UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
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October 1, 2001

Ref: 8EPR-SR

MEMORANDUM

TO: Tim Cunningham, City of Aurora Planning Department (1 copy)
Diana Shannon, City and County of Denver (1 copy)
Dennis Bollmann, City and County of Denver (2 copies)
Bill Detweiler, Arapahoe County Planning Division (1 copy)
John Jacus, The Lowry Coalition (1 copy)
Scott Mefford, Hydrokinetics Inc. (1 copy)
Bonnie Rader, Citizens For Lowry Landfill Environmental Action Now (4 copies)
Steve Richtel, Waste Management Inc. (1 copy)
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Charlotte Hartman, Coordinator, National Sludge Alliance (1 copy)
Joan Seeman, Sierra Club Hazardous Waste Committee Chair, Rocky Mountain Chapter (1 copy)

FROM: Gwendolyn Hooten
Remedial Project Manager

SUBJECT: Final Five-Year Review Report

The United States Environmental Protection Agency (EPA) hereby announces the completion of the first Five-Year Review for the Lowry Landfill Superfund Site. We received numerous comments regarding the draft Five-Year Review report. These comments are provided in Attachment 14 of the final report. The final report was completed after the review of each of the comments, however, we have not provided responses to the comments in the final report. We will be providing responses to these comments at a later date. The final Five-Year Review report requires an addendum for each remedy component where a protectiveness determination was dependent upon obtaining further information. These addenda are scheduled to be completed no

later than September 30, 2002. If you have any questions, please feel free to give me at a call at 303-312-6646.

Attachment

cc: Timothy C. Shangraw, Parsons Engineering Science, Inc. (1 copy)
Paul Rosasco, EMSI (1 copy)
Tim Schneider, CH2M Hill, w/o attachment
Cecil Slaughter, USGS, (1 copy)

Five-Year Review Report

First Five-Year Review Report
for
Lowry Landfill Superfund Site
Arapahoe County, Colorado

September 28, 2001

PREPARED BY:

Region 8
United States Environmental Protection Agency
Denver, Colorado

Approved by:

Max H. Dodson, Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
U.S. EPA Region 8

Date:

September 28, 2001

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List of Acronyms

EC	degrees Celsius
µg/dL	micrograms per deciliter
µg/g	micrograms per gram
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
1,2-DCA	1,2-dichloroethane
AAL	Allowable Ambient Limit
AO	Administrative Order
ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
Aurora	City of Aurora, Colorado
BHHRA	Baseline Human Health Risk Assessment
CBSGW	Colorado Basic Standards for Ground Water
CBSSW	Colorado Basic Standards for Surface Water
CCR	Code of Colorado Regulations
CDH	Colorado Department of Health (former name of CDPHE)
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CLLEAN	Citizens for Lowry Landfill Environmental Action Now
COC	Chemical of Concerns
CSM	Conceptual Site Model
CWA	Clean Water Act
CWM	Chemical Waste Management, Inc.
DADS	Denver Arapahoe Disposal Site
dB	decibel
Denver	City and County of Denver, Colorado
DNAPLs	Dense Non-Aqueous Phase Liquids
ECCV	East Cherry Creek Valley Water & Sanitation District
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
E/S/W	East/South/West
FR	Federal Register
FS	Feasibility Study
ft/day	feet per day
ft^3/yr	cubic feet per year
FTO	Flameless Thermal Oxidizer
FTPA	Former Tire Pile Area
GMP	Gas Monitoring Probes
gpm	gallons per minute
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Tables
HM	Halomethane

IDLH	Immediately Dangerous to Life or Health
IEUBK	Integrated Exposure Uptake Biokinetic Model
IRIS	Integrated Risk Information System
IRM	Interim Remedial Measure
kg	kilograms
L	liter
LDN 65	Day/Night Average Noise Level of 65 dB
LDRs	Land Disposal Restrictions
LFG	Landfill Gas
LFS	Landfill Solids
LNAPL	Light Non-Aqueous Phase Liquids
Lowry Site	Lowry Landfill Superfund Site
Lowry Trust	Lowry Environmental Protection Clean-up Trust
MCL	Maximum Contaminant Level
Metro	Metro Wastewater Reclamation District
mg/kg	milligram per kilogram
mph	miles per hour
NAPL	Non-Aqueous Phase Liquid
NBBW	North Boundary Barrier Wall
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	Not Detected
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NTES	North Toe Extraction System
O&M	Operation & Maintenance
Order	Administrative Order for Remedial Design/Remedial Action, EPA Docket No. CERCLA VIII-95-05
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
OU 1	Shallow Ground Water and Subsurface Liquids Operable Unit
OU 2	Landfill Solids Operable Unit
OU 3	Landfill Gas Operable Unit
OU 4	Soils Operable Unit
OU 5	Surface Water and Sediments Operable Unit
OU 6	Deep Ground Water Operable Unit
PA/SI	Preliminary Assessment/Site Inspection
PAH	Polynuclear Aromatic Hydrocarbon
PCB	polychlorinated biphenyl
pCi/µg	PicoCuries per microgram
pCi/L	PicoCuries per liter
PCMP	Performance and Compliance Monitoring Plan, Shallow Groundwater Containment, Collection, and Diversion System
POA	Point of Action
POC	Point of Compliance
POTW	Publicly Owned Treatment Works

PQL	Practical Quantitation Limit
PRP	Potentially Responsible Party
QA	Quality Assurance
QC	Quality Control
RA	Risk Assessment
RAC 6	Response Action Contract, EPA Region 6
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act of 1976
RD/RA	Remedial Design/Remedial Action
Respondents	Denver, WMC, and CWM
RfD	reference dose
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RWST	raw water storage tank
SARA	Superfund Amendments and Reauthorization Act of 1986
SBSVE	South Boundary Soil Vapor Extraction System
scfm	standard cubic feet per minute
SDWA	Safe Drinking Water Act
SF	slope factor
Site	Lowry Landfill Superfund Site
SOW	Statement of Work
Superfund	Comprehensive Environmental Response, Compensation and Liability Act
SVOC	Semivolatile Organic Compounds
SW	Surface Water
SWRA	Surface Water Removal Action
TARA	Technical Approach for Risk Assessment
TBC	To be Considered
TCHD	Tri-County Health Department
TEL	Threshold Exposure Limit
Trust	Lowry Environmental Protection Clean-up Trust
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WMC	Waste Management of Colorado, Inc.
WTP	water treatment plant

Executive Summary

This is the first Five-Year Review of the Lowry Landfill Superfund Site. Most, but not all, of the remedy components required by the Record of Decision and subsequent EPA remedial decision documents for this Site have been completed. The remedy components that have been completed (and accepted by the U.S. Environmental Protection Agency [EPA]) include:

- Well Plugging Program
- Wetlands Mitigation
- North Boundary Barrier Wall
- North Face Landfill Cover
- East/South/West Groundwater Barrier Wall
- North Toe Extraction System
- Landfill Gas Collection and Treatment System

The remedy components that are not yet complete and accepted by EPA are:

- New Water Treatment Plant
- Former Tire Pile Area Waste Pits

The following additional remedy elements are also part of the Site remedy:

- Surface Water Removal Action
- Landfill Cover Maintenance
- Groundwater Monitoring Wells and Compliance Program

The protectiveness of these additional remedy elements was also evaluated in the Five-Year Review process. The following remedy components or elements were found to be protective:

- Well Plugging Program
- Wetlands Mitigation
- Landfill Gas Collection and Treatment System
- North Face Landfill Cover
- Surface Water Removal Action

The protectiveness of the following components or elements of the sitewide remedy cannot be determined until further information is obtained:

- East/South/West Groundwater Barrier Wall
- North Boundary Barrier Wall System
- Groundwater Monitoring Wells and Compliance Program

It cannot be determined whether or not the East/South/West Groundwater Barrier component of the sitewide remedy is protective of human health and the environment. Potential contaminant migration in excess of Performance Standards and beyond the Point of Compliance has been observed at the following locations along the East/South/West Groundwater Barrier Wall: MW39-WD, MW51-WD, and the PM-15 area. At each of these locations, the Respondents to Administrative Order for Remedial Design/Remedial Action, EPA Docket No. CERCLA VIII-95-05, are investigating the nature and extent of the potential contamination. Although there does not appear to be an immediate threat to existing receptors (because no-one is currently drinking the ground water), this Five-Year Review concludes that this component of

the may not be effectively containing the Site-related chemicals as required by the Record of Decision and subsequent EPA remedial decision documents.

It cannot be determined whether or not the North Boundary Barrier Wall System component of the sitewide remedy is protective of human health and the environment. Contaminant concentrations as high as 22 times groundwater performance standards have been observed at MW37-WD, a North Boundary Barrier Wall compliance monitoring well. Exceedances of a lesser magnitude were also observed at three other North Boundary Barrier Wall monitoring wells: GW-114A, MW-1000, and U701-WD In response, the Respondents are performing a re-evaluation of the capture effectiveness of the North Boundary Barrier Wall System, including construction and sampling of additional monitoring wells, taking water-level measurements, and additional sampling of existing groundwater monitoring wells in this area. There does not appear to be an immediate threat to existing receptors (because no-one is currently drinking the ground water). However, because the current monitoring system is inadequate to verify that the North Boundary Barrier Wall System is effectively containing the Site-related chemicals as required by the Record of Decision and subsequent EPA remedial decision documents, this Five-Year Review concludes that it cannot be determined whether or not this component of the remedy is protective.

It cannot be determined whether or not the Groundwater Monitoring Wells and Compliance Program is protective of human health and the environment. The lateral spacing between individual monitoring wells is too large in some areas to demonstrate containment. The lignite layer has too few wells and possibly improperly positioned wells to demonstrate containment. The unweathered Dawson formation and Denver formation have too few monitoring wells to demonstrate containment.

The following additional remedy element was found to be protective in the short-term; however, in order for the remedy to be protective in the long-term, follow-up actions will need to be taken:

- Landfill Cover Maintenance

The Landfill Cover exhibits several closed depressions that have not been filled or otherwise corrected to provide drainage. This results in ponding and infiltration of precipitation rather than promoting runoff. Increased infiltration into the landfill mass creates additional contaminated ground water. This delays the expected ultimate stabilization of ground water within the landfill mass at a lower elevation than existed prior to remedy implementation. Follow-up actions need to be taken to eliminate these closed depressions and provide for proper cover drainage.

Finally, a few issues of concern that neither pose an immediate threat nor have the potential to allow uncontrolled migration of contaminants were identified. If these issues are left unaddressed, they could impact protectiveness in the future. This Five-Year Review provides recommendations for all issues of concern noted.

Because construction of the sitewide remedy has not yet been completed, a protectiveness statement for the sitewide remedy cannot be made at this time.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site Name *(from WasteLAN)*: Lowry Landfill

EPA ID *(from WasteLAN)*: COD 980499248 Site 0800186

Region: 8	State: **CO**	City/County: **Arapahoe County**

SITE STATUS

NPL Status: ☒ Final ☐ Deleted ☐ Other (specify) _____

Remediation Status (choose all that apply): ☒ Under Construction ☐ Operating ☐ Complete

Multiple OUs? ☒ Yes ☐ No	**Construction Completion Date:** Not Applicable

Has site been put into reuse? ☐ Yes ☒ No

REVIEW STATUS

Reviewing Agency: ☒ EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____

Author Name: **Gwen Hooten, EPA Region 8, with support from RAC6 contractor CH2M HILL**

Author Title: **Remedial Project Manager**	Author Affiliation: **EPA Region 8**

Review Period: **September 2000 through September 2001**

Date(s) of site inspection: March 30, 2001

Type of review: ☒ **Statutory**
☐ **Policy** (☐ **Post-SARA** ☐ **Pre-SARA** ☐ **NPL-Removal Only**
☐ **Non-NPL Remedial Action Site** ☐ **NPL State/Tribe-lead**
☐ **Regional Discretion**)

Review number: ☒ **1 (first)** ☐ **2 (second)** ☐ **3 (third)** ☐ **Other (specify)** _____

Triggering action:
☐ **Actual RA Onsite Construction at OU#__** ☐ **Actual RA Start at OU#__**
☐ **Construction Completion** ☐ **Previous Five-Year Review Report**

☐ **Other (specify)** Initiation of well plugging program (part of the Landfill Gas Collection and Treatment Remedy Component)

Triggering action date *(from WasteLAN)*: **August 7, 1996 from Site Monthly Progress Report No. 20**

Due date *(five years after triggering action date)*: **August 7, 2001**

Five-Year Review Summary Form

Issues:

The following issues of concern will require obtaining further information before protectiveness can be determined.

- VOC exceedances in the vicinity of MW38-WD
- VOC exceedances at several compliance monitoring locations along the East/South/West Groundwater Containment, Collection and Diversion Barrier
- Lateral spacing between individual monitoring wells is too large in some areas to detect possible excedances beyond the Point of Compliance
- Unweathered Dawson and Denver formations have too few monitoring wells to verify containment
- Lignite Layer has too few monitoring wells to verify containment
- VOC exceedances at compliance monitoring wells near the North Boundary Barrier Wall

The following issues of concern do not warrant a finding that the relevant remedy components are not protective in the long-term as long as corrective actions are taken in the immediate future:

- Depressions in southwestern portion of cover and near north center of cover
- Low-level inorganic exceedances at MW43-WD

Addenda to this Five-Year Review will be prepared when adequate information is available to determine the protectiveness of the remedy components associated with the above issues. However, all addenda shall be completed no later than September 30, 2002.

Recommendations and Follow-Up Actions:

The report makes numerous recommendations for additional work at the Site. In general, this work includes activities to define the nature and extent of contamination at several locations beyond the Point of Compliance, as well as work to correct deficient performance of some portions of the remedy (such as the Water Treatment Plant, which must be upgraded to permit operation of another portion of the remedy).

Protectiveness Statement(s):

Because construction of the sitewide remedy is not complete, a sitewide protectiveness statement has not been developed.

Long-Term Protectiveness:

Since the remedy is not complete, long-term protectiveness cannot be assessed at present. It does not appear that there is anything that would prevent this remedy from being protective in the long-term as long as the remedy is completed and work recommended by this Five-Year Review Report is successfully completed.

Other Comments:

The remainder of the remedy should be completed expeditiously.

Lowry Landfill Superfund Site
First Five-Year Review Report

Section 1 Introduction

1.1 Purpose and Scope

The United States Environmental Protection Agency – Region 8 (EPA) has conducted a Five-Year Review of the Lowry Landfill Superfund Site (Lowry Site or Site) located in Arapahoe County, Colorado. The review was conducted from September 2000 through August 2001. The purpose of a Five-Year Review is to determine whether the remedy at a Superfund site remains protective of human health and the environment. This report documents the results of the review. For the Lowry Site, the entire Site – including all parts of the remedy and all areas of the Site – has been covered in this single, integrated, sitewide Five-Year Review.

CH2M HILL, EPA's oversight contractor under RAC 6 Contract No. 68-W6-FRFE-06ZZ, Work Authorization No. WA 048-FRFE-06ZZ, provided support for preparation of this Five-Year Review Report.

The main purpose of a Five-Year Review is to evaluate the implementation and performance of the selected remedy. It is not intended to reconsider decisions made during the selection of the remedy. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and provide recommendations to address any issues that may have been found.

1.2 Authority and Guidance

EPA must implement Five-Year Reviews consistent with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA), 42 USC 9601[1], *et seq.*, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300[2]. Existing EPA guidance on Five-Year Reviews includes the following:

- Office of Solid Waste and Emergency Response (OSWER) Directive 9355-7-02 (May 23,1991), *Structure and Components of Five-Year Reviews*. (Introduces Five-Year Review requirements.)
- OSWER Directive 9355-7-02FS1(August 1991) Fact Sheet, *Structure and Components of Five-Year Reviews.*
- OSWER Directive 9355-7-02A (July 26,1994), *Supplemental Five-Year Review Guidance*. (Introduces level of review considerations for sites where response is ongoing.)
- OSWER Directive 9355-7-03A (December 21,1995), *Second Supplemental Five-Year Review Guidance*. (Identifies three purposes of Five-Year Reviews and emphasizes that reviews should include a signed protectiveness determination along with recommendations to correct deficiencies.)

[1] Title 42, Section 9601 of the United States Code.

[2] Section 40, Part 300 of the Code of Federal Regulations.

- OSWER Directive 9355.7-03B-P (July 17, 2001), *Comprehensive Five-Year Review Guidance*. (Provides integrated guidance for the Five-Year Review process.)

This Five-Year Review is required by statute at the Lowry Site because upon completion of the remedial action, hazardous substances, pollutants, or contaminants will remain above levels that will allow for unlimited use and unrestricted exposure. This requirement is set forth in CERCLA and the NCP.

CERCLA Section 121(c) states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of each remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

The NCP states in 40 CFR 300.430(f)(4)(ii):

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action. This review is required because contaminants are or will be left onsite above levels that allow for unlimited use and unrestricted exposure.

In addition, statutory reviews are required if the Record of Decision (ROD) was signed on or after the effective date of the Superfund Amendments and Reauthorization Act of 1986 (SARA). The ROD for the Lowry Site was signed on March 10, 1991, after the effective date of SARA. Therefore, a statutory Five-Year Review is required. Subsequent to the signing of the ROD, two Explanations of Significant Differences (ESDs) and a Minor Modification were issued by EPA. These documents are hereinafter collectively referred to as the ROD.

This is the first Five-Year Review for this Site. The triggering date for this statutory review is August 7, 1996, as shown in *Monthly Progress No. 20*. The triggering date was the date of the start of the well plugging program, the first remedy component implemented at the Lowry Site.

1.3 Work Required by Administrative Order

Administrative Order for Remedial Design/Remedial Action, EPA Docket No. CERCLA VIII- 95-05 (the Order), governs the implementation of the sitewide remedy by the City and County of Denver, Colorado (Denver), Waste Management of Colorado, Inc. (WMC), and Chemical Waste Management, Inc. (CWM), on behalf of themselves and 31 other Potentially Responsible Parties (PRPs) at the Site. Denver, WMC, and CWM are collectively referred to as the Respondents. The Statement of Work (SOW) attached to the Order required the Respondents to develop and submit, among other items, the following:

- Interim Work Plans
  - Interim Waste Management Plan
  - Interim Compliance Monitoring Plan
- Miscellaneous Work Plans
  - Site Management Plan
  - Records Management Plan

  - Well Abandonment Plan
  - Contingency Plan
  - Health and Safety Plan
- Remedial Design Submittals
  - Remedial Design Work Plan
  - Design Sampling and Analysis Plan
  - Field Investigation Quality Assurance Project Plan
  - Design Investigation Report(s)
  - Wetlands Mitigation Plan
  - Institutional Controls Plan
- Design Submissions (designs, calculations, etc.)
- Remedial Action Work Plan
- Operation & Maintenance (O&M) Submittals
  - O&M Plan
  - O&M Manuals
  - Compliance Monitoring Plan
  - Compliance Status Reports
- Remedial Action Close-Out Report
- Work Close-Out Report

In addition, the Order requires implementation and O&M of approved designs, O&M of certain Interim Remedial Measures (IRMs) that had been previously constructed, and monitoring and reporting.

1.4 Remedy Components and Additional Remedy Elements

This Five-Year Review addresses each of the remedy components of the sitewide remedial action. For the purposes of this Five-Year Review, "remedy components" are specific, individual remedial actions identified in the ROD and tracked separately in EPA's WasteLAN database. In addition to these remedy components, additional activities such as monitoring, system operations, and maintenance are required to provide a fully functional remedy. Throughout this report, these items are referred to as "additional remedy elements."

The Five-Year Review process determines the protectiveness of components where construction has been completed. Components where construction has not been completed are also discussed, but no protectiveness conclusions are drawn for these components.

The remedy components at the Lowry Site, and their construction completion status, are as follows:

- Construction (including acceptance by EPA) is complete:

  - Well Plugging and Abandonment
  - Wetlands Mitigation
  - North Boundary Barrier Wall
  - North Face Landfill Cover
  - East/South/West (E/S/W) Groundwater Barrier Wall
  - North Toe Extraction System (NTES)
  - Landfill Gas Extraction and Treatment

- Construction is not complete:

  - New Water Treatment Plant
  - Former Tire Pile Area (FTPA) Waste Pit Excavation

The additional remedy elements at the Lowry Site are:

- Surface Water Removal Action
- Landfill Cover Maintenance
- Groundwater Monitoring Wells and Compliance Program
- Institutional Controls

1.5 Five-Year Review Team

The Lowry Landfill Superfund Site Five-Year Review was led by Gwen Hooten, EPA's Remedial Project Manager for the Lowry Landfill Site. This review was conducted in accordance with EPA's *Comprehensive Five-Year Review Guidance* dated June 2001 (EPA 540-R-01-007).

The following team members participated in the Five-Year Review:

- Helen Dawson – EPA Region 8 Hydrogeologist
- Jessie Goldfarb – EPA's Lowry Enforcement Attorney
- Nancy Mueller – EPA's Lowry Community Involvement Coordinator
- Lee Pivonka – CDPHE's Lowry Project Officer
- Marion Galant – CDPHE's Lowry Community Involvement Specialist
- CH2M HILL – EPA's oversight contractor at the Lowry Landfill Site
- Tom Sale Groundwater Consulting – Subcontractor to CH2M HILL

Section 2 Site Chronology

Table 2-1 lists the chronology of events for the Lowry Site. Sources of this information are listed in Attachment 1, *Documents Reviewed*.

TABLE 2-1
Lowry Site Chronology

DATE	EVENT
1939	Denver purchased 60,000 acres southeast of Denver and deeded the land to the federal government.
1940 –1960 (approximate)	Site part of Lowry Bombing Range
1964	Denver made application to use a portion of the Site as a sanitary landfill. The United States granted the application subject to certain terms and conditions and conveyed all or portions of five sections of the Lowry Bombing Range, including the Site, back to Denver by quitclaim deed.
1965 –1980	Denver operated Lowry Landfill as a municipal and industrial landfill. The landfill accepted a variety of wastes, including but not necessarily limited to: municipal refuse, liquid and solid industrial wastes, miscellaneous radioactive wastes, and sewage sludge.
1971 – 1979	Citizens issued complaints to regulatory authorities regarding odors, fires, conditions of disposal practices causing spread of contamination to the surrounding area and to groundwater. EPA, the Colorado Department of Health, and Denver engaged in an ongoing process to identify contamination problems and modify operational practices.
Mid-1970s – 1984	Preliminary pre-Remedial Investigation (RI) investigations were conducted by EPA, the United States Geological Survey (USGS), and the Colorado Department of Public Health and Environment (CDPHE, formerly known as the Colorado Department of Health or CDH), and were performed by Denver and WMC,. These investigations included: • Groundwater monitoring well installation and sampling • Surface water and sediment sampling • Air studies • Soil-gas monitoring well installation and sampling
1977 –1980	Shell Oil Company constructed and operated salt brine evaporation ponds in the northeast portion of Section 31 under an agreement with Denver.
1980	WMC took over the operation of the landfill under a contract with Denver. The landfill stopped accepting industrial waste and started accepting only municipal refuse. CWM began operating a disposal facility in Sections 31 and 32 consisting of a burial cell for bulk solids and evaporation ponds for treatment of bulk liquid wastes.
1982	CWM closed the facility in Sections 31 and 32. Preliminary Assessment Site Inspection
1984	Lowry Landfill was named a Superfund Site and placed on the National Priorities List (NPL). Denver implemented an immediate removal measure (IRM) consisting of a subsurface groundwater drain backed by a compacted clay barrier wall (the North Boundary Barrier Wall [NBBW]) and a water treatment plant. EPA issued a Community Relations Plan for the Lowry Site

TABLE 2-1
Lowry Site Chronology

DATE	EVENT
1985 – 1986	Phase I RI consisted of the following key activities: • Geophysical surveys • Waste pit liquid sampling • Hydrogeologic studies including installing and sampling monitoring wells • Surficial soil sampling • Air monitoring • Soil-vapor studies • Surface water, leachate, and sediment sampling • Water-level measurements
September 1986	EPA released the Phase I report summarizing the findings of the Phase I RI fieldwork.
1987	The Agency for Toxic Substances and Disease Registry (ATSDR) Assessment
1987 – 1989	EPA conducted Phase II RI consisting of: • Groundwater monitoring well installation • Groundwater and waste pit liquid sampling • Surface water sampling • Water- and liquid-level monitoring • Fracture investigation • Infiltration study • Air monitoring • Identification of Operable Units (OUs)[1] S OU 1 – Shallow Groundwater and Subsurface Liquids S OU 2 – Landfill Solids (LFS) S OU 3 – Landfill Gas (LFG) S OU 4 – Soils S OU 5 – Surface Water (SW) and Sediments S OU 6 – Deep Groundwater • Preliminary Identification of Remedial Alternatives • Overall Site Work Plan • Preliminary Endangerment Assessment
1988	Engineering Evaluation/Cost Analysis (EE/CA) for alternatives for the Surface Water Removal Action (SWRA)
1988 – 1991	EPA negotiated the following Administrative Orders (AOs) with the PRPs: • AO for OU 1 RI/FS with the Lowry Coalition. This AO was later amended to include the OU 6 RI/Feasibility Study (FS) • AO for OUs 2 and 3 RI/FS with Denver, WMC, and CWM • AO for OUs 4 and 5 RI/FS with Denver and Metro Wastewater Reclamation District (Metro)
1989	Community Relations Plan Update
1989 – 1990	Drum Removal Action
1989 – 1992	Denver implemented a tire-shredding operation to shred approximately 7-1/2 million tires stockpiled in Section 6.
1990	The Section 6 landfill stopped accepting municipal solid waste.

[1] OUs are discussed in Section 3.8.

TABLE 2-1
Lowry Site Chronology

DATE	EVENT
1990 – 1991	Additional site characterization field program including: • Pilot borings, piezometers, and monitoring wells drilling and installation • Hydraulic testing • Solids, groundwater, waste pit liquid, and waste pit gas sampling • Water- and liquid-level monitoring
1991	Consent Decree for the Surface Water Removal Action (SWRA) EPA and CDH negotiated an agreement with Denver and WMC to collect and treat surface water (implement the SWRA). Design of the system began.
1991 – 1992	Closure of Brine Ponds in Sections 31 and 32
August 1991	RI of OU 1 and OU 6 (The Lowry Coalition)
1992	Completion of upgrades to the old water treatment plant (WTP)
February 1992	FS of OUs 1 and 6 (The Lowry Coalition) RI of OUs 2 and 3 (Denver, WMC, CWM)
April 1992	RI of OUs 4 and 5 (Metro and Denver)
May 1992	FS of OUs 2 and 3 (Denver, WMC, CWM)
June 1992 – November 1992	Construction of SWRA
August 1992	FS of OUs 4 and 5 (Metro and Denver) Baseline Risk Assessment OU 1 and OU 6
November 1992	Section 6 landfill mass final clay cover construction program completed
December 1992	Baseline Risk Assessment of OUs 2, 3, 4, and 5 Sitewide and Radionuclide Risk Assessment Proposed Plan for Sitewide remedy
March 1994	ROD signed. The ROD specified components and requirements for the sitewide remedy.
November 1994	AO for Remedial Design/Remedial Action (RD/RA), EPA Docket No. CERCLA VIII-95-05, issued to 34 PRPs. Denver, WMC, and CWM (the Respondents) agreed to perform the RD/RA on behalf of themselves and 31 other PRPs. The Respondents are currently performing work at the Site under EPA oversight.
April 1995	Addendum to Community Relations Plan
August 1995	First ESD for the ROD: 1. Corrected Groundwater Compliance Boundary Performance Standards 2. Corrected Air Quality Performance Standards 3. Corrected Landfill Gas Point of Action Boundary Standards 4. Identified the Colorado Basic Standards for Groundwater as the Numeric Standards for Point of Action (POA) Boundary
June 1996	Landfill Gas Collection and Treatment System remedial design approved by EPA
August 1996	Initiation of Well Plugging Program Wetlands Mitigation remedial design approved by EPA
November 1996	Construction started on the Landfill Gas Collection and Treatment System

TABLE 2-1
Lowry Site Chronology

DATE	EVENT
1997 – Present	Ongoing Operation and Management of Landfill Gas Flare
	Ongoing compliance and performance monitoring
January 1997	Construction completed on the Landfill Gas Collection and Treatment System
February 1997	East/South/West Barrier Wall remedial design approved
March 1997	North Toe Ground-Water Extraction System Remedial design approved by the EPA
April 1997	Wetlands Mitigation construction started and completed
May 1997	East/South/West Barrier Wall construction began Construction completed on the Well Plugging System
June-July 1997	Wetlands mitigation damaged by flooding
September 1997	Construction began on North Toe Groundwater Extraction System
October 1997	South Boundary Soil Vapor Extraction (SBSVE) system installed Second ESD for the ROD, relative to: 1. Onsite pretreatment of contaminated groundwater followed by discharge for offsite treatment at Metro's and Aurora's Publicly Owned Treatment Works (POTWs) 2. Onsite treatment and disposal of contaminated soil and debris excavated from Former Tire Pile Area
December 1997	Construction completed on the North Toe Groundwater Extraction System East/South/West Barrier Wall construction completed
June 1998	FTPA Middle Waste Pit excavation remedial design approved by EPA POTW Pipeline and Potable Waterline remedial design completed
August 1998	Construction started on POTW Pipeline and Potable Waterline
September 1998	FTPA Middle Waste Pit excavation remedial design approved by EPA North Boundary Groundwater Barrier Wall System evaluation approved by EPA
November 1998	Construction completed on POTW Pipeline and Potable Waterline
February 1999	FTPA Middle Waste Pit excavation completion
March 1999	Wetlands reconstruction started Second Addendum to Community Relations Plan
April 1999	Construction of the FTPA Middle Waste Pit treatment cell
May 1999	Wetlands reconstruction completed Start and discontinuation of the FTPA North Waste Pit excavation New WTP remedial design completed
June 1999	North Face Landfill Cover remedial design approved by EPA
July 1999	Construction started on the North Face Landfill Cover
August 1999	South Boundary Soil Vapor Extraction System remedial design approved by EPA
September 1999	Construction began on new WTP Construction completed on the North Face Landfill Cover

TABLE 2-1
Lowry Site Chronology

DATE	EVENT
2000 – Present	Early Warning Monitoring System implemented to identify contaminants that may impact WTP operations
	Additional Treatability Studies for treatment of North Toe Extraction Site waters (1,4-dioxane) Ongoing monitoring of new WTP and effluent
	Ongoing design investigation to evaluate in situ thermal treatment technology for North and South FTPA Waste Pits
January 2000 – Present	Pumping of PM-11 and PM-15 area ground water according to Performance and Compliance Monitoring Plan, Shallow Groundwater Containment, Collection, and Diversion System (PCMP) requirements. Pumping at PM-11 was later discontinued because an inward gradient was achieved by the pumping, but had to be reinitiated because the inward gradient did not persist in the absence of pumping.
March 2000	Construction of new WTP completed
September 2000	Connected Flameless Thermal Oxidizer (FTO) Unit to Treatment Cell
September 2000 – September 30, 2001	EPA conducts Five-Year Review to evaluate operations and protectiveness of the sitewide remedy.
November 2000	South Boundary Soil Vapor Extraction System stopped operations
May 2001 – Present	Evaluation of PM-4 area, MW38-WD area, MW39-WD area, and MW51-WD area
May 2001 – Present	Reevaluation of North Boundary Barrier Wall

Section 3 Background

3.1 Location

The Lowry Landfill Superfund Site is located in the western three-quarters of Section 6, Township 5 South, Range 65 West in unincorporated Arapahoe County, Colorado, approximately 15 miles southeast of the City and County of Denver and one-half mile east of Aurora, near the intersection of East Quincy Avenue and Gun Club Road. The street address is 3500 South Gun Club Road, Denver, Colorado. The Lowry Site consists of approximately 480 acres, and is a portion of the Denver Arapahoe Disposal Site (DADS). The Site is owned by Denver, with the exception of an approximately 1.2-acre parcel in the southeast corner of the Site, which is owned by a private company[1]. DADS consists of Sections 4, 6, and 9, Township 5 South, Range 65 West and Sections 31 and 32, Township 4 South, Range 65 West (Figure 3-1).

3.2 Physical Conditions

The Lowry Site consists of gentle slopes on the north half of the section and a topographic high on the south half of the section caused by past landfilling activities. The Site is located in gently rolling short-grass prairie characteristic of the Great Plains. The surrounding land is largely undisturbed native prairie, disturbed weedy prairie, and areas of unirrigated small grain crops.

The Site is currently fenced. WMC, current operator of the landfill, regularly patrols the fence. The main entrance to the Site is a gate at the intersection of East Hampden Avenue and Gun Club Road. DADS operates 24 hours a day, six days a week. The gate is closed and locked on Sundays.

3.3 Zoning and Current Land Use

Land uses and current zoning by Arapahoe County in the vicinity of the Lowry Site are presented in Attachment 2, Zoning and Land Use Summary. Arapahoe County has zoned the Site and the surrounding property A-1 (agricultural) with three exceptions: Section 1 (west of the Site), Section 12 (southwest of the Site) and Section 8 (southeast of the Site) are zoned M-U (mixed-use planned unit development). Aurora's comprehensive plan describes the Site as PF (public facility, reflecting the anticipated long-term remediation and landfill use of the facility).

A portion of the Site (Attachment 2) is within Aurora's Day/Night Average Noise Level of 65 decibels (dB) (LDN 65) noise contour. Within Aurora, no residential development is permitted within the LDN 65 noise contour. Although much of the area surrounding the Site is currently in unincorporated Arapahoe County, in accordance with the *Arapahoe County Comprehensive Plan* adopted June 19, 2001, Arapahoe County will recognize and defer to Aurora's adopted E-470 Corridor Plan, which includes the Lowry Site. Attachment 2 presents Aurora's *E-470 Corridor Zone and Subdistricts* map.

[1] This parcel was owned by the U.S. Department of Health, Education, and Welfare at the time of transfer of the balance of the Site to Denver, and was subsequently sold.

In 1968, Arapahoe County issued a Certificate of Designation for the Lowry Landfill, which allows landfilling on the majority of Sections 4, 6, 9, 31 and 32. The Certificate of Designation is held by Denver and was issued for an indefinite period of time.

In the past, much of the area surrounding the Site was undeveloped and used for cattle ranching and grazing and for production of dryland (no irrigation) winter wheat. With encroaching urban growth and the completion of the E-470 tollway west of the Site, the land use in the vicinity of the Site is beginning to change. Development, including residential construction, is approaching properties owned by the Lowry Environmental Protection Clean-up Trust (Lowry Trust or Trust). The Trust is comprised of monies collected by Denver, WMC, and CWM in settlement of the third-party contribution actions against other PRPs at the Site. These properties, which are immediately adjacent to or near the Site in Sections 1, 5, 6, 7, 32, and 36 (Attachment 2), are referred to as the Lowry Trust Property, which surrounds the perimeter of the Lowry Site. In January 2000, Aurora completed rezoning for the land in the E-470 Corridor. This rezoning will permit new residential developments closer to the Lowry Site. Attachment 2 includes aerial photographs taken on several dates showing the encroaching development.

3.4 Land Ownership

Denver owns Section 31 adjacent to Section 6 on the north and Section 32 northeast of Section 6. (Figure 3-2 shows the land section designations in the vicinity of the Site.) Again, the Trust has purchased certain property immediately adjacent to or near the Site (see "Map 3" included in Attachment 2). The land in Sections 1 and 36 acquired by the Trust was deeded with restrictions that run with the land. These restrictions limit the uses of that property to open space, recreational uses, park, farming, grazing, construction and operation of water supply wells, rail, light rail, and public highway uses. In their Comments on the Draft Five-Year Review, dated September 10, 2001 ("Comments on the Draft Five Year Review" [included in Attachment 14]), Denver and Waste Management wrote that the following parties have the right to enforce the restrictive covenants in the deeds: (1) the grantee, the Lowry Environmental Protection/Cleanup Trust Fund; (2) the grantors of each parcel; (3) Denver as the owner of land to whose benefit the covenants run (Section 6); and (4) other owners of land to whose benefit the covenants run (owners of the East half of Section 1 for Section 1, and the owners of Sections 26, 35 and the W1/2 Section 36 for Section 36) and their successors in title; and (5) the West Arapahoe Soil Conservation District for Section 36.

On June 27,1991, Denver Mayor Federico Peña signed Executive Order No. 97, which limits the use of ground water and limits development at the Site. A copy is presented in Attachment 3.

3.5 Restrictive Covenants

On June 29, 2001, Denver recorded with the Arapahoe County Clerk and Recorder's Office a number of restrictive covenants relative to on- and off-Site properties and certain water rights. These may be found in Attachment 3.

3.6 Future Land Use

The area around the Site is an urban growth area for both Arapahoe County and the City of Aurora. In Arapahoe County, growth in this area will be served exclusively by ground water, at least for the foreseeable future. Arapahoe County is in the process of completing an update of its 1985 Comprehensive Plan. This plan does not include policies specific to development near

the Site. The Urban Service Land Use Plan map designates areas north, south, and west of the Site for urban residential development. In January 2000, Aurora adopted the E-470 ordinance. This ordinance provides for significant development along the E-470 corridor near the Lowry Site. Aurora is currently developing the Northeast Plains Growth Management Study, a plan for developing lands east of the E-470 corridor.

On October 22, 1993, Aurora adopted Ordinance No. 93-88. This ordinance prohibits the drilling or use of any wells in the Dawson Aquifer within one-half mile of the exterior boundaries of Section 6 until such time as EPA's groundwater remedy for the Site has been implemented consistent with the ROD, and EPA's Five-Year Review of the remedy concludes that the remedy is performing satisfactorily. This restriction does not apply to wells for monitoring, remediation, or reinjecting ground water. The ordinance also prohibits the development or construction of buildings within one-quarter mile of the east, south or west exterior boundaries of Section 6 prior to implementation of the ROD remedy and completion of a Five-Year Review that concludes that the remedy is performing satisfactorily. Finally, the ordinance requires sellers within one-quarter mile of the east, south, and west exterior boundaries of the Site to give purchasers notice of the proximity of the Superfund site. When a Five-Year Review concludes that the remedy is performing satisfactorily, the requirements and prohibitions of Aurora Ordinance 93-88 (as currently written) will expire unless Aurora takes action such as revising or repealing the Ordinance.

3.7 Groundwater Use

At present, there are no potable water wells on the Site. Generally, private wells in the vicinity of the Site are used for, but are not limited to, potable water, irrigation, and livestock purposes. Nearby private wells are located approximately 2 miles north (downgradient) of the Site. Four of the private wells that are closest to the Site were sampled by EPA in 1986 and 1995. No organic constituents were detected, and all samples were below maximum contaminant levels (MCLs) for inorganic constituents. One shallow private well has been sampled twice since 1995. No organic constituents were detected, and all samples were below MCLs for inorganic constituents.

The East Cherry Creek Valley Water & Sanitation District (ECCV) owns groundwater rights in the vicinity of the Site. The ECCV serves unincorporated areas to the west and southwest of Section 6, using a series of deep groundwater wells to produce water for domestic uses. The ECCV regularly samples and tests these wells to measure compliance with requirements of the Safe Drinking Water Act (SDWA). Analytes tested under the SDWA include inorganic constituents, organic constituents, and primary anions and cations. Additionally, the ECCV tests these samples for radionuclides. Aurora residents are served by the Aurora municipal water system, which provides water from surface reservoirs rather than ground water.

3.8 Operable Units

During the RI/FS process, the Site was divided into six OUs based on the complexity of the contamination problems and the size of the Site. OUs were established for each of the environmental media as follows:

- OU 1 – Shallow Ground Water and Subsurface Liquids
- OU 2 – Landfill Solids
- OU 3 – Landfill Gas

- OU 4 – Soils
- OU 5 – Surface Water and Sediments
- OU 6 – Deep Ground Water

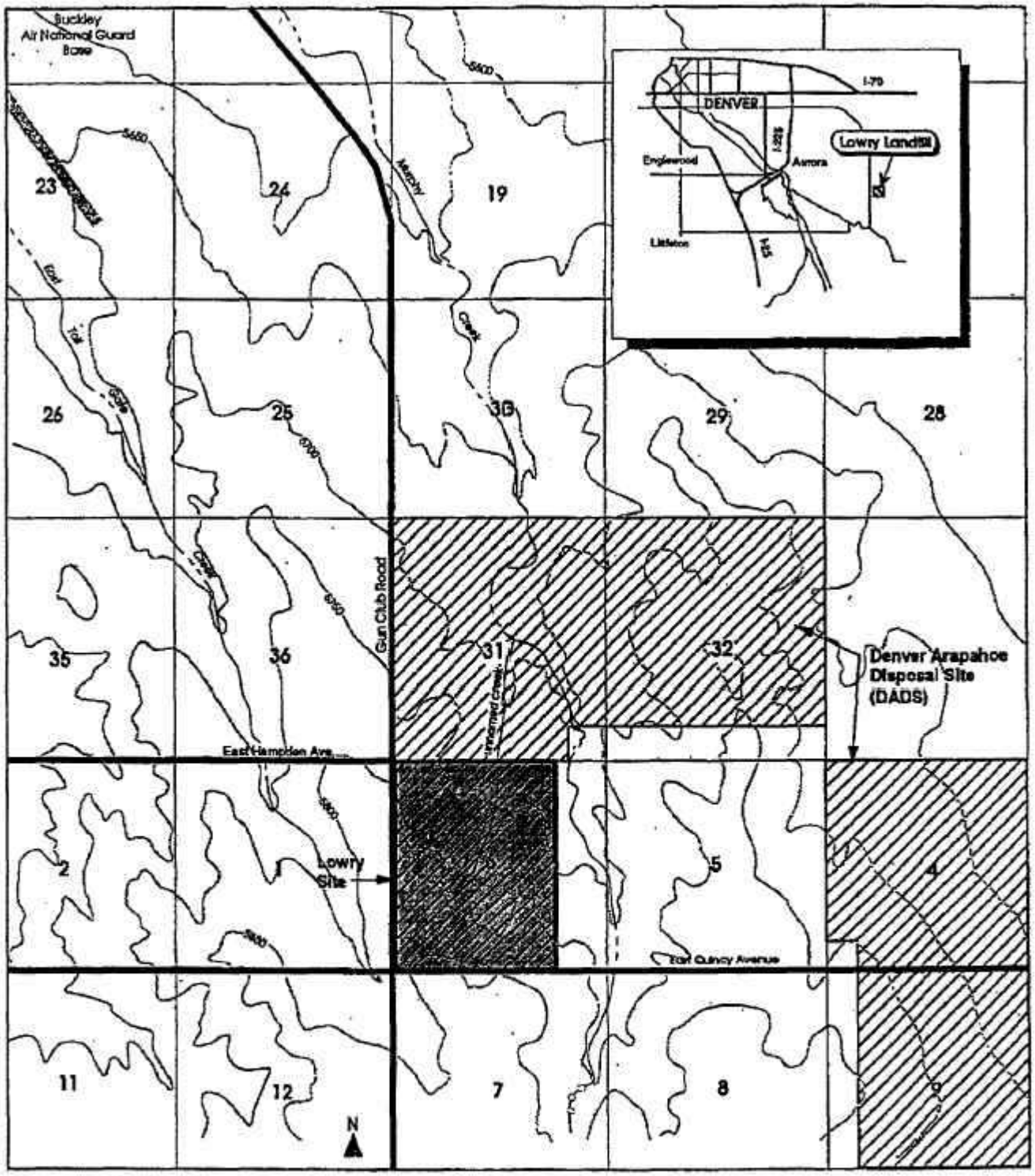
To facilitate effective implementation of the RI/FS activities, the OUs were grouped and studied as follows: OUs 1 and 6, OUs 2 and 3, and OUs 4 and 5.

3.9 Contaminants

Section 2, *Site Chronology,* summarizes the history of contamination, investigations, and responses at the Site. The primary threats to human health and the environment at the Site are posed by landfill gas, waste-pit liquids, contaminated liquids in drums, contaminated ground water, and contaminated seepage in the former unnamed creek drainage. Other threats were from contaminated landfill solids, soils, and sediments. The ROD summarizes the alternatives considered for all threats and presents the final selected sitewide remedy to address these threats. The Site contamination included volatile and semivolatile organic constituents, metals, pesticides, polychlorinated biphenyls (PCBs), and methane and other gases. Frequently detected chemicals include methane and many chlorinated solvents, especially 1,1,1-trichloroethane; 1,1-dichloroethane; chloroethane; methylene chloride; trichloroethylene; tetrachloroethylene (perchloroethylene); vinyl chloride, and 1,4-dioxane.

3.10 Basis for Taking Action

As stated in the ROD (page 5-1), the primary threats to human health and the environment posed by the Lowry Site consist of exposure to and contamination by landfill gas, waste-pit liquids, drums, ground water, and contaminated seepage in the former unnamed creek drainage. Other threats were posed by contaminated landfill solids, soils, sediments, and ground water.



DEN Graph/Lowry ROD/100

Figure 3-1
THE LOWRY SITE AND DADS FACILITY LOCATION
LOWRY RECORD OF DECISION

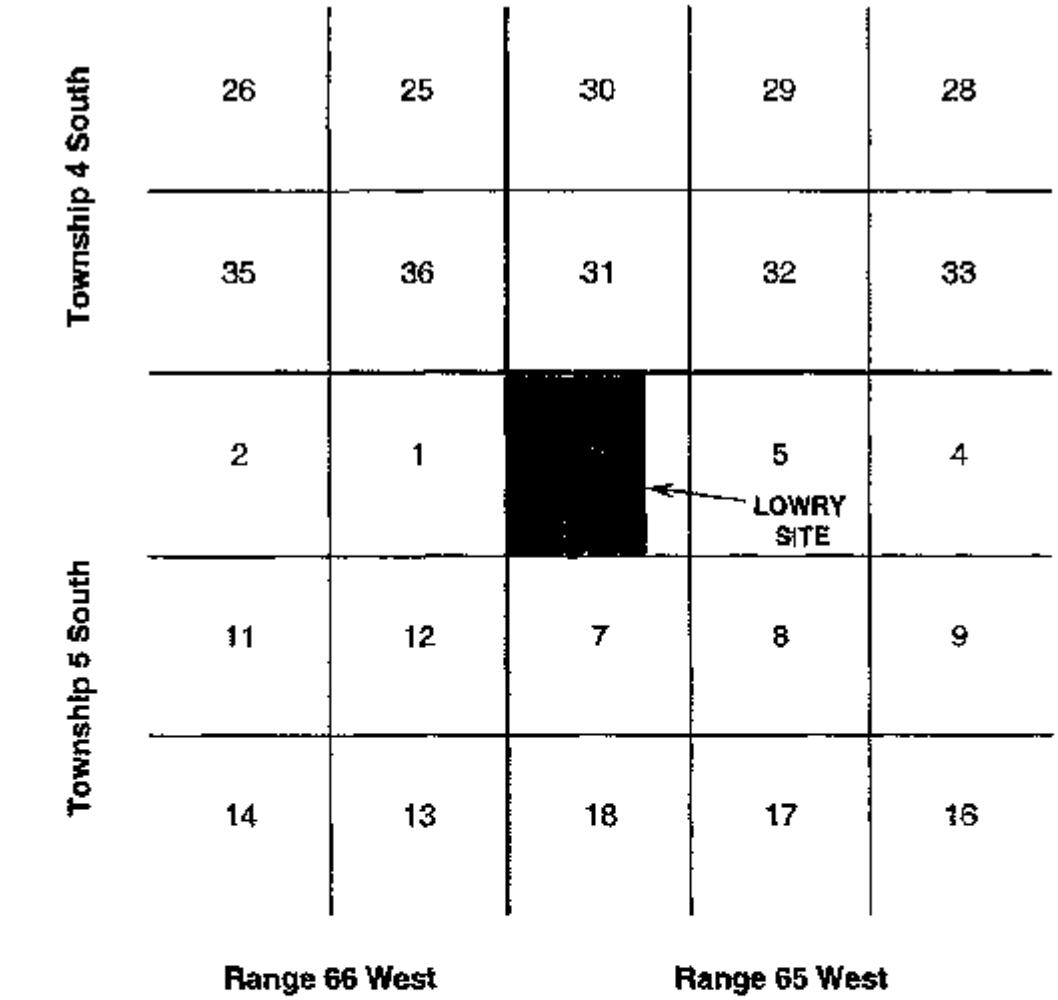


Figure 3-2
Land Section Designations in the Vicinity of the Lowry Site

Section 4 Remedial Actions

This Five-Year Review addresses remedial actions completed since the trigger date. Completed components and additional remedy elements, as well as components that were initiated but have not been completed, will be discussed. This section provides a description of the remedial action objectives identified in the ROD, a definition of containment as applied at the Lowry Site, the original remedy selection, a summary of the remedy design and implementation, a summary of changes to the remedy, and an overview of the ongoing O&M activities.

4.1 Remedial Action Objectives

The ROD identified Remedial Action Objectives (RAOs) for each of the OUs at the Site. RAOs, chemical-specific remediation goals, and Performance Standards are developed by EPA and identified in the ROD to define what must be achieved to protect human health and the environment.

The following RAOs were identified in the ROD for the shallow ground water, subsurface liquids, and deep ground water (OUs 1 and 6):

- Prevention of exposure to humans and the environment (through ingestion, inhalation, or dermal absorption) from liquids (either ground water or waste-pit liquids) containing contaminants in excess of the Performance Standards
- Prevention of migration of contaminants beyond the compliance boundary in excess of the Performance Standards
- Prevention of horizontal migration of dissolved ground water contaminants offsite and to surface waters
- Prevention of vertical migration of dissolved groundwater contaminants beyond the lignite layer
- Prevention of movement of non-aqueous phase liquids (NAPLs) beyond the compliance boundary and minimization of movement of NAPLs
- Minimization of infiltration and leachate production in the waste-pit source area

The following RAOs were identified for Landfill Solids (OU 2):

- Protection of human health and the environment from direct contact or ingestion of landfill solids or soils intermingled with landfill solids containing contaminants
- Protection of humans from inhalation of volatilized contaminants from landfill solids or soils intermingled with landfill solids, and inhalation of contaminated airborne particulate matter from soils or landfill solids that exceed Performance Standards
- Minimization of the production and migration of leachate, from landfill solids or soils intermingled with landfill solids, to the saturated zone and ground water
- Minimization of the migration of soils intermingled with solids, caused by erosion or entrainment by wind or water

- Prevention of offsite migration of landfill solids and soils intermingled with solids into other media
- Protection of human health and the environment from direct contact with or ingestion of leachate that exceeds the Performance Standards for shallow ground water and subsurface liquids
- Prevention of offsite migration of leachate or infiltration into other media

The following RAOs were identified for Landfill Gas (OU 3):

- Protection of human health from inhalation of landfill gases in excess of the Performance Standards
- Protection of human health and the environment from explosion hazards associated with landfill gases
- Prevention of offsite migration of landfill gas or migration to other media

The following RAOs were identified for soils, surface water, and sediments (OUs 4 and 5):

- Protection of human health and the environment from direct contact or ingestion of soils, surface water, and sediments containing contaminants that exceed the Performance Standards
- Protection of human health from inhalation of volatilized contaminants from the soils, surface water, or sediments; and inhalation of contaminated airborne particulate matter from soils or sediments that exceeds Performance Standards
- Minimization of the production and migration of contaminated surface water to the saturated zone and ground water
- Minimization of the migration of soils and sediments by erosion or entrainment by wind or water
- Minimization of migration of contaminated surface water offsite and into other media

4.2 Definition of Containment

The selected sitewide remedy (described in Section 4.3, *Original Remedy Selection*) includes a combination of containment and collection and treatment. On page 11-5, the ROD states, "The containment components of the ground-water remedy shall effectively isolate the contamination at the Lowry Site from the surrounding areas by controlling horizontal migration of contaminated ground water through the construction of containment and diversion systems." On page 11-3, the ROD states, "The selected remedy for shallow ground water and subsurface liquids and deep ground water (ground-water remedy) shall contain, collect, and treat contaminated shallow ground water at the Lowry Site."

The use of containment as a component of the Site remedy is consistent with federal regulations and EPA guidance for Superfund Sites. The following citations are particularly relevant:

- The NCP, at 40 CFR 300.430(a)(1)(iii)(B) states, "EPA expects to use engineering controls, such as containment, for waste that poses a relatively low long-term threat or where treatment is impracticable."

- The NCP, at 40 CFR 300.430(a)(1)(iii)(D) states, "The use of institutional controls shall not substitute for active response measures (for example, treatment and/or containment of source material, restoration of ground waters to their beneficial uses) as the sole remedy unless such active measures are determined not to be practicable, based on the balancing of trade-offs among alternatives that is conducted during the selection of remedy."

- US EPA, 1991, Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites (EPA/540/P-91/001) states (p. 4-33), "An ideal barrier will completely encircle the landfill area, will be keyed into a lower aquitard, and will include a low permeability cap and a groundwater collection system to maintain an inward gradient across the barrier. Such a barrier is generally much more effective in controlling movement of ground water and pollutants than an upgradient or downgradient barrier or a partially-penetrating barrier (that is, one that is not keyed in to an impervious layer)."

Because containment is a key aspect of the Lowry Site remedy, as part of this Five-Year Review, EPA has carefully reviewed the meaning of the term "containment," and has concluded that "containment" means that "Performance Standards are being met at and beyond the point of compliance (POC)."

EPA's definition of containment at the Site, based on the *Revised Conceptual Site Model* (Attachment 4) and the current understanding of Site heterogeneities, is as follows:

The Respondents must either:

A) provide engineered controls that will break the migration pathway and provide a routine compliance monitoring program that will assure Performance Standards are met at and beyond the compliance boundary, or;

B) demonstrate that ground water is hydraulically controlled by natural gradients (or by imposed gradients maintained by extraction systems such as wells) that will prevent exceedances of Groundwater Performance Standards at the POC through a monitoring program that provides adequate coverage (spacing, frequency, duration, etc.) to provide a statistically significant confidence level.

In either case, the associated monitoring system must provide sufficient confidence that heterogeneous features potentially serving as preferential pathways are adequately identified and monitored.

4.3 Original Remedy Selection

The overall cleanup strategy selected at the Lowry Site is to reduce the potential for current or future exposure to landfill gas, waste-pit liquids, seepage in the unnamed creek drainage, and contaminated ground water. Landfill gas, seepage, and ground water are to be contained, collected, and treated. Drums, drum contents, and contaminated soils in the FTPA are to be excavated, treated, and disposed offsite at a permitted disposal facility.

The selected sitewide remedy integrated the IRMs and remedies for all the OUs, and comprehensively addressed all contaminated media at the Lowry Site. IRMs were implemented

before the issuance of the ROD to address the seepage in the unnamed creek drainage and the migration of contaminated ground water in the alluvium underlying the unnamed creek drainage. The migration of contaminated ground water in the alluvium is being addressed through the construction and operation of the NBBW and WTP. Primary threats from contaminated seepage in the unnamed creek have been addressed through implementation of the SWRA, which included an upgrade of the existing WTP.

Contaminated ground water is being addressed by containment, collection, and treatment using an onsite treatment plant. Landfill gas is being addressed by containment, collection, and treatment using enclosed flare technology. Contaminated seepage and surface water are being addressed through a drainage and underground collection system in the unnamed creek area as part of the SWRA. The response action identified for the FTPA waste pits was to address principal threats (drums, drum contents, and contaminated soils) through treatment and offsite disposal to reduce the toxicity, mobility, and volume of contaminants. As will be discussed in Section 4.4, *Design and Implementation of the Lowry Sitewide Remedy*, the FTPA waste pit portion of the remedy is currently undergoing a treatability study with an innovative technology. Landfill mass solids and soils were judged to be low-level threats at the Lowry Site and are addressed through containment.

4.4 Design and Implementation of the Lowry Sitewide Remedy

This section describes the major remedy components and the additional remedy elements of the Lowry Sitewide Remedy and summarizes the status of the design and implementation of each. (See Figure 4-1).

4.4.1 Completed Remedy Components

The following remedy components have been completed as of July 2001:

- **Well Plugging and Abandonment Program.** This program plugged and abandoned approximately 91 of the more than 300 wells at the Lowry Landfill Site. These wells were no longer used for monitoring. The well plugging program began in August 1996 and was completed in March 1997. In addition, 13 more unused wells and three unused gas monitoring probes were abandoned and plugged between June and August 1998.

- **Wetlands Mitigation.** A replacement wetlands was constructed northeast of the Site to mitigate loss of wetlands areas caused by SWRA construction activities within the unnamed creek. In August 1996, EPA and CDPHE approved the Remedial Design to replace about an acre of wetlands lost during construction of the Lowry Landfill remedies. Wetlands construction was completed in spring 1997, but heavy flooding in summer 1997 damaged the wetlands shortly after completion. The Respondents reconstructed the wetlands in fall 1998 and spring 1999.

- **Landfill Gas Collection and Treatment System.** An LFG collection system consisting of interior and perimeter collection wells, collection piping, and an enclosed flare was constructed to prevent lateral migration of LFG away from the Site and to treat the LFG. In June 1996, EPA and CDPHE approved the Remedial Design for the Landfill Gas Collection and Treatment System. The system was constructed in late 1996 and began operating in mid-January 1997.

- **East/South/West Groundwater Barrier Wall.** An approximately 50-foot-deep groundwater containment, collection, and diversion system was constructed on the east, south, and west

sides of the landfill mass. This wall's purpose is to minimize the potential for clean ground water to enter the Site and to restrict contaminated ground water from flowing offsite. EPA and CDPHE approved the Remedial Design for the East/South/West Barrier Wall in February 1997. Construction began in May 1997 and was completed in December 1997.

- **North Boundary Barrier Wall System.** The NBBW was constructed in 1984 to remove and treat contaminated ground water flowing north from the Lowry Landfill. The ROD required the Respondents to perform an evaluation of the NBBW to determine if the wall needed to be elongated, deepened, or replaced to restrict offsite migration of contaminated ground water. The Respondents installed piezometers to demonstrate hydraulic capture on the east side of the NBBW and submitted an evaluation report in 1998. This evaluation was approved by EPA in 1998. The piezometers were abandoned shortly thereafter. The ROD states that the protectiveness of this component of the selected remedy shall be ensured on the northern boundary by the implementation of monitoring systems at the compliance boundary (POC) and at the POA boundary (installation of an early warning monitoring well network). Subsequent water quality and gradient (vertical and lateral) data from monitoring wells near the NBBW suggest that Site-related contaminants may be flowing around and/or under the NBBW. The Respondents are currently installing monitoring wells to begin implementation of a monitoring program to demonstrate compliance with the ROD requirements on an ongoing basis.

- **North Face Landfill Cover.** This component consisted of placing an additional two feet of cover on the north face of the landfill mass. The Remedial Design for the North Face Landfill Cover was approved in June 1999. The cover was completed in late 1999. This work included placing an additional two feet of select earth cover on the north face of the former landfill, an area of approximately 29 acres.

4.4.2 Additional Remedy Elements

The following additional remedy elements, while not necessarily requiring construction, are required to provide a complete remedy. They are being implemented by the Respondents.

- **Landfill Cover Maintenance.** This element consists of continued maintenance of the landfill mass cover to minimize the potential for receptor contact with contamination from the landfill mass, and to reduce infiltration and thus reduce additional groundwater contamination.

- **Surface Water Removal Action.** Continued O&M of the SWRA is required by the ROD. The Respondents have operated, monitored, and maintained the SWRA since its completion in November 1992.

- **Groundwater Monitoring Wells and Compliance Program.** The Groundwater Monitoring Wells and Compliance Program is an ongoing part of the remedy. Specific wells and groups of wells have been completed to monitor the performance of individual remedy components, as necessary (for example, the East/South/West Barrier Wall). Monitoring is performed at locations on both the POC and on the POA. If releases beyond the POC are detected, corrections to the containment systems must be made, with the potential for additional extraction wells and/or expansion of the barrier system, and/or other technologies to maintain containment. If releases beyond the POA are detected, similar response actions are required to prevent degradation of water quality in areas onsite where

groundwater Performance Standards were not known to be exceeded at the time of the ROD, and to thus help maintain containment.

- **Landfill Gas Monitoring Probes and Compliance Program.** A perimeter gas monitoring system has been installed to detect potential landfill gas migration. If migration is detected, corrections to the system must be made with the potential for installation of additional extraction wells to restrict offsite landfill gas migration.

- **Surface Water Monitoring.** This consists of surface water monitoring to allow detection of potential releases of contaminants to surface water. The Respondents have monitored surface water in accordance with the surface water monitoring program described in the Final Interim Compliance Monitoring Plan since February 1996.

- **Institutional Controls.** The ROD, as modified by the Minor Modification of the March 10, 1994 Record of Decision, dated August 7, 1995 requires establishment of institutional controls to prohibit at the Site all activities and uses that EPA determines would interfere or be incompatible with, or that would in any way reduce or impair the effectiveness or protectiveness of, the Sitewide remedy. To the extent deemed necessary to protect human health and the environment, these shall include, but are not limited to, prohibitions on all groundwater well construction and use not necessary for implementation and monitoring of the selected remedy; prohibitions on access; and prohibitions on activities and land use not connected with design, construction, and implementation of monitoring of the selected Sitewide remedy (excluding ongoing permitted solid waste disposal activities and uses that EPA determines would not interfere or be incompatible with, and that would in no way reduce or impair the effectiveness or protectiveness of, the Sitewide remedy.) Offsite institutional controls are to serve as an additional measure of protection to enhance the effectiveness of the selected remedy and to act as preventative measures to preserve the implementability and effectiveness of any of the selected remedy contingency measures that EPA determines must be implemented at the Lowry Site. The existing and currently proposed institutional controls are as follows:

  – **Denver Executive Order No. 97.** This order was issued on June 27, 1991, by Denver Mayor Federico Peña. In summary, it enacted specific prohibitions on the use of surface water and ground water, including ground water from the Dawson, Denver, Arapahoe, and Laramie-Fox Hills aquifers at the Site. There are also limitations on groundwater production or dewatering at Sections 4, 9, and 32 without the express written consent of the Mayor of Denver or his designee. It also limits structures on Sections 6 and 31 to those necessary to remediate the Site or continue landfilling operations. Attachment 3 contains a complete copy of the order, which explains the prohibitions in more detail.

  – **Covenants.** Refer to the covenants described in Section 3.4, *Land Ownership,* as well as those found in Attachment 3.

  – **Aurora City Ordinance No. 93-88.** This ordinance became effective October 22, 1993. In summary, until such time as EPA determines that the ROD has been implemented and the EPA's Five-Year Review has occurred and concludes that the remedy is protective at the POC, this ordinance is intended to:

    - Limit drilling or use of any wells in the Dawson aquifer within one-half mile of the exterior boundaries of Section 6.

- Limit development or construction of buildings within one-quarter mile of the east, south, and west boundaries of the Site.

- Requires notice of the presence of the Site be given to prospective purchasers of real property located within one-quarter mile of the east, south, and west boundaries of the Site.

  Attachment 3 contains a complete copy of the Ordinance.

– **Arapahoe County.** Refer to Section 3.3, *Zoning and Current Land Use*, for a discussion the intergovernmental agreement between Aurora and Arapahoe County.

– **Other.** Other existing and currently proposed institutional controls include: (1) a Notice of Nonconsent for the Withdrawal of Groundwater, which Denver recorded in Arapahoe County's real property records in May 1991 (in their Comments on the Draft Five-Year Review, Denver and Waste Management wrote that the Notice of Nonconsent ensures that no public water provider may include the Site in its service area and obtain the right to use ground water underlying the Site by implied consent, i.e., it reserves Denver's sole right to control and develop the groundwater resource); (2) the Buckley LDN 65 Noise contour, which includes the Site and property adjacent to the Site to the northeast (in their Comments on the Draft Five Year Review, Denver and Waste Management wrote that Aurora and Arapahoe County restrict lands within the LDL from being used for residential purposes); and (3) access (in their Comments on the Draft Five Year Review, Denver and Waste Management wrote that access is limited and controlled by fencing).

- **Erosion Monitoring.** This consists of visual monitoring of actual and potential soil erosion. The Respondents have performed this work as part of ongoing Site O&M. This element is not discussed separately in this Five-Year Review Report; it is included as part of overall Site Operations and Maintenance.

4.4.3 Incomplete Remedy Components

The following remedy components have not been completed as of July 2001:

- **North Toe Groundwater Extraction System.** The NTES is intended to remove contaminated ground water from an extraction trench located at the north toe of the landfill mass and approximately centered on the unnamed creek drainage. EPA and CDPHE approved the Remedial Design for the NTES in April 1997. The NTES was constructed in spring 1998, but pumping has not yet been initiated.

- **The New Onsite Water Treatment Plant.** Annual treatment of approximately 6.4 million gallons of contaminated ground water from the existing NBBW, from the new groundwater containment, collection, and diversion system, from the NTES, and from other Site sources is required, using either the existing WTP, an upgraded treatment plant, or a new WTP. The Remedial Design for the new WTP was approved by EPA and CDPHE in December 1998. Construction began in May 1999 and was completed in March 2000. However, a construction completion certification has not been issued by EPA since the WTP cannot yet treat all of the required influent.

- **Former Tile Pile Area Waste Pits.** The ROD requires excavation, removal, and treatment of Principal Threat Wastes (surface and subsurface drums, wastes, and contaminated soils)

within the FTPA waste pits. The FTPA Waste Pit Remedial Design was approved by EPA and CDPHE in September 1998. Excavation of the Middle Waste Pit began in September 1998 and was completed in February 1999. Excavation of the North and South Waste Pits has not been completed, as described in the next section.

4.5 Changes to the Remedy

This section summarizes significant changes to the sitewide remedy that have been made since the signing of the ROD. The major changes are as follows:

- **Wetlands Mitigation.** Following construction of the wetlands mitigation in 1997, severe storms damaged the new wetlands. The wetlands mitigation plan was modified, and the wetlands were reconstructed in fall 1998 and spring 1999. The reconstructed wetlands area is stabilized and has been revegetated. Animal damage to trees has also occurred; this has been addressed by replacing dead trees.

- **East/South/West Barrier Wall.** The ROD required construction of groundwater collection systems to intercept and collect contaminated ground water within the sand channels in the shallow groundwater aquifer. The ROD also required construction of upgradient groundwater extraction wells to collect uncontaminated upgradient ground water for diversion around the Site. During design of the East/South/West Barrier Wall, the Respondents proposed and EPA approved using an "Observational Method" approach to managing ground water along the barrier wall. This approach was used in lieu of active groundwater extraction wells and collection trenches. Using this Observational Method, groundwater quality and gradients are being monitored at performance monitoring wells along the East/South/West Barrier Wall. The objective of this monitoring is to identify locations along the barrier wall where additional response action (that is, localized groundwater extraction and treatment, and additional focused monitoring) is necessary to maintain containment. The November 1998 Final Performance and Compliance Monitoring Plan for Shallow Groundwater Containment, Collection, and Diversion System, East/South West Site Boundaries (PCMP) describes the monitoring program and the application of the Observational Method to implement planned response actions.

- **FTPA Waste Pits**

  – **Middle Waste Pit Treatment Cell.** In October 1997, EPA issued the Second Explanation of Significant Differences (1997 ESD) for the Lowry Site. The 1997 ESD permitted onsite treatment and disposal of contaminated soil and debris excavated from the FTPA Waste Pits. Non-aqueous liquid wastes were disposed offsite as originally required by the ROD. To treat the contaminated soil, and debris onsite, the Respondents constructed a geomembrane-lined Treatment Cell north of the landfill mass. Soil and debris excavated from the Middle Waste Pit were placed in this cell and were covered with a geomembrane. A system of slotted plastic pipes permits vacuum extraction of soil gas from the treatment cell. This soil gas is thermally treated to destroy the organic constituents in the soil gas.

  – **FTPA North and South Waste Pits:** The purpose of the FTPA Waste Pits Remedy is to address principal threat wastes including drums, soils, debris, and liquids. Excavation of the Middle Waste Pit began in September 1998 and was completed in February 1999. During excavation of the Middle Waste Pit, it was determined that additional emissions

control measures would be needed for excavation of the other two FTPA Waste Pits (the North Pit and the South Pit). A portable enclosed structure was erected over the North Waste Pit to control vapor emissions during excavation, and a granular activated carbon air treatment system was provided to treat the emissions prior to discharge of air from the enclosed structure. When excavation began on the FTPA North Waste Pit in May 1999, volatile organic compound (VOC) emissions in the work area proved to be Immediately Dangerous to Life or Health (IDLH), as defined by the U.S. Occupational Health and Safety Administration (OSHA), threatening worker safety. Because of this, the remedy for the FTPA North and South Waste Pits has been revisited. An alternate in-place electrical resistance heating remedy is currently being evaluated to reduce the amount of principal threat wastes buried in these pits to a level commensurate with that of the excavated middle pit. An ESD to the ROD is planned upon successful completion of the pilot study.

- **Water Treatment Plant**

  - **Discharge to POTW.** The ROD required onsite treatment and discharge of contaminated Site ground water. The 1997 ESD permitted onsite pretreatment of contaminated ground water with subsequent offsite discharge to Aurora and Metro's POTWs. Implementation of the change by the Respondents required construction of the POTW Pipeline to convey WTP discharge to the sanitary sewer system for conveyance to the POTWs. In addition, a potable waterline was installed to convey potable water to the injection trench north of the NBBW. Injection of potable water in the injection trench makes up for the offsite discharge of the ground water produced and treated by the remedy.

  - **Treatment of NTES Water.** During startup of the WTP, water produced from the NTES was found to be resistant to treatment by ultraviolet oxidation, which is the principal organic constituent destruction process in the upgraded WTP. The Performance Standards for 1,4-dioxane cannot be achieved at the required NTES extraction flow rate using the WTP as it now exists. Therefore, until the plant can be further modified to treat 1,4-dioxane to the required discharge standards, the NTES cannot be operated at the required flow rate. Treatability testing is under way to address methods to permit the WTP to treat NTES water at the required flow rate.

  - **Early Warning Monitoring Program.** This program monitors water quality upgradient of locations where water is collected for treatment at the onsite WTP. This system is intended to allow for timely modifications to be made to the treatment processes if it is determined that new contaminants or concentrations of known contaminants are expected to exceed the treatment capabilities of the WTP.

- **Landfill Gas Collection and Treatment System**

  - **Revised Subsurface Gas Standards.** These standards were revised in accordance with risk-based standards that were developed by the Respondents and approved by EPA in 2000.

  - **South Boundary Soil Vapor Extraction System.** The SBSVE system was installed along the southern Site perimeter in the late summer of 1999 in response to a Notice of Violation (NOV) issued by EPA. The SBSVE system was operated for 13 months, from

October 1999 to November 2000. In November 2000, the Performance Standards were revised, as discussed above. The SBSVE system was shut down in November 2000.

4.6 Operation and Maintenance

O&M refers to activities conducted at the Site after a response action is considered operational and functional, to facilitate the continued operation of the remedy components. Because of the complexity and multiple components of the Lowry Site remedy, there are multiple O&M Manuals for the Site. Parsons ES, the O&M Contractor, reported that the manuals are adequate and are updated on an as-needed basis.

4.6.1 Current Status of Operation and Maintenance

The following is a summary of the O&M status of the Lowry Landfill Remedy:

- **Wetlands.** O&M is ongoing. The main O&M activities are monitoring the wetlands for erosion and plant health, and performing necessary repairs to maintain the condition of the wetlands. Two 100-year storms in 1997 destroyed new wetlands construction. Since that time, drainages were restored, erosion repaired, and vegetation replanted. Additional revegetation has been necessary due to occasional damage caused by deer and antelope.

- **LFG Extraction and Treatment**. O&M is ongoing. The main O&M activities are operating the LFG Flare, monitoring the gas composition and flow rates from the various extraction wells, and balancing and adjusting the system. Activities also include manually removing condensate from traps in the conveyance piping for treatment in the WTP, where such traps are not connected to the WTP by piping. Through May 2001, approximately 450 million cubic feet of LFG have been collected and successfully flared. The Site has not produced as much gas as originally envisioned in the Remedial Design. As a result, the collection system and flare have been operated intermittently, approximately 38 hours per week at a typical rate of approximately 950 standard cubic feet per minute (scfm). The Respondents have recently submitted a proposal for EPA and CDPHE approval to connect the DADS landfill gas collection system to the flare. EPA has approved this change in flare operation with conditions relating to air quality modeling and LFG destruction efficiency. A noteworthy operational issue is the continued monitoring of inlet gas quality beyond the four quarters initially mandated in the LFG Compliance Monitoring Plan. The monitoring was continued on a quarterly basis since the first four quarters of data did not appear to exhibit a clear or consistent trend in gas composition.

- **Middle FTPA Waste Pit Treatment Cell**. O&M is ongoing. The main O&M activities are operating and monitoring the thermal soil gas treatment unit, monitoring the temperature of the materials in the cell, monitoring the degree of treatment that has been completed by analyzing soil samples, inspecting the cover and piping for leaks, and repairing any leaks found. Approximately 15,000 cubic yards of waste material was removed from the FTPA Middle Waste Pit. This material was blended with tire chips and placed into an onsite treatment cell for active vapor extraction. The vapor extraction system is currently operating full time, and is scheduled to continue until treatment cell Performance Standards are met.

- **New Onsite WTP**. O&M is ongoing. The main O&M activities are operation and monitoring of the WTP processes, most of which are automated. Manual activities include sludge dewatering and handling, chemical feedstock replenishment, water quality sampling

and analysis, and equipment calibration and maintenance. The new WTP is treating water from the NBBW, water produced from extraction wells constructed in three areas along the east/south/west barrier wall system, LFG condensate, and water from other incidental sources allowed for by the permit. The WTP discharge is conveyed to Aurora's sanitary sewer system via the POTW Pipeline. The byproduct sludge from the WTP is accumulated and tested to determine the required disposal method. To date, all of the sludge has been acceptable for disposal and has been disposed at DADS.

- **Landfill Cover**. O&M is ongoing. The main O&M activities are monitoring the cover for settlement, erosion, and vegetative cover health, and repair of damages such as erosion gullies, areas of dead vegetation, and maintaining drainage on the cover where it has been interrupted or impeded by settlement. There have been several areas of poor drainage on the top of the landfill mass, caused by settlement within the landfill mass. The resulting depressions in the cover prevent precipitation from draining off the cover. The Respondents have submitted a proposal to correct these depressions by providing additional fill from the former Stapleton Airport and reconstructing the cap with steeper slopes. EPA and CDPHE have not accepted this proposal. The reasons are specified in a letter from EPA to the Respondents dated April 10, 2001. On July 23, 2001, the Respondents replied to this letter, questioning the basis of EPA's rejection of their proposal. To date, the depressions have not been filled or otherwise addressed.

- **North Toe Extraction System**. O&M has not started, pending resolution of the NTES treatability valuation and modifications to the WTP.

- **East/South/West Barrier Wall and NBBW**. O&M is ongoing in accordance with the PCMP. The main O&M activities include operating extraction and treatment wells where required by the PCMP, conveying produced water to the WTP for treatment, and installing additional extraction and monitoring wells as required by the PCMP. In addition, the traffic cap over the East/South/West Barrier Wall must be periodically graded and provided with supplemental granular surfacing material.

- **Revised Contingency Plan**. The Revised Contingency Plan, dated September 17, 1999, was prepared in cooperation with local police, emergency response, and fire protection authorities. The emergency measures are tested from time to time in cooperation with the applicable authorities.

4.6.2 Changes in Operation and Maintenance

The following is a summary of changes in O&M have occurred within the past five years:

- **Landfill Gas Flare Operations**. Production of LFG from the Lowry Landfill Site was less than anticipated **S** roughly 10% of the volume estimated during design. To accommodate the low flow, the system has been balanced to run two days per week, 18 hours per day, and at a typical flow rate of approximately 950 scfm (compared to a full-time design flow of 2,000 scfm). As of June 2001, additional LFG from DADS is also being treated at the Section 6 LFG flare.

- **FTPA Waste Pits**. The Respondents have replaced the original off-gas treatment unit for the Middle Waste Pit Treatment Cell. The original unit was a catalytic oxidation unit. The replacement unit is an FTO installed to provide improved destruction efficiency.

- **North Boundary Barrier Wall**. The Respondents optimized WTP operations to maximize the amount of time the NBBW sump pump remains on-line. The Respondents also have reconfigured instrumentation and controls for potable water injection into the NBBW injection trench to minimize recharge surging.

- **Water Treatment Plant**. The Respondents have made many minor modifications and adjustments to the WTP to improve treatment effectiveness and reliability. Some of the notable changes include reconfiguration of two carbon adsorption units in series, adding a caustic feed loop to the back end of the plant to assure that the pH of plant effluent never drops below its permit limit, modifying the condensate holding tank to serve as a mixing tank, adding a heated sample chamber to the gas chromatograph, and adding a water chiller to the effluent end of the plant to maintain effluent temperature at or below the permit limit of 20 degrees Celsius (EC). Many other minor changes have been made to improve WTP operation and reliability.

- **East/South/West Barrier Wall**. There are several areas along the East/South/West Barrier Wall where conditions have required changes in Site O&M:

  - **MW39-WD and MW51-W Areas**. Two of the 14 compliance monitoring wells installed outside of the East/South/West Barrier Wall (MW39-WD and MW51-WD) have shown concentrations of VOCs above Performance Standards since their installation. Additional wells have been installed in these two areas to evaluate the nature and extent of the VOC issues.

  - **MW43-WD.** Well MW43-WD has shown levels of iron and manganese above Performance Standards. Groundwater monitoring data near wells PM-5 and PM-6 show an inward gradient. The gradient at MW43-WD is unknown. The well is being monitored for concentration trends. A comprehensive review of sitewide inorganic background concentrations is currently under way. The results of this study may indicate that some or all of the observed concentrations are due to naturally occurring background conditions.

  - **PM-11 and PM-15 Areas**. In January 2000, the PCMP triggered pumping inside of the East/South/West Barrier Wall at the PM-11 and PM-15 areas, and beyond the north end of the East/South/West Barrier Wall at PM-15. At the southeastern corner of the East/South/West Barrier Wall (at the PM-11 area), pumping was successful in inducing inward gradients across the wall, providing containment in this area. Pumping along the northeasternmost portion of the wall is continuing (PM-15 area), although, to date, complete gradient reversal has not been achieved in this area. Efforts to reverse the gradient in the PM-15 area are continuing.

  - **PM-4 Area**. In June 2001, ten wells were installed to investigate the nature and extent of an area of potential outward gradient near PM-4. Also in June 2001, gradient control pumping was started in this area. The Respondents are currently evaluating the hydrogeologic data to develop an appropriate corrective action plan.

4.6.3 Operation and Maintenance Labor Requirements

The Site has full-time O&M staff. Site O&M labor requirements total approximately six full-time equivalents, as shown in Table 4-1.

4.6.4 Operation and Maintenance Costs

Table 4-2 presents a summary of average annual O&M costs based on year 2000, as provided by the Respondents.

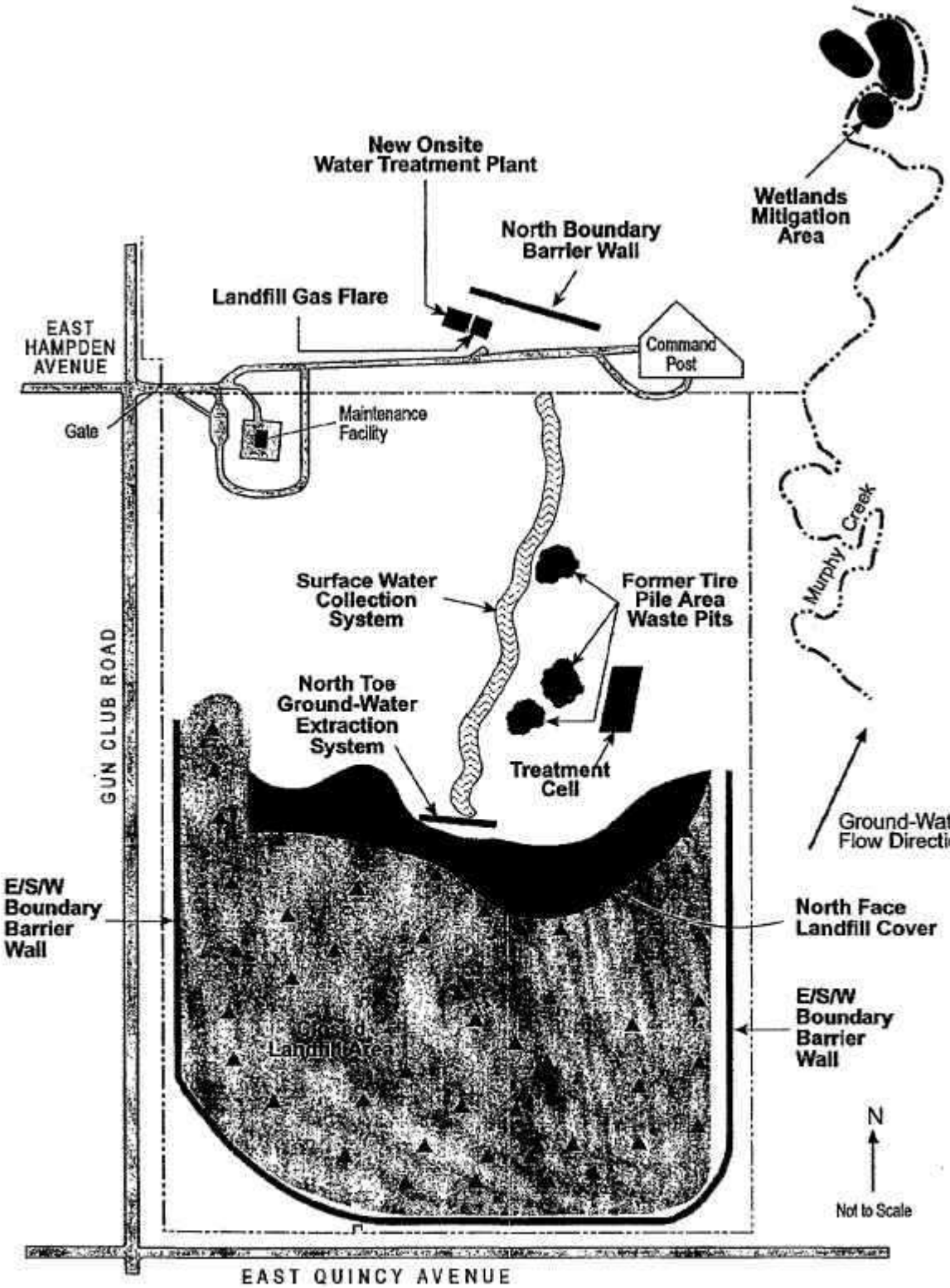
The total annual O&M cost for 2000 was $1.8 million. For 2001 through April, the total O&M cost is $520,000, which annualizes to $1.6 million. These costs do not include EPA and CDPHE oversight, management, and oversight contractor costs.

TABLE 4-1
O&M Labor Summary

Component	Activity	Labor Hours
Project Management	Contractor management, regulatory interface	80 hr/week
Wetlands	Site Inspection and Reporting	24 hr/quarter
LFG Extraction and Treatment	Weekly Monitoring and Inspection	4 hr/week
	Monthly Wellfield Monitoring and Adjustment	24 hr/month
	Quarterly Status Reporting	24 hr/quarter
	Quarterly Inlet Monitoring	40 hr/quarter
	Annual Maintenance and Testing	40 hr/year
Slurry Wall E/S/W	Daily Extraction System O&M	4 hr/day
	Groundwater Monitoring	160 hr/mo
	PCMP Compliance	100 hr/mo
	Quarterly Status Reporting	120 hr/quarter
Middle Waste Pit and Treatment Cell	Treatment Cell O&M	2 hr/day
	Weekly Monitoring and Inspection	8 hr/week
	Quarterly Status Reporting	24 hr/quarter
WTP	Plant O&M	4 hr/day
	GC O&M	12 hr/month
	Compliance Monitoring and Reporting	60 hr/month
	Plant Engineering (NTES Evaluation)	40 hr/month
	Quarterly Status Reporting	40 hr/month
North Face Cover	Cover Inspections	4 hr/month
	Quarterly Status Reporting	4 hr/quarter
North Boundary Barrier Wall	Piezometric Monitoring	4 hr/week
	Quarterly Status Reporting	40 hr/quarter
North Toe Extraction System	Early Warning Monitoring	80 hr/year

TABLE 4-2
O&M Cost Summary

Area	Approximate 2000 Cost
Groundwater	$622,000
Landfill Gas	$314,000
Landfill Cover	$50,000
Surface Water	$10,000
Institutional Controls	$10,000
Water Treatment Plant	$596,000
Other	$180,000
TOTAL	**$1,784,000**



Legend:

Grey = Construction Complete
Black = In Progress
▲ = Gas Extraction Wells

Figure 4-1
Major Remedy Components

DEN/M/130814.CR.CR/Lowry Map/9-01

Section 5 Progress Since Last Five-Year Review

This is the first Five-Year Review for the Lowry Site. Consequently, this report does not include a discussion of prior findings and recommendations from any prior Five-Year Review.

Section 6 Five-Year Review Process

This section summarizes the information collected as part of the review process. Information collected includes community interviews, a Site inspection, a review of standards and To Be Considered requirements (TBCs), a review of the Site risk assessment, and a review of Site data.

The Lowry Five-Year Review consisted of the following activities:

- In February 2001, a fact sheet explaining the Five-Year Review process (not the findings) was distributed to more than 1,300 parties on the Site mailing list (Attachment 9).
- A notice of the forthcoming review was placed in the *Denver Post*, the *Rocky Mountain News* and five other local newspapers in March 2001 (Attachment 9).
- A Site inspection was conducted on March 30, 2001 (Section 6.2, *Site Inspection*, and Attachment 6).
- Interviews with relevant parties **S** representatives of local governments, regulatory agencies, and the Respondents and their operation contractors **S** were conducted using written questionnaires. Interviews with members of affected communities were conducted either in person or by written questionnaire (Section 6.1, *Interviews*, and Attachment 5).
- A detailed review of relevant documents and Site monitoring data was conducted (Attachment 1).
- A review of the Site Conceptual Model was completed (Attachment 4).
- Review of ARARs, Performance Standards, and TBCs was conducted (Section 6.3.1, *Identification and Review of Newly Promulgated or Revised Regulatory Standards and To Be Considered Requirements*, and Attachment 7).
- A review of Risk Assessment methodology and changes in exposure pathways, toxicity, and chemical toxicity values was conducted (Section 6.3.2, *Risk Assessment Review*, and Attachment 8).
- A review of institutional controls and land use was conducted (Sections 3.3, 3.5, and 3.6).
- This report was completed in September 2001 and will be available in the Site Record Centers.
- Upon completion of this report, notice of the completion of the Five-Year Review will be placed in local newspapers, and a summary of the report will be distributed via Fact Sheet.

The Lowry Site Five-Year Review was conducted by the team identified in Section 1.5, *Five-Year Review Team.*

6.1 Interviews

EPA's Five-Year Review process calls for interviews of various parties to identify successes and problems with remedy implementation. For the Site, some interviews with residents were conducted in person, while interviews with other individuals, organizations, and agencies were conducted using questionnaires. This section summarizes the results of the interviews.

6.1.1 Summary of Personal Interviews

During the course of this Five-Year Review, personal interviews were conducted with several parties involved with the Site. The following parties were interviewed:

- Citizens for Lowry Landfill Environmental Action Now (CLLEAN), recipients of a Technical Assistance Grant at the Lowry Site
- Residents in the area of Metro's Deer Trail Farm
- Adrienne Anderson, a resident of Denver

Interview Record Forms, which document the issues discussed, are included in Attachment 5.

In the interviews, there were several positive comments on the progress made at the Site. Several remedy components are completed and working successfully. The community in the vicinity of the Site expressed appreciation that the waste pits have been covered, which addressed numerous concerns in the area such as odors and respiratory illnesses. In addition, several people expressed appreciation that an innovative technology (in-place heating) for the FTPA North and South Waste Pits remedy was being considered.

Comments from Residents in the Vicinity of the Site

Some of the key points made by residents in the vicinity of the Site are summarized below. More detail is contained in the interview notes, included in Attachment 5.

- People are concerned that the containment remedy may be failing to contain contaminated ground water on the east, west, and north of the Site. They are concerned that the solution to containment issues will be to move the POC.
- It was expressed that better characterization of the Site's hydrogeology is needed. They would like more information about potential sand lenses and fractures underneath the Site.
- There are concerns about the reliability and effectiveness of the onsite WTP and its inability to treat high levels of 1,4-dioxane.
- It was noted that the excavation and removal remedy for the FTPA waste pits failed for two of the pits, which necessitated reevaluation of the remedy.
- Concerns were expressed about the maintenance and control of runoff on the landfill cover.
- There are concerns about vertical contamination to the underlying aquifers.
- People are concerned about an apparent lack of access control and monitoring that may permit trespassing on the Site.
- Development is approaching the Site, and people buying property in the area are not being adequately informed about the Lowry Landfill Superfund Site.
- Some people believe that the Respondents are managing the Lowry Site remediation to increase the value of the Lowry Trust funds, and they would like to have the financial details of the Trust made public.

- People are concerned with the political process and fear that the Respondents have more power in the political process than the community.

Comments from Residents in the Vicinity of Metro's Farm

- Concerns from the residents in the vicinity of Metro's Deer Trail Site primarily focus on the application of biosolids to Metro's farmlands in Deer Trail.

- Concerns were expressed about farming practices on Metro's farm and problems with wind and soil erosion. They believe that although Metro has made improvements, they should follow the advice of the soil conservation districts to reduce wind and water erosion.

- Concerns were expressed that Metro's biosolids are applied to an area located in the Fox Hills Sandstone Aquifer recharge zone.

- Farmers are concerned about a public perception that Superfund waste is entering the food chain through land application of biosolids. They are afraid this perception could have negative impacts on the market for their wheat and other agricultural products. Several people expressed concern that Metro's farmlands are used to grow food crops instead of grasses, which may contribute to this perception.

- People do not understand why the sludge, containing residues from a Superfund Site located in the Denver Metropolitan area, is coming out to the farmlands in Deer Trail, rather than being contained onsite.

- Frustration was expressed that the concerns of people in the Deer Trail area are not being listened to and have not impacted decisions.

