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Superfund Record of Decision:

Love Canal, NY

50272-101

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The Love Canal site is located in the southeast corner of the city of Niagara Falls and is approximately one-quarter mile north of the Niagara River. The canal was one of two initial excavations designed to provide inexpensive hydroelectric power for industrial development around the turn of the 20th century. Hooker Chemicals and Plastics Corporation (Hooker), now Occidental Chemical Corporation, disposed of over 21,000 tons of chemical wastes, including dioxin tainted trichlorophenols, into Love Canal between 1942 and 1953. In the mid to late 1970s, continued periods of high precipitation contributed to water accumulation in the disposal area causing chemically-contaminated leachate to be carried to the surface and into contact with residential basement foundations. Also, dioxin and other contaminants migrated from Love Canal to the sewers which have outfalls to nearby creeks. The remedial program at Love Canal has been extensive and has occurred in two phases. Phase one consisted of measures aimed at site containment. Phase two is directed at remediating contaminated drainage tracts. Approximately 30,400 yd^3 - 40,900 yd^3 of creek and sewer sediments are contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin, commonly referred to as dioxin.

(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision
Love Canal, NY
Second Remedial Action
Contaminated Media: sediments, debris
Key Contaminants: dioxin

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 75
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EPA/ROD/R02-88/055
Love Canal, NY
Second Remedial Action

16. ABSTRACT (continued)

The selected remedial action for this site includes: construction of an onsite dewatering/containment facility (DCF) to include a separate construction/demolition debris facility (CDF); onsite containment of sewer and creek sediments in the DCF prior to thermal destruction in a transportable thermal destruction unit; onsite storage in the DCF of leachate treatment residuals and other material generated as a result of remediation; onsite storage of uncontaminated debris in the CDF; onsite disposal of non-hazardous thermal treatment residuals to avoid disturbance of the existing cap; and scaling down of the DCF to only include the construction/demolition debris material. The estimated present worth cost for this remedial action ranges from $26,400,000 to $31,400,000.

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Love Canal, City of Niagara Falls, Niagara County, New York

STATEMENT OF PURPOSE

This decision document represents the selected remedial action for the final destruction/disposal of Love Canal dioxin-contaminated sewer and creek sediments, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 USC §9601, et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986, and to the extent practicable, the National Oil and Hazardous Substance Pollution Contingency Plan, 40 CFR Part 300.

STATEMENT OF BASIS

This decision is based on the administrative record for the Love Canal site. The attached index identifies the items that comprise the administrative record, upon which the selection of a remedial action is based. A copy of the administrative record is located at the New York Department of Environmental Conservation (NYDEC) Love Canal Public Information Office (9820 Colvin Boulevard, Niagara Falls, NY) and at the Regional office (26 Federal Plaza, New York, New York).

DESCRIPTION OF SELECTED REMEDY

This Record of Decision for the Love Canal site calls for the following actions that address the destruction/disposal of dioxin-contaminated sewer and creek sediments. The following actions represent only a portion of the remediation that is on-going or proposed for the Love Canal site.

- The sewer and creek sediments will be thermally treated at the Love Canal site. The wastes will be treated with a transportable thermal destruction unit (TTDU), so that mobilization and demobilization can be readily accomplished. Six nines (99.9999%) destruction and removal efficiency will be the performance standard.

- The TTDU will treat all creek and sewer sediments placed in the dewatering/containment facility (DCF) (to be constructed), as well as residuals stored on-site from the

operation of the on-site leachate treatment facility, and other associated material generated as a result of remediation (e.g., haul roads.)

- Materials not requiring thermal treatment (e.g., uncontaminated debris from excavated Ring II homes) will be placed in a separate construction/demolition debris facility (CDDF), which will be a compartment within the DCF.

- After determination that the residuals from the thermal destruction process are non-hazardous, they will be disposed on site in selective areas, so as not to impinge on the integrity of the existing cap over Love Canal.

- Upon completion of thermal treatment, the dewatering/containment facility (DCF) will be scaled down to accommodate the construction/demolition debris only.

DECLARATIONS

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable, or relevant and appropriate, and is cost-effective. This remedy satisfies the statutory preference for remedies that employ treatment which permanently and significantly reduces the toxicity, mobility or volume of hazardous substances as their principal element. Finally, this remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The State of New York has been consulted and agrees with the approved remedy.

10/26/87
Date

J. Winston Porter,
Assistant Administrator
Office of Solid Waste and
Emergency Response

Love Canal Site
Niagara Falls, New York

SITE LOCATION AND DESCRIPTION

The Love Canal site is located in the southeast corner of the City of Niagara Falls and is approximately one-quarter mile north of the Niagara River. It was one of two initial excavations in what was to be a canal to provide inexpensive hydroelectric power for industrial development around the turn of the 20th century. The abandoned excavation, partially filled with water, was used largely for recreational purposes. The Canal was approximately 9,750 feet long and ranged in depth from 10-25 feet. Hooker Chemicals & Plastics Corp. (now Occidental Chemical Corporation) disposed of over 21,000 tons of various chemicals, including dioxin tainted trichlorophenols into Love Canal between 1942 and 1953.

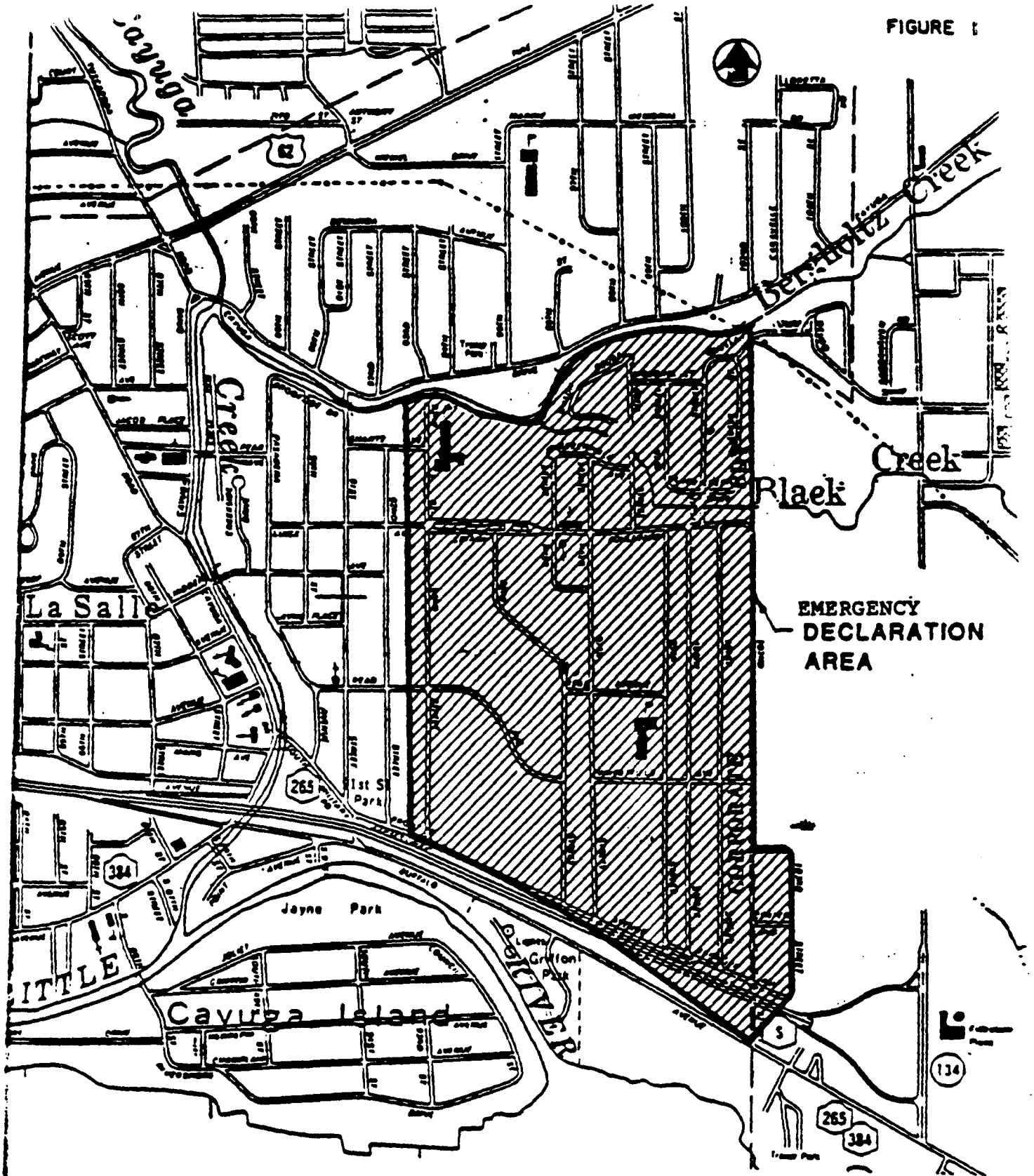
Families residing in the Emergency Declaration Area (EDA) and Rings I & II, a residential area completely surrounding Canal (see Figure 1), were eligible to voluntarily relocate or sell their residence to State or Federal government agencies. According to Love Canal Area Revitilization Agency (LCARA), approximately 750 of the 850 homeowners sold their property and relocated. In addition, approximately 270 of the 300 families residing in the LaSalle senior citizen, and Griffen Manor Apartments decided to relocate. All but two homes within the areas designated as Rings I & II (homes on streets immediately bordering the Canal) have been demolished, as has the school built adjacent to the Canal. Most of the debris from the demolition was buried in place on-site. In addition, other homes within the EDA have been or are scheduled to be demolished due to deteriorating conditions.

Black Creek and Bergholtz Creek pass through the northern portion of the EDA and flow into Cayuga Creek which in turn flows to the Niagara River. Backyards of occupied homes abut these creeks. Signs have been posted advising against fishing in these creeks; however fishing may still occur in the creeks. Niagara River water, after treatment, is used for drinking water. A small area of the EDA north of Love Canal proper and adjacent to Bergholtz Creek is within the 100 year floodplain Ground water in the area is not used as a source of drinking water. The ground water is being addressed through a long term monitoring/perimeter study program and is not included in this remedial action operable unit.

SITE HISTORY

Hooker Chemicals & Plastics Corp. (Hooker) disposed of over 21,000 tons of chemical wastes in the Canal between 1942 and 1953. The Love Canal property was deeded by Hooker in April 1953 to the City of Niagara Falls Board of Education. During

FIGURE 1



DECLARATION AREA MAP

the mid-1950's home construction accelerated in the area. In 1954, a public elementary school was built adjacent to the middle portion of the Canal. By 1972, area lots were almost completely developed including lots with backyards directly abutting the landfill.

In the mid-late 1970's, continued periods of high precipitation contributed to the rising water table elevations. Water accumulated in the landfill and carried chemically-contaminated leachate to the surface and into contact with basement foundations. As documented in the Environmental Protection Agency (EPA) report entitled Love Canal Sewers and Creeks Remedial Alternatives and Risk Assessment March, 1985, dioxin and other contaminants migrated from Love Canal to sewers in the EDA which have outfalls to nearby Black and Bergholtz Creeks. In response to complaints from residents of homes abutting the Canal, the New York State Department of Environmental Conservation (DEC), with the assistance of the EPA, conducted studies on ground water pollution, and basement air and sump water contamination in late 1977.

Additional monitoring studies were conducted by DEC, EPA and the New York State Department of Health (DOH) early in 1978. The results of these studies indicated contamination in some Ring I homes. This led the DOH Commissioner to declare a state of emergency at Love Canal on August 2, 1978. President Carter declared an Environmental Emergency at Love Canal on August 7, 1978, enabling the Federal government to provide financial assistance to the State for the initiation of remedial measures, and for relocation of residents.

On May 22, 1980, President Carter declared a second Federal Emergency which made funds available to additional residents to enable them to voluntarily relocate from the area. Residents were moved from the area under an authorization by Congress that appropriated $15 million. This action was carried out under a Memorandum of Understanding between the State of New York and the Federal Emergency Management Agency through the newly-formed Love Canal Area Revitalization Agency.

HISTORY OF REMEDIAL ACTIVITIES

The remedial program at Love Canal has been extensive and has occurred in two distinct phases. The first phase consisted of measures aimed at site containment. The second phase was directed at remediating contaminated drainage tracts.

In October 1978, site containment measures were instituted by DEC that included the construction of a tile drain and leachate collection system; placement of clay cover (cap) over the Canal; the erection of an on-site leachate treatment facility;

and the installation of a fence around the Love Canal (proper). On July 12, 1982, a cooperative agreement was entered into between the DEC and EPA. Under this agreement several additional remedial tasks were undertaken. In the fall of 1982 sewers leaving the Canal were severed to deter future contaminant flow via these pathways. In 1984, the installation of an expanded cap (from 16 to 40 acres), including a synthetic liner and clay cover, was completed. Subsequently, a long term monitoring/perimeter study program was implemented. This program is evaluating the effectiveness of the leachate collection system and also is assessing the extent of contaminant migration in the soil and ground water and the depth of fill in Love Canal proper.

CURRENT SITE STATUS

Studies evaluating alternatives for remediating contaminated drainage tracts (i.e., sewers, creeks, and 102nd Street Outfall delta area) were completed in 1983 and 1985. The March, 1985 CH2MHill report, and the Malcolm Pirnie Inc. report, Environmental Information Document (EID) "Site Investigations and Remedial Action Alternatives, Love Canal" of October 1983 provided the basis for approval of the first Record of Decision (ROD) for the site, which was signed May 6, 1985. For purposes of the administrative record, the May 6, 1985 ROD is incorporated into this ROD.

The first ROD called for: the removal of dioxin-contaminated sediments from specific stretches of Black and Bergholtz creeks and storm and sanitary sewers, and interim storage of the sediments in a containment facility; the construction of a temporary berm at the 102nd Street outfall delta area (to be coordinated with remediation of the 102nd Street Landfill Superfund with site); and the installation of a permanent administration building on-site (completed in 1986).

The ROD determined that the sediments should be placed in an interim containment facility 1/ for several reasons, including: a viable option for destruction/disposal of the sediments did not exist at that time; the creek material would require dewatering, sizing, shredding etc., prior to implementation of any treatment alternative; and the rate of sediment removal would be much greater than the rate at which the wastes would be treated and therefore, a temporary dewatering and staging facility was needed (e.g., the creek excavation would be completed in approximately 18 - 24 weeks, whereas thermal destruction of the sediment would require at least one year to complete).

