RMEG (child) ⁸

Contaminant	Sediment St. Lucie River Concentration Range (ppm) ²	Sediment Drainage Ditches Concentration Range ¹ (ppm)	Sediment Drainage Ditches Sample ID of Maximum Concentration	Comparison Value ³	
				Value (ppm)	Source
Pyrene	ND	0.12 J - 0.18 I	SD04	60	RMEG (pica child)
				2,000	RMEG (child)
Toluene	ND	0.003 J; 0.0039 I	SD03	400	RMEG (pica child)
				10,000	RMEG (child)
Aluminum	230	300 - 4,000	SD02	78,000	RBCn
Arsenic	ND	0.7 I - 1 I	SD04	0.5	CREG
				0.6	Chronic EMEG (pica child)
				20	Chronic EMEG (child)
Barium	1.1; 7.48	3.06 - 10	SD02	100	RMEG (pica child)
				4,000	RMEG (child)
Cadmium	ND	0.25 I - 0.53 I	SD04	0.4	Chronic EMEG (pica child)
				10	Chronic EMEG (child)
Calcium	1,800	1,800 - 19,000	SD01	None	
Chromium	1.2 - 4.06	2.1 J - 20.4	SD04	10	RMEG (pica child) ⁵
				300	RMEG (child) ⁵
Copper	7.2 J	5.9 J - 51 J	SD04	3,100	RBCn

Loxahatchee Nursery

Final Release

Contaminant	Sediment St. Lucie River Concentration Range (ppm) ²	Sediment Drainage Ditches Concentration Range ¹ (ppm)	Sediment Drainage Ditches Sample ID of Maximum Concentration	Comparison Value ³	
				Value (ppm)	Source
Iron	2,700	480 - 3,100	SD02	23,000	RBCn
Lead	1.8 - 2.0 I	2.5 - 10	SD04	500	EPA Action Level
Magnesium	ND	590; 640	SD02	None	
Manganese	15 J	2.4 J - 110 J	SD02	10	RMEG (pica child)
				300	RMEG (child)
				4,000	RMEG (adult)
Potassium	8.9 J	14 - 52	SD04	None	
Silver	ND	0.25 I	SD04	10	RMEG (pica child)
				300	RMEG (child)
Vanadium	0.78 J	0.82 J - 8.9 J	SD02	6	Intermediate EMEG pica child)
				200	Intermediate EMEG (child)
Zinc	7.6 J	4.4 J - 68	SD04	600	Chronic EMEG (pica child)
				20,000	Chronic EMEG (child)

Sources: EPA, 1998b; EPA, 1998d; EPA, 1998e; EPA, 1998f; and FDEP, 1998.

Table Notes:

1. The values listed in this column indicate the range of detected concentrations for each contaminant.

2. ppm = parts per million.
3. Please refer to Appendix D for an explanation of the comparison values used in this public health assessment.
4. J = estimated value.
5. Comparison value is for hexavalent chromium.
6. ND = material was analyzed for but not detected (value below the minimum quantitation limit).
7. Comparison value is for chlordane.
8. Comparison value is for PCB - 1254.
9. I = value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit.

Table 9: Tank Pull Sampling Results - 1992

Contaminant	Concentration (ppb) ¹	Comparison Value ²	
		Value	Source
Chlordane	8	6	Chronic EMEG (child)
		20	Chronic EMEG (adult)
4,4' - DDD	0.3	0.1	CREG
4,4' - DDE	1.0	0.1	CREG
4,4' - DDT	0.5	5	RMEG (child)
		20	RMEG (adult)
Dieldrin	0.75	0.5	Chronic EMEG (child)
		2	Chronic EMEG (adult)
Endosulfan II	0.4	20	Chronic EMEG (child) ³
		70	Chronic EMEG (adult) ³
Ethyl benzene	8	1,000	RMEG (child)
		4,000	RMEG (adult)
		700	MCL
p-Xylene	2	520	RBCn
m-Xylene	11	6,000	Intermediate EMEG (child)
		20,000	Intermediate EMEG (adult)
o-xylene	12	1,400	RBCn

Sources: ATSDR, 1996a; and Evergreen Engineering, 1996.

