

SECOND FIVE-YEAR REVIEW REPORT

**Second Five-Year Review Report
for
RED OAK LANDFILL SUPERFUND SITE
City of Red Oak
Montgomery County, Iowa**

September 2007

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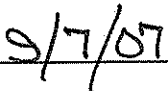


Table of Contents

List of Abbreviations	iv
Executive Summary	v
Five-Year Review Summary Form	vi
1.0 INTRODUCTION	1
2.0 SITE CHRONOLOGY	2
3.0 BACKGROUND	3
3.1 Physical Characteristics	3
3.2 Land and Resource Use	3
3.3 History of Contamination	3
3.4 Initial Response.....	3
3.5 Basis for Taking Action: Contaminants.....	4
4.0 REMEDIAL ACTIONS.....	4
4.1 Remedy Selection	4
4.2 Remedy Implementation.....	5
4.3 System Operation, Operation and Maintenance	6
5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW	7
6.0 FIVE-YEAR REVIEW PROCESS.....	8
6.1 Administrative Components	8
6.2 Community Involvement	8
6.3 Document Review.....	8
6.4 Data Review.....	9
6.4.1 Surface Water.....	9
6.4.2 Ground Water.....	10
6.4.3 Volatile Organic Compounds	10
6.4.4 Metals.....	10
6.4.5 Groundwater Use Review	11
6.5 Site Inspection.....	11
6.6 Interviews.....	12
7.0 TECHNICAL ASSESSMENT	12
7.1 Question A: Is the Remedy functioning as intended by the Decision Documents?	12
7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the Remedy selection still valid?.....	13
7.3 Question C: Has any other information come to light that could call into question the protectiveness of the Remedy?	13
7.4 Technical Assessment Summary	13
8.0 ISSUES	14
9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS.....	15
10.0 PROTECTIVENESS STATEMENT.....	16
11.0 NEXT REVIEW	16

Tables:

Table 1: Chronology of the Site Events

Table 2: Comparison of Total vs. Dissolved Metal Concentration in Surface Water

Table 3a: Comparison of Total vs. Dissolved Metals in GW01

Table 3b: Comparison of Total vs. Dissolved Metals in GW02

Table 3c: Comparison of Total vs. Dissolved Metals in GW03

Table 3d: Comparison of Total vs. Dissolved Metals in GW04

Table 3e: Comparison of Total vs. Dissolved Metals in GW05

Table 4: Issues

Table 5: Recommendations and Follow-Up Actions

Attachments:

Attachment 1: Site Location Map

Attachment 2: Site Plan

Attachment 3: List of Documents Review

Attachment 4: Applicable or Relevant and Appropriate Requirements (ARARs)

List of Abbreviations

AWQC	Ambient Water Quality Criteria
ARAR	Applicable or Relevant and Appropriate Requirement
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COD	Chemical Oxygen Demand
CWA	Clean Water Act
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Difference
MCL	Maximum Contaminant Level
MOMP	Monitoring, Operation and Maintenance Plan
NCP	National Contingency Plan
NPL	National Priority List
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
TAL	Target Analyte List
TCL	Target Compound List
TOX	Total Organic Halides
VOC	Volatile Organic Compounds

Executive Summary

The Second Five-Year Review has been performed for the Red Oak Landfill Superfund Site in Red Oak, Iowa. The Red Oak Landfill Superfund Site was originally a limestone quarry which operated from the late 1940s to the early 1960s. The city of Red Oak purchased the property in 1962 and operated it as a landfill until it closed in April 1974. Waste disposed of at the site reportedly included construction and demolition debris, tree pruning waste, municipal refuse and industrial waste including toluene, methyl isobutyl ketene, tetrachloroethylene, mineral spirits etc. from facilities in the Red Oak Area. The site posed a threat to public health through direct contact with soil and waste buried at the site in addition to river bank slope erosion and potential leaching and migration of contaminants into surface water and groundwater. The site was proposed to the National Priorities List (NPL) in June 1986. A Remedial Investigation/Feasibility Study (RI/FS) was performed in 1989 and a Proposed Plan was approved in 1992. The Record of Decision (ROD) was signed in 1993. The remedy selected for the Red Oak Landfill included capping of the contaminated soils and wastes on-site, construction of diversion and drainage structures, contouring and revegetation of the riverbank slope, access and institutional controls, and groundwater monitoring. An Explanation of Significant Difference (ESD) was signed in 1996 to change cap design and river bank shape. The site achieved construction completion in 2001. The trigger for the first Five-Year Review was the actual start of construction in 1997. The trigger date for the completion of the Second Five-Year review is the signature date of the First Five-Year Review.

For the Second Five-Year Review, groundwater monitoring events conducted since the First Five-Year Review were reviewed. The conclusions drawn from the review indicate that the contaminants levels have not increased in the on-site monitoring wells and the landfill has not impacted the nearby East Nishnabotna River. The site is also inspected on a regular basis and the drainage structures, landfill cap and the monitoring wells are in good condition.

This Second Five-Year Review covers the period since the First Five-Year Review. This report covers the activities from the Summer of 2002 to the Summer of 2007. The assessment of this Second Five-Year Review found that the remedy implemented for this site continues to be protective of human health and the environment. The Remedial Actions appear to be functioning as designed, and the site is in good condition. No deficiencies were noted that directly impact the protectiveness of the remedy as implemented.

The remedy at this site is protective of human health and the environment. All threats at this site have been addressed through capping of contaminated soil and waste on-site, construction of diversion and drainage structures, contouring and revegetation of the river bank slope, access and institutional controls, and groundwater and surface water monitoring.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name (from WasteLAN): Red Oak City Landfill Superfund Site		
EPA ID (from WasteLAN): 1AD980632509		
Region: 7	State: IA	City/County: Red Oak/Montgomery
SITE STATUS		
NPL status: <input checked="" type="checkbox"/> Final <input type="checkbox"/> Deleted <input type="checkbox"/> Other (specify)		
Remediation status (choose all that apply): <input type="checkbox"/> Under Construction <input type="checkbox"/> Operating <input checked="" type="checkbox"/> Complete		
Site Wide FYR <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		Construction completion date: <u>06/21/2001</u>
Has site been put into reuse? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO		
REVIEW STATUS		
Lead agency: <input checked="" type="checkbox"/> EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency		
Author name: Robert Weber with support from U.S. Army Corps of Engineers, Kansas City District, Kansas City, Missouri		
Author title: Remedial Project Manager		Author affiliation: U.S. EPA, Region 7
Review period: <u>8/31/2002</u> to <u>8/31/2007</u>		
Date(s) of site inspection: <u>4/3/2007</u>		
Type of review: <input checked="" type="checkbox"/> Statutory <input type="checkbox"/> Policy <input checked="" type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-SARA <input type="checkbox"/> NPL-Removal only <input type="checkbox"/> Non-NPL Remedial Action-site <input type="checkbox"/> NPL State/Tribe-lead <input type="checkbox"/> Regional Discretion		
Review number: <input type="checkbox"/> 1 (first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify)		
Triggering action: <input type="checkbox"/> Actual RA Onsite Construction at OU # _____ <input type="checkbox"/> Actual RA Start <input type="checkbox"/> Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report <input type="checkbox"/> Other (specify)		
Triggering action date (from WasteLAN): <u>9/10/2002</u>		
Due date (five years after triggering action date): <u>9/10/2007</u>		

Five-Year Review Summary Form cont'd.

Issues:

- It was reported in the last Five-Year review that the deed at the county recorder's office fails to mention the requirements of the state registry. This issue is still pending.
- Animal trails along the south and east edges of the cover were observed.
- A crack/separation was observed in the concrete drainage structure on the eastern portion of the cap at the top (near the river bank slope).
- Cut bank erosion was noted near the middle point at the base of the river. The erosion has not reached the waste material.
- The city of Red Oak would like to consider reuse of a portion of the landfill.

