DIVISION OF ENVIRONMENT
QUALITY MANAGEMENT PLAN

PART III:

BUREAU OF WASTE MANAGEMENT
QUALITY ASSURANCE MANAGEMENT PLAN

Revision 5

February 26, 2020

Kansas Department of Health and Environment
Division of Environment
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Revision History	(Original Version was effective 7/1/1995)	
Date	Revision	Change
3/14/2003	1	Major changes to organization and language in entire document
1/24/2005	2	Minor changes to Section 1
10/6/2005	3	Minor changes to Section 1 and 4
1/25/2011	4	Minor changes to Section 1, 5, 6, and 7
2/26/2020	5	Major changes to entire document

1.0 Introduction

Department Programs

There are three primary data acquisition activities performed by the BWM: solid and hazardous waste tracking for permitted solid waste facilities, hazardous waste generators, and permitted hazardous waste treatment, storage, and disposal facilities; solid and hazardous waste facility inspections; and post closure car and corrective action performance monitoring.

Many of these facilities are required to routinely submit waste generation and disposal information in the forms of reports and notifications to the bureau. While not all data obtained by the bureau is directly collected from environmental media, all data is managed in accordance with the quality assurance and quality control measures presented in section 4.3 of the BWM Quality Assurance Management Plan (QMP) Part II and in Section 6.0 of this document.

Facility Reported Data

Solid waste landfills and hazardous waste generators and treatment, storage, and disposal facilities must report quantities of waste generated, disposed, or otherwise managed by a facility. This information is collected and recorded by BWM staff to verify facility compliance with regulation. This information is reviewed by field staff when preparing for a facility inspection to verify the solid and hazardous waste records accurately reflect the types and quantities of wastes being reported in manifest and tonnage reports.

Inspection Collected Data

Closed solid and hazardous waste facilities undergoing post-closure or corrective action are required to report post closure conditions of waste burial sites or effectiveness of remedial actions to address releases at facilities where solid and hazardous wastes have been managed. Qualitative and quantitative monitoring data are routinely collected by facilities or their consultants to confirm that the obligations established in operating or post-closure plans developed to meet the requirements of BWM issued permits or orders are being fulfilled.

Quality Assurance Policy Statement

Inspections are conducted by the bureau at operating and closed solid and hazardous waste facilities to verify and confirm the accuracy of the waste activities being reported. All sampling activities conducted by BWM personnel will comply with the following goals:

- Environmental data collection activities will be accomplished and documented in accordance with Divisional QMPs and all applicable standard operating procedures (SOPs).

- BWM project managers tasked with reviewing and approving project specific quality assurance project plans and sampling and analysis plans will ensure these plans are compliant with KDHE's QMPs and that all environmental data collection activities adhere to the approved plans.

Section 2. Quality Assurance Objectives

Quality Assurance objectives within KDHE's solid and hazardous waste management programs are intended to ensure all monitoring and analytical data acquired or reviewed by Bureau of Waste Management (BWM) staff are scientifically valid, defensible, and of known and acceptable precision and accuracy. These quality assurance objectives are achieved by evaluating data against the quality indicators of *representativeness*, *completeness*, *comparability*, *precision*, *accuracy* (bias), and *sensitivity* (quantitation limits). The remainder of this document describes the criteria and procedures developed to meet these Data Quality objectives.

One of the fundamental data acquisition activities performed by BWM is direct environmental sample collection. Standard operating procedures (SOPs) that describe the procedures to conduct inspections and collect environmental samples are presented in Appendix A. These SOPs were developed to provide guidance to staff performing environmental sampling and associated activities, therefore this quality assurance management plan focuses on environmental sampling. Health and safety considerations are covered in a separate plan as outlined by the Division of Environment's Health and Safety Policy.

For all activities requiring environmental sample collection, site-specific sampling plans that outline data quality objectives and sample collection locations are established for each sampling activity prior to initiating the sample collection activities. The plans are developed or reviewed by program staff to ensure the plans utilize approved procedures defined in the Division of Environment Quality Management Plans and SOPs developed by the BWM and Bureau of Environmental Remediation (BER).

Additionally, SOPs from the Bureau of Environmental Remediation (BER) are utilized by BWM staff when sampling groundwater, surface water, soils, or sediments. BER SOPs are also utilized for decontamination of sampling equipment, collection of quality control measures for water-quality data samples, and evaluation and validation of data. Data quality objectives for other environmental data collection activities shall be developed for sit-specific sampling plans in accordance with the applicable BER SOPs available on the KDHE QMP webpage.

