Love Canal Emergency Declaration Area
Remediation of EDA 2 and 3

Final Study Report

May 1991

New York State Department of Health

2 University Place
Albany, New York 12203-3399

New York State Department of Environmental Conservation

50 Wolf Road
Albany, New York 12233-7010

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STATE OF NEW YORK - DEPARTMENT OF HEALTH

INTEROFFICE MEMORANDUM

TO: Distribution list

FROM: Edward G. Horn, Ph.D.,
Division of Environmental Health Assessment

SUBJECT: Love Canal Report

DATE: May 29, 1991

The attached report entitled *Love Canal Emergency Declaration Area: Remediation of EDA 2 and 3 - Final Study Report* was released at the Love Canal Technical Review Committee meeting in Niagara Falls, New York on May 15, 1991. The draft report, which was released on November 15, 1990, was slightly modified to more clearly identify its purpose. In addition, comments from the public and responses to these comments were incorporated in the report as Appendix D.

At the TRC meeting on May 15, the New York Department of Environmental Conservation also released a report entitled *Love Canal EDA 2 and 3: Cost Analysis Report* which assesses the cost of several alternative remedial actions. A press release (also attached) explains the next steps that will be taken regarding this part of the Love Canal EDA.

Thank you for your help with and/or interest in this project.

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Attachments

MAY 31 1991

NEWS BULLETIN

New York State Disaster Preparedness Commission

Thomas C. Jorling
Acting Chairman
State Coordinating Officer
New York State Commissioner
of Environmental Conservation

Contact: Benjamin A. Marvin
(518) 457-5400

FOR RELEASE: IMMEDIATE, WEDNESDAY, MAY 15, 1991

New York State Disaster Preparedness Commission Acting Chairman Thomas C. Jorling announced today a new initiative to determine the future use of Love Canal Areas 2 and 3, two of the areas which failed to meet the criteria for habitability in the 1988 Love Canal Habitability Study.

The Commission has directed the Love Canal Area Revitalization Agency (LCARA) to review new reports which analyze the cost of remediating Areas 2 and 3 to levels that would be acceptable for residential development under the habitability criteria. LCARA will revise its Master Plan and Generic Environmental Impact Statement and resubmit them to the Commission. A public hearing on LCARA's revised plan and impact statement will then be held by the Commission, with a final decision on LCARA's proposed land use to be made by the Commission shortly thereafter.

Mr. Jorling said: "Nearly 13 years ago, New York State and the federal government responded to the emergency at Love Canal by containing the source of contamination in the canal itself and relocating area residents. Since then, we have spent many millions of dollars to design and implement remedial activities to address the canal and the off-site impacts. As the restoration of a viable Love Canal community progresses, these are the steps we need to take to conclude the debate on the course that the revitalization should follow."

The 1988 habitability study concluded that the Love Canal Emergency Declaration Areas 2 and 3, while failing to meet the established criteria, could be habitable if contaminated soils were remediated to levels consistent with other areas. In July 1989, the Love Canal Land Use Advisory Committee recommended that the best use of Areas 2 and 3, if economically feasible, was residential. One year later, LCARA prepared a Land Use Master Plan which identified commercial development as its selected land use. Citing the apparent inconsistency, the Commission was unable to approve the portions of LCARA's master plan relating to Areas 2 and 3.

(Over)

To help resolve the economic feasibility question, the state Departments of Environmental Conservation and Health undertook two studies of the remediation requirements and their costs. The first study, by the Health Department, determined that the removal and replacement of six inches of soil would be sufficient to allow residential use. The second study, by DEC, evaluated the construction costs of remedial alternatives and found they would range from $7 million to $17 million. These reports have been provided to LCARA to assist the agency in its response to the Commission's previous findings.

LCARA has been requested to resubmit its Master Plan and Generic Environmental Impact Statement by July 1, 1991. The documents will be available for public review, and a public hearing will be held at a later date to receive comment on the revitalization proposal. After consideration of public comments and review of the chosen land use, the Disaster Preparedness Commission will issue its decision on the alternative selected by LCARA.

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List of Abbreviations Used

BHC	benzene hexachloride, an older name for HCCH
CDC	United States Department of Health and Human Services, Centers for Disease Control
cy	cubic yard
DCB	dichlorobenzene
EDA	Love Canal Emergency Declaration Area
GC-MS	gas chromatography - mass spectrometry
HCCH	hexachlorocyclohexane
HxCB	hexachlorobenzene
LCIC	Love Canal Indicator Chemical
ND	not detected
NYDEC	New York State Department of Environmental Conservation
NYDOH	New York State Department of Health
PETG	poly(ethylene terephthalate) - a copolyester plastic
ppb	part per billion, microgram per kilogram, nanogram per gram
TCB	trichlorobenzene
TeCB	tetrachlorobenzene
TRC	Love Canal Technical Review Committee

Acknowledgements

This project was jointly carried out by the New York Departments of Health (NYDOH) and Environmental Conservation (NYDEC). The cooperation of the following individuals was essential to the project:

Project design, management, and reporting

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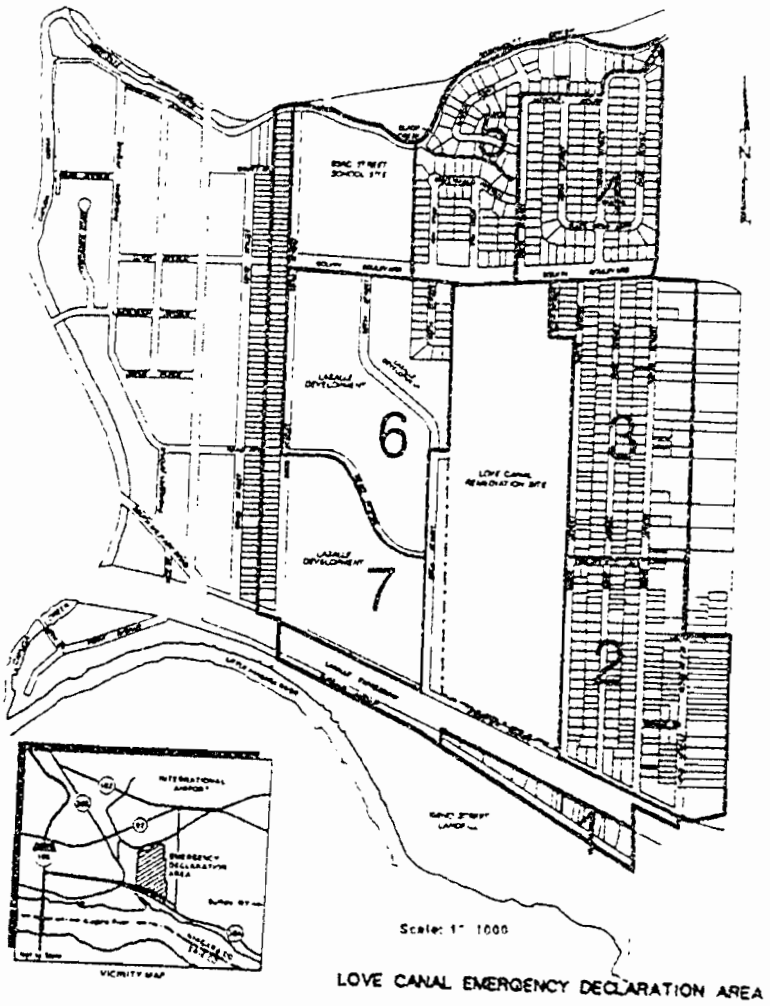
William Stasiuk	NYDOH	Center for Environmental Health
Charlene Thiemann	NYDOH	Health Liaison Program
Allison Wakeman	NYDOH	Environmental Exposure Investigation

Figure 1. Location of Love Canal Emergency Declaration Area and the sampling areas used in the Habitability Study. This map is modified from maps in Volume 3 of the Habitability Study Report (TRC, 1988).



Introduction

On September 27, 1988, Commissioner of Health David Axelrod issued a decision on the habitability of the Love Canal Emergency Declaration Area (EDA) (NYDOH, 1988). The decision was based on the application of criteria developed by the State and Federal governments (CDC and NYDOH, 1986) to sampling data generated and interpreted in the Habitability Study (TRC, 1988). Among other findings, the habitability decision concluded that the neighborhoods east of the Love Canal and south of Colvin Boulevard (EDA 2 and 3) did not meet the habitability criteria and therefore were "not suitable for normal residential use without remediation of the contaminated soil" (see Figure 1 for a location map of the Love Canal, the EDA and the sampling areas). Commissioner of Environmental Conservation Thomas Jorling has stated that the State will remediate the non-habitable area (EDA 2 and 3) if necessary, and the Department of Environmental Conservation (NYDEC) is prepared to evaluate this potential remediation of EDA 2 and 3.

As noted in the habitability decision, EDA 2 and 3 are not habitable because soils there contained levels of seven Love Canal Indicator Chemicals (LCICs) at statistically higher levels than in comparison neighborhoods in Niagara Falls and EDA 4-7. These statistical differences persisted when the comparisons were carried out on the data excluding the highest 10% of each LCIC reported in the area, and the differences diminished or vanished when reported values less than 1.0 or 2.0 ppb were excluded. Thus, these differences were found to be the consequence of overall low levels of LCICs (median soil concentrations of less than 2.0 ppb) found in EDA 2-3. Given this finding, remediation of soil in EDA 2-3 would be effective only if all surface soils are addressed, and the more traditional approach of identifying "hot spots" for remediation would not be effective.

The Habitability Study assessed levels of LCICs in the soil surface.[1] A primary alternative for remediation is soil removal and disposal. Removal of 12 inches of soil from the 81-acre EDA 2-3 area would produce about 80,000 cubic yards (cy) of soil for disposal, and removal of 3 or 6 inches would generate about 20,000 cy or 40,000 cy of soil, respectively, for disposal. Potential explanations for the LCIC levels found in the EDA (NYSDOH, 1988)[2] suggested that contamination could be limited to surface soils less than 12 inches deep. The removal of 3 or 6 inches of soil would be considerably less disruptive to the neighborhood and less difficult and costly to implement than the removal of 12 inches of soil. Therefore, this study was designed to determine whether removal of 3 or 6 inches would be adequate remediation for EDA 2 and 3.

Alternative remediation was considered and included treatment of the top 12 inches of soil, covering the entire area with 12 inches of topsoil without removal, and removing the

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[1] The depth of soil samples in the habitability study was 12 inches for 75% of samples and at least 7 inches for all samples (TRC, 1988, Vol V, p 5-7)

[2] NYDOH (1988) considered four possible pathways for movement of chemicals from the Love Canal to the EDA

1. migration through permeable surface soils including utility lines,
2. surface runoff of leachate along swales and through storm sewers,
3. airborne transport and precipitation of chemical gasses and contaminated fugitive dust, and
4. use of contaminated soil from the Love Canal as fill in the EDA

The pattern of contamination that was found in EDA 2 and 3 is most consistent with airborne transport and deposition/precipitation from the Love Canal particularly during the period of active dumping (1942-1953)

surface soil and replacing it with topsoil (EC Jordan, 1991). Treatment alternatives were not considered to be feasible, and covering the area was rejected because of difficulties with grading around streets, sidewalks, houses and large trees.

This report is not a Feasibility Study or Remediation Plan for EDA 2-3. Rather, the report is limited to an evaluation of the depth of soil in EDA 2-3 that would need to be removed to remediate soil contamination there. NYDEC has prepared a Cost Analysis Report which includes an explanation of how remediation would be conducted. After a final land use determination has been made for EDA 2-3, detailed design documents would be prepared if remediation is carried out.

Study objective

To determine whether elevated levels of Love Canal Indicator Chemicals (LCICs) in EDA 2-3 soils are significantly higher in the top 3 inches or top 6 inches than in the soil beneath these depths, or whether elevated levels extend to 12 inches. Mathematically, this means that the following inequalities should be statistically evaluated:

$$[LCIC]_{0\text{-}3} > [LCIC]_{3\text{-}12}$$

$$[LCIC]_{0\text{-}6} > [LCIC]_{6\text{-}12}$$

where $[LCIC]$ is the individual LCIC concentration in the specified depth of soil in the core.

Study design and methods

An evaluation of the inequalities described in the Study Objectives section required gathering cores of soil to a depth of 12 inches. The locations were selected to maximize the chance of detecting LCICs by identifying sample locations used in EDA 2 and 3 during the Habitability Study (TRC, 1988, Volume 3) that had the highest concentrations of chlorobenzenes and hexachlorocyclohexanes (HCCHs, referred to as BHCs in the Habitability Study) and obtaining new samples from these sample locations. Once collected, the cores were cut into three sections (0-3", 3-6", and 6-12") for analysis of LCICs. This permitted statistical comparison of LCIC concentrations in the top three inches (referred to as $[LCIC]_{0\text{-}3}$) to LCIC concentrations in the remainder of the core ($[LCIC]_{3\text{-}12}$) and of LCIC concentrations in the top six inches ($[LCIC]_{0\text{-}6}$) to LCIC concentrations in the bottom six inches ($[LCIC]_{6\text{-}12}$). Concentrations of LCICs in the top 6 inches ($[LCIC]_{0\text{-}6}$) and in the bottom 9 inches ($[LCIC]_{3\text{-}12}$), were estimated in the following manner:

$$[LCIC]_{0\text{-}6} = \frac{[LCIC]_{0\text{-}3} + [LCIC]_{3\text{-}6}}{2}$$

$$[LCIC]_{3\text{-}12} = \frac{[LCIC]_{3\text{-}6} + 2[LCIC]_{6\text{-}12}}{3}$$

where *[LCIC]* is the individual LCIC concentration in the specified depth of soil in the core.

The Wilcoxon signed rank test (Lehmann and D'Abrera, 1975 and McClave and Dietrich, 1988) was used to compare these concentrations. This statistical test required paired comparisons for each core and thus effectively compared LCIC concentrations at different depths within each core. The Wilcoxon rank sum test was used in the Habitability Study instead of the Wilcoxon signed rank test which requires paired data because it was not possible to identify sample pairs in the Habitability Study.

From December 4-8, 1989, samples were collected by NYDOH and NYDEC at 84 different locations at which the highest concentrations of LCICs were found in the Habitability Study (Figures 2 and 3). Soil cores were taken to 12 inches using an Environmentalist's Subsoil Probe sampler. The core was 0.9 inches in diameter and was collected into a PETG copolyester liner. The cores were labelled and placed in insulated boxes with "Blue Ice" to keep the cores cold. At the end of each day, all samples were sent by overnight mail to the Wadsworth Center for Laboratories and Research (Department of Health laboratories) in Albany. A detailed description of the sampling protocol and a copy of the sample shipment forms for each sample are in Appendix A.

The cores were cut into three sections in the laboratory. Soil from each of the three sections was analyzed for the soil LCICs (except chloronaphthalene), i.e.

α-HCCH	1,2-dichlorobenzene
β-HCCH	1,2,4-trichlorobenzene
δ-HCCH	1,2,3,4-tetrachlorobenzene
γ-HCCH	

Analysis was also carried out for hexachlorobenzene. Chloronaphthalene was not analyzed, because in the Habitability Study this chemical was found to be uniformly low in all areas tested, i.e. no significant differences were detected in any of the comparisons, median concentrations ranged from not detected to 0.07 ppb for all the areas tested, and the maximum level detected in any sample in the study was 0.32 ppb. Hexachlorobenzene was added because it was disposed at the Love Canal, and analysis for the chemical was simply carried out with the procedure being used. It had been rejected as a soil LCIC for the Habitability Study because of its relatively low potential for migration in groundwater and soil (CDC and NYDOH, 1986, Appendix 9).

The LCICs were extracted by steam distillation and analyzed by gas chromatography-mass spectrometry (GC-MS). See Appendix B for details.

Figure 2. Location of soil core samples collected in EDA 2 on December 4-8, 1989.

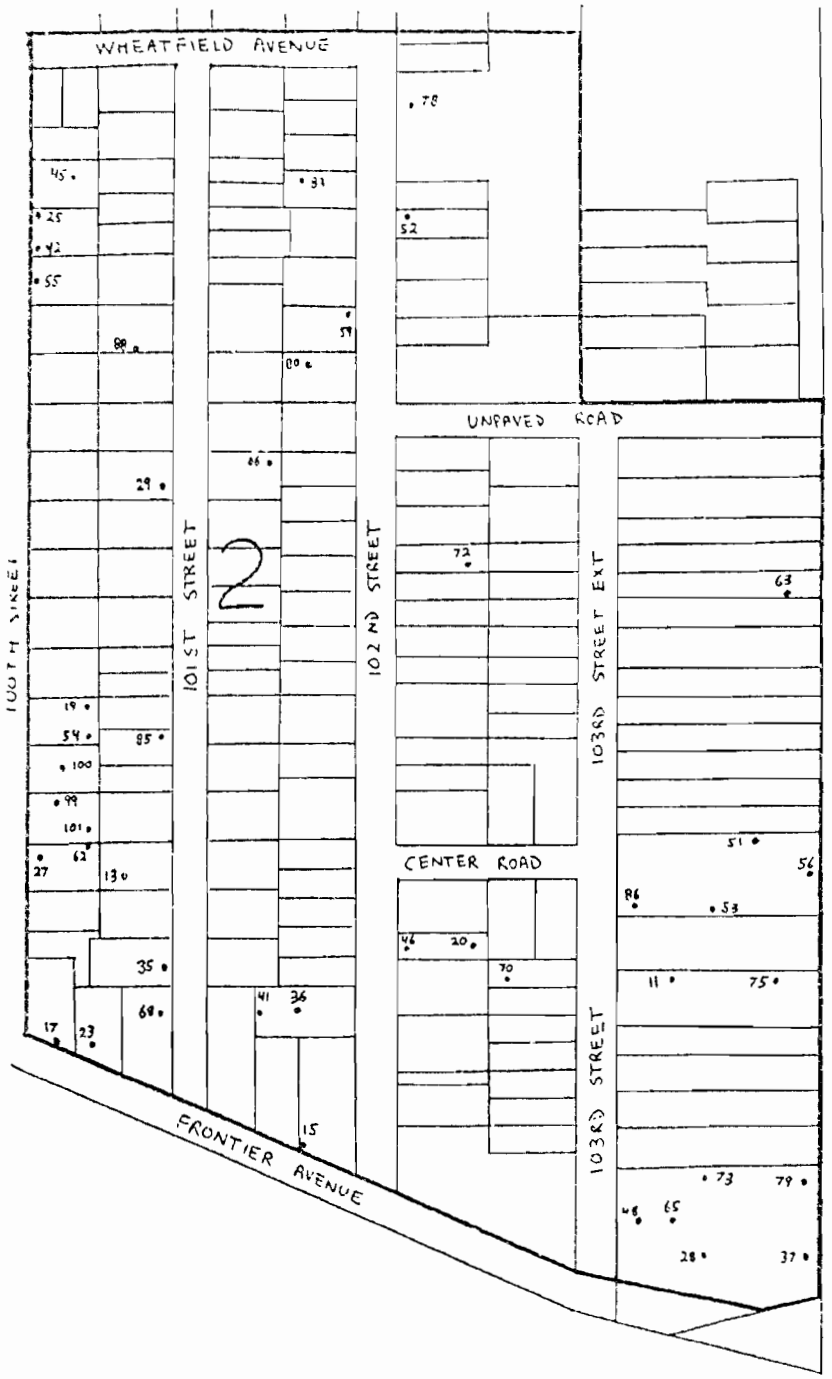

Figure 3. Location of soil core samples collected in EDA 3 on December 4-8, 1989.

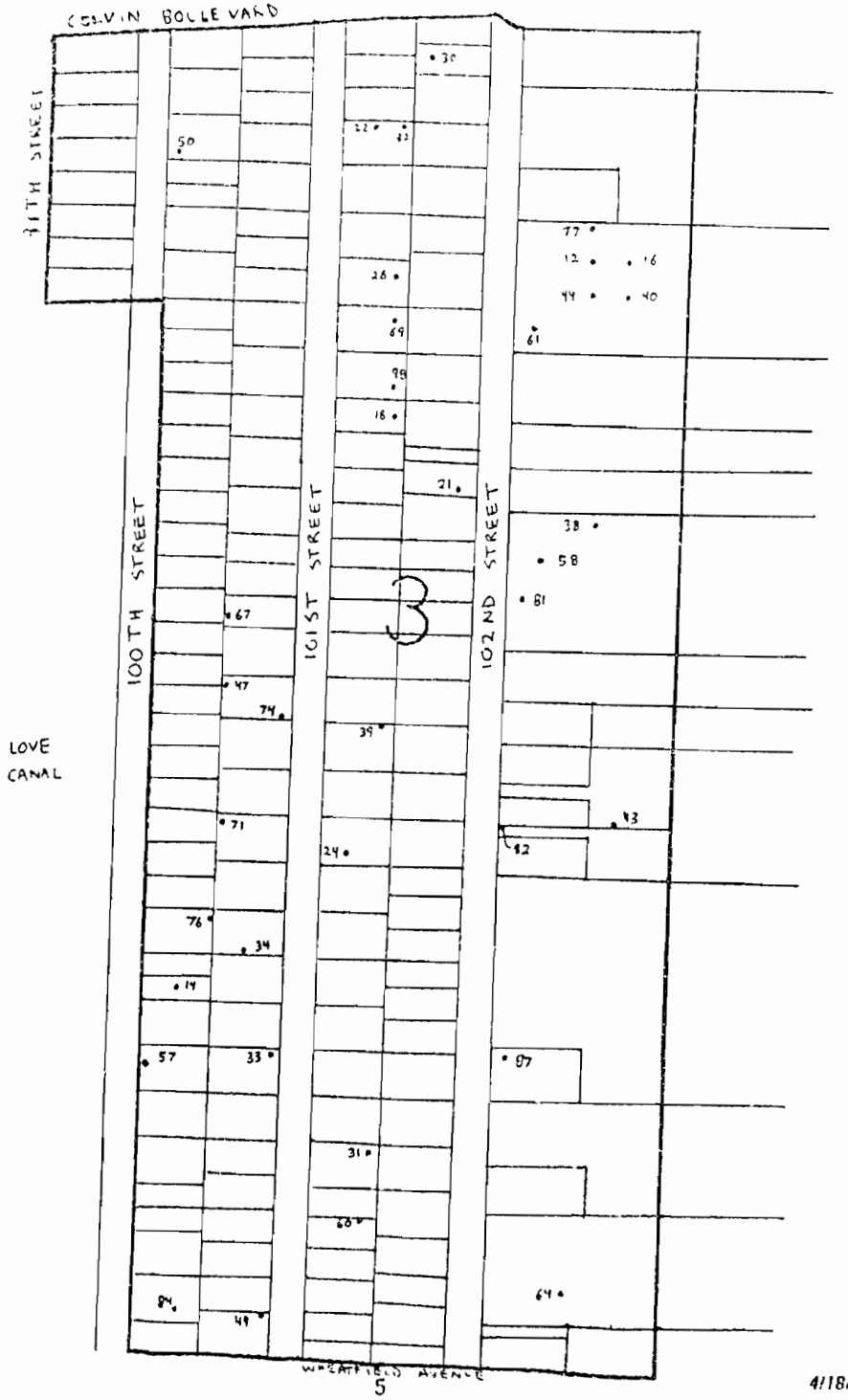

Figure 4. Percent of samples in which LCICs were detected. Total sample size is 243 (three samples each from 81 cores).