Recommendations and Follow-Up Actions:

- As stated in the First Five-Year report, the State should address pertinent requirements of the state registry rules with the City, so the property deed can accurately reflect these requirements. In lieu of placing the site on the state registry, the state of Iowa may elect to impose another mechanism to achieve the goal of the notice.
- The animal trails along the southern and eastern edge of the landfill cover should be monitored and repaired as needed.
- The river bank slope should be closely monitored and repaired if necessary for cracks, erosion and other abnormalities.
- The crack/separation observed in the concrete drainage structure on the eastern portion of the cap at the top (near the river bank slope) should be repaired.
- Any potential reuse activities will need to be evaluated to determine appropriateness for the site to assure such use does not disturb any remedial measures and conforms with the requirements in the Consent Decree (CD), ROD, and ESD. The site has been included as part of EPA's "Return to Reuse Initiative" to facilitate technical support during any potential future reuse activities.

Protectiveness Statement(s):

The remedy at the site, in its present state, is protective of human health and the environment. All threats at the site have been addressed through capping of contaminated soil and waste on-site, construction of diversion and drainage structures, contouring and revegetation of river bank slope, access and institutional controls and groundwater monitoring.

Long-Term Protectiveness:

Long-term protectiveness of the remedial action continues to be verified by regular inspections, maintenance, and sampling of surface and groundwater at the site, as specified in the Monitoring Operation and Maintenance plan (MOMP). Current data indicate no impacts to surface water from the landfill. There is no evidence of any exposure to or impact from groundwater contaminants in the private wells in the surrounding area. The data indicate that the remedy is functioning as intended.

Other Comments:

None

**RED OAK LANDFILL SUPERFUND SITE
RED OAK, IOWA
SECOND FIVE-YEAR REVIEW REPORT**

1.0 INTRODUCTION

The purpose of the five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Reports. In addition, Five-Year Review Reports identify issues found during the review, if any and identify recommendations to address them.

The Agency is preparing this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 (c) and the National Contingency Plan (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 such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with Section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The Agency interpreted this requirement further in the NCP: 40 CFR 300.430(f)(4)(ii) states:

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 the initiation of the selected remedial action.

The United States Environmental Protection Agency (EPA) Region VII, conducted the Second Five-Year Review of the remedial actions implemented at the Red Oak Landfill Superfund Site in Red Oak, Iowa. This review was conducted from February of 2007 through August 2007. This report documents the results of the review.

This is the Second Five-Year Review for the Red Oak Landfill Site. The triggering action for this review is the date of the First Five-Year Review. The First Five-Year Review was required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE CHRONOLOGY

Table 1 – Chronology of Site Events

Event	Date
Limestone quarry activities at the site	1947-1962
City purchased property and operated it as a landfill	1962-1974
Superfund 103 (c) Notification by Union Carbide and Uniroyal	1981
Final Listing on EPA National Priorities List	3/31/1989
Administrative Order on Consent for Remedial Investigation/Feasibility Study (RI/FS)	12/4/1989
Remedial Investigation/Feasibility Study made available to public	8/1992
Proposed Plan identifying EPA's preferred remedy presented to public; start of public comment period	8/1992
ROD selecting the remedy is signed	3/31/1993
Explanation of Significant Differences (ESD) to change cap design and river bank shaping	1/30/1996
Consent Decree (CD) finalizing settlement for responsible party performance of remedy entered by Federal Court	11/27/1996
Start of on-site construction (date that triggers five-year review)	8/16/1997
Completion of on-site construction	11/21/1997
Cap and slope repairs completed	11/1998
O&M Plan approved by EPA	9/29/1999
Pre-final inspection of remedial action	10/27/1999
Additional slope repairs completed	11/1999
Preliminary Close Out Report signed	6/21/2001
First Five-Year Review for Red Oak Landfill Superfund Site	9/10/ 2002
EPA Certification of Completion of the Remedy	11/19/2002
Final Closeout Report signed	6/13/2005
Deletion from the NPL	9/26/2005

3.0 BACKGROUND

3.1 Physical Characteristics

The Red Oak Landfill site occupies 40 acres in Montgomery County, Iowa, located about 1.5 miles northwest of the city of Red Oak (City) on the west bank of the East Nishnabotna River and on the east side of Parkwest Road, now known as G Avenue. Red Oak is a community of approximately 6,300 residents.

3.2 Land and Resource Use

The site was originally a limestone quarry which operated from the late 1940s to the early 1960s. The city of Red Oak purchased the property in 1962 and operated it as a landfill until it closed in April 1974. Current surrounding land use is agricultural. The East Nishnabotna River is used for fishing. It is anticipated that land use in the surrounding area will remain similar to current uses. The site is currently fenced and posted with warning signs, and the landfill waste is contained within the fenced area under an impermeable cap. The groundwater immediately beneath the site within and above the Plattsmouth Limestone (the unit quarried from the site) is not used as a drinking water source, although there are 14 groundwater wells within a one-mile radius used for drinking water or nonpotable uses from the surrounding glacial, alluvial, and bedrock aquifers. These wells are not endangered. The wells are either upgradient of the site or on the opposite side of the East Nishnabotna River. Additionally, most of any water beneath the landfill will discharge to the river. Seeps from the landfill to the river have not been detected in recent years showing that the cap is working.

3.3 History of Contamination

Wastes disposed of at the site reportedly included construction and demolition debris, tree pruning waste, municipal refuse, and industrial waste from facilities in the Red Oak area. The industrial wastes included toluene, methyl isobutyl ketone, tetrachloroethylene, mineral spirits, diacetone alcohol, laminated paper containing approximately three percent mercurous chloride from battery production, and drummed filter cake containing lead. The site posed a threat to the public health through direct contact, slope erosion, and potential leaching and migration of contaminants into surface water and groundwater.

3.4 Initial Response

The site was proposed to the National Priorities List (NPL) on June 10, 1986, and became final on March 31, 1989. An Administrative Order on Consent for the RI/FS was effective on December 4, 1989, and the responsible parties conducted the RI/FS under EPA oversight. In August 1992, the proposed plan identifying the preferred remedy was presented to the public for their review and comment, along with the RI/FS reports.

3.5 Basis for Taking Action: Contaminants

Hazardous substances that have been released at the site include aluminum, barium, cadmium, chromium, copper, lead, manganese, mercury, nickel, silver, zinc, acetone, 1,2-dichloroethene, tetrachloroethylene, bis(2-ethylhexyl) phthalate, and polycyclic aromatic hydrocarbons (PAHs). These contaminants were of concern primarily in the surface soil and exposed waste. Exposures to soil and exposed waste are associated with significant human health risks due to exceedance of EPA's risk management criteria for either the average or the reasonable maximum exposure scenarios. The carcinogenic risks were highest for exposure to soil and waste due to the concentrations of carcinogenic PAHs. Non-carcinogenic hazards were highest for exposure to soil and waste due to lead, manganese, and cadmium. Exposure to contaminated groundwater at the site was determined not to represent a significant exposure pathway.

4.0 REMEDIAL ACTIONS

4.1 Remedy Selection

The Record of Decision (ROD) for the Red Oak Landfill site was signed on March 31, 1993. The Remedial Action Objectives (RAOs) were developed as a result of data collected during the remedial investigation to aid in the development and screening of remedial alternatives to be considered for the ROD. The RAOs for the site were to:

- Reduce or eliminate the threat of direct contact with, ingestion of, or inhalation of materials containing acetone, 1, 2-dichloroethene, tetrachloroethylene, toluene, and other contaminants contained in soil and waste buried at the site;
- Reduce surface water infiltration through the buried waste materials to minimize the potential for leaching of contaminants from the waste materials to groundwater and surface water;
- Control erosion of the river bank slope to minimize the potential for exposure of buried waste materials; and
- Address potential exposure to increased contaminant levels in the future due to erosion of existing surficial materials.

The major components of the remedy selected in the ROD include:

- Installation of an engineered low-permeability cap over the surface of the landfill;
- Construction of diversion and drainage structures to manage surface drainage resulting from the reduced permeability of the landfill cover;
- Stabilization of the river bank slope by contouring and revegetation along with further study of the stability of the slope;
- Access control provided by a perimeter fence around the landfill area;

- Institutional controls, including deed restrictions, to control future land use at the site; and
- Long-term groundwater monitoring to evaluate the effectiveness of the remedy and ensure groundwater contaminant levels remains protective.

