

ATTACHMENT 2-1
REMEDIAL ACTION PLAN CHECKLIST

This page intentionally left blank



Nebraska Department of Environmental Quality

Remedial Action Plan Checklist

This checklist should be used when preparing a Remedial Action Plan (RAP). It serves two purposes: First, it helps the applicant develop an appropriate RAP, both in terms of content and format. Second, it supports NDEQ's review of the RAP after the application is received.

This checklist is not an all-inclusive list of the information that may be necessary to develop an appropriate RAP. It is intended as an aid to assist in developing the RAP. NDEQ may request additional information, and some categories of information may not be applicable to every RAP.

Please specify in the boxes opposite each item whether the information is present (Y), absent (N), or not applicable (NA). Indicate the page number within the RAP where the information is included. Specific information for individual elements of the RAP are indicated. Additional general information for the RAP, including specific formats for tables and figures, are included at the end of the checklist. All acronyms are defined at the end of the checklist.

Applicant Name _____

Site or Property Name _____

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
2.1 EXECUTIVE SUMMARY		
➤ Summary and conclusions of the completed investigation		
➤ Identification of potential receptors		
➤ Overview of the conceptual site model		
➤ Interim remedial measures completed to date		
➤ Future land use plans		
➤ Remedial Action Objectives (RAOs) and proposed remediation goals (from the Remediation Goals Lookup Tables)		
➤ Description of anticipated remedial actions		
• Conceptual approach		
• Rationale used to support selection of remedial action and how it meets the five remedy evaluation criteria and RAOs developed		
➤ Any other site-specific issues that should be considered during completion of remedial actions		
2.2 INVESTIGATION REPORT		
2.2.1 Compilation and Analysis of Background Information		
2.2.1.1 Site Information		
➤ Site name		
➤ Site type		
➤ Standard Industrial Classification code		
➤ Facility status (active/inactive, etc.)		
➤ Street address		
➤ Directions to site relative to nearest intersection of major highways		
➤ Nearest city or town and county		
➤ Legal description (¼, ¼, ¼, section, township, range)		
➤ Latitude and longitude in decimal degrees (linked to NAD 83)		
➤ Location map based on a USGS 7.5-minute quadrangle, with a reference to the quadrangle name and date		
➤ Applicant, owner, or designated point of contact with contact information		
➤ Contractors or consultants to the applicant or owner, with contact information		
➤ Documentation indicating that the applicant holds or can acquire title to all lands or has the necessary easements and rights-of-way for the remedial actions		
2.2.1.2 Physical Setting		
Surface features		
➤ Site layout map showing natural and man-made (current or former) features within 2,000 feet of site		
• Property boundary		
• Primary surface and subsurface structures		
• Roads, fences, other man-made boundaries		
• Streams, lakes, wooded areas, etc.		
• Onsite and nearby utility lines and conduits		
Climate and meteorology		
➤ Sources of information		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> National Oceanic and Atmospheric Administration – National Climatic Data Center (NOAA-NCDC) 		
<ul style="list-style-type: none"> University of Nebraska-Lincoln – High Plains Regional Climate Center (UNL – HPRCC) 		
<ul style="list-style-type: none"> Natural Resources Conservation Service – National Water and Climate Center (NRCS – NWCC) 		
➤ Mean annual rainfall		
➤ Mean seasonal temperatures		
➤ Mean wind velocity and direction		
<ul style="list-style-type: none"> Wind rose 		
➤ Daily mean variances in atmospheric parameters		
Vegetation		
➤ Sources of information		
<ul style="list-style-type: none"> Natural Resources Conservation Service – National Plant Data Center (NRCS – NPDC) 		
<ul style="list-style-type: none"> University of Nebraska-Lincoln – Institute of Agriculture and Natural Resources (UNL – IANR) 		
➤ Type of plant cover		
➤ Density of plant cover		
➤ Sensitive environments – locally and regionally		
Topography and hydrology		
➤ Source of information		
<ul style="list-style-type: none"> United States Geologic Survey (USGS) 		
<ul style="list-style-type: none"> University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) 		
<ul style="list-style-type: none"> Nebraska Department of Natural Resources (NDNR) 		
➤ Descriptions and map(s) of		
<ul style="list-style-type: none"> Topography 		
<ul style="list-style-type: none"> Drainage direction and routes 		
<ul style="list-style-type: none"> On- and off-site surface water bodies 		
<ul style="list-style-type: none"> Flood plains 		
<ul style="list-style-type: none"> Wetlands 		
➤ Graphs/data indicating recurrence interval of floods on and near the site		
Soils and Geology		
➤ Source of information for soils		
<ul style="list-style-type: none"> USDA - NRCS County Soil Survey (online or published) 		
<ul style="list-style-type: none"> Personal communication with specific county NRCS personnel (surveys not available or being revised) 		
➤ Description of soils typical to site		
<ul style="list-style-type: none"> Topographic setting (<i>i.e.</i>, upland slope or alluvial valley) 		
<ul style="list-style-type: none"> Probable parent material 		
<ul style="list-style-type: none"> Total organic content 		
<ul style="list-style-type: none"> Porosity and permeability 		
➤ Soil map(s)		
➤ Source of information for geology		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> United States Geologic Survey (USGS) 		
<ul style="list-style-type: none"> University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) 		
<ul style="list-style-type: none"> Nebraska Department of Natural Resources (NDNR) 		
➤ Generalized stratigraphic section showing regional geologic formations, formal names and ages of units, lithologies, and unconformities		
➤ Map(s) showing regional structural features		
➤ Map(s) showing important surficial deposits and/or other geologic features		
➤ Regional and local geologic cross-sections with control points, emphasizing:		
<ul style="list-style-type: none"> Relict channels 		
<ul style="list-style-type: none"> Paleosols 		
<ul style="list-style-type: none"> Impermeable layers or boundaries 		
<ul style="list-style-type: none"> Potential preferential pathways 		
<ul style="list-style-type: none"> Geometry of complex geologic strata 		
<ul style="list-style-type: none"> Other important geologic features 		
Hydrogeology		
➤ Source of information		
<ul style="list-style-type: none"> United States Geologic Survey (USGS) 		
<ul style="list-style-type: none"> University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) 		
<ul style="list-style-type: none"> Nebraska Department of Natural Resources (NDNR) 		
