

**Presumptive Remedy Policy**  
**Investigation and Cleanup of Nitrogen at**  
**Agriculture-Related Sites in Kansas**



**BER Policy # BER-RS-047**

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## Concurrence



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## Acronyms and Abbreviations

ADS	Agency Decision Statement
BER-RS	Bureau of Environmental Remediation/Remedial Section Policy
CI/CAS	Comprehensive Investigation/Corrective Action Study
EPA	United States Environmental Protection Agency
EUC	Environmental Use Control
GPS	Global Positioning System
KARB	Kansas Agricultural Remediation Board
KDA	Kansas Department of Agriculture
KDHE	Kansas Department of Health and Environment
KDHE-BER	Kansas Department of Health and Environment, Bureau of Environmental Remediation
KSU	Kansas State University
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
mg/L	milligram per liter
NCP	Nitrogen Cleanup Plan
NCR	Nitrogen Cleanup Report
NPR	Nitrogen Presumptive Remedy
QAPP/HSP	Quality Assurance Project Plan/Health and Safety Plan
RSK	KDHE Risk-based Standards for Kansas RSK Manual, 5 <sup>th</sup> Edition
SCP	State Cooperative Program
SOP	Standard Operating Procedure
VCPRP	Voluntary Cleanup and Property Redevelopment Program
VCI/VCP	Voluntary Cleanup Investigation/Voluntary Cleanup Plan
VOCs	Volatile Organic Compounds

## Glossary

Ammonia	Chemical formula $\text{NH}_3$ (un-ionized) (ammonia) or $\text{NH}_4^+$ (ionized) (ammonium). Ammonia can be expressed as either milligrams (mg) of ammonia molecule per Liter (mg $\text{NH}_3/\text{L}$ ); or, mg of ammonia-nitrogen per liter (mg $\text{NH}_3\text{-N}/\text{L}$ ). To report as mg $\text{NH}_3\text{-N}/\text{L}$ , multiply mg $\text{NH}_3/\text{L}$ by 0.823. Ammonia (Total) as N lab analysis includes both the ionized and un-ionized forms.
Beneficial reuse	Reuse of soil or groundwater to remediate contamination in a process that permits recycling the contaminant rather than disposal of the material.
Bioremediation	Use of living organisms to remove pollutants from soil, water, or wastewater.
Denitrification	Chemical or biological breakdown of nitrate or ammonia to nitrogen gas, thus decreasing concentration in soil or groundwater.
EUC	Environmental Use Control measures are an administrative or legal control intended to restrict or prohibit human activities and property use in such a way as to prevent or reduce exposures to contamination.
Excavation	Physical removal of contaminated soil by backhoe or other heavy equipment.
Facility	A location that could include a business or other operation utilizing, providing, or manufacturing nitrogen compounds or other source materials responsible for nitrate contamination.
Fertilizer	Forms of nitrogen as nitrate or ammonia compounds applied for crop growth.
Herbicide	A chemical used to control, suppress, or kill plants, or to severely interrupt their normal growth process.
Implementing Party	Potentially Responsible Party involved with a contaminated site and responsible for cleanup.
<i>In-Situ</i>	In the original place. In-situ treatment does not require digging up and moving contaminated material. In-situ is the opposite of <b>ex-situ</b> .
Microbes	Bacteria that utilize nitrate or nitrogen and cause conversion to nitrogen gas.

Nitrate	Chemical formula $\text{NO}_3$ . Nitrate can be expressed as either milligrams (mg) of nitrate molecule per Liter (mg $\text{NO}_3/\text{L}$ ); or, mg of nitrate-nitrogen per liter (mg $\text{NO}_3\text{-N}/\text{L}$ ). The EPA Maximum Contaminant Level for Nitrate in water is expressed as 10 mg $\text{NO}_3\text{-N}/\text{L}$ or 45 mg $\text{NO}_3/\text{L}$ . To report as mg $\text{NO}_3\text{-N}/\text{L}$ , multiply mg $\text{NO}_3/\text{L}$ by 0.225.
Nitrite	Chemical formula $\text{NO}_2$ . Nitrite can be expressed as either mg of nitrite molecule per Liter (mg $\text{NO}_2/\text{L}$ ); or, mg of nitrite-nitrogen per liter (mg $\text{NO}_2\text{-N}/\text{L}$ ). The EPA MCL for Nitrite in water is 1.0 mg $\text{NO}_2\text{-N}/\text{L}$ . To report as mg $\text{NO}_2\text{-N}/\text{L}$ , multiply mg $\text{NO}_2/\text{L}$ by 0.304.
Nitrogen (Total)	Nitrogen (total) is the total amount of Nitrate as mg $\text{NO}_3\text{-N}/\text{L}$ , Nitrite as mg $\text{NO}_2\text{-N}/\text{L}$ , Ammonia, and organically bonded Nitrogen.
Pesticide	A substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.
Phytoremediation	Use of plants to remove a contaminant from soil or groundwater.
Pilot-scale studies	Laboratory or small-scale field demonstrations of remediation technologies to determine if a methodology is appropriate for a given site.
Presumptive Remedy	Preferred proven technologies that can be applied to contaminated sites that share common characteristics based on KDHE's experience and its scientific and engineering evaluation of alternative technologies. The objective of presumptive remedy initiatives is to streamline site characterization and selection of cleanup action(s).
Receptor	Human or environmental end receiver impacted by contaminated soils, groundwater, or surface water.
Remediation	Process for cleanup of a contaminated site which includes methods appropriate for cleanup of soils, groundwater, and surface water if impacted.
Septic system	Waste water treatment system for a single family unit when a public system not available.
Split samples	KDHE collects split samples of soil or water at a site to observe field sampling techniques in comparison with the field sampling plan and to compare laboratory methods used by different laboratories for the same analyses.

- Tier 2                    A comparison of the concentration of a contaminant to the risk-based cleanup values in the KDHE Tier 2 Risk-based Summary Table, found in Appendix A of the KDHE Risk-based Standards for Kansas manual.
- Tier 3                    A process involving collecting the necessary data, under KDHE/BER direction, to replace default values in the Tier 2 equations with site-specific information.
- Water-well survey    A process to identify all groundwater and surface water users in the vicinity of a contaminated area in order to determine if they are impacted.