An Explanation of Significant Differences (ESD) was issued on January 30, 1996. Based on a study by the responsible parties, EPA determined that river bank slope shaping could be limited, the thickness of the landfill cap could be reduced, the slope study and further stabilization measures could be eliminated, and costs could be re-estimated. These changes were incorporated into the ESD.

Institutional controls were required for the site. These controls were sought in two ways. First, before remediation, the state had already placed the site on Iowa's Registry of Hazardous Waste or Hazardous Substance Disposal Sites, which prevents changes in land ownership or use without state approval. A registry notice was put in place by the State. Second, under the 1996 Consent Decree (CD) with EPA, the site owners granted an easement to the city containing restrictive covenants that limited future uses of the site. A provision was also added to the CD in the event the city ever became a site owner; the provision required the city to retain an easement, similar to the one in place from the previous owners, if the city ever decided to sell the property.

At the present time, the city continues to own the property. When the original owner died, he gifted the property to the city. The deed granting the property to the city, filed seven months after the CD became final, contains language which acts as a deed notice and acknowledges the grantee's assumption (i.e., the city's assumption) of the requirements of the CD concerning this real estate. In lieu of placing the site on the state registry, the state of Iowa may elect to impose another mechanism to achieve the goal of the notice.

4.2 Remedy Implementation

In a CD signed with EPA on November 27, 1996, the responsible parties agreed to perform the Remedial Design/Remedial Action (RD/RA) and pay past costs for cleaning up the site. The RD was conducted in conformance with the ROD as modified by the ESD. The RD was approved by EPA on July 28, 1997.

The RA was initiated on August 16, 1997. The initial construction activities were completed on November 21, 1997. The Potentially Responsible Party (PRPs) were divided into three groups according to the obligations they took on:

- The construction parties, consisting of Eveready Battery and its parent;
- A group of Operation and Maintenance (O&M) parties consisting of Magna International and the City; and
- A group of cash-out parties.

Construction of the remedy was initially thought to be completed in November 1997. However, areas of failure of both the landfill cap and the riverbank slope were discovered in the spring of 1998. The cap was repaired in May 1998, and the slope was repaired in September 1998.

In February 1999, the dispute provision of the CD was invoked by Eveready, concerning EPA's declination to view the entire remedy as completed. No formal statement of dispute was ever filed by Eveready at the time, and the dispute was allowed to lapse. A May 1999 site visit was set to inspect both the slope and cap, but before this meeting occurred, a second failure of the slope was discovered in the spring of 1999. Additional lab analysis was conducted to find the cause, and repairs were made in July and September 1999. It was agreed that an inspection of the project site would be conducted in October 1999, to verify that there was an adequate growth of new vegetation on the cap and slope. EPA conducted a pre-final inspection on October 27, 1999, which resulted in a "punch list" of identified construction deficiencies, mostly minor in nature. The punch list items for the cap included mowing; weed control, drainage ditch vegetation removal, erosion repair, monitoring well functionality, placement of warning signs, and removal of a silt fence. EPA determined, once these punch list items were satisfactorily completed, construction of the cap and its accompanying drainage structures would be considered completed in accordance with the ROD, ESD and RD. EPA then notified the construction and O&M parties in October 2000 that the cap portion of the remedy was now operational and ready to be maintained by the O&M parties. The remaining items on the punch list of concern to EPA were slope revegetation and slope stability. EPA had declared the cap remedy operational but final certification of the remedy awaited further assurance that the slope would survive the thaw season during a wet spring. The spring of 2000 was relatively dry, and the spring of 2001 was relatively wet. Based on the observation that little additional damage to the slope occurred in the winter of 2000-2001, EPA determined that construction of the remedy as embodied in the RD had been completed. The construction completion designation was achieved when the Preliminary Closeout Report was signed on June 21, 2001. EPA stated its intention to carefully monitor the landfill over the next several winters to obtain more assurance that the slope would hold. If additional damage occurred, repairs and/or other measures would be needed, and this would extend the period of monitoring. EPA reserved all of its rights to require additional remedies through a ROD amendment. EPA reserved all of its rights to require additional revegetation work or other remedies as required in the event of further slope deterioration. After the slope was determined to be adequate, EPA certified the completion of the Remedy on November 19, 2002. EPA issued a final closeout report on June 13, 2005. The site was deleted from the NPL on September 26, 2005.

4.3 System Operation, Operation and Maintenance

Pursuant to the Monitoring Operation and Maintenance Plan (MOMP), the primary activities associated with the MOMP include the following:

- Inspection of landfill cap, drainage structures and river bank slope with regards to vegetative cover, settlement, stability, fencing and monitoring well protection, including any necessary repairs;

- Annual reseeded to be done as necessary, as well as semiannual mowing and noxious weed control;
- Conducting groundwater and surface water sampling; and
- Sampling of landfill seeps occurring on the river bank slope.

The responsible parties have been conducting monitoring and maintenance per MOMP. Since 2001, the landfill cap, stabilized riverbank slope, monitoring wells, fence and security structures, and drainage structures have been inspected on an annual basis. Mowing of landfill cap is done on a semiannual basis.

Costs associated with the landfill O&M are presented as follows:

Calendar Year	City of Red Oak, Iowa O&M Costs	Intier Automotive (Magna International) Estimated O&M Costs
2002	\$2,074.79	\$25,965.00
2003	\$1,277.40	\$22,468.00
2004	\$2,157.50	\$899.00
2005	\$1,670.62	\$8,925.00
2006	\$2,088.00	\$16,101.00

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

Since the First Five-Year Review, modifications to the site monitoring and analytical program were proposed by the PRPs. Modifications to the groundwater sampling and analytical programs were accepted with some amendment by EPA Region 7 in a correspondence dated April 24, 2003. Modification to the surface water sampling program was accepted by EPA Region 7 in February 2004. These modifications were formally included into the Monitoring, Operation and Maintenance Plan via revisions in April 2004. The modifications included the reduction of sampling frequency of groundwater from semi-annually to annually and surface water to every five years unless analytical results and site conditions warrant greater frequency. The second modification approved by EPA consisted of reducing the analytical testing program to incorporate the Analyte Short List including volatiles, metals, and inorganics. This is further discussed in Section 6.4.

During the last five years, the PRPs have conducted landfill cap inspections, stabilized riverbank slope inspections and surface water and groundwater sampling. Five sampling events were conducted and reported during this time frame. The monitoring reports were submitted to EPA. The results of the surface and groundwater sampling are discussed in detail in Section 6.4.

On November 19, 2002, EPA certified the stabilized riverbank slope. Regular inspections have been conducted from 2003 to present. A few issues and follow up actions were discussed during the First Five-Year Review Report. These included:

- Placement of a sign notifying workers to drive around the slope rather than up it
- Notice of the State Registry on the property deed by the State of Iowa and the City of Red Oak
- Adequate rock cover on the North drainage channel near the gate

With the exception of state registry issue, the other two issues were resolved during this period. The state registry issue is still pending. It was recommended that the state address pertinent requirements of the registry rules so that the latest deed actually reflects these requirements. In lieu of placing the site on the state registry, the state of Iowa may elect to impose another mechanism to achieve the goal of the notice.

6.0 FIVE-YEAR REVIEW PROCESS

The Five-Year Review has been conducted in accordance with the EPA's Comprehensive Five-Year Review Guidance, dated June 2001 (EPA, 2001). A site inspection was conducted and a review of the applicable data and documentation covering the period of the review was evaluated. The findings of the review are presented in the following sections.

6.1 Administrative Components

The Red Oak Landfill Five-Year Review team was led by Rob Weber, the EPA remedial project manager (RPM) for the site. The review was conducted between February 20, 2007, and August 31, 2007. The review included community involvement, document review, data review, site inspection, local interviews and report development and review.

6.2 Community Involvement

Activities to involve the community in the Second Five-Year Review were initiated in February 2007. A public notice announcing the start of this review was published in Red Oak Courier and Red Oak Shopper on February 20, 2007. The public was invited to submit any comments to EPA. No comments were received.