➤ Approximate depth to groundwater		
➤ Approximate depth to bedrock		
➤ Primary, surficial, and/or perched aquifer characteristics		
<ul style="list-style-type: none"> Hydraulic conductivity and porosity 		
<ul style="list-style-type: none"> Thickness 		
<ul style="list-style-type: none"> aquifer material 		
<ul style="list-style-type: none"> Description of aquifer usage 		
<ul style="list-style-type: none"> Potentiometric surface maps or water table maps with control points 		
<ul style="list-style-type: none"> Approximate groundwater flow direction and rate 		
➤ Confining zone or aquitard characteristics		
➤ Nearby pumping wells that influence groundwater flow		
<ul style="list-style-type: none"> Well depth and completion zone 		
<ul style="list-style-type: none"> Pump level and pumping rate and frequency pumped 		
<ul style="list-style-type: none"> Radius of influence of drawdown cone 		
<ul style="list-style-type: none"> Capture zone 		
2.2.1.3 Historical Operations and Site Conditions		
➤ A list of the previous owners and their ownership dates (provide copies of deeds or other county records in an appendix)		
➤ Any historical or alternative facility names		
➤ Discussion of historical site use, previous business operations, and periods of operation		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Sources of information <ul style="list-style-type: none"> ▪ Nebraska Department of Natural Resources (NDNR) ▪ Nebraska Department of Roads (NDOR) ▪ University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) ▪ United States Department of Agriculture (USDA) – Farm Service Agency ▪ United States Department of Agriculture – Natural Resources Conservation Service (USDA – NRCS) ▪ Environmental Protection Agency (EPA) Environmental Monitoring Systems Laboratory ▪ Department of Defense (DOD) ▪ United States Geological Survey USGS – Earth Resources Observation Systems ▪ County government ▪ City government ▪ Local library historical collections ▪ Local newspaper archives ▪ Private historical collection • Dates that the site was active • Site map showing historical operation areas • Historical aerial photographs • Topographic maps • Sanborn or other fire insurance maps • Local historical collections, or city directories that illustrate site use and periods of operation • Types of historical operations <ul style="list-style-type: none"> ▪ Landfill ▪ Grain storage facility ▪ Former manufactured gas plant ▪ Dry cleaners ▪ Salvage yard ▪ Formerly Used Defense Site (FUDS) ▪ Gas station ▪ Drum storage ▪ Pesticide formulation ▪ Agricultural chemical distribution or cooperative ▪ Explosive or fireworks manufacturing ▪ Ammunition production or disposal ▪ Battery-breaking operation ▪ Mining operation, including mills and smelters ▪ Solvent recycler ▪ Waste oil recycler ▪ Metals plating operation ▪ Other industrial, manufacturing, or potentially hazardous waste generation, treatment, storage or disposal operation at the site. 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> ▪ Previous site uses believed to be nonhazardous 		
➤ Possible contaminant sources		
<ul style="list-style-type: none"> • Aboveground storage tank 		
<ul style="list-style-type: none"> • Underground storage tank 		
<ul style="list-style-type: none"> • Drum 		
<ul style="list-style-type: none"> • Other container 		
<ul style="list-style-type: none"> • Aboveground pipeline 		
<ul style="list-style-type: none"> • Underground pipeline 		
<ul style="list-style-type: none"> • Lagoon or pond 		
<ul style="list-style-type: none"> • Seepage pit or dry well 		
<ul style="list-style-type: none"> • Septic tank or lateral field 		
<ul style="list-style-type: none"> • Surface spill or discharge 		
<ul style="list-style-type: none"> • Pit 		
<ul style="list-style-type: none"> • Drip tank 		
<ul style="list-style-type: none"> • Adjacent property 		
➤ Detailed description of information regarding historical non-hazardous solid waste generated or managed at the site		
➤ Detailed description of information regarding historical hazardous wastes generated, received, disposed of, or managed at the site		
<ul style="list-style-type: none"> • Types of hazardous wastes 		
<ul style="list-style-type: none"> • Quantities and rates of hazardous wastes generated, received, disposed of, or managed 		
<ul style="list-style-type: none"> • Discussion of historical waste management practices 		
<ul style="list-style-type: none"> • Source of information <ul style="list-style-type: none"> ▪ Load or waste manifests 		
<ul style="list-style-type: none"> ▪ MSDSs 		
<ul style="list-style-type: none"> ▪ Bills of lading 		
<ul style="list-style-type: none"> ▪ Historical sources regarding facility production 		
➤ Detailed description of processing or storage locations		
<ul style="list-style-type: none"> • Transformer shear area 		
<ul style="list-style-type: none"> • Chemical storage/ formulation areas 		
<ul style="list-style-type: none"> • Battery storage area 		
➤ Detailed description of information regarding historical environmental incidents, spills, or releases of hazardous constituents, for all previous businesses		
<ul style="list-style-type: none"> • Source of information <ul style="list-style-type: none"> ▪ NDEQ Petroleum Remediation files 		
<ul style="list-style-type: none"> ▪ NDEQ National Pollutant Discharge Elimination System files 		
<ul style="list-style-type: none"> ▪ NDEQ Integrated Waste Management files 		
<ul style="list-style-type: none"> ▪ NDEQ environmental assessment files 		
<ul style="list-style-type: none"> ▪ NDEQ release assessment files 		
<ul style="list-style-type: none"> ▪ NDEQ Superfund files 		
<ul style="list-style-type: none"> ▪ NDEQ RCRA files 		
<ul style="list-style-type: none"> ▪ NDEQ RAPMA files 		
<ul style="list-style-type: none"> ▪ EPA CERCLIS 		
<ul style="list-style-type: none"> ▪ EPA RCRA INFO 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
▪ EPA TRIS		
▪ USDA		
▪ DOD – FUDS		
▪ County health department		
▪ Other sources (i.e., interviews, newspaper accounts, internet)		
2.2.1.4 Current Operations and Site Conditions		
➤ Discussion and illustration of current site use and business operations		
• Aerial photographs		
• Topographic maps		
• City directories		
• Types of operations		
▪ Landfill		
▪ Grain storage facility		
▪ Former manufactured gas plant		
▪ Dry cleaner		
▪ Salvage yard		
▪ Formerly Used Defense Site (FUDS)		
▪ Gas station		
▪ Drum storage		
▪ Pesticide formulation		
▪ Agricultural chemical distribution or cooperative		
▪ Explosive or fireworks manufacturing		
▪ Ammunition production or disposal		
▪ Battery-breaking operation		
▪ Mining operation, including mills and smelters		
▪ Solvent recycler		
▪ Waste oil recycler		
▪ Metals plating operation		
▪ Other industrial, manufacturing, or potentially hazardous waste generation, treatment, storage or disposal operation at the site.		