## 1. Introduction to the NPR Process

### Introduction

This policy has been developed to address agriculture and bulk distribution-related sites that included the use, manufacture, transportation, and/or distribution of chemicals or other processes resulting in nitrogen contamination. For the purposes of this policy “nitrogen” includes nitrate, nitrite, and ammonia. However, it may be necessary to differentiate between the specific compounds based on site specific circumstances. This policy can also be used for sites outside the agriculture industry at the discretion of their respective regulatory programs.

A nitrogen presumptive remedy (NPR) is an approach or technology that has consistently been applied, and demonstrated to be effective, in cleaning up or addressing nitrogen contamination in soil and/or groundwater. The benefit to utilizing a demonstrated technology is that it encourages focused assessments targeted at the known approach, and simplifies the overall remedy selection process. While no two sites are identical, NPRs are designed to account for a wide variety of site-specific circumstances and provide a streamlined mechanism to remove contaminant mass in a timely manner. Typically NPRs used at nitrogen sites in Kansas include the following:

Media	Typical Presumptive Remedies
Soil	Soil excavation and off-site land application for beneficial reuse; phytoremediation with trees, grasses, alfalfa, or other appropriate nitrogen-consuming crops or flora.
Groundwater	Phytoremediation with trees, grasses, alfalfa, or other appropriate nitrogen-consuming crops or flora, where roots are demonstrated to reach the saturated zone; in-situ bioremediation for denitrification using a carbon source or augmented with microbes along with a carbon source; pump and irrigate; pump and use water for mixing water at fertilizer plants.

If KDHE approves the use of a NPR, the Implementing Party must prepare a NPR work plan for KDHE-BER approval for the remedy they are proposing to implement. The NPR must be implemented in accord with the approved work plan.

### Purpose

The purpose of this document is to provide a comprehensive guidance document that outlines a clear framework to successfully manage and mitigate risks to human health and the environment posed by nitrogen contamination in soil and groundwater. While the approaches identified in this document are intended to fit the majority of sites in Kansas, certain site characteristics may dictate another approach. This includes sites with complicated

hydrogeologic settings, other contaminants present, and significant infrastructure constraints. Following this policy will satisfy State Cooperative Program requirements for a Comprehensive Investigation/Corrective Action Study (CI/CAS) and the Voluntary Cleanup and Property Redevelopment Program (VCPRP) requirements for Voluntary Cleanup Investigation/Voluntary Cleanup Proposal (VCI/VCP) at sites limited to nitrogen contamination.

### **Identification of Receptors**

Site response activities and cleanup measures are based on risks posed by the site, which must be evaluated on a site-by-site basis. In order to evaluate each site based on risk, one must have a clear understanding of the human health and environmental receptors *potentially* or *actually* impacted by the facility. Domestic and public water supply drinking water sources are the primary concern for contaminated groundwater sites. However, receptors can also include (but are not limited to) surface water bodies such as rivers/streams/lakes. Activities necessary to identify receptors potentially or actually impacted from a facility may include, but are not limited to:

- Conducting water well surveys consistent with Policy BER-RS-056 - Considerations for Performing Water Well Surveys near Contaminated Sites.
- Conducting water well sampling if site-related contamination is present on nearby properties.

Identification of receptors should be performed early in the investigation process or at the point when site data indicates the site-related contamination may pose an actual, imminent, or potential threat to human health or the environment. If drinking water wells (public or private) are shown to be impacted above the regulatory standards by contamination from the site, an alternate drinking water supply or appropriate form of treatment must be provided by the Implementing Party. Well abandonment may be appropriate if a well is inactive or no future use of the well is planned. If the owner of the receptor declines the offer for alternate water supply, the declination must be clearly documented in writing.

The type(s) of remediation ultimately selected must mitigate risks to current and future receptors; remedial efforts should be performed under a beneficial reuse model when practical. Regardless of the type of facility, receptors shall be identified and addressed in a timely manner. In addition, the source shall be addressed to reduce exposure to or leaching of contamination from contaminated soils. The timing of the source remediation could be short- or long-term, depending on the type of facility, the degree of contamination and its corresponding level of risk to human health or the environment and with respect to immediate, short-term or long-term impact to a receptor.

## Operational vs. Non-Operational Facilities

Facilities with nitrogen contamination generally fall into two basic categories: operational or non-operational, based on the level of activity at a facility. Operational facilities may include active ammonia manufacturing plants and agribusiness facilities. Non-operational facilities generally consist of closed agribusiness facilities or inactive manufacturing plants. This policy is not intended for confined animal feeding operations or for non-point source groundwater impacts. The long-term cleanup approach for nitrogen sites shall be consistent across the State of Kansas. Understanding the type of facility being investigated and targeted for cleanup is essential in order to make logical and practical decisions in the short-term. Both operational and non-operational sites offer unique cleanup challenges and efforts should be tailored accordingly.

### Operational Facilities

Operational facilities should initially focus efforts on spill cleanup and operational management with use of best management practices to prevent future spills and/or recontamination of areas that have already been addressed. In addition, institutional controls, such as Environmental Use Controls (EUCs), should be considered as a component of the cleanup strategy to help manage risks. Operational facilities are typically more aware of areas where spills or other releases have occurred. In this case, facilities should target source area cleanup efforts to mitigate contaminant mass in the short-term with the understanding that long-term actions or restrictions may be appropriate.

- **Groundwater:** If groundwater contamination migrates off-site, additional remedial strategies may need to be implemented to mitigate the impacts, particularly if receptors are actually or potentially impacted by the contamination. Operational facilities need to focus on remedial methods that will prevent further off-site migration.
- **Soil:** Short-term and long-term efforts should focus on removing accessible source material to prevent leaching of nitrogen to groundwater and conversion of ammonia to nitrate. Infrastructure constraints, such as underground pipelines, buildings, tanks, or unique site operational issues, etc. will help determine what remedial methods are applicable to a site. Residual soil contamination may continue to leach nitrogen to groundwater; therefore, additional groundwater remedial actions may be necessary, as determined on a site-specific basis. It may be necessary to have an EUC applied to the facility to limit the exposure to contamination and/or preserve protective covers that help limit migration. EUCs are discussed further in Section 11.