Other Community Concerns

Some members of the public do not trust the decision to pipe pre-treated ground water from the Lowry Site to local POTWs for further treatment. Adrienne Anderson fears that radionuclides were illegally disposed at the Lowry Site. She is concerned that water leaving the Site is contaminated with radionuclides (especially plutonium) at levels unsafe for POTW workers, for people living close to Metro's farmland (approximately 50,000 acres near Deer Trail, Colorado) where biosolids are used as fertilizer, and for people who eat food grown on the farmlands. John Metli is concerned with the perception that there may be plutonium in the biosolids from the Lowry water; he is concerned that this perception could negatively impact the entire farming community in Elbert County.

6.1.2 Summary of Questionnaires

Attachment 5 includes written questionnaires received from several parties. The parties and their comments are summarized below:

- **Metro**. Metro believes that the WTP and discharge have been successful from a technical perspective. The discharge has not compromised Metro's ability to comply with environmental, health, and safety regulations. There is persistent public opposition to the application of biosolids and concern about Lowry contaminants potentially entering the food chain. There have been a few minor violations of the discharge permit, which have been corrected. Metro believes that communications with the Respondents have been excellent. Metro would like to be informed of all communications about the Site that

provide information or impact discharges to the sanitary system, including monitoring well data.

- **The Respondents**. The Respondents believe that they have successfully implemented most of the components of the sitewide remedy and that the remedy is functioning well. They are concerned that the success of the remedy is being judged at a POC that is positioned inside the waste management area and within an area of known contamination. They believe that this leads to a false indication of non-compliance with the containment objective. They are also concerned about continuing and what they consider to be incorrect perceptions created by a small, vocal group of concerned citizens that man-made radionuclides from Rocky Flats may have been disposed at the landfill, requiring what they consider to be unnecessary continuing studies of radionuclides at the Site. They are currently evaluating the solution to landfill cover drainage issues.

- **Parsons ES, the RD/RA and O&M Contractor**. Parsons believes that the project is successful and that containment is being achieved. They would like to see a timely regulatory review of all submittals. They would like to see more technical work groups to reduce lengthy comment cycles. They believe that the health and safety record has been excellent.

- **Tri-County Health Department**. The Tri-County Health Department (TCHD) is concerned about land use planning and suggested that EPA consult closely with Arapahoe County and the City of Aurora. They have received odor complaints from residents near the Site but confirmed that the odors were from other sources. They would like to see a regular summary of issues and updates regarding remedy implementation. TCHD has limited resources and is not able to be as involved as they would like. They are complimentary of several of the remedy components: the groundwater monitoring system, LFG collection and treatment, and the SWRA. TCHD is concerned about containment, the need for additional deep monitoring wells to detect possible vertical migration, and maintenance of the landfill cover.

- **City of Aurora**. Aurora believes that considerable progress has been made in implementing stabilization and containment of the contamination. They are concerned that containment has not been achieved and are also concerned about the maintenance and control of runoff on the landfill cap. They are also concerned that the water treatment plant is unable to treat the levels of 1,4-dioxane present in the NTES water and that the excavation remedy cannot be carried out at two of the FTPA Waste Pits. Aurora cited a number of the successfully completed remedy components. They are concerned about pressure from the Respondents to address issues regarding the remedy through administrative changes to the ROD, a “piecemeal” approach to remediation, and the Respondents’ attempts to move the POC.

- **Emergency Response Officials**. Successes noted include the effective operation of the project. However, one party thought the remedy was not successful because the excavation of the FTPA remedy was discontinued. There have been some odor complaints, especially during implementation of the FTPA remedy. While one party thought communication was excellent, another thought there was a need for more communication with residents and health departments.

6.2 Site Inspection

A Site inspection was conducted at the Site on March 30, 2001. The completed Site Inspection Checklist is provided in Attachment 6. Photographs taken during the Site visit are provided in Attachment 10.

Site access is restricted by a fence and guards. Various warning and informational signs are posted around the Site (Attachment 11 and Photographs 1 through 15). Many of the signs are old and outdated. The fence was in good condition.

The Site inspection started at the command post where there is a decontamination pad (Photographs 16 and 17) and drum storage page (Photograph 18). The pads were in good condition.

The WTP (Photograph 19) and landfill gas flare (Photographs 20 and 21) are located adjacent to each other. The WTP process consists of conditioning the water using a water softening system (which incidentally removes some solids and dissolved inorganic constituents), then treatment of organic constituents using ultraviolet/oxidation with granular activated carbon polishing. The water is discharged to Metro and the City of Aurora under pretreatment discharge Permit I-118. The WTP is new and in good condition.

At the time of the inspection, the LFG flare was being operated two days per week. (Starting on June 18, 2001, it is being operated continuously to flare LFG from both the Section 6 landfill and the Section 31 landfill). The flare shows signs of minor rusting at the top. Although the rust can be seen, it does not appear to be hindering the operations of the flare.

Surface water samplers are placed at three locations on and near the Site (Photograph 22). The samplers were in good condition.

The FTPA has three pits: North, Middle, and South. The Middle Waste Pit was excavated and the material placed in a treatment cell with an FTO to treat the off-gas (Photograph 23). Water has ponded along the southern edge of the treatment cell (Photograph 24), and some rips were identified in the cover (Photographs 25 and 26). These rips have been repaired since the date of the Site inspection. The North and South Waste Pits have not yet been remediated, but monitoring wells and test probes have been installed as part of treatability studies to evaluate treatment options for those two waste pits (Photograph 27). A drum staging area located near the FTPA was noted to have water overflowing from the northwest corner (Photograph 28). Tire shreds that were from the former tire piles are located in a monofill (Photograph 29). The monofill was in good condition.

There are two extraction areas along the east side of the landfill: the PM-11 area and the PM-15 area (Photographs 30 through 32). These were in good condition and appear to be operating properly.

The landfill has a cover that is well-vegetated. However, the cover has several large closed depressions that pond stormwater on the landfill cover, which enhances infiltration into the landfill (Photographs 33 and 34).

Approximately two hundred wells exist at the Site. A representative number of wells was observed during the inspection; not all wells were observed. Most of the wells observed were in good condition and are covered and locked. A few wells were identified during the Site inspection as being unlocked (Photographs 35 through 38).

During remediation, some wetlands were destroyed. These wetlands were mitigated by constructing a new wetlands area just to the north of the Site (Photographs 39 through 42). These wetlands are located along Murphy Creek and were dormant when the Site inspection occurred, but the wetlands appeared to be generally in good condition, except for a few trees that had been killed due to bark stripping by deer, antelope, or other animals. These trees were replaced by the Respondents subsequent to the Site inspection.

6.3 Review of Applicable or Relevant and Appropriate Requirements and Risk Information

6.3.1 Identification and Review of Newly Promulgated or Revised Regulatory Standards and To Be Considered Requirements

The remedies selected in the 1994 ROD, 1995 ESD, and 1997 ESD are intended to be protective of human health and the environment and comply with Federal and State standards that are applicable or relevant and appropriate requirements (ARARs) and To Be Considered requirements (TBCs). Pursuant to this Five-Year Review, the ARARs identified in the ROD and ESDs were reviewed, and any changes or newly promulgated standards were identified. Table 6-1 provides a summary of changes to ARARs since the ROD. This table includes chemical-specific and action-specific requirements. No changes to location-specific requirements were identified.

Chemical-Specific Applicable or Relevant and Appropriate Requirements

Ground Water

Table 6-2 provides groundwater ARARs from the ROD, 1995 ESD, background inorganic constituent concentrations, and new changes since the 1995 ESD. The new changes since the 1995 ESD are as follows:

- Revised Colorado Basic Standards for Ground Water (CBSGW). These revisions are recommended for adoption as Performance Standards, as shown in Table 6-2.

- The National Primary Drinking Water Regulations for Radionuclides Final Rule (65 FR 236, December 7, 2000) provide new uranium MCLs. As shown in Table 6-2, these new standards are less stringent than Performance Standards indicated in the 1994 ROD and 1995 ESD. In the preamble to the Final Rule, EPA indicates that the best estimate mass:activity ratio is 0.9 pCi/Fg, and therefore a first approximation mass:activity ratio is 1:1 for typical systems (65 FR 76713)[1] . Given this conversion, the uranium MCLs are less stringent than the existing Performance Standards. However, since the MCLs represent changes to regulations based on an improved understanding of science as it relates to protectiveness, they are recommended for adoption when this rule becomes effective.

Table 6-2 also shows revised toxicity concentrations. These are discussed in Section 6.3.2, *Risk Assessment Review*. In cases where there is an existing ARAR (for example, an MCL), the ARAR

[1] In the proposed rule, EPA estimated that 20 micrograms per liter (Fg/L) would typically correspond to 30 picoCuries per liter (pCi/L) ("activity"), based on an assumed mass:activity ratio of 1.5 picoCuries per microgram (pCi/Fg). In the final rule, EPA states, "While such values are known to occur in ground water, this conversion factor does not reflect our "best estimate" today. The best estimate of a geometric average mass:activity ratio is 0.9 pCi/Fg for values near the MCL, based on data from the Radionuclides Notice of Data Availability Technical Support Document (see USEPA, 2000). Given the closeness of this value to unity (1 pCi/Fg), the available data suggest that, to a first approximation, the mass:activity ratio is 1:1 for typical systems." (65 FR 76713).

is generally used as the Performance Standard, even if the concentration derived based on site-specific risk calculations is lower (OSWER Directive 9355.0-30, April 22, 1991). This is reflected in the Recommended Performance Standard column of Table 6-2.

Standards from the Metro Wastewater Reclamation District Permit I-118 are also included in Table 6-2. These standards are valid for pretreated water that is discharged from the Site to Metro's and Aurora's wastewater treatment systems for further treatment and discharge. If water is discharged onsite, then the water must meet the Performance Standards listed in Table 6-2.

Air

Table 6-3 shows air standards from the ROD, 1995 ESD, new standards, and risk-based standards. New standards are based on the 1995 Massachusetts guidance for Allowable Ambient Levels (AALs) and Threshold Effects Exposure Limits (TELs). These revisions are recommended for adoption because the Massachusetts AALs have been revised and adopted. The final two columns in Table 6-3 reflect allowable discharge concentrations from the LFG flare and FTPA treatment cell. These concentrations were calculated using a model that reflects what concentrations can be discharged from a point source (either the flare or treatment cell) based on a hypothetical person standing at the Site boundary breathing air that meets Performance Standards.

Surface Water

Table 6-4 lists surface water standards from the ROD and new standards. The new standards are revised Colorado Basic Standards for Surface Water (CBSSW) and are recommended for adoption because they are the current standards for the State of Colorado.

Landfill Gas

Table 6-5 lists soil vapor standards for the LFG compliance boundary. LFG compliance boundary standards in the ROD were based on ambient air quality standards. Since the ROD, improved modeling in the form of the Johnson and Ettinger model has been published and routinely used for soil vapor concentrations. In 2000, EPA approved the use of revised soil vapor standards based on the Johnson and Ettinger model for soil vapors at the compliance boundary. These revised standards are for the chemicals of concern (COCs) from the ROD. In addition, soil vapor standards were developed for constituents in the LFG that may have a negative impact on ground water. These revised standards are listed in Table 6-5 and are recommended for adoption because they reflect an improvement in understanding and modeling of subsurface gas movement.

Action-Specific Applicable or Relevant and Appropriate Requirements

Action-specific standards, such as 40 CFR Part 268 (Land Disposal Restrictions) and 40 CFR Parts 230/231 (Dredge and Fill Permits) do not indicate that existing ARARs are not protective, and, therefore, adoption of these revisions is not recommended. A U.S. Supreme Court ruling on January 9, 2001, Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, 2000 WL 15333 (2001), limited regulatory jurisdiction under Section 404(a) of the Clean Water Act (CWA) to protect isolated, non-navigable intrastate waters used as habitat by migratory birds. However, the wetlands at the Site were designated as such because they are adjacent to unnamed creek, which flows intermittently into Murphy Creek, which is a tributary of Sand Creek, which is a tributary of the South Platte River, a navigable water. Since

substantive requirements to minimize potential harm or adverse affects to wetlands are still ARARs, this court decision appears to have no effect on Site ARARs.

On April 20, 2001, Colorado approved a new institutional controls law (Senate Bill 01-145; see Attachment 15) that allows the State to enforce environmental covenants at sites where waste is left in place, such as Lowry Landfill. This law would be applicable if EPA issues a decision document such as a ROD Amendment or an ESD after July 1, 2001.

6.3.2 Risk Assessment Review

The assumptions and methods used in the Draft Baseline Risk Assessment (BRA) were reviewed against current Site conditions and state-of-practice risk assessment techniques. The purpose of this review was to assess the potential impact of any changes in the assumptions or methods on the protectiveness of the remedy. The assumptions and methods used in the BRA are not presented here, except as necessary to contrast the differences between the assumptions and methods used in the ROD and the current assumptions and methods.

Changes in Exposure Pathways

No changes in Site conditions that significantly affect exposure pathways were identified as part of the Five-Year Review. An exposure pathway is made up of five components that must be present for the pathway to be considered potentially complete: a contaminant source, a release mechanism and transport mechanism, an exposure medium, an exposure route, and a receptor. Of these five components, there only has been a change in understanding and/or assumptions with respect to the contaminant source and the release and transport mechanisms. A discussion of the latest understanding of the five components of an exposure pathway is presented in this section.

- **Contaminant Source(s):** Although the source of contaminants has not changed, additional contaminants (in addition to those having established Performance Standards) have been detected at the Site. During the ongoing monitoring effort at the Site, the following contaminants were detected repeatedly in ground water, water treatment plant (WTP) effluent, and LFG samples:

    - 1,4-Dioxane
    - Chloromethane
    - 1,1,2-Trichloro-1,2,2-trifluoroethane
    - 1,2-Dichloroethene
    - Butanol
    - Dichlorodifluoromethane
    - Ethyl acetate
    - Ethyl ether
    - Trichlorofluoromethane
    - Chloroethane
    - Dichlorofluoroethane
    - Dichlorofluoromethane
    - Diethylether
    - Ethanol
    - t-Butyl alcohol
    - Tetrahydrofuran

Of these contaminants, only the first nine have toxicity values. These nine were reviewed to see if they would be classified as groundwater COCs, and also if they would result in risk levels that would impact the protectiveness of the remedy. The 1,4-dioxane concentrations detected in ground water, WTP effluent, and surface water result in risks that may impact the protectiveness of the remedy. 1,4-dioxane was detected in 12 percent of the samples (52 detects in 419 total samples; a maximum detection of 47,000 μg/L; a minimum detection of 16 μg/L; and an average detect of 5,496 μg/L). See Table 6-6. All the detected concentrations exceed the calculated 1×10^{-6} risk-based concentration of 8 μg/L (which is derived based only on groundwater ingestion, since only an oral slope factor is now available for 1,4-dioxane), assuming a residential exposure scenario. Concentrations in surface water samples from SW-1 and the WTP effluent samples also exceed the 1×10^{-6} risk-based concentration, assuming a future residential exposure scenario. Based on this review, a new Performance Standard of 8 μg/L is recommended for 1,4-dioxane (see Table 6-2).

- **Release and Transport Mechanisms:** The understanding and assumptions regarding the identified release and transport mechanisms have not changed, with one exception. As discussed in Section 7.4.1, changes in the understanding of the hydrologic and hydrogeologic conditions have occurred. The nature of the off-site groundwater flow is being investigated by the Respondents. However, changes in the groundwater flow will not alter the risk management decisions made at the Site. The Performance Standards for containment of groundwater are based on an exposure scenario that assume a receptor at or beyond the Point of Compliance. The existing Performance Standards are sufficiently protective.

- **Exposure Media:** No changes in Site conditions or the nature and extent of contamination that affect the exposure media were identified as part of the Five-Year Review.

- **Exposure Routes:** No changes in Site conditions or the receptor behavior that affect the exposure routes were identified as part of the Five-Year Review.

- **Receptors:** No changes in the potential receptors were identified as part of the Five-Year Review.

Changes in Toxicity and Other Contaminant Characteristics

The toxicity values for contaminants analyzed in ground water were reviewed during the Five-Year Review. The toxicity values (that is, carcinogenic slope factors, noncarcinogenic oral reference doses, and inhalation reference concentrations) and other contaminant characteristics of the contaminants analyzed during the BRA process were compared to values in the most recent versions of the toxicity (USEPA, 2001a; USEPA,1997a; Oak Ridge National Laboratory [ORNL], 2001) and physical-chemical property databases (ORNL, 2001). Attachment 8 presents the results of the review of the toxicity values. Specifically, Attachment 8 includes the toxicity values, references, and associated information presented in the BRA/ROD and those available during the Five-Year Review.

Based on this review, it was found that a number of toxicity values have changed and a number of contaminants have approved toxicity values that did not exist when the ROD and 1995 ESD were prepared. Whether the changes in the toxicity values would change the estimated risks, and subsequently the protectiveness of the remedy presented in the ROD, was evaluated. Other contaminant characteristics (that is, chemical properties) have not changed in a way to affect the risk estimates or the remedy presented in the ROD.

In some cases, risk estimates changed (both increased and decreased) for groundwater COCs because of changes in toxicity values (that is, oral slope factors, oral reference doses, or inhalation reference concentrations). These changes resulted in a recommended revision of the Performance Standards for the following organic contaminants: 4-methyl-2-pentanone (MIBK), bis(2-ethylhexyl)phthalate, and naphthalene (see Table 6-2).

The slope factor for some risk assessment radionuclides has changed based on new research, as reported in the Federal Guidance Report No. 13 (EPA, 1999), as shown in Table 6-7. The slope factors have changed based on the use of more recent methods and models that factor mortality rates, age and gender dependence on intake, dosimetry, metabolism, and radiogenic risk (USEPA, 2000). In addition, oral values are now tabulated separately for ingestion of tap water, dietary intakes (food), and incidental soil ingestion. The toxicity-concentration screen used in the risk assessment as part of the COC selection process was rerun using the new slope factors; however, the changes in the slope factors do not impact the COC list and the radionuclides presented in the ROD remain as COCs. The changes to the estimated risks because of the changes in the slope factors are presented in Table 6-8. The changes in the radionuclide slope factors result in changes in the risk-based concentrations that are used in the development of the Performance Standards. Therefore, revised Performance Standards are recommended for the following radionuclides: americum-241, lead-210, potassium-40, and thorium-228 (see Table 6-2).

The following contaminants were not identified as COCs in the BHHRA because no toxicity values were available at the time of the ROD; however, they did have Performance Standards identified in the ROD or 1995 ESD because they were detected in more than 10 percent of the groundwater samples then available:

- 1,4-Dichlorobenzene
- Benzyl Alcohol
- Carbazole
- Dibenzofuran
- 1,2-Dichloropropane
- 1,4-Dichlorobenzene
- 2,4-D
- Chloromethane
- Ethylene glycol
- Fluoranthene
- gamma-Chlordane
- Heptachlor
- Selenium

Since then, toxicity values have become available for these contaminants. They were evaluated using the COC selection process identified in the BHHRA. Based on this evaluation, the toxicity and concentrations of these contaminants are not high enough to select them as COCs.

Finally, COCs that now have toxicity values for other exposure routes or for other toxicity endpoints that were not available during completion of the ROD or 1995 ESD were evaluated. The following COCs are in this category: 1,1,2,2-Tetrachloroethane; Trichloroethene; and trans-1,3-Dichloropropene. For example, trichloroethene was originally identified as a COC based on an oral slope factor, but an oral reference dose is now available that was not available during

completion of the ROD or 1995 ESD. None of these changes resulted in significant changes in the risk estimates, and therefore did not result in a change in a COC's Performance Standard.

Changes in Risk Assessment Methods

The state-of-practice risk assessment methods were reviewed as part of the Five-Year Review process. Changes in the methods used to assess risk may impact the estimates of risk, which could impact the protectiveness of the remedy. Although the following changes were noted, the impact on the risk estimates is minimal and does not affect the risk management decisions at the Site.

Risk Assessment Guidance for Superfund

In 1998, EPA introduced the Interim Final version of the Risk Assessment Guidance for Superfund (RAGS): Volume I Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments) for use on all Superfund sites. With RAGS Part D (USEPA,1998a), EPA standardized the parameters, data, calculations, and conclusions from all stages of the human health risk assessment process in a manner that is clear and consistent. Another key element of RAGS Part D is the Technical Approach for Risk Assessment (TARA). Risk-related activities, beginning with scoping and problem formulation, extending through collection and analysis of risk-related data, and supporting risk management decision making and remedial design/remedial action issues are addressed. During the Lowry Landfill Baseline Human Health Risk Assessment (BHHRA), the principles and methods of TARA were followed. For example, the EPA risk assessor led every phase of the development of the risk assessment scope and problem formulation,, and also led implementation of the risk assessment.

Exposure Factors Handbook

The *Exposure Factors Handbook* provides a summary of the available statistical data on various factors used in assessing human exposure (USEPA, 1997b). These factors include drinking water consumption; soil ingestion; inhalation rates; dermal factors including skin area and soil adherence factors; consumption of fruits and vegetables, fish, meats, dairy products, homegrown foods; breast milk intake; human activity factors; consumer product use; and residential characteristics. Recommended values are for the general population and also for various segments of the population who may have characteristics different from the general population. As noted above, the exposure pathways have not changed, and the exposure factors used in the BRA for exposure routes that were assessed quantitatively are consistent with the factors presented in the *Exposure Factors Handbook*.

Assessment of Risk to Lead Exposure

The BHHRA used Version 0.5 of the Integrated Exposure Uptake Biokinetic Model (IEUBK) to model potential lead exposures to children (Volume 2C, USEPA, 1994). Since the publication of the BHHRA, EPA has released two new versions of the IEUBK model: IEBUK DOS model (0.99d) and IEUBKwin. Aside from a number of corrections, parameter value changes, and minor enhancements, the functionality and calculations of the IEUBKwin model are identical to those of the IEUBK model (0.99d). The conversion to a Windows platform also has resulted in a more user-friendly model. In addition, EPA has released a draft version of an adult lead model.

Lead in groundwater at the Site remains below the generally recognized action level of 15 μg/L. The changes in the IEUBK model have not resulted in an increase or decrease of this action level,

therefore, there is no consequence for risk management decisions at the Site and the current groundwater compliance boundary Performance Standard of 15 μg/L is considered protective of potential exposures to lead.

Assessment of Risks to Subsurface Vapor Intrusion into Buildings

There is a potential for subsurface contamination in ground water to adversely impact indoor air quality. During the ROD, the potential for vapor intrusion was assessed using a conservative volatilization model (that is, it was assumed that indoor air concentrations would equal the soil gas concentrations). Since the completion of the ROD, models that allow for consideration of soil gas migration into buildings have been developed (for example, the Johnson and Ettinger Model [USEPA, 2001b]). The Respondents used a version of this model to propose new Soil Vapor Action Levels in 2000. EPA approved this approach in October 2000. The resulting Soil Vapor Action Levels are higher than those in the ROD, but the exposure point concentrations remain unchanged. Therefore, the protectiveness of the remedy is not impacted.

Other Risk Assessment Guidance

EPA has published other risk assessment guidance documents released during the past five years, including:

- Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, Dermal Risk Assessment, Interim Guidance (USEPA, 1998b)

- Policy for Use of Probabilistic Techniques in Risk Assessment at the U.S. Environmental Protection Agency (USEPA, 1997d)

- Guiding Principles of Monte Carlo Analysis (USEPA, 1997e)

- Proposed Guidelines for Carcinogenic Risk Assessment (USEPA, 1996a)

- Guidelines for Reproductive Toxicity Risk Assessment (USEPA, 1996b)

- Guidelines for Neurotoxicity Risk Assessment (USEPA, 1998c)

Review of these documents suggests that the application of these methods would not likely result in a difference in the estimated risk.

6.4 Data Review

Data were reviewed in quarterly O&M Status Reports, electronic databases, and hard copy validated and unvalidated data received from the Respondents. Material reviewed included numerical data, graphs, maps, and hydrographs. The most recent updated electronic database of validated Site analytical data was submitted by the Respondents on May 10, 2001. The following data were reviewed:

- Water Treatment Plant Effluent Water Quality Compliance Data
- North Boundary Barrier Wall Water System Elevation, Wells, and Piezometers
- Raw Water Storage Tank (RWST) Influent
- NBBW Influent
- NTES Influent
- PM-11 Influent Water Quality Data

- PM-15 Influent Water Quality Data
- Command Post Soil Sampling Data
- Performance/Boundary Groundwater Monitoring Wells
- East-Side Water Levels and Pumping Data
- Water-level and Well Inspection Data
- Water Treatment Plant Early Warning Monitoring Wells
- Water Treatment Plant Injection Trench
- Compliance Groundwater Monitoring Wells
- Performance Groundwater Monitoring Wells
- Point of Action Groundwater Monitoring Wells
- Lateral Groundwater Flow Data and Water-level Contours
- Vertical Groundwater Flow Data
- Calculation of Required Inward Gradients
- Trend Test Data Graphs
- Landfill Gas Extraction Wells Gas Quality Data
- Landfill Gas Monitoring Probes
- SBSVE System Field Measurements
- SBSVE Effluent Monitoring
- Wetlands Inspections
- Surface Water Monitoring
- Landfill Cover Inspections
- Former Tire Pile Area Treatment Cell Data
- Former Tire Pile Area Vapor and Air Emission Data
- Former Tire Pile Area Design Investigation and Treatability Test Data
- NTES Treatability Evaluation Data

Table 6-9 summarizes exceedances by remedy component and element. Attachment 12 includes a series of graphical summaries of groundwater data through late 2000. These figures were previously prepared for use in meetings among EPA, CDPHE, and the Respondents. They are included because they provide a concise visual summary of much of the Site groundwater performance and compliance monitoring data.

6.5 References

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U.S. Environmental Protection Agency, 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors." OSWER Directive 9285.6-03. March.

U.S. Environmental Protection Agency, 1990. National Oil and Hazardous Substances Pollution Contingency Plan (NCP). 40 CFR Part 300, 53 Federal Register 51394.

U.S. Environmental Protection Agency, 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A. EPA/540/1-89/002. December.

U.S. Environmental Protection Agency, 1986 Guidelines for Carcinogen Risk Assessment. Federal Register 51:33992-34003. September 24.

TABLE 6-1
Identification of Newly Promulgated or Revised Regulatory Standards and To Be Considered Requirements

Citation	Description	Evaluation
	Chemical-Specific ARARs – Federal	
Safe Drinking Water Act		
40 CFR Part 141, Subpart G	Establishes health-based MCLs for public drinking water systems. New MCLs for radionuclides were finalized in 65 FR 236 (December 7, 2000) and are effective December 8, 2003.	MCLs are relevant and appropriate since shallow and deep ground water in the vicinity of the Lowry Site is being used or may be used as a source of water for a public water system or private supply wells. Pursuant to the ROD and 1997 ESD, effluent from groundwater treatment is either discharged offsite to a POTW or onsite to a shallow infiltration trench. New MCLs for uranium are potentially relevant and appropriate for onsite infiltration of treated ground water. The uranium MCLs have been changed due to a better understanding of the science supporting the standards; therefore, adoption of the new uranium standards is recommended.
	Chemical-Specific ARARs – State	
Colorado Water Quality Control Act		
5 CCR 1002-8, Section 3.11.0 [Renumbered 5 CCR 1002-41], *Colorado Basic Standards for Groundwater*, and Section 3.12.0, [Renumbered 5 CCR 1002-42], *Classifications and Water Quality Standards for Groundwater*	Establishes a system for classifying ground water and sets water quality standards based on classification. These regulations were renumbered 5 CCR 1002-41 and 1002-42 (20 Colo. Reg. 8, August 10, 1997). Numerical groundwater standards were amended in 22 Colo. Reg. 2 (February 10, 1999), effective March 2, 1999.	These regulations establish standards for both classified and unclassified ground water. The statewide standards are applicable because ground water at and near the Lowry Site has not been classified. Pursuant to the ROD and 1997 ESD, effluent from the groundwater treatment is either discharged offsite to a POTW or onsite to a shallow infiltration trench. Revised groundwater standards are noted in Table 6-2
5 CCR 1002-8, Section 3.1.0 [Renumbered 5 CCR 1002-31], *Basic Standards and Methodologies for Surface Water,* and Section 3.2.0 [Renumbered 5 CCR 1002-38], *Classifications and Numeric Standards for South Platte River Basin*	Establishes basic standards and a system for classifying surface waters of the State, including the South Platte River Basin. Water quality and variance standards are based on use classification. These regulations were renumbered 5 CCR 1002-31 and 1002-38 (20 Colo. Reg. 8, August 10, 1997). Surface water standards were amended in 23 Colo. Reg. 6 (June 10, 2000) and 23 Colo. Reg. 11 (November 10, 2000).	Murphy Creek and the unnamed creek are classified and regulated as tributaries of the South Platte River Basin (Stream Segment 16). Segment 16 is classified as Recreation Class 1a, Warm Water Aquatic Life Class 2, and Agricultural Supply. Because of this classification, statewide interim organic pollutant standards for aquatic life segments (Section 3.1.11 and Table C) are applicable to the remedy. Chemical-specific standards established for Stream Segment 16 are applicable to the remedy. If surface-water discharge results from injection of the treated water, surface water standards will be established based on the most stringent surface water ARAR. Revised surface water standards are noted in Table 6-4.

TABLE 6-1
Identification of Newly Promulgated or Revised Regulatory Standards and To Be Considered Requirements

Citation	Description	Evaluation
Colorado Air Quality Act/Air Pollution Regulations		
Massachusetts AALs and TELs	Establishes health-based air standards. These standards were revised during the Five-Year Review period.	TBCs. These standards were used to design the SWRA when considering air pollution controls for the WTP. The plant will continue to meet these standards. Revised air quality Performance Standards are noted in Table 6-4.
Action-Specific ARARs – Federal		
Solid Waste Disposal Act – RCRA Subtitle C Regulations		
40 CFR Part 268, *Land Disposal Restrictions*	Establishes prohibitions on land disposal unless treatment standards are met or a "no migration exemption" is granted. Revisions were made to 40 CFR 268.49 (63 FR 28602-28622).	Land Disposal Restrictions (LDR) are applicable to excavation in the FTPA. EPA has promulgated changes in the LDRs with regard to the classification of contaminated soil as remediation waste. Because these revisions do not establish that the existing requirements are no longer protective, their adoption as an ARAR is not recommended.
Federal Water Pollution Control Act (amended by the Clean Water Act)		
40 CFR, Part 230/231, *Guidelines for Specification of Disposal Sites for Dredged or Fill Materials*	The discharge of dredged or fill material into the waters of the U.S. is prohibited without a permit. *Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers, et al.,* 2000 WL 15333 (2001) was decided by the U.S. Supreme Court on January 9, 2001 (No. 99-1178).	Wetlands were destroyed during construction of the SWRA and must be mitigated during implementation of the selected remedy by constructing new wetlands. In *Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers et al.,* (No. 99-1178, January 9, 2001), the Supreme Court limited regulatory jurisdiction under Section 404(a) of the CWA to protect isolated, non-navigable, intrastate waters used as habitat by migratory birds. However, the wetlands at the Site were designated as such because they are adjacent to unnamed creek, which flows intermittently into Murphy Creek, which is a tributary of Sand Creek, which is a tributary to the South Platte River, which is a navigable water.

Table 6-2
Groundwater Performance Standards

Chemical	ROD[a]	ESD[b]	1996 Inorganic Values[c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit[d]	PQL[e]
Organics									
1,1-Dichloroethane	-	990				990	C	9350	
1,1-Dichlorethylene	0.068	7				7	A	13	
1,2-Dichloroethylene(cis)	70				61	70	D		
1,2-Dichlorethylene(trans)	100				122	100	D		
1,1,1-Trichloroethane	200					200	D	2.17	
1,1,2-Trichloroethane	0.32	3				3	A	92	
1,1,2,2-Tetrachloroethane	0.089				0.055	0.055	B	25.3	
1,2-Dibromo-3-Chloropropane	0.2					0.2	D		
1,2-Dichlorobenzene	600					600	D		
1,2-Dichloroethane	0.2	0.4				0.4	A		1
1,2-Dichloropropane	0.56					0.56	D	78	1
1,2-Diphenylhydrazine	0.05					0.05	D		
1,2,4-Trichlorobenzene	20	70			194	70	A	390	
1,2,4,5-Tetrachlorobenzene	2					2	D		10
1,3-Dichlorobenzene	620					620	D		
1,4-Dichlorobenzene	75					75	A	No Limit	
1,4-Dioxane	not COC				8	8	B		200
2-Butanone (methyl ethyl ketone)	780				1904	1904	C	No Limit	
2-Chlorophenol	0.1					0.1	A	No Limit	
2-Hexanone	–					--	--	No Limit	
2-Methylnaphthalene	0.0031(total PAHs)					0.0031 (total PAHs)	A	No Limit	
2,3,7,8-TCDD (dioxin equivalence)	2.2 x 10-7				0.000000448	2.2 x 10-7	A	0.000107	0.2
2,4-D(dichlorophenoxyacetic acid)	70					70	D	22800	
2,4-Dichlorophenol	21					21	A	No Limit	50
2,4-Dinitrophenol	14					14	A	No Limit	50
2,4,5 TP(trichlorophenoxypropionic acid)	10	50				50	D		
2,4,6-Trichlorophenol	2					2	D		50
4-Methyl-2-pentanone (MIBK)	780				158	158	C	No Limit	
Acetone	1,600					1,600	C	1,800,000	
Alachlor	2					2	D		
Aldicarb	3					3	D		10
Aldicarb Sulfone	2					2	D		3
Aldicarb Sulfoxide	4					4	D		20
Aldrin	0.002				0.004	0.002	D	No Limit	0.1
Atrazine	3					3	D		

Table 6-2
Groundwater Performance Standards

Chemical	ROD[a]	ESD[b]	1996 Inorganic Values[c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit[d]	PQL[e]
Benzene	0.62	5			0.35	5	A	44	
Benzidine	0.0002					0.0002	D		10
Benzo(a)anthracene	0.0031(total PAHs)	0.1		0.1	0.092	0.1 (total PAHs)	A	No Limit	
Benzo(a)pyrene (PAH)	0.2			0.01		0.01	D		
Benzyl Alcohol	- -					--	--	No Limit	
Bis(2-chloroethyl)ether	0.016	0.03				0.03	A	No Limit	10
Bis(2-ethylhexyl)phthalate	6.1				4.8	4.8	B	2330	10
Bromodichloromethane	0.3					0.3	D		1
Bromoform	4					4	D		
Carbazole	- -					--	--	No Limit	
Carbofuran	36					36	D		
Carbon tetrachloride	0.026	0.3				0.3	B	78	1
Chlordane	0.004	0.03				0.03	D		1
Chlorobenzene	100					100	D	1000	
Chloroethane	- -					--	--	No Limit	
Chloroform	0.19	6			0.16	6	A	73	
Chlorophenol	1	0.2				0.2	D	No Limit	
Dalapon	200					200	D		
DDT Metabolite (DDE)	0.1				0.2	0.1	D	No Limit	
DDT	0.1				0.2	0.1	D	0.49	
Di(2-ethylhexyl)adipate	400					400	D		
Di(2-ethylhexyl)phthalate	6					6	D		10
Di-n-Octylphthalate	- -					--	--	No Limit	
Dibenzofuran	- -					--	–	No Limit	
Dibromochloromethane	14			0.42		0.42	D		
Dieldrin	0.002				0.0042	0.002	D	No Limit	0.1
Dinoseb	7					7	D		
Diquat	20					20	D		
Endothall	100					100	D		115
Endrin	0.2					0.2	D	No Limit	
Endrin Aldehyde	0.2					0.2	D		
Ethylbenzene	680					680	D	2640	
Ethylenedibromide	0.05					0.05	A		
Fluoranthene	188					100	A	No Limit	
Glyphosate	700					700	D		
Heptachlor	0.008					0.008	D	0.3	0.05

Table 6-2
Groundwater Performance Standards

Chemical	ROD[a]	ESD[b]	1996 Inorganic Values[c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit[d]	PQL[e]
Heptachlor Epoxide	0.09			0.004		0.004	D		
Hexachlorobenzene	1					1	D		10
Hexachlorobutadiene	1					1	D		10
Hexachlorocyclohexane, Alpha	0.2	0.006				0.006	D		0.05
Hexachlorocyclohexane, Gamma (Lindane)	0.004	0.2				0.2	D		
Hexachlorocyclopentadiene	50					50	D	No Limit	
Isophorone	1050			40		40	D		
Malathion	2,500	–				2,500	D		
Methoxychlor	40					40	D		
Methylene chloride	0.19	5				5	A	1990	
Monohydric phenol	1	–				1	D		
Naphthalene	--	63			6.2	6.2	C	4850	
Nitrobenzene	3.5					3.5	D		10
Oxamyl (vydate)	200					200	D		
PCBs (Arochlor 1260)	0.005				0.034	0.005	D	2.43	1
Pentachlorobenzene	6					6	D		10
Pentachlorophenol	0.71	1				1	A	272	50
Phenanthrene	0.0031(total PAHs)					0.0031(total PAHs)	A	No Limit	
Phenol	1	300				300	D	22800	
Picloram	500					500	D		
Simazine	4					4	D		
Styrene	100					100	D	4260	
Tetrachloroethylene	1.5	5				5	A	1410	
Toluene	1,000					1,000	A	2,650	
Toxaphene	0.03					0.03	D		5
Trans-1,3-dichloropropene	3.4	87			0.4	87	A	No Limit	
Trichloroethylene	2.6	5			1.6	5	A	780	
Vinyl chloride	0.037	2			0.041	2	A	9.2	
Xylenes (total)	10,000					10,000	D	2,730	
Inorganics and Miscellaneous									
Aluminum	5,000					5,000	D	No Limit	
Antimony	6		770			770	D	No Limit	
Arsenic	0.049	50	52.18		0.045	52.18	E	330	
Asbestos (fibers/l)	30000					30,000	D		
Barium	1000		200			1,000	D	No Limit	
Beryllium	4		5			5	E	7.8	

Table 6-2
Groundwater Performance Standards

Chemical	ROD[a]	ESD[b]	1996 Inorganic Values[c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit[d]	PQL[e]
Boron	750		200			750	D		
Cadmium	5		5.48		18	5.48	E	1810	
Chloride	250,000		1000000			1,000,000	E	No Limit	
Cobalt	50		13.67			50	A	No Limit	
Coliform (total) per 100 ml	<1	1				<1	D		
Color, color units	15					15	D		
Corrosivity	Noncorrosive					Noncorrosive	D		
Copper	200		90.9			200	D	6100	
Chromium (as Cr[Vl])	50		83.47			83.47	E		
Chromium (total)	50		11.04		109	50	D	3600	
Cyanide	200		7.39			200	D	2000	
Fluoride	2000		50000			50,000	E	No Limit	
Foaming Agents	500					500	D		
Iron	300		2060			2060	E		
Lead	15		50			50	E	2200	
Manganese	50		1620		876	1620	E	22800	
Mercury	2					2	D	64	
Nickel	2	100				100	A	5600	
Nitrate as N	10,000		29100			29,100	E		
Nitrate and Nitrite as N	10,000		34000			34,000	E		
Nitrite as N	1,000		1000			1,000	E		
pH	6.5 to 8.5					6.5 to 8.5	D		
Selenium	10		371.98			371.98	E	660	
Silver	50					50	D	1520	
Sulfate	250,000		2400000			2,400,000	E	No Limit	
Thallium	1.1	2			2.4	10	E	No Limit	
Vanadium	100					100	D	No Limit	
Zinc	2,000				10950	2,000	D		
Radionuclide									
Americium-241	1.3 pCi/l	.2 pCi/l			0.46	0.46 pCi/l	C	0.27	
Beta and photon emitters, mrem/yr	4					4	D	168	
Cesium-134	80 pCi/l				3	80 pCi/l	D	95	
Gross Alpha	15 pCi/l					15 pCi/l	D	115	
Lead-210	0.072 pCi/l				0.037	0.037 pCi/l	B	3.3	
Plutonium-238,-239, and –240	15 pCi/l			0.15 pCi/l	0.35	0.15 pCi/l	A	0.31	
Potassium-40	76 pCi/l	4.3 pCi/l			1.9	1.9 pCi/l	B	330	

Table 6-2
Groundwater Performance Standards

Chemical	ROD[a]	ESD[b]	1996 Inorganic Values[c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit[d]	PQL[e]
Radium-226 and –228	5				0.12	5 pCi/l	A	7.1	
Strontium-90	1.3 pCi/l	8.0 pCi/l			0.63	8.0 pCi/l	A	11	
Thorium-228	0.87 pCi/l				0.16	0.16 pCi/l	B	1.1	
Thorium-230	3.7 pCi/l	60 pCi/l			0.52	60 pCi/l	A	62	
Thorium-232	12 pCi/l	60 pCi/l			0.47	60 pCi/l	A	62	
Tritium	20,000 pCi/l and 880 pCi/l	20,000 pCi/l			830	20,000 pCi/l	D	20300	
Uranium-234	3.0 pCi/l			30 pCi/l	0.67	30 pCi/l	A	64	
Uranium-235	20 pCi/l	3.0 pCi/l		30 pCi/l	0.68	30 pCi/l	A	9.4	
Uranium-238	5.2 pCi/l	1.7 pCi/l		30 pCi/l	0.55	30 pCi/l	A	46	
Basis:									
A = ARAR		[a] Record of Decision, March 1994							
B = Carcinogenic Risk Based		[b] Explanation of Significant Differences, August 1995							
C = Noncarcinogenic Risk Based		[c] Summary Statistics for Groundwater, 1996							
D = Colorado Basic Standard for Groundwater (non-COC)		[d] Metro Wastewater Reclamation District Industrial Wastewater Discharge Permit No. I-118							
E = Background		[e] If Practical Quantitation Limit (PQL) is greater than performance standard, then analyzing to PQL is adequate to show standard is achieved.							

Table 6-3
Air Quality Performance Standards

	ROD[a]		ESD[b]		Five-Year Review Standards[c]				
Chemical/Element	AAL	TEL	AAL	TEL	AAL	TEL	Risk-Based	LFG Flare[d]	FTPA Treatment Cell[e]
Organics									
1,1,1-Trichloroethane	1038.37	1038.37			1038.37	1038.37	--	1.56E+07	1.71E+08
1,1,2-Trichloroethane	0.06	14.84			0.06	14.84	--	5.99E+04	4.41E+04
1,1-Dichloroethane	--	–			--	--	521	7.82E+06	8.56E+07
1,1,2,2-Tetrachloroethane	0.02	18.67			0.02	18.67	--	2.00E+04	1.47E+04
1,2,4 Trichlorobenzene	–	–			--	--	11	1.65E+05	1.81E+06
1,2-Dichloroethylene (total)	107.81	215.62			107.81	215.62	--	3.24E+06	3.54E+07
1,1-Dichloroethylene (vinylidene chloride)	–[f]	–[f]			0.02[f]	1.08[f]	0.049	7.36E+02	7.95E+03
1,2-Dichlorobenzene (ortho)	81.74	81.74			81.74	81.74	--	1.23E+06	1.34E+07
1,2-Dichloroethane	0.04	11.01			0.04	11.01	--	3.99E+04	2.94E+04
1,2-Dichloropropane	0.05	94.23			0.05	0.9	--	4.99E+04	3.67E+04
1,4-Dichlorobenzene	0.18	122.61			0.18	122.61	--	1.80E+05	1.32E+05
2,3,7,8-TCDD(dioxin equivalence)	--	–			--	--	--		
2,4-Dichlorophenol	–	–			--	--	--		
2,4-Dimethylphenol	–	–			--	--	--		
2,4-Dinitrophenol	–	–			--	--	--		
2-Butanone (methyl ethyl ketone)	32.07	32.07			10	200	--	4.82E+05	5.27E+06
2-Chlorophenol	–	–			--	--	--		
2-Hexanone	10.88	10.88			10.88	10.88	--	1.63E+05	1.79E+06
2-Methylphenol	–	–			--	--	--		
2-Methylnaphthalene[g]	14.25	14.25			14.25	14.25	--	2.14E+05	
4,4-DDT	--	--			--	--	0.0103	1.55E+02	
4-Methylphenol	–	–			--	--	--		
4-Methyl-2-pentanone	–	–			--	--	--		
Acetone	160.54	160.54			160.54	160.54	--	2.41E+06	2.64E+07
Acrylonitrile	0.01	1.18			0.01	0.4	--	9.98E+03	7.35E+03
Aniline	0.14	2.07			0.1	0.2	--	3.11E+04	
Benzene	0.12	1.74			0.12	1.74	--	2.61E+04	8.80E+04
Benzo(a)anthracene	–	–			--	--	--		
Benzo(a)alcohol	–	–			--	--	--		
Bis(2-chloroethyl)ether	–	–			--	--	--		
Bis(2-ethylhexyl)phthalate	–	–			--	--	--		
Carbazole	–	–			--	--	--		
Carbon disulfide	0.27	0.27	0.82	0.82	0.1	0.1	--	1.23E+04	1.35E+05
Carbon tetrachloride	0.07	85.52			0.07	85.52	--	6.99E+04	5.15E+04
Chlorobenzene	6.26	93.88			6.26	93.88	--	1.41E+06	4.60E+06
Chloroethane	358.78	717.55			358.78	717.55	--	1.08E+07	1.18E+08
Chloroform	0.04	132.76			0.04	132.76	--	3.99E+04	2.94E+04

Table 6-3
Air Quality Performance Standards

	ROD[a]		ESD[b]		Five-Year Review Standards[c]				
Chemical/Element	AAL	TEL	AAL	TEL	AAL	TEL	Risk-Based	LFG Flare[d]	FTPA Treatment Cell[e]
Chloromethane (methyl chloride)	--	–			--	--	0.56	8.41E+03	9.20E+04
Dibenzofuran	–	–			--	--	–		
Dieldrin	--	--			--	--	0.000219	3.29E+00	
Di-n-Octylphthalate	–	–			--	--	–		
Ethylbenzene	118.04	118.04			300	300	--	1.77E+06	1.94E+07
Ethylenedibromide	–	–			--	--	--		
Fluoranthene	–	–			--	--	--		
Gamma BHC (lindane)	0.003	0.14			0.003	0.14	--	4.51E+01	
Heptachlor	0.001	0.14			0.001	0.14	--		
Methylene chloride	0.24	9.45			--	--	--	1.42E+05	1.76E+05
Naphthalene[g]	14.25	14.25			14.25	14.25	--	2.14E+05	
NDMA	–	–			--	--	0.0001	1.50E+00	
PCBs	0.0005	0.003			0.0005	0.003	--	7.51E+00	
Pentachlorophenol	0.01	0.01			0.01	0.01	--	1.50E+02	
Phenanthrene	–	–			--	--	--		
Phenol	52.33	52.33			52.33	52.33	--	7.86E+05	
Styrene	1.75	115.81			2	200	--	1.74E+06	1.29E+06
Tetrachloroethylene	0.02	922.18			0.02	922.18	--	2.00E+04	1.47E+04
Toluene	10.24	10.24			20	80	--	1.54E+05	1.66E+06
trans-1,3-Dichloropropene	--	–			--	--	--		
Trichloroethylene	0.61	36.52			0.61	36.52	--	5.48E+05	4.49E+05
Vinyl chloride[h]	3.47	0.38			0.38	3.47	--	5.21E+04	2.79E+06
Xylenes (total)	11.8	11.8			11.8	11.8	--	1.77E+05	1.93E+06
Inorganics									
Ammonia	4.73	4.73			100	100	--	7.10E+04	
Arsenic	--	--			0.0002	0.0005	0.0007	1.05E+01	
Barium	--	--			--	--	0.5	7.51E+03	
Beryllium	0.0004	0.001			0.0004	0.001	--	6.01E+00	
Cadmium	0.001	0.003			0.001	0.003	--	1.50E+01	
Chromium	--	--			0.68	1.36	0.000085		
Lead	0.07	0.14			0.07	0.14	--	1.05E+03	
Manganese	--	--			--	--	1	1.50E+04	
Mercury	--	--			0.01	0.14	0.3	4.51E+03	
Nickel	0.18	0.27			0.18	0.27	--	2.70E+03	
Selenium	0.54	0.54			0.54	0.54	--	8.11E+03	
Vanadium	0.27	0.27			0.27	0.27	--	4.05E+03	

[a]Record of Decision, March 1994

Table 6-3
Air Quality Performance Standards

	ROD[a]		ESD[b]		Five-Year Review Standards[c]				
Chemical/Element	AAL	TEL	AAL	TEL	AAL	TEL	Risk-Based	LFG Flare[d]	FTPA Treatment Cell[e]
[b]Explanation of Significant Differences, August 1995									
[c]Commonwealth of Massachusetts Department of Environmental Protection TELs and AALs for Ambient Air, December 1995									
AAL - ambient; TEL threshold effects level									
[d]Final Compliance Monitoring Plan Landfill Gas Remedy, November 14, 1997									
[e]Final Operations, Sampling, and Monitoring Plan, FTPA Waste Pit Remedy , July 24, 1998									
[f]1994 ROD did not list Massachusetts standards for 1,1-dichloroethene mistakenly omitted. Standard was listed under the chemical name vinylidene chloride and should have been included									
[g]Value is for total of 2-methylnapthalene and naphthalene									
[h]Values for AAL and TEL were mistakenly reversed in the ROD									

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD -Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
Organics									
Acenaphthene	–		420	1,700		520			10
Acrolein	–		110	68		21			10
Acrylonitrile	--		0.065	7,500		2,600			5
Aldicarb	--	10	7	--		--			10
Aldrin	--	0.002	0.0021	1.5		--			0.1
Benzene	--	1	1.2	5,300		--			1
Benzidine	--	0.0002		2,500		--			10
Beryllium	100 (30 day)	0.007		--		--			--
BHC Hexachlorocyclohexane	--	–		100		--			0.05
Bromodichloromethane (HM)	–	0.3	.56 (W&F)		11,000	--			1
Bromoform (HM)	--	4	4.3 (W&F)	--		--			1
Carbofuran	--	36	40	--		--			--
Carbon Tetrachloride	--	0.3	0.27	35,200		--			1
Chlorobenzene	--	100		--		--			1
Chlordane	--	0.03	0.1	1.2		0.0043			1
Chloroethyl Ether (bis-2-)	--	0.03	0.032	--		--			10
Chloroform (HM)	--	6	5.7 (W&F)	28,900		1240			1
4-Chloro 3-Methyl Phenol	--		210	30		--			50
2-Chlorophenol	–		35	4380		2000			50
Chlorphyrifos	–		21	0.083		0.041			0.1
DDT	--	0.1		0.55		0.001			0.1
DDT Metabolite (DDE)	--	0.1		1,050		--			0.1
DDT Metabolite (DDD)	–		0.15	0.6		--			0.1
Demeton	--	–		--		0.1			1
Dibromochloromethane (HM)	--	14		--		--			1
1,2-Dichlorobenzene	–	620	600	--		--			1
1,3-Dichlorobenzene	–	620	600	--		--			1
1,4-Dichlorobenzene	–	75		--		--			1
1,2-Dichloroethane	–	0.4	0.38	118,000		20,000			1
1,1-Dichlorethylene	–	7		--		--			1
1,2-cis-Dichlorethylene	--	70		--		--			1
1,2-trans-Dichloroethylene	–	100		--		--			1
2,4-Dichlorophenol	–	21		2,020		365			50
Dichlorophenoxyacetic Acid (2,4-D)	--	70		--		–			2.02

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD -Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
1,2-Dichloropropane	–	0.56	0.52	23000		5700			1
1,3-Dichloropropylene	–	–		6,060		244			1
Dieldrin	--	0.002		1.3	2.4	0.0019	0.056		0.1
2,4-Dimethylphenol	--		140	2,120		--			50
2,4-Dinitrophenol	--	14		--		--			50
2,6-Dinitrotoluene	--	--		330		230			10
Dioxin (2,3,7,8-TCDD)	--	2.2 x 10-7		0.01		0.00001			0.02
1,2-Diphenylhydrazine	--	0.05	0.044	270		--			
Endosulfan	--		0.35	0.22	0.11	0.056			0.1
Endrin	--	0.2	2	0.09	0.086	0.0023	0.036		0.1
Endrin Aldehyde	--	0.2	2.1	--		--			0.1
Ethylbenzene	--	680	700	32,000		--			1
Fluoranthene (PAH)	--		280	3,980		--			10
Guthion	--			--		0.01			1.5
Heptachlor	--	0.008		0.26	0.52	0.0038			0.05
Heptachlor Epoxide	–	0.09	0.004	0.26	0.52	0.0038			0.05
Hexachlorobenzene	–	6	1	--		--			10
Hexachlorobutadiene	–	1	14	90		9.3			10
Hexachlorocyclohexane, Alpha	--	0.006	0.0056	0.0039	--	--			0.05
Hexachlorocyclohexane, Gamma (Lindane)	--	0.2		1		0.08			0.05
Hexachloroethane	--		7	980		540			10
Hexachlorocyclopentadiene	--		50	7		5			10
Indeno(1,2,3-cd)pyrene (PAH)	--		0.048	--		--			10
Isophorone	--	1050	40	117,000		--			10
Malathion	--		140	--		0.1			0.2
Methoxychlor	--	40		--		0.03			0.5
Mirex	--	--		--		0.001			0.1
Naphthalene (PAH)	--		28	2,300		620			10
Nitrobenzene	--	3.5		27,000		--			10
Parathion	--	--		0.065		0.013			
PCBs	--	0.005	0.0175	2		0.014			1
Pentachlorobenzene	--	6	5.6	--		--			10
Pentachlorophenol	–	200	1	9	19	5.7	15		50
Phenol	--		4,200	10,200		2,560			50
1,2,4,5-Tetrachlorobenzene	–	2	2.1	--		–			10

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD -Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
1,1,2,2-Tetrachloroethane	–		0.18	--		2,400			1
Tetrachloroethylene	--	5		5,280		840			1
Toluene	--	1000		17,500		--			1
Toxaphene	--	0.03	0.032	0.73		0.0002			5
1,1,1-Trichloroethane	–	200		--		--			1
1,1,2-Trichloroethane	–	3		9,400		--			1
Trichloroethylene	--	5		45,000		21,900			1
2,4,6-Trichlorophenol	–	2	3.2	--		970			50
Trichlorophenoxypropionic Acid (2,4,5-TP)	–	50		--		--			0.5
Vinyl Chloride	--	2		--		--			2
Inorganics and Miscellaneous									
Antimony	--	14	6	--		--			
Aluminum	--	--		750		87		19	
Ammonia (un-ionized as N)	--	500		site specific		60-100			
Arsenic	100 (30 day)	50		360	340	150		1	
Asbestos, fibers/l	--	30,000	7,000,000	--		--			
Barium	--	1,000		--		--		23	--
Boron	750 (30 day)	--		--		--			--
Cadmium	10 (30 day)	10 (1 day)	5 (1 day)	--[a]		--[a]		1	
Chloride	--	250,000		--		--			
Chromium (hexavalent)	100 (30 day)	50 (1 day)		16		11		5	
Chromium (trivalent)	100 (30 day)	50 (1 day)		--[a]		--[a]		5	
Copper	200 (30 day)	1,000 (30 day)		--[a]		--[a]		14	
Cyanide (free)	200 (1 day)	200 (1 day)			5		5	7	
Dissolved Oxygen	3000	3,000	3,000	--		--			
e. coli	--	--	126/100 ml	--					
Fecal Coliform	–	2,000/100 ml	200/100 ml	--		--			
Fluoride	--	2,000		--		--			
Iron	--	300 (30 day)		--		1,000 (tot rec)			
Lead	100 (30 day)	50 (1 day)		--[a]		--[a]		0	
Manganese	200 (30 day)	50 (dis)(30 day)			--[a]	1000	--	26	
Mercury	--	2.0 (1 day)		2.4		0.1	0.77	2	
Nickel	200 (30 day)		100 (30 day)	--[a]		--[a]		2	
Nitrate as N	100,000	10,000 (1 day)		--		–			

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD -Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
Nitrite as N (NO_2-N)	10,000	1,000 (1 day)		–		–			
pH	--	5.0 - 9.0	6.5 - 9.0	–		–			
Selenium	20 (30 day)	10 (1 day)	50 (30 day)	135	18.4	17	4.6		
Silver	--	50	100 (1 day)	--[a]		--[a]		1	
Sulfide as H2S	--	50			2		2		
Sulfate	--	250,000		--					
Thallium	--		0.5	--		15	15		
Uranium	--	--		--[a]		--[a]			
Zinc	2,000 (30 day)	5,000 (30 day)		--[a]		--[a]		26	
Radionuclides									
Cesium 134, pCi/l	–	80h		--		--			--
Plutonium 238,239, and 240, pCi/l	–	15h	0.15	--		--			
Radium 226 and 228, pCi/l	–	5h		--		--			
Strontium 90, pCi/l	–	8h		--		--			
Thorium 230 and 232 pCi/l	–	60h		--		--			
Tritium, pCi/l	–	20000h		--		--			

[a] Value is dependent on hardness of water

[b] From Summary Statistics for Surface Water 1996

[c] Practical Quantitation Limit

Table 6-5
Landfill Gas Compliance Boundary Standards

Chemical	ROD Standard [a]	Soil Vapor Action Levels [b]
Acetone		1,648
Benzene	0.12	605
Bromodichloromethane		16,900
Bromoform		96
Bromomethane		2,550
2-Butanone	700	1,549
Carbon disulfide	0.27	1,250,000
Carbon tetrachloride		1,240
Chlorobenzene		15,300
Chloroethane		756
Chloroform	0.04	212
Chloromethane		764
1,2-Dibromo-3-chloropropane		13
Dibromochloromethane		452
1,2-Dichlorobenzene		48,000
1,1-Dichloroethane	400	10,751
1,1-Dichloroethene	0.033	98
1,2-Dichloroethane	0.04	20
cis-1,2-Dichloroethene		92,400
trans-1,2-Dichloroethene		21,900
1,2-Dichloropropane		200
trans-1,2-Dichloropropene		60,900
1,4-Dioxane		1
Ethylbenzene	118.04	219,640
Ethylene dibromide		29
2-Hexanone		69,300,000
Ethylene dibromide		13,416
2-Hexanone		10,800
Methane	5% LEL	5% LEL
Methylene chloride	0.24	450
4-Methyl-1,2-pentanone		13,416
Styrene		10,800
1,1,2,2-Tetrachloroethane		83

Table 6-5
Landfill Gas Compliance Boundary Standards

Chemical	ROD Standard [a]	Soil Vapor Action Levels [b]
Tetrachloroethene		3,795
Toluene	10.24	272,000
1,1,1-Trichloroethane	700	100,400
1,1,2-Trichloroethane		92
Trichloroethene		2,070
Vinyl chloride	0.02	56
Xylenes (total)	11.8	2,760,000

[a] Record of Decision, March 1994

[b] Letter dated February 16, 2000 regarding *Responses to EPA Comments (dated December 16, 1999) on the Response to Comments and 2nd Edition of the Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas, dated October 1999*; and letter dated November 13, 2000 regarding *Response to EPA Comments (dated October 17, 2000) on Response to EPA Comments (dated December 16, 2000) and 2nd Edition of the Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas (dated February 16, 2000)*

Table 6-6
Contaminants Not Identified as a Contaminant of Concern in the Draft Baseline Risk Assessment that Exceed a Risk-Based Concentration
Lowry Landfill Five-Year Review

Contaminant	Oral Slope Factor [mg/kg-day]-1	Residential Groundwater Cancer Risk-Based Concentration Target Risk = 10^{-6} [ug/L]	Groundwater Sampling Data from Recent Sampling Events: Maximum Detected Groundwater Concentration [ug/L]	Sample ID of Maximum Detected Concentration in Groundwater	Sample Date of maximum Detected Concentration in Groundwater	Number of Detects in Groundwater	Number of Total Samples Collected in Groundwater	Average of Detected Concentrations [ug/L]		Maximum Detected Effluent Concentration [ug/L]
1,4-Dioxane[a]	0.011	8	47,000	West Cleanout	9/9/98	52	419	5,496		5500

Notes:

a : Inhalation slope factor, oral reference dose, and inhalation reference dose are not available for 1,4-Dioxane

Source of Toxicity Values: IRIS (USEPA, 2001a) and HEAST (USEPA, 1997b)

Table 6-7
Summary of Changes in the Radionuclide Slops Factors
Lowry Landfill Five-Year Review

Radionuclide	Radionuclide Slope Factor					
	ROD Ingestion	ROD Inhalation	ROD External	5-Year Review Water Ingestion	5-Year Review Inhalation	5-Year Review External
Americium-241(alpha and gamma)	2.40E-10	3.20E-08	4.90E-09	1.04E-10	2.81E-08	2.76E-08
Cadmium-109	7.90E-12	6.50E-11	7.30E-10	5E-12	2.19E-11	8.73E-09
Cesium-137 + D	2.80E-11	1.90E-11	2.00E-06	3.04E-11	1.19E-11	2.55E-06
Europium-154	3.00E-12	1.40E-10	4.10E-06	1.03E-11	1.15E-10	5.83E-06
Tritium	5.40E-14	7.80E-14	0	5.07E-14	5.62E-14	0.00E+00
Potassium-40	1.10E-11	7.60E-12	5.40E-07	2.47E-11	1.03E-11	7.97E-07
Lead-210 + D	6.60E-10	4.00E-09	1.60E-10	1.27E-09	1.39E-08	4.21E-09
Plutonium-239	2.30E-10	3.80E-08	1.70E-11	1.35E-10	3.33E-08	2.00E-10
Radium-226 + D	1.20E-10	3.00E-09	6.00E-06	3.86E-10	1.16E-08	8.49E-06
Strontium-90 + D	3.60E-11	6.20E-11	0.00E+00	7.4E-11	1.13E-10	1.96E-08
Thorium-228 + D	5.50E-11	7.80E-08	5.60E-06	3E-10	1.43E-07	7.76E-06
Thorium-230	1.30E-11	2.90E-08	5.40E-11	9.1E-11	2.85E-08	8.19E-10
Thorium-232	1.20E-11	2.80E-08	2.60E-11	1.01E-10	4.33E-08	3.42E-10
Uranium-234	1.60E-11	2.60E-08	3.00E-11	7.07E-11	1.14E-08	2.52E-10
Uranium-235	1.60E-11	2.50E-08	2.40E-07	6.96E-11	1.01E-08	5.18E-07
Uranium-238 + D	2.80E-11	5.20E-08	3.60E-08	8.71E-11	9.35E-09	1.14E-07

Notes:

D : Includes short-lived decay products with half-lives less than or equal to 6 months

Table 6-8
Summary of Changes in the Radionuclide Risk
Lowry Landfill Five-Year Review

Radionuclide	ROD Future Onsite Residential Scenario Source Area Wells RME Risk GW Ingestion	5-Year Review Future Onsite Residential Scenario Source Area Wells RME Risk GW Ingestion	ROD Future Onsite Residential Scenario RME Risk SW Ingestion	5-Year Review Future Onsite Residential Scenario RME Risk SW Ingestion	ROD Future Onsite Residential Scenario Upgradient Wells RME Risk GW Ingestion	5-Year Review Future Onsite Residential Scenario Upgradient Wells RME Risk GW Ingestion
Americium-241(alpha and gamma)	1.2E-05	5.2E-06			6.6E-06	2.9E-06
Cadmium-109	--	--	6.0E-08	3.8E-08		
Cesium-137 + D	--	--	5.6E-09	6.1E-09		
Europoium-154	--	--				
Trituim	3.6E-06	3.4E-06	4.5E-09	4.2E-09	2.2E-05	4.9E-05
Potassium-40	1.1E-04	2.5E-04	3.4E-08	7.6E-08		
Lead-210 + D	1.5E-04	2.9E-04			2.8E-06	1.6E-06
Plutonium-239	3.9E-05	2.3E-05	2.2E-08	1.3E-08	1.3E-04	4.2E-04
Radium-226 + D	1.9E-04	6.1E-04				
Strontium-90 + D	3.4E-06	7.0E-06	1.8E-09	3.7E-09		
Thorium-228 + D	8.3E-06	4.5E-05			5.8E-06	3.2E-05
Thorium-230	2.0E-05	1.4E-04				
Thorium-232	7.6E-06	6.4E-05	1.1E-08	9.3E-08	3.0E-06	2.5E-05
Uranium-234	1.6E-05	7.1E-05	2.8E-09	1.2E-08	7.4E-07	3.3E-06
Uranium-235	6.0E-06	2.6E-05	1.2E-08	5.2E-08	6.6E-06	2.9E-05
Uranium-238 + D	4.3E-05	1.3E-04	1.0E-08	3.1E-08	3.1E-06	9.6E-06
	6E-04	**2E-03**	**2E-07**	**3E-07**	**2E-04**	**6E-04**

Notes:

ROD : Record of Decision

RME : Reasonable Maximum Exposure

GW = groundwater

SW = surface water

D : Includes short-lived decay products with half-lives less than or equal to 6 months.

Blank cell : not detected or not a risk assessment radionuclide

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
NBBW	Groundwater	2nd Qtr 1994	Compliance	MW-1000	08-Apr-1994	1,1-Dichloroethene	11.00	=	7.00	ug/L
NBBW	Groundwater	2nd Qtr 1994	Compliance	MW-1000	08-Apr-1994	1,2-Dichloroethane	2.60	=	1.00	ug/L
NBBW	Groundwater	2nd Qtr 1994	Compliance	MW-1000	08-Apr-1994	1,2-Dichloropropane	3.40	=	1.00	ug/L
NBBW	Groundwater	2nd Qtr 1994	Compliance	MW-1000	08-Apr-1994	Tetrachloroethene	9.20	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1994	Compliance	MW34-UD	13-May-1994	Alpha, Gross	320.00	=	55.40	pCi/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1994	Compliance	MW34-UD	13-May-1994	Beta, Gross	490.00	=	80.00	pCi/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1994	Compliance	MW36-UD	16-May-1994	Sulfate	8,500,000.00	=	2,400,000.00	ug/L
NBBW	Groundwater	3rd Qtr 1994	Compliance	MW-1000	25-July-1994	1,1-Dichloroethene	27.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1994	Compliance	MW-1000	25-July-1994	1,2-Dichloroethane	3.40	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1994	Compliance	MW-1000	25-July-1994	1,2-Dichloropropane	5.30	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1994	Compliance	MW-1000	25-July-1994	Tetrachloroethene	17.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1994	Compliance	MW-1000	25-July-1994	Trichloroethene	7.40	=	5.00	ug/L
NBBW	Groundwater	4th Qtr 1994	Compliance	MW-1000	14-Oct-1994	1,1-Dichloroethene	33.00	=	7.00	ug/L
NBBW	Groundwater	4th Qtr 1994	Compliance	MW-1000	14-Oct-1994	1,2-Dichloroethane	2.20	=	1.00	ug/L
NBBW	Groundwater	4th Qtr 1994	Compliance	MW-1000	14-Oct-1994	1,2-Dichloropropane	4.80	=	1.00	ug/L
NBBW	Groundwater	4th Qtr 1994	Compliance	MW-1000	14-Oct-1994	Tetrachloroethene	17.00	=	5.00	ug/L
NBBW	Groundwater	4th Qtr 1994	Compliance	MW-1000	14-Oct-1994	Trichloroethene	8.90	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1994	Compliance	MW34-UD	20-Oct-1994	Chromium, Hexavalent	300.00	=	83.47	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1994	Compliance	MW34-UD	20-Oct-1994	Nitrogen, Nitrate plus Nitrate	76,000.00	J	34,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1994	Compliance	MW33-UD	24-Oct-1994	Chromium, Hexavalent	200.00	J	83.47	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1994	Compliance	MW35-UD	24-Oct-1994	Chromium, Hexavalent	500.00	J	83.47	ug/L
NBBW	Groundwater	1st Qtr 1995	Compliance	MW-1000	20-Jan-1995	1,1-Dichloroethene	26.00	=	7.00	ug/L
NBBW	Groundwater	1st Qtr 1995	Compliance	MW-1000	20-Jan-1995	1,2-Dichloroethane	2.60	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1995	Compliance	MW-1000	20-Jan-1995	1,2-Dichloropropane	4.60	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1995	Compliance	MW-1000	20-Jan-1995	Tetrachloroethene	19.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1995	Compliance	MW-1000	20-Jan-1995	Trichloroethene	7.80	=	5.00	ug/L
NBBW	Groundwater	2nd Qtr 1995	Compliance	MW-1000	28-Apr-1995	1,1-Dichloroethene	26.00	=	7.00	ug/L
NBBW	Groundwater	2nd Qtr 1995	Compliance	MW-1000	28-Apr-1995	1,2-Dichloropropane	4.00	=	1.00	ug/L
NBBW	Groundwater	2nd Qtr 1995	Compliance	MW-1000	28-Apr-1995	Tetrachloroethene	19.00	=	5.00	ug/L
NBBW	Groundwater	2nd Qtr 1995	Compliance	MW-1000	28-Apr-1995	Trichloroethene	8.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1995	Compliance	MW-1000	14-Jul-1995	1,1,2,2-Tetrachloroethane	7.60	=	0.09	ug/L
NBBW	Groundwater	3rd Qtr 1995	Compliance	MW-1000	14-Jul-1995	1,1,2-Triochloroethane	3.60	=	3.00	ug/L
NBBW	Groundwater	3rd Qtr 1995	Compliance	MW-1000	14-Jul-1995	1,1-Dichloroethene	10.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1995	Compliance	MW-1000	14-Jul-1995	1,2-Dichloroethane	1.90	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1995	Compliance	MW-1000	14-Jul-1995	1,2-Dichloropropane	2.40	=	1.00	ug/L
NBBW	Groundwater	4th Qtr 1995	Compliance	MW-1000	31-Oct-1995	1,1,2,2-Tetrachloroethane	16.00	=	0.09	ug/L
NBBW	Groundwater	4th Qtr 1995	Compliance	MW-1000	31-Oct-1995	1,1,2-Triochloroethane	8.60	=	3.00	ug/L
NBBW	Groundwater	4th Qtr 1995	Compliance	MW-1000	31-Oct-1995	1,1-Dichloroethene	19.00	=	7.00	ug/L
NBBW	Groundwater	4th Qtr 1995	Compliance	MW-1000	31-Oct-1995	1,2-Dichloroethane	2.10	=	1.00	ug/L
NBBW	Groundwater	4th Qtr 1995	Compliance	MW-1000	31-Oct-1995	1,2-Dichloropropane	3.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1996	Compliance	MW-1000	20- Mar-1996	1,1-Dichloroethene	29.00	=	7.00	ug/L
NBBW	Groundwater	1st Qtr 1996	Compliance	MW-1000	20- Mar-1996	1,2-Dichloroethane	2.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1996	Compliance	MW-1000	20- Mar-1996	1,2-Dichloropropane	4.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1996	Compliance	MW-1000	20- Mar-1996	Tetrachloroethene	17.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1996	Compliance	MW-1000	20- Mar-1996	Trichloroethene	7.00	=	5.00	ug/L
WTP	Air	3rd Qtr 1996	Compliance	Port 8	15-Jul-1996	1,1-Dichloroethene	2,300.00	*	87.00	ug/m3
WTP	Air	3rd Qtr 1996	Compliance	Port 9	15-Jul-1996	1,1-Dichloroethene	1,500.00	*	87.00	ug/m3
NBBW	Groundwater	3rd Qtr 1996	Compliance	MW-1000	19-Jul-1996	1,1-Dichloroethene	20.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1996	Compliance	MW-1000	19-Jul-1996	1,2-Dichloroethane	2.00	=	1.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
NBBW	Groundwater	3rd Qtr 1996	Compliance	MW-1000	19-Jul-1996	1,2-Dichloropropane	3.00	J	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1996	Compliance	MW-1000	19-Jul-1996	Tetrachloroethene	12.00	=	5.00	ug/L
Ground water monitoring wells	Groundwater	3rd Qtr 1996	Compliance	Gw-120	22-Jul-1996	Thallium	10.10	=	10.00	ug/L
NBBW	Groundwater	3rd Qtr 1996	Compliance	GW-101	26-Jul-1996	Thallium	10.60	=	10.00	ug/L
WTP	Air	4th Qtr 1996	Compliance	Port 8	09-Oct-1996	1,1-Dichloroethene	860.00	*	87.00	ug/m3
WTP	Air	4th Qtr 1996	Compliance	Port 9	09-Oct-1996	1,1-Dichloroethene	110.00	*	87.00	ug/m3
WTP	Air	4th Qtr 1996	Compliance	Port 9 DUP	09-Oct-1996	1,1-Dichloroethene	100.00	*	87.00	ug/m3
NBBW	Groundwater	1st Qtr 1997	Compliance	MW-1000	22-Jan-1997	1,1-Dichloroethene	22.00	=	7.00	ug/L
NBBW	Groundwater	1st Qtr 1997	Compliance	MW-1000	22-Jan-1997	1,2-Dichloroethane	2.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1997	Compliance	MW-1000	22-Jan-1997	1,2-Dichloropropane	3.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1997	Compliance	MW-1000	22-Jan-1997	Tetrachloroethene	14.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1997	Compliance	MW-1000	22-Jan-1997	Trichloroethene	6.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1997	Compliance	GW-101	23-Jan-1997	Thallium	13.40	=	10.00	ug/L
NBBW	Groundwater	2nd Qtr 1997	Compliance	MW37-WD	23-Apr-1997	1,1-Dichloroethene	28.00	=	7.00	ug/L
NBBW	Groundwater	2nd Qtr 1997	Compliance	MW37-WD	23-Apr-1997	Tetrachloroethene	7.00	=	5.00	ug/L
NBBW	Groundwater	2nd Qtr 1997	Compliance	MW37-WD	28-May-1997	1,1-Dichloroethene	32.00	=	7.00	ug/L
NBBW	Groundwater	2nd Qtr 1997	Compliance	MW37-WD	28-May-1997	Tetrachloroethene	8.00	=	5.00	ug/L
NBBW	Groundwater	2nd Qtr 1997	Compliance	MW37-WD	28-May-1997	Trichloroethene	6.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW-1000	11-Jul-1997	1,1-Dichloroethene	12.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW-1000	11-Jul-1997	1,2-Dichloropropane	2.00	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW-1000	11-Jul-1997	Nickel	184.00	=	100.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW-1000	11-Jul-1997	Tetrachloroethene	9.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW37-WD	11-Jul-1997	1,1-Dichloroethene	32.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW37-WD	11-Jul-1997	1,2-Dichloroethane	2.00	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW37-WD	11-Jul-1997	1,2-Dichloropropane	2.00	J	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW37-WD	11-Jul-1997	Tetrachloroethene	9.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1997	Compliance	MW37-WD	11-Jul-1997	Trichloroethene	6.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW-1000	07-Jan-1998	1,2-Dichloropropane	2.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW-1000	07-Jan-1998	Nickel	195.00	=	100.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW-1000	07-Jan-1998	Tetrachloroethene	7.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW37-WD	07-Jan-1998	1,1-Dichloroethene	37.00	=	7.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW37-WD	07-Jan-1998	1,2-Dichloroethane	2.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW37-WD	07-Jan-1998	1,2-Dichloropropane	2.00	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW37-WD	07-Jan-1998	Tetrachloroethene	10.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1998	Compliance	MW37-WD	07-Jan-1998	Trichloroethene	7.00	J	5.00	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-10	27-Aug-1998	1,1,1-Trichloroethane	1,300.00	*	700.00	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-10	27-Aug-1998	1,1-Dichloroethane	2,000.00	*	400.00	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-10	27-Aug-1998	1,1-Dichloroethene	64.00	*	0.03	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-10	27-Aug-1998	Chloroform	660.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-10	27-Aug-1998	Methylene Chloride	230.00	*	0.24	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-10	27-Aug-1998	Vinyl Chloride	13.00	*	0.02	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-11	27-Aug-1998	Chloroform	18.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-11	27-Aug-1998	Toluene	170.00	*	10.24	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-11	27-Aug-1998	Xylene	14.00	*	11.80	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-8	27-Aug-1998	Chloroform	340.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-9	27-Aug-1998	Benzene	11.00	*	0.12	ug/L
LFG	Soil Gas	3rd Qtr 1998	Compliance	MP-9	27-Aug-1998	Toluene	170.00	*	10.24	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW-1000	31-Aug-1998	1,1-Dichloroethene	7.40	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW-1000	31-Aug-1998	1,2-Dichloropropane	1.10	=	1.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW-1000	31-Aug-1998	Tetrachloroethene	5.80	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	B-519	01-Sep-1998	Thallium	20.00	=	10.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	GW-114A	03-Sep-1998	Methylene Chloride	17.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	GW-114A	03-Sep-1998	Nitrogen, Nitrate	7,300.00	=	1,000.00	ug/L
Ground water monitoring wells	Groundwater	3rd Qtr 1998	POA	GW-POA1	08-Sep-1998	1,2-Dichloroethane	14,000.00	=	1.00	ug/L
Ground water monitoring wells	Groundwater	3rd Qtr 1998	POA	GW-POA1	08-Sep-1998	Trichloroethene	300.00	J	5.00	ug/L
Ground water monitoring wells	Groundwater	3rd Qtr 1998	POA	GW-POA5	09-Sep-1998	1,2-Dichloroethane	1.30	=	1.00	ug/L
Ground water monitoring wells	Groundwater	3rd Qtr 1998	Compliance	MW23-WD	09-Sep-1998	Thallium	21.00	=	10.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	B-306	10-Sep-1998	Thallium	12.00	=	10.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW37-WD	11-Sep-1998	1,1-Dichloroethene	49.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW37-WD	11-Sep-1998	1,2-Dichloroethane	1.60	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW37-WD	11-Sep-1998	1,2-Dichloropropane	1.70	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW37-WD	11-Sep-1998	Bis(2-Ethylhexyl)phthalate	20.00	=	10.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW37-WD	11-Sep-1998	Tetrachloroethene	10.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1998	Compliance	MW37-WD	11-Sep-1998	Trichloroethene	7.70	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW54-WD	14-Sep-1998	Uranium-238	2.80	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW46-WD	15-Sep-1998	Uranium-235	3.90	=	3.00	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW46-WD	15-Sep-1998	Uranium-238	21.00	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW48-WD	15-Sep-1998	Lead-210	1.10	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW48-WD	15-Sep-1998	Uranium-238	6.10	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW53-WD	15-Sep-1998	Lead-210	1.30	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW53-WD	15-Sep-1998	Selenium	380.00	=	371.98	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW53-WD	15-Sep-1998	Uranium-238	20.00	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW50-WD	22-Sep-1998	Lead-210	1.60	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW52-WD	22-Sep-1998	Lead-210	0.90	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW52-WD	22-Sep-1998	Uranium-238	3.80	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW45-WD	23-Sep-1998	Uranium-238	12.00	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW47-WD	23-Sep-1998	Alpha, Gross	70.00	=	55.40	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW47-WD	23-Sep-1998	Lead-210	2.40	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW47-WD	23-Sep-1998	Uranium-235	6.40	=	3.00	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW47-WD	23-Sep-1998	Uranium-238	44.00	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW49-WD	23-Sep-1998	Lead-210	1.20	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW49-WD	23-Sep-1998	Uranium-238	4.50	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW51-WD	23-Sep-1998	Methylene Chloride	17.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW51-WD	23-Sep-1998	Tetrachloroethene	11.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	1,1-Dichloroethene	27.00	J	7.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	1,2-Dichloroethane	4,100.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	Chloroform	210.00	=	6.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	Cis-1,2-Dichloroethene	150.00	=	70.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	Iron	3,100.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	Methylene Chloride	20.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	Tetrachloroethene	26.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	Trichloroethene	150.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW38-WD	24-Sep-1998	Uranium-238	9.10	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW40-WD	24-Sep-1998	Uranium-235	3.20	=	3.00	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW40-WD	24-Sep-1998	Uranium-238	16.00	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW42-WD	24-Sep-1998	Lead-210	1.20	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW42-WD	24-Sep-1998	Uranium-238	2.60	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW43-WD	24-Sep-1998	Manganese	8,300.00	=	1,620.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW43-WD	24-Sep-1998	Methylene Chloride	7.30	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW43-WD	24-Sep-1998	Uranium-238	3.80	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW39-WD	25-Sep-1998	Tetrachloroethene	8.50	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW39-WD	25-Sep-1998	Uranium-235	4.30	=	3.00	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW39-WD	25-Sep-1998	Uranium-238	20.00	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-11I	25-Sep-1998	Methylene Chloride	69.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-11I	25-Sep-1998	Tetrachloroethene	14.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-11I	25-Sep-1998	Trichloroethene	16.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-14I	25-Sep-1998	Methylene Chloride	8.50	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-15I	25-Sep-1998	1,1-Dichloroethene	8.80	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-15I	25-Sep-1998	Methylene Chloride	30.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-15I	25-Sep-1998	Tetrachloroethene	140.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-15I	25-Sep-1998	Trichloroethene	21.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW41-WD	28-Sep-1998	Lead-210	1.00	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW41-WD	28-Sep-1998	Manganese	4,700.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW41-WD	28-Sep-1998	Uranium-235	3.10	=	3.00	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Compliance	MW41-WD	28-Sep-1998	Uranium-238	14.00	=	1.70	PCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-8I	28-Sep-1998	1,2-Dichloroethane	1.30	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-8I	28-Sep-1998	Trichloroethene	6.20	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-2I	29-Sep-1998	1,2-Dichloropropane	1.10	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-2I	29-Sep-1998	Tetrachloroethene	11.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-3I	29-Sep-1998	Methylene Chloride	6.50	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-3I	29-Sep-1998	Tetrachloroethene	44.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-3I	29-Sep-1998	Trichloroethene	14.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-3I	29-Sep-1998	Vinyl Chloride	9.80	=	2.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-4I	29-Sep-1998	Vinyl Chloride	2.80	=	2.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-13I	01-Oct-1998	1,2-Dichloroethane	4.50	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-13I	01-Oct-1998	Methylene Chloride	160.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1998	Performance	PM-13I	01-Oct-1998	Trichloroethene	11.00	=	5.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	01-Oct-1998	1,1,1-Trichloroethane	1,400.00	*	700.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	01-Oct-1998	1,1-Dichloroethane	1,300.00	*	400.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	01-Oct-1998	Chloroform	410.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	01-Oct-1998	Methylene Chloride	100.00	*	0.24	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	01-Oct-1998	Xylene	14.00	*	11.80	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-11	01-Oct-1998	Chloroform	27.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-11	01-Oct-1998	Xylene	23.00	*	11.80	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-8	01-Oct-1998	Chloroform	130.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-8	01-Oct-1998	Toluene	16.00	*	10.24	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-8	01-Oct-1998	Xylene	20.00	*	11.80	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-9	01-Oct-1998	Benzene	13.00	*	0.12	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-9	01-Oct-1998	Toluene	12.00	*	10.24	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	27-Oct-1998	1,1,1-Trichloroethane	1,800.00	*	700.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	27-Oct-1998	1,1-Dichloroethane	1,900.00	*	400.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	27-Oct-1998	Chloroform	520.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	27-Oct-1998	Methylene Chloride	180.00	*	0.24	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-11	27-Oct-1998	Chloroform	18.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-8	27-Oct-1998	Chloroform	110.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-9	27-Oct-1998	Benzene	21.00	*	0.12	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW38-WD	20-Nov-1998	1,1-Dichloroethene	27.00	J	7.00	ug/L