▪ Previous site uses believed to be nonhazardous		
➤ Possible contaminant sources		
• Aboveground storage tank		
• Underground storage tank		
• Drum		
• Other container		
• Aboveground pipeline		
• Underground pipeline		
• Lagoon or pond		
• Seepage pit or dry well		
• Septic tank or lateral field		
• Surface spill or discharge		
• Pit		
• Drip tank		
• Adjacent property		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ A detailed description of information regarding current hazardous wastes generated, received, disposed, or managed at the site		
• Types of hazardous wastes		
• Quantities and rates of hazardous wastes generated, received, disposed, or managed		
• Discussion of current waste management practices		
• Source of information		
▪ Load or waste manifests		
▪ Landfill invoices		
▪ MSDSs		
▪ Bills of lading		
• Generation rates of hazardous constituents		
➤ A detailed description of information regarding current releases of hazardous constituents		
➤ Descriptions of all storage or disposal vessels, above and below ground, including the following information:		
• Location		
• Number		
• Type		
• Size		
• Age		
• Condition		
• Labels present		
• Contents, past or current		
• Any conduits or disposal systems associated with the vessels		
• Any piping, particularly below ground, to or from vessel		
➤ Existing institutional controls affecting the site		
• Description of institutional controls		
• Name and contact information for person(s) responsible for implementing, monitoring, and enforcing institutional controls		
➤ List of current environmental permits		
➤ Descriptions of any ongoing interim remedial actions		
➤ Descriptions of any ongoing investigations, remediation, or monitoring activities		
➤ Results of searching the following databases for the site or property adjacent to the site:		
• Federal National Priorities List		
• Federal CERCLIS		
• Federal RCRA treatment, storage, or disposal facilities (RCRIS)		
• Federal RCRA generators		
• Federal Emergency Response Notification System list		
• NDEQ's Integrated Information System (IIS)		
▪ State hazardous waste sites		
▪ State landfills		
▪ State Leaking Underground Storage Tanks		
• State Fire Marshal registered underground storage tanks		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> EPA TRIS database 		
<ul style="list-style-type: none"> Other database or source identifying relevant information 		
<ul style="list-style-type: none"> ➤ Results of interviews with the site owner, administrator, or former employees with attached questionnaire 		
2.2.1.5 Previously Reported Investigations		
Summary of previous reports		
<ul style="list-style-type: none"> ➤ Summary and chronology of previous reports with reference to location of attached report in RAP 		
<ul style="list-style-type: none"> ➤ Summary of any relevant correspondence from NDEQ, EPA, or private entities (such as consulting firms) regarding previous environmental reports, with copies of correspondence provided in an appendix 		
<ul style="list-style-type: none"> ➤ Summary of findings, conclusions, and recommendations of previously reported investigations 		
Data Quality and Temporal Variability		
<ul style="list-style-type: none"> ➤ Were appropriate QA/QC standards and procedures in-place during the collection of these data? Explain. 		
<ul style="list-style-type: none"> ➤ Did the results of QA/QC samples indicate any potential problems with the data? Explain. 		
<ul style="list-style-type: none"> ➤ Were laboratory methods, detection limits, and holding times adequate for the intended use of the data (i.e. if data is to be used for defining nature and extend of contamination at MCLs, were detection limits below currently established MCLs)? Explain. 		
<ul style="list-style-type: none"> ➤ Is any of the data variable temporally (i.e. are conditions likely to have changed significantly since the data was last collected)? Explain. 		
2.2.1.6 Potential Chemicals of Concern		
<ul style="list-style-type: none"> ➤ Bulleted list of potential chemicals of concern based on review of all existing historical data and previous investigations 		
<ul style="list-style-type: none"> ➤ Discussion of the relationship between each type of material received or processed on site and each of the chemicals of concern 		
2.2.1.7 Data Gaps		
<ul style="list-style-type: none"> ➤ Bulleted list of data gaps and/or deficiencies identified based on review of all existing historical data and previous investigations (see sections 2.2.1.2 – 2.2.1.5 of the guidance and this checklist) 		
<ul style="list-style-type: none"> ➤ Some commonly encountered data gaps are: 		
<ul style="list-style-type: none"> Physical site characteristics <ul style="list-style-type: none"> Geology, hydrogeology, soils, etc. 		