3.0 Sampling Site Selection Criteria

The selection of field sampling locations is based on several factors including type and purpose of sample, *representativeness*, *completeness*, accessibility, and safety.

When possible, site reconnaissance using maps and aerial photographs of the general area shall be conducted prior to arrival. Field staff will familiarize themselves with general terrain, major waterways, road networks, unique topographical features, and other manmade objects or natural features in order to select appropriate sample locations. Other factors which may influence site selection include: relationship to known or suspected sources of pollution, availability of media to sample, and potential safety hazards.

Selection criteria will primarily depend upon the type of medium being sampled. The medium could include: groundwater, surface water, wastewater, other liquids, soil, sludge, other solids, or other waste materials. The location and number of samples collected shall be sufficiently *representative* and *complete* to meet the data quality objectives of a project. Field staff shall follow approved sampling and analysis plans and workplans when confirming the locations for sample collection. Sample locations shall be selected using the protocols in the applicable standard operating procedures in Appendix A of this document and BER SOPs located on the KDHE QMP webpage.

Samples of unknown materials can present the highest danger to field staff. Special care must be taken to avoid or control conditions that may become dangerous to human health and the environment. Safety concerns at industrial sampling sites include strong acids and bases, toxic materials, toxic atmospheres, slippery floors, electrical hazards, heavy equipment, and confined spaces, and other hazards are common at industrial sites. It is important that the sampler have the necessary safety equipment and safety training. The 40-hour Health and Safety Training Course and annual 8-hour refresher course, is mandatory for those personnel collecting samples at industrial sites. Staff are not trained for and will not perform or participate in any confined space entry.

4.0 Sampling Procedures and Sample Custody

Environmental sample collection activities vary depending on the program responsibilities. Staff performing hazardous waste generator facility inspections or hazardous waste treatment, storage, and disposal facility inspections may need to verify the *accuracy* of the information provided by the facility regarding a generated waste or contaminated media associated with waste management activities. Inspectors may need to collect environmental samples to confirm that waste determinations are accurate or that treatment standards are being met for a waste or contaminated media. Hazardous waste treatment, storage and disposal facilities may also be required to perform monitoring or remedial action to address contaminated environmental media including, soil, surface water, groundwater that resulted from waste management activities.

Similarly, staff performing solid waste facility inspections, may need to collect leachate, groundwater, soil, or air samples to confirm compliance with the solid waste regulations or specific requirements of a permit or order.

Many facilities hire third-party consultants to perform routine environmental sampling activities. These consultants develop sampling and analysis plans to meet the requirements of a project. BWM staff review and approve project-specific SAPs and QAPPs submitted by these third-party consultants, considering all applicable federal and state regulations, policies, guidance, and SOPs. Therefore, all samples shall be collected in accordance with the approved sampling and analysis plans developed for a project.

All waste sample collection activities shall be conducted according to the procedures given in SOP BWM-005, located in Appendix A of this document. Staff collecting samples from contaminated media shall follow the procedures presented in Appendix A – Standard Operating procedures of the BER QMP III. The sample collector shall log the date, time, name, and location of the sample collection according to the prescribed chain-of-custody procedures found in SOP BWM-006 unless project specific procedures stipulate otherwise.

Sample collection techniques must be consistently applied to every sample location to ensure there is *comparability* among samples being collected. To evaluate consistent field sampling technique, 1 duplicate sample is typically collected for every 20 samples collected, unless otherwise specified in KDHE or EPA approved sampling and analysis plan. The collection of field duplicates serves as a quality control measure of performance for overall *precision*.

The possibility of sample contamination during sample preparation, storage, and analysis is assessed through the use of quality control samples, sometimes identified as blanks. These blanks are subjected to the same treatment as the rest of the samples collected during an inspection or investigation project. The type of blanks used, or the decision to use blanks will be made on a project specific basis by the program/project manager. Field blanks are collected to identify issues with *accuracy* and *bias* associated with consistent sample collection technique by field personnel. Significant data quality issues related to field staff performance will be addressed immediately.

5.0 Analytical Procedures

Analytical procedures used in the waste management program vary greatly due to the complexity and number of possible wastes and environmental media to be analyzed. Samples shall be analyzed using ASTM, EPA/SW-846, or alternate laboratory methods approved by EPA and the State of Kansas. All analytical procedures shall be performed by the KDHE laboratory or a laboratory certified by KDHE for those methods of chemical analyses. The analyst shall record the dates the samples were submitted for analyses, the date the analyses were performed, who performed the analyses, analytical methods and techniques used, method detection limits, dilution factors, and the results of such analyses for the environmental samples and laboratory QA/QC samples.