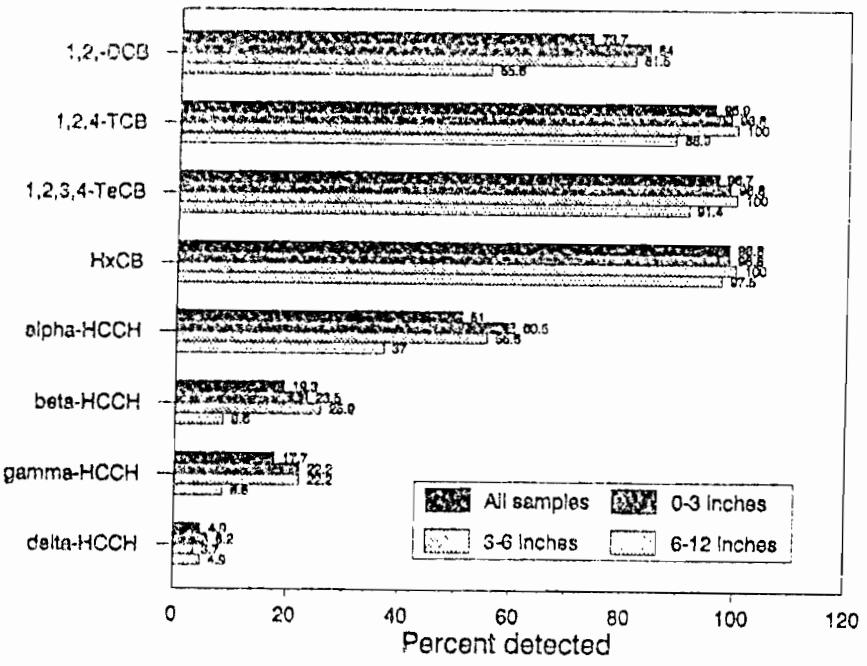

Table 1. Percent of samples with LCICs detected in sections of soil cores from EDA 2-3.

LCIC	0-3 inches	3-6 inches	6-12 inches	All samples
1,2-dichlorobenzene	84.0	81.5	55.6	73.7
1,2,4-trichlorobenzene	98.8	100.0	88.9	95.9
1,2,3,4-tetrachlorobenzene	98.8	100.0	91.4	96.7
hexachlorobenzene	98.8	100.0	97.5	98.8
α-HCCH	60.5	55.6	37.0	51.0
β-HCCH	23.5	25.9	8.6	19.3
γ-HCCH	22.2	22.2	8.6	17.7
δ-HCCH	6.2	3.7	4.9	4.9

Results

Descriptive statistics

Core samples were collected from 84 locations in the sample area. Three cores were found by the laboratory to be less than the full 12 inches and were therefore not analyzed. Thus, analytical results were obtained for 81 cores (Appendix C).

Figure 4 and Table 1 present the percent of samples in which LCICs were detected. The chlorobenzenes were detected in the majority of samples and more frequently in the top 6 inches of the cores than in the lower 6 inches. The HCCHs were detected less frequently than chlorobenzenes in the samples. However, the pattern of contamination was similar, i.e. HCCHs were detected more frequently in the top 6 inches than the lower 6 inches of the cores.

In samples where LCICs were not detected, the detection limit was reported. The medians of these detection limits are reported in Table 2 and depicted in Figure 5. Detection limits were generally uniform with overall medians for each LCIC between 0.5 and 1.3 ppb except for hexachlorobenzene which was 0.3 ppb. Median detection limits of LCICs in the 0-3" samples and the 3-6" samples were not very different from one another. However, median detection limits of LCICs in the lower 6 inches (6-12") of the cores were somewhat less than in the top 6 inches of the cores, particularly for the chlorobenzenes.

Statistical comparisons

Critical values (*z* values) and one-tailed probabilities were calculated by the Wilcoxon signed rank test for three pairs of core sections (Table 3). LCIC concentrations in the top 3 inches of the cores are generally greater than in the bottom 9 inches of the core samples. However, for two of the LCICs (β- and δ-HCCH) the differences are not statistically significant at the 5% or 1% level. Except for δ-HCCH, LCIC concentrations are all significantly greater at the 5% level in the top 6 inches than in the bottom 6 inches. It is likely that the statistical comparisons for δ-HCCH are weaker than for the other LCICs because only 7 cores had detectable δ-HCCH.

Although most of the LCIC concentrations in the top 3 inches are greater than in the lower 9 inches of the core, this difference is largely the consequence of much lower concentrations of LCICs in the bottom 6 inches of each core compared to the top 6 inches of each core. Concentrations of LCICs in the 0-3" section and in the 3-6" section of each core were also statistically compared by a Wilcoxon signed rank test (Table 3). Concentrations of LCICs in the 0-3" samples were not significantly greater than those in the 3-6" samples at the 1% level of significance, and at the 5% level of significance only trichlorobenzene and α-HCCH were significantly more concentrated at the top of the core (i.e. in the 0-3" samples).

These results indicate that LCIC concentrations in the surface 3 inches and next 3 inches of soil are not significantly different from one another. However, LCICs in the top 6 inches of soil are significantly more concentrated than in the next 6 inches. This can be seen clearly in Figure 6 and Table 4 and suggests that removal of 6 inches of soil will reduce the concentration of LCICs at the surface. As explained below, this reduction in soil LCIC concentrations will be sufficient to satisfy the Habitability Criteria.

Figure 5. Median detection limits for samples where LCIC was not detected. Total sample size is 243 (three samples each from 81 cores).

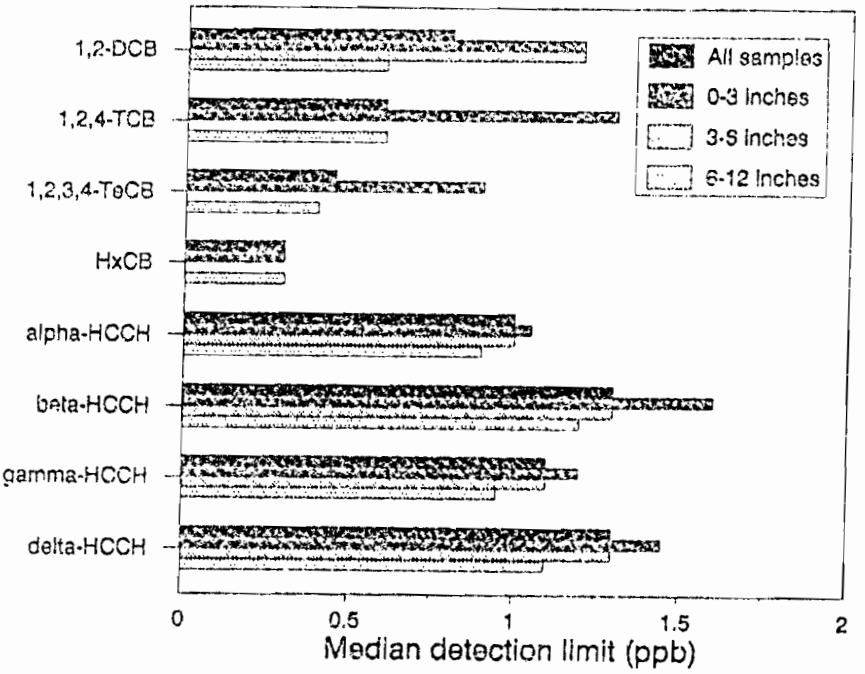

Table 2. Median detection limits for LCIC concentrations (ppb) in sections of soil cores from EDA 2-3.

LCIC	0-3 Inches N	0-3 Inches Median	3-6 Inches N	3-6 Inches Median	6-12 Inches N	6-12 Inches Median	All samples N	All samples Median
1,2-dichlorobenzene	13	1.20	15	1.20	36	0.60	64	0.80
1,2,4-trichlorobenzene	1	1.30	0	-	9	0.60	10	0.60
1,2,3,4-tetrachlorobenzene	1	0.90	0	-	7	0.40	8	0.45
hexachlorobenzene	1	0.30	0	-	2	0.30	3	0.30
α-HCCH	32	1.05	36	1.00	51	0.90	119	1.00
β-HCCH	62	1.80	60	1.30	74	1.20	196	1.30
γ-HCCH	63	1.20	63	1.10	74	0.95	200	1.10
δ-HCCH	76	1.45	78	1.30	77	1.10	231	1.30

Table 3. Comparison of LCIC concentrations in various portions of cores from EDA 2-3. The z value is the calculated normal variate from the Wilcoxon signed rank test and p is the probability (one-tailed) that the inequality statement is true. NDs were treated as 0 values.

LCIC	0-3" > 3-12"			0-6" > 6-12"			0-3" > 3-6"		
	z	p	N	z	p	N	z	p	N
1,2-dichlorobenzene	3.5690	0.9998	74	5.0371	1.0000	74	1.0762	0.8591	69
1,2,4-trichlorobenzene	4.0656	1.0000	81	5.7747	1.0000	80	1.8962	0.9710	79
1,2,3,4-tetrachlorobenzene	4.0656	1.0000	81	5.7959	1.0000	81	1.5132	0.9349	80
hexachlorobenzene	2.1046	0.9823	81	3.8682	0.9999	80	-2.2327	0.0128	80
α-HCCH	3.6317	0.9999	62	5.0655	1.0000	62	1.7758	0.9621	57
β-HCCH	1.2253	0.8898	27	1.8139	0.9652	27	0.8476	0.8017	25
γ-HCCH	2.1083	0.9825	29	3.1246	0.9991	29	1.5977	0.9449	27
δ-HCCH	1.1832	0.8816	7	0.8452	0.8010	7	1.3628	0.9135	6

EDA 2 and 3 were declared not habitable because the Habitability Study found concentrations of LCICs in the surface soils (up to 12") from that area were significantly greater than concentrations of the same chemicals in surface soils from the Niagara Falls comparison areas. To be successful, remediation of surface soil in EDA 2 and 3 should leave LCIC concentrations in surface soil that are less than or equal to LCIC concentrations that would be expected in the Niagara Falls comparison areas. This comparison cannot be directly carried out for at least two reasons. The cores in this study were taken from those locations with the highest LCICs found in EDA 2 and 3 in the Habitability Study. Thus, the median concentrations of LCICs from this study would be expected to be greater than those found in the Habitability Study for this reason alone. In addition, any differences that might be observed could be the result of slight differences in analytical methodology used in the two studies and not actual soil concentrations.

Another approach to determining whether the amount of reduction in concentration of LCICs would be adequate is to first estimate from the Habitability Study how much more contaminated EDA 2 and 3 soils are relative to soils from the comparison areas. If the surface soil after remediation has been reduced by at least that amount, remediation could be considered adequate. For example, assume that the Habitability Study found that the soil concentration of an LCIC was twice as great in EDA 2 and 3 as in the comparison areas. Then, remediation would be effective if the current concentration of that LCIC in the surface soil could be reduced by at least half of the concentration found.

In the Habitability Study, median concentrations of LCICs in EDA 2 and 3 relative to the comparison areas were somewhat variable for each of the LCICs. Where it could be determined (for the chlorobenzenes and α-HCCH), the median LCIC concentration in EDA 2 and 3 was between 1 and 2 times greater than the median LCIC concentration in the Niagara Falls comparison areas (Table 5). This ratio could not be determined for the other HCCHs because the median concentration for these chemicals was below the analytical detection limit in the comparison areas.

In this study, median concentrations of chlorobenzenes in the top 6 inches of the cores were 2 to 4 times greater than in the bottom 6 inches of the cores (Table 6). For most of the HCCHs, the median concentrations were less than the analytical detection limit, and therefore the amount of difference could not be calculated. Therefore, removal of the top 6 inches of soil in EDA 2 and 3 would leave soils that have chlorobenzene concentrations that would be 25% to 50% of the present surface concentrations. It is not possible to say what the consequences of removing 6 inches would be for HCCHs. In this study, the median concentration

Figure 6. Median LCIC concentrations (ppb) in sections of soil cores from EDA 2-3.

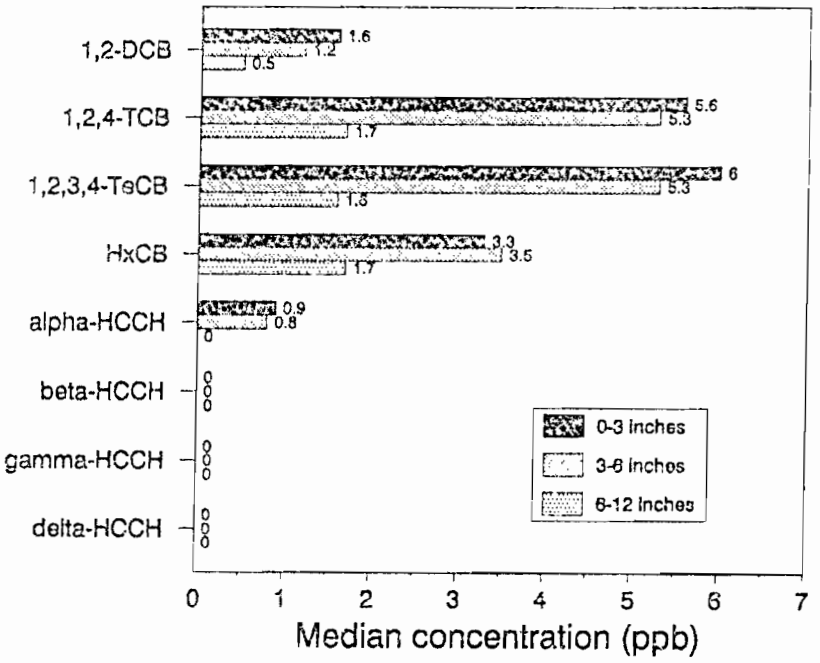

Table 4. Median LCIC concentrations (ppb) in sections of soil cores from EDA 2-3.

LCIC	0-3 inches N	0-3 inches Median	3-6 inches N	3-6 inches Median	6-12 inches N	6-12 inches Median
1,2-dichlorobenzene	81	1.60	81	1.20	81	0.50
1,2,4-trichlorobenzene	81	5.60	81	5.30	81	1.70
1,2,3,4-tetrachlorobenzene	81	6.00	81	5.30	81	1.60
hexachlorobenzene	81	3.30	81	3.50	81	1.70
α-HCCH	81	0.90	81	0.80	81	ND
β-HCCH	81	ND	81	ND	81	ND
γ-HCCH	81	ND	81	ND	81	ND
δ-HCCH	81	ND	81	ND	81	ND

Isomers of Hexachlorocyclohexane

Table 5. Median concentrations in parts per billion (ppb) of LCICs in soil from EDA 2-3 and the Niagara Falls Comparison Areas.

LCIC	EDA 2-3		NF Comparison Areas[1]		Ratio[2]
	N	Median	N	Median	
DCB	141	0.40	108	0.41	1.00
TCB	155	0.89	113	0.64	1.39
TeCB	154	1.09	111	0.56	1.95
α-HCCH[3]	154	0.29	113	0.14	1.43
β-HCCH[3]	147	0.17	103	ND	-
δ-HCCH[3]	151	ND	111	ND	-
γ-HCCH[3]	152	0.01	113	ND	-

[1] The NF Comparison Areas were Census Tracts 221 and 225. Values listed are combined for the two comparison areas.

[2] Ratio is: $\frac{\textit{median concentration in EDA 2\&3}}{\textit{median concentration in NF Comparison Areas}}$

[3] Referred to as BHCs in the Habitability Study Reports (TRC, 1988).

Table 6. Median concentrations in parts per billion (ppb) of LCICs in cores of soil from EDA 2-3.

LCIC	0-6 inches[1]		6-12 inches		Ratio[2]
	N	Median	N	Median	
DCB	81	1.55	81	0.50	3.10
TCB	81	6.20	81	1.70	3.65
TeCB	81	6.70	81	1.60	4.19
HxCB	81	3.65	81	1.70	2.15
α-HCCH	81	0.80	81	ND	-
β-HCCH	81	ND	81	ND	-
δ-HCCH	81	ND	81	ND	-
γ-HCCH	81	ND	81	ND	-

[1] The concentration for the top 6 inches of soil (0-6" section) in each core was estimated from the following:

$$\frac{[LCIC]_{0\text{-}3} + [LCIC]_{3\text{-}6}}{2}$$

[2] Ratio is:

$$\frac{\textit{median concentration in 0-6 inch core section}}{\textit{median concentration in 6-12 inch core section}}$$

of α-HCCH in the top 6 inches of soil was 0.8 ppb, and in the bottom 6 inches it was below the detection limit. Therefore, the concentration of α-HCCH will be reduced by the removal of 6 inches of soil, but the extent of the reduction cannot be determined.

Conclusions

In soil core samples from EDA 2 and 3, LCICs were more frequently detected in the top 3 inches and the next 3 inches than in the bottom 6 inches of the 12-inch cores. Median LCIC concentrations in the top 3 inches and next 3 inches were not significantly different; however, median concentrations of LCICs in the top 6 inches of the cores were significantly greater than concentrations in the next 6 inches of soil, being 2 to 4 times higher in the top 6 inches, depending on LCIC. In the Habitability Study, LCIC concentrations in EDA 2 and 3 were less than 2 times higher than LCIC concentrations in the Niagara Falls comparison areas.

Because the LCIC concentrations in the top 3 inches of soil were not significantly different from concentrations in the next 3 inches and, for two of the LCICs, not significantly different from concentrations in the next 9 inches of soil, removal of 3 inches of soil would not be adequate remediation of EDA 2 and 3. However, removal of 6 inches of soil from EDA 2 and 3 will leave LCIC concentrations in the soil that are significantly less than what is there now. Such a removal would reduce the soil LCIC concentrations at the surface to a greater extent than the difference in LCIC concentrations between EDA 2 and 3 and the comparison area soils measured in the Habitability Study. Thus, removal of 6 inches of soil from EDA 2 and 3 would be sufficient to remediate the area to permit residential use, i.e. to satisfy the conditions of habitability established for the Love Canal EDA (CDC and NYDOH, 1986). Such remediation is not required to permit commercial or industrial use.

References

Centers for Disease Control and New York Department of Health. December 1986. Love Canal Emergency Declaration Area: Proposed Habitability Criteria.

EC Jordan. May 1991. Love Canal EDA 2 and 3. Cost Analysis Report. New York Department of Environmental Conservation, Superfund Standby Contract, Work Assignment No. D002472-8.

Lehmann, EL and HJM D'Abrera. 1975. *Nonparametrics: Statistical Methods Based on Ranks*. Holden-Day, Inc., Oakland, CA.

McClave, JT and FH Dietrich, II. 1988. *Statistics*, Fourth Edition. Dellen Publishing Company, San Francisco, CA.

Technical Review Committee. 1988. Love Canal Emergency Declaration Area Habitability Study Final Report.

Volume I - Introduction and Decision-Making Documentation, May 1988. 80 pp.
Volume II - Air Assessment - Indicator Chemicals, February 1988. 54 pp.
Volume III - Soil Assessment - Indicator Chemicals, May 1988. 313 pp.
Volume IV - Soil Assessment - 2,3,7,8-TCDD, March 1988. 51 pp.
Volume V - Peer Review Summary - TRC Response, July 1988. 477 pp.

New York Department of Health. September 1988. Love Canal Emergency Declaration Area Decision on Habitability. 36 pp.

Appendix A. Sampling Protocol and Shipment Forms

Soil Sampling Protocol for Love Canal Sampling
Week of 12/4/89

1. After determining locations from previous selected lots, triangulate exact sampling locations using measuring tape and permanent points (i.e. telephone poles, fire hydrants, manhole covers, sewer grates, street curbs). Record in field notes.

2. Prepare soil sampling probe by removing probe cutting shoe by unscrewing, inserting a clean 18" copolyester tube liner into the bottom hollow stem of the probe, inserting an 18" stainless steel tube into the top of the probe (serves as a spacer), and then screwing on the probe cutting shoe (hand tight).

3. Insert the probe into the soil sampler body.

4. Position the soil sampler over the sampling location, perpendicular to the ground surface and affix the hammer assembly.

5. Drive the probe into the surficial soil to a depth of at least 14" using the 12.5 pound drop-hammer (the hammer was marked with tape to denote the sample depth desired).

6. Extract the probe from the soil using the soil sampler jack assembly.

7. Within the sampling van, unscrew the probe cutting shoe (a pipe wrench is sometimes necessary) and remove.

8. Remove the inner tube from the sampling probe by inserting a wooden dowel into the opposite end of the probe and gently pushing on the spacer tube. The sample tube full of soil is then withdrawn from the bottom end.

9. Measure length of sample in tube. If greater than 14", go to step 10. If less than 14", return sample to ground, discard used sample tube and go to step 14.

10. Affix teflon tape to the top end of the tube and cover with a red vinyl cap provided with the tube. Repeat the procedure for the bottom end of the tube using a black vinyl cap.

11. Wipe the outside of the tube with a dry paper towel to remove soil residue.

12. Place the sample tube in a cooler at 4 degrees C., no liquid ice is to be used.

13. Complete request for analysis form.

14. Clean the sampler body assembly (probe bottom end and cutting shoe) with deionized water and Tide liquid laundry soap. A final rinse with deionized water was used to remove the soap residue.

15. Place a new clean tube into the sampling probe and repeat procedure.

16. Ship samples by 5:00 p.m. each day to NYSDOH Wadsworth Laboratory using chain of custody procedures and Emery overnight delivery.