<ul style="list-style-type: none"> Nature and extent of contamination <ul style="list-style-type: none"> Source areas and sources Lateral and vertical extent of contamination Magnitude of contamination Highest concentrations detected 		
<ul style="list-style-type: none"> Geologic and hydrogeologic characteristics affecting fate and transport <ul style="list-style-type: none"> Carbon content of soils Cation exchange capacity of soils dissolved oxygen concentration oxidation-reduction potential 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> Potential receptors <ul style="list-style-type: none"> Water supply wells within 1 mile Sensitive populations: daycares, schools, nursing homes Sensitive habitats 		
➤ For additional information that may help you identify data gaps, see sections 2.2.3 – 2.2.6 of the guidance and this checklist		
2.2.2 Field Investigation		
2.2.2.1 Investigation Objectives		
<ul style="list-style-type: none"> Bulleted list of objectives for investigation Rationale for selection of each objective 		
2.2.2.2 Data Quality Objectives		
<ul style="list-style-type: none"> Bulleted list of objectives for data quality, organized by media Rationale to support selection of each objective 		
2.2.2.3 Sampling and Analysis Procedures		
Field Sampling Procedures		
<ul style="list-style-type: none"> Sample (i.e. soil boring, direct-push well) locations <ul style="list-style-type: none"> Descriptions of locations (latitude/longitude coordinates referenced to NAD 83) Map showing sampling locations Description of location survey method (Global Positioning System – GPS – preferred) Explanation of methods for locating future follow-up samples (e.g. property may be redeveloped and site layout may change) Location and number of background samples Rationale to support selection of sampling locations Sampling intervals <ul style="list-style-type: none"> Descriptions of intervals Table, diagram, or cross section indicating intervals for each sampling point Rationale to support selection of sampling intervals Sample types <ul style="list-style-type: none"> Sampling information for each medium sampled Sampling methods, with justification for method Sample collection <ul style="list-style-type: none"> Collection methods for soil sampling <ul style="list-style-type: none"> Were grab or composite soil samples taken? Drilling method (hollow stem, direct push, mud rotary) Auger size Sampler type (split spoon, continuous, etc.) Center bit type Collection methods for groundwater sampling <ul style="list-style-type: none"> Sampling methods (traditional, low-flow purging, passive-diffusive bags, etc.) Purging rate and volume Measured stabilization parameters – dissolved oxygen, oxidation-reduction potential, pH, specific conductance, etc. 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
• Total number of samples taken		
• Description of sample labeling/identification system		
• Order of sample collection with regards to volatilization and expected contamination levels		
➤ Field screening methods		
➤ Sampling equipment		
• Equipment used		
• Cleaning procedures		
• Was calibration of instruments performed?		
➤ Table or list of analytical parameters		
➤ Analytical methods		
• Analytical laboratory, with contact information		
• Holding times for all samples analyzed		
• Practical Quantitation Limits (PQLs) for each media:		
▪ For groundwater, PQLs must be less than the applicable regulatory limit – MCLs, PRGs, 1×10^{-6} excess cancer risk levels, VCP lookup tables, or site specific risk based cleanup levels		
▪ For soil, PQLs must be less than the applicable regulatory limit – PRGs, 1×10^{-6} excess cancer risk levels, VCP lookup tables, or site specific risk based cleanup levels		
▪ For surface water, PQLs must be less than the applicable regulatory limit		
• Description and table of analytical laboratory methods used for each parameter and media		
▪ Standard method for VOCs: 8260b		
▪ Standards method for SVOCs: 8270		
▪ Various methods for metals		
▪ Methods for Dioxins 8280 or 8290 depending on detection limit needed.		
▪ Phenols: 8270 or 8310. 8310 will be necessary for most groundwater analysis because the detection limit for 8270 is above the MCL for some contaminants.		
• Description of any alternative laboratory methods used, including explanation of why the methods were appropriate		
➤ Well purging data		
• Purging technique		
• Purging dates		
• Volumes purged		
• Rate of purging		
• Temporal variations in parameter values, such as pH, temperature, conductivity, redox, turbidity, or dissolved oxygen		
• Detection of immiscible layers		
Quality Assurance/Quality Control		
➤ Description (i.e. number and location) of QA/QC samples		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Trip blanks – one per every cooler used to transport and store samples 		
<ul style="list-style-type: none"> • Field blanks – minimum of 10% (i.e. 1 field blank for every 10 samples) 		
<ul style="list-style-type: none"> • Equipment rinsate blanks – minimum of 10% (i.e. 1 rinsate blank for every 10 samples) 		
<ul style="list-style-type: none"> • Field split samples 		
<ul style="list-style-type: none"> • Field duplicate samples – minimum of 10% (i.e. 1 duplicate for every 10 samples) 		
<ul style="list-style-type: none"> • Matrix spike and matrix spike duplicates 		
2.2.2.4 Health and Safety		
<ul style="list-style-type: none"> ➤ Brief statement that a health and safety plan was prepared and used during the investigation 		
2.2.2.5 Investigation-Derived Waste		
<ul style="list-style-type: none"> ➤ Source of information: NDEQ Investigation-Derived Waste (IDW) Environmental Guidance - Draft 		
<ul style="list-style-type: none"> ➤ Description of strategy for managing and disposing of investigation-derived waste 		
<ul style="list-style-type: none"> • Procedures for segregation of hazardous and non-hazardous waste 		
<ul style="list-style-type: none"> • Description of how hazardous waste sent off-site was managed <ul style="list-style-type: none"> ▪ Location(s) of disposal site ▪ Supporting documentation such as load manifests or disposal receipts 		
<ul style="list-style-type: none"> ➤ Description of procedures used to ensure compliance with federal and state rules 		
<ul style="list-style-type: none"> • Analyze total metals first, then TCLP for any samples that exceed 20X the TCLP limit 		
2.2.3 Physical Site Characterization		
2.2.3.1 Surface Water		
<ul style="list-style-type: none"> ➤ Description of physical aspects of surface water bodies, including lakes, rivers, and impoundments 		