Upon completion of this report, a notice will be placed in the same local newspapers announcing the completion of Five-Year Review, and the availability of the report at the Red Oak Public Library and EPA Region 7 Records Center.

6.3 Document Review

This Second Five-Year Review included review of all relevant documents including O&M records and monitoring data (Attachment 3).

6.4 Data Review

This section discusses the surface water and groundwater monitoring results from 2002 to 2006. In 2003, modifications to the site MOMP was proposed by the responsible parties based upon the semi-annual groundwater monitoring results of 2001/2002, and 2003 annual groundwater monitoring results. The results indicated that a number of compounds such as antimony, arsenic beryllium, copper, lead, mercury, silver, thallium, vanadium, cyanide, barium cadmium, selenium and zinc be removed from the annual Target Analyte List (TAL), because these compounds were detected less than or very close to the method detection limit or were consistently below the Maximum Contaminant Level (MCL). These modifications were accepted by EPA Region 7 with some amendment. These modifications were formally integrated into the MOMP via revisions in April 2004. The approved modifications included the following:

- Reduction of sampling frequency of groundwater from semi-annually to annually and surface water to every five years unless analytical results and site conditions suggest otherwise.
- Reduction of analytical testing program to incorporate the Analyte Short List which included: Target Compound List (TCL)-VOCs; TAL-inorganics (total and dissolved): aluminum, arsenic, barium, cadmium, chromium, cobalt, iron, manganese, nickel, selenium, sodium, zinc, chloride, ammonia, nitrogen, chemical oxygen demand (COD) and total organic halides (TOX).
- The following have been removed from the annual monitoring program: antimony, beryllium, calcium, copper, lead, magnesium, mercury, potassium, silver, thallium, vanadium, cyanide and phenols.

6.4.1 Surface Water

In accordance with approved modifications to the MOMP in 2003, surface water samples were collected at two locations along the west bank of the East Nishnabotna River. The samples were collected on November 13, 2002 and September 27, 2005. Surface water sampling was not conducted during the 2003, 2004 and 2006 monitoring activities. Samples (SW01) and (SW02) were collected downstream and upstream of the landfill, respectively. These samples were analyzed for TAL –VOCs and metals. No VOCs were detected above the laboratory reporting limits. Surface water samples were evaluated for both total and dissolved metals. Table 2 illustrates the total metals concentration in both upstream (SW02) and downstream samples (SW01). No evidence of metals impact from the landfill were observed in any surface water samples, TAL metal concentrations from upstream samples were similar to downstream samples. It appears that no harmful chemicals are exiting from the landfill and contaminating the river.

No active seeps or evidence of seepage have been identified on the riverbank slope. Monitored parameter concentrations in monitoring wells GW02, GW03 and GW05 which are located near the river have not shown any significant increases. This suggests that the potential for surface water impact from contaminants in groundwater is minimal.

6.4.2 Ground Water

During this Second Five-Year Review, five rounds of groundwater monitoring were conducted and reported: November 2002, July 2003, July 2004, September 2005, and June 2006. During this period, five existing groundwater monitoring wells (GW01, GW02, GW03, GW04, and GW05) were sampled for TCL-VOCs and TAL -Inorganics (Tables 3a-e). These monitoring wells were sampled on an annual basis. A groundwater sampling round was also conducted in June 2007 but the validated data will not be available at the time of this Five-Year Review Report and will be included in the next Five-Year Review.

6.4.3 Volatile Organic Compounds

A review of the groundwater analytical data from these wells reveals that VOCs are generally detected only in one monitoring well (GW05). Historically, at this location, low levels of acetone, (52 µg/L), 4 methyl-2-pentanone (ranging 104-169 µg/L), toluene (ranging 10-108 µg/L) and xylenes (6 µg/L) were present in GW-05. *Cis*-1,2-dichloroethene was detected only once in GW02 during the 2001 sampling round. No VOCs were detected during the 2006 sampling event. The VOCs analysis of groundwater reveals that overall VOC concentration in the groundwater is exhibiting a decreasing trend. No VOCs were detected during the last (2006) round of sampling in any of the five wells on-site.

6.4.4 Metals

The groundwater samples were evaluated for both total and dissolved metals. The following paragraphs discuss the results of metals analyses.

Historically the total lead has been detected slightly over the drinking water level of 15 µg/L. After the 2001 sampling event, lead exceedances were not observed in any monitoring wells on-site. In 2004, lead along with other selected metals (see bullet 3, Section 6.4) were removed from the annual monitoring program.

Table 3a illustrates the presence of total and dissolved metals in groundwater monitoring well GW01. Total aluminum concentrations significantly exceeded the action levels in GW01. However, since 2002, dissolved aluminum concentrations have been below the detection levels.

Other total metals that are detected slightly above the action levels are cobalt, iron, manganese, sodium and nickel. With the exception of sodium, all other metals were detected below their action levels in the dissolved samples.

Table 3b shows total and dissolved metal concentrations detected in monitoring well GW02 during the last five annual sampling rounds. Aluminum is significantly higher than its action level in all samples. However, the dissolved concentrations are significantly lower.

Total cobalt exceeds action levels in four out of the last five sampling events and total chromium exceeds in the last two. However, neither cobalt nor chromium was detected in the dissolved results. Iron and manganese were detected in the total sample but are below the action levels in the dissolved samples.

Table 3c illustrates the total and dissolved metals for monitoring well GW03. Total aluminum, arsenic, cobalt, iron, manganese and sodium were detected above their respective action levels. However, the levels of dissolved metals were decreased below the action levels in the latest round of sampling with the exception of manganese and sodium.

Table 3d shows the results of metals concentration in GW04. This well shows only two compounds (aluminum and sodium) exceeding the action levels in total and dissolved metals. Dissolved aluminum is nondetect in the 2006 sampling round.

Monitoring well GW04 shows only two compounds, total aluminum and sodium above the action levels. The dissolved values are all below action levels except sodium (Table 3d).

Sampling rounds collected in monitoring well GW05 during the last five periods shows aluminum, iron, manganese, and sodium detected above the action levels for those compounds. The dissolved values are slightly less than the total values (Table 3e).

Total metals above health based MCLs are arsenic and chromium in GW02 and arsenic in GW03. Dissolved metals may indicate those elements that are bio-available. When observing only dissolved metals compared to MCLs, there are no exceedances of health-based action criteria. Contaminants are present in the groundwater, but exposure to the contaminated groundwater is not a complete exposure pathway.

6.4.5 Groundwater Use Review

As required in the MOMP, a groundwater use review was conducted by ATC Associates, Inc. (contractor to Intier Automotive Seating, Inc. [Magna International]) within the two miles radius of the landfill to identify new construction or development within the area. ATC Associates Inc. has been conducting such surveys on an annual basis. Several developments have been taking place within the two miles radius of the site. A house has been constructed on a portion of the adjoining property to the west-northwest of the site. A new well has been installed. This well is approximately 150 to 200 feet north of the northwest corner of the property and is approximately 50 feet deep. This well is upgradient from monitoring well GW01 which is considered an upgradient well for the landfill. Groundwater flow direction is east-south east. Most of any water within the landfill will discharge to the East Nishnabotna River. Based upon the contaminant trends observed to date, the landfill is not considered to represent a significant threat to this domestic well. Additionally and based on a surface water review presented above, the potential impacts to surface water from groundwater is minimal. Any groundwater contamination appears to be contained within the landfill.

6.5 Site Inspection

A Site inspection was conducted on April 3, 2007, by EPA's Remedial Project Manager in cooperation with the Iowa Department of Natural Resources, The city of Red Oak, Iowa and Intier Automotive Seating, Inc.(Magna International). The purpose of this inspection was to assess the protectiveness of the remedy, including the integrity of the cap, condition of the river bank slope and drainage structures, physical conditions of the groundwater monitoring wells, and presence of fencing to restrict access.

Examination of the site revealed no major problems. The landfill cap was in good condition. Some animal trails were observed along the south and east edges of the cover. Vegetative cover was well established and no significant settling problems were evident. Review of the O&M documents indicates periodic inspections by City officials and Magna International representatives have been conducted. EPA recommends that the south and east edge of the landfill cover be monitored and repaired as needed.

