Contents

CHAPTER I: Executive Summary		Page
Summary	Acronyms, Abbreviations, and Terms	. vii
Summary	CHAPTER 1: Executive Summary	3
Background		
The ÖTA Analysis	Background	4
Scope of the OTA Analysis		
The Four Arguments for ÖTA's Principal Findings		
Possible Steps Toward Rehabitation	The Four Arguments for OTA's Principal Findings	7
Implications for the Superfund Program 15 1. The "How Clean Is Clean?" Issue 15 2. Health Effects Data and Decisions inhabitability 16 3. Technical Guidelines for Monitoring Studies 16 4. Selection and Implementation of Remediation Programs 16 S. Long-Term Institutional Capabilities and Issues. 17 APPENDIX A: Remediation 21 Summary 21 Categories of Remedial Technology 21 Evaluation of Alternative Technologies at Love Canal 22 Control Action at the Love Canal Site 25 Uncertainties Associated With the Remedial Action 28 APPENDIX B: Design of the EPA Monitoring Study 30 Summary 30 Scope of the EPA Monitoring Study 30 Evaluation of the Sampling Effort 31 Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions 40 Summary 40 Basis of the Habitability Decision 40 Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54	Possible Steps Toward Rehabitation	14
1. The "How Clean Is Clean?" Issue	Implications for the Superfund Program	. 15
2. Health Effects Data and Decisions inhabitability 16 3. Technical Guidelines for Monitoring Studies 16 4. Selection and Implementation of Remediation Programs 16 S. Long-Term Institutional Capabilities and Issues. 17 APPENDIX A: Remediation 21 Summary 21 Categories of Remedial Technology 21 Evaluation of Alternative Technologies at Love Canal 24 Control Action at the Love Canal Site 25 Uncertainties Associated With the Remedial Action 28 APPENDIX B: Design of the EPA Monitoring Study 30 Summary 30 Scope of the EPA Monitoring Study 30 Evaluation of the Sampling Effort 31 Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions 40 Summary 40 Basis of the Habitability Decision 40 Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54	l. The "How Clean Is Clean?" Issue	. 15
3. Technical Guidelines for Monitoring Studies 4. Selection and Implementation of Remediation Programs 5. Long-Term Institutional Capabilities and Issues 17 APPENDIX A: Remediation Summary 21 Categories of Remedial Technology 21 Evaluation of Alternative Technologies at Love Canal 24 Control Action at the Love Canal Site 25 Uncertainties Associated With the Remedial Action 28 APPENDIX B: Design of the EPA Monitoring Study 30 Summary 30 Scope of the EPA Monitoring Study 30 Scope of the EPA Monitoring Study 31 Conclusions About the Sampling Effort 31 Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions 40 Summary 40 Basis of the Habitability Decision 40 Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 41 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 40 APPENDIX D: Analysis of the EPA Data 54 Summary 54	2. Health Effects Data and Decisions inhabitability	. 16
4. Selection and Implementation of Remediation Programs 16 S. Long-Term Institutional Capabilities and Issues. 17 APPENDIX A: Remediation 21 Summary 21 Categories of Remedial Technology 21 Evaluation of Alternative Technologies at Love Canal 24 Control Action at the Love Canal Site 25 Uncertainties Associated With the Remedial Action. 28 APPENDIX B: Design of the EPA Monitoring Study 30 Summary 30 Scope of the EPA Monitoring Study 30 Scope of the EPA Monitoring Study 30 Evaluation of the Sampling Effort 31 Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions 40 Summary 40 Basis of the Habitability Decision 40 Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54		
S. Long-Term Institutional Capabilities and Issues. 17 APPENDIX A: Remediation 21 Summary 21 Categories of Remedial Technology 21 Evaluation of Alternative Technologies at Love Canal 24 Control Action at the Love Canal Site 25 Uncertainties Associated With the Remedial Action. 28 APPENDIX B: Design of the EPA Monitoring Study 30 Summary 30 Scope of the EPA Monitoring Study 30 Evaluation of the Sampling Effort 31 Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions 40 Summary 40 Basis of the Habitability Decision 40 Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54	4. Selection and Implementation of Remediation Programs	. 16