1/ As discussed infra, the interim containment facility is now termed a dewatering/containment facility (DCF).

The design of the creek remedy (i.e., sediment excavation and construction of the dewatering/containment facility) is currently at the 95% completion stage. The original design called for the construction of a containment facility approximately 900 feet long, 300 feet wide and 25 feet above grade (at crest). As such, the facility would be approximately 12 feet above the crest of Love Canal proper (which is approximately 13 feet above grade), but below the roof of the on-site Leachate Treatment Facility. The containment facility would be constructed in the southwest corner of the Love Canal proper.

Due to the required size of the containment facility and site limitations, the facility would have to be constructed over approximately 24 of the demolished Ring II homes (see Figure 1). The old basement foundations and house debris would have to be removed in order to provide a stable foundation for the containment facility. The facility has been designed and sited to minimize the number of demolished homes that require excavation. A change in the lateral dimensions of the facility would require the removal of Ring I basement debris and would further encroach on the Love Canal cap, therefore potentially impacting the integrity of the cap. As designed, the containment facility is scheduled for construction in 1988, so that it could receive creek sediments scheduled for removal in 1989.

Sediments in Bergholtz Creek will be removed from approximately 150 feet above its confluence with Black Creek to its confluence with Cayuga Creek. Sediments will be removed from Black Creek from the 98th Street culverts to its confluence with Bergholtz Creek.

Approximately fifteen thousand cubic yards (cy) of sediment is scheduled to be removed from Black and Bergholtz Creeks in 1989. Additionally, an approximate nine to nineteen thousand cy may be generated as a result of the creek cleaning effort (i.e., haul roads placed in the creek during remediation) and from approximately 2400 drums containing spent activated carbon, and miscellaneous remedial wastes currently stored on-site. Approximately 5500 cy of house debris and soil from the area where where Ring II homes once stood will be stored in a Construction/ Demolition Debris Facility (CDDF). The house debris and soil need to be removed in order to build the dewatering/containment facility.

The contaminant of concern in the creek and sewer sediments is 2,3,7,8 - tetrachlorodibenzo-p-dioxin ("dioxin"). The creeks and sewers have been sampled for dioxin on several different occasions. Results of the creek sampling indicate dioxin concentrations in the range of non-detectable (generally less than 1 ppb) to 46 ppb in the top 12 inches of creek sediments (See 1985 EPA report). No dioxin has been detected above the detection limit in the sediment/bed below the one foot mark.

In addition, dioxin has been detected in fish and other aquatic organisms from these creeks. The levels of the dioxin in the fish were above the New York State Department of Health and the U.S. Food and Drug Administration guidelines for dioxin in fish.

Current plans call for removal of the contaminated sediments in the creek sediment/bed. The removal of the sediments from the creeks is necessary to eliminate the potential for direct contact with the sediments/soils above 1 ppb and also to reduce the potential for further bioaccumulation of dioxin in the creek biota. As recommended in the 1985 ROD and 1985 EPA report, approximately 18 inches of creek sediments will be removed in order to eliminate the contaminant pathways mentioned above. This represents a permanent solution for potential risks to public health and the environment.

In addition to the 24,000-34,000 cy of creek sediment and associated material (excluding house debris), approximately 1,000 cy of sewer sediment would be stored in the dewatering/ containment facility. The concentration range found in the sewers was from non-detectable to 650 ppb. Therefore, the total amount of material which would be stored in the facility would be 30,000-41,000 cy. Table 1 provides a breakdown of quantities and sources of material to be generated from the creek remediation.

During the time when the interim containment facility was being designed, EPA and the State were evaluating final treatment and disposal options for the creek and sewer sediments.

EPA prepared a Draft Addendum Feasibility Study (Addendum FS) that examined final remedies for the sediments. The Addendum FS, entitled Alternatives for Destruction/Disposal of Love Canal Creek and Sewer Sediments, was released for public review on June 24, 1987.

As a consequence, EPA and the State have revisited the design of the dewatering/containment facility to assure that it is able to meet the goals and objectives outlined in the Addendum FS. Specifically the review included re-estimating the quantity of material generated during the remediation which could require thermal treatment. The review focused on several pertinent factors: (1) sediments needing to be dewatered; (2) a storage area needed for staging material prior to thermal treatment; and (3) the feasibility of separating those materials containing an average dioxin concentration above 1 ppb from those below 1 ppb. The Centers for Disease Control (CDC) has generally applied a level of concern for dioxin in residential soils at 1 ppb for other areas in the country. In addition, criteria for rehabitating the EPA call for dioxin levels in surface soil to be below 1 ppb.

Table 1
Quantities of Soil/Sediment/Debris
Requiring Thermal Treatment

Activity	Waste Stream Generated	Quantity (cubic yards)	Remarks
Creek Remediation	Creek sediments	15,000	
	Creek haul roads, access and staging areas	2,000-6,500[1]	
DCF/CDDF	Excavation	2,400	CDDF to be constructed as a compartment of the DCF.
	Haul road fill	800	
	Basement debris	4,000[2]	
	Daily cover	0-6,000[1]	
	DCF drainage blanket	2,500	
DDSF*	Excavation and basement debris	1,500[2]	
On-site Storage	Drums	1,200	
	Sewer sediment	1,000	
Total Volume		30,400-40,900	

1--Range as specified in TAMS Conceptual Design Report (August, 1987)
2--To be stored permanently in the CDDF

* Decontamination/Drum Storage Facility. The DDSF would be constructed to provide appropriate drum storage/ and decontamination facilities, to comply with RCRA storage regulations.

Source: TAMS Inc., "Black and Bergholtz Creeks Remediation Conceptual Design Report" (August, 1987)

Based upon this review, the interim containment facility is now termed a dewatering/containment facility (DCF) and would contain a separate storage area for the Ring II house debris. This storage area would be termed a Construction Demolition/ Debris Facility (CDDF).

A report on the results of this review can be found in the August, 1987 TAMS, Inc "Black & Bergholtz Creek Conceptual Design Report."

The construction cost for the creek remedy selected in 1985 is approximately $13 million. Of this $13 million, approximately $4 million will be spent on construction of the DCF. Construction of the facility is scheduled to begin in the 1988 construction season. The remaining $9 million will be allocated for the actual excavation of the creek sediments and construction of decontamination/drum storage facility in 1989. In addition, $750,000 has already been spent on the design of the creek remedy, which is 95% completed.

Several remedial activities are ongoing. Sampling is being performed at the 102nd Street outfall under the 102nd Street Landfill Superfund site remedial investigation; a remedial investigation/feasibility study is being conducted at the 93rd Street School.

In addition, approximately 16,000 gallons of Leachate Treatment Facility (LTF) sludge are stored on-site. The viability of thermally treating the LTF sludge with a plasma arc unit is currently being evaluated under the Superfund Innovative Technology Evaluation Program. Operation of the Love Canal LTF will continue to generate sludge and activated carbon.

The majority of sewer cleaning work required under the 1985 ROD was completed in August 1986 while the remainder was cleaned in the fall of 1987. Work entailed the removal of dioxin-contaminated sewer sediments by hydraulic cleaning, followed by remote television camera inspection to assure that sediments had been completely removed. Approximately 68,000 linear feet of sewer was cleaned. These sewer sediments have been dewatered in a sewer sediment dewatering facility and are currently being stored on-site. The sewer sediment dewatering facility could not be used to dewater the creek sediments since it is not nearly large enough, nor is it designed to treat wastes that have the physical characteristics of the creek sediment. This facility will be decontaminated once the sewer sediments have been removed.

A comparison study to examine the suitability of the EDA for human habitation is underway. A technical review committee (TRC), composed of senior officials of the EPA, DEC, DOH, and CDC was formed to oversee this work and other activities pertaining to the habitability of the EDA. Criteria for the habitability study have been developed by the TRC and a group of expert scientists. The criteria were peer reviewed by an independent scientific panel and revised accordingly. Criteria call for a measurement of the presence of a set of chemicals specific to Love Canal (Love Canal Indicator Chemicals (LCICs)) in the EDA soil and air, as well as dioxin in soil. The EDA soil LCIC concentrations will be compared to soil LCIC concentrations in the samples taken from other Buffalo/ Niagara Falls communities. A pilot study was conducted in 1986, and used to design the full-scale study. The results and recommendations from the pilot study were also peer reviewed. Field sampling began in July 1987. A draft report detailing the results of the study is scheduled to be prepared in the winter of 1987/1988. The final report will be made available to the DOH Commissioner who will determine whether or not the EDA should be rehabitated.

ENFORCEMENT

On December 20, 1979, the U.S. Department of Justice on behalf of EPA, filed a federal law suit against Hooker Chemicals and Plastics Corp. pursuant to numerous environmental statutes, alleging an imminent and substantial endangerment to human health and the environment. New York State filed a lawsuit in state court in April, 1980, against Hooker for damages sustained at Love Canal. This action was stayed on August 8, 1980. On September 11, 1980, New York State was realigned as a plaintiff in the federal case, and on September 18, 1980, the State filed its claims in federal court.

On April 16, 1982, The Department of Justice on behalf of EPA sent Hooker a CERCLA notice letter. On July 26, 1982, EPA and the State met with Hooker to explain the remediation activites which would be taken under Superfund. Hooker has refused to assume responsibility for remedial action at Love Canal. On January 17, 1984, the United States filed its second amended complaint against Hooker to include claims under Sections 106 and 107 of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Hooker has filed counter claims against the United States and the State and cross and cross claims against the City of Niagara Falls, the Niagara Falls Board of Education, and Niagara County.

COMMUNITY RELATIONS

The governmental effort to ensure significant community involvement at Love Canal has been extensive. A comprehensive public relations strategy has been developed by DEC to keep

concerned parties cognizant of CERCLA activities at the site. The DEC maintains a Love Canal public information office at which Love Canal documents are made available for public review as they are produced. The office is located in the EDA at 9820 Colvin Boulevard. In addition to this office, the EPA has a public information office in the City of Niagara Falls. The public is also kept informed through frequent public meetings.

A public meeting and a workshop were held respectively on March 5, 1985, and March 12, 1985 to discuss the cleaning of contaminated sewer and creek sediments and interim storage of the sediments. A more detailed discussion of the outcome of these public meetings can be found in the March 28, 1985 Responsiveness Summary.

The Draft Addendum FS identifying three remedial options was released for public comment on June 24, 1987. The Proposed Plan For Destruction/Disposal of Love Canal Sewer and Creek Sediments was released for public comment on August 5, 1987. EPA and DEC held a technical workshop to discuss thermal destruction technology and the implementation of the Proposed Plan on August 12, 1987. In addition, EPA and DEC held a public meeting on August 25, 1987 to discuss the addendum FS and proposed plan. The October 26, 1987 Responsiveness Summary addresses questions and concerns raised by the public during the public comment period which closed October 9, 1987.

ALTERNATIVES EVALUATION

The alternatives identification and screening process was conducted as required by the National Contingency Plan (NCP). The effectiveness, implementability and cost of each of the remedial alternatives were summarized in the Draft FS Addendum and Proposed Plan. The Superfund Amendments and Reauthorization Act of 1986 (SARA) requires that permanent solutions and alternative treatment technologies or resource recovery options be utilized to the maximum extent practicable. In addition, under SARA, treatment alternatives which significantly reduce the mobility, toxicity, or volume of the waste are preferred over remedial actions which do not involve treatment. These factors have been fully considered in the evaluation of the alternatives that is discussed below.

Alternatives for final destruction/disposal of the dioxin-contaminated sediments are evaluated in the Draft Addendum FS. Treatment alternatives evaluated include biological (e.g. microbial degradation), physical (e.g. in-situ vitrification and thermal destruction), and chemical (e.g. polyethylene glycol dechlorination) methods. Disposal alternatives evaluated include transport to an off-site facility and on-site disposal.

All but three alternatives which underwent initial screening were eliminated. Table 2 lists the technologies/disposal options which were evaluated and summarizes reasons for retaining or rejecting specific technologies/disposal options. A more detailed discussion of the rejected technologies/disposal is provided in Appendix A of the Draft Addendum FS. Several of these technologies could be applied to the treatment of dioxin-contaminated soils. However, none has demonstrated the desired destruction and removal efficiencies (DREs) for initial dioxin concentrations in the concentration ranges which exist in the creek sediments. In addition, none have resulted in a non-hazardous residual which would not pose a threat to human health or the environment through any exposure pathway. In summary, the technologies which were rejected have not achieved the preferred stage of development for utilization at Love Canal.

TABLE 2
SUMMARY OF TREATMENT TECHNOLOGIES/DISPOSAL
OPTIONS EVALUATED IN INITIAL SCREENING

Location/ Remedial Action	Status	Reason for Rejection
1. DISPOSAL		
On-site:		
Beneath Existing Cap	Rejected	No volume available in cap below liner; would require excavation of more contaminated material. Integrity of existing cap and containment system could be compromised.
Beneath Expanded Cap	Rejected	Integrity of existing cap and containment system could be compromised. Public is extremely opposed to expanded cap disposal.
Final Disposal in Currently Designed Dewatering/ Containment Facility	Retained	
Off-site Disposal	Rejected	No disposal facilities currently permitted to receive dioxin-contaminated wastes.
2. TREATMENT		
Off-site Thermal Destruction	Rejected	No thermal destruction facilities permitted or certified to treat dioxin-contaminated waste.
Biological Treatment	Rejected	Not demonstrated to be effective on dioxin in sediments.
Chemical Treatment	Rejected	Not demonstrated to be effective on sediments with initial concentration in the low ppb range.
Physical Treatment	Rejected	Not demonstrated to be effective on dioxin in soils/sediments
On-site Thermal Destruction	Retained	

Three remedial alternatives were developed from the two technologies that passed the initial screening. The alternatives are as follow:

1. On-site land disposal;

2. On-site disposal of untreated sediment containing an average dioxin concentration less than 1 ppb; On-site thermal destruction of untreated sediment containing an average dioxin concentration greater than 1 ppb; On-site disposal of non-hazardous residuals from the thermal destruction process

3. On-site disposal of untreated sediment with an average dioxin concentration less than 1 ppb; On-site thermal destruction of untreated sediment containing an average dioxin concentration of greater than 1 ppb; Off-site disposal of non-hazardous thermal treatment residuals.

