

# Risk-Based Corrective Action (RBCA) at Petroleum Release Sites: Tier 1 / Tier 2 Assessments & Reports

*Overview of the revised NDEQ  
Petroleum Remediation Section  
Guidance Document*

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# Objectives

- Highlight additions and changes to the guidance document
- Discuss changes to the Tier 1 and Tier 2 Report Forms

# Guidance Document Format

- Background
- Pre-Investigation
- Tier 1 / Tier 2 Assessments
- Risk-Based Evaluation
- Supplemental Information

# Section 1.0

## Background & Applicability

# 1.0 – Background

- Developed by the NDEQ Petroleum Remediation Section based on:
  - Title 118 – *Ground Water Quality Standards and Use Classification*
  - Title 126 – *Rules and Regulations Pertaining to the Management of Wastes*
  - ASTM E-1739 – *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*
  - Recommendations made by the Technical Advisory Committee created by the Nebraska Legislature

# 1.0 – Applicability

- DOES apply to petroleum releases from:
  - Underground Storage Tanks
  - Aboveground Storage Tanks
  - Pipelines
  - Transportation vessels

# 1.0 – Applicability

- NOT intended for petroleum wastes considered hazardous in accordance with:
  - Title 128 – *Nebraska Hazardous Waste Regulations*
  - 40 CFR Part 302

# 1.1 – Workplans & Costs

- Costs for LUST and LAST investigations may be eligible for reimbursement under Title 200 – *Rules and Regulations for Petroleum Release Remedial Action Reimbursement Fund*
- To be eligible for reimbursement:
  - Workplan & cost estimate must be submitted
  - Department must approve the workplan and review costs before the related work begins

# 1.1 – Workplans & Costs

- Some costs may not be eligible for reimbursement:
  - Work done without first receiving the Department's approval
  - Costs associated with finishing incomplete work

# 1.1 – Workplans & Costs

- The RBCA guidance document may be referenced in the workplan to serve as the description of investigation procedures
- Changes from methods presented in the guidance document:
  - Must be **highlighted** and explained in the workplan
  - Must receive Department approval before work begins

# 1.1 – Workplans & Costs

- Voluntary Remedial Action program
  - Release must be reported according to Title 126
  - Responsible Party can proceed with remedial actions if none have yet been required by the Department
  - Must follow the Department's guidance documents and regulations
  - Considered for reimbursement when the Department requires and approves remedial action at the site

# 1.1 – Workplans & Costs

- Remedial actions may also be regulated by other agencies:
  - Geologists Regulation Act
  - Engineers & Architects Regulation Act
  - Health & Human Services Contractors' Licensing Program
  - Other Federal, State, and local laws

# Section 2.0

## NDEQ RBCA Process Overview

## 2.2 – General RBCA Process

- Flowchart provided in Figure 2-1
- Pre-Investigation Site Visit (wp)
- Tier 1 Investigation and Report (wp)
- Tier 1 Evaluation
- Tier 2 Site Investigation (wp)
- Tier 2 Evaluation

## 2.2 – General RBCA Process

6. Remedial Action Conceptual Plan
7. Remedial Action Plan (wp)
8. Implement Remedial Action Plan (wp)
9. Review of Remedial Action Effectiveness

## 2.2 – General RBCA Process

10. Public Notice and Comment Period

11. Monitoring Well Abandonment (wp)

12. Site Closure

## 2.2 – General RBCA Process

- Unexpected Site Conditions (free product, vapors in structures, or surface water impact):
  - Contact NDEQ and other authorities as specified in Table 2-1 (*correction to the March 2009 version*)
  - The Department may modify the investigation requirements on a case-by-case basis

# 2.3 – Investigation Process

## ➤ Goals:

- Characterize the area around the release site
- Create a Site Conceptual Exposure Scenario and consider risk to the potential exposure pathways:
  - Contact and ingestion of surface soil
  - Inhalation of COCs from subsurface soil
  - Leaching of COCs from soil to ground water
  - Surface water and ecological impacts
  - Inhalation of COCs from ground water
  - Ingestion of COCs from ground water

## 2.4 – Tiered Process Characteristics

### ➤ Tier 1:

- Conservative, non-site-specific exposure factors, fate and transport models, and parameter values
- Risk-Based Screening Levels (RBSLs) developed to apply to broad categories of sites