89362PRO0190

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ALBANY, N.Y. 12201

Cooler A-10

CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
BATCH #4026				
895133 895134 895135	771 102nd St.	12-4-89 11:22	Core 77	Soil
895136 895137 895138	771 102nd St.	12-4-89 11:33	Core 12	Soil
895139 895140 895141	771 102nd St.	12-4-89 11:44	Core 44	Soil
895142 895143 895144	771 102nd St.	12-4-89 11:55	Core 40	Soil
BATCH #4027				
895145 895146 895147	771 102nd St.	12-4-89 12:05	Core 16	Soil
895148 895149 895150	771 102nd St.	12-4-89 12:15	Core 61	Soil
895151 895152 895153	759 101st St.	12-4-89 12:26	Core 26	Soil
895154 895155 895156	753 101st St.	12-4-89 12:40	Core 69	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	[illegible]	NYSDOH	12-4-89	16:55
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by	[illegible]	NYS DOH Lab	12-5-89	[illegible]
11. Sample Accessioned by	[illegible]	NYS DOH Lab	12-5-89	[illegible]

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Cooler A-10

CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

BATCH # 4028

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895157 895158 895159	Lot C West of 10016	12-4-89 15:30	Core 23	Soil
895160 895161 895162	10,004 Frontier Ave	12-4-89 15:38	Core 17	Soil
895163 895164 895165	10016 Frontier Ave.	12-4-89 15:47	Core 68	Soil
895166 895167 895168	404 101st St.	12-4-89 15:55	Core 35	Soil
			Total Shipment: 12 cores	

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify)

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark E. VanValkenburg	NYSDOH	12-4-89	16:35
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by	G.H. Richards	NYSDOH/Lab	12-5-89	10:30
11. Sample Accessioned by	A.J. Hoffman	NYSDOH/Lab	12-5-89	11:00

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CHAIN OF CUSTODY RECORD

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SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
	513 100th St.	12-5-89 9:30	Love Canal EDA 2+3 Core 45	Soil
	Lot B N. of 509	12-5-89 9:36	Love Canal EDA 2+3 Core 25	Soil
	Lot B N. of 509	12-5-89 9:44	Love Canal EDA 2+3 Core 42	Soil
	509 100th St.	12-5-89 9:59	Love Canal EDA 2+3 Core 55	Soil
	431 100th St.	12-5-89 10:11	Love Canal EDA 2+3 Core 100	Soil
427	~~431~~ 100th St.	12-5-89 10:19	Love Canal EDA 2+3 Core 101	Soil
	435 100th St.	12-5-89 10:55	Love Canal EDA 2+3 Core 19	Soil
	435 100th St.	12-5-89 11:05	Love Canal EDA 2+3 Core 54	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Jack E. VanValkenburg	NYSDOH	12-6-89	~~12:35~~ MCVJ
5. Sample Received by				16:35
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by				

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CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
423	427 100th St.	12-5-89 11:13	Love Canal EDA 2+3 Core 27	Soil
	413 103rd St.	12-5-89 13:55	Love Canal EDA 2+3 Core 65	Soil
	413 103rd St.	12-5-89 14:01	Love Canal EDA 2+3 Core 48	Soil
	413 103rd St.	12-5-89 14:08	Love Canal EDA 2+3 Core 73	Soil
	413 103rd St.	12-5-89 14:16	Love Canal EDA 2+3 Core 79	Soil
	413 103rd St.	12-5-89 14:25	Love Canal EDA 2+3 Core 37	Soil
	413 103rd St.	12-5-89 14:36	Love Canal EDA 2+3 Core 28	Soil
	Lot 8 N. of 423	12-5-89 14:56	Love Canal EDA 2+3 Core 11	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ N&OH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark E. VanValkenburg	NYSDOH	12-5-89	16:35
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by				

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CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
	Lot B N. of #23	12-5-89 15:07	Love Canal EDA 2+3 Core 7.5	Soil
			Total Shipments 17 cores	

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark E. VanValkenburg	NYSDOH	12-5-89	16:35
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by				

1 cooler

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CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895257 895258 895259	796 102nd St.	12-6-89 11:37	Love Canal EDA 2+3 Core 30	Soil
895260 895261 895262	736 102nd St.	12-6-89 11:45	Love Canal EDA 2+3 Core 21	Soil
895263 895264 895265	Lot G S. of 775	12-6-89 11:52	Love Canal EDA 2+3 Core 38	Soil
895266 895267 895268	Lot G S. of 775	12-6-89 11:59	Love Canal EDA 2+3 Core 58	Soil
895269 895270 895271	Lot DD 102nd St.	12-6-89 12:23	Love Canal EDA 2+3 Core 43	Soil
895272 895273 895274	619 102nd St.	12-6-89 12:36	Love Canal EDA 2+3 Core 64	Soil
895275 895276 895277	Lot N S. of 593	12-6-89 12:44	Love Canal EDA 2+3 Core 78	Soil
895278 895279 895280	521 102nd St.	12-6-89 12:50	Love Canal EDA 2+3 Core 52	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	[illegible]	NYSDOH	12-6-89	17:10
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by		NYSDOH	12/7/89	1340
11. Sample Accessioned by	[illegible]			

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CHAIN OF CUSTODY RECORD

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SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895281 895283 895282	481 102nd St.	12-6-89 12:56	Love Canal EDA 2+3 Core 72	Soil
895284 895286 895285	433 102nd St.	12-6-89 13:04	Love Canal EDA 2+3 Core 46	Soil
895287 895289 895288	433 102nd St.	12-6-89 13:11	Love Canal EDA 2+3 Core 20	Soil
895290 895292 895291	Lot C S. of 432	12-6-89 13:17	Love Canal EDA 2+3 Core 36	Soil
895293 895295 895294	Lot C S. of 432	12-6-89 13:23	Love Canal EDA 2+3 Core 41	Soil
895296 895298 895297	10114 Frontier	12-6-89 13:30	Love Canal EDA 2+3 Core 15	Soil
895299 895301 895300	Lot H N. of 432	12-6-89 13:43	Love Canal EDA 2+3 Core 70	Soil
895302 895304 895303	465 103rd St	12-6-89 13:50	Love Canal EDA 2+3 Core 53	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

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CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark E VanValkenburg	NYSDOH	12-6-89	17:10
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by	[illegible]	NYSDOH	12/7/89	1340

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CHAIN OF CUSTODY RECORD

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SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895305 895306 895307	465 103rd St.	12-6-89 13:57	Love Canal EDA 2+3 Core 56	Soil
895308 895309 895310	465 103rd St.	12-6-89 14:07	Love Canal EDA 2+3 Core 51	Soil
895311 895312 895313	483 103rd St.	12-6-89 14:19	Love Canal EDA 2+3 Core 63	Soil
895314 895315 895316	512 102nd St.	12-6-89 14:56	Love Canal EDA 2+3 Core 59	Soil
895317 895318 895319	490 101st St	12-6-89 15:17	Love Canal EDA 2+3 Core 29	Soil
895320 895321 895322	493 101st St.	12-6-89 15:25	Love Canal EDA 2+3 Core 66	Soil
895323 895324 895325	434 101st St.	12-6-89 15:53	Love Canal EDA 2+3 Core 13	Soil
895326 895327 895328	423 100th St	12-6-89 16:01	Love Canal EDA 2+3 Core 62	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark E. Monteleone	NYSDOH	12-6-89	17:10
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by		NYSDOH	12/7/89	1540
11. Sample Accessioned by				

Dec carbon

page 1

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CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895347 895347 895348	427 100th St.	12-7-89 8:57	Love Canal EDA 2+3 Core 99	Soil
895350 895352 895351	787 100th St.	12-7-89 10:57	Love Canal EDA 2+3 Core 50	Soil
895353 895355 895354	789 101st St.	12-7-89 11:05	Love Canal EDA 2+3 Core 22	Soil
895356 895358 895357	789 101st St.	12-7-89 11:10	Love Canal EDA 2+3 Core 32	Soil
895359 895361 895360	753 101st St.	12-7-89 11:18	Love Canal EDA 2+3 Core 98	Soil
895362 895364 895363	Lot K N. of 735	12-7-89 11:34	Love Canal EDA 2+3 Core 18	Soil
895365 895367 895366	710 101st St.	12-7-89 11:40	Love Canal EDA 2+3 Core 67	Soil
895368 895370 895369	702 101st St.	12-7-89 11:50	Love Canal EDA 2+3 Core 47	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify)

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark E. Brackbill	NYSDOH	12-7-89	17:15
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by		NYS DOH	12/8/89	1145

One cooler

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CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895371 895373 895372	702 101st St.	12-7-89 11:56	Love Canal EDA 2+3 Core 74	Soil
895374 895376 895375	697 101st St.	12-7-89 12:01	Love Canal EDA 2+3 Core 39	Soil
895377 895379 895378	685 101st St.	12-7-89 12:07	Love Canal EDA 2+3 Core 24	Soil
895380 895382 895381	Lot E 100th St.	12-7-89 12:13	Love Canal EDA 2+3 Core 71	Soil
895383 895385 895384	668 101st St.	12-7-89 12:20	Love Canal EDA 2+3 Core 34	Soil
895386 895388 895387	669 100th St.	12-7-89 12:27	Love Canal EDA 2+3 Core 76	Soil
895389 895391 895390	657 100th St.	12-7-89 12:42	Love Canal EDA 2+3 Core 14	Soil
895392 895394 895393	646 101st St.	12-7-89 13:12	Love Canal EDA 2+3 Core 33	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark E. VanValkenburg	NYSDOH	12/7/89	17:15
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by	[signature]	NYS DOH	12/8/89	11:45

One cooler

page 3

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
ALBANY, N.Y. 12201

CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895395 895397 895396	602 101st St.	12-7-89 13:20	Love Canal EDA 2+3 Core 49	Soil
895398 895400 895399	6145 100th St.	12-7-89 14:00	Love Canal EDA 2+3 Core 57	Soil
			Total Shipment: 18 cores	

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Nyles E. VanVallenburg	NYSDOH	12/7/89	17:15
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by	[illegible]	NYS DOH	12/8/89	1145

One cooler

801

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
ALBANY, N.Y. 12201

CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895401, 895402, 895403	Lot H S. of 639	12-8-89 9:06	Love Canal EDA 2+3 Core 31	Soil
895404 895406 895405	621 101st St.	12-8-89 9:20	Love Canal EDA 2+3 Core 60	Soil
895407 895409 895408	512 102nd St.	12-8-89 9:45	Love Canal EDA 2+3 Core 59 - Resample	Soil
895410 895412 895411	465 103rd St.	12-8-89 10:00	Love Canal EDA 2+3 Core 56 - Resample	Soil
895413 895415 895414	465 103rd St.	12-8-89 10:07	Love Canal EDA 2+3 Core 86	Soil
895416 895418 895417	510 102nd St.	12-8-89 10:14	Love Canal EDA 2+3 Core 80	Soil
895419 895421 895420	542 102nd St.	12-8-89 10:25	Love Canal EDA 2+3 Core 83	Soil
895422 895424 895423	510 101st St.	12-8-89 10:36	Love Canal EDA 2+3 Core 88	Soil

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	Mark S. Vanderbilt Jr.	NYSDOH	12-8-89	14:00
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by		NYS DOH	12/5/89	1115
11. Sample Accessioned by				

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER FOR LABORATORIES AND RESEARCH
ALBANY, N.Y. 12201

CHAIN OF CUSTODY RECORD

Must be completed for samples which might be used for enforcement proceedings or litigation.

SAMPLE ID (LAB USE ONLY)	FIELD REFERENCE NO.	DATE/TIME COLLECTED	SAMPLE COLLECTION POINT	TYPE: WATER, AIR SOIL, ETC.
895425 895427 895426	454 101st St.	12-8-89 10:47	Love Canal EDA 2+3 Core 85	Soil
895428 895430 895429	641 100th St.	12-8-89 10:56	Love Canal EDA 2+3 Core 84	Soil
895431 895433 895432	Lot G S. of 775	12-8-89 11:10	Love Canal EDA 2+3 Core 81	Soil
895434 895436 895435	679 102nd St.	12-8-89 11:16	Love Canal EDA 2+3 Core 82	Soil
895437 895439 895438	639 102nd St	12-8-89 11:31	Love Canal EDA 2+3 Core 87	Soil
			Total Shipment: 13 cores	

SPECIFY METHOD OF PRESERVATION

- ☐ NaOH
- ☒ Cool, 4°C
- ☐ Acidification (specify)
- ☐ Other (specify

TRANSPORTING SAMPLES

DURING TRANSPORT OF THE SAMPLE FROM SAMPLING SITE TO LABORATORY, THE CHAIN OF CUSTODY MUST BE UNBROKEN. GENERALLY THIS WILL REQUIRE THAT THE SAMPLE BE DELIVERED BY THE SAMPLE COLLECTOR OR HIS DESIGNATED REPRESENTATIVE WHO WILL SIGN FOR THE RECEIPT, INTEGRITY AND TRANSFER OF THE SAMPLE DURING SHIPMENT. IF INTEGRITY OF SAMPLE IS QUESTIONED, DESCRIBE PROBLEM ON REVERSE SIDE OF THIS FORM.

CUSTODY OF SAMPLES

	NAME	AFFILIATION	DATE	TIME
1. Sample Container Prepared by				
2. Received by				
3. Received by				
4. Sample Collected by	[illegible]	NYSDOH	12-8-89	14:15
5. Sample Received by				
6. Sample Received by				
7. Sample Received by				
8. Sample Received by				
9. Sample Received by				
10. Sample Rec'd Lab by				
11. Sample Accessioned by	[signature]	NYS DOH	12/9/89	1115

Appendix B. Analytical Protocol

Modified Nielson-Kryger Steam Distillation of Soils Applied to Love Canal Soil Cores

New York State Department of Health
Center for Laboratories and Research
Albany, N.Y. 12201

1. Scope and Application

   1.1 This method was applied to the determination of semi-volatile compounds in soil cores collected at the Love Canal Site during December 1989.

   1.2 The procedure was utilized for analysis of these soil samples for the following compounds using GC/Mass Selective Detector in selected ion monitoring mode.

1,2-dichlorobenzene	alpha HCCH
1,2,4-trichlorobenzene	beta HCCH
1,2,3,4-tetrachlorobenzene	gamma HCCH
hexachlorobenzene	delta HCCH

   1.3 Other compounds may be determined by this procedure following documented method development with appropriate recoveries.

2. Summary of Method

   2.1 A 50 gram sample of soil is slurred with organic-free water and acidified and "distilled" into hexane using a modified Nielson-Kryger steam distillation apparatus. The extract is treated for sulfur removal and, in most cases, is suitable for gas chromatographic analysis without any further clean-up. The extract is concentrated using Kuderna-Danish apparatus.

3. Interferences

   3.1 The modified steam distillation technique used generally provides a significantly "cleaner" extract than some of the more classical techniques such as Soxhlet reflux. The technique is not totally interference-free and the several sample matrices may present a variety of problems of which the analyst must be aware.

4. Apparatus and Materials

   4.1 Modified Nielsen-Kryger Condenser with Teflon stopcock and 24/40 glass joint (Ace Glass Co. #6555-13)
   4.2 Teflon sleeves for 24/40 joint
   4.3 Ring Stand, Clamps and Rubber Tubing
   4.4 Round bottom boiling flask with 24/40 glass joint - 2 liter
   4.5 Hemispherical heating mantle - 2 liter
   4.6 Variable transformer
   4.7 Heat resistant magnetic stir plates and magnetic stirring bars
   4.8 Pasteur pipets
   4.9 Erlenmeyer flasks - 125 ml with 24/40 ground glass joint and ground glass stoppers
   4.10 Kuderna-Danish apparatus (K-D)
      4.10.1 Evaporative flasks, 125 ml
      4.10.2 Snyder columns, six ball or three ball

4.10.3 Distillation receiver, 12 ml graduated
4.10.4 Boiling bumpers
4.10.5 Vigreaux distilling columns

4.11 Gas chromatograph - analytical system complete with gas chromatograph capable of on-column injection, with splitless injection mode, Mass Selective Detector (MSD), and all required accessories including column supplies, gases, etc.

4.11.1 Column: 50 meter Hewlett Packard Ultra-2 capillary, 0.2 mm diameter, 0.25 µm (or equivalent) film thickness.

5. Reagents

5.1 Hexane - nanograde or equivalent
5.2 Acetone - nanograde or equivalent
5.3 Organic-free water: free of analytes of interest by gas chromatography/MSD
5.4 Anhydrous Sodium Sulfate - cleaned in a muffle furnace for 2 hrs at 425°C. Store in a clean reagent bottle.
5.5 Elemental Mercury - triple distilled
5.6 Sulfuric Acid, 50%
5.7 Spiking Solution (Method Spike) - Prepare spiking solution(s) of compound(s) of interest such that a convenient spiking volume (i.e. 100 µl) will yield expected concentrations of analytes in actual samples.
5.8 Internal Standard Spiking Solution - Prepare a spiking solution containing ^{13}C-Labelled analogs of the target analytes such that a convenient spiking volume (i.e. 100µl) will yield measurable signals by GC/MSD analysis.

6. Quality Control Procedures

6.1 One organic-free water blank, one method spike of organic-free water, one matrix spike and a duplicate sample is analyzed with each batch of samples. Matrix spike and duplicate sample was obtained from half of the 6"-12" sample. The spike must contain compounds representative of those being analyzed but need not contain all of the compounds of interest.
6.2 Internal standard spike compounds are added to each sample, method spike and the blank.
6.3 All glassware must be washed with detergent, rinsed with copious amounts of organic-free water and oven dried. To insure that glassware is clean, rinse glassware with nanograde hexane, combine the rinse solvent, concentrate by K-D evaporation and check a portion by gas chromatography. Rinse glassware again with nanograde hexane just prior to use. Magnetic stirring bars should be boiled overnight in concentrated nitric acid for effective cleaning and rinsed with copious amounts of organic-free water.

7. Sample Handling and Preservation

7.1 Samples are submitted as cores in sealed PETG copolymer core liner tubes which had been refrigerated during transit from the site to the laboratory.

7.2 Each core is divided into 3 samples, the top 3" (0-3"), the next 3" (3-6") and the next 6" (6-12"). Each section is given a unique laboratory identification number. The core is measured and each section of tube cut with a scalpel and the soil removed and weighed. The 6-12" samples are placed in a mason jar, mixed thoroughly, and an aliquot (approximately half) weighed from the mason jar. A second aliquot may be used for quality control purposes as a matrix spike or for duplicate analysis.

8. Procedure

8.1 Distillation and Solvent Extraction

8.1.1 Set up steam distillation apparatus as shown in Figure 1.

8.1.2 Prepare samples as follows:

8.1.2.1 For solid samples, place 50 grams of sample in a 2 liter boiling flask, add 800 ml or organic-free water and a stir bar. Add spiking solution(s). Cautiously add 20 ml 50% H_2SO_4. The pH must be <1. Check with pH paper and record.

8.1.2.2 For liquid samples or slurries, measure 800 ml of sample and add to a 2 liter boiling flask together with a stir bar. Add spiking solution(s). Cautiously add 20 ml 50% H_2SO_4. Check with pH paper and record. The pH must be <1.

8.1.3 Add Internal Spiking solution to all samples including method spike and blank. Add Spiking Solution to Method Spike.

8.1.4 Place boiling flasks in heating mantlers positioned directly below the condensers. Mantlers are placed on top of heat resistant magnetic stir plates. Connect condensers to boiling flasks.

8.1.5 Add 5 ml organic-free water and 15 ml of nanograde hexane to condenser by decanting hexane along inside wall of condenser.

8.1.6 Turn on magnetic stirrers for all samples. Turn on cooling water to condensers. Turn on heating mantles and adjust variable transformer for a rolling boil. If more than one set-up, adjust transformers to that samples begin boiling at same time.

8.1.7 Boil for 1 hour. Allow 15-20 minutes for boil to begin. At the conclusion of the extraction, check pH of the acidified aqueous sample. If the pH is higher than 2, add additional 50% H_2SO_4, redistill and sample to yield a second hexane extract. In this case, both extracts are analyzed and the final concentrations of both extracts are added together.

8.1.8 Drain off water layer and discard.

8.1.9 Collect extracted hexane distillate (from solvent withdrawal tube) in receiving flask (125 ml Erlenmeyer).

8.1.10 Rinse condenser with 50 ml of hexane and add to receiving flask.

8.2 Sample Clean-up

8.2.1 Remove aqueous layer with Pasteur pipet and discard.

8.2.2 Add anhydrous sodium sulfate (previously cleaned) until Na_2SO_4 is free flowing in hexane extract.

8.2.3 Quantitatively transfer sample (rinse 3 times with small amount of hexane) to a K-D apparatus and concentrate to 2.0 ml.

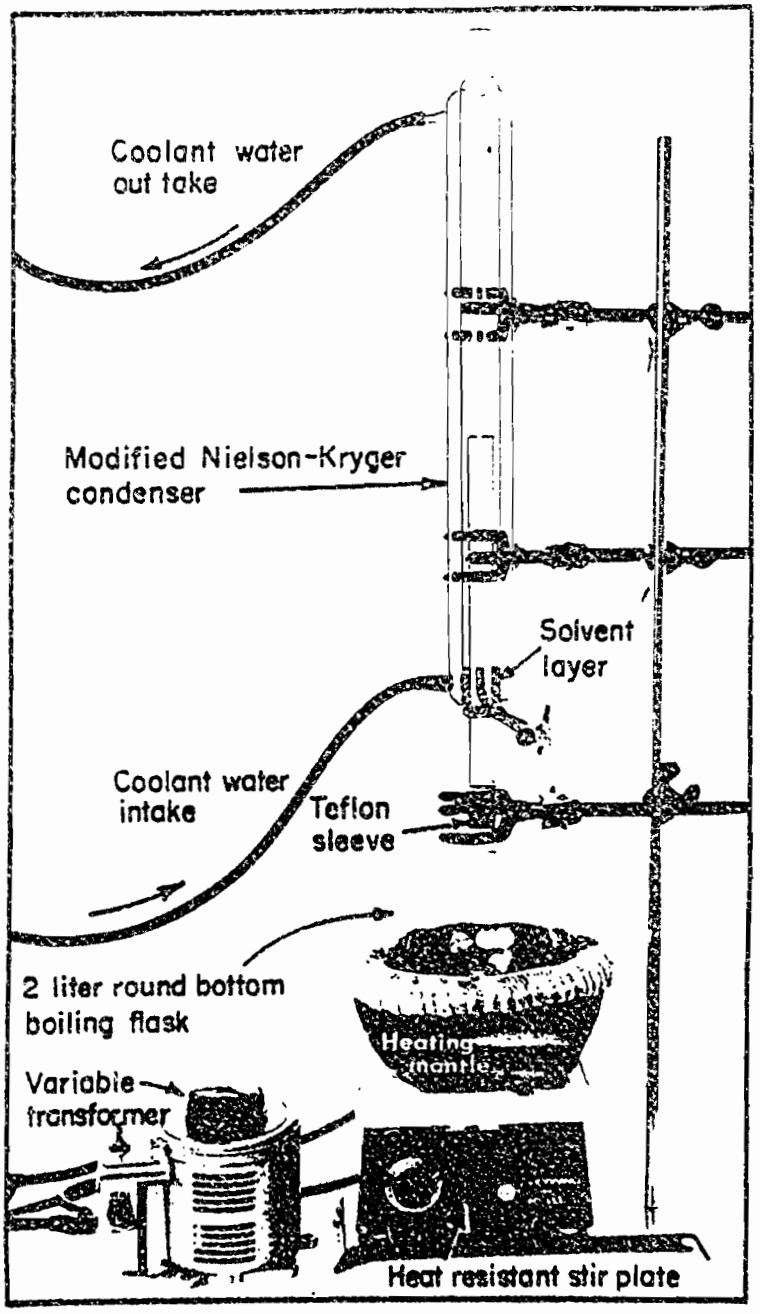
8.2.4 Add a few drops (approximately 0.5 ml) of elemental mercury (triple distilled) to the 10 ml glass stoppered K-D ampule. Shake for 30 minutes using mechanical shaker, medium setting. Let settle.