The three alternatives were evaluated in light of the 1985 ROD, which called for the removal of the creek and sewer sediments and interim storage of the sediment. The alternatives analyzed here deal with final treatment/disposal of the sediments as removed and stored in the dewatering/containment facility.

DESCRIPTION OF ALTERNATIVES

This section provides a brief description of the three alternatives. A more detailed description of the alternatives can be found in the Draft Addendum FS.

Alternative 1 - On-Site Land Disposal

This alternative would use the recently designed on-site dewatering/containment facility required for implementation of the 1985 creek remedy. It would be designed to meet all the Federal and State requirements for a dewatering/containment facility. The facility would contain leak detection and leachate collection systems as well as a double liner, cap and ground water monitoring system.

To implement this alternative, the sediments would be removed from the creeks and sewers, placed in the containment facility, and dewatered. Subsequent to dewatering, the facility would be capped. Ground water monitoring and post-closure maintenance would continue indefinitely.

Alternative 2 - On-Site Thermal Destruction/On-Site Disposal

This alternative would use both an on-site dewatering/containment facility and an on-site thermal destruction unit. To implement this option, the sediments would be removed from the creeks and sewers and placed in the DCF. After dewatering, sediments would be treated in a transportable thermal destruction unit where a 99.9999% destruction and removal efficiency (six 9's DRE) for dioxin would be the performance standard.

There are two major considerations involved with this alternative: (1) which sediments to thermally treat; and (2) the options for disposal of the residuals of thermal destruction.

As originally conceived, a sampling program would distinguish between those sediments containing dioxin above the previously prescribed level of concern of] ppb of dioxin in residential soils. Under this approach, those sediment testing above 1 ppb would be thermally treated. Those testing below] ppb would remain in the DCF untreated. However, due to the potential difficulty of effectively separating greater than] ppb material from less than] ppb material and the time and implementation issues associated with assuring separation, the thermal destruction of all excavated sediments was also considered as a possibility under this alternative.

TAMS was tasked to examine the implementability of effectively separating the sediments above the] ppb level from those below, as compared to the option of thermally treating all excavated sediments and associated material. The feasibility of implementing a segregation program is discussed under the implementability section of the alternatives evaluation (pg.]8).

Secondly, regarding the final disposal of the thermally-treated sediments, there are also two options. The first option would be to dispose of the treated residuals in the DCF. The second option would be to place the non-hazardous residuals in selective areas of the site in such a way that the integrity of the existing cap would not be threatened. For example the sediments can be placed in the northeast and southeast corners of the site. This would result in less than a 3 foot increase in elevation in these areas.

If the residuals were disposed of on the site, the DCF would be altered prior to closure to account for the reduced volume of material.

Alternative 3 - On-Site Thermal Destruction/Off-Site Disposal of Residuals

This alternative is identical to Alternative 2 except with regard to disposal of residuals. Alternative 3 makes two assumptions. The first assumption is that the thermally treated sediment residuals would be non-hazardous. The second assumption is that a Subtitle D landfill would accept the residual materials for disposal. If an appreciable quantity of residuals were disposed of off-site, the DCF would be altered prior to closure to account for the reduced volume of material.

EVALUATION CRITERIA

The above three alternatives were evaluated using evaluation criteria derived from the National Contingency Plan (NCP) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). These criteria relate directly to factors mandated by SARA in Section 121 including Section 121(b)(1)(A-G) and EPA's Interim Guidance on Selection of Remedy (December 24, 1986 and July 24, 1987). The criteria are as follow:

- Compliance with legally applicable or relevant and appropriate requirements
- Reduction of toxicity, mobility or volume
- Short-term effectiveness
- Long-term effectiveness and permanence
- Implementability
- Cost
- Community acceptance
- State acceptance
- Protection of human health and the environment

COMPARISON OF ALTERNATIVES

A comparative discussion of the three alternatives using the evaluation criteria is provided below.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA, as amended by SARA, requires that remedial actions comply with all applicable or relevant and appropriate Federal and State requirements for the hazardous substances, pollutants, or contaminants that are present on-site.

Each of the three Alternatives would comply with applicable or relevant and appropriate requirements (ARARs). The on-site DCF will comply with all the requirements of Part 264 Subpart N of RCRA (design requirements for facilities such as the DCF) and Title 6, Part 373 of the New York Compilation of Rules and Regulations (design requirements for secondary containment, leachate collection and detection systems). The construction/demolition debris facility would comply with Part 257 of RCRA (Subtitle D non-hazardous waste facility) and Title 6, Part 360 of the New York Compilation of Rules and Regulations. Consistent with SARA, the continued effectiveness of the DCF would be evaluated every five years to assure continued protection of human health and the environment.

Land Disposal restrictions under Subtitle C of RCRA and implementing regulations governing the disposal of dioxin-contaminated wastes are expected to go into effect in November 1988. Because the creek sediments will not be excavated until 1989, final disposal of these sediments in the DCF (i.e., Alternative 1) would have to comply with the RCRA land disposal restrictions. The proposed land disposal restrictions state that dioxin-contaminated materials may be land disposed only if they pass the proposed Toxicity Characteristic Leaching Procedure (TCLP) (see Appendix A of the 1987 Draft Addendum FS for a more detailed discussion). Based upon results of the dioxin analyses of the creek sediment (see data tables provided in EPA, 1985 report), the Agency expects that the excavated sediment would pass the existing proposed TCLP test. Under Alternatives 2 and 3, the DCF will be used as an integral component of the waste treatment method. The placement of the creek sediments and associated materials in the DCF is considered a necessary component of the thermal destruction process. The Agency expects that the treated sediment residuals will also pass the TCLP.

While permits are not required for on-site remedial actions at Superfund sites, any action must meet the substantive technical requirements of the permit process. The thermal destruction process would comply with all the applicable requirements of Part 264 Subpart O of RCRA (design and operating requirements for hazardous waste incinerators).

Operation of an on-site thermal destruction unit would require that the transportable unit undergo waste specific trial or demonstration burns to demonstrate satisfactory destruction of the toxic components of the waste. The trial or demonstration burn must show that the unit achieves 99.9999% destruction and removal efficiency (six 9s DRE), and controls air emissions of products of incomplete combustion, acid gases and particulates to specified levels. Specific operating requirements for a thermal destruction unit would be established based upon results of trial or demonstration burns. Under Alternative 3, off-site disposal of residuals would require that the residuals be certified as non-hazardous. Similarly, if it was determined under Alternative 2 that the residuals should not be placed in the DCF, but rather disposed of on-site in some other fashion, the material must also be non-hazardous.

Reduction of Toxicity, Mobility, or Volume

This evaluation criterion relates to the performance of a technology or remedial alternative in terms of eliminating or controlling risks posed by the toxicity, mobility or volume of hazardous substances.

Under Alternative 1, in addition to dewatering the sediments, the DCF would contain the contaminants on a long-term basis and prevent their migration out of the facility. Leaving the sediments in the creeks and sewers creates a high potential for migration and bioaccumulation. Dioxin, the contaminant of concern, has limited solubility in water, is not volatile, and binds tightly to sediments. Therefore, the DCF should effectively prevent the migration of dioxin (i.e., it reduces mobility). Alternative 1 does not provide a reduction in the toxicity or volume of sediments since it does not involve treatment.

In contrast to Alternative 1, the thermal destruction under Alternative 2 and 3 would virtually eliminate the toxicity of the creek and sewer sediments. They would also reduce the volume of the material, but only to the extent the creek sediments contain organic matter. Only the volume of organic vegetative material

overlying the creek bed and the sewer sediment, which is not expected to be greater than 20% of the total quantity of material, would be substantially reduced. The long-term mobility of the contaminated sediments would be reduced by thermal destruction, since the contaminants would be destroyed, but there would be a limited increase in the mobility of contaminants over the short-term due to air releases of products of incomplete combustion and increased materials handling. This would be controlled through careful handling and operational procedures for the thermal treatment process (such as scrubbers). The only difference between the two thermal destruction alternatives is that Alternative 3 would result in a smaller volume of material being disposed on-site.

Short-Term Effectiveness

The short-term effectiveness criterion measures how well an alternative is expected to perform, the time to achieve performance, and the potential adverse impacts of its implementation.

Alternative 1, final on-site land disposal of creek and sewer sediments in the DCF, provides a greater degree of protection over the short-term, since the on-site thermal destruction under Alternatives 2 and 3 would require additional materials handling on-site, such as pretreatment (e.g., shredding, crushing) of the contaminated sediments prior to feeding to the thermal destruction unit. The thermal destruction alternatives may result in air emissions from operation of the thermal destruction unit. As noted above, strict measures would be implemented to ensure that such emissions would not be harmful to human health or the environment.

Alternative 3 would require off-site disposal of residuals. This would require the loading of the residuals onto trucks for off-site transport. If the material below 1 ppb cannot feasibly be separated from that above 1 ppb, then a total of 25,000-35,000 cy would be thermally treated. If it is assumed that 1 cy of untreated sediment would result in 1 cy of treated residual, then more than 1500 - 2000 truckloads (17 cy per truckload) would be needed for transport of residuals to an off-site facility. This would result in a great deal of truck traffic through the community and other communities enroute to an off-site disposal site.

The time required to implement and complete action called for in the alternatives varies widely. Excavation of the creeks will occur during 1989. Sediments may not be sufficiently dewatered until 1990, at which time under Alternative 1 the facility would be capped and closed. Alternative 1, therefore, would not require any additional time or action to implement.

On-site thermal destruction (Alternatives 2 and 3) would require similar steps and timeframes leading up to full-scale operation. Figure 2 outlines those steps and estimated time-frames. The required time ranges from 32 to 60 months. The first element, procurement of a design contractor for preparation of bid specifications for treatment of the wastes, could begin immediately. The procurement of a contractor to treat the wastes could be carried out upon the completion of the design phase.

It is not likely that trial burns would begin until after the summer of 1989. At best, the initiation of full-scale operation may occur in the Spring of 1990. After full-scale operation is initiated, the treatment of the wastes (assume 25,000 - 35,000 cy) under Alternative 2 could be conducted in about 12 to 16 months if a unit with a capacity of 5.0 tons per hour (capacity based on 75% operational efficiency) were operated 24 hours a day. This would put the completion date for treatment at 1991 to 1993. Under Alternative 2, the residuals could be disposed of by spreading over selective sections of the site. This action could be accomplished by 1992 to 1994. If the DCF was used for residual disposal, the closure of the DCF would place the final completion date at 1992 to 1994. The timeframe for capping and closing the DCF under Alternative 3 would be about the same as for Alternative 2.

Long-Term Effectiveness and Permanence

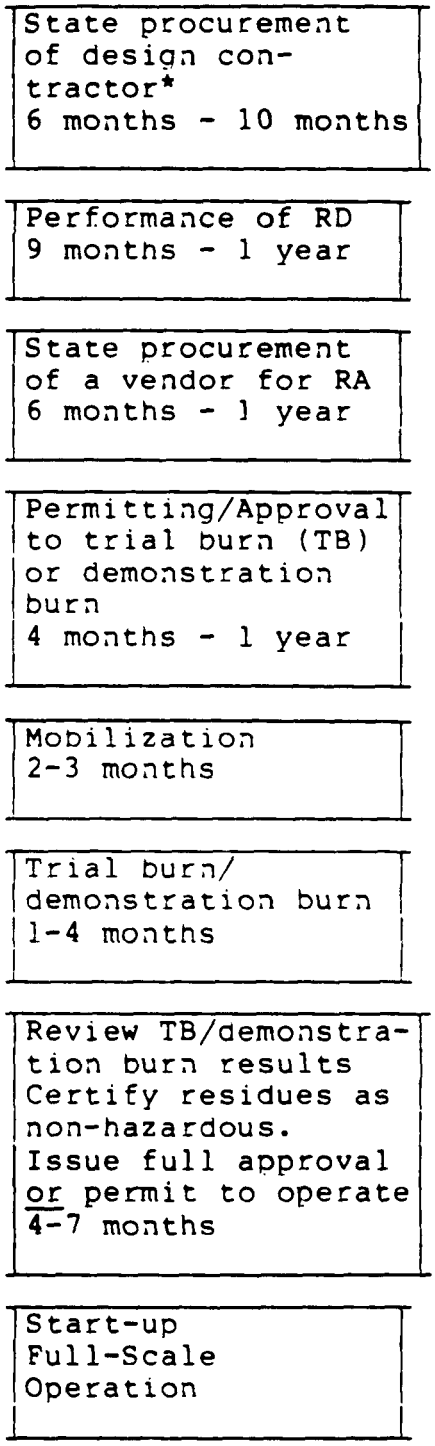
Long-term effectiveness and permanence addresses the long-term protection and reliability of an alternative.

Over the long-term, on-site thermal destruction Alternatives 2 and 3 provide essentially equivalent protection to the local community. As mentioned earlier, the residuals from thermal destruction are expected to be non-hazardous. This will be determined at the appropriate time (most likely at the trial burn stage. Assuming the residuals are non-hazardous, whether the residuals are disposed off-site or on-site is of no concern from a health perspective. Both of the on-site destruction alternatives provide greater protection than Alternative 1, on-site land disposal, since Alternative 1 does not eliminate the toxicity threat posed by contaminated sediments.

The final disposal in the DCF under Alternative 1 prevents exposure to the sediments. Dioxin has a very limited solubility in water, is not volatile, and binds tightly to sediment soil. Therefore, exposure to the sediments, not the leachate generated from dewatering during storage, is of most concern. Because the DCF is designed to meet all applicable or relevant and appropriate requirements for a RCRA facility, human

Figure 2

Transportable Thermal Destruction Unit - Estimated Time Frames for Events Leading to Start-Up Full-Scale Operation



*Design contractor will perform necessary studies/tests to adequately define waste characteristics and prepare performance based bid specifications used for the selection of a vendor, as well as establishing criteria for evaluating different vendor technologies.

exposure to the sediments during containment would not be likely.

Under Alternative 1, the stored sediments would continue to contain dioxin (some at concentrations greater than 1 ppb) and, therefore, would not be as "clean" as material generated from thermal destruction of the sediments. Alternative 1, therefore, does not provide a permanent reduction in toxicity of the waste, and would require long-term waste management, such as general maintenance or potential replacement of the facility. In addition, the disposal remedy would have to be revisited every five years (as part of revisiting the wastes contained in Love Canal proper) to ensure the continued effectiveness of the facility.