Table Notes:

1. ppb = parts per billion.
2. Please refer to Appendix D for an explanation of the comparison values used in this public health assessment.
3. Comparison value is for Endosulfan.

APPENDIX D -- COMPARISON VALUES

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 site-specific "contaminants of concern". The latter term should not be misinterpreted as an implication of "hazard". As ATSDR uses the phrase, a "contaminant of concern" is merely a chemical substance detected at the site in question and selected by the health assessor 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 must be emphasized 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. The whole purpose behind highly conservative, health-based standards and guidelines is to enable health professionals to recognize and resolve potential public health hazards before they can become actual public health consequences. Thus, comparison values are designed to be preventive, rather than predictive, of adverse health effects. The probability that such effects will actually occur depends, not on environmental concentrations alone, but on a unique combination of site-specific conditions and individual lifestyle and genetic factors that affect the route, magnitude, and duration of actual exposure.

Listed and described below are the various comparison values that ATSDR uses to select chemicals for further evaluation, as well as other non-ATSDR values that are sometimes used to put environmental concentrations into a meaningful frame of reference.

CREG	=	Cancer Risk Evaluation Guides
MRL	=	Minimal Risk Level
EMEG	=	Environmental Media Evaluation Guides
IEMEG	=	Intermediate Environmental Media Evaluation Guide
RMEG	=	Reference Dose Media Evaluation Guide
RfD	=	Reference Dose
RfC	=	Reference Dose Concentration
RBC	=	Risk-Based Concentration
DWEL	=	Drinking Water Equivalent Level
MCL	=	Maximum Contaminant Level
CLHA	=	Child Longer Term Health Advisory

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations 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, or cancer potency factors, using default values for exposure rates. However, neither CREGs nor CSFs can be used to make realistic predictions of cancer risk. The true risk is always unknown and may be as low as zero.

Minimal Risk Levels (MRL) are estimates of daily human exposure to a chemical (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 calculated using data from human and animal studies and are reported for acute (≤ 14 days), intermediate (15-364 days), and chronic (≥ 365 days) exposures. MRLs are published in ATSDR Toxicological Profiles for specific chemicals.

Environmental Media Evaluation Guides (EMEGs) are concentrations that are calculated from ATSDR minimal risk levels by factoring in default body weights and ingestion rates.

Intermediate Environmental Media Evaluation Guides (IEMEG) are calculated from ATSDR minimal risk levels; they factor in body weight and ingestion rates for intermediate exposures (those occurring for more than 14 days and less than 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 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. Like ATSDR's MRL, EPA's RfD is a dose expressed in mg/kg/day.

Reference Concentrations (RfC) is a concentration of a substance in air that EPA considers unlikely to cause noncancer adverse health effects over a lifetime of chronic exposure.

Risk-Based Concentrations (RBC) are media-specific concentrations derived by Region III of the Environmental Protection Agency Region III from RfDs, RfC's, or EPA's cancer slope factors. They represent concentrations of a contaminant in tap water, ambient air, fish, or soil (industrial or residential) that are considered unlikely to cause adverse health effects over a lifetime of chronic exposure. RBCs are based either on cancer ("c") or noncancer ("n") effects.

Drinking Water Equivalent Levels (DWEL) 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 at an intake rate of 2 L/day for life, assuming that drinking water is the sole source of exposure.

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.

Child Longer Term Health Advisory (CLHA) represents the concentration of a substance in drinking water that would have no deleterious effect on a child exposed for up to 7 years.

Reference for Comparison Values:

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

APPENDIX E -- ATSDR METHODOLOGY

ATSDR Methodology

ATSDR evaluates contaminants detected in environmental media at the site and determines whether an exposure to them has public health significance. ATSDR selects and discusses the contaminants based upon the following factors:

- concentrations of contaminants on and off site;
- community health concerns; and
- comparison of on- and off-site concentrations with ATSDR health comparison values for (1) noncarcinogenic endpoints and (2) carcinogenic endpoints.

ATSDR health comparison values are concentrations of contaminants that are media specific (e.g., water, air, or soil). The comparison values are considered to be safe under default conditions of exposure and are used as screening values in the preliminary identification of site-specific "contaminants of concern." The "contaminants of concern" are those contaminants that were detected above the screening comparison values and contaminants without comparison values. However, the comparison values in the Tables in Appendix C are those that ATSDR considers to be the most appropriate, considering site-specific conditions of exposure, i.e., specifically the duration of exposure (acute, intermediate or chronic) to the environmental medium in question most likely to prevail at the site. Please refer to the Toxicological Evaluation section and Appendix D for further clarification and description of the comparison values used in this public health assessment.