Overall *sensitivity* of the measurement by laboratories is evaluated with laboratory matrix spike and duplicate spike (MS/DS) samples. At the discretion of the Bureau QA Representative, the bureau director, or the division director, blind reference samples spiked with known concentrations of one or more parameters may be submitted to the laboratory and used as a general indicator of the overall *accuracy* of the data reported by the laboratory. Spiked samples preparation will follow accepted EPA/SW-846 methods or alternate laboratory techniques approved by EPA and the State of Kansas.

Detection limits necessary for success of the project as well as the sample container, preservation, handling, and holding times, are unique for the analysis requested and must be agreed upon in advance with the analyzing laboratory according to their standard operating procedures.

6.0 Data Management

The three sections in BWM collect various forms of environmental sample data to monitor facilities to ensure that waste management activities are in compliance with state and federal regulations, policy, and guidance. Monitoring data includes both environmental sample data that is submitted to the Bureau regularly by facilities and consultants, as well as, environmental data from samples collected by BWM field staff that is received from the KHEL laboratory.

Completed sample analysis reports from the laboratory are delivered by mail or email to the appropriate program staff, as defined on the sample submission form. BWM staff review and store the data according to their program's records management procedures.

Copies of sample analysis reports shall be sent to the Bureau QA Representative when issues with analytical reports arise. The data shall be checked by the Bureau QA Representative for conspicuous oversights or dubious results.

Should problems be noted in the data reports, the program staff, program/project manager, or Bureau QA Representative shall verify the data with the laboratory. The data will not be accepted or used if it is confirmed to contain erroneous results. Each analytical report is electronically filed at the KHEL or Kansas certified laboratory; and paper and electronic copies received by bureau staff are maintained in the appropriate BWM file in accordance with the BWM record retention policy.

7.0 Quality Assurance Program Assessment

7.1 In-house Audits

The Bureau QA Representative, in conjunction with the section chiefs and program/project managers, conducts annual audits of sample, collection, analysis, and data recording procedures. Each audit is comprised of a system audit that consists of a qualitative review of QA systems. Each section chief is responsible for submitting to the Bureau QA Representative an annual QA report for each of their programs/projects that is subject to this QMP (see Part I, Section 4.7 of the QMP).

7.2 Quality Control Samples

Should sample quality control problems be identified, the Bureau QA Representative will perform an unscheduled system audit. If necessary, the Bureau QA Representative will work with the laboratory to identify any contributing sources of contamination. The scope and magnitude of any sample contamination problem, as well as all measures implemented to resolve the problem, will be documented by the Bureau QA Representative in annual QA reports to the division director (see Part I, Section 4.7 of the QMP).

7.3 Procedures for Addressing Staff Performance Problems

Should a member of the project staff have difficulty with a given work procedure (e.g., as determined during an internal performance audit) an effort is made by the Bureau QA Representative to identify the scope and seriousness of the problem, identify any data affected by the problem, and recommend an appropriate course of corrective action. All affected data are either deleted from the file or flagged within the file, at the discretion of the Bureau QA Representative. Possible corrective actions include further in-house or external training for the employee, a reassignment of work duties, or modification of the work procedure.

8.0 Quality Assurance Reporting Procedures

The Bureau QA Representative is responsible for informing the bureau director and division director of the QA/QC status and needs of the solid and hazardous waste management programs. The Bureau QA Representative is also responsible for maintaining adequate communication with KDHE Division of Health and Environmental Laboratories (KHEL) with regard to program QA/QC concerns.

In addition to these routine communication requirements, the Bureau QA Representative prepares an annual program QA/QC status report that is routed through the bureau director to the divisional QA officer. Each section chief shall prepare a summary report for the QA/QC activities of each of their programs and submit this information to the Bureau QA Representative to be incorporated in the annual program QA/QC status report. The program QA/QC status reports will contain the following types of information:

- Description of program QA/QC activities relative to bureau QA objectives;
- Discussion of significant QA/QC problems, corrective actions, progress, needs, plans, and recommendations;
- Results of internal and any external system or performance audits;
- Summary of QA/QC-related training performed since the last QA/QC status report; and
- Any other pertinent information specifically requested by the bureau director or the divisional QA officer.