Implementability

Implementability addresses how easy or difficult, feasible or infeasible it would be to carry out a given alternative. This covers implementation from design through construction and operation and maintenance.

The implementability of the alternatives is evaluated in terms of technical and administrative feasibility, and availability of needed goods and services. All three alternatives evaluated here are all technically feasible. However, some implementation problems are inherent in each of the alternatives.

As noted above, interim storage of the sediments in the DCF is necessary prior to the implementation of any treatment alternative so that the sediments could be further dewatered, characterized, crushed, etc. Routine maintenance and monitoring of the DCF during dewatering and processing would ensure reliability and minimize the potential for failure. If monitoring indicates a problem with the DCF, maintenance or repairs would be made. It should be noted that with the selection of Alternative 1, the DCF may need major repair or replacement over the long-term. Such short-term or long-term repairs are clearly feasible, but may result in a limited short-term increase in risk from human exposure to the sediments.

As noted above, under Alternatives 2 and 3, there are substantial implementation problems in segregation of sediments above 1 ppb from those below 1 ppb.

The first step in segregating the sediments would be to design a plan to determine which sediments are below the action level and which are above. Since existing creek sampling data is not adequate for making this determination, additional testing would be required. The sediments could be sampled at any one of three different stages of the remediation process in order to segregate those requiring treatment, namely:

1) Recharacterizing the sediment in-situ prior to excavation.

2) Characterizing the sediment as it is being excavated from the creeks but prior to placement in the DCF.

3) Characterizing the sediment after it has been removed and placed in the DCF.

The objective of recharacterization of creek sediments in-situ would be to isolate zones of contamination above and below 1 ppb prior to removal. A sampling effort to delineate these zones would need to be developed, implemented and evaluated in accordance with protocols. It is hard to define the scope of the sampling program without doing a detailed statistical design. If it is assumed that 10 random samples per 100 cubic yards of in-situ sediment is required for analytical testing, for a total of 1000 samples), then it would take approximately 9 months to evaluate, report and decide on material excavation requirements based on these samples. Full implementation of a program of this type could cost 0.5 to to 1.0 million dollars.

Although the sampling aspects of option 1 are feasible, significant difficulties would arise during the implementation of an excavation program based upon in-situ sampling. The creek material would have to be removed in a controlled manner (e.g. 6" lifts or discrete areal removal) that would slow excavation production rates and increase the complexity of the program. Slower excavation could hinder the completion of excavation in one season, and therefore impact the overall remediation schedule. Furthermore, filling of the DCF with sediments would need to be controlled so that sediments above and below the action level could be segregated. Special measures would need to be taken to minimize cross-contamination. Such measures would include construction of additional berms within the DCF, thereby potentially increasing the dimensions of the DCF. Since modifications to the existing design would be required, the remediation schedule would be adversely impacted to a substantial degree.

Site characteristics significantly restrict characterization of the sediments after excavation but before placement in the DCF. Characterization during excavation would be carried out by placing the excavated creek sediments in temporary storage containers and staging the material. Each storage container would be sampled and tested to determine its contamination level. Based on the results of this testing the materials would be deposited in segregated compartments of the DCF. Because of the large temporary staging area required (limited by site characteristics), and the inability to predict size and design of the various components of the DCF which might be required, this method is not feasible.

A program that involves sampling after the sediments are excavated and placed in the DCF also has substantial implementation problems. The sediments to be excavated from the creeks and deposited within the DCF will be "soft and runny" even after gravity separation of free water. It would be infeasible to separate this soft and runny creek bottom material within the DCF, until the results of analytical tests are evaluated, to determine whether removal and thermal treatment is required. Furthermore, there remains the possibility of cross-contamination following sampling due to settling out of potentially contaminated suspended solids from an aqueous level which may be generated during filling operations. Therefore, sampling after placement in the DCF, is not likely to be implementable from a technical standpoint.

In summary, significant problems exist in either instituting an effective sampling program once the sediments are excavated or implementing an excavation and storage program based upon in-situ sampling of the creeks. Physical site limitations, the "soft and runny" nature of the sediments, schedule constraints, technical considerations etc., are such that segregation of the sediments is not deemed practical or implementable. The feasible alternative to sampling and segregation is the treatment of all sediments and associated materials. Although thermal treatment of all materials appears to be the most costly alternative, it is an implementable alternative, free of additional technical complexity, modifications to the existing design, and schedule delays. Thus, thermal treatment of all sediments remains an implementable and cost-effective approach.

Alternatives 2 and 3 are expected to be completed between 1992 to 1994 (assuming 25,000 - 35,000 cy require treatment and using a 5 ton/hr. unit). The time required for actual on-site thermal destruction could potentially be decreased by using two or more transportable units; however, due to on-site space limitations, it is unlikely that two or more units could be used at the site.

Routine maintenance and monitoring of the thermal destruction unit are also clearly feasible and would ensure reliability and minimize the potential for failure. If monitoring indicates the potential for failure of the thermal destruction unit, the unit would be shut down until corrective measures are taken.

Operation of thermal destruction units has shown that they are capable of successfully destroying dioxin-contaminated materials and are able to meet applicable or relevant and appropriate requirements. In addition, operation of the EPA mobile incinerator system elsewhere has demonstrated that the residues from the treatment of dioxin-contaminated materials can be determined to be non-hazardous. Based on this experience, the residues from Love Canal sediments should also be able to be determined non-hazardous. Process wastewater from the on-site thermal destruction could be treated at the Love Canal Leachate Treatment Facility. Depending upon the size of the thermal destruction unit and the equipment required for pretreatment of materials, the fenceline at Love Canal may have to be expanded to site the unit and accessories. The TAMS report evaluated the use of rotary kiln incinerator as a baseline and determined that such a unit could be sited within the fenceline just north of the DCF and the Administration Building (west side of Canal).

Full-scale operation of transportable units at hazardous waste sites has been limited. Units have experienced extended periods of downtime (beyond that taken into account in the 75% operational efficiency previously noted). It is likely that operation of a unit at Love Canal would also result in some extended downtime periods. Downtime periods would delay the completion of thermal destruction of wastes and ultimately closure of the DCF. However, in all situations, transportable units have been repairable and have been brought back up to full-scale operation.

As stated above, transportable thermal destruction units are currently available for use at hazardous waste sites and could be used at Love Canal. Sufficient disposal capacity exists on-site in the DCF for final disposal of the treated creek and sewer sediments.

The residuals from the thermal destruction process are expected to be non-hazardous; however, it is unlikely that an off-site facility would accept Love Canal materials. It is difficult to predict whether a facility will accept these Love Canal residuals at the time the residuals require disposal. If off-site facilities are not willing to accept the residuals, residual materials would have to be returned to the DCF or disposed of in selective areas

on-site, so as not to impinge on the integrity of the cap. If an off-site subtitle D facility agreed to accept the delisted material, the DCF may still be needed to contain the house debris. The size of the facility could be altered if a substantial quantity of material were treated and disposed of off-site or disposed on-site in some fashion other than in the DCF. Therefore, some degree of aesthetic impacts of the DCF may continue under any of the three alternatives.

Cost

Costs are evaluated in terms of capital and operation and maintenance costs. As noted above, the baseline cost for the creek remedy selected under the 1985 ROD (i.e., construction of the DCF and creek sediment excavation) is estimated to be $13 million ($4M for construction of DCF and $9M for creek excavation). This $13 million is included in the anticipated costs for Alternatives 1-3.

The on-site land disposal under Alternative 1 has the lowest cost over the short-term since it does not require any additional action above that called for in the 1985 ROD. Therefore, the total cost for this alternative would be the baseline cost of $13 million. As noted, this alternative does not provide a permanent reduction in the toxicity of those sediments which pose the threat to human health and the environment.

As noted in Figure 2, following excavation and storage of the sediments, several additional tasks must be completed prior to initiation of thermal destruction of the sediments under Alternatives 2 and 3. Table 3 provides a summary of component costs for Alternatives 2 and 3 as well as Alternative 1. The design of the thermal destruction plan and preparation of bid specification is estimated to be $500,000. Trial burn expenses are also estimated to be $500,000.

Table 4 provides cost/ton estimates for on-site thermal destruction of the sediments (Alternatives 2 and 3). The estimates were provided by vendors of transportable thermal destruction units. The estimates cover introduction of the waste to the unit and removal of ash residue from the unit. Site preparation and materials pretreatment (sizing, shredding, crushing) is estimated to add approximately 10% to the thermal destruction processing costs.

Table 3
Summary of Estimated Costs for Alternatives 1-3
(Assume all materials require treatment)

	Alternative 1	Alternative 2	Alternative 3
Construction of DCF (1985 ROD)	$4M	$4M+	$4M+
Creek Excavation	$9M	$9M	$9M
Design/ Preparation of Bid Specs.	---	$0.5M	$0.5M
Trial Burns	---	$0.5M	$0.5M
Waste Handling/ Pretreatment	---	$1.1M-$1.6M	$1.1M-$1.6M
Thermal Treatment	---	$11.3M-15.8M	$11.3M-15.8M
Off-site Transport of Ash	---	---	$0.51M-$0.74M
Off-site Disposal of Ash	---	---	$1.0M-$1.4M
Total Estimated Cost	$13M	$26.4M-$31.4M*	$27.9M-$33.4M

* Additional costs of approx. $0.4M would be incurred if the material were spread on-site.

Cost incurred to alter the DCF would be roughly equivalent to costs which would have been incurred had the residuals been returned to the DCF and a RCRA cap placed over the facility. These costs are approx. $0.4M and are included in $4M.

TABLE 4
TRANSPORTABLE THERMAL DESTRUCTION UNIT
TOTAL COST/TON ($/TON)

Based on a Total of 25,000 - 40,000 Cubic Yards of Sediment

% Moisture		
20(1)	Range	$150-450
	Median	200
	Mean	230
50(2)	Range	$150-400
	Median	260
	Mean	260
70(3)	Range	$170-350
	Median/Mean	260

(1) Costs at 20% moisture were obtained from responses to questionaires received from five thermal destruction unit designers and/or manufacturers.

(2) Costs at 50% moisture were obtained from six designers and/or manufacturers.

(3) Costs at 70% moisture were obtained from two designers and/or manufacturers.

An estimated cost of $450/cy for on-site thermal destruction was used. This estimate was based upon: (1) an estimate for sediment moisture content of 50% (as used in 1985 ROD); (2) the median value provided in Table 4; and (3) a bulk density representative of moisture free sediments equal to 1.33 (g/ml). These assumptions result in a conversion factor of 1.68 tons of sediment per cy sediment and therefore, a cost of $450/cy (versus $260/ton) to treat the sediment. $11.3 - $15.8 million would be required to treat 25,000 - 35,000 cy of sediment and associated material.

Using the median value, total costs for treating 25,000 cy (16,000 cy of contaminated creek and sewer sediments, 9,000 cy of associated material) of the waste (including trial burns and pretreatment) is estimated to be $12.9 million. Therefore, the complete remedial cost for excavation of the creeks (per the 1985 ROD) and associated material and treatment of 25,000 cy of sediments would be approximately $26.4 million. Assuming 35,000 cy (16,000 cy of contaminated creek and sewers sediments, 19,000 cy of associated material) of material require treatment and making the same assumptions as above, the cost for implementing Alternative 2 would be $31.4 million.

The cost for the treatment portion of Alternative 3 is identical to that provided under Alternative 2. Additional costs would be incurred for transportation of residual material to the off-site disposal facility and disposal of the residuals.

Assuming 25,000 cy of sediments require treatment and that the volume of the residual treated sediment (moisture free) is also about 25,000 cy, then approximately 1500 truck loads (17 cy per truck) of material would need to be disposed of off-site. Assuming that a disposal facility is located within 100 miles of the facility, and cost per loaded mile is $3.50, then transporation costs would total $525,000. Disposal costs at a subtitle D facility are estimated to be $980,000 (assuming a tipping fee of $35 per ton and a conversion factor of 1.12 tons/cy for moisture free residuals).

Under Alternative 3, the total estimated cost for thermal destruction and disposal of 25,000 cy of sediment would be $14.9 million. Complete remedial action cost for excavation of the creeks (1985 ROD) and treatment and disposal of the sediments would be approximately $27.9 million. Applying the same assumptions and basing the estimate on treatment of 35,000 cy of sediments, the estimated cost for implementing Alternative 3 is $33.4 million.

Under Alternatives 2 and 3, if the residuals are not returned to the DCF and the DCF is altered or dismantled to accommodate a smaller volume of material, the costs incurred to alter the DCF would be roughly equivalent to costs which would have been incurred had the residuals been returned to the DCF and a RCRA cap placed over the facility. These costs are approximately $0.4M. Costs for spreading residuals on-site under Alternative 2 are estimated to be $0.4M. Table 3 provides the cost of the individual components of the three alternatives.

All of the alternatives examined here may require long-term operation and maintenance of the DCF. These costs are expected to be low since the DCF will be built on land currently being maintained under the remedial program (e.g., limited incremental lawn maintenance costs) and since the DCF would utilize the existing Love Canal Leachate Treatment Facility for treatment of any leachate (generation of leachate is expected to be minimal after the sediments are dewatered and the facility is closed in 1990). In addition, the DCF monitoring wells would be monitored as part of the existing Love Canal perimeter well monitoring program.

The operation and maintenance costs for a 20,000 cy containment facility were estimated by CH2M Hill (1985 FS report) to be $3000/yr. It would cost approximately $5000/yr for operation of a DCF (assuming 40,000 cy capacity). Replacement or major repair costs may be necessary over the long-term (i.e. 20-40 yrs.). Both on-site thermal destruction options would also require similar expenses for operation and maintenance if the DCF was not dismantled.

Studies to be performed every five years to ensure the continued effectiveness of Alternative 1 would be included as part of a larger five year study to ensure the continued effectiveness of the containment of Love Canal proper. The costs associated with the review of the DCF as part of a five year review are not expected to exceed $100,000 per review.

Community Acceptance

This evaluation criterion addresses the degree to which members of the local community support the remedial alternatives being evaluated.

The local community has shown a mixed degree of acceptance of all alternatives due to various short-term remedial action impacts and aesthetic impacts. Any variation of the alternatives is likely to generate the same mixed acceptance.