<ul style="list-style-type: none"> ➤ Maps, diagrams, or tables containing flow rates, channel dimensions and elevations, river stages, and historical flooding characteristics 		
<ul style="list-style-type: none"> ➤ Maps and diagrams illustrating surface water/groundwater relationships 		
<ul style="list-style-type: none"> ➤ Topographic maps 		
2.2.3.2 Soils and Geology		
<ul style="list-style-type: none"> ➤ Sampling location maps 		
<ul style="list-style-type: none"> • Locations of soil borings, direct-push sampling, or other investigation points used to characterize soils and geology 		
<ul style="list-style-type: none"> ➤ Geologic cross-sections 		
<ul style="list-style-type: none"> • Cross section showing geologic strata and water table, oriented parallel to groundwater flow direction 		
<ul style="list-style-type: none"> • Cross section showing geologic strata and water table, oriented perpendicular to groundwater flow direction 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> Cross section(s) showing other geologic or man-made features that might influence the transport of contaminants in the subsurface, such as fractures zones, highly permeable channels, and/or utility conduits 		
2.2.3.3 Hydrogeology		
➤ Sampling location maps		
<ul style="list-style-type: none"> Locations of monitoring wells, piezometers, direct-push sampling locations, or other investigation points used to characterize hydrogeology 		
➤ Potentiometric surface and/or water table maps		
<ul style="list-style-type: none"> Control points at which the static water level is measured 		
<ul style="list-style-type: none"> Water-level elevations at control points 		
<ul style="list-style-type: none"> Contour interval appropriate for gradient across site 		
<ul style="list-style-type: none"> Arrow indicating groundwater flow direction 		
<ul style="list-style-type: none"> Additional maps depicting seasonal and/or long-term changes in water table elevation and groundwater flow direction 		
➤ Aquifer characteristics		
<ul style="list-style-type: none"> Hydraulic conductivity 		
<ul style="list-style-type: none"> Storativity 		
<ul style="list-style-type: none"> Transmissivity 		
<ul style="list-style-type: none"> Specific yield 		
➤ Well completion information		
<ul style="list-style-type: none"> Well identification numbers and coordinates in decimal degrees, linked to NAD 83 		
<ul style="list-style-type: none"> Elevations of ground surface, top of well casing, relative to mean sea level 		
<ul style="list-style-type: none"> Static water level 		
<ul style="list-style-type: none"> Screen length 		
<ul style="list-style-type: none"> Screened interval, in depth below ground surface and estimated elevation above mean sea level 		
<ul style="list-style-type: none"> Dates of well completion and water level measurements 		
2.2.4 Nature and Extent of Contamination		
2.2.4.1 Sources		
➤ Discussion of known and suspected on-site sources, 'hot spots,' and potential sources of contamination migrating from off-site		
➤ Source location maps		
<ul style="list-style-type: none"> Tanks, lagoons, pits, or other potential or known source areas 		
<ul style="list-style-type: none"> Areas of contaminated soil identified based on historical information or sampling and analysis 		
<ul style="list-style-type: none"> 'Hot spots' 		
<ul style="list-style-type: none"> Potential sources of contamination migrating from off-site 		
2.2.4.2 Air		
➤ Descriptions of each source of airborne contaminants (e.g. contaminated soils, off-gassing lagoon, etc.)		
➤ Other appropriate information that can be used to determine the extent and direction of migration		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Notify NDEQ if it is determined that an on-going source of air contamination exists at the site		
• Information gathered as a result of discussions with NDEQ, including sampling locations, methods, and analytical results in tabular form		
2.2.4.3 Surface water and sediments		
➤ Discussion of nature and extent of contamination in surface water and sediments		
➤ Sample location maps		
➤ Table(s) containing sample information and laboratory analytical results		
• Sample identification		
• Sample collection method		
• Sampling date		
• Sample location (linked to NAD 83)		
• Target compounds		
• Results from field screening		
• Concentrations of contaminants detected (values exceeding applicable regulatory limits should be highlighted)		
• Analytical method and detection limits for each compound		
• Appropriate data validation qualifiers		
• QA/QC sample results		
➤ Maps showing the distribution of contamination in surface water and sediment		
2.2.4.4 Soils and vadose zone		
➤ Discussion of nature and extent of contamination in soils and vadose zone		
➤ Lateral and vertical extent of contamination defined to most conservative RGs (from RG Lookup Tables)		
➤ Table(s) containing sample information and laboratory analytical results		
• Sample identification		
• Sample collection method		
• Sampling date		
• Sample location (linked to NAD 83) and depth		
• Target compounds		
• Results from field screening		
• Concentrations of contaminants detected (values exceeding applicable regulatory limits should be highlighted)		
• Analytical method and detection limits for each compound		
• Appropriate data validation qualifiers		
• QA/QC sample results		
➤ Sample location maps		
➤ Maps illustrating the horizontal distribution of soil contamination		
➤ At least two (2) cross sections oriented perpendicular to each other showing the vertical distribution of soil contamination		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
2.2.4.5 Groundwater		
➤ Discussion of nature and extent of contamination in groundwater		
➤ Lateral and vertical extent of contamination defined to MCLs		
➤ Table(s) containing sample information and laboratory analytical results		
• Well identification		
• Sample collection method		
• Sampling date		
• Sample location (linked to NAD 83) and depth		
• Target compounds		
• Results from field screening		
• Concentrations of contaminants detected (values exceeding applicable regulatory limits should be highlighted)		
• Analytical method and detection limits for each compound		
• Appropriate data validation qualifiers		
• QA/QC sample results		
➤ Sample location maps		
➤ Isoconcentration maps showing horizontal distribution of contamination in groundwater		