8.2.5 If precipitate does not settle out, filter the extract through glass wool in a Pasteur pipet which has previously been rinsed with hexane. Concentrate by K-D technique to 1.0 ml.

8.2.6 Transfer the clean extract to a vial and close using a cap with septum. Label the vial and analyze by gas chromatography/mass selective detection in selected ion mode.

FIGURE 1.

STEAM DISTILLATION APPARATUS



9. Recommended Gas Chromatography Conditions

Oven Temperature Profile:
- Initial Value = 80°C
- Initial Time = 2.00 min
- Level 1
  - PRGM Rate = 5.00°C/min
  - Final Value = 180°C
  - Final Time = 5.00 min
- Level 2
  - PRGM Rate = 5.00°C/min
  - Final Value = 295°C
  - Final Time = 0.10 min

Transfer Line Temperature = 280°C

Injector Temperature = 250°C

10. References

10.1 Nielson, T.K. and Kryger, S., Dansk Tidsskr. Farm. 43, 39 (1969).

10.2 Veith, G.D. and Kiwus, L.M., An Exhaustive Steam-Distillation and Solvent-Extraction Unit for Pesticides and Industrial Chemicals, Bull. of Environ. Contam. and Toxicol., 17, 6 (1977).

10.3 Narang, A.S., Vernoy, C.A. and Eadon, G.A. Evaluation of Nielsen-Kryger Steam Distillation Technique for Recovery of Phenols from Soil, J. Assoc. Off. Analyt. Chem., 66, 6 (1983).

IMPLEMENTED: September 1982, Revised March 1984, Revised for Love Canal Soils Project 1989
Revised from HANDBK49 (312-5)

Appendix C. Individual Sample Results

The location of each core is depicted in Figures 2 and 3 (pp. 6-7).

Core #	Area	Depth (inches)	Chlorobenzenes				Hexachlorocyclohexanes			
			DCB	TCB	TeCB	HxCB	α-HCCH	β-HCCH	γ-HCCH	δ-HCCH
11	2	0-3"	2	9.5	6.6	4.4	6.3	1.2	0.5	<0.6
		3-6"	1.7	9.5	6.6	6.8	14	2.2	0.9	<0.6
		6-12"	0.6	5	3.3	3.6	4.8	1.1	0.4	<0.5
12	3	0-3"	2.1	4.8	3.9	19	<1.3	<2	<1.8	<2.7
		3-6"	0.7	1.2	1.1	27	<1.4	<2.1	<1.9	<2.9
		6-12"	<0.7	<0.6	<0.6	4.8	<1.2	<1.8	<1.6	<2.5
13	2	0-3"	<0.7	0.9	0.7	0.4	<0.4	<0.8	<0.6	<0.7
		3-6"	3.1	13	13	8.1	1.7	0.7	0.6	<0.7
		6-12"	1.4	4.3	4.5	4.5	0.6	<0.7	<0.5	<0.7
14	3	0-3"	<2.4	<1.3	<0.9	<0.3	0.9	<1.6	<1.3	<1.7
		3-6"	1.2	4.5	3.7	2.2	1.5	<1.3	<1.1	<1.4
		6-12"	2.6	9.2	6.9	5.3	2.3	1.7	0.5	<1.1
15	2	0-3"	2.7	13	13	8.8	3.7	1.6	0.8	<0.9
		3-6"	2	7.5	7.9	15	3.6	1.6	1.1	<1
		6-12"	0.7	3.2	3.1	4.6	0.8	<0.9	<0.7	<0.9
16	3	0-3"	<2.4	5.5	7.9	4.1	1.9	<3.5	<3	<3.5
		3-6"	3.3	8.8	26	4.9	1.7	<3.2	<2.7	<3.2
		6-12"	3.4	11	9.9	4.2	1.5	<2.6	<2.2	<2.6
17	2	0-3"	2.4	9	11	5.7	3.1	1.5	<0.8	<0.9
		3-6"	2.2	8.5	13	5.8	3.4	1.6	<0.8	<1
		6-12"	2.8	8.7	9.6	12	1.5	<0.8	<0.5	<0.6
18	3	0-3"	2.6	9.1	9.6	2.7	3.4	<1.6	2.1	<1.7
		3-6"	0.9	4.7	9.7	1.3	2	<1.1	<1	<1.2
		6-12"	<0.8	0.7	3.5	0.3	<0.8	<1	<0.9	<1.1
19	2	0-3"	1.7	9.2	11	7.4	<1.1	<1.8	<1.5	<1.9
		3-6"	3.8	12	13	6.8	<1.5	<2.4	<2	<2.5
		6-12"	<1.1	0.6	0.6	0.8	<1.2	<1.9	<1.6	<2
20	2	0-3"	1.5	8.2	7.6	4.5	1.5	<1.3	<1.1	<1.3
		3-6"	1.7	7.3	6.4	6.3	1	<0.8	<0.7	<0.9
		6-12"	1.3	1.5	1.5	6.1	0.4	<0.8	<0.7	<0.8
21	3	0-3"	13	34	22	31	42	160	20	11
		3-6"	13	120	79	42	150	38	9.1	3.6
		6-12"	1.3	4.3	2.8	3	9.1	480	5.7	1.1
22	3	0-3"	1.2	6.5	4.3	2.9	2.8	2.9	2.2	<1.7
		3-6"	1.1	5.4	3.4	3.5	1.5	1.4	<1.1	<1.3
		6-12"	1.7	6.7	3.5	5.3	3.8	4.1	1.5	<1.2
23	2	0-3"	5.2	16	17	9.2	3.6	<3.6	<2.6	<3
		3-6"	2.7	8.2	8.9	11	<2.1	<3.9	<2.8	<3.2
		6-12"	<0.6	0.5	0.3	1.2	<0.7	<1.2	<0.9	<1

Values are concentrations in nanograms chemical per gram of soil or parts per billion (ppb)

Legend

DCB	1,2,dichlorobenzene	α-HCCH	alpha hexachlorocyclohexane
TCB	1,2,4-trichlorobenzene	β-HCCH	beta hexachlorocyclohexane
TeCB	1,2,3,4-tetrachlorobenzene	γ-HCCH	gamma hexachlorocyclohexane
HxCB	hexachlorobenzene	δ-HCCH	delta hexachlorocyclohexane

Core #	Area	Depth (inches)	Chlorobenzenes				Hexachlorocyclohexanes			
			DCB	TCB	TeCB	HxCB	α-HCCH	β-HCCH	γ-HCCH	δ-HCCH
24	3	0-3"	3.9	12	9.6	1.9	3	1.5	<1.4	<1.6
		3-6"	5.9	23	11	1.8	3.6	2.4	1.1	<1.4
		6-12"	1.5	6.2	3.5	1	1.9	<1.2	<0.9	<1.1
25	2	0-3"	2.5	16	20	3.4	2.7	<2.7	<2.2	<2.8
		3-6"	<1.3	13	19	3.3	1.3	<1.9	<1.6	<2
		6-12"	<0.6	0.6	0.9	0.6	<1	<1.7	<1.4	<1.7
26	3	0-3"	<2.2	1.7	2.2	1.1	<1.9	<3	<2.5	<2.9
		3-6"	<0.6	0.4	0.8	0.7	<1.6	<2.5	<2.1	<2.4
		6-12"	<2	<1.1	0.5	0.5	<1.2	<2	<1.7	<2
27	2	0-3"	2	7.8	7.3	3.3	<0.5	<0.7	<0.6	<0.8
		3-6"	2	8.9	9	6.5	1.9	0.6	0.5	<0.6
		6-12"	2.7	11	11	8.6	1.2	<0.6	<0.5	<0.6
28	2	0-3"	2	7.1	8.3	5.6	2.8	1.5	0.8	<1
		3-6"	1.7	6.5	7.2	7.7	2.2	<1	<0.9	<1.2
		6-12"	<0.5	0.6	0.5	0.9	<0.5	<0.6	<0.6	<0.7
29	2	0-3"	1	3.3	2.8	1.9	<0.9	<1.3	<1.1	<1.3
		3-6"	1.2	2.9	2.5	3	0.8	<1	1.1	<1.1
		6-12"	1.2	2.2	1.8	2.8	<0.6	<0.8	<0.7	<0.9
30	3	0-3"	44	510	140	380	2900	670	150	53
		3-6"	2.7	7.6	5.1	7	0.8	<0.7	<0.5	<0.6
		6-12"	0.3	1.1	0.9	1.3	<0.5	<0.7	<0.6	<0.7
31	3	0-3"	3.8	17	13	8.3	10	15	<1.8	<2
		3-6"	0.9	3.8	5.2	2.7	<1.3	<1.7	<1.5	<1.7
		6-12"	<0.9	0.5	0.6	0.6	<1.1	<1.5	<1.3	<1.4
32	3	0-3"	0.8	3	2.1	1.8	<1.3	<1.5	<1.5	<1.8
		3-6"	1	3.1	2.1	2.8	<0.9	<1.1	<1.1	<1.3
		6-12"	0.5	1.6	1.1	3.1	<0.7	<0.8	<0.8	<1
33	3	0-3"	1.1	5	5.6	1.7	0.9	<1.4	<1.1	<1.5
		3-6"	1.1	4.8	6.2	2.1	1.1	<1.1	0.4	<1.2
		6-12"	0.8	3.8	4.6	2	0.8	<1	<0.8	<1.1
34	3	0-3"	0.3	2.1	3	1.1	<1	<1.6	<1.2	<1.5
		3-6"	1	4.1	4.5	1.9	1	<1.2	<0.9	<1.1
		6-12"	<1.6	1.5	2	1.6	<1.4	<2.2	<1.7	<2
35	2	0-3"	7.4	45	13	6.2	5.1	4	<1	<1.2
		3-6"	4.3	20	8.7	5.2	3.8	4.1	<0.9	<1
		6-12"	56	530	110	65	310	810	35	3.2

Values are concentrations in nanograms chemical per gram of soil or parts per billion (ppb)

Legend

DCB	1,2,dichlorobenzene	α-HCCH	alpha hexachlorocyclohexane
TCB	1,2,4-trichlorobenzene	β-HCCH	beta hexachlorocyclohexane
TeCB	1,2,3,4-tetrachlorobenzene	γ-HCCH	gamma hexachlorocyclohexane
HxCB	hexachlorobenzene	δ-HCCH	delta hexachlorocyclohexane

Core #	Area	Depth (inches)	Chlorobenzenes				Hexachlorocyclohexanes			
			DCB	TCB	TeCB	HxCB	α-HCCH	β-HCCH	γ-HCCH	δ-HCCH
36	2	0-3"	4.3	21	17	19	4.4	1.3	1	<1.3
		3-6"	2.8	11	11	28	2.6	0.7	<0.8	<1
		6-12"	<0.3	1.7	1.1	3.2	<0.6	<0.9	<0.7	<0.9
37	2	0-3"	1.6	5.2	6.9	3.1	1.8	<0.8	<0.8	<1
		3-6"	1.1	5.3	5.3	3.8	1.8	<0.6	<0.6	<0.8
		6-12"	<0.8	1.4	1.6	1.5	0.6	<0.8	<0.7	<0.9
38	3	0-3"	<0.3	2.4	2.9	2	0.6	<0.8	<0.6	<0.8
		3-6"	<1.2	1.4	2.3	1.7	<0.7	<1	<0.8	<0.9
		6-12"	<0.3	<0.3	<0.2	0.2	<0.5	<0.7	<0.6	<0.7
39	3	0-3"	0.5	4.4	3.7	2.8	<1.1	<1.8	<1.3	<1.6
		3-6"	<1.3	1.5	0.8	1.2	<1	<1.6	<1.2	<1.5
		6-12"	<1.2	2.7	1.5	1.3	<1.2	<1.8	<1.4	<1.7
40	3	0-3"	<2	2.5	2.4	1.3	<1.8	<2.7	<2.4	<3.8
		3-6"	<0.9	1.1	0.6	0.6	<1	<1.5	<1.3	<2.1
		6-12"	0.8	2.5	2.8	2.5	<1.4	<2.1	<1.9	<2.9
41	2	0-3"	2.4	12	14	6.5	2.6	1	1	<1
		3-6"	2.6	13	15	8.1	2.2	<1	0.7	<1
		6-12"	0.4	1.6	1.6	2	<0.6	<0.9	<0.8	<1
42	2	0-3"	2	14	19	3.3	1.6	<1.7	<1.2	<1.8
		3-6"	1.1	6.6	8.4	2.6	<0.7	<1.2	<0.9	<1.3
		6-12"	<0.3	0.3	0.4	0.3	<0.7	<1.2	<0.9	<1.3
43	3	0-3"	0.6	2.6	1.7	1.3	<0.6	<0.9	<0.8	<1
		3-6"	3.3	12	5.4	2.3	1	0.5	<0.6	<0.8
		6-12"	1.1	5.3	3.5	2.4	0.8	<0.8	<0.7	<0.9
44	3	0-3"	1	5.5	5.9	4.1	<1.5	<2.3	<2	<3.1
		3-6"	1.2	6.9	7.5	5.2	1.2	<2.1	<1.8	<2.9
		6-12"	0.5	3.2	26	4	<1	<1.5	<1.4	<2.2
45	2	0-3"	<0.7	1.2	1.6	0.4	<0.7	<1.1	<0.9	<1.2
		3-6"	<2.6	4	2.9	1	<1	<1.6	<1.4	<1.7
		6-12"	<1.6	0.7	1.3	0.4	<1.1	<1.8	<1.5	<1.9
46	2	0-3"	4.2	7.4	7.1	9.1	2.8	<0.9	<0.8	<0.9
		3-6"	3.5	6.8	6.9	11	2.7	1.1	1.2	<0.9
		6-12"	1.1	2.2	4.5	5.2	0.6	<0.8	<0.7	<0.9
47	3	0-3"	0.6	2.9	3	1.6	<1.4	<1.8	<1.6	<1.9
		3-6"	1.1	3.4	3.2	2	<0.8	<1	<0.9	<1
		6-12"	1.6	6.5	6.1	5.7	1.2	<1.1	<1.1	<1.2

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Legend

DCB	1,2,dichlorobenzene	α-HCCH	alpha hexachlorocyclohexane
TCB	1,2,4-trichlorobenzene	β-HCCH	beta hexachlorocyclohexane
TeCB	1,2,3,4-tetrachlorobenzene	γ-HCCH	gamma hexachlorocyclohexane
HxCB	hexachlorobenzene	δ-HCCH	delta hexachlorocyclohexane

Core #	Area	Depth (inches)	Chlorobenzenes				Hexachlorocyclohexanes			
			DCB	TCB	TeCB	HxCB	α-HCCH	β-HCCH	γ-HCCH	δ-HCCH
48	2	0-3"	2.7	14	12	48	12	11	3.4	3.7
		3-6"	1.9	6.8	5	28	2.7	2.3	1.2	1.3
		6-12"	0.5	1.7	0.6	2.4	0.3	<0.7	<0.6	<0.8
49	3	0-3"	1	6.2	9	0.8	<1.1	<1.8	<1.5	<2
		3-6"	0.7	3.6	6.5	1.3	0.6	<1.5	<1.2	<1.6
		6-12"	<0.5	1.2	1.5	0.5	<0.6	<1.1	<0.9	<1.1
50	3	0-3"	2.5	27	54	10	13	3.6	3.4	3.4
		3-6"	5.3	57	100	14	16	5.2	4.2	2.2
		6-12"	0.6	5.8	11	4.7	3.6	1.3	1	0.6
52	2	0-3"	1	4.9	5	2.7	0.9	<0.9	<0.8	<1
		3-6"	0.5	3.1	3.3	2.9	0.6	<1	<0.9	<1.1
		6-12"	<0.6	0.2	0.2	0.6	<0.8	<1.1	<1	<1.2
53	2	0-3"	0.6	3.5	3.3	2.4	1.4	<1.4	<1.1	<1.4
		3-6"	<6.7	4.8	6.2	3.4	1.3	<1.8	<1.5	<1.9
		6-12"	0.7	3.3	3.2	5.7	1.1	<1.2	<1	<1.2
54	2	0-3"	3.9	17	15	8.8	1.6	<1.7	<1.2	<1.8
		3-6"	2.9	9.9	11	9.3	0.8	<1.2	<0.9	<1.3
		6-12"	<0.4	0.7	0.4	1.2	<0.7	<1.2	<0.9	<1.3
55	2	0-3"	<1.9	2.6	2.8	3	<1	<1.6	<1.3	<1.6
		3-6"	<0.4	0.8	0.4	0.4	<0.9	<1.5	<1.3	<1.6
		6-12"	<0.4	0.8	0.4	<0.4	<1.3	<2.1	<1.7	<2.2
56	2	0-3"	<0.7	2.4	1.9	0.6	1.4	<2.1	<1.3	<1.7
		3-6"	<0.6	0.4	0.2	0.3	<1	<1.9	<1.2	<1.5
		6-12"	<0.7	<0.7	<0.5	<0.2	<0.9	<1.7	<1.1	<1.4
57	3	0-3"	1.1	7.7	15	2.3	<1.1	<1.5	<1.3	<1.5
		3-6"	3.7	35	32	2.5	<1.3	<1.7	<1.5	<1.6
		6-12"	4.2	49	80	4	<1.4	<1.8	<1.6	<1.8
58	3	0-3"	0.9	5.2	5.2	2.6	1	<1.2	<1	<1.3
		3-6"	1.7	6.6	6.9	4.8	<1.1	<1.6	<1.4	<1.8
		6-12"	<0.6	<0.4	<0.3	0.2	<0.7	<1	<0.9	<1.1
59	2	0-3"	1	5.6	3.9	1.5	4.2	1.5	1	<0.7
		3-6"	2.4	8.9	6.5	3	3.1	1.4	<1.1	<1.2
		6-12"	2.5	6	3.6	2.4	2.4	<1.2	<1	<1.1
60	3	0-3"	0.9	4.1	3.3	4.9	0.6	<1.7	<1.5	<1.7
		3-6"	<1.2	2.1	2.1	1.6	<1.1	<1.5	<1.3	<1.5
		6-12"	<0.6	1.1	1.5	0.4	<0.9	<1.1	<1	<1.1

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Legend

DCB	1,2,dichlorobenzene	α-HCCH	alpha hexachlorocyclohexane
TCB	1,2,4-trichlorobenzene	β-HCCH	beta hexachlorocyclohexane
TeCB	1,2,3,4-tetrachlorobenzene	γ-HCCH	gamma hexachlorocyclohexane
HxCB	hexachlorobenzene	δ-HCCH	delta hexachlorocyclohexane

Core #	Area	Depth (inches)	Chlorobenzenes				Hexachlorocyclohexanes			
			DCB	TCB	TeCB	HxCB	α-HCCH	β-HCCH	γ-HCCH	δ-HCCH
61	3	0-3"	2.8	9.5	10	4.1	4	<3.6	2.1	<3.5
		3-6"	4.9	10	11	5.5	2.4	<2.8	1.1	<2.7
		6-12"	1	4.4	2.8	4.9	<1.7	<2.6	<2.2	<2.6
62	2	0-3"	0.9	3.9	3.6	2.4	0.5	<0.9	<0.7	<0.9
		3-6"	0.6	3	2.7	2.3	<0.4	<0.7	<0.6	<0.7
		6-12"	0.3	1	0.7	1.1	<0.5	<0.8	<0.6	<0.8
63	2	0-3"	0.8	4.2	3.8	1.6	<0.8	<1.2	<1	<1.3
		3-6"	1	7.6	2.7	1.4	<0.9	<1.3	<1.1	<1.3
		6-12"	<0.7	1.2	0.7	0.7	<1	<1.5	<1.2	<1.6
64	3	0-3"	1.2	4.6	4.7	1.8	<0.7	<1	<0.9	<1.1
		3-6"	0.8	3.3	3.6	1.8	0.5	<0.8	<0.7	<0.9
		6-12"	<0.4	2.8	3.3	1.6	0.3	<0.7	<0.6	<0.8
65	2	0-3"	2.4	13	11	41	11	14	<1.1	1.8
		3-6"	2.6	9.4	8.5	31	4.8	5.1	<1.1	<1.3
		6-12"	1.4	3.2	2.1	6.1	<0.4	<0.6	<0.5	<0.7
66	2	0-3"	3.5	4.7	4.7	8.3	<0.4	<0.7	<0.5	<0.6
		3-6"	10	5.2	5.1	11	<0.4	<0.7	<0.5	<0.6
		6-12"	3.8	3.3	3.4	13	0.4	<0.6	<0.5	<0.6
67	3	0-3"	<1	0.5	0.7	0.4	<0.8	<0.9	<0.9	<1
		3-6"	2.4	12	13	5	<1	<1.2	<1.1	<1.3
		6-12"	0.7	2.3	2.2	1.7	<1.2	<1.4	<1.3	<1.5
68	2	0-3"	4	14	13	6.8	2.6	<1.6	2	<1.3
		3-6"	2.4	7.5	8	7.5	1.4	<0.9	1	<1
		6-12"	0.6	2.7	2.5	2.3	<0.5	<0.9	<0.7	<0.8
69	3	0-3"	3.8	15	10	4.8	2.3	<2.7	<2.3	<2.7
		3-6"	8.5	39	18	8.1	5.6	2	1.4	<2.1
		6-12"	2	9.6	4.9	3.4	1.6	<1.9	<1.6	<1.9
70	2	0-3"	1.7	7	8	4.5	1.4	<0.7	<0.6	<0.8
		3-6"	1.4	6.8	6.6	5.4	1.7	<0.7	0.6	<0.7
		6-12"	0.9	5.5	6.2	4.7	1	<1	<0.8	<1
71	3	0-3"	1.4	5.5	5.9	23	<1.3	<2.1	<1.6	<1.9
		3-6"	0.9	4.5	4.9	47	<0.9	<1.5	<1.1	<1.3
		6-12"	1	2.4	2.3	42	<0.9	<1.4	<1.1	<1.3
72	2	0-3"	1.5	3.9	3.8	2.4	<0.9	<1.3	<1.1	<1.3
		3-6"	1.4	2.4	1.9	1.7	<1	<1.5	<1.3	<1.5
		6-12"	1.3	15	6.3	3	<1.3	<1.9	<1.7	<2