## 2.4 – Tiered Process Characteristics

### ➤ Tier 2:

- Uses the same exposure factors and models as Tier 1
- Incorporates site-specific parameter values
- Site-Specific Target Levels (SSTLs) generally higher than the Tier 1 RBSLs used for the same site

## 2.4 – Tiered Process Characteristics

- Target risk and level of protection remains the same for both tiers

# Section 3.0

## Pre-Investigation Assessment

## 3.2.1 – Site Visit Goals

- Locate source areas
- Identify points of exposure
  - Water supply wells
  - Subsurface structures
  - Surface water bodies
- Conduct a utility survey
- Select potential drilling locations
- Prepare a site map

## 3.2.1 – Property Access

- Contact NDEQ project manager for assistance with access problems
- Railroad property:
  - State that remedial actions required by NDEQ
  - Possible fee waivers
  - Contact project manager if necessary
- Payments for access are generally NOT eligible for reimbursement

## 3.2.2 – Source Areas

- Known points of leakage
- Stained soils
- Elevated sampling results
- Consult project manager if necessary

## 3.2.2 – Source Areas

- Figure 3-1 provides examples of source area determinations for typical petroleum release scenarios
  - LUST
  - LAST
  - Transportation
  - Pipeline

# Section 4.0

## General RBCA

### Site Investigation Requirements

# 4.1 – Introduction

- Information required for both Tier 1 and Tier 2 investigations
- Contact the Department:
  - Free product
  - Sheen on surface water
  - Vapors in structures

## 4.2 – Chemicals of Concern

- Depends on:
  - Material released
  - Product storage history
  
- Table 4-1 lists Chemicals of Concern for typical petroleum products

## 4.2 – Chemicals of Concern

### ➤ Gasoline and JP-4:

- Benzene
- Toluene
- Ethylbenzene
- Total Xylenes
- N-Hexane
- MTBE

## 4.2 – Chemicals of Concern

### ➤ Diesel fuel and waste oil:

- Benzene
- Toluene
- Ethylbenzene
- Total Xylenes
- Total Extractable Hydrocarbons (TEH)
- Polycyclic Aromatic Hydrocarbons (PAHs)

## 4.2 – Chemicals of Concern

- Target levels for some PAHs are very low
- TEH Surrogate Method
  - TEH results used to estimate concentrations of PAHs based on constituent percentages
  - Applies to:
    - Naphthalene
    - Pyrene
    - Benzo(a)pyrene

## 4.3.1 – Maps

- All structures and physical features depicted must be based on current information
- Aerial photographs:
  - May be submitted
  - NOT a substitute for any of the required maps

## 4.3.1 – Maps

- Area map
- Site map
- Free product map
- Contaminant maps
  - Not required for Tier 1
  - Required for each COC/Media for Tier 2 according to Table 4-2

## 4.3.4 – GPS Locations

- Provide location coordinates for:
  - Each source area
  - The site itself
- Recommended but not required:
  - Individual well locations

## 4.3.4 – GPS Locations

### ➤ Accuracy:

- Recreational-quality GPS sufficient for site and source-area locations
- Sub-meter accuracy recommended for individual well locations

## 4.4 – Land Use & Receptors

- “Receptor” refers to humans potentially exposed to COCs
- “Points of Exposure” (POE) refers to physical locations
  - Water supply wells
  - Basements or subsurface structures
- “Ecological Exposure” refers to locations where COCs or free product may affect wildlife

## 4.4.3 – Water Well Survey

- Municipal wells within 2000'
- Domestic, irrigation, industrial, and agricultural wells within 1000'
- Sandpoint and hand-pumped wells within 500'

## 4.4.3 – Water Well Survey

### ➤ Unregistered wells:

- Contact local water commissioner or utility superintendent
- Visual survey of properties within 200' of the source (*correction to the March 2009 version*)

## 4.4.4 – Subsurface Structures

- Buildings with basements or crawl spaces
- Cellars
- Storm and sanitary sewers
- Utility conduits
- Any other space that might allow accumulation of vapors

## 4.4.4 – Subsurface Structures

- Identify location and depth of all structures within 200' of the source or extent of contamination
  - Consult local utility superintendent
  - Visual survey of properties

