PHASE III AND IV WORK PLAN

VANADIUM CORPORATION OF AMERICA SITE
NIAGARA FALLS, NEW YORK

DECEMBER 2004
REF. NO. 19867 (3)
This report is printed on recycled paper.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	GENERAL	1
1.2	WORK PLAN ORGANIZATION	1
2.0	BACKGROUND	3
2.1	SITE DESCRIPTION	3
2.2	SITE INVESTIGATIONS	3
3.0	PHASE III – REMEDIAL INVESTIGATION REPORT	5
3.1	PREVIOUS INVESTIGATIONS	5
3.2	PHYSICAL SITE CHARACTERISTICS	5
3.3	NATURE AND EXTENT OF CONTAMINATION	5
3.4	CONTAMINANT FATE AND TRANSPORT	6
3.5	HUMAN HEALTH IMPACT EVALUATION	6
4.0	PHASE IV – REMEDIAL ALTERNATIVES ANALYSIS/FEASIBILITY STUDY	7
4.1	REMEDIAL ACTION OBJECTIVES	7
4.2	IDENTIFICATION AND SCREENING OF TECHNOLOGIES	8
4.4	DEVELOPMENT OF REMEDIAL ALTERNATIVES	8
4.5	DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES	9
4.6	SELECTION OF PREFERRED REMEDIAL ALTERNATIVE	10
5.0	REPORTING	11
6.0	SCHEDULE	12
7.0	REFERENCES	13

LIST OF FIGURES
(Following Text)

FIGURE 1.1 SITE LOCATION

FIGURE 1.2 SITE PLAN

FIGURE 2.1 HISTORICAL SAMPLING LOCATIONS – NYSDEC (1996)

FIGURE 2.2 HISTORICAL SAMPLING LOCATIONS – NYSDEC (1999/2000)

FIGURE 2.3 HISTORICAL SAMPLING LOCATIONS – GOLDER ASSOCIATES INC. (2001)

FIGURE 2.4 HISTORICAL SAMPLING LOCATIONS – CRA (2003/2004)

FIGURE 2.5 OU3 SURFACE SOIL SAMPLING LOCATIONS

FIGURE 2.6 OU3 SLAG MATERIAL SAMPLING LOCATIONS

FIGURE 2.7 OU3 SUBSURFACE SOIL SAMPLING LOCATIONS

FIGURE 2.8 OU3 GROUNDWATER SAMPLING LOCATIONS

FIGURE 2.9 OU3 SURFACE WATER/SEDIMENT SAMPLING LOCATIONS

LIST OF TABLES
(Following Text)

TABLE 2.1 PREVIOUS INVESTIGATIONS AT OU3

1.0 INTRODUCTION

1.1 GENERAL

The Vanadium Corporation of America Site (Site) is located in Niagara Falls, Niagara County, New York. The Site location is presented on Figure 1.1 and a Site Plan is presented on Figure 1.2. The Site currently includes property parcels owned by Airco Properties, Inc., SKW Metals and Alloys, Inc., and the New York Power Authority (NYPA) and Niagara Mohawk Power Corporation (NiMo). The New York State Department of Environmental Conservation (NYSDEC) has designated the Site as a Class 2 inactive hazardous waste disposal site. NYSDEC has designated the SKW Metals and Alloys, Inc. parcel as Operable Unit 1 (OU1); the Airco Properties, Inc. parcel as Operable Unit 2 (OU2); and the NYPA and NiMo parcel as Operable Unit 3 (OU3).

An Order on Consent (Index No. B9-0470-94-12) was executed by NYSDEC and NYPA, NiMo, and Cyprus Amax Minerals Company (Respondents) for OU3. The Order on Consent outlines the scope of work for conducting a Remedial Investigation/Feasibility Study (RI/FS) for OU3. As presented in the Order on Consent, the work to be performed will be done in a phased manner, as summarized below:

Phase 1 – Additional Data Collection;

Phase 2 – Evaluation of Human Health Impacts;

Phase 3 – Remedial Investigation Report; and

Phase 4 – Remedial Alternatives Analysis/Feasibility Study.