In general, the community opposes storage or final disposal of any sediments or residuals in an on-site containment facility. As noted above, Alternative 1 would involve disposal of material in the DCF as well as disposal of approximately 5,500 cy of basement debris in the CDDF. In addition, the on-site treatment Alternatives 2 and 3 require interim storage of the contaminated sediments in the DCF so that the materials may be further dewatered, characterized, sized, crushed, ground, etc., prior to treatment.

Members of the community have questioned whether the operation of an on-site thermal destruction unit would delay rehabitation of the Emergency Declaration Area (EDA) until 1992-1994. Some members of the community oppose the removal of the sediments from the creeks (required under 1985 ROD).

Based upon the Responsiveness Summary and the unavailability of offsite disposal/destruction, public acceptance can be characterized as follows:

1. Acceptance of on-site destruction of all creek materials not just those containing dioxin above 1 ppb.

2. Better acceptance for leaving open the option of off-site disposal of residuals in case it becomes a possibility in the future; otherwise dispose of the residuals outside the DCF.

3. Better acceptance for dismantling or scaling down the DCF as much as possible following destruction of all creek materials.

Detailed responses to the community concerns are contained in the responsiveness summary (Attachment).

State Acceptance

The State acceptance criterion addresses the concern and degree of support that the State government has expressed regarding the remedial alternative being evaluated.

The State supports the thermal destruction of excavated creek and sewer sediments and the thermal destruction of all existing waste material stored in the Love Canal site, with all residuals becoming delistable waste.

The State has projected that the schedule for remediation will be longer than the current schedule (1992-1994).

Protection of Human Health and the Environment

Protection of human health and the environment is the central mandate of CERCLA as amended by SARA. Protection is achieved primarily by reducing health and environmental threats to acceptable levels and taking appropriate action to ensure that there will be no unacceptable risks to human health and the environment through any exposure pathways.

All of the alternatives evaluated here are protective of human health and the environment under the standards mandated by CERCLA as amended by SARA. On-site thermal destruction under Alternatives 2 and 3 provide the greatest degree of protection because both virtually eliminate the toxicity of the dioxin-contaminated sediments. Because thermal treatment of the sediment would destroy the dioxin in the sediment, the potential mobility of dioxin in those sediments would also be eliminated.

Appropriate measures would need to be taken during creek excavation work and construction of the DCF (applicable to all three options) to protect workers and the community. In addition, prior to implementing treatment under Alternatives 2 and 3, measures would have to be taken to assure that implementation of the thermal destruction process does not pose a threat to human health or the environment. A few of the potential problems are outlined below.

Workers and the residents would be protected through measures outlined in project specific health and safety plans and through contractor adherence to Occupational Safety and Health Act (OSHA) regulations.

An on-site transportable thermal destruction unit (TTDU) and/or associated air pollution control equipment, materials handling equipment, or materials pretreatment equipment may generate noise during routine operation. Any such noise would probably not be noticeable except during night-time operation (if night-time operation is acceptable to the community). Proprietors of TTDUs have indicated a willingness to house or insulate any noisy pieces of equipment or take any other measures necessary to eliminate the generation of noise.

Dust and particulate matter could be generated during materials handling and pretreatment. The potential for air releases of products of incomplete combustion also exists. Measures would be taken to ensure that all these potential hazards are controlled prior to full-scale operation.

Under Alternative 1, the DCF would remain as a permanent structure and would, therefore, continue to impact the community aesthetically. If the residuals are disposed off-site as in Alternative 3, or spread on-site as in Alternative 2, then the aesthetic impact of the DCF could be lessened since the size of the DCF could be reduced upon completion of thermal treatment.

For thermal treatment/off-site disposal under Alternative 3, a major potential safety and noise impact would be the need to transport approximately 1500 - 2000 (assuming all creek and sewer material (25,000-35,000 cy) is treated) truckloads of the treated residuals to an off-site disposal facility. The on-site containment option would have the least problems during the remedial action implementation phase. However, in the long term, the thermal destruction alternatives would provide the greatest degree of protection since the toxicity of the waste will be virtually eliminated.

SELECTED REMEDY

Based upon CERCLA as amended by SARA and detailed evaluation of the alternatives, the Agency has determined that Alternative 2, on-site thermal destruction/on-site disposal is the selected remedy.

As a result of public comment on the Proposed Plan and concern that effective separation of materials containing less than 1 ppb is not practical, a technical review was conducted by EPA and the State to determine the feasibility of separation of these materials. Based upon this review (refer to implementability discussion Pg. 18), separation and consolidation of

the dioxin-contaminated sediments above 1 ppb from those below 1 ppb is not implementable and will lead to unacceptable project delays. In addition, the community is opposed to any option which does not call for thermal destruction of all the contaminated creek and sewer sediments. As a consequence of the above factors, all materials (excluding 5,500 cy of house debris to be placed in the CDDF) will be thermally treated.

The entire quantity of sewer sediment (approximately 1000 cy) would require treatment. The majority of the 2400 drums of waste stored on-site (activated carbon from the leachate treatment facility, inner sewer sediments, and miscellaneous solid waste from remedial efforts) would also be expected to require treatment. Based upon this review, the total quantity of material that would require treatment is estimated to be 25,000 - 35,000 cy (see Table 1).

These materials would be treated in a transportable thermal destruction unit operated at Love Canal. On-site thermal treatment of the sediments will involve transporting and setting up a transportable unit on the site to treat the sediments. The sediments will have to be dewatered prior to treatment. In addition, the sediment will require some degree of pretreatment such as screening, shredding or crushing to be suitable for feeding to the thermal destruction unit. Storage systems for waste blending and material feeding will also be necessary. Included with this technology will be the need to have laboratory facilities present at the site to assure compliance with all regulatory emission or discharge standards. These components are necessary to ensure the protectiveness and effectiveness of the selected remedy.

The steps involved in establishing a TTDU are outlined in figure 2. The time required to procure, mobilize and begin full-scale operation of a unit could be between 32 months and 60 months. It is possible that some of these steps could be performed in parallel. However, it is unlikely that full-scale operation could begin in less than 32 months. Once full-scale operation begins, the 25,000-35,000 cy of material could be treated in 12 to 16 months if a 5 ton per hour unit (assuming 75% operational capacity) was operated 24 hours a day. Operation of the TTDU 24 hours a day has not received any negative community reaction. The overall schedule for the remediation of the creek and sewer sediments is provided in Table 5.

Following the thermal destruction process, the DCF would be scaled down to accommodate only the construction/demolition debris material.

Table 5
OVERALL REMEDIAL SCHEDULE

		1987	1988	1989	1990	1991
1.	Record of Decision	X				
2.	Construction of DCF		X	X		
3.	Excavate Creeks/Fill DCF			X		
4.	Thermal treatment procurement package	X	X			
5.	Installation of thermal treatment unit/test burn			X		
6.	Treat dioxin-contaminated sediments				X	X

Statutory Findings

The selected remedy satisfies the nine evaluation criteria to the greatest degree of any of the alternatives examined.

The thermal destruction process would comply with all action-specific ARARs as specified in RCRA, (see 40 C.F.R. Section 264, Subpart O). The thermal destruction process would be required to demonstrate six 9s DRE. In addition, the residuals from the thermal destruction would be determined non-hazardous and would not pose a threat through any exposure pathway to human health or the environment.

The Agency has been explicitly directed by Congress in CERCLA §121(b) to select remedial actions which utilize permanent solutions and alternative treatment technologies or resource recovery options to the maximum extent practicable. In addition, the Agency is to prefer remedial actions that permanently and significantly reduce the mobility, toxicity or volume of site wastes. Applying this statuatory preference here, Alternative 2 provides the greatest degree of long-term effectiveness and permanence by utilizing a treatment technology that will virtually destroy the dioxin. In addition, excavation to approximately 18 inches will also fulfill the preference for permanent elimination or reduction of the public health and environmental risk. Because of the potential mobility of the sediments and the bioaccumulation in fish, this permanent solution is appropriate. There would be virtually no residual risk associated with this alternative since the contaminant of concern, dioxin, would be virtually eliminated through the thermal destruction process and the excavation plan. In addition, there would be no need for eventual replacement of the remedy since the residuals from the treatment process will be nonhazardous. Finally, this remedy is reliable and would avoid the long-term uncertainties associated with land disposal of untreated wastes. Hence protection of human health and the environment on a long-term permanent basis is best assured by Alternative 2.

The Agency believes that the thermal destruction technology is available and reliable for the treatment of dioxin-contaminated waste. The land area is available for the siting of the TTDU and disposal of the residuals on-site. Trial-burn data would be utilized to ensure the operational reliability of the thermal destruction process. Although this remedy would require measures to control possible risks related to construction and operation (e.g., air emissions), the Agency's analysis indicates that all these factors can be adequately controlled.

Capital cost for the thermal destruction of all the sediments is higher than the cost of land disposal of the sediments in the DCF. However, the fact that the remedy is permanent means that future replacement of the DCF and associated costs under Alternative 1 (design life of the DCF is twenty years) would not be incurred.

In addition, the costs of five year reviews, operation and maintenance and major repairs of the DCF would not be incurred. While the selection of remedy involves balancing costs and cost-effectiveness against the relative benefits of each alternative, the Agency is statutorily required to favor remedies that are permanent and that utilize treatment technologies, which permanently and significantly reduce the toxicity, mobility or volume of the contaminants. Thus, even though Alternative 1 is less expensive than Alternative 2, the Agency finds that the balance is tipped in favor of permanent thermal treatment under Alternative 2.

The community prefers that all contaminated sediments be destroyed and that no final disposal facility be left at Love Canal. The selected remedy meets public acceptance by virtually destroying all the contaminated sediments. The selected remedy calls for a scaling down of the DCF to accommodate solely the house debris. Although the community opposes any final disposal facility including a construction/demolition debris facility, the house debris is not known to be contaminated and would not pose any threat to human health and the environment. In addition, the community opposes placing the non-hazardous residuals on-site. Similar to the house debris, the residuals do not pose a threat to human health and the environmental. Thus, the selected remedy has considered community acceptance to the maximum degree possible in light of the other factors to be weighed.

The selected remedy would be protective of human health and the environment by: 1) utilizing treatment to reduce toxicity and mobility of the waste; 2) being the most effective and permanent remedy in the long-term; 3) being the easiest to implement and 4) assuring short-term effectiveness.

In summary, EPA has selected Alternative 2 because it is protective of human health and the environment, will attain all applicable or relevant and appropriate requirements, is cost-effective, and utilizes permanent solutions and alternative treatment technologies or resource recovery options to the maximum extent practicable. Additionally, since this alternative employs thermal destruction to eliminate the principal threat at the site, this option would also satisfy SARA's preference for remedies which employ treatment as their principal element to permanently and significantly reduce toxicity, mobility or volume of the contaminants.

United States
Environmental Protection
Agency

EPA

Responsiveness Summary for Proposed Plan for Destruction/ Disposal of Love Canal Creek and Sewer Sediments

1. INTRODUCTION

In August 1985, the United States Environmental Protection Agency (EPA) released a document entitled "Proposed Plan for Destruction/ Disposal of Love Canal Creek and Sewer Sediments." The present document serves as a companion document to the June 1987 draft feasibility study entitled "Alternatives for Destruction/Disposal of Love Canal Creek and Sewer Sediments". Copies of the Proposed Plan are available at the EPA Public Information Office, Carborundum Center, Suite 530, 345 Third Street, Niagara Falls, New York, and the New York State Department of Environmental Conservation (NYSDEC), Love Canal Public Information Office, Colvin Boulevard, Niagara Falls.

As called for in Section 117 of the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA has presented the Proposed Plan for public review. EPA accepted written comments on both documents until October 9, 1987. A public meeting was held on August 25, 1987, at the Frontier Avenue Firehall, Wheatfield, New York, to discuss the proposed remedial action directed toward the final destruction/disposal of the dioxin-contaminated sediments from specific stretches of sewers and creeks at the Love Canal hazardous waste site. In addition, a workshop was held in Niagara Falls on August 12, 1987 to discuss the thermal destruction of dioxin-contaminated wastes from Love Canal.

Background

The Love Canal site is located in the southeast corner of the City of Niagara Falls and is approximately one-quarter mile north of

the Niagara River. Hooker Chemical & Plastics Corp. (now Occidental Chemical Corporation) disposed of over 21,000 tons of various chemicals (including dioxin-tainted trichlorophenols) into Love Canal between 1942 and 1953. Over the course of the next two and one half decades, contaminated leachate migrated to the surface of the Canal and to the basements of nearby residences which have since been demolished. Contaminants also migrated through area sewers that have outfalls in nearby Black and Bergholtz creeks.

NYSDEC and EPA entered into an initial assistance agreement for remediation at the site in 1978; in July 1982, EPA and DEC entered into a cooperative agreement under the Federal Superfund program to continue the remedial activities at the site. Contamination at the site itself has been contained through the implementation of various remedial measures including the installation of a barrier drain leachate collection system; a leachate treatment facility; and a clay cap over the original 16-acre site; and in 1984, an expanded 40-acre cap with synthetic liner. Following containment, studies were undertaken to address the remediation of contaminated drainage tracts (i.e., sewers and creeks). The studies led to the May 6, 1985, Record of Decision (ROD) that called for the removal of contaminated sediments from specific stretches of the sewers and creeks. It was determined that the excavated sediments should be placed in an interim containment facility. There were several reasons for this decision, including: a viable option for destruction/disposal of the sediments did not exist at that time; the creek material would require dewatering, sizing, shredding, etc., prior to implementation of any treatment alternative; the rate of sediment removal would be much greater than the rate at which the wastes could be treated (i.e., the creek excavation would be completed in approximately 24 weeks, whereas thermal destruction of the sediment would require at least one year of operation).

Approximately 95% of the sewers which required remediation were cleaned in 1986. The creek excavation is planned for 1989. Approximately 25,000 - 35,000 cy of creek and sewer sediment and miscellaneous remedial wastes will require destruction/disposal. The draft feasibility study recommended that three alternatives for destruction/disposal of these wastes be considered.