## 4.4.5 – Ecological Exposures

- Identify permanent surface water bodies within 1000' of the source or extent of contamination
- Visually inspect each for the presence of a sheen or other signs of contaminant impact

## 4.5 – Monitoring Wells

- All monitoring wells must be constructed in accordance with the Department of Health & Human Services (DHHS) Title 178 – *Environmental Health*
- Variances:
  - Obtain NDEQ agreement
  - Contact NDHHS to request variance
  - Document in workplan and report

# 4.5.1 – Monitoring Well Installation

## ➤ General requirements:

- Minimum 2” diameter
- Screen length not to exceed 10’ without approval
- Use commercially-slotted or continually-wrapped schedule 40 PVC screen
- Anticipated static water level should intersect the midpoint of the screen

# 4.5.1 – Monitoring Well Installation

## ➤ Auger drilling

- Hollow-stem (preferred)
- Solid-stem
  - Requires Department approval
  - Locations away from known source areas
  - Material will maintain integrity without support

# 4.5.1 – Monitoring Well Installation

## ➤ Direct-push technologies

- NOT for permanent ground water monitoring well installations under Title 178
- CANNOT be used for Tier 1 investigations
- Acceptable for some Tier 2 data collection:
  - Soil vapor assessment
  - Soil and ground water assessment, if all required data can be collected and Title 178 is not violated

# 4.5.1 – Monitoring Well Installation

## ➤ Other methods

- May be necessary in certain situations
  - Depth to ground water
  - Shallow bedrock
- Contact the Department for approval

## 4.5.2 – Monitoring Well Development

- Title 178 requires development of all cased water wells
- Development must continue until:
  - Visibly clear water is discharged
  - Indicator parameters have stabilized
- Equilibrium time after development is site-specific and at consultant's discretion

## 4.5.3 – Purging

- Must minimize water agitation
- Allowable methods:
  - Pneumatic pumps
  - Centrifugal pumps
  - Positive displacement pumps
  - Bailing (gently)

## 4.5.3 – Purging

### ➤ Coarse-grained materials

- Must be purged prior to dissolved sample collection
- Purge until:
  - A minimum of five well volumes has been removed
  - Indicator parameters have stabilized

## 4.5.3 – Purging

### ➤ Fine-grained materials

- Wells screened at the water table:
  - Must NOT be purged
- Wells screened below the water table:
  - Purge by removal of water to the top of the screen

## 4.5.3 – Purging

- Mixtures of fine and coarse materials
  - Attempt to purge as for coarse-grained sediments
  - If well is in danger of being purged dry:
    - Stop purging and proceed with sampling
    - Document failed attempt in investigation report
    - The well will be considered “low-yield” and must be treated as a fine-grained well for all future sampling events

## 4.5.4 – Well Abandonment

- Two options for wells no longer needed for investigation or remedial activities:
  - Abandonment in accordance with Title 178
  - Retention by responsible party or property owner for subsequent use

## 4.5.4.1 – Well Retention

### ➤ Written request specifying:

- Well identification number
- Site map indicating location
- Intended future use of the well

### ➤ If approved:

- Registration transfers to new owner
- Owner assumes full responsibility for the well

## 4.6 – Free Product

- Measurable thickness ( $\geq 0.01$  feet)
- Notify the Department if free product is discovered during the investigation
- Additional actions required depend on site conditions
  - Response flowchart provided in Figure 4-1

## 4.6 – Free Product

- Depth to ground water  $\leq$  20' BGL and subsurface structures are present:
  - Immediately conduct a vapor assessment and report results
- Depth to ground water  $>$  20' BGL or no subsurface structures present:
  - Site investigation continues as planned except for no ground water sample collection from wells containing free product

## 4.6 – Free Product

- Depending on site conditions, the Department may require additional actions
  - Delineation of the areal extent of the free product plume
  - Installation and sampling of sentinel wells

## 4.7.2 – Soil Sampling

- Number of surface soil samples varies by source
  - UST systems or buried piping
    - Collect one sample from each source-area boring if surface soil contamination is present
  - Land releases:
    - One sample from each source area of 100 sq. ft or less
    - One sample for each additional 400 sq. ft. of affected area.
    - Refer to Figure 3-1b for example