Following the preliminary identification of site-specific "contaminants of concern", which are described in the Environmental Contamination and Other Hazards section, ATSDR staff discuss in the Pathways Analyses section whether nearby residents are exposed to contamination migrating from the site. If exposure to contamination is identified, the significance of this exposure, with relation to adverse health effects, is discussed in the Toxicological Evaluation section. ATSDR staff also address specific community concerns in the Community Health

Concerns Evaluation section. Finally, based on the evaluations from all preceding sections of the public health assessment, ATSDR staff determine conclusions and prepare recommendations.

APPENDIX F -- ATSDR HEALTH CONSULTATION

ATSDR Record of Activity

UID #: TYM4 Date: 9-30-96 Time: 10:00 am pm

Site Name: Loxahatchee Nursery Site City: Palm City Cnty: Martin State: FL

CERCLIS #: _____ Cost Recovery #: A307 Region: 4

Site Status (1) NPL Non-NPL RCRA Non-Site specific Federal
(2) Emergency Response Remedial Removal Other: Petition Site

Activities

Incoming Call Public Meeting* Health Consult* Site Visit*
 Outgoing Call Other Meeting Health Referral Info Provided
 Conference Call Data Review Written Response Training
 Incoming Mail Other:

Requestor and Affiliation: (1) ATSDR Petition Response Branch
Phone: _____
Address: _____
City: _____ State: _____ Zip Code: _____

Contacts and Affiliation

(1) Steven Kinsler, Ph.D. Toxicologist () _____
(1) Carl Blair, ATSDR REG 4 Rep. () _____

1=ATSDR 2=EPA 3=Other Fed 4=State Health 5=State Environment
6=Local Health 7=Elected Official 8=Private Co 9=Private Citizen
10=News Media 11=Citizen Group 12=USCG 13=Natl Resps Cntr 14=Other

Program Areas

Health Assessment Health Studies Tox Info-profile Worker Hlth
 Petition Assessment Health Survellnc Tox Info-Nonprofil Admin
 Emergency Response Disease Registry Subst-Spec Resch Other
 Health Consultation Exposr Registry Health Education

Background and Statement of Issues:

ATSDR's Petitions Response Branch requested that the Exposure and Investigation and Consultation Branch review the available data and information for the Loxahatchee Nursery site and determine if adequate sampling has been conducted to evaluate potential public health concerns and if additional environmental sampling is needed to define the extent of contamination at the site. Currently, this site is under review by the Petitions Response Branch.

The Loxahatchee Nursery Site is currently inactive and is located at 2051 SW Mapp Road, Palm City, Florida. The site is approximately 10 acres in

size and is surrounded by residential homes (Gull Harbor / Pelican Cove Residential Area) on private water wells and a county park. A small pond is located in the middle of the site. A vacant building and a partially dismantled building are also located on-site. As reported in the Draft Petition Scoping Report (September 1996), the site topography slopes to the east and surface water runoff flows into the drainage canals that drain into Gull Harbor. Public access to the site is unrestricted. During a recent site scoping visit conducted by ATSDR Region 4 Representative, evidence of children playing on-site was observed. The future use of the site is residential.

The Loxahatchee Nursery site began as a flower farm in the 1940's. The flower farm was converted to a nursery of specialty and long term growth plants in 1972. Benlate DF, a Dupont product which arrests the growth of plants, was used at the site (the time frames this product was used at the site was not included in the data report) [1]. Use of the site as a nursery ceased in January 1992 and the site was cleared of all plants due to an agreement between the operators and Dupont [1].