This document entitled "Phase III and IV Work Plan" was prepared to describe the requirements of Phase 3 – Remedial Investigation Report and Phase 4 – Remedial Alternatives Analysis/Feasibility Study. The Work Plan organization is presented in Section 1.2.

1.2 WORK PLAN ORGANIZATION

The Phase III and IV Work Plan is organized as follows:

Section 1.0 presents the introduction;

Section 2.0 presents Site background information;

Section 3.0 outlines the requirements for the Remedial Investigation Report;

Section 4.0 outlines the requirements for the Remedial Alternatives Analysis/ Feasibility Study;

Section 5.0 presents the reporting requirements;

Section 6.0 presents the schedule; and

Section 7.0 presents the references used in the preparation of this Work Plan.

2.0 BACKGROUND

2.1 SITE DESCRIPTION

The Vanadium Corporation of America (Vanadium) site (Site) is located in Niagara Falls, Niagara County, New York. The property is bounded on the north by an automobile depot and vacant property, to the west by Witmer Road (Route 31), on the east by Interstate 190, and on the south by vacant land and industrial facilities. The nearest water bodies are the Lower Niagara River located approximately 1.4 miles west of the property and the NYPA reservoir, located approximately 0.8 miles north of the property. Water transfer units (conduits) are located beneath the NYPA property. These conduits transfer water from the Upper Niagara River, located to the south, to the NYPA reservoir. Numerous high voltage electrical transmission lines cross the Site.

The Site consists of a 25-acre parcel owned by Airco Properties, Inc. (Airco), a 27-acre parcel owned by SKW Alloys, Inc. (SKW), and right-of-way comprising approximately 88 acres owned by NiMo and the NYPA. The SKW parcel has been designated by NYSDEC as OU1, the Airco parcel has been designated as OU2, and the NYPA and NiMo parcel has been designated as OU3. This Work Plan addresses the work being conducted solely on OU3.

2.2 SITE INVESTIGATIONS

Several investigations have been performed at the Site. The majority of the previous investigations focussed on OU1 and OU2. Investigation activities on OU3 commenced in 1996. This section presents a brief summary of the investigation activities that have been performed at OU3. Table 2.1 presents a listing of the previous OU3 Site investigations.

NYSDEC Investigation - 1996

In 1996, NYSDEC performed an investigation under the Immediate Investigative Work Assignment (IIWA) program to evaluate OU3. The investigation by NYSDEC included installing eight monitoring wells for groundwater sampling, 12 soil borings for soil sampling, two test pit samples to investigate existing waste piles, and the collection of surface water and sediment samples from an existing pond located near soil boring SB-2 (see Figure 2.1). A summary of the sampling locations is presented on Figure 2.1. The results of the IIWA are presented in the IIWA Report (NYSDEC, 1997).

NYSDEC Investigation – 1999/2000

In 1999 and 2000, NYSDEC performed an IIWA Investigation for the NiMo Right of Way (ROW) to determine the presence and location of any waste/fill areas and to determine if the NiMo ROW was the source of the volatile organic contamination found in the Union Carbide (UCAR) well BW-4. The first phase of the investigation consisted of the installation of two overburden and bedrock groundwater monitoring well pairs, and subsequent groundwater sampling. The second Phase included an on-Site soil/waste investigation, Site survey/mapping, soil/waste sampling, and laboratory analyses. A summary of the sampling locations is presented on Figure 2.2. The results of these investigations are presented in the IIWA Report, Niagara Mohawk Right of Way Site (NYSDEC, 2001).

Golder Associates Inc. Investigation - 2001

In 2001, Golder Associates performed supplemental investigations at OU3 that included the collection and analyses of groundwater samples and water level measurements from the existing Site monitoring wells. Seven water samples were collected and analyzed for TAL metals and hexavalent chromium. A summary of the sampling locations is presented on Figure 2.3. The results of the Golder Site investigations are presented in the report entitled "Delineation of Surface Water Bodies, Wetlands, and Ecological Receptors at the Former Vanadium Corporation of America Site" (Golder, 2001).