## **Non-Operational Facilities**

Remediation at non-operational facilities should focus on a streamlined path to remove nitrogen source material and to prevent off-site migration of contaminated groundwater exceeding KDHE-approved cleanup standards. If infrastructure or other site conditions prevent source area removal and nitrogen remains in the soil at concentrations above the cleanup standards, an EUC may be needed. However, the need for an EUC should be determined on a site-by-site basis and will be dependent on risk to human health and the environment.

## **2. Available Resources**

### **Meeting with KDHE for Discussion of Site and the Remedial Process**

KDHE encourages upfront and ongoing communication with users of this policy regarding options available at any stage of the remediation process. An upfront scoping meeting concerning the process often provides an opportunity to determine the path forward for a site. Options concerning remedial methods, characterization procedures, the need for an EUC, and the overall process can be presented and discussed.

### **Kansas Agricultural Remediation Board**

One of the programs potentially available to assist agricultural contaminated sites with funding investigation and remediation activities in Kansas is the Kansas Agricultural Remediation Board (KARB). Reimbursement of remedial costs may be available from the KARB based on criteria established by the group. KARB has requirements and procedures concerning the reimbursement program listed on their website at <http://karb.org/>.

### **Kansas Department of Agriculture**

The Kansas Department of Agriculture (KDA) Fertilizer and Pesticide Program regulates the labeling and storage of nitrogen fertilizers. Information pertaining to best management practices, including safe handling and storage through secondary containment, can be found at <http://agriculture.ks.gov/divisions-programs/pesticide-fertilizer/fertilizer>.

### **Kansas State University**

The Kansas State University (KSU) Department of Agronomy can provide technical assistance and resources with respect to crops, soil, and range sciences. Tools regarding soil test interpretations and fertilizer land application rate recommendations, including calculating nitrogen for specific crops, are available at the Department of Agronomy website at <http://www.agronomy.k-state.edu/services/soiltesting/fertilizer-recommendations.html>.

### 3. Cleanup Levels for Site Closure

The following discussion pertains to the cleanup levels in soil and groundwater necessary to obtain unrestricted site closure from BER.

- **Soil:** In soil, nitrogen is treated differently from Tier 2 contaminants as the soil cleanup guidelines provided below are not based on their potential toxicity to humans through exposure to contaminated soil, but rather on the potential for contamination in the soil to leach to groundwater. The soil cleanup guidelines provided below were developed by KDHE-BER in consultation with KSU agronomy experts to provide generic soil cleanup goals that are generally protective of groundwater and capable of sustaining vegetative growth.

In areas where no vegetation is present (i.e., contamination in a gravel roadway, parking area, etc.) the following Risk-based Standards for Kansas (RSK) standards apply:

- Upper 8 inches of soil - 85 milligrams/kilogram (mg/kg) total nitrogen (N);
- Below 8 inches in depth - 40 mg/kg nitrogen (N).

In areas where vegetation is present (i.e., cultivated and cropped agricultural ground, pasture, lawn, etc.) the following RSK standards apply:

- Upper 24 inches of soil - 200 mg/kg total nitrogen (N)
- Below 24 inches in depth - 40 mg/kg nitrogen (N).

- **Groundwater:** Nitrate and/or nitrite in groundwater pose significant threats of toxicity to infants. The Maximum Contaminant Level (MCL) for nitrate is 10.0 milligrams/liter (mg/L) nitrate as nitrogen or 45 mg/L nitrate; the MCL for nitrite is 1.0 mg/L.

#### Cleanup Level Considerations

It is critical to understand background nitrate-N concentrations in groundwater prior to establishing the remediation goal for a site. If the nitrate-N contamination levels for groundwater for the area surrounding the site are above the MCL of 10 mg/L because of non-point source pollution and the site nitrate-N concentrations are well above the observed “background levels” then the remediation goal may be evaluated with KDHE to determine a more appropriate cleanup level consistent with the Appendix “Background Evaluation for Nitrate Sites.”

The KDHE RSK Manual (KDHE, 2010) outlines other considerations for cleanup levels that differ from those listed above. In any of these scenarios the Implementing Party needs to discuss the situation with KDHE upfront to receive approval for an alternate cleanup level. In

lieu of such direct comparison to the default values identified above in Section 3, a Tier 3 Analysis is recommended to establish site-specific remedial cleanup goals, and may provide some relief in terms of soil cleanup levels that are more conducive to reaching site closure. Coordination with KDHE is key throughout the Tier 3 evaluation process. Scoping discussions between KDHE and the Implementing Party throughout the process is essential to successfully completing the analysis process. A Tier 3 Analysis entails modifications to the default values for physical and chemical-specific parameters based on site-specific conditions. A soil screening level equation for soil to groundwater migration and parameter definitions is available in the RSK Manual. The hydrogeologic parameters generally applicable for site-specific modification include soil porosity and density. Other approaches for establishing alternate cleanup levels may be approved by KDHE on a site-specific basis.



- **Soil:** In some cases, it may not be practical or cost effective to clean up soil to the default or Tier 3 calculated values. In such cases, soil cleanup levels are based on a cost benefit analysis, which is used to evaluate various excavation variables. Documentation must be provided to support a cost benefit analysis. Factors to consider include (but are not necessarily limited to) cost, volume of soil, depth of excavation, contaminant concentrations and mass, etc. Residual soil contamination following a cost-benefit clean-up may necessitate institutional controls. KDHE will ultimately determine the appropriate cleanup objectives for the site.
- **Groundwater:** EPA-promulgated MCLs when available will be the final cleanup levels for groundwater, with consideration of background contribution, independent of Tier 3 analysis. Alternate cleanup goals for *actively remediating* groundwater may be considered if appropriate measures are in place to protect receptors and reduce the potential for offsite migration of contamination or if existing and future risk to receptors are such that they are acceptable to KDHE.