The three alternatives, as provided in the draft feasibility study are: On-Site Land Disposal; On-Site Thermal Destruction/On-Site Disposal; and, On-Site Thermal Destruction/Off-Site Disposal. The Proposed Plan evaluates these three alternatives using criteria derived from the National Contingency Plan (NCP) and SARA. These criteria are: Protection of human health and the environment; Compliance with legally applicable or relevant and appropriate requirements; Reduction of toxicity, mobility, or volume; Short-term effectiveness; Long-term effectiveness and permanence; Implementability; Cost; Community acceptance; and State acceptance.

At this time, based on all available information, the selected option is Alternative 2, On-Site Thermal Destruction/On-Site Disposal. The objective of Alternative 2 is to thermally treat (via transportable thermal destruction unit) the material contaminated with dioxin. By thermally treating the dioxin, the toxicity and mobility of the threat posed by the dioxin would be virtually eliminated.

The design of the May 1985 ROD Creek Remedy (i.e., sediment excavation and construction of the interim containment facility) is currently at the 95% completion stage. The design calls for the construction of a containment facility, which would be approximately 900 feet long, 300 feet wide, and 25 feet above grade (at crest).

EPA and the State have revisited the project design to assure that it meets the goals and objectives outlined in the Proposed Plan. Specifically, the review included re-estimating the quantity of associated material requiring thermal treatment and focused on the fact that the sediments need dewatering, and that a storage area is needed for staging material prior to thermal treatment. The scale of the containment facility has not changed significantly, since it would still receive approximately the same quantity of material as planned earlier for interim storage. The facility is now referred to as the dewatering/containment facility (DCF).

As originally conceived under the selected alternative, sediments contaminated with an average dioxin concentration greater than 1 ppb would be thermally treated, while those contaminated with less than 1 ppb of dioxin would remain in the DCF untreated.

As a result of public comment on the Proposed Plan and concern that effective separation of materials containing less than 1 ppb is not practical, a technical review was conducted by EPA and the State. As a result of this review, EPA has determined that it is infeasible to separate these materials, that separation will lead to project delay, and that separation is generally a non-implementable option. As a consequence, all material (excluding 5,500 cy of house debris to be placed in the Construction/Demolition Debris Facility [CDDF]) will be treated.

There were two options available for treated residuals from the thermal destruction process. The first would be to dispose of the residuals in the DCF. The second would be to place the residuals on the site rather than returning them to the DCF. Implementation of the second option may allow the scale of the DCF to be reduced following thermal treatment. Based upon analysis of the two options and on public comment, EPA has determined that the residuals should be spread on-site, adjacent to the existing cap.

Prior to approving full-scale operation of a thermal treatment unit at the site, trial burns would be required to demonstrate that the unit is capable of successfully and safely treating the dioxin-contaminated waste. Specifically, 99.9999% destruction and removal efficiency for thermal treatment of dioxin would have to be achieved and the treated waste residuals would have to be non-hazardous.

This Proposed Plan would make use of the DCF, a CDDF for the basement debris (for the debris to be removed from Ring II basements so that a stable foundation can be provided for the DCF), and an on-site thermal destruction unit. The estimated total cost ranges from $26.4 to 31.1 million.

This Responsiveness Summary details the comments received from residents of the Love Canal Emergency Declaration Area, citizen groups from Niagara Falls and surrounding communities, the scientific experts who reviewed the document, and other interested parties. The discussions answer the most prevalent concerns expressed by citizens, as well as addressing individual comments. Verbatim transcripts of public meetings, written comments, meeting notes, telephone memoranda, newspaper accounts, and notes made following conversations were used when compiling the comments.

2. CONSTRUCTION DEBRIS

Question: Will Ring II basement debris be placed in the dewatering/ containment facility (DCF)? Will this material be permanently stored or thermally destroyed?

Response: Excavated Ring II basements will be placed in one section of the DCF, known as the construction/demolition debris facility (CDDF). No contact will occur with excavated creek sediments. Ring II basement debris will not be thermally threated. It will be permanently stored.

Question: What will happen to material contaminated during the creek remediation--haul road material, for example?

Response: Contaminated construction debris from the actual creek remediation will be placed in the DCF with contaminated creek sediment and will be thermally treated. Material which is not contaminated will not be stored with the sediments in the DCF; however, it may be stored with the basement debris in the CDDF.

3. DEWATERING

Question: Is dewatering of sediments necessary?

Response: Some dewatering of sediments is necessary for any thermal treatment process qualifying as implementable at the Love Canal site.

Question: What is involved in sediment dewatering?

Response: Several steps will be taken to dewater the sediments, including dewatering in the DCF. Initial dewatering of the sediments will occur at creekside. This will include drainage of free liquids during excavation, followed by further drainage at a holding/staging area at creekside. This initial dewatering is anticipated to take approximately 1 week. A schedule will be finalized during the design phase. The material will be transferred to the DCF where it will undergo further dewatering until a thermal destruction unit is available to treat the sediments. The sediments may be further dewatered or dried as part of the thermal treatment process in order to promote efficient and cost effective thermal treatment. At creekside and at the DCF, measures will be taken to avoid odors and other nuisances.

4. SEGREGATION OF DIOXIN-CONTAMINATED MATERIALS

Question: Is it possible to segregate waste contaminated with more than 1 part per billion (ppb) of dioxin from material contaminated with less than 1 ppb? How much would it cost to provide this separation? How much would it cost to burn all the waste? Will excavation and the mixing of the wastes which may occur dilute the dioxin so that all the material ends up below 1 ppb?

Response: The feasibility of segregating wastes contaminated with greater than 1 ppb from waste with less than 1 ppb is an important consideration in the formulation of the remedial plan. Based upon this concern, EPA and NYSDEC directed TAMS consultants to evaluate measures to segregate the materials. The alternatives examined for sampling were:

- Re-characterize the sediments in-situ prior to excavation so that segregation during excavation could occur;

- Characterize the sediments at creekside following excavation but prior to placement in the DCF to allow segregation at this point; or

- Characterize the sediments after placement in the DCF but prior to thermal treatment.

For reasons discussed in detail in the ROD, EPA concludes that significant problems exist with regard to either instituting an effective sampling program once the sediments are excavated, or implementing an excavation and storage program based upon in-situ sampling of the creeks. Physical site limitations, the "soft and runny" nature of the sediments, schedule constraints, technical considerations, etc., are such that segregation of the sediments is not deemed feasible or implementable. The only implementable alternative to sampling and segregation is the treatment of all sediments and associated materials. Although treatment of all materials appears to be the more costly alternative, it is an alternative that is free of additional technical complexity, modifications to the existing design, and schedule delays. These factors make the non- separation approach the most implementable and cost-effective approach.

5. RESIDUAL DISPOSAL

Question: Where will the residuals be disposed of on-site?

Response: The residuals will be spread on-site within the fence line at Love Canal, adjacent to the existing cap. The residuals would be placed in such a manner that they would not compromise the integrity of the existing cap. Potential areas for placement of the residuals on-site include the northeast and southeast corners. This would result in less than a 3-foot increase in elevation in these areas.

Question: Will the residuals be disposed of above or below the existing cap?

Response: The possibility of disposing of creek sediments on the capped area of the Canal is not considered technically feasible. Disposing of the sediments above the synthetic membrane liner and below the liner were considered and rejected for several reasons: the effects of the weight of the material on the Canal contents cannot be fully evaluated; and the integrity of the cap and barrier drain system may be compromised. Therefore, residuals will be disposed of in areas adjacent to the cap. Under no circumstances would the residuals be placed on the cap or under the cap.

Question: Could the residuals from thermal destruction be placed back in the creeks?

Response: This could occur under the following set of circumstances: if thermal destruction of the sediments could be conducted at the same rate as excavation of the sediments; if all work could be conducted in one construction season; and if no flood event impaired the remediation process. However, this set of circumstances is not possible. The creek sediment will be excavated in 18 to 24 weeks, while thermal treatment will take 12 to 16 months. Placement of the sediments back in the creeks over more than one construction season would require further berming and dewatering of the creeks to remove sediments which would have been deposited during that time. This would result in additional construction costs and impacts on residents whose properties abut the creeks.

Question: What off-site disposal options are being considered for disposal of residuals?

Response: A 1984 marketplace study conducted by EPA found that commercial waste disposal facilities are not interested in accepting treated wastes from Love Canal, even if they are non-hazardous. Although this could change, the further impacts of more than 1,500 truckloads of waste and associated traffic on the community have led EPA to conclude that at this time off-site disposal of the residuals from thermal destruction of creek and sewer sediments is not an implementable alternative.

6. THERMAL DESTRUCTION TECHNOLOGY

Question: Is destruction of dioxin by thermal treatment proven, or is this just an experiment?

Response: Destruction of dioxin-contaminated materials by thermal destruction has been proven effective. Destruction of dioxin in contaminated soils has been used successfully by EPA to remediate other hazardous waste sites. At this time, several manufacturers as well as EPA operate thermal destruction units proven to be capable of destroying the dioxin in Black and Bergholtz Creek sediments.

Question: What is emitted into the air from incineration? Do we have to worry about the air we are breathing?

Response: Operation of the thermal destruction unit will comply with all applicable or relevent and appropriate state and federal emissions requirements in addition to the six 9s (99.9999%) thermal destruction efficiency. Compliance with these emissions requirements will be assured through use of air pollution control equipment, through continuous monitoring of stack emissions, and through the use of specific parameters for operation of the thermal destruction unit. These requirements are designed to assure the protection of public health and the environment. Operation of the thermal destruction unit would not be approved unless trial burns indicate that the unit could be operated in such a manner.

Question: Will thermal destruction capacity increase as time goes on, or will the unit start at full capacity?

Response: Following successful completion of trial burns, the unit would be operated at full design capacity.

Question: Where will the trial burns be done?

Response: The trial burns will be conducted on-site at Love Canal.

Question: Will the public be notified before burning begins?

Response: NYSDEC's public participation program will keep the public informed of activities related to thermal destruction.

7. OTHER/NON-CATEGORICAL

Question: Is 93rd Street covered under Superfund?

Response: A Remedial Investigation/Feasibility Study is currently being conducted at the 93rd Street School, which is an operable unit of the Love Canal Site. A record of decision selecting an appropriate remedy for the school is expected to be signed in the spring of 1988.

Question: Did you give us 24 hours notice of the public meeting?

Response: During the weeks leading up to the August 25, 1987, public meeting, there was an extensive effort made by EPA to assure that all concerned individuals knew of the meeting. Two weeks before the meeting, a Legal Notice was printed in the Niagara Gazette announcing the public meeting. The Niagara Gazette printed two front page articles, and the Buffalo News printed three articles announcing the date, time, and location of the meeting during the 2 weeks preceding the meeting. One week before the meeting, a press release was sent to all local newspapers, and radio and television stations. Additionally, a mailing was sent to more than 1,000 areas residents, public officials, and other concerned individuals to assure that they were aware of the upcoming public meeting.

Question: Has Hooker been consulted regarding the locating of the thermal destruction unit at Love Canal?

Response: Hooker, now Occidental Chemical Corporation, has been kept aware of remedial activities at Love Canal through public notice and through direct correspondence. Their comments on the proposed plan will be considered with all others.

Question: Would you recommend a containment facility be placed in front of the Jefferson Memorial if there was contamination in the Potomac Basin?

Response: Selection of appropriate remedies depends upon site-specific conditions which dictate whether treatment or non-treatment options will be pursued.

Question: Following the release of the proposed plan for destruction/disposal of Love Canal creek and sewer sediments, a vendor of environmental clean-up technology submitted an alternative plan. This plan called for the use of an essentially closed system for the hydraulic removal, and hydraulic transport of creek sediments with concurrent dewatering and thermal destruction of the dioxin in the sediments, followed by off-site disposal of the residuals of thermal destruction. The advantages suggested in connection with this alternative included the elimination of the DCF, the elimination of traffic caused by the trucking of sediments from creekside to the DCF, lower cost, the completion of the project in two construction seasons, and shorter time required for implementation.

Response: The proposed alternative calls for the thermal destruction of creek sediment without interim storage in a DCF. The advantage of using the DCF is that sediments can be removed from the creeks prior to the approval of the operation of a thermal destruction facility. EPA's timetable for meeting the requirements of the contracting and permitting process would require three to four years before the operation of a thermal destruction facility could be approved. As such, the dioxin-contaminated sediments would remain in the creeks until at least 1992, while under the remedy selected by EPA the sediments would be removed during 1989. It is clear that by removing the contaminated sediments from the environment a minimum of three years sooner, the

remedy selected by EPA provides better protection of human health and the environment over the short term than does the proposed alternative.

The proposed alternative calls for hydraulic dredging of contaminated sediments from the creeks. Hydraulic dredging was considered and eliminated during the preliminary design phase of the project. It was eliminated both on the basis of its inability to insure complete removal of the contaminated zone of material, and on its adaptability to project site conditions. The Black Creek portion of the project and the banks of the creeks along the entire project do not have sufficient water during most of the construction season to permit hydraulic dredging using standard equipment. Additionally, the large amount of debris in the creeks (branches, bricks, wheels, etc.) makes the use of mechanical excavation equipment, as is currently planned, more appropriate for this project.

Under the proposed alternative, the hydraulically excavated material would be transported by piping to a temporary dewatering facility located near the thermal destruction unit. A separation tank capable of holding 200,000 gallons would also be required at this location according to the proposed alternative. In order to accomplish this without piping across city streets, an area adjacent to the creeks would be required. The only area adjacent to the creeks sufficient to accommodate these facilities is the area adjacent to the 93rd Street School. However, the utilization of this area is limited due to the ongoing RI/FS at the school, and the possibility of interfering with future remedial action at this site. As such, the dewatering and thermal destruction activities of the project would have to be performed away from the creeks, probably within the same area proposed for the DCF, therefore requiring the transportation of the dredged material by truck.

Linking the removal of the sediments from the creeks with the thermal destruction process is unacceptable to EPA. Under the proposed alternative, the rate of sediment removal would be controlled by the rate at which the thermal destruction facility can process the material.

Should any mechanical problems occur with the thermal destruction facility requiring a delay in the processing of the wastes, creek excavation would be halted. The failure of any of the other components of this complex materials processing system (i.e., pumps, filter presses, settling tanks) could also cause a delay in the excavation of the creeks. Under the selected remedy, all sediments to be excavated would be removed during one construction season, stored and staged in the DCF, and then processed by the thermal destruction unit when it was available.

Based upon these problems with the proposed alternative, EPA considers it to be less easily implemented, potentially more costly, and less protective of human health and the environment than the selected alternative.