➤ At least two (2) isoconcentration cross-sections, oriented parallel and perpendicular to groundwater flow direction, showing vertical distribution of contamination in groundwater		
➤ Isopach maps and cross sections showing locations, horizontal extent, and thickness of free product		
2.2.5 Contaminant Fate and Transport		
2.2.5.1 Contaminant characteristics		
➤ Narrative description of each contaminant's characteristics affecting fate and transport		
Chemical and physical properties of contaminants		
➤ Table of contaminant properties		
➤ Name of contaminant		
➤ Density		
➤ Solubility		
➤ Octanol/water partition coefficient		
➤ Vapor pressure, volatility		
➤ Other relevant properties		
Contaminant persistence		
➤ Description of each contaminant's persistence in air		
➤ Description of each contaminant's persistence in surface water and sediments		
➤ Description of each contaminant's persistence in soil and vadose zone sediments		
➤ Description of each contaminant's persistence in groundwater		
Transport and Partitioning		
➤ Description of the chemical and physical properties of each contaminant that affect transport (i.e. solubility, density)		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Description of the chemical and physical properties of each contaminant that affect partitioning (i.e. octanol/water partition coefficient, octanol/carbon coefficient)		
Transformation and Degradation		
➤ Discussion of the likelihood that contaminants will be transformed or degraded into other compounds		
➤ Table listing each contaminant and its transformation and/or degradation products		
➤ Description of the chemical characteristics affecting fate and transport of transformation and/or degradation products		
2.2.5.2 Site characteristics		
Environmental media		
➤ Description of media characteristics that might influence contaminant fate and transport		
• Evaluation of the potential affect of existing aqueous geochemical conditions on contaminant fate and transport		
• total organic carbon content		
• porosity		
• permeability		
• pH		
• alkalinity		
• cation exchange capacity		
• hardness		
• alkalinity		
• any observed heterogeneity associated with the media characteristics		
Migration pathways		
➤ Description of migration pathways that exist at the site		
• Groundwater		
• Surface water		
• Soil in surface water as sediment		
• Air in soil as soil gas		
• Soil in air as windblown dust		
Preferential flow paths		
➤ Anthropogenic		
• Sewers		
• Utility trenches		
• Wells		
• Basements		
• Tunnels		
• Elevator shafts		
➤ Natural		
• Sand/gravel lenses		
• Paleo-channels		
• Fractures in bedrock		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Rationale used to omit any preferential flow paths from further evaluation		
Exposure pathways		
➤ Ingestion of soil		
➤ Inhalation of volatiles and particulates from soils (e.g. windblown dust)		
➤ Dermal contact with soils		
➤ Ingestion of water		
➤ Inhalation of volatiles from water during showering/bathing		
➤ Inhalation of vapors from vapor intrusion into indoor air (e.g., through foundations, floor drains, etc.)		
2.2.6 Potential Receptors		
2.2.6.1 Human receptors		
➤ Description of nearby population centers, including general demographic description		
➤ Present and planned sensitive populations within 2,000 feet of the site		
• Daycare or businesses with daycare facilities		
• Schools		
• Nursing homes and retirement communities		
• Hospitals and rehabilitation facilities		
➤ Land use survey of the area within 500 feet of site, including information about		
• General demographics		
• Zoning		
• Land usage at site and at adjacent properties (e.g., commercial, residential)		
• Table of adjacent landowners, with contact information		
• Any current institutional controls affecting the site		
➤ List of all water supply wells within 1 mile of site, including wells constructed before 1990s		
• Sources of information used in survey		
• Location (latitude/longitude coordinates referenced to NAD 83)		
• Well use – irrigation, private drinking water supply, industrial, etc.		
• Diameter		
• Depth		
• Screened interval		
• Capacity		
• Static and pumping water levels		
• Well head elevation		
• Owner		
• Location of the closest water supply well		
• Location and description of most susceptible water supply well		
• Location and description of any impacted water supply wells		
• Proof of notification of offsite impacted land owner		
• List of any water supply wells downgradient from the site within 5 miles		
• Map of any wellhead protection areas near the site		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ If groundwater contamination is present, include analytical results of samples from down-gradient drinking water supply wells (results should be presented in section 2.2.4.5)		
2.2.6.2 Ecological Receptors		
➤ Location and description of sensitive environments within 2,000 feet of the site		
• Wetlands or wildlife habitats		
• Threatened or endangered species known or suspected to live on the site		
➤ Location and description of area natural resources		
• Groundwater use(s)		
• Agricultural use(s)		
• Other natural resources		
➤ Surface water survey		
• Location of closest surface water body		
• Location and description of the most susceptible surface water body		
• Location and description of any impacted surface water bodies		
• List of any surface water bodies downgradient from site within 1,000 feet		
• Surface water survey map		
➤ Answers to the questions listed in Section 2.2 of the <i>Protocol for VCP Remediation Goal Lookup Tables</i> document		
2.2.7 Conceptual Site Model		
➤ Summary of how and where contaminants are expected to move		
➤ Potential impacts to human health and the environment based on predicted movement of contaminants		
➤ Depiction of intended land use		
• Location and use of buildings		
• Location and depth of below-grade structures		
▪ basements		
▪ utility trenches		
▪ tunnels		
▪ elevator shafts		
▪ tanks		
• Description of landscaping features or decorative ponds		
• Description of any potential sensitive populations		
• Description of any current or proposed institutional controls		
➤ Potential contaminant exposure pathways		
• Ingestion of soil		
• Inhalation of volatiles and particulates from soils (e.g. windblown dust)		
• Dermal contact with soils		
• Ingestion of water		
• Inhalation of volatiles from water during showering/bathing		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> Inhalation of vapors from vapor intrusion into indoor air (e.g., through foundations, floor drains, etc.) 		