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Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW38-WD	20-Nov-1998	1,2-Dichloroethane	3,700.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW38-WD	20-Nov-1998	Chloroform	180.00	=	6.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW38-WD	20-Nov-1998	Cis-1,2-Dichloroethene	120.00	=	70.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW38-WD	20-Nov-1998	Iron	2,300.00	J	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW38-WD	20-Nov-1998	Tetrachloroethene	26.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW38-WD	20-Nov-1998	Trichloroethene	140.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW49-WD	23-Nov-1998	Manganese	1,920.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW39-WD	24-Nov-1998	Tetrachloroethene	9.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW43-WD	24-Nov-1998	Manganese	6,970.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW45-WD	24-Nov-1998	Thallium	10.20	J	10.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW48-WD	24-Nov-1998	Manganese	8,050.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW51-WD	24-Nov-1998	Tetrachloroethene	7.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW52-WD	24-Nov-1998	Iron	3,760.00	=	2,060.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	07-Dec-1998	1,1,1-Trichloroethane	2,000.00	=	700.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	07-Dec-1998	1,1-Dichloroethane	1,900.00	=	400.00	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	07-Dec-1998	Chloroform	560.00	=	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-10	07-Dec-1998	Methylene Chloride	260.00	=	0.24	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-11	07-Dec-1998	Chloroform	39.00	=	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-11	07-Dec-1998	Toluene	19.00	=	10.24	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-8	07-Dec-1998	Chloroform	71.00	=	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-9	07-Dec-1998	1,2-Dichloroethane	16.00	=	0.04	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-9	07-Dec-1998	Benzene	31.00	=	0.12	ug/L
LFG	Soil Gas	4th Qtr 1998	Compliance	MP-9	07-Dec-1998	Toluene	12.00	=	10.24	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-2I	21-Dec-1998	1,2-Dichloropropane	1.30	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-2I	21-Dec-1998	Tetrachloroethene	10.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-3I	21-Dec-1998	Methylene Chloride	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-3I	21-Dec-1998	Tetrachloroethene	59.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-3I	21-Dec-1998	Trichloroethene	21.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-3I	21-Dec-1998	Vinyl Chloride	12.00	=	2.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	1,1-Dichloroethene	64.00	J	7.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	1,2-Dichloroethane	16,000.00	=	1.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	Benzene	34.00	J	5.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	Chloroform	29.00	J	6.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	Methylene Chloride	22.00	J	5.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	Tetrachloroethene	32.00	J	5.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	Trichloroethene	320.00	J	5.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1998	POA	GW-POA1	22-Dec-1998	Trichloroethene	350.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Compliance	MW41-WD	23-Dec-1998	Manganese	3,340.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-11I	23-Dec-1998	Methylene Chloride	18.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-11I	23-Dec-1998	Tetrachloroethene	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-11I	23-Dec-1998	Trichloroethene	15.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-14I	23-Dec-1998	Methylene Chloride	6.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-15I	23-Dec-1998	1,1-Dichloroethene	7.60	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-15I	23-Dec-1998	Methylene Chloride	24.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-15I	23-Dec-1998	Tetrachloroethene	140.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-15I	23-Dec-1998	Trichloroethene	23.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-4I	23-Dec-1998	1,2-Dichloroethane	1.20	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1998	Performance	PM-4I	23-Dec-1998	Vinyl Chloride	3.00	=	2.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 1999	POA	GW-POA1	11-Jan-1999	1,2-Dichloroethane	17,000.00	=	1.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
Ground water monitoring wells	Groundwater	1st Qtr 1999	POA	GW-POA1	11-Jan-1999	Acetone	1,700.00	J	1,600.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 1999	POA	GW-POA1	11-Jan-1999	Cis-1,2-Dichloroethene	79.00	J	70.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 1999	POA	GW-POA1	11-Jan-1999	Trichloroethene	380.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW46-WD	13-Jan-1999	Potassium-40	170.00	=	4.30	pCi/L
NBBW	Groundwater	1st Qtr 1999	Compliance	GW-114A	13-Jan-1999	Methylene Chloride	36.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	GW-114A	13-Jan-1999	Thallium	14.50	J	10.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	GW-114A	13-Jan-1999	Trichloroethene	6.30	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	MW-1000	13-Jan-1999	1,2-Dichloropropane	1.10	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	MW37-WD	13-Jan-1999	1,1-Dichloroethene	48.00	=	7.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	MW37-WD	13-Jan-1999	1,2,-Dichloroethane	1.60	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	MW37-WD	13-Jan-1999	1,2-Dichloropropane	1.70	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	MW37-WD	13-Jan-1999	Tetrachloroethene	9.60	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 1999	Compliance	MW37-WD	13-Jan-1999	Trichloroethene	8.30	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW47-WD	14-Jan-1999	Alpha, Gross	130.00	=	55.40	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW47-WD	14-Jan-1999	Potassium-40	230.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW47-WD	14-Jan-1999	Thallium	17.40	J	10.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW48-WD	14-Jan-1999	Manganese	2,100.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW49-WD	14-Jan-1999	Potassium-40	330.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW49-WD	14-Jan-1999	Thallium	32.10	J	10.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW38-WD	15-Jan-1999	1,2-Dichloroethane	3,900.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW38-WD	15-Jan-1999	Chloroform	200.00	J	6.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW38-WD	15-Jan-1999	Cis-1,2-Dichloroethene	140.00	=	70.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW38-WD	15-Jan-1999	Iron	2,120.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW38-WD	15-Jan-1999	Potassium-40	220.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW38-WD	15-Jan-1999	Trichloroethene	150.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW45-WD	15-Jan-1999	Potassium-40	290.00	J	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW39-WD	19-Jan-1999	Potassium-40	76.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW39-WD	19-Jan-1999	Tetrachloroethene	13.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW40-WD	19-Jan-1999	Potassium-40	78.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW42-WD	19-Jan-1999	Potassium-40	140.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW43-WD	19-Jan-1999	Manganese	7,230.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW43-WD	19-Jan-1999	Methylene Chloride	12.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW43-WD	19-Jan-1999	Potassium-40	12.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW41-WD	20-Jan-1999	Manganese	5,790.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW41-WD	20-Jan-1999	Potassium-40	250.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW50-WD	20-Jan-1999	Potassium-40	150.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW51-WD	20-Jan-1999	Tetrachloroethene	7.70	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW52-WD	20-Jan-1999	Iron	4,680.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW52-WD	20-Jan-1999	Potassium-40	290.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW53-WD	20-Jan-1999	Potassium-40	180.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Compliance	MW54-WD	20-Jan-1999	Potassium-40	280.00	=	4.30	pCi/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-10	04-Feb-1999	1,1,1-Trichloroethane	1,600.00	*	700.00	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-10	04-Feb-1999	1,1-Dichloroethane	1,800.00	*	400.00	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-10	04-Feb-1999	Chloroform	450.00	*	0.04	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-10	04-Feb-1999	Methylene Chloride	290.00	*	0.24	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-11	04-Feb-1999	Chloroform	28.00	*	0.04	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-8	04-Feb-1999	Chloroform	44.00	*	0.04	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-9	04-Feb-1999	Benzene	29.00	*	0.12	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Performance	PM-13I	16-Mar-1999	1,2-Dichloroethene	1.50	J	1.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Performance	PM-13I	16-Mar-1999	Methylene Chloride	41.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 1999	Performance	PM-13I	16-Mar-1999	Trichloroethene	8.30	=	5.00	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-10	26-Mar-1999	Chloroform	60.00	*	0.04	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-10	26-Mar-1999	Methylene Chloride	35.00	*	0.24	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-11	26-Mar-1999	Chloroform	32.00	*	0.04	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-8	26-Mar-1999	Chloroform	20.00	*	0.04	ug/L
LFG	Soil Gas	1st Qtr 1999	Compliance	MP-9	26-Mar-1999	Benzene	28.00	*	0.12	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW38-WD	06-Apr-1999	1,2-Dichloroethane	4,000.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW38-WD	06-Apr-1999	Chloroform	190.00	=	6.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW38-WD	06-Apr-1999	Cis-1,2-Dichloroethene	130.00	=	70.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW38-WD	06-Apr-1999	Tetrachloroethene	28.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW38-WD	06-Apr-1999	Trichloroethene	140.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW39-WD	06-Apr-1999	Tetrachloroethene	13.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW39-WD	06-Apr-1999	Thallium	12.00	=	10.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW41-WD	06-Apr-1999	Manganese	5,240.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW42-WD	06-Apr-1999	Thallium	17.20	=	10.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW43-WD	06-Apr-1999	1,2-Dichloroethane	5.00	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW43-WD	06-Apr-1999	Manganese	8,560.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW45-WD	06-Apr-1999	Thallium	25.40	=	10.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW46-WD	06-Apr-1999	Thallium	22.00	=	10.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW47-WD	08-Apr-1999	Thallium	10.10	J	10.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW48-WD	08-Apr-1999	Manganese	4,470.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW50-WD	08-Apr-1999	Thallium	24.20	J	10.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Compliance	MW51-WD	08-Apr-1999	Tetrachloroethene	9.40	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-4I	08-Apr-1999	1,2-Dichloroethane	1.60	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-4I	08-Apr-1999	Tetrachloroethene	5.10	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-4I	08-Apr-1999	Vinyl Chloride	3.20	=	2.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-11I	09-Apr-1999	Methylene Chloride	20.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-11I	09-Apr-1999	Tetrachloroethene	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-11I	09-Apr-1999	Trichloroethene	16.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-13I	09-Apr-1999	Methylene Chloride	21.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-13I	09-Apr-1999	Tetrachloroethene	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-13I	09-Apr-1999	Trichloroethene	17.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-14I	09-Apr-1999	Methylene Chloride	6.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-15I	09-Apr-1999	1,1-Dichloroethene	7.80	J	7.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-15I	09-Apr-1999	Methylene Chloride	22.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-15I	09-Apr-1999	Tetrachloroethene	120.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-15I	09-Apr-1999	Trichloroethene	19.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-2I	09-Apr-1999	1,2-Dichloropropane	1.10	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-2I	09-Apr-1999	Tetrachloroethene	7.90	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-3I	09-Apr-1999	Methylene Chloride	14.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-3I	09-Apr-1999	Tetrachloroethene	42.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-3I	09-Apr-1999	Trichloroethene	21.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 1999	Performance	PM-3I	09-Apr-1999	Vinyl Chloride	5.60	=	2.00	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	30-Apr-1999	1,1,1-Tetrachloroethane	1,100.00	*	700.00	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	30-Apr-1999	1,1-Dichloroethane	950.00	*	400.00	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	30-Apr-1999	Chloroform	270.00	*	0.04	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	30-Apr-1999	Methylene Chloride	140.00	*	0.24	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-11	30-Apr-1999	Chloroform	26.00	*	0.04	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-11	30-Apr-1999	Methylene Chloride	8.90	*	0.24	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-8	30-Apr-1999	Chloroform	26.00	*	0.04	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-9	30-Apr-1999	1,2-Dichloroethane	12.00	*	0.04	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-9	30-Apr-1999	Benzene	29.00	*	0.12	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-9	30-Apr-1999	Toluene	14.00	*	10.24	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-9	04-May-1999	Methane	7.00	*	5.00	%LEL
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	26-May-1999	1,1,1-Trichloroethane	1,200.00	*	700.00	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	26-May-1999	1,1-Dichloroethane	1,100.00	*	400.00	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	26-May-1999	Chloroform	280.00	*	0.04	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-10	26-May-1999	Methylene Chloride	150.00	*	0.24	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-11	26-May-1999	Chloroform	28.00	*	0.04	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-8	26-May-1999	Benzene	18.00	*	0.12	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-8	26-May-1999	Chloroform	20.00	*	0.04	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-8	26-May-1999	Toluene	81.00	*	10.24	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-8	26-May-1999	Xylene	49.00	*	11.80	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-9	26-May-1999	Benzene	27.00	*	0.12	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-9	26-May-1999	Toluene	14.00	*	10.24	ug/L
LFG	Soil Gas	2nd Qtr 1999	Compliance	MP-9	26-May-1999	Xylene	12.00	*	11.80	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	12-Jul-1999	1,1,1-Trichloroethane	860.00	*	700.00	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	12-Jul-1999	1,1-Dichloroethane	790.00	*	400.00	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	12-Jul-1999	Chloroform	260.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	12-Jul-1999	Methylene Chloride	120.00	*	0.24	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-11	12-Jul-1999	Chloroform	31.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-8	12-Jul-1999	Chloroform	22.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-9	12-Jul-1999	Benzene	8.60	*	0.12	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	GW-114A	26-Jul-1999	Methylene Chloride	14.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	MW-1000	26-Jul-1999	1,2-Dichloropropane	1.50	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	MW-1000	26-Jul-1999	Tetrachloroethene	5.30	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW38-WD	03-Aug-1999	1,2-Dichloroethane	3,100.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW38-WD	03-Aug-1999	Chloroform	150.00	J	6.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW38-WD	03-Aug-1999	Cis-1,2-Dichloroethene	120.00	J	70.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW38-WD	03-Aug-1999	Tetrachloroethene	28.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW38-WD	03-Aug-1999	Trichloroethene	110.00	J	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	MW37-WD	03-Aug-1999	1,1-Dichloroethene	54.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	MW37-WD	03-Aug-1999	1,2-Dichloroethane	1.80	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	MW37-WD	03-Aug-1999	1,2-Dichloropropane	1.90	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	MW37-WD	03-Aug-1999	Tetrachloroethene	11.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 1999	Compliance	MW37-WD	03-Aug-1999	Trichloroethene	8.80	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW51-WD	19-Aug-1999	Tetrachloroethene	7.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW39-WD	20-Aug-1999	Tetrachloroethene	16.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Compliance	MW43-WD	20-Aug-1999	1,2-Dichloroethane	2.10	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Aug-1999	1,2-Dichloroethane	1.60	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Aug-1999	Tetrachloroethene	130.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Aug-1999	Trichloroethene	24.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	02-Sep-1999	Methylene Chloride	50.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	02-Sep-1999	Tetrachloroethene	16.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	02-Sep-1999	Trichloroethene	21.00	=	5.00	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	21-Sep-1999	1,1,1-Trichloroethane	1,200.00	*	700.00	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	21-Sep-1999	1,1-Dichloroethane	1,300.00	*	400.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	21-Sep-1999	2-Butanone	12,000.00	*	700.00	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	21-Sep-1999	Chloroform	390.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-10	21-Sep-1999	Methylene Chloride	220.00	*	0.24	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-11	21-Sep-1999	Benzene	49.00	*	0.12	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-11	21-Sep-1999	Chloroform	12.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-11	21-Sep-1999	Toluene	90.00	*	10.24	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-11	21-Sep-1999	Xylene	87.00	*	11.80	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-8	22-Sep-1999	2-Butanone	840.00	*	700.00	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-8	22-Sep-1999	Benzene	17.00	*	0.12	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-8	22-Sep-1999	Chloroform	26.00	*	0.04	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-8	22-Sep-1999	Toluene	34.00	*	10.24	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-8	22-Sep-1999	Xylene	34.00	*	11.80	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-9	22-Sep-1999	2-Butanone	1,600.00	*	700.00	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-9	22-Sep-1999	Benzene	300.00	*	0.12	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-9	22-Sep-1999	Toluene	510.00	*	10.24	ug/L
LFG	Soil Gas	3rd Qtr 1999	Compliance	MP-9	22-Sep-1999	Xylene	260.00	*	11.80	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	BM-15N1	29-Sep-1999	Manganese	1,710.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	BM-15N1	29-Sep-1999	Tetrachloroethene	7.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	BM-15N1	29-Sep-1999	Tetrachloroethene	7.40	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	BM-15N2	29-Sep-1999	Manganese	1,710.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	BM-15N2	29-Sep-1999	Nitrogen, Nitrate	33,900.00	=	29,100.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	30-Sep-1999	Methylene Chloride	23.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	30-Sep-1999	Methylene Chloride	27.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	30-Sep-1999	Tetrachloroethene	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	30-Sep-1999	Tetrachloroethene	13.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-11I	30-Sep-1999	Trichloroethene	16.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Sep-1999	1,2-Dichloroethane	1.90	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Sep-1999	Benzene	5.10	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Sep-1999	Methylene Chloride	13.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Sep-1999	Nitrogen, Nitrate	39,700.00	=	29,100.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Sep-1999	Tetrachloroethene	130.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 1999	Performance	PM-15I	30-Sep-1999	Trichloroethene	25.00	=	5.00	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-10	20-Oct-1999	Xylene	12.00	*	11.80	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-8	20-Oct-1999	Chloroform	17.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-8	20-Oct-1999	Dichlorodiflouro	990.00	*	274.00	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-8	20-Oct-1999	Xylene	19.00	*	11.80	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-9	20-Oct-1999	Benzene	19.00	*	0.12	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW40-WD	26-Oct-1999	Nitrogen, Nitrate	6,100.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW41-WD	26-Oct-1999	Nitrogen, Nitrate	3,700.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW42-WD	26-Oct-1999	Nitrogen, Nitrate	4,300.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW43-WD	26-Oct-1999	Iron	3,060.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW43-WD	26-Oct-1999	Manganese	6,370.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW45-WD	26-Oct-1999	Thallium	10.70	=	10.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW38-WD	27-Oct-1999	1,1-Dichloroethene	26.00	J	7.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW38-WD	27-Oct-1999	1,2-Dichloroethane	3,300.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW38-WD	27-Oct-1999	Chloroform	170.00	=	6.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW38-WD	27-Oct-1999	Tetrachloroethene	35.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW38-WD	27-Oct-1999	Trichloroethene	140.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW39-WD	27-Oct-1999	Nitrogen, Nitrate	3,000.00	=	1,000.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW39-WD	27-Oct-1999	Tetrachloroethene	14.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW46-WD	27-Oct-1999	Nitrogen, Nitrite	9,700.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW47-WD	27-Oct-1999	Nitrogen, Nitrite	13,100.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW48-WD	27-Oct-1999	Nitrogen, Nitrite	3,700.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW51-WD	27-Oct-1999	Tetrachloroethene	13.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW53-WD	27-Oct-1999	Nitrogen, Nitrite	15,800.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW49-WD	28-Oct-1999	Nitrogen, Nitrite	12,600.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW50-WD	28-Oct-1999	Nitrogen, Nitrite	14,100.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW58-WD	08-Nov-1999	Nitrogen, Nitrite	10,700.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW56-WD	09-Nov-1999	Nitrogen, Nitrite	1,700.00	=	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Compliance	MW59-WD	10-Nov-1999	Nitrogen, Nitrite	13,900.00	=	1,000.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1999	POA	GW-POA1	12-Nov-1999	1,2-Dichloroethane	5,800.00	=	1.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1999	POA	GW-POA1	12-Nov-1999	Methylene Chloride	67.00	J	5.00	ug/L
Ground water monitoring wells	Groundwater	4th Qtr 1999	POA	GW-POA1	12-Nov-1999	Trichloroethene	140.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Performance	PM-15I	15-Nov-1999	1,1-Dichloroethene	13.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Performance	PM-15I	15-Nov-1999	Methylene Chloride	16.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Performance	PM-15I	15-Nov-1999	Tetrachloroethene	120.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Performance	PM-15I	15-Nov-1999	Trichloroethene	15.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 1999	Performance	PM-15I	15-Nov-1999	Vinyl Chloride	2.60	J	2.00	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-8	22-Nov-1999	Chloroform	16.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-9	22-Nov-1999	Methylene Chloride	15.00	*	0.24	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-10	21-Dec-1999	Chloroform	48.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-10	21-Dec-1999	Dichlorodiflouro.	330.00	*	274.00	ug/L
LFG	Soil Gas	4th Qtr 1999	Compliance	MP-8	21-Dec-1999	Chloroform	13.00	*	0.04	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100S	13-Jan-2000	1,2-Dichloroethane	1.70	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100S	13-Jan-2000	Trichloroethene	8.80	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	13-Jan-2000	1,2-Dichloroethane	29.00	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	13-Jan-2000	Methylene Chloride	36.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	13-Jan-2000	Tetrachloroethene	8.90	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	13-Jan-2000	Trichloroethene	18.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100N	14-Jan-2000	Tetrachloroethene	8.60	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100N	14-Jan-2000	Trichloroethene	9.60	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	14-Jan-2000	1,1-Dichloroethene	12.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	14-Jan-2000	1,2-Dichloroethane	180.00	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	14-Jan-2000	Tetrachloroethene	11.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	14-Jan-2000	Trichloroethene	27.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-11I	14-Jan-2000	Tetrachloroethene	11.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-11I	14-Jan-2000	Tetrachloroethene	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-11I	14-Jan-2000	Trichloroethene	15.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-11I	14-Jan-2000	Trichloroethene	14.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15N1	18-Jan-2000	1,2-Dichloroethane	14.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15N1	18-Jan-2000	Trichloroethene	5.40	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15N2	18-Jan-2000	1,2-Dichloroethane	13.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-15I	18-Jan-2000	1,1-Dichloroethene	21.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-15I	18-Jan-2000	Methylene Chloride	21.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-15I	18-Jan-2000	Tetrachloroethene	140.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-15I	18-Jan-2000	Trichloroethene	15.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	PM-15I	18-Jan-2000	Vinyl Chloride	3.70	J	2.00	ug/L
LFG	Soil Gas	1st Qtr 2000	Compliance	MP-10	18-Jan-2000	Chloroform	14.00	*	0.04	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
LFG	Soil Gas	1st Qtr 2000	Compliance	MP-8	18-Jan-2000	Toluene	14.00	*	10.24	ug/L
LFG	Soil Gas	1st Qtr 2000	Compliance	MP-9	18-Jan-2000	Benzene	16.00	G*	0.12	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	19-Jan-2000	1,1-Dichloroethene	46.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	19-Jan-2000	1,2-Dichloroethane	2.10	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	19-Jan-2000	Methylene Chloride	34.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	19-Jan-2000	Trichloroethene	20.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	19-Jan-2000	Vinyl Chloride	3.70	J	2.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	27-Jan-2000	1,1-Dichloroethene	18.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	27-Jan-2000	1,2-Dichloroethane	6.30	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	27-Jan-2000	Methylene Chloride	13.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	27-Jan-2000	Tetrachloroethene	8.80	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	27-Jan-2000	Trichloroethene	31.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	27-Jan-2000	Vinyl Chloride	3.70	=	2.00	ug/L
LFG	Soil Gas	1st Qtr 2000	Compliance	MP-19	28-Jan-2000	1,2-dichloroethane	54.00	=	20.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100N	07-Feb-2000	1,2-Dichloroethane	4.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100N	07-Feb-2000	Methylene Chloride	11.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100N	07-Feb-2000	Tetrachloroethene	8.80	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100N	07-Feb-2000	Trichloroethene	11.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-100S	07-Feb-2000	Methylene Chloride	8.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	07-Feb-2000	1,2-Dichloroethane	5.30	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	07-Feb-2000	Methylene Chloride	28.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	07-Feb-2000	Tetrachloroethene	6.50	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50N	07-Feb-2000	Trichloroethene	10.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	07-Feb-2000	1,2-Dichloroethane	25.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	07-Feb-2000	Methylene Chloride	60.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	07-Feb-2000	Tetrachloroethene	6.50	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-11I-50S	07-Feb-2000	Trichloroethene	14.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW39-WD	10-Feb-2000	Tetrachloroethene	19.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW43-WD	10-Feb-2000	Iron	19,700.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW43-WD	10-Feb-2000	Manganese	6,050.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW51-WD	11-Feb-2000	Tetrachloroethene	13.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	14-Feb-2000	1,1-Dichloroethene	21.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	14-Feb-2000	1,2-Dichloroethane	13.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	14-Feb-2000	Methylene Chloride	36.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-100S	14-Feb-2000	Trichloroethene	16.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	14-Feb-2000	1,1-Dichloroethene	15.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	14-Feb-2000	1,2-Dichloroethane	1.50	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	14-Feb-2000	Methylene Chloride	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	14-Feb-2000	Tetrachloroethene	6.50	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	14-Feb-2000	Trichloroethene	25.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-50S	14-Feb-2000	Vinyl Chloride	2.80	J	2.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	1,1-Dichloroethene	30.00	J	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	1,2-Dichloroethane	3,600.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	Benzene	10.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	Chloroform	150.00	=	6.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	Cis-1,2-Dichloroethene	130.00	=	70.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	Methylene Chloride	23.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	Tetrachloroethene	29.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Compliance	MW38-WD	16-Feb-2000	Trichloroethene	130.00	=	5.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
Ground water monitoring wells	Groundwater	1st Qtr 2000	POA	GW-POA1	16-Feb-2000	1,1-Dichloroethene	15.00	J	7.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2000	POA	GW-POA1	16-Feb-2000	1,2-Dichloroethane	3,700.00	=	1.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2000	POA	GW-POA1	16-Feb-2000	Methylene Chloride	22.00	J	5.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2000	POA	GW-POA1	16-Feb-2000	Trichloroethene	120.00	=	5.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2000	POA	GW-POA4	16-Feb-2000	1,2-Dichloroethane	3.30	=	1.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2000	POA	GW-POA5	16-Feb-2000	1,2-Dichloroethane	5.90	=	1.00	ug/L
NBBW	Groundwater	1st Qtr 2000	Compliance	GW-114A	16-Feb-2000	Methylene Chloride	20.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 2000	Compliance	MW37-WD	16-Feb-2000	1,1-Dichloroethene	52.00	=	7.00	ug/L
NBBW	Groundwater	1st Qtr 2000	Compliance	MW37-WD	16-Feb-2000	1,2-Dichloroethane	1.70	J	1.00	ug/L
NBBW	Groundwater	1st Qtr 2000	Compliance	MW37-WD	16-Feb-2000	1,2-Dichloropropane	1.80	J	1.00	ug/L
NBBW	Groundwater	1st Qtr 2000	Compliance	MW37-WD	16-Feb-2000	Tetrachloroethene	13.00	=	5.00	ug/L
NBBW	Groundwater	1st Qtr 2000	Compliance	MW37-WD	16-Feb-2000	Trichloroethene	10.00	=	5.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2000	POA	GW-POA2	21-Feb-2000	1,2-Dichloroethane	2.80	=	1.00	ug/L
LFG	Soil Gas	1st Qtr 2000	Compliance	MP-8	23-Feb-2000	Chloroform	10.00	*	0.04	ug/L
LFG	Soil Gas	1st Qtr 2000	Compliance	MP-9	23-Feb-2000	Benzene	9.30	G*	0.12	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15N1	24-Feb-2000	1,2-Dichloroethane	12.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15N1	24-Feb-2000	Tetrachloroethene	5.70	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15N2	24-Feb-2000	1,2-Dichloroethane	10.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-150S	23-Mar-2000	1,1-Dichloroethene	16.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-150S	23-Mar-2000	1,2-Dichloroethane	3.10	J	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2000	Performance	BM-15I-150S	23-Mar-2000	Trichloroethene	14.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-150N	04-Apr-2000	Tetrachloroethene	6.20	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-150N	04-Apr-2000	Trichloroethene	6.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-200N	05-Apr-2000	1,2-Dichloroethane	3.90	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-15N3	05-Apr-2000	1,2-Dichloroethane	4.60	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW39-WD	12-Apr-2000	Tetrachloroethene	15.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW43-WD	14-Apr-2000	Iron	14,900.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW43-WD	14-Apr-2000	Manganese	5,490.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW51-WD	14-Apr-2000	Tetrachloroethene	9.30	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW38-WD	17-Apr-2000	1,1-Dichloroethene	30.00	J	7.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW38-WD	17-Apr-2000	1,2-Dichloroethane	3,800.00	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW38-WD	17-Apr-2000	Chloroform	170.00	=	6.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW38-WD	17-Apr-2000	Cis-1,2-Dichloroethene	140.00	=	70.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW38-WD	17-Apr-2000	Tetrachloroethene	33.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW38-WD	17-Apr-2000	Trichloroethene	140.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Compliance	MW60-WD	17-Apr-2000	1,2-Dichloroethane	3.30	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-15N3	10-May-2000	1,2-Dichloroethane	3.40	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-150N	12-May-2000	1,2-Dichloroethane	1.80	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-150N	12-May-2000	Chloroform	8.80	=	6.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-150N	12-May-2000	Trichloroethene	5.40	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-200N	12-May-2000	1,2-Dichloroethane	3.90	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-15I-150S	12-May-2000	1,2-Dichloroethane	2.10	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-15I-150S	12-May-2000	Methylene Chloride	14.00	J	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-15I-150S	12-May-2000	Trichloroethene	10.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-100S	07-Jun-2000	Americium-241	0.34	=	0.20	pCi/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-100S	07-Jun-2000	Lead-210	3.70	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-100S	07-Jun-2000	Potassium-40	31.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-11I-100S	07-Jun-2000	Uranium-238	9.10	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-15I-200S	08-Jun-2000	Americium-241	0.48	=	0.20	pCi/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
East/South/West Barrier Wall	Groundwater	2nd Qtr 2000	Performance	BM-15I-200S	08-Jun-2000	Uranium-238	10.00	=	1.70	pCi/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW-1000	11-Jul-2000	1,2-Dichloropropane	1.20	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW-1000	11-Jul-2000	Tetrachloroethene	5.10	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW37-WD	11-Jul-2000	1,1,2-Trichloroethane	3.10	J	3.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW37-WD	11-Jul-2000	1,1-Dichloroethene	150.00	=	7.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW37-WD	11-Jul-2000	1,2-Dichloroethane	4.90	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW37-WD	11-Jul-2000	1,2-Dichloropropane	5.30	=	1.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW37-WD	11-Jul-2000	Cis-1,2-Dichloroethene	80.00	=	70.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW37-WD	11-Jul-2000	Tetrachloroethene	56.00	=	5.00	ug/L
NBBW	Groundwater	3rd Qtr 2000	Compliance	MW37-WD	11-Jul-2000	Trichloroethene	30.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-4I	24-Jul-2000	1,2-Dichloroethane	3.50	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-4I	24-Jul-2000	Vinyl Chloride	3.50	=	2.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Compliance	MW43-WD	25-Jul-2000	Iron	17,700.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Compliance	MW43-WD	25-Jul-2000	Manganese	4,890.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-13I	25-Jul-2000	1,2-Dichloroethane	1.90	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-13I	25-Jul-2000	Methylene Chloride	26.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-13I	25-Jul-2000	Tetrachloroethene	6.90	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-13I	25-Jul-2000	Trichloroethene	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-11I-100N	26-Jul-2000	Tetrachloroethene	5.10	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-11I-100N	26-Jul-2000	Trichloroethene	6.30	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-11I	26-Jul-2000	Trichloroethene	7.30	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-3I	26-Jul-2000	Tetrachloroethene	39.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-3I	26-Jul-2000	Trichloroethene	15.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-3I	26-Jul-2000	Vinyl Chloride	4.90	=	2.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15I-100S	27-Jul-2000	1,1-Dichloroethene	29.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15I-100S	27-Jul-2000	Methylene Chloride	18.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15I-100S	27-Jul-2000	Trichloroethene	18.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15I-100S	27-Jul-2000	Vinyl Chloride	3.20	=	2.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15N1	27-Jul-2000	Tetrachloroethene	8.20	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15N2	27-Jul-2000	1,2-Dichloroethane	1.60	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-15I	27-Jul-2000	1,1-Dichloroethene	17.00	=	7.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-15I	27-Jul-2000	Methylene Chloride	19.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-15I	27-Jul-2000	Tetrachloroethene	95.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-15I	27-Jul-2000	Trichloroethene	12.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-15I	27-Jul-2000	Vinyl Chloride	2.60	J	2.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	PM-21	28-Jul-2000	Tetrachloroethene	9.80	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-11I-100S	01-Aug-2000	Lead-210	6.70	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-11I-100S	01-Aug-2000	Uranium-238	7.80	=	1.70	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15I-200S	01-Aug-2000	Lead-210	9.10	=	0.07	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15I-200S	01-Aug-2000	Potassium-40	224.00	=	4.30	pCi/L
East/South/West Barrier Wall	Groundwater	3rd Qtr 2000	Performance	BM-15I-200S	01-Aug-2000	Uranium-238	10.00	=	1.70	pCi/L
Ground water monitoring wells	Groundwater	3rd Qtr 2000	POA	GW-POA5	22-Aug-2000	1,2-Dichloroethane	1.70	=	1.00	ug/L
LFG	Soil Gas	3rd Qtr 2000	Compliance	MP-21	01-Sep-2000	Chloroform	250.00	=	212.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Compliance	MW39-WD	08-Nov-2000	Tetrachloroethene	19.00	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Compliance	MW43-WD	08-Nov-2000	Iron	19,400.00	=	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Compliance	MW43-WD	08-Nov-2000	Manganese	5,160.00	=	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Compliance	MW51-WD	08-Nov-2000	Tetrachloroethene	9.20	=	5.00	ug/L
WTP	WPT Effluent	4th Qtr 2000	I-118	TP-750	10-Nov-2000	1,4-Dioxane	240.00	*	200.00	ug/L
WTP	WPT Effluent	4th Qtr 2000	I-118	TP-750	10-Nov-2000	Potassium-40	74 +/- 56	*	4.30	pCi/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
LFG	Soil Gas	4th Qtr 2000	Compliance	MP-10	22-Nov-2000	Chloroform	53.00	*	0.04	ug/L
LFG	Soil Gas	4th Qtr 2000	Compliance	MP-10	22-Nov-2000	Dichlorodiflouro.	520.00	*	274.00	ug/L
LFG	Soil Gas	4th Qtr 2000	Compliance	MP-10	22-Nov-2000	Methylene Chloride	70.00	*	0.24	ug/L
LFG	Soil Gas	4th Qtr 2000	Compliance	MP-11	22-Nov-2000	Chloroform	9.80	*	0.04	ug/m3
LFG	Soil Gas	4th Qtr 2000	Compliance	MP-11	22-Nov-2000	Methylene Chloride	7.30	*	0.24	ug/L
WTP	WTP Effluent	4th Qtr 2000	I-118	TP-750	22-Nov-2000	Lead-210	2.0 +/- 1.3	*	0.07	pCi/L
WTP	WTP Effluent	4th Qtr 2000	I-118	TP-750	22-Nov-2000	Potassium-40	240 +/- 26	*	4.30	pCi/L
WTP	WTP Effluent	4th Qtr 2000	I-118	TP-750	27-Nov-2000	Beta/Photon emitters	150 +/- 30	*	80.00	pCi/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Performance	PM-4I	13-Dec-2000	1,2-Dichloroethane	2.90	=	1.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Performance	PM-4I	13-Dec-2000	Nitrogen, Nitrite	3,100.00	J	1,000.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Performance	PM-4I	13-Dec-2000	Tetrachloroethene	5.60	=	5.00	ug/L
East/South/West Barrier Wall	Groundwater	4th Qtr 2000	Performance	PM-4I	13-Dec-2000	Vinyl Chloride	4.60	=	2.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-11I-100N	08-Feb-2001	Tetrachloroethene	6.60	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-11I-100N	08-Feb-2001	Trichloroethene	7.20	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-100S	08-Feb-2001	1,1-Dichloroethene	33.00	*	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-100S	08-Feb-2001	Methylene Chloride	19.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-100S	08-Feb-2001	Trichloroethene	17.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-100S	08-Feb-2001	Vinyl Chloride	2.40	*	2.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-150S	08-Feb-2001	1,1-Dichloroethene	9.90	*	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-150S	08-Feb-2001	Methylene Chloride	6.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-150S	08-Feb-2001	Trichloroethene	7.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-50S	08-Feb-2001	1,1-Dichloroethene	14.00	*	7.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-50S	08-Feb-2001	Tetrachloroethene	6.30	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-50S	08-Feb-2001	Trichloroethene	19.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-50S	08-Feb-2001	Vinyl Chloride	3.10	*	2.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	BM-15I-NI	08-Feb-2001	Tetrachloroethene	8.50	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-11I	08-Feb-2001	Tetrachloroethene	5.10	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-11I	08-Feb-2001	Trichloroethene	7.60	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-15I	08-Feb-2001	1,1-Dichloroethene	14.00	*	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-15I	08-Feb-2001	Carbon Tetrachloride	3.20	*	1.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-15I	08-Feb-2001	Methylene Chloride	18.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-15I	08-Feb-2001	Tetrachloroethene	64.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-15I	08-Feb-2001	Trichloroethene	9.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	1st Qtr 2001	Performance	PM-15WR	08-Feb-2001	Selenium	502.00	*	372.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2001	POA	GW-POA1	08-Feb-2001	1,2-Dichloroethane	7,900.00	*	1.00	ug/L
Ground water monitoring wells	Groundwater	1st Qtr 2001	POA	GW-POA5	08-Feb-2001	1,2-Dichloroethane	1.20	*	1.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	GW-114A	08-Feb-2001	Methylene Chloride	8.50	*	5.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW-1000	08-Feb-2001	1,1-Dichloroethene	13.00	*	7.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW-1000	08-Feb-2001	1,2-Dichloropropane	1.50	*	1.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW-1000	08-Feb-2001	Tetrachloroethene	7.50	*	5.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW37-WD	08-Feb-2001	1,1-Dichloroethene	110.00	*	7.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW37-WD	08-Feb-2001	1,2-Dichloroethane	2.60	*	1.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW37-WD	08-Feb-2001	1,2-Dichloropropane	2.70	*	1.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW37-WD	08-Feb-2001	Nitrate, as N	47,400.00	*	29,100.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW37-WD	08-Feb-2001	Tetrachloroethene	28.00	*	5.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	MW37-WD	08-Feb-2001	Trichloroethene	17.00	*	5.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	U-701-WD	08-Feb-2001	1,1-Dichloroethene	23.00	*	7.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	U-701-WD	08-Feb-2001	1,2-Dichloropropane	1.20	*	1.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	U-701-WD	08-Feb-2001	Nickel	721.00	*	100.00	ug/L

Table 6-9
Chronological Listing of Monitoring Data that Exceed Performance Standards for Remedy Components

Component	Medium	Quarter	System	Location	Date	Contaminant	Result	Flag	Standard	Units
NBBW	Groundwater	1st Qtr 2001	Compliance	U-701-WD	08-Feb-2001	Nitrate, as N	44,900.00	*	29,100.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	U-701-WD	08-Feb-2001	Nitrate-Nitrite	47,000.00	*	34,000.00	ug/L
NBBW	Groundwater	1st Qtr 2001	Compliance	U-701-WD	08-Feb-2001	Trichloroethene	5.20	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW38-WD	01-May-2001	1,2-Dichloroethane	4,100.00	*	1.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW38-WD	01-May-2001	Chloroform	140.00	*	6.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW38-WD	01-May-2001	cis-1,2-Dichloroethene	166.00	*	70.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW38-WD	01-May-2001	Trichloroethene	120.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW39-WD	01-May-2001	Tetrachloroethene	15.00	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW43-WD	01-May-2001	Iron	12,000.00	*	2,060.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW43-WD	01-May-2001	Manganese	5,180.00	*	1,620.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW49-WD	01-May-2001	Methylene Chloride	5.10	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW49-WD	01-May-2001	Tetrachloroethene	7.90	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW49-WD	01-May-2001	Trichloroethene	7.40	*	5.00	ug/L
East/South/West Barrier Wall	Groundwater	2nd Qtr 2001	Compliance	MW51-WD	01-May-2001	Tetrachloroethene	10.00	*	5.00	ug/L

Flag Legend

= - Detect

J - Estimated value

* - Unvalidated value

G* - Unvalidated data; elevated reporting limit

Section 7 Technical Assessment

This section assesses the effectiveness of the remedy. The purpose of this assessment is to determine whether or not the remedy is, or is expected to be, protective of human health and the environment. This determination is intended to examine whether or not the remedy is achieving, or is expected to achieve, the RAOs stated in the ROD.

7.1 Basis for Determination of Effectiveness

The determination of effectiveness is made by answering three key questions specified in EPA's *Comprehensive Five-Year Review Guidance* (EPA 540-R-01-007);, June 2001):

- **Question A –** Is the remedy functioning as intended by the decision documents?
- **Question B –** Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?
- **Question C –** Has any other information come to light that could call into question the protectiveness of the remedy?

The text in this section is structured around these three questions. The answers to the questions support the determination that most of the Lowry Landfill Site remedy components are effective (that is, they are protective of human health and the environment). However, there is one component (the East/South/West Barrier Wall) and an associated additional remedy element (the Groundwater Monitoring Wells and Compliance Program) that are judged to be not currently effective. Further, the effectiveness of the NBBW cannot be determined at this time. It is expected that implementation of revised and/or additional remedial measures will be required to achieve overall remedy effectiveness.

7.2 Question A – Is the remedy functioning as intended by the decision documents?

Most of the remedy components and additional remedy elements are functioning as intended. However, the groundwater containment component of the remedy is not functioning as intended by the decision documents. Specifically, the East/South/West Barrier Wall component and the Groundwater Monitoring Wells and Compliance Program additional remedy element are not functioning as intended. This is described in more detail later in this section.

The text in this subsection describes how the determination of effectiveness was made for each remedy component and additional remedy element.

The Lowry Site remedy is complex and has a number of components and additional remedy elements. Although most of the remedy components are complete, some of the remedy components are still under construction. For components under construction, the *Comprehensive Five-Year Review Guidance* indicates that the focus should be on whether or not immediate threats have been addressed. This is done by considering the following:

- Health and Safety Plan(s) (HASPs) and/or Contingency Plan(s)
- Implementation of Institutional Controls and Other Measures

For remedy components that are complete, the above two items are considered, as well as the following additional items:

- Remedial Action Performance
- System Operations/O&M
- Cost of System Operations/O&M
- Opportunities for Optimization
- Early Indicators of Potential Remedy Failure
- Implementation of Institutional Controls and Other Measures

Because the Lowry Site has both complete and incomplete components, as well as additional remedy elements, all of the above factors are discussed in the following text, with most of the emphasis on the completed components.

7.2.1 Health and Safety Plan/Contingency Plan

Health and Safety Plan

The Respondents manage the Site, and are therefore responsible for all Site health and safety. A sitewide HASP is in place, as well as individual HASPs for various construction activities that are ongoing at the Site.

Contingency Plan

The sitewide *Final Contingency Plan* identifies emergency procedures for potential incidents at the Site, and addresses notification of emergency personnel (for example, fire or police), if warranted. This contingency plan is in place, is sufficient to control risks, and is properly implemented. Therefore, this component of the remedy is functioning as intended by the decision documents.

7.2.2 Implementation of Institutional Controls and Other Measures

Access Controls

The Respondents maintain effective fencing and security monitoring at the Site. Fences are in place and are maintained, and the Site entrance – which is shared with the DADS landfill – is monitored. The Respondents maintain a Site Command Post that is regularly staffed (see Section 4.6.3, *Operation & Maintenance Labor Requirements*). In addition, a small workforce of Respondents' staff and contractors are regularly onsite to operate systems such as the WTP, LFG flare, and groundwater and gas monitoring wells, and to continue implementation of incomplete remedy components. These controls limit the potential for exposure to the public. Therefore, this component of the remedy is functioning as intended by the decision documents.

Signage

Some of the signage is obsolete (for example, "US. Bombing & Gunnery Range" signs), some are incorrect (for example, signs regarding types of traffic to use gates at the Command Post), and some are damaged, faded, or otherwise have reduced legibility. This does not reduce the remedy's effectiveness, but all signage should be reviewed and updated as appropriate. Since the Site inspection, the Respondents have removed some signs and corrected others. When the review and update is complete, this component of the remedy is expected to function as intended by the decision documents.

Institutional Control Plan and Covenants

The SOW attached to the Order required the Respondents to submit an Institutional Controls Plan for approval by EPA. The Respondents submitted a Draft Institutional Controls Plan on September 6, 1996. By letter dated October 30, 1996, EPA disapproved the Plan and required that the Respondents submit the following: (1) changes to the Plan required by EPA; and (2) complete and acceptable covenants to run with the land outlining onsite and offsite institutional controls, which covenants were part of the Institutional Controls Plan.

The Respondents provided a copy of proposed covenants to EPA on June 24, 2001, via fax. On June 27, 2001, EPA provided a letter to the Respondents via fax stating EPA's concern that the covenants did not conform to the requirements of the ROD. The letter further stated that because it had been almost five years since EPA had reviewed and commented on the last iteration of the plan provided to EPA, and because additional information regarding institutional controls had become available to EPA since that time, EPA would again review the September 6, 1996 version of the plan and would provide additional comments on that Plan, together with comments on the covenants, by July 11, 2001. The letter requested that the Respondents not finalize the covenants or the Institutional Controls Plan until EPA's concerns regarding those documents had been resolved.

Despite EPA's request, the Respondents recorded covenants that had not been approved by EPA with the Arapahoe County Clerk and Recorder's Office on June 29, 2001. Furthermore, on August 31, 2001, they submitted an Errata Sheet to be attached to the Institutional Controls Plan that did not consider or address EPA's July 11, 2001 comments.

The implementation of the work under the Order cannot be considered to be complete until EPA-approved amended covenants that run with the land have been properly recorded, and until EPA approves the Institutional Controls Plan for the Site. When all of the Institutional Controls and associated enforcement mechanisms are approved and are in place, this component of the remedy is expected to function as intended by the decision documents.

7.2.3 Remedial Action Performance

This subsection discusses the performance of each component of the sitewide remedy, including both complete remedy components, additional remedy elements, and incomplete components.

Completed Remedy Components

Well Plugging and Abandonment Program

The Well Plugging and Abandonment Program is complete. It was implemented to remove and abandon monitoring wells that were not required to implement the remedy. Removal of these wells reduced the potential that these unused wells could act as vertical pathways for future contaminant migration, and reduced the potential for short-circuiting during operations of the landfill gas remedy. Removal of these pathways improved the overall effectiveness of the remedy. Therefore, this component of the remedy is functioning as intended by the decision documents.

Wetlands Mitigation

The Wetlands Mitigation is complete. It was intended to mitigate the wetlands destruction that occurred along the unnamed creek when the SWRA was implemented. The new wetlands are

becoming established, and the Respondents are maintaining the wetlands (for example, replacing trees damaged by animal activity). Ongoing maintenance has proven necessary in the past, and will likely be necessary in the future. This component of the remedy is functioning as intended by the decision documents.

Landfill Gas Collection and Treatment System

The installation of the LFG Collection and Treatment System is complete. It is being operated and maintained effectively by the Respondents. Ongoing monitoring is conducted at both gas monitoring probes around the landfill mass and at the influent and effluent of the LFG flare. The monitoring data indicate that the LFG Collection and Treatment System is preventing migration and release of LFG. Therefore, this component of the remedy is functioning as intended by the decision documents.

East/South/West Groundwater Barrier Wall (East/South/West Barrier Wall)

The East/South/West Barrier Wall construction is complete. This component consists of the in-place soil/bentonite cutoff wall, coupled with a groundwater monitoring program that is integrated with the "Groundwater Monitoring Wells and Compliance Program" discussed below. The monitoring program is intended to verify hydraulic containment, which is defined as maintaining an inward hydraulic gradient at the engineering feature (the barrier wall) in any areas where contaminants have been detected above Groundwater Performance Standards inside of the barrier wall. At any location where contaminants have been detected above Groundwater Performance Standards inside of the barrier wall and there is an outward hydraulic gradient, response actions to correct the gradient (that is, pumping to cause the gradient to be inward) must be initiated. The POC is located at the wall, so any exceedances observed beyond the wall that are not pre-existing contamination represent a containment failure. The Respondents are operating and maintaining this remedy component.

The East/South/West Barrier Wall has been partially effective in isolating waste and contaminants. However, as discussed in Section 4.6.2, *Changes in Operation & Mainetnance*, there are three locations at which some compounds occur beyond the East/South/West Barrier Wall at levels above the Performance Standards: MW39-WD, MW43-WD, and MW51-WD. Table 6-9 summarizes all of these exceedances. In addition, at the PM-15 area, exceedances have been observed beyond the POC immediately north of the north end of the east wall. The Respondents are currently investigating the nature and extent of each of these exceedances. Currently, since the migration pathways and mechanisms are not understood, it cannot be concluded that potential migration is controlled. Consequently, as a whole, this component of the remedy is not functioning as intended by the decision documents.

North Boundary Barrier Wall System (NBBW)

The NBBW was constructed and placed into service as an interim measure before the ROD was signed. In large part, it has been effective in preventing contaminants from leaving the Site. The ROD required that the Respondents conduct an evaluation of the effectiveness of the NBBW. This study was completed and accepted by EPA in March 1998. The study was based in part on a series of temporary piezometers that were installed and monitored for a limited time. However, review of monitoring data from compliance well U-701-WD (see Attachment 12 and Table 6-9) indicates the possibility of contaminant flow around and/or beneath the NBBW. Also, the ROD requires ongoing monitoring of the NBBW to ensure its continued protectiveness

(ROD, page 11-6). As a result, the EPA has directed the Respondents to develop a continuous monitoring system that can demonstrate capture at the NBBW.

Wells MW37-WD and GW-114A are located at the east and west ends, respectively, of the NBBW. At MW37-WD, persistent exceedances for several chlorinated compounds (principally 1,1-dichloroethene; 1,2-dichloroethane; trichloroethene; and tetrachloroethene) have been observed up to approximately 22 times above the Groundwater Performance Standards. At GW-114A, occasional detections of chlorinated compounds (principally trichloroethene and methylene chloride) have been observed within one order of magnitude above the Groundwater Performance Standards. Water monitored by GW37-WD and GW-114A may be captured by the NBBW, but this is not certain at present.

Monitoring well MW-1000 is north of the NBBW, and exhibits persistent detections of a number of chlorinated solvents above Performance Standards (see Table 6-9). The exceedances at MW-1000 are typically within one order of magnitude of the Performance Standards. As shown in Attachment 12, the general trend of these concentrations at MW-1000 appears to be downward. This may suggest that contamination at MW-1000 is not due to leakage beyond the NBBW (for example, it existed before the NBBW was installed).

Monitoring well U-701-WD is also located north of the NBBW. It exhibits persistent detections of a number of chlorinated solvents above Performance Standards (see Table 6-9). The exceedances at U-701-WD are typically within one order of magnitude of the Performance Standards. As shown in Attachment 12, although there are persistent exceedances, there is no clear trend. In addition, data regarding vertical groundwater gradients in the vicinity of the NBBW typically show a downward vertical gradient upgradient of the NBBW, and an upward vertical gradient downgradient of the NBBW. Coupled with the persistent exceedances at U-701-WD, this suggests the potential for contaminated groundwater flow beyond the NBBW.

Because performance standards are exceeded at all four of the above compliance monitoring wells, the NBBW is not functioning as intended by the decision documents.

North Face Landfill Cover

The North Face Landfill Cover is complete. The Respondents are maintaining this portion of the landfill cover as necessary. The North Face Landfill Cover has been effective in isolating waste and contaminants, and in promoting runoff to reduce infiltration. Therefore, this component of the remedy is functioning as intended by the decision documents.

Additional Remedy Elements

Landfill Cover Maintenance

The landfill cover was placed as part of the closure of the Section 6 landfill, and is complete as stated in the 1992 report, *Quality Assurance Monitoring 1992 Final Cover Construction Lowry Superfund, Section 6 Arapahoe County, Colorado* (Golder Construction Services Inc, November 1992). The ROD requires maintenance of this existing cover. Several closed depressions have formed in the cover, which will cause ponding of precipitation and therefore, will produce more infiltration than if the cover were properly sloped to drain. Therefore, this component of the remedy is not functioning as intended by the decision documents.

Surface Water Removal Action (SWRA)

The SWRA was constructed by the Respondents as an interim remedial measure, and it has been effectively operated and maintained by the Respondents. Therefore, this component of the remedy is functioning as intended by the decision documents.

Groundwater Monitoring Wells and Compliance Program

The Groundwater Monitoring Wells and Compliance Program is an ongoing part of the remedy. Specific wells and groups of wells have been completed to monitor the performance of individual remedy components, as necessary (for example, the East/South/West Groundwater Barrier Wall). For the most part, the Groundwater Monitoring Wells and Compliance Program has been effective in verifying performance of the remedy components. However, there are several areas of concern:

- **Monitoring Well Spacing in the Northern Portion of the Site.** In the northern portion of the Site, where the East/South/West Groundwater Barrier Wall does not exist, the spacing between compliance monitoring wells is too large. Information gained during remedy implementation and operation has provided a better understanding of the subsurface conditions at the Site. This resulted in revision of the Conceptual Site Model (CSM) (see Attachment 4) and a review of the existing compliance well spacing. Based on this and a review of the range of widths of sandy strata observed in Site wells, the current well spacing of 600 or more feet between some of the compliance wells in the northern part of the Site is too great to provide a reasonable degree of confidence that site-related contamination is being contained by the natural hydraulic gradients or by the gradients created by engineering controls (such as the NBBW, NTES, and East/South/West Groundwater Barrier Wall). Consequently, additional compliance monitoring wells in the northern portion of the Site are needed.

- **Lignite Layer Monitoring Wells.** There are currently four compliance monitoring wells in the lignite layer beneath the Site. This layer is intended to serve as a monitoring zone for verifying vertical containment. Review of the lateral and vertical groundwater potentials and the hydraulic properties of the subsurface materials at the Site suggests that there is potential for downward groundwater migration at the Site. Although there are two lignite wells located at the north limit of the landfill mass, there are no lignite wells located farther north. It is possible that groundwater flow downward and to the north could pass beyond the existing lignite wells and not be detected. Consequently, additional wells should be constructed in the lignite layer at locations expected that are most likely to receive potential flow from the Site's source area.

- **Monitoring Wells in the Unweathered Dawson Formation.** Currently, there are 28 monitoring wells screened only in the unweathered Dawson formation beneath the Site. This unit is located immediately beneath the weathered Dawson formation, and the contact is irregular. (Refer to the CSM, Attachment 4.) The A and C channel sands[1] at the Site are known to have portions in the weathered and in the unweathered portions of the Dawson formation. In addition, recently discovered sand strata at MW38-WD (1998) and at PM-4I (2001) are located in the unweathered Dawson formation. Although there is a series of performance monitoring wells monitoring the East/South/West Barrier Wall in the weathered Dawson formation, there are no co-located wells monitoring the unweathered

[1] The A and C Sands are described in the Remedial Investigation, OUs 1 and 6 (Harding Lawson Associates, 1992).

Dawson formation beneath the East/South/West Barrier Wall to verify containment beneath the East/South/West Barrier Wall. Similarly, there are few unweathered Dawson wells co-located with compliance monitoring wells in the weathered Dawson formation around the northern portion of the Site. It is possible that groundwater flow in the unweathered Dawson formation could pass beyond the POC without being detected by the current compliance well monitoring network. Consequently, additional wells should be constructed in the unweathered Dawson formation at locations that EPA determines are most likely to receive potential flow from the Site's source area.

- **Exceedances at the MW38-WD Area.** At the MW38-WD area, persistent exceedances more than three orders of magnitude above the Groundwater Performance Standards have been observed at the POC in an area approximately 1,200 feet north of the north end of the west reach of the East/South/West Barrier Wall. The nature and extent of each of these exceedances is currently being investigated by the Respondents. Currently, since the migration pathways and mechanism are not understood, it cannot be concluded that potential migration is controlled.

As a result of these conditions, this component of the remedy is not functioning as intended by the decision documents.

Landfill Gas Monitoring Probes and Compliance Program

The Landfill Gas Monitoring Wells and Compliance Program is an ongoing part of the remedy. A series of gas monitoring probes have been installed around the landfill mass to verify containment of LFG by the LFG Collection and Treatment System. For the most part, the LFG Monitoring Probes and Compliance Program has been effective in verifying performance of the remedy components. There were exceedances along the southern boundary of the Site, and the Respondents installed the SBSVE system to extract and treat the soil gas. The monitoring probes in this area do not show exceedances at this time. There are occasional, generally non-recurring exceedances of chloroform at MP-6 that are not considered to be an immediate threat. Therefore, this component of the remedy is functioning as intended by the decision documents.

Surface Water Monitoring

Surface water monitoring is performed at a series of three surface water monitoring points. Exceedances of surface water standards have not been observed. Therefore, this component of the remedy is functioning as intended by the decision documents.

Incomplete Remedy Components

North Toe Groundwater Extraction System (NTES)

The construction of the NTES is complete, but it has not yet been placed into service since the WTP as currently configured cannot treat the water from the NTES at the flow rate required to meet the ROD requirements. Therefore, this component of the remedy is not functioning as intended by the decision documents.

New Onsite Water Treatment Plant (WTP)

The construction of the new WTP has been completed in accordance with the approved design documents. However, EPA has not approved the construction completion report because the WTP did not meet its performance objectives. The Respondents are operating and maintaining the new WTP. It is effectively treating water from all required Site sources except the NTES.

During startup, it was determined that the new WTP is not capable of effectively treating water from the NTES at the rate required to achieve groundwater capture at the NTES in a reasonable time frame. The Respondents are conducting treatability studies to assess modifications to the new WTP to make it capable of treating all required Site sources including the NTES. The outcome of these studies is not yet known, but preliminary results from some of the treatment options being studied appear to be favorable. Based on this, it is possible that practical modifications can be identified that will allow the new WTP to treat all of the required Site water, including the NTES water at a rate consistent with groundwater capture in a reasonable time frame. However, because the treatment process modifications have not yet been proven to be practical, whether or not this component of the remedy will ultimately function as intended by the decision documents cannot be determined at this time.

Former Tire Pile Area

FTPA Middle Waste Pit Excavation

The FTPA Middle Waste Pit excavation is complete. The excavated material has been placed into a treatment cell, discussed below. The excavated area was graded to drain and has been seeded. A good stand of grass is developing. The excavation was effective in isolating contaminants from the environment. Therefore, this component of the remedy is functioning as intended by the decision documents.

FTPA Treatment Cell

The soils from the FTPA Middle Waste Pit excavation have been placed into a treatment cell, which the Respondents are currently operating. Review of the data from the treatment cell operations shows that it is effectively removing and destroying contaminants from the materials placed in the treatment cell. Upon completion of the treatment period, a final cover will be placed over the treatment cell, and long-term O&M can begin for this facility. Because the data verify that the materials in the treatment cell now meet Performance Standards, the treatment phase of this component of the remedy is functioning as intended by the decision documents. Upon completion of treatment and closure of the cell, this long-term containment component of the remedy is expected to function as intended by the decision documents.

FTPA North and South Waste Pits

The soils from the FTPA North and South Waste Pits have not been excavated as intended due to conditions dangerous to onsite workers. The Respondents are, performing ongoing studies and pilot testing to assess the potential for using in-place thermal treatment for these materials. Therefore, whether or not this component of the remedy will function as intended by the decision documents cannot be determined at this time.

Water was observed overflowing from the FTPA drum staging area during the Site inspection performed for this Five-Year Review. This is a temporary facility being used during implementation of the remedy components for the FTPA North and South Waste Pits, so it is not specifically identified in the decision documents. The drum staging area was lined to capture and permit treatment of all runoff from the pad. The Respondents were notified of this condition, and have responded with the following plan:

> The Respondents will monitor the containment berm during and after all significant rain events. Any accumulated stormwater will be pumped on a weekly basis by a vacuum tanker truck and transported to the treatment plant's Raw Water Storage Tanks (RWSTs) for

storage prior to treatment. In the event stormwater is threatening to overflow the containment berm and the vacuum truck is not available, as a contingency measure accumulated stormwater is pumped directly into the RWSTs via the newly installed 2" FTPA Process Line. Appropriate connections, valves, riser pipe, and a quick-connect fitting to the top of the riser pipe will be installed this fall. Contingency action will entail connecting a flexible, hose between the riser pipe and a portable 2" trash pump, then pumping water with the trash pump from the pad directly into the Process Line. The WTP operator will ensure that sufficient storage capacity is available in the RWSTs to prevent overtopping.

If consistently implemented, this facility is expected to function as intended by the Work Plan for the FTPA North and South Waste Pits and related design documents.

7.2.4 System Operations/O&M

System operations procedures are generally consistent with requirements. Difficulties that have occurred to date have been handled properly. However, the following issues were noted:

- More attention to landfill cap repair and maintenance is necessary.
- Some monitoring wells were found to be unlocked during the Site inspection.

In addition, several years of experience in using the existing Performance and Compliance Monitoring Plan (PCMP) for the East/South/West Groundwater Barrier Wall suggest that it could be improved. Specifically, several possibilities were not contemplated by the existing PCMP, such as:

- Monitoring and potential response actions at the ends of the wall

- How to deal with persistent, nearly identical water levels in internal and external well pairs along the wall

- How to deal with groundwater gradients that frequently reverse from one monitoring event to the next

Other than these items, the O&M activities for the completed systems are functioning as intended by the decision documents.

7.2.5 Cost of System Operations/O&M

As discussed in Section 2, *Site Chronology*, the remedy implementation, O&M is funded by a Trust Fund managed by the Respondents. The details of the operation of the Trust Fund are sealed by the court. The Respondents are paying for remedy O&M.

7.2.6 Opportunities for Optimization

The Site remedy is operated and maintained by the Respondents. They have proposed various optimizations from time to time, such as decreased sampling frequencies or changes in analytical methods. Each such request is reviewed and assessed individually. The final decision whether or not to make changes that could affect the effectiveness of the remedy is made by EPA. This process is intended to ensure that the remedy functions as intended by the decision documents. To date, none of the optimizations implemented have interfered with the proper functioning of the remedy.

7.2.7 Early Indicators of Potential Remedy Failure

A potential remedy failure exists when there are conditions that would require a major remedy modification to be implemented in order to meet Performance Standards (*Comprehensive Five-Year Review Guidance*, page 4-10). Such conditions are termed "early indicators of potential remedy failure." The following possible early indicators of potential remedy failure were noted during the review. For each, the rationale for identifying them as a possible early indicator of potential remedy failure is provided.

- **Exceedances of Performance Standards at MW38-WD.** This compliance well is located at the POC. Exceedances more than three orders of magnitude greater than Groundwater Performance Standards for 1,2-dichloroethane have been observed at this well, as well as lesser exceedances for other constituents (see Table 6-9). No engineering controls exist or were explicitly contemplated in this area by the decision documents. Although the ROD (page 11-8) provides for generalized contingency measures such as additional engineering controls, such measures would be in addition to the basic remedy described in the ROD. Robust response actions may be needed in this area to achieve containment.

- **Exceedances of Performance Standards at MW39-WD.** VOC concentrations beyond the POC exist at up to 4 times Groundwater Performance Standards (see Table 6-9), and may be slowly increasing in this area. There are no additional engineering controls existing or explicitly contemplated in this area by the decision documents. However, the ROD does contemplate contingency measures where contaminant levels exceed Performance Standards at the POA or POC. The ROD states (page 11-8) that "... appropriate measures shall be taken to prevent and remediate contaminant migration beyond the compliance boundary." The rationale for considering this as a possible early indicator of failure is the consistent observation of contaminant concentrations in excess of Performance Standards beyond the POC.

- **Exceedances of Performance Standards at MW51-WD.** VOC and inorganic concentrations occur beyond the POC at levels up to approximately three times greater than the Groundwater Performance Standards (see Table 6-9). There are no additional engineering controls existing or explicitly contemplated in this area by the decision documents. However, the ROD does contemplate contingency measures where contaminant levels exceed Performance Standards at the POA or POC. The ROD states (page 11-8) that "... appropriate measures shall be taken to prevent and remediate contaminant migration beyond the compliance boundary." The rationale for considering this as a possible early indicator of failure is the same as for MW39-WD.

- **Exceedances of Performance Standards at the PM-4 area.** VOC concentrations exist at the interior well up to approximately 3 times the Groundwater Performance Standards (see Table 6-9). The PCMP requires groundwater extraction at any location where there is an outward gradient and there are contaminant concentrations in excess of Performance Standards. An outward gradient existed at this location for a number of quarters without exceedances of Performance Standards. Subsequently, Performance Standards were exceeded at well PM-4I. This triggered groundwater extraction at the PM-4 area. There is a saturated sand layer below the East/South/West Groundwater Barrier Wall that appears to be hydraulically connected beneath the wall and for some distance parallel to the wall. Observation of water levels in an exterior well during pumping of an interior well showed an almost immediate hydraulic response during pumping. These factors suggest significant

hydraulic connection through – or more likely, beneath – the East/South/West Barrier Wall. Other than the East/South/West Barrier Wall and the PCMP, there are no engineering controls existing or explicitly contemplated in this area by the decision documents. The contingency responses in the PCMP were based on the assumption that only small amounts of ground water (small enough that they could be treated without expanding the new WTP capacity) would need to be extracted. If a significant hydraulic connection exists beneath the wall in this area that can convey Site-related contaminants, a more robust response would be required in this area. The ROD contemplates contingency measures where contaminant levels exceed Performance Standards at the POA or POC. The ROD states (page 11-8) that "... appropriate measures shall be taken to prevent and remediate contaminant migration beyond the compliance boundary." The rationale for considering this as a possible early indicator of failure is the same as for MW39-WD.

- **Exceedances of Performance Standards at the PM-15 area.** VOC concentrations at the interior well (PM-15I) are above Performance Standards. VOC concentrations have been found at several wells beyond the POC, north and east of the north end of the east side of the East/South/West Groundwater Barrier Wall. Intensive pumping from discrete wells in this area has not yet been able to reverse the existing outward gradient even where the barrier wall exists. Lateral features such as a drainage trench (French drain) may be necessary to achieve containment.

The existence of these possible early indicators of potential remedy failure indicate that the East/South/West Groundwater Barrier Wall is not functioning as intended by the decision documents. Further, the information from the MW38-WD area indicates that containment is not being achieved in this area, and robust response actions may be needed in this area to achieve containment.

7.3 Question B – Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection still valid?

Most of the assumptions used at the time of remedy selection are still valid. This subsection summarizes the assumptions that have changed.

7.3.1 Changes in Standards and To Be Considereds

Massachusetts AALs and TELs are used by CDPHE to evaluate allowable air emissions. Therefore, they are TBCs. This Five-Year Review identified changes in the Massachusetts AALs and TELs. Some of the changes are less stringent, and some are more stringent, than those in the ROD.

New radionuclide standards in water have been promulgated at the federal level (MCLs) and state level (Colorado Basic Standards for Ground Water). Some of these new standards are lower than the standards in the ROD, and some are higher. They reflect a change in the toxicity values for the radionuclides.

These changes do not require changes in the remedy. However, the changes are recommended for adoption because they reflect a better understanding of contaminant effects on humans.

7.3.2 Changes in Exposure Pathways

Changes in the Site conditions that affect exposure pathways were identified as part of the Five-Year Review. At this time, there are no current or planned changes in land use (of the Superfund Site) or exposure scenarios. However, several new contaminants were identified in this Five-Year Review, including 1,4-dioxane, chloromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, 1,2-dichloroethene, butanol, dichlorodifluoromethane, ethyl acetate, ethyl ether, and trichlorofluoromethane. As shown in Table 6-6, only 1,4-dioxane is recommended for adoption as a new Performance Standard.

7.3.3 Changes in Toxicity and Other Contaminant Characteristics

Toxicity factors for some contaminants of concern have changed. Eighteen chemicals had new toxicity values (see Section 6.2, *Site Inspection*).

7.3.4 Changes in Risk Assessment Methodologies

Although there were minor changes in risk assessment methodologies since the time of the ROD, these changes do not call into question the protectiveness of the remedy.

7.3.5 Review of Existing Remedial Action Objectives

The existing Remedial Action Objectives (RAOs) for the Site are presented in Section 4.1, *Remedial Action Objectives*. Although there are some portions of the Site remedy that do not presently meet these RAOs (for example, minimization of infiltration and leachate production in the waste-pit source area [discussed in Section 8.2, *Issues of Concern – Additional Remedy Elements*]), this Five-Year review concludes that all of the RAOs remain achievable. Furthermore, no new Site conditions have come to light that suggest a need to revise any of the RAOs. Therefore, no changes to the RAOs are recommended.

7.4 Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

The following additional information has been identified that could call into question the protectiveness of the remedy.

7.4.1 Changes in Understanding of Groundwater Flow

Implementation of the sitewide remedy has provided much more exploration and analytical data at the Site. Review of these data has led to a better understanding of the subsurface conditions at the Site. Attachment 4, *Revised Conceptual Site Model*, summarizes this improved understanding. One of the key conclusions that results from the better understanding of the Site conditions is that groundwater flow at the Site is not necessarily orthogonal (at right angles) to groundwater elevation contours.

In the past, it was thought that most of the Site groundwater flow would converge toward the NBBW based on the assumption that most groundwater flow would be orthogonal to the groundwater elevation contours. However, the probable presence of geologic features such as sand channels, joints, and fractures can provide preferential flow paths for ground water.

Depending on the orientation of such a feature, it may cause ground water to flow in a direction skewed from orthogonal to groundwater contours.

The clearest example of preferential pathway migration is at MW38-WD, which is approximately 1,200 feet north of the north end of the western wall. This area is generally north-northwest of the landfill mass. A sand layer (believed to be a sand channel) up to 20 or more feet thick and approximately 200 feet wide has been found in this area. Examination of the groundwater contours in this area suggests that groundwater flow – if assumed to be orthogonal to groundwater elevation contours – is in a generally north-northeasterly direction. Thus, ground water at MW38-WD would be assumed to be flowing onto the Site from the west. However, at MW38-WD, compliance monitoring has detected VOCs above Groundwater Performance Standards for 1,2-dichloroethane (maximum observed value of 4,100 ~g/L versus a standard of 1 ~g/L). The groundwater flow contours alone would suggest that flow to the MW38-WD area from the landfill mass should not occur, but the observed concentration data suggest that flow from the landfill mass is occurring[2].

Efforts are now under way in the MW38-WD area to investigate this contamination. The Respondents are drilling borings to delineate the sand (approximately 21 as of September 25, 2001)and developing several wells (approximately nine as of September 25, 2001) for the purposes of collecting water quality data to determine source, nature, and extent of migration of contaminants.

7.5 Summary of Technical Assessment

Table 7-1 summarizes the technical assessment.

[2] Localized surface dumping was initially considered as a possible explanation for the unexpected exceedances at MW38-WD, but near-surface soil gas monitoring has been performed in the vicinity of MW38-WD, and has not detected any suspected surface dumping areas.

Table 7-1
Summary of Technical Assessment

Component/Element	Question A – Is the remedy functioning as intended by the decision document? (Preferred answer: Yes)	Question B – Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid? (Preferred answer: Yes)	Question C – Has any other information come to light that could call into question the protectiveness of the remedy? (Preferred answer: No)
COMPLETED REMEDY COMPONENTS			
Well Plugging and Abandonment Program	Yes	Yes	No
Wetlands Mitigation	Yes	Yes	No
LFG Collection & Treatment System	Yes	Yes	No
E/S/W Groundwater Barrier Wall	No	Yes	Yes
North Boundary Barrier Wall	No	Yes	Yes
North Face Cover	Yes	Yes	No
ADDITIONAL REMEDY ELEMENTS			
Landfill Cover Maintenance	No	Yes	Yes
Surface Water Removal Action	Yes	Yes	No
Groundwater Monitoring Wells and Compliance Program	No	Yes	Yes
Landfill Gas Monitoring Probes and Compliance Program	Yes	Yes	No
Surface Water Monitoring	Yes	Yes	No
INCOMPLETE REMEDY COMPONENTS			
North Toe Extraction System	No	Yes	Yes
New Onsite Water Treatment Plant	No	Yes	Yes
FTPA Middle Waste Pit Excavation	Yes	Yes	No
FTPA Treatment Cell	Operations: Yes Closure: Expected to perform as intended in the future	Yes	No
FTPA North & South Waste Pits	Cannot be determined at present	Yes	Yes
FTPA Drum Staging Area	Expected to perform as intended in the future	Yes	No

Section 8 Issues of Concern

Some issues of concern were found during the Five-Year Review.

8.1 Issues of Concern – Completed Remedy Components

Table 8-1 summarizes issues of concern relating to completed remedy components and indicates how each issue affects remedy protectiveness. For some components, existing information is not sufficient to determine the effect. Protectiveness is defined in Section 10.1, *Basis for Determination or Protectiveness,* and is further discussed in Section 10.2*, Protectiveness Statements for Completed Remedy Components and Key Additional Remedy Elements*.

The following text discusses each issue of concern.

- **VOC exceedances at MW39-WD.** Investigations by the Respondents are ongoing in this area. Exceedances found to date beyond (west of) the East/South/West Barrier Wall are above Performance Standards by a factor of up to approximately 4. For example, tetrachloroethene has been detected at concentrations of 9.6 to 19 µg/L versus a standard of 5 µg/L. The level of the exceedances is consistent. However, until the nature and extent of the contamination are understood in this area, protectiveness of the East/South/West Barrier Wall in this area cannot be determined until further information is obtained.

- **Low-level inorganic exceedances at MW43-WD.** Exceedances are for iron and manganese, two common inorganic soil constituents that are naturally occurring but are also commonly associated with landfill leachate. Studies are under way to better define the naturally occurring background concentrations of inorganic constituents near the Site. Until these background studies are complete, the effect on protectiveness of the East/South/West Barrier Wall in this area is unknown.

- **VOC exceedances at MW51-WD.** Investigations by the Respondents are ongoing in this area. Exceedances found to date beyond (east of) the East/South/West Barrier Wall are above Performance Standards by a factor of up to approximately 3. For example, tetrachloroethene has been detected at concentrations of 7.6 to 13 µg/L, versus a standard of 5 µg/L. This well is near Murphy Creek on the east side of the Site. However, because the nature and extent of the contamination is still not fully understood in this area, protectiveness of the East/South/West Barrier Wall in this area cannot be determined until further information is obtained.

- **VOC exceedances in the interior well, an outward gradient, and a saturated sand layer below the East/South/West Barrier Wall at the PM-4 area.** Investigations by the Respondents are ongoing in this area. Exceedances found to date are above Performance Standards by a factor of 3.5. For example, 1,2-DCA has been detected at concentrations of 1.2 to 3.5 µg/L versus a standard of 1 µg/L. Inspection of past water-level data for PM-4I and PM-4X reveal very little difference in water levels between these two wells, one 10 feet inside and one 10 feet outside of the East/South/West Barrier Wall. This could be indicative of a direct hydraulic connection either through or, more likely, beneath the wall. The recent discovery of a saturated sand layer approximately 2 feet thick beneath the East/South/West Barrier Wall in this area could provide a pathway for contaminants to migrate beyond the

POC. Until studies are complete, protectiveness of the East/South/West Barrier Wall in this area cannot be determined until further information is obtained.

- **VOC exceedances beyond the POC at the PM-15 Area.** Investigations by the Respondents are ongoing in this area. Exceedances found to date beyond (north and east of) the East/South/West Barrier Wall are above Performance Standards. Before pumping was started in this area, tetrachloroethylene (PCE) concentrations from 95 to 140 µg/L were found in PM-15I, versus a Performance Standard of 5 µg/L. Murphy Creek is located to the east. Inward gradients have not been consistently achieved in this area. Until studies are complete, protectiveness of the East/South/West Barrier Wall in this area cannot be determined until further information is obtained.

- **The NBBW may not be completely effective in restricting offsite migration of contaminated ground water.** Investigations by the Respondents are ongoing in this area. Exceedances found to date beyond (north of) the NBBW are above Performance Standards by a factor of up to approximately 22. For example, 1,1-dichloroethene has been detected at concentrations of 7.4 to 150 µg/L versus a standard of 7 µg/L in a number of wells in this area. Because the NBBW is at the north (downgradient) end of the Site and collects most of the ground water that is treated at the Site, and because releases in this area would most likely be into the very permeable alluvium of the unnamed creek, the NBBW performance is considered to be a critical component of the containment remedy. Until it is clear that the NBBW is functioning as intended, protectiveness of the NBBW cannot be determined until further information is obtained.

- **There is not an ongoing, periodic groundwater monitoring system at the NBBW to demonstrate containment.** Investigations by the Respondents are ongoing in this area (see above item). Until there is a ongoing, periodic groundwater monitoring system that demonstrates that the NBBW is functioning as intended, protectiveness cannot be determined.

8.2 Issues of Concern – Additional Remedy Elements

Table 8-2 summarizes issues of concern relating to additional remedy elements that, while not components of the remedy, are necessary to monitor and implement the remedy. The table also indicates if the issues are judged to affect remedy protectiveness. Protectiveness is defined in Section 10.1, *Basis for Determination of Protectiveness,* and is further discussed in Section 10.2, *Protectiveness Statements for Completed Remedy Components and Key Additional Remedy Elements.*

If issues of concern that do not affect current protectiveness are allowed to continue without correction, they could lead to a condition that is not protective in the future.

The following text discusses each issue of concern.

- **Depressions in the landfill cover in the southwestern portion and near the north center.** The Respondents were notified about these depressions on June 16, 2000. On January 19, 2001, the Respondents submitted a proposal to correct these depressions by providing additional fill from the former Stapleton Airport and reconstructing the cap with steeper slopes. This is intended to reduce the potential for future formation of dosed depressions – and thus reduce the potential for infiltration – as the solid waste in the landfill continues to decompose and settle. EPA and CDPHE have not accepted this proposal. The reasons are

specified in a letter from EPA to the Respondents dated April 10, 2001. On July 23, 2001, the Respondents replied to this letter, questioning the basis of EPA's rejection of their proposal. To date, the depressions have not been filled or otherwise addressed. The depressions in the landfill cover violate the requirements of the approved landfill cover operation and maintenance plan. In addition, they are inconsistent with the following RAOs:

- Minimization of infiltration and leachate production (OUs 1 and 6)

- Minimization of the production and migration of leachate, from landfill solids or soils intermingled with landfill solids, to the saturated zone and ground water (OU 2)

If left unaddressed, future protectiveness will be affected.

- **The lateral spacing between individual monitoring wells is too large in some areas (generally the portions of the Site north of the East/South/West Barrier Wall) to detect possible exceedanees beyond the POC.** This issue came to light as a result of a better understanding of the Site conditions since the issuance of the ROD. This better understanding is summarized in Section 7.4.1, *Changes in Understanding of Groundwater Flow*. The improved understanding of the Site has resulted from review of much of the subsurface information and monitoring data developed by the Respondents during implementation of the remedy, and from investigations related to areas of concern such as MW38-WD and PM-15. Studies are currently under way to better define the well spacing needed to properly monitor these areas. Until these studies are complete and the monitoring system is in place, current protectiveness cannot be determined.

- **The lignite layer monitoring network has too few and possibly improperly positioned monitoring wells to demonstrate containment.** The better understanding of the CSM and reconsideration of the previous groundwater modeling results considering the revised CSM suggests that additional lignite wells are needed. Until these wells are in place, current protectiveness cannot be determined.

- **There is insufficient monitoring of the unweathered Dawson and Denver formations to demonstrate containment.** The better understanding of the CSM and reconsideration of the previous groundwater modeling results considering the revised CSM suggests that additional unweathered Dawson and Denver wells are needed. Until these wells are in place, current protectiveness cannot be determined.

- **Unlocked monitoring well caps.** Several monitoring well caps were found to be unlocked during the Site inspection (Attachment 6, *Inspection Checklist*). An unlocked monitoring well cap may compromise the integrity of the monitoring well data.

- **Significant VOC exceedances are occurring at MW38-WD.** Investigations by the Respondents are ongoing in this area. Concentrations of 1,2-dichloroethane (1,2-DCA) in the range of 3,100 to 4,100 µg/L have been consistently observed in this well, which is at the POC (although this location is approximately 300 feet inside the property boundary). This is more than three orders of magnitude above the 1,2-DCA Performance Standard of 1 µg/L. Other VOCs are also present in this well at levels well above their Performance Standards. The presence of such high concentrations at a location at least 2,000 feet away from the nearest known waste pits, and in a location formerly thought not to be directly downgradient of the waste pits, was not expected and is a serious concern. Investigations are under way in this area to define the nature and extent of the contamination. However, the

exceedances are so much greater than the Performance Standards that this affects protectiveness.

- **Practical Quantitation Limits are not regularly reviewed and updated to keep pace with improved laboratory analytical techniques.** When analytical techniques are not sufficiently accurate to measure concentrations as low as the Performance Standard, the Practical Quantitation Limit (PQL) is used in lieu of the Performance Standard. Since laboratory techniques can be expected to improve with time, PQLs should be annually updated until the PQLs are at or below the Performance Standard.

- **Incorrect and Illegible Signage.** Obsolete and illegible signs were noted during the Site inspection. The Respondents are responsible for signage at the Site.

- **Institutional Controls Plan.** As described in Section 7.2.2, *Implementation of Institutional Controls and Other Measures*, the Respondents submitted a draft Institutional Controls Plan to EPA on or about September 6, 1996. EPA found the Plan to be inadequate and disapproved it, with comments, on October 30, 1996. On June 27, 2001, EPA faxed a letter to Denver stating, among other things, that because it had been almost five years since EPA had reviewed and commented on the last iteration of the Plan provided to EPA, and because additional information regarding institutional controls had become available to the Agency since that time, EPA would again review the September 6, 1996 iteration of the Plan. The letter further stated that EPA would provide additional written comments on the Plan on July 11, 2001, and did so. On August 31, 2001, the Respondents submitted an Errata Sheet to be attached to the draft Institutional Controls Plan. However, the Errata Sheet did not consider or address EPA's July 11, 2001 comments. Lack of an approved Plan affects future protectiveness.

- **The covenants recorded by the Respondents were not approved by EPA and are not consistent with ROD requirements.** The covenants relating to onsite properties recorded by Denver on June 29, 2001 appear to allow the Site to be used for open space. However, because the covenants do not include a definition of "open space", it is unclear whether Denver intends the land to be used for recreational purposes, or whether it would be fenced off and closed to all except authorized personnel. In the absence of a risk assessment (which would have to be performed by the Respondents under the oversight of EPA) that satisfies EPA, in consultation with CDPHE, that recreational use would not expose users to unacceptable risks, EPA will not approve covenants that allow recreational use of the Site. These covenants should be amended to be consistent with ROD requirements. EPA must approve these amended covenants before they are recorded. Without acceptable covenants, future protectiveness is affected.

- **Aurora Ordinance No. 93-88 is only enforceable to the extent that the properties that are the subject of the ordinance have been annexed by Aurora.** To date, they have not been so annexed. Without this control, future protectiveness may be affected.

Table 8-2 also notes one minor issue (unlocked monitoring well caps).

8.3 Issues of Concern – Incomplete Remedy Components

Table 8-3 summarizes issues of concern relating to remedy components that are not yet complete. These issues are being addressed and these remedy components are expected to be

protective when complete. They have been included in this Five-Year Review to provide a fully integrated summary of the current Site conditions.

8.4 Unresolved Concerns or Items Raised by Support Agencies and the Community

The principal unresolved issues raised by the community are related to the alleged presence of radionuclides (especially plutonium and americium) in excess of background levels at the Site. Comments received from Adrienne Anderson and Joan Seeman (Sierra Club) discussing this issue are included in Attachment 14. Much of this concern stems from early laboratory analyses with elevated detection limits. These data were collected during the RI phase of Site work. These data have been determined to be questionable. Risk assessment calculations have shown that the quantified risk from radionuclides at the Site is less than national background risk. All radionuclide data collected since the RI have confirmed low (near zero) presence of plutonium and americium. EPA concludes that no credible evidence exists to suggest that radionuclide concentrations are elevated at the Site. For example, to date, over 200 analyses for plutonium and americium in the WTP effluent have shown either no detections or detections at less than one-tenth of the groundwater Performance Standards. For more information, see the following:

- *Baseline Risk Assessment, Sitewide Risk Issues,* Volume 2C (EPA, April 1993)
- *Responsiveness Summary to the Second ESD* (EPA, November 1997)
- *Radionuclides and the Lowry Site,* Radionuclide Fact Sheet, (EPA, April 2001)

TABLE 8-1
Identified Issues of Concern – Completed Remedy Components

Issues of Concern	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Well Plugging Program		
• No issues noted	N	N
Wetlands Mitigation		
• No issues noted	N	N
Landfill Gas Collection And Treatment		
• No issues noted	N	N
East/South/West Groundwater Barrier Wall		
• MW39-WD – VOC exceedances (up to approximately 4 times Performance Standards)	CBD	CBD
• MW43-WD – Inorganic exceedances (up to approximately 10 times Performance Standards)	CBD	CBD
• MW51-WD – VOC exceedances (up to approximately 3 times Performance Standards)	CBD	CBD
• PM-4 Area – VOC exceedances at interior well (up to approximately 3 times Performance Standards), lack of an inward gradient, saturated sand layer below the East/South/West Barrier Wall	CBD	CBD
• PM-15 Area – VOC exceedances beyond the POC (up to approximately 28 times Performance Standards) and lack of an inward gradient	CBD	CBD
North Boundary Barrier Wail		
• May not be completely effective in restricting offsite migration of contaminated ground water	CBD	CBD
• There is not an ongoing groundwater monitoring system to demonstrate ongoing containment	CBD	Y
North Face Cover		
• No issues noted	N	N

Legend: Y = Yes N = No CBD = Cannot be determined until further information is obtained

TABLE 8-2
Identified Issues of Concern – Additional Remedy Elements

Issues of Concern	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Landfill Cover Maintenance		
• Depressions in southwestern portion of cover and near north center of cover	N	Y
Surface Water Removal Action		
• No issues noted	N	N
Groundwater Monitoring Wells And Compliance Program		
• Lateral spacing between individual monitoring wells is too large in some areas to demonstrate containment	CBD	Y
• Lignite layer has too few and possibly improperly positioned monitoring wells to demonstrate containment	CBD	Y
• Unweathered Dawson and Denver formations have too few monitoring wells to demonstrate containment	CBD	Y
• Unlocked monitoring well caps	N	N
• MW38-WD – VOC exceedances over 1,000 times Performance Standard	Y	Y
• Practical Quantitation Limits are not regularly reviewed and updated to keep pace with improved laboratory analytical techniques	N	Y
Landfill Gas Monitoring Probes And Compliance Program		
• No issues noted	N	N
Institutional Controls		
• Some incorrect and illegible signage	N	N
• Respondents have not submitted an approvable Institutional Controls Plan	Y (Note 1)	Y (Note 1)
• Covenants that have been recorded are not consistent with ROD requirements	Y (Note 1)	Y (Note 1)
• Aurora City Ordinance No. 93-88 not enforceable because affected properties have not yet been annexed by Aurora	Y (Note 1)	Y (Note 1)
Surface Water Removal Action		
• No issues noted	N	N
Erosion Monitoring		
• No issues noted	N	N

Legend: Y = Yes N = No CBD = Cannot be determined until further information is obtained

Note:

1. The Five-Year Review Guidance Document indicates that a remedy is not protective if either (a) an immediate threat is present; (b) the migration of contaminants is uncontrolled and poses an unacceptable risks to human \health and the environment; (c) potential or actual exposure is clearly present or there is evidence of exposure; or (d) the remedy cannot meet a new cleanup level and the previous cleanup level is outside the risk range. This Institutional Control is an administrative measure that does not actively prevent or control migration of contaminants, actively prevent exposure to contaminants, or affect cleanup levels. See Section 4.1, *Definition of Containment.*

TABLE 8-3
Identified Issues of Concern – Incomplete Remedy Components

Issues of Concern
North Toe Extraction System
• Not operating
Water Treatment Plant
• Not yet able to treat 1,4-dioxane to extent required to treat NTES water
FTPA Middle Waste Pit And Treatment Cell (Note 1)
• No identified issues
FTPA North & South Waste Pits
• Water was overflowing from the northwest corner of the temporary drum storage pad on the day of the Site inspection (no drums were on the pad the day of the inspection). The Respondents have proposed a plan to prevent this from happening in the future.

Legend: Y = Yes N = No
Note:
1. This component is complete, and the Respondents have requested construction completion certification from EPA; EPA is reviewing this request for approval.

Section 9 Recommendations and Follow-up Actions

This section summarizes recommendations and required follow-up actions identified as a result of the Five-Year Review process.

9.1 Completed Remedy Components

Table 9-1 summarizes recommendations and required follow-up actions for completed remedy components based on the findings of the Five-Year Review. The left column lists each issue identified in Table 8-1. The next column identifies the recommendations or required follow-up actions. All of the recommended designs, investigations, response actions, and other items will require EPA approval prior to implementation. For each recommendation, the Respondents are expected to perform the recommended designs, investigations, response actions, and other items, and the EPA will provide oversight.

Section 11.2.1.2 of the ROD requires implementation of appropriate contingency measures as necessary to prevent and remediate contaminant migration beyond the POC. Therefore, ESDs or ROD amendments are not required to implement these contingency measures contemplated by the ROD.

The fifth column provides a milestone date for completion of the specific recommendations or follow-up actions. Some of these dates are approximate, because in many cases phased investigations will be necessary to identify the nature and extent of the issue and the required response. These milestone dates are provided as a general expectation of the schedule to be maintained in responding to this Five-Year Review. The last column identifies whether or not implementation of the recommendations or follow-up actions are anticipated to affect the protectiveness of the remedy.

Each Work Plan identified in Table 9-1 should define the appropriate objectives, scope, and schedule. Each Work Plan shall include work elements ranging from completion of characterization of the nature and extent of contamination, through remedial action implementation (if necessary). With respect to the feasibility study element of the Work Plan, it shall include a range of possible response actions, from no further action to active response approaches. Each Work Plan shall identify the activities needed for investigations and feasibility studies, and shall identify a tentative scope and schedule for remedial design and remedial action implementation. Identifying active responses approaches will help identify data needs beyond those needed solely for characterization and guide the investigations and subsequent work. Each Work Plan shall also provide for preparation of data summary reports and progress reports. Each Work Plan shall include a schedule for all of the work including remedial action implementation. As the work progresses, revisions may be required as the remedial actions (if any) become more defined. EPA approval will be required for each Work Plan prior to implementation. Prior to the development of any of these Work Plans, the Respondents should meet with EPA and CDPHE to discuss and agree upon the Work Plan objectives. Continued meetings among EPA, CDPHE and the Respondents should be held throughout Work Plan development and implementation to expedite the work.

During the Five-Year Review process, numerous meetings were held with the Respondents to discuss the progress and preliminary findings of the Five-Year Review. As a result of these

meetings, the Respondents have undertaken a number of actions to begin addressing several of the issues identified during the Five-Year Review:

- The Respondents have submitted a proposal to correct depressions in the landfill cover by providing additional fill from the former Stapleton Airport and reconstructing the cap with steeper slopes. As discussed in Section 8.2, *Issues of Concern – Additional Remedy Elements*, EPA and CDPHE have not accepted this proposal. EPA is awaiting a new proposal from the Respondents to address the depressions in the landfill cover.

- Investigations are ongoing at the following areas: MW38-WD, MW39-WD, MW51-WD, PM-4, PM-15, and the NBBW.

- Some of the incorrect signage at the Site has been replaced or updated.

9.2 Additional Remedy Elements

Table 9-2 summarizes recommendations and required follow-up actions for completed remedy components based on the findings of the Five-Year Review. The left column lists each issue identified in Table 8-2. The format of the table is similar to that of Table 9-1. The Respondents are expected to carry out the recommendations in Table 9-2, including Work Plans, as discussed for Table 9-1. EPA will provide oversight.

9.3 Incomplete Remedy Components

Table 9-3 summarizes recommendations and required follow-up actions for incomplete portions of the remedy based on the findings of the Five-Year Review. The left column lists each issue identified in Table 8-3. The format of the table is similar to that of Table 9-1. The Respondents are expected to carry out the recommendations in Table 9-3, including Work Plans, as discussed for Table 9-1. EPA will provide oversight.

The Respondents are actively working on all of the issues identified in Table 9-3 except the last one. The overflow from the temporary drum storage pad is a concern because contaminated soil from the North and South Waste Pits is handled there, and thus there is a potential that contamination could potentially leave the pad area via the overflow.

9.4 Other Recommendations

In addition to the above recommendations, the following additional recommendations are made as a result of the Five-Year Review process:

- EPA should develop a decision document to identify several changes that have been made to the remedy, as well as changes that are recommended in the Five-Year Review report:

  – Recommended changes to Groundwater Performance Standards (Table 9-4)
  – Recommended changes to Air Quality Performance Standards (Table 9-5)
  – Recommended changes to Surface Water Performance Standards (Table 9-6)
  – Recommended changes to Soil Vapor Performance Standards (Table 9-7)

- The Respondents, in conjunction with EPA and CDPHE, should continue their Community Involvement program to keep residents in the Elbert and Arapahoe counties area informed,

and to address continuing concerns about land application of biosolids at the Metrogro farms.

TABLE 9-1
Recommendations and Follow-up Actions – Completed Remedy Components

Issues[1]	Recommendations/ Follow-up Actions[2]	Milestone Date	Affects Protectiveness (Y/N)	
			Current	Future
Performance Standards exceedances at MW39-WD Area	Prepare Work Plan to complete investigation of conditions at MW39-WD to identify nature and extent of contamination, and to identify required response activities	12/31/01	Y	Y
	Perform and document investigations defined by Work plan	3/31/02		
	Perform and document necessary response actions	TBD		
Performance Standards exceedances at MW43-WD Area	Prepare Work Plan to define final sitewide inorganic background level, to determine that conditions at MW43-WD are Site-related, and to identify required response activities, if any	12/31/01	N	Y
	Perform and document investigations defined by Work Plan	3/31/02		
	Perform and document necessary response actions	TBD		
Performance Standards exceedances at MW51-WD Area	Prepare Work Plan for continued investigation of conditions at MW51-WD to identify nature and extent of contamination, and to identify required response activities	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	3/30/02		
	Perform and document necessary response actions	TBD		
PM-4 Area	Continue implementing PCMP	Per PCMP	Y	Y
	Prepare Work Plan for investigation of sand layer beneath East/South/West/Barrier Wall to determine if it is a pathway for offsite migration of contamination	9/30/01		
	Perform and document investigations defined by Work Plan	12/31/01		
	Perform and document necessary response actions	TBD		
PM-15 Area – Low-level exceedances beyond the POC	Prepare Work Plan for complete investigations to identify nature and extend of contaminations, and to identify required response activities	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	03/30/02		
	Perform and document necessary response actions	TBD		
NBBW may not be completely effective in containing all target ground water	Prepare Work Plan for investigations needed to define capture at NBBW, and to determine any needed remedial measures	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	6/30/02		
	Perform and document necessary response actions	TBD		
There is not an ongoing groundwater monitoring system to demonstrate ongoing containment at the NBBW	Prepare Work Plan for investigations needed to install complete groundwater monitoring system at the NBBW that can verify ongoing containment	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	6/30/02		
	Perform and document necessary response actions	TBD		
Practical Quantitation Limits are not regularly updated	Perform annual update of Practical Quantitation Limits, and submit report documenting work performed.	12/31/01 and annually thereafter	Y	Y

Legend: Y = Yes N = No TBD = To be determined, based on the findings of the investigations

Notes:

1. These issues impact the ability to effectively assess the protectiveness of the remedy.
2. As used in this table, the term “document” means to prepare and submit a report that describes and summarizes of the work, and details the results of the work.

TABLE 9-2
Recommendations and Follow-up Actions – Additional Remedy Components

Issues[1]	Recommendations/ Follow-up Actions	Milestone Date	Affects Protectiveness (Y/N)	
			Current	Future
Landfill Cover: Depressions in southwestern portion of cover and near north center of cover	Prepare drainage plan and design to correct landfill cover drainage	10/31/01	N	Y
	Implement design	12/31/01		
Lateral spacing between individual monitoring wells is too large in some areas to detect possible exceedances beyond the POC	Prepare Work Plan to identify required spacing	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	3/31/02		
	Perform and document necessary response actions	TBD		
Lignite layer has too few monitoring wells to verify containment	Prepare Work Plan to identify approach to define the required number and location of wells	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	3/31/02		
	Perform and document necessary response actions	TBD		
Unweathered Dawson and Denver formations have too few monitoring wells to verify containment	Prepare Work Plan to identify approach to define the required number and location of wells	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	3/31/02		
	Perform and document necessary response actions	TBD		
Unlocked monitoring well caps	1. Lock all unlocked wells except during sampling, sounding, maintenance, and similar activities 2. Implement system to keep wells locked in future	10/31/01	N	N
Performance Standards exceedances at MW38-WD Area	Prepare Work Plan for remainder of ongoing investigations of conditions at MW38-WD to identify nature and extent of contamination, and to identify required response activities	12/31/01	Y	Y
	Perform and document investigations defined by Work Plan	6/30/02		
	Perform and document necessary response actions	TBD		
Some incorrect and illegible signage	Review all signage and update	12/31/01	N	N
Respondents have not submitted an approvable Institutional Controls Plan	Submit an approvable plan to EPA	1/15/02	N	Y

Legend: Y = Yes N = No NA = Not Applicable TBD = To be determined, based on the findings of the investigations

Notes:

1. These issues impact the ability to effectively assess the protectiveness of the remedy.
2. As used in this table, the term “document” means to prepare and submit a report that describes and summarizes of the work, and details the results of the work.

TABLE 9-3
Recommendations and Follow-up Actions – Incomplete Remedy Components

Issues[1]	Recommendations/ Follow-up Actions	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
			Current	Future
North Toe Extraction System not operating	Complete WTP upgrade, then operates NTES as required by ROD	Coordinate with WTP upgrade	Y	Y
Water Treatment Plant is not yet able to treat 1,4-dioxane in water from NTES	Prepare Work Plan to identify required plant modifications	12/31/01	Y	Y
	Preform and document investigations defined by Work Plan	4/15/02		
	Implement and document conclusions of investigations	9/30/02		
	Operate WTP as required by ROD	9/30/02 on		
FTPA North and South Waste Pits: Work is ongoing but incomplete	Continue work	Per approved work plan & schedule	Y	Y
Overflowing Water from NTES Drum Staging Area	Implement and document recently submitted plan to manage and treat such water as needed	12/31/01	N	Y

Notes:

1. These issues impact the ability to effectively assess the protectiveness of the remedy.

2. As used in this table, the term “document” means to prepare and submit a report that describes and summarizes of the work, and details the results of the work.