1992 On-Site Soil and Groundwater Sampling Event Prior to Underground Storage Tank Removals:

On January 21, 1992 two composite soil samples and two groundwater samples were collected from the area of the on-site pesticide storage shed and analyzed for organochlorine and organophosphate pesticides and polychlorinated biphenyls (PCBs) [2]. The depths of the soil samples were not indicated in the data report. Soil sample #1 was collected 1 foot north of the northwest corner of the shed (1 foot of gravel covered the surface) and soil sample #2 was collected 20 inches southeast of the corner of the shed. Two temporary groundwater wells were installed to collect the two groundwater samples. The groundwater samples were collected from the same locations as the soil samples (TW#1 and TW#2). As reported in the May 1994 Preliminary Contamination Assessment Plan for Loxahatchee Nursery [2], the two soil samples were found to be contaminated with organochlorine pesticides (See Attachment 1 for Analytical Results). However, the data from this sampling event is inaccurately labeled. All the samples are labeled as using a soil method for the water samples, etc. As reported in the narrative summary in the 1994 Preliminary Contamination Assessment Plan [2], the following contaminants were identified in the soil samples: Lindane, DDD, endosulfan II, endrin, endrin aldehyde, heptachlor epoxide, and chlordane. Chlordane levels detected in soils were greater than 1000 parts per billion (ppb) (data was not included in analytical report but was only reported in the narrative summary of reference 2). Water analysis results for organophosphate detected only diazinon in TW#2 groundwater sample at 4.9 ppb [2]. The analysis for organochlorines in groundwater samples found approximately the same contaminants that were detected in the soils (only reported in the narrative summary of reference 2). Chlordane was detected at levels of 200 ppb in TW#1 groundwater sample [2].

1992 and 1994 Sampling Events Following On-Site Underground Storage Tank Removals:

Petroleum and chlorinated pesticide compounds were first discovered in the soil and groundwater at the site by environmental audits (removals) conducted in January 1992 and May 1994 by the Florida Department of Environmental Protection (FDEP) during underground storage tank (UST) removals [1,2]. Petroleum contamination was attributed to two USTs that were identified on-site and have since been removed. The pesticide contamination is suspected to have been the result of equipment washing outside an on-site storage shed in which chemicals and application equipment were stored. Soil, water (from the bottom of the tank beds), and groundwater sampling were conducted during the 1992 and 1994 UST removals. The sampling was conducted as confirmatory sampling after the UST removals.

During the 1992 UST audit (removal), three water samples from the bottom of the tank bed and three grab soil samples were collected from on-site soil stock piles from the excavated area of the UST. Fifteen additional soil samples were collected from depths of two to 7 feet in various locations of the tank bed. The soil samples were screened using an organic vapor analyzer (OVA) and measured levels ranged from 0 parts per million (ppm) to greater than 1000 ppm volatile organic compounds. The water samples were analyzed for chlorinated hydrocarbon pesticides and gasoline constituents. The water sampling results indicated at the following maximum concentrations: Ethylbenzene 8 ppb, p-Xylene 2 ppb, m-Xylene 11 ppb, o-Xylene 12 ppb, Dieldren 0.75 ppb, Chlordane 8 ppb, DDD 0.3 ppb, DDE 1 ppb, and DDT 0.5 ppb.

During the 1994 UST audit (removal), three soil samples were screened using an OVA meter at the following depths: 6 inches, 1 foot, and 3.5 feet. One water sample was collected from a temporary well which was installed in the middle of the excavation after the tank was removed and analyzed for gasoline constituents. The results of the water sample indicated total BTEX levels of 39 ppb with a level of 8 ppb benzene. Following the 1992 and 1994 UST removals the excavated soil was stockpiled on visqueen and bermed with clean fill and then disposed of on-site.

As a result of the UST removals, four monitoring wells were installed at the site in 1994 for petroleum contamination assessment [1]. The wells were installed based on the area of documented contamination and the reported regional groundwater flow to the east [1,2]. In addition to these four monitoring wells, three additional permanent monitoring wells were installed.

1992-1996 Residential Well Sampling Events in the Gull Harbor / Pelican Cove Area:

On March 4, 1992, the Martin County Public Health Unit (MCPHU) sampled two private wells in the Gull Harbor/Pelican Cove area for Benlate DF and carbamate pesticides [3]. The results of these samples indicated levels were below the detection levels (data do not indicate the detection level of analysis). On August 31, 1993, the MCPHU sampled eight private wells in

the Gull Harbor/Pelican Cove area for hydrocarbons. One well had trace levels (2.1 ppb) of 1,2-dichloropropane. EPA's Maximum Contaminant Level (MCL) for 1,2-dichloropropane is 5 ppb [4]. After the detection of 1,2-dichloropropane in this private well, several rounds of sampling followed, analyzing for pesticides and hydrocarbons (See Attachment 2 for Analytical Results from Residential Wells). No further well contamination was discovered until a follow-up round of sampling was conducted on July 9, 1996.