APPENDIX A: Remediation		
Summary		
Summary	APPENDIX A: Remediation	. 21
Categories of Remedial Technology		
Evaluation of Alternative Technologies at Love Canal Control Action at the Love Canal Site Uncertainties Associated With the Remedial Action. APPENDIX B: Design of the EPA Monitoring Study Summary Scope of the EPA Monitoring Study Scope of the EPA Monitoring Study Scope of the Sampling Effort Conclusions About the Sampling Effort Conclusions About the Sampling Strategy APPENDIX C: Results of the EPA Study Related to the Habitability Decisions Summary Basis of the Habitability Decision Problems With Statistical Comparisons of EPA Results Range of Variability for Reported Values What If EPA's Numbers Are Wrong? Uncertainties in Potential Health Effects The Special Case of Dioxin APPENDIX D: Analysis of the EPA Data Summary Statistical Stat		
Control Action at the Love Canal Site	Evaluation of Alternative Technologies at Love Canal	. 24
Uncertainties Associated With the Remedial Action. 28 APPENDIX B: Design of the EPA Monitoring Study 30 Summary 30 Scope of the EPA Monitoring Study 30 Evaluation of the Sampling Effort 31 Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions 40 Summary 40 Basis of the Habitability Decision 40 Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54	Control Action at the Love Canal Site	. 25
APPENDIX B: Design of the EPA Monitoring Study Summary Scope of the EPA Monitoring Study Evaluation of the Sampling Effort Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions Summary Basis of the Habitability Decision Problems With Statistical Comparisons of EPA Results Range of Variability for Reported Values What If EPA's Numbers Are Wrong? Uncertainties in Potential Health Effects The Special Case of Dioxin 49 APPENDIX D: Analysis of the EPA Data Summary 54 Summary 55	Uncertainties Associated With the Remedial Action	. 28
Summary		
Scope of the EPA Monitoring Study Evaluation of the Sampling Effort Conclusions About the Sampling Strategy 37 APPENDIX C: Results of the EPA Study Related to the Habitability Decisions Summary 40 Basis of the Habitability Decision Problems With Statistical Comparisons of EPA Results Range of Variability for Reported Values What If EPA's Numbers Are Wrong? 41 Uncertainties in Potential Health Effects The Special Case of Dioxin 42 APPENDIX D: Analysis of the EPA Data Summary 54		
Evaluation of the Sampling Effort		
Conclusions About the Sampling Strategy	Scope of the EPA Monitoring Study	. 30
APPENDIX C: Results of the EPA Study Related to the Habitability Decisions Summary Basis of the Habitability Decision Problems With Statistical Comparisons of EPA Results Range of Variability for Reported Values What If EPA's Numbers Are Wrong? Uncertainties in Potential Health Effects The Special Case of Dioxin 40 41 42 43 44 45 45 45 45 46 47 48 49 49 49 40 40 40 40 40 40 40		
Summary 40 Basis of the Habitability Decision 40 Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54		
Basis of the Habitability Decision		
Problems With Statistical Comparisons of EPA Results 40 Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54	Summary	. 40
Range of Variability for Reported Values 41 What If EPA's Numbers Are Wrong? 44 Uncertainties in Potential Health Effects 45 The Special Case of Dioxin 51 APPENDIX D: Analysis of the EPA Data 54 Summary 54	Basis of the Habitability Decision	. 40
What If EPA's Numbers Are Wrong?	Problems With Statistical Comparisons of EPA Results	. 40
Uncertainties in Potential Health Effects	Range of Variability for Reported Values	. 41
The Special Case of Dioxin	What If EPA's Numbers Are Wrong?	. 44
APPENDIX D: Analysis of the EPA Data		
Summary	The Special Case of Dioxin	. 51
Summary	ΔPPFNDIX D: Analysis of the FPA Data	54
Summing		
Statistical Analysis of Indicator Substances	Statistical Analysis of Indicator Substances	. 54