Table 9-4
Recommended Changes to Groundwater Performance Standards

Chemical	Recommended Performance Standard
Organics	
1,1,2,2-Tetrachlorethane	0.055
1,4-Dioxane	8
2-Butanone (methyl ethyl ketone)	1904
4-Methyl-2-pentanone (MIBK)	158
Benzo(a)anthracene	0.1 (total PAHs)
Benzo(a)pyrene (PAH)	0.01
Bis(2-ethylhexyl)phthalate	4.8
Dibromochloromethane	0.42
Heptachlor Epoxide	0.004
Isophorone	40
Radionuclides	
Plutonium-238, -239 and -240	0.15 pCi/l
Uranium-234	30 pCi/l
Uranium-235	30 pCi/l
Uranium-238	30 pCi/l

Table 9–5
Recommended Changes to Air Performance Standards

	Five-Year Review Standards[a]	
Chemical/Element	AAL	TEL
Organics		
1,1,1-Trichloroethane	1038.37	1038.37
1,1,2-Trichloroethane	0.06	14.84
1,1,2,2-Tetrachloroethane	0.02	18.67
1,2-Dichloroethylene (total)	107.81	215.62
1,1-Dichloroethylene (vinylidene chloride)	0.02 [b]	1.08 [b]
1,2-Dichlorobenzene (ortho)	81.74	81.74
1,2-Dichloroethane	0.04	11.01
1,2-Dichloropropane	0.05	0.9
1,4-Dichlorobenzene	0.18	122.61
2-Butanone (methyl ethyl ketone)	10	200
2-Hexanone	10.88	10.88
2-Methylnaphthalene[c]	14.25	14.25
Acetone	160.54	160.54
Acrylonitrile	0.01	0.4
Aniline	0.1	0.2
Benzene	0.12	1.74
Carbon disulfide	0.1	0.1
Carbon tetrachloride	0.07	85.52
Chlorobenzene	6.26	93.88
Chloroethane	358.78	717.55
Chloroform	0.04	132.76
Ethylbenzene	300	300
Gamma BHC (lindane)	0.003	0.14
Heptachlor	0.001	0.14
Naphthalene[c]	14.25	14.25
PCBs	0.0005	0.003
Pentachlorophenol	0.01	0.01
Phenol	52.33	52.33
Styrene	2	200
Tetrachloroethylene	0.02	922.18
Toluene	20	80
Trichloroethylene	0.61	36.52
Vinyl chloride[d]	0.38	3.47
Xylenes (total)	11.8	11.8
Inorganics		
Ammonia	100	100
Arsenic	0.0002	0.0005
Beryllium	0.0004	0.001
Cadmium	0.001	0.003
Chromium	0.68	1.36
Lead	0.07	0.14
Mercury	0.01	0.14
Nickel	0.18	0.27
Selenium	0.54	0.54
Vanadium	0.27	0.27

[a] Commonwealth of Massachusetts Department of Environment Protection TELs and AALs for Ambient Air, December 1995
AAL - ambient; TEL threshold effects level

[b] 1994 ROD did not list Massachusetts standards for 1,1-dichloroethene mistakenly omitted. Standard was listed under the chem

[c] Value is for total of 2-methylnapthalene and naphthalene

[d] Values for AAL and TEL were mistakenly reversed in the ROD

Table 9-6
Recommended Changes to Surface Water Performance Standards

	Water Supply Segments (Five - Year Review)	Aquatic Life (Five-Year Review - Acute)	Aquatic life (Five-Year Review - Chronic)
Organics			
Acenaphthene	420		
Acrolein	110		
Acrylonitirile	0.065		
Aldicarb	7		
Aldrin	0.0021		
Benzene	1.2		
Bromodichlormethane (HM)	.56 (W&F)	11,000	
Bromoform (HM)	4.3 (W&F)		
Carbofuran	40		
Carbon Tetrachloride	0.27		
Chlordane	0.1		
Chloroethyl Ether (bis-2-)	0.032		
Chloroform (HM)	5.7 (W&F)		
4-Chloro 3-Methyl Phenol	210		
2-Chlorophenol	35		
Chlorphyritos	21		
DDT Metabolite (DDD)	0.15		
1,2-Dichlorobenzene	600		
1,3-Dichrlorobenzene	600		
1,2-Dichloroethane	0.38		
1,2-Dichloropropane	0.52		
Dieldrin		2.4	0.056
2,4-Dimethylphenol	140		
1,2-Diphenylhydrazine	0.044		
Endosulfan	0.35	0.11	
Endrin	2	0.086	0.036
Endrin Aldehyde	2.1		
Ethylbenzene	700		
Fluoranthene (PAH)	280		
Heptachlor		0.52	
Heptachlor Epoxide	0.004	0.52	
Hexachlorobenzene	1		
Hexachlorobutadiene	14		
Hexachlorocyclohexane, Alpha	0.0056		
Hexachloroethane	7		
Hexachlorocyclopentadiene	50		
Indeno (1,2,3-cd)pyrene (PAH)	0.048		
Isophorone	40		
Malathion	140		
Naphthalene (PAH)	28		
PCBs	0.0175		
Pentachlorobenzene	5.6		
Pentachlorophenol	1	19	15
Phenol	4,200		

Table 9-6
Recommended Changes to Surface Water Performance Standards

	Water Supply Segments (Five - Year Review)	Aquatic Life (Five-Year Review - Acute)	Aquatic life (Five-Year Review - Chronic)
1,2,4,5-Tetrachlorobenzene	2.1		
1,1,2,2-Tetrachlorethane	0.18		
Toxaphene	0.032		
2,4,6-Trichlorophenol	3.2		
Inorganics			
Antimony	6		
Arsenic		340	
Asbestos, fibers/l	7,000,000		
Cadmium	5 (1 day)		
Cyanide (free)		5	5
Mercury			0.77
Nickel	100 (30 day)		
pH	6.5--9.0		
Selenium	50 (1 day)	18.4	4.6
Silver	100 (1 day)		
Sulfide as H2S		2	2
Sulfate			15
Thallium	0.5		
Radionuclides			
Plutonium 238,239, and 240, pCi/l	0.15		

Table 9-7
Recommended Changes to Soil Vapor Performance Standards

Chemical	Soil Vapor Action Levels [a]
Acetone	1,648
Benzene	605
Bromodichloromethane	16,900
Bromoform	96
Bromomethane	2,550
2-Butanone	1,549
Carbon disulfide	1,250,000
Carbon tetrachloride	1,240
Chlorobenzene	15,300
Chloroethane	756
Chloroform	212
Chloromethane	764
1,2-Dibromo-3-chloropropane	13
Dibromochloromethane	452
1,2-Dichlorobenzene	48,000
1,1-Dichloroethane	10,751
1,1-Dichloroethene	98
1,2-Dichloropropane	20
cis-1,2,-Dichloroethene	92,400
trans-1,2-Dichloroethene	21,900
1,2-Dichloroethene	200
trans-1,2-Dichloropropene	60,900
1,4-Dioxane	1
Ethylbenzene	219,640
Ethylene dibromide	29
2-Hexanone	69,300,000
Ethylene dibromide	13,416
2-Hexanone	10,800
Methane	5% LEL
Methylene chloride	450
4-Methyl-1,2-pentanone	13,416
Styrene	10,800
1,1,2,2-Tetrachloroethane	83
Tetrachloroethane	3,795
Toluene	272,000
1,1,1-Trichloroethane	100,400
1,1,2-Trichloroethane	92
Trichloroethene	2,070
Vinyl chloride	56
Xylenes (total)	2,760,000

[a] Letter dated February 16, 2000 regarding *Responses to EPA Comments (dated December 16,1999) on the Response to Comments and 2nd Edition of the Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas, dated October 1999;* and letter dated November 13, 2000 regarding *Response to EPA Comments (dated October 17, 2000) on Response to EPA Comments (dated December 16, 2000) and 2nd Edition of the Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas (dated February 16, 2000)*

Section 10 Protectiveness Statements

The protection of human health and the environment by the remedial actions at the Site is discussed below. The protectiveness is considered individually for each completed remedy component and several key additional remedy elements. Since the entire sitewide remedy is not yet complete, an overall protectiveness statement is not presented for the sitewide remedy. Several of the issues identified for the additional remedy elements (especially for the Groundwater Monitoring Wells and Compliance Program) suggest that containment is not being achieved at all locations on the POC.

10.1 Basis for Determination of Protectiveness

In accordance with the Five-Year Review Guidance, the determination of whether or not the remedy is protective of human health and the environment is generally reached by evaluating whether the remedy is achieving or will achieve the remedial action objectives stated in the ROD. To make this determination, Questions A, B, and C are answered (Section 7, *Technical Assessment*). If the answers to these three questions are *yes*, *yes* and *no* respectively, then the remedy normally is considered to be protective. If the answers to the questions are other than *yes*, *yes*, and *no*, then the remedy may be placed into any one of the following five categories, depending on the findings of the Five-Year Review:

- Protective
- Will be protective once the remedy is complete
- Protective in the short-term; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken
- Not protective, unless specified action(s) are taken to ensure protectiveness
- Protectiveness cannot be determined until further information is obtained[1]

Even if there is a need to conduct further actions, the remedy may be protective. Normally, the remedy is considered to be not protective only if one or more of the following conditions occur:

- An immediate threat is present (for example, exposure pathways that could result in unacceptable risk are not being controlled)
- Migration of contaminants is uncontrolled and poses an unacceptable risk to human health or the environment
- Potential or actual exposure is clearly present or there is evidence of exposure (for example, institutional controls are not in place or not enforced and exposure is occurring)
- The remedy cannot meet a new cleanup level and the previous cleanup level is outside of the risk range

As discussed below, immediate threats at the Lowry Site have been addressed by completion of some remedy components. However, at several locations (refer to Section 7.2.7, *Early Indicators*

[1] In this case, a time frame is to be provided indicating when a protectiveness determination will be made. This is done through an addendum to the Five-Year Review.

of Potential Remedy Failure), there are possible indications of containment failure. Despite this, none of the remedy components or elements fails any of the four specific conditions above. Consequently, no portion of the Lowry remedy has been found to be "not protective" by this Five-Year Review.

10.2 Protectiveness Statements for Completed Remedy Components and Key Additional Remedy Elements

The following text discusses the protectiveness of each of the completed remedy components and three key additional remedy elements in detail.

10.2.1 Well Plugging Program

The Well Plugging Program component of the sitewide remedy is protective of human health and the environment.

Approximately 91 unused wells were abandoned and plugged between August 1996 and March 1997, and an additional 13 unused wells and three unused gas monitoring probes were abandoned and plugged between June and August 1998.

10.2.2 Wetlands Mitigation

The Wetlands Mitigation component of the sitewide remedy is protective of human health and the environment.

The wetlands construction is complete, and repairs have recently been made to address flood damage and tree damage. O&M is ongoing. The wetlands mitigation is located in an area outside of the Site, and is not a component of the containment or monitoring function of the remedy.

10.2.3 Landfill Gas Collection and Treatment System

The LFG Collection and Treatment System component of the sitewide remedy is protective of human health and the environment.

The LFG collection system has been operated successfully since mid-1997. Analytical and gas probe vacuum monitoring data demonstrate that the LFG collection system is preventing the offsite migration of LFG. Analytical data for both influent and effluent gas streams demonstrate that the LFG flare is achieving the required destruction of Site-related chemicals.

10.2.4 East/South/West Groundwater Barrier Wall

The protectiveness of the East/South/West Groundwater Barrier Wail component of the sitewide remedy cannot be determined until further information is obtained.

Potential contaminant migration in excess of Performance Standards and beyond the POC has been observed at the following locations: MW39-WD, MW51-WD, and the PM-15 area. At each of these locations, the Respondents are investigating the nature and extent of the potential contamination. Although there does not appear to be an immediate threat to existing receptors (because there is no-one presently drinking the ground water), this Five-Year Review concludes

that the East/South/West Groundwater Barrier Wall does not appear to be effectively containing the Site-related chemicals as required by the ROD.

10.2.5 North Boundary Barrier Wall System (NBBW)

The protectiveness of the NBBW component of the sitewide remedy cannot be determined until further information is obtained.

Contaminants have been observed at four NBBW compliance monitoring wells: GW-114A, MW37-WD, MW-1000, and U701-WD. The Respondents are conducting a reevaluation of the capture effectiveness of the NBBW, including construction and sampling of additional monitoring wells, water-level measurements, and additional sampling of existing groundwater monitoring wells in this area. There does not appear to be an immediate apparent threat to existing receptors (because there is no-one presently drinking the ground water). However, because the current monitoring system is inadequate to verify that the NBBW is effectively containing the Site-related chemicals as required by the ROD, this Five-Year Review concludes that it cannot be determined whether or not this component of the remedy is protective.

10.2.6 North Face Landfill Cover

The North Face Landfill Cover component of the sitewide remedy is protective of human health and the environment.

The North Face Landfill Cover was completed in late 1999. The addition of 2 feet of cover to the north face of the landfill mass has reduced the potential for contact with landfill materials, and has improved the ability of the north face of the landfill to promote runoff, thereby reducing the potential for infiltration into the landfill mass.

10.2.7 Landfill Cover Maintenance

The Landfill Cover Maintenance element of the sitewide remedy is protective in the short-term; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken.

The Landfill Cover exhibits several closed depressions that have not been filled or otherwise corrected to provide drainage. This results in ponding and infiltration of precipitation rather than promoting runoff. Increased infiltration into the landfill mass creates additional contaminated ground water. This delays the expected ultimate stabilization of ground water within the landfill mass at a lower elevation than existed prior to remedy implementation. Follow-up actions need to be taken to eliminate these closed depressions and provide for proper cover drainage.

10.2.8 Surface Water Removal Action

The SWRA element of the sitewide remedy is protective of human health and the environment.

The SWRA was constructed between June and November of 1992 as an interim removal measure prior to ROD signing. The ROD requires continued operation and maintenance of this system. It has been effectively operated and maintained by the Respondents since construction.

10.2.9 Groundwater Monitoring Wells and Compliance Program

The protectiveness of the Groundwater Monitoring Wells and Compliance Program element for the sitewide remedy cannot be determined until further information is obtained. The lateral spacing between individual monitoring wells is too large in some areas to demonstrate containment. The lignite layer has too few wells and possibly improperly positioned wells to demonstrate containment. The unweathered Dawson formation and Denver formation have too few monitoring wells to demonstrate containment.

10.2.10 Summary of Protectiveness for Individual Remedy Components and Elements

The following components and elements of the sitewide remedy are protective:

- Well Plugging Program
- Wetlands Mitigation
- Landfill Gas Collection and Treatment System
- North Face Landfill Cover
- Surface Water Removal Action

The protectiveness of the following components and elements of the sitewide remedy cannot be determined until further information is obtained:

- East/South/West Groundwater Barrier Wall
- North Boundary Barrier Wall System (NBBW)
- Groundwater Monitoring Wells and Compliance Program

The following element of the sitewide remedy is protective in the short-term; however, in order for the remedy to be protective in the long-term, follow-up actions need to be taken:

- Landfill Cover Maintenance

The protectiveness of the other additional remedy elements and of incomplete remedy components is not determined as part of the Five-Year Review process. However, at the Lowry Site, several issues identified for these features of the remedy are presented in Tables 9-2 and 9-3. These issues support the conclusion that containment is not being achieved at all locations on the POC. In addition, an approvable institutional controls plan has not been submitted to EPA.

10.2.11 Schedule for Addenda to this Five-Year Review

The protectiveness of several of the remedy elements cannot be determined at this time. In accordance with the Five-Year Review Guidance, a schedule must be provided indicating when the protectiveness determination will be made by addendum to the Five-Year Review. Considering the extent of further investigations that are needed, as summarized in Table 9-1, the protectiveness determination should be made and documented in one or more addenda to be prepared and issued no later than September 30, 2002.

10.3 Protectiveness Statement for the Sitewide Remedy

Because construction of the sitewide remedy has not yet been completed, a protectiveness statement for the sitewide remedy cannot be made at this time.

Section 11 Next Review

The Lowry Site requires ongoing Five-Year Reviews because, upon completion of the remedial action, hazardous substances, pollutants, or contaminants will remain above levels that provide for unlimited and unrestricted exposure. The next review is to be conducted within five years of the completion of this Five-Year Review report. The completion date of this report is the date of the signature shown on the signature sheet at the front of this report.

As discussed in Section 10.2.11, *Schedule for Addenda to this Five-Year Review*, one or more addenda to this Five-Year Review are required no later than September 30, 2002 to determine the protectiveness of several individual components and elements of the remedy. However, this does not delay the required completion date for the next Five-Year Review.

Section 12 Other Comments

The Lowry Site remedy is not yet complete. Implementation of the following components is ongoing:

- **FTPA North and South Waste Pits.** To control VOC emissions during excavation of the North Waste Pit, an enclosed structure was erected above the pit, and an air handling and treatment system (using granular activated carbon) was provided. Excavation was discontinued at the North Waste Pit due to the presence of an IDLH atmosphere in the structure shortly after excavation started. Excavation at the South Waste Pit was deferred because similar conditions were anticipated at the South Waste Pit by the Respondents. The Respondents are currently performing studies and field work to assess the feasibility of applying in-place electrical thermal treatment for these waste pits. It is currently anticipated that remediation will not be complete before mid-2002, assuming that the technology proves to be feasible.

- **WTP.** The WTP construction was completed in accordance with the approved design, but it proved unable to treat high concentrations of 1,4-dioxane that are produced from the NTES. The Respondents are currently performing studies and pilot tests to evaluate further plant modifications to permit treatment of this water. The technologies currently being studied are advanced oxidation using ultraviolet light and biological treatment. It is currently anticipated that if one of these technologies proves feasible, the WTP could be modified to begin accepting NTES water by mid-2002.

- **NTES.** The construction of the NTES has been completed, but since the WTP cannot treat the NTES water at the design flow, the NTES is not being operated. As soon as the WTP modifications described above are complete, the NTES will be placed in service.

- **Institutional Controls.** On August 31, 2001 the Respondents submitted an Errata Sheet to be attached to the Institutional Controls Plan. However, the Errata Sheet did not consider or address EPA's July 11, 2001 comments (see Section 8.2, *Issues of Concern – Additional Remedy Elements*). A final Institutional Controls Plans is due to be submitted to EPA on November 1, 2001.

In addition, the Respondents are conducting a number of ongoing investigations at areas where the performance of the existing remedy is uncertain, or where the nature and extent of contamination requires definition. These areas are summarized in Section 8, *Issues*.

As discussed in Section 9, *Recommendations and Follow-Up Actions*, Work Plans should be developed for the remaining work at the Site.

The July 31, 2001 draft was prepared using the then-current October 1999 draft *Comprehensive Five-Year Review Guidance* (EPA 540R-98-050). On July 17, 2001, OSWER Directive 9355.7-03B-P was issued, requiring use of the June 2001 final *Comprehensive Five-Year Review Guidance* (EPA 540-R-01-007). This Five-Year Review was completed using the final guidance. EPA provided the draft version of this Five-Year Review to the Lowry Landfill Technical Advisory Group on July 31, 2001. EPA has reviewed each of these comments and made changes in this final document where appropriate. Comments on the July 31, 2001 draft are provided in Attachment 14.

ATTACHMENT 1

ATTACHMENT 1

Documents Reviewed

This attachment provides a list of the documents reviewed as part of this Five-Year Review. Each section addresses a different aspect of the implementation of the remedy, including the remedy decision, remedy implementation, operation and maintenance (O&M), legal documentation, and community involvement. Documents reviewed specifically, in whole or in part, for this report are listed in the following categories:

- Basis for the Response Action
- Implementation of the Response
- Operations and Maintenance
- Legal
- Guidance
- Community Involvement

In addition to these documents, the Site Files contain 140,000 documents pertaining to the Lowry Site remedy and presenting the basis for the remedy decision.

1.1 Basis for the Response Action

Arapahoe County, Colorado. 1992. Mapping Division.

Bartlett, R. and B. James. 1988. "Mobility and Bioavailability of Chromium in Soils." *Advanced Environmental Science and Technology*, Volume 20, pp. 267-304.

Bartlett, R. and B. James. 1979. "Behavior of Chromium in Soils: III. Oxidation." *Journal of Environmental Quality*, Volume 8, pp. 31-35.

Beijer, K. and A. Jernelov. 1979. "General Aspects and Specific Data on Ecological Effects of Metals." Pages 197 to 209. *Handbook on the Toxicology of Metals*. L. Friberg (ed.) Elsevier/North Holland Biomedical Press, New York.

Brown, S., D. Lincoln, and W. Wallace. 1989. Application of the Observational Method to Remediation of Hazardous Waste Sites. CH2M HILL. April.

Camp Dresser & McKee, Inc. 1992. Addendum No. 1 to the Initial Data Evaluation, Lowry Landfill: Soil and Surface Water and Sediments Operable Units (OUs 4&S), Remedial Investigation and Feasibility Study. Arapahoe County, Colorado. DCN 8543-11.1.0-AIS. January 24.

Camp Dresser & McKee, Inc. 1992. Addendum No. 1. Additional Site Characterization: Sampling Plan Field Operation Plan, Lowry Landfill: Soils and Surface Water and Sediments Operable Units (OUs 4&5) Remedial Investigation and Feasibility Study. Arapahoe County, Colorado. April 13.

Camp Dresser & McKee, Inc. 1992. Additional Site Characterization: Sampling Plan Field Operation Plan, Lowry Landfill: Soils and Surface Water and Sediments Operable Units (OUs 4&5) Remedial Investigation and Feasibility Study. Arapahoe County, Colorado. January.

Camp Dresser & McKee, Inc. 1992. Draft Phase I Feasibility Study. Lowry Landfill: Soils and Surface Water and Sediments Operable Units (OUs 4&5) Remedial Investigation and Feasibility Study, Arapahoe County, Colorado. July 24.

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ATTACHMENT 2

ATTACHMENT 2

Zoning and Land Use Summary

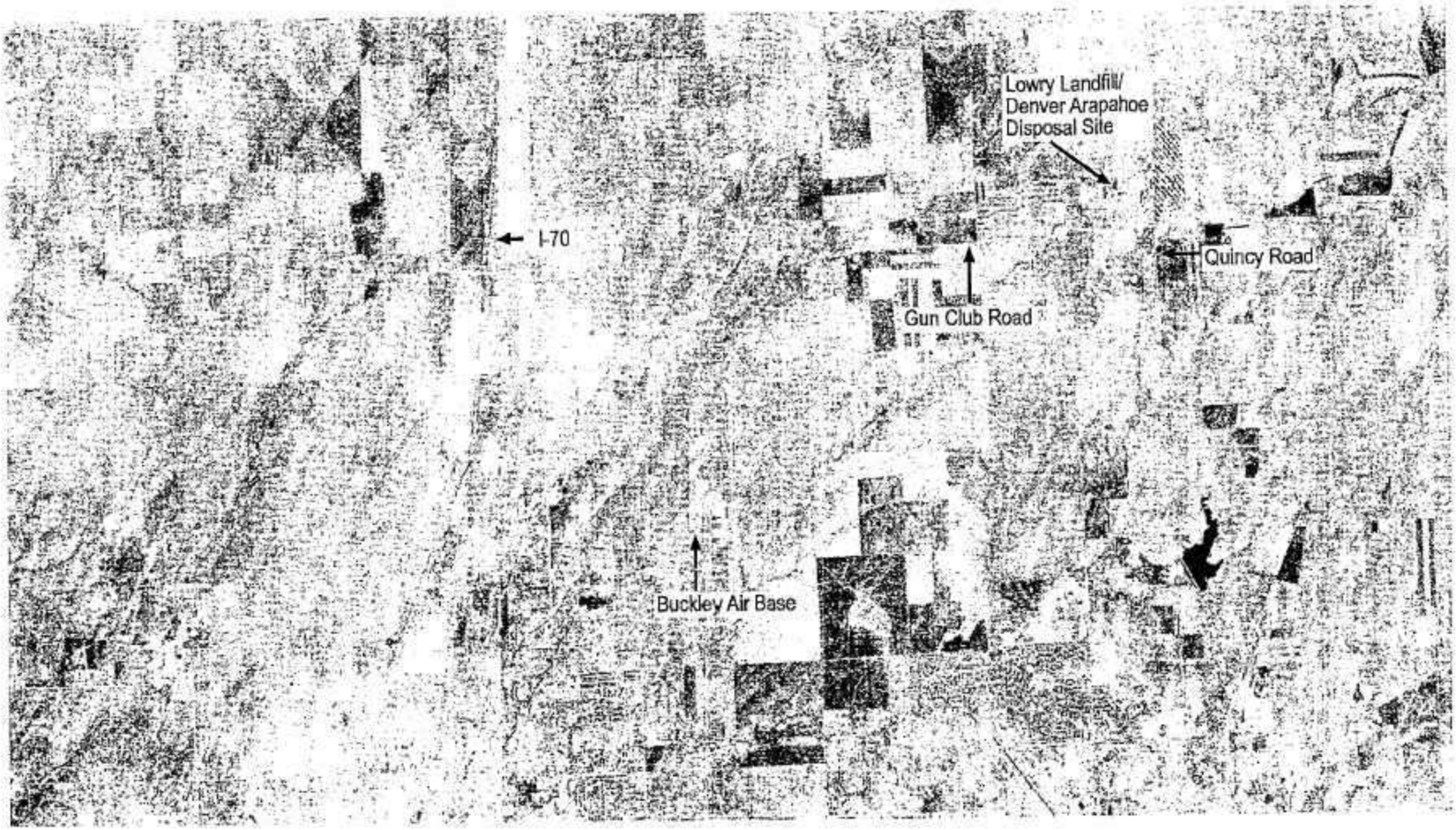
Attachment 2 provides the following information about zoning and land use:

- 1974, 1995, May 2000, and October 2000 Aerial Photographs of the Site and the vicinity
- January 18, 2000 City of Aurora Map of E-470 Corridor Zone and Subdistricts
- October 1994 map (Parsons ES) showing proposed institutional controls and the Buckley Day-Night Average Sound Level (LDN 65)
- City of Aurora Comprehensive Map of the Denver Arapahoe Disposal Site and Vicinity
- Map showing Principal Zoning in the Vicinity of the Lowry Site based on information presented at the Lowry Technical Advisory Group Meeting held on January 20, 2000
- Property Ownership Map for the Lowry Landfill Superfund Site, July 2001 (Parsons ES)

Poor Quality Source Document

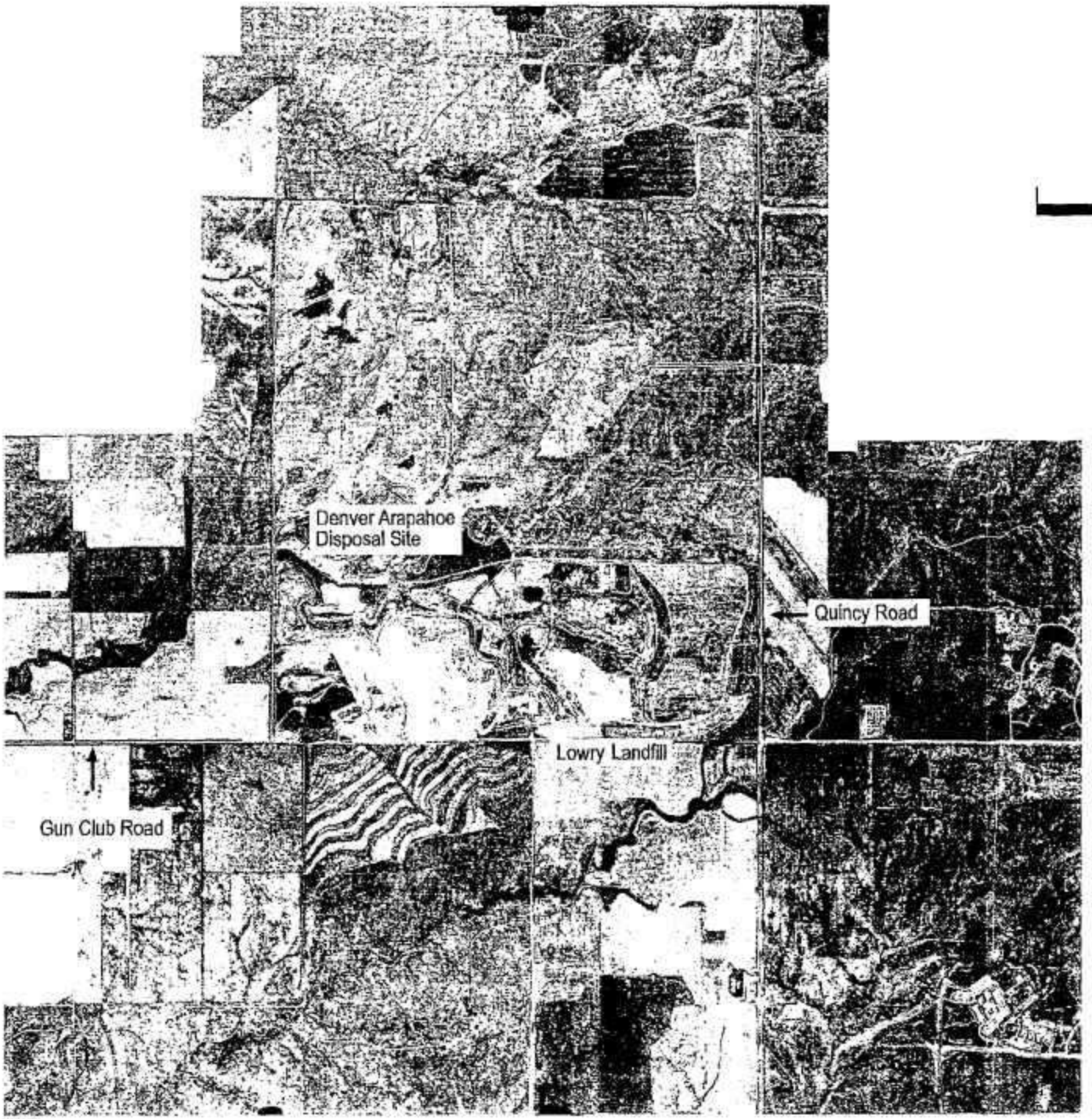
The following document images have been scanned from the best available source copy.

To view the actual hard copy, contact the Superfund Records Center at 303-312-6473



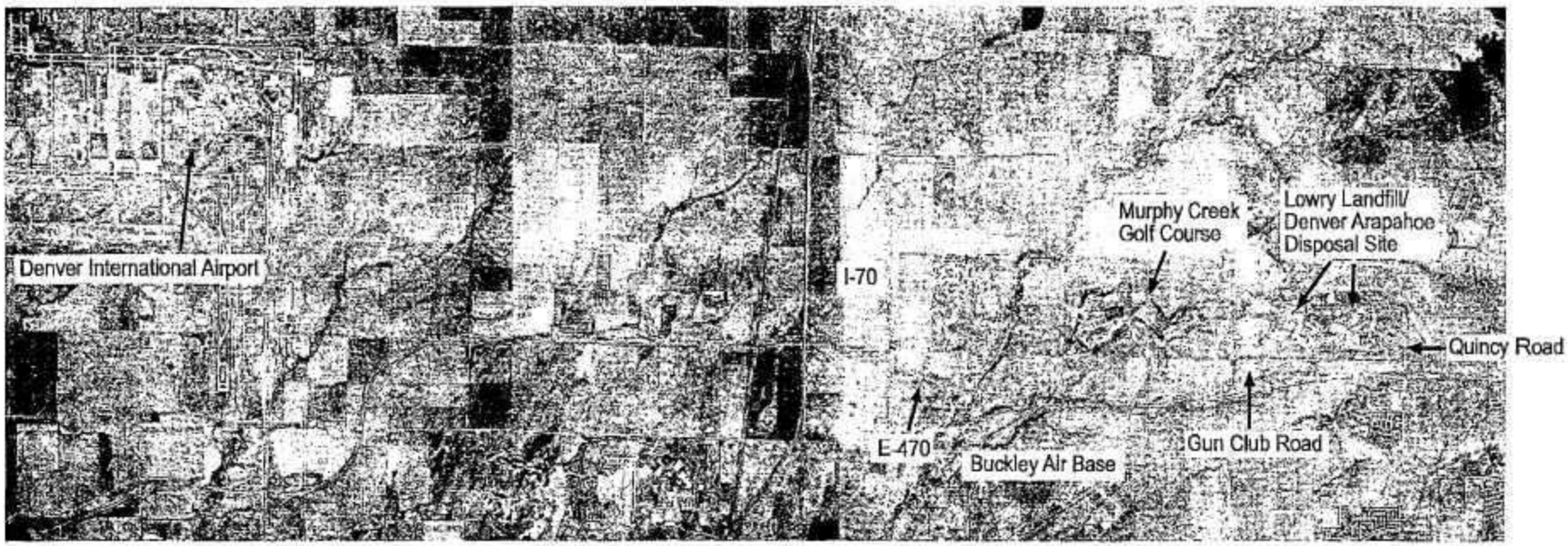
1 mile

1974 Aerial Photograph



1995 Aerial Photograph

May 2000 Aerial Photograph



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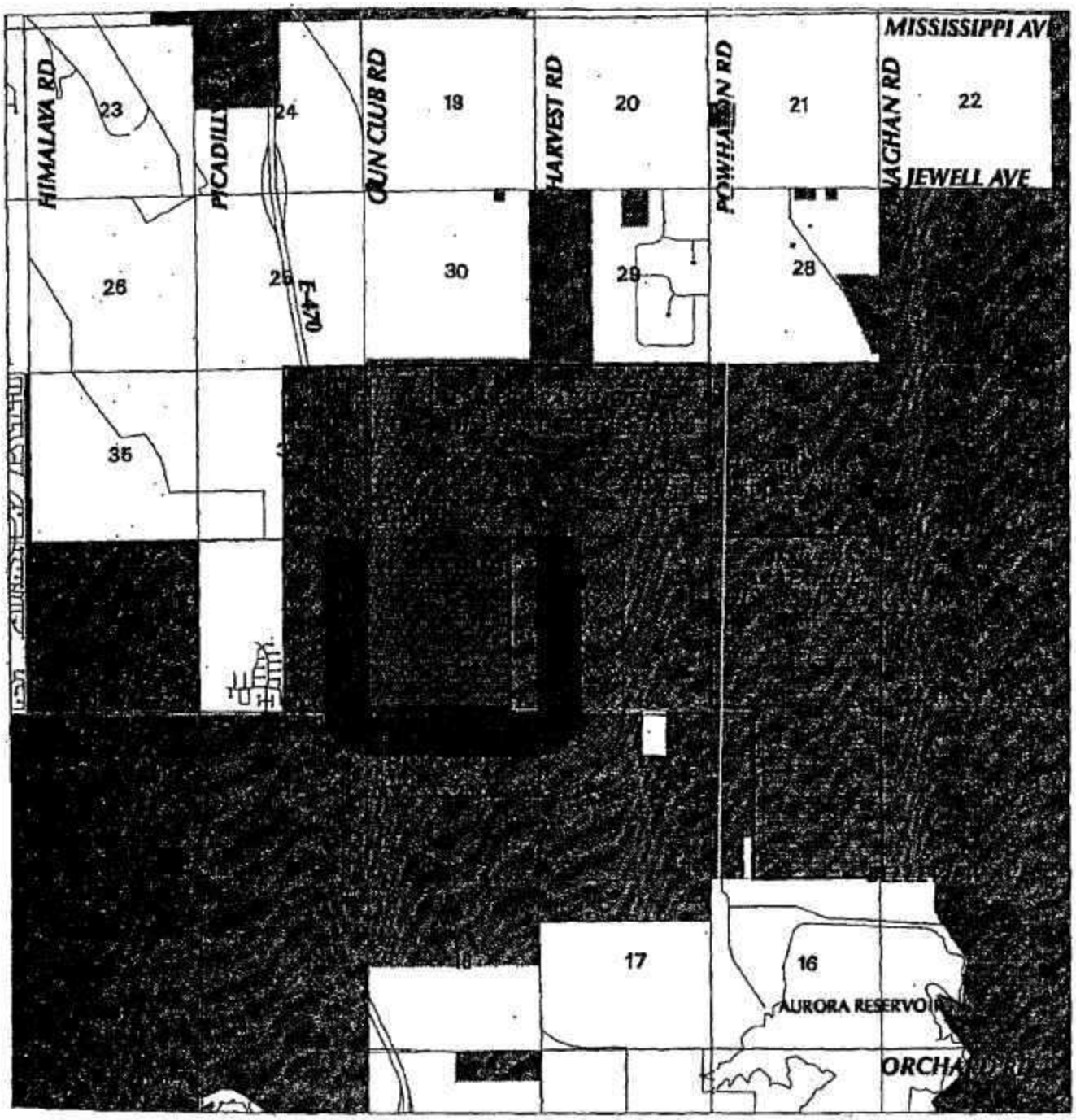
1 mile

October 2000 Aerial Photograph



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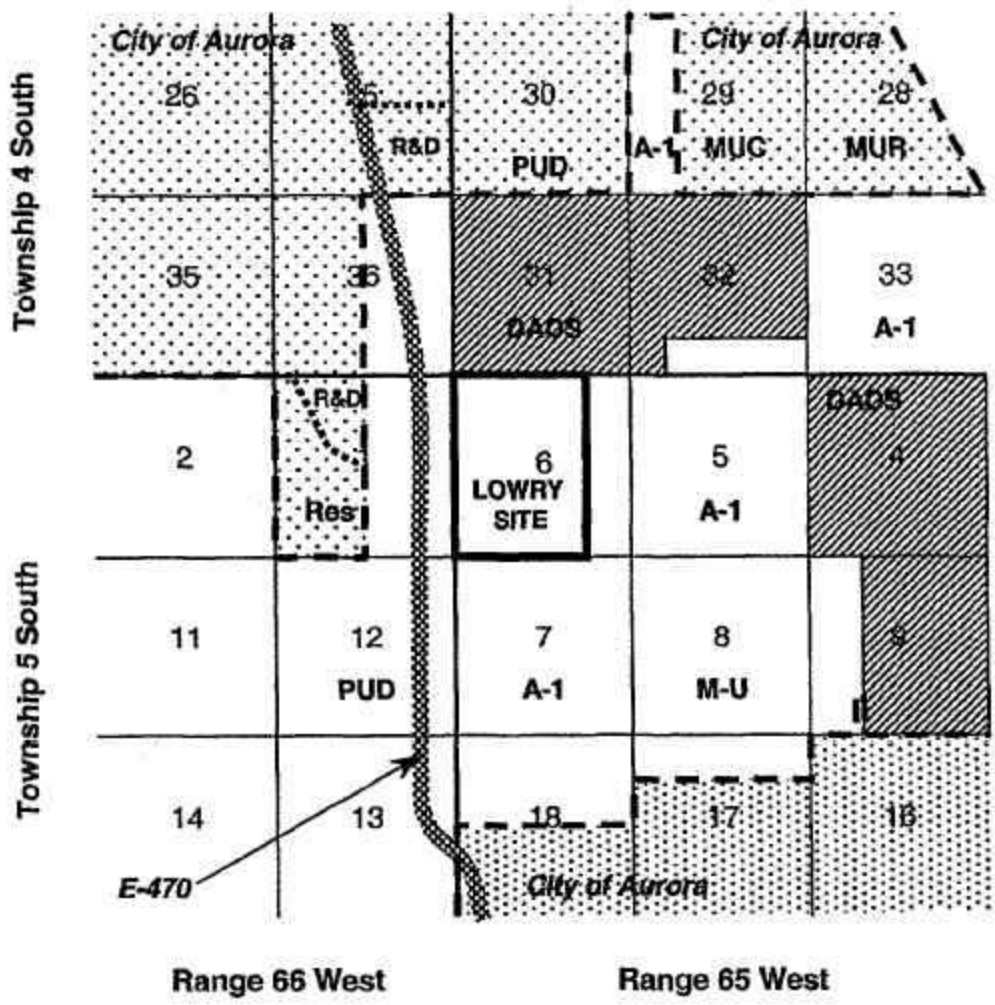
AURORA Comprehensive Plan

Map 3

1000 0 1000 2000 3000 Feet

DENVER ARAPAHOE DISPOSAL AND SUPERFUND SITES

NOTE: SECTIONS 31, 32, 6, 4 AND 9 WITHIN THE DENVER ARAPAHOE DISPOSAL SITE BOUNDARY ARE PERMITTED FOR SOLID WASTE DISPOSAL.



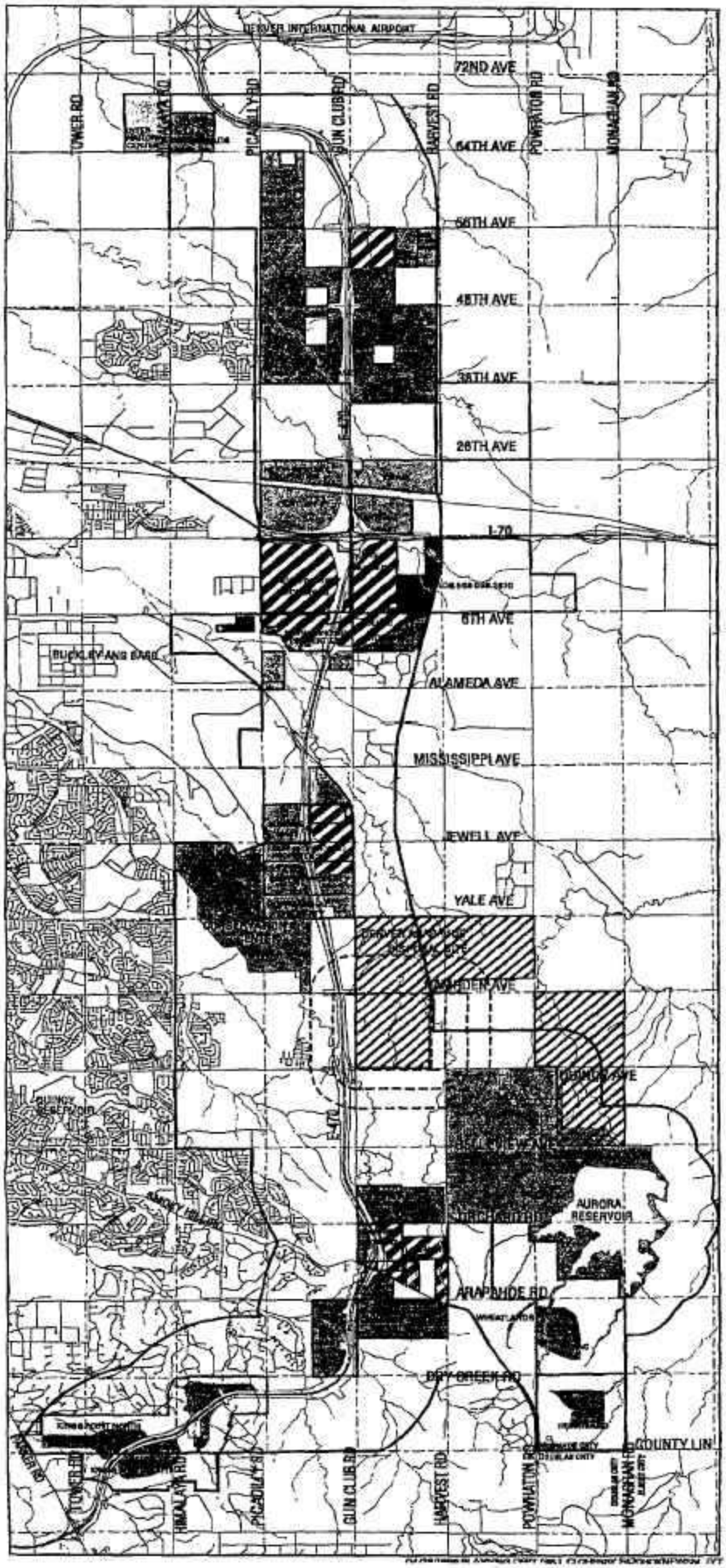
North

Not to Scale

Legend

- Section Line
- Township and Range Line
- 6 Section Number
- Aurora City Limits

Principal Zoning
in the Vicinity of the Lowry Site



E-470 Corridor Zone and Subdistricts

SUBDISTRICT LEGEND

- AIRPORT CORPORATE THEME
- AIRPORT COMMERCIAL/DISTRIBUTION THEME
- REGIONAL RETAIL/COMMERCIAL THEME
- LIGHT INDUSTRIAL/FLEX OFFICE THEME
- BUCKLEY RESEARCH & DEVELOPMENT THEME
- RESIDENTIAL MEDIUM DENSITY THEME (3-8 DU/AC)
- RESIDENTIAL RESERVOIR DENSITY THEME (1-4 DU/AC)
- RESIDENTIAL LOW DENSITY THEME (< 2 DU/AC)
- REGIONAL PARK AND OPEN SPACE THEME
- REGIONAL ACTIVITY CENTER
- DENVER ARAPAHOE DISPOSAL SITE
- EXISTING GDP BOUNDARY
- E-470 CORRIDOR ZONING STUDY BOUNDARY
- SUPERFUND BOUNDARY

SCALE 1:76000

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MILES

Last Revision: Jan 18, 2000

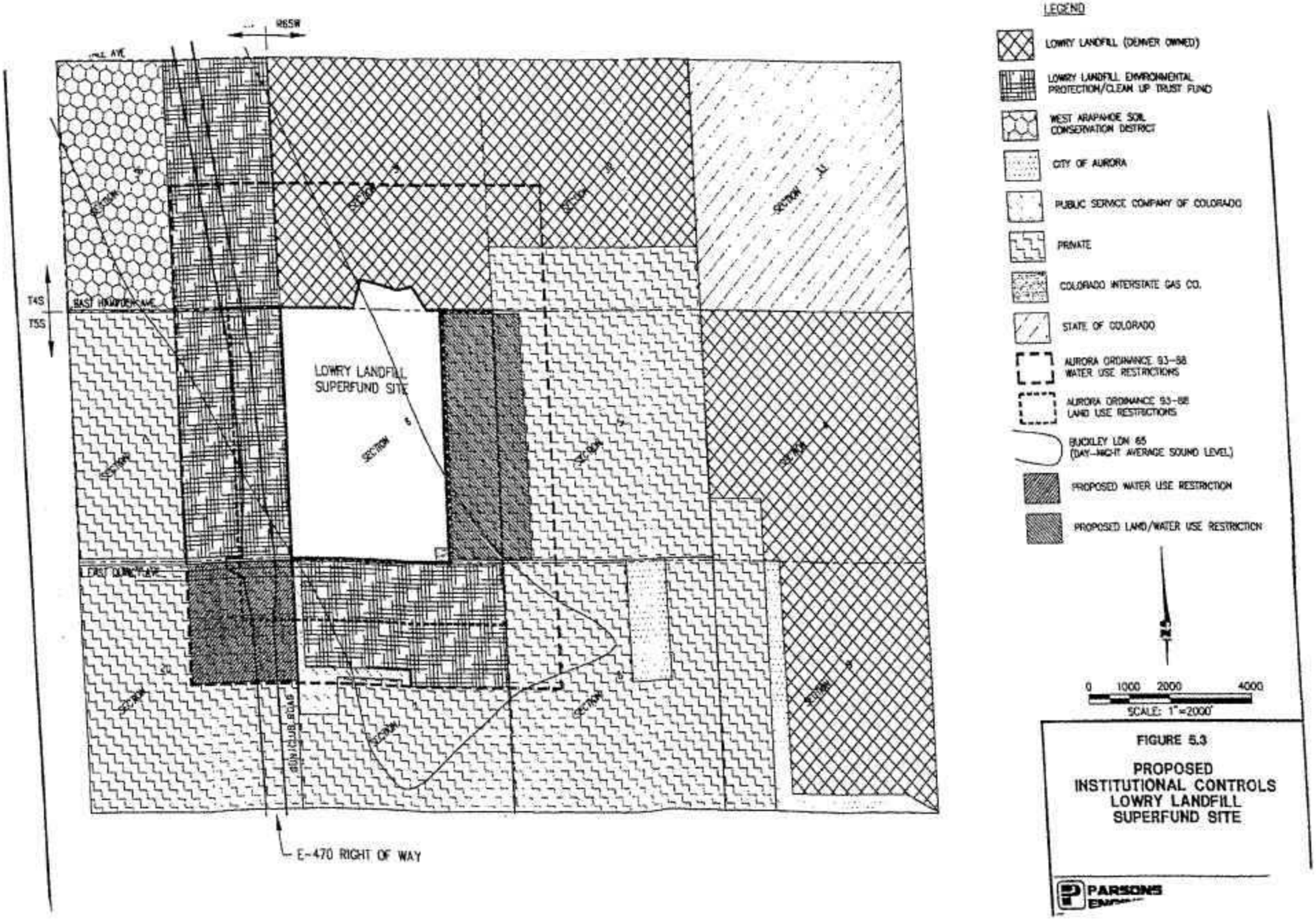


FIGURE 5.3

PROPOSED
INSTITUTIONAL CONTROLS
LOWRY LANDFILL
SUPERFUND SITE

PARSONS

LR1042, 10/24/95 at 15:15

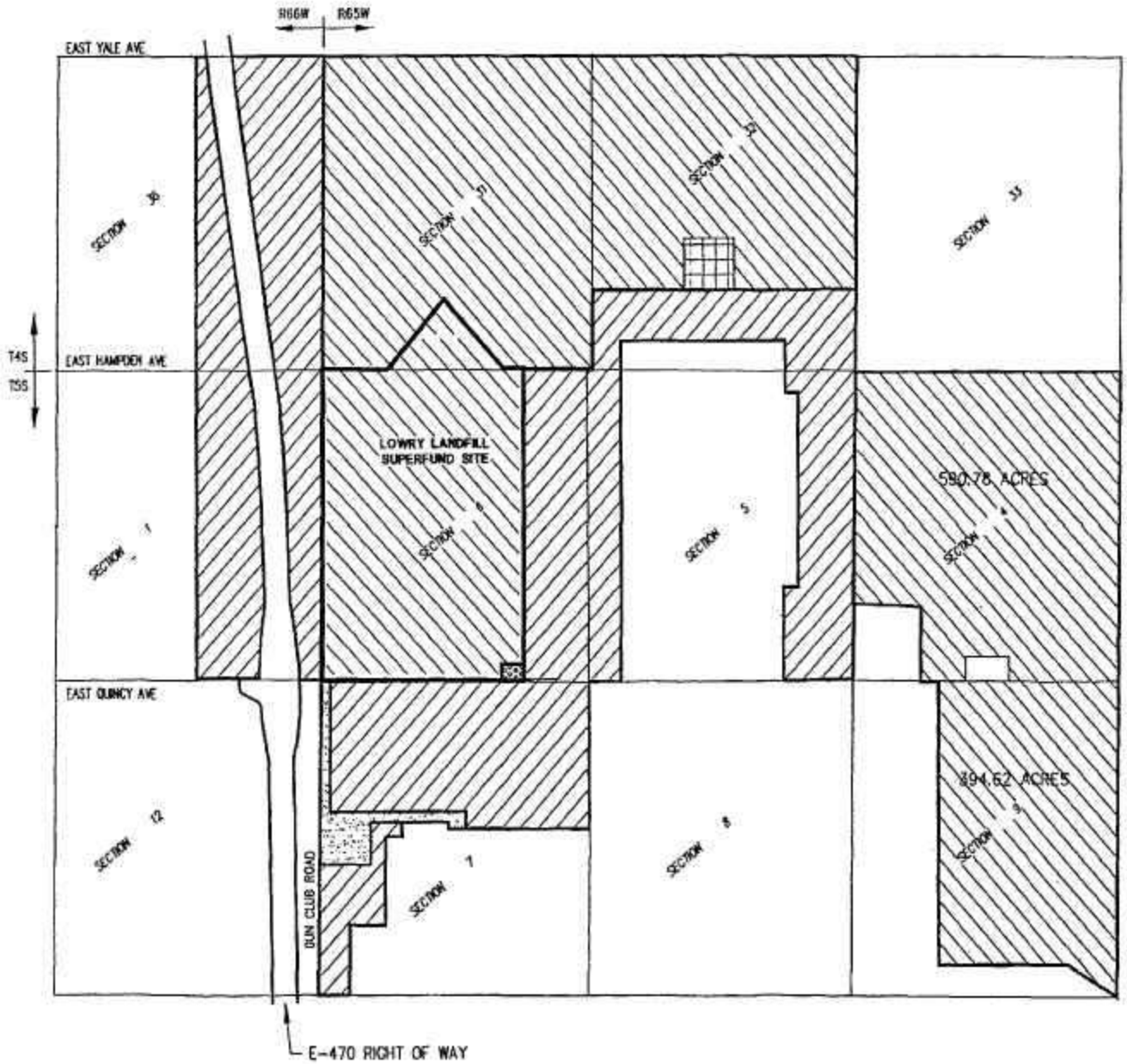


FIGURE 1

PROPERTY OWNERSHIP MAP
LOWRY LANDFILL
SUPERFUND SITE
(JULY, 2001)

Arapahoe County, Colorado

PARSONS
PARSONS ENGINEERING SCIENCE, INC.
Denver, Colorado

S:\ES\cad\LOWRYLF\727479\500101\DWG\275.dwg, 08/31/01 SV

ATTACHMENT 3

ATTACHMENT 3

Institutional Controls

Attachment 3 contains copies of the following institutional controls for the Lowry Site:

- City and County of Denver Executive Order 97, dated June 27, 1991
- City of Aurora Ordinance 93-88, dated October 12, 1993
- The Respondents' Submittal of Restrictive Covenants, Lowry Landfill Superfund Site, filed with the Arapahoe County Clerk and Recorder in June 2001.
- Property Ownership and Existing Institutional Controls Map, July 2001 (Parsons ES)

Federico Peña
MAYOR

City and County of Denver
CITY AND COUNTY BUILDING • DENVER, COLORADO • 80202
TELEPHONE (303) 575-2721

EXECUTIVE ORDER NO. 97

TO: All Departments and Agencies Under the Mayor

FROM: Mayor

DATE: June 27, 1991

SUBJECT: Restrictions on the Use of-Land, Surface Water and Groundwater at the Lowry Landfill (Denver–Arapahoe Disposal Site)

1. This Executive Order establishes the policy of the City and County of Denver concerning activities and use of the land and water, including surface water and ground water, at the Lowry Landfill. This Executive Order supersedes any prior policies or orders relating to the use of land or water at Lowry Landfill.

2. “Lowry Landfill”, as used herein, includes the following property:

The West Half (½), and the West Half of the East Half (W1/2E1/2), of Section 6, Township 5 South, Range 65 West of the Sixth Principal Meridian (“Section 6");

and

All of Section 31, Township 4 South, Range 65 West of the Sixth Principal Meridian (Section 31");

and

The North Half (N1/2), and the North Half of the South Half (N1/2S1/2), of Section 32, Township 4 South, Range 65 West of the Sixth Principal Meridian (“Section 32");

and

The North Half (N1/2), the Southeast Quarter (SE1/4), the North Half of the Southwest Quarter (N1/2SW1/4), and the Southeast Quarter of the Southwest Quarter (SE1/4SW1/4), of Section 4, Township 5 South, Range 65 West of the Sixth Principal Meridian (“Section 4");

The East Half (E1/2), and the East Half of the West Half (E1/2W1/2), of Section 9, Township 5 South, Range 65 West of the Sixth Principal Meridian except for the property described on Exhibit A; (“Section 9")

3. No direct use or reuse shall be made of the surface water or of alluvial ground water or of ground water in the Dawson and Denver aquifers on or underlying either Section 6 or Section 31 which could cause exposure of humans or animals to contaminants in said water; provided, however, that this restriction shall not interfere with treatment and subsequent use or discharge of any such water.

4. No direct use or reuse shall be made of ground water in the Arapahoe and Laramie-Fox Hills aquifers underlying Sections 6 and 31 for domestic, residential or municipal water supply purposes.

5. No water production or dewatering wells shall be constructed on Sections 4, 9, and 32 without the express written consent of the Mayor or his designee.

6. Certain uses of Sections 6 and 31 would be inconsistent with the landfill uses of those sections and the nature of Section 6 as a listed site on the National Priorities List pursuant to the Comprehensive Environmental Response Compensation and Liability Act (“CERCLA”). Section 6 and Section 31, therefore, shall not be used for any of the following purposes or any other purposes designated by the Mayor from time to time: agricultural; residential development, including boarding houses, motels and hotels; commercial development; day care centers; pre-schools; schools; hospitals; nursing homes; office buildings; community centers; correctional facilities; community recreational facilities; senior citizen centers; restaurants; hunting or fishing.

7. No employee, agent, invitee, lessee, or other person or entity shall construct a building or other structure on those portions of Sections 6 and 31 that have been used as a landfill; provided, however, that buildings and structures necessary to remediation of the contamination may be constructed with the express written consent of the Mayor or his designee.

8. No employee, agent, invitee, lessee, or other person or entity shall dispose, discharge, deposit, inject, dump, spill, leak or place any waste or other material, liquid or solid, upon the Lowry Landfill property without the express written consent of the Mayor or his designee.

9. No excavation or drilling shall be done anywhere on Sections 6 and 31 without the express written consent of the Mayor or his designee.

10. Appropriate health and safety plans shall be prepared for all employees, agents, invitees and lessees working on Sections 6 and 31. All those working on Sections 6 and 31 shall be familiar with the health and safety plans. Failure to adhere to the health and

safety plans shall be grounds for dismissal from employment by the City or denial of access to Sections 6 and 31.

11. Any violation of this Executive Order shall be grounds for the termination of any access rights of the violating person or entity, including revocable permits, access agreements or contracts. The City Attorney's office is authorized to enforce the terms of this Executive Order by appropriate trespass, contract actions, and/or any other remedy available at law or in equity.

Approved for Legality:

Patricia L. Wells
Attorney for the City and
County of Denver

Approved:

Federico Peña
Mayor

William R. Roberts
Manager of Public Works

Thomas Moe
Manager of Health & Hospitals

Manuel Martinez
Manager of Safety

Alan N. Charnes
Manager of Revenue

Mary C. Krang
Manager of Social Services

Donald and Carolyn Etter
Managers of Parks and Recreation

Paul B. Hoskins
Manager of General Services

EXHIBIT A

A parcel of land situated in Section 9, T5S, R65W, 6th P.M., Arapahoe County, Colorado, more particularly described as follows:

Commencing at the SE corner of the SE 1/4 of Section 9, T5S, R65W, 6 th P.M., Arapahoe County, Colorado:

thence N89E56' 43"W along the south line of said SE 1/4 a distance of 461.45 feet to the Point of Beginning;

thence N89E56' 43"W, continuing along said south line a distance of 2,179.54 feet to the SE corner of the E ½ of the SW 1/4 of said Section 9;

thence N89E56' 56"W along the south line of said E ½ a distance of 1,320.46 feet to the SW corner of said E1/2;

thence N00E26' 24"E along the west line of said E ½ a distance of 2,628.77 feet to the SW corner of the E ½ of the NW 1/4 of said Section 9;

thence N00E26' 45"W along the west line of the E ½ of said NW 1/4 a distance of 2,573.49 feet to a point lying on the south right-of-way line of East Quincy Avenue;

thence N89E43' 06"E along said south right-of-way line a distance of 40.00 feet;

thence S00E26' 45"E parallel with the west line of the E ½ of said NW 1/4 a distance of 2,573.55 feet to a point on the north line of said SW 1/4;

thence S00E26' 24"W, parallel with the test line of the E ½ of said SW 1/4, a distance of 1,508.79 feet;

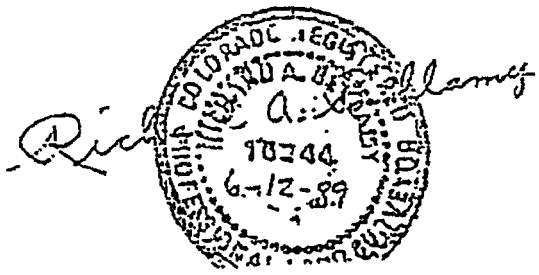
thence S89E56' 43"E a distance of 2,810.00 feet;

thence S29E47' 07"E a distance of 1,291.19 feet to the Point of Beginning.

The above described parcel contains 3,719,349 square feet (85.384 acres more or less).

The bearings used in this description were taken from the plat of Aurora Reservoir Subdivision Filing No. 1.

LEGALS 075
6/9/89



EFFECTIVE DATE: 10-22-93

EXAMINED

ORDINANCE NO. 93-88

A BILL

FOR AN ORDINANCE AMENDING SECTIONS 39-70, 41-797, AND 41-800, AND REPEALING SECTION 41-798 OF THE CITY CODE OF THE CITY OF AURORA, COLORADO, REGARDING WATER WELLS AND DEVELOPMENT IN THE VICINITY OF LOWRY LANDFILL

WHEREAS, the City Council of the City of Aurora, Colorado, finds that the Baseline Risk Assessment and supporting technical data for the Lowry Landfill Superfund site suggest that the site presents no current off-site public health exposure risk, but that there is a short term potential for public health risk related to gas migration until the selected cleanup plan has been effectively implemented; and

WHEREAS, the Council finds that risk to off-site groundwater is limited primarily to the shallow system, but that such risk is long term in nature and may increase over time if the cleanup remedy does not contain contaminants on the Superfund site; and

WHEREAS, the Council finds pursuant to Section 41-796(c) of the City Code that it is necessary to revise the existing water well and development restrictions in the vicinity of Lowry Landfill; and

WHEREAS, the proposed cleanup will be a containment-based remedy involving the permanent retention of most of the pollutants on the site, therefore, mechanisms are warranted to advise future generations of the presence of these hazardous substances; and

WHEREAS, it is the City of Aurora's expectation that the Record of Decision will ensure permanent protectiveness at the compliance boundary. Any development prohibitions enacted by the City are meant to be temporary in nature, and are not to be construed as institutional controls providing an off-site buffer within which Superfund site contaminants may be allowed to migrate.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AURORA, COLORADO:

Section 1. That Section 39-70(d) of the City Code of the City of Aurora, Colorado, is hereby amended to read as follows:

Sec. 39-70. Prohibition of use of independent water system; cross-connection; Lowry LLandfill vicinity.

(d) It shall be unlawful for any person to develop or use for any purpose wells in the following locations in the vicinity of Lowry Landfill; provided such locations are within the city limits of the city:

(1) Sections 31, 36, west 1/2 of Sections 25 and 32, Township 4 South, Range 66 West of the sixth principal meridian, Arapahoe County, Colorado;

(2) The East 1/2 of Sections 25 and 36, Township 4 South, Range 66 West of the sixth principal meridian, Arapahoe County, Colorado;

(3) Section 6, the north 1/2 of Section 7, the northwest 1/4 of Section 8 and the west 1/2 of Section 5, Township 5 South, Range 65 West of the sixth principal meridian, Arapahoe County, Colorado, and

(4) The northeast 1/4 of Section 12, and the east 1/2 of Section 1, Township 5 South, Range 66 West of the sixth principal meridian, Arapahoe County, Colorado.

An exception to the prohibition herein shall be wells that are used for monitoring ground water quality.

THE FOLLOWING REGULATIONS SHALL APPLY TO THE AREA WITHIN 1/2 MILE OF SECTION 6, TOWNSHIP 5 SOUTH, RANGE 65 WEST OF THE SIXTH PRINCIPAL MERIDIAN, CITY OF AURORA, ARAPAHOE COUNTY, COLORADO:

(1) IT SHALL BE UNLAWFUL FOR ANY PERSON TO DRILL, DEVELOP, OR USE ANY WELLS IN THE DAWSON AQUIFER WITHIN 1/2 MILE OF THE EXTERIOR BOUNDARIES OF SECTION 6 UNTIL SUCH TIME AS THE ENVIRONMENTAL PROTECTION AGENCY'S GROUNDWATER REMEDY FOR THE LOWRY LANDFILL SUPERFUND SITE HAS BEEN IMPLEMENTED CONSISTENT WITH THE RECORD OF DECISION AND THE AGENCY'S FIVE (5) YEAR PERFORMANCE REVIEW OF THE REMEDY HAS OCCURRED, AS DETERMINED BY THE CITY COUNCIL. THIS PROHIBITION SHALL NOT APPLY TO WELLS THAT ARE USED FOR MONITORING GROUNDWATER QUALITY, EXTRACTING GROUNDWATER FOR REMEDIATION, OR REINJECTING TREATED GROUNDWATER.

(2) AFTER THE FIVE (5) YEAR PERFORMANCE REVIEW HAS OCCURRED AND THE ENVIRONMENTAL PROTECTION AGENCY

REPORTS THAT THE REMEDY IS PROTECTIVE AT THE COMPLIANCE BOUNDARY, THE PROHIBITION AGAINST DRILLING WELLS IN THE DAWSON AQUIFER SHALL EXPIRE, PROVIDED THAT THE DRILLING OR USE OF SUCH WELLS WITHIN 1/2 MILE OF THE BOUNDARIES OF SECTION 6 SHALL ONLY OCCUR WITH THE APPROVAL OF THE CITY OF AURORA.

(3) THERE ARE HEREBY ADOPTED BY THIS REFERENCE THE COLORADO PRIMARY DRINKING WATER REGULATIONS, PROMULGATED BY THE STATE BOARD OF HEALTH AND FOUND IN VOLUME 5 OF THE COLORADO CODE OF REGULATIONS 1007-3, AS AMENDED, WHICH REGULATIONS SHALL APPLY TO WATER QUALITY AT THE POINT OF USE IN THE FOLLOWING CATEGORIES:

A. COMMUNITY DRINKING WATER SYSTEMS;
B. NONCOMMUNITY DRINKING WATER SYSTEMS; AND
C. SYSTEMS WITH FEWER THAN 15 SERVICE CONNECTIONS OR WHICH REGULARLY SERVE AN AVERAGE OF FEWER THAN 25 PERSONS FEWER THAN 60 DAYS OF THE YEAR AND PROVIDING WELL WATER FOR ORDINARY HOUSEHOLD PURPOSES, THE WATERING OF POULTRY, DOMESTIC ANIMALS, AND LIVESTOCK ON FARMS AND RANCHES, AND THE IRRIGATION OF HOME GARDENS AND LAWNS.

RECORDS OF WATER QUALITY MONITORING REQUIRED BY THE DRINKING WATER REGULATIONS SHALL BE KEPT AND SHALL BE MADE AVAILABLE TO THE CITY UPON REQUEST.

Section 2. That Section 41-797 of the City Code of the City of Aurora, Colorado, is hereby amended to read as follows:

Sec. 41-797. Development within one QUARTER mile of landfill.

(a) No development or construction of buildings or structures shall be permitted within one QUARTER (1 1/4) mile OF THE EAST, SOUTH, OR WEST EXTERIOR BOUNDARIES of Section 6 prior to the IMPLEMENTATION OF THE ENVIRONMENTAL PROTECTION AGENCY'S REMEDY AS DEFINED IN THE RECORD OF DECISION FOR THE LOWRY LANDFILL SUPERFUND SITE AND THE COMPLETION OF THE FIVE (5) YEAR PERFORMANCE REVIEW WHICH CONFIRMS THAT THE REMEDY IS PROTECTIVE OF PUBLIC HEALTH AND ENVIRONMENT AT THE COMPLIANCE BOUNDARY, *stabilization of the landfill located thereon/ Stabilization shall be deemed to have occurred upon the completion of the following conditions/* as determined by the city council/. THIS PROHIBITION SHALL NOT APPLY TO THE DEVELOPMENT OR CONSTRUCTION OF BUILDINGS OR STRUCTURES THAT

ARE USED FOR CHARACTERIZING OR REMEDIATING THE CONTAMINATION AT THE LOWRY LANDFILL NOR TO THE DEVELOPMENT OR CONSTRUCTION OF ROADWAYS, PUBLIC UTILITIES, AND STRUCTURES ACCESSORY THERETO.

(1) Abatement of the fire risk;

(2) Installation of a surface water treatment system;

(3) Installation a monitoring system for well water quality to monitor the magnitude and extent of contamination;

(4) Installation of gas monitoring system and preparation of a gas migration control program;

(5) Implementation of an emergency notification and response plan;

(6) Stabilization of waste pits to prevent differential settlement;

(7) The record of decision has been issued;

(8) Such additional conditions as determined to be necessary by city council based upon new information unknown or not available at the time of the enactment of this article.

(b) Upon city council's determination that the landfill has been stabilized REMEDY IS PROTECTIVE OF PUBLIC HEALTH AND ENVIRONMENT AT THE COMPLIANCE BOUNDARY, development and construction of buildings and structures may be permitted within one QUARTER (1 1/4) mile of Section 6, provided the underlying zoning permits such development. subject to the following prohibited exceptions:

(1) Any residential uses;

(2) Nonresidential uses such as schools, child care facilities, hospitals and convalescent care facilities or similar uses which include occupancy by the young, the elderly, the infirm or the incapacitated;

(3) Motels, motels, or conference centers;

(c) For uses not prohibited above, the developer of which shall demonstrate to the city council's satisfaction that the proposed development will not be adverse to the health, safety or welfare of occupants and users of the

development, and will not exacerbate hazardous conditions in the vicinity of the landfill. In making a determination, city council shall consider the recommendation of the planning commission and comments of the Lowry landfill monitoring committee, tri-county health department, the U.S. Environmental Protection Agency, and other health and regulatory agencies. AT SUCH TIME AS DEVELOPMENT IS PERMITTED WITHIN 1/4 MILE OF THE EAST, SOUTH, AND WEST EXTERIOR BOUNDARIES OF SECTION 6, EVERY DEVELOPMENT APPLICATION SHALL BE ACCOMPANIED BY AN AGREEMENT IN A FORM SATISFACTORY TO CITY COUNCIL THAT SHALL HOLD HARMLESS THE CITY OF AURORA FROM ANY DAMAGE CLAIM ARISING FROM PERMISSION TO DEVELOP.

Section 3. That Section 41-798 of the City Code of the City of Aurora, Colorado, is hereby repealed in its entirety.

Section 4. That Section 41-800 of the City Code of the City of Aurora, Colorado, is hereby amended to read as follows:

Sec. 41-800. Notice of proximity of landfill.

(a) Vendors of real property located in sections within one QUARTER (1 1/4) mile of the perimeter EAST, SOUTH, OR WEST EXTERIOR BOUNDARIES of Section 6 shall provide the following notice to prospective purchasers:

NOTICE OF LANDFILL SITE

The following described property is located in a section that is within one QUARTER (1 1/4) mile of THE EAST, SOUTH, OR WEST EXTERIOR BOUNDARIES OF SECTION 6 WHICH CONTAINS A FACILITY GENERALLY REFERRED TO AS the Lowry Landfill SUPERFUND SITE, which includes a hazardous waste facility which THAT has been added to the national priority list for superfund cleanup. A closed chemical waste facility, a bladge disposal area, and an operating sanitary landfill.

Vendor/grantor:
Property description:
Street address:

(b) The notice required herein shall be presented to prospective purchasers of real property located in sections within one QUARTER (1 1/4) mile of the perimeter EAST, SOUTH, OR WEST EXTERIOR BOUNDARIES of Section 6 prior to entering into a contract of sale for the real property. Such notice shall be on a separate sheet of paper in at least ten-point bold-faced type, if printed, or in capital letters, if

typewritten, and shall contain a signature line for the prospective purchaser(s), preceded by a statement that he or she has received a copy of said notice.

(c) *Whenever a certificate of occupancy is required for a structure located within one (1) mile of the perimeter of Section 5, a copy of the notice required by this section, signed by the current owner of the land upon which such structure is attached, shall be presented to the chief building official or his designee as condition precedent to the issuance of said certificate of occupancy in addition to all other requirements of the City Code.* THE NOTICE REQUIRED HEREIN SHALL BE RECORDED WITH THE CLERK AND RECORDER OF ARAPAHOE COUNTY.

Section 5. That all ordinances or parts of ordinances of the City Code of the City of Aurora, Colorado, in conflict herewith are expressly repealed.

Section 6. That pursuant to Section 5-5 of the Charter of the City of Aurora, Colorado, the second publication of this ordinance shall be by reference, utilizing the ordinance title.

INTRODUCED, READ AND ORDERED PUBLISHED this 23rd day of August, A.D. 1993.

PASSED AND ORDERED PUBLISHED BY REFERENCE this 13th day of September, A.D. 1993.

PAUL E. TAUER, Mayor

ATTEST:

DONNA L. YOUNG, City Clerk

APPROVED AS TO FORM:

{wwd.11}

Sec. 41-789. Application.

The comprehensive plan and such other parts of the comprehensive plan which may be adopted from time to time, together with all amendments and other development plans adopted as amendments to the comprehensive plan in the future, shall serve to guide the city council and the planning and zoning commission in their decisions and recommendations in all land use and land development proposals within the city.
(Code 1963, § 8-21-2; Ord. No. 90-21, § 2, 4-9-90)

Sec. 41-790. Amendments.

(a) Amendments and revisions to the comprehensive plan shall be made by ordinance which shall be passed by the affirmative vote of not less than two-thirds of the entire membership of the city council.

(b) All recommendations by the planning and zoning commission for amendments to the comprehensive plan shall be by not less than a two-thirds vote of the entire membership of the commission. These recommendations shall be conveyed to the city council for the city council's consideration in adopting any amendments to and updating of the comprehensive plan. All proposed amendments to the comprehensive plan shall be referred to the planning commission for their recommendations, but said recommendations shall not be binding upon the city council.
(Code 1963, §§ 8-21-3, 8-21-4)

Sec. 41-791. Review and updating.

The comprehensive plan shall be reviewed and updated so as to maintain the plan and map on a current basis not less than once every five (5) years.
(Code 1963, § 8-21-4; Ord. No. 90-21, § 3, 4-9-90)

Secs. 41-792—41-795. Reserved

ARTICLE XXV. LOWRY LANDFILL*

Sec. 41.796. Purpose; application of article.

(a) The city council finds and determines that there exists a potential major public health threat posed by unregulated development in the vicinity of Section 6, Township 5 South, Range 65 West of the sixth principal meridian, Arapahoe County, Colorado, hereinafter referred to as Section 6. To minimize exposure of residential and other land uses to potential hazards in the vicinity of Lowry Landfill, there is [are] hereby adopted regulations which shall limit inappropriate or incompatible land use and occupancy of structures and shall provide notice of the proximity of the Landfill to prospective purchases of real property in the area.

(b) The application of this article is limited to land within the city limits of the city and is in addition to the provisions of the City Code and the underlying zone districts. Where the provisions conflict, this article shall control.

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*Editor's note—Section 1 of Ord. No. 87-165, adopted June 29, 1987, enacted a new Art. XXV, §§ 41-996-41-801, to read as herein set out. Section 2 of the ordinance renumbered former Arts. XXV—XXVIII as Arts. XXVI—XXIX.

(c) The city council recognizes that significant studies and testing are currently taking place at Section 6. Significant new information has and will continue to come to light regarding the potential hazards at Section 6. In recognition of this dynamic situation, the city council reserves its inherent right to review this article whenever significant new information is brought forward for public debate.
(Ord. No. 87-165, § 1, 6-29-87)

Sec. 41-797. Development within one quarter mile of landfill.

(a) No development or construction of buildings or structures shall be permitted within one-quarter (¼) mile of the east, south, or west exterior boundaries of Section 6 prior to the implementation of the Environmental Protection Agency's remedy as defined in the record of decision for the Lowry Landfill Superfund Site and the completion of the five-year performance review which confirms that the remedy is protective of public health and environment at the compliance boundary, as determined by the city council. This prohibition shall not apply to the development or construction of buildings or structures that are used for characterizing or remediating the contamination at the Lowry Landfill nor to the development or construction of roadways, public utilities, and structures accessory thereto.

(b) Upon city council's determination that the remedy is protective of public health and environment at the compliance boundary, development and construction of buildings and structures may be permitted within one-quarter (¼) mile of Section 6, provided the underlying zoning permits such development.

(c) At such time as development is permitted within one-quarter (¼) mile of the east, south, and west exterior boundaries of Section 6, every development application shall be accompanied by an agreement in a form satisfactory to city council that shall hold harmless the City of Aurora from any damage claim arising from permission to develop.
(Ord. No. 87-165, § 1, 6-29-87; Ord. No. 93-88, § 2, 9-13-93)

Sec. 41-798. Reserved.

Editor's note–Section 3 of Ord. No. 93-88, adopted Sept. 13, 1993, repealed § 41-798, which pertained to development beyond one mile from landfill and derived from Ord. No. 87-165, § l, adopted June 29, 1987.

Sec. 41-799. Development conditions.

City council may attach such conditions and stipulations to its approval of a development proposal as it deems necessary to protect health, safety and welfare, and to maintain compliance with the purposes of this article, and in response to new information unavailable at the time of enactment of this article. Such conditions may include posting of notice of location of the landfill site to advise occupants and tenants.
(Ord. No. 87-165, § 1, 6-29-87)

Sec. 41-800. Notice of proximity of landfill.

(a) Vendors of real property located within one-quarter (¼) mile of the east, south or west exterior boundaries of Section 6 shall provide the following notice to prospective purchasers.

NOTICE OF LANDFILL SITE

The following described property is located within one-quarter (¼) mile of the east, south, or west exterior boundaries of Section 6 which contains a facility generally referred to as

the Lowry Landfill Superfund Site that has been added to the national priority list for superfund cleanup.

Vendor/grantor:
Property description:
Street address:

(b) The notice required herein shall be presented to prospective purchasers of real property located in sections within one-quarter (¼) mile of the east, south, or west exterior boundaries of Section 6 prior to entering into a contract of sale for the real property. Such notice shall be on a separate sheet of paper in at least ten-point bold-faced type, if printed, or in capital letters, if typewritten, and shall contain a signature line for the prospective purchaser(s), preceded by a statement that he or she has received a copy of said notice.

(c) The notice required herein shall be recorded with the clerk and recorder of Arapahoe County.
(Ord. No. 87-165, § 1, 6-29-87; Ord. No. 93-88, § 4, 9-13-93)

Sec. 41-801. Failure to provide notice; penalty.

(a) It shall be unlawful to fail to provide notice of the location of the landfill site to prospective purchasers as required by section 41-800 of this Code.

(b) Any person who shall be convicted of, or plead guilty or no contest to, a violation of this section shall, for each offense, be subject to the penalties found in section 1-14(a).
(Ord. No. 87-165, § 1, 6-29-87; Ord. No. 92-95, § 21, 12-7-92)

Sees. 41-802, 41-803. Reserved.

ARTICLE XXVI. NOISE*

Sec. 41-804. Declaration of policy.

The city council finds and declares that noise is a significant source of environmental pollution that represents a present and increasing threat to the public peace and to the health, safety and welfare of the residents of the City of Aurora and to its visitors. Accordingly, it is the policy of council to provide standards for permissible sound levels in various areas and manners and at various times and to prohibit sound in excess of those levels.

Unless specified within this article, the restrictions contained in the following sections are not to be construed as repealing any other noise-related ordinances in the city code.
(Ord. No. 85-30, § 2, 4-1-85)

_____

*__Editor's note__– Art. XXV was renumbered as Art. XXVI by § 2 of Ord. No. 87-165, adopted June 29, 1987. See also the editor's footnote to Art. XXV.

__Cross references__– Barking dogs, § 7-23; aircraft noise reduction, § 9.220 et seq.; disturbing the peace, § 27-67; peddlers' noisemaking devices prohibited, § 30-3; mufflers on motor vehicles, § 37-105; permit for sound truck, § 37-113; noise in industrial districts, § 41-483; sound attenuating fences next to residential districts, § 41-710; airport influence district, § 41-825 et seq.; residential uses within commercial aircraft noise impacted areas, § 41-845 et seq.

(e) *Effective date.* An ordinance for disconnection shall be effective as established by the Home Rule Charter. A copy shall be recorded with the county clerk and recorder of the county in which such tract is situated.

(f) *Exclusive procedure.* The procedure for disconnection described herein is the sole and exclusive procedure for seeking disconnection from the city. It is the intent of the city council of the city of Aurora to exercise the Home Rule powers granted to certain municipal corporations by Section 6 ofArticle XX of the Colorado Constitution, to supersede all provisions in C.R.S., Title 31, relating to disconnection.

(Ord. No. 97-01, § 1, 2-3-97)

Secs. 146-2169– 146-2195. Reserved

ARTICLE XX. COMPREHENSIVE PLAN*

Sec. 146-2196. Adoption.

There is adopted a comprehensive plan for the orderly development and redevelopment of the city. The city comprehensive plan shall include all exhibits attached thereto and such amendments to the comprehensive plan which are adopted by ordinance from time to time.

(Code 1979, § 41-788)

Sec. 146-2197. Application.

The comprehensive plan and such other parts of the comprehensive plan which may be adopted from time to time, together with all amendments and other development plans adopted as amendments to the comprehensive plan in the future, shall serve to guide the city council and the planning and zoning commission in their decisions and recommendations in all land use and land development proposals within the city.

(Code 1979, § 41-789)

Sec. 146-2198. Amendments.

(a) Amendments and revisions to the comprehensive plan shall be made by ordinance which shall be passed by the affirmative vote of not less than two-thirds of the entire membership of the city council.

(b) All recommendations by the planning and zoning commission for amendments to the comprehensive plan shall be by not less than a two-thirds vote of the entire membership of the commission. These recommendations shall be conveyed to the city council for the city councils consideration in adopting any amendments to and updating of the comprehensive plan. All proposed amendments to the comprehensive plan shall be referred to the planning and zoning commission for their recommendations, but the recommendations shall not be binding upon the city council.

(Code 1979, § 41-790)

Sec. 146-2199. Review and updating.

The comprehensive plan shall be reviewed and updated so as to maintain the plan and map on a current basis not less than once every five years.

(Code 1979, § 41-791)

Secs. 146-2200-146-2225. Reserved.

ARTICLE XXI. LOWRY LANDFILL†

Sec. 146-2226. Purpose; application of article.

(a) The city council finds and determines that there exists a potential major public health threat posed by unregulated development in the vicinity of section 6, township 5 south, range 65 west of the sixth principal meridian, Arapahoe County, Colorado, referred to in this article

_____

*Cross reference–Planning, ch. 106.

†Cross references–Environment, ch. 62; solid waste, ch. 114.

as "section 6." To minimize exposure of residential and other land uses to potential hazards in the vicinity of Lowry Landfill, there are adopted regulations which shall limit inappropriate or incompatible land use and occupancy of structures and which shall provide notice of the proximity of the landfill to prospective purchasers of real property in the area.

(b) The application of this article is limited to land within the city limits and is in addition to the provisions of this Code and the underlying zone districts. Where the provisions conflict, this article shall control.

(c) The city council recognizes that significant studies and testing are currently taking place at section 6. Significant new information has and will continue to come to light regarding the potential hazards at section 6. In recognition of this dynamic situation, the city council reserves its inherent right to review this article whenever significant new information is brought forward for public debate.
(Code 1979, § 41-796)

Sec. 146-2227. Development within one-quarter mile.

(a) No development or construction of buildings or structures shall be permitted within one-quarter mile of the east, south, or west exterior boundaries of section 6 prior to the implementation of the Environmental Protection Agency's remedy as defined in the record of decision for the Lowry Landfill Superfund Site and the completion of the five-year performance review which confirms that the remedy is protective of the public health and environment at the compliance boundary, as determined by the city council. This prohibition shall not apply to the development or construction of buildings or structures that are used for characterizing or remediating the contamination at the Lowry Landfill or to the development or construction of roadways, public utilities, and structures accessory thereto.

(b) Upon the city council's determination that the remedy is protective of the public health and environment at the compliance boundary, development and construction of buildings and structures may be permitted within one-fourth mile of section 6, provided the underlying zoning permits such development.

(c) At such time as development is permitted within one-fourth mile of the east, south, and west exterior boundaries of section 6, every development application shall be accompanied by an agreement in a form satisfactory to the city council that shall hold harmless the city from any damage claim arising from permission to develop.
(Code 1979 § 41-797)

Sec. 146-2228. Development conditions.

Under this article, the city council may attach such conditions and stipulations to its approval of a development proposal as it deems necessary to protect the health, safety and welfare and to maintain compliance with the purposes of this article and in response to new information unavailable at the time of enactment of the ordinance from which this article derives. Such conditions may include posting of notice of location of the landfill site to advise occupants and tenants.
(Code 1979, § 41-799)

Sec. 146-2229. Notice of proximity of landfill.

(a) Under this article, vendors of real property located within one-quarter mile of the east, south or west exterior boundaries of section 6 shall provide the following notice to prospective purchasers:

NOTICE OF LANDFILL SITE

The following described property is located within one-quarter mile of the east, south, or west exterior boundaries of Section 6 which contains a facility generally referred to as the Lowry Landfill Superfund Site that has been added to the national priority list for superfund cleanup.

Vendor/grantor:
Property description:
Street address:

(b) The notice required in this section shall he presented to prospective purchasers of real property located within one-quarter mile of the east, south, or west exterior boundaries of section 6 prior to entering into a contract of sale for the real property. Such notice shall be on a separate sheet of paper in at least ten-point boldface type, if printed, or in capital letters, if typewritten and shall contain a signature line for the prospective purchaser, preceded by a statement that he or she has received a copy of the notice.

(c) The notice required in this section shall be recorded with the clerk and recorder of Arapahoe County.
(Code 1979, § 41-800; Ord. No. 95-53, exhibit A (§ 41-800), 9-11-95)

Sec. 146-2230. Failure to provide notice; penalty.

(a) It shall be unlawful to fail to provide notice of the location of the landfill site to prospective purchasers as required by section 146-2229.

(b) Any person who shall be convicted of or plead guilty or no contest to a violation of this section shall for each offense, be subject to the penalties found in subsection 1-13(a).
(Code 1979, § 41-801)

July 13, 2001

Rec'd 7/17/01
JRS

Ms. Gwendolyn Hooten, RPM
U.S. EPA
Office of Ecosystems Protection and Remediation
Mail Code 8EPR-SR
99918th Street, Suite 300
Denver, CO 80202-2466

JUL 17 2001
8ES

Re: **Submittal of Restrictive Covenanats, Lowry Landfill Superfund Site**

Dear Ms. Hooten:

On behalf of the City and County of Denver, Waste Management (on behalf of its subsidiaries Chemical Waste Management, Inc. and Waste Management of Colorado, Inc.) and their settling defendants (collectively Respondents), please find enclosed copies of the recently recorded restrictive covenants for the Lowry Landfill Superfund Site and covenants filed for certain properties adjacent to the Site. These copies are of the documents as filed; we will forward copies of the originals as soon as we receive them back from the Arapahoe County Clerk and Recorder. Barry Levene received copies of these documents by hand-delivery on July 11.

These covenants were recorded specifically so they could be considered in the current Five-Year Review of the Site. We consider it very important that these covenants be fully considered in the Five-Year Review. EPA guidance issued in October 1999 provides that changes such as land use and exposure pathways be considered in a Five-Year Review. In this case, we believe that the exposure assumptions used at the time of remedy selection are no longer valid, the risk scenario has been changed significantly due to these restrictive covenants, which prevent various exposure pathways including ground-water and direct exposure pathways. We consider this to be new information indicating that the remedy is more protective than originally established at the time of remedy selection.

We appreciate your consideration of this matter. We look forward to talking with you further about these covenants and the Five-Year Review. If you have any questions, please give either of us a call.

Sincerely,

Dennis D. Bollmann, P.G.
City & County of Denver
Environmental Services
1391 Speer Blvd., Suite 700
Denver, CO 80204

Lori T. Tagawa, P.G.
Waste Management
3900 S. Wadsworth Blvd., Suite 620
Lakewood, CO 80235

c: EPA (two additional copies)
Lee Pivonka, CDPHE (two copies)
Jim Schneider, CH2M Hill
Tim Shangraw, Parsons
Bonnie Rader, CLEAN
Carol MacLennan, TCHD
Bill Detweiler, Arapahoe County Planning
Tim Cunningham, Aurora

DECLARATORY STATEMENT OF ENVIRONMENTAL COVENANTS TO RUN WITH LAND

WHEREAS, the Lowry Environmental Protection/Cleanup Trust Fund ("Trust") owns the property described in Exhibit A to this Declaratory Statement (the "Property"); and

WHEREAS, no dwelling units or residential developments exist on the Property; and

WHEREAS, the Property is adjacent to the Lowry Landfill Superfund Site located in Section 6, Township 5 South, Range 65 West of the Sixth Principal Meridian and in a portion of Section 31, Township 4 South, Range 65 West of the Sixth Principal Meridian, which is owned by the City and County of Denver (hereafter referred to as "Lowry Landfill"); and

WHEREAS, the City and County of Denver ("Denver"), as a public service to the communities and businesses of the metropolitan area and as required by the original deed from the United States to the City, made the Lowry Landfill available for disposal of municipal solid waste, sewage sludge, and liquid and solid industrial waste; and

WHEREAS, the industrial waste has contaminated the Lowry Landfill and some ground water underlying the Lowry Landfill; and

WHEREAS, the Lowry Landfill has been declared to be a Superfund site by the United States Environmental Protection Agency ("EPA"); and

WHEREAS, EPA has determined that the remedial actions to be taken on the Lowry Landfill should be implemented as specified in the Record of Decision ("ROD"), as amended, which has been placed on file with the City Clerk for the City and County of Denver; and

WHEREAS, the contaminants from the Lowry Landfill have not been detected on the Property at concentrations that would pose any risk to public heath or the environment; and **WHEREAS,** no engineered feature or structure of the Lowry Landfill remedy is located on the Property; and

WHEREAS, to enhance the Lowry Landfill remedy, the Lowry Trust has voluntarily decided to restrict the use of and access to the Property through the adoption of certain covenants to run with the land; and

WHEREAS, these covenants are intended to restrict residential use of land adjacent to the Lowry Landfill Superfund Site and to restrict construction of wells in the Dawson and

Denver aquifers on the Property which might draw contamination off the Lowry Landfill Superfund Site;

NOW THEREFORE,

I. DECLARATION. The Lowry Environmental Protection/Cleanup Trust Fund, a Colorado trust whose Affidavit for Property held in Trust is filed in the Arapahoe County real property records and whose address is c/o FAY CPA, 1675 Larimer Street, Suite 730, Denver, Colorado 80202, being the owner of the real property situated, lying, and being in Arapahoe County, State of Colorado, and fully described on Exhibit A, attached hereto, hereby makes the following declarations as to limitations, restrictions and uses to which the Property may be put, which shall be binding upon all parties and all persons claiming under them, and which shall be for the benefit of all current and future owners of the Property and the City and County of Denver, which owns the Lowry Landfill, or its approved successors and assigns. The Lowry Trust further declares that said declarations shall constitute covenants to run with and the benefits shall inure to the real property for a term up to and including January 1, 2051, at which time said limitations, restrictions, and covenants shall be automatically extended for successive periods of ten years unless modified or terminated as provided for in this declaration of covenants.