<ul style="list-style-type: none"> ➤ Illustration of why contamination is a problem and why remediation is needed, in light of proposed land use 		
2.2.8 Summary and Conclusions		
<ul style="list-style-type: none"> ➤ Summary of significant findings of investigation 		
<ul style="list-style-type: none"> ➤ Conclusions regarding the full nature and extent of contamination 		
<ul style="list-style-type: none"> • Source areas or 'hot spots' of contamination in soil, groundwater, and/or surface water 		
<ul style="list-style-type: none"> • Horizontal and vertical extent of contamination in each media 		
<ul style="list-style-type: none"> ➤ Potential contamination migration routes for each media 		
<ul style="list-style-type: none"> ➤ Potential impacts of contamination to human health and the environment 		
2.3 REMEDIAL ACTION WORK PLAN		
2.3.1 Interim Remedial Actions		
<ul style="list-style-type: none"> ➤ Detailed description of any interim remedial actions for the site <ul style="list-style-type: none"> • Locations • Duration • Methods 		
<ul style="list-style-type: none"> ➤ Justification of the implementation of interim remedial actions 		
<ul style="list-style-type: none"> ➤ Evaluation of whether interim remedial actions are compatible with the final remedy 		
<ul style="list-style-type: none"> ➤ Evaluation of whether interim remedial actions can be the final remedy 		
<ul style="list-style-type: none"> ➤ Description of the process by which the interim remedial actions will be decommissioned or incorporated into the final remedy 		
2.3.2 Remedial Action Objectives		
<ul style="list-style-type: none"> ➤ Bulleted list of RAOs <ul style="list-style-type: none"> • Contaminant(s) of concern • Cleanup levels for each contaminant • Locations at which cleanup levels will be achieved • Timeframe according to which remedial actions will be completed • Exposure routes to be addressed • Potential receptors to be addressed 		
<ul style="list-style-type: none"> ➤ Rationale for deciding which contaminants will be remediated and the level to which they will be reduced 		
<ul style="list-style-type: none"> ➤ Preliminary RAC Determination worksheet provided 		
2.3.3 Proposed Remedial Action		
<ul style="list-style-type: none"> ➤ Briefly describe the selected remedial action and explain how it will achieve the following environmental results (you do not have to describe the step-by-step evaluation in the report): <ul style="list-style-type: none"> • Overall ability to protect human health and the environment • Compliance with Applicable or Relevant and Appropriate Requirements (ARARS) • Long-and short-term effectiveness and permanence • Reduction of toxicity, mobility, or volume through treatment • Community acceptance 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Description of selected remedial action, including the information described in relevant sections below		
2.3.3.1 Presumptive Remedies		
➤ Description and justification for use of presumptive remedies, if applicable		
2.3.3.2 Innovative Technologies		
➤ In-situ bioremediation of groundwater		
• Type of biodegradation mechanism		
• Maps showing the locations of injectate wells		
• Well construction information		
• Maps, cross sections, and construction information for reactive barriers or other systems used to introduce reactants into the subsurface		
➤ Phytoremediation		
• Type of application and details of process employed		
• Plant types, root depths, locations, and other information		
➤ Passive groundwater remediation (i.e., monitored natural attenuation)		
• Methods for verifying that contaminants are degrading, rather than being diluted		
• Methods for verifying that contaminants are degrading at a rate that makes it suitable as a remedy		
• See section 2.3.3.5 for additional information regarding groundwater monitoring		
➤ Other innovative technology		
• Brief description of the technology		
• Maps, cross sections, and/or diagrams to illustrate planned remedial system		
2.3.3.3 Traditional Technologies		
➤ Soil excavation and removal		
• Extent and depth of soil to be excavated		
• Plans for refilling and regrading excavated areas		
• Maps and diagrams to illustrate locations, sizes, and shapes of these areas		
➤ In situ treatment of soil		
• Describe type of <i>in situ</i> treatment to be used		
• Overall systems for injection or extraction		
• Maps of cross-sections showing treatment points or radius of influence of the treatment system		
➤ Groundwater pump-and-treat		
• Describe basic treatment process		
• Maps showing locations of wells		
• Well construction information		
• Capture zone information		
• Other appropriate maps, cross sections, and diagrams		
➤ Air sparging/Soil vapor extraction		
• Maps of well locations		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
• Well construction information		
• Radius of influence of the system		
• Cross sections illustrating relationship among wells, contaminated zones, water table, and stratigraphic features		
2.3.3.4 Engineering Controls		
➤ Low-permeability barriers and containment structures		
• Describe type of engineering control		
• Thickness and engineering properties of cover material		
• Grading plans for the site		
• Maps, cross sections, and diagrams as appropriate		
• For landfill caps, contact NDEQ regarding information about other applicable guidance and checklists of information to submit		
➤ Physical access barriers		
• Describe type of barrier		
• Maps, diagrams, and cross sections to illustrate location, size, and other construction information		
➤ Discussion of why the engineering control is appropriate for the site		
2.3.3.5 Institutional Controls		
➤ Descriptions of planned institutional controls, including category and type:		
• Governmental controls		
▪ Zoning		
▪ Building codes		
▪ Drilling permit requirements		
▪ State or local groundwater use regulations		
• Proprietary controls		
▪ Covenants		
▪ Easements		
• Enforcement and permit tools with institutional control components		
▪ Remedy agreements		
▪ Administrative orders		
▪ Consent decrees		
▪ Permit conditions		
• Informational devices		
▪ State registries		
▪ Deed notices		
▪ Advisories		