Along the extreme south end of the riverbank, some longitudinal cracks were observed. Additionally, near the base of the river bank at its midpoint, some cut bank erosion was observed. The erosion does not appear to be reaching the waste material given the distance of at least 100 feet from buried waste materials and the limited erosion. Buried waste materials are also located at a higher elevation than the river. EPA recommends continued monitoring of these areas and conducting mitigation actions if the cracks or erosion worsen.

A small crack/separation was observed in the concrete drainage structure on the eastern portion of the cap at the top (near the riverbank slope). EPA recommends repair of this area.

Fencing and signs were in place and no evidence of trespassing was noted. Monitoring wells were found to be in good condition.

6.6 Interviews

Interviews were conducted with Mr. Brad Wright, City Manager, Mr. William Willis a representative of ATC Associates, Inc. (contractor to Intier Automotive Seating, Inc.[Magna International]), and Tom Bentley, the Red Oak Waste Water Treatment Plant Superintendent. These interviews were conducted during the site inspection. No significant problems were identified during these interviews. The city has expressed interest in the reuse of a portion of the landfill. Reuse being considered at the landfill may include a local model airplane flying field, a natural habitat, or other complementary activities. If site reuse is considered, it must be consistent with the requirements in the CD.

7.0 TECHNICAL ASSESSMENT

7.1 Question A: Is the Remedy functioning as intended by the Decision Documents?

The review of the documents, Applicable or Relevant and Appropriate Requirements (ARAR), risk assumptions, and the results of the site inspection indicate that the remedy implemented at this site is functioning as intended by the ROD, and as modified by ESD. The capping of the landfill has achieved the remedial objectives of reducing or eliminating the threat of direct contact with, ingestion of, or inhalation of landfill contaminants present in soil and waste buried at the site. The capping also helped in reducing or eliminating surface water infiltration through the buried waste materials. This in turn helped minimized the potential for leaching of contaminants from the buried waste materials to groundwater and surface water. The effective implementation of access and institutional controls further prevents exposure.

The regular maintenance of the cap and associated drainage structures has been effective. Regular inspections reveal that the cap is in good shape and has had no major problems. The stabilized river bank slope is generally intact with only minor cracks that have been monitored carefully. The institutional controls in place appear to have been working properly. No activities were observed that have violated the institutional controls. The landfill cap, slope and surrounding areas were undisturbed and no uses of groundwater or surface water that would result in new exposures were observed.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the Remedy selection still valid?

No changes in the physical conditions have been observed at the site that would affect the protectiveness of the remedy.

1. Changes in Standards and To Be Considered: The remedial construction and slope stabilization have been completed at this site and all the ARARs cited in the ROD have been met. Long Term Monitoring is ongoing and the impact to groundwater and the river has been monitored as required. During the last five years a few modifications to the monitoring plan were proposed by the responsible parties and approved by EPA.

2. Changes in Exposure Pathways, Toxicity, and other Contaminant Characteristics: The exposure assumptions used to develop the Human Health Risk Assessment included both current exposures and potential future exposures. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment. These assumptions are considered conservative in evaluating risk and developing risk-based cleanup levels. Based upon the data analysis, no changes to these assumptions or the cleanup levels developed from them is warranted at this time. No changes were observed during this Second Five-Year review that could affect the protectiveness of the remedy implemented at this site.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the Remedy?

The surface water and groundwater sampling illustrates that no discernible impacts were observed to the river from the landfill. No additional risks have been identified during this Second Five-Year Review. The periodic inspection of the landfill cap and the stabilized slope reveals no signs of any significant damage or impact from human activities or weather related events. There is no other information that calls into question the protectiveness of the remedy.

7.4 Technical Assessment Summary

Based upon the review of data, site inspection, and the interviews, the remedy at this site is functioning as intended by the ROD and as modified by the ESD. There have been no changes in the physical conditions at the site that would affect the protectiveness of the remedy. The ARARs cited in the ROD have been met. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment. There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into questions the protectiveness of the remedy.

8.0 ISSUES

Table 4 - Issues

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
Along the extreme south end of the riverbank, some longitudinal cracks were observed. Additionally, near the base of the river bank at its midpoint, some limited cut bank erosion was observed. This erosion has not reached the waste material given that plan drawings show that a distance of approximately 100 feet or more exists between the river and the buried industrial and municipal waste materials. In the ESD, slope instability was no longer thought to be attributable to possible "toe erosion" of the slope by the river. In the ESD, the requirement for further study and a possible follow-up remedy was no longer required. Observations from the April 2007 site visit confirm this.	N	N
The issue of the inclusion of the state registry information on the property deed at the county recorder's office is still pending. In lieu of placing the site on the state registry, the state of Iowa may elect to impose another mechanism to achieve the goal of the notice.	N	N
A small crack/separation was observed in concrete drainage structure on the eastern portion of the cap at the top (near the riverbank slope).	N	N
Reuse of a portion of the landfill is being considered by the city of Red Oak.	N	N

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 5 – Recommendations and Follow-up Actions

Issue	Recommendations /Follow-up Actions	Responsible Party	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
					Current	Future
River slope longitudinal cracks and cut bank erosion	Should be monitored and repaired when necessary.	City of Red Oak and Magna International	EPA/ State of Iowa	Ongoing	N	N
Deed reference regarding state registry	The state should address pertinent requirements. The State of Iowa may elect to negotiate placement of an environmental covenant on the site, in which case the registry listing would be eliminated.	State of Iowa and City of Red Oak	EPA/ State of Iowa	Ongoing	N	N
Crack in concrete drainage structure	Recommend repair as needed.	City of Red Oak and Magna International	EPA/ State of Iowa	Ongoing	N	N
Site Reuse	Evaluate the proposed reuse activities in relation to the current remedy and decision documents including the consent decree in place at the site. The site has been included as part of EPA's "Return to Reuse Initiative" to facilitate technical support during any potential future reuse activities.	City of Red Oak and Magna International	EPA/State of Iowa	Ongoing	N	N

10.0 PROTECTIVENESS STATEMENT

The remedy at this site is protective of human health and the environment. All threats at this site have been addressed through capping of contaminated soil and waste on-site, construction of diversion and drainage structures, contouring and revegetation of the river bank slope, access and institutional controls, and groundwater and surface water monitoring.