II. INTENT. The purposes of these Covenants are to enhance the Lowry Landfill remedy by restricting certain uses of the Property so as to limit the potential for exposure of persons and the environment to contaminants from the Lowry Landfill, and to prevent the potential spread of contamination from Lowry Landfill by restricting installation of groundwater wells in the Dawson and Denver aquifers.

III. LIMITATIONS, RESTRICTIONS, AND COVENANTS.

A. Drilling of wells - No new wells for any use of groundwater from the Dawson or Denver aquifers shall be constructed on the Property, except for monitoring or remediation purposes necessary for implementation of the remedy for Lowry Landfill described in the ROD, or other wells which are not inconsistent with the purposes to be served by these covenants.

B. Uses - The use of the Property shall be restricted to landfilling, monitoring or remediation activities, industrial, commercial (including office space), agricultural, transportation, utilities, open space, recreation, or other uses which are not inconsistent with the

purposes to be served by these covenants. The Property shall not be used under any circumstances for day care centers, schools, nursing homes, hospitals, or residential purposes, including but not limited to single family or multi-family dwellings.

IV. ENFORCEMENT AND MODIFICATIONS.

A. If any person or entity shall violate or attempt to violate any of the covenants herein, any person or entity owning any part the Property, the Lowry Trust, the Mayor of the City and County of Denver, or its approved successors and assigns, may enforce these covenants by any means allowed by law, including prosecuting any proceedings at law or in equity against the person or entity violating or attempting to violate any such covenants to enjoin him or it from so doing and to recover damages and costs for such violation or attempted violation. A representative of Denver or it's approved successors and assigns shall be authorized to visit the Property quarterly to insure that there are no apparent violations of these covenants.

B. These covenants shall not be terminated, revoked or modified, in whole or in part, unless such modification, revocation or termination is not inconsistent with the purposes to be served by the remedy described in the ROD and is approved by Denver or its approved successors and assigns, and by vote of a majority of the then-owners of the Property. Owners of the Property shall have one vote for each acre, or part of an acre, owned.

C. Invalidation of any one of these covenants by judgment or court order shall in no way affect any of the other provisions, which shall remain in full force and effect.

D. These covenants shall not be construed to restrict or limit in any way the authority of EPA or Colorado Department of Public Health and Environment under federal and state law.

E. The interests and rights of Denver under these covenants may not be transferred or assigned except to a governmental entity or a charitable organization, which assignments must be approved by the Lowry Trust.

*

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*

IN WITNESS WHEREOF, the Lowry Environmental/Cleanup Trust Fund has caused these covenants to be executed by its proper trustees lawfully authorized so to do, on this ___ day of June 28, 2001.

LOWRY ENVIRONMENTAL PROTECTION/CLEANUP TRUST FUND

By _____
Co-Trustee

By _____
Co-Trustee

STATE OF COLORADO)
)ss
COUNTY OF DENVER)

Subscribed and sworn to before me this 28th day of June, 2001, by Cheryl Cohen-Vader as Co-Trustee of the Lowry Environmental Cleanup Trust Fund, a Colorado Trust.

Witness my hand and official seal.

My commission expires: July 27, 2004

CAMERON S. MEDDLING NOTARY PUBLIC STATE OF COLORADO

_____
Notary Public

_____
Address

STATE OF COLORADO)
JEFFERSON)ss
COUNTY OF ~~DENVER~~)

Subscribed and sworn to before me this 28th day of June, 2001, by Steven D. Richtel as Co-Trustee of the Lowry Environmental Cleanup Trust Fund, a Colorado Trust.

Witness my hand and official seal.

My commission expires: Kimberly L. Vernon My Commission Expires October 24, 2004

KIMBERLY L. VERNON
NOTARY PUBLIC
STATE OF COLORADO

_____
Notary Public

4647 S. Badger Lane
Address
Littleton, CO 80127

G:\Contracts & Insurance Administration\ SULLITS\Lowry\7lowry covenants Trust.doc

EXHIBIT A

Parcel A:

The East ½ of the East ½ of Section 6, Township 5 South, Range 65 West of the 6th Principal Meridian, County of Arapahoe, State of Colorado;

EXCEPT that portion conveyed to Arapahoe County in deed recorded August 8, 1978 in Book 2826 at Page 723 and any portion lying within East Quincy Avenue.

Parcel B:

A parcel of land located in Section 5, Township 5 South, Range 65 West of the 6th Principal Meridian, and Section 32, Township 4 South, Range 65 West of the 6th Principal Meridian, County of Arapahoe, State of Colorado, more particularly described as follows:

Commencing at the SW corner of said Section 5; thence N 01E 02' 23" E along the west line of the SW ¼ of said Section 5 a distance of 55.01 feet to a point lying on the North R.O.W. line of East Quincy Avenue as described in Book 2826 at Pages 722 and 723, said point being the point of beginning; thence S89E 59' 44" E along said north R.O.W. line, 55.00 feet northerly and parallel with the south line of said SW ¼ a distance of 574.40 feet; thence N 00E 24' 13" E a distance of 5271.75 feet to a point lying on the North line of the NW ¼ of said Section 5 being the South line of the SW ¼ of said Section 32; thence continuing N 00E 24' 13"E a distance of 574.59 feet; thence S89E 35' 47" E and parallel with the North section line of said Section 5 being the South section line of said Section 32 a distance of 792.04 feet; thence N00E 02' 05" W a distance of 751.89 feet; thence West along a line parallel with the North section line of Section 5 being the South line of Section 32 approximately 1316 feet to a point on the West section line of Section 32 being the East section line of Section 31; thence South along the West section line of Section 32 approximately 1327 feet to the Northeast corner of Section 6 being the Northwest corner of Section 5; thence South along the West section line of said Section 5 being the East line of Section 6 to the point of beginning;

EXCEPT that portion conveyed to Arapahoe County in deed recorded August 8, 1978 in Book 2826 at Page 723 and any portion lying within East Quincy Avenue.

Parcel C:

The North ½ of Section 7, Township 5 South, Range 65 West of the 6th P.M., County of Arapahoe, State of Colorado,

EXCEPT the North 40 feet,
EXCEPT the West 40 feet, and
EXCEPT those portions conveyed to Public Service Company of Colorado in deeds recorded December 21, 1960, in Book 1232 at Pages 260 and 262; and
EXCEPT that portion described in partial release of Deed of Trust recorded December 9, 1987 in Book 5327, Page 713; and

EXCEPT that portion described in deeds recorded January 20, 1989 in Book 5617, Pages 476 and 481.

Parcel D:

A parcel of land located in the Northwest ¼ of Section 7, Township 5 South, Range 65 West of the 6th Principal Meridian, County of Arapahoe, State of Colorado, more particularly described as follows:

Commencing at the Northwest corner of said Section 7, thence South 0E 33' 50" West along the West line of the Northwest ¼ of said Section 7 a distance of 40.00 feet; thence South 89E 23' 33" East parallel with the North line of said Northwest ¼ a distance of 230.00 feet to the Northeast corner of a parcel of land recorded in Book 1232 at Page 262 in the records of Arapahoe County, being the true point of beginning; thence continuing South 89E 23' 33" East a distance of 1320.00 feet; thence South 0E 33' 50" West a distance of 1320.00 feet thence North 89E 23' 33" West a distance of 1320.00 feet to a point on the boundary of the aforesaid parcel recorded in Book 1232 at Page 262; thence North 0E 33' 50" East along said boundary a distance of 1320.00 feet to the true point of beginning;

EXCEPT the North 30 feet thereof.

Parcel E:

A parcel of land located in the Northwest ¼ of Section 7, Township 5 South, Range 65 West of the 6th Principal Meridian, County of Arapahoe, State of Colorado, more particularly described as follows:

Commencing at the Northwest corner of said Section 7; thence South 0E 33' 50" West along the West line of the Northwest ¼ of said Section 7 a distance of 1360.00 feet; thence South 89E 23' 33" East parallel with the North line of said Northwest 1/4 a distance of 230.00 feet to a point on the boundary of a parcel of land recorded in Book 1232 at Page 262 in the records of Arapahoe County, being the true point of beginning; thence continuing South 89E 23' 33" East a distance of 1320.00 feet; thence South 0E 33' 50" West a distance of 948.90 feet to a point on the boundary of the aforesaid parcel recorded in Book 1232 at Page 262; thence along the boundary of said parcel the following two (2) courses:

1. North 89E 45' 02" West a distance of 1320.02 feet.

2. Thence North 0E 33' 50" East a distance of 957.15 feet to the true point of beginning.

Parcel F:

The East ½ of Section 1, Township 5 South, Range 66 West of the 6th P.M.,

EXCEPT that part conveyed to County of Arapahoe for road purposes in deed recorded in Book 462 at Page 45; and also

EXCEPT any portion thereof lying within Hampden Avenue and Quincy Avenue; and
EXCEPT that portion conveyed to the City of Aurora in deed recorded October 10, 1988 in Book 5548 at Page 257; Arapahoe County, Colorado; and
EXCEPT that portion conveyed to the E-470 Public Highway Authority for public highway purposes by deed recorded at Reception No. A6001152 of the records of Arapahoe County, Colorado; but including the Lowry Trust's right to explore for water on said parcel.

Parcel G:

The East ½ of Section 36, Township 4 South, Range 66 West of the 6th Principal Meridian, County of Arapahoe, State of Colorado;

EXCEPT the Easterly, Northerly and Southerly 30 feet thereof; and
EXCEPT that portion conveyed to the E-470 Public Highway Authority for public highway purposes by deed recorded at Reception No. A6001152 of the records of Arapahoe County, Colorado; but including the Lowry Trust's right to explore for water on said parcel.

DECLARATORY STATEMENT OF ENVIRONMENTAL COVENANTS TO RUN WITH WATER RIGHTS

WHEREAS, the Lowry Environmental Protection/Cleanup Trust Fund, a Colorado trust whose Affidavit for Property held in Trust is filed in the Arapahoe County real property records and whose address is c/o FAY CPA,1675 Larimer Street, Suite 730, Denver, Colorado 80202 ("Lowry Trust") owns the water rights in the Dawson and Denver aquifers underlying the NE1/4 of Section 12, Township 5 South, Range 66 West, 6th P.M., more specifically described below (the "Water Rights"); and

WHEREAS, the Water Rights underlie property adjacent to the Lowry Landfill Superfund Site located in Section 6, Township 5 South, Range 65 West of the Sixth Principal Meridian and in a portion of Section 31, Township 4 South, Range 65 West of the Sixth Principal Meridian, which is owned by the City and County of Denver (hereafter referred to as "Lowry Landfill"); and

WHEREAS, the City and County of Denver ("Denver"), as a public service to the communities and businesses of the metropolitan area and as required by the original deed from the United States to Denver, made the Lowry Landfill available for disposal of municipal solid waste, sewage sludge, and liquid and solid industrial waste; and

WHEREAS, the industrial waste has contaminated the Lowrylandfill and some water underlying the Lowry Landfill; and

WHEREAS, the Lowry Landfill has been declared to be a Superfund site by the United States Environmental Protection Agency ("EPA"); and

WHEREAS, EPA has determined that the remedial actions to be taken on the Lowry Landfill should be implemented as specified in the Record of Decision ("ROD"), as amended, which has been placed on file with the City Clerk for the City and County of Denver; and

WHEREAS, the contaminants from the Lowry Landfill have not been detected in the Dawson or the Denver aquifers in the NE 1/4 of Section 12; and

WHEREAS, to protect the Water Rights from contamination and to enhance the Lowry Landfill remedy, the Lowry Trust has voluntarily decided to restrict the use of the Water Rights through the adoption of certain covenants to run with the Water Rights; and

WHEREAS, these covenants are intended to restrict use of the Water Rights in a manner that might draw contamination off the Lowry Landfill;

NOW THEREFORE, the Lowry Trust covenants as follows:

I. DECLARATION. The Lowry Environmental Protection/Cleanup Trust Fund, a Colorado trust whose Affidavit for Property held in Trust is filed in the Arapahoe County real property records and whose address is c/o FAY CPA, 1675 Larimer Street, Suite 730, Denver, Colorado 80202,-being the owner of the Water Rights which are defined as the vested property rights situated, lying, and being in Arapahoe County, State of Colorado, described as follows:

> All groundwater in the Dawson and Denver Aquifers underlying the NE ¼ of Section 12, Township 5 South, Range 66 West, 6th P.M. which, together with other groundwater, was decreed by the Water Court for Water Division 1 on March 14, 1983, in Case No. 81CW427, as modified by Order of the Water Court dated July 5, 1989, and consists of: a divided 12.03% (160 acres/1330 acres) interest in the total 279 acre foot maximum annual appropriation of Dawson Aquifer groundwater decreed to wells DA-1, DA-2, and DA-3 in Case No. 81CW427, which equals an annual appropriation of 33.56 acre feet; and a divided 12.03% o (160 acres/1330 acres) interest in the total 215 acre foot maximum annual appropriation of Denver Aquifer groundwater decreed to wells DN-1, DN-2, and DN-3 in Case No. 81CW427, which equals an annual appropriation of 25.86 acre feet-;
>
> Together with the exclusive rights to obtain a permit for, construct, and use any well located within the NE ¼ of Section 12, Township 5 South, Range 66 West, 6th P.M. to withdraw groundwater from the Dawson and Denver Aquifers including, without limitation, all of the Lowry Trust's right, title, interest, or claim to any easement, license, right or other legal or equitable interest to enter or occupy the said NE 1/4 of Section 12 for the purpose of withdrawing any groundwater from the Dawson and Denver Aquifers-;

hereby makes the following declarations as to limitations, restrictions and uses to which the Water Rights may be put, which shall be binding upon all parties and all persons claiming under it, and which shall be for the benefit of all current and future owners of the Water Rights the Lowry Landfill, and Denver, or their approved successors and assigns. The Lowry Trust further declares that said declarations shall constitute covenants that run with the Water Rights for a term up to and including January 1, 2051, at which time said limitations, restrictions, and covenants shall be automatically extended for successive periods of ten years unless modified or terminated as provided for in this Declaration of Environmental Covenants.

II. INTENT. The purposes of this Declaratory Statement of Environmental Covenants are to protect the Water Rights from contamination and to enhance the Lowry Landfill remedy by

restricting use of the Water Rights so as to prevent the potential spread of contamination from Lowry Landfill.

III. LIMITATIONS, RESTRICTIONS, AND COVENANTS. During the term of this Declaration of Environmental Covenants, the Water Rights shall not be used, nor shall any wells be constructed within the NE1/4 of Section 12, Township 5 South, Range 66 West, 6th P.M. to withdraw any groundwater from the Dawson and Denver Aquifers underlying the said NE 1/4 of Section 12, for any uses which are inconsistent with the purposes to be served by these covenants. These limitations, restrictions, and covenants shall not affect the existence or validity
of the Water Rights, or any other right to water underlying the said NE 1/4 of Section 12; and they are not intended to be, and shall not be construed to be, evidence of intent to abandon the Water Rights, or any other right to water underlying the said NE 1/4 of Section 12, or any use to which the Water Rights or any other right to water may be put.

IV. ENFORCEMENT AND MODIFICATIONS.

A. If any person or entity shall violate or attempt to violate any of the covenants herein, any person or entity owning any part of the Water Rights and/or the Lowry Landfill, and the Lowry Trust and/or Denver, or their approved successors and assigns, may enforce these covenants by any means allowed by law, including prosecuting any proceedings at law or in equity against the person or entity violating or attempting to violate any such covenants to enjoin such person or entity from so doing and to recover damages and costs for such violation or attempted violation. A representative of Denver or it's approved successors and assigns shall be authorized to observe the
NE ¼ of Section 12, Township 5 South, Range 66 West, 6th P.M. quarterly to ensure that there are no apparent violations of these covenants.

B. These covenants shall not be terminated, revoked or modified, in whole or in part, unless such modification, revocation or termination is not inconsistent with the purposes to -be served by the remedy described in the ROD and is approved by the Lowry Trust and Denver or their approved successors and assigns, and by the affirmative vote of the then current owner(s) of a majority interest in the Water Rights.

C. Invalidation of any one of these covenants by judgment or court order shall in no way affect any of the other provisions, which shall remain in full force and effect.

D. These covenants shall not be construed to restrict or limit in any way the authority of EPA or Colorado Department of Public Health and Environment under federal and state law.

E. The interests and rights of Denver under these covenants may not be transferred or assigned except to a governmental entity or a charitable organization, which assignments must be approved by the Lowry Trust.

IN WITNESS WHEREOF, the Lowry Environmental/Cleanup Trust Fund has caused these covenants to be executed by its proper trustees lawfully authorized so to do, on this 28 day of June, 2001.

LOWRY ENVIRONMENTAL PROTECTION/CLEANUP TRUST FUND

By _____
Co-Trustee

By _____
Co-Trustee

STATE OF COLORADO)
)ss
COUNTY OF DENVER)

Subscribed and sworn to before me this 28th day of June, 2001, by Cheryl Cohen-Vance as Co-Trustee, and Steven D. Richtel as Co-Trustee, of the Lowry Environmental Cleanup Trust Fund, a Colorado Trust.

Witness my hand and official seal.

My commission expires: 7/27/2004

Kimberly L. Vernon
9647 S. Badger Lane
Littleton CO 80127
Kimberly L. Vernon
My Commission Expires
October 24, 2004

KIMBERLY L. VERNON
NOTARY PUBLIC
STATE OF COLORADO

JAMERRION S. MEDDLING NOTARY PUBLIC STATE OF COLORADO

Notary Public

114 W. Cooper Ave
Address

DECLARATORY STATEMENT OF ENVIRONMENTAL COVENANTS
TO RUN WITH LAND
FOR A PORTION OF SECTION 31, TOWNSHIP 4 SOUTH, RANGE 65 WEST, 6TH P.M.

WHEREAS, the City and County of Denver ("City") owns the property described more fully below, but commonly known as Section 31 of the Denver Arapahoe Disposal Facility (the "Property"); and

WHEREAS, no dwelling units or residential developments exist on the Property; and

WHEREAS, the City also owns adjacent property known as the Lowry Landfill located in Section 6, Township 5 South, Range 65 West of the Sixth Principal Meridian and part of Section 31, Township 4 South, Range 65 East of the Sixth Principal Meridian; and

WHEREAS, the City, as a public service to the communities and businesses of the metropolitan area and as required by the original deed from the United States to the City, made the Lowry Landfill available for disposal of municipal solid waste, sewage sludge, and liquid and solid industrial waste; and

WHEREAS, industrial waste has contaminated the Lowry Landfill and shallow ground water underlying it; and

WHEREAS, the Lowry Landfill has been declared to be a Superfund site by the United States Environmental Protection Agency ("EPA"); and

WHEREAS, EPA has determined that the remedial actions to be taken on the Lowry Landfill should be implemented as specified in the Record of Decision ("ROD"), as amended, which has been placed on file with the City Clerk for the City and County of Denver; and

WHEREAS, the contaminants from the Lowry Landfill have not been detected on the Property at concentrations that would pose any risk to public heath or the environment; and

WHEREAS, no engineered feature or structure of the Lowry Landfill remedy is located on the Property; and

WHEREAS, to enhance the remedy for the Lowry Landfill, to limit human exposure to the contaminants that might come from Lowry Landfill and to prevent construction of wells in the Dawson and Denver aquifers on the Property which might draw contamination off the Lowry Landfill Superfund Site and thereby reduce any health or environmental risks presented by the

contaminants or the spread of those contaminants, the City has voluntarily decided to restrict the use of and access to the Property through the adoption of certain covenants to run with the land;

NOW THEREFORE,

I. DECLARATION. The City and County of Denver, a body politic and corporate existing under and by virtue of the constitution of the State of Colorado, being the owner of the following described real property situated, lying, and being in Arapahoe County, State of Colorado, to-wit:

Section 31

All of Section 31, Township 4 South, Range 65 West of the Sixth Principal Meridian;

EXCEPT a strip of land, 15.0 feet in width, located in the SW ¼ of Section 31, more particularly described as follows: Commencing at the southwest corner of said Section 31; thence northerly along the west line of said section 650.00 feet; thence easterly and perpendicular to said west line 50.00 feet to a point on the east right of way line of State Road 30, said point being the True Point of Beginning of the herein described parcel; thence northerly, along said east right of way line, 430.00 feet; thence easterly, perpendicular to said right of way line 15.00 feet; thence southerly and parallel to said right of way line 430.00 feet; thence westerly, perpendicular to said right of way line, 15.00 feet to the True Point of Beginning, containing 6450 square feet (0.148 acres); and

EXCEPT that part of Section 31 located south of the ground water treatment plant injection trench more particularly described as follows: Commencing at the Southeast corner of the West Half of the East Half (W½E½) of Section 31, Township 4 South, Range 65 West of the Sixth Principal Meridian; thence North 47E29'20" West for a distance of 1650.64 feet; thence South 53E25'35" West for a distance of 1831.46 feet; thence East along south line of said Section 31 for a distance of 2687.60 feet.

hereby makes the following declarations as to limitations, restrictions and uses to which the Property may be put, which shall be binding upon all parties and all persons claiming under them, and which shall be for the benefit of all current and future owners of the Property and the Lowry Environmental Protection/Cleanup Trust Fund (Lowry Trust), which owns adjacent property, or its approved successors and assigns. Denver further declares that said declarations shall constitute covenants to run with and the benefits shall inure to said real property for a term up to and including January 1, 2051, at which time said limitations, restrictions, and covenants shall be automatically extended for successive periods of ten years unless modified or terminated as provided for in this declaration of covenants.

II. INTENT. The purposes of these Covenants are to protect human health and the environment by restricting certain uses of the Property so as to limit the potential exposure of persons to contaminants from the Lowry Landfill, and to prevent the potential spread of contamination from Lowry Landfill by restricting installation of groundwater wells in the Dawson and Denver aquifers.

III. LIMITATIONS, RESTRICTIONS, AND COVENANTS.

A. Drilling of wells - No new wells for use of groundwater from the Dawson or Denver aquifers shall be constructed on the Property, except for monitoring or remediation purposes necessary for closure of the landfill located on the Property or implementation of the remedy for Lowry Landfill described in the ROD, or other wells which are not inconsistent with the purposes to be served by these covenants.

B. Uses - The use of the Property shall be restricted to landfilling, monitoring or remediation activities, industrial, commercial (including office space), utilities, agricultural, open space, recreation, or other uses which are not inconsistent with the purposes to be served by these covenants. The Property shall not be used under any circumstances for day care centers, schools, nursing homes, hospitals, or residential purposes, including but not limited to single family or multi-family dwellings.

IV. ENFORCEMENT AND MODIFICATIONS.

A. If any person or entity shall violate or attempt to violate any of the covenants herein, any person or entity owning any part the Property, the Mayor of the City and County of Denver, the Lowry Trust, or its approved successors and assigns, may enforce these covenants by any means allowed by law, including prosecuting any proceedings at law or in equity against the person or entity violating or attempting to violate any such covenants to enjoin him or it from so doing and to recover damages and costs for such violation or attempted violation. A representative of the Lowry Trust or it's approved successors and assigns shall visit the Property quarterly to insure that there are no apparent violations of these covenants.

B. These covenants shall not be terminated, revoked or modified, in whole or in part, unless such modification, revocation or termination is not inconsistent with the purposes to be served by the remedy described in the ROD and is approved by the Lowry Trust or its approved successors and assigns, and by vote of a majority of the then-owners of the Property.

Owners of the Property shall have one vote for each acre, or part of an acre, owned. The City's votes shall be exercised by the Mayor or his designee.

C. Invalidation of any one of these covenants by judgment or court order shall in no way affect any of the other provisions, which shall remain in full force and effect.

D. These covenants shall not be construed to restrict or limit in any way the authority of EPA or Colorado Department of Public Health and Environment under federal and state law.

E. The interests and rights of the Lowry Trust under these covenants may not be transferred or assigned except to a governmental entity, or a charitable organization whose express purpose is to preserve open space, which assignments must be approved by the City.

IN WITNESS WHEREOF, the City and County of Denver has caused these covenants to be executed by its proper officers lawfully authorized so to do, on this 26 day of June 2001.

CITY AND COUNTY OF DENVER

ATTEST: DEPUTY CITY CLERK

By Esla Vincent

ROSEMARY E. RODRIGUEZ, Clerk and Recorder, Ex-Officio Clerk of the City and County of Denver

ACTING MAYOR

TINA R. GELT NOTARY PUBLIC STATE OF COLORADO

STATE OF COLORADO)
)ss
COUNTY OF DENVER)

Subscribed and sworn to before me this 26 day of June 2001, by Stephanie Scott, Acting as Mayor, and Esla Vincent Deputy as City Clerk, of the City and County of Denver, a municipal corporation of the State of Colorado.

Witness my hand and official seal.

My commission expires: 5-1104

Tina R Gelt
Notary Public
9085 E. Oxford Dr.
Denver, CO 80237
Address

DECLARATORY STATEMENT OF ENVIRONMENTAL COVENANTS

TO RUN WITH LAND

FOR SECTION 6 AND A PORTION OF SECTION 31 OF THE LOWRY LANDFILL

WHEREAS, the City and County of Denver ("City") owns the property described more fully below but commonly known as Section 6, Township 5 South, Range 65 West of the Sixth Principal Meridian and a portion of Section 31, Township 4 South, Range 65 West of the Sixth Principal Meridian of the Lowry Landfill (the "Property"); and

WHEREAS, no dwelling units or residential developments exist on or within 0.5 miles of the Property; and

WHEREAS, the City, as a public service to the communities and businesses of the metropolitan area and as required by the original deed from the United States to the City, made the Property available for disposal of municipal solid waste, sewage sludge, and liquid and solid industrial waste; and

WHEREAS, the industrial waste has contaminated the Property and some ground water underlying the Property; and

WHEREAS, the Property has been declared to be a Superfund site by the United States Environmental Protection Agency ("EPA"); and

WHEREAS, EPA has determined that the remedial actions to be taken on the Property should be implemented as specified in the Record of Decision ("ROD"), as amended, which has been placed on file with the City Clerk for the City and County of Denver; and

WHEREAS, to protect and aid in the implementation of the remedy and to limit human exposure to the contaminants thereby reducing any health or environmental risks presented by

be binding upon all parties and all persons claiming under them, and which shall be for the benefit of all current and future owners of the Property and the Lowry Environmental Protection/Cleanup Trust Fund (Lowry Trust), which owns adjacent property, or its approved successors and assigns. Denver further declares that said declarations shall constitute covenants to run with and the benefits shall inure to said real property for a term up to and including January 1, 2051, at which time said limitations, restrictions, and covenants shall be automatically extended for successive periods of ten years unless modified or terminated as provided for in this declaration of covenants.

II. INTENT. The purposes of these Covenants are to protect human health and the environment by restricting access to and uses of the Property so as to protect the treatment systems, the landfill cap, site drainage ways, and other remedial components and by limiting the exposure of persons and the environment to the contaminants, and to create and preserve open space.

III. LIMITATIONS, RESTRICTIONS, AND COVENANTS.

A. Drilling of wells - No new wells for use of groundwater shall be constructed on the Property, except for monitoring or remediation purposes necessary for implementation of the remedy described in the ROD, or other wells which are not inconsistent with the purposes to be served by these covenants or the remedy described in the ROD.

B. Excavation - No excavation shall be conducted on the Property except as necessary for landfill purposes or for monitoring or remediation necessary to implement the remedy identified in the ROD.

C. Structures - No structures shall be constructed on the Property except as necessary for landfill purposes or for monitoring or remediation necessary to implement the remedy identified in the ROD.

D. Uses - The use of the Property shall be restricted to landfilling, monitoring or remediation activities, or other uses which are not inconsistent with the purposes to be served by these covenants or the remedy described in the ROD. The Property shall not be used under any circumstances for day care centers, schools, nursing homes, hospitals, or residential purposes, including but not limited to single family or multi-family dwellings.

E. Access - Access to the Property shall be limited to persons who are authorized to be on site for uses listed in paragraph D above. Such access shall be located and used in a manner not inconsistent with the purposes to be served by these covenants or the remedy described in the ROD. Access on the Property shall be limited to areas approved by the Mayor or his designee.

IV. ENFORCEMENT AND MODIFICATIONS.

A. If any person or entity shall violate or attempt to violate any of the covenants herein, any person or entity owning any part the Property, the Mayor of the City and County of Denver, the Lowry Trust, or its approved successors and assigns, may enforce these covenants by any means allowed by law, including prosecuting any proceedings at law or in equity against the person or entity violating or attempting to violate any such covenants to enjoin him or it from so doing and to recover damages and costs for such violation or attempted violation. A representative of the Lowry Trust or it's approved successors and assigns shall visit the Property quarterly to insure that there are no apparent violations of these covenants.

B. These covenants shall not be terminated, revoked or modified, in whole or in part, unless such modification, revocation or termination is not inconsistent with the purposes to be served by the remedy described in the ROD and is approved by the Lowry Trust or its approved successors and assigns, and by vote of a majority of the then-owners of the Property. Owners of the Property shall have one vote for each acre, or part of an acre, owned. The City's votes shall be exercised by the Mayor or his designee.

C. Invalidation of any one of these covenants by judgment or court order shall in no way affect any of the other provisions, which shall remain in full force and effect.

D. These covenants shall not be construed to restrict or limit in any way the authority of EPA or Colorado Department of Public Health and Environment under federal and state law.

E. The interests and rights of the Lowry Trust under these covenants may not be transferred or assigned except to a governmental entity, or a charitable organization whose express purpose is to preserve open space, which assignments must be approved by the City.

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IN WITNESS WHEREOF, the City and County of Denver has caused these covenants to be executed by its proper officers lawfully authorized so to do, on this 29th day of June, 2001.

CITY AND COUNTY OF DENVER

By _____
Mayor

ATTEST:

By _____
ROSEMARY E. RODRIGUEZ, Clerk and Recorder, Ex-Officio Clerk of the City and County of Denver

STATE OF COLORADO)
)ss
COUNTY OF DENVER)

Subscribed and sworn to before me this 29th day of June, 2001, by Wellington E. Webb as Mayor, and Rosemary E. Rodriguez, as City Clerk, of the City and County of Denver, a municipal corporation of the State of Colorado.

Witness my hand and official seal.
My commission expires: 5-1-04

_____
Notary Public
9085 E. Oxford Dr.
Denver, CO 80237
Address

STATE OF COLORADO

City and COUNTY OF Denver) ss.

The undersigned being of lawful age, being first duly sworn, upon oath deposes and says:

1. This Affidavit relates to a ☒ trust ☐ joint venture.

2. Affiant(s) is a ☒ trustee of the trust ☐ member of the joint venture named below, and has the authority to execute and record this Affidavit.

3. The name of the ☒ trust ☐ joint venture which may acquire, convey, encumber, lease, or otherwise deal with any interest in real property is Lowry Environmental Protection/Cleanup Trust Fund.

4. The names and addresses of all the trustees of the trust ~~and all the joint venturers of the joint venture~~ are:

Name	Address
Steven D. Richtel	Waste Management of Colorado, 3900 So. Wadsworth Blvd., Suite 620, Lakewood, Colorado 80215
Cheryl Cohen-Vader (f/k/a Cheryl D. Cohen)	Manager of Revenue, City and County of Denver, 144 West Colfax, Room 300, Denver Colorado 80202

5. ☒ ALL of the trustees ~~or joint venturers~~ are required to act on behalf of the trust ~~or joint venture~~ in any acquisition, conveyance, encumbrance, lease, or other dealing with an interest in property in the name of the trust ~~or joint venture~~.

or

☐ FEWER THAN ALL of the trustees or joint venturers are authorized to act on behalf of the trust or joint venture in any acquisition, conveyance, encumbrance, lease, or other dealing with an interest in property in the name of the trust or joint venture. The trustee(s) or joint venturer(s) so authorized (or the manner of designating said trustee(s) or joint venturer(s)) and any limitations upon their authority are as follows:

6. This affidavit is executed and recorded pursuant to the provisions of Section 38-30-166, C.R.S.

Affiants*

Steven D. Richtel

Subscribed and sworn to before me this 29th day of June, 2001 by Steven D. Richtel

Witness my hand and seal. KIMBERLY L. VERNON NOTARY PUBLIC STATE OF COLORADO

Notary Public

My Commission Expires:

Kimberly L. Vernon My Commission Expires October 24, 2004

Cheryl Cohen-Vader (f/k/a Cheryl D. Cohen)

Subscribed and sworn to before me this 29th day of June, 2001 by Cheryl Cohen-Vader (f/k/a Cheryl D. Cohen)

Witness my hand and seal.

Notary Public

My Commission Expires: July 27, [illegible]

NOTARY PUBLIC STATE OF COLORADO

My Commission Expires [illegible]

No. 300. Rev. 7-92. AFFIDAVIT FOR PROPERTY HELD IN TRUST OR JOINT VENTURE ©

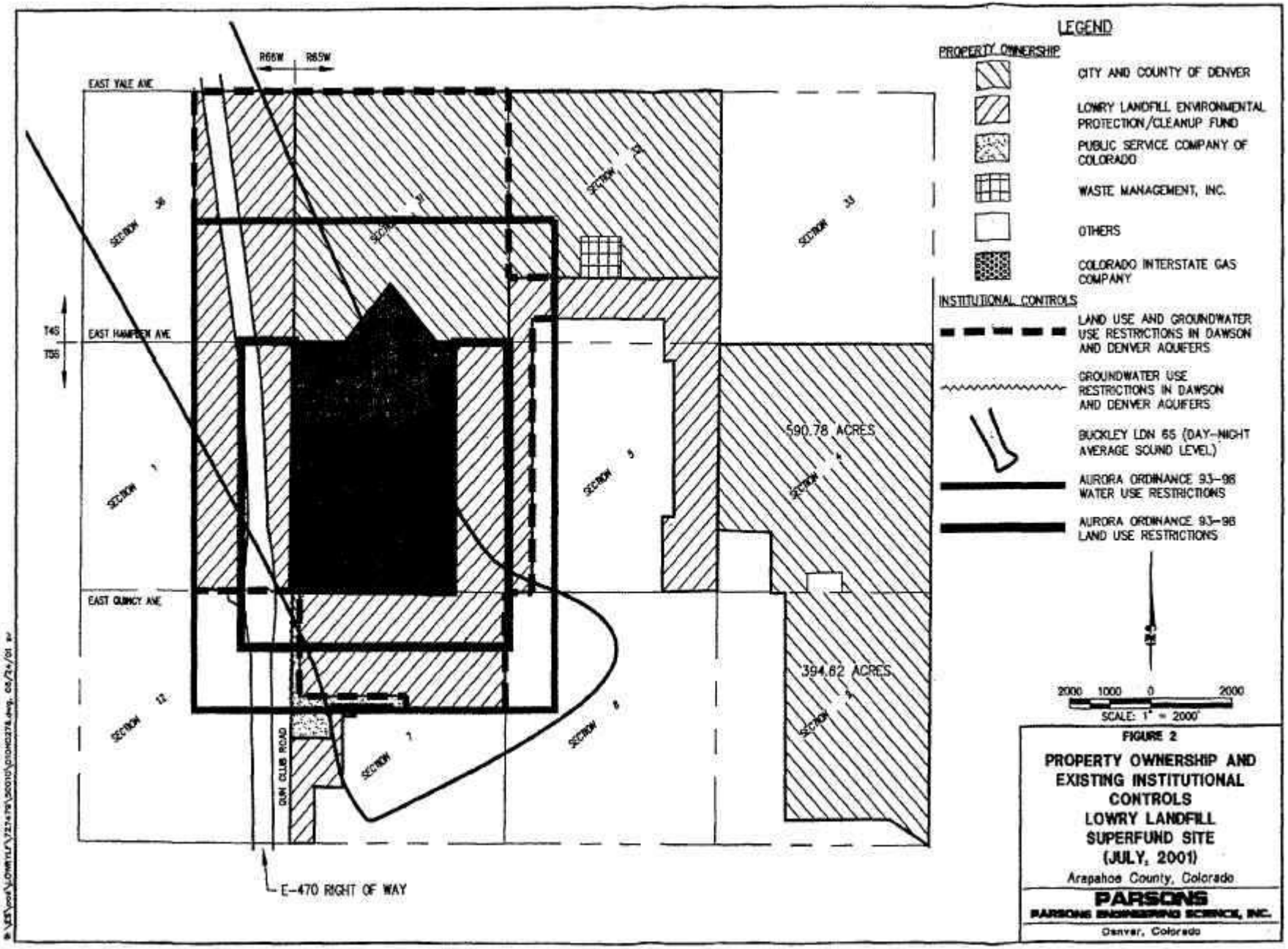


FIGURE 2

PROPERTY OWNERSHIP AND EXISTING INSTITUTIONAL CONTROLS LOWRY LANDFILL SUPERFUND SITE (JULY, 2001)

Arapahoe County, Colorado

PARSONS

PARSONS ENGINEERING SCIENCE, INC.

Denver, Colorado

ATTACHMENT 4

ATTACHMENT 4

Revised Conceptual Site Model

The attached table summarizes the revised Conceptual Site Model (CSM), based upon improved understanding of the Site. This improved understanding has resulted from additional data (for example, boring logs and observations of monitoring well responses to pumping) developed during remedy implementation. The table presents the CSM in three columns:

- The left column quotes the CSM as discussed in the 1992 Remedial Investigation report for OUs 1 and 6.
- The center column presents the revised CSM.
- The right column discusses the rationale for revisions.

This table was prepared during development of the Five-Year Review report and was discussed with the Respondents at a working meeting.

Following the table are three figures that graphically show the relationship of several key remedy components to the CSM.

Lowry Landfill – Preliminary Draft Revised Site Conceptual Model
April, 2001

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
Development of the site hydrogeologic conceptual model was an iterative process beginning with the EPA preliminary conceptual model for the Shallow Groundwater and Subsurface Liquids OU[3] (EPA, 1989c). This model was revised during the IDE[4] on the basis of a rigorous evaluation of existing site data and was also expanded to include the Deep Groundwater OU. Additional data obtained during the ASC[5] made it necessary to further revise / refine the model presented in the IDESCR[6] (HLA, 1990b). The conceptual model presented herein is a result of these multiple efforts and represents an additional step in the scientific process. As this process continues, the model may require further revision.	Development of the site hydrodeologic conceptual model was an iterative process beginning with the EPA preliminary conceptual model for the Shallow Groundwater and Subsurface Liquids OU (EPA, 1989). This model was revised during the IDE on the basis of a rigorous evaluation of existing site data and was also expanded to include the Deep Groundwater OU. Additional data obtained during the ASC made it necessary to further revise / refine the model presented in the IDESCR (HLA, 1990). A further refinement the conceptual model was presented in the Remedial Investigation (RI) report (HLA, 1992). Further revisions have been made based on additional knowledge gained since completion of the RI report, including but not limited to the following: • Additional explorations conducted during implementation of the Record of Decision (ROD; EPA, 1994) • Observation of the performance of remedial systems (e.g., the soil/bentonite wall) • Subsurface responses observed during implementation of the PCMP (Parsons ES, 1998) • Review of ongoing monitoring data from the site It is anticipated that additional revisions to the conceptual site model may be required as work at the site continues.	Describe basis of these revisions, and acknowledge that further revisions may also be needed as site understanding grows.

[1] Text quoted from the RI for OUs 1&6, Volume III, Section 4, pp. 4-111 to 4-115 (HLA, 1992). Horizontal rules denote ends of paragraphs in the original text.
[2] This column outlines our current understanding of the conceptual site model in a format parallel with the RI Report model. If presented in a stand-alone document, it would be re-ordered and edited to eliminate some repetition that arises from using this columnar format.
[3] Operable Unit (EPA, 1989)
[4] Initial Data Evaluation work performed by Harding-Lawson Associates 1989-1990 (summarized in HLA, 1990)
[5] Additional Site Characterization work performed by Harding-Lawson Associates 1990-1991 (multiple documents)
[6] Initial Data Evaluation Summary and Conclusions Report (HLA, 1990)

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
The bedrock strata of the site consist predominantly of claystones and siltstones with interfingering sandstones and locally occurring lignites and carbonaceous zones.	The bedrock strata of the site consist predominantly of interbedded and interfingered claystones, siltstones, and sandstones, with locally occurring lignites and carbonaceous zones. At the Site, the Dawson and Denver formation strata were deposited primarily in an environment of meandering streams and associated floodplains.	Slightly more detailed description of the depositional environment.
The primary water-yielding units include the alluvium, weathered bedrock, and the sandier portions of the unweathered Dawson formation and underlying formations extending downward to the Pierre shale.	The primary water-yielding units include the alluvium, permeable zones in the weathered bedrock (sand layers and channels, fractured zones, and other geologic discontinuities); and the sandier portions of the unweathered Dawson formation and underlying formations extending downward to the Pierre shale.	Added specific recognition of sandy units since their presence is critically influential on groundwater flow and contaminant transport at the Site.
These units comprise the regionally defined Dawson, Denver, Arapahoe, and Laramie-Fox Hills Aquifers.	(No changes)	
For the purposes of geologic and hydrogeologic evaluations, the site has been subdivided into the shallow and deep groundwater systems, corresponding to the Shallow Groundwater and Subsurface Liquids OU (OU 1) and the Deep Groundwater OU (OU 6).	(No changes)	
The boundary between these two systems (and the corresponding OUs) is represented by the regionally defined boundary between the Dawson and Denver Aquifers, referred to as the separation layer by the office of the State Engineer.	(No changes)	

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
The shallow groundwater system includes groundwater within the refuse, waste pits, alluvium, bedrock of the Dawson Aquifer, and the separation layer.	The shallow groundwater system includes all groundwater within the following: • The landfill, including refuse, debris, waste pits, and all other fill materials • Alluvium • Bedrock of the Dawson Aquifer, both unweathered and weathered) • The separation layer.	Clarification.
The deep groundwater system includes groundwater within the Denver, Arapahoe, and Laramie-Fox Hills Aquifers.	(No changes)	
The majority of data onsite is available from the Dawson Aquifer and the portion of the Denver Aquifer above the lignite (i.e., top of Denver Formation).	The majority of onsite data are available for the Dawson formation. Most of the remaining data are from the portion of the Denver formation above the lignite.	Clarification
This model is, therefore, based primarily on data from these units.	Since most of the data and most of the waste materials reside in or above the shallow groundwater – specifically within or above the weathered Dawson formation – the model is more detailed and specific in this portion of the geologic column.	Most data are shallow, and most contamination is still thought to be shallow. However, the model is based on data from all units.
The strata comprising the shallow and uppermost portion of the deep groundwater system are representative of a fluvial depositional environment.	(Omitted; discussed above.)	
Sands associated with this environment, which have been subdivided into channel and overbank facies, impart both large-scale and small-scale heterogeneities to the site.	(No changes)	
Three correlatable channel sands have been identified and are referred to as the A, B, and C channel sand sequences.	(No changes)	

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
However, other correlatable channel sequences are expected to be present on the basis of the interpreted depositional model.	(No changes)	
	In addition, other smaller scale sand channels, joints, bedding planes, fracture zones, sand lenses, and other hydraulically conductive geologic discontinuities may exist on the site and serve as preferential flow pathways. Due to their smaller dimensions, these types of features may not be as easily correlatable as features such as the A, B, and C sand meander belts.	Examples: possible sand channel at MW38-WD; sand strata in PM-11 and PM-15 areas.
Diagenetic processes (including cementation and/ or the formation of claycoats on framework grains), the percentage of fines and the nature of the sedimentary fabric (i.e., grain size, grain shape, sorting), are factors that control the hydraulic conductivity and water-level data within them, ...	Factors that control the hydraulic conductivity of the site strata include, but are not limited to: • Diagenetic processes (e.g., cementation, compaction, secondary mineralization, formation of claycoats on framework grains, and so on) • The percentage and character of fines (e.g, silt versus clay, clay mineralogy, grain size distribution, and so on) • The nature of the sedimentary fabric (e.g., grain size, grain shape, sorting, clay mineralogy, and so on) • Secondary features such as bedding planes, joints, fractures, slickensides, and so on Piezometric levels within each water-bearing zone are controlled by several factors, including but not limited to: • Regional discharge and recharge (including effects of runoff, infiltration, localized groundwater discharge, and evapotranspiration) • Hydraulic connectivity with adjacent water-bearing zones • Lag time caused by the net effect of hydraulic conductivity, groundwater storage, effective pore space, and so on	Added detail and interpretation about the consequences of the depositional environment of the strata at the Site. These factors influence the way that groundwater an contaminants may behave at the site, both in the absence and the presence of modifying influences such as engineering controls (e.g., wells, trenches, covers, etc.).

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
	Lateral correlation between strata at the site is generally difficult, because of the environment of deposition: • There is high lateral variability of the strata, with frequent facies changes. • The sand channels have limited width and sinuous geometry, making them difficult to trace laterally. • The meander belts, while somewhat wider, are also of limited width and variable orientation, and are expected to exhibit variable material properties. • The meandering nature of the streams during deposition would have resulted in frequent re-erosion and reworking of sediments, possibly causing abrupt lateral transitions in strata. • Overbank and flood deposits could have widely varying geometries depending on the amount of material deposited and the nature of the terrain on which it was deposited.	
...it is not currently possible to accurately evaluate hydraulic gradients or groundwater flow velocities within these units.	Because of these factors, it is difficult to evaluate hydraulic gradients within these units with any degree of accuracy, and it is not practically possible to accurately determine groundwater flow velocities. Data from MW38-WD suggest that contaminant transport velocities may be on the order of 100 feet per year or more.	Reworded to include factors added above. In general, while the RI model identifies the potential difficulties in evaluating gradients and flows, the proposed model provides more detail about the degree to which geologic features such as sand channels cause these difficulties.
The shallow groundwater system has been subdivided into three hydrogeologic units or subsystems, on the basis of media type, lithology, potentiometric levels, and chemistry data.	(No changes)	

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
These subsystems are the weathered system (including weathered bedrock, waste pits, and refuse), the unweathered A sand, and the unweathered Dawson Aquifer.	These subsystems are the alluvium, the weathered portion of the Dawson formation (including weathered bedrock, waste pits, and the entire landfill mass), and the unweathered portion of the Dawson Aquifer (which includes the uppermost portion of the Denver formation above the separation layer).	Term "landfill mass" is used to include all other non-refuse parts of the landfill (e.g., intermediate cover). Remove A sand as a distinct subsystem and add alluvium as a distinct subsystem.
	The demarcation between the weathered and unweathered portions of the Dawson formation is arbitrary and irregular. At any given boring (or other vertical section), it is defined as the depth at which the observable effects of weathering generally vanish, primarily as evidenced by lack of oxidation staining and increased rock soundness. Due to factors such as lateral facies changes and variable depths and intensities of weathering, the demarcation does not follow a specific stratum; rather, its depth varies from location to location, creating an irregular "surface" when mapped or shown on cross-sections. In reality, the demarcation is a transition zone rather than a discrete surface. This has consequences when considering an engineering control intended to penetrate the entire weathered Dawson strata, since there is not a clearly defined interface or stratum to serve as the target depth of such a feature.	Define demarcation between unweathered and weathered Dawson.
	The overall average hydraulic conductivity of the weathered Dawson formation is about two orders of magnitude greater than the overall average hydraulic conductivity of the unweathered Dawson formation. Similar hydraulic conductivity contrasts exist between sandy units and fine-grained units (e.g, claystones and siltstones). In considering groundwater transport, the hydraulic conductivity variations are more important than the aquifer subsystem classification (i.e, weathered versus unweathered Dawson) since the groundwater flow will tend to be in the more conductive units. In short, the material type is more important than the subsystem (weathered versus unweathered).	Review of data from RI Table 4.13 Emphasize importance of hydraulic conductivity (and therefore conductive features such as sand channels).

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
The uppermost system beneath the site is the weathered system.	The uppermost groundwater subsystem beneath the site is the alluvium. It consists of the recent alluvium in the unnamed creek channel and tributary channels on site. Some of this alluvium was removed during landfill construction, but the extent of removal is not well known in all areas.	Add alluvium.
	The next groundwater subsystem is the weathered subsystem.	Add alluvium.
It consists of refuse and waste pits that are in hydraulic communication with weathered bedrock, saturated weathered bedrock media, and alluvium.	It consists of the landfill mass and waste pit contacts that are in hydraulic communication with weathered bedrock, (whether saturated or unsaturated).	Term “landfill mass” is used as discussed above.
The saturated weathered bedrock includes portions of the A and C sands.	The saturated weathered bedrock includes portions of the A and C sands. In addition, other sands, such as channel sands, lenticular sands from overbank deposits, or other deposits with relatively greater hydraulic conductivity may exist in both unweathered and the weathered Dawson horizons.	This interpretation is consistent with MW38-WD, sands observed near PM-15, and the geologic environment of deposition.
The water table in the area of the refuse and waste pits is mounded.	The water table elevation generally slopes downward to the north and intersects at least some of the refuse and waste pits. The water table elevation varies over time.	Further definition of water table shape & relationship to waste pits.
In addition, this system also includes those waste pits that are nonequilibrated with the shallow groundwater system (i.e., occur above the water table or have water liquid levels that are above the water table).	(No changes)	
The A sand subsystem consists of that portion of the A channel sand that is unweathered, and its extent generally conforms to the extent of the A channel sand.	(No changes)	

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
That portion of the channel sand that is weathered is considered a part of the uppermost, weathered bedrock system.	For general site characterization purposes, the weathered portion of the A channel sand is included as a part of the weathered bedrock system. However, both the vertical and horizontal hydraulic conductivities of the A sand are about two orders of magnitude greater than the corresponding hydraulic conductivities of the claystone portions of the weathered Dawson formation. The hydraulic conductivity within the A sand will also vary depending on the material type (e g., channel sands versus levee deposits).	RI Table 4.13
For the purpose of this evaluation, this subsystem has been grouped with the unweathered Dawson.	Similarly, the unweathered portion of the A channel sand is grouped with the unweathered Dawson formation. The vertical hydraulic conductivity of the unweathered A sand is more than one order of magnitude greater than the vertical hydraulic conductivity of the claystone portions of the unweathered Dawson formation. The horizontal hydraulic conductivity of the unweathered A sand is about two orders of magnitude greater than the horizontal hydraulic conductivity of the claystone portions of the unweathered Dawson formation.	RI Table 4.13 *Note: The C sand is not discussed separately in this draft.*
The unweathered Dawson Aquifer subsystem consists of all saturated bedrock above the base of the separation layer that is not a part of either the weathered bedrock or the unweathered A and systems.	(No changes)	
Groundwater within the deep system occurs in bedrock strata below the top of the separation layer to the top of the Pierre Shale.	Groundwater within the deep system occurs in all bedrock strata below the top of the separation layer.	Clarification
The majority of data from this system is available for the uppermost Denver Aquifer (i.e, between separation layer and lignite).	The majority of site data for the deep system is available for the uppermost Denver Aquifer (i.e., between the separation layer and the lignite).	Reflects known boring density & depths.
Therefore, the hydrogeologic characteristics of this system have been evaluated in terms of media above the lignite (“upper” Denver), within the lignite, and below the lignite.	(No changes)	

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
The hydraulic conductivity of the site media is generally low, although it ranges over nine orders of magnitude.	The hydraulic conductivity of the site media ranges over nine orders of magnitude. A substantial volumetric majority of the strata consists of claystones and siltstones with relatively low hydraulic conductivities (on the order of 10^{-5} cm/sec or less). A smaller volumetric percentage of the site strata consists of sandy units that exhibit substantially higher hydraulic conductivities (as high as 8 x 10^{-1} cm/sec). To a great extent, it is the geologic units with the higher hydraulic conductivities (i.e., the sand units) that will control or strongly influence the potential for groundwater flow and contaminant migration. Other geologic discontinuities such as joints, fractures, and bedding planes may introduce other preferential flow paths.	RI Table 4.13
On the basis of potentiometric data, liquid from saturated refuse and waste pits discharges principally to the weathered bedrock and alluvium.	(No changes)	
The highest permeability media comprise the weathered bedrock system, and the majority of groundwater flow occurs laterally to the north/northwest through this system.	Overall, of the three shallow groundwater subsystems described above, the alluvium exhibits the highest overall average permeability. However, it is of limited extent. Consequently, the water table exists primarily in the weathered bedrock system. The observed potentiometric heads in this system suggest that the primary potential for groundwater flow is in a generally northerly direction through this system. However, geologic discontinuities, especially sand bodies (e.g., sand channels) are expected to serve as preferential pathways to conduct flow in directions not orthogonal to the water level contours.	RI Table 4.13, RI Figures 4.11 and 4.50

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
The predominant direction of flow within the remaining hydrogeologic systems is also to the north with components of downward flow.	Similarly, the observed potentiometric heads within the remaining hydrogeologic systems would suggest that the predominant groundwater gradient is also to the north, with downward gradient components. Again, the presence of more permeable discontinuities such as sand channels is expected to result in flow directions not necessarily orthogonal to head contours.	Example: B sand
On the basis of current information, no preferential pathways (i.e., fractures, faults) for vertical groundwater flow are believed to occur at the site.	Some preferential pathways for vertical groundwater or waste pit liquid flow (e.g., fractures, joints) are believed to occur at the site. Some lateral and vertical migration of dense, non-aqueous phase liquids (DNAPLs) has been observed. Evidence of wide-spread DNAPL migration in the bedrock has not been observed to date.	Examples: MPM-N-E-7; NTES-EW1 Note: Uncertainty exists regarding the frequency or extent of DNAPL occurrence beyond the pits.
Fractures may control flow at a very localized scale only.	(Omit; covered above.)	
The majority of groundwater discharge and the highest velocities occur laterally to the north in the weathered Dawson and alluvium.	The predominant horizontal gradients occur in a generally northerly direction in the weathered Dawson and alluvium. As a result, the majority of groundwater flux is also believed to flow in this general direction, although flow directions may be influenced by geologic discontinuities. Despite the overall northward gradient, localized eastward gradients – including some of the highest gradients on the site – have been observed along the eastern site boundary, and some westward gradients may be present along the western site boundary. Again, actual flow directions will be influenced by geologic features such as sand channels.	PM-11 area; PM-15 area; MW38-WD area.
Much lower discharge and velocities occurs downward across the separation layer.	Much lower groundwater flux is thought to occur downward across the separation layer.	Clarify that this is an Interpretation.
Because of the heterogeneity of the site media and the high variability in lateral and vertical conductivities, the site is considered to be considered to be heterogeneous and anisotropic.	Because of the heterogeneity of the site media and the high variability in lateral and vertical conductivities, the site is considered heterogeneous and anisotropic.	MW38-WD

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
	The heterogeneities and anisotropy are a result of multiple causes, including but not necessarily limited to the following: • Varying types of subsurface materials (e.g, sandstone, siltstone, claystone, etc.) • Facies changes within various strata • Variable material properties (mineralogy, cementation, density, grain size, etc.) • Variable weathering and other secondary modifications (oxidation, secondary mineralization, slickensides, fractures, bedding planes, joints, etc.) • Variable geometry of the materials (channels, lenticular bodies, overbank deposits; possible truncations due to erosion during deposition, compaction shearing, etc.) • Anisotropic hydraulic properties These factors combine to make interpretations and predictions about groundwater flow and contaminant transport very difficult. The presence of geologic discontinuities, especially sand channels, has a particularly significant impact on ground-water transport (and hence contaminant transport) at the Site. Some of the most important conclusions that result from the presence of these discontinuities are: • Groundwater flow (including contaminated groundwater) is probably concentrated in the discontinuities. • Groundwater flow (and thus dissolved contaminant transport) in the discontinuities is not necessarily orthogonal to groundwater equipotential contours.	Expansion of the importance and the impacts of the presence of the discontinuities

RI REPORT[1]	CURRENT UNDERSTANDING[2]	RATIONALE FOR CHANGE
	• The location and extent of all of the sand channels is unknown. It is reasonable and prudent – and consistent with this site conceptual model – to assume that there may be unknown sand channels that are oriented such that they may permit offsite flow of contaminants. Because of this, and due to the potentially erratic, unknown, and unpredictable presence, orientation and character of these features, achieving a reasonable degree of certainty regarding the potential for offsite migration of contaminants will require a network of sampling points more closely spaced than presently in place. The necessary spacing must be determined based on consideration of the observed and anticipated scale of the discontinuities as well as other factors such as the potential dispersion and/or diffusion of contaminants from such pathways.	

References

EPA (US Environmental Protection Agency), 1989. [to be determined – reference in RI is incorrect]

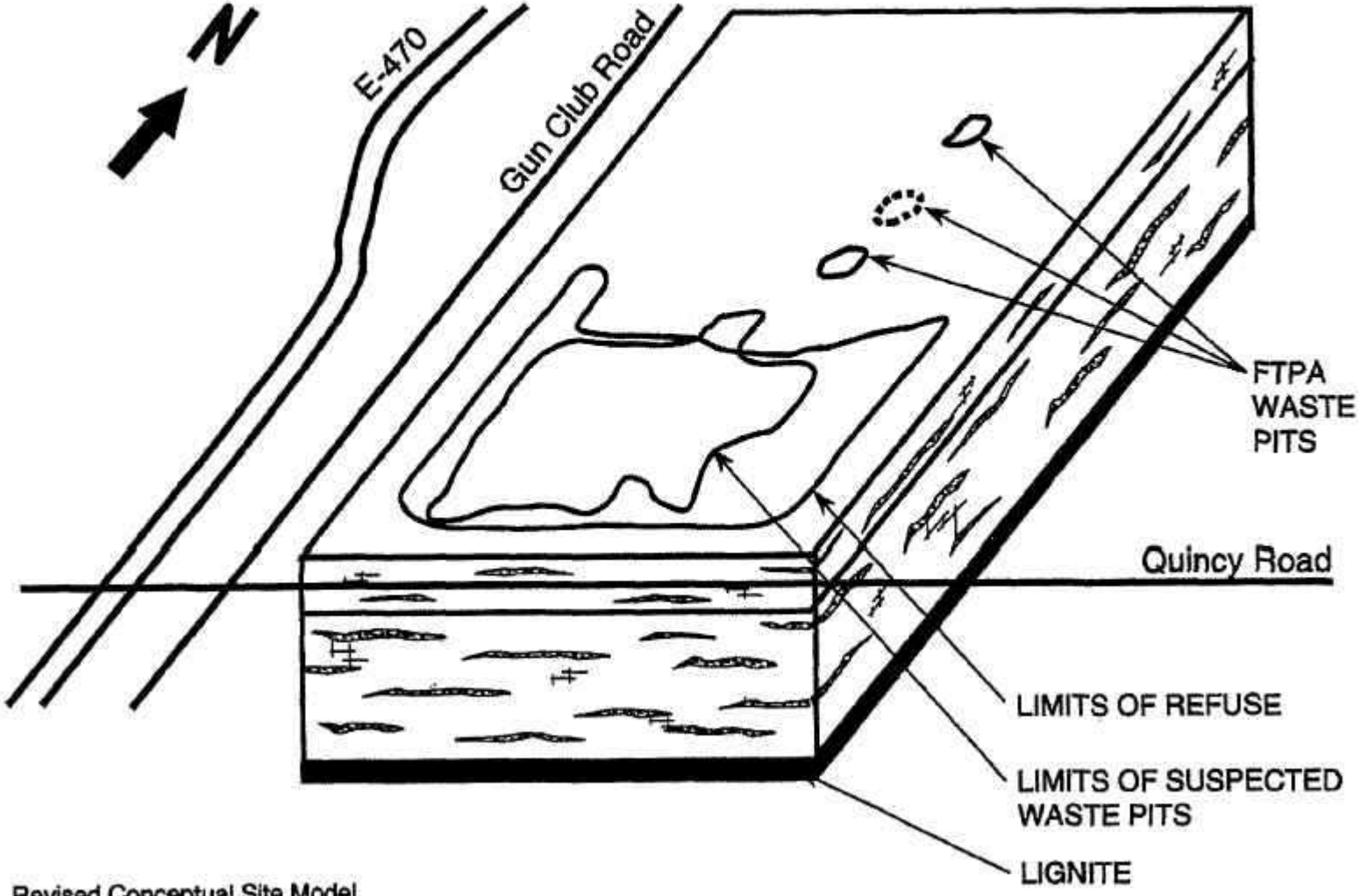
EPA, 1994. *Record of Decision, Lowry Landfill Superfund Site.*

HLA (Harding-Lawson Associates), 1990. *The Initial Data Evaluation Summary and Conclusions Report for the Shallow Groundwater Containment, Collection and Diversion System, East/South/West Site Boundaries, Lowry Landfill, Arapahoe County, Colorado.*

HLA,1992. *Final Remedial Investigation Report for the Shallow Groundwater and Subsurface Liquids and Deep Groundwater Operable Units, Lowry Landfill, Arapahoe County, Colorado.*

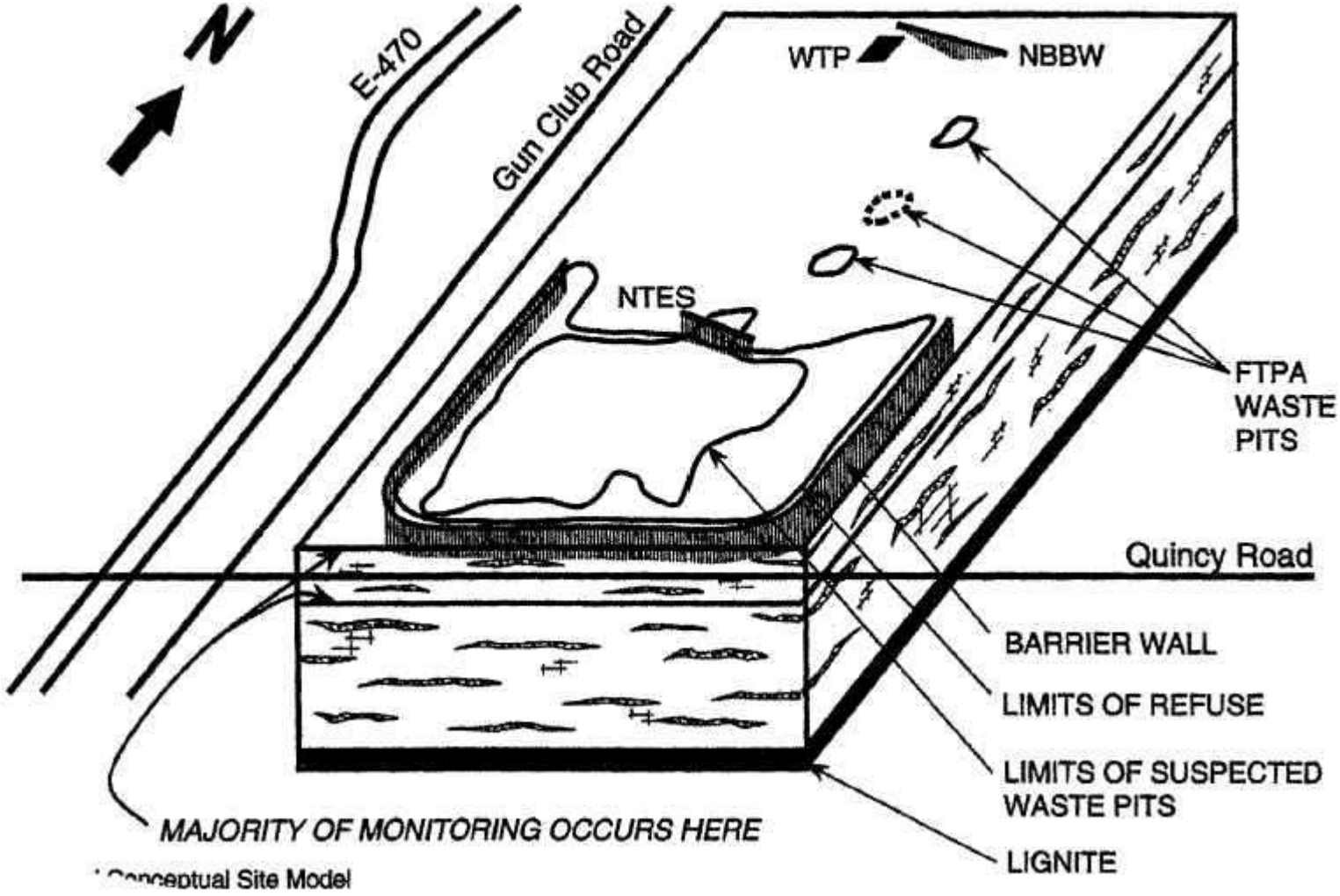
Parsons Engineering Science, 1998. *Final Performance and Compliance Monitoring Plan for Shallow Groundwater Containment, Collection and Diversion System, East/South/West Site Boundaries, Lowry Landfill Superfund Site Remedial Action.*

Conceptual Site Model



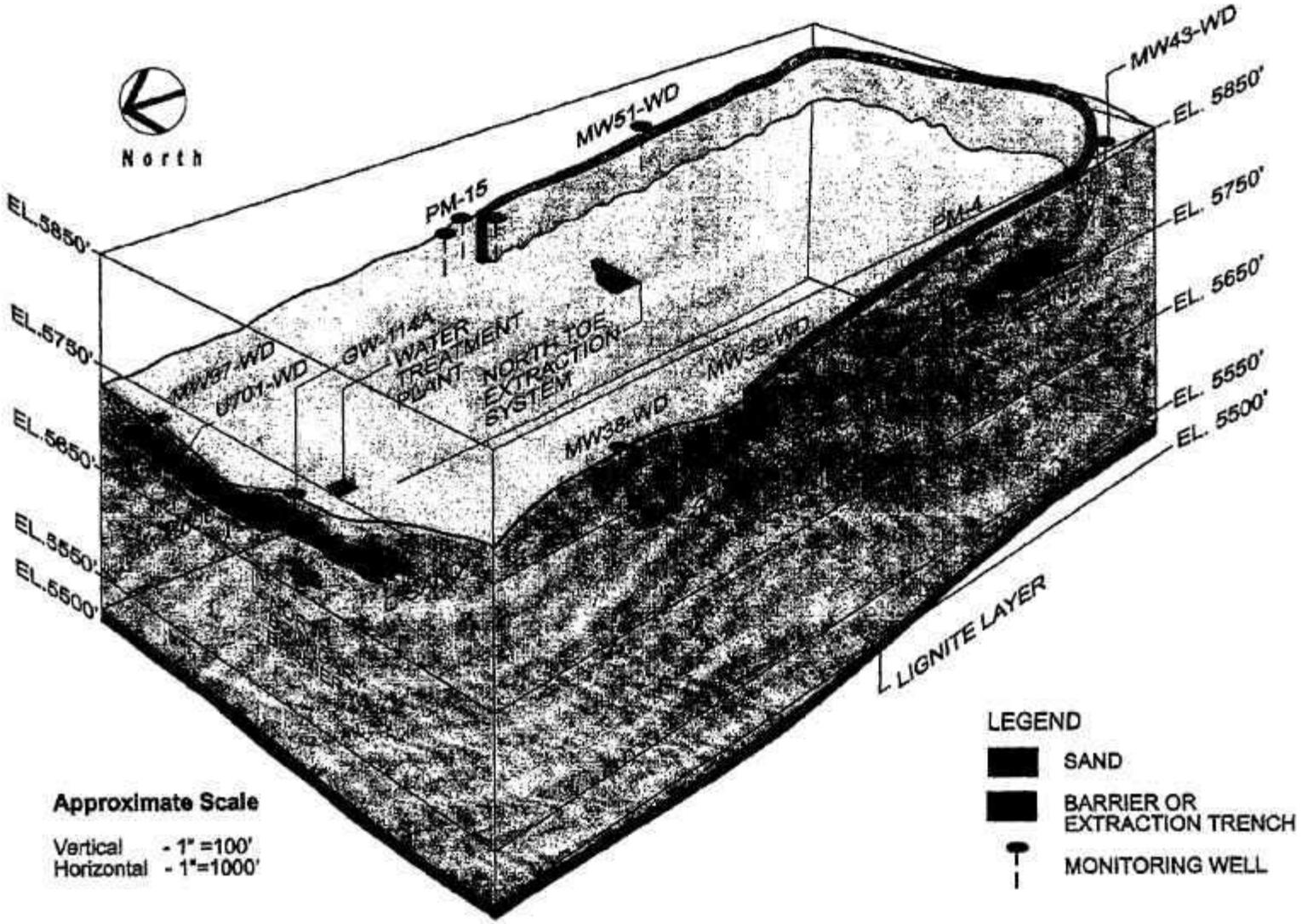
Revised Conceptual Site Model

Groundwater Remedy Components



Conceptual Site Model

Lowry Landfill Superfund Site



ATTACHMENT 5

ATTACHMENT 5

Interviews

This attachment contains the interview forms from in-person and telephone interviews as well as those received in the mail.

The following people or groups were interviewed in person or on the telephone, and summaries of the questions and responses are included:

- Citizens for Lowry Landfill Environmental Action Now
- Pam Wheldon
- John Price
- Larry Scott/John Metli
- Ed Butler
- Joe Kalcevic
- Mary Sue Liss

The following mailed questionnaires were returned to EPA and are included:

- The Respondents (Denver, WMC, and Chemical Waste Management)
- Parsons ES
- City of Aurora
- Tri-County Health Department
- Metro Wastewater Reclamation District
- Adrienne Anderson
- Emergency Response Officials

Lowry Landfill—Five-Year Review
Community Interview

Citizens for Lowry Landfill Environmental Action Now (CLLEAN) Board of Directors: Fred Mould (Gun Club Estates), Richard and Bonnie Rader (Thunderbird Estates), Lora Atwood (Dove Hill Estates), Tom Pyle (Consultant to CLLEAN), and Harlan Garner.

1. Where do you live in relation to the Lowry Site?

Fred lives 3 miles north of the Site, and says that it is too close. Richard and Bonnie Rader replied that they live 4 miles to the north of the Site. Lora Atwood lives about 1 mile to the south. Harlan lives about 3 miles north of the Site.

2. In general, what is your impression of the Lowry project?

Fred commented that he did not know about the Lowry Site until he met Bonnie Rader. He would like larger signs to inform people that the Lowry Site is a Superfund Site. He noted that there are large developments planned close to the landfill. He thinks that the agencies are doing a good job but would like to see the remedy change from containment to cleanup.

Richard Rader commented that Lowry is a very difficult Site to deal with. It has been frustrating to see the slow progress. Remediation has taken a long time because the Site is big and no one really knows exactly what is beneath the Site and what the total project consists of.

Bonnie Rader commented that the Respondents (Denver, Waste Management of Colorado [WMC], and the other Potentially Responsible Parties [PRPs]) are hindering the progress in eliminating the threats to human health and the environment. Back in 1980, when the pits were open and were accessible, no one was willing to pump the pits. Now it seems there is just a focus to keep contaminants out of the air and to keep piling dirt on top of the pits. They are not trying to get rid of the contaminants but are covering them up. The people responsible for dumping the chemicals at Lowry are impeding progress and dragging their feet.

Lora noted that she and her family moved to the area 11 years ago. They investigated the surrounding area and were assured by their realtor that the Lowry Site was no longer a problem. They were frustrated when they found out that it wasn't cleaned up. They first came to CLLEAN about concerns with E-470 issues. They are concerned that the public doesn't know about the Site and its problems. They moved out to the area for better air. She has asthma and is concerned about air pollution. She is glad to see that there are efforts being made to remedy the Site, but it is not enough, because the evidence from the last few months say that the present remedies are not working.

Harlan remembers dumping at the Lowry Landfall as a child. There was a pool of liquids at the bottom of the waste pits. He believes that no one is certain of the magnitude of the project or what was dumped there. The realtors, developers, etc. , don't want prospective purchasers to know about the Superfund Site. The PRPs put forth the minimum effort. They perform tests and then say they didn't have right size equipment to address problems. If we did the minimum with our own residences, we would all be living in sheds. The Respondents don't want to spend the money in the Lowry Trust. He referred to the Trust as a cash cow that would die when it is spent. The Respondents spend as little of the Trust as possible. Harlan would like the Site remediation to be completed. The public needs to be better informed. It should be required for sellers to provide full disclosure of the Superfund Site and to sign disclosure forms. He is planning to move in a couple of years because of issues related to traffic, city growth, the Superfund Site, etc. He

expressed concerns that the people who move to the new Murphy Creek subdivision won't realize how close they are to a Superfund Site and won't be informed of the problems.

The group commented that the Aurora Ordinance passed in 1993 restricts land development within one-quarter mile of the Lowry Site and drilling within one-half mile of the Lowry Site. It was noted that the Aurora ordinance was changed in 1993 to restrict development within one-quarter mile, whereas in 1987, the ordinance had restricted land development within 1 mile of the Site to allow for the E-470 corridor to be considered clean. The Aurora ordinance will be reviewed to see if it should be extended after EPA's Five-Year Review is completed

3. What effect have the Site operations and on your community?

Fred commented that the community is not affected by the Site because many people don't know about it. He didn't know about the Site until he saw the slurry wall trench and met Bonnie Rader. The more he knows, the more he's displeased about the Site. He believes that more community education about the Site is needed and more disclosure is needed by reactors and developers .

Richard moved to the neighborhood about 7 years ago, and the community was not aware of the Superfund Site at that time. As he became more involved in the community he became increasingly aware of the problems of the Superfund Site and the quality of the water in the aquifers. There weren't odors from the Site at the time he moved in to the area.

Bonnie lived in the neighborhood from the early 70s through 1981. At that time, the chemicals from the pits carried in the air to their homes. They could taste the chemicals and their eyes would be covered with film because chemicals were so thick in the air. The people who lived closest to the Site were the most affected by the air quality. Some people had heart problems that were affected by air quality. Bonnie's son had bronchial pneumonia with no fever and severe asthma that abated when the pits were covered. Her family experienced severe nosebleeds, tingling hands and feet, headaches, and depression. The smell of chemicals from the waste pits was unique; therefore, they could distinguish between odors from the waste pit chemicals, the brine ponds, and the sewage sludge. The chemicals didn't bother everyone in the neighborhood. Many people thought that since the Site was owned by Denver under the oversight of the State, it was taken care of. In 1981, after the community learned what was happening at the Lowry Site, the citizens became active. They realized the importance of air emissions and odors that were migrating 8 miles into Aurora. The concerns about the Site brought together the farming and urban communities. After the waste pits were covered, people could no longer smell the odors, and the community concerns decreased. Now people who are on well water are concerned about potential water contamination. The water issues have brought together people who would like to see the chemicals at the Lowry Site cleaned up and not contained. EPA, the State, and CLLEAN have done their best to inform the community about the Site but it is difficult to get the community involved until someone is hurt. Bonnie commented that if people call the City of Aurora to ask whether the Site presents a problem, they are told that there isn't a problem. The community in the area of the Lowry Site came together in 1980 after there was a letter in the Rocky Mountain News about the problems at the Site.

Lora commented that some of the earlier meetings showed slides from when the waste pits were open had a larger community response. The community's attentions are divided among many issues, and the Dove Hill Estates neighborhood relies on Bob Atwood, another member of CLLEAN, and Lora to report to the group about the Superfund Site activities. Four residents had their wells checked by EPA several years ago; no problems were found. During excavation of the middle waste pit, there were some odors. People in the area tend to think that everything is under control at the Site. They were more upset about the bombing range explosions than the Superfund Site problems.

Harlan commented that they could smell odors when the middle waste pit was opened. He is concerned about the quality of his well water. So far, tests that have been performed on local wells have come out fine. He wonders how long it will be before contaminated liquids in the bottom of the landfill will migrate down to the aquifer. The City of Aurora is not concerned about water quality, but contamination could become an issue in the future. His neighbors also rely on him for information and to tell them when there's a problem with the Superfund Site. People don't want to come to meetings until there's a serious problem.

Fred expressed concerns that there are a lot of abandoned wells that could be conduits for downward migration of contamination into deeper aquifers. If there are sand lenses or fractures, contamination could move downward. Lora expressed concerns about contamination moving into the aquifers and eventually into the wells.

4. Are you aware of any community concerns regarding the Site or its operations and administration? If so, please give details.

Fred provided comments in written form. They are copied below:

"I have sat in many TAG meeting in my three years as a board member of CLLEAN and listened to the experts discuss their ideas about how to contain the millions of gallons of pollutants that were dumped into the Lowry Landfill Superfund Site. I listened and listened to the great ideas put forth on containment. It is now time for me to speak to the 5-year Review.

Containment has slowed the migration of the chemicals and there is no doubt about that. Now the parties that are responsible for the Site want to extend the boundaries of compliance. This flies in the face of reason. The boundaries of compliance were set so that containment would have a defined end. If the wishes of the Responsible Parties to move the boundaries outward are allowed to proceed then, there seems to be an alternative motive for Denver and Waste Management. The monies that are paid by the responsible parties to Denver are not accounted for on public record and could easily be misappropriated. These records should be opened! There is a lot of money being spent on containment and it appears that containment efforts are not working to the degree that was expected. The only other alternative is to clean up the Site. Record of Decision outlined containment instead of removal and treatment as the remedy for the Site. Containment efforts are expensive and it appears to me that this is a cash cow gone awry with no end in site. All efforts for containment take in account for horizontal migration and not for vertical migration. There is now talk about putting more felt on top of the treatment cells which would push the contaminants deeper. In my opinion, containment will never work and it is time to quit throwing good money after bad and mitigate the losses before the Denver Aquifer is contaminated and renders it useless for future generations. What is done today at the Site affects the future of the Denver area and also what is NOT done today adversely affects the Denver area."

Richard commented that community concerns focus on potential water and air contamination. The community doesn't care about landfill operations or administration of the Site. They are mainly concerned about catastrophic events. The community looks to CLLEAN to keep them informed about the Superfund Site. Richard is concerned about Site operations and doesn't have confidence in Denver and WMC to properly manage operations at the Site. He believes they have a conflict of interest and doesn't think they should be there. It appears that they are concerned with conserving the trust and making as much money as possible from Site operations. He is concerned about truck traffic and one of the FTPA pits. He cited as an example that Waste Management was awarded a contract to shred and market the tire shreds. Richard noted that there were other proposals. And in fact he had proposed selling tires to Canon City but other contractors were shut out. He noted that there were problems with capturing volatiles during excavation at the middle waste pit. CLLEAN had suggested a bubble before excavation and this

idea was rejected because it was too expensive. Later, the Respondents excavated the north waste pit and failed and tried a minimal bubble that also failed. CLLEAN also suggested additional Site characterization before selecting a remedy and suggested a grid of closely spaced monitoring wells, and additional computer modeling. This idea was rejected and now the PRPs are continuing to drill endlessly. Also, the PRPs are now admitting that old wells that were abandoned did not have proper casings although they drilled the wells.

Bonnie commented that all of the area residents who know about the Site are concerned but it is too overwhelming. When they show pictures of the Site, the people are alarmed. People don't come to meetings because they feel they don't have a technical background. The technical issues at the Site can be intimidating to lay people.

Bonnie believes that since the very beginning, WMC's efforts have been directed at keeping the operations going and not making things better.

A long history of mismanagement and cover up at the Site have destroyed any confidence that the Site will be managed in an environmentally safe manner. The residents did not have confidence that WMC would manage any portion of the Site in a manner that was protective of public health and environment. A number of incidents at the RCRA facility proved the public correct:

1) *When WMC took over operations at Section 6, the focus was not to clean the chemicals from the pits. The focus was to cover the old pits in as easy and inexpensive a manner as possible. WMC did not want the chemicals carrying to homes of area residents because that would hurt their chances to open a RCRA facility. Rather than pump the chemicals from the pits in Section 6 and store them in tanks or bladders until a technology became available to treat/detoxify/destroy them, WMC covered the pits with trash and clay. <u>This is the reason the chemicals continue to pose a threat to public health and the environment</u>. The primary goal of WMC was to open a RCRA operation on Section 32 and to operate a Sub-title D solid waste landfill on Section 31.*

2) *The RCRA solidification process that WMC promised was never completed. As a result, 16,000 drums of liquid wastes were stored/buried illegally.*

3) *May 1982 - RCRA burial cell located on Section 32 flooded in violation of RCRA. WMC had built the cell 25 feet in to the water table. Drums were leaking, there was an overflow of contaminated liquids. The monitoring wells were installed at improper depths so as to preclude early identification of chemical contamination in the groundwater. EPA fined WMC $193,000.00.*

4) *One of the three RCRA evaporation ponds on Section 32 breached. The leakage was not reported to the EPA or the Colorado Department of Health for more than two years. WMC attempted to repair the breach during weekends and in the middle of the night. At the same time, WMC's Contingency Plan was not adequate because it did not deal with non-sudden leaks of contaminants. Only after a dedicated Colorado Department of Health Inspector insisted on inspecting the detection system was it discovered that WMC had kept two sets of books regarding the breach, one for the company and one to show to the Agencies during inspection. After this revelation, the EPA cracked down on WMC and their water monitoring system. Four violations were levied amounting to $48,650.00.*

5) *When WMC was closing the RCRA cell, it was discovered that WMC had illegally accepted PCBs in violation of their RCRA permit.*

CLLEAN has major concerns that the Denver Arapahoe Disposal Site (DADS) will eventually become a hazardous waste cleanup site. DADS is receiving petroleum contaminated soils and a myriad of other sources that may eventually leak into the groundwater in Section 31.

Bonnie commented that there isn't enough manpower at EPA and State to watch over the Respondents.

Lora believes that the operation at the Superfund Site speaks for itself. They tried the bubble over the excavation and abandoned excavation. Now they are having problems with the Water Treatment Plant being unable to treat all the contaminants. Lora commented that the Lowry Trust should be made public. The public should know how much is there and how much has been spent. She wonders if the other PRPs know how the Trust is being spent, what is being accomplished, and what is not being accomplished. She would like to see the remediation move faster.

Harlan expressed that the Respondents do not think that the community is worth paying attention to. CLLEAN hired Tom Pyle as an engineering consultant, and they still feel that they are not being taken seriously. The Respondents don't seem to listen to their consultant either. CLLEAN suggested a bubble over the excavation and they ignored this suggestion until they were having problems with emissions and then they put up a minimal bubble. They could probably have used a larger bubble. Now they are having difficulties with treatment systems at the water treatment plant and need to upgrade the UV Oxidation system because it is not working. They seem to be using a minimalistic approach. They always claim that there are more contaminants than they anticipated. Maybe they are only finding what they want to find in characterization studies. CLLEAN's consultant, Tom Pyle, has suggested technologies that have been ignored. Denver and WMC are powerful and would like to get CLLEAN out of the way and then say that EPA and the State are also not needed.

Tom Pyle added that the overall remedy is containment. He cited instances where the PRPs have fallen short in their technologies, treatment and analyses. The public can't have faith in containment because the PRPs have been unsuccessful in so many aspects of the remedy. The Respondents were unsuccessful in the FTPA excavation, the North Toe Extraction System, and the water treatment plant. Tom stressed that if they also fail at containment, it is an even bigger issue for the community. The public can't have faith in containment. If the PRPs miscalculate containment, then the ramifications are huge for the community.

5. Are you aware of any events, incidents, or activities at the Site that concern you? Please explain your response.

CLLEAN felt this question was answered in earlier responses.

6. Do you feel well informed about the Sites activities and progress?

Fred feels that they are getting partial information from Denver and WMC. He thinks if there was an atomic bomb, the community would hear the blast and then find out about it. He thinks Denver and WMC and their contractor Parsons are not telling them everything. He believes in cleanup not containment because containment won't work. He doesn't think there's much progress being made at the Site.

Richard expressed confidence in the regulators and believes that EPA and CDPHE are telling them all that they know. He doesn't think Denver and WMC will tell them anything unless they have to.

Bonnie Radar feels that they are well informed. She appreciates that she can call EPA or CDPHE's Lowry Project Managers for information or look for information in the Site Administrative Record. Bonnie thinks there's been progress at the Site. She remembers when the chemicals were coming into their houses. She doesn't think there's been sufficient progress and believes that politics are limiting progress. Bonnie said that there are excellent people in the agencies who try to defend the public. However, it appears that Denver and WMC have money

and power. The people who dumped at Lowry are big business with lots of influence to get what they want. CLLEAN thinks that Lowry may be more dangerous than the Shattuck Superfund Site. However, Shattuck was owned by out-of-town people, whereas Lowry is owned by Denver.

Bonnie feels that CLLEAN is well informed but doesn't know everything. She thinks that EPA and the State also don't know everything. She thinks that the remedy is containing as best it can. (She commented that she doesn't think that containment will work but it's there.) The air emissions are better than when the waste pits were open and that people are monitoring the situation at the Site. CLLEAN would like additional studies using innovative technologies to provide more information about the Site hydrogeology (sand lenses and fractures) and the contaminants beneath the Site.

Lora expressed concerns about the communications recently. There have been smaller group-facilitated meetings that excluded CLLEAN. They do not feel that Denver and WMC are keeping them informed. Lora was encouraged by the communication at the May 17, 2001 TAG meeting. She commented that Denver and WMC always say that the contaminants are worse than they anticipated. Lora said that maybe they should expect the worst-case scenario.

Harlan said that EPA and CDPHE inform the public of everything they are aware of. He thinks that Denver and WMC are not telling the agencies everything. He thinks the TAG meetings were going well before the mediators got involved. It appears that the mediator's role is to soften the truth and make it more palatable. Politics are important at this Site. CLLEAN is fighting a major force with Denver and WMC and fears the agencies lack the clout to fight them. He worries that Denver and WMC may have sufficient power to have Lowry removed from the National Priorities List.

Bonnie added that Denver and WMC continue to start new activities at the Site that serve to feed the activities of DADS Site into the Superfund Site. The agencies and communities find out after the fact. She cited that they are collecting gas from Section 31 and plan to use the Landfill Gas Flare for this gas. They have proposed landfilling at the Superfund Site using contaminated soils from Stapleton. Their goal appears to be to make money from the Superfund Site and not to put back money into the Site for cleanup. They make decisions about what goes into the Site. If Denver and WMC are making money on the secret trust, the public should know and the money should be channeled to the Superfund Site for cleanup.

Lora mentioned that CLLEAN had proposed that they treat all the water onsite and put it into the wetlands. Instead, Denver and WMC wanted to send pre-treated water to Metro's POTW so they could get benefits from Metro. Denver and WMC have proposed using contaminated soils from Stapleton as a cap. They are probably getting paid to remove those soils. She noted that they are putting soils on DADS that smell bad. She said that the Superfund Site appears to be making more money for WMC.

Bonnie commented that since average citizens such as Tom Pyle would not be allowed to dispose of volatile, contaminated soils at DADS, then why should WMC be allowed to dispose of Stapleton Soils at DADS.

7. Do you receive Site fact sheets and updates? How effective are these in providing information about the Site?

Fred commented that Bonnie gets the information and passes them on to the rest of the CLLEAN Board. Lora commented that she would like EPA to set up a web site about the Lowry Site to provide information to the community. Richard Rader commented on the Respondents discharging water from the onsite water treatment plant to Metro's POTW. He noted that CLLEAN had proposed treating the water onsite using reverse osmosis, which was said to be too costly. In his estimate, the costs for RO are less than what will be paid by the agencies to ward

off the public outcry and fears about plutonium in the water being discharged. The money being spent on how to treat NTES water will also increase the costs of the remedy.

Richard said that CLLEAN is lucky to have a Technical Assistance Grant to review Site activities and that their consultant, Tom Pyle, has done an excellent job in transmitting information to them from meetings. They also get information from the Technical Advisory Group meetings.

Bonnie expressed appreciation for the fact sheets that are available to everyone on the board and the public. She thinks they have been very effective in communicating complex issues and providing a synopsis of Site activities. Her only criticism is that the word "cleanup "is used in the fact sheets and the Site is not being cleaned up. The source will remain there indefinitely; consequently, she prefers the word remediation. Bonnie keeps all the fact sheets and refers to them often.

Fred commented that people confuse the Lowry Superfund Site with the DADS landfill. They think it's all one thing and will close in a few years. He noted that this was also said at the planning meeting for the new Murphy Creek Subdivision. They compare the Lowry Landfill to the County Line Landfill and do not understand the dangers of the Superfund Site. The planning commission also doesn't seem to realize the difference between the active landfill and the Superfund Site. The developers have money and are sometimes spreading misinformation.

Bonnie commented that there are small signs that were installed by EPA when Marc Herman was the Remedial Project Manager. There is a need for more larger signs. CLLEAN had proposed large signs with CLLEAN's name on it announcing that more than 100 million gallons of contaminated liquids had been disposed of. They would like the Superfund Site signs to be visible from the road. The public may not know all of the details but at least they would know whom to ask for more information. CLLEAN feels that people should know about the Superfund Site before they buy property in the vicinity.

Fred commented that there used to be a shop foreman who worked on equipment at the Superfund Site and it would be interesting to track his health.

8. Are you all on the mailing list for fact sheets? Would you like to have your name added/removed from the mailing list?

The group replied that they are all on the list and would like to remain on it

9. Have you attended public meetings or availability sessions? How effective have these been in providing information about the Site? Do you like open houses or presentations?

Fred replied that some public meetings are more effective than others. He thinks that an open forum such as an open house is generally more effective than presentations to an audience.

Richard commented that Site visits were important although there really wasn't much to see except dirt and weeds. He appreciated the ability to request Site visits.

Bonnie has an abhorrence of public meetings. She doesn't like to be talked at but likes to discuss issues. She realizes that public meetings are required as part of the Superfund process. She likes availability sessions and thinks they allow everyone a chance to discuss issues one-to-one with the agencies and eliminate the opportunity for grandstanding. CLLEAN commended the agencies for the availability sessions. Public hearings also have caused some of the information to go over the heads of lay people and caused concerns about getting the floor and being heard. The poster sessions best serve the public and individuals and prevent some groups from taking over the meetings.

CLLEAN appreciates the Site visits. These visits help to provide knowledge of what's happening at the Site and help provide an understanding of the technologies discussed at meetings.

Lora commented that they also appreciated the Site visits to view the technical activities first hand.

Harlan commented that public meetings area great forum. He noted that he doesn't have a chemical engineering background. He appreciates not being talked down to. He feels that EPA and the State are accessible and thinks that is very important to the community. CLLEAN appreciates the free flow of information from EPA and CDPHE. He commented that the agencies are operating with one hand tied behind their back.