On July 9, 1996, eighteen private wells in the Gull Harbor/Pelican Cove area were sampled and analyzed for hydrocarbons and ten private wells were sampled and analyzed for pesticides. Three wells had trace levels of 1,2-dichloropropane (0.1 ppb, 0.15 ppb, 3.6 ppb), and one well had levels of 1,2-dichloropropane at 150 ppb. The presence of 1,2-dichloropropane in the groundwater is suspected to be pesticide related because the compound was used on on-site soils to treat for nematodes [5]. In addition, a trace level of naphthalene (0.37 ppb) was also detected at one private well. EPA's drinking water equivalent level (DWEL) for naphthalene is 100 ppb [4].

1996 On-site Soil and Monitoring Well Sampling Event:

The most current on-site sampling was conducted February 26, 1996 [6]. Three monitoring well water and four soil samples were collected and analyzed for pesticides and PCBs. Two soil samples were collected from stockpiled soils located on the east and west boundaries of the site and two soil samples were collected from a depth of 0 to 12 inches adjacent to the east and west stockpiled soils. The soil samples were reported as grab samples, but the depth of the samples was not included in the data report. The soil sample identified as West had the following levels of pesticides: DDE 72 ppb, DDD 30 ppb, DDT 11 ppb, Dieldrin 13 ppb, and Chlordane 90 ppb. The soil sample identified as East had the following levels of pesticides: DDE 12 ppb, DDT 6.2 ppb, and Chlordane 15 ppb. The soil sample identified as Pile SE had the following levels of pesticides: DDE 20 ppb, and Chlordane 440 ppb. The soil sample identified as Pile NW had the following levels of pesticides: Chlordane, 32 ppb. The monitoring well water analytical results were as follows: MW-3 beta-BHC, 0.24 ppb. Monitoring well water samples 1 and 2 did not have levels of pesticide or PCB contamination above detection limits. The detection limits as indicated in the analytical report were low enough to be protective of public health [6].

Discussion and Conclusions:

Based on the data and information evaluated, residential private potable wells located adjacent to the site may have been impacted by site related groundwater contamination. One private well water sample had 150 ppb 1,2-dichloropropane, exceeding EPA's 5 ppb MCL. This resident is receiving bottled water. However, the information provided to ATSDR did not mention if the residents were using the private well water for showering or bathing, etc. Exposure to VOCs in potable groundwater can occur via ingestion, inhalation, and dermal exposure. Studies indicate that

significant exposure to VOCs can occur during bathing, showering, and other household activities as the chemicals volatilize into the air (and are subsequently inhaled) or are absorbed through the skin [7-10]. The studies indicate that exposure to VOCs via inhalation and dermal absorption may equal or exceed that from ingestion alone. Use of bottled water in the home for drinking and cooking purposes may help reduce exposure to VOCs in private well water; however, use of VOC-contaminated well water for other household purposes (bathing, showering, washing dishes, washing clothes, etc.) may result in significant exposures to VOCs via inhalation and dermal exposure. If 150 ppb 1,2-dichloropropane is representative of groundwater contaminant concentrations in this private well, use of this well water for uses other than drinking water may result in unacceptable exposures. Additional sampling and analysis of this private well may be necessary to confirm elevated 1,2-dichloropropane levels.

The trace levels of 1,2-dichloropropane and naphthalene detected in the other private wells do not represent a health concern. However, the MCPHU will continue to monitor the private residential wells used as potable water sources in the Gull Harbor / Pelican Cove area to ensure that the levels of groundwater contaminants do not present a public health threat.

The 1992 groundwater results and the 1996 monitoring well water results indicate that the site has been impacted by groundwater contamination. The soil samples collected in 1992 and 1996 also indicate low levels of pesticide contamination. However, these limited soil data (depths not indicated in data report) cannot be used to determine if a health threat exists in surface soils throughout the 10 acre site. Because human exposures usually occurs to contaminants in the top 3 inches of soil, surface soil sampling and analysis is needed to evaluate public health threats.