Conestoga-Rovers & Associates Investigation – 2003/2004

In 2003, Conestoga-Rovers & Associates (CRA) performed a Phase I Investigation at OU3. This investigation included the advancement of 15 soil borings for soil sampling, installation of 14 monitoring wells for groundwater sampling, collection of hydraulic water level measurements, excavation of 21 test pit locations to delineate the extent of slag material, collection of 31 surface soil samples from across the Site, and the collection of surface water and sediment samples from 17 locations from the existing ponds and ditches on Site. All samples were analyzed for TAL metals and hexavalent chromium. The soil and sediment samples were also analyzed for pH. A summary of the sampling locations is presented on Figure 2.4. The results are presented in the Phase I Letter Report (CRA, 2004b).

Figures 2.5 to 2.9 present a summary of all sampling locations in OU3 for surface soil, slag material, subsurface soil, groundwater, and surface water/sediment. Data collected from all of these sampling locations will be used for the RI.

3.0 PHASE III – REMEDIAL INVESTIGATION REPORT

The purpose of the Remedial Investigation (RI) is to sufficiently define environmental conditions at the Site to permit an evaluation of potential remedial measures for the Site (i.e., Feasibility Study).

Specific objectives of the RI are:

- to characterize the on-Site and off-Site hydrogeologic conditions including horizontal and vertical groundwater flow directions;
- to define the areal and vertical limits of contamination of surface and subsurface soils;
- to characterize chemical concentrations in the groundwater, surface water, and sediments; and
- to investigate potential chemical migration from the Site.

3.1 PREVIOUS INVESTIGATIONS

The RI Report will present descriptions of previous Site investigation activities. Table 2.1 presents a summary of all the previous investigations completed at the Site.

3.2 PHYSICAL SITE CHARACTERISTICS

Data collected during previous Site investigations will be used to define the regional and Site characteristics, including the topography, geology, hydrogeology, and surface water hydrology.

Borehole logs from previous Site investigations will be presented in the RI Report and will be used to develop stratigraphic cross-sections through the Site. Water level data will be used to create groundwater contour maps and define groundwater flow conditions.

3.3 NATURE AND EXTENT OF CONTAMINATION

All analytical results for surface soil, subsurface soil, groundwater, surface water, and sediment samples collected at the Site will be tabulated and presented in the RI. The analytical data will be compared to applicable criteria in order to determine the chemical

distribution in each media. Relevant data will be presented on figures to assist in defining the extent of contamination at the Site.

The criteria to be used for each medium is as follows:

Soil:	NYSDEC TAGM #4046 – Determination of Soil Cleanup Objectives and Cleanup Levels (NYSDEC, 1994).
Groundwater:	NYSDEC Technical and Operational Guidance Series, Ambient Water Quality Standards for Class GA groundwater (NYSDEC, 1998a).
Surface Water:	NYSDEC Technical and Operational Guidance Series, Ambient Water Quality Standards for consumption of fresh water fish (NYSDEC, 1998b).
Sediment:	NYSDEC Technical Guidance for Screening Contaminated Sediments (NYSDEC, 1999).

3.4 CONTAMINANT FATE AND TRANSPORT

A Site Conceptual Model (CSM) will be developed for the Site. Based on the CSM, potential chemical migration pathways will be determined. A general description of the physical and chemical properties of the primary Site-associated compounds and the influence of these properties on the fate and transport of each compound will be presented. Additionally, the chemical migration potential for each pathway will be evaluated.

3.5 HUMAN HEALTH IMPACT EVALUATION

The results and discussion of Phase II – Evaluation of Human Health Impacts will be provided as part of the RI (CRA, 2004a). Significant exposure pathways will be identified for both current and potential future conditions. The complete Human Health Impact Evaluation Report will be included as an Appendix to the RI Report.

4.0 PHASE IV – REMEDIAL ALTERNATIVES ANALYSIS/FEASIBILITY STUDY

The Remedial Alternatives Analysis/Feasibility Study will be completed in accordance with the following guidance:

- New York State Department of Environmental Conservation, Draft DER-10, Technical Guidance for Site Investigation and Remediation, December 2002;
- New York State Department of Environmental Conservation, Technical and Administrative Guidance Memorandum (TAGM) #4030, Selection of Remedial Actions at Inactive Hazardous Waste Sites, May 15, 1990; and
- United States Environmental Protection Agency, Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988.