10. How has the land use in the vicinity of the Site changed?

Fred said the area has changed from rural to urban. Aurora is surrounding the Site. E-470, Quincy, and Jewell are the conduits for development. People buying property don't know the dangers.

Richard is concerned that development will come right up to the gate of the Site. He commented that there are plans to build a power plant close to the Site. The population is growing very quickly in this area. There are plans for a new shopping center east of Gun Club and south of Smoky Hill. It was noted that the buffer zone in the Aurora ordinance is now only one-quarter mile.

Bonnie thinks that Aurora and Arapahoe County are not using due diligence in informing the public about the Site. They say that development is safe because they are not using groundwater and will be using city water. People are not being informed of potential impacts from the Site.

Harlan commented on the model where the Respondents used pure air and mixed it with air in the basement to change the soil vapor standards. They didn't use contaminated air because using pure air made the model look better. Harlan wants to see proper information in the models, rather than skewed information. If they are getting volatiles from the soils, there must be volatiles in the air.

11. Has the Lowry Landfill Superfund Site had any influence on land use in your area?

The group replied that initially the Superfund Site had an influence, but now that the buffer zone is smaller, development is no longer limited in the area. They would like Aurora and Arapahoe County to be more involved in the Site, because they are not disseminating correct information.

12. Are you a participant in the Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues? What do you think of the format?

Fred thinks TAG meetings are effective. Took a while to learn the language. Meetings are informative and information is wonderful.

Richard said the May 17, 2001 TAG meeting was interesting. Denver and WMC are trying hard to convince CLLEAN that they are concerned about the Site and are investigating questionable areas. The meeting served to clear the air a little. TAG meetings are effective forums.

Bonnie stated that the TAG meetings are effective as a forum for discussing technical issues. It is difficult to discuss all of the issues in a two-hour meeting. Some attendees go to Site meetings during the day and appear to be there under duress. The discussion among the parties is informative and helpful. Discussions help the community to understand how Denver and WMC respond to the agencies and how the agencies respond to them. There are political constraints on the agencies, and it appears that Denver and WMC push their weight around. Having the

community involved helps put issues on the table and brings things out in the open. The TAG meetings allow the community to ask questions and get information. They did not have access to as much information in the past. The Lowry Landfill Monitoring Committee was also a good forum. However, at those meetings when the community brought up using innovative characterization technologies, WMC told them it was a black hole. The TAG meetings allow more dialogue. They can have conversations about technologies. CLLEAN and the Respondents are going to investigate the technologies together. The discussions at the TAG are invaluable and allow for open and honest discussions. The TAG meetings are difficult because there is much information presented in a short timeframe. CLLEAN will push for more TAG meetings and open and honest dialogues.

Richard believes that both Parsons ES (the Respondents' contractor) and CH2M HILL (EPA's contractor) are being loyal to their clients. If they switched places, their roles would be reversed. Parsons ES did once talk down to them in a presentation.

Lora commented that the TAG meetings are valuable and especially appreciated the May 17, 2001 meeting because there was a lot of open communication among the parties. Not everyone is equally good at disseminating information. It was noted that there is a need to speak louder at meetings so everyone can hear.

Bonnie said that they would support the facilitated meetings if it appears that they improve communications among the parties. WMC and Denver contacted CLLEAN to meet the board.

Harlan believes the TAG meetings are important because they allow the citizens to observe the agencies looking out for their interests and being their advocates. He doesn't like the closed-door, facilitated meetings. Any information the community receives is good, although it can be overwhelming. He thinks the question and answer periods are very valuable.

Bonnie said CLLEAN is glad they got the opportunity at the last meeting to express their trust for EPA and CDPHE's Lowry Project Managers and their distrust of the political process. It is important for the Site parties to hear the public's opinions and understand their perspective. CLLEAN mistrusts the political system, not the agencies. CLLEAN requested that EPA hold the May 17, 2001 TAG meeting because they felt left out of the process.

13. Have you attended any problem-solving groups? If so, are these groups effective in resolving project issues?

Tom Pyle and Bonnie have attended Problem-Solving Group Meetings. They think they are valuable but they are scheduled in the daytime, which means that Bonnie has to take time off from work. Bonnie has benefitted from the work group meetings. Although she doesn't understand every complex issue, they allow her the opportunity to ask questions of agencies or the Respondents. She is glad that Tom Pyle is able to attend the meetings.

Tom Pyle thinks the TAG meeting and Problem-Solving Group Meetings are excellent. They allow everyone to be involved and to see the process of making technical decisions. It is helpful for him to attend technical meeting and report back to CLLEAN.

The closed-door, facilitated sessions do not allow CLLEAN the opportunity to be involved in the decision process. Community groups are sophisticated and want to know the discussions and not only the conclusions. The problem-solving groups are great technical forums to resolve issues but also allow public participation in the process.

Are you aware of any access restrictions at the Site? Are you aware of any signs at the Site? If so, how effective are the access restrictions and signs at the Site?

The signs at the Site need to be larger. Sometimes if people go out there to get on the Site they could be stopped. However, CLLEAN members have never been stopped. Anyone can go out there. The gate is sometimes closed at night but is always closed on Sunday.

14. What do you think has been successful about the Lowry remedy?

Fred's comments are contained in his written statement included previously.

Richard complimented the tire removal (which also relocated snakes and reduced fire danger). Bonnie commented that the waste pit chemicals are no longer in the air. The tires are shredded and were buried in the monofill to reduce fears of tire fires. Incoming groundwater is being diverted from moving in and mixing with contaminants (to the best of their knowledge). The Respondents are investigating technologies for the FTPA North and south waste pit remedy. The bubble didn't work for the north waste pit excavation, and the Respondents discovered that the Volatile Organic Compounds were worse than they had expected. CLLEAN is involved in the Lowry Site, and although they haven't gotten their way in all things, they have had positive impact on the Site. Public involvement has been successful on this Site. CLLEAN is glad that the waste pit chemicals are no longer in the air and that the wetlands were rebuilt.

Lora thinks the monitoring wells are good because they are showing that the contaminants are not contained.

Harlan said that the slurry wall slowed down migration of chemicals offsite. The public is more aware of what is happening. Problems with the waste pit excavation gave CLLEAN some credibility because they were right about what is going on and the seriousness of contaminants and air emissions. The Respondents now realize that the problems are worse than they thought. Maybe they will eventually realize the difficulties with containment.

Richard expressed concerns about DNAPLs at the Site and is glad that they are removing DNAPLs form the waste pits.

15. What do you think are problems with the Lowry remedy?

Fred stated that containment won't work in the long run.

Richard agrees that containment won't work.

Bonnie said that this remedy is containment, not cleanup. Containment tends to eventually fail and cannot be considered a permanent remedy. They are not sure what impact containment may have on the groundwater flow or chemicals. They would like more information about fractures and lenses and additional characterization of the Site. CLLEAN could accept containment, treatment, and discharge to the POTW if they would work as intended. If using this to control for now as interim remedies (JANE: that sentence made no sense to me. I don't know how to fix it!). It appears that the Superfund Site is going to be a permanent money making machine for Denver and WMC. Bonnie cited problems with the landfill gas flare system. CLLEAN is worried about the sphere of influence and putting gases from the active landfill into the flare will put more stuff into the air. CLLEAN is concerned about poor maintenance of the landfill cap, depressions, and are afraid there may be emissions from the cap. CLLEAN is also concerned about the Respondents' proposal to add contaminated soils from Stapleton as landfill cover in Section 6.

Lora is concerned about the LFG flare and wants more monitoring to know what's coming in and what's going out of the flare. She also doesn't think the containment remedy will work.

Harlan doesn't think the Respondents are attacking the problems aggressively enough. He thinks containment is a band-aid, and eventually pumping will be needed. They would like to see dates attached to achieving performance standards and would also like to see fines imposed if they

don't achieve performance standards by the required dates. The Respondents appear to be milking this job. It is time to cut the throat of the "cash cow" (the Lowry Trust fund).

16. Do you have any comments, suggestions, or recommendation regarding the Site's management or operations?

CLLEAN does not want to move the POC. They feel that moving the POC will put off dealing with chronic problems. They think that finding contamination at Well MW-38WD means that containment is not working the way it was intended, and the Respondents must be more aggressive.

Richard thinks that Denver has a conflict of interest at the Site, and WMC has a history of problematic operations. He thinks that EPA should get a contractor to do the work. CLLEAN would like to see the PRPs who settled with Denver and WMC brought back to the table. CLLEAN is not sure the other Lowry PRPs are fully aware of the extent of the problems with the Site remedy. They think they have been released from liability, but in actuality, they still have liability. Contractors that are related to WMC have worked on the Site and perform sampling. It appears that they bring their own people in under a different name and it seems like nepotism.

Richard said that the Respondents have had their chance to do the remediation but they have not succeeded so they should be removed. It was discussed that it is EPA's policy to allow the Respondents the first opportunity to do the work; however, they've been doing it for twenty years. EPA would have to show they are totally incompetent to remove them from the Site. The Respondents want to do O&M. The public could initiate a lawsuit against the agencies to remove the Respondents from the Site, but that would be costly. Bonnie commented that perhaps the citizens can try to influence the Superfund reauthorization law. However, WMC has a powerful lobby. Politicians tend to cater to the deep pockets. The citizens don't have as much money as Denver and WMC. If it were proved that they are incompetent, the Respondents would have to pay EPA three times the cost to perform the remedy. If it is shown that contamination from Well MW-38WD is going offsite, EPA may be able to take enforcement action. It was noted that the unilateral order doesn't specify time-lines. EPA can only enforce on compliance issues.

Lowry Landfill—Five-Year Review Interview Questions

Name: Pam Wheldon

Elbert County Community

1. **Where do you live in relation to the Lowry Site?**

   70 miles east of Lowry. The closest Metro property is about 6 miles (where they are applying biosolids), and the actual Metro site is 8 miles.

2. **In general, what is your impression of the Lowry project?**

   Metro's farming practices seemed to be making headway but have regressed lately. The current farmer is not paying attention to the Soil Conservation Districts. More strip farming, plant backs, and terraces are needed. More conservation tillage is needed to prevent the soil from blowing.

   They should clean up the water and use it to recharge the aquifer at the Site. They should keep the water onsite and reuse what they can.

   She feels pretty confident that Metro is doing the best to make sure the water and biosolids are not harmful.

3. **What effect have the Site operations had on your community?**

   There is frustration about blowing dust. The community is divided in some ways but is doubtful that the community will ever really accept Metro's application of biosolids containing Lowry wastes.

4. **Are you aware of any community concerns regarding the Site or its operations and administration? If so, please give details.**

   The community has the same concerns as they had had for several years, but lots of folks feel there have been no results.

5. **Are you aware of any events, incidents, or activities at the Site that concern you? Please explain your response.**

   A few years ago, they applied biosolids and then there was a serious rainstorm and the neighbor to the east complained that their well water smelled differently. They are concerned about biosolids being discharged of the Metro property by wind and soil erosion. There are odors, possibly from the sludge, in the surface impoundment on a neighbor's land.

6. **Do you feel well informed about the Site's activities and progress?**

   I stay involved in the Site. It appears that Metro tries their best to keep the community involved.

7. **Do you receive Site fact sheets and updates? How effective are these in providing information about the Site?**

Yes. The fact sheets are informative, and I read them. EPA is doing a good job with the fact sheets. They are a helpful tool. However, many of the people in the Elbert County community are frustrated that they are not being heard.

8. Would you like to have your name added/removed from the mailing list?

Yes, I would like to stay on the mailing list.

9. Have you attended public meetings or availability sessions? How effective have these been in providing information about the Site?

I have attended them in the past. Some citizens are very opinionated and only see one side of an issue. It's difficult to change those people and you just have to keep trying.

10. How has the land use in the vicinity of the Site changed?

Metro is trying to keep the erosion of soil and water down. However, the current farmer of Metro's land doesn't leave any residue to hold the soil. The current farmer has problems. It may be a good idea for Metro to breakup the land into smaller parts and get several farmers involved. It may be possible to do a better job of controlling erosion among several people.

11. Has the Lowry Landfill Superfund Site had any influence on land use in your area?

No, just the Metro farm.

12. Are you a participant in EPA's Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues?

I have not participated for a while. The people who really want to know all the issues are interested. However, if people's minds are already made up, nothing seems to change their mind. As an example, some people have made up their minds that there are high levels of plutonium leaving the Site. Lots of people in the Deer Trail/Elbert County Community think that their area is just a dumping ground. It is hard to change people's minds.

13. Have you attended any problem-solving groups? If so, are these groups effective in resolving project issues?

I don't attend, but folks in the area of the Lowry Site, such as CLLEAN, think these are helpful.

14. Are you aware of any access restrictions at the Site? Are you aware of any signs at the Site? If so, how effective are the access restrictions and signs at the Site?

The Metro farm has signs and gates. For the most part, the signs are effective. Most people do respect the signs, however, sometimes hunters go out there.

15. What do you think has been successful about the Lowry remedy?

There has been progress in remediating the Site: The waste pits have been covered, and there has been some degree of containment. The problem is that having the pre-treated water leaving the Site may not be the correct remedy.

16. What do you think are problems with the Lowry remedy?

The key problem is that no one knows everything that is beneath the Lowry Landfill. There could be something at the Site that hasn't been detected, which may not be able to be treated in the water treatment plant and could end up in the biosolids sent to the Deer Trail area.

17. Do you have any comments, suggestions, or recommendation regarding the Site's management or operations?

It may take a long time for people in the community to accept the biosolids containing Lowry waste being applied to Metro's farmlands. There have been some improvements on the land and in Metro's farm practice. The community may need to have patience and trust that the project may work. The farmers are upset that the land shouldn't have been torn up in the first place. Metro is trying to make it work on extremely bad land. If they would show a big improvement, people would be impressed. It is important for the community to stay involved in this project.

Lowry Landfill—Five-Year Review
Interview Questions

Name: John Price

Deer Trail Community

1. Where do you live in relation to the Lowry Site?

I live on City Road 217 about 5 miles north of Deer Trail.

2. In general, what is your impression of the Lowry project?

I've never been impressed with the Lowry project. I don't trust the technology of today to take care of the future. We are being assured that the technologies of today will work; however, the problems at Lowry were caused by technologies that were acceptable at the time.

3. What effect have the Site operations had on your community?

The problem has been the application of the Metro-Grow sludge. The Lowry sludge is being mixed with other sludge, and Lowry may not have affected the community more than the other sludge. However, lots of people in this community don't want Lowry waste in the sludge. People don't trust the sludge and the Lowry contribution.

4. Are you aware of any community concerns regarding the Site or its operations and administration? If so, please give details.

The community is concerned about the application of sludge and Metro's farm practices in general. Metro hasn't worked well with other agencies such as the Soil Conservation Districts. Metro has made promises to improve farming practices and implement farm plans, but it doesn't seem to have happened. Key problems are runoff and wind erosion. There is a tour of Metro's property coming up. People who attended the previous tour in the spring didn't like what they saw.

5. Are you aware of any events, incidents, or activities at the Site that concern you? Please explain your response.

One of the concerns is that they are paying to pave the road but are now getting truck traffic from county roads. (County Rd. 217 [paved road] and 241 [a gravel road]). Big trucks should not be on side county roads and should stay on I-70 (which is actually shorter).

6. Do you feel well informed about the Site's activities and progress?

The information is available for those who want it. Metro and the other parties have been up front in sharing information about both Metro and the Lowry Site. I have received cooperation from government agencies and pretty speedy responses.

7. Do you receive Site fact sheets and updates? How effective are these in providing information about the Site?

I get fact sheets about the Lowry Site and think they provide most of the information. I also receive quarterly reports from USGS.

8. Would you like to have your name added/removed from the mailing list?

I would like to remain on the mailing list.

9. Have you attended public meetings or availability sessions? How effective have these been in providing information about the Site?

I haven't done too much in the last year because of the lawsuit against Metro. Metro originally was asking for $200,000 in legal fees but agreed to settle for about $100 dollars apiece. I've stayed away from meetings until the lawsuit was done but will probably attend meetings in the future.

10. How has the land use in the vicinity of the Lowry Site changed?

I don't know. A lot of building is happening around here.

11. Has the Metro Farm Site had any influence on land use in your area?

No. No one changed the use of the ground surrounding Metro. The land was farmed before Metro got it. The land probably should never have been farmed but it was. The land use is the same.

12. Are you aware of any issues that may come up as a result of development in this area?

It could impact land prices in the area. There is definitely some development in this area. People may hesitate to buy land next to the Metro farmlands. It could potentially affect prices if development moves out into that area.

13. Are you a participant in the Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues?

No.

14. Have you attended any problem-solving groups? If so, are these groups effective in resolving project issues?

Only the groups that have met in the Deer Trail area. These meetings have been as effective as they can be.

15. Are you aware of any access restrictions at the Site? Are you aware of any signs at the Lowry or Metro Farm Site? If so, how effective are the access restrictions and signs at the Site?

No. I don't really know about the Lowry Site. I don't get to the Site very often. I think they discourage people from coming on the Site except for tours. There are signs at the entrance of the Metro Site, and I think they are mostly effective. Tommy Thompson farms the land, and there are people working on the Site. Sometimes people trespass for arrowhead hunting.

16. What do you think has been successful about the Lowry remedy?

There has been progress made on the Lowry cleanup, but I don't agree with the process of sending Lowry water offsite to Metro to be included in the sludge applied on Metro's farmland.

17. What do you think are problems with the Lowry remedy?

The groundwater is the primary concern. If it is safe enough to come out here, why not treat it and put it back on the Lowry Site. They are just mixing it, diluting it, and calling it safe. The Lowry remedy seems to be a dilution solution, and I don't believe it is safe.

18. Do you have any comments, suggestions, or recommendation regarding the Metro Site's management or operations?

No comments until the next tour of the Metro farm. Metro needs to work more effectively with the Soil Conservation Districts, Agate, and Deer Trail. These people have suggestions. My major concern with the Lowry Site is Metro's involvement and the inclusion of the Lowry water in the sludge.

Lowry Landfill—Five-Year Review
Interview Questions

Name: Larry Scott/John Metli

Deer Trail/Elbert County Community

1. Where do you live in relation to the Lowry Site?

Larry Scott lives 65 miles southeast and John Metli lives 45 miles southeast of the Lowry Site.

Larry Scott lives 40 miles south and west of Metro's farm, and John Metli lives 50 miles southwest of Metro's farm.

2. In general, what is your impression of the Lowry project?

Larry Scott: Metro has to go somewhere with the sludge, but I am not sure that the Lowry residue has to come out here. There may be alternative methods of getting rid of the Lowry groundwater. I am not sure if food crops are the best use of Metro sludge.

John Metli: I don't go along with the Lowry remedy. I make a living off the land, and agriculture and Superfund waste don't mix. Lowry wastes do not belong out here, and there is no place in my life for Superfund wastes.

3. What effect have the Site operations had on your community?

Larry Scott: The primary problem is wind erosion on the Metro farm. There are potential future concerns about water erosion. Wind erosion is the primary concern right now. In the last five years, there have been major wind storms. There has been only one wet year in the last few years. There are north and south prevailing winds. It would be good to have terraces for eventual control of the water flow, but wind is the biggest problem.

John Metli: I have been going to meetings for 6 years but wish I didn't have to go to meetings, but I have major concerns for the land, agriculture, and my neighbors.

4. Are you aware of any community concerns regarding the Site or its operations and administration? If so, please give details.

Larry Scott: If sludge containing Lowry waste is coming out here, we need to question whether they are using the biosolids properly for protecting public health. The State regulations specify that biosolids need to be contained onsite, which isn't happening.

John Metli: A neighbor adjacent to the Metro farm is afraid to have his kids swim in the places he swam as a kid. There are concerns about surface water and wind erosion onto adjacent properties. Wind erosion is a major concern. A substantial amount of dust blew onto my property before the Lowry waste was added to the Metro biosolids. The wind erosion has changed my lifestyle. If it was Aurora, and the wind was blowing soils from the Metro farm, there would be more action, but this is a rural area.

5. Are you aware of any events, incidents, or activities at the Site that concern you? Please explain your response.

John Metli: I became concerned in 1995 or 1996, when there was massive blowing, followed by heavy rains. The County commissioners heard about movement of large amounts of soil. There was a cease and desist order placed on Metro. Families in this area have been here for generations. I attended meetings to resolve the erosion issue and then found out that Lowry waste may be included in the sludge. I have been involved in this issue since that time. There are concerns about water quality in the Fox-Hill Aquifer, and there have been some cattle deaths.

Larry Scott: I live downgradient of the Metro farm and am concerned about the potential for contamination of the Fox- Hill Aquifer. All of Elbert County could be affected if the aquifer becomes contaminated.

6. Do you feel well informed about the Site's activities and progress?

They are well informed, but this is a battle they wish they didn't have to go through.

7. Do you receive Site fact sheets and updates? How effective are these in providing information about the Site?

Yes, they are both on the mailing list. The fact sheets tell us what they are planning on doing, not what they get done. Metro often has plans and then must change them. The fact sheets from EPA are understandable even to those without a chemistry background.

8. Would you like to have your name added/removed from the mailing list?

They both would like to remain on the mailing list.

9. Have you attended public meetings or availability sessions? How effective have these been in providing information about the Site?

Larry Scott: I understand the issues but come from a chemical background. A lot of people may have difficulty understanding complex technical issues that are not clearly explained. I worry about volatile hydrocarbons but others don't. I understand that "ND" means non-detect.

John Metli: In general, there is an information overload. A lot of technical issues are not explained clearly. Some of the audience is not technically sophisticated. There is a perception that agriculture is a simple way of life, but in reality, it is very complicated and requires multiple skills (carpentry, business, veterinary medicine etc.). Farmers don't always understand technical issues, but then again technical folks don't always understand ranching.

10. How has the land use in the vicinity of the Site changed?

John Metli. There have been no changes to land use, but they have oiled the road in Arapahoe County.

Larry-Scott: The changes occurred before Metro bought their farm land. The ground was busted up about 20 years ago, and it shouldn't have been. We may actually get more remediation from Metro's operation than a regular farming operation. The economics of it is that a farmer could not pay the equipment costs much less make a profit. Metro may be better able to stabilize the land than the average farmer.

11. Has the Lowry Landfill Superfund Site had any influence on land use in your area?

John Metli: The biggest change is fear among the neighbors with children. In April of this year, dirt was blowing 1,000 feet in the air. This caused a definite interruption to their activities.

12. Are you a participant in the Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues?

No. We have not attended TAG meetings.

13. Have you attended any problem-solving groups? If so, are these groups effective in resolving project issues?

Both are participating in the Radionuclide Work Group. We talked with EPA informally about the Site remediation and have attended Site tours. We have not been involved in the Lowry planning but have mostly been involved with the Metro farm issues, conservation plans, and wind erosion.

John Metli became an Elbert County commissioner about a year and a half ago. Elbert County has a grant to be involved in the Radionuclide Work Group.

14. Are you aware of any access restrictions at the Site? Are you aware of any signs at the Site? If so, how effective are the access restrictions and signs at the Site?

There are "No Trespassing" signs, but it doesn't stop people from going on the Metro property.

15. What do you think has been successful about the Lowry remedy?

Larry Scott: They are getting rid of some compounds that I am concerned about. There is a diverse problem at the Lowry Site. One solution may not fit all the problems at the Site. The chlorinated hydrocarbons are being removed in the water treatment plant. The concerns about radionuclides seem to be overblown and do not seem to be a major problem if the effluent. Metro's monitoring plan will give them some answers, but he would like more frequent tests. The monitoring program seems to emphasize long-range testing, and it would be a better expenditure of funds if more immediate information were provided.

John Metli: The major contributors at Lowry should be happy because they have a cheap solution and strapped it on the back of agriculture. With new tests, there is always a test that will show the results that they want.

16. What do you think are problems with the Lowry remedy?

Larry Scott: There is a perception of a problem with the Lowry wastes being included in Metro's biosolids. Although the problems may not be real, the perception could have a drastic effect on the farmers and Colorado wheat. I would like to see more pathogen testing at Metro's plant. I am concerned about the agronomic application rates of biosolids. I would like to see them raise the residue and not sell the wheat if they continue to apply biosolids. It might even be a better economic solution for Metro, because they are spending a lot of money to apply the biosolids and must be having problems making money from their crops.

John Metli: There are scientists and tests that show that what they are doing is okay, but agriculture has been stonewalled. Farmers wrote a letter to the governor to stop discharging Lowry water to Metro until a study is done to estimate the effect on farmers and agriculture. It is important to consider the effects on the agricultural community and family farms. If Oprah Winfrey has a guest who talks about mad cow disease, then cattle sales go down. Public perceptions of food safety are extremely important to the marketability of farm crops. For example, bio-engineered corn combines two species of corn. However, following news stories, there was a perception that bio-engineered corn is bad, and it damaged the market for corn. When something happens, it affects the farmers' ability to sell their products and lowers the prices. EPA, Metro, and the State don't understand the impacts to family farmers of this decision. It is a fact that American farmers are the most efficient farmers in the world. In the eighteenth century, as many as 70 percent of the people were farmers, whereas now only about 10 percent of the population is farmers. American farmers are feeding a huge population. Strapping Superfund cleanup onto farmers' backs could drive more family farms out of business.

The farmers are not being respected. The farmers have backing of the Colorado Farm Bureau, the Cattlemen's Association, and the Soil Conservation Districts. They have asked the Elbert County Commissioners to fight the decision to send Lowry waste to Metro and have done a good job in keeping it out of papers. They have the support of the farm community. The perception that there may be plutonium in the biosolids from the Lowry water could negatively impact the entire farming community.

17. Do you have any comments, suggestions, or recommendation regarding the Site's management or operations?

John Metli: Don't do this. Don't put Lowry water in the sludge. If it were applied to a golf course, it might kill the grass. Keep the Lowry water onsite.

Larry Scott: I understand that Metro has to go somewhere with their sludge but don't agree that is has to go to Deer Trail. If Metro does have to apply their sludge in this community, then why does it have to contain Lowry waste and why is it used it for food crops? They may be able to control the bad perception by not growing crops on their land.

John Metli: Metro and EPA's scientists did work to study the problem and left the farmers out of the process, and now the farmers are bearing the brunt of the problem.

Lowry Landfill—Five-Year Review
Interview Questions

Name: Ed Butler

Deer Trail/Agate Community

1. **Where do you live in relation to the Lowry Site?**

   8 miles east of Agate and 60 miles east of the Lowry Site. My land borders the Metro Farm.

2. **In general, what is your impression of the Lowry project?**

   There should be another alternative to taking Superfund waste from one place and putting it somewhere else. I am currently the President of the Soil Conservation District. Five years ago, a motion was passed to oppose having any Superfund wastes come into the district and Elbert County.

3. **What effect have the Site operations had on your community?**

   There has been an increase in dust and air pollution and water runoff downgradient of Metro's farm. Biosolids are leaving the Metro site.

4. **Are you aware of any community concerns regarding the Site or its operations and administration? If so, please give details.**

   People don't like the dust and what's in it.

5. **Are you aware of any events, incidents, or activities at the Site that concern you?. Please explain your response.**

   March and April 2001, there were heavy winds resulting in lots of dust. Metro uses poor framing practices. This is probably the worst case of wind erosion in the United States. I've talked to others about this situation, and there's no comparison.

6. **Do you feel well informed about the Site's activities and progress?**

   Metro did not used to inform the community about problems, but now Metro is taking steps to keep the community better informed. The Metro folks tend to live in Denver and don't care about the Deer Trail/Elbert County Community. The community doesn't have to be informed to see the dust. The dust speaks for itself.

7. **Do you receive Site fact sheets and updates? How effective are these in providing information about the Site?**

   Yes, he does get material from EPA, but it has been a while.

8. **Would you like to have your name added/removed from the mailing list?**

   Would like to stay on the mailing list.

9. **Have you attended public meetings or availability sessions? How effective have these been in providing information about the Site?**

   I attended a public meeting in Byers and used to go to others. The meetings are effective, but I don't hear what I want to hear.

10. **How has the land use in the vicinity of the Site changed?**

    The situation has gotten worse since Metro started farming.

11. **Has the Lowry Landfill Superfund Site had any influence on land use in your area?**

    No, but the Metro farm certainly has had influence on the community, although it hasn't changed the land use.

12. **Are you a participant in the Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues?**

    Not for a long time.

13. **Have you attended any problem-solving groups? If so, are these groups effective in resolving project issues?**

    Yes, the Rad Work Group. I used to attend some CDPHE work groups in Denver (about 4 or 5 years ago). The meetings pertained to biosolids and water quality issues.

14. **Are you aware of any access restrictions at the Site? Are you aware of any signs at the Site? If so, how effective are the access restrictions and signs at the Site?**

    There are signs everywhere saying, "No Trespassing." I am not sure how effective the signs are. I don't trespass and only go on the property with Metro's staff.

15. **What do you think are the successes of the Lowry Remedy?**

    I don't think there are successes.

16. **What do you think are problems with the Lowry remedy?**

    The problems are that Superfund materials should not be moved to another area and spread on 52,000 acres of the most erodable soil in the United States. I am not sure that radionuclides are the worst problem with the Lowry wastes.

17. **Do you have any comments, suggestions, or recommendation regarding the Site's management or operations?**

    The State biosolids regulations (Section 4.9.0) preclude biosolids with industrial components. EPA and the State should check these regulations. I deal directly with Metro and receive information from USGS. I call Metro and complain when dirt is blowing. I am starting to get more response from Metro, because I am getting more support from the County Commissioners. While Metro responds, they don't always take any actions to improve the problems. Sometimes it seems that the community is not being heard.

Lowry Landfill—Five-Year Review
Interview Questions

Name: Joe Kalcevic

Deer Trail Community

1. Where do you live in relation to the Lowry Site?

I live about 6 miles north of Byers, about 40 miles east of the Lowry Site. I farm 22,000 acres beside Metro property south and east. Most of it is above it. Tommy Thompson sold land to Metro about 7 to 8 years ago.

2. In general, what is your impression of the Lowry project?

I only know what I've heard. I know some folks who were involved in placing subterranean dams (slurry walls) there. I farm about 60,000 acres of land and have worked with Metro as neighbors for 7 or 8 years. They are trying but have trouble with wind erosion and holding the moisture on their land. They have a lot of sludge to apply to the land, about 20 loads a day. Littleton and other cities are also applying sludge to the east of my farm. These cities don't have as much sludge to worry about and are said to grow good crops. When you leave sludge on the surface, it dries like ashes and moves the dirt. They need to apply sludge to the ground and drive over it and tamp the ground. Wind erosion is a big problem. Some other farmers use Metro-Grow near Linden, and they have had good crops. But their surface water is marginal.

Many people drink water from the Fox-Hills Aquifer. Sands where the aquifer replenishes are on the Metro property. The ground is higher in sulfates. A few years ago, EPA and CSU did studies on the badger. The manure goes away in a few years, but I am concerned about radioactive substances in the Fox-Hill recharge zone. l am concerned about potential contamination of the Fox-Hill Aquifer. Some neighbors dug wells and are concerned about sludge getting in the water. Some of the neighbors lost cattle from sulfates. I have been using quarter strips instead of blocks, which helps to avoid problems from wind erosion. However, when there are 80 mile per hour winds and heavy rains, there will be wind and soil erosion no matter what you do.

3. What effect have the Site operations had on your community?

The roads have gotten better. John Jolly's been here for 4 generations. Other neighbors have been here for a while. Some people in neighboring ranches have lost cattle from the sulfates in the water. I haven't lost any cattle in the past but have recently lost some cattle. CSU and EPA studied the cattle deaths.

4. Are you aware of any community concerns regarding the Site or its operations and administration? If so, please give details.

The community is very concerned about Metro's practices, but they are getting used to it. Tracy Yeager from USGS works well with the community and does a good job of monitoring the water. At first, USGS was just checking the deep groundwater but now they are also checking the shallow water. They compare groundwater samples to land where sludge has not been applied (about 5,000 to 6,000 acres of land).

5. Are you aware of any events, incidents, or activities at the Site that concern you? Please explain your response.

Dirt movement, erosion, and wind are primary concerns. About two years ago, 8 or 10,000 acres of dirt were blowing. Sometimes, the wind erosion may be prevented, but sometimes it can't. There has been increased truck traffic, but the truck drivers are generally pretty cautious. A lot of people are concerned about plutonium from the Lowry Site being sent to Metro, which may end up in the sludge out here.

6. Do you feel well informed about the Site's activities and progress?

Metro has sent a lot of information to stakeholders from Elbert County. Metro folks are not bad people to work with, and they do try to forewarn people about potential problems. They have a job to do.

7. Do you receive Site fact sheets and updates? How effective are these in providing information about the Site?

Yes, I've gotten some of the EPA fact sheets but don't always understand them. They should be simpler and shorter and are too repetitive. They don't address the concerns of the farmers as well as some of the other information. The fact sheets have lots of other information about the Site and are pretty dry reading.

8. Would you like to have your name added/removed from the mailing list?

Yes, I would like to remain on the mailing list.

9. Have you attended public meetings or availability sessions? How effective have these been in providing information about the Site?

I have attended a couple of Metro's meetings. USGS and Metro try to keep the community informed and ask our opinions. I haven't been to EPA meetings. I went to a meeting in Bennett when they first began talking about including Lowry water in Metro's biosolids.

10. How has the land use in the vicinity of Metro's area changed?

The Metro farm is very large with some good soils and some lousy soils. My farm has some even worse soils. I had bid on Tommy Thompson's land before Metro bought it. The farm is large and hard to operate and takes a lot of money to grow crops. The land has always been a problem, even before Metro took it over. It may have actually improved since Metro took over. It is so big, that if they make a mistake, there will be problems next spring.

11. Has the Lowry Landfill Superfund Site had any influence on land use in your area?

A lot more people are starting to use Metro's sludge as fertilizer. No one used to use it, but it is a cheap fertilizer. I haven't used it. We have considered using the sludge on our farm but decided against it. We decided to use other fertilizer in case there are problems found with Metro's fertilizer, then our land won't be involved

12. Are you a participant in the Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues?

No. I haven't attended TAG meetings.

13. Have you attended any problem-solving groups? If so, are these groups effective in resolving project issues?

I have heard about them but haven't participated.

14. Are you aware of any access restrictions at Metro's land?

There are no trespassing signs, but lots of people ignore them. The local people pay attention to it but other folks don't. They go through our land to get there when it rains. I have a key to the locked roads. l can use Metro's road. I work closely with Metro to farm land from Adams to Arapahoe County. Their roads are easily accessible when I need them. There is more accessibility now because there are more roads.

15. What do you think has been successful about the Lowry remedy?

I think they are building a lot of houses around the Lowry Site, so I hope the subterranean dams (slurry walls) are working. They should have put those dams in sooner, but they seem to have helped the groundwater situation.

16. What do you think are problems with the Lowry remedy?

I don't know. But I have concerns that nothing works exactly like it's planned. The slurry wall has been there to the north since 1985. I am concerned that waste from Lowry is in the biosolids applied out here. I am concerned that if someone goofs, then it will create problems and go other places. It would be better to contain the water on the Lowry Site. There are lots of houses around there, and the folks there would get more attention. I grew up in the Northglenn area and farmed there. Metro tries hard but they aren't farmers. Tommy Thompson does the best he can, but it is difficult land to farm.

17. Do you have any comments, suggestions, or recommendation regarding the Site's management or operations?

If you can, keep it really tight at Lowry and document it well to show folks you are doing things correctly. It is pretty scary because stuff is being thrown out here, and the farmers are concerned.

Lowry Landfill–Five-Year Review
Interview Questions

Name: Mary Sue Liss

Elbert County Community

1. **Where do you live in relation to the Lowry Site?**

   I live approximately 80 miles southeast of the land fill and approximately 100 miles south of the Metro site.

2. **In general, what is your impression of the Lowry project?**

   There has been sufficient amount of testing for background. There is a need for continuing stringent effluent testing. The concept of independent resting by a separate entity is important. There is a lot of respect for the USGS testing in Deer Trail.

3. **What effect have the Site operations had on your community?**

   There is a great deal of anger, frustration, consternation, confusion, and distrust surrounding the issue of Lowry groundwater being discharged to Metro and included in the sludge applied on Metro's farmlands. I am working as a coordinator and liaison for the community and work for Elbert County. People lack an understanding of biosolids and also don't have a lot of information about the biosolids. There is some resistance to education.

4. **Are you aware of any community concerns regarding the Site or its operations and administration? If so, please give details.**

   Metro's neighbors distrust Metro's farming operations and the application of biosolids. Some admit that the problems are not Metro's fault, and they think the ground should never have been broken. Others have previously used bad farming practices on that land.

5. **Are you aware of any events, incidents, or activities at the Site that concern you?. Please explain your response.**

   Wind erosion is the key complaint. The erosion problem is not directly related to the Lowry contribution to the sludge, but they have concerns that the Lowry wastes are blowing in the wind.

6. **Do you feel well informed about the Site's activities and progress?**

   Yes.

7. **Do you receive Site fact sheets and updates? How effective are these in providing information about the Site?**

   Yes.

8. **Would you like to have your name added/removed from the mailing list?**

   I would like to remain on the list.

9. Have you attended public meetings or availability sessions? How effective have these been in providing information about the Site?

A valiant attempt has been made. It isn't possible to quantify the correlation between the information given and the results obtained. There needs to be an ongoing effort and the information needs may change. People may want to know different things as they have an increasing understanding of biosolids.

10. How has the land use in the vicinity of the Site changed?

We are beginning to see changes because of wind erosion. Metro has pledged to take additional soil conservation steps.

11. Has the Lowry Landfill Superfund Site had any influence on land use in your area?

There is definitely a perception issue that has affected the community.

12. Are you a participant in the Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues?

No.

13. Have you attended any problem-solving groups? If so, are these groups effective in resolving project issues?

Yes. I am part of the Metro Stakeholders group and attend the Lowry Radionuclide Work Group. I also attend Elbert County-based meetings and workshops. These groups can be effective. However, there is a learning curve, and the Radionuclide Work Group may have to change to fit the audience.

14. Are you aware of any access restrictions at the Site? Are you aware of any signs at the Site? If so, how effective are the access restrictions and signs at the Site?

As an employee of Elbert County, I can go out there whenever I want. I also serve as the Health Officer. 1 am not aware of verbal or written Site access restrictions.

15. What do you think has been successful about the Lowry remedy?

The wastewater treatment plant is a step in the right direction. The remedy is containing contaminated groundwater. I have attended Site tours and heard EPA's overviews of the Site.

16. What do you think are problems with the Lowry remedy?

The community asks why the Lowry water has to go through Metro. There are perceptions that Metro is applying "Superfund Sludge" or "Super Sludge." There are definitely perception issues with the Lowry Remedy. These perceptions have been exacerbated by newspaper articles and some community groups. Some newspaper reports have not accurately reported the data.

17. Do you have any comments, suggestions, or recommendation regarding the Site's management or operations?

The goal is to try to defeat a perception issue. It is important to continue testing, but it is also important to reassure the public to gain more credibility. Public education and disseminating meaningful, believable data are important so that people obtain factual information rather than rumors. The goal is to get past the perceptions and obtain the facts.

Lowry Landfill–5-year Review
Interview Questions

Please return to: Jane Koewing
CH2M HILL
PL Box 241325
Denver CO, 80224-9325

(If additional space is required for your responses, please attach additional pages.)

Respondents

What is the O&M status of each remedy component?

Response:

Wetlands: RD/RA complete; O&M ongoing. Wetlands are functioning as designed.

LFG Collection, Extraction and Treatment: RD/RA complete; O&M ongoing. LFG has been successfully collected, extracted, and combusted since 1997. All perimeter gas-monitoring probes at the Site are monitored regularly and no gas migration issues exist. Voluntary improvements are under design by the Respondents to enable more continuous gas extraction, and to reduce potential gas to groundwater impacts. The South Boundary Soil Vapor Extraction (SBSVE) system corrective action was also successfully completed.

Slurry Wall E/S/W: RD/RA complete; O&M ongoing. The slurry wall is performing as designed. The Performance and Compliance Monitoring Plan (PCMP) wells are also being monitored. Implementation of PCMP groundwater pumping from wells inside the wall, and along its northern extension is underway. Results are being extensively discussed with EPA and stakeholders. Evaluations of groundwater containment at the site perimeter where the slurry wall is not present are also underway. The bottom line is that some 21 to 37 years following disposal of liquid wastes at the Site, there are no data at any spot around the Site perimeter that show off-site migration of groundwater contamination.

Middle FTPA Waste Pit Extraction and Treatment Cell Construction: RD/RA complete; O&M ongoing. Attempts to excavate the north and south pits had to be abandoned due to health and safety concerns; however, Respondents are designing and testing a revised approach to the remedy at the remaining pits.

WTP: RD/RA* complete; O&M ongoing.

North Face Cover: RD/RA complete; O&M ongoing

North Boundary Barrier Wall Evaluation: RD/RA complete; O&M ongoing

North Toe Extraction System: RD/RA complete; O&M pending*

* Original design of the WTP is complete and successfully implemented for treatment of extracted water from the NBBW, PCMP, LFG condensate, and other site water. However, due to a change in water chemistry from that included in the NTES design basis, the current WTP design cannot treat NTES water to permitted limits. Additional evaluations are ongoing to assess the most effective means of removing 1,4-dioxane from NTES water. When the WTP plant is upgraded to treat NTES water, O&M of the NTES will commence.

Please provide an overview of contractor construction activities at the site.

Response: Construction contractors were responsible for installing the LFG remedy, WTP, and N. Face cover and all performed well. Their craft labor, equipment operators, selection and use of heavy equipment, QC subcontractors, superintendents, and management teams met all requirements. Construction contractors were responsible for the wetland mitigation, slurry wall E/S/W, middle waste pits, and North Toe Extraction System (NTES). These contractors experienced some difficulty in meeting job requirements, but through diligence, eventually were successful at constructing these elements to approved design specifications. In some cases, difficulties were caused by bad weather and equipment malfunction (slurry wall E/S/W, and wetlands). In other cases, they were caused by changed subsurface conditions (slurry wall E/S/W and middle waste pits) that were not discovered during the RI/FS or design investigation. However, as indicated above, all completed construction fully complied with the technical specifications and/or design intent of each remedy.

Are there any potential operation and maintenance problems?

Response: O&M issues are addressed by remedy below:

Wetlands: O&M is ongoing with no significant problems. Two 100-year storms in 1997 destroyed new wetlands construction. Since that time, drainages have been restored, erosion filled, and vegetation replanted. Recently, revegetation has been necessary due to occasional grazing by deer and antelope.

LFG Extraction and Treatment: O&M is ongoing. Through May 2001, approximately 450 million cubic feet of landfill gas have been collected and successfully flared. However, the landfill has not produced as much gas as originally envisioned in the RD. As a result, the collection system and flare have been operated intermittently – approximately 38 hours per week at a rate of 950 scfm. A proposal to add the DADS landfill gas collection system to the flare has been presented to the EPA for approval. If approved, the increased gas flow will enable the gas collection and flare system at the Superfund Site to operate more efficiently.

The SBSVE system was installed along the southern site perimeter in the summer/fall 1999 in response to a Notice of Violation (NOV) issued by the EPA. The SVE system was operated for 13 months, resulting in the successful reduction of soil vapor concentrations to values less than performance standards. Having met performance standards, the SBSVE system was decommissioned in November 2000. An

agreement in principle to settle the NOV has been reached between the Respondents and the EPA, but negotiations over the legal documentation of the agreement has been protracted and is not yet in place. However, the agreement in principle called for supplemental environmental protection work to be implemented and that work (consisting of applying asphalt to a road at DADS to reduce dust emissions) has been implemented.

A noteworthy, operational issue is the continued monitoring of inlet gas quality beyond the four quarters initially mandated in the LFG Compliance Monitoring Plan. Respondents note that the intent of the inlet gas monitoring program was to demonstrate consistency of LFG quality over time (one-year period) to ensure that changing atmospheric or seasonal conditions, or degradation of buried wastes within the landfill prism, did not significantly change the quality of gas produced. Since February 1997, eleven sampling events have occurred, consisting of an initial round in February/March 1997, two consecutive quarters in 1998-1999, and seven consecutive quarters between 1999-2001. All analytical data have shown the same basic "fingerprint", and for most constituents, concentrations have remained within the same order-of-magnitude. Thus, the Respondents believe the intent of inlet monitoring has been satisfied. For the past eight months, and in accordance with the approved Plan, Respondents have requested approval to change the monitoring frequency to annually. EPA has not responded.

Slurry Wall E/S/W: O&M is ongoing in accordance with the Performance and Compliance Monitoring Plan. Of the 15 compliance monitoring wells installed outside of the slurry wall, all but three are demonstrating compliance with performance standards. Two of the three (MW39-WD and MW51-WD) have consistently shown very low concentrations of VOCs, slightly above performance standards. Additional wells have been installed near these wells to evaluate the nature and extent of the VOC issues. The third well has shown levels of iron and manganese above performance standards. Because groundwater movement near this well is inward toward the slurry wall, the well is being monitored for concentrations trends.

Efforts are also underway in three areas along the wall at which PCMP monitoring has triggered need for investigation/corrective action. At the southeastern corner of the wall (PM-11 area), active pumping from inside the wall (up to 0.5 gpm) has induced inward gradients across the wall for more than a year, assuring containment in this area of concern. Similarly, active pumping along the northeastern limit of the wall (PM-15 area) (less than 0.5 gpm) is effectively preventing offsite migration of contaminants in this area. On the western side, 10 wells were recently installed to investigate the nature and extent of the only identified area of potential outward gradient near PM-4. Respondents are currently evaluating these hydrogeologic data to develop an appropriate corrective action plan.

Efforts are also underway in one area north of the western wall (MW38-WD) at which compliance monitoring detected organic compounds above performance standards. This area is north of the landfill mass. Respondents have conducted initial investigations that showed no off-site migration. However, to increase EPA confidence, the Respondents are actively conducting additional evaluations of the nature and extent of this anomalous finding.

Finally, the traffic cap constructed over the slurry wall is in need of repair due to a high amount of vehicular travel along the wall. Respondents are in the process of resurfacing the traffic cap with recycled asphalt to protect the cap.

Middle FTPA Waste Pit Extraction and Treatment Cell Construction: O&M is ongoing with no significant problems. Approximately 15,000 CY of waste material was removed from this pit to effectively "clean-close" the pit. This material was then blended with tire chips and placed into an onsite treatment cell for active vapor extraction. The vapor extraction system is currently operating full time, and is scheduled to continue for another year.

WTP: O&M is ongoing with no significant problems. The new WTP and associated POTW pipeline are successfully treating waters from the North Boundary Barrier Wall, PCMP wells, LFG condensate, and other incidental sources allowed for by the permit, and conveying them to Aurora's POTW line, respectively. Respondents have remained in full compliance with the terms and conditions of the discharge permit. Regarding the NTES treatability issue, Respondents have commissioned an expert panel to address the treatment evaluation.

Several additions/modifications have been made to the WTP since start-up to optimize the system and add assurance for compliance with the discharge permit. These include adding a caustic feed loop to the back end of the plant to assure that the pH of plant effluent never drops below its permit limit of 5.0, and adding a water chiller to the back end of the plant to maintain effluent temperature at or below 20EC. In addition, the specific gravity of acid and caustic chemicals used at the plant was reduced to prevent freezing of the caustic chemical during cold months, and volatilization of acid during warm months.

North Face Cover: O&M is ongoing with no significant problems. Aside from the North Face Cover, Respondents are addressing a drainage control issue on the top deck of the landfill. Because of ongoing settlement within the landfill prism, and the Respondents understanding that the relatively flat grade of the current cover (0-2 percent) was to be temporary when installed, positive drainage off the cover is difficult to promote. Respondents have proposed a permanent solution to EPA/CDPHE to raise the finished grade of the cover by effectively "doming" the landfill cover. Respondents are now discussing the regulatory implications of such a remedy with EPA and CDPHE.

North Boundary Barrier Wall Evaluation: O&M is ongoing with no problems. The Respondents evaluated the effectiveness of the wall, and EPA approved the report in 1998. Recently, the EPA has again asked the Respondents to evaluate the wall effectiveness, and the Respondents are implementing additional investigations and evaluations to again address EPA's questions.

The Respondents believe that as long as the NBBW sump remains pumping and reinjection continues into the NBBW injection trench, contaminant capture along the north boundary of the Site will occur. However, to increase EPA confidence, Respondents are installing additional wells between the NBBW and injection trench to demonstrate containment and capture.

North Toe Extraction System: O&M is pending resolution of the NTES treatability evaluation and modifications to the WTP.

How effective is the O&M Plan for each component? Please describe changes to the O&M plans for the components you are involved with. Have there been unexpected O&M difficulties at the site since startup or in the last 5-years?

Response: The O&M Plans are effective, with the possible exception of the PCMP which needs to be revised to reflect updated site knowledge gained from several years operating experience.

All O&M Manuals are updated as necessary to reflect changes to component operations necessary to optimize their functions. For example, when the WTP is upgraded to treat NTES water, its O&M Manual will be revised to address changes to plant equipment and operations. Likewise, if pumping additional waters from perimeter extraction wells becomes necessary, changes to the WTP manual to address pumping/transport/treatment procedures will be required. In addition, Metro will become involved to prepare any necessary changes to the discharge permit.

Is there a continuous O&M presence? If so, please describe staff and activities. If there is not a continuous onsite presence, describe staff and frequency of the inspections and activities.

Response: The site has continuous O&M presence. Site O&M labor requirements total approximately six full time equivalents, as detailed in the following table. To this must be added the EPA/CDPHE and their ovesight contractor labor.

Component	Activity	Labor Hours
Project Management	Contractor management, regulatory interface	80 hr/week
Wetlands	Site Inspection and Reporting	24 hr/quarter
LFG Extraction and Treatment	Weekly Monitoring and Inspection	4 hr/week
	Monthly Wellfield Monitoring and Adjustment	24 hr/month
	Quarterly Status Reporting	24 hr/quarter
	Quarterly Inlet Monitoring	40 hr/quarter
	Annual Maintenance and Testing	40 hr/year
Slurry Wall E/S/W	Daily Extraction System O&M	4 hr/day
	Groundwater Monitoring	160 hr/mo
	PCMP Compliance	100 hr/mo
	Quarterly Status Reporting	120 hr/quarter
Middle Waste Pit	Treatment Cell O&M	2 hr/day

and Treatment Cell	Weekly Monitoring and Inspection Quarterly Status Reporting	8 hr/week 24 hr/quarter
WTP	Plant O&M GC O&M Compliance Monitoring and Reporting Plant Engineering (NTES Evaluation) Quarterly Status Reporting	4 hr/day 12 hr/month 60 hr/month 40 hr/month 40 hr/month
North Face Cover	Cover Inspections Quarterly Status Reporting	4 hr/month 4 hr/month
North Boundary Barrier Wall	Piezometric Monitoring Quarterly Status Reporting	4 hr/month 40 hr/quarter
North Toe Extraction System	Early Warning Monitoring	80 hr/year

Can you provide information about any potential causes for concern about the remedy?

Response: Extensive data have been produced and exchanged as part of the ongoing process of monitoring the slurry wall as the point of compliance (POC). The Respondents are concerned that the success of the remedy is being judged at a POC that is positioned inside the waste management area and within an area of known groundwater contamination. Both of these criteria are inconsistent with the state and federal regulations that guide selection of the POC. As currently drawn, the POC at the slurry wall can lead to a false indication of non-compliance of the containment objective. Rather, the Respondents interpretation of the subject ARARs indicate that the POC should be at the Site property boundaries, which form the boundary of the waste management area, and bound known contamination.

As indicated earlier, long-term promotion of positive drainage from the existing landfill cover has become an issue due to settlement of the landfill prism and relatively flat cover. Respondents have proposed a permanent solution by "doming" the landfill cover consistent with modern landfill closure design using fill materials now targeted for disposal at DADS. For example, Respondents estimate the fill required to accomplish a 5 percent grade would be approximately 1.2 million CY. The Respondents believe the proposal to be environmentally sound, in keeping with the ARARs, and consistent with the approach approved by EPA at numerous similar state and federal Superfund Sites around the United States. The type of fill material and regulatory status of the landfill are being evaluated to assess the viability of this alternative.

Have there been any significant changes in the O&M requirements, maintenance schedules, or routines since start up or in the last 5-years? If so, do they affect the protectiveness or effectiveness of the remedy? Please provide any insights into potential operation and maintenance problems.

Response: Significant changes in O&M have occurred with the LFG remedy, and the slurry wall E/S/W. Specifically, production of LFG from the Section 6 landfill has been much less than anticipated – roughly 10% of design production. To accommodate such low flow, the system has been balanced to run two days per week, 18 hours per day, and at a flow rate of 950 scfm (compared to a full-time design flow of 2,000 cfm). These operating criteria are within the turn-down range of the system equipment. However, intermittent operations limit the well field's ability to maximize capture of LFG. Rather, continuous extraction at a lower flow rate will better accomplish capture. Such continuous operations will occur with the currently-proposed addition of LFG from the DADS Section 31 landfill to the Lowry blower/flare station.

For the slurry wall E/S/W, gradient control pumping and new extraction wells have been installed in two areas (PM-11 and PM-15) along the east boundary wall, and wells have been installed near PM-4 along the west wall. Only very low flows (combined total of less that 1 gpm) have been produced from the PM-11 and 15 areas, and the pumped waters contain only trace concentrations of compounds of concern. Thus, the gradient control pumping is enhancing the protectiveness of the remedy, and is not imposing additional risk to the WTP or compliance with the discharge permit.

Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Response: System optimization is an ongoing process for all remedial components. For the LFG remedy, system operations have been consolidated to two days per week, at an optimal flow rate of 950 scfm to best balance the amount of LFG production with the turn-down limitations of the blower/flare station. As indicated earlier, Respondents believe that the system can be further optimized by combining LFG from DADS Section 31 into the Lowry flare, and operating the Lowry wellfield and flare continuously. In addition, because inlet gas quality has remained relatively constant over time, Respondents have requested EPA approval to reduce the sampling frequency to annually, as provided in the approved LFG Compliance Monitoring Plan.

For the Slurry Wall E/S/W, pumping from inside the wall, and north of eastern wall, is being optimize by maximizing drawdown in individual wells to enhance the radius of influence from each well.

For the Middle FTPA waste pit treatment cell, Respondents have replaced the original off-gas treatment unit (catalytic oxidation unit) with a flameless thermal oxidizer to provide more complete oxidation of organic vapors, in a more reliable manner.

For the WTP, Respondents have added two new pH control loops to better control pH within the process, replaced several water pumps with more chemically-resistant feed pumps to improve performance and on-line service, changed the specification of caustic and acid chemicals to the same chemicals with lower specific gravities to reduce pumping problems during cold weather (caustic) and volatilization during warmer weather (acid). Finally, Respondents constantly tune the instruments within the plant to optimize treatment.

For the North Boundary Barrier Wall, Respondents have optimized WTP operations to maximize the amount of time the NBBW sump pump remains on-line. Respondents also have reconfigured instrumentation and controls for potable water injection into the NBBW injection trench to minimize recharge surging. Combined, these measures will minimize fluctuations of groundwater levels in the vicinity of the NBBW to enhance contaminant capture.

For Sitewide sampling and analysis, work scopes for the various groundwater and WTP sampling programs have been consolidated into clearly defined work packages to clarify target analyte lists and sampling frequencies. In addition, the sampling, analytical, validation, and reporting schedules have been resource-leveled to optimize the utility and reliability of staff and contractor resources.

How has the land use in the area changed? How do you see it changing in the future?

Response: Land use on and adjacent to the Superfund Site has remained consistent with that described in the Institutional Controls Plan. Because Denver and/or the Lowry Trust retain control of the Site property and that contiguous to it, Respondents do not envision use of this land use changing to uses inconsistent with the Superfund remedy in the future. Please see further discussion about institutional controls in a subsequent response.

What do you think has been successful about the Lowry remedy?

Response: In just six years Respondents have successfully implemented most of the Sitewide remedy. Most of the remedy is now in O&M. This was accomplished in half the time of the remedial investigations. For those components still in design/construction, progress is being made to complete them within the next several years. Overall, considerable effort and cooperation on the part of all stakeholders have been required to make this a successful project.

What do you think are problems with the Lowry remedy?

Response: As indicated earlier, the POC boundary around east, south, and west site boundaries is based on the physical presence of the E/S/W boundary slurry wall, not on the limit of waste disposal or lateral extent of groundwater contamination prior to remedy implementation. By placing the compliance boundary inside known contamination, the remedy was set up to be immediately out of compliance even if no new contamination crossed the point of compliance. Based on historical data, the limits of waste disposal and groundwater contamination both lie outside of the slurry wall. The POC should be the property boundary. If a Point of Action is to be implemented as described in the ROD, it should be the E/S/W boundary slurry wall.

Such a POA will enable corrective measures to be taken inside or outside the slurry wall, as necessary, to ensure that contaminated groundwater adjacent to or outside the slurry wall does not reach the POC. As currently positioned, the POC can create a false statement of non-compliance.

Another problem is the perceived presence by a small, yet vocal group of concerned citizens that man-made radionuclides from the Rocky Flats DOE facility have been buried in the Site landfill. The administrative record supports the Respondents' and EPA's positions that man-made radionuclides were not disposed in the landfill. In addition, ongoing monitoring at the Site has found no radionuclides above background levels. The Respondents, EPA, CDPHE, and Metro Wastewater Reclamation District have, on numerous occasions, held public meetings to present scientific and administrative evidence to educate the public and concerned citizens that man-made radionuclides were not disposed in the landfill. Respondents view the additional investigations proposed by USGS and others to investigate the presence of man-made radionuclides within the landfill as an unnecessary expenditure of resources that can be better applied implementing the remedy.

Describe any operational problems with the Lowry remedy.

Response: At this time, Respondents perceive three significant operational challenges with the remedy.

The first is a need to demonstrate capture to EPA's satisfaction that containment to a statistically significant level of confidence is occurring. This demonstration will require the expenditure of extensive man-hours and at considerable expense, despite the fact that no data exist that show off-site groundwater contamination. This problem is being discussed by a panel of groundwater experts sponsored by both the Respondents and the regulators.

The second is the current inability to treat NTES water to meet the 1,4-dioxane discharge permit limit. Treatability studies are currently in progress to evaluate advanced oxidation and biological treatment technologies for this unique problem.

The third is the reliability of electrical power and telephone service at the Site. Historically, both have been poor, with interruptions occurring several times a week, sometimes for days at a time. Such interruptions cause the WTP and NBBW groundwater extraction system to shut down. Investigation of alternate power and telecommunications options are underway.

Is the site in compliance with permit standards, performance standards, and reporting requirements?

Response: The WTP is in compliance with permit standards and reporting requirements.

Because of the location of the POC in contravention with ARARs and EPA guidance, well data shows exceedance of the standards to be met at a properly located POC. However, the Site is in compliance with the Groundwater Performance and Compliance Monitoring Plan, and with the Interim Compliance Monitoring Plan.

Site surface water is in compliance with surface water performance standards.

The LFG remedy is in compliance with all ambient air quality and subsurface gas performance standards.

The FTPA off-gas treatment systems are in compliance with all ambient air quality standards.

All sitewide reporting requirements are being met.

Provide information about any areas of non-compliance with performance/compliance standards, permit and reporting requirements.

Response: Please see previous responses.

What are the institutional controls at the site? How are institutional controls enforced?

Response: All institutional controls are described in the Final Institutional Controls Plan, Lowry Landfill Superfund Site, dated September 6, 1996. Additional land use controls are discussed in the following response. Institutional controls are being enforced by the City of Aurora, Arapahoe County, City and County of Denver, and the Lowry Trusts. The Lowry Landfill has a comprehensive layered system of public and private institutional controls in place. These controls are in place on-site in areas where contamination has come to be located and EPA has regulatory authority and off-site where no contamination has been found and Respondents have voluntarily implemented controls.

On-site Institutional Controls:

1. Public controls.

a. Zoning. Aurora's comprehensive plan describes the Site as PF (public facility reflecting the anticipated long-term remediation and landfill use of the facility. Arapahoe County has zoned the Site A-1 (agricultural usage).

b. The Site is within Aurora's LDN 65 noise contour. Within this area no residential development is permitted in Aurora. Although much of the area surrounding the Sire is presently in unincorporated Arapahoe County, pursuant to a 1989 intergovernmental agreement between Aurora and Arapahoe County, Arapahoe County will consider Aurora's restrictions on a case-by-case basis in making any land use decisions in this area.

c. Certificate of Designation. The Lowry Landfill Certificate of Designation is a permit issued by Arapahoe County allowing landfilling on the majority of Sections 4, 6, 9, 31 and 32. The Certificate of designation is held by Denver and was issued for an indefinite period of time.

d. Federal Superfund Lien. In 1989, the United States Environmental Protection Agency recorded a lien on all real property rights to property located within the western three quarters of Section 6 and all of Section 31 to secure payment to the United States of the costs for which Denver is liable under CERCLA. Denver is unable to transfer ownership of this property until the lien is removed.

e. The Administrative Order issued by EPA has been recorded in the real property records of the Clerk and Recorder of Arapahoe County. This effectively puts any future prospective purchaser of a property interest on notice of the Superfund Site.

f. Restriction on the development of nontributary groundwater. Colorado statutes give the owner of the overlying property the preferential right to develop the groundwater underlying its property for beneficial use. Denver owns the Site. A water providing utility may gain the right to develop the groundwater by consent either express or implied. To prevent this, Denver has recorded a Notice of Nonconsent in the real property records of the Arapahoe County Clerk and Recorder. Denver has the exclusive right to develop this groundwater for use, and is in the process of adjudicating its water rights to define the property interest. The use of the water will be restricted by covenants described below.

2. Private Controls.

a. Executive Order No. 97. This executive order issued by Denver's Mayor on June 27, 1991, restricts the use of land, surface water and groundwater on the Denver-owned Lowry Landfill property including all, or portions of, Sections 4, 6, 9, 31 and 32. The executive order prohibits all use of groundwater in the Denver and Dawson aquifers of Sections 6 and 31, prohibits the use of groundwater in the Arapahoe and Laramie-Fox-Hills aquifers for domestic, residential, or municipal purposes, requires the express written permission of the Mayor for water production on Sections 4, 9 and 32; and prohibits most land uses on Sections 6 and 31 including agricultural, residential commercial, day care centers, pre-schools, schools, hospitals, nursing homes office buildings, community centers, correctional facilities, community recreation facilities, senior citizen centers, restaurants, hunting and fishing.

b. Restrictive Environmental Covenants. By July 1, 2001, Denver will have recorded in the real property records of the Arapahoe County Clerk and Recorder a Declaration of Environmental Covenants running with the land for the Site. These covenants will prohibit well drilling on the site except for monitoring or remediation purposes; will prohibit excavation except for remediation, monitoring or landfilling purposes; prohibit structures except for remediation, monitoring or landfilling purposes; will restrict the use of the property to landfilling, monitoring, remediation, open space, recreation purposes; prohibit residential use, day care, schools, nursing homes, or hospitals on the Site.

c. Site Security and Access. The entire Lowry Landfill is currently fenced. The current operator of the landfill regularly patrols the fence. The main entrance to Lowry Landfill is a gate at the intersection of East Hampden and Gun Club Road. DADS operates 24 hours a day six days a week. The gate is closed and locked on Sundays.

Off-site Controls.

1. Public.

a. Zoning. Arapahoe County has zoned the Site and the surrounding property A-1 (agricultural) with three exceptions: Sections 12 and 1 (west and southwest of the Site) and Section 8 (Southeast of the Site) (Arapahoe County Fairgrounds) are zoned M-U (mixed use planned unit development).

b. Aurora's development restrictions. On October 22, 1993, Aurora adopted Ordinance No. 93-88. This ordinance prohibits the drilling development, or use of any wells in the Dawson Aquifer within one-half mile of the exterior boundaries of Section 6 until such time as EPA's groundwater remedy for the Site has been implemented consistent with the Record of Decision and EPA's five-year review of the remedy has occurred. This restriction does not apply to wells for monitoring, remediation or reinjecting groundwater. This ordinance also prohibits the development or construction of buildings within ¼ mile of the east, south or west exterior boundaries of Section 6 prior to implementation of EPA's remedy and completion of the five-year review. Finally, the ordinance requires seller within ¼ mile of the east, south and west exterior boundaries of the Site to give purchasers notice of the proximity of the Superfund site.

c. Certificate of Designation. As discussed above, Sections 31, 32, 4, and 9 are all subject to a Certificate of Designation for landfilling issued by Arapahoe County.

2. Private.

a. Denver owns Sections 31 and 32 immediately adjacent to Section 6 on the north.

b. The Lowry Environmental Protection Clean-up Trust has purchased the property immediately adjacent to or near Section 6 in Sections 36, 1, 7, 6, 5 and 32.

c. The Lowry Trust has purchased the ground water rights in the Dawson and Denver Aquifers in Section 12.

d. The land the Lowry Trust acquired in Sections 36 and 1 was deeded with restrictions that run with the land limiting the uses of that property to open space, recreational uses, park, farming, grazing, construction and operation of water supply wells, rail, light rail and public highway uses. As a beneficiary of these restrictions, Denver will have the independent right to enforce these restrictions.

e. Restrictive Environmental Covenants. By July 1, 2001, the Lowry Trust will have recorded in the real property records of the Arapahoe County Clerk and Recorder a Declaration of Environmental Covenants running with the land for trust–owned land in Sections 1, 7, 6, and 5. These covenants will prohibit well drilling in the Dawson and Denver aquifers except for monitoring or remediation purposes; will restrict the use of the property to landfilling, monitoring, remediation, industrial, commercial, open space, recreation purposes; and will prohibit residential

use, day care, schools, nursing homes, or hospitals on the Site. The Lowry Trust will also adopt a restrictive covenant for its groundwater rights in Section 12 prohibiting the use of the Denver/Dawson water for anything other than remediation purposes. Denver will record a similar covenant for that part of Section 31 not located within the Superfund Site.

Are there any land acquisitions that would affect your ability to control surrounding land use? If so, are there restrictions in the deed that run with the land? Please provide copies of deeds or other information that specifically address restrictions that run with the land.

Response: Please see response to previous question.

If there are occurrences of vandalism, are the events logged anywhere? If so, please provide log.

Response: No vandalism has occurred on the Site.

Describe operational and construction quality control measures and how issues are documented?

Response: Operational quality control is provided by use of checklists, calculation briefs, and data validation reports. All of these measures are documented in the project files, and in the case of data validation reports, submitted to EPA under separate cover.

Any necessary construction is performed in accordance with the Construction QC Plan prepared as a companion document to the constructed remedy. QC documentation is provided as required in the Plan.

What security measures are in place at the site and how well do they work?

Response: Security measures are described in the Institutional Controls Plan and work well.

How effective are the contingency plans?

Response: The Revised Contingency Plan, dated September 17, 1999, was prepared in close cooperation with local police, emergency response, and fire protection authorities. The emergency measures tested to date work well.

Please provide a statement of site O&M costs.

Response: The following average annual O&M costs are as follows based on year 2000 and annualized for 2001, unless noted otherwise:

- Groundwater $622,000
- Landfill Gas $314,000
- Landfill Covers $50,000

- Surface Water $10,000
- Institutional Controls $10,000
- Water Treatment Plant $596,000
- Other $180,000

The total annual O&M cost for 2000 was $2,600,000; and for 2001 through April is $520,000 which annualizes to $1,600,000. This is approximately 6 full time employees or about $2,000,000 per year. To these figures, EPA management and oversight contractor costs should be added.

Have any problems in construction or operation of the remedy been encountered which may require changes in the ROD?

Response: Respondents are aware of two issues that may require changes to the ROD. The first is a need to revise subsurface gas standards in accordance with risk-based standards that were developed by the Respondents and approved by EPA last year. These standards are based on a more realistic risk-based scenario than that in the ROD.

The second issue is resultant from an observed threat to worker safety and potential public health caused by open excavation of the north and south waste pits. An alternate in-situ remedy is currently being evaluated to avoid this problem, yet reduce the principal threat of waste buried in these pits to a level commensurate with that of the excavated middle pit. To the extent that treatability studies can demonstrate adequate removal of principal threat wastes, full scale implementation of the in situ remedy at the north and south pits will likely require an Explanation of Significant Difference to the ROD.

Please provide names of the operation and maintenance and design and construction contractors with points of contact for the following:

Response: Parsons provided design, procurement, and construction management, and operations and maintenance services on all of the remedies. Point of contact is Mr. Peter Guest. Other contractors still in business and points of contact are summarized below:

Remedy	Company	Name
Wetlands	Kelly Surveying	Dianne Kelly
	Arrow Engineering	John Krieshel
LFG Remedy	Air Pollution Testing, Inc	Al Jensen
	R.E. Davis	R.E.Davis
	SCS Engineers	Mark Beizer
Slury Wall E/S/W	Advanced Terra Testing	Chris Wienecke
	Arrow Engineering	John Krieshel
	EMSI	Paul Rosasco
	Goodson and Associates	Al Amundson
	IT Corporation	Jim Bowley
	Layne Drilling	Brian Dellette

	Severn Trent Laboratories	Gail DeRuzzo
Middle FTPA Waste Pit	Advanced Terra Testing	Chris Wienecke
	Alzeta Corporation	Lowell Howard
	Kelly Surveying	Dianne Kelly
	Catalytic Combustion	Bob Twiddy
	CET Environmental Serv.	Steve Beck
	Clean Harbors	Dave Roland
	ECS Environmental Serv	Karen Dammann
	Kiber Environmental Serv.	Robert Semenak
	Layne Drilling	Brian Dellette
	Severn Trent Laboratories	Gail DeRuzzo
	Sprung Structures	Richard Pabon
	PDP Analytical Services	Ram Gavva
	Thermo Remediation Serv.	Greg Beyke
	Universal Drilling, Inc.	Jerry Werth
WTP	Advanced Terra Testing	Chris Wienecke
	Applied Process Tech	Terry Applebury
	Calgon Corp	Wayne Lem
	Clean Harbors	Dave Roland
	ECS Environmental Serv	Karen Dammann
	EMSI	Robert Jelinek
	Goodson and Associates	Al Amundson
	IT Corporation	Jim Bowley
	J.A. Jones	Steve Palmrose
	Kelly Surveying	Dianne Kelly
	Malcolm Pirnie	Mike Kavanaugh
	Michigan Tech Univ	John Crittenden
	Severn Trent Laboratories	Gail DeRuzzo
	Purifics Environmental Tech	Tony Powell
	Univ of Missouri	Craig Adams
	US Filter	Richard Woodling
North Face Cover	Advanced Terra Testing	Chris Wienecke
	IT Corporation	Jim Bowley
	Kelly Surveying	Dianne Kelly
North Boundary Barrier Wall	Site Services	Neil Eckhoff
North Toe Extraction System	Advanced Terra Testing	Chris Wienecke
	Arrow Engineering	John Krieshel
	Goodson and Associates	Al Amundson
	ReTec	Richard Greenwood
	Slurry Walls, Inc	Fritz Ackhorner

Do you have any comments, suggestions or recommendations regarding the site's management or operations?

Response: A few suggestions to facilitate remedy implementation into the future include:

- Timely regulatory review of all submittals.
- More technical work-group organization to enhance sharing of technical information, promote open discussion of issues, and alleviate cumbersome comment/review cycles.

LOWRY LANDFILL – 5-YEAR REVIEW INTERVIEW QUESTIONS

TO: JANE KOEWING
CH2M HILL
PL BOX 241325
DENVER, CO 80224-9325

FROM: RD/RA CONTRACTOR (PARSONS)

DATE: 06/13/01

What remedy components were you involved in?

Response: Parsons was involved in all of the remedy components.

Describe your role in each phase of the project for each remedy component including design, construction and operation and maintenance:

Response: Parsons was involved in the various project phases as follows:

Wetlands: Design, construction management, and O&M

LFG Extraction and Treatment: Design, construction management, and O&M

Slurry Wall E/S/W: Design, construction management, and O&M

Middle FTPA Waste Pit Extraction and Treatment Cell Construction: Design, construction management, and O&M

WTP: Design, construction management, and O&M

North Face Cover: Design, construction management, and O&M

North Boundary Barrier Wall Evaluation: Lead author

North Toe Extraction System: Design and construction management.

Construction contractors were procured by Parsons for the Respondents, and then retained by the Respondents.

Please provide an overview of contractor construction activities at the site.

Response: Construction contractor activities included:

Wetlands: Excavation, regrading, erosion protecting, and revegetation of the wetland mitigation area.

LFG Extraction and Treatment: Installation of 50 LFG extraction wells and 24 subsurface gas monitoring probes, installation of buried lateral and header piping, construction of manual and automatic condensate traps, installation of a blower/flare station, start-up testing and wellfield balancing, and ongoing O&M of the extraction wellfield, compliance monitoring probes, condensate gathering system, and blower/flare station.

Construction activities also included installation and operation of a Vapor Extraction System along the southern boundary of the Site, following installation of the E/S/W slurry wall, and detection of subsurface gas outside (south) of the slurry wall.

Slurry Wall E/S/W: Excavation and construction of an 8,800 linear foot soil bentonite slurry wall around the eastern, southern, and western boundaries of the Section 6 landfill prism. The task also involved installation of 15 pairs of Performance Monitoring wells for gradient monitoring across the wall and water quality monitoring inside the wall, and another 20 compliance monitoring wells immediately outside the wall.

Following wall and well installation, and in conformance with the Performance and Compliance Monitoring Plan, groundwater extraction systems utilizing vertical extraction wells were installed at two locations along the east side wall to reverse gradients across the wall.

Middle FTPA Waste Pit Extraction and Treatment Cell Construction: Excavation of the middle waste pit, blending of waste material with tire chips, and onsite disposal of blended material into a treatment cell for active vapor extraction. Construction also involved backfilling and reclaiming the middle pit following excavation, and start-up and operations of an off-gas thermal treatment system at the treatment cell.

Attempts were made to excavate wastes from the north and south pits, but upon encountering high fugitive VOCs emissions from the initial excavations, worker safety and protection of public heath became concerns. As a result, and following consultation with EPA and CDPHE, excavation of these pits was discontinued. An alternate in-situ remedy is currently being designed for these waste pits.

WTP: Construction of a new water treatment facility adjacent to an operating plant, changeover of process flows to the new plant, and start-up testing of the new facility. Construction also included installation of a 7,500 LF pressure

pipeline for discharge of pretreated water to a POTW, and installation of a 13,000 LF pressure pipeline for delivery of potable water to the plant.

North Face Cover: Construction involved addition of a minimum of 18-inches of compacted clay cover, and a 6-inch vegetation layer over an existing compacted clay cover. The approximately 20-acre north face cover also included erosion control measures, revegetation, and erosion maintenance during reclamation. Onsite borrow sources were reclaimed following construction.

North Boundary Barrier Wall Evaluation: Construction activities involved installation of additional piezometers and monitoring wells; monitoring and sampling of wells, sumps, and piezometers; and a technical evaluation of hydrogeologic, water quality, and piezometric data. It was concluded that as long as pumping from the NBBW extraction sump, and reinjection into the NBBW injection trench continued, contaminant capture could be demonstrated.

North Toe Extraction System: Construction involved installation of a 350 LF groundwater extraction trench, ranging in depth from 20 to 40 feet below grade. Construction utilized a biodegradable polymer to maintain trench stability during construction. In-trench materials included protective geofabric along the bottom, sides, and top of the trench, and drainage media comprised of pea gravel and tire chips. In addition, an extraction sump and pump, lateral cleanout piping, in-trench piezometers, and approximately 3,000 LF of buried connector piping and control wiring to the new WTP were constructed.

What is the status of each remedy component?

Response:

Wetlands: RD/RA complete; O&M ongoing

LFG Extraction and Treatment: RD/RA complete; O&M ongoing

Slurry Wall E/S/W: RD/RA complete; O&M ongoing

Middle FTPA Waste Pit Extraction and Treatment Cell Construction: RD/RA complete; O&M ongoing

WTP: RD/RA* complete; O&M ongoing

North Face Cover: RD/RA complete; O&M ongoing

North Boundary Barrier Wall Evaluation: RD/RA complete; O&M ongoing

North Toe Extraction System: RD/RA complete; O&M pending*

* Original design of the WTP is complete and implemented. However, due to a change in water quality from that included in the NTES design basis, the current WTP design is not adequate to treat NTES water to permitted limits. Additional evaluations are ongoing to assess the most effective means of removing 1,4-dioxane from NTES water. When the WTP plant is upgraded to treat NTES water, O&M of the NTES will begin.

Please comment on the progress of the project and changes in designs due to field conditions.

Response: With the exception of the WTP and north and south waste pits, all remedial components have been installed in accordance with their design intentions. A summary of these components, and comments on changes to their designs or construction methods due to changed field conditions, is presented below:

Remedial Component	Status	Comments
Wetlands	Implementation complete, O&M ongoing	Immediately following construction of the wetland mitigation site, severe flooding from back-to-back 100-year storms altered the alignment of the Murphy Creek channel, and damaged the constructed wetland. The mitigation plan had to be modified, and some reconstruction work became necessary. The reconstructed wetland is currently stabilized and revegetated in accordance with the revised mitigation plan.
Landfill Gas Remedy	Implementation complete, O&M ongoing	No changes to the LFG remedy design were necessary. However, due to a lower production of LFG from the landfill than was originally anticipated, system operation has been reduced to several days per week, as opposed to continuous.
Slurry Wall E/S/W	Implementation complete, O&M ongoing	The presence of hard sandstone layers in the weathered Dawson Formation along the wall alignment, in some cases, prevented trackhoes used to excavate the slurry trench from

		penetrating to design depths. In these areas, alternate excavation techniques, including use of pneumatic rock hammers and caisson rigs, became necessary. Following installation, implementation of the groundwater Performance and Compliance Monitoring Plan along the slurry wall has triggered a need for pumping inside and beyond the northern extension of the wall. At the southeastern corner of the wall (PM-11 area), active pumping from inside the wall (up to 0.7 gpm) has induced inward gradients across the wall, assuring containment in this area of concern. Similarly, active pumping along the northeastern limit of the wall (PM-15 area) is effectively preventing offsite migration of contaminants in this area.
Middle FTPA Waste Pit and Treatment Cell Construction	Implementation complete, O&M ongoing	Excavation with onsite treatment of waste pit material was the design intent of the middle, north, and south waste pits. Excavation of the middle pit, although successfully implemented, was prolonged by control of fugitive VOC emissions from the pit excavation, excess volume of wastes encountered in the pit, and enlarging the treatment cell to accommodate the additional waste material encountered. When attempting to excavate the north and south pits, release of fugitive VOCs proved to be unsafe and impractical to control. As a result, the remedy for these pits has been re-scoped to employ a safer, in-situ treatment method. Such a remedial approach is the subject of an

		ongoing design investigation.
Water Treatment Plant	Implementation complete, NTES treatability evaluation and O&M ongoing	During start-up of the WTP, the quality of NTES water changed from that encountered during design to a water containing high concentrations of UV-light absorbing organics. Such organics are not amenable to removal by chemical precipitation or carbon adsorbance, and have compromised the effectiveness of the installed UV-oxidation equipment to destroy 1,4-dioxane. Until the plant can be modified to overcome this treatment challenge, no NTES water will be treated in the plant. While treatability evaluations are underway to address this issue, the WTP is successfully treating all other Site waters in conformance with the discharge permit. On balance, many other technical and administrative challenges were overcome to successfully deliver the WTP remedy that exists today. Among others, these include constructing offsite pipelines beneath the E-470 highway, addressing public concerns about the use of offsite POTWs for final treatment, inclusion of extensive monitoring into the discharge permit to address public concerns, and demonstrating compliance with the permit.
North Face Cover	Implementation complete, O&M ongoing	Remedy successfully implemented and working as designed. No significant changes required.
North Boundary Barrier Wall Evaluation	Evaluation complete, O&M ongoing	The NBBW evaluation was complete in 1998, showing the wall to be effective at capturing contamination migrating in the unnamed creek

		alluvium. Evaluation received EPA approval. Since then, EPA has requested Respondents to reevaluate the wall's effectiveness under current pumping conditions. Respondents are currently addressing EPA's concerns.
North Toe Extraction System	Implementation complete, O&M pending resolution of WTP treatability evaluation	Remedy successfully implemented and initial performance testing demonstrated effective drawdowns at the design pumping rates. No significant changes required.

Describe any difficulties experienced in the field which have impacted construction progress or implementability.

Response: Construction contractors responsible for installing the LFG remedy, WTP (including potable and POTW pipelines), and N. Face cover performed very well. Their craft labor, equipment operators, selection and use of heavy equipment, QC subcontractors, superintendents, and management teams met Parsons' expectations. Construction contractors responsible for the wetland mitigation, slurry wall E/S/W, middle waste pits, and North Toe Extraction System (NTES) experienced difficulty in meeting job requirements, but eventually conformed. In some cases, difficulties were caused by bad weather and equipment malfunction (wetlands and (E/S/W slurry wall). In other cases they were caused by changed subsurface conditions (E/S/W slurry wall and middle waste pits) that were not discovered during the RI/FS or design investigations. However, as indicated earlier, all construction eventually complied with the technical specifications and/or design intent of each respective remedy.

Describe the quality of the construction.

Response: The quality of construction was excellent. All quality control objectives were met on all remedial components.

Do you believe the emergency response plans are adequate?

Response: The emergency response plans are adequate.

What emergencies are you aware of that have occurred at Lowry in the past 5 years?

Kelly Surveying Associates	Diane Kelly
Kiber Environmental Services, Inc.	Robert Semenak
Layne Drilling	Brian Dellette
Parsons Corp.	Peter Guest
Severn Trent Laboratories	Gail DeRuzzo
PDP Analytical Services	Ram Gavva
Purifies Environmental Technologies, Inc.	Tony Powell
Retec	Richard Greenwood
SCS Engineers	Mark Beizer
Site Services	Neil Eckhoff
Slurry Walls Inc.	Fritz Ackhorner
Sprung Structures	Richard Pabon
Thermo Remediation Services, Inc.	Greg Beyke
Universal Drilling, Inc.	Jerry Werth
US Filter	Richard Woodling

PLANNING DEPARTMENT

1470 South Havana Street
Aurora, Colorado 80012
303-739-7250
FAX 303-739-7268

May 31, 2001

Jane Koewing
CH2M HILL
PL Box 241325
Denver, Colorado 80224-9325

RE: Response to Lowry Landfill 5-Year Review Interview Questions

Dear Jane,

Enclosed you will find the responses from the City of Aurora regarding the interview questions associated with EPA's 5-Year Review of the remediation activities at the Lowry Landfill Superfund Site.

Should you have any questions, please do not hesitate to contact me at (303) 739-7220.

Sincerely,

Jim A. Ives, C.E.P.
Environmental Coordinator

Enclosure:

Cc: Denise M. Balkas, Director of Planning
Frank Ragan, Deputy City Manager, Operations

Lowry Landfill – 5-year Review
Interview Questions

State and Local Authorities

- *What is your role on the Lowry project?*

The City of Aurora is an active participant on the Technical Advisory Group (TAG) and the technical problem-solving groups including Radionuclides, Groundwater, and the Former Tire Pile Area (FTPA). City staff provide oversight of the remedial actions occurring on the Superfund site to help ensure that the City's citizens and environment are not being impacted and that the Record of Decision (ROD) is being adhered to by the site respondents (City and County of Denver and Waste Management, Inc.).

- *In general, what is your impression of the Lowry project?*

Considerable progress has been made in characterizing the site and in implementing stabilization and containment of the contamination. However, it does not appear that containment has been achieved. Groundwater contamination exceeding regulatory standards has been detected in point of compliance wells. The water treatment plant is unable to treat 1,4- dioxane. The excavation and removal remedy in the FTPA was determined not to be feasible due to volatile emissions and now an innovative technology is being attempted. There is a concern over the potential for off-site migration of groundwater and the need to obtain complete containment at the site.

- *Have there been any changes in State laws and regulations, ordinances, policy changes, etc. in the last few years that may impact your role or your view of the protectiveness of the remedy?*

With the exception of the E-470 rezoning, the City of Aurora has not passed any new ordinances that directly impact the Superfund site.

- *Please describe any new ordinances (or changes to existing ones), changes in actual or projected land use, or status of institutional controls*

The City of Aurora has re-zoned the E-470 Corridor, including the area adjacent to the Lowry Landfill. The area in and around the landfill has been designated as a regional park and open space theme. A copy of the zoning map was previously distributed to the TAG and to the Environmental Protection Agency (EPA).

- *Is the site in compliance with permit and reporting requirements?*

As far as we can determine from the information provided to the City of Aurora, the site appears to be generally in compliance with the applicable requirements. However, there are a few exceedences of groundwater standards beyond the point of compliance.

! *Are you aware of any community concerns regarding the project? If so, please give details.*

The majority of community concerns have been expressed by CLLEAN, a local citizen group. Because CLLEAN is a participant on the TAG, their concerns and comments have been shared with the primary stakeholders. In addition, allegations from an ad-hoc environmentalist group have been expressed regarding possible radionuclide contamination at the landfill. This in turn has resulted in concerns by residents living near the wastewater sludge disposal areas. The regulatory agencies and the respondents have expended considerable time and effort in attempting to dispel these allegations and concerns.

! *Have there been routine communication or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?*

As a participant on the TAG and technical problem-solving group, the City of Aurora has been involved in site activities and communication. Staff has also had the opportunity to make site visits and inspections.

! *Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please provide details.*

The City's Utility Department has been notified and become involved with the Metro Wastewater Reclamation District when the water treatment plant at the landfill was not in compliance with its discharge permit requirements.

! *How has the land use in the area changed? How do you see it changing in the future? (Provide any documentation of new ordinances; land use restrictions master plan.)*

As was mentioned above, the E-470 Corridor has been rezoned. The land use surrounding the landfill is beginning to change. Development is edging closer to the Trust buffer zone, which surrounds the perimeter of the landfill. Even though the buffer zone provides some protection from contamination at the landfill, new residential developments will place individuals closer than previously to the Superfund site. This makes the effectiveness and compliance of the remedies at the landfill even more important for the protection of the public health and the environment. Total containment at the site is imperative in order to afford the necessary protection.

! *Do you feel well informed about the site's activities and progress?*

The EPA and respondents do keep the TAG and the City of Aurora well informed. In addition to the TAG and problem-solving group meetings, the monthly, quarterly, and operation & maintenance reports prepared by the site consultants provide the City with the necessary information.

! *Are you a participant in TAG meetings, and if so are they effective as a forum for discussion of technical issues?*

As stated previously, the City of Aurora actively participates in the TAG meetings. The TAG meetings are a good forum for disseminating project information to the stakeholders. However, the technical problem-solving group meetings have proved to be a better forum for the conduct of discussions regarding technical issues. The participants at the work group meetings tend to have technical backgrounds, which enable more productive and in-depth discussions. Once issues are resolved in the work groups, they are brought back to the TAG and summary briefings are provided.

! *Are you a participant in problem-solving/work groups? If so which groups have you attended and are these groups effective in resolving project issues?*

As indicated above the City of Aurora has participated in the Groundwater, FTPA, and the Radionuclides work groups. These works groups are effective in raising issues that may otherwise not be discussed at TAG meetings. For the most part, these work groups have been successful in resolving project issues.

! *What do you think has been successful about the Lowry remedy?*

A number of successes have been achieved at the Superfund site. These include the following:

- % The shredding and removal of approximately 8 million old tires from the site.
- % The installation of numerous groundwater monitoring wells
- % The construction of the North Boundary Groundwater Barrier Wall system
- % The establishment of the North Face Landfill Cover
- % The installation of the North Toe Groundwater Extraction System
- % The construction of the Bentonite Slurry Wall along East/South/West sides of landfill
- % The design and construction of the Water Treatment Plant and associated Publicly Owned Treatment Works Pipeline and Potable Waterline
- % The excavation and removal of the Middle Waste Pit in the FTPA
- % The design and implementation of a landfill gas collection and treatment system
- % The wetlands restoration mitigation construction.

! *What do you think are problems with the Lowry remedy?*

A number of problems exist with the current remedy including the following:

- % The key problem at the site is the failure to contain contaminated groundwater migration. Groundwater exceedances have been measured outside of the northeast slurry wall and beyond established points of compliance. A better characterization of the site's geohydrology appears to be needed in order to develop and implement effective containment. The North Boundary Barrier

Wall may not be fully effective and it appears that contaminated groundwater is actively migrating around the northeast end of the slurry wall.

- % Another problem is the reliability and effectiveness of the onsite water treatment plant. The plant has been unable to treat high levels of 1,4-dioxane.

- % The excavation and removal remedy at the FTPA failed for two of the pits. This failure forced a re-evaluation of the remedy and the selection of in-situ resistance heating (six-phase heating) and vapor extraction and treatment.

- % The maintenance and control of runoff on the landfill cap is also a potential problem, if not addressed soon.

! *Do you have any comments, suggestions or recommendations regarding the site's management or operations?*

City staff has a concern over the continued pressure from the respondents to address issues regarding the remedy through administrative changes to the Record of Decision (ROD) rather than formal rulemaking. It is beginning to appear that remediation at the landfill is being addressed in a piecemeal fashion. Some focus and evaluation of the total site remediation should be undertaken in order to produce an effective containment remedy for the entire site. Continued attention to specific, isolated issues creates a potential to lose sight of the bigger picture. The recent attempt by the respondents to move the point of compliance further out thereby enlarging the area of groundwater contamination raises additional concern for the City. Efforts should be undertaken to prevent contaminated groundwater from reaching the point of compliance. If this does not occur, then containment is not fully attained for the site.

TRI-COUNTY HEALTH DEPARTMENT'S
RESPONSE TO
LOWRY LANDFILL – 5-YEAR REVIEW INTERVIEW QUESTIONS

What is your role on the Lowry Project?

Tri-County Health Department (TCHD) is the local health department serving Adams, Arapahoe, and Douglas Counties. As the local agency responsible for protection of public health and the environment in Arapahoe County, we track the progress of the Lowry cleanup and provide local health based input to EPA, CDPHE, Denver, and Waste Management. We participate in Lowry Work Groups (Groundwater and FTPA), the TAG, provide information related to the cleanup to Arapahoe County, and respond to community concerns and questions when they arise. The City of Aurora is also in TCHD's service area; thus we coordinate with the City regarding issues related to the Lowry cleanup.

In general, what is your impression of the Lowry Project?

TCHD's general impressions of the Lowry Project are listed below and are based on our limited role as described above.