## 4.7.2 – Soil Sampling

- Subsurface soil, Tier 1 investigation:
  - Continuous sampling for source area borings
  - If evidence of vadose zone contamination is detected in a non-source boring:
    - Continuous sampling required for the remainder of that boring
    - Samples must be collected as for a source area

## 4.7.2 – Soil Sampling

- Subsurface soil, Tier 2 investigation:
  - Continuous sampling required for:
    - Soil contaminant characterization
    - Geologic cross sections
  - If vadose zone contamination is detected in a boring outside a known source area:
    - Continuous sampling required for the remainder of that boring
    - Samples must be collected as for a source area

## 4.7.3 – Ground Water Sampling

- Ground water collection methods must minimize agitation
- Methods not allowed due to excessive agitation:
  - Suction pumps
  - Airlift pumps
  - Inertial lift pumps (Waterra™ or similar)
  - Peristaltic pumps

# 4.7.3 – Ground Water Sampling

- Acceptable ground water sampling methods include:
  - Gear-driven pumps
  - Helical rotor pumps
  - Pneumatic piston pumps (sealed drive gas)
  - Bladder pumps
  - Passive diffusion bag samplers
    - Wells screened below the water table
    - MTBE has not been detected
    - Vertical aquifer flow gradient is not present
  - HydraSleeves™ or similar
  - Bailing (gently)

## 4.7.4 – Subsurface Structure Vapor Assessment

- Initial screening:
  - Photoionization detector (PID)
  - Flame ionization detector (FID)
- If elevated levels are observed with the PID/FID:
  - Use a combustible gas indicator or explosimeter
  - Immediate notification if readings exceed 1% of the lower explosive limit (LEL)

## 4.8 – Saturated Zone Characteristics

- Ground water flow direction
- Hydraulic conductivity and gradient
- Depth to ground water
- Water table fluctuations
- Porosity
- Calculated ground water flow velocity

## 4.8.1 – Ground Water Flow Direction

- Monitoring well locations must avoid a linear arrangement
  - At least one monitoring well must be 15 degrees or more off-axis to allow for triangulation
  - Example provided in Figure 4-2

## 4.8.2 – Hydraulic Conductivity

- Measured values from slug or pump tests are not required for the Tier 1 or Tier 2 investigations
- Values are to be selected from Table 4-3 based on the predominant sediment type

## 4.8.4 – Depth to Ground Water

- Water levels used for determining ground water flow direction or preparing ground water contour maps must be obtained during a single measurement event

## 4.8.5 – Ground Water Variations

- Provide information about seasonal variations in water table depth and ground water flow direction
  - Site-specific data
    - Observed
    - Smear zone thickness
    - Anecdotal
  - Information from other nearby sites

## 4.8.6 – Porosity

- Tier 1 investigations use default values based on the predominant sediment type where a point of exposure is located:
  - Sands and gravels = 0.30
  - Silts and clays = 0.35
  
- Tier 2 investigations use site-specific values

## 4.9 – QA / QC Considerations

- Samples should be handled quickly, carefully, and consistently
- Only costs associated with useable data are eligible for Title 200 reimbursement
- If samples must be recollected due to a QA / QC issue, the cost of the first sampling event will most likely not be reimbursed

# 4.9 – QA / QC Considerations

## ➤ Required QA / QC samples:

- “Blind” duplicates
- Field blanks
- Trip blanks
- Temperature blanks (or thermometers)

# 4.9.5 – QA / QC Documents

## ➤ Chain-of-Custody

- Begins when the trip blanks are placed into the sample cooler

## ➤ Laboratory documents

- Spiked-sample analysis results
- Chromatograms for all samples

## 4.10 – Documentation

- Investigation results must be submitted on the Department's RBCA Report Forms
  - Site information and physical characteristics
  - Sample results
  - Room provided for simple narratives
  - Longer narratives, documentation of regulatory variances, or other explanations may be attached if necessary.