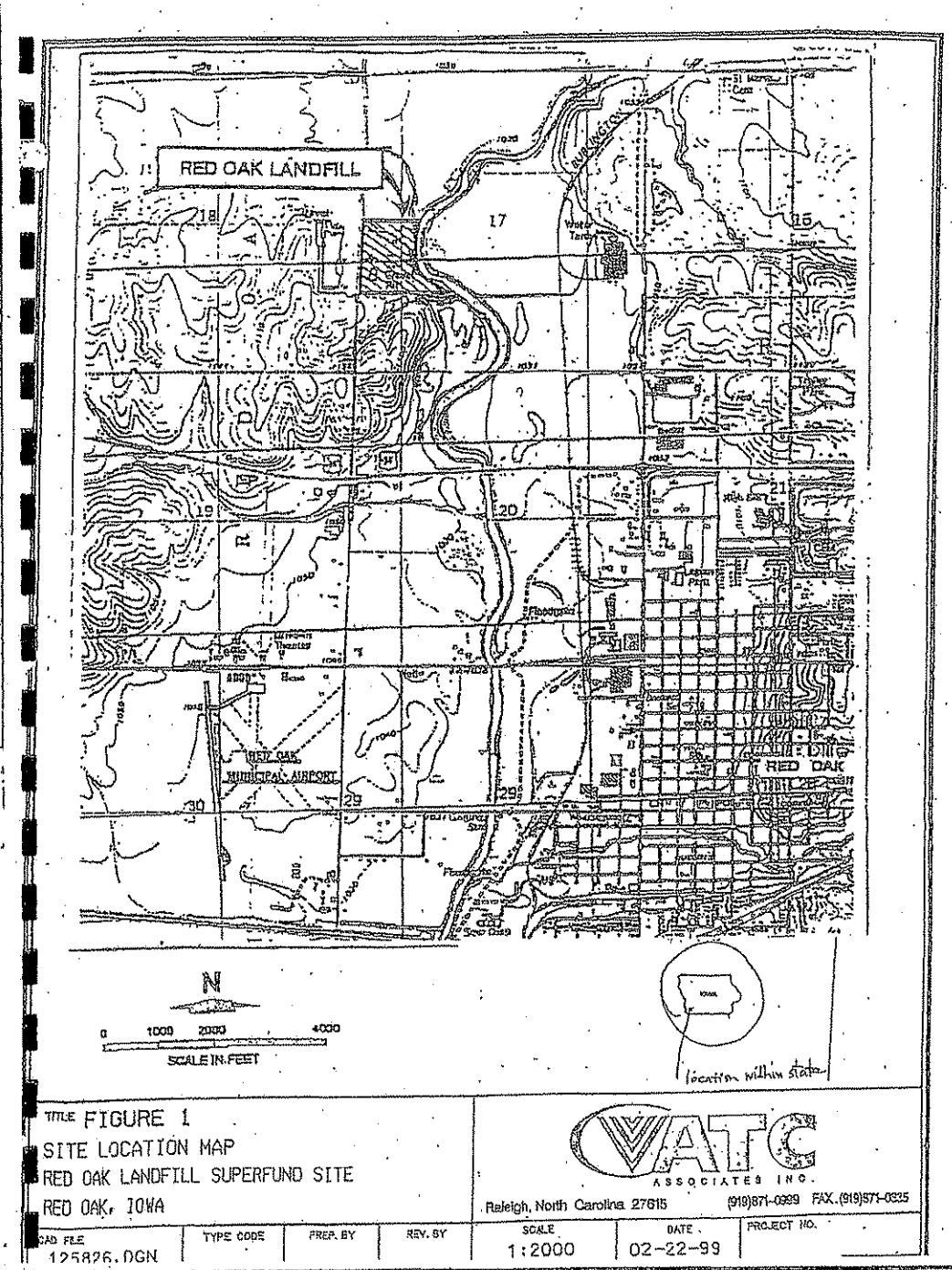
11.0 NEXT REVIEW

The next Five-Year Review for the Red Oak Landfill Superfund Site is required by September 2012 within five years of the signature date of this review.

ATTACHMENTS

ATTACHMENT 1

SITE LOCATION MAP



ATTACHMENT 2

SITE PLAN

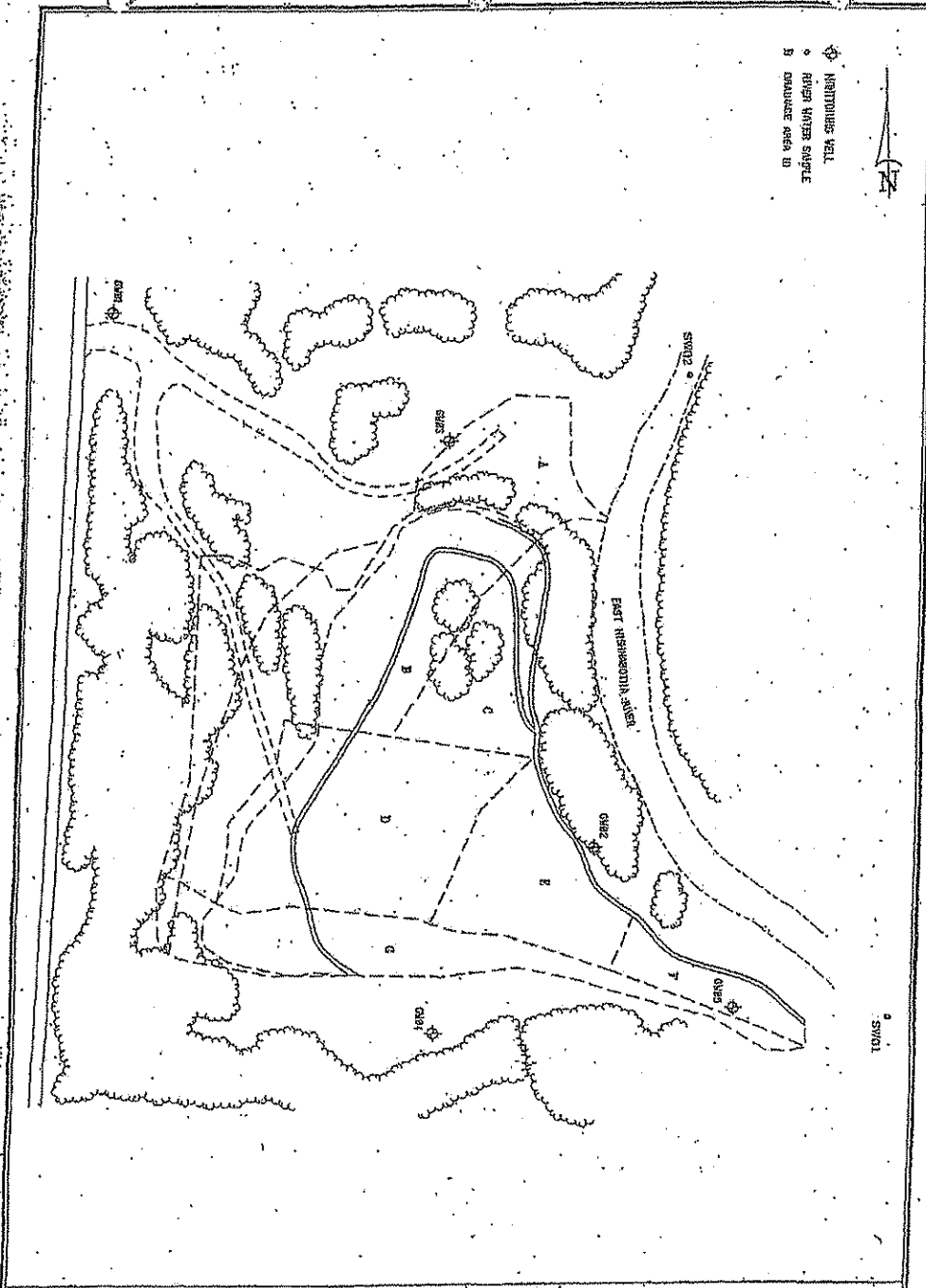


FIGURE 2
SITE PLAN AND MONITORING WELL LOCATIONS
RED OAK LANDFILL SUPERFUND SITE
RED OAK, IOWA



Raleigh, North Carolina 27616 (919) 871-0099 FAX (919) 871-0035

JOB FILE	TYPE CODE	IND. BY	REV. BY	SCALE	DATE	PROJECT NO.
1400000000				N. T. S.	02-08-99	

ATTACHMENT 3

LIST OF DOCUMENTS REVIEWED

1. Record of Decision, Red Oak Landfill, March 31, 1993
2. Explanation of Significant Differences, Red Oak Landfill Site, January 30, 1996
3. Consent Decree, United States v. Eveready Battery Co., Inc., et al, Civil Action 1-96-CV-10041, November 27, 1996
4. Environmental Protection Restrictive Covenant and Access Easement, R. John Swanson and Blanche Kinnison, Co-executors of the Estate of Lowell G. Kinnison; Blanche I. Kinnison; and The City of Red Oak, Iowa, December 11, 1996
5. Warranty Deed, The Northwest Quarter of the Southwest Quarter in Section 17, Township 72 North, Range 38, West of the 5th P. M., Gift to the City of Red Oak, Iowa, June 25, 1997
6. Monitoring, Operation and Maintenance Plan, Red Oak Landfill Site, June 11, 1999 and subsequent revisions
7. Comprehensive Five-Year Review Guidance, U.S. EPA, June 2001
8. Preliminary Closeout Report, Red Oak Landfill Site, June 21, 2001
9. First Five-Year Review Report, Red Oak Landfill Site, September 2002
10. Monitoring and Maintenance Report, Red Oak Landfill Site, Fall 2002
11. Monitoring and Maintenance Report, Red Oak Landfill Site, Fall 2002
12. Remedial Action Report, Red Oak Landfill Site, December 10, 2002
13. Monitoring and Maintenance Report, Red Oak Landfill Site, Summer 2003
14. Monitoring and Maintenance Report, Red Oak Landfill Site, 2004
15. Monitoring and Maintenance Report, Red Oak Landfill Site, 2005
16. Final Closeout Report, Red Oak Landfill Site, June 13, 2005
17. Monitoring and Maintenance Report, Red Oak Landfill Site, 2006