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Legend

DCB	1,2,dichlorobenzene	α-HCCH	alpha hexachlorocyclohexane
TCB	1,2,4-trichlorobenzene	β-HCCH	beta hexachlorocyclohexane
TeCB	1,2,3,4-tetrachlorobenzene	γ-HCCH	gamma hexachlorocyclohexane
HxCB	hexachlorobenzene	δ-HCCH	delta hexachlorocyclohexane

Core #	Area	Depth (inches)	Chlorobenzenes				Hexachlorocyclohexanes			
			DCB	TCB	TeCB	HxCB	α-HCCH	β-HCCH	γ-HCCH	δ-HCCH
73	2	0-3"	2.4	11	9.9	22	5.1	2.6	1	<0.8
		3-6"	0.6	2	1.7	2.6	<0.5	<0.7	<0.6	<0.8
		6-12"	<0.9	<0.6	<0.5	0.2	1	<1.4	<1.2	<1.4
74	3	0-3"	1.1	5	4.5	1.3	0.9	<1	<0.9	<1.1
		3-6"	0.3	1	1	0.9	<1	<1.2	<1.1	<1.2
		6-12"	<0.5	1	0.6	1.3	<0.9	<1.2	<1.1	<1.2
75	2	0-3"	29	180	40	70	300	32	22	<1.8
		3-6"	32	180	42	69	270	34	21	5.9
		6-12"	11	38	20	28	56	560	26	5.8
76	3	0-3"	1.7	8.1	10	1.7	0.7	<1.7	<1.4	<1.9
		3-6"	0.5	3.4	3.5	1.3	<0.8	<1.3	<1.1	<1.4
		6-12"	<0.8	0.6	0.9	0.4	<0.9	<1.4	<1.2	<1.6
77	3	0-3"	2.4	3.5	2.8	7.3	<1.3	<2	<1.8	<2.8
		3-6"	1.3	4.1	29	16	<1	<1.6	<1.4	<2.2
		6-12"	0.6	1.3	1.1	5	<1.3	<2	<1.7	<2.7
78	2	0-3"	2.3	8.6	8.7	3.7	1.4	<1	1.4	<1.1
		3-6"	1.6	5.2	5.1	3.6	1.1	<0.9	<0.8	<1
		6-12"	<0.4	0.9	0.9	1.2	<0.6	<0.9	<0.8	<1
79	2	0-3"	1	4.1	4.6	4.1	1.7	<0.8	<0.7	<0.9
		3-6"	0.6	3.4	3.8	5	1.5	<0.4	<0.6	<0.8
		6-12"	<0.6	<0.5	0.5	0.5	<0.5	<0.7	<0.6	<0.8
80	2	0-3"	2.4	6	6	5.5	<1	<1.6	<1.1	<1.4
		3-6"	1.9	2.2	2.3	10	<1.1	<2.2	<1.3	<1.7
		6-12"	<0.8	0.3	0.4	1	<1	<2	<1.2	<1.6
81	3	0-3"	1	4.2	4.7	1.5	<1.8	<2.7	<2.2	<2.8
		3-6"	<1.2	2.3	2.4	0.9	<1.1	<1.7	<1.4	<1.7
		6-12"	1.1	3.2	3.1	1.2	<1	<1.6	<1.3	<1.7
82	3	0-3"	<0.7	1.5	1	0.5	<1.3	<1.8	<1.5	<1.6
		3-6"	<0.7	1	0.7	0.4	<0.9	<1.3	<1.1	<1.2
		6-12"	<0.8	0.4	0.3	0.3	<0.8	<1.1	<1	<1
83	2	0-3"	1.6	4	2.8	1.1	<1.2	<2.2	<1.4	<1.7
		3-6"	<1.3	1	1.3	0.8	<1.2	<2.3	<1.4	<1.8
		6-12"	0.8	2.5	1.6	1.4	1	<2	<1.3	<1.6
84	3	0-3"	<2.3	2.9	3.1	0.6	<1.3	<2	<1.6	<2
		3-6"	<1.7	3.4	3.2	0.7	<0.9	<1.4	<1.2	<1.5
		6-12"	0.5	4.1	5.3	1.7	0.7	<1.4	<1.2	<1.5

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Legend

DCB	1,2,dichlorobenzene	α-HCCH	alpha hexachlorocyclohexane
TCB	1,2,4-trichlorobenzene	β-HCCH	beta hexachlorocyclohexane
TeCB	1,2,3,4-tetrachlorobenzene	γ-HCCH	gamma hexachlorocyclohexane
HxCB	hexachlorobenzene	δ-HCCH	delta hexachlorocyclohexane

Core #	Area	Depth (inches)	Chlorobenzenes				Hexachlorocyclohexanes			
			DCB	TCB	TeCB	HxCB	α-HCCH	β-HCCH	γ-HCCH	δ-HCCH
85	2	0-3"	1.9	5.8	6.5	3.6	1.5	<1.6	<1.3	<1.6
		3-6"	2	8.3	9.6	9.6	3.2	2.3	<2.4	<3
		6-12"	1.8	5.8	7	7.3	1.1	<1.4	<1.2	<1.5
86	2	0-3"	2	7.2	7.9	2.7	1.2	<1.6	<1	<1.2
		3-6"	2.3	6.8	8.3	3.5	1.4	1.4	0.7	<1.6
		6-12"	2.8	4.5	2.2	3	<0.9	<1.7	<1	<1.3
87	3	0-3"	1.3	5.3	4.4	7.8	<0.8	<1.2	<1	<1
		3-6"	1.1	3.6	3.4	2.6	<0.9	<1.2	<1.1	<1.1
		6-12"	<0.6	0.4	0.3	0.5	<0.7	<1	<0.9	<0.9
88	2	0-3"	1.7	7	8.1	2.4	1	<1.8	<1.5	<1.8
		3-6"	0.6	2.9	2.3	1.3	<1.1	<1.6	<1.3	<1.7
		6-12"	<0.8	<0.6	<0.4	0.2	<1	<1.5	<1.3	<1.6
98	3	0-3'	<1.2	2.8	3	1.5	<1	<1.2	<1.1	<1.4
		3-6"	<0.9	1.3	1.4	1	<0.8	<0.9	<0.9	<1
		6-12"	<0.9	0.5	0.5	0.3	<0.8	<0.9	<0.9	<1.1
99	2	0-3"	0.4	2.1	3	1.9	0.6	2.2	<0.7	<0.9
		3-6"	5.2	16	19	8.2	1.8	0.8	<0.7	<0.9
		6-12"	2.9	8.9	9.8	9	0.9	<0.6	<0.5	<0.6
100	2	0-3"	1.6	6.7	8.6	5.3	0.7	<1.4	<1	<1.5
		3-6"	0.7	3.4	4.4	3.1	<0.8	<1.4	<1	<1.5
		6-12"	<0.2	0.1	0.2	0.2	<0.5	<1	<0.7	<1
101	2	0-3"	3.3	15	16	11	1.8	<1.2	1	<1.3
		3-6"	1.4	8.5	4.6	5.2	1	<1.1	<0.8	<1.2
		6-12"	<0.3	<0.3	<0.2	0.3	<0.7	<1.3	<0.9	<1.4

Values are concentrations in nanograms chemical per gram of soil or parts per billion (ppb)

Legend

DCB	1,2,dichlorobenzene	α-HCCH	alpha hexachlorocyclohexane
TCB	1,2,4-trichlorobenzene	β-HCCH	beta hexachlorocyclohexane
TeCB	1,2,3,4-tetrachlorobenzene	γ-HCCH	gamma hexachlorocyclohexane
HxCB	hexachlorobenzene	δ-HCCH	delta hexachlorocyclohexane

Appendix D. Public Comments and Responses

On November 15, 1990 a draft of this report (dated November 9, 1990) was released for public comment. Written comments were received from three organizations and are included in this Appendix. Verbal comments were also received by the Health Liaison Program (Charlene Thiemann) and the NYDEC Love Canal Public Information Office (Michael Podd) and have been characterized below by the recipients of the comments. Responses to the comments are provided at the end of this Appendix.

Written Comments from Citizen's Clearinghouse for Hazardous Waste

Citizen's Clearinghouse for Hazardous Wastes
A Grassroots Environmental Crisis Center

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RECEIVED
JAN 28 1991
Division of Environmental Health Assessment

January 25, 1991

State of New York
Department of Health
Corning Tower
The Governor Nelson A. Rockefeller Empire State PLaza
Albany, NY 12237

Att: Dr. Edward Horn

Dear Dr. Horn:

As you may know, I have had a long history and interest in the remedial cleanup efforts at Love Canal. I first became involved when I was hired by the state of New York to be the state's technical liaison to the Love Canal Homeowner's Association (LCHA). My primary responsibility was to be on-site, as a representative of the community, during the original two phases of cleanup at the canal. I reported both to the residents and to the state. I worked in this capacity for two years (1978-1980).

Since that time, I have followed the State's activities at Love Canal, working with local residents, the Ecumenical Task Force, the Citizens Environmental Coalition and in my current capacity as Science Director as CCHW. I have prepared written comments on the Habitability Study, the DRAFT Environmental Impact Statement and on many other reports and documents evaluating the degree of contamination at Love Canal.

With this background and experience, I have evaluated and prepared these comments on the Love Canal Emergency Declaration Area Remediation of EDA 2 and 3 DRAFT Study Report prepared by the New York State Department of Health (DOH) and the New York State Department of Environmental Conservation (DEC), dated December 9, 1990.

I am deeply disturbed and disappointed that DOH and DEC has proposed such a limited and inadequate cleanup plan for EDA 2 and 3. This Remediation Plan has a great number of weaknesses including the failure to consider Hot spots, swales and other historically wet areas, the presence of contamination at depths greater than 6-12", the simplicity (and general foolishness) of moving waste from one site to

CCHW 1

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another, the failure to meet the requirements of Superfund and the failure to provide any information on how the excavation activities would be conducted. These problems are discussed in some detail below.

More fundamentally, this Remedial Plan is flawed because it proposes to use the original Habitability criteria as the "Cleanup Standard" to establish the degree of cleanup that is needed in EDA 2 and 3.

While this may appear reasonable, it assumes that the original Habitability criteria are scientifically valid and appropriate for use in this manner. This is not the case.

The original Habitability criteria are scientifically flawed and have been challenged by scientists and others concerned about the process and procedures used to determine the Habitability of Love Canal area. DOH and DEC have chosen to ignore these comments and have proceeded with the resettlement of the Love Canal area even though they violated and largely ignored their own scientifically established Habitability criteria.

CCHW 2

Although these points have been raised before, it is important to raise them here again because of the impact the Habitability study has on this proposed remedial plan. Briefly, the habitability study is flawed because DOH altered their elaborate study design in mid-stream. DOH failed to make any decisions of habitability using the original comparison areas that were selected as part of a public "open" review process. The original comparison areas were in Cheektowaga and Tonawanda, suburbs of Niagara Falls.

Instead, two different comparison areas, selected from within the city of Niagara Falls, were used to determine if any areas of Love Canal were habitable. The second two comparison areas were selected after data was collected from the original comparison areas and compared to the contaminant levels in the Love Canal EDAs. Had these original comparison areas been used, virtually none of the Love Canal would have been found to be habitable.

Since this was clearly an unacceptable position for the state, they violated their own process by selecting a second group of comparison areas (selected by DOH and DEC only; there was no public input on the selection of these sites, and more critically, there was no public input on the need to select these sites).

Statisticians Dr. Michael Stoline, a member of the Technical Review Committee's outside "Expert Review Panel" and Dr. Marvin Schneiderman, Retired Director of the Cancer Prevention and Control division of the National Cancer Institute, both criticized the use of these two new comparison areas. They both felt that the contaminant levels in the new comparison areas failed to meet the statistical criteria set out in early Task Force meetings and therefore should not have been used. Stoline and Schneiderman's comments were ignored and DOH and DEC went forward with using comparison areas that did not meet their own criteria. Detailed comments on these concerns are attached.

In addition, the "selected" comparison areas in Niagara Falls are known to be contaminated with wastes from the same company, Occidental Petroleum/Hooker Chemical, that is responsible for the contamination at Love Canal. One area is downwind from the Occidental/Hooker incinerator and in the other, random dumping of toxic waste from by Occidental/Hooker has been found.

CCHW 3

Finally, this Habitability study fails to address the issue of whether the levels of contamination found in the Love Canal EDAs are safe for anyone who might move into EDA 2 or 3, or for that matter, for people living in the comparison areas of Niagara Falls. A more appropriate procedure would be to compare the contaminant levels in EDA 2 and 3 to the originally established comparison areas in Cheektowaga and Tonawanda.

CCHW 4

Because of these flaws, the Habitability study is scientifically invalid and should not be used to evaluate habitability of any of the Love Canal EDAs. Consequently, it is equally invalid to use this study as a measure of how clean EDA 2 and 3 should be. If DOH and DEC do this, they will be compounding the errors of made in the Habitability study.

Furthermore, there is no scientific or technical basis for establishing the Habitability criteria as a "Cleanup Standard" that other contaminated areas should be measured against. This is especially true given the scientific flaws outlined above.

The fundamental premise of cleaning up a contaminated site is that the cleanup should eliminate health risks posed by the site and the area should be restored to what it was before the contamination occurred. This premise appears not to have been considered at all in the remedial assessment for EDA 2 and 3.

More specific problems with the proposed remedial plan include:

CCHW 5

(1) The proposed approach ignores the presence of "Hot spots" throughout EDA 2 and 3. While common sense might suggests that selecting a few indicator chemicals may not be sufficient to detect Hot spots, DOH and DEC were given specific evidence that Hot spots exist in EDA 2 when they found contamination in the storm sewer lines (see DEC letter to residents written by Gerald Rider, December 21, 1990).

Although this contamination was previously undetected it's significance was casually dismissed by DOH and DEC. Yet it was considered serious enough to warrant digging 15 test pits to establish the degree of contamination present in this area. The results of the test pit excavations have not yet been made public. Clearly this area represents a Hot spot that was not considered as part of the Remedial Report. These and other Hot spots will require more extensive remediation than the simple removal of the top 6" of soil. How many more hot spots may exist?

CCHW 6

(2) Swales and other historically wet areas are ignored. Like Hot spots, swales and other historically wet areas of the canal proper are ignored by the proposed remedial plan. These areas have always had higher levels of contamination, yet their presence has been ignored. These areas need to be considered as part of the remedial plan.

CCHW 7

(3) Contamination likely exists at depths greater than 6 or even 12 inches. Results of recent tests of the monitoring wells around the Love Canal landfill indicate new areas of contamination. DOH and DEC have again dismissed these findings, saying the contamination is not coming from the landfill. Perhaps this is the case. But the source has not been established and since the wells are deeper than 12", the soils around these wells are also likely contaminated. The remedial plan needs to address these areas of contamination.

The recent finding of contamination in monitoring wells and the previously undetected contamination in the storm sewers highlights the importance for DOH and DEC to acknowledge that they do not fully know the extent of contamination in the Love Canal community? These findings, as recent as one month ago, clearly establish

that DOH and DEC do not have full knowledge of the extent and degree of contamination in the Love Canal EDAs. How many more surprises remain to be found?

(4) The remedial plan fails to consider other cleanup alternatives. The Remedial Report does not evaluate any cleanup alternatives other than removal of topsoil. No other remedial methods are discussed or evaluated. Other cleanup alternatives may provide more effective cleanup not only of the topsoil but also of the deeper contamination as well. This also violates the requires of the Superfund law (see below).

(5) Removing soil from one site to is not a preferred remedial alternative. Taking contaminated soil from one site to another does not provide permanent cleanup and does not solve any problems. It simply perpetuates the "Toxic Merry Go Round" where wastes removed from one location end up contaminating another area where it is disposed of. In this case, DOH and DEC have not said anything whatsoever about what will happen to the excavated soils.

CCHW 8

(6) The cleanup plan fails to meet requires of Superfund. The US EPA requires cleanup at Superfund sites to be determined after a feasibility study has been conducted. This study would consider a number of cleanup alternatives including those that provide permanent cleanup. This remedial plan fails to follow either of these requirements and thus is in violation of the Superfund law.

(7) No information is provided as to how the cleanup plan would be carried out. Even though most of the community has been evacuated, some people remain in the area, especially in EDA 2 and 3, where this work will be undertaken. Yet, the Remedial Report says nothing about how the excavation of these soils would occur and what steps will be taken to prevent and minimize release of contaminants into the community.

The planned cleanup of EDA 2 and 3 is a legitimate concern. However, this proposed Remedial Plan cannot be the basis for establishing how this will be done. DOH and DEC have attempted to oversimplify the complex nature of contamination in these areas by arguing that "the removal of the top 6" of soil EDA 2

and 3 would be sufficient to remediate the area, i.e. to satisfy the conditions of habitability established for the Love Canal EDA."

Cleaning up a contaminated area is much more complicated than simply scrapping off the topsoil. DOH knows this, EPA knows this and the general public knows this. Twelve years ago when Love Canal first broke, little was known about how to remediate sites. At that time, the best that could be done was to remove the contaminated soil to another landfill area. Then as these sites leaked and threatened public health, this approach was abandoned in favor of more effective permanent cleanup alternatives. It also made good common sense.

Today, I am hard pressed to believe that DOH and DEC can do no better than to put Love Canal soils on the Toxic Merry Go Round. There is no scientific justification for doing this. Certainly this Remedial Report does not provide any technical or scientific data to support such a decision.

In closing, the proposed Remedial Plan is incomplete and appropriate to evaluate how to clean up the contamination soils in EDA 2 and 3. In addition, this proposed plan is scientifically invalid because it uses the Habitability criteria as the basis for determining how much cleanup is needed.

I hope you will seriously consider these comments and prepare a more thorough and complete remedial assessment plan that is consistent with the requirements of Superfund.

Please feel free to contact me if you have any questions on these comments or if you need any additional information.

Sincerely,

Stephen U. Lester
Science Director

Sl/cd

Enclosures

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A Grassroots Environmental Crisis Center

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COMMENTS ON THE LOVE CANAL HABITABILITY STUDY

Prepared by

Lois Marie Gibbs, Executive Director
Stephen U. Lester, Science Director
August, 1989, updated July, 1990

CCHW
9

The New York State Department of Health (DOH) has concluded that portions of the Love Canal community are as "habitable" as other areas of Niagara Falls. This decision is based on comparing levels of residual contamination in Love Canal with contaminant levels in other areas. This approach of comparing one set of environmental data to another, without actually determining health risks, is not sound scientific procedure for making public health decisions.

DOH violated basic scientific study design by altering their procedures in mid-stream. After realizing that the contaminant levels in the Love Canal areas were significantly higher than the two selected comparison areas. DOH then decided, for reasons they never explained, that they needed additional comparison areas and selected two new areas, both located within the city of Niagara Falls.

To compound matters, when DOH made their decisions on habitability, they only used the results from the two "new" comparison areas in Niagara Falls. The determination of habitability of the Love Canal areas were not based on comparisons to the originally selected controls.

Furthermore, the selected control areas were known to be contaminated by the same polluter who is responsible for Love Canal. This approach is seriously flawed and biased for the reasons described in these comments.

1) A reproductive risk assessment has not been done.

The primary health hazard at Love Canal has always been the reproductive risk to young children and pregnant women. Of all the health studies that have been undertaken at Love Canal, damage to the fetus and to young children has been clearly documented. These reproductive hazards were the

basis for two evacuations ordered by the Health Commissioner for the state of New York. Despite this, there has been no evaluation of the reproductive risks posed by the contaminant levels found in any of the Emergency Declaration Areas (EDA). As a result, there is no way to judge whether the reproductive risks at Love Canal have changed since the evacuation orders were given.

It would be wrong to allow women of child bearing age and children to live in these areas without some understanding of the reproductive risks. If for some reason a reproductive risk assessment cannot be given to new families, than the prudent decision would be to err on the side of protecting public health. No one of child bearing age should be allowed to move in. This is especially true given the history of the site.

2) The selection of inappropriate comparison areas.

The selection of appropriate comparison or control areas is the most critical factor in determining the habitability of the Love Canal Emergency Declaration Areas (EDAs). The determination of habitability is based on whether there is a statistically significant difference between an EDA area and the comparison areas for any of the indicator chemicals. If the comparison areas have contaminant levels that are similar to the EDAs, there will be no statistical difference between the two groups and the EDA will be "habitable." And vice versa, if there is a statistical difference between the two groups, the EDA is not "habitable."

The New York State Department of Health (DOH) set up an elaborate technical and public review process to select comparison areas. DOH went to great lengths to define objective criteria and to develop a thorough process for selecting appropriate comparison areas. They involved the public through public meetings held by the Technical Review Committee (TRC), a group that consisted of all the government agencies involved - DOH, the New York State Department of Environmental Conservation, US Environmental Protection Agency and the Centers for Disease Control. They also involved outside expert Review Panels (there were 3 different panels used at different times during the 5 year period of this study) to oversee the work of DOH.

DOH's decision was to select two areas to be used for comparison: one in Cheektowaga and the other in Tonawanda (referred to as "C&T"). Both locations are in the greater Buffalo-Niagara Falls area (see Vol 1, Love Canal Emergency Declaration Area Habitability Study, Chapter 6).

They then conducted "pilot" testing in the comparison areas and determined median contamination levels. When they compared the results to median contaminant levels in the Love Canal EDAs, they found the levels in Love Canal to be significantly higher than the two comparison areas. This meant that none of Love Canal would be habitable according to the states's criteria. DOH then decided, for reasons they have never explained, that they needed additional comparison areas and selected two new areas, both located within the city of Niagara Falls.

The selection of these two additional comparison areas had a tremendous impact on the habitability determinations. DOH based the decisions of habitability only on the results from the two "new" comparison areas in Niagara Falls. The determination of habitability in the Love Canal EDAs were not based on comparisons to the originally selected controls. If they had, only one of the seven EDAs would have been habitable according to the criteria that was established.

By choosing to make habitability determinations based only on comparisons between the EDA areas and the Niagara Falls areas, DOH biased the entire comparison process against finding any differences between the EDA areas and the comparison or control areas.

The addition of the Niagara Falls comparison areas was also questioned by Dr. Michael Stoline, a member of one of the Expert Review Panels. The only response he was given was that the new sites meet the selection criteria (Vol 5, Habitability Report, p. 5-4). Whether this is true or not, the addition of these control areas was not subject to the same public review process that was used to select the original areas.