## 4.10 – Documentation

- Investigation reports must also include:
  - Maps
  - Boring and monitoring well data
  - Cross sections (Tier 2 only)
  - Sampling data
    - Analytical method / version
    - Lab sheets and chromatograms
    - Chain-of-Custody sheets

## 4.10.2.1 – Licensing & Registration

- Companies and individuals must hold a license issued by DHHS to install, service, or sample monitoring or water wells
- All monitoring wells must be registered with the DNR

## 4.10.2.2 – Boring Logs

## 4.10.2.3 – Monitoring Wells

- Include the names of all consultant and drilling company personnel present during installation
- Provide the DHHS license numbers of personnel involved in installing the boring or monitoring well

## 4.10.2.4 – Soil Vapor Monitoring Wells

- Permanent vapor monitoring wells must be registered with the DNR
- Include the names of all consultant and drilling company personnel present during installation
- Provide the DHHS license numbers of personnel involved in installing the vapor monitoring well

## 4.10.3 – Cross Sections

- Tier 1: no cross sections necessary
- Tier 2: at least two cross sections
  - One parallel to ground water flow
  - One perpendicular to ground water flow
  - Cross sections must intersect the source area

## 4.10.5 – Electronic Report Submittal

- Complete reports may not be submitted via e-mail
- In some circumstances, e-mail submittal of specific data may be acceptable:
  - Departmental approval required in advance
  - Printed form must still be submitted

## 4.10.5 – Electronic Report Submittal

- Supporting information may be submitted on a standard CD-R instead of in printed form:
  - Laboratory data (if a summary table is provided in the report)
  - Well registration and abandonment forms

## 4.10.5 – Electronic Report Submittal

- If information is submitted on CD:
  - The CD must be labeled with the site name, DEQ spill number and IIS number, and report name and date
  - The CD must be titled as an Appendix to the report, with a table of contents included in the printed report listing each file on the CD
  - Files are to be in PDF format
  - The CD may be submitted unattached or bound into the printed report

Break

# Section 5.0

## Tier 1 Site Investigation

# 5.0 – Tier 1 Site Investigation

- Direct-push technologies may NOT be used for Tier 1 investigations because Title 178 does not allow their use for the installation of permanent monitoring wells

## 5.2.1 – Subsurface Soil Samples

- Number of samples required from each boring depends on the depth to ground water
- Examples provided in Figure 5-1

## 5.2.1 – Subsurface Soil Samples

- Ground water depth < 10' BGL:
  - One soil sample required
  - Taken at the point of highest contamination as measured by field instrumentation
  - Sample collected above the capillary zone

## 5.2.1 – Subsurface Soil Samples

- Ground water between 10' and 25' BGL:
  - Two soil samples required
  - Taken at the points of highest contamination as measured by field instrumentation
  - Samples collected above the capillary zone

## 5.2.1 – Subsurface Soil Samples

- Ground water depth > 25' BGL:
  - Two or three soil samples required
  - Two samples must be collected in the initial 25' BGL at the points of highest contamination as measured by field instrumentation
  - A third sample is required from the remainder of the boring only if field instrumentation indicates a higher concentration than was identified in the first 25'
  - All samples collected above the capillary zone

## 5.3 – Ground Water Samples

- One sample collected from a monitoring well located upgradient of the source area
  - To establish background water quality
- One sample from each source area

## 5.3 – Ground Water Samples

- One sample collected from a monitoring well located downgradient from the source area
  - If more than one source area is present, sample from the monitoring well where the greatest contamination concentration is expected

## 5.3 – Ground Water Samples

- If a water supply well is located within 250' of the site and may influence the dissolved contaminant plume:
  - Collect a sample from a monitoring well located between the source and the supply well, screened at depth to address the possibility of vertical contaminant migration

## 5.4 – Waiver of Ground Water Sampling

- Drilling to and sampling of ground water may be waived under certain conditions:
  - All source areas are investigated
  - Contamination is no longer detected by field instrumentation
  - The estimated remaining depth to ground water is greater than 25'
- Examples provided in Figure 5-2

## 5.4 – Waiver of Ground Water Sampling

- If the waiver conditions are met, two additional soil samples are required from each boring:
  - One from a point at least 5' below the last indication of contamination
  - One from a point at least 10' below the previous sample interval
- These samples are in addition to any soil samples collected from points of contamination

## 5.4 – Waiver of Ground Water Sampling

- If multiple source areas are present:
  - Waivers are considered for each source independently
  - If at least one but not all source areas meet waiver requirements, contact the project manager to determine appropriate locations for remaining upgradient and downgradient monitoring wells