4.1 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are medium-specific or operable-unit specific objectives for the protection of public health and the environment and are developed based on contaminant-specific Standards, Criteria, and Guidance (SCGs) (NYSDEC, 2002). The overall remedial objective is to protect human health and the environment. At a minimum, the remedial alternative will eliminate or mitigate all significant threats to public health and the environment through the proper application of scientific and engineering principles.

RAOs will be developed which specify the contaminants and media of interest, and address the potential exposure pathways. The RAOs will be established by:

- identifying applicable SCGs taking into consideration the current and, where applicable, future land use for the Site;
- identifying all contaminants exceeding applicable SCGs and the environmental media impacted by the contaminants; and
- identifying all actual or potential public health exposures resulting from contaminants in environmental media at, or impacted by, the Site.

The RAOs will be used to define the area and volumes for the different media to be subject to remediation.

4.2 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

In this step of the FS, technologies applicable to each medium of interest will be identified and screened. Each technology will be screened for:

1. **Effectiveness** – evaluates the potential effectiveness of the technology of handling the estimated areas or volumes of media and meeting the RAOs. The potential impacts to human health and the environment during the construction and implementation phase, and how proven and reliable the technology is with respect to the contaminants and conditions at the Site are also evaluated.
2. **Implementability** - evaluates both the technical and administrative feasibility of implementing the technology. Initially, an implementability evaluation involves using readily available information from the RI on contaminant types and concentrations and on-Site characteristics to screen out technologies that cannot be effectively implemented at the Site. A subsequent, more detailed implementability evaluation includes the ability to obtain necessary permits for off-Site actions, the availability of treatment, storage, and disposal services, and the availability of necessary equipment and skilled workers to implement the technology.
3. **Cost** – uses relative capital and operations and maintenance costs rather than detailed estimates. At this stage, the cost analysis is made on the basis of engineering judgement, and each technology is evaluated as to whether costs are high, low, or medium relative to other technologies.

This screening process will eliminate technologies that cannot be effectively implemented at the Site.

4.4 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Those technologies that remain after the screening process identified above will be assembled into complete remedial alternatives. These alternatives must include a "no action" alternative and an alternative which would restore the Site to "pre-disposal conditions" (NYSDEC, 2002). Other alternatives to be considered are based on:

- current, intended, and reasonably anticipated future use of the Site;
- removal of source areas of contamination; and
- containment of contamination.

The remedial alternatives for this Site will include, but are not necessarily limited to, the following:

- no action;
- on-Site consolidation and capping;
- partial excavation with off-Site disposal/capping of remaining slag material;
- total excavation and off-Site disposal of slag ; and
- total excavation and off-Site disposal of Site-impacted sediment.

4.5 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

The detailed analysis of remedial alternatives will be completed by analyzing each alternative against the following seven criteria:

1. **Compliance with SCGs** – addresses whether or not a remedial alternative will meet applicable environmental laws, regulations, standards, and guidance. For any SCGs that will not be met, a discussion and evaluation of the impacts will be provided.
2. **Overall Protection of Human Health and the Environment** – evaluates the ability of the remedial alternative to protect public health and the environment, assessing how risks posed through each existing or potential pathway of exposure are eliminated, reduced, or controlled through removal, treatment, engineering controls, or institutional controls. The ability of the remedial alternative to achieve each of the RAOs is evaluated.
3. **Short-term Impacts and Effectiveness** – evaluates the potential short-term adverse impacts and risks of the remedial alternative upon the community, the workers, and the environment during construction and/or implementation.
4. **Long-term Impacts and Effectiveness** – evaluates the long-term effectiveness of the remedial alternative following implementation. If wastes or treated residuals remain on Site after the selected remedial alternative has been implemented, the following items will be evaluated:
   - the magnitude of the remaining risks;
   - the adequacy of the engineering and institutional controls intended to limit the risk;
   - the reliability of these controls; and
   - the ability of the remedial alternative to continue to meet RAOs in the future.

5. **Reduction of Toxicity, Mobility, or Volume** – assesses the ability of the remedial alternative to reduce the toxicity, mobility, or volume of Site contamination. Preference will be given to remedial alternatives that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the Site.