#### 4. Nitrogen Presumptive Remedy Investigation

An NPR Investigation is an assessment of soil, groundwater, and/or surface water quality at a particular site in order to evaluate the nature and extent of known or suspected contaminants of concern associated with that site. The NPR Investigation is generally the first step in the process of cleaning up a site contaminated with nitrogen contaminants. It is also a critical step in terms of estimating the volume of soil potentially requiring excavation in order to reach site

closure in a cost effective and streamlined manner. The data collected during an NPR Investigation may also be necessary to provide the framework for evaluating cleanup alternatives for groundwater. NPR Investigation activities should be tailored to site-specific circumstances, but generally include the following fundamental approaches:

- Identify and evaluate the contaminants of concern; this may constitute just nitrogen compounds or include others. For example, herbicides and/or pesticides may also be present, which would be a consideration in future cleanup and disposal actions. Other contaminants will be addressed as appropriate on a site-specific basis.
- Identify and evaluate the media of concern. For nitrogen, this generally entails soil, groundwater, and/or surface water sampling and analysis.
- Identify all human and ecological receptors potentially affected by the contaminants. This includes conducting a water well survey if groundwater is impacted.
- Establish site specific background concentrations for nitrogen.
- Evaluate existing wells in the site vicinity, establish a groundwater monitoring well network and implement long-term monitoring if groundwater contamination from the site is known or suspected.

### **Minimum Expectations for Investigation and Remediation**

There are minimum requirements that must be met in order to address nitrogen contamination in soil and groundwater. The investigation shall provide sufficient detail to define groundwater flow and fully delineate the lateral and vertical extent of contamination if groundwater is known or suspected to be contaminated at levels exceeding the applicable regulatory levels. In order to eliminate groundwater as a pathway of concern, sufficient data must be present and approved by KDHE to support that the pathway is incomplete. Potential site-specific factors for eliminating groundwater as a pathway of concern may include, but are not limited to the following:

- Geologic Conditions – Site conditions indicate the presence of impervious bedrock (e.g., shale, limestone, etc.) isolating the contamination in soil from groundwater.
- Hydrogeologic Conditions – Groundwater is determined to not be potable based on KDHE-BER Policy 045 - Considerations for Groundwater Use and Applying RSK Standards to Contaminated Groundwater for all areas to which contamination has or may migrate.
- Other Conditions – Groundwater is below the regulatory standards for contaminants, or the contaminants are shown to be from offsite sources or within naturally occurring background levels.

Nitrogen concentrations in soil can be field screened using readily available field kits and confirmed by laboratory analysis. KDHE recommends Implementing Parties consider using field

screening methods to provide real-time data and guide field activities. This may reduce the overall costs associated with the investigation. Use of field screening can also help determine the lateral and vertical limits of nitrogen contamination, as well as identify and fill any potential data gaps during the investigation. All field screening procedures, and associated reporting limits, need to be thoroughly outlined in the Work Plan and include a standard operating procedure (SOP) for that particular field analysis being utilized. Field screening methods that do not provide results at or below the approved cleanup levels may be used to guide sampling and remedial activities, but may not be useful for final delineation of nitrogen impacts. The expectation is that a minimum of ten percent of the samples (representing high, medium, and low field screen results) will be sent to an off-site laboratory for confirmation purposes. Commercial mobile laboratories are also available and can provide field screening results. Similar to field kit screening, if a mobile laboratory is utilized, a minimum of ten percent of samples are expected to be verified by an off-site fixed laboratory. Samples collected to support site closure decisions should be submitted to an off-site fixed laboratory.

### **Other Contaminant Considerations**

In addition to nitrogen, other contaminants may be present at agricultural facilities. Such contaminants include but are not limited to herbicides/pesticides, volatile organic compounds (VOCs), metals, chlorides, and petroleum hydrocarbons in soil, groundwater, and surface water. While this policy does not specifically address these other contaminants, they may drive aspects of investigation or cleanup actions (e.g., land application or waste disposal). These other contaminations should be discussed during the initial scoping meeting.

### **Analytical Method Considerations**

Nitrate, nitrite, and ammonia concentrations are typically reported “as nitrogen” or “as N.” Analytical results expressed “as ammonia,” “as nitrate,” or “as nitrite” must be converted to “as N” based on the ratios of the molecular weight of nitrogen to the molecular weights of the compounds in question for comparison to the soil cleanup guidelines and groundwater standards. The calculation for converting to “N” can be found in the glossary section. Fixed laboratory analysis in both soil and groundwater must be conducted by a KDHE-accredited laboratory using certified analytical methods. A list of KDHE-accredited laboratories can be found at [www.kdheks.gov/labs/](http://www.kdheks.gov/labs/). It is critical to ensure that samples can be delivered to the laboratory and analyzed within method-specified holding times. In addition, some methods provide separate results for nitrate and nitrite (both as N), while others may provide a combined nitrate/nitrite result.

For soil confirmation there are only two methods that contemplate solid extraction in the laboratory method: EPA Method 300 and EPA Method 9056 are applicable for soil analysis. EPA Method 353.2 is not appropriate for soil confirmation/validation as the method does not

address solid extraction. EPA Method 353.2 can be used to acquire “screening data,” but a percentage of the data would need to be confirmed using EPA Method 300 or EPA Method 9056 at a laboratory accredited by KDHE for the selected method. There is no holding time involved with nitrate analysis in soil, at least not until they start the extraction process at the laboratory; however, samples should be properly stored under chain of custody protocol and delivered to the laboratory as soon as practicable.