ATTACHMENT 4

Applicable or Relevant and Appropriate Requirements (ARARs)

Medium/Authority	ARAR	Status	Requirement Synopsis	Action to be taken to Attain ARAR
Surface Water/Clean Water Act	Federal-CWA-Ambient Water Quality Criteria (AWQC) Protection of Freshwater Aquatic Life, Human Health, Fish Consumption	Relevant & Appropriate	AWQC are developed under the CWA as guidelines from which states develop water standards. CERCLA requires compliance with such guidelines when they are relevant and appropriate. A more stringent AWQC for aquatic life may be found relevant and appropriate rather than an MCL, when protection of aquatic organisms is being considered at a site. Federal AWQC are health-based criteria which have been developed for 95 carcinogenic compounds; these criteria considered exposure to chemicals from drinking water and/or fish from drinking water and/or fish consumption. Acute and chronic exposure levels are established.	The remedy selected has attained AWQC in the river water. River sampling continues to show no discernible impact from the site upon the river.
Floodplains/Resource Conservation and Recovery Act (RCRA)	Federal 40 Code of Federal Regulations Part 264.18 Location Standards.	Relevant & Appropriate	This regulation identifies geological features that a proposed location for a RCRA hazardous waste treatment and/or disposal facility must avoid. Three specific geological features are identified of which one applies to the site. This feature and the significance is: Flood Plain: A facility located in a 100-year floodplain must be designed, constructed, operated and maintained to prevent washout of any hazardous waste unless the owner or operator can demonstrate to the EPA Regional Administrator that he can meet the criteria established under this subpart which exempts him from complying with this requirement.	This site is located within a 100-year floodplain. On-site remediation activities complied with the requirements of 40 CFR Parts 264.18 (a) to prevent washout of the landfill waste.
Solid Waste	State Solid Waste 576 IAC 103 & 110	Relevant & Appropriate	Sanitary landfill monitoring, closure, and post-closure regulations were considered relevant and appropriate.	These requirements were met in the design of the cap, and MOMP requirements for post-closure care and groundwater monitoring. New (revised) requirements have also been satisfied by the existing remedy.
Air/Clean Air Act & State Air Act	567 IAC 28	Relevant & Appropriate	These standards were considered to apply to the site during and after construction. Fugitive dust during construction and landfill emissions after construction applied	Efforts were made during construction to control fugitive dust, and the cap was designed to consider landfill emissions.

Table 2:

**Total Metals Concentration in Surface Water Samples
RED OAK LANDFILL SUPERFUND SITE, RED OAK, IOWA**

Target Compound List	Upstream (SW02)			Downstream (SW 01)		
	11/13/2002	7/30/2003	9/27/2005	11/13/2002	7/30/2003	9/27/2005
Date						
Aluminum	550	387	566	625	579	873
Arsenic	<15	<15	2.1	<15	<15	1.9
Barium	135	124	136	122	134	126
Cadmium	<2	<2	<.5	<2	<2	0.5
Chromium	<4	<4	<10	<4	<4	<10
Cobalt	<3	5	<10	<3	4	<10
Iron	444	341	850	290	513	800
Manganese	301	187	139	144	96	105
Nickel	<6	<6	<10	<6	<6	<10
Selenium	21	<10	1.1	13	<10	1
Sodium	13400	11100	10900	14700	11300	10800
Zinc	<10	<10	<10	<10	<10	<10

Dissolved Metals Concentration in Surface Water Samples

Target Compound List	Upstream (SW02)			Downstream (SW 01)		
	11/13/2002	7/30/2003	9/27/2005	11/13/2002	7/30/2003	9/27/2005
Date						
Aluminum	420	196	<50	507	194	<50
Arsenic	<15	<15	1.4	<15	<15	1.7
Barium	126	138	118	121	122	115
Cadmium	<2	<2	<0.5	<2	<2	<.5
Chromium	<4	<4	<10	<4	<4	<10
Cobalt	<3	5	<10	<3	4	<10
Iron	57	<50	<50	<50	<50	<50
Manganese	182	93	80	113	23	52
Nickel	<6	<6	<10	<6	<6	<10
Selenium	14	<10	<1	18	<10	1
Sodium	14000	11500	11600	14000	12200	11000
Zinc	<10	<10	<10	<10	<10	<10

All values are presented in µg/L (parts per billion)

Table 3a

TOTAL METALS CONCENTRATION IN GROUNDWATER
 MONITORING WELL GW01
 RED OAK LANDFILL SUPERFUND SITE, RED
 OAK, IOWA

Target Compound List	MCL (µg/L)	Secondary MCL (mg/L)	Action Level (µg/L)	GW01				
				11/13/2 002	7/23/2 003	7/12/2 004	9/27/2 005	6/8/2 006
Date								
Aluminum	-	200	50-200	1800	470	371	13374	6180
Arsenic	10*	-	10	0.00	0.00	0.00	6.5	4.0
Barium	2000	-	2000	224	161	163	289	210
Cadmium	5	-	5	<2	<2	<2	0.7	0.5
Chromium	100	-	100	<4	<4	<3	26	20
Cobalt	-	-	4	5	4	<3	<10	<10
Iron	-	300	300	2300	771	450	11100	4990
Manganese	-	50	50	410	81	51	507	280
Nickel	100	-	100	14	<6	<7	28	10
Selenium	50	-	50	<10	<10	<15	1.1	1.0
Sodium	-	-	20000	36300	40800	52900	39700	3310 0
Zinc	-	5000	5000	46	<10	<15	25	<10

DISSOLVED METALS CONCENTRATION IN GROUNDWATER
 MONITORING WELL GW01

Target Compound List	MCL (µg/L)	Secondary MCL (mg/L)	Action Level (µg/L)	GW01				
				11/13/2 002	7/23/2 003	7/12/2 004	9/27/2 005	6/8/2 006
Date								
Aluminum	-	200	50-200	440	<100	<167	<50	<50
Arsenic	10*	-	10	<15	<15	,2	<1	<1
Barium	2000	-	2000	150	132	161	139	128
Cadmium	5	-	5	<2	<2	,2	<0.5	<.5
Chromium	100	-	100	<4	<4	<3	<10	<10
Cobalt	-	-	4	3	<3	<3	<10	<10
Iron	-	300	300	268	<50	<67	<50	<10
Manganese	-	50	50	21	<2	<7	<10	<10
Nickel	100	-	100	<6	<6	<7	<10	<10
Selenium	50	-	50	<10	<10	,15	<1	<1
Sodium	-	-	20000	35900	43500	55000	37900	3810 0
Zinc	-	5000	5000	<10	<10	<15	25	<10

All values are presented in µg/L (parts per billion)
 Values presented in bold type exceed the MCLs/Action
 Levels/laboratory reporting limits.
 The MCL for Arsenic is 10
 µg/L.