Why DOH violated their selection process to include the two Niagara Falls comparison areas is not clear. One possible reason is because they knew, based on the results of the pilot studies (see Comment # 3), that if they only used the original comparison areas (C&T), very little of the Love Canal area would be "habitable." Politically, this scenario was not acceptable since there were major pressures to move families back into Love Canal. Therefore, something had to be done to include comparison areas that would provide data "proving" significant portions of Love Canal were "habitable."

3) DOH biased the comparison area selection process by conducting testing in areas of Niagara Falls that were not included in any of the planning or design documents that were reviewed by the public or the Expert Review Panels.

DOH conducted a "pilot testing program" as part of the implementation of the habitability criteria process. The purpose of these pilot studies was to:

- o Test the sampling and analytical methods proposed for the comparison studies;
- o Provide preliminary data on the levels and statistical distributions of Love Canal Indicator Chemicals (LCICs);
- o Provide a basis for determining the number of samples that needed to be taken to produce statistically valid results for the comparison studies.

None of these objectives includes any basis for adding new comparison areas. This is how the process was violated:

1 - First they took samples from EDA and C&T.
2 - They read the results and saw real differences in the two areas.
3 - Based on these differences they collected samples from Niagara Falls.
4 - The collection of samples from Niagara Falls was not part of the agreed upon process.
5 - They read the samples from Niagara Falls, saw they were closer to EDA and decided to add two new control areas, Census Tracts 221 and 225, located in Niagara Falls.
6 - Committee members of the outside expert Review Panels raised this issue in writing.
7 - This was in direct violation of the agreed upon process and voids the habitability conclusions.

To explain in more detail:

DOH collected samples from C&T and the EDA in the pilot studies. Major differences were found in the contaminant levels between the two areas. DOH then conducted a "follow up study that collected soil samples from areas within EDA, Cheektowaga, Niagara Falls and the town of Wheatfield" (Vol 1, p. 2-6). The decision to gather new test data from areas of Niagara Falls was not part of the decision-making process reviewed by the public and the outside Expert Review Panels. It is not clear who ordered these tests to be done or why.

CORRECTION

THE FOLLOWING DOCUMENTS

HAVE BEEN REPHOTOGRAPHED

TO ASSURE LEGIBILITY

3) DOH biased the comparison area selection process by conducting testing in areas of Niagara Falls that were not included in any of the planning or design documents that were reviewed by the public or the Expert Review Panels.

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The data from these follow-up studies gave DOH information on contaminant levels in the C&T area, the EDA and in Niagara Falls. With this information, DOH could see that there were major differences between the selected comparison areas (C&T) and areas of Niagara Falls. The selected comparison areas (C&T) had significantly lower levels of contamination than the Niagara Falls sites and the EDA. Once DOH knew that the Niagara Falls areas had higher background levels, they were biased and could no longer objectively decide which control areas to use.

DOH had made it clear in the Habitability report that, if given a choice, they would select the comparison area with the highest background levels for use in comparison to the EDA (Vol 1, p. 6-16). Combining this predisposed bias with the knowledge that the C&T comparison areas were significantly less contaminated then the Niagara Falls sites, put DOH in a compromised position.

DOH was compromised because the decision made in the peer reviewed Habitability report was to combine the data from all the comparison areas (Vol. 1, p. 6-16). The peer reviewed decision was to reject the option of selecting the highest background site. This is not what DOH did. Using the results from the pilot testing, DOH selected the comparison area with the highest background levels even though this option had been rejected in the peer reviewed Habitability report (see Comment #7 below).

A major purpose for the open review process was to ensure that the process for determining whether Love Canal was habitable was objective and not biased. Testing in completely new areas of Niagara Falls was not part of the original objectives of the "Pilot Testing Program." Nor was adding new comparison areas. These changes were not agreed upon by the outside Expert Review Panel nor the public and represents a violation of the process that should void the decisions on habitability.

4) No technical justification is provided for why DOH felt it was necessary to add a second set of comparison areas.

DOH added two additional comparison areas from Niagara Falls without providing any technical data to support this decision. Based on the results of the pilot studies, DOH said there were inconsistent patterns if contamination between EDA and C&T. But the data provided by DOH showed that 30% of the samples in the EDA had 1,2,4-trichlorobenzene (TCB) and 1,2,3,4-tetrachlorobenzene (TeCB) while only 2% of the samples from C&T had them.

According to DOH, this pattern was not consistent for the other indicator chemicals. While this may be true, it is not necessarily inconsistent. Another interpretation is that the EDA area is 15 times more contaminated with TCB and TeCB than the control area. DOH reported that "these two contaminants might have reached the EDA from some other local source other than the Love Canal waste site" (Vol 1 p. 6-17). Perhaps, but the source could also have been the Love Canal landfill.

Given the importance of the decision to add additional comparison areas on the entire habitability determination, how can DOH not provide the complete data to justify this decision? Given the fact that $14 million was spent on the habitability process, why was this critical information not included in the final report and not discussed beyond a few sentences that best can be summarized as "trust our judgement on this." This decision is too crucial to the process to be dismissed so lightly.

5) Habitability determinations were based only on comparisons to the two Niagara Falls comparison areas.

DOH violated their elaborate process for determining habitability in other ways. Not only did they add comparison areas that "guaranteed" some areas of Love Canal would be habitable, but they also chose to only use data that met their needs. They give no reasons for why they used some data and ignored other data.

The best example of this can be seen by looking at the comparisons areas that were used to make the habitability determinations. DOH compared the EDA areas to the two Niagara Falls areas and to the C&T areas. The data from the C&T areas were combined but the data from the two Niagara Falls areas were not combined (this is another direct violation of DOH's procedures that is discussed in Comment #7).

But when the habitability determinations were made, DOH only drew conclusions from analyses of the data between the Niagara Falls comparison areas and the EDAs. They did not make any determinations of habitability based on comparisons between the original comparison areas and the EDAs. Yet, the C&T comparison areas were the comparison areas chosen by the peer reviewed selection process.

If DOH had chosen to determine habitability using the C&T comparison areas, very little of Love Canal would have been found to be habitable. In virtually every instance, the Love Canal Indicator Chemicals were statistically highly in each of the EDA areas when compared to C&T (see Comment #7 below).

Had DOH combined the sampling data from all four comparison areas, they would have found that the habitability determinations would be different for significant parts of the EDA. Some of this analysis was done by DOH, but not as part of their efforts to follow their decision-making process. In response to questions raised by the outside expert Review Panel, DOH did combine all 4 comparison areas and compare the results to the EDA areas. The results, shown on Table M-5a of Volume 5 of the Habitability report, are as follows:

LCIC	EDA Areas that are statistically different than the combined comparison areas
a-BHC	1,2,3,4,5,7
d-BHC	1,.2,3,4,5
b-BHC	1,2,3,4,7
g-BHC	1,2,3,4
CNP	-
TeCB	1,2,3,4,5,7
TCB	1,2,3,5,7
DCB	1

If even one of these chemicals is statistically different than the level in the control area, then that entire EDA section would not be habitable according to the habitability criteria.

By combining the sampling results from the comparison areas, the determinations of habitability would have been very different than when only the Niagara Falls comparison areas were used. When the EDA areas are compared to the combined comparison areas, EDA areas 1,2,3,4, 5 and 7 all had at least one LCIC that was statistically different than the combined comparison areas.

Accordingly, these EDA areas would be declared <u>not habitable according to the habitability criteria</u>. Only area EDA 6 would have passed the habitability criteria. Why did DOH not follow the procedures outlined in the Habitability report?

<u>8) Failure to address hot spots, particularly in EDA 4</u>.

Dr. Michael Stoline, a member of the outside expert Review Panel, submitted written comments on the final determinations of habitability of Love Canal on May 10, 1989. Dr. Stoline disagreed with a number of the determinations of habitability, especially for EDA 4 and he raised several important issues.

First, he raised the fact that EDA 4 is no different from the Niagara Falls comparison areas and on this basis alone, does not meet the criteria for habitability. Dr. Stoline specifically recommended "re-assessment and interpretation of habitability with specific reference to adherence to the comparison criteria 'of one order of magnitude differences.'"

Dr. Stoline is concerned that the levels of b-BHC in EDA 4 represents a hot spot that is not addressed because of the way the data is analyzed and that other hot spots likely exist throughout the EDA. According to Dr. Stoline, hot spots exist in 5% of the areas sampled in EDA 4.

This is a significant comment that is not being addressed by the decision on habitability except to say that it will be dealt with by the Land Use Committee. With all due respect to the members of the Land Use Committee, they do not have the technical skills to assess these hot spots, let alone identify them.

Dr. Stoline provided in depth analysis of the hot spots in the EDA compared to Niagara Falls comparison areas 221 and 225 (hereafter referred to as NF-221 and NF-225). He uses the 95 percentile as a way to compare the data. The 95 percentile tells you that 95% of the samples had lower concentration levels than the 95 percentile level. This analysis is a good way to assess the presence of hot spots, which clearly exist in EDAs 4 and 5 (see Table on page 4 of May 10th comments).

According to Dr. Stoline, EDA 4 does not meet the criteria for habitability. His analysis supports his contention. DOH should not ignore his comments. If EDA 4 does not meet the criteria, it should not be declared habitable. DOH should also not leave the issue of hot spots to the Land Use Committee to deal with.

9) Niagara Falls comparison area 225 (NF-225) is not an appropriate comparison area.

Dr. Stoline clearly describes the fact that the Niagara Falls comparison area 225 (NF-225) is not an appropriate control area because it contains too much contamination. His argument is based on comparison of contamination in NF-225 and NF-221 for the eight soil LCICs (see table on bottom of p. 6 of May 10th comments). Dr. Stoline argues that EDA 1 and 4 are the only two EDA sections that have at least one LCIC that exceeds contaminant levels by one order of magnitude at the 95 percentile. By this logic, if EDA 1 is not habitable, then EDA 4 is not habitable?

Dr. Marvin Schneiderman, retired Associate Director of the Cancer Cause and Prevention Division of the National Cancer Institute agrees with Dr. Stoline's analysis and comments that NF-225 is not a proper comparison area. Dr. Schneiderman reviewed much of the data on the habitability decision and comments that "at least one of the chemicals ("2 cloro") is a non-discriminator" because there is less than a two fold difference between the highest and the lowest areas, for the 95 percentile.

What this means is that the contamination in NF-225 is statistically similar to the contamination in the EDA areas. As a result, NF-225 is a "non- discriminator" and should not be used for comparisons because it cannot discriminate among the EDA areas (see Table on page 7 of Stoline's comments and page 2 of Schneiderman's comments). According to Dr. Schneiderman's assessment, EDA's 1,2,3, probably 4 and 5 are excessively high compared to NF-221 and thus do not meet the criteria for habitability.

The comments of these two highly regarded statisticians raise important fundamental weaknesses in DOH's statistical assessment. Although DOH is unaware of Dr. Schneiderman's comments, they have continued to ignore Dr. Stoline's comments. These comments rightfully should be addressed because the issues they raise influence the determinations of habitability in different EDA areas.

10) Statistical procedures used to determine habitability were not appropriate for the task.

Dr. Stoline claims that the procedures used in the habitability determination were "defensible for the purposes of collection of data and a first round assessment of habitability. However, these statistical procedures are, by themselves, not appropriate for the complete determination of habitability" (Stoline comments May 10, 1989). Dr. Stoline raised this same concern a year earlier and his advice and recommendations have been ignored.

Dr. Stoline is statistician (there were two statisticians on the outside Expert Review Panels). The area of expertise that he brings to the TRC is statistical analysis. Why ask an expert to review a set of procedures and then ignore this specific advice and recommendations.

To summarize, DOH set out a number of criteria for selecting comparison sites, for comparing data from the selected comparison sites to the EDA areas and for analyzing the data. DOH did not follow these procedures and arbitrarily used only data that seemed

to meet their hidden agenda of making sure that a significant portion of Love Canal was found "habitable" according the DOH's lengthy review process.

In our opinion, it is a violation of people's trust and scientific integrity for DOH to ignore these issues and give the Land Use Committee the go ahead for residential use. Clearly, using DOH's own criteria, all but EDA 6 are not habitable. Thus "prudent public health policy" would dictate that families should not be allowed to move into the area.

Even though EDA 6 may pass the criteria, there still remains the question of reproductive risks. It would be wrong to permit women of child bearing age to move into the area without a clear understanding of the reproductive risks.

There are many other issues that should be sufficient to stop the proposed settlement of Love Canal including, the fact that the furthest point of the EDA from the canal proper is three tenths of a mile; the fact that Love Canal has not been fully cleaned up; residual contamination remains in storm sewers, groundwater and in surface soils and, throughout the area, "Hot Spots" of high contamination have been identified; the presence of 21,000 tons of toxic waste "contained" within a barrier drain system in the center of the community. This containment system is, at best, a temporary measure that will eventually fail allowing chemicals to leak back into the community.

There is no scientific basis for moving back into people back into Love Canal. New York state's process was biased and unscientific and places potential new homeowners at undetermined health risks. This proposed resettlement of Love Canal should be stopped.

Written Comments from Citizens' Environmental Coalition

Citizens Environmental Coalition
33 Central Avenue, Albany, New York 12210
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RECEIVED
JAN 31 1991
Division of Environmental Health Assessment

Dr. Edward Horn
Center for Environmental Health
NYS Department of Health
2 University Place
Albany, New York 12203

January 28, 1991

Dear Dr. Horn:

Thank you for extending the comment period on the Love Canal Declaration Area Remediation of EDA 2 and 3 Draft Study Report. As you may know, Citizens' Environmental Coalition is a statewide coalition of 80 community, environmental and labor groups which has strongly opposed the resettlement of Love Canal for years and continues to do so.

We are deeply concerned about the proposed remediation of EDA 2 and 3 and the conclusions in your report. The justification for only removing 6 inches of soil from EDA 2 and 3 again rests on a comparison approach to other contaminated areas. This is not a public health protective approach. Hexachlorobenzene, for instance, "has been shown to cause cancer in mice and hamsters and is a suspect human carcinogen." (NYSDOH Chemical Fact Sheet). We believe the levels of contamination found at 6 to 12 inches are significant and should be cleaned up. We disagree with the conclusion that it is "sufficient" to only clean up to levels which are similar to the conditions of habitability established for the Love Canal EDA. A remedial plan should be established with the goal to clean up to background levels (before wastes were deposited there). It is our understanding that DOH is working with the Departments of Law and Environmental Conservation on a Cleanup Level Task Force which has decided on a goal of cleaning up to background levels. The Environmental Conservation Law states that remediation of inactive hazardous wastes sites should be to "eliminate" any "significant threats". A comparison approach undermines any preventative health policy on toxic substances and legitimizes certain levels of contamination.

CEC 1

CEC 2

We beleive any remediation plan should be developed separate from the Department of Health's habitability decision as these are two different processes. One was to determine if Love Canal's contamination was "habitable" with no clear definition of what that meant and a clear statement by the Commissioner that it did not mean safe. The other process is to determine how to clean up EDA 2 and 3. What is gained by cleaning up only 6 inches of soil and leaving behind documented contamination which could cause potential exposure problems to future residents of chemicals for which we are not fully knowledgable of all their health impacts. The remedial effort should not be a reduction of contamination of the most concentrated area (which is not fully known because of lack of groundwater testing) but rather a full cleanup to at least 12 inches.

CEC 3

The lack of groundwater testing in the study, as well as, air is disturbing and results in an incomplete picture of the EDA 2 and 3 area contamination. Another problem is the lack of testing for all chemicals known to have been dumped at Love Canal. Testing for indicator chemicals is not adequate. We believe an incomplete picture of contamination is being remediated incompletely.

CEC 4

We respectfully request that DOH expand their testing of the areas and recommend a full cleanup of all contamination found. We appreciate the extension of the public comment period, however, we are disappointed that we had to ask for the report and the comment period. It is unfortunate that DOH did not proactively set up a public participation process and therefore, ETF, CCHW, NRDC and our group -- all of whom have submitted testimony and letters to DOH for years on this site -- did not automatically receive the report and a comment period.

We hope you will consider our concerns in your deliberations. Thank you.

Sincerely,

Anne Rabe

Anne Rabe
Executive Director

Written Comments from Natural Resources Defense Council

Natural Resources
Defense Council

[illegible]

January 28, 1991

BY FAX / CONFIRMATORY LETTER BY MAIL

RECEIVED
FEB - 4 1991
Division of Environmental
Health Assessment

Ed Horn
Environmental Scientist
2 University Place
Division of Environmental Health Assessment
Albany, New York 12203

Re: Draft Study Report on
Remediation of EDA 2 and 3

Dear Mr. Horn:

I enclose some comments by NRDC on the draft study report on remediation of EDA 2 and 3.

I hope that you will find these comments constructive and helpful. As you will note, our comments also include some questions.

Please call me if you would like to discuss our comments or any aspect of the Love Canal situation.

Yours truly,

James F. Simon
Senior Attorney

JFS/kr
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COMMENTS OF

THE NATURAL RESOURCES DEFENSE COUNCIL

ON

THE NEW YORK DEPARTMENT OF HEALTH'S

DRAFT STUDY REPORT ON

REMEDIATION OF LOVE CANAL EMERGENCY DECLARATION AREAS 2 AND 3

January 28, 1991

James F. Simon
Senior Staff Attorney
Natural Resources Defense Counciol
40 West 20th Street
New York, New York 10011
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The Natural Resources Defense Council ("NRDC") welcomes this opportunity to comment on the New York State Department of Health's ("DOH's") Draft Study Report on Remediation of Love Canal Emergency Declaration Areas 2 and 3 (the "study" or "draft study report").

NRDC is a non-profit membership organization dedicated to protecting natural resources, the environment, and public health. NRDC has over 130,000 members throughout the country, including over 14,500 residing in New York State. Since its founding in 1970, NRDC has sought to improve public health, among other ways, by working to reduce or eliminate threats the public's exposure to unsafe substances.

NRDC has a staff of lawyers and scientists in New York, Washington, D.C., Los Angeles, San Francisco, and Honolulu. Since the early 1980s, one public health issue on which our staff has worked has been Love Canal and the debate and legislation following the discovery of chemical contamination at Love Canal.

Recently, NRDC has been among several independent organizations to point out that the Love Canal Habitability Study has several fundamental flaws, including a failure to assess the risk of rehabitation of the Love Canal Emergency Declaration Area ("EDA").

The study report purports to follow the methodology of the Love Canal Habitability Study. As a result, the study report, in our view, begins from the wrong point. The study report cannot, therefore, help but contain problems. We wish to point out some of these problems below.

We know that the DOH staff, like us, wish to prevent dangers to public health at Love Canal. We hope that the DOH staff will accept these comments as constructive criticism and amend the draft study report in response. Our comments are not intended as personal criticisms.

We would like to thank DOH's staff for granting an extension of time in which to submit these comments.

I. FAILURE TO FOLLOW THE NATIONAL CONTINGENCY PLAN

The study report does not comply with the procedural and substantive requirements of the National Contingency Plan ("NCP"), 40 C.F.R. Part 300.

NRDC 1

The draft study report does not cite the NCP, does not utilize standards from the NCP, and does not make reference to EPA guidances on how to implement the NCP. In several respects, the draft study report is inconsistent with the NCP. In light of the fact that the draft study report appears to assume that the NCP is inapplicable, it does not seem profitable to list all of the inconsistencies. Examples of inconsistency with the NCP include the following: the draft study report does not include an investigation into the toxicity, propensity to bioaccumulate, and persistence of relevant wastes; does not analyze routes of human health exposure; does not assess the risks to human health and the environment; does not evaluate compliance with applicable or relevant and appropriate requirements; and does not evaluate alternative responses. See, e.g., 40 C.F.R. § 300.430.

If the DOH staff believe that the NCP is not legally applicable to remediation of EDA 2 and 3, we would request an explanation of the basis for their belief.

Furthermore, even if the NCP were not legally applicable, the NCP would be a useful guide for any remediation. The NCP was developed by the U.S. Environmental Protection Agency after extensive public comment to provide the basis for complete remediation of hazardous waste sites. Even if the NCP were not legally applicable, we would request an explanation as to the extent to which the DOH staff used the NCP as a guide.

II. THE DRAFT STUDY REPORT'S FOUNDATION IN THE LOVE CANAL HABITABILITY STUDY

NRDC 2

The draft study report is based on the methodology and assumptions of the Love Canal Habitability Study. NRDC has submitted comments on more than one occasion to DOH concerning the Love Canal Habitability Study. NRDC hereby incorporates by reference its comments on the Habitability Study. For example, we attach a copy of a letter of May 3, 1990 from NRDC's Jacqueline Warren and Rebecca Todd to EPA Administrator William Reilly.

III. IMPROPER SCOPE OF THE STUDY

NRDC 3

A. <u>The study does not investigate alternatives</u>.

The draft study report does not investigate alternative remedial measures. Instead, the draft study report assumes that the remedial measure will be removal of soil and asks only whether the depth of removal should be 3, 6, or 12 inches.

B. The study fails to investigate contamination sources other than presence in soil.

The draft study report fails to investigate contamination sources other than the presence in soil. For example, the draft study report ignores the potential contamination of groundwater. Furthermore, the draft study report takes no account of surface waters within EDA 2 and 3.

NRDC 4

C. The study fails to address harm that may be caused to nearby residents due to soil removal or to evaluate ways to mitigate the harm.

The draft study report fails to investigate the harm that may be caused by the remediation itself. If removal of the top layer of soil is chosen as the remediation method, the construction activities associated with removal will have a tendency to kick up dust, including the contaminants present in the soil. The draft study report should evaluate the risk presented by the construction activities and ways to mitigate or eliminate the risk.

NRDC 5

D. The study fails to evaluate the method of treating or disposing of the removed soil.

The soil removed from EDA 2 and 3 must be treated or disposed of. The draft study fails to evaluate alternatives for treatment or disposal.

NRDC 6

E. The study improperly limits its investigation to Love Canal Indicator Chemicals.

NRDC 7

The draft study report looks into the presence of only the Love Canal Indicator Chemicals ("LCICs"). We have three comments about the choice to investigate only LCICs.

First, it must be recognized that the LCICs were not selected on the basis of risk.

Second, the LCICs represent variations on only two types of chemicals: some chlorobenzenes and hexachlorocyclohexanes. These chemicals do not represent the full range of chemical and physical characteristics, including persistence and pathways through the environment, found in the chemicals dumped in Love Canal.

Third, the LCICs were used -- as their name implies -- as indicator chemicals. By hypothesis, the presence of LCICs in EDA 2 and 3 at elevated levels implies the presence of other Love Canal chemicals at EDA 2 and 3. The draft study report fails to investigate whether the soil removal will remediate the presence of the other Love Canal chemicals.