- EPA and CDPHE staff overseeing the cleanup are dedicated professionals with sound technical skills who are generally receptive to input from TCHD regarding the cleanup.

- Denver and Waste Management want a remedy that is protective of human health and the environment, but sometimes give the appearance that cost effectiveness is more important than long-term protectiveness.

- The primary element of the Lowry remedy is containment. Recent groundwater monitoring data and the condition of the final cover leave the impression that containment isn't being achieved.

- The apparent heterogeneity of the site raises our concern that contaminant transport mechanisms may never be fully understood. This heightens our concerns regarding the adequacy of the existing conceptual model and containment approach.

- Even considering the complexity of the site and the sometimes cumbersome CERCLA process, progress seems extremely slow in implementing the requirements of the ROD.

- Trying to achieve a complete understanding of hydrogeologic conditions appears to us to add to the delay in implementing revisions or modifications to remedial actions.

TRI-COUNTY HEALTH DEPARTMENT'S
RESPONSE TO
LOWRY LANDFILL – 5-YEAR REVIEW INTERVIEW QUESTIONS

Have there been any changes in State laws and regulations, ordinances, policy changes, etc., in the last few years that may impact your role or your view of the protectiveness of the remedy

Not applicable to TCHD.

Please describe any new ordinances (or changes to existing ones), changes in actual or projected land use, or status of institutional controls.

We encourage EPA to consult closely with Arapahoe County and the City of Aurora for the specifics of their land use planning activities in the vicinity of the Superfund site. Arapahoe County is just completing an update of its Comprehensive Plan. The final draft document does not include policies specific to development near Lowry. However, the Urban Service Area Land Use Plan map designates areas north, south and west of the site for urban residential development (beyond the buffer areas purchased by the Lowry Trust).

Last year, the City of Aurora adopted into its zoning regulations the E-470 ordinance, which provides for significant residential development along the E-470 corridor near Lowry. The City is currently developing the Northeast Plains Growth Management Study, a plan for development of lands east of the E-470 corridor. EPA's 5-Year Review is a trigger for review of the two City ordinances adopted in 1993 that restrict water well and land development in the vicinity of Lowry Landfill.

Is the site in compliance with permit and reporting requirements?

Not applicable to TCHD.

Are you aware of any community concerns regarding the project? If so, please give details.

CLLEAN has continuing concerns about the current adequacy of the cleanup, as well as its long-term effectiveness. We will not detail these concerns, as CLLEAN has communicated these directly to EPA as part of its 5-Year Review interview, at TAG meetings and in written correspondence.

TRI-COUNTY HEALTH DEPARTMENT'S
RESPONSE TO
LOWRY LANDFILL – 5-YEAR REVIEW INTERVIEW QUESTIONS

Have there been routine communication or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

TCHD doesn't have sufficient qualified personnel to routinely participate in the Lowry project. Our involvement is limited to partial participation in Work Groups and the TAG. Because of these resource limitations, we are unable to provide the type of input to EPA, CDPHE and the Respondents that we believe could assist in having the cleanup move forward in a more effective and protective manner. We continue to seek funding sources to allow us to participate in the Lowry project in a manner similar to our oversight role at the Rocky Mountain Arsenal cleanup.

Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please provide details.

In the winter and spring of this year, TCHD received a number of odor complaints from residents living near Lowry. In follow-up, TCHD confirmed that the odors were not related to the Superfund site.

How has the land use in the area changed? How do you see it changing in the future? (Provide any documentation of new ordinances, land use restrictions, master plan.)

Please see our response to the question on new ordinances and institutional controls on page 2. The area around Lowry Landfill is a significant urban growth area for both Arapahoe County and the City of Aurora. In Arapahoe County, growth in this area will be served almost exclusively by groundwater. Groundwater will be an increasingly scarce and valuable commodity, and may well be the factor limiting growth and determining the economic viability of the area. It is critical that we take a conservative, long term view with respect to protection of the aquifers beneath the Superfund site.

Do you feel well informed about the site's activities and progress?

Given the limited time that TCHD has available to spend on Lowry, we don't feel well informed. There is an abundance of data, frequent correspondence between the regulators and the Respondents, and quarterly reports (data dumps). TCHD doesn't find this information to be presented in a "user friendly" manner. Issues, concerns or problems at the site appear to us to be inadequately summarized. We feel that we learn of significant findings or problems well after the fact.

TCHD acknowledges that part of reason we are not "well informed" is our resource limitations. Given time, we could get the information we need by reviewing the information submitted or by phoning, corresponding, or meeting with EPA, CDPHE or the Respondents. However, more focused and timely presentations of issues, concerns, or problems would be beneficial. A regular summary of issues and updates regarding all components of remedy implementation would be of value to TCHD. This summary would also benefit local jurisdictions and the interested public if the information was presented in a "user friendly" format.

Are you a participant in TAG meetings and if so are they effective as a forum for discussion of technical issues?

Yes, TCHD participates in the TAG. We do not always find the TAG to be an effective forum for a fruitful discussion of technical issues. The ineffectiveness of some TAG meetings is directly related to the concerns expressed above related to dissemination of information. If stakeholders were provided clear summaries of issues/concerns/problems prior to each TAG, we believe that a more productive dialogue regarding the cleanup could take place. As TCHD has stated, we believe that it is important to provide timely TAG and Work Group meeting minutes that summarize decisions, concerns, action items and requests for information.

Are you a participant in problem solving/work groups? If so, which groups have you attended and are these groups effective to resolving project issues?

Yes, TCHD participates in the Groundwater and FTPA Work Groups. In general, TCHD finds the work groups to be an effective forum for resolving project issues. Our only recommendation would be to continue to get relevant information out to the participants in advance of each meeting. This procedure allows us to come more prepared to offer TCHD's input.

What to you think has been successful about the Lowry remedy?

Components of the Lowry remedy that TCHD views as having been successfully implemented are listed below:

- The groundwater monitoring system has been successful in that it has detected apparent releases or additional contamination outside of the containment systems.

- The landfill gas collection and treatment system appears to be effective in addressing the Landfill Gas OU.

- The Surface Water Removal Action appears to be working.

What do you think are problems with the Lowry remedy?

Components of the Lowry remedy that TCHD perceives as problematic are listed below:

- We have concerns that the barrier wall system may not be containing site contaminants on either the east or the west. On the east, contaminants have already been detected beyond the north end of the wall, suggesting that the barrier may not be located to intersect all pathways of migration. Also on the east side, until we know the effect of continued pumping of existing wells and the installation of additional wells in the PM-15 area, we cannot be certain that contaminants are not migrating through the wall. Detection of contaminants at depths of 50 feet in this area also raises concerns about whether contaminants may be migrating beneath the wall. On the west, data from wells MW-39 and MW-43 raise similar questions about the wall's ability to prevent contaminant migration. Finally, we believe that data from MW-38 and other wells its vicinity raise the possibility that at least one preferential pathway exists, outside of the confines of the barrier wall. The ROD states that if releases are detected, a variety of potential corrections to the containment system be evaluated, in addition to more extraction wells. We support the evaluation of these remedial techniques, including expansion of the barrier system and/or other technologies to restrict off site groundwater migration.

- Detection of low level contamination at both ends of the North Boundary Barrier Wall suggests that the NBBW may not be effectively containing shallow contamination that is moving north.

- Particularly in light of unexplained conditions at MW-38, we believe the sitewide groundwater monitoring program is inadequate to detect the potential for vertical migration of contaminants over the long term. Additional deep monitoring wells should be added to the compliance monitoring system.

- Despite chronic subsidence and identification of substantial cracking of the landfill cap over a year ago, adequate maintenance of the landfill mass cover has not occurred in a timely manner. This may be allowing surface water to infiltrate the landfill mass, increasing the amount of liquid that will need to be contained and/or treated and contributing to the potential for contaminant migration. TCHD believes that it is inconsistent with the spirit and specifics of the ROD to allow the placement of additional solid waste material over the landfill mass as a means of correcting

problems with the landfill cover. We support EPA's recent direction to the Respondents for addressing the landfill cover issue, and encourage EPA to require a comprehensive repair without delay.

Do you have any comments, suggestions or recommendations regarding the Site's management or operations?

Addressed by previous comments.

Lowry Landfill—5-year Review
Interview Questions

Please return to: Jane Koewing
CH2M HILL
PL Box 241325
Denver CO, 80224-9325

(If additional space is required for your responses, please attach additional pages.)

State and Local Authorities (CDPHE, TCHD, Aurora, Arapahoe Planning, Metro Wastewater Reclamation District)

What is your role on the Lowry project?

The Metro District and Aurora prepared and enforce the Industrial Wastewater Discharge Permit issued to the Lowry Landfill Site for its discharges to the sanitary sewer system.

In general, what is your impression of the Lowry project?

There were some problems early in the project, such as unsatisfactory analytical detection limits and poor public communications which engendered quite a bit of public criticism. As a result EPA implemented the following aspects to the project: an early warning monitoring system to ensure protection of the environment; an independent monitoring program by the USGS at the Lowry site to ensure the project adequately protects human health and environment.; and a number of problem policy/workgroups/TAG meetings to improve communications.

Have there been any changes in State laws and regulations, ordinances, policy changes, etc., in the last few years that may impact your role or your view of the protectiveness of the remedy?

No

Please describe any new ordinances (or changes to existing ones), changes in actual or projected land use, or status of institutional controls.

None.

Is the site in compliance with permit and reporting requirements?

The site is currently in compliance with all permit and reporting requirements.

Are you aware of any community concerns regarding the project? If so, please give details.

Yes – the same concerns of which EPA is also aware. The concerns do not appear to be widespread, but they are extremely persistent. A group of environmentalists is opposed to allowing the Lowry pollutants to contaminate the food chain by becoming a part of Metro's biosolids, and some eastern Colorado residents are concerned with the effect of the word, "Superfund," on Colorado agriculture.

Have there been routine communication or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site?

The Metro District receives monthly reports on site activities from the permittees, and monitors the discharge, at a minimum, eight times per year. The District has routine correspondence with the permittees regarding these reports and reports submitted to EPA. In addition, the District has conducted 3 inspections of the Facility since July 2000 and has participated with EPA on site visits for stakeholders and other interested parties.

Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please provide details.

There have been a few minor violations of the wastewater discharge permit: the permittees failed to monitor for peroxide in the fall as required; failed to submit all information required with the August/September periodic compliance reports; exceeded the 20 gpm maximum flow rate (<4 minutes total during manual start-up while servicing pump); had a pH discharge violation on 1/22/01(during manual start-up while servicing pump); submitted late the 3rd and 4th quarter EPA/CDPHE monitoring reports; and failed to meet required MDLs for some radionuclides. In addition, the permittees failed to sign/certify all reports/information by an authorized representative.

Enforcement action was taken against the permittees for all permit violations, as required by the federal Pretreatment Regulations.

How has the land use in the area changed? How do you see it changing in the future? (Provide any documentation of new ordinances, land use restrictions master plan.)

N/ A for Metro

Do you feel well informed about the site's activities and progress?

The District would like to be informed of all communications about the site that provide information or impact discharges to the sanitary sewer system, including all monitoring well data. On a number of occasions (like this questionnaire, USGS radionuclide data, correspondence from EPA or the State to the permittees) we have not received information in a timely manner, or have had to request copies.

Are you a participant in TAG meetings and if so are they effective as a forum for discussion of technical issues?

Yes, the District has found the TAG meetings to be a very effective forum and an opportunity to be updated on other projects (other than groundwater) at the site.

Are you a participant in problem solving/work groups? If so which groups have you attended and are these groups effective in resolving project issues?

Radionuclide Work Group. I think this group prepared excellent presentations for interested members of the public on the history, risks, and other information associated with radionuclides at Lowry. Whether it is effective in resolving project issues remains to be seen, with the ongoing USGS radionuclide investigations being critical. Answering the questions, "How much radioactivity is really there?" and "Will it hurt us?" will be important in continuing to make gains in public acceptance of the project.

What do you think has been successful about the Lowry remedy

From a technical perspective, the discharge has not in the least compromised Metro's ability to comply with all environmental, health and safety regulations. This was the goal when the discharge was accepted, and it continues to be met.

What do you think are problems with the Lowry remedy?

The public opposition mentioned elsewhere in this questionnaire.

Do you have any comments, suggestions or recommendations regarding the Site's management or operations?

The early warning monitoring systems need to be evaluated and updated, as needed, as the management and operations of the Site are modified and/or finalized.

As stated earlier, the District would like to receive copies of relevant information from other agencies in a more timely manner. In addition, the District would like to commend the permittees for their ongoing communications. They have not hesitated to contact Metro for guidance or permit interpretations, laboratoy problems, report content requirements, etc.

Describe your responsibilities and authorities under Permit No. I-118. (Metro)

Permit No. I-118 was co-issued by the City of Aurora and the Metro District. The Metro District has an approved pretreatment program by EPA which requires Metro to implement and enforce all requirements of its permits and pretreatment program. The Metro District has the authority to penalize, revoke the permit and sever sewer connections if necessary.

Describe the permit in terms of protectiveness of the public. (Metro)

Site-specific limitations identified in the discharge permit were developed to ensure that the District will: comply with its CDPS/NPDS discharge permit; comply with state water quality standards; achieve risk-based effluent concentration limits developed by EPA for pollutants not regulated by water quality standards; maintain "exceptional quality sludge" levels of pollutants in the biosolids products; prevent interference with treatment processes; restrict releases of hazardous air pollutants; protect works from adverse health and safety effects caused by the presence of toxic and reactive gases in the sewer system; and protect the sewerage system from explosion hazard and undue corrosion.

Describe the quality of water received from Lowry. Has the Lowry Landfill Water Treatment Facility met the permit standards (Metro)?

Except for the pH violation identified earlier, the discharge from the site has met all other permit limitations.

Describe Metro's treatment process and how the water from Lowry will be treated to include any by-products from the treatment process (e.g., biosolids). Describe the quality of the treated water and biosolids (if any). (Metro)

Primary treatment removes pollutants from wastewater through screening, skimming and settling. Secondary treatment uses microorganisms to remove suspended and dissolved organic matter. Chlorine is added to kill harmful microorganisms called pathogens, and then the effluent is dechlorinated with sulfur dioxide prior to discharge into the river. Nitification-denitification is applied to about half of the District's effluent to convert ammonia to nitrates which are further converted during denitirfication to harmless nitrogen

and released into the atmosphere as a gas. The District removes and concentrates the solids which are then sent to anaerobic digesters where it is stabilized in a biological decomposition process using microorganisms in an oxygen-free environment. The biosolids are then used as organic fertilizer and soil conditioner. Small portion of the biosolids cake is composted into a peat moss-like soil conditioner.

The Metro District's effluent consistently complies with the numerical effluent limitations in the Clean Water Act permit that governs the water it discharges. The District has experienced several whole effluent toxicity test failures in recent years, attributed to the pesticide diazinon (not related to Lowry). The District has been implementing an aggressive public education campaign aimed at reducing diazinon discharges to the sanitary sewer system. The District's biosolids are well below EPA's metals standards for "Exceptional Quality" biosolids under the federal 503 biosolids regulations.

Describe the final disposition of the water treated in your facility and the biosolids generated (if any). (Metro)

Metro's treated effluent is discharged to Segment 15 of the South Platte River.

Metro applies its biosolids as a soil conditioner and fertilizer on agricultural land and composts a small portion (approximately 2-3%) for commercial landscaping and private residential uses.

Signed: Steve Pearlman

Organization: Metro Wastewater Reclamation District

Date: June 21, 2001

Lowry Landfill—5-year Review
Interview Questions

Please return to: Jane Koewing
CH2M HILL
PL Box 241325
Denver CO, 80224-9325

(If additional space is required for your responses, please attach additional pages.)

Community

Where do you live in relation to the Lowry Site?

I represent concerned citizens and workers who range from those living within a half mile of the Lowry Landfill Superfund site, to those who work at MWRD processing the Lowry-contaminated sludge and effluent, in various occupational capacities, and who will be exposed to Lowry contaminants at the MWRD sewage plant, a facility, that is neither NRC/DOE licensed or OSHA protected. Further, as a result of MWRD's demonstrated anti-union activities and threats to workers in evidence over the Lowry deal, the facility is now no longer protected by a union, though many of its workers continue to have grave concern over the facility's acceptance of the Lowry effluent, though are too fearful to speak out, due to overt acts of retribution MWRD has waged against workers and their representatives. I personally live approximately one mile from areas that wastewater contaminated with Lowry effluent has been slated for use as "irrigation water", according to the EPA-approved plan with Metro Wastewater Reclamation and the owner/operator of the Lowry Landfill Superfund Site, the City of Denver and Waste Management, Inc., with the potential for persistent and deadly poisons, including plutonium, americium, dioxins, PCBs and numerous other compounds, regulated and unregulated by MWRD's permit, to me redispersed to previously uncontaminated areas of metropolitan Denver and Colorado.

In general, what is your impression of the Lowry project?

From an exhaustive five year investigation of the EPA's Administrative Record and other pertinent documents, it is apparent that EPA has acted to protect the interests of selected government agencies and contractors and key corporations who are liable parties for dumping wastes at the Lowry site, instead of meeting its statutory obligations to protect public health and safety and the environment. It is also apparent that this failure has resulted from a complex web of conflicts of interest – such as CH2Mhill's multi-million dollar contract with EPA for Lowry Landfill while concurrently working for Lowry liable parties at DOE, DoD and DOE/DoD-contract sites, including Rocky Flats, Coors and Martin Marietta, and other sites with extensive violations of law where NRC-licensed radioactive materials have been improperly handled, including Shattuck. As a result, the integrity of the CERCLA process has been grossly compromised at this site at every stage in the CERCLA process, from identification of the nature of wastes at the site to selection and implementation of the remediation, rammed through against citizen opposition. Because of EPA's heinous actions at the Lowry site, the public cannot have confidence that they are being protected, as EPA has condoned the redistribution of some of the most dangerous wastes known, instead of treating them in accordance with proper rules for handling and disposal of mixed hazardous and radioactive wastes. In an attempt to carry out this ruse, EPA officials have made false statements to the public, engaged in defamation against those raising appropriate health and safety concerns, and has in addition to compromising the Congressionally-mandated laws at this Superfund site, *have also further compromised the public's trust in the EPA as a credible agency.*

What effect have the site operations had on your community?

EPA's actions in the Lowry case have clearly had a divisive, deleterious effect in Colorado, pitting the interests of Lowry liable parties against small family farmers, sewage plant workers and other, at-risk, vulnerable populations, where many citizens are appropriately fearful of exposure to the dangerous radionuclides and other highly toxic and persistent compounds found to be present in Lowry's effluent. Rural Deer Trail residents and homeowners near Lowry face decreased property values and compromised, contaminated properties, subject to airborne and/or waterborne contamination from Lowry itself. Furthermore, as Lowry contaminants are now being relocated to previously uncontaminated geographic locations in Colorado, these secondary Lowry sites - including MWRD's sludge disposal site, which will receive Lowry poisons for at least the next half century, according to the EPA-approved plan – will also be subject to degraded properties and property values and unnecessary public health and environmental risks to Lowry contaminants in the future. Other areas targeted for this plan, with EPA's apparent kiss of approval, are Denver/Aurora metro area parks, golf courses, playground and recreation areas, and residential yards, which will then also be potentially subject to long-term degradation and contamination from Lowry contaminants, both improperly regulated (such as plutonium and americium) in MWRD's Lowry permit, and numerous other toxic compounds completely unregulated by MWRD or EPA. Furthermore, the uptake of chemical and radioactive elements into the food chain where crops are grown for commercial sale and distribution (Metro Wastewater's Deer Trail "farm", or sludge disposal site), as well as the application of MWRD's Lowry contaminant-laced "MetroGro" for unregulated landscaping and home garden and other uses will also have the potential to adversely impact the economic viability of agricultural products in eastern Colorado and any other points of agricultural application, as well as food safety for consumers.

Are you aware of any community concerns regarding the site or its operations and administration? If so, please give details.

As detailed elsewhere

Are you aware of any events, incidents, or activities at the site that concern you. Please explain your response.

As detailed elsewhere

Do you feel well informed about the site's activities and progress?

Absolutely not. EPA has continued to withhold over 9,000 records under FOIA from my review, many of which appear from their titles to be pertinent to the public in making fully-informed input on the Lowry site plans. EPA withheld key lab data and other documents corroborating the presence of plutonium and other nuclear wastes in the Lowry groundwater, surface water, soil and sediment, until AFTER MWRD's discharge permit for Lowry had been issued. Furthermore, I am aware of an EPA attorney seeking advice from the owner of the Lowry Superfund site about how to withhold documents from me that I had requested under FOIA from the Lowry Administrative Record, documents that have never been provided. EPA's information and fact sheets have been little more that PR documents, designed to mislead the public about the true extent of hazards and risks associated with its plan with Lowry polluters to scatter their CERCLA liability into the public domain, and shift their liability and risks onto taxpayers, food consumers, unprotected workers, golfers, visitors to public parks, and

residents of subdivisions in the Denver metro area, whose yards are to be watered with "recycled" water from MWRD effluent (now including Lowry's Superfund contaminants), according to the MWRD-Denver Water Board plan. EPA has failed, to date, to disclose to the public all the points of potential exposure, which would result from its proved plan for Lowry contaminated groundwater.

Do you receive site fact sheets and updates? How effective are these in providing information about the site?

Yes, as stated above, EPA's fact sheets on Lowry are little more than PR propaganda documents, failing to disclose to the public the existence of plutonium and other radionuclides at the site that are being dispersed to wider public areas and potential exposure. EPA and its contractor CH2Mhill also continue to mislead the public, by claiming that any radionuclides are "within background limits" when EPA and its contractors are fully aware that the areas selected for background sampling were and are highly contaminated with plutonium, americium, dioxins and other poisons that obviously do not represent ambient, uncontaminated conditions, but other areas of contamination that EPA has failed to incorporate into the Lowry Superfund site boundaries for remediation.

Would you like to have your name added/removed from the mailing list?

Have you attended public meetings or availability sessions? How effective have these been in providing information about the site.

The "public meetings" and "availability sessions" EPA has hosted for the Lowry Superfund Site have been an abomination to the public's rights to full participation in the CERCLA process, as EPA has designed these sessions to simply quell public dissent over their plans, and have simply ignored the unanimous opposition to its plans that were clearly expressed in these sessions.

How has the land use in the vicinity of the site changed?

EPA's improper drawing of the boundary for the Lowry Landfill CERCLA site, intentionally excluding immediately contiguous, contaminated land and then mischaracterizing it to the public as "background" has led to improper land use decisions by Arapahoe County and the City of Aurora, who have platted residential subdivisions in or proximate to inadequately investigated areas where environmental contamination is evident, and where other uses that will increase the potential for human exposures have been approved.

Has the Lowry Landfill Superfund Site had any influence on land use in your area?

As above.

Are you a participant in the Technical Advisory Group meetings? If so, are the meetings effective as a forum for discussion of technical issues?

The recipient of the TAG money, "CLLEAN", has done absolutely nothing to inform the wider community of concerned citizens about Lowry hazards, has failed to return phone calls of interested parties, and has no credibility in the larger environmental or occupational health community as an effective, credible organization advocating the wider public concerns over this site. Its "leadership" is comprised of the husband and wife of a couple of households who act as a clique, and selectively communicate with other concerned organizations and individuals, though funded with public monies to perform this service. TAG monies to this "group"are a misuse of public funds.

Have you attended any problem solving groups? If so, are these groups effective in resolving project issues?

EPA has not acted with an interest or integrity in reaching a proper resolution to the true problems at Lowry Landfill. Furthermore, major parties at interest in EPA's plan, now implemented, to flush Lowry poisons into the public domain and onto farm land growing crops for human consumption have had their input ignored in the decision-making process, as the controversial MWRD discharge permit for Lowry, for example, was railroaded into effect, despite unanimous citizen opposition.

Are you aware of any access restrictions at the Site? Are you aware of any signs at the Site? If so, how effective are the access restrictions and signs at the site?

The Lowry Superfund Site is inadequately posted as to its hazards, especially given the rapidly encroaching population up to its perimeter (though improperly drawn). EPA should also warn the public that Lowry contaminants are being transferred to other areas, including, but not limited to, the MWRD's Deer Trail property, all parks and recreation and residential areas receiving Lowry Landfill-contaminated MWRD effluent as "irrigation water", and each of these areas of potential exposure should be properly posted.

What do you think has been successful about the Lowry remedy?

While the barrier walls may have prevented some lateral migration of Lowry groundwater contaminants WITHIN the defined boundaries of the site, they have done nothing to prevent the migration of contaminant plumes immediately OUTSIDE of the boundaries, which EPA has completely failed to address or remediate in any way.

What do you think are problems with the Lowry remedy?

Among a few points of concern: 1) EPA's failure to include all contiguous contaminated areas in the Lowry CERCLA site boundaries and falsely portraying excluded contaminated areas as "background" to confuse the public as to the nature and true extent of contamination in and around the current, as drawn, CERCLA site boundaries; 2)EPA's failure to seek prosecution for false statements by Dow and Rockwell and others in their initial 104(e) CERCLA responses when clearly warranted; 3) EPA's granting "de minimus" settlements to Rockwell and DOE at Rocky Flats without local notice when special nuclear wastes including plutonium are clearly present in significant quantities at Lowry, as evidenced by DOE-certified laboratory analyses and analyses from EPA's own labs; 4) EPA's failure to warn the public of the true nature and extent of hazards found at Lowry, and allowing improper remediation proposals and land use decisions to be made, as a result; 4) EPA's continued use of CH2Mhill, despite the contract firm's admitted conflict of interest between EPA and Rocky Flats and other DOE/DOE contractors over the plutonium at Lowry; 5) EPA's continued use of CH2Mhill, despite its conflicts of interest with other key Lowry PRPs, including Martin Marietta, whose waste stream

contaminants (including n-nitrosodimethylamine and other breakdown products of Aerozine 50 missile fuel) have also been curiously deleted as being present at the site deleted while the firm has financially benefited from major, lucrative contracts with this polluter at its Jefferson County, Colorado aerospace and other Martin Marietta (now Lockheed Martin) installations around the nation, thereby compromising a credible environmental investigation and appropriate assignations of liability; 7) EPA-granting a "de minimus settlement to Martin Marietta, when documents reveal it dumped many thousands of gallons not only in, but AROUND the Lowry Landfill and surrounding Lowry Bombing Rang environs for years, with no effort made by EPA to investigate the adverse effects of this dumping outside the EPA's Lowry boundary and the in areas improperly purported to be "background" areas to Lowry Landfill.; locating key, "background wells" in an area with documented historic use as a military dumping lagoon for Titan Missile (and perhaps other military site) wastes; and 8) EPA's failure to notify the public of the presence of plutonium at Lowry when the Record of Decision was to be amended, to allow the radioactively contaminated wastewater to be simply flushed to the public infrastructure without prior treatment for removal of the long-living, persistent atomic wastes.

Do you have any comments, suggestions, or recommendation regarding the site's management or operations?

Full and complete investigation of USEPA's actions in region VIII regarding the Lowry Landfill, conflicts of interest with liable parties and their contractors, for improper, and possibly illegal actions in their decision making and actions at the site by the U.S. EPA Ombudsman's Office and Congressional Oversight Committees of the USEPA. In the interim, CH2Mhill should be removed as site contractor for EPA, EPA should appoint new personnel to handle the site that have not been involved in past actions that have compromised the public trust and EPA should immediately halt the discharge from Lowry and develop – with full public participation – an alternative remediation based upon appropriate clean-up methods for mixed radioactive and hazardous waste that addresses the full areal extent of radioactive and toxic contamination beyond the current boundaries of the Lowry Landfill Superfund Site, uninvestigated for remediation, to date.

Signature

Adrienne Anderson

Date

July 9, 2001

Lowry Landfill—5-year Review
Interview Questions

Please return to:

Jane Koewing
CH2M HILL
PL Box 241325
Denver CO, 80224-9325

(If additional space is required for your responses, please attach additional pages.)

Local Emergency Response Officials

What is your general impression of the Lowry project?

Project is run very effectively and seems committed to remediating site while protecting the health of the general public.

Are the contractors' health and safety and contingency plans adequate?

From the plans I have been briefed on I feel that they are adequate

Do you believe the emergency response plans are adequate?

From my knowledge of what would occur in case of an emergency release, response plans are adequate

Have there been routine communications or activities (site inspections reporting activities etc.) conducted by your office regarding this site? If so, please give purpose and results.

We provide the RMA Health Liaison for CDPHE. We monitor reports of health concerns from the public and report to CDPHE. We are also provided air monitoring and site activities reports.

Do you feel well informed about the site's activities and progress?

Yes

Does the contractor safely implement the plans?

It appears so. I haven't heard or experienced otherwise.

Have there been any complaints, violations or other incidents relating to the site requiring a response by your office? If so, please give details of the events and results of the responses.

No. We have had a few calls concerning potential health impacts. We collected info and referred callers to their medical provider. Our assessments were that complaints were not likely related to RMA.

What emergencies have you responded to in the past 5 years?

None

Do you have any comments, suggestions or recommendations regarding the site's management or operations?

No

ATTACHMENT 6

ATTACHMENT 6

Inspection Checklist

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: LOWRY LANDFILL	Date of Inspection: MARCH 30, 2001
Location and Region: COLORADO REGION 8	EPA ID: COD 980499248
Agency, Office, or Company Leading the Five-Year Review: EPA	Weather/Temperature: WINDY AND COOL

Remedy Includes: (Check all that apply)

- ☒ Landfill cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other _____

Attachments: ☒ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M Site Manager _____ _____ _____

Name Title Date

Interviewed ☐ at site ☐ at office ☐ by phone Phone No.: _____

Problems, suggestions: ☐ Report attached _____

2. O&M Staff _____ _____ _____

Name Title Date

Interviewed ☐ at site ☐ at office ☐ by phone Phone No.: _____

Problems, suggestions: ☐ Report attached _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone No.

Problems, suggestions: ☐ Report attached _____

_____

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone No.

Problems, suggestions: ☐ Report attached _____

_____

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone No.

Problems, suggestions: ☐ Report attached _____

_____

Agency _____

Contact _____ _____ _____ _____

Name Title Date Phone No.

Problems, suggestions: ☐ Report attached _____

_____

4. **Other interviews (optional) ☐ Report attached**

III. ONSITE DOCUMENTS AND RECORDS VERIFIED (Check all that apply)

1. O&M Documents GWTP; SOILS, SOLIDS & SEDS; TREATMENT CELL; E. ALIGN WELLS;

☒ O&M manual LFG SYSTEMS; LF COVER;	☒ Readily available	☒ Up-to-date	☐ N/A
☒ As-built drawings ALL CONST. ACTIVITIES	☒ Readily available	☒ Up-to-date	☐ N/A
☒ Maintenance logs TREATMENT CELL, GWTP, LFG. SYSTEM	☒ Readily available	☒ Up-to-date	☐ N/A

Remarks

2. Site-Specific Health and Safety Plan ☒ Readily available ☒ Up-to-date ☐ N/A

☒ Contingency plan/emergency response plan ☒ Readily available ☒ Up-to-date ☐ N/A

Remarks RESPONSE PLAN IS SECTION 7 OF GWTP & SECTION 9 OF THE FTPA H&S PLANS

3. O&M and OSHA Training Records ☒ Readily available ☒ Up-to-date ☐ N/A

Remarks TRAINING RECORDS FOR PARSONS PERSONNEL ONLY
SUBCONTRACTORS MAINTAIN OWN RECORDS.

4. Permits and Service Agreements

☐ Air discharge permit	☐ Readily available	☐ Up-to-date	☐ N/A
☒ Effluent discharge GWTP	☒ Readily available	☒ Up-to-date	☐ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up-to-date	☐ N/A
☐ Other permits	☐ Readily available	☐ Up-to-date	☐ N/A

Remarks DISCHARGE PERMIT I-118 W/ AMENDMENTS FOR DISCHARGE TO POTW PIPELINE

5. Gas Generation Records ☐ Readily available ☐ Up-to-date ☒ N/A

Remarks

6. Settlement Monument Records ☐ Readily available ☐ Up-to-date ☒ N/A

Remarks

7. Groundwater Monitoring Records ☒ Readily available ☒ Up-to-date ☐ N/A

Remarks UP TO 4th QTR. 2000

8. Leachate Extraction Records TREATMENT CELL ☒ Readily available ☒ Up-to-date ☐ N/A

Remarks LFG CONDENSATE TO GWTP - AUTO DATA LOGGED ON GWTP REPORT. MANUAL CONDENSATE TRAPS RECORDED ON MONTHLY BASIS

9. Discharge Compliance Records

☐ Air	☐ Readily available	☐ Up-to-date	☒ N/A
☒ Water (effluent)	☒ Readily available	☒ Up-to-date	☐ N/A

Remarks PERIODIC COMPLIANCE REPORTS FOR PERMIT # I-118 (APPROX. THREE MONTH LAG TIME - CURRENTLY HAVE NOV. 2000)

10. Daily Access/Security Logs ☒ Readily available ☒ Up-to-date ☐ N/A

Remarks SIGN IN SHEET

IV. O&M COSTS

N/A PRP LEAD DON'T PROVIDE INFO

1. O&M Organization

☐ State in-house ☐ Contractor for State
☒ PRP in-house ☐ Contractor for PRP
☐ Other _____

2. O&M Cost Records

☐ Readily available ☐ Up-to-date
☐ Funding mechanism/agreement in place
Original O&M cost estimate _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From _____ (Date) To _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From _____ (Date) To _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From _____ (Date) To _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From _____ (Date) To _____ (Date) _____ (Total Cost) ☐ Breakdown attached
From _____ (Date) To _____ (Date) _____ (Total Cost) ☐ Breakdown attached

3. Unanticipated or Unusually High O&M Costs During Review Period

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☐ Gates secured ☐ N/A
Remarks _____

B. Other Access Restrictions

1. **Signs and Security Measures** ☒ Location shown on site map ☐ N/A
   Remarks EPA SIGNS

C. Institutional Controls

1. **Implementation and Enforcement** STATE ENGINEERS OFFICE - NO WELLS IN 1 MILE
   Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☐ N/A
   Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☐ N/A
   Type of monitoring (e.g., self-reporting, drive by)
   Frequency
   Responsible party/agency
   Contact

Name	Title	Date	Phone No.

   Reporting is up-to-date ☐ Yes ☐ No ☐ N/A
   Reports are verified by the lead agency ☐ Yes ☐ No ☐ N/A
   Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ☐ N/A
   Violations have been reported ☐ Yes ☐ No ☐ N/A
   Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A
   Remarks

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☐ No vandalism evident
   Remarks DOES OCCUR - PRPs ARE RESPONSIBLE (FENCE REPAIRS ARE NECESSARY)

2. **Land-Use Changes Onsite** ☐ N/A
   Remarks ONLY AS NECESSARY TO ACCOMODATE REMEDY

3. **Land-Use Changes Offsite** ☐ N/A
   Remarks URBAN ENCROACHMENT

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. Roads Damaged ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks

B. Other Site Conditions

Remarks

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. Settlement (low spots) ☒ Location shown on site map ☐ Settlement not evident

Areal extent _____ Depth _____

Remarks SEVERAL LARGE DEPRESSIONS - IMPAIRS DRAINAGE AND PROMOTES INFILTRATION

2. Cracks ☐ Location shown on site map ☒ Cracking not evident

Lengths _____ Widths _____ Depths _____

Remarks

3. Erosion ☐ Location shown on site map ☐ Erosion not evident

Areal extent _____ Depth _____

Remarks

4. Holes ☐ Location shown on site map ☒ Holes not evident

Areal extent _____ Depth _____

Remarks

5. Vegetative Cover ☒ Grass ☒ Cover properly established ☒ No signs of stress

☐ Trees/shrubs (indicate size and locations on a diagram)

Remarks

6. Alternative Cover (armored rock, concrete, etc.) ☒ N/A

Remarks

7. Bulges ☐ Location shown on site map ☒ Bulges not evident
Areal extent _____ Height _____
Remarks _____

8. Wet Areas/Water Damage ☒ Wet areas/water damage not evident
☐ Wet Areas ☐ Location shown on site map Areal extent _____
☐ Ponding ☐ Location shown on site map Areal extent _____
☐ Seeps ☐ Location shown on site map Areal extent _____
☐ Soft subgrade ☐ Location shown on site map Areal extent _____
Remarks _____

9. Slope Instability ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent _____
Remarks _____

B. Benches ☐ Applicable ☒ N/A
(Horizontally constructed mounds of earth placed across steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. Flows Bypass Bench ☐ Location shown on site map ☐ N/A or okay
Remarks _____

2. Bench Breached ☐ Location shown on site map ☐ N/A or okay
Remarks _____

3. Bench Overtopped ☐ Location shown on site map ☐ N/A or okay
Remarks _____

C. Letdown Channels ☐ Applicable ☒ N/A
(Channel lines with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. Settlement ☐ Location shown on site map ☐ No evidence of settlement
Areal extent _____ Depth _____
Remarks _____

2. Material Degradation ☐ Location shown on site map ☐ No evidence of degradation
Material type _____ Areal Extent _____
Remarks _____

3. Erosion ☐ Location shown on site map ☐ No evidence of erosion
Areal extent _____ Depth _____
Remarks _____

4. Undercutting ☐ Location shown on site map ☐ No evidence of undercutting
Areal extent _____ Depth _____
Remarks _____

5. Obstructions Type _____ ☐ No obstructions
☐ Location shown on site map Areal extent _____
Size _____
Remarks _____

6. Excessive Vegetative Growth Type _____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent _____
Remarks _____

D. Cover Penetrations ☒ Applicable ☐ N/A

1. Gas Vents ☒ Active ☐ Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks _____

2. Gas Monitoring Probes
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks _____

3. Monitoring Wells (within surface area of landfill)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks CLOSED, NOT LOCKED - MPZ-9, GW-114A, TR-1, RW-PZ-1

4. Leachate Extraction Wells
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☒ N/A
Remarks _____

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks _____

E. Gas Collection and Treatment ☒ Applicable ☐ N/A

1. Gas Treatment Facilities

☐ Flaring ☐ Thermal destruction ☐ Collection for reuse

☐ Good condition ☐ Needs O&M

Remarks NOT OPERATING - FLARE IS RUSTED FUTURE REPAIRS OR REPLACEMENT MAY BE NECESSARY

2. Gas Collection Wells, Manifolds, and Piping

☐ Good condition ☐ Needs O&M

Remarks

3. Gas Monitoring Facilities (e.g., gas monitoring of adjacent homes or buildings)

☐ Good condition ☐ Needs O&M ☒ N/A

Remarks

F. Cover Drainage Layer ☐ Applicable ☒ N/A

1. Outlet Pipes Inspected ☐ Functioning ☐ N/A

Remarks

2. Outlet Rock Inspected ☐ Functioning ☐ N/A

Remarks

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

1. Siltation Areal extent _____ Depth _____ ☐ N/A

☐ Siltation not evident

Remarks

2. Erosion Areal extent _____ Depth _____

☐ Erosion not evident

Remarks

3. Outlet Works ☐ Functioning ☐ N/A

Remarks

4. Dam ☐ Functioning ☐ N/A

Remarks

H. Retaining Walls ☐ Applicable ☒ N/A

1. Deformation ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement _____ Vertical displacement _____
Rotational displacement _____
Remarks _____

2. Degradation ☐ Location shown on site map ☐ Degradation not evident
Remarks _____

I. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation ☐ Location shown on site map ☒ Siltation not evident
Areal extent _____ Depth _____
Remarks _____

2. Vegetative Growth ☐ Location shown on site map ☐ N/A
Areal extent _____ Type _____
Remarks _____

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks _____

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks _____

VIII. VERTICAL BARRIER WELLS ☒ Applicable ☐ N/A

1. Settlement ☒ Location shown on site map ☒ Settlement not evident
Areal extent _____ Depth _____
Remarks _____

2. Performance Monitoring Type of monitoring – PCMP REQUIRED
☐ Performance not monitored
Frequency QUARTERLY ☐ Evidence of breaching
Head differential VARIES - SEE REPORTS ☐ Evidence of leakage or underflow
Remarks _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical
☒ Good condition ☐ All required wells located ☐ Needs O&M ☐ N/A
Remarks ALL UNLOCKED AT PM 15

2. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☒ Good condition ☐ Needs O&M

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. Collection Structures, Pumps, and Electrical

☒ Good condition ☐ Needs O&M

Remarks

2. Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☒ Good condition ☐ Needs O&M

Remarks

3. Spare Parts and Equipment

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks

C. Treatment System ☒ Applicable ☐ N/A

1. Treatment Train (check components that apply)

☒ Metals removal PARTIAL ☐ Oil/water separation ☐ Bioremediation ☒ UV | OX

☐ Air stripping ☒ Carbon adsorbers

☐ Filters

☐ Additive (e.g., chelation agent, flocculent)

☐ Others GC OPERATION

☒ Good condition ☐ Needs O&M

☒ Sampling ports properly marked and functional

☐ Sampling/maintenance log displayed and up-to-date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually 10 - 20 GPM

☐ Quantity of surface water treated annually 0

Remarks

2. Electrical Enclosures and Panels (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs O&M

Remarks

3. Tanks, Vaults, Storage Vessels

☐ N/A ☒ Good condition ☒ Proper secondary containment ☐ Needs O&M

Remarks

4. Discharge Structure and Appurtenances

☐ N/A ☒ Good condition ☐ Needs O&M

Remarks

5. Treatment Building(s)

☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair

☒ Chemicals and equipment properly stored

Remarks

6. Monitoring Wells (pump and treatment remedy)

☒ Properly secured/locked NO ☒ Functioning ☒ Routinely sampled ☒ Good condition

☐ All required wells located ☐ Needs O&M ☐ N/A

Remarks

D. Monitored Natural Attenuation

1. Monitoring Wells (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs O&M ☒ N/A

Remarks

X. OTHER REMEDIES

If there are remedies applied at the site that are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

XI. MIDDLE WASTE PIT ☒ Applicable ☐ N/A

A. Surface

1. Settlement (low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent _____ Depth _____
Remarks _____

2. Cracks ☐ Location shown on site map ☒ Cracking not evident
Lengths _____ Widths _____ Depths _____
Remarks _____

3. Erosion ☐ Location shown on site map ☒ Erosion not evident
Areal extent _____ Depth _____
Remarks MINOR EROSION

4. Holes ☐ Location shown on site map ☒ Holes not evident
Areal extent _____ Depth _____
Remarks _____

5. Vegetative Cover ☒ Grass ☐ Cover properly established ☒ No signs of stress
☐ Trees/shrubs (indicate size and locations on a diagram)
Remarks _____

6. Wet Areas/Water Damage ☒ Wet areas/water damage not evident

☐ Wet Areas	☐ Location shown on site map	Areal extent _____
☐ Ponding	☐ Location shown on site map	Areal extent _____
☐ Seeps	☐ Location shown on site map	Areal extent _____
☐ Soft subgrade	☐ Location shown on site map	Areal extent _____

Remarks _____

9. Slope Instability ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent _____
Remarks _____

B. Cover Penetrations ☐ Applicable ☒ N/A

1. Monitoring Wells (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks _____

2. Settlement Monuments ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks _____

C. Perimeter Ditches/Offsite Discharge ☐ Applicable ☒ N/A

1. Siltation ☐ Location shown on site map ☐ Siltation not evident
Areal extent _____ Depth _____
Remarks _____

2. Vegetative Growth ☐ Location shown on site map ☐ N/A
Areal extent _____ Type _____
Remarks _____

3. Erosion ☐ Location shown on site map ☐ Erosion not evident
Areal extent _____ Depth _____
Remarks _____

4. Discharge Structure ☐ Functioning ☐ N/A
Remarks _____

XII. NORTH & SOUTH WASTE PITS ☒ Applicable ☐ N/A

A. Surface

1. Settlement (low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent _____ Depth _____
Remarks _____

2. Cracks ☐ Location shown on site map ☒ Cracking not evident
Lengths _____ Widths _____ Depths _____
Remarks _____

3. Erosion ☐ Location shown on site map ☒ Erosion not evident
Areal extent _____ Depth _____
Remarks _____

4. Holes ☐ Location shown on site map ☒ Holes not evident
Areal extent _____ Depth _____
Remarks _____

5. Vegetative Cover ☒ Grass ☐ Cover properly established ☒ No signs of stress
☐ Trees/shrubs (indicate size and locations on a diagram)
Remarks RECENTLY PLANTED GRASS

6. Wet Areas/Water Damage ☐ Wet areas/water damage not evident

☐ Wet Areas	☐ Location shown on site map	Areal extent
☐ Ponding	☐ Location shown on site map	Areal extent
☐ Seeps	☐ Location shown on site map	Areal extent
☐ Soft subgrade	☐ Location shown on site map	Areal extent

Remarks

9. Slope Instability ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability

Areal extent

Remarks

B. Cover Penetrations ☐ Applicable ☒ N/A

1. Monitoring Wells (within surface area of landfill)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A

Remarks

2. Settlement Monuments ☐ Located ☐ Routinely surveyed ☒ N/A

Remarks

C. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation ☐ Location shown on site map ☒ Siltation not evident

Areal extent _____ Depth _____

Remarks VERY LITTLE SILTATION NOTICED

2. Vegetative Growth ☐ Location shown on site map ☐ N/A

Areal extent _____ Type _____

Remarks SOME GROWTH - NOT A FACTOR IN DRAINAGE.

3. Erosion ☐ Location shown on site map ☒ Erosion not evident

Areal extent _____ Depth _____

Remarks

4. Discharge Structure ☐ Functioning ☒ N/A

Remarks

XII. TIRE SHREDS MONOFILL ☒ Applicable ☐ N/A

A. Surface

1. Edges of Cell (low spots) ☐ Location shown on site map ☒ Settlement not evident

Areal extent _____ Depth _____

Remarks

2. Erosion ☐ Erosion not evident

3. Erosion/Water Damage ☐ Erosion/water damage not evident

☐ Erosion ☐ Location shown on site map Areal extent
Remarks MINOR Depth
☐ Wet Areas ☐ Location shown on site map Areal extent
☐ Seeps ☐ Location shown on site map Areal extent
☐ Soft subgrade ☐ Location shown on site map Areal extent
Remarks

4. Slope Instability ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent
Remarks

5. Shreds Management ☒ Shreds confined to monofill area ☐ Shreds outside monofill area
Areal extent
Remarks

☐ Evidence of animal activity ☒ No evidence of animal activity
Areal extent
Remarks DUCKS IN WATER

B. Perimeter Ditches/Offsite Discharge ☒ Applicable ☐ N/A

1. Siltation ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks

2. Vegetative Growth ☐ Location shown on site map ☒ N/A
Areal extent Type
Remarks

3. Erosion ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks

4. Discharge Structure ☐ Functioning ☒ N/A
Remarks

XIV. FTPA TREATMENT CELL ☒ Applicable ☐ N/A

A. Cover

1. Settlement (low spots) ☐ Location shown on site map ☐ Settlement not evident
Areal extent _____ Depth _____
Remarks COVER BILLOWING IN THE STRONG WIND

2. Tears/Punctures ☒ Location shown on site map ☐ Damage not evident
Lengths 12" Widths 6" Depths _____
Remarks MIDDLE 1/3 TO SOUTHEND

3. Erosion around Base ☐ Location shown on site map ☒ Erosion not evident
Areal extent _____ Depth _____
Remarks _____

4. Bulges ☐ Location shown on site map ☒ Bulges not evident
Areal extent _____ Height _____
Remarks _____

5. Slope Instability ☐ Slides ☐ Location shown on site map ☒ No evidence of slope instability
Areal extent _____
Remarks _____

C. Cover Penetrations ☒ Applicable ☐ N/A

1. Extraction Pipes ☒ Active ☐ Passive
☐ Properly secured at penetration ☐ Functioning ☐ Poor condition ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks _____

2. Gas Monitoring Probes
☒ Properly secured/locked NO ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks _____

3. Monitoring/Sampling Devices (within surface area of cell)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks _____

4. Temperature Monitoring Probes
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks 2 CUTS FOR THERMOCOUPLES - AIR FLOWING + 2 PENETRATIONS

5. Settlement Monuments ☐ Located ☐ Routinely surveyed ☒ N/A
Remarks

D. Gas Collection and Treatment ☒ Applicable ☐ N/A

1. Gas Treatment Facilities
☒ Flaring FTO ☐ Thermal destruction ☐ Collection for reuse
☐ Good condition ☐ Needs O&M
Remarks

2. Gas Collection Wells, Manifolds, and Piping
☒ Good condition ☐ Needs O&M
Remarks

E. Perimeter Ditches/Drainage ☒ Applicable ☐ N/A

1. Siltation ☐ Location shown on site map ☒ Siltation not evident
Areal extent Depth
Remarks SOME PONDING ON SOUTH EAST CORNER

2. Vegetative Growth ☐ Location shown on site map ☒ N/A
Areal extent Type
Remarks

3. Erosion ☐ Location shown on site map ☒ Erosion not evident
Areal extent Depth
Remarks

4. Discharge Structure ☒ Functioning ☐ N/A
Remarks CULVERT

XV. Surface Water Removal Action ☒ Applicable ☐ N/A

A. Cover

1. Settlement (low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent Depth
Remarks MINOR EROSION

2. Slope Instability ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent
Remarks

B. Cover Penetrations ☒ Applicable ☐ N/A

1. Monitoring/Sampling Devices

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs O&M ☐ N/A
Remarks

XVI. Wetland Mitigation ☐ Applicable ☐ N/A

A. Wetlands

1. Vegetative Cover ☐ Grass ☐ Cover properly established ☐ No signs of stress
☒ Trees/shrubs (indicate size and locations on a diagram)
Remarks SUITABLE USE OF TREES AND SHRUBS

2. Slope Instability ☒ Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent
Remarks WORKING ON SLIDES FROM LAST YEAR.

3. Siltation Areal extent Depth ☐ N/A
☒ Siltation not evident
Remarks CURRENTLY THERE IS NO EVIDENCE OF SILTATION.

4. Erosion Areal extent Depth
☐ Erosion not evident
Remarks OBVIOUS LOCALIZED EROSION

XVII. POTW and Potable Waterlines ☒ Applicable ☐ N/A

A. Pipelines ☒ Applicable ☐ N/A

1. Pumps, Wellhead Plumbing, and Electrical

☒ Good condition ☐ All required wells located ☐ Needs O&M ☐ N/A
Remarks

2. Pipes, Valves, Valve Boxes, and Other Appurtenances

☒ Good condition ☐ Needs O&M
Remarks

3. Spare Parts and Equipment

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

XVIII. North Toe Extraction System ☐ Applicable ☐ N/A

1. Settlement ☐ Location shown on site map ☒ Settlement not evident
Areal extent Depth
Remarks

2. Performance Monitoring Type of monitoring

☐ Performance not monitored

Frequency _____ ☐ Evidence of breaching

Head differential _____ ☐ Evidence of leakage or underflow

Remarks _____

3. Pumps, Wellhead Plumbing, and Electrical

☒ Good condition ☒ All required wells located ☐ Needs O&M ☐ N/A

Remarks CAPS FOR WELLS NEXT TO WELLS - MAY HAVE DEDICATED PUMP

4. Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances

☒ Good condition ☐ Needs O&M

Remarks _____

5. Spare Parts and Equipment

☐ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks _____

XIX. Command Post ☒ Applicable ☐ N/A

1. Fencing Damaged ☐ Location shown on site map ☐ Gates secured ☐ N/A

Remarks NO

2. Signs and Security Measures ☒ Location shown on site map ☐ N/A

Remarks YES

3. Drum Storage Pad Damage ☐ Location shown on site map ☐ N/A

Remarks GOOD CONDITION

4. Decontamination Pad Damage ☐ Location shown on site map ☐ N/A

Remarks NONE - HOUSEKEEPING ISSUES - DISCHARGE LINE ON GROUND (COULD SPRAY ONTO GROUND) - RED LIGHT BLINKING.

ATTACHMENT 7

ATTACHMENT 7

Review of ARARs, Performance Standards, and TBCs

This attachment includes copies of Tables 6-2, 6-3, 6-4, and 6-5 from the main text. Copies of the references follow each table. These references are where the Performance Standards were originally published. For example, Table 6-2 is groundwater Performance Standards, and the backup information includes the relevant pages from the ROD, the 1995 ESD, the inorganic background document, and Permit I-118.

A copy of Colorado Senate Bill 01-145 is included at the end of this Attachment.

Table 6-2
Groundwater Performance Standards

Chemical	ROD [a]	ESD [b]	1996 Inorganic Values [c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit [d]	PQL [e]
Organics									
1,1-Dichloroethane	-	990				990	C	9350	
1,1-Dichloroethylene	0.068	7				7	A	13	
1,2-Dichloroethylene(cis)	70				61	70	D		
1,2-Dichloroethylene(trans)	100				122	100	D		
1,1,1-Trichloroethane	200					200	D	2.17	
1,1,2-Trichloroethane	0.32	3				3	A	92	
1,1,2,2-Tetrachloroethane	0.089				0.055	0.055	B	25.3	
1,2-Dibromo-3-Chloropropane	0.2					0.2	D		
1,2-Dichlorobenzene	600					600	D		
1,2-Dichloroethane	0.2	0.4				0.4	A		1
1,2-Dichloropropane	0.56					0.56	D	78	1
1,2-Diphenylhydrazine	0.05					0.05	D		
1,2,4-Trichlorobenzene	20	70			194	70	A	390	
1,2,4,5-Tetrachlorobenzene	2					2	D		10
1,3-Dichlorobenzene	620					620	D		
1,4-Dichlorobenzene	75					75	A	No Limit	
1,4-Dioxane	not COC				5	5	B		70
2-Butanone (methyl ethyl ketone)	780				1904	1904	C	No Limit	
2-Chlorophenol	0.1					0.1	A	No Limit	
2-Hexanone	–					--	--	No Limit	
2-Methylnaphthalene	0.0031 (total PAHs)					0.0031 (total PAHs)	A	No Limit	
2,3,7,8-TCDD (dioxin equivalence)	2.2 x 10-7				0.000000448	2.2 x 10-7	A	0.000107	0.2
2,4-D(dichlorophenoxyacetic acid)	70					70	D	22800	
2,4-Dichlorophenol	21					21	A	No Limit	50
2,4-Dinitrophenol	14					14	A	No Limit	50
2,4,5 TP(trichlorophenoxypropionic acid)	10	50				50	D		
2,4,6-Trichlorophenol	2					2	D		50
4-Methyl-2-pentanone (MIBK)	780				158	158	C	No Limit	
Acetone	1,600					1,600	C	1,800,000	
Alachlor	2					2	D		
Aldicarb	3					3	D		10
Aldicarb Sulfone	2					2	D		3
Aldicarb Sulfoxide	4					4	D		20
Aldrin	0.002				0.004	0.002	D	No Limit	0.1
Atrazine	3					3	D		

Table 6-2
Groundwater Performance Standards

Chemical	ROD [a]	ESD [b]	1996 Inorganic Values [c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit [d]	PQL [e]
Benzene	0.62	5			0.35	5	A	44	
Benzidine	0.0002					0.0002	D		10
Benzo(a)anthracene	0.0031 (total PAHs)	0.1		0.1	0.092	0.1 (total PAHs)	A	No Limit	
Benzo(a)pyrene (PAH)	0.2			0.01		0.01	D		
Benzyl Alcohol	--					--	--	No Limit	
Bis(2-chloroethyl)ether	0.016	0.03				0.03	A	No Limit	10
Bis(2-ethylhexyl)phthalate	6.1				4.8	4.8	B	2330	10
Bromodichloromethane	0.3					0.3	D		1
Bromoform	4					4	D		
Carbazole	--					--	--	No Limit	
Carbofuran	36					36	D		
Carbon tetrachloride	0.026	0.3				0.3	B	78	1
Chlordane	0.004	0.03				0.03	D		1
Chlorobenzene	100					100	D	1000	
Chloroethane	–					--	--	No Limit	
Chloroform	0.19	6			0.16	6	A	73	
Chlorophenol	1	0.2				0.2	D	No Limit	
Dalapon	200					200	D		
DDT Metabolite (DDE)	0.1				0.2	0.1	D	No Limit	
DDT	0.1				0.2	0.1	D	0.49	
Di(2-ethylhexyl)adipate	400					400	D		
Di(2-ethylhexyl)phthalate	6					6	D		10
Di-n-Octylphthalate	--					--	--	No Limit	
Dibenzofuran	–					--	--	No Limit	
Dibromochloromethane	14			0.42		0.42	D		
Dieldrin	0.002				0.0042	0.002	D	No Limit	0.1
Dinoseb	7					7	D		
Diquat	20					20	D		
Endothall	100					100	D		115
Endrin	0.2					0.2	D	No Limit	
Endrin Aldehyde	0.2					0.2	D		
Ethylbenzene	680					680	D	2640	
Ethylenedibromide	0.05					0.05	A		
Fluoranthene	188					100	A	No Limit	
Glyphosate	700					700	D		
Heptachlor	0.008					0.008	D	0.3	0.05

Table 6-2
Groundwater Performance Standards

Chemical	ROD [a]	ESD [b]	1996 Inorganic Values [c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit [d]	PQL [e]
Heptachlor Epoxide	0.09			0.004		0.004	D		
Hexachlorobenzene	1					1	D		10
Hexachlorobutadiene	1					1	D		10
Hexachlorocyclohexane, Alpha	0.2	0.006				0.006	D		0.05
Hexachlorocyclohexane, Gamma (Lindane)	0.004	0.2				0.2	D		
Hexachlorocyclopentadiene	50					50	D	No Limit	
Isophorone	1050			40		40	D		
Malathion	2,500	--				2,500	D		
Methoxychlor	40					40	D		
Methylene chloride	0.19	5				5	A	1990	
Monohydric phenol	1	--				1	D		
Naphthalene	--	63			6.2	63	C	4850	
Nitrobenzene	3.5					3.5	D		10
Oxamyl (vydate)	200					200	D		
PCBs (Arochlor 1260)	0.005				0.034	0.005	D	2.43	1
Pentachlorobenzene	6					6	D		10
Pentachlorophenol	0.71	1				1	A	272	50
Phenanthrene	0.0031 (total PAHs)					0.0031 (total PAHs)	A	No Limit	
Phenol	1	300				300	D	22800	
Picloram	500					500	D		
Simazine	4					4	D		
Styrene	100					100	D	4260	
Tetrachloroethylene	1.5	5				5	A	1410	
Toluene	1,000					1,000	A	2,650	
Toxaphene	0.03					0.03	D		5
Trans-1,3-dichloropropene	3.4	87			0.4	87	A	No Limit	
Trichloroethylene	2.6	5			1.6	5	A	780	
Vinyl chloride	0.037	2			0.041	2	A	9.2	
Xylenes (total)	10,000					10,000	D	2,730	
Inorganics and Miscellaneous									
Aluminum	5,000					5,000	D	No Limit	
Antimony	6		770			770	D	No Limit	
Arsenic	0.049	50	52.18		0.045	52.18	E	330	
Asbestos (fibers/l)	30000					30,000	D		
Barium	1000		200			1,000	D	No Limit	
Beryllium	4		5			5	E	7.8	

Table 6-2
Groundwater Performance Standards

Chemical	ROD [a]	ESD [b]	1996 Inorganic Values [c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit [d]	PQL [e]
Boron	750		200			750	D		
Cadmium	5		5.48		18	5.48	E	1810	
Chloride	250,000		1000000			1,000,000	E	No Limit	
Cobalt	50		13.67			50	A	No Limit	
Coliform (total) per 100 ml	<1	1				<1	D		
Color, color units	15					15	D		
Corrosivity	Noncorrosive					Noncorrosive	D		
Copper	200		90.9			200	D	6100	
Chromium (as Cr[VI])	50		83.47			83.47	E		
Chromium (total)	50		11.04		109	50	D	3600	
Cyanide	200		7.39			200	D	2000	
Fluoride	2000		50000			50,000	E	No Limit	
Foaming Agents	500					500	D		
Iron	300		2060			2060	E		
Lead	15		50			50	E	2200	
Manganese	50		1620		876	1620	E	22800	
Mercury	2					2	D	64	
Nickel	2	100				100	A	5600	
Nitrate as N	10,000					10,000	D		
Nitrate and Nitrite as N	10,000					10,000	D		
Nitrite as N	1,000					1,000	D		
PH	6.5 to 8.5					6.5 to 8.5	D		
Selenium	10		371.98			371.98	E	660	
Silver	50					50	D	1520	
Sulfate	250,000		2400000			2,400,000	E	No Limit	
Thallium	1.1	2			2.4	10	E	No Limit	
Vanadium	100					100	D	No Limit	
Zinc	2,000				10950	2,000	D		
Radionuclides									
Americium-241	1.3 pCi/l	.2 pCi/l				0.2 pCi/l	C	0.27	
Beta and photon emitters, mrem/yr	4					4	D	168	
Cesium-134	80 pCi/l					80 pCi/l	D	95	
Gross Alpha	15 pCi/l					15 pCi/l	D	115	
Lead-210	0.072 pCi/l					0.072 pCi/l	B	3.3	
Plutonium-238, -239, and -240	15 pCi/l			0.15 pCi/l		0.15 pCi/l	A	0.31	
Potassium-40	76 pCi/l	4.3 pCi/l				4.3 pCi/l	C	330	

Table 6-2
Groundwater Performance Standards

Chemical	ROD [a]	ESD [b]	1996 Inorganic Values [c]	New Changes (since 1995 ESD)	Revised Toxicity Concentrations	Recommended Performance Standard	Basis	I-118 Permit [d]	PQL [e]
Radium-226 and -228	5					5 pCi/l	A	7.1	
Strontium-90	1.3 pCi/l	8.0 pCi/l				8.0 pCi/l	A	11	
Thorium-228	0.87 pCi/l					0.87 pCi/l	B	1.1	
Thorium-230	3.7 pCi/l	60 pCi/l				60 pCi/l	A	62	
Thorium-232	12 pCi/l	60 pCi/l				12 pCi/l	C	62	
Tritium	20,000 pCi/l and 880 pCi/l	20,000				20,000 pCi/l	D	20300	
Uranium-234	3.0 pCi/l			3.0 pCi/l		30 pCi/l	B	64	
Uranium-235	20 pCi/l	3.0 pCi/l		3.0 pCi/l		30 pCi/l	B	9.4	
Uranium-238	5.2 pCi/l	1.7 pCi/l		3.0 pCi/l		30 pCi/l	B	46	
Basis:									
A = ARAR		[a] Record of Decision, March 1994							
B = Carcinogenic Risk Based		[b] Explanation of Significant Differences, August 1995							
C = Noncarcinogenic Risk Based		[c] Summary Statistics for Groundwater, 1996							
D = Colorado Basic Standard for Groundwater (non-COC)		[d] Metro Wastewater Reclamation District Industrial Wastewater Discharge Permit No. I-118							
E = Background		[e] If Practical Quantitation Limit (PQL) is greater than performance standard, then analyzing to PQL is adequate to show standard is achieved.							

United States Environmental Protection Agency
Region VIII
999 18th Street – Suite 500
Denver, Colorado 80202-2466

Record of Decision

Lowry Landfill Superfund Site

Arapahoe County, Colorado

March 1994

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Performance Standard (Fg/l)	Basis
Organics		
1,1-Dichloroethane	–	–
1,1-Dichloroethylene	0.068	B
1,2-Dichloroethylene(cis)	70	D
1,2-Dichloroethylene(trans)	100	D
1,1,1-Trichloroethane	200	D
1,1,2-Trichloroethane	0.32	B
1,1,2,2-Tetrachloroethane	0.089	B
1,2-Dibromo-3-Chloropropane	0.2	D
1,2-Dichlorobenzene	600	D
1,2-Dichloroethane	0.2	B
1,2-Dichloropropane	0.56	D
1,2-Diphenylhydrazine	0.05	D
1,2,4-Trichlorobenzene	20	C
1,2,4,5-Tetrachlorobenzene	2	D
1,3-Dichlorobenzene	620	D
1,4-Dichlorobenzene	75	A
2-Butanone	780	C
2-Chlorophenol	0.1	A
2-Hexanone	–	–
2-Methylnaphthalene	0.0031 (total PAHs)	A
2,3,7,8-TCDD (dioxin equivalence)	.00000022	A
2,4-D(dichlorophenoxyacetic acid)	70	D
2,4-Dichlorophenol	21	A
2,4-Dinitrophenol	14	A
2,4,5 TP(trichlorophenoxypropionic acid)	10	D
2,4,6-Trichlorophenol	2	D
4-Methyl-2-pentanone	780	C
Acetone	1,600	C
Alachlor	2.0	D
Aldicarb	3.0	D
Aldicarb Sulfone	2.0	D
Aldicarb Sulfoxide	4.0	D
Aldrin	0.002	D
Atrazine	3.0	D
Benzene	0.62	B
Benzidine	0.0002	D

Notes:
A = ARAR/TBC.
B = Carcinogenic (1×10^{-6}) target risk for adult.
C = Noncarcinogenic target concentration for child.
D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
– = No information available.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Performance Standard (Fg/l)	Basis
Benzo(a)anthracene	0.0031 (total PAHs)	A
Benzo(a)pyrene (PAH)	0.2	D
Benzyl Alcohol	--	--
Bis(2-chloroethyl)ether	0.016	B
Bis(2-ethylhexyl)phthalate	6.1	B
Bromodichloromethane	0.3	D
Bromoform	4.0	D
Carbazole	--	--
Carbofuran	36	D
Carbon tetrachloride	0.026	B
Chlordane	0.004	D
Chlorobenzene	100	D
Chloroethane	--	--
Chloroform	0.19	A
Chlorophenol	1	D
Dalapon	200	D
DDT Metabolite (DDE)	0.1	D
DDT	0.1	D
Di(2-ethylhexyl)adipate	400	D
Di(2-ethylhexyl)phthalate	6	D
Di-n-Octylphthalate	--	--
Dibenzofuran	--	--
Dibromochloromethane	14	D
Dichloromethane	5	D
Dieldrin	0.002	D
Dinoseb	7	D
Diquat	20	D
Ethylbenzene	680	D
Endothall	100	D
Endrin	0.2	D
Endrin Aldehyde	0.2	D
Ethylenedibromide	0.05	A
Fluoranthene	188	A
Glyphosate	700	D
Heptachlor	0.008	D
Heptachlor Epoxide	0.09	D
Hexachlorobenzene	1	D
Hexachlorobutadiene	1	D

Notes:
A = ARAR/TBC.
B = Carcinogenic (1×10^{-6}) target risk for adult.
C = Noncarcinogenic target concentration for child.
D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
– = No information available.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Performance Standard (Fg/l)	Basis
Hexachlorocyclohexane, Alpha	0.2	D
Hexachlorocyclohexane, Gamma (Lindane)	0.004	D
Hexachlorocyclopentadiene	50	D
Isophorone	1,050	D
Malathion	2,500	D*
Methoxychlor	40	D
Methylene chloride	0.19	A
Monohydric phenol	1	D
Naphthalene	--	--
Nitrobenzene	3.5	D
Oxamyl (vydate)	200	D
PCBs	0.005	D
Pentachlorobenzene	6	D
Pentachlorophenol	0.71	B
Phenanthrene	0.0031 (total PAHs)	A
Phenol	1	D
Picloram	500	D
Simazine	4	D
Styrene	100	D
Tetrachloroethylene	1.5	B
Toluene	1,000	A
Toxaphene	0.03	D
Trans-1,3-dichloropropene	3.4	C
Trichloroethylene	2.6	B
Vinyl chloride	0.037	B
Xylenes (total)	10,000	D
Inorganics and Miscellaneous		
Aluminum	5,000	D
Antimony	6	D
Arsenic	0.049	B
Asbestos (fibers/1)	30,000	D
Barium	1,000	D
Beryllium	4	D
Boron	750	D
Cadmium	5	D
Chloride	250,000	D

Notes:
A = ARAR/TBC.
B = Carcinogenic (1×10^{-6}) target risk for adult.
C = Noncarcinogenic target concentration for child.
D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
D* = Must be met at the western compliance boundary, based on classifications and Water Quality Standards for Ground Water.
– = No information available.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Performance Standard (Fg/l)	Basis
Cobalt	50	A
Coliform (total) per 100 ml	<1	D
Color, color units	15	D
Corrosivity	noncorrosive	D
Copper	200	D
Chromium (as Cr[VI])	50	A
Chromium (total)	50	D
Cyanide	200	D
Fluoride	2,000	D
Foaming Agents	500	D
Iron	300	D
Lead	15	A
Manganese	50	A
Mercury	2	D
Nickel	2	A
Nitrate as N	10,000	D
Nitrate and Nitrite as N	10,000	D
Nitrite as N	1,000	D
pH	6.5 to 8.5	D
Selenium	10	D
Silver	50	D
Sulfate	250,000	D
Thallium	1.1	C
Vanadium	100	D
Zinc	2,000	D
Radionuclides		
Americium-241	1.3 pCi/l	C
Beta and photon emitters, mrem/yr	4	D
Cesium-134	80 pCi/l	D
Gross Alpha	15 pCi/l	D
Lead-210	0.072 pCi/l	B
Plutonium-238, -239, and -240	15 pCi/l	A
Potassium-40	76 pCi/l	C
Radium-226 and -228	5	A
Strontium-90	1.3 pCi/l	B
Thorium-228	0.87 pCi/l	B
Thorium-230	3.7 pCi/l	B
Thorium-232	12 pCi/l	C

Notes:
A = ARAR/TBC.
B = Carcinogenic (1×10^{-6}) target risk for adult.
C = Noncarcinogenic target concentration for child.
D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
– = No information available.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Performance Standard (Fg/l)	Basis
Tritium	880 pCi/l	B
Tritium	20,000 pCi/l	D
Uranium-234	3.0 pCi/l	B
Uranium-235	20 pCi/l	C
Uranium-238	5.2 pCi/l	C
Xylenes (total)	10,000	D

Notes:
A = ARAR/TBC.
B = Carcinogenic (1×10^{-6}) target risk for adult.
C = Noncarcinogenic target concentration for child.
D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
– = No information available.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
999 18th STREET - SUITE 500
DENVER, COLORADO 80202-2466

LOWRY LANDFILL SUPERFUND SITE

EXPLANATION OF SIGNIFICANT DIFFERENCES

AUGUST 1995

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Concentration (Fg/l)		Basis
	Performance Standard	PQL	
Organics			
1,1-Dichloroethane	990		C
1,1-Dichloroethylene	7		A
1,2-Dichloroethylene(cis)	70		D
1,2-Dichloroethylene(trans)	100		D
1,1,1-Trichloroethane	200		D
1,1,2-Trichloroethane	3		A
1,1,2,2-Tetrachloroethane	0.089		B
1,2-Dibromo-3-Chloropropane	0.2		D
1,2-Dichlorobenzene	600		D
1,2-Dichloroethane	0.4	1	A
1,2-Dichloropropane	0.56	1	D
1,2-Diphenlyhydrazine	0.05		D
1,2,4-Trichlorobenzene	70		A
1,2,4,5-Tetrachlorobenzene	2	10	D
1,3-Dichlorobenzene	620		D
1,4-Dichlorobenzene	75		A
2-Butanone	780		C
2-Chlorophenol	0.1		A
2-Hexanone	--		--
2-Methylnaphthalene	0.0031 (total PAHs)		A
2,3,7,8-TCDD (dioxin equivalence)	.00000022	0.2	A
2,4-D (dichlorophenoxyacetic acid)	70		D
2,4-Dichlorophenol	21	50	A
2,4-Dinitrophenol	14	50	A
2,4,5 TP (trichlorophenoxypropionic acid)	50		D
2,4,6-Trichlorophenol	2	50	D
4-Methyl-2-pentanone	780		C
Acetone	1,600		C
Alachlor	2.0		D
Aldicarb	3.0	10	D
Aldicarb Sulfone	2.0	3	D
Aldicarb Sulfoxide	4.0	20	D

Notes:
- A = ARAR/TBC.
- B = Carcinogenic (1×10^{-6}) target risk for adult.
- C = Noncarcinogenic target concentration for child.
- D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
- – = No information available.
- PQL = Practical quantitation limits, levels at which the concentration of a given chemical can be quantified using existing analytical methods. For those chemicals where the PQL exceeds the regulatory value, the PQL will be utilized for measuring compliance.
- ▒ = Performance standard has been changed from the value published in the ROD and/or a PQL has been added.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Concentration (Fg/l)		Basis
	Performance Standard	PQL	
Aldrin	0.002	0.1	D
Atrazine	3.0		D
Benzene	5		A
Benzedine	0.0002	10	D
Benzo(a)anthracene	0.1		A
Benzo(a)pyrene (PAH)	0.2		D
Benzyl Alcohol	--		--
bis(2-Chloroethyl)ether	0.03	10	A
bis(2-Ethylhexyl)phthalate	6.1	10	B
Bromodichloromethane	0.3	1	D
Bromoform	4.0		D
Carbazole	--		--
Carbofuran	36		D
Carbon tetrachloride	0.3	1	A
Chlordane	0.03	1.0	D
Chlorobenzene	100		D
Chloroethane	--		--
Chloroform	6		A
Chlorophenol	0.2		D
Dalapon	200		D
DDT Metabolite (DDE)	0.1		D
DDT (4,4'-DDT)	0.1		D
Di(2-ethylhexyl)adipate	400		D
Di(2-ethylhexyl)phthalate	6	10	D
Di-n-Octylphthalate	--		--
Dibenzofuran	--		--
Dibromochloromethane	14		D
Dieldrin	0.002	0.1	D
Dinoseb	7		D
Diquat	20		D
Endothall	100	115	D
Endrin	0.2		D
Endrin Aldehyde	0.2		D
Ethylbenzene	680		D

Notes:
- A = ARAR/TBC.
- B = Carcinogenic (1×10^{-6}) target risk for adult.
- C = Noncarcinogenic target concentration for child.
- D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
- – = No information available.
- PQL = Practical quantitation limits, levels at which the concentration of a given chemical can be quantified using existing analytical methods. For those chemicals where the PQL exceeds the regulatory value, the PQL will be utilized for measuring compliance.
- ▩ = Performance standard has been changed from the value published in the ROD and/or a PQL has been added.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Concentration (Fg/l)		Basis
	Performance Standard	PQL	
Ethylenedibromide (1,2-dibromoethane)	0.05		A
Fluoranthene	188		A
Glyphosate	700		D
Heptachlor	0.008	0.05	D
Heptachlor Epoxide	0.09		D
Hexachlorobenzene	1	10	D
Hexachlorobutadiene	1	10	D
Hexachlorocyclohexane, Alpha 2-BHC	0.006	0.05	D
Hexachlorocyclohexane, Gamma (Lindane) 2-BHC	0.2		D
Hexachlorocyclopentadiene	50		D
Isophorone	1,050		D
Malathion			*
Methoxychlor	40		D
Methylene chloride	5		A
Monohydric phenol			*
Naphthalene	63		C
Nitrobenzene	3.5	10	D
Oxamyl (vydate)	200		D
PCBs	0.005	1.0	D
Pentachlorobenzene	6	10	D
Pentachlorophenol	1	50	A
Phenanthrene	0.0031 (total PAHs)		A
Phenol	300		D
Picloram	500		D
Simazine	4		D
Styrene	100		D
Tetrachloroethylene	5		A
Toluene	1,000		A
Toxaphene	0.03	5	D
trans-1,3-Dichloropropene	87		A
Trichloroethylene	5		A

Notes:
- A = ARAR/TBC.
- B = Carcinogenic (1×10^{-6}) target risk for adult.
- C = Noncarcinogenic target concentration for child.
- D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
- – = No information available.
- PQL = Practical quantitation limits, levels at which the concentration of a given chemical can be quantified using existing analytical methods. For those chemicals where the PQL exceeds the regulatory value, the PQL will be utilized for measuring compliance.
- ▒ = Performance standard has been changed from the value published in the ROD and/or a PQL has been added.
- * = Chemical should not be in the table because it is not a COC and does not have a Colorado Basic Standard for Ground Water value.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Concentration (Fg/l)		Basis
	Performance Standard	PQL	
Vinyl chloride	2		A
Xylenes (total)	10,000		D
Inorganics and Miscellaneous			
Aluminum	5,000		D
Antimony	6		D
Arsenic	50		A
Asbestos (fibers/l)	30,000		D
Barium	1,000		D
Beryllium	4		D
Boron	750		D
Cadmium	5		D
Chloride	250,000		D
Cobalt	50		A
Coliform (total) per 100 ml	1		D
Color, color units	15		D
Corrosivity	noncorrosive		D
Copper	200		D
Chromium (as Cr[VI])	50		A
Chromium (total)	50		D
Cyanide	200		D
Fluoride	2,000		D
Foaming Agents	500		D
Iron	300		D
Lead	15		A
Manganese	50		A
Mercury	2		D
Nickel	100		A
Nitrate as N	10,000		D
Nitrate and Nitrite as N	10,000		D
Nitrite as N	1,000		D
pH	6.58 to 8.5		D
Selenium	10		D
Silver	50		D
Sulfate	250,000		D

Notes:
- A = ARAR/TBC.
- B = Carcinogenic (1×10^{-6}) target risk for adult.
- C = Noncarcinogenic target concentration for child.
- D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
- – = No information available.
- PQL = Practical quantitation limits, levels at which the concentration of a given chemical can be quantified using existing analytical methods. For those chemicals where the PQL exceeds the regulatory value, the PQL will be utilized for measuring compliance.
- ▒ = Performance standard has been changed from the value published in the ROD and/or a PQL has been added.

Table 11-2
Ground-Water Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Concentration (Fg/l)		Basis
	Performance Standard	PQL	
Thallium	2		A
Vanadium	100		D
Zinc	2,000		D
Radionuclides			
Americium-241	0.2 pCi/l		B
Beta and photon emitters, mrem/yr	4		D
Cesium-134	80 pCi/l		D
Gross Alpha (excluding radon and uranium)	15 pCi/l		D
Lead-210	0.072 pCi/l		B
Plutonium-238, -239, and -240	15 pCi/l		A
Potassium-40	4.3 pCi/l		B
Radium-226 and -228	5 pCi/l		A
Strontium-90	8.0 pCi/l		A
Thorium-228	0.87 pCi/l		B
Thorium-230 and -232	60 pCi/l		A
Tritium	20,000 pCi/l		D
Uranium-234	3.0 pCi/l		B
Uranium-235	3.0 pCi/l		B
Uranium-238	1.7 pCi/l		B

Notes:
- A = ARAR/TBC.
- B = Carcinogenic (1×10^{-6}) target risk for adult.
- C = Noncarcinogenic target concentration for child.
- D = Colorado Basic Standards for Ground Water for chemicals that are not COCs.
- – = No information available.
- PQL = Practical quantitation limits, levels at which the concentration of a given chemical can be quantified using existing analytical methods. For those chemicals where the PQL exceeds the regulatory value, the PQL will be utilized for measuring compliance.
- ▒ = Performance standard has been changed from the value published in the ROD and/or a PQL has been added.

Summary of New Site Performance Standards

Parameter Name	N	Detect	Model Type	Min	Max	Avg	Pred Limit	Perf Stnd	CRDL	New Standard	Units
Alpha, Gross	60	42	normal	0.00	77.70	13.06	55.40	15.00		55.40	pCi/L
Aluminum	70	29	nonpar	23.00	24600.00	590.33	1950.00	5000.00	200.00	5000.00	ug/L
Antimony	89	12	nonpar	1.00	770.00	86.84	770.00	6.00	60.00	770.00	ug/L
Arsenic	138	9	Poisson	0.50	10000.00	80.31	52.18	50.00	10.00	52.18	ug/L
Barium	141	67	nonpar	4.00	200.00	107.59	200.00	1000.00	200.00	1000.00	ug/L
Beryllium	92	6	Poisson	0.89	10.00	2.34	2.89	4.00	5.00	5.00	pCi/L
Beta, Gross	58	42	nonpar	0.00	88.00	19.94	66.54	80.00		80.00	ug/L
Boron	10	5	nonpar	11.00	200.00	115.66	200.00	750.00	750.00	750.00	ug/L
Cadmium	137	1	Possion	1.00	25.00	5.98	5.48	5.00	5.00	5.48	ug/L
Chloride	116	116	nonpar	23000.00	1000000.00	217891.12	1000000.00	250000.00		1000000.00	ug/L
Chromium	137	3	Poisson	2.90	210.00	12.14	11.04	50.00	10.00	50.00	ug/L
Chromium, Hexavalent	58	1	Poisson	10.00	500.00	148.38	83.47	50.00		83.47	ug/L
Cobalt	93	7	Poisson	0.90	200.00	22.02	13.67	50.00	50.00	50.00	ug/L
Copper	93	25	nonpar	2.00	90.90	13.70	90.90	200.00	25.00	200.00	ug/L
Cyanide	76	3	Poisson	0.02	30.00	10.46	7.39	200.00	10.00	200.00	ug/L
Fluoride	59	22	nonpar	210.00	100000.00	17949.83	50000.00	2000.00		50000.00	ug/L
Iron	123	27	nonpar	6.00	43000.00	566.68	2060.40	300.00	100.00	2060.00	ug/L
Lead	140	17	nonpar	0.50	50.00	11.25	50.00	15.00	3.00	50.00	ug/L
Manganese	132	82	nonpar	2.00	1620.00	203.44	1620.00	50.00	15.00	1620.00	ug/L
Mercury	125	8	Poisson	0.01	2.00	0.26	0.78	2.00	0.20	2.00	ug/L
Nickel	97	11	nonpar	14.50	251000.00	2496.85	57.90	100.00	40.00	100.00	ug/L
Nitrogen, Nitrate	71	56	nonpar	50.00	29100.00	7271.55	29100.00	10000.00		29100.00	ug/L
Nitrogen, Nitrate, Nitrite	61	60	nonpar	100.00	34000.00	5124.43	34000.00	10000.00		34000.00	ug/L
Nitrogen, Nitrite	2	0	nonpar	50.00	50.00	50.00		1000.00		1000.00	ug/L
Selenium	133	93	nonpar	1.00	469.00	107.92	371.98	10.00	5.00	371.98	ug/L
Silver	140	0	n/a	3.00	125.00	19.36	n/a	50.00	10.00	50.00	ug/L
Sulfate	131	130	nonpar	25000.00	2400000.00	1298670.23	2400000.00	250000.00		2400000.00	ug/L
Thallium	48	0	n/a	1.10	100.00	24.45	n/a	2.00	10.00	10.00	ug/L
Vanadium	93	2	Poisson	6.00	200.00	23.93	16.65	100.00	50.00	100.00	ug/L
Zinc	97	48	nonpar	3.00	655000.00	6578.59	403.00	2000.00	20.00	2000.00	ug/L

Metro Wastewater Reclamation District
City of Aurora Utilities Department
INDUSTRIAL WASTEWATER DISCHARGE PERMIT NO. I-118

Pursuant to the provisions of Division 2. Article VI, Section 138-291 of the *Aurora City Code*, as amended (hereinafter referred to as the "*City Code*") and Section 6 of the Metro Wastewater Reclamation District *Rules and Regulations Governing the Operation*, *Use*, *and Services of the System* (hereinafter referred to as the "Metro District's *Rules and Regulations*"), **the City and County of Denver and Waste Management**, **Inc.** (hereinafter referred to as the "permittees" for the **Lowry Landfill Superfund Site** hereinafter referred to as the "Site" located at **3500 South Gun Club Road**, **Aurora**, **Colorado**) are authorized by the City of Aurora (hereinafter referred to as the "City") and the Metro Wastewater Reclamation District (hereinafter referred to as the "Metro District" to discharge treated groundwater and incidental operational wastestreams through the outfall(s) identified herein to the sanitary sewer system, in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit is issued to:

City and County of Denver
Department of Environmental Services
1391 Speer Boulevard, Suite 700
Denver, Colorado 80204-2558
and
Waste Management, Inc.
3900 South Wadsworth Boulevard, Suite 620
Lakewood, Colorado 80235

For the:

Lowry Landfill Superfund Site
3500 South Gun Club Road
Aurora, Colorado 80018

This permit shall become effective August 1, 1999

This permit shall expire July 31, 2004

The deadline to apply for permit reissuance is February 1, 2004

Telephone numbers of Regulatory Agencies:

City of Aurora Wastewater Division	303-361-0848
City of Aurora (after business hours)	303-699-3903
Metro Wastewater Reclamation District	303-286-3000

Issued this 14th day of July 1999, by the City of Aurora.

Authorized by: _____
Kevin Wegener, Manager of Wastewater Operations

Issued this 14th day of July 1999, by the Metro Wastewater Reclamation District.

Approved by: _____
Steve Pearlman, Director of Regulatory and Connector Relations

Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting and Review of Superfund Risk Assessments) Final December 2001

RAGS D Update

As of May 1, 2002, Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting and Review of Superfund Risk Assessments) Final December 2001, will supercede an interim version published in 1998 and is effective immediately for all new Comprehensive Environmental Response Compensation and Liability Act (CERCLA) risk assessments.

Background

The March 21, 1995 memorandum on Risk Characterization Policy and Guidance from EPA Administrator Carol Browner directed improvement in the transparency, clarity, consistency, and reasonableness of risk assessments at EPA. Over the years, we have looked for opportunities for improving the presentation of Superfund risk assessments. In addition, the General Accounting Office (GAO), members of Congress, and others have called for the betterment of Superfund risk assessments. The October 1995 Superfund Administrative Reform #6A directed EPA to establish National criteria to plan, report and review Superfund risk assessments. EPA has developed an approach to respond to these challenges, which is presented in RAGS Part D.

An Agency workgroup of regional and headquarters risk assessors (the RAGS Part D Workgroup) has been active since the second quarter of FY 96 developing Planning Tools and other approaches to support standardization of risk assessments. Preliminary draft Planning Tools developed by the Workgroup in 1996 were tested and subjected to regional and state review in the fourth quarter of FY 96. Additional development and testing were performed by the Workgroup in FY 97, and a second regional review occurred in fourth quarter FY 97. Training on the use of RAGS Part D was conducted during FY 98. The Workgroup coordinated extensively with the development team for the National Superfund Database (CERCLIS 3) during FY 97, concurrent with CERCLIS 3 development and testing efforts. RAGS Part D Revision 0 was released in January 1998 as interim guidance and underwent field testing and evaluation for a 3 -year period. During FY 01 the Workgroup worked extensively to address all comments and concerns raised during field testing and evaluation of RAGS Part D Revision 0. This final guidance considers the comments received from users of RAGS Part D Revision 0 and

provides recommended Planning Table and format changes as appropriate. The Planning Tools in RAGS Part D (Planning Tables, Instructions for the Planning Tables, Planning Worksheets, and Example Scenarios) reflect the results of continued development, testing, and are now available for immediate use.