In summary, all samples collected for nitrate analysis must be analyzed using laboratory methods appropriate for the environmental media of interest. Please note: KDHE does not provide accreditation to laboratories for the analysis of ammonia in soil. Specific analytical methods, holding times, and preservatives for nitrate and ammonia are as follows:

Common Laboratory Analyses for Agricultural Sites					
Analyte	Media	Approved Methods	Container	Preservative	Hold Time
Nitrate	Soil	EPA 300, EPA 9056	4 oz. glass jar	≤4°C	28 days
Ammonia	Soil	SM 4500, EPA 350.1	4 oz. glass jar	≤4°C	28 days
Nitrate	Water	EPA 300, EPA 353.2, EPA 9056, SM 4500	250 ml plastic bottle	≤4°C	48 hours
Nitrate/Nitrite	Water	EPA 353.2, SM 4500	250 ml plastic bottle	≤4°C, H <sub>2</sub> SO <sub>4</sub>	28 days
Ammonia	Water	SM 4500, EPA 350.1	250 ml plastic bottle	≤4°C, H <sub>2</sub> SO <sub>4</sub>	28 days

\* The KDHE Project Manager must approve all proposed analytical methods.

### Pilot Tests

It may be appropriate to conduct bench- or pilot-scale treatability studies to evaluate cleanup alternatives during the investigation process. Treatability studies are conducted to provide sufficient data for treatment alternatives, which may be necessary under an Interim Measure or long-term remedial design. The studies can reduce costs by minimizing mobilizations and by identifying viable treatment alternatives that will work with site specific circumstances. Examples may include, but are not limited to pump and irrigate, injection pilot tests, or phytoremediation bench scale tests. If pilot testing is proposed, the Implementing Party must submit a treatability study work plan for KDHE review and approval.

## 5. NPR Investigation Work Plan and Report

An NPR Investigation Work Plan must be submitted and approved by KDHE before the investigation is implemented. The components within the Work Plan may vary based on overall site-specific objectives, but generally include a field sampling plan, a quality assurance project plan, a health and safety plan, and a detailed working schedule. The Work Plan and components thereof should be prepared consistent with State and Federal guidance, policies, and standard operating procedures. Upfront communication and coordination between the Implementing Party and the KDHE program responsible for providing oversight will ensure that

the Investigation Work Plan objectives are efficiently and effectively met. An example NPR Investigation Work Plan outline is attached in the Appendices.

## **6. NPR Investigation Implementation**

Once the NPR Investigation Work Plan has been approved by KDHE, the next step is implementation in accordance with the KDHE-approved Work Plan. The Implementing Party must notify the KDHE Project Manager of field work by completing a “Field Activities Notification Form,” a minimum of seven (7) days prior to initiation of work. The online form is available at [http://www.kdheks.gov/remedial/fieldactivities\\_notification.html](http://www.kdheks.gov/remedial/fieldactivities_notification.html).

KDHE provides oversight throughout the investigative process. KDHE representatives may be present onsite for a portion or all of the field activities, depending on the site-specific circumstances and/or objectives. Oversight during the implementation step may include but not be limited to field oversight, collection of split samples, site reconnaissance (including the collection of photographic documentation), quality assurance/quality control audits, and/or field screening. Staff conducting field investigation activities, including contractors, should be familiar with the NPR Investigation Work Plan and have access to a copy for reference during the investigation activities.

### **Documentation**

Supporting documentation is critical to substantiate the data collected during the NPR Investigation. All activities should be documented in a field notebook, with photographic documentation as appropriate. Detailed field notes are required to document significant findings and deviations from the approved work plan and must be provided in the NPR Report. All substantive field deviations should be approved by the KDHE Project Manager prior to implementation.

Sampling locations should be documented so that they can be accurately relocated in the field, if necessary. Therefore, all sample locations should be documented using a global positioning system (GPS) instrument and/or survey with appropriate accuracy. In addition, it may be beneficial to collect photographic documentation with respect to an identifiable feature as well as detailed measurements from a stationary point using a measuring wheel so sampling points can be relocated, if necessary.

## **7. NPR Investigation Report**

Once all phases of the NPR investigation field work are complete, a NPR Investigation Report is generated in accordance with program specific and industry standards. The report should contain a detailed description of the activities performed and an evaluation of the data and

subsequent magnitude of environmental impacts with respect to applicable KDHE Tier 2 or Tier 3 (if applicable) RSKs. The report should present the data in a clear and concise format with appendices containing relevant supporting documentation such as field notes, boring logs, laboratory analytical data reports, QA/QC data validation summary, etc. Finally, the report will assess the need for additional investigation and/or remedial action, and will summarize potential implications relative to reported conditions and prospective receptors. An example NPR Investigation Report outline is attached in the Appendices.



## 8. Presumptive Remedy for Soil

After the NPR Investigation has been completed and approved, a Presumptive Remedy is proposed to address the contamination identified. Soil remediation at nitrogen impacted sites generally includes excavation, land farming of impacted soils at properties with vegetation suitable for uptake of nitrogen at appropriate levels, or potential disposal at appropriate landfill sites if concentrations of nitrogen in soils is not suitable for beneficial reuse. A plan for land application for beneficial reuse of contaminated soil as part of the remediation process may be submitted to the project manager. Further discussion of the land application process is presented on the forms in the Appendices. Forms are also accessible at: [http://www.kdheks.gov/remedial/scu/nitrate\\_contaminated\\_sites.html](http://www.kdheks.gov/remedial/scu/nitrate_contaminated_sites.html).

The costs and benefits of potential remedial actions should be evaluated to determine the volume of material to be removed. A table of cost for excavation should be generated for comparison of costs of removing, hauling, and land applying all soil that can be reasonably excavated from the 0 to 5 foot (or other selected interval) depth that has nitrogen above the cleanup level. The information can be used to determine the most cost-effective excavation plan for each site. It is not always practical to restore every site to KDHE's site closure cleanup levels or background concentrations. The Implementing Party should discuss with KDHE the expected nitrogen concentrations that can remain due to various circumstances. If significant volumes of nitrogen remain in the soil because of infrastructure, additional remedial actions and/or institutional controls may be needed for the site.

## 9. Presumptive Remedies for Groundwater

The final goals for sites with known impacts to drinking water aquifers are to prevent unacceptable impacts to human health or the environment and restore the drinking water aquifer to allow for future use. Although there are many potential options to address nitrogen contamination in groundwater, KDHE has identified several presumptive remedies that may be appropriate depending on site-specific conditions. Beneficial reuse of pumped impacted groundwater typically includes use as make-up water in an operational facility or irrigation of grasses or crops on nearby agricultural land. Implementing parties are encouraged to coordinate with KDHE throughout the remedy selection process to help ensure that the selected presumptive remedy is appropriate for a particular site. Common presumptive remedies for groundwater include installation of an alternate drinking water supply, hydraulic containment with treatment or beneficial reuse, phytoremediation, and in-situ treatment. Whatever the NPR selected for groundwater, long-term monitoring will undoubtedly be a component of the remedy.