The limited soil data collected prior to and after the 1992 and 1994 UST removals does not reflect current site conditions nor can the data be used to evaluate public health concerns in surface soils at the site.

ATSDR believes that the extent of contamination in surface soils, subsurface soils, and surface water (on-site pond) has not been adequately characterized at this site.

ATSDR considers surface soil sampling to represent the first few inches (0-3 inches) of soil that a person may come in contact with. An exposure scenario can then be evaluated for the on-site surface soils via ingestion, inhalation of dust, or dermal contact for a person who may come in contact with surface soils. Since no surface soil data exists for the on-site soils or for any adjacent surface soils of the site (that were likely to have been and/or now being contaminated via off-site migration of site contaminants via surface water runoff), ATSDR cannot evaluate the health threat that may be posed by exposure to soils contaminated by site-specific contaminants. In addition, adequate subsurface soil sampling has not been conducted at the site to determine if contamination exists that may result in future health concerns.

Action Required/Recommendations/Info Provided:

Based on the information provided, ATSDR recommends the following:

1. Adequately characterize the nature and extent of contamination in on-site surface soils (0-3 inches).
2. Adequately characterize the nature and extent of contamination in surface soils beyond the boundaries of the site (areas should include stream beds or seeps formed from on-site surface water run-off).
3. Adequately characterize the nature and extent of contamination in on-site subsurface soils to ensure that no future public health threat exists.
4. Adequately characterize the nature and extent of contamination in surface water in the on-site pond.
5. Additional private well data is needed from the resident's well currently receiving bottled water to determine if a whole-house alternate water supply is necessary to reduce or stop exposure to contaminated well water.
6. Continue to monitor private wells used for potable purposes in the area to determine if wells are being impacted by site-specific contamination.
7. Restrict public access to the site until sampling activities have been completed that may determine if public health concerns exists due to exposure to site-specific contaminants.

If requested, ATSDR will review sampling plans for the site and data when it becomes available.

Signature: Tammie McRae, M.S.  Date: 9-30-96

Concurrence: Steven Kinsler, Ph.D.  Date: 9/30/96

Enclosures: Yes () No (x); MIS entered: Yes () No ()

cc: EICB File
Ed Skowronski
Carl Blair, ATSDR Region 4 Representative
PERIS

References:

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APPENDIX G -- ATSDR RESPONSE TO COMMENTS

ATSDR RESPONSE TO COMMENTS

This appendix contains a summary of the comments ATSDR received during the public comment period for the Loxahatchee Nursery public health assessment. Each comment was logged and became part of the administrative record. Both the comments and ATSDR's responses are included in the text below. The comments have been numbered and are in *italic* with ATSDR's response directly below each comment. Personal identifiers and names mentioned in the comments ATSDR received have not been included. Also, similar comments received from different individuals have been combined into one comment.

1. *We want this nursery resampled for the breakdown products of benlate along with its contaminants, flusilazole and chlorothalonil. We want two sets of samples taken at the same time and one set sent to an out-of-state laboratory of our choosing.*

ATSDR is considering sampling at the Loxahatchee Nursery site and testing for the chemical flusilazole. Please refer to the Community Health Concerns Evaluation section of this public health assessment, which has been modified from the public comment version to include more information concerning flusilazole. Benlate's breakdown product, carbendazim, has been analyzed for in private wells, monitoring wells, soil, and sediment without being detected. Therefore, ATSDR does not recommend any further analyses for benlate or its breakdown products.

2. *We want the pond and its fish to be tested.*

Because ATSDR has no chemical-specific environmental data from the pond, the agency has identified the pond as a "data gap" and is considering sampling water and sediment from the pond.

3. *Independent soil and water analysis should be conducted on the properties surrounding the nursery.*

At this time, ATSDR does not recommend any further residential soil sampling. Soil and water analyses have been performed on the properties surrounding the nursery. No contaminants at levels of health concern were detected. Of note, the MCHD plans to periodically monitor the groundwater quality of private potable water sources in the area.