## 5.4 – Waiver of Ground Water Sampling

- The ground water sampling waiver may also apply to source area borings that do not encounter any contamination
  - Anticipated ground water depth must be 50' or greater
  - Soil samples required at 25' BGL and 35' BGL

## 5.4 – Waiver of Ground Water Sampling

- If auger refusal occurs before encountering ground water:
  - Collect a soil sample from the bottom of the boring for laboratory analysis
  - Submit the results and collection depth with an explanation in the Tier 1 report

# Section 6.0

## Tier 2 Site Investigation

# 6.0 – Tier 2 Site Investigation

- Involves only the exposure pathways where contaminant levels exceeded the Tier 1 RBSLs
- Direct-push technology is allowed for some Tier 2 investigation use
  - CANNOT be used to install permanent monitoring wells
  - Table 6-1 compares applicability of auger drilling and direct push for the various pathways

# 6.0 – Tier 2 Investigation

- Any proposed changes to methods listed in the guidance document must be highlighted and explained in the workplan
- If a variance is desired from Title 178 requirements:
  - Obtain NDEQ agreement in advance
  - Contact DHHS to request variance
  - Document in workplan and report

# 6.0 – Tier 2 Investigation

- Identify prospective off-site sampling locations and obtain property access as early in the Tier 2 process as possible
  - Contact NDEQ project manager for assistance if necessary

# 6.0 – Tier 2 Investigation

- Involves only the exposure pathways where contaminant levels exceeded the Tier 1 RBSLs
  - Ground water ingestion
  - Soil leaching to ground water
  - Vapors from contaminated ground water
  - Vapors from contaminated subsurface soil

# 6.1.1 – Ground Water Ingestion

- The horizontal dimensions of the dissolved contaminant plume must be delineated to the levels listed in Table 4-2
- All monitoring points (including Tier 1 monitoring wells) must be sampled for all applicable COCs
- Assessment of the possibility of vertical contaminant migration may be required

## 6.1.2 – Soil Leaching to Ground Water

- Vadose zone soil contamination must be delineated around each source area
  - Example provided in Figure 6-1
- Tier 2 borings must be sampled for all applicable COCs
- Number of required samples is different from Tier 1
  - One sample per boring from depths < 25' BGL
  - One additional sample per boring from depths > 25' BGL
  - Samples to be taken from points of maximum contamination
- Soil physical / chemical parameters must be determined

## 6.1.3 – Vapors from Ground Water

- New vapor survey of all subsurface structures must be performed, including:
  - Monitoring results
  - Owner's contact information
  - Typical use of each structure
- Pathway can be assessed in two ways:
  - Using ground water samples
  - Using soil vapor samples

## 6.1.3 – Vapors from Ground Water

- Assessment using ground water sampling
  - Delineate the extent of the dissolved contamination to the levels in Table 4-2 for all applicable COCs
  - Collect soil samples from the vadose zone to determine physical / chemical parameter values

## 6.1.3 – Vapors from Ground Water

- Assessment using soil gas sampling
  - Install monitoring points within three feet above the capillary zone in the following locations:
    - All source areas
    - Adjacent to all on-site and the nearest off-site structures
    - At least one location between the source areas and each structure
  - Collect soil gas samples from each monitoring point and analyze for applicable COCs

## 6.1.4 – Vapors from Contaminated Soil

- New vapor survey of all subsurface structures must be performed, including:
  - Monitoring results
  - Owner's contact information
  - Typical use of each structure
- Pathway can be assessed in two ways:
  - Using soil samples
  - Using soil vapor samples

## 6.1.4 – Vapors from Contaminated Soil

### ➤ Assessment using soil sampling

- Delineate the extent of the soil contamination within the upper 25' of the vadose zone
- Locate at least one boring as close as possible to structures within the area of contaminated soil, between the structure and the source
- Collect two soil samples from each boring:
  - Points of highest contamination as measured by field instruments
  - Both samples must be collected above the water table
- Collect soil samples from the vadose zone to determine physical / chemical parameter values