### Nitrogen Cleanup Plan

The Nitrogen Cleanup Plan (NCP) presents the design for implementing the NPR. The scope of NCPs can be highly variable depending on the remedial work involved. The NCP scope may consist of focused short-term actions; more complex sites may require the support of an environmental engineer. KDHE recommends scoping meetings prior to development of the NCP to make sure stakeholders are in agreement regarding the anticipated level of effort necessary for the NCP. In general, NCPs consist of the following components:

- Site background
- Summary of previous investigation results
- Description of selected remedy
- Remedial Action Objectives
- Description of proposed future work for soil
- Description of proposed future work for groundwater
- Permitting/other requirements
- Beneficial Reuse/Land Application details
- Design specifications/drawings/schematics
- Performance monitoring plan
- Quality Assurance Project Plan/Health and Safety Plan
- Schedule

### Nitrogen Cleanup Implementation

Once the NCP has been approved by KDHE, the next step is implementation. The Implementing Party shall notify the KDHE Project Manager of field work by completing a "Field Activities

Notification Form” at least seven (7) days prior to start of work. The form is available on KDHE’s website at [http://www.kdheks.gov/remedial/fieldactivities\\_notification.html](http://www.kdheks.gov/remedial/fieldactivities_notification.html). As with the investigation, KDHE may be onsite during NCP implementation.

## **Nitrogen Cleanup Report**

Following implementation of the NCP, the Implementing Party submits a Nitrogen Cleanup Report (NCR) to document the remedial actions performed. The NCR includes the final performance monitoring to demonstrate the effectiveness of the work performed. NCR’s typically include the following components:

- Complete description of all cleanup activities
- Evaluation of the performance of the cleanup activities and need for additional response
- As-built drawings (where appropriate)
- Start-up testing results
- Long-Term Monitoring Plan
- Operations and Maintenance Plan

## **10. Decision Documents**

The decision document phase provides the public with the opportunity to review and comment on the action completed to date and any future actions that may be necessary, including but not limited to operations and maintenance, long-term monitoring, contingency implementation, or EUCs.

### **For Sites in KDHE’s State Cooperative Program**

Following the investigation and soil presumptive remedy phases, KDHE prepares the Draft Agency Decision Statement (ADS) for public comment. The Draft ADS summarizes investigation findings, the outcome of the soil presumptive remedy and identifies the proposed future actions to address residual contamination at a site (e.g., groundwater) or recommends site closure. KDHE bases the proposed future actions on the performance of the NPR completed and remaining risks posed by the site. The Draft ADS is released for a 15-day public comment period, during which KDHE may host a public meeting, as appropriate. At the end of the comment period, KDHE prepares the Final ADS, which includes a written response to the comments received during the public comment period.

### **For Sites in KDHE’s Voluntary Cleanup and Property Redevelopment Program**

All affected media can be addressed under this policy in the VCPRP. In the event the implementing party does not wish to continue the NPR process, the expectation of the VCPRP is that the Implementing Party will develop a Voluntary Cleanup Proposal and Voluntary Cleanup Plan (VCP). KDHE will solicit public comment prior to providing approval of the VCP.

## 11. Exit Strategies

The final objective for any remedial site is for KDHE-BER to determine that no additional work by the Implementing Party is necessary to ensure the protection of human health and the environment. This can be attained through cleanup to residential screening levels (clean closure) or cleanup to non-residential screening levels (typically with EUCs). In the State Cooperative Program (SCP), sites that meet these goals can be resolved or resolved with restrictions. In the VCPRP, sites that meet specific goals can be granted a No Further Action determination by KDHE.

In some cases, monitoring and/or other response actions may be necessary in the long term. This work is typically performed within the SCP or VCPRP program, but in some circumstances may be performed by the EUC program.

EUCs may be a necessary component of the overall remedial strategy for a site in the event residual impacts persist. Restrictions are placed on a property when residual contamination is left in place that allows for potential exposure pathways or risk to human health or the environment. The need for EUCs will be determined on a site-by-site basis based on current and future risks. EUCs will generally be required when contaminated groundwater remains on the property after feasible cleanup options are exhausted and/or nitrogen impacted soils remain underneath structures after implementation of NPR activities. Additionally, EUCs may not be required when targeted cleanup levels have been met as approved by KDHE or if groundwater has been demonstrated to be non-potable and does not have the potential to impact potable aquifers or other receptors.

Additional information detailing EUCs, long-term care agreements, and financial assurance, can be found on KDHE's website: <http://www.kdheks.gov/remedial/euc/index.html>.

## **APPENDICES**

## Background Evaluation for Nitrogen Sites

Nitrogen contamination can originate from an array of potential sources. Subsequently establishing and/or evaluating site specific background concentrations for nitrogen in soil and groundwater at or near a Site should be accomplished during the NPR investigation. Various activities and/or settings can create or contribute to accumulation of nitrogen concentrations in soil and/or groundwater. The following are various factors and or activities that may have a bearing on nitrogen levels in soil or groundwater for a particular area:

- Agricultural activities – crop fertilizers application consisting of nitrate or ammonia; turf management operations, gardening.
- Human wastes - septic tanks or municipal waste water treatment facilities.
- Animal wastes – manure, feed lots, dairies, confined feeding operations.
- Explosives – ammunition manufacturing with ammonium nitrate.
- Natural causes- geologic and/or content of organic matter.
- Precipitation in conjunction to the above-mentioned.

For groundwater samples, background samples should be collected hydraulically up gradient from the Facility or property being investigated to establish and/or distinguish between site-related nitrogen and any other potential contributing sources. Selection of location suitable for background soil sampling needs to consider the soil type(s) and the depth intervals, both of which should be consistent with that being evaluated at the Site. The quantity of samples to be collected should be evaluated on a Site-specific basis, but needs to provide a representative depiction of overall Site wide conditions.