4. *We want a cancer survey of the residents of the surrounding area.*

From ATSDR's perspective, an adverse health effect to be evaluated should be plausibly related to the release of hazardous substances from the site being investigated. ATSDR reviewed environmental data for the Loxahatchee Nursery site and did not identify any contaminants at

levels of concern for increased cancer risk. Of note, in response to a request from the community to review the rate of cancer, the MCHD plans to review cancer incidence data. For more information on this issue, please contact the MCHD directly.

5. *We would like a federal investigation before a grand jury into the matter of federal and state agencies collaborating with DuPont to withhold crucial life and health information from the people of the United States and the State of Florida.*

This request is out of the purview of ATSDR's activities at the site.

6. *In Appendix G, Health Consultation, it stated that the resident that had a high level of 1,2-dichloropropane was receiving bottled water and the report made recommendation #5 that more information is needed to stop exposure. This well was fitted with a charcoal filter almost immediately after the contamination was found. When ATSDR investigators visited the site, the filter was installed on the well. This affects section B on page 4.*

The information referred to in this comment pertains to recommendations ATSDR made in our September 1996 health consultation. These are not our current recommendations which are found in the Recommendation section of this public health assessment. To avoid confusion, ATSDR has modified section B to only state that the 1996 health consultation recommended additional sampling activities. Information contained in the copy of the 1996 health consultation found in Appendix G cannot be modified as it is considered a released, final document.

7. *Several sections of the public health assessment reference historical use of 1,2-dichloropropane as a soil fumigant at the nursery. I have spoken with all owners or operators from 1944 to 1992, none of whom report ever using this chemical on the premises. They did use methyl bromide as a nematocide.*

ATSDR thanks the commentor for this information. It was reported to ATSDR that 1,2-dichloropropane was used on site and the agency included this information in the public comment release of the document. All references to the use of 1,2-dichloropropane on site have been removed from the main text of the final release public health assessment because the reports of its use are conflicting. Of note, not stating the source of the 1,2-dichloropropane in the public health assessment does not affect ATSDR's conclusions and recommendations regarding this site. Further, in the Community Health Concerns Evaluation section, ATSDR states that 1,2-dichloropropane has not been detected in on-site monitoring well, soil, or sediment samples which suggests the nursery is not the source.

8. *The Background section reports that pesticides were applied via injection through the irrigation system. Fertilizers were occasionally applied in this fashion, but pesticides were not.*

The sentence in question has been modified to indicate that fertilizers were delivered to the plants through the nursery's irrigation system.

9. *The Background section reports that the nursery was developed on filled wetlands. This is not true. The topography, except for beds graded up from original grade, remains the same as when the land was cleared in 1944. The same sentence also indicates that a tile drainage system exists beneath the site.*

Based on this information, ATSDR has deleted the sentence in question from the main text of the public health assessment. Deleting this sentence does not alter ATSDR's conclusions and recommendations regarding this site.

10. *The report indicates a septic tank system is present on site. Was this located during the March 1998 sampling event? If so, why was the septic tank system not sampled?*

The septic tank system was not located during the March 1998 sampling event. ATSDR believes the septic tank is used by the on-site residence; however, ATSDR was not able to find any documentation to indicate the septic tank's location or use.

11. *Pages 6 and 10 of the report appear to contradict the depth to the water table beneath the site.*

ATSDR does not believe the sentences in question contradict one another. Page 6 states, "In this area, the water table is encountered at 8 feet or less below ground surface." Page 10 then goes on to state that, during the March 1998 sampling event, groundwater was encountered at 1.5–2 feet below land surface. ATSDR does not see a contradiction with stating that groundwater in the area is encountered at *8 feet or less*, because 1.5–2 feet falls within the previously defined range. The water table in this area fluctuates depending on the season.

12. *In the Pathway Analysis section, the document reports one Completed Exposure Pathway beginning with 1,2-dichloropropane applied at the nursery and ending with it in a drinking water well. As this chemical was not used on site, it originated elsewhere. In fact, the high relative concentration in the one well, which is located in a drainage swale north of the nursery, along with failure to find 1,2-dichloropropane anywhere else within the nursery or surrounds, argues against the nursery being the source. It is much more likely that a local homeowner used this chemical as a degreaser, which is one of its known applications, and disposed of it in the drainage swale upgradient of the well in question.*

As stated in comment number 7, ATSDR has removed references to the use of 1,2-dichloropropane on-site because the Agency has received conflicting information on this issue. However, a human exposure pathway can be "complete" even if the source of contamination is

not known, so exposure to 1,2-dichloropropane remains in the public health assessment as a completed exposure pathway.