Please click on one of the following topics for further information:

Regional Representatives

The following people are members of the RAGS Part D Workgroup, and have been identified as EPA contacts for RAGS Part D:

Office	RAGS Part D Contact	Phone Number
Region 1	Sarah Levinson Margaret McDonough	(617)918-1276 (617)918-1276
Region II	Marian Olsen	(212)637-4313
Region III	Jennifer Hubbard	(215)814-3328
Region IV	Glenn Adams	(404)562-8667
Region V	Andrew Podowski	(312)886-7573
Region VI	Ghassan Khoury	(214)665-8515
RegionVII	Judy Facey	(913)551-7934
Region VIII	Jim Luey	(303)312-6791
Region IX	Stan Smucker	(415)744-2311
Region X	Dana Davoli	(206)553-2135
EPA Headquarters	Karen L. Martin	703)603-9925

Table 4 (cont.). Monitoring Frequencies & Limitations, Non-Radioactive Pollutants

POLLUTANT	MONITORING FREQUENCY	LIMIT (ug/L) 10 GPM	LIMIT (ug/L) 15 GPM	LIMIT (ug/L) 20 GPM	**METRO MDL** [1] (ug/L)
Acrylonitrile	Monthly	117	78	58	50
Additive Limit [3]	Monthly	4.390	4.390	4.390	n/a
Arsenic (total)	Monthly	330	330	330	10
Benzene	Monthly	44	44	44	5
BETX[4]	Monthly	750	750	750	5
Bis (2-Ethylhexyl) Phthalate	Monthly	4,670	3,110	2.330	10
Carbon disulfide	Monthly	190	190	190	50
Carbon Tetrachloride	Monthly	86	86	78	5
Chloroform	Monthly	146	97	73	5
Ethylbenzene	Monthly	2,640	2,640	2.640	5
Manganese	Monthly	45.600	30.400	22.800	20
Methylene Chloride	Monthly	3.990	2.660	1.990	5
Pentachlorophenol	Monthly	544	363	272	50
Phenol	Monthly	45.600	30.400	22.800	10
Selenium (total)	Monthly	660	660	660	5
Tetrachloroethylene	Monthly	1.500	1.500	1,410	5
Toluene	Monthly	2,650	2,650	2,650	5
Trichloroethylene	Monthly	1,560	1,040	780	5
Vinyl Chloride	Monthly	18.5	12.3	9.2	5
Xylenes	Monthly	2.730	2.730	2.730	5
Zinc (total)	Monthly	15,600	15.600	15.600	20
1,2-Dichloropropane	Quarterly	156	104	78	5
2,4-D	Quarterly	45.600	30,400	22,800	2
4,4-DDT	Quarterly	0.97	0.65	0.49	0.1
Beryllium	Quarterly	15.6	10.4	7.8	20
Chlorobenzene	Quarterly	1,000	1,000	1,000	0.5
Cyanide (total)	Quarterly	2.000	2.000	2.000	30
Ethylene Glycol	Quarterly	45,600	30.400	22,800	5,000
PCBs	Quarterly	4.86	3.24	2.43	1
Chlorides	Quarterly	no limit	no limit	no limit	4,000
Sulfates	Quarterly	no limit	no limit	no limit	5,000
1,2,4-Trichlorobenzene	Yearly	390	390	390	10
Cadmium (total)	Yearly	3.400	2.410	1,810	10
Chromium (total)	Yearly	3.600	3.600	3,600	20
Copper (total)	Yearly	6.100	6.100	6,100	20
Heptachlor	Yearly	0.3	0.3	0.3	0.05

Table 4 (cont.). Monitoring Frequencies & Limitations, Non-Radioactive Pollutants

POLLUTANT	MONITORING FREQUENCY	LIMIT (ug/L) 10 GPM	LIMIT (ug/L) 15 GPM	LIMIT (ug/L) 20 GPM	**METRO MDL [1]** (ug/L)
Lead (total)	Yearly	2.200	2.200	2.200	10
Mercury (total)	Yearly	130	85	64	0.2
Molybdenum (total)	Yearly	710	710	710	30
Naphthalene	Yearly	4.850	4,850	4,850	10
Nickel (total)	Yearly	5,600	5,600	5.600	20
Silver (total)	Yearly[5]	2,900	2.030	1,520	10
Styrene	Yearly	4,260	4,260	4,260	5.0
Vinyl Acetate	Yearly	2,710	2,710	2,710	10.0
1,2-Dibromoethane (EDB)	Yearly	no limit	no limit	no limit	5
1,2-Dichloroethene (cis)	Yearly	no limit	no limit	no limit	5
1,3-Dichloropropene (trans)	Yearly	no limit	no limit	no limit	5
1,4-Dichlorobenzene	Yearly	no limit	no limit	no limit	10
2-Butanone (MEK)	Yearly	no limit	no limit	no limit	50
2-Chlorophenol	Yearly	no limit	no limit	no limit	10
2-Hexanone	Yearly	no limit	no limit	no limit	50
2-Methylnaphthalene	Yearly	no limit	no limit	no limit	10
2-Methylphenol	Yearly	no limit	no limit	no limit	10
2,4-Dichlorophenol	Yearly	no limit	no limit	no limit	10
2,4-Dimethylphenol	Yearly	no limit	no limit	no limit	10
2,4-Dinitrophenol	Yearly	no limit	no limit	no limit	50
4-Chloroaniline	Yearly	no limit	no limit	no limit	20
4-Methyl-2-Pentanone (MIBK)	Yearly	no limit	no limit	no limit	50
4-Methylphenol	Yearly	no limit	no limit	no limit	10
4,4-DDD	Yearly	no limit	no limit	no limit	0.1
4,4-DDE	Yearly	no limit	no limit	no limit	0.1
Aldrin	Yearly	no limit	no limit	no limit	0.1
Aluminum	Yearly[5]	no limit	no limit	no limit	100
Aniline	Yearly	no limit	no limit	no limit	20
Antimony	Yearly[5]	no limit	no limit	no limit	100
Barium	Yearly[5]	no limit	no limit	no limit	100
Benzo(a)anthracene	Yearly	no limit	no limit	no limit	10
Benzo(b)fluoranthene	Yearly	no limit	no limit	no limit	10
Benzoic acid	Yearly	no limit	no limit	no limit	50
Benzyl alcohol	Yearly	no limit	no limit	no limit	20
Benzyl Butyl Phthalate	Yearly	no limit	no limit	no limit	10

Table 4 (cont.). Monitoring Frequencies & Limitations, Non-Radioactive Pollutants

POLLUTANT	MONITORING FREQUENCY	LIMIT (ug/L) 10 GPM	LIMIT (ug/L) 15 GPM	LIMIT (ug/L) 20 GPM	METRO MDL[1] (ug/L)
beta-BHC	Yearly	no limit	no limit	no limit	0.05
Bis(2-Cholorethyl)Ethene	Yearly	no limit	no limit	no limit	10
Carbazole	Yearly	no limit	no limit	no limit	20
Chloroethane	Yearly	no limit	no limit	no limit	5
Cobalt	Yearly[5]	no limit	no limit	no limit	50
Dibenzofuran	Yearly	no limit	no limit	no limit	10
Dieldrin	Yearly	no limit	no limit	no limit	0.1
Di-n-Butyl Phthalate	Yearly	no limit	no limit	no limit	10
Di-n-Octyl Phthalate	Yearly	no limit	no limit	no limit	10
Endrin	Yearly	no limit	no limit	no limit	0.1
Endrin Keton	Yearly	no limit	no limit	no limit	0.1
Fluoranthene	Yearly	no limit	no limit	no limit	10
Fluoride	Yearly[5]	no limit	no limit	no limit	100
gamma-BHC	Yearly	no limit	no limit	no limit	0.05
gamma-Chlordane	Yearly	no limit	no limit	no limit	0.1
Hexachlorocyclopentadiene	Yearly	no limit	no limit	no limit	10
Phenanthrene	Yearly	no limit	no limit	no limit	10
Pyrene	Yearly	no limit	no limit	no limit	10
Thallium	Yearly[5]	no limit	no limit	no limit	100
Vanadium	Yearly[5]	no limit	no limit	no limit	10
Whole Effluent Toxicity	Yearly	no limit	no limit	no limit	N/A

(1) For inorganic pollutants the limits shown are instrument detection limits, not MDLs.

(2) MDLs are congener-specific

(3) Additive limit = sum of 1,1-Dichloroethane + 1,1-Dichloroethylene + 1,1,1-Trichloroethane+ 1,1,2-Trichloroethane + 1,1,2,2-Tetrachloroethane + 1,2-Dichloroethane 1,2-Dichloroethene (trans) + Acrylonitrile + Benzene + Carbon Tetrachloride + Chloroform + Methylene Chloride + Tetrachloroethylene + Trichloroethylene + Vinyl Chloride.

(4) BETX = Benzene + Ethylbenzene + Toluene + ortho, meta and para Xylenes.

(5) Metro's monitoring may be used to fulfill this monitoring requirement.

Table 5. Monitoring Frequencies & Limitations, Radionuclides

RADIONUCLIDES	MONITORING FREQUENCY(1)	ABSOLUTE MAXIMUM up to 20 gpm (pCi/L)	DETECTION LIMIT (pCi/L)
Americium-241	2/Month	0.27	0.1
Beta/Photon emitters	2/Month	168	4(beta/5(photon)
Gross Alpha	2/Month	115	3.0
Plutonium-238+239+240	2/Month	0.31	0.05
Cesium-134	2/Quarter	95	5.0
Lead-210	2/Quarter	3.3	2.0
Potassium-40	2/Quarter	330	10
Radium-226 + 228	2/Quarter	7.1	0.2(226)/1.0(228)
Strontium-90	2/Quarter	11	1
Thorium-228	2/Quarter	1.1	0.4
Thorium-230 + 232	2/Quarter	62	0.4
Tritium	2/Quarter	20,300	500
Uranium-234	2/Quarter	64	1.3
Uranium-235	2/Quarter	9.4	1.3
Uranium-238	2/Quarter	46	1.3

(1) Monitoring frequencies will be reduced to half those specified 18 months after commencement of discharge.

The limits shown for many of the pollutants in the above tables differ from those calculated as preliminary limits and included in the "Draft Evaluation of the POTW Treatment Option" prepared for the City and County of Denver, Chemical Waste Management, Inc., and Waste Management of Colorado, Inc., (April 23, 1996). Table 6 and accompanying footnotes explain the differences between the preliminary limits and those presented in this document as the current limits. Because the preliminary limits were based on a projected 20 gpm flow rate from the Site, Table 6 compares those limits with the current limits at the same flow rate.

Table 6 contains all pollutants proposed to be limited in the "Draft Evaluation," plus pollutants that were not proposed to be limited initially, but for which limits were subsequently developed. Radionuclides, for which limits were yet to be determined at the time the “Draft Evaluation” was prepared, are not discussed in the following table, nor are those pollutants which were not proposed to be limited, and are still not proposed to be limited. The entry "nl" in the table next to a value indicates that a limit was calculated, but that no limit was proposed based on the limit-setting criteria discussed above.

Table 6-3
Air Quality Performance Standards

	ROD [a]		ESD [b]		Five-Year Review Standards [c]				
Chemical/Element	AAL	TEL	AAL	TEL	AAL	TEL	Risk-Based	LFG Flare [d]	FTPA Treatment Cell [e]
Organics									
1,1,1-Trichloroethane	1038.37	1038.37			1038.37	1038.37	--	1.56E+07	1.71E+08
1,1,2-Trichloroethane	0.06	14.84			0.06	14.84	--	5.99E+04	4.41E+04
1,1-Dichloroethane	--	--			--	--	521	7.82E+06	8.56E+07
1,1,2,2-Tetrachloroethane	0.02	18.67			0.02	18.67	--	2.00E+04	1.47E+04
1,2,4 Trichlorobenzene	--	--			--	--	11	1.65E+05	1.81E+06
1,2-Dichloroethylene (total)	107.81	215.62			107.81	215.62	--	3.24E+06	3.54E+07
1,1-Dichloroethylene (vinylidene chloride)	-- [f]	-- [f]			0.02 [f]	1.08 [f]	0.049	7.36E+02	7.95E+03
1,2-Dichlorobenzene (ortho)	81.74	81.74			81.74	81.74	--	1.23E+06	1.34E+07
1,2-Dichloroethane	0.04	11.01			0.04	11.01	--	3.99E+04	2.94E+04
1,2-Dichloropropane	0.05	94.23			0.05	0.9	--	4.99E+04	3.67E+04
1,4-Dichlorobenzene	0.18	122.61			0.18	122.61	--	1.80E+05	1.32E+05
2,3,7,8-TCDD (dioxin equivalence)	--	--			--	--	--		
2,4-Dichlorophenol	--	--			--	--	--		
2,4-Dimethylphenol	–	–			--	--	--		
2,4-Dinitrophenol	–	–			--	--	--		
2-Butanone (methyl ethyl ketone)	32.07	32.07			10	200	--	4.82E+05	5.27E+06
2-Chlorophenol	--	--			--	--	--		
2-Hexanone	10.88	10.88			10.88	10.88	--	1.63E+05	1.79E+06
2-Methylphenol	--	--			--	--	--		
2-Methylnaphthalene [g]	14.25	14.25			14.25	14.25	--	2.14E+05	
4,4-DDT	--	--			--	--	0.0103	1.55E+02	
4-Methylphenol	--	--			--	--	--		
4-Methyl-2-pentanone	--	--			--	--	--		
Acetone	160.54	160.54			160.54	160.54	--	2.41E+06	2.64E+07
Acrylonitrile	0.01	1.18			0.01	0.4	--	9.98E+03	7.35E+03
Aniline	0.14	2.07			0.1	0.2	--	3.11E+04	
Benzene	0.12	1.74			0.12	1.74	--	2.61E+04	8.80E+04
Benzo(a)anthracene	--	--			--	--	--		
Benzyl alcohol	--	--			--	--	--		
Bis(2-chloroethyl)ether	--	--			--	--	--		
Bis(2-ethylhexyl)phthalate	--	--			--	--	--		
Carbazole	--	--			--	--	--		
Carbon disulfide	0.27	0.27	0.82	0.82	0.1	0.1	--	1.23E+04	1.35E+05

units are ug/m3

Table 6-3
Air Quality Performance Standards

	ROD [a]		ESD [b]		Five-Year Review Standards [c]				
Chemical/Element	AAL	TEL	AAL	TEL	AAL	TEL	Risk-Based	LFG Flare [d]	FTPA Treatment Cell [e]
Carbon tetrachloride	0.07	85.52			0.07	85.52	--	6.99E+04	5.15E+04
Chlorobenzene	6.26	93.88			6.26	93.88	--	1.41E+06	4.60E+06
Chloroethane	358.78	717.55			358.78	717.55	--	1.08E+07	1.18E+08
Chloroform	0.04	132.76			0.04	132.76	--	3.99E+04	2.94E+04
Chloromethane (methyl chloride)	--	--			--	--	0.56	8.41E+03	9.20E+04
Dibenzofuran	--	--			--	--	--		
Dieldrin	--	--			--	--	0.000219	3.29E+00	
Di-n-Octylphthalate	--	--			--	--	--		
Ethylbenzene	118.04	118.04			300	300	--	1.77E+06	1.94E+07
Ethylenedibromide	--	--			--	--	--		
Fluoranthene	--	--			--	--	--		
Gamma BHC (lindane)	0.003	0.14			0.003	0.14	--	4.51E+01	
Heptachlor	0.001	0.14			0.001	0.14	--		
Methylene chloride	0.24	9.45			--	--	--	1.42E+05	1.76E+05
Naphthalene [g]	14.25	14.25			14.25	14.25	--	2.14E+05	
NDMA	--	--			--	--	0.0001	1.50E+00	
PCBs	0.0005	0.003			0.0005	0.003	--	7.51E+00	
Pentachlorophenol	0.01	0.01			0.01	0.01	--	1.50E+02	
Phenanthrene	–	–			--	--	--		
Phenol	52.33	52.33			52.33	52.33	--	7.86E+05	
Styrene	1.75	115.81			2	200	--	1.74E+06	1.29E+06
Tetrachloroethylene	0.02	922.18			0.02	922.18	--	2.00E+04	1.47E+04
Toluene	10.24	10.24			20	80	--	1.54E+05	1.66E+06
trans-1,3-Dichloropropene	--	--			--	--	--		
Trichloroethylene	0.61	36.52			0.61	36.52	--	5.48E+05	4.49E+05
Vinyl chloride [h]	3.47	0.38			0.38	3.47	--	5.21E+04	2.79E+05
Xylenes (total)	11.8	11.8			11.8	11.8	--	1.77E+05	1.93E+06
Inorganics									
Ammonia	4.73	4.73			100	100	--	7.10E+04	
Arsenic	--	--			0.0002	0.0005	0.0007	1.05E+01	
Barium	--	--			--	--	0.5	7.51E+03	
Beryllium	0.0004	0.001			0.0004	0.001	--	6.01E+00	
Cadmium	0.001	0.003			0.001	0.003	--	1.50E+01	
Chromium	--	--			0.68	1.36	0.000085		

Table 6-3
Air Quality Performance Standards

	ROD [a]		ESD [b]		Five-Year Review Standards [c]				
Chemical/Element	AAL	TEL	AAL	TEL	AAL	TEL	Risk-Based	LFG Flare [d]	FTPA Treatment Cell [e]
Lead	0.07	0.14			0.07	0.14	--	1.50E+03	
Manganese	--	--			--	--	1	1.50E+04	
Mercury	--	--			0.01	0.14	0.3	4.51E+03	
Nickel	0.18	0.27			0.18	0.27	--	2.70E+03	
Selenium	0.54	0.54			0.54	0.54	--	8.11E+03	
Vanadium	0.27	0.27			0.27	0.27	--	4.05E+03	
[a] Record of Decision, March 1994									
[b] Explanation of Significant Differences, August 1995									
[c] Commonwealth of Massachusetts Department of Environmental Protection TELs and AALs for Ambient Air, December 1995									
AAL - ambient; TEL threshold effect level									
[d] Final Compliance Monitoring Plan, Landfill Gas Remedy, November 14, 1997									
[e] Final Operations, Sampling, and Monitoring Plan, FTPA Waste Pit Remedy, July 24, 1998									
[f] 1994 ROD did not list Massachusetts standards for 1,1-dichloroethene mistakenly omitted. Standard was listed under the chemical name vinylidene chloride and should have been included									
[g] Value is for total of 2-methylnapthalene and napthalene									
[h] Values for AAL and TEL were mistakenly reversed in the ROD									

units are ug/m3

United States Environmental Protection Agency
Region VIII
999 18th Street – Suite 500
Denver Colorado 80202-2466

Record of Decision

Lowry Landfill Superfund Site

Arapahoe County, Colorado

March 1994

Table 11-5
Air Quality Performance Standards
Sitewide Remedy

Chemical/Element	Concentration (µg/m³) Annual Average (AAL)	24-Hour Average (TEL)	Other	Source
Organics				
1,1,1-Trichloroethane	1038.37	1038.37	--	Massachusetts Guidance
1,1,2-Trichloroethane	0.06	14.84	--	Massachusetts Guidance
1,1-Dichloroethane	--	--	521	Noncarcinogenic Risk
1,1,2,2-Tetrachloroethane	0.02	18.67	--	Massachusetts Guidance
1,2,4 Trichlorobenzene	--	--	11	Based on RfC
1,2-Dichloroethylene (total)	107.81	215.62	--	Massachusetts Guidance
1,1-Dichloroethylene	--	--	0.049	Carcinogenic Risk
1,2-Dichlorobenzene (ortho)	81.74	81.74	--	Massachusetts Guidance
1,2-Dichloroethane	0.04	11.01	--	Massachusetts Guidance
1,2-Dichloroethylene	107.81	215.62	--	Massachusetts Guidance
1,2-Dichloropropane	0.05	94.23	--	Massachusetts Guidance
1,4-Dichlorobenzene	0.18	122.61	--	Massachusetts Guidance
2,3,7,8-TCDD (dioxin equivalence)	--	--	--	
2,4-Dichlorophenol	--	--	--	
2,4-Dimethylphenol	--	--	--	
2,4-Dinitrophenol	--	--	--	
2-Butanone	32.07	32.07	--	
2-Chlorophenol	--	--	--	
2-Hexanone	10.88	10.88	--	Massachusetts Guidance
2-Methylphenol	--	--	--	
2-Methylnaphthalene	14.25[a]	14.25[a]	--	Massachusetts Guidance
4,4-DDT	--	--	0.0103	Based on Slope factor
4-Methylphenol	--	--	--	
4-Methyl-2-pentanone	--	--	--	
Acetone	160.54	160.54	--	Massachusetts Guidance
Acrylonitrile	0.01	1.18	--	Massachusetts Guidance
Aniline	0.14	2.07	--	Massachusetts Guidance
Benzene	0.12	1.74	--	Massachusetts Guidance
Benzo(a)anthracene	--	--	--	
Benzyl alcohol	--	--	--	
Bis(2-chloroethyl)ether	--	--	--	

[a]Value is for sum of naphthalene and 2-methyl naphthalene.

Table 11-5
Air Quality Performance Standards
Sitewide Remedy

Chemical/Element	Concentration (µg/m³) Annual Average (AAL)	24-Hour Average (TEL)	Other	Source
Bis(2-ethylhexyl)phthalate	--	--	–	
Carbazole	--	--	--	
Carbon disulfide	0.27	0.27	--	Massachusetts Guidance
Carbon tetrachloride	0.07	85.52	--	Massachusetts Guidance
Chlorobenzene	6.26	93.88	--	Massachusetts Guidance
Chloroethane	358.78	717.55	--	Massachusetts Guidance
Chloroform	0.04	132.76	--	Massachusetts Guidance
Chloromethane (methyl chloride)	--	--	0.56	Based on Slope Factor
Dibenzofuran	--	--	--	
Dieldrin	--	--	0.000219	Based on Slope Factor
Di-n-Octylphthalate	--	--	--	
Ethylbenzene	118.04	118.04	--	Massachusetts Guidance
Ethylenedibromide	--	--	--	
Fluoranthene	–	–	–	
Gamma BHC (lindane)	0.003	0.14	--	Massachusetts Guidance
Heptachlor	0.001	0.14	--	Massachusetts Guidance
Methylene chloride	0.24	9.45	--	Massachusetts Guidance
Naphthalene	14.25[a]	14.25[a]	--	Massachusetts Guidance
NDMA	–	–	0.0001	Based on Slope Factor
PCBs	0.0005	0.003	--	Massachusetts Guidance
Pentachlorophenol	0.01	0.01	--	Massachusetts Guidance
Phenanthrene	--	–	–	
Phenol	52.33	52.33	--	Massachusetts Guidance
Styrene	1.75	115.81	--	Massachusetts Guidance
Tetrachloroethylene	0.02	922.18	--	Massachusetts Guidance
Toluene	10.24	10.24	--	Massachusetts Guidance
trans-1,3-Dichloropropane	--	--	–	
Trichloroethylene	0.61	36.52	--	Massachusetts Guidance
Vinyl chloride	3.47	0.30	0.028	Carcinogenic Risk
Xylenes (total)	11.8	11.8	--	Massachusetts Guidance

[a]Value is for sum of naphthalene and 2-methyl naphthalene.

Table 11-5
Air Quality Performance Standards
Sitewide Remedy

Chemical/Element	Concentration (µg/m³) Annual Average (AAL)	24-Hour Average (TEL)	Other	Source
Inorganics				
Ammonia	4.73	4.73	--	Massachusetts Guidance
Arsenic	--	--	0.0007	Based on Slope Factor
Barium	--	--	0.5	Based on Unit Risk
Beryllium	0.0004	0.001	--	Massachusetts Guidance
Cadmium	0.001	0.003	--	Massachusetts Guidance
Chromium	--	--	0.000085	Based on Slope Factor
Lead	0.07	0.14	--	Massachusetts Guidance
Manganese	--	--	1	Based on RfC
Mercury	--	--	0.3	Based on Unit Risk
Nickel	0.18	0.27	--	Massachusetts Guidance
Selenium	0.54	0.54	--	Massachusetts Guidance
Vanadium	0.27	0.27	--	Massachusetts Guidance

[a]Value is for sum of naphthalene and 2-methyl naphthalene.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 300
DENVER, CO 80202-2466
http://www.epa.gov/region08

May 8, 2001

MAY 10 2001

Ref: 8EPR-SR

MEMORANDUM

SUBJECT: Minor Modification of the March 10, 1994 Record of Decision, Lowry Landfill Superfund Site, Arapahoe County, Colorado

FROM: Gwendolyn Hooten, Remedial Project Manager

TO: Lowry Landfill Superfund Site File

The purpose of this memorandum is to document EPA's justification for a minor modification of the March 10, 1994 Record of Decision (ROD) for the Lowry Landfill Superfund Site. The modification is considered minor because it has little impact on the overall scope, performance, or cost of the remedy selected in the ROD.

This modification changes the 1,1-DCE air quality performance standard listed in Table 11-5 of the ROD. Table 11-5 of the ROD lists the Air Quality Performance Standards for the Sitewide Remedy. In 1989, the Massachusetts Department of Environmental Quality Engineering(MDEQE), Office of Research and Standards (ORS) developed protective exposure concentrations of selected air contaminants. These ORS concentrations were chosen as the primary basis for selecting standards that would apply to the chemicals of concern for the Lowry Landfill Sitewide Remedy. In the event that a compound of concern was not included on the 1989 ORS list of compounds, an alternate basis for a performance standard, such as reference concentration, carcinogenic risk, or slope factors, was considered. In the case of 1,1-DCE (CAS#75-35-4), EPA used other available information to develop 0.049 ug/m^3 as the standard in the ROD as indicated in the "Other" column of the table. However, the 1989 ORS did include a standard for 1,1-DCE under the chemical name vinylidene chloride. This modification acknowledges the oversight in the ROD, and reaffirms the MDEQE ORS as the primary basis for selecting air quality standards. The exposure concentrations for 1,1-DCE in Table 11-5 are now as follows:

Annual Average Allowable Ambient Limit (AAL)	0.02 ug/m^3
24-hour average Threshold Effects Exposure Limit (TEL)	1.08 ug/m^3

These numbers replace the air quality performance standard for 1,1-DCE of 0.049 ug/m^3

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

WILLIAM F. WELD
Governor

ARGEO PAUL CELLUCCI
Lt. Governor

TRUDY COXE
Secretary

DAVID B. STRUHS
Commissioner

MEMORANDUM

TO: Bob Donaldson, Donald Squires, Steve Dennis, Don Steele, Tom Denormandie, Nancy Seidman, Leah Weiss, Bob Boiselle, Ed MacDonald-NERO, Mike Maher-CRO, Chris Tilden-SERO, Loretta Oi-WRO, Mark Scheelweis-WRO, Tom Cusson-CRO, John Winkler-SERO, Jim Belsky-NERO

FROM: Carol Rowan West, Director, Office of Research and Standards
Barbara Kwetz Director, Division of Air Quality Control

DATE: December 6, 1995

SUBJECT: Revised Air Guidelines

We are pleased to provide you with an updated list of DEP's ambient air guidelines. This list represents the culmination of work of staff of the Office of Research and Standards (ORS) who have reviewed the scientific literature and revised the guidelines to take into account new toxicity data. The revisions have undergone external scientific peer review.

A notable change we would like to call to your attention is the use of Reference Concentrations (RfCs) as a starting point for noncancer effects rather than occupational limits. The U.S. EPA establishes RfCs which are defined as air concentrations of a chemical to which a person can be exposed for a lifetime without any anticipated adverse health effects. In addition, ORS has set air guidelines for a few new chemicals including carbon disulfide, carbonyl sulfide, antimony, arsenic, hydrogen bromide, and hydrogen cyanide.

As you may know, the Clean Air Act Amendments require the U.S. EPA to develop and implement a national air toxics program which will be implemented by DEP. As the national program develops further, we will be developing and sending you a policy to clarify how the new EPA standards will be utilized in place of these air guidelines. Until that time, you should continue to use these updated air guidelines in your work.

If you have any questions about the changes in the air guidelines, please contact Diane Manganaro or Tsedash Zewdie at ORS' (292-5570). Thank you.

cc: Michael Hutcheson
Diane Manganaro
Tsedash Zewdie

(December, 1995)

Massachusetts Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air

CHEMICAL	CAS NUMBER	Threshold Effects Exposure Limit (TEL)		Allowable Ambient Limit (AAL)	
		(24-hour average)		(annual average)	
		ug/m3	(ppb)	ug/m3	(ppb)
Acetaldehyde	75070	2	(1.11)	0.5	(0.28)
Acetone	67641[3]	160.54	(68.03)	160.54	(68.03)
*Acrylonitrile	107131	0.4	(0.18)	0.01	(0.0046)
Alkanes/Alkenes (not to exceed 25% n-hexane)		95.24	-	47.62	-
*Ammonia	764417	100	(143.57)	100	(143.57)
*Aniline	62533	0.2	(0.053)	0.1	(0.026)
*Antimony	7440360	2	-	1	-
Arsenic	7440382	0.0005	-	0.0002	-
Asbestos	1332214	0.0002 f/cm3		0.000004 f/cm3	
Benzene	71432	1.74	(0.54)	0.12	(0.04)
Benzyl Chloride	100447	14.08	(2.72)	0.94	(0.18)
Beryllium	7440417	0.001	-	0.0004	-
1,3-Butadiene	106990	1.20	(0.54)	0.003	(0.002)
n-Butyl Alcohol	71363	412.24	(136.05)	412.24	(136.05)
Cadmium	7440439	0.003	-	0.001	-
Calcium Chromate	13765190	0.003	-	0.0001	-
Carbon Disulfide	75150	0.1	(0.032)	0.1	(0.032)
Carbon Tetrachloride	56235	85.52	(13.61)	0.07	(0.01)
Carbonyl Sulfide	463581	0.1	(0.041)	0.1	(0.041)
Chlordane	57749	0.14	(0.008)	0.03	(0.002)

(December, 1995)

Massachusetts Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air

CHEMICAL	CAS NUMBER	Threshold Effects Exposure Limit (TEL)		Allowable Ambient Limit (AAL)	
		(24-hour average)		(annual average)	
		ug/m3	(ppb)	ug/m3	(ppb)
Chlorine	7782505	3.95	(1.36)	3.95	(1.36)
Chlorobenzene	108907	93.88	(20.41)	6.26	(1.36)
Chloroethane	75003	717.55	(272.11)	358.78	(136.05)
Chloroform	67663	132.76	(27.21)	0.04	(0.01)
Chloroprene	126998	0.98	(0.27)	0.98	(0.27)
Chromic Acid	7738945	0.003	-	0.0001	-
Chromium (metal)	7440473	1.36	-	0.68	-
Chromium (VI) Compounds		0.003	-	0.0001	-
Copper	7440508	0.54	-	0.54	-
p-Cresol	106445	24.05	(5.44)	12.02	(2.72)
Cyclohexane	110827	280.82	(81.63)	280.82	(81.63)
o-Dichlorobenzene	95501	81.74	(13.61)	81.74	(13.61)
p-Dichlorobenzene	106467	122.61	(20.41)	0.18	(0.03)
1,2-Dichloroethane	107062	11.01	(2.72)	0.04	(0.01)
1,2-Dichloroethylene	540590	215.62	(54.42)	107.81	(27.21)
Dichloromethane	75092	9.45	(2.72)	0.24	(0.07)
1,2-Dichloropropane	78875	0.9	(0.19)	0.05	(0.01)
Diethylamine	109897	8.13	(2.72)	4.07	(1.36)
Dis(2-ethylhexyl)phthalate	117817	1.36	(0.09)	0.77	(0.05)
Dimethylformamide	68122	6	(2.01)	3	(1.004)

(December, 1995)

Massachusetts Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air

CHEMICAL	CAS NUMBER	Threshold Effects Exposure Limit (TEL)		Allowable Ambient Limit (AAL)	
		(24-hour average)		(annual average)	
		ug/m3	(ppb)	ug/m3	(ppb)
1,4-Dioxane	123911	24.49	(6.80)	0.24	(0.07)
Diphenyl	92524	0.34	(0.05)	0.09	(0.01)
Diphenylamine	122394	2.72	(0.39)	0.68	(0.10)
*Ephichlorohydrin	106898	0.08	(0.021)	0.08	(0.021)
Ethanol	64175	51.24	(27.21)	51.24	(27.21)
Ethyl Acetate	141786	391.84	(108.84)	391.84	(108.84)
Ethyl Acrylate	140885	0.56	(0.14)	0.28	(0.07)
*Ethylbenzene	100414	300	(69.09)	300	(69.09)
Ethylene Glycol	107211	34.50	(13.61)	34.50	(13.61)
Ethyl Ether	60297	329.80	(108.84)	164.90	(54.42)
Flouride	16984488	6.80	(8.76)	6.80	(8.76)
Formaldehyde	50000	0.33	(0.27)	0.08	(0.06)
Furan	110009	0.40	(0.14)	0.02	(0.007)
Heptachlor	76448	0.14	(0.009)	0.001	(0.0001)
Hexachlorocyclopentadiene	77474	0.006	(0.0005)	0.006	(0.0005)
Hexachloroethane	67721	0.53	(0.05)	0.25	(0.03)
2-Hexanone	591786	10.88	(2.66)	10.88	(2.66)
Hydrazine	302012	0.007	(0.005)	0.002	(0.001)
Hydrogen Bromide	10035106	5	(1.51)	5	(1.51)
Hydrogen Chloride	7647010	7	(4.69)	7	(4.69)

(December, 1995)

Massachusetts Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air

CHEMICAL	CAS NUMBER	Threshold Effects Exposure Limit (TEL)		Allowable Ambient Limit (AAL)	
		(24-hour average)		(annual average)	
		ug/m3	(ppb)	ug/m3	(ppb)
Hydrogen Fluoride	7664393	0.68	(0.83)	0.34	(0.42)
* Hydrogen Sulfide	7783064	0.9	(0.65)	0.9	(0.65)
Isoamyl Acetate	123922	144.76	(27.21)	144.76	(27.21)
Isobutyl Acetate	110190	193.77	(40.82)	193.77	(40.82)
Isobutyl Alcohol	78831	41.22	(13.61)	41.22	(13.61)
Isopropyl Acetate	108214	283.81	(68.03)	283.81	(68.03)
Lead	7439921	0.14	-	0.07	-
Lead Subacetate	1335326	0.14	-	0.01	-
Lindane	58899	0.14	(0.11)	0.003	(0.0002)
Maleic Anhydride	108316	0.27	(0.07)	0.14	(0.03)
Mercury (elemental)	7439976	0.14	-	0.07	-
(inorganic)		0.14	-	0.01	-
(methylmercury)		0.003	-	0.0014	-
Methanol	67561	7.13	(5.44)	7.13	(5.44)
*1,2-Methoxy Ethanol	109864	3	(0.96)	2	(0.64)
Methyl Acrylate	96333	9.57	(2.72)	4.79	(1.36)
Methyl Bromide	74839	5.28	(1.36)	2.64	(0.68)
* Methyl Ethyl Ketone (MEK)	78933	2.00	(68.82)	10	(3.39)
Methyl Isobutyl Ketone	108101	55.70	(13.61)	55.70	(13.61)

(December, 1995)

Massachusetts Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air

CHEMICAL	CAS NUMBER	Threshold Effects Exposure Limit (TEL)		Allowable Ambient Limit (AAL)	
		(24-hour average)		(annual average)	
		ug/m3	(ppb)	ug/m3	(ppb)
(MIBK)					
Methyl Methacrylate	80626	22.27	(5.44)	22.27	(5.44)
Naphthalene (including 2-methylnaphthalene)	91203	14.25	(2.72)	14.25	(2.72)
Nickel (metal)	7440020	0.27	-	0.18	-
Nickel Oxide	1313991	0.27	-	0.01	-
Nitrobenzene	98953	13.69	(2.72)	6.84	(1.36)
Pentachlorophenol	87865	0.01	(0.001)	0.01	(0.001)
Phenol	108952	52.33	(13.61)	52.33	(13.61)
Phosphoric Acid	7664382	0.27	(0.07)	0.27	(0.07)
Phthalic Anhydride	85449	1.65	(0.27)	0.82	(0.14)
PCBs	1336363	0.003	-	0.0005	-
Propyl Alcohol	71238	133.63	(54.42)	133.63	(54.42)
*Propylene Oxide	75569	6	(2.53)	0.3	(0.13)
Resorcinol	108463	12.24	(2.72)	3.06	(0.68)
Selenium	7782492	0.54	-	0.54	-
Selenium Sulfide	7446346	0.54	-	0.05	-
*Styrene	100425	200	(46.96)	2	(0.47)
Sulfuric Acid	7664939	2.72	(0.68)	2.72	(0.68)
1,2,2-Tetrachloro-1,2-Difluoroethane	76120	1133.33	(136.05)	566.67	(68.03)
1,1,2,2-Tetrachloroethane	79345	18.67	(2.72)	0.02	(0.003)

(December, 1995)

Massachusetts Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air

CHEMICAL	CAS NUMBER	Threshold Effects Exposure Limit (TEL)		Allowable Ambient Limit (AAL)	
		(24-hour average)		(annual average)	
		ug/m3	(ppb)	ug/m3	(ppb)
Tetrachloroethylene	127184	922.18	(136.05)	0.02	(0.003)
Tetrahydrofuran	109999	160.35	(54.42)	80.18	(27.21)
* Toluene	108883	80	*(21.23)	20	(5.31)
Toluene Diisocyanante	584849	0.10	(0.01)	0.10	(0.01)
o-Toluidine	95534	2.38	(0.54)	0.17	(0.04)
1,1,1-Trichloroethane	71556	1038.37	(190.48)	1038.37	(190.48)
1,1,2-Trichloroethane	79005	14.84	(2.72)	0.06	(0.01)
Trichloroethylene	79016	36.52	(6.80)	0.61	(0.11)
2,4,6-Trichlorophenol	88062	-	-	0.16	-
*Triethylamine	121448	1	(0.24)	0.7	(0.17)
Vanadium	1314621	0.27	-	0.27	-
Vanadium Pentoxide	1314621	0.14	(0.02)	0.03	(0.005)
* Vinyl Acetate	108054	30	(8.52)	8	(2.27)
Vinyl Chloride	75014	3.47	(1.36)	0.38	(0.15)
Vinylidene Chloride	75354	1.08	(0.27)	0.02	(0.01)
Xylenes (m-,o-,p- isomers)	1330207	11.80	(2.72)	11.80	(2.72)

All new and revised values are expressed in ug/m^3 to one significant figure. To allow for more accurate interconversion between ug/m^3 and ppb, no rounding of the ppb-equivalent values was conducted.

New and revised criteria are shaded.

*Criteria which were derived based on an Environmental Protection Agency Reference Concentration (RfC)

FINAL
COMPLIANCE MONITORING PLAN
LANDFILL GAS REMEDY
LOWRY LANDFILL SUPERFUND SITE
REMEDIAL ACTION

Prepared for

CITY AND COUNTY OF DENVER

and

WASTE MANAGEMENT

November 14, 1997

Prepared by

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TABLE 3.1
ALLOWABLE AIR QUALITY PERFORMANCE STANDARDS
COMPARED TO PRLs

Compound	Allowable Outlet Concentration (Fg/m^3)	EPA Analytical Method	PRLs (Fg/m^3)
1,1,1-trichloroethane	1.56E+07	TO-14	55 [a/]
1,1,2-trichloroethane	5.99E+04	TO-14	55
1,1-dichloroethane	7.82E+06	TO-14	40.5
1,1,2,2-tetrachloroethane	2.00E+04	TO-14	350
1,2,4-trichlorobenzene	1.65E+05	TO-14	750
1,2-dichloroethylene (total)	3.24E+06	TO-14	40
1,1-dichloroethylene	7.36E+02	TO-14	40
1,2-dichlorobenzene (ortho)	1.23E+06	TO-14	60
1,2-dichloroethane	3.99E+04	TO-14	40.5
1,2-dichloroethylene	3.24E+06	TO-14	40
1,2-dichloropropane	4.99E+04	TO-14	46
1,4-dichlorobenzene	1.80E+05	TO-14	60
2-butanone	4.82E+05	TO-14	145
2-methyl naphthalene [b/]	2.14E+05	5 (mod.)	10
2-hexanone	1.63E+05	TO-14	600
acetone	2.41E+06	TO-14	540
acrylonitrile	9.98E+03	TO-14	250 [c/]
aniline	3.11E+04	5 (mod)	10
benzene	2.61E+04	TO-14	32
carbon disulfide	1.23E+04	TO-14	155
carbon tetrachloride	6.99E+04	TO-14	65
chlorobenzene	1.41E+06	TO-14	46
chloroethane	1.08E+07	TO-14	55
chloroform	3.99E+04	TO-14	10
chloromethane	8.41E+03	TO-14	41
ethylbenzene	1.77E+06	TO-14	43.5
methylene chloride	1.42E+05	TO-14	34.5
napthalene [b/]	2.14E+05	5 (mod)	10

TABLE 3.1 (Continued)
ALLOWABLE AIR QUALITY PERFORMANCE STANDARDS
COMPARED TO PRLs

Compound	Allowable Outlet Concentration (Fg/m^3)	EPA Analytical Method	PRLs (Fg/m^3)
NDMA	1.50E+00	24 [e/]	0.01
pentachlorophenol	1.50E+02	5 (mod)	50
phenol	7.86E+05	5 (mod)	10
styrene	1.74E+06	TO-14	42.5
tetrachloroethylene	2.00E+04	TO-14	70
toluene	1.54E+05	TO-14	37.5
trichloroethylene	5.48E+05	TO-14	55
vinyl chloride	5.21E+04	TO-14	25.5
xylenes	1.77E+05	TO-14	43.5
4,4-DDT	1.55E+02	TO-10	0.4
Dieldrin	3.29E+00	TO-10	0.4
Gamma BHC (Lindane)	4.51E+01	TO-10	0.2
PCBs	7.51E+00	TO-10	2-4 [d/]
Ammonia	7.10+04	350.3	100
Arsenic	1.05E+01	29	0.4
Barium	7.51E+03	29	0.4
Beryllium	6.01E+00	29	0.4
Cadmium	1.50E+01	29	0.4
Lead	1.05E+03	29	0.4
Manganese	1.50E+04	29	0.4
Mercury	4.51E+03	29	0.5
Nickel	2.70E+03	29	0.4
Selenium	8.11E+03	29	0.4
Vanadium	4.05E+03	29	0.4

[a/] Reporting limits for Method TO-14 are elevated by a factor of 5 over those reported in Table 3.2 to accommodate higher moisture and carbon dioxide concentrations expected in the LFG samples.

[b/] Value is sum for naphthalene and 2-methyl naphthalene.

[c/] Since acrylonitrile is not a standard TO-14 compound, a 1-point calibration will be performed for quantitation.

[d/] PRL range is for individual PCB compounds.

[e/] Goodyear IH Method No. 24

FINAL
OPERATIONS, SAMPLING, AND MONITORING PLAN
LOWRY LANDFILL SUPERFUND SITE
FTPA WASTE PIT REMEDY

Prepared for

CITY AND COUNTY OF DENVER
CHEMICAL WASTE MANAGEMENT, INC.
WASTE MANAGEMENT OF COLORADO, INC.

July 24, 1998

Prepared by

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TABLE 3.2
MAXIMUM ALLOWABLE EMISSIONS
FTPA WASTE PITS
LOWRY LANDFILL SUPERFUND SITE
REMEDIAL DESIGN

Compound	Allowable Exhaust Gas Concentration From Treatment Cell Stack ($\mu g/m^3$)
1,1,1-trichloroethane	170,539,836.34
1,1,2-trichloroethane	44,099.68
1,1-dichloroethane	85,568,086.83
1,1,2,2-tetrachloroethane	14,667.31
1,2,4-trichlorobenzene	1,805,726.04
1,2-dichloroethylene (total)	35,413,034.32
1,1-dichloroethylene	7,951.67
1,2-dichlorobenzene (ortho)	13,424,828.06
1,2-dichloroethane	29,398.15
1,2-dichloropropane	36,749.37
1,4-dichlorobenzene	132,361.88
2-butanone	5,267,118.13
2-hexanone	1,786,911.29
acetone	26,366,795.89
acrylonitrile	7,353.44
benzene	87,965.80
carbon disulfide	134,675.30
carbon tetrachloride	51,449.80
chlorobenzene	4,603,234.31
chloroethane	117,849,099.24
chloroform	29,394.99
chloromethane	91,973.38
ethylbenzene	19,386,673.65
methylene chloride	176,346.10
styrene	1,286,833.13
tetrachloroethylene	14,706.88
toluene	1,663,141.92
trichloroethylene	448,559.71
vinyl chloride	279,344.73
xylenes	1,926,234.54

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD - Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
Organics									
Acenaphthene	--		420	1,700		520			10
Acrolein	--		110	68		21			10
Acrylonitrile	--		0.065	7,500		2,600			5
Aldicarb	--	10	7	--		--			10
Aldrin	--	0.002	0.0021	1.5		--			0.1
Benzene	--	1	1.2	5,300		--			1
Benzidine	--	0.0002		2,500		--			10
Beryllium	100 (30 day)	0.007		--		--			--
BHC Hexachlorocyclohexane	--	--		100		--			0.05
Bromodichloromethane (HM)	--	0.3	.56 (W&F)		11,000	--			1
Bromoform (HM)	--	4	4.3 (W&F)	--		--			1
Carbofuran	--	36	40	--		--			--
Carbon Tetrachloride	--	0.3	0.27	35,200		--			1
Chlorobenzene	--	100		--		--			1
Chlordane	--	0.03	0.1	1.2		0.0043			1
Chloroethyl Ether (bis-2-)	--	0.03	0.032	--		--			10
Chloroform (HM)	--	6	5.7 (W&F)	28,900		1240			1
4-Chloro 3-Methyl Phenol	--		210	30		--			50
2-Chlorophenol	--		35	4380		2000			50
Chlorophyrifos	--		21	0.083		0.041			0.1
DDT	--	0.1		0.55		0.001			0.1
DDT Metabolite (DDE)	--	0.1		1,050		--			0.1
DDT Metabolite (DDD)	--		0.15	0.6		--			0.1
Demeton	--	--		--		0.1			1
Dibromochloroethane (HM)	--	14		--		--			1
1,2-Dichlorobenzene	--	620	600	--		--			1
1,3-Dichlorobenzene	--	620	600	--		--			1
1,4-Dichlorobenzene	--	75		--		--			1
1,2-Dichloroethane	--	0.4	0.38	118,000		20,000			1
1,1-Dichloroethylene	--	7		--		--			1
1,2-cis-Dichloroethylene	--	70		--		--			1
1,2-trans-Dichloroethylene	--	100		--		--			1
2,4-Dichlorophenol	--	21		2,020		365			50
Dichlorophenoxyacetic Acid (2,4-D)	--	70		--		--			2.02

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD - Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
1,2-Dichloropropane	--	0.56	0.52	23000		5700			1
1,3-Dichloropropylene	--	--		6,060		244			1
Dieldrin	--	0.002		1.3	2.4	0.0019	0.056		0.1
2,4-Dimethylphenol	--		140	2,120		--			50
2,4-Dinitrophenol	--	14		--		--			50
2,6-Dinitrotoluene	--	--		330		230			10
Dioxin (2,3,7,8-TCDD)	--	2.2 x 10-7		0.01		0.00001			0.02
1,2-Diphenylhydrazine	--	0.05	0.044	270		--			
Endosulfan	--		0.35	0.22	0.11	0.056			0.1
Endrin	--	0.2	2	0.09	0.086	0.0023	0.036		0.1
Endrin Aldehyde	--	0.2	2.1	--		--			0.1
Ethylbenzene	--	680	700	32,000		--			1
Fluoranthene (PAH)	--		280	3,980		--			10
Guthion	--			--		0.01			1.5
Heptachlor	--	0.008		0.26	0.52	0.0038			0.05
Heptachlor Epoxide	--	0.09	0.004	0.26	0.52	0.0038			0.05
Hexachlorobenzene	--	6	1	--		--			10
Hexachlorobutadiene	--	1	14	90		9.3			10
Hexachlorocyclohexane, Alpha	--	0.006	0.0056	0.0039	--	--			0.05
Hexachlorocyclohexane, Gamma (Lindane)	--	0.2		1		0.08			0.05
Hexachloroethane	--		7	980		540			10
Hexachlorocyclopentadiene	--		50	7		5			10
Indeno(1,2,3-cd)pyrene (PAH)	--		0.048	--		--			10
Isophorone	--	1050	40	117,000		--			10
Malathion	--		140	--		0.1			0.2
Methoxychlor	--	40		--		0.03			0.5
Mirex	--	--		--		0.001			0.1
Naphthalene (PAH)	--		28	2,300		620			10
Nitrobenzene	--	3.5		27,000		--			10
Parathion	--	--		0.065		0.013			
PCBs	--	0.005	0.0175	2		0.014			1
Pentachlorobenzene	--	6	5.6	--		--			10
Pentachlorophenol	--	200	1	9	19	5.7	15		50
Phenol	--		4,200	10,200		2,560			50
1,2,4,5-Tetrachlorobenzene	--	2	2.1	--		--			10

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD - Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
1,1,2,2-Tetrachlorethane	--		0.18	--		2,400			1
Tetrachloroethylene	--	5		5,280		840			1
Toluene	--	1000		17,500		--			1
Toxaphene	--	0.03	0.032	0.73		0.0002			5
1,1,1-Trichloroethane	--	200		--		--			1
1,1,2-Trichloroethane	--	3		9,400		--			1
Trichloroethylene	--	5		45,000		21,900			1
2,4,6-Trichlorophenol	--	2	3.2	--		970			50
Trichlorophenoxypropionic Acid (2,4,5-TP)	--	50		--		--			0.5
Vinyl Chloride	--	2		--		--			2
Inorganics									
Antimony	--	14	6	--		--			
Aluminum	--	--		750		87		19	
Ammonia (un-ionized as N)	--	500		site specific		60-100			
Arsenic	100 (30 day)	50		360	340	150		1	
Asbestos, fibers/l	--	30,000	7,000,000	--		--			
Barium	--	1,000		--		--		23	
Boron	750 (30 day)	--		--		--			--
Cadmium	10 (30 day)	10 (1 day)	5 (1 day)	--[a]		--[a]		1	--
Chloride	--	250,000		--		--			
Chromium (hexavalent)	100 (30 day)	50 (1 day)		16		11		5	
Chromium (trivalent)	100 (30 day)	50 (1 day)		--[a]		--[a]		5	
Copper	200 (30 day)	1,000 (30 day)		--[a]		--[a]		14	
Cyanide (free)	200 (1 day)	200 (1 day)			5		5	7	
Dissolved Oxygen	3000	3,000		--		--			
Fecal Coliform	--	2,000/100 ml		--		--			
Fluoride	--	2,000		--		--			
Iron	--	300 (30 day)		--		1,000 (tot rec)			
Lead	100 (30 day)	50 (1 day)		--[a]		--[a]		0	
Manganese	200 (30 day)	50 (dis)(30 day)			--[a]	1000	--[a]	26	
Mercury	--	2.0 (1 day)		2.4		0.1	0.77	2	
Nickel	200 (30 day)		100 (30 day)	--[a]		--[a]		2	
Nitrate as N	100,000	10,000 (1 day)		--		--			
Nitrate as N (NO_2-N)	10,000	1,000 (1 day)		--		--			

Table 6-4
Surface Water Standards

	Agricultural Standard (ROD)	Water Supply Segments (ROD)	Water Supply Segments (Five-Year Review)	Aquatic Life (ROD - Acute)	Aquatic Life (Five-Year Review - Acute)	Aquatic Life (ROD - Chronic)	Aquatic Life (Five-Year Review - Chronic)	Background Inorganics[b]	PQL[c]
pH	--	5.0--9.0	6.5--9.0	--		--			
Selenium	20 (30 day)	10 (1 day)	50 (1 day)	135	18.4	17	4.6		
Silver	--	50	100 (1 day)	--[a]		--[a]		1	
Sulfide as H2S	--	50			2		2		
Sulfate	--	250,000		--			15		
Thallium	--		0.5	--		15			
Uranium	--	--		--[a]		--[a]			
Zinc	2,000 (30 day)	5,000 (30 day)		--[a]		--[a]		26	
Radionuclides									
Cesium 134, pCi/l	--	80h		--		--			--
Plutonium 238,239, and 240, pCi/l	--	15h	0.15	--		--			
Radium 226 and 228, pCi/l	--	5h		--		--			
Strontium 90, pCi/l	--	8h		--		--			
Thorium 230 and 232 pCi/l	--	60h		--		--			
Tritium, pCi/l	--	20000h		--		--			
[a] Value is dependent on hardness of water									

United States Environmental Protection Agency
Region VIII
999 18th Street – Suite 500
Denver, Colorado 80202-2466

Record of Decision

Lowry Landfill Superfund Site

Arapahoe County, Colorado

March 1994

Table 11-4
Surface Water Standards
Basic Standards and Methodologies for Surface Water
Site-Specific Standards for Use Classification
Recreation Class 2, Aquatic Life Warm Water Class 2, Agricultural

	Agricultural Standard (Fg/L)	Water Supply Segments (Fg/L)	Aquatic Life (Acute)	Aquatic Life (Chronic)	PQL (Fg/L)
Organics					
Acenaphthene	–	–	1,700	520	10
Acrolein	–	–	68	21	10
Acrylonitrile	–	–	7,500	2,600	5
Aldicarb	–	10	–	–	10
Aldrin	–	0.002	1.5	–	0.1
Benzene	–	1	5,300	–	1.0
Benzidine	–	0.0002	2,500	–	10
Beryllium	100 (30 day)	0.007	–	–	–
BHC Hexachlorocyclohexane	–	–	100	–	0.05
Bromodichlormethane (HM)	–	0.3	–	–	1.0
Bromoform (HM)	–	4	–	–	1.0
Carbofuran	–	36	–	–	–
Carbon Tetrachloride	–	0.3	35,200	–	1.0
Chlorobenzene	–	100	–	–	1.0
Chlordane	–	0.03	1.2	0.0043	1.0
Chloroethyl Ether (bis-2-)	–	0.03	–	–	10
Chloroform (HM)	–	6	28,900	1240	1.0
Chloro-4 Methyl-3 Phenol	–	–	30	–	50
2-Chlorophenol	–	–	4,380	2000	50
Chlorophyrifos	–	–	0.083	0.041	0.1
DDT	–	0.1	0.55	0.001	0.1
DDT Metabolite (DDE)	–	0.1	1,050	–	0.1
DDT Metabolite (DDD)	–	–	0.6	–	0.1
Demeton	–	–	–	0.1	1.0
Dibromochloromethane (HM)	–	14	–	–	1.0
1,2-Dichlorobenzene	–	620	–	–	1.0
1,3-Dichlorobenzene	–	620	–	–	1.0
1,4-Dichlorobenzene	–	75	–	–	1.0

Table 11-4
Surface Water Standards
Basic Standards and Methodologies for Surface Water
Site-Specific Standards for Use Classification
Recreation Class 2, Aquatic Life Warm Water Class 2, Agricultural

	Agricultural Standard (Fg/L)	Water Supply Segments (Fg/L)	Aquatic Life (Acute)	Aquatic Life (Chronic)	PQL (Fg/L)
1,2-Dichloroethane	–	0.4	118,000	20,000	1.0
1,1-Dichlorethylene	–	7	–	–	1.0
1,2-cis-Dichloroethylene	–	70	–	–	1.0
1,2-trans-Dichloroethylene	–	100	–	–	1.0
2,4-Dichlorophenol	–	21	2,020	365	50
Dichlorophenoxyacetic Acid (2,4-D)	–	70	–	–	2.02
1,4-Dichlorobenzene	–	75	–	–	1.0
1,2-Dichloroethane	–	0.4	118,000	20,000	1.0
1,1-Dichloroethylene	-	7	–	–	1.0
1,2-cis-Dichloroethylene	–	70	–	–	1.0
1,2-trans-Dichloroethylene	–	100	–	–	1.0
2,4-Dichlorophenol	–	21	2,020	365	50
Dichlorophenoxyacetic Acid (2,4-D)	–	70	–	–	2.02
1,2-Dichloropropane	–	0.56	23000	5700	1.0
1,3-Dichloropropylene	–	–	6,060	244	1.0
Dieldrin	–	0.002	1.3	0.0019	0.1
2,4-Dimethylphenol	–	–	2,120	–	50
2,4-Dinitrophenol	–	14	–	–	50
2,6-Dinitrotoluene	–	–	330	230	10
Dioxin (2,3,7,8-TCDD)	–	2.2 x 10-7	0.01	0.00001	0.02
1,2-Diphenylhydrazine	–	0.05	270	–	
Endosulfan	–	–	0.22	0.056	0.1
Endrin	–	0.2	0.09	0.0023	0.1
Endrin Aldehyde	–	0.2	–	–	0.1
Ethylbenzene	–	680	32,000	–	1.0
Fluoranthene (PAH)	–	–	3,980	–	10
Guthion	–	–	–	0.01	1.5
Heptachlor	–	0.008	0.26	0.0038	0.05
Heptachlor Epoxide	–	0.09	0.26	0.0038	0.05

Table 11-4
Surface Water Standards
Basic Standards and Methodologies for Surface Water
Site-Specific Standards for Use Classification
Recreation Class 2, Aquatic Life Warm Water Class 2, Agricultural

	Agricultural Standard (Fg/L)	Water Supply Segments (Fg/L)	Aquatic Life (Acute)	Aquatic Life (Chronic)	PQL (Fg/L)
Hexachlorobenzene	–	6	–	–	10
Hexachlorobutadiene	–	1.0	90	9.3	10
Hexachlorocyclohexane, Alpha	–	0.006	0.0039	–	0.05
Hexachlorocyclohexane, Gamma (Lindane)	–	0.2	1.0	0.080	0.05
Hexachloroethane	–	–	980	540	10
Hexachlorocyclopentadiene	–	–	7	5	10
Indeno(1,2,3-cd)pyrene (PAH)	–	–	–	–	10
Isophorone	–	1050	117,000	–	10
Malathion	–	–	–	0.1	0.2
Methoxychlor	–	40	–	0.03	0.5
Mirex	–	–	–	0.001	0.1
Naphthalene (PAH)	–	–	2,300	620	10
Nitrobenzene	–	3.5	27,000	–	10
Parathion	–	–	0.065	0.013	
PCBs		0.005	2.0	0.014	1.0
Pentachlorobenzene	–	6	–	–	10
Pentachlorophenol	–	200	9	5.7	50
Phenol	–	–	10,200	2,560	50
1,2,4,5-Tetrachlorobenzene	–	2	–	–	10
1,1,2,2-Tetrachloroethane	–	–	–	2,400	1.0
Tetrachloroethylene	–	5.0	5,280	840	1.0
Toluene	–	1000	17,500	–	1.0
Toxaphene	–	0.03	0.73	0.0002	5.0
1,1,1-Trichloroethane	–	200	–	–	1.0
1,1,2-Trichloroethane	–	3	9,400	–	1.0
Trichloroethylene	–	5	45,000	21,900	1.0
2,4,6-Trichlorophenol	–	2.0	–	970	50
Trichlorophenoxypropionic Acid (2,4,5-TP)	–	50	–	–	0.5
Vinyl Chloride	–	2	–	–	2

Table 11-4
Surface Water Standards
Basic Standards and Methodologies for Surface Water
Site-Specific Standards for Use Classification
Recreation Class 2, Aquatic Life Warm Water Class 2, Agricultural

	Agricultural Standard (Fg/L)	Water Supply Segments (Fg/L)	Aquatic Life (Acute)	Aquatic Life (Chronic)	PQL (Fg/L)
Inorganics					
Antimony	–	14	–	–	
Aluminum	–	–	750	87	
Ammonia (un-ionized as N)	–	500	site specific	60-100	
Arsenic	100 (30day)	50	360	150	
Asbestos, fibers/l	–	30000	–	–	
Barium	–	1,000	–	–	
Boron	750 (30day)	–	–	–	–
Cadmium	10 (30 day)	10 (1 day)	hardness dep.	hardness dep.	–
Chloride	–	250,000	–	–	
Chromium (hexavalent)	100 (30 day)	50 (1 day)	16	11	
Chromium (trivalent)	100 (30 day)	50 (1 day)	hardness dep.	hardness dep.	
Copper	200 (30 day)	1,000 (30 day)	hardness dep.	hardness dep.	
Cyanide (free)	200 (1 day)	200 (1 day)	–	–	
Dissolved Oxygen	3000	3,000	–	–	
Fecal Coliform	–	2,000/100ml	–	–	
Fluoride	–	2,000	–	–	
Iron	–	300 (30 day) a	–	1,000 (tot rec)	
Lead	100 (30 day)	50 (1 day)	hardness dep.	hardness dep.	
Manganese	200 (30 day)	50 (dis)(30 day)	–	1,000	
Mercury	–	2.0 (1 day)	2.4	0.1	
Nickel	200 (30 day)	–	hardness dep.	hardness dep.	
Nitrite as N	100,000	10,000 (1 day)	–	–	
Nitrite as N (NO2-N)	10,000	1,000 (1 day)	–	–	
pH	–	5.0-9.0	–	–	
Selenium	20 (30 day)	10 (1 day)	135	17	
Silver	–	50	hardness dep.	hardness dep.	
Sulfide as H2S	–	50	–	–	

Table 11-4
Surface Water Standards
Basic Standards and Methodologies for Surface Water
Site-Specific Standards for Use Classification
Recreation Class 2, Aquatic Life Warm Water Class 2, Agricultural

	Agricultural Standard (Fg/L)	Water Supply Segments (Fg/L)	Aquatic Life (Acute)	Aquatic Life (Chronic)	PQL (Fg/L)
Sulfate	–	250,000	–	–	
Thallium	–	–	–	15	
Uranium	–	–	hardness dep.	hardness dep.	
Zinc	2,000 (30 day)	5,000 (30day)	hardness dep.	hardness dep.	
Radionuclides					
Cesium 134, pCi/l	–	80h	–	–	–
Plutonium 238,239, and 240, pCi/l	–	15h	–	–	
Radium 226 and 228, pCi/l	–	5h	–	–	
Strontium 90, pCi/l	–	8h	–	–	
Thorium 230 and 232 pCi/l	–	60h	–	–	
Tritium, pCi/l	–	20,000h	–	–	

Table 6-5
LFG Compliance Boundary Standards

Chemical	ROD Standard [a]	Soil Vapor Action Levels [b]
Acetone		1,648
Benzene	0.12	605
Bromodichloromethane		16,900
Bromoform		96
Bromomethane		2,550
2-Butanone	700	1,549
Carbon disulfide	0.27	1,250,000
Carbon tetrachloride		1,240
Chlorobenzene		15,300
Chloroethane		756
Chloroform	0.04	212
Chloromethane		764
1,2-Dibromo-3-chloropropane		13
Dibromochloromethane		452
1,2-Dichlorobenzene		48,000
1,1-Dichloroethane	400	10,751
1,1-Dichloroethene	0.033	98
1,2-Dichloroethane	0.04	20
cis-1,2-Dichloroethene		92,400
trans-1,2-Dichloroethene		21,900
1,2-Dichloropropane		200
trans-1,2-Dichloropropene		60,900
1,4-Dioxane		1
Ethylbenzene	118.04	219,640
Ethylene dibromide		29
2-Hexanone		69,300,000
Ethylene dibromide		13,416
2-Hexanone		10,800
Methane	5% LEL	5% LEL
Methylene chloride	0.24	450
4-Methyl-1,2-pentanone		13,416
Styrene		10,800
1,1,2,2-Tetrachloroethane		83
Tetrachlrooethene		3,795
Toluene	10.24	272,000
1,1,1-Trichloroethane	700	100,400
1,1,2-Trichloroethane		92
Trichloroethene		2,070
Vinyl chloride	0.02	56
Xylenes (total)	11.8	2,760,000
[a] Record of Decision, March 1994		

[b] Letter dated February 16, 2000 regarding *Responses to EPA Comments (dated December 16, 1999) on the Response to Comments and 2nd Edition of the Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas, dated October 1999;* and letter dated November 13, 2000 regarding *Response to EPA Comments (dated October 17, 2000) on Response to EPA Comments (dated December 16, 2000) and 2nd Edition of the Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas (dated February 16, 2000*)

United States Environmental Protection Agency
Region VIII
999 18th Street – Suite 500
Denver, Colorado 80202-2466

Record of Decision

Lowry Landfill Superfund Site

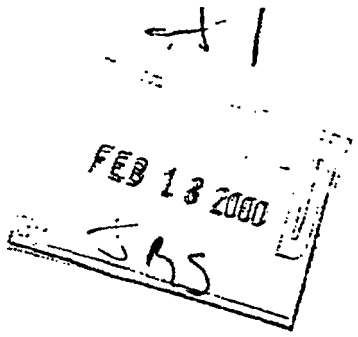
Arapahoe County, Colorado

March 1994

Table 11-7
Landfill Gas Compliance Boundary Performance Standards
Sitewide Remedy

Chemical	Performance Standard (Fg/m^3)	Basis
1,1,1-Trichloroethane	700	C
1,1-Dichloroethane	400	C
1,1-Dichloroethylene	0.033	B
1,2-Dichloroethane	0.040	A
2-Butanone	700	C
Benzene	0.12	A
Carbon disulfide	0.27	A
Chloroform	0.04	A
Ethylbenzene	118.04	A
Methylene chloride	0.24	A
Methane	5% LEL	D
Toluene	10.24	A
Total Xylenes	11.8	A
Vinyl chloride	0.020	B

Notes: A = ARAR/TBC (based on the Massachusetts AALs).
B = Carcinogenic (1 X 10^{-6}) target risk (adult).
C = Noncarcinogenic target calculation (Hazard Index = 1).
D = 40 CFR, Part 241.
LEL = Lower Explosive Limit.



February 16, 2000

Ms. Gwen Hooten, RPM
U.S. Environmental Protection Agency
Office of Ecosystems Protection and Remediation
Mail Code 8EPR-SR
999 18th Street, Suite 300
Denver, Colorado 80202-2466

Subject: **Response to EPA Comments (dated December 16, 1999) on the Response to Comments and 2nd Edition of the *Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas,* dated October 1999**

Dear Ms. Hooten:

On behalf of the City and County of Denver and Waste Management (on behalf of its subsidiaries Chemical Waste Maangement, Inc. and Waste Management of Colorado, Inc. and their settling defendants (collectively Respondents), we are submitting the subject response to comments prepared by Camp Dresser & McKee, Inc. for your review. Based on this response, the attached table proposes new performance standards for soil vapor based on the lower of 1) residential inhalation of indoor air or 2) soil vapor equilibium concentrations protective of groundwater drinking water standards. If you have any questions, please call either of us.

Sincerely,

Lori T. Tagawa, P.G.
Waste Management of Colorado. Inc.
Chemical Waste Management. Inc.
3900 S. Wadsworth Blvd., Suite 620
Lakewood, Colorado 80235

Dennis D. Bollmann, P.G.
City and County of Denver
Environmental Services
1391 Speer, Suite 700
Denver. Colorado 80204

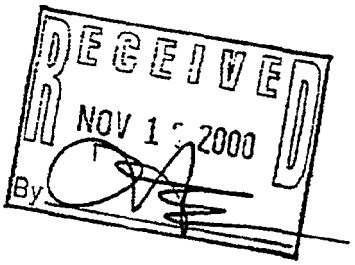
attachments

c: Lee Pivonka, CDPHE
James Schneider, CH2M Hill
Tim Cunningham, City of Aurora Planning Department
Bill Detweiler, Arapahoe County Planning Division
Bonnie Rader, CLLEAN
Richard Schelin, CALL
Chris Wiant, Tri-County Health Department

LOWRY LANDFILL SUPERFUND SITE
PROPOSED SOIL VAPOR ACTION LEVELS

Compound	Current Performance Standard (ug/m3)	Laboratory Reporting Limit (ug/m3)	Residential Soil Vapor Action Level (ug/m3)	Gas-to-GW Soil Vapor Action Level (ug/m3)	Proposed Soil Vapor Action Level (ug/m3)
Vinyl chloride	0.02	5.1	56	1,622	56
1,1 dichloroethene	0.03	7.9	98	5,600	98
Carbon disulfide	0.27	31.0	1,460,000	1,250,000	1,250,000
Methylene chloride	0.24	6.9	10,373	450	450
1,1 dichloroethane	400	8.1	10,751	161,370	10,751
2 butanone	700	29.0	2,168,000	1,549	1,549
Chloroform	0.04	9.7	212	618	212
1,1,1 trichloroethane	700	11.0	2,123,000	100,400	100,400
Benzene	0.12	6.4	605	1,145	605
1,2 dichloroethane	0.04	8.1	188	20	20
Toluene	10.24	7.5	844,703	272,000	272,000
Ethylbenzene	118.04	8.7	2,131,000	219,640	219,640
Xylene	11.80	8.7	14,790,000	2,760,000	2,760,000
Dichlorodifluoromethane	274	9.9	428,548	5,775,000	428,548
Trichlorofluoromethane	961	11.0	1,493,000	3,120,000	1,493,000
1,1,2 trichloro 1,2,2 trifluoroethane	41,300	15.0	69,150,000	1,239,000,000	69,150,000
Chloromethane	1.5	8.2	1,468	570	570

November 13, 2000



Ms. Gwendolyn Hooten, RPM
U.S. EPA
Office of Ecosystems Protection and Remediation
Mail Code 8EPR-SR
999 18th Street, Suite 300
Denver, CO 80202-2466

Re: Response to **EPA Comments (dated October 17, 2000) on Response to EPA Comments (dated December 16, 2000) and 2nd Edition of the Development of Action Levels for Soil Vapors in Lowry Landfill Offsite Areas (dated February 16, 2000),** Lowry Landfill Superfund Site

Dear Ms. Hooten:

The City and County of Denver, Waste Management (on behalf of its subsidiaries Chemical Waste Management, Inc. and Waste Management of Colorado, Inc.) and their settling defendants (collectively Respondents) hereby submit responses to October 17, 2000 comments regarding Development of Action Levels for Soil Vapors.

If you have any questions regarding these response to comments, please give either of us a call.

Sincerely,

Dennis D. Bollmann, P.G.
City & County of Denver -
Environmental Services
1391 Speer Blvd., Suite 700
Denver, CO 80204

Lori T. Tagawa, P.G.
Waste Management
3900 S. Wadsworth Blvd., Suite 620
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c: EPA (2 additional copies)
Lee Pivonka, CDPHE (two copies)
Tim Schneider, CH2M Hill
Tim Shangraw, Parsons
Bonnie Rader, CLEAN
Carol Maclennan, TCHD
Bill Detweiler, Arapahoe County Planning
Tim Cunningham, Aurora

TABLE 1
Soil Vapor Action Levels

CASRN	CHEMICAL	Action Level for Soil Gas ($\mu g/m^3$) [(a)]	Action Level Basis [(b)]	Head Space Concentration at Equilibrium with Groundwater/Drinking Water Standard ($\mu g/m^3$)	Action Level ($\mu g/m^3$)
67-64-1	Acetone	2,070,000	N	1,648	1,648
75-27-4	Bromodichloromethane	145	C	16,900	145
75-25-2	Bromoform	5,509	C	96	96
74-83-9	Bromomethane	1,592	N	2,550	1,592
56-23-5	Carbon tetrachloride	332	C	1,240	332
108-90-7	Chlorobenzene	42,643	N	15,300	15,300
75-00-3	Chloroethane	20,170,000	N	756	756
74-87-3	Chloromethane	NA	NA	764	764
96-12-8	1,2-Dibromo-3-chloropropane	NA	NA	13	13
124-48-1	Dibromochloromethane	238	C	452	238
95-50-1	1,2-Dichlorobenzene	64,117	N	48,000	48,000
156-59-2	cis-1,2-Dichloroethene	74,710	N	92,400	74,710
156-60-5	trans-1,2-Dichloroethene	156,780	N	21,900	21,900
78-87-5	1,2-Dichloropropane	8,539	N	200	200
542-75-6 [(c)]	trans-1,3-Dichloropropene	1,259	C	60,900	1,259
123-91-1	1,4-Dioxane	1,393	C	1	1
106-93-4	Ethylene dibromide	25	C	29	25
591-78-6	2-Hexanone	7,576	N	69,300,000	7,576
108-10-1	4-Methyl-2-pentanone	150,442	N	13,416	13,416
100-42-5	Styrene	NA	NA	10,800	10,800
79-34-5	1,1,2,2-Tetrachloroethane	87	C	83	83
127-18-4	Tetrachloroethene	8,463	C	3,795	3,795
79-00-5	1,1,2-Trichloroethane	312	C	92	92
79-01-6	Trichloroethene	2,879	C	2,070	2,070

Notes

(a) RBCA modeled values

(b) PRG is based on Carcinogenic(C) or Noncarcinogenic (N) toxicity criteria

(c) Toxicity criteria used is for 1,3-Dichloropropene (criteria for isomers is not available)

NA indicates that at residual saturation concentration in soil resulting indoor air concentration is below target risk levels

NOTE: This bill has been prepared for the signature of the appropriate legislative officers and the Governor. To determine whether the Governor has signed the bill or taken other action on it, please consult the legislative status sheet, the legislative history, or the Session Laws.

2001

SENATE BILL 01-145

BY SENATOR(S) Phillips;
also REPRESENTATIVE(S) Witwer, Boyd, Mace, Plant, Romanoff, Sanchez, and Stengel.

CONCERNING THE ENFORCEABILITY OF ENVIRONMENTAL REAL COVENANTS.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. 25-15-101, Colorado Revised Statutes, is amended BY THE ADDITION OF THE FOLLOWING NEW SUBSECTIONS to read:

25-15-101. Definitions. As used in this article, unless the context otherwise requires:

(4.3) "ENVIRONMENTAL COVENANT" MEANS AN INSTRUMENT CONTAINING ENVIRONMENTAL USE RESTRICTIONS CREATED PURSUANT TO SECTION 25-15-321.

(4.5) "ENVIRONMENTAL REMEDIATION PROJECT" MEANS CLOSURE OF A HAZARDOUS WASTE MANAGEMENT UNIT OR SOLID WASTE DISPOSAL SITE OR ANY REMEDIATION OF ENVIRONMENTAL CONTAMINATION, INCLUDING DETERMINATIONS TO RELY SOLELY OR PARTIALLY ON ENVIRONMENTAL USE

Capital letters indicate new material added to existing statute; dashes through the words indicate deletions from existing statutes and such material not part of act.

RESTRICTIONS TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT BUT EXCLUDING INTERIM MEASURES THAT ARE NOT INTENDED AS THE FINAL REMEDIAL ACTION, THAT IS CONDUCTED UNDER ANY OF THE FOLLOWING:

(I) SUBCHAPTER III OR IX OF THE FEDERAL "RESOURCE CONSERVATION AND RECOVERY ACT OF 1976", 42 U.S.C. SEC. 6921 TO 6939e AND 6991 TO 6991i, AS AMENDED;

(II) SECTION 7002 OR 7003 OF THE FEDERAL "RESOURCE CONSERVATION AND RECOVERY ACT OF 1976", 42 U.S.C. SEC. 6972 AND 6973, AS AMENDED;

(III) THE FEDERAL "COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980", 42 U.S.C. SEC. 9601 TO 9647, AS AMENDED;

(IV) THE FEDERAL "URANIUM MILL TAILINGS RADIATION CONTROL ACT OF 1978", 42 U.S.C. SEC. 7901 ET SEQ., AS AMENDED;

(V) PART 1 OF ARTICLE 11 OF THIS TITLE, INCLUDING ANY DECOMMISSIONING OF SITES LICENSED UNDER THAT PART;

(VI) PART 3 OF ARTICLE 11 OF THIS TITLE;

(VII) PART 3 OF ARTICLE 15 OF THIS TITLE; AND

(VIII) ARTICLE 30 OF TITLE 20, C.R.S.

(4.7) "ENVIRONMENTAL USE RESTRICTION" MEANS A PROHIBITION OF ONE OR MORE USES OF OR ACTIVITIES ON SPECIFIED REAL PROPERTY, INCLUDING DRILLING FOR OR PUMPING GROUNDWATER; A REQUIREMENT TO PERFORM CERTAIN ACTS, INCLUDING REQUIREMENTS FOR MAINTENANCE, OPERATION, OR MONITORING NECESSARY TO PRESERVE SUCH PROHIBITION OF USES OR ACTIVITIES; OR BOTH, WHERE SUCH PROHIBITIONS OR REQUIREMENTS ARE RELIED UPON IN THE REMEDIAL DECISION FOR AN ENVIRONMENTAL REMEDIATION PROJECT FOR THE PURPOSE OF PROTECTING HUMAN HEALTH OR THE ENVIRONMENT.

(5.5) "HAZARDOUS SUBSTANCE" MEANS ANY SUBSTANCE THAT IS DEFINED AS A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT UNDER THE FEDERAL "COMPREHENSIVE ENVIRONMENTAL RESPONSE,

COMPENSATION, AND LIABILITY ACT OF 1980", 42 U.S.C. SEC. 9601 TO 9647, AS AMENDED, OR ITS IMPLEMENTING REGULATIONS.

(12.5) "OWNER", AS USED IN SECTIONS 25-15-317 TO 25-15-326, MEANS THE RECORD OWNER OF REAL PROPERTY AND, IF ANY, ANY OTHER PERSON OR ENTITY OTHERWISE LEGALLY AUTHORIZED TO MAKE DECISIONS REGARDING THE TRANSFER OF THE SUBJECT PROPERTY OR PLACEMENT OF ENCUMBRANCES ON THE SUBJECT PROPERTY, OTHER THAN BY THE EXERCISE OF EMINENT DOMAIN.

(13.5) "REMEDIAL DECISION" MEANS THE ADMINISTRATIVE DETERMINATION BY THE DEPARTMENT, THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, OR OTHER APPROPRIATE GOVERNMENT ENTITY UNDER THE LAWS CITED IN SUBSECTION (4.5) OF THIS SECTION, THAT ESTABLISHES THE REMEDIAL REQUIREMENTS FOR THE ENVIRONMENTAL REMEDIATION PROJECT.

SECTION 2. Part 3 of article 15 of title 25, Colorado Revised Statutes, is amended BY THE ADDITION OF THE FOLLOWING NEW SECTIONS to read:

25-15-317. Legislative declaration. THE GENERAL ASSEMBLY DECLARES THAT IT IS IN THE PUBLIC INTEREST TO ENSURE THAT ENVIRONMENTAL REMEDIATION PROJECTS PROTECT HUMAN HEALTH AND THE ENVIRONMENT. THE GENERAL ASSEMBLY FINDS THAT ENVIRONMENTAL REMEDIATION PROJECTS MAY LEAVE RESIDUAL CONTAMINATION AT LEVELS THAT HAVE BEEN DETERMINED TO BE SAFE FOR A SPECIFIC USE, BUT NOT ALL USES, AND MAY INCORPORATE ENGINEERED STRUCTURES THAT MUST BE MAINTAINED OR PROTECTED AGAINST DAMAGE TO REMAIN EFFECTIVE. THE GENERAL ASSEMBLY FINDS THAT IN SUCH CASES, IT IS NECESSARY TO PROVIDE AN EFFECTIVE AND ENFORCEABLE MEANS OF ENSURING THE CONDUCT OF ANY REQUIRED MAINTENANCE, MONITORING, OR OPERATION, AND OF RESTRICTING FUTURE USES OF THE LAND, INCLUDING PLACING RESTRICTIONS ON DRILLING FOR OR PUMPING GROUNDWATER FOR AS LONG AS ANY RESIDUAL CONTAMINATION REMAINS HAZARDOUS. THE GENERAL ASSEMBLY, THEREFORE, DECLARES THAT IT IS IN THE PUBLIC INTEREST TO CREATE ENVIRONMENTAL COVENANTS BECAUSE SUCH COVENANTS ARE NECESSARY FOR THE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

25-15-318. Nature of environmental covenants. (1) AN ENVIRONMENTAL COVENANT SHALL BE PERPETUAL UNLESS BY ITS TERMS IT IS LIMITED TO A SPECIFIC DURATION, UNLESS THE DEPARTMENT APPROVES A REQUEST TO TERMINATE OR MODIFY IT PURSUANT TO SECTION 25-15-319 (1) (h), OR UNLESS IT IS TERMINATED BY A COURT OF COMPETENT JURISDICTION. AN ENVIRONMENTAL COVENANT MAY NOT BE EXTINGUISHED, LIMITED, OR IMPAIRED THROUGH ISSUANCE OF A TAX DEED OR THROUGH ADVERSE POSSESSION, NOR MAY AN ENVIRONMENTAL COVENANT BE EXTINGUISHED, LIMITED, OR IMPAIRED BY REASON OF THE DOCTRINES OF ABANDONMENT, WAIVER, LACK OF ENFORCEMENT, OR OTHER COMMON LAW PRINCIPLES RELATING TO COVENANTS, OR BY THE EXERCISE OF EMINENT DOMAIN.

(2) NOTWITHSTANDING ANY OTHER PROVISION OF LAW, INCLUDING ANY COMMON LAW REQUIREMENT FOR PRIVITY OF ESTATE, AN ENVIRONMENTAL COVENANT SHALL RUN WITH THE LAND AND SHALL BIND THE OWNER OF THE LAND, THE OWNER'S SUCCESSORS AND ASSIGNS, AND ANY PERSON USING THE LAND.

(3) THE REQUIREMENTS AND RESTRICTIONS OF AN ENVIRONMENTAL COVENANT ARE REQUIREMENTS UNDER THIS PART 3 BUT MAY ONLY BE ENFORCED AS PROVIDED IN SECTION 25-15-322. THE CREATION OF AN ENVIRONMENTAL COVENANT DOES NOT TRIGGER THE APPLICATION OF ANY OTHER REQUIREMENT OF THIS PART 3.

(4) THE DEPARTMENT SHALL NOT ACQUIRE ANY LIABILITY UNDER STATE LAW BY VIRTUE OF ACCEPTING AN ENVIRONMENTAL COVENANT, NOR SHALL ANY NAMED BENEFICIARY OF AN ENVIRONMENTAL COVENANT ACQUIRE ANY LIABILITY UNDER STATE LAW BY VIRTUE OF BEING SUCH A BENEFICIARY.

25-15-319. Contents of environmental covenants. (1) AN ENVIRONMENTAL COVENANT SHALL INCLUDE PROVISIONS REGARDING:

(a) ITS DURATION AND ANY CONDITIONS UNDER WHICH IT MAY BE MODIFIED OR TERMINATED;

(b) ANY ENVIRONMENTAL USE RESTRICTIONS RELIED ON IN THE REMEDIATION DECISION FOR THE ENVIRONMENTAL REMEDIATION PROJECT FOR THE SUBJECT PROPERTY;

(c) A REQUIREMENT THAT THE OWNER OF THE PROPERTY SUBJECT TO

THE ENVIRONMENTAL COVENANT NOTIFY THE DEPARTMENT AT LEAST FIFTEEN DAYS IN ADVANCE OF ANY TRANSFER OF OWNERSHIP OF SOME OR ALL OF THE REAL PROPERTY SUBJECT TO THE ENVIRONMENTAL COVENANT;

(d) A REQUIREMENT THAT THE OWNER OF THE PROPERTY NOTIFY THE DEPARTMENT SIMULTANEOUSLY WITH SUBMITTING ANY APPLICATION TO A LOCAL GOVERNMENT FOR A BUILDING PERMIT OR CHANGE IN LAND USE;

(e) A REQUIREMENT TO ALLOW THE DEPARTMENT RIGHT OF ENTRY AT REASONABLE TIMES WITH PRIOR NOTICE FOR THE PURPOSE OF DETERMINING COMPLIANCE WITH THE TERMS OF THE ENVIRONMENTAL COVENANT. NOTHING IN THIS SECTION SHALL IMPAIR ANY OTHER AUTHORITY THE DEPARTMENT MAY OTHERWISE HAVE TO ENTER AND INSPECT PROPERTY SUBJECT TO THE ENVIRONMENTAL COVENANT.

(f) INCLUSION OF THE FOLLOWING STATEMENT ON THE FIRST PAGE OF THE INSTRUMENT CREATING THE ENVIRONMENTAL COVENANT IN FIFTEEN-POINT BOLD-FACED TYPE: "THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL COVENANT HELD BY THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT PURSUANT TO SECTION 25-15-321, C.R.S.";

(g) AN AGREEMENT TO INCORPORATE EITHER IN FULL OR BY REFERENCE THE ENVIRONMENTAL COVENANT IN ANY LEASES, LICENSES, OR OTHER INSTRUMENTS GRANTING A RIGHT TO USE THE PROPERTY THAT MAY BE AFFECTED BY THE ENVIRONMENTAL COVENANT;

(h) MODIFICATION OR TERMINATION OF THE ENVIRONMENTAL COVENANT CONSISTENT WITH THIS SUBSECTION (1). THE OWNER OF LAND SUBJECT TO AN ENVIRONMENTAL COVENANT MAY REQUEST THAT THE DEPARTMENT APPROVE MODIFICATION OR TERMINATION OF THE COVENANT. THE REQUEST SHALL CONTAIN INFORMATION SHOWING THAT THE PROPOSED MODIFICATION OR TERMINATION SHALL, IF IMPLEMENTED, ENSURE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THE DEPARTMENT SHALL REVIEW ANY SUBMITTED INFORMATION, AND MAY REQUEST ADDITIONAL INFORMATION. IF THE DEPARTMENT DETERMINES THAT THE PROPOSAL TO MODIFY OR TERMINATE THE ENVIRONMENTAL COVENANT WILL ENSURE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, IT SHALL APPROVE THE PROPOSAL. NO MODIFICATION OR TERMINATION OF AN ENVIRONMENTAL COVENANT SHALL BE EFFECTIVE UNLESS IT HAS BEEN APPROVED IN WRITING BY THE DEPARTMENT. INFORMATION TO SUPPORT A

REQUEST FOR MODIFICATION OR TERMINATION MAY INCLUDE ONE OR MORE OF THE FOLLOWING:

(I) A PROPOSAL TO PERFORM ADDITIONAL REMEDIAL WORK;

(II) NEW INFORMATION REGARDING THE RISKS POSED BY THE RESIDUAL CONTAMINATION;

(III) INFORMATION DEMONSTRATING THAT RESIDUAL CONTAMINATION HAS DIMINISHED;

(IV) INFORMATION DEMONSTRATING THAT AN ENGINEERED FEATURE OR STRUCTURE IS NO LONGER NECESSARY;

(V) INFORMATION DEMONSTRATING THAT THE PROPOSED MODIFICATION WOULD NOT ADVERSELY IMPACT THE REMEDY AND IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT; AND

(VI) OTHER APPROPRIATE SUPPORTING INFORMATION; AND

(i) SUCH OTHER SUBJECTS AS MAY BE APPROPRIATE.

25-15-320. Environmental covenants - when required - waiver. (1) NO ENVIRONMENTAL COVENANT SHALL BE REQUIRED FOR ANY ENVIRONMENTAL REMEDIATION PROJECT THAT RESULTS IN RESIDUAL CONTAMINATION LEVELS THAT HAVE BEEN DETERMINED BY THE RELEVANT REGULATORY AGENCY TO BE SAFE FOR ALL USES AND THAT DOES NOT INCORPORATE ANY ENGINEERED FEATURE OR STRUCTURE OR REQUIRE ANY MONITORING, MAINTENANCE, OR OPERATION.

(2) AN ENVIRONMENTAL COVENANT UNDER THIS PART 3 SHALL BE REQUIRED FOR ANY ENVIRONMENTAL REMEDIATION PROJECT IN WHICH THE RELEVANT REGULATORY AUTHORITY MAKES A REMEDIAL DECISION ON OR AFTER JULY 1, 2001, THAT WOULD RESULT IN EITHER OR BOTH OF THE FOLLOWING:

(a) RESIDUAL CONTAMINATION AT LEVELS THAT HAVE BEEN DETERMINED TO BE SAFE FOR ONE OR MORE SPECIFIC USES, BUT NOT ALL USES; OR

(b) INCORPORATION OF AN ENGINEERED FEATURE OR STRUCTURE

THAT REQUIRES MONITORING, MAINTENANCE, OR OPERATION OR THAT WILL NOT FUNCTION AS INTENDED IF IT IS DISTURBED.

(3) THE DEPARTMENT MAY WAIVE THE REQUIREMENT FOR AN ENVIRONMENTAL COVENANT IN THE FOLLOWING CIRCUMSTANCES:

(a) IF THE DEPARTMENT DETERMINES THAT IT IS AUTHORIZED UNDER ANOTHER STATUTE OR DECISION OF THE COLORADO SUPREME COURT TO IMPLEMENT AND ENFORCE ENVIRONMENTAL USE RESTRICTIONS AGAINST THE PRESENT AND SUBSEQUENT OWNERS OF REAL PROPERTY REMEDIATED PURSUANT TO AN ENVIRONMENTAL REMEDIATION PROJECT, AND IMPLEMENTS ENVIRONMENTAL USE RESTRICTIONS UNDER SUCH STATUTE OR DECISION; OR

(b) FOR A PARCEL OF LAND INVOLVED IN AN ENVIRONMENTAL REMEDIATION PROJECT THAT IS OWNED BY ANY PERSON WHO IS NON BEING REQUIRED TO REMEDIATE THE CONTAMINATION, AND:

(I) THE OWNER OF ANY SUCH PARCEL DOES NOT GRANT AN ENVIRONMENTAL COVENANT UNDER THIS SECTION;

(II) THE COUNTY, CITY AND COUNTY, OR MUNICIPALITY HAVING JURISDICTION OVER THE AFFECTED LAND HAS ENACTED AN ORDINANCE OR RESOLUTION IMPOSING THE RELEVANT ENVIRONMENTAL USE RESTRICTIONS; AND

(III) THE COUNTY, CITY AND COUNTY, OR MUNICIPALITY HAVING JURISDICTION AND THE DEPARTMENT HAVE ENTERED INTO AN INTERGOVERNMENTAL AGREEMENT FOR OVERSIGHT AND ENFORCEMENT OF THE LOCAL ORDINANCE OR RESOLUTION PURSUANT TO SECTION 29-1-203, C.R.S. SUCH AGREEMENT SHALL BE BINDING AND MUTUALLY ENFORCEABLE. THE DEPARTMENT'S AUTHORITY UNDER ANY SUCH AGREEMENT SHALL BE LIMITED TO PROPERTIES THAT ARE SUBJECT TO THE REQUIREMENTS OF THIS SECTION. ANY INTERGOVERNMENTAL AGREEMENT UNDER THIS SECTION SHALL REQUIRE THAT, INSOFAR AS THE LOCAL ORDINANCE OR RESOLUTION APPLIES TO PROPERTIES THAT ARE SUBJECT TO THE REQUIREMENTS OF THIS SECTION, ANY AMENDMENTS TO THE LOCAL ORDINANCE OR RESOLUTION SHALL INCORPORATE SUCH REQUIREMENTS AS THE DEPARTMENT MAY RECOMMEND TO ENSURE CONTINUED PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

(4) THE DEPARTMENT SHALL HAVE SUCH AUTHORITY AS MAY BE

PROVIDED IN THE INTERGOVERNMENTAL AGREEMENT TO BRING SUIT FOR INJUNCTIVE RELIEF TO ENFORCE ANY LOCAL ORDINANCE OR RESOLUTION DESCRIBED IN SUBSECTION (3) OF THIS SECTION WITH RESPECT TO PROPERTIES THAT ARE SUBJECT TO THE REQUIREMENTS OF THIS SECTION.

(5) THE DEPARTMENT MAY ACCEPT AND ENFORCE ENVIRONMENTAL COVENANTS IN CASES WHERE SUCH COVENANTS ARE NOT REQUIRED, INCLUDING APPROVALS OF VOLUNTARY CLEANUP PLANS OR PETITIONS FOR NO ACTION DETERMINATIONS UNDER SECTIONS 25-16-306 AND 25-16-307, BUT THE OWNER OF THE REMEDIATED LAND NONETHELESS DESIRES TO CREATE SUCH A COVENANT.

25-15-321. Creation, modification, and termination of an environmental covenant. (1) AN ENVIRONMENTAL COVENANT UNDER THIS PART 3 MAY BE CREATED ONLY BY THE OWNER OF THE PROPERTY THROUGH A WRITTEN GRANT TO THE DEPARTMENT BY A DEED OR OTHER INSTRUMENT OF CONVEYANCE SPECIFICALLY STATING THE INTENTION OF THE GRANTOR TO CREATE SUCH A RESTRICTION UNDER THIS ARTICLE.

(2) THE DEPARTMENT IS AUTHORIZED TO ACCEPT, REFUSE TO ACCEPT, CONDITIONALLY ACCEPT, HOLD, MODIFY, AND TERMINATE ENVIRONMENTAL COVENANTS.

(3) INSTRUMENTS CREATING, MODIFYING, OR TERMINATING AN ENVIRONMENTAL COVENANT SHALL BE RECORDED AS ANY OTHER INSTRUMENT AFFECTING TITLE TO AND INTERESTS IN REAL PROPERTY.

(4) IF THE ONLY USES ALLOWED UNDER THE PROPOSED ENVIRONMENTAL COVENANT ARE PROHIBITED BY EXISTING ORDINANCE OR RESOLUTION, THE DEPARTMENT SHALL CONDITION ITS ACCEPTANCE OF THE COVENANT UPON THE APPLICANT'S DEMONSTRATION THAT SUCH APPLICANT HAS OBTAINED APPROVAL FROM THE RELEVANT AUTHORITY THAT WOULD ALLOW FOR ONE OR MORE OF THE PROPOSED USES.

(5) PERSONS PROPOSING TO CREATE, MODIFY, OR TERMINATE AN ENVIRONMENTAL COVENANT SHALL PROVIDE WRITTEN NOTICE OF THEIR INTENTION TO ALL PERSONS HOLDING AN INTEREST OF RECORD IN THE REAL PROPERTY THAT WILL BE SUBJECT TO THE ENVIRONMENTAL COVENANT, TO ALL PERSONS KNOWN TO THEM TO HAVE AN UNRECORDED INTEREST IN THE PROPERTY, AND TO ALL AFFECTED PERSONS IN POSSESSION OF THE PROPERTY PRIOR TO SUCH CREATION, MODIFICATION, OR TERMINATION, AND SHALL