Background groundwater sampling locations should generally be located hydraulically up gradient from the Site; however, locations far enough down gradient as to not be affected by Site conditions or contaminants may be suitable as well. Evaluation of the land use surrounding

the Site is important to determine if farming (irrigated or dry land), septic tanks, animal feed lots, lagoons, or cities with wastewater infrastructure and/or treatment plants are in the area. It may be appropriate to utilize existing information or obtain readily available information to establish background concentrations in groundwater. Domestic, irrigation, and industrial wells in the area surrounding the Site may be able to be utilized to evaluate the groundwater quality relative to the Site. If existing wells are to be used, construction information becomes important to demonstrate geologic and hydrogeologic connection as it relates to the groundwater bearing zones at the Site.

This appendix is intended to supplement existing KDHE guidance documents that are pertinent to establishing background concentrations; particularly, KDHE-BER Policy (BER-RS-038, revised) *Determining Background Levels for Chemicals of Concern*, available at [http://www.kdheks.gov/ber/policies/BER\\_RS\\_038.pdf](http://www.kdheks.gov/ber/policies/BER_RS_038.pdf) and *Section 3.1-Tier 1- Comparison to Background* of the Risk-Based Standards for Kansas RSK Manual-5th Version available at [http://www.kdheks.gov/remedial/download/RSK\\_Manual\\_14.pdf](http://www.kdheks.gov/remedial/download/RSK_Manual_14.pdf).

**KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT  
BUREAU OF ENVIRONMENTAL REMEDIATION**

**LAND APPLICATION WORK PLAN FOR SOIL OR WATER FROM  
AGRICULTURAL CHEMICAL INCIDENTS OR SITES**

*REFER TO THE GENERAL INSTRUCTIONS PRIOR TO COMPLETING THIS WORK PLAN*

**1. FACILITY OR INCIDENT INFORMATION:**

Facility or Incident Name:	KDHE Identifier or Agreement Number:
Street Address or Location:	Mailing Address (if different from street address):
City/Zip:	Contact Person:
Title of Contact Person:	Telephone: (    )

**2. PROPOSED LAND APPLICATION SITE:**

Property owner/contact person:	
Legal description of property:    Section _____    Township _____    Range _____	
Directions to land application site:	
Mailing address:	City / Zip:
County:	Telephone Number: (    )
<input type="checkbox"/> <b>Map, or aerial photograph must be provided with specific identification of proposed land application site</b>	

### 3. PROPOSED DESCRIPTION OF WORK

Media to be land applied: <input type="checkbox"/> Soil <input type="checkbox"/> Water	Contaminants of Concern: <input type="checkbox"/> Fertilizers <input type="checkbox"/> Pesticides <input type="checkbox"/> Herbicides
Proposed land application start date: ___/___/___	Proposed land application completion date: ___/___/___
Total Cubic Yards of Soil to be Land Applied: _____ Yd <sup>3</sup>	Total Gallons of Water to be Land Applied: _____ Gals
Maximum concentration of contaminant to be Land Applied: _____	Crop/Use of proposed land application site: _____
Application rate: _____	Acres for land application: _____
Application rates and necessary acreage determined by: <input type="checkbox"/> Certified Professional Agronomist*** <input type="checkbox"/> Certified Crop Advisor*** <input type="checkbox"/> Kansas State Extension Office <input type="checkbox"/> <b>NRCS Office</b>	

#### DISCLAIMERS

\*Development of this land application work plan must account for all Applicable or Relevant and Appropriate Requirements (ARARs). These ARARs include, but are not limited to, proper permitting through KDHE Bureau of Water (BOW), compliance with restrictions mandated by state and federal pesticide laws as regulated by Kansas Department of Agriculture (KDA) Pesticide and Fertilizer Program, and proper permitting by KDHE Division of Water Resources (DWR) for extraction of groundwater.

\*\*A BOW discharge permit is not required for Bureau of Environmental Remediation (BER) land applications, provided the land application work plan is consistent with BOW regulations. These regulations include: no earthen groundwater containment ponds, no application during runoff conditions (e.g. frozen/saturated ground, snow, etc.), no exceedance of application rate as determined by the certified agronomist/crop advisor, and a minimum of annual reporting to BER.

\*\*\*“certified crop adviser” or “certified professional agronomist” must be certified through either the American Society of Agronomy or through the Kansas Certified Crop adviser program. If you would like to be more information regarding the certification program for certified crop advisers or certified agronomists that will sign off on the land application forms, consult the links explaining these certification programs:

- a) <https://www.certifiedcropadviser.org/about-program>
- b) <http://www.ksagretailers.org/mx/hm.asp?id=CCAProgram>

# **GENERAL INSTRUCTIONS**

## **FOR COMPLETING THE KDHE LAND APPLICATION WORK PLAN**

These instructions will assist the preparer to complete the KDHE Land Application Work Plan for land application of contaminated soil and/or water. The Work Plan is to be typed, or legibly printed in ink.

### **1. FACILITY OR INCIDENT INFORMATION:**

In section one, provide the name of the facility, or business from which the soil or water is to be removed and land applied. If the contaminated material is not located at a facility, for example the spill occurred in the field, the KDHE spill report number for the incident is to be provided. Provide the street address or location of the facility or incident, the mailing address of the owner of the property, the name of the contact person who will be responsible for communication with KDHE and that contact person's title within the company controlling the facility, and the telephone number where the contact person can be reached.

Provide the KDHE identified sites list number, spill incident number, the Consent Order (CO) number, or the Voluntary Cleanup and Property Redevelopment Program (VCPRP) Agreement number for the site.

### **2. PROPOSED LAND APPLICATION SITE:**

Provide the name, mailing address, county, and telephone number of the owner, or contact person for the property (if different from owner), on whose property the contaminated soil or water will be land applied. Give the legal description to the nearest 1/64<sup>th</sup> of the section of the location where the material will be land applied, (i.e. NW<sup>1</sup>/<sub>4</sub>, NW<sup>1</sup>/<sub>4</sub>, NW<sup>1</sup>/<sub>4</sub> of Section 12, Township 4, Range 18W). Provide printed or typed directions to the land application location from the nearest town, including miles and significant landmarks, along with a detailed map of the proposed land application location.