Furthermore, the additional Love Canal chemicals may be present in the dust created by the soil removal. The extent of the risk posed by these additional chemicals during soil removal must be evaluated.

IV. IMPROPER ASSUMPTIONS AND EVALUATION OF DATA.

A. The study improperly assumes that the soil in EDA 2 and 3 is divided into uniform and regular strata.

NRDC 8

The draft study report improperly assumes that the soil in EDA 2 and 3 has settled in uniform and regular strata. This

assumption underlies the comparison between the soil layers at various depths throughout the areas.

This assumption is not plausible. EDA 2 and 3 were residential areas for many years. The areas were subject to the construction, filling, digging, and landscaping common to residential areas. These activities make it impossible to assume that the presence of chemicals at certain depths throughout the area are comparable or subject to the statistical analysis employed in the draft study report.

B. The study fails to correlate the study samples with the samples taken for the Love Canal Habitability Study.

NRDC 9

The draft study report compares soil samples in EDA 2 and 3 in December 1989 to earlier samples taken in EDA 2 and 3, as well as other areas, in connection with the Love Canal Habitability Study. However, the draft study report does not contain information correlating the December 1989 samples with earlier samples from EDA 2 and 3. Such a correlation is necessary to check for differences in the data that may be due to various extraneous causes: for example, time, weather, differences in location, or analytical variability.

C. The study fails to correlate the soil samples with other important soil measurements.

NRDC 10

A well-devised sampling plan for the soil samples would include measurements of variables that may be suspected of affecting the degree of contamination: for example, the amount of moisture in the soil; soil type, including organic content;

and vegetation. These measurements would be important to ensure that the statistical analysis is not skewed by other factors that more strongly correlate with the presence of LCICs. However, the sampling plan for the draft study report included no such safeguards.

V. FAILURE TO EXPLAIN IMPORTANT DATA

NRDC 11

The draft study report fails to explain -- or even acknowledge -- implications from the data that raise questions about conclusion. A review of Appendix C, "Individual Sample Results," reveals many sampling locations where LCICs are present in the soil from 6 to 12 inches below the surface in amounts as great or greater than at 3 inches. Indeed, we count 17 such locations out of 39 total sampling locations in EDA 3. That is, approximately 44 percent of the sampling locations in EDA 3 show a pattern of contamination inconsistent with the general conclusion of the draft study report that removal of the top six inches of soil will be sufficient remediation.

VI. QUESTION ABOUT THE STATUS OF THE DRAFT STUDY REPORT

NRDC 12

The legal status of the draft study report is not made clear in the report. Nor does the report state what procedure DOH intends to follow hereafter. We request clarification of these points.

Our questions include the following:

a. Under what statutory or regulatory authority is this study report made?

b. Under what statutory or regulatory authority will the remediation be made? NRDC 13

c. Will DOH respond to these comments? If so, when?

d. What are the next steps? For example, when will the final study report be issued, and what steps will follow thereafter? NRDC 14

e. Do commenters on the draft study report have any recourse to an appeal if their comments are not accepted? If so, on what basis and on what schedule?

VII. SHARING COMMENTS WITH THE TECHNICAL REVIEW COMMITTEE

We request that DOH share these comments with the New York Department of Environmental Conservation and the Technical Review Committee established for Love Canal.

NRDC appreciates this opportunity to comment on the draft study report and looks forward to DOH's response.

Natural Resources
Defense Council

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New York, New York 10011
212 727-2700
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May 3, 1990

Mr. William K. Reilly,
Administrator
Environmental Protection Agency
401 M Street, S.W. (A-100)
Washington, DC 20460

Dear Administrator Reilly,

We understand that you are going to decide very soon whether or not to approve the proposed rehabitation of the Love Canal Emergency Declaration Area, and we are writing this letter to reiterate NRDC's continuing strong opposition to the proposal. Indeed, the more closely we have examined the history of the proposal and considered its future implications, the more unconscionable it appears on legal, scientific, and ethical grounds. Although there is support for the proposal within EPA and some groups within New York State, you should be aware that there is substantial opposition and concern among local and national citizens organizations. We therefore urge you to withhold your approval for the proposed rehabitation of the Love Canal EDA.

We sincerely hope that the serious issues raised by the proposal can be resolved amicably, and are committed to working with the EPA and any other interested parties in order to find an acceptable solution. Nevertheless, because of the gravity of the situation and the national implications that we foresee following EPA approval of the rehabitation proposal, we are fully prepared to seek a legal resolution of our concerns. In the hope of convincing you of the inadvisability of proceeding with the rehabitation as proposed, we offer for your consideration the following further thoughts and concerns, along with a copy of NRDC's testimony before the New York State Assembly Standing Committee on Environmental Conservation dated March 9, 1990, with enclosures. In addition, we are enclosing a copy of the CBS Evening News segment on the proposed rehabitation, in case you missed the broadcast on March 15, 1990.

I. Precedential Implications

If implemented, the proposed rehabitation of the Love Canal Emergency Declaration Area will set a negative precedent throughout the federal Superfund program and in comparable state programs across the United States. Remediation technologies at Superfund sites and residual contamination levels in surrounding areas that are equivalent to what is deemed to be "habitable" at

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the Love Canal EDA will come to be regarded by citizens, industry, and government as safe and appropriate for human habitation. The ability of both Federal and State Superfund programs to effectively and efficiently clean up hazardous waste sites will be seriously undermined in the face of this erroneous "habitable equals safe" equation.

The Habitability Study defines habitable as "suitable for human habitation, including all ages and both sexes (including pregnant women) engaged in normal activities." Habitability Study at 3-1. In so doing, it carefully and quite deliberately avoids addressing the issue of safety. Thus, the word "habitable" as used in the proposed resettling of Love Canal does not mean safe; it merely means that people can physically reside there. Indeed, the Habitability Study itself states that

> "[t]he intent of the recommended approach (of using Comparison Areas and Love Canal Indicator Chemicals, or LCICs) is to determine if the chemicals from Love Canal have reached the EDA in sufficient quantity to create a significant difference between the concentration of the LCICs in the EDA and the concentration in the comparison areas. <u>This approach purposely does not assess the health impacts of the Love Canal on the EDA.</u>

Habitability Study at 2-2 (emphasis added). New York State Commissioner of Health David Axelrod further corroborated the glaring lack of human health and safety analyses in stating that "[t]here is <u>nothing</u> in my (Habitability) decision which addresses the element of risk." Letter from David Axelrod to the New York Environmental Law Institute dated October 17, 1988 (emphasis added).

Because health impacts on residents are ignored, nearly <u>any</u> area could be deemed habitable or suitable for human habitation under the definition used in the Habitability Study. Thus, the Comparison Approach employed in the Habitability Study effectively translates into a "no worse than" test, pursuant to which it is deemed acceptable for people to move back into an area that is found to be no worse with regard to toxic contamination than another where people presently live. Under such a rationale, the universe of habitable areas is large, and certainly larger than the more appropriate universe of areas where it is actually safe for people to live.

The "no worse than" test as applied in the Niagara Frontier devolves into a "just as contaminated" test. Indeed, the fundamental flaw in using background values to help ascertain habitability was graphically illustrated by the discovery of contaminated fill in one of the comparison areas. The danger of using background values inheres in the possibility, turned reality here, that the background itself may have unacceptable

levels of contaminants. In a related vein, the discovery of hotspots in one of the areas proposed for rehabitation throws further doubt on the methodologies used in the Habitability Study, and provides additional substantial support for its rejection.

Merely appending a caveat or issuing a press release that the rehabitation at Love Canal is site-specific and will have no ramifications for Federal or State Superfund programs is an empty and futile gesture. Simply stating something does not make it so; people across the country are watching Love Canal with interest and are unlikely to heed explanations attempting to circumscribe the influence of the decision made regarding rehabitation. Nor will an explanation negate the effect that approving the rehabitation will have on the improving reputation of the Superfund program, the Environmental Protection Agency, or the Administration.

II. Risk Assessment

The lack of an adequate understanding of the human health and safety ramifications of resettling the Emergency Declaration Area is directly contrary to the requirements of CERCLA §312, which directs the EPA "to conduct or cause to be conducted" a risk assessment for each of the potential uses of the EDA, including rehabitation. The legislative history of the Love Canal Property Acquisition Amendment, which was enacted as §312, reveals that a risk assessment was explicitly warranted and expected. The House Conference Report of October 3, 1986, states that "[t]he amendment requires the Administrator to conduct and publish a habitability and land-use study <u>assessing the risks</u> associated with inhabiting the Love Canal Area." H.R. Rep. No. 99-962, 99th Cong., 2d Sess. 280 (1986) (emphasis added).

Despite the language and express legislative intent of §312, those working on the Habitability Study that was published in May 1988 neglected Congress' explicit directive in 1986 that a risk assessment be performed for the proposed rehabitation. In fact, the Habitability Study contains a section specifically explaining why a risk assessment was <u>not</u> done. Thus, nothing even remotely resembling a standard risk assessment has been done for any of the potential uses of the EDA. In fact, there has not even been a discussion of all of the potential uses of the EDA, and some with real promise have been largely ignored.

III. Affected Populations

NRDC has serious concerns about who will purchase homes in the EDA if they become available, and the impact of contamination on those purchasers. According to the most recent estimates, approximately 185 persons have expressed interest in purchasing homes in the EDA should they become available. Although there is

no recent demographic analysis of those interested in EDA homes, LCARA informs us that a significant percentage of the prospective purchasers are persons of color with limited economic means. Homes in the EDA would provide inexpensive "starter homes" for such minorities and others who currently reside in the Niagara Falls area. The disparate impact of hazardous waste sites on minorities has been documented repeatedly; EPA should be sensitive to this problem and to the ease with which it could be avoided here.

The lure of inexpensive housing is also likely to draw relatively young families with children and women of child-bearing age. These groups should be considered especially sensitive to the effects of toxic chemical exposures. Persons considering buying homes in the EDA are entitled to rely on representations made by the government and expert agencies as to the risks associated with living in those homes. Yet, adequate assurances regarding present and future risks cannot be given them, nor to our knowledge have steps been taken to accurately communicate to prospective purchasers the history and current status of the Love Canal hazardous waste site and surrounding community. For all of these reasons, NRDC has urged both EPA and New York State to refrain from inviting people to resettle the Love Canal Emergency Declaration Area.

IV. Future Liability

Another consideration in evaluating the prudence of rehabitating the Love Canal EDA concerns potential future liability. As all such remedies must, the cap and containment system at the Love Canal site will eventually fail. The resulting toxic breakout could seriously adversely affect the health of those who resettle the EDA. Even without such a breakout, it is certain that health problems <u>will</u> occur at Love Canal. Whether they are due to the 21,800 tons of hazardous wastes still buried on site, or to some other agent, the first suspect by default will be Love Canal.

In large measure, the proposed rehabitation is problematic because of the certainty of remedy failure in the future, and the unavoidable uncertainties created by the inherent limitations of current technologies and available knowledge concerning hazardous waste remediation. Rather than dealing with future health problems and complaints, the attendant bad publicity, attempts to ascertain the cause of those health problems, and questions of liability, EPA should withhold its imprimatur from the proposed rehabitation.

V. Conclusion

The proposed rehabitation of the Love Canal Emergency Declaration Area is an extremely bad idea whose time has

apparently come. For the reasons stated above and in our testimony before the New York State Assembly Standing Committee on Environmental Conservation dated March 9, 1990; our letter to you dated February 5, 1990; and our comments to LCARA on the Love Canal Master Plan Draft Generic Environmental Impact Statement dated January 20, 1990, we reiterate our urgent request that you disapprove the proposed rehabitation. The time has come to acknowledge that there are serious legal and methodological problems with the proposed rehabitation and the Habitability Study on which it relies, and move on to considering uses of the EDA that will jeopardize neither human health nor the integrity of the entire Superfund program.

Yours truly,

Jacqueline M. Warren
Senior Staff Attorney

Rebecca E. Todd
Legal Fellow

Natural Resources
Defense Council
40 West 20th Street
New York, NY 10011

Encl.

cc: E. Donald Elliott
Don R. Clay
Lewis Crampton
Constantine Sidamon-Eristoff
Frank Murray
James A. Sevinsky
Thomas C. Jorling
David Axelrod

Additional Verbal Comments

Verbal comments were received by the Health Liaison Program (Charlene Thiemann) and the NYDEC Love Canal Public Information Office (Michael Podd) and have been characterized below by the recipients of the comments.

Louise Lewis, Love Canal Environmental Action Committee

1. Remaining residents want the remedial work done quickly and do not want to wait two years for its completion.

Unnamed Love Canal residents

2. The report should have included a feasibility study for remediation and not just analysis of sampling data.
3. A safety hazard may be created, particularly near sidewalks, if 6 inches of soil are removed and not replaced.
4. The State should consider removal without replacement at vacant properties, but the removed soil should be replaced with clean fill where homes are occupied.

Responses to Public Comment

Citizen's Clearinghouse for Hazardous Waste

1 This report is not a Remedial Plan. It is an assessment of the depth of soil in EDA 2-3 that would need to be removed to remediate soil contamination. Two new paragraphs have been added to the end of the Introduction section (p. 2) to make this clear. Responses to the detailed points are addressed below.

2. The State believes that the original habitability criteria are scientifically sound and appropriate for the Love Canal and that these criteria should serve as the standard for remediation in EDA 2-3. These criteria are the product of many years of effort by the governments' Technical Review Committee, independent scientific advisors and the public. All discussions and decisions, including those related to the selection of comparison areas and the interpretation of data from these areas, were made in open public meetings. The decisions were subjected to independent peer and public review both before and after being implemented. A response to the letter of May 3, 1990 from NRDC has already been provided by William K. Reilly, Administrator of the USEPA (Appendix F).

3. Comparison areas in Niagara Falls are not "known to be contaminated" in any general way with wastes from Occidental Petroleum/Hooker Chemical or anyone else. Soils containing elevated levels of Love Canal Indicator Chemicals (LCICs) were discovered in the parking lot of the Niagara Community Church after the Habitability Study was completed. This property is in the southeastern corner of the Census Tract 221 comparison area. The contamination was determined to be localized to that area and the effect of its presence in the area on the comparisons in the Habitability Study was evaluated. A panel of independent experts reviewed the information in a public meeting and agreed that the presence of this area of contamination did not invalidate or influence the results of the Habitability Study.

   Area-wide sources of LCICs such as emissions from incinerators were specifically considered by the Expert Panel, TRC and peer reviewers when the comparison areas were being selected. The Niagara Falls comparison areas were specifically included in the study in order to discriminate these possible sources of LCICs in the EDA from Love Canal sources.

4. The New York Department of Health did issue a statement regarding the risks to public health of the levels of contamination found in the EDA and comparison areas (Appendix E). Webster's Third New International Dictionary (1986) defines safe as "freed from harm, injury, or risk: no longer threatened by danger or injury; secure from threat of danger, harm, or loss". In an absolute sense, the EDA, as indeed any neighborhood, cannot be considered safe.

   Habitability for the EDA was defined in relative terms rather than absolute terms. As described by the habitability criteria, the issue in the EDA is whether chemicals from the Love Canal migrated so as to render the surrounding EDA not habitable. The comparisons with the Niagara Falls neighborhoods were more appropriate than those with Cheektowaga and Tonawanda to resolve this issue.

   Cleanup cannot "eliminate health risks". The comparison approach taken in this study and the potential remediation seeks to assess and restore the EDA to what it would be had the Love Canal not been there.

5. No "hot spots" of LCIC contamination have been identified "throughout EDA 2 and 3". Contamination in the storm sewer along Frontier Avenue is not relevant to habitability of EDA 2-3, and it is being remediated separately from potential remediation of soils in EDA 2-3.

6. The importance of swales to transport of contamination from the Love Canal to EDA 2-3 was considered by the habitability decision (NYDOH, 1988 pp. 25-26). Data do not support the contention that swales and historically wet areas "have always had higher levels of contamination", and the data do not support a hypothesis that swales have deposited chemical contamination from the Love Canal in EDA 2-3 even though considerable effort was expended to assess the possibility.

7. The potential presence of contamination in soil deeper than twelve inches is not at this time of public health significance to the EDA. Buried contamination is still being discovered in many areas of western New York and indeed throughout the State. When discovered during excavation for development or building expansion, its health significance is evaluated and appropriate steps taker to prevent exposure of future residents. The data suggest that the EDA is no different than any other part of Niagara Falls in this regard. If such contamination is discovered in the future, it will be addressed in the same manner as it is being handled elsewhere.

8. As noted above, this report is not the Remedial Plan. Other remediation alternatives have been assessed.

9. A response to the document entitled *Comments on the Love Canal Habitability Study* has already been provided by William K. Reilly, Administrator of the USEPA (Appendix F).

Citizens' Environmental Coalition

1. Median hexachlorobenzene (HxCB) concentrations in soils from this study are probably biased high, because the sample locations selected were those with the highest LCIC soil concentrations in the Habitability Study so that the statistical problems caused by a high number of non-detects could be minimized. Even so, the median HxCB concentration in the top 3 inches of soil was 3.3 ppb and 3.5 ppb in the next 3 inches. At 6-12 inches the median HxCB was 1.7 ppb. The highest HxCB concentration found in any sample was 380 ppb (in the top 3 inches of a core). The highest concentration in any core for the 6-12 inch depth was 65 ppb. Clearly remediation will reduce any risk posed by HxCB in the soil, but the presence of these concentrations of HxCB do not alter the conclusions presented in the NYDOH fact sheet entitled *Love Canal Soil Assessment Indicator Chemicals, May 1988* (Appendix E).

2. "Cleaning up to background" requires a comparison approach and the definition of "background". Remediation of EDA 2-3 to address contamination of the surface 6 inches of soil is equivalent to cleaning up this area to the level of "background" for this region of Niagara Falls. The Habitability Study comparison areas were chosen because they were not influenced by the Love Canal or other sites of hazardous waste disposal. Removal of the surface 6 inches of soil in EDA 2-3 would result in the remaining soils being no more contaminated than soil in neighborhoods not influenced by hazardous waste disposal sites. This remediation is equivalent to restoring the area to what it would be had the Love Canal not been there.

   As stated in the Habitability Decision (NYDOH, 1988), risks posed to residents in EDA 2-3 are now greater than those to residents of the comparison areas and would therefore require remediation for residential use of the area. However, there is no "significant threat" in EDA 2-3 to eliminate. As noted in Appendix E and in the Habitability Decision, even without remediation, contamination in EDA 2-3 is not an immediate health threat to residents in the area. In addition, commercial or industrial uses of EDA 2-3 would not require remediation.

3. The Habitability Criteria clearly define "habitable" as "suitable for human habitation", and discuss this definition at some length (CDC and NYDOH, 1986, Appendix 4). Habitability for the EDA was defined in relative terms rather than absolute terms. Webster's Third New International Dictionary (1986) defines safe as "freed from harm, injury, or risk: no longer threatened by danger or injury; secure from threat of danger, harm, or loss". In an absolute sense, the EDA, as indeed any neighborhood, cannot be considered safe. The Habitability Study results indicate that chemicals from the Love Canal are not a source of additional risk to residents living in the habitable portion of the EDA.

4. Groundwater testing was considered during formulation of the Habitability Criteria and rejected as a criterion because the exposure potential from shallow and deep groundwater was considered to be low, as the neighborhood is served by public water from the Niagara Falls and Wheatfield systems (CDC and NYDOH, 1986, Appendix 9). In addition, data indicated that groundwater was not a major route of transport of contaminants from the Love Canal into the EDA. Groundwater testing is being carried out by NYDEC to monitor containment of the Love Canal.

   Exposure to contaminants in groundwater remains unlikely, and there is no clear evidence that the Love Canal is contributing to groundwater contamination in the Love Canal vicinity. The current groundwater monitoring program at the Love Canal will provide ample time to take any necessary precautions to prevent exposure of residents to possible groundwater contamination in the event that a potential risk of such exposure is identified.

Natural Resources Defense Council

1. This study was carried out under the authority of State law (Article 27 of the Environmental Conservation Law and Section 1388 of the Public Health Law). The National Contingency Plan (NCP) is not applicable.

   This report is not a Remedial Plan for EDA 2-3. NYDEC has prepared a Cost Analysis Report and would prepare detailed design documents if remediation is carried out after a final land use determination has been made for EDA 2-3. A new paragraph has been added to the end of the Introduction section (p. 2) in this report to clarify the matter

   The specific issues which are provided as examples of inconsistencies with the NCP (e.g. investigation of toxicity, bioaccumulation potential, and persistence of wastes; routes of exposure; risks to health; etc.) were addressed in the formulation of the Habitability Criteria (CDC and NYDOH, 1986) and thus evaluated by the Habitability Study.

2. The State believes that the original habitability criteria are scientifically sound and appropriate for the Love Canal and that these criteria should serve as the standard for remediation in EDA 2-3. These criteria are the product of many years of effort by the governments' Technical Review Committee, independent scientific advisors and the public. All discussions and decisions, including those related to the selection of comparison areas and the interpretation of data from these areas, were made in open public meetings. The decisions were subjected to independent peer and public review both before and after being implemented. A response to the letter of May 3, 1990 from NRDC has already been provided by William K. Reilly, Administrator of the USEPA (Appendix F).

3. As noted above, this report is not a Remedial Plan for EDA 2-3. Alternative remedial measures were considered and rejected as not feasible or practical

4. Groundwater testing was considered during formulation of the Habitability Criteria and rejected as a criterion because the exposure potential from shallow and deep groundwater was considered to be low, as the neighborhood is served by public water from the Niagara Falls and Wheatfield systems (CDC and NYDOH, 1986, Appendix 9). In addition, data indicated that groundwater was not a major route of transport of contaminants from the Love Canal into the EDA. Groundwater testing is being carried out by NYDEC to monitor containment of the Love Canal.

   Exposure to contaminants in groundwater remains unlikely, and there is no clear evidence that the Love Canal is contributing to groundwater contamination in the Love Canal vicinity. The current groundwater monitoring program at the Love Canal will provide ample time to take any necessary precautions to prevent exposure of residents to possible groundwater contamination in the event that a potential risk of such exposure is identified.

   There are no bodies of surface water in EDA 2-3.

5. If remediation is carried out, detailed design documents will consider any potential harm associated with remediation and ways to mitigate that potential harm.

6. As noted in the Cost Analysis Report, all waste materials from EDA 2-3 would be nonhazardous solid waste. Two alternatives for the disposal of removed soil have been considered in that report.

7. The Love Canal Indicator Chemicals (LCICs), which included chloronaphthalene in addition to the three chlorobenzenes and hexachlorocyclohexanes, represent chemicals disposed of at the Love Canal that have the potential to move through soil and are

sufficiently persistent to remain today even if they had moved into the EDA many years ago. The LCICs are believed to be good indicators of potential movement of contamination from the Love Canal to EDA neighborhoods. Therefore, one would expect that other chemicals associated with the Love Canal which may be present in the EDA would be at similarly low concentrations.