13. *The report states that three private wells had trace levels of 1,2-dichloropropane. However, trace levels of this solvent have been found in five private wells.*

The draft public health assessment contained private well data sampled from 1992 to July 1996. Based on this comment, ATSDR requested updated data from MCHD. Additional data from August to December 1996 were obtained and are included in this final public health assessment. Two additional wells were found to contain 1,2-dichloropropane at trace levels and the main text of this document has been modified to indicate *five* wells instead of *three*.

14. *The Martin County Public Health Unit (MCPHU) is now the Martin County Health Department (MCHD).*

ATSDR thanks the commentor for this information which has been added to the final public health assessment text in the Public Health Actions section.

15. *The pond was sampled by FDEP and two 7-day chronic static-renewal definitive toxicity bioassays were performed on the samples collected. The samples did not demonstrate chronic toxicity to the test species. Although the samples had exceeded normal holding times, toxicants were expected to be stable.*

ATSDR thanks the commentor for this information. However, because chemical-specific environmental sampling data (i.e., for surface water or sediment) have not been collected for the pond, ATSDR recommends additional characterization of the pond as indicated in the Recommendation section of the public health assessment.

16. *How can LN-SS08, LN-SS01, and LN-TW01 be considered background or off site as they appear to be on the triangular parcel of land that is part of the Loxahatchee Nursery? This parcel of land was a part of the nursery operations and did have ornamentals on it.*

As indicated in several places in the Environmental Contamination and Other Hazards section of this public health assessment, ATSDR did not consider the sampling locations mentioned in this comment to reflect "background" conditions. Please refer to the main text for further clarification of the background issue. Additionally, references to "on-site" and "off site" in public health assessments are arbitrary boundaries created by ATSDR staff for the purpose of delineating data and evaluating human exposure pathways. The parcel in question is across the street from where primary nursery operations occurred. The parcel is directly adjacent to the county park. The data reports that ATSDR received indicated this parcel was outside of property boundaries. For this public health assessment, ATSDR assumed that off-site exposures

would occur more frequently than on-site exposures. For these reasons, ATSDR staff included sampling data from the locations mentioned in this comment with the "off-site" data.

17. *In the Community Health Concerns Evaluation section of the report, ATSDR states that "levels detected of these metals fall within observed ranges for metals in eastern United States soil and are probably not due to nursery activities." A more recent report (Ma et al, 1997) on Florida soils suggests that the arsenic level at LN-SS01 and the chromium level at LN-SS10A are indicative of anthropogenic sources.*

ATSDR reviewed the report (Ma et al, 1997) the commentor graciously provided. The report concluded that background values of most metals in 40 Florida soils were lower than the average of United States soils. ATSDR has deleted the sentence in question from the main text of the public health assessment.

18. *The sediment analytical results revealed exceedances of the Sediment Guidance Criteria for chlordane; 4,4'-DDD; 4,4'-DDE; 4,4'-DDT; chrysene; flouranthene; and pyrene. The soil analytical results revealed exceedances of the Florida Soil Cleanup Goals for residential direct exposure for arsenic in several samples. The soil analytical results revealed exceedances of the Florida Soil Cleanup Goals for residential direct exposure and leachability for chlordane in two samples. The soil analytical results revealed exceedances of the Florida Soil Cleanup Goals for leachability for chromium and dieldrin in one sample each. The groundwater analytical results revealed exceedances of the Florida Drinking Water Standards for 1,2-dichloropropane in one private well. As discussed in the text of ATSDR's report, this well has been fitted with a carbon filter which removes the contaminant from the water.*

ATSDR thanks the commentor for this information. As stated in the main text, ATSDR concluded that under site-specific conditions of exposure, none of the contaminants detected in soil or sediment are likely to pose a hazard to public health. ATSDR understands that if the site is to be developed residential, certain criteria and cleanup goals set by the state of Florida must be met; however, as a nonregulatory agency, commenting on the cleanup goals set by the state are out of the purview of this public health assessment.