### **3. PROPOSED DESCRIPTION OF WORK:**

Indicate the type of material (soil, water) and contaminants of concern to be land applied by checking the appropriate boxes. Indicate the proposed start and completion dates of the land application. Note that land application of soil will not be permitted during periods when the land application site is frozen and the applied material cannot be incorporated.

Indicate the total proposed quantity of material to be land applied (if soil, cubic yards; if groundwater, gallons), along with the maximum concentration of the contaminant detected and the crop or land use of the proposed land application site.

An application rate for the contaminated material must be determined by a certified agronomist or crop advisor. In addition, the Kansas State Extension Agronomy or NRCS offices may also determine application rates; however, the determined rates must be signed off on by a certified agronomist/crop advisor.

# **GENERAL INSTRUCTIONS**

## **FOR COMPLETING THE LAND APPLICATION AGREEMENT FORM**

These instructions will assist in completing the KDHE Land Application Agreement Form for land application of contaminated soil and/or water. The Agreement Form is to be legibly printed in ink, or typed.

- 1.** Provide the name of the site, or incident location, from which the contaminated material is being removed for land application. Use the same name as that in Section 1 of the Land Application Work Plan.
- 2.** Provide the name of the responsible/voluntary party; that person is to sign and date the agreement form.
- 3.** Provide the name of the applicator that will perform the land spreading; that person is to sign and date the agreement form. If the applicator is a commercial applicator, include the name of the company and Pesticide Applicator License Number.
- 4.** Provide the name of the owner of the property on which the land application will occur; that person is to sign and date the agreement form. If the property is commercially owned, provide the name of the institution; the manager or operator of the property is to sign and date the agreement form.
- 5.** Provide the name of the certified agronomist/crop advisor that developed the work plan (including contaminant application rate) for the contaminated material; that person is to sign and date the agreement form.

**LAND APPLICATION AGREEMENT FORM**

By signing this Agreement form, both parties agree to the terms and conditions for the land application of soil or water containing nitrogen and other contaminants identified on the Land Application Work Plan, if applicable, removed from \_\_\_\_\_ site in accordance with the applicable and correct rates, crops/beneficial use, application timing, and acres as developed by the certified agronomist/crop advisor below. The responsible/voluntary party agrees to report to KDHE within 30 days of the completion of land application.

Both parties understand that the KDHE may monitor compliance with the terms of this work plan by conducting on-site inspections, sampling, or other oversight activities. KDHE reserves the right to modify or rescind this proposal for just and reasonable cause upon written notification to the parties.

\_\_\_\_\_  
Name of Responsible/Voluntary Party (Please type or print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Applicator (Please type or print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\*KS Pesticide Applicator Business License Number \_\_\_\_\_

\*If landowner is applying the material to his own land, a KS Pesticide Applicator Business License is not required\*

As Landowner of the property that is to receive the land application, I, \_\_\_\_\_, agree to provide access to my property for the purposes of land application at rates determined by the certified agronomist/crop advisor below. I also agree to comply with all applicable restrictions stated on the label of the products determined to be present in the contaminated material being land applied, and to follow reasonable agronomic practices that take into account contributions from this application in my future pesticide, nutrient, and fertility program.

I understand and agree that the KDHE may monitor compliance with the terms of this work plan by conducting on-site inspections, sampling, or other oversight activities. KDHE reserves the right to modify or rescind this proposal for just and reasonable cause upon written notification to the parties.

\_\_\_\_\_  
Name of Land Owner (Please print or type)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

As a certified agronomist/crop advisor, I, \_\_\_\_\_, verify this work plan was developed in accordance with the applicable and correct rates, crops/beneficial use, application timing, and acres for land application of soil or water containing fertilizers, pesticides, or herbicides removed from \_\_\_\_\_ site. I further verify that I am aware of and have taken into account all contaminants of concern associated with the material to be land applied when determining application rates.

\_\_\_\_\_  
Name of Certified Agronomist/Crop Advisor (Please print or type)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## NPR Investigation Work Plan Outline

- **Introduction**

- Discussion of current and historical facility operations, identifying areas of potential contamination sources
- Summary of any previous investigation results
- Geologic, hydrogeologic, and topographic information for the site and/or region
- Maps identifying site location and facility structures, as well as any known receptors

- **Field Sampling Plan**

- Discussion of media to be sampled
- Water well survey procedures if groundwater is known to be impacted
- Detailed description of procedures for collecting, handling, transporting, and analyzing samples from each media
  - Proposed Sample Table
    - number of samples for each media (including duplicates),
    - analytical methods to be used,
    - hold times associated with each method
    - sample containers to be used for each type of sample
  - Maps of proposed sample locations
  - Copies of any Standard Operating Procedures (SOPs) to be utilized

- **Quality Assurance Project Plan**

- Quality Assurance Objectives
- Sample custody procedures
- Any applicable field screening procedures
- Laboratory QA/QC procedures
- Data Validation and Reporting

- **Health and Safety Plan**

- **Estimated Schedule**

## **NPR Investigation Report Outline**

- **Introduction**

- Discussion of current and historical facility operations, identifying areas of potential contamination sources
- Summary of any previous investigation results
- Geologic, hydrogeologic, and topographic information for the site and/or region
- Maps identifying site location and facility structures, as well as any known receptors

- **Summary of Investigation Results**

- Description of samples taken and analytical results
- Vertical and horizontal extent of contamination
- Maps of sample locations, analytical results, showing extent of contamination and identifying any potential receptors
- Groundwater elevation contour map indicating groundwater flow direction
- Tables showing groundwater elevation measurements, sample results, sample collection depths, etc.
- Description of any deviations from the NPR Work Plan
- Copies of analytical reports
- Data validation reports
- WWC-5 forms and lithological logs from any monitoring wells installed

- **Conclusions/Recommendations**

- **Updated Schedule**