Table 3b

**TOTAL METALS CONCENTRATION IN GROUNDWATER MONITORING
WELL GW02
RED OAK LANDFILL SUPERFUND SITE, RED
OAK, IOWA**

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW02				
				11/7/20 02	7/23/20 03	7/12/20 04	9/27/20 05	6/8/20 06
Date								
Aluminum	-	200	50-200	1340	1470	1030	49748	14980
Arsenic	10*	-	10	0.00	0.00	0.00	15.1	2
Barium	2000	-	2000	227	304	183	1293	450
Cadmium	5	-	5	<2	<2	<2	3.2	1.2
Chromium	100	-	100	43	211	30	2173	480
Cobalt	-	-	4	6	10	<3	53	10
Iron	-	300	300	1340	3140	855	54200	14100
Manganese	-	50	50	347	580	358	5743	1810
Nickel	100	-	100	118	93	53	418	150
Selenium	50	-	50	<10	<10	<15	3.8	1
Sodium	-	-	20000	20300	19300	18500	17400	16600
Zinc	-	5000	5000	15	25	16	189	60

**DISSOLVED METALS CONCENTRATION IN GROUNDWATER
MONITORING WELL GW02**

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW02				
				11/7/20 02	7/23/20 03	7/12/20 04	9/27/20 05	6/8/20 06
Date								
Aluminum	-	200	50-200	322	<100	<167	<61	<50
Arsenic	10*	-	10	<15	<15	<15	<1	<1
Barium	2000	-	2000	134	85	94	84	118
Cadmium	5	-	5	<2	<2	<2	<.5	<.5
Chromium	100	-	100	<4	<4	<3	<10	<10
Cobalt	-	-	4	4	<3	<3	<10	<10
Iron	-	300	300	<50	<50	<87	<50	<10
Manganese	-	50	50	3	<2	<7	<10	<10
Nickel	100	-	100	118	10	9	14	<10
Selenium	50	-	50	<10	<10	<15	2.3	3
Sodium	-	-	20000	20300	19000	18800	17149	19500
Zinc	-	5000	5000	15	<10	<15	<10	<10

All values are presented in µg/L (parts per billion)
 Values presented in bold type exceed the MCLs/Action
 Levels/laboratory reporting limits.
 The MCL for Arsenic is 10
 µg/L.

Table 3c

**TOTAL METALS CONCENTRATION IN GROUNDWATER
MONITORING WELL GW03
RED OAK LANDFILL SUPERFUND SITE,
RED OAK, IOWA**

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW03				
				11/7/2002	7/23/2003	7/12/2004	9/27/2005	6/8/2006
Date								
Aluminum	-	200	50-200	617	1300	574	2203	2260
Arsenic	10*	-	10	0.00	58	42	155	136
Barium	2000	-	2000	615	776	551	738	600
Cadmium	5	-	5	4	3	<2	0.7	0.6
Chromium	100	-	100	<4	5	4	17	10
Cobalt	-	-	4	5	7	<3	<10	<10
Iron	-	300	300	24000	28400	21300	34100	32600
Manganese	-	50	50	4820	4910	3740	3599	3440
Nickel	100	-	100	<6	8	<7	19	10
Selenium	50	-	50	<10	<10	<10	<1	2
Sodium	-	-	20000	29900	27000	26300	16000	15600
Zinc	-	5000	5000	61	232	101	127	120

**DISSOLVED METALS CONCENTRATION IN GROUNDWATER
MONITORING WELL GW03**

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW03				
				11/7/2002	7/23/2003	7/12/2004	9/27/2005	6/8/2006
Date								
Aluminum	-	200	50-200	306	<100	<167	262	<50
Arsenic	10*	-	10	34.00	26	8	20	5
Barium	2000	-	2000	581	517	528	412	281
Cadmium	5	-	5	4	<2	<2	<0.5	<0.5
Chromium	100	-	100	<4	<4	<3	<10	<10
Cobalt	-	-	4	5	3	<3	<10	<10
Iron	-	300	300	19600	16700	15200	12000	<10
Manganese	-	50	50	4280	3770	3190	2789	3060
Nickel	100	-	100	<6	<6	<7	<10	<10
Selenium	50	-	50	<10	<10	<15	<1	<1
Sodium	-	-	20000	29200	29000	26700	15000	17400
Zinc	-	5000	5000	<10	<10	<15	<10	<10

All values are presented in µg/L (parts per billion)

Values presented in bold type exceed the MCLs/Action Levels/laboratory reporting limits.

The MCL for Arsenic is 10 µg/L.

Table 3d

**TOTAL METALS CONCENTRATION IN GROUNDWATER MONITORING
WELL GW04
RED OAK LANDFILL SUPERFUND SITE, RED
OAK, IOWA**

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW04				
				11/13/2002	7/30/2003	7/21/2004	9/27/2005	6/15/2006
Date								
Aluminum	-	200	50-200	469	276	<167	55	290
Arsenic	10*	-	10	0	0	0	2.3	0
Barium	2000	-	2000	28	38	52	38	40
Cadmium	5	-	5	<2	<2	<2	0.6	0.5
Chromium	100	-	100	<4	<4	4	<10	<10
Cobalt	-	-	4	<3	3	3	<10	<10
Iron	-	300	300	85	98	196	80	120
Manganese	-	50	50	6	13	16	15	10
Nickel	100	-	100	<6	9	16	12	<10
Selenium	50	-	50	22	<10	<15	3.2	8
Sodium	-	-	20000	80200	96900	102000	77200	79700
Zinc	-	5000	5000	<10	<10	<15	<10	<10

**DISSOLVED METALS CONCENTRATION IN GROUNDWATER
MONITORING WELL GW04**

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW04				
				11/13/2002	7/30/2003	7/21/2004	9/27/2005	6/15/2006
Date								
Aluminum	-	200	50-200	448	188	<167	<50	<50
Arsenic	10*	-	10	<15	<15	<2	2.1	<1
Barium	2000	-	2000	29	33	47	36	38
Cadmium	5	-	5	<2	<2	<2	<0.5	0.6
Chromium	100	-	100	<4	<4	<3	<10	<10
Cobalt	-	-	4	<3	5	<3	<10	<10
Iron	-	300	300	58	69	<67	<50	<10
Manganese	-	50	50	3	<2	<7	16	<10
Nickel	100	-	100	<6	10	13	11	<10
Selenium	50	-	50	16	<10	<15	1.2	7
Sodium	-	-	20000	77800	89100	101000	76900	85600
Zinc	-	5000	5000	<10	<10	<15	<10	<10

All values are presented in µg/L (parts per billion)
 Values presented in bold type exceed the MCLs/Action Levels/laboratory reporting limits.
 The MCL for Arsenic is 10 µg/L.

Table 3e

TOTAL METALS CONCENTRATION IN GROUNDWATER
MONITORING WELL GW05
RED OAK LANDFILL SUPERFUND SITE, RED OAK,
IOWA

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW05				
				11/7/2002	7/23/2003	7/12/2004	9/20/2005	6/8/2006
Date								
Aluminum	-	200	50-200	748	408	<167	43560	460
Arsenic	10*	-	10	0	0	0	13.5	9
Barium	2000	-	2000	510	357	368	511	410
Cadmium	5	-	5	3	<2	<2	0.9	<.05
Chromium	100	-	100	<4	<4	<3	12	<10
Cobalt	-	-	4	27	16	13	30	20
Iron	-	300	300	11100	6400	4980	9790	7190
Manganese	-	50	50	6350	4350	3340	5637	4310
Nickel	100	-	100	16	7	8	32	<10
Selenium	50	-	50	<10	<10	<15	2.4	5
Sodium	-	-	20000	34800	40500	42500	29300	32500
Zinc	-	5000	5000	66	28	<125	58	30

DISSOLVED METALS CONCENTRATION IN GROUNDWATER
MONITORING WELL GW05

Target Compound List	MCL (µg/L)	Secondary MCL (µg/L)	Action Level (µg/L)	GW05				
				11/7/2002	7/23/2003	7/12/2004	9/20/2005	6/8/2006
Date								
Aluminum	-	200	50-200	198	<100	<167	<50	<50
Arsenic	10*	-	10	<15	15	15	8.29	4
Barium	2000	-	2000	503	338	358	448	382
Cadmium	5	-	5	<2	<2	<2	<.5	<.5
Chromium	100	-	100	<4	<4	<3	<10	<10
Cobalt	-	-	4	26	12	13	26	10
Iron	-	300	300	9300	5440	4880	4210	<10
Manganese	-	50	50	6130	4060	3450	5362	4550
Nickel	100	-	100	11	6	<7	25	<10
Selenium	50	-	50	<10	<10	<15	1	8
Sodium	-	-	20000	35600	38800	44400	30300	37600
Zinc	-	5000	5000	<10	<10	<15	<10	<10

All values are presented in µg/L (parts per billion)
Values presented in bold type exceed the MCLs/Action Levels/laboratory reporting limits.
The MCL for Arsenic is 10 µg/L.