If remediation is carried out, detailed design documents will address the potential for exposure during remediation and its mitigation.

8. This study did not assume that soil in EDA 2-3 is stratified in a regular or uniform manner. The Habitability Study focused on the top 12 inches of soil because that is the depth where exposure of residents might occur from normal activities (e.g. playing in the yard, gardening). The soil depths in this study were chosen based on practical limitations to any excavation of soil.

9. The data from this study were compared with similar results from the Habitability Study. As pointed out in the report, the differences found in this study relative to previous data from the Habitability Study could be a consequence of the different analytical procedures used.

10. Soil moisture, soil type, organic content and vegetation were not relevant parameters to the hypothesis being tested by this study. Soil samples were taken from locations that had exhibited the highest concentrations of LCICs in the Habitability Study.

11. EDA 2 and 3 were not separately analyzed in the report because the Habitability Study found that each of the sampling areas was significantly more contaminated with LCICs than the Niagara Falls comparison areas and other parts of the EDA and that aggregating the four neighborhoods within EDA 2-3 had no effect on the comparisons with other areas. The statistical comparisons presented in Table 3 of this report have been separately carried out for EDA 2 and EDA 3 (Table D-1). The conclusions reached for the combined area also apply to each of the areas separately.

12. As noted above, this study was carried out under the authority of State law (Article 27 of the Environmental Conservation Law and Section 1388 of the Public Health Law).

13. Remediation would be conducted under the same authority.

14. The comments have been made a part of the report and responses provided. This is the final study report.

NYDEC has utilized the findings of this report in formulating the Cost Analysis Report. If, after a final land use determination has been made for EDA 2-3, remediation is carried out, NYDEC would prepare detailed design documents.

There is no administrative procedure for appeal of these comments. In New York State all governmental actions are subject to judicial review under Article 78 of the Civil Practice Law and Rules.

Table D-1. Comparison of LCIC concentrations in various portions of cores from EDA 2 and EDA 3. The z value is the calculated normal variate from the Wilcoxon signed rank test and p is the probability (one-tailed) that the inequality is true. NDs treated as 0 values.

LCIC	0-3" > 3-12"			0-6" > 6-12"			0-3" > 3-6"		
	z	p	N	z	p	N	z	p	N
EDA 2									
1,2-dichlorobenzene	3.091	0.999	41	4.205	0.999	41	2.144	0.984	40
1,2,4-trichlorobenzene	3.816	0.999	44	4.552	1.000	43	2.676	0.996	42
1,2,3,4-tetrachlorobenzene	4.015	0.999	44	4.843	1.000	44	2.474	0.993	44
hexachlorobenzene	1.984	0.976	44	3.198	0.999	44	-1.622	0.052	44
α-HCCH	3.560	0.999	36	4.452	1.000	38	2.334	0.990	35
β-HCCH	1.285	0.901	18	2.199	0.986	18	0.402	0.656	17
γ-HCCH	1.248	0.894	19	2.334	0.990	19	1.241	0.893	18
δ-HCCH	-.365	0.358	4	-.730	0.232	4	0.000	0.500	3
EDA 3									
1,2-dichlorobenzene	1.706	0.956	33	2.752	0.997	33	-.530	0.298	29
1,2,4-trichlorobenzene	1.607	0.946	37	3.477	0.999	37	0.083	0.533	37
1,2,3,4-tetrachlorobenzene	1.494	0.932	37	3.304	0.999	37	-.401	0.344	36
hexachlorobenzene	0.588	0.722	37	2.082	0.981	36	-1.461	0.072	36
α-HCCH	1.057	0.855	24	2.386	0.991	24	0.114	0.545	22
β-HCCH	0.296	0.616	9	0.711	0.761	9	0.840	0.800	8
γ-HCCH	1.784	0.963	10	2.293	0.989	10	1.244	0.893	9
δ-HCCH	1.604	0.946	3	1.604	0.946	3	1.604	0.946	3

Table 3 (p. 7) is copied below for ease of comparison:

Table 3. Comparison of LCIC concentrations in various portions of cores from EDA 2-3. The z value is the calculated normal variate from the Wilcoxon signed rank test and p is the probability (one-tailed) that the inequality is true. NDs treated as 0 values.

LCIC	0-3" > 3-12"			0-6" > 6-12"			0-3" > 3-6"		
	z	p	N	z	p	N	z	p	N
1,2-dichlorobenzene	3.5690	0.9998	74	5.0371	1.0000	74	1.0762	0.8591	69
1,2,4-trichlorobenzene	4.0656	1.0000	81	5.7747	1.0000	80	1.8962	0.9710	79
1,2,3,4-tetrachlorobenzene	4.0656	1.0000	81	5.7959	1.0000	81	1.5132	0.9349	80
hexachlorobenzene	2.1046	0.9823	81	3.8682	0.9999	80	-2.2327	0.0128	80
α-HCCH	3.6317	0.9999	62	5.0655	1.0000	62	1.7758	0.9621	57
β-HCCH	1.2253	0.8898	27	1.8139	0.9652	27	0.8476	0.8017	25
γ-HCCH	2.1083	0.9825	29	3.1246	0.9991	29	1.5977	0.9449	27
δ-HCCH	1.1832	0.8816	7	0.8452	0.8010	7	1.3628	0.9135	6

Additional Verbal Comments

1. Planning for remediation of EDA 2-3 has been expedited to the extent that it is possible. The State is committed to resolving this matter as soon as possible.

2. The Cost Analysis Report could not be prepared without the results of this study. This Cost Analysis Report has been under preparation while this report was being finalized. Dividing the work in this fashion has expedited completion of the tasks.

3. Safety hazards such as those implied in this comment would be addressed during the remediation. The Cost Analysis Report contains general provisions, and detailed design documents would be prepared if remediation is carried out.

4. Soil replacement has been considered for all properties. The cost implications of not replacing soil around vacant properties can be determined from the Cost Analysis Report.

Appendix E. New York Department of Health Fact Sheet

LOVE CANAL SOIL ASSESSMENT
INDICATOR CHEMICALS

May 1988

Introduction

The Love Canal indicator chemicals (LCICs) for soils in the Emergency Declaration Area (EDA) are intended to provide an indication of the presence of the chemicals in the EDA that may be associated with the Love Canal. Thus, the significance of levels of LCICs in soil from the EDA cannot be completely evaluated independent of the larger question of the entire mixture of chemicals they represent. However, in anticipation of questions from residents about the health significance of these findings a preliminary evaluation was made of the limited question of what these individual chemicals would mean if present in the soil of a residential yard at levels found in the study.

Exposure to any chemical in the soil would require direct contact. The greatest potential for exposure is from eating soil (ingestion). Some exposure could also result form absorption of chemicals from soil on the skin or from breathing soil picked up by the wind, although these routes of exposure are generally much less important than the ingestion route. To evaluate the health significance of the individual LCICs in soil, the concentrations of the chemicals in soil, their toxicity, and data on typical additional exposure to the chemicals in the general environment or through residues in food were examined.

LCIC Concentrations in Soil

Information on typical levels of the LCICs in soil is not available, but the data from this study provide an indication of what is typically found in the Niagara Falls, Cheektowaga and Tonawanda sampling areas. The method used in this study to measure the LCICs in soil samples had detection limits which varied for each sample and LCIC and which were approximately 0.2 parts per billion (0.2 ppb). The hexachlorocyclohexanes, also known as benzenehexachlorides (BHCs), were generally detected in less than half of the samples at levels as high as 4108 ppb or 4.1 ppm. 1,2-dichlorobenzene (DCB) was found in 649 of 655 samples at levels as high as 19.8 ppb. 1,2,4-trichlorobenzene (TCB) was found to be present in 683 of 685 samples, at levels to 167 ppb. 1,2,3,4-tetrachlorobenzene was found in 665 of 676

samples at levels to 192 ppb. 2-chloronaphthalene was detected in somewhat more than half of the 640 samples at levels as high as 0.32 ppb.

Typical Additional Exposure

For hexachlorocyclohexane isomers, known as A-BHC, B-BHC, D-BHC, and G-BHC, are also among the LCICs. These compounds, particularly G-BHC (lindane), have been widely used as insecticides and in veterinary and human medicine. A-BHC and G-BHC are among the chemical residues detected most frequently in foods in market basket surveys conducted by the US Food and Drug Administration. For 300 food composites analyzed in 1976-77, A-BHC and G-BHC were found in more than 10% of the samples, at levels from 1 to 14 ppb. B-BHC and D-BHC were also found occasionally at levels from 1 to 13 ppb. Typical adult dietary intake of the four BHC isomers was estimated to be about one microgram (millionth of a gram) per day, about the amount contained in 1/4 pound of dirt contaminated at 10 ppb or in 1/4 gram of soil at 4000 ppb.

1,2-dichlorobenzene (DCB), 1,2,4-trichlorobenzene (TCB), 1,2,3,4-tetrachlorobenzene (TeCB) and 2-chloronaphthalene (CNP) belong to a class of chemicals known as chlorinated aromatic compounds. DCB and TCB are liquids at normal temperatures while TeCB and CNP are waxy solids. The compounds have been used as solvents, chemical intermediates in making other compounds, lubricants and insecticides. No data are available regarding typical dietary intake of these compounds.

Toxicity

The four BHCs are not very toxic on an acute basis nor have they been found to cause cancer or mutagenic or reproductive problems in humans. However, mice and rats fed diets containing BHC for their lifetime have developed liver cancer. In these laboratory studies the exposure levels are roughly 1.5 million times the exposure than people normally receive from their food. DCB, TCB, TeCB and CNP have not been studied for adverse health effects as much as the BHCs. However, sufficient information is available to suggest that the liver and kidneys are most likely to be affected. The smallest amount of chemical which caused an effect for any of these chlorinated aromatic compounds is more than 1000 times greater than the amount a person would take in from a 1/4 pound of soil containing 200 ppb.

Summary

Thus, based on the available information, the levels of individual LCICs observed in this study do not present a hazard to persons living in the areas that were sampled.

Appendix F. Reilly Response to Citizen's Clearinghouse for Hazardous Waste

United States
Environmental Protection Agency
Washington, D.C. 20460

May 14, 1990

The Administrator

Ms. Lois Gibbs
Executive Director
Citizens Clearinghouse for
Hazardous Wastes, Inc.
P.O. Box 926
Arlington, Virginia 22216

Dear Ms. Gibbs:

I appreciated very much the chance to meet you in January and hear in detail your concerns about Love Canal. This letter responds to the issues you raised during our conversation and to your recent written comments on the Love Canal Habitability Study. I know I promised to get back to you promptly. The delay in responding to you reflects the fact that a great deal of examination, thought, and consultation has gone into my review. Love Canal, as you know, has a complex history.

I have considered your comments and looked into the Habitability Study itself. I have consulted with the Agency's General Counsel Don Elliott, Regional Administrator Connie Eristoff, Assistant Administrator Don Clay, with members of the Peer Review Panel that evaluated the Study, and with others. The overriding question I have focused on is "have we complied with the law?" I am now satisfied that the answer to that question is "yes." Specifically, I have concluded that the Love Canal Habitability Study was conducted in full conformance with the law, that it was rigorously designed and carried out to ensure that it was scientifically sound and unbiased, and that it was subjected to full scrutiny and comment by nationally-recognized independent experts and the public. All this the law demands of EPA. We are not called upon to make decisions about the future land uses of the area.

Based upon the information in the Study, decisions about the future use of the Love Canal Emergency Declaration Area (EDA) are being made by state and local authorities, which are the appropriate levels of government to make such calls. State and local agencies, in making their decisions about the future use of the land adjacent to Love Canal and about the associated environmental impacts, will clearly need to take into account the full range of issues, uncertainties, and public sentiments that are present.

Before addressing the specific issues you have raised, I want to make very clear that the area of concern here is not the Love Canal site itself. The Habitability Study was not undertaken to assess the habitability of the Love Canal disposal site or the two rings of homes that originally surrounded it. These homes were torn down and the land on which they stood, along with Love Canal, are buried under a 40-acre cap with a liner and extensive barrier drain collection system, which is operated and maintained by New York State. An extensive, fenced buffer area separates the site from the Emergency Declaration Area. The site is surrounded by monitoring wells and routine monitoring to date shows that this containment system is working effectively. Thus, the area assessed by the Habitability Study -- the Emergency Declaration Area -- is outside of the Love Canal Site.

In this letter, I want to address the issues raised during our meeting and in your subsequent written comments. It may be helpful first to recount briefly the background of the Love Canal Habitability Study. As you know, in 1982 the U.S. Department of Health and Human Services issued a decision on the habitability of the Love Canal Emergency Declaration Area. This decision was based on the results of an extensive environmental sampling program in which several thousand samples were collected and analyzed for a broad spectrum of chemicals. Except for contamination in Love Canal area sewers and creeks, which has now been cleaned up, the study found no indication that any Love Canal chemicals had migrated into the Emergency Declaration Area.

It is important to note that another federal agency, the U.S. Department of Health and Human Services, determined that the Emergency Declaration Area was suitable for residential use provided that the EDA sewers and their contaminated drainage tracts were remediated and that continuous safeguards were in place to monitor the site and prevent further leakage from it. These tasks were accomplished as part of the Love Canal remediation program; the New York State Department of Health concurred in this finding.

After this decision, however, some issues were raised about how this program to sample and analyze chemicals in the EDA was designed and carried out. To provide further assurances that the habitability decision was technically sound, EPA decided that a second study on habitability should be conducted. This second study, which began in 1983, was subsequently mandated by the Superfund Amendments and Reauthorization Act of 1986.

To respond to the concerns you raised in your meeting with me, I have reviewed the following issues: (1) whether the EPA Habitability Study was conducted in conformance with the law; (2) whether it is scientifically sound; and (3) whether it was conducted with full public consultation.

Section 312(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) directed EPA to "conduct or cause to be conducted a habitability and land use study" which would assess the risks associated with inhabiting the Emergency Declaration Area; compare the level of hazardous waste contamination in the Emergency Declaration Area to that present in other comparable communities; and assess the potential uses of the land within the Emergency Declaration Area, including but not limited to residential, industrial, commercial and recreational uses, and the risks associated with such potential uses. I have concluded that the Habitability Study fulfills those statutory requirements for the following reasons.

The Habitability Study assesses the risks associated with inhabiting the Emergency Declaration Area in a number of ways. First, it compares the levels of certain indicator chemicals in the Emergency Declaration Area soil to the levels found in four comparable communities. These indicator chemicals were deemed by the scientists conducting the study to be representative of those chemicals which would likely have been present if the area had been affected by chemicals from the Love Canal disposal site. The comparison approach used in the Study assesses the relative risks of inhabiting the Emergency Declaration Area by comparing contamination levels in the EDA to levels found in comparable residential communities which are presently inhabited but are not affected by a chemical landfill.

Moreover, the Technical Review Committee, which was created in August of 1983 in order to develop a scientifically sound approach for determining the habitability of the Emergency Declaration Area and to provide high-level oversight of all Love Canal matters, thoroughly evaluated the various approaches that could be used to conduct the study. The Technical Review Committee was comprised of experts from EPA, the Centers for Disease Control, the New York State Department of Health, and the New York State Department of Environmental Conservation. After extensive deliberation, and public discussion, the Technical Review Committee concluded that the comparative approach used in the study was the most scientifically sound way to assess the habitability of the Emergency Declaration Area, particularly in light of the lack of relevant standards for the chemicals that might be found in the EDA and the lack of toxicological data for these chemicals.

The use of the comparative approach was supported by EPA's independent panel of scientific experts, including representatives from the New York University Medical Center, Yale University School of Medicine, the University of California School of Public Health, the Lawrence Livermore Laboratory, Massachusetts General Hospital, Harvard University, the University of Texas, and other institutions. This expert peer review panel, which held a meeting on May 10-11, 1989 to discuss New York State's Habitability Decision, concluded that "the lack of appropriate toxicological data for the many chemicals present in the Canal and the lack of standards of acceptability for these chemicals makes the exposure and risk assessment approach unworkable at this time."

In conducting the Study, the Technical Review Committee recommended an approach that went beyond the comparison of comparable communities, as discussed in your letter. The Habitability Study went to great lengths to assess the risks of inhabiting the Emergency Declaration Area by analyzing approximately 2300 surface soil samples taken from this area to determine whether they contained levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in excess of the 1 part per billion (ppb) level of concern established through a quantitative risk assessment as a standard by the Centers for Disease Control. The Technical Review Committee focused on TCDD because this 1 ppb level of concern was the only relevant standard available for chemicals in the Emergency Declaration Area.

Only one Emergency Declaration Area soil sample (from a vacant lot) was found to contain TCDD at a level in excess of the 1 ppb level of concern, and that soil has since been remediated. Ninety-seven percent of the samples did not contain <u>any</u> traces of TCDD that could be detected by even the most sensitive analytical instruments. After reviewing the results of these analyses, the U.S. Agency for Toxic Substances and Disease Registry concluded that "2,3,7,8-TCDD is not present in the surface soil of the Emergency Declaration Area at a concentration of human health concern."

Finally, the Technical Review Committee analyzed air samples from 562 residences in the Emergency Declaration Area to determine whether persistent chemicals from Love Canal found their way into surrounding homes. Chlorobenzene was not detected at all, and chlorotoluene was detected in one home. After carefully evaluating all of the data, the Technical Review Committee determined that the presence of the chlorotoluene could not be attributed to Love Canal. By determining whether toxic chemicals were present in the air of Emergency Declaration Area residences, the Technical Review Committee assessed a second path of risks of inhabiting the EDA. The methods employed to conduct these independent scientific reviews were deemed to be the most practical and appropriate under the circumstances.

With regard to assessing the potential alternative uses and risks of those uses as required by the statute, I believe that by assessing the risks of residing in the Emergency Declaration Area, which the Technical Review Committee determined was the highest use of the land, EPA has fulfilled the requirement to assess the potential uses of land within the Emergency Declaration Area. In developing the Habitability Criteria, Dr. Frederick Pohland of The Georgia Institute of Technology stated that "[t]he most sensitive habitability criteria would, I think, be applied to individual residences and so, in a way we would cover just about any other option should the decision be for something other than residences."

EPA has been cooperating with the state agencies which have evaluated the potential uses of the land in the Emergency Declaration Area. By funding both the Love Canal Land Use Advisory Committee, as well as the Love Canal Area Revitalization Agency, and by assessing the risks of residing in the Emergency Declaration Area and thus, in effect, the risks of other potential uses, I believe that EPA has complied with the statutory requirements of CERCLA section 312(e)(3).

With respect to the second matter, scientific validity, after a thorough review, I have concluded that the Habitability Study was conducted in a scientifically sound manner. To assure the study's scientific validity, the Technical Review Committee convened a panel of distinguished scientists from across the nation nominated by TRC members and the public to assist in developing the criteria for determining whether the Emergency Declaration Area was habitable. The habitability criteria, the pilot studies, and the design and results of the Habitability Study were scrutinized by EPA's peer review panel comprised of independent scientific experts.

The peer review panel, which reviewed the results of the Habitability Study, unanimously concluded that "each of the component parts of the habitability study was well planned, well executed, and had a high level of data quality assurance, and that the resulting data are of high quality and are appropriate for making a determination on habitability." EPA's independent review of the study has also concluded it was scientifically sound and unbiased. To further assure myself, I spoke personally and at some length with several scientists on the peer review panel who all assured me that in their opinion the study was valid and appropriate.

With respect to the third issue you raised concerning public involvement in conducting and reviewing the study, the Technical Review Committee held decision-making meetings at four to six week intervals throughout the entire, 6-year course of the study. All of these meetings -- a total of fifty -- were held in a public forum open and accessible to all. These meetings were advertised in local newspapers and through extensive mailings; they were held in convenient locations in Niagara Falls.

Before closing, I want to take particular note of your final concern about the broader public policy implications. Love Canal has become a national symbol for the environmental threats we face from hazardous waste and a powerful impetus to take strong steps to prevent such events from ever occurring again.

The role of the Federal government has been to ensure that the Habitability Study was conducted in a credible and scientific manner. Having done so, EPA properly, and in accordance with the law, provided the Habitability Study to the State of New York in order that the appropriate settlement and land use decisions could be made. EPA's involvement in solving chemical contamination problems at Love Canal will continue. The Agency has maintained and will continue to maintain a strong role in the ongoing investigative and cleanup work at Love Canal. Well over $100 million in Federal funds has been expended in support of these activities. The Agency will continue to provide funding to New York State for other activities.

In closing, let me stress again how much I appreciate your visit last January. I value the role of citizens and grassroots environmental organizations and applaud, in particular, your unceasing efforts and your personal struggle to focus public attention on the plight of your former community. Your current work with the Citizens Clearinghouse for Hazardous Wastes also serves a valuable purpose. These are not easy issues, and my belief is that we can both learn a great deal from each other.

Again, thank you for taking the time to raise your concerns regarding this matter with me. My staff and I look forward to working with you on this and other important issues.

Sincerely yours,

William K. Reilly

P.S. And congratulations on winning the Goldman Prize!

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 17 1990

THE ADMINISTRATOR

Jacqueline M. Warren, Esquire
Senior Staff Attorney
Natural Resources Defense Council
40 West 20th Street
New York, New York 10011

Dear Jackie:

As you know, Monday I responded to many of the concerns which you and Lois Gibbs raised during our meeting in January about the Love Canal Habitability Study. In that letter, a copy of which is enclosed, I explained why I believe that EPA has complied with the statutory requirements of CERCLA section 312(e).

Today I wish to respond to one additional issue which you brought to my attention during our meeting and in your subsequent letters of February 5, 1990 and May 3, 1990. I would also like to take this opportunity to thank you for taking the time to bring these difficult issues to my attention.

In your letters, you discuss your "practical concerns" as to the precedential effect on the Superfund program of any resettlement of the Emergency Declaration Area as a result of the "comparison analysis" included in the Habitability Study. As I understand it, you are concerned that a comparison analysis will be adopted as a method for assessing risks at other Superfund sites.

As I discussed in my May 14, 1990 letter, the history of study of the Emergency Declaration Area and the resulting statutory requirements pertaining to that area contained in section 312(e) of the Superfund Amendments and Reauthorization Act, are site specific. EPA's analyses of the Emergency Declaration Area are scientifically valid and consistent with the requirements of the statute as regards the Emergency Declaration Area. Absent a similar fact situation and statutory requirement I would not expect our actions to create a precedent controlling future Agency decisionmaking.

I look forward to working with you on this and other important issues.

Sincerely yours,

William K. Reilly

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