➤ Discussion of how the institutional control will minimize the potential for human exposure to contamination and protect the integrity of the remedy		
2.3.4 Performance monitoring		
➤ Strategy for conducting performance monitoring		
• Monitoring or sampling objectives		
• Planned or existing monitoring locations		
• Monitoring schedule		
• Analytical parameters		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Timeline for submittal of periodic performance monitoring reports. Reports should include:		
• Analytical results		
• QA/QC results		
• Chain of custody records		
• Groundwater sampling and field data sheets		
• Data tables containing groundwater elevations and well data		
• Groundwater contour maps		
➤ Operation and maintenance plan for		
• Inspection procedures and tasks to be completed as part of the routine operation and maintenance of the system		
• General description of the contingencies that will be used in the event the performance monitoring system requires repair or modification beyond the scope of routine operation and maintenance		
➤ Statement that you contacted NDEQ to determine whether a startup reports will be needed		
➤ Expected remediation timeframe (an acceptable timeframe will be the period of potential exposure to contamination in the absence of any remediation or 20 years, whichever is less)		
2.3.5 Remediation Waste Management Plan		
➤ Procedures for managing and disposing of remediation-derived waste		
➤ Facilities or methods for on-site treatment		
➤ Other information as outlined in Attachment 2-3		
2.3.6 Permitting and Regulatory Involvement		
➤ Description of applicable permits and regulations		
• Air discharge permit		
• Solid waste disposal permit		
• Groundwater well permits		
• Surface water appropriations permit		
• Injection or reinjection permit		
• Discharge to surface water permit		
• Discharge to sanitary sewers permit		
• Local building, plumbing, and electrical permits		
• Necessary easements or variances		
• Access agreements		
➤ Statement that a site-specific Health and Safety Plan will be used for field activities associated with the remedial action		
2.3.7 Proposed Schedule of Remedial Activities		
➤ Table containing:		
• Description of activity		
• Date of planned initiation		
• Date of planned completion		
• Other relevant information		
2.4 TABLES		
➤ All tables are numbered and titled		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ All tables are easily legible and understandable		
➤ All abbreviations used in the table or table title are spelled out in table footnotes		
2.5 FIGURES		
➤ Horizontal and vertical scales bars on cross-sections		
➤ Horizontal scale bars on maps		
➤ Legend		
➤ Orientation labels (i.e., north arrow) on maps		
➤ Date, title, and source of base maps		
➤ Cross-section control points shown on an associated map, with reference to map on cross-section		
➤ Date(s) data was collected indicated on map		
➤ All features on maps clearly labeled		
➤ Site boundaries clearly labeled		
➤ Photographs scanned and printed at high resolution (300 dpi scanned, 600 dpi printed), preferably in color, including aerial photographs		
2.6 APPENDICES		
➤ Borehole logs		
• Facility name		
• Borehole identification		
• Borehole location, linked to NAD 83		
• Drilling method		
• Soil/bedrock lithological description (soil or rock type)		
• Soil/bedrock texture, fractures, and secondary porosity features		
• Color (Munsell soil color or Geological Society of America rock color chart identification)		
• Degree of saturation		
• Depths to water and bottom		
• Drilling rate or blow counts		
• Start and stop times and dates for drilling		
• Sampling equipment used		
• Percent sample recovered		
• Organic vapor field screening readings		
• Sample depth, number, and type		
➤ Well construction logs		
• Facility name		
• Well identification		
• Well location		
• Borehole diameter, total depth, plug back depth		
• Casing and screen material		
• Casing and screen diameter		
• Screen length and interval		
• Screen slot size		
• Sump length		
• Filter pack size and interval		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
• Spacing between casing and borehole wall		
• Placement and construction of seal and grout		
• Protective casing and surface structures		
➤ Complete results of field screening		
➤ Analytical reports for soil gas, groundwater, or soil samples, including QA/QC results		
➤ Data validation and usability summary		
➤ Vadose zone or aquifer testing data and estimation calculations		
➤ Flow modeling data, calculations, and results		
➤ Photographic documentation of investigative activities		
➤ Copies of log books, field sheets, chain-of-custody forms, or other relevant supporting documentation.		
➤ Copies of waste manifests, aerial photographs, and other documents used to characterize the site		
➤ Copies of relevant property deeds		
➤ Quality Assurance Project Plan (QAPP)		
➤ If QAPP has been modified for RAWP, include new document here		

ACRONYMS/ABBREVIATIONS

CERCLIS	= Comprehensive Environmental Response, Compensation, and Liability Act Information System
CSD	= Conservation and Survey Division
DOD	= Department of Defense (U.S.)
Dpi	= dots per inch
EPA	= Environmental Protection Agency (U.S.)
FUDS	= Formerly used defense sites
MCL	= Maximum Contaminant Level
MSDS	= Manufacturer's safety data sheet
N	= Not included/absent
NA	= Not applicable
NAD 83	= North American Datum 1983
NDEQ	= Nebraska Department of Environmental Quality
NDNR	= Nebraska Department of Natural Resources
NRCS	= Natural Resources Conservation Service
PQL	= Practical quantitation limit
PRG	= Preliminary remediation goal
QA	= Quality assurance
QC	= Quality control
RAC	= Remedial action class
RAO	= Remedial action objective
RAP	= Remedial Action Plan
RAPMA	= Remedial Action Plan Monitoring Act
RAWP	= Remedial action work plan
RCRA	= Resource Conservation and Recovery Act
RCRIS	= RCRA Information System
RG	= Remediation goal
SVOC	= Semi-volatile organic compound
TCLP	= Toxicity Characteristic Leaching Procedure
TRIS	= Toxics Release Inventory System
UNL	= University of Nebraska - Lincoln
USDA	= U.S. Department of Agriculture
USGS	= U.S. Geological Survey
VCP	= Voluntary Cleanup Program
VOC	= Volatile organic compound
Y	= Yes/present

This page intentionally left blank