## 6.1.4 – Vapors from Contaminated Soil

- Assessment using soil gas sampling
  - Install monitoring points above the capillary zone in the following locations:
    - All source areas, within the soil contaminant mass\*
    - Adjacent to all on-site and the nearest off-site structures, at three feet BGL or the depth of the structure's footings, whichever is greater
    - At least one location between the source areas and each structure, within the soil contaminant mass \*
  - Collect soil gas samples from each monitoring point and analyze for applicable COCs

## 6.2 – Soil Characteristics

- Site-specific values required for the fate and transport equations for all exposure pathways
  - Soil porosity
  - Capillary zone thickness
  - Selected from values in Tables 6-2 and 6-3, rather than sample analysis

## 6.2 – Soil Characteristics

- Chemical and physical parameters required for the soil leaching to ground water exposure pathway
  - Soil dry bulk density
  - Volumetric water content
  - Fractional organic carbon

## 6.2 – Soil Characteristics

- Chemical and physical parameters required for the inhalation exposure pathways if assessment is based on soil or ground water samples
  - Soil dry bulk density
  - Volumetric water content
  - Fractional organic carbon

## 6.2 – Soil Characteristics

- Chemical and physical parameter value determination is not required for sites where:
  - Only an inhalation pathway is being assessed
  - and
  - Soil gas samples are used instead of soil or ground water contamination values

## 6.3.1 – Soil Gas Sampling Points

- May be temporary or permanent
- Construction of permanent monitoring points should be similar throughout the site
- Acceptable installation methods include:
  - Direct-push technologies
  - Auger drilling
  - Hand-installed (with Department approval)

## 6.3.2 – Soil Gas Sampling

- Sample point must be sealed to exclude ambient air
- Purge before sampling
- Sample analysis options:
  - Field gas chromatograph
  - Collected in a summa canister for laboratory analysis
  - Collected in a Tedlar bag for laboratory analysis within 72 hours of sample collection
- No duplicate samples or blanks are necessary

# Section 7.0

## Risk-Based Evaluation: General Considerations

# 7.0 – Risk-based Evaluation

- Site Conceptual Exposure Scenario (7.2)
- Target Levels (7.3)
- Ground water (7.4)
- Indoor air quality (7.5)
- Surface soils (7.6)
- Surface water & ecology (7.7)
- Representative contaminant concentrations (7.8)

# Section 8.0

## Tier 1 Evaluation

## 8.3 – Look-Up Tables

- Table 8-11 is provided for surface water or ecological exposures from contaminated ground water
- Table 8-12 is provided for surface water or ecological exposures from contaminated soils leaching to ground water

# Section 9.0

## Tier 2 Evaluation

# Supplemental Information

- List of Acronyms (p. vii)
- References (10.0)
- Glossary (11.0)
- Appendices

# Appendices

- PAH Evaluation using Total Hydrocarbons
- Tier 1 Report Forms
- Tier 2 Report Forms
- Target Level Default Data
- Fate & Transport Equations
- Contact List

# Appendix B – Tier 1 Report Forms

## ➤ Added forms for:

- Consultant and licensing information
- GPS Coordinates
- Additional sheets for analytical data

## ➤ Space for comments and notes is limited

# Appendix C – Tier 2 Report Forms

## ➤ Added forms for:

- Consultant and licensing information
- GPS Coordinates
- Additional sheets for analytical data

## ➤ Space for comments and notes is limited

# Appendix F – Contact List

- State agencies and other organizations that pertain to site investigations or remedial activities
  - Department of Environmental Quality
  - State Fire Marshal
  - Department of Health & Human Services
  - Department of Natural Resources
  - Nebraska Board of Geologists
  - Nebraska Board of Engineers & Architects
  - Nebraska Natural Resource Districts
  - U.S. Environmental Protection Agency

# Implementation

- New guidance document and report forms will take effect on May 1, 2009
  - All investigations started on or after that date
  - Procedures can be used for investigations currently in progress
    - Contact project manager

# More Information

- Copies of the guidance document and report forms are available from:
  - NDEQ website ([deq.ne.gov](http://deq.ne.gov))
  - NDEQ Petroleum Remediation Section

# Future Information

- NDEQ RBCA Update e-mail list
  - [scott.mcintyre@nebraska.gov](mailto:scott.mcintyre@nebraska.gov)
- Questions & Information page will be added to the Petroleum Remediation Section part of the NDEQ website

# Questions?