Contents—Continued

List of Tables

Table	
A-1.	Advantages and Disadvantages of Control Technologies
A-2.	Summary of Lifecycle Costs
A-3.	Performance Criteria Evaluation
A-4.	Priority Pollutants
B-1.	Criteria Used To Evaluate EPA Sampling Effort
B-2.	Number of Sites and Samples for Target Substances 33
	Approximate Size of EDA Study Regions 34
B-4.	Sampling Effort for Dioxin
B-5.	Comparison of Dioxin Sampling Effort Between Eastern Missouri and the EDA 39
c-1.	Number of Samples Required To Detect Actual Differences Between
	the EDA and Control Areas
	Maximum Values Reported for Organic Compounds
c-3.	Maximum Values Reported for Dioxin, pub
c-4.	Summary of Test Results Available on Health Effects of Chemicals
	Disposed in Love Canal and Monitored by EPA
c-5.	Comparison of Regulated Exposure Limits to Detected Maximum
	Concentrations in the EDA: Water
C-6.	Comparison of Regulated Exposure Limits to Detected Maximum
	Concentrations in the EDA: Air
D-1,	Odds Ratio and Detection Rates for 1,2-Dichlorobenzene
D-2,	Detection of Indicator Substance and Numbers of Samples Analyzed
D 0	for Environmental Media in the Control Areas
D-3,	Detection of Indicator Substance and Numbers of Samples Analyzed
ъ.	for Environmental Media in the EDA
D-4.	Detection of Substances Not Found in Control Areas and Numbers of
D -	Samples Analyzed for Environmental Media in the EDA
D-5.	Summary of Mantel-Haenszel Results
l iet	of Figures
LIST	or rigures
Figure	
B-1.	The 10 Subregions of the EDA Included in the EDA Monitoring Study
B-2.	Distribution of Shallow Well Sampling Sites
B-3.	Distribution of Deep Well Sampling Sites
B-4.	Distribution of Soil Sampling Sites
B-5.	Distribution of Sump Water Sampling Sites
B-6.	Disribution of Storm Sewer Sampling Sites
B-7.	Surface Water Sampling Sites Along the Black Creek and the Bergholtz Creek 36
B-8.	Distribution of Air Sampling Sites
B-9.	Distribution of Drinking Water Sampling Sites
B-10	Distribution of Dioxin Sampling Sites

Acronyms, Abbreviations, and Terms

Acronyms and Abbreviations

ACGIH	American Conference of Government	LOD – limit(s) of detection
	Industrial Hygienists	LOQ – limit(s) of quantitation
ACS	 American Chemical Society 	MDL – method detection limit(s)
С	 control areas sampled by EPA moni- 	NAS - National Academy of Sciences
	toring study	NBS - National Bureau of Standards, U.S.
CDC	 Centers for Disease Control, Public 	Department of Commerce
	Health Service, U.S. Department of	NCI – National Cancer Institute
	Commerce	NTP National Toxicology Program
CERCLA	 Comprehensive Environmental Re- 	NYS/DEC - New York State Department of En-
	sponse, Compensation, and Liability	vironmental Conservation
	Act of 1980, 42 U.S.C. 9601 et seq.,	NYS/DOH - New York State Department of Health
	known colloquially as "Superfund"	NYS/DOL - New York State Department of Law
DHHS	 U.S. Department of Health and 	OTA – Office of Technology Assessment, U.S.
	Human Services	Congress
EDA	 emergency declaration area 	ppb — parts per billion, equal to micrograms
EDF	 Environmental Defense Fund 	per liter in water, micrograms per
EPA	 U.S. Environmental Protection Agency 	kilogram in solids or gases
FEMA	Federal Emergency Management Act	ppm — parts per million
	of 1978, CFR Title 44, Part 2, and	ppt — parts per trillion
	associated Agency	RCRA – Resource Conservation and Recovery
GAO	— General Accounting Office, U.S.	Act of 1976, 42 U.S.C. 6901 et seq.
GI IO	Congress	TLV - threshold limit value
anm	— gallons per minute	TSCA – Toxic Substances Control Act of 1976,
gpm IARC	International Agency for Research on	15 U.S.C. 2601 et seq.
IAIC	Cancer, U.N. World Health	μg/kg — micrograms per kilogram, equal to ppb
	Organization	in solids or gases
LCARA	Love Canal Area Revitalization	
LUMIKA		µg/1 — micrograms per liter, equal to ppb in water
	Agency	water

Terms

emergency declaration area (EDA): area sampled by EPA monitoring study, outside 49-acre area surrounding the canal landfill, divided by EPA into 10 subregions for sampling purposes.

environmental medium: one of five environmental components sampled by EPA, including water, soil, sediment, air, biota.

environmental submedium: 1 of 22 components of the five environmental media

indicator substances: substance which was known to have been disposed into canal landfill

Love Canal: 49-acre area including canal landfill sampled by EPA monitoring study

target substance: 1 of 50 substances monitored in EPA monitoring study