8. OUTSIDE WASTES

Question: What will prevent the site from being expanded from the original purpose to a permanent landfill which will ultimately take on residuals which CECOS can't handle?

Response: This Record of Decision (ROD) document gives EPA authority to thermally treat the Love Canal creek and sewer sediments and associated remedial waste material. EPA could not allow wastes from other Superfund sites to be brought to Love Canal without first going through the same procedure which was followed before finalizing this ROD. This procedure included the release of a proposed plan and the consideration of public comment. EPA is not considering accepting or treating any wastes other than those which are specified in this ROD.

Question. Are you going to be handling wastes from 93rd Street or 102nd Street at Love Canal?

Response: While 93rd Street is an operable unit of the Love Canal Site, it is not part of this ROD. The 102nd Street Landfill is a separate Superfund Site currently under investigation by the responsible parties.

9. POINT OF ORIGIN

Question: Doesn't Superfund say all waste must be returned to its point or origin? Why not send it back to Hooker?

Response: For the purpose of remediating a hazardous waste site, Superfund policy states that any waste emanating from a Superfund site may be stored or treated at that site. A source of contamination does not necessarily refer to the place of manufacture; rather, it refers to the place where contamination has come to be located. For example, the contaminants in the creeks were determined to have emanated from Love Canal. Therefore, they are being brought back to Love Canal, their source, and will be thermally treated at the Love Canal Site.

10. POLICY

Question: If thermally treated wastes are non-hazardous, why need they be stored at Love Canal? Why not somewhere else?

Response: See Section 5.

Question: Who is responsible for setting up the six 9s criteria for thermal destruction of dioxin?

Response: EPA's six 9s (99.9999%) destruction and removal efficiency (DRE) was published in the January 14, 1985, Federal Register, Part 11, 40 CFR Parts 261, 264, 265, 250, and 775, Dioxin Containing Wastes Rule (Section IV, B.2(a)). These regulations were promulgated following standard procedures. The regulations were first proposed for comments, comments were addressed, and the regulations were finalized. More specific details regarding these regulations are provided in the above reference. Six 9s DRE is required of incinerators that burn polychlorinated biphenyls (PCBs); compounds that are less toxic than dioxin. Since dioxin is one of the most toxic compounds known, the best achievable DRE should be required. The six 9s DRE will result in the lowest achievable emission rate and thereby minimize any short-term impacts to human health and the environment.

Question: Is contamination in Cayuga Creek being addressed?

Response: Cayuga Creek was most recently sampled in 1986. At that time, further monitoring of Cayuga Creek was recommended to help determine the impact of the Black and Bergholtz creeks cleanup on the Cayuga Creek fish and the potential for secondary human contact with dioxin through ingestion of fish.

Question: Is EPA going towards containment on-site as a policy?

Response: As specified in the Superfund Amendments and Reauthorization Act (SARA), EPA is mandated to utilize permanent solutions and treatment technologies to the maximum extent practicable.

Question: Are you going to consider our feelings, or are you going to forget about us after this public meeting?

Response: EPA and NYSDEC consider public comment throughout the decision-making process. This Responsiveness Summary is a formal response to those questions and comments received at the August 25, 1987, Public Meeting, as well as those received in writing. Community acceptance is one factor considered in selecting a remedy. Many comments and concerns have been incorporated into this Record of Decision.

Question: If it is decided to contain wastes on-site, does it mean that the Department of Health does not have to make a habitability decision?

Response: For the Commissioner of Health to make a decision about habitability, an acceptable plan for the remediation of the creeks must be in place. The Commissioner has stated that the choice of one alternative or another would not affect his ability to make a decision about habitability.

Question: Can the public be part of the process of selecting a treatment technology?

Response: DEC has a public participation program in place to keep the public informed of all remedial activites taking place at the site. The criteria for the selection of the thermal treatment technology have been presented to the public for comment, in order to adequately address their concerns. In addition, the public will be an integral part of the design and construction process.

Question: Can you define a "permanent remedy?"

Response: A permanent remedy is one which eliminates or controls the risks posed by the toxicity, mobility, or volume of hazardous substances, over the long-term.

Question: Does EPA make this decision alone, or does the decision get made with DEC?

Response: Although the EPA Assistant Administrator selects the remedy for the site, the State actively participated in the decision process, and formally concurs with the selected remedy. State comments and concerns are addressed in a section of the Record of Decision devoted to State acceptance of the selected remedy.

Question: What incentive is EPA giving to industry to develop incinerators?

Response: Operation of the EPA mobile incinerator at the Denny Farm, Missouri, Superfund site demonstrated the ability of rotary kiln incinerators to treat dioxin wastes. EPA Office of Research and development also operates an incinerator in Pine Bluff, Arkansas, which performs test burns on Superfund wastes. In addition, EPA's Superfund Innovative Technology Evaluation (SITE) program provides the opportunity for proprietors of innovative technologies to demonstrate their technologies. This includes the demonstration of thermal destruction processes.

Question: Is your mind made up on having the dewatering containment facility (DCF) at Love Canal?

Response: The DCF is an integral part of the Black and Bergholtz Creek remediation. The DCF is needed to dewater and store sediments, as well as for the staging of sediments prior to thermal treatment.

Question: Why not burn all the dioxin?

Response: See Section 4.

Question: What will happen to all the unoccupied homes if EPA is not going to start thermal destruction until after 1990?

Response: The operation of a thermal destruction facility at Love Canal should not affect the decision as to when the area should be rehabitated. In the meantime, EPA and DEC have implemented a program for maintaining the unoccupied homes owned by the Love Canal Area Revitalization Agency (LCARA). The Commissioner of Health is expected to make a decision on habitability in 1988.

11. RISK

Question: What is the risk for each alternative?

Response: The three alternatives evaluated for destruction/disposal of dioxin-contaminated creek and sewer sediments at Love Canal have different risks associated with them. The ROD and the underlying studies detail the nature of these risks. The on-site containment of wastes, with no treatment, while posing the smallest short-term risk, does not reduce the toxicity or volume of the dioxin over the long-term. The thermal destruction alternatives, by destroying the dioxin, reduce the long-term risk posed by the contaminated sediments. EPA considers that the long-term benefits that would be gained by destroying the dioxin would outweigh the short-term risk potentially posed by the operation of the thermal destruction unit.

12. TRAFFIC

Question: Will the roads of Niagara Falls be backed up with truckloads of contaminated sediments?

Response: Trucks will only be permitted to travel on designated haul routes, as shown in the August, 1987, conceptual design report.

Question: How much truck traffic will be generated by the creek excavation?

Response: The number and size of trucks transporting sediments will be dependent upon the contractor's approved operations plan. It is anticipated that loaded trucks transporting sediments from the creek to the DCF would make no more than 25 trips in a given day.

Question: How many truckloads could be handled in 1 day?

Response: Twenty-five truckloads of sediments can easily be disposed of in the DCF daily. Thermal destruction would occur at a much slower rate. This is one of the primary reasons why a DCF is needed. Offsite truck traffic will not be required for the transfer of sediment from the DCF to the thermal de- -tion unit.

13. Response to Occidental Chemical Corporation's Comments on the Proposed Plan for Destruction/Disposal of Love Canal Creek and Sewer Sediments Submitted October 8, 1987.

The comments presented by Occidental Chemical Corporation (OCC) address the adequacy of the remedial investigations and feasibility studies as they concern the risks posed to public health and the environment prior to remediation and health considerations in the selection of an adequate remedial alternative.

In the Record of Decision that was signed on May 5, 1985, EPA fully considered the need to remediate the creeks because of TCDD contamination, and found it necessary to remediate to the level of 1 ppb. The proposed plan under consideration addresses the destruction and disposal of the creek sediments following their excavation as called for in the May 5, 1985 ROD. Therefore most of OCC's comments address issues that have been previously decided. Nonetheless, the Agency will respond to OCC's comments, especially to the extent that additional information has been provided in the current record which supplements the 1985 ROD.

a. Consistency With Agency Procedures

OCC states that the USEPA Superfund Public Health Evaluation Manual (SPHEM) requires that a proper public health evaluation consists of: 1) a baseline health evaluation, and 2) development of performance goals for remedial alternatives. OCC then contends that the RI/FS (for the 1985 ROD) does not include an adequate public health evaluation, and that a performance goal for creek remediation was only set or suggested by a document in the current record.

Response: In October 1986, EPA published SPHEM as a guidance document to supplement earlier guidance on conducting evaluations of potential public health impacts at Superfund sites. The May 1985 decision to remediate the creeks predates the publication of the SPHEM by more than a year; therefore, the SPHEM is not directly applicable to the May 1985 decision. Nonetheless, the 1985 decision is consistent with the principles in SPHEM, as shown by the RI/FS contained in the Malcolm Pirnie and CH_2M Hill reports, and by the two Responsiveness Summaries and the 1985 Decision Document.

SPHEM provides that a public health evaluation should contain two key elements as part of a feasibility study:

> "1) a baseline public health evaluation and 2) public health analysis of remedial alternatives." SPHEM at 4.

A baseline public health evaluation is an analysis of site conditions prior to remedial action. The 1985 ROD (including the above mentioned documents) provides such an evaluation of site conditions. The 1985 ROD selected TCDD as the indicator chemical because of its high toxicity at concentrations lower than any other contaminant. Also, the 1985 ROD considered exposure of TCDD in the streams in the residential area and considered the routes of exposure. EPA has found the remediation of Black and Bergholtz creeks to be necessary because the potential exists and will continue to exist for human exposure to the TCDD in these creeks.

Exposure to TCDD in a residential area presents a serious health concern, particularly because EPA generally considers carcinogenesis to be a non-threshold effect. Exposure at the Love Canal site, which may occur during recreational activity or through ingestion of fish, presents a significant concern for the health and welfare of residents of the EDA as well as the Niagara Falls area. EPA applied the CDC level of concern of 1 ppb of TCDD to the situation at Love Canal, considered remedial alternatives, and selected excavation of approximately 18 inches of sediment for specific portions of the streams. This represents a permanent solution to the risks to public health and the environment.

The 1985 ROD provided a public health analysis of remedial alternatives and developed performance goals. The remedial alternatives included no action, in-situ stabilization and excavation. Each of these was evaluated in terms of public health and environmental impact. EPA used the principles of risk assessment in arriving at the 1 ppb level for TCDD in Black and Bergholtz creeks consistent with the guidance provided in SPHEM. The SPHEM is flexible and recognizes that there are differences among sites to be assessed. While SPHEM provides one approach for analyzing risk, it advises that in performing risk assessment: (1) other approaches may be equally valid; (2) the evaluation should be limited to the complexity and level of detail necessary to adequately assess the risk; and (3) the applicability and level of detail of the process is dependent upon professional judgment. SPHEM at 4-6. EPA's assessment of risk currently in the record is consistent with the SPHEM.

Although the SPHEM states that the purpose of the performance goal procedure is to use techniques of risk analysis to assist in setting target levels of contaminants at exposure points, and that a risk-based approach can be used to determine the extent of removal where soil removal is part of the remediation, the SPHEM clearly allows flexibility of approach on a case-by-case basis. In the 1985 ROD, EPA decided on the amount of sediment to remove -- approximately 18 inches -- based on engineering judgment and design requirements needed to effectuate a permanent and protective remedy.

OCC also states without being specific that the risk assessments and risk management documents for Love Canal do not use a risk-based approach like that performed for Times Beach and other Superfund sites. EPA has not selected a remedy for Times Beach, and there is no record of decision for that site; therefore, OCC is incorrect in asserting that EPA is acting inconsistently with decisions for Times Beach. Because OCC has not supplied any specific comments as to alleged differences between EPA's decision at Love Canal and its decisions at other Superfund sites, the Agency is unable to provide any further response.

b. Applicable or Relevant and Appropriate Requirements (ARARs)

OCC comments that CDC did not establish 1 ppb of TCDD as the automatic level of concern for soil regardless of location and potential exposure, and therefore 1 ppb is not an "applicable or relevant and appropriate requirement" (ARAR) which EPA must observe in selecting a remedy.

Response: CDC has established 1 ppb of TCDD as the "level of concern" for residential soils. Since "ARARS" involve duly promulgated statutory or regulatory requirements, standards, limitations, and criteria, the CDC level of concern is not strictly an ARAR. EPA has not treated it as an ARAR in making its decision. In both the 1985 ROD and the current record, EPA did not decide to remediate the creeks to 1 ppb "automatically;" rather, it considered the specific circumstances of the Love Canal site. Among these are: the location of the contaminated creeks, which flow through residential yards on both banks; the fact that these residential yards are subject to flooding from the creeks; the nature of the aquatic organisms inhabiting the creeks; the recreational uses the residents make of the creeks; and the bioaccumulation of TCDD in the food chain. In light of these factors, EPA determined that the 1 ppb level of concern recommended by CDC for residential soils is appropriate for this site.

The propriety of applying a 1 ppb cleanup level to Black and Bergholtz creeks is further supported by the study currently underway to assess the habitability of the Love Canal Emergency Declaration Area (EDA). Habitability criteria were established by New York State Department of Health (NYSDOH), the CDC, EPA and the New York Department of Environmental Conservation (DEC). The previously established level of concern for dioxin in residential soils of 1 ppb was used as a starting point in establishing habitability criteria for the EDA. Based on a concern for public health the decision was made that if TCDD was found in concentrations above 1 ppb in the EDA or a portion of the EDA, which includes Black and Bergholtz creeks, then that area would be considered habitable only if remediation could be accomplished and other circumstances do not cause it to be declared uninhabitable. These criteria were subjected to peer review and public comment and have been accepted by all the above agencies.

c. Comparative Risk Assessment Methodologies for Direct Ingestion

OCC's comments include its own public health evaluation ostensibly based on the same methodology as CDC used at Times Beach, on the basis of which OCC asserts that remediation of the creeks is not justified.

Response: The methodology used by OCC departs from that actually used by CDC for Times Beach in two key respects: first, it ignores adult exposures (from ages 18-70), and second, it omits pathways of exposure other than direct ingestion (such as inhalation and dermal absorption). The second omission is minor since these two pathways account for only a small portion of the total lifetime intake in CDC's model.