6. **Implementability** – evaluates the technical and administrative feasibility of implementing the remedial alternative.

7. **Cost** – estimates capital, operation, maintenance, and monitoring costs, and is presented on a present worth basis.

An eighth criteria that will not be used in the detailed analysis of remedial alternatives is community acceptance. This will be completed in the form of a public meeting and comment period following the NYSDEC issue of the Proposed Remedial Action Plan (PRAP).

Once the various remedial alternatives have been individually screened against the seven criteria, an analysis will be conducted whereby each remedial alternative is compared to each of the other alternatives.

4.6 SELECTION OF PREFERRED REMEDIAL ALTERNATIVE

The final step in the FS will be to select the preferred remedial alternative for the Site. The preferred remedial alternative will be the alternative that best satisfies the seven criteria as described in Section 4.5.

5.0 REPORTING

The Phase III and IV Report will be submitted in the form of a bound report, and will present the RI/FS. The Phase III and IV Report will be distributed in accordance with the Order on Consent. The report format will be as follows:

1.0 Introduction

2.0 Background

- 2.1 Site Description
- 2.2 Site Investigations

3.0 Remedial Investigation Report

- 3.1 Physical Site Characteristics
- 3.2 Nature and Extent of Contamination
- 3.3 Contaminant Fate and Transport
- 3.4 Human Health Impact Evaluation

4.0 Remedial Alternatives Analysis/Feasibility Study

- 4.1 Remedial Action Objectives
- 4.2 Identification and Screening of Technologies
- 4.3 Development of Remedial Alternatives
- 4.4 Detailed Analysis of Remedial Alternatives
- 4.5 Selection of Preferred Remedial Alternative

5.0 References

6.0 SCHEDULE

It is anticipated that the RI/FS Report will be submitted to NYSDEC in early February 2005.

7.0 REFERENCES

Conestoga-Rovers & Associates (CRA), 2004a. *Phase II Work Plan, Operable Unit 3.* Vanadium Corporation of America, Niagara Falls, New York. Prepared in November 2004.

Conestoga-Rovers & Associates (CRA), 2004b. *Phase I Letter Report.* Vanadium Corporation of America, Niagara Falls, New York. Dated August 6, 2004.

Golder Associates, Inc. (Golder), 2001. *Delineation of Surface Water Bodies, Wetlands, and Ecological Receptors at the Former Vanadium Corporation of America Site.* Town of Niagara, New York. New York Hazardous Waste Disposal Site No. 932001. Operable Unit #3. Prepared December 2001.

New York State Department of Environmental Conservation (NYSDEC), 2002. *Draft DER-10, Technical Guidance for Site Investigation and Remediation.* Dated December 25, 2002.

New York State Department of Environmental Conservation (NYSDEC), 2001. *IIWA Report.* Niagara Mohawk Right of Way Site. Town of Niagara, Niagara County. Prepared February 2001.

New York State Department of Environmental Conservation (NYSDEC), 1999. *Technical Guidance for Screening Contaminated Sediments.* Division of Fish, Wildlife and Marine Resources. Dated January 25, 1999.

New York State Department of Environmental Conservation (NYSDEC), 1998a. *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, Source of Drinking Water (Groundwater).* Dated June 1998.

New York State Department of Environmental Conservation (NYSDEC), 1998b. *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, Human Consumption of Fish (fresh water).* Dated June 1998.

New York State Department of Environmental Conservation (NYSDEC), 1997. Immediate Investigative Work Assignment (IIWA). Vanadium Corporation of America Site #932001. Operable Unit No. 3. Prepared August 1997.

New York State Department of Environmental Conservation (NYSDEC), 1994. *Determination of Soil Cleanup Objectives and Cleanup Levels.* Technical and Administrative Guidance Memorandum #4046. Dated January 24, 1994.

New York State Department of Environmental Conservation (NYSDEC), 1990. *Selection of Remedial Actions at Inactive Hazardous Waste Sites.* Technical and Administrative Guidance Memorandum #4030. Revised May 15, 1990.

United States Environmental Protection Agency (EPA), 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final. October 1988.