Adult exposures, however, should not be ignored. By assuming adult exposures to be zero, OCC significantly understates the resultant TCDD level of concern. Although OCC asserts that soil ingestion rates for ages 18 to 70 years were "not ascertainable from [the] CDC article," the value provided in Kimbrough et al. (1984) in Table 5 (p. 74) for five-year olds applies for all older ages as well. The contribution to total lifetime intake of dioxin during this age period as well as from other exposure routes is part of the basis for CDC's 1 ppb level.

Because of these problems, as well as problems with OCC's exposure assumptions described below, OCC's analysis is flawed and not appropriately conservative.

d. Exposure Assumptions

OCC's comments contain numerous statements and assumptions related to the Agency's assessment of potential exposures and recreational uses of the creeks.

Response: The Agency's assessment of potential exposures is appropriate for this site. OCC's information does not clearly call into question the Agency's assessment for several reasons. Many of the exposure assumptions and site descriptions are provided without references or supporting documentation, and are insufficiently conservative for the purposes of risk assessment. For example, OCC offers no support for statements such as "children of young age are not routinely allowed to play in these creeks regularly" (page 1). OCC has apparently ignored contrary documented evidence provided in the administrative record which demonstrates that the creeks have in fact been used as primary sources of recreation (wading, swimming, fishing, and ice skating) and that edible fish as well as other food-chain organisms (e.g., crayfish) have been caught in these creeks.

OCC states that the physical configuration of the creeks (steep banks with muddy slopes and bottoms), is such that it is unlikely that children under 5 years old would ever be allowed to play in the creeks, even under supervision. This statement implies that steep banks and muddy slopes are found at all points along the creeks. This is not an accurate depiction of conditions at the site. (See "Site Investigations and Remedial Action Alternatives Love Canal," Malcolm Pirnie, Inc., October 1983). Stretches of the banks are gently sloped, and directly abut unfenced backyards of homes. Hence, it is not reasonable to assume that children under five years old would never be allowed to play in portions of the creeks, even if supervised and that when unsupervised, would not venture into the creeks on their own.

The Agency's approach is to ensure adequate protection of human health and the environment. In part, this is accomplished by making conservative exposure assessments, which necessarily ensure that adequate protection will be achieved. OCC's comments are based on some exposure assumptions that are not appropriately conservative. OCC's assumptions that no adults will come in contact with creek sediments, and that children will come in contact with creek sediments only 52 days per year, are examples. Since the creeks run through residential areas, more extensive contact with creek sediments than OCC has postulated is reasonable and should be assumed in developing a conservative risk assessment. In the absence of empirical data regarding activities of exposed populations, conservative assumptions should be made.

OCC claims that the documents cited in EPA's risk manageme assessment document show that the exposure assumptions employed by OCC "conservatively overstate the actual exposure." OCC does not provide any specifics in footnote 8 of its comments to support its statement. EPA has reviewed the documents referred to and has found nothing to support OCC's view. EPA's September 1987 memo does not question the exposure assumptions used by Kimbrough et. al. (1984) in arriving at the 1 ppb level for dioxin. Therefore, the EPA's memo does not show that "OCC's analysis of exposure to sediments conservativel overstates the actual exposure scenario along the creeks."

e. Exposure to TCDD-Contaminated Fish

In estimating exposure to TCDD-contaminated fish, OCC makes a number of assumptions which it claims to be "conservative."

Response: The assumptions upon which OCC's scenarios are based are not conservative and at least one calculation is erroneous. Examples are:

1) OCC's Exposure Scenarios are Based Only on Children. Both of OCC's scenarios assume only children fish in Cayuga and Bergholtz creeks and that only children consume fish caught from the creeks.

This assumption, and the next assumption discussed, are based upon OCC's assumption that adults would seldom, if ever, fish these streams and that the fish that children would catch would be rough fish, not likely to be consumed. OCC's assumptions ignore these facts: a) dioxin levels above Federal and State guidelines have been found in fish, such as northern pike and rock bass caught in Cayuga Creek (9/28/87 Sterling to Garbarini memorandum); b) fish migrate from these creeks to the Niagara River, so that fishermen who fish in the Niagara River near the confluence with Cayuga may be catching fish that lived in, and were exposed to sediments in, the creeks; and c) adults and children who live near the creeks may fish there more often than elsewhere simply because of convenience.

Because of this assumption, OCC used an abbreviated exposure period of only 10 years. This assumption is not appropriately conservative. Adults should also be included. If adults let their children eat fish they catch, it is likely that the adults will also eat the fish, as well as children younger than eight. It is reasonable to expect that adults and children younger than eight will also fish in the creeks.

2) OCC Improperly Assumes that Only a Small Fraction of Fish Consumed are from the Creeks. OCC's assumption that only 1% to 10% of total fish ingested are from the creeks is certainly not conservative. A realistic worst case assumption is that 75% of fish eaten by local residents are from these creeks.

3) OCC Uses An Improper Assumption for Body Weight. OCC assumes an average body weight of 70 kg. Although 70 kg is an appropriate weight to use for adult risk assessments, OCC bases its risk calculations only on children ages 8 to 18. Thus, the body weight for its calculations is approximately two times too high.

4) OCC Improperly Uses Geometric Means. As discussed below, it is more appropriate to use arithmetic mean values rather than geometric mean values in determining the level of risk.

5) OCC Has Erred In Calculating ADI. OCC converted FDA's fish advisory level to an ADI using typical assumptions of body weight and fish consumption. As described later, OCC incorrectly stated the ADI units (at least for the FDA number). It should read 13 pg/day, not 13 pg/kg/day, for the FDA ADI. This error means that the calculations on page 9 overestimate "allowable levels" and "safety margins" by a factor of 70 because OCC erroneously double counted human body weight in arriving at an allowable daily intake in Table 2.

6) OCC Uses an Improper ADI Approach. OCC uses the "allowable daily intake" approach in calculating an appropriate safety factor. However, ADI is commonly used for non-carcinogens, not for carcinogens such as dioxin.

7) OCC used the FDA's advisory level of 25 ppt TCDD as its basis for calculating a margin of safety. However, using the risk assessment methodology accepted in the Hyde Park case, 25 ppt of TCDD in fish corresponds to a 7.8×10^{-4} risk. (Affidavit of Joseph V. Rodericks, Ph.D., In Support of Stipulation and Judgment Approving Settlement Agreement, December 11, 1985, United States v. Hooker Chemicals & Plastics Corp. (C.A. 79-989 W.D. N.Y.)).

Using OCC's unorthodox methodology and making different, but reasonable, assumptions and correcting OCC's errors, the calculated safety margin would be much lower than suggested by OCC; in fact, these may be no safety margin at all.

f. Position of New York DEC re Need to Remediate Creek Banks

OCC comments that the risk from direct exposure to the creek or bank sediments is not a basis for remediation. OCC quotes from a January 23, 1987 letter from DEC to EPA that excavation or other measures relative to the banks is not warranted.

Response: This letter from DEC was only one part of the correspondence and communications between the relevant agencies. The January 23, 1987 statement had been made without reviewing the pertinent sampling data. On February 13, 1987, DOH wrote the DEC to suggest that the banks be considered for inclusion in the remedial excavation to the extent warranted by sampling results. In March 1987, the representatives of the above agencies met and reviewed the composite sampling data results from May 1986. This review resulted in a determination that the data indicated TCDD probably above 1 ppb on the creek banks. Consequently, on May 29, 1987, John J. Willson of DEC again wrote to George Pavlou of EPA, this time to state that DEC believes "that the current plan to remediate the creek beds and banks complies with the intent of the (1985) ROD."

g. Position of New York DOH re Posting of Creeks

OCC quotes a letter from J. Hawley, Ph.D., to J.J. Willson, dated March 3, 1987 to the effect that DEC has concluded that the posting of the areas of Black and Bergholtz Creeks and Cayuga Creek to advise that no species of fish be consumed are "protective of the public health."

Response: Actually, the statement was made by DOH in its letter to DEC. Dr. Hawley in his statement referred only to Cayuga Creek, not to Black or Bergholtz Creeks. His statement was preceded by the important qualification that "(i)f followed" these measures would be protective. Dr. Hawley also wrote that "(t)he levels of 2,3,7,8-TCDD found in Bergholtz Creek are considerably in excess of the levels in Cayuga Creek" in the context of discussing the need for the dredging of Bergholtz Creek between Love Canal and Cayuga Creek.

h. Remedial Alternatives

OCC proposes three alternative remedial actions in its comments: 1) removal of fish from the creeks, 2) removal of the fish plus covering the stream beds with coarse aggregate, and 3) the first two options plus excavating six inches from

the stream beds, and placing the sediment under the expanded clay cap. OCC also recommends delaying taking any action until performing further risk assessment.

Response: OCC's proposals are similar to those considered and rejected during the process of selecting a remedy for the creeks because they do not adequately protect human health and the environment on a permanent basis.

As a general matter, delaying remediation does not adequately protect human health because delays in remediation would allow sediments to travel farther downstream, or in the event of severe storms, to be washed into yards along creek banks. Fencing and posting of the creeks would not eliminate the potential for human exposure and would do nothing to prevent further contamination of downstream creek and river reaches.

Clearing all fish from Black and Bergholtz creeks and preventing fish of "consumable size" from returning by installing a weir would not prevent the further downstream migration of contaminants. Nor would it reduce the possibility of human exposure to the contaminants, or reduce the possibility of fish coming in contact with dioxin contaminated sediments downstream from such a weir. The fish weir proposal would result in a further disturbance of the ecosystem, and would further degrade the quality of life in the area. In addition, fish weirs are inherently unreliable in the long term, as fish may be inadvertently or deliberately re-introduced to the cleared creeks by fishermen or other humans or by natural means such as deposition by birds of fish eggs originating from other near-by waters. This solution is contrary to the preference expressed in CERCLA § 121(b) for permanent remedies that significantly reduce or eliminate the toxicity, mobility, or volume of the hazardous substances.

Installing filter fabric and/or gravel fill over the creek beds could reduce sediment transport to the Niagara River after installation. However, during installation the sediment would be disturbed, resulting in increased downstream migration. After the filter or gravel is installed, leaching of the contaminants into the water column could still occur. Thus, this remedy is not considered adequately protective of human health or the environment, and does not satisfy the SARA mandate for remedies which reduce the mobility as well as the toxicity and volume of contaminants.

Excavating six inches of sediment from the creeks and placing it under the clay cap at Love Canal is not an

implementable alternative. After considering the limitations on construction/excavation techniques within the constraints of the Love Canal site, EPA has determined that to assure an adequate margin of safety on a permanent basis, approximately eighteen inches of sediment should be removed from the creeks. Furthermore, in its January 5, 1984 letter commenting on the remedial action alternatives for sewer and creek sediments, OCC recommended the excavation of 18 inches of sediment.

Even following dewatering, the effects of the weight of the sediments on the Canal contents, if placed under the Canal cap, could not be fully understood. Therefore, it is not appropriate to implement OCC's proposal to dispose of the sediments there.

To assure adequate protection of human health and the environment, and to satisfy the SARA mandate to select a permanent remedy which significantly reduces the toxicity, mobility, or volume of contaminants, Black and Bergholtz creeks must be remediated.

i. Use of Means In Evaluating Data

OCC's comments on pages 7 and 8 shows the geometric mean concentrations of TCDD in sediment, and uses these geometric means to argue that the existing level of TCDD contamination in the creeks is acceptable. Use of geometric mean values in this context is misleading and underestimates the average exposure to TCDD, based on the available data. Arithmetic mean values would be more appropriate for OCC's exposure scenarios. Risk is a function of total lifetime exposure, which is the sum of each exposure event. Since total exposure is an arithmetic sum, an arithmetic mean is the most meaningful representation of the average exposure concentration.

The arithmetic mean of the twenty positive TCDD sediments measurements is 12.7 ppb of TCDD. If the 24 "non-detect" samples are included at OCC's assigned value of 0.20 ppb, the arithmetic mean of the 44 samples is 5.4 ppb of TCDD. These two arithmetic means are 3.3 and 7.0 times higher than the geometric means, respectively.

j. Department of Health Sampling Results

OCC's comments on page 7, footnote 9, question the accuracy of the sampling results reported by DOH in a memorandum dated June 28, 1984. OCC comments that these results may be

overstated by about one-third. OCC had previously made comments on these sample results in its March 28, 1985 letter. This letter was responded to as part of the 1985 ROD, by letter of April 4, 1985 by CH_2M Hill because OCC's letter was submitted after the close of the comment period. CH_2M Hill stated that the Malcolm Pirnie report served as the basis for the Remedial Alternative Evaluation and Risk Assessment and that the data gathered by Malcolm Pirnie were subjected to quality assurance audit and clearly showed the presence of Love Canal related contaminants in the creeks.

If the DOH results reported in the June 28, 1984 memorandum are divided by two or even three, the result would still be levels of TCDD above 1 ppb. Additionally, OCC provides no information to form a basis for stating that the DOH laboratory did not meet generally acceptable standards of quality. This is the first time OCC has claimed that the DOH data packages are incomplete even though OCC has been receiving this information on a regular basis.

LOVE CANAL FEASIBILITY STUDY/PROPOSED PLAN

RESPONSIVENESS SUMMARY

INDIVIDUALS SUBMITTING COMMENTS INCLUDE:

Albond, Mr. Harvey
Bugman, Ms. Rose
Cardone, Ms. Barbara
Cook, Mr. Richard J.
Crafts, Ms. Susan D.
Dane, Mr. Thomas
De Darie, Ms. Linda
Devantier, Mr. Edward
Donovan, Mr. Gerald F.
Eldridge, Mr. Frank F.
Eldridges, Ms. Audrey
Giarrizzo, Mr. Sam
Hale, Ms. Joann
Hardcastle, Mr. Glenn
Hense, Mr. Paul
Hoffman, Ms. S. Margeen
Iadicicco, Ms. Violet
LaFalce, Hon. Rep. John G.
Lentine, Ms. Roberta
Lewis, Ms. Louise
LoVerid, Mr. Don
Lubick, Ms. Susan
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Moynihan, Hon. Sen. Patrick
Niagara County Legislature, The
Occidental Chemical Corporation
O'Connor, Mr. Lloyd
Pilliterre, Mr. Joseph T.
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Rhoney, Mr. Earl M.
Sanoin, Mr. Cory
Sobel, Mr. Ed
Soda, Mr. Frank A.
Volte, Mr. Bruno
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