APPENDIX A

BUREAU OF WASTE MANAGEMENT

STANDARD OPERATING PROCEDURES

KANSAS SOLID AND HAZARDOUS WASTE MANAGEMENT PROGRAMS

Revision 5
February 26, 2020

BUREAU OF WASTE MANAGEMENT
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Date	Revision	Change
4/28/2003	1	All SOPs Revised; SOPs BWM-008 and BWM-009 added
1/24/2005	2	SOPs BWM-001, BWM-003, and BWM-004 rescinded
10/6/2005	3	SOP BWM-005 and BWM-006 updated
1/25/2011	4	SOP BWM-010 and BWM-011 added; SOP BWM-008 revised
2/26/2020	5	All SOPs revised; SOP BWM-007 and BWM-009 rescinded; Removed BER SOPs

STANDARD OPERATING PROCEDURE BWM-002

GUIDELINES FOR CONDUCTING RCRA INSPECTIONS

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SOP No. BWM-002

GUIDELINES FOR CONDUCTING RCRA INSPECTIONS

1.0 PRE-INSPECTION PROCEDURES

Prior to conducting a RCRA inspection, the inspector should take time to review the facility file and appropriate databases regarding the facility maintained by the Bureau of Waste Management (BWM). This is necessary to become familiar with the type and quantity of waste generated, locations of waste management activities, disposal methods for regulated waste, compliance status, and contact person at the facility. In most cases, the inspection will be conducted on an "unannounced basis" (not pre-scheduled with the facility). The exception to this rule would be when the inspection will be facilitated by the presence of the contact person, the inspector may inform the contact person of the date and time of the upcoming inspection. In these cases, only a 24 to 48-hour prior notice will be given.

The inspector should have the following items when conducting RCRA inspections:

- The inspector’s State of Kansas employee identification card;
- A supply of business cards;
- A fully charged tablet computer installed with digital inspection forms and power cord.
- Back-up paper copies of all inspection forms, including appropriate checklists;
- A clipboard and writing instruments for taking additional notes or when it is necessary to conduct the inspection using back-up paper copies of the inspection forms;
- Sampling containers and sampling equipment (including laboratory forms);
- Appropriate health and safety equipment (i.e. protective eye wear, hearing protection, steel-toed boots, hard hat etc.);
- A digital camera for documenting findings. The tablet computer can be used as a backup. (Be sure to have extra batteries and memory cards for the digital camera);
- Copies of both the Kansas and EPA Statutes and Regulations regarding hazardous/solid waste;
- Copies of handouts to be given to facilities;
- Binoculars;
- Flashlight (preferably intrinsically safe).

2.0 INSPECTION PROCEDURES

Upon entering the facility, the inspector should identify themselves as a Kansas Department of Health and Environment Staff Member, and request to see the contact person (if one has been previously identified). If no contact person is known, or if the contact person listed in the file is not available, the inspector should request to speak to someone in management. The inspector should present the contact person or other facility representative with a business card, and if requested, show their State of Kansas employee identification card, or credentials.

If the inspector is refused entry to the facility, or to any facility records or processes that must be seen to complete the inspection, they should first attempt to arrange for the facility representative to contact the Compliance and Enforcement Unit Chief of BWM by telephone. If the facility representative refuses to contact the BWM Unit Chief, grant entry to the facility or process areas, or provide or allow access to facility files, the inspector should leave the facility immediately and contact the BWM Compliance and Enforcement Unit Chief by telephone for instructions.

The entry phase of the inspection should take place in an office or conference away from the noise and distraction of any manufacturing areas of the facility. The inspector should explain the scope of the inspection, including whether it is routine, a follow-up, the result of a complaint, or for a special purpose. Examples of the type of information that should be obtained in this entry interview are: the kind of facility; number of employees; processes and products manufactured; types and quantity of wastes generated; and where wastes are disposed or recycled. At this time, the inspector should also inform the facility representative of their right to declare information confidential, so long as they have justification for such a request.

The following guidelines should be followed when completing checklists and forms during the inspection:

- All applicable items on the form should be addressed. If information is not available, this should be noted. If a section of the form does not apply, enter a N/A in that section.

- Inspectors should record any relevant information that cannot be adequately documented in the checklists and provide this information in the summary of the inspection report. Examples include commitments made by the facility to forward information, environmental problems that might be of interest to another KDHE program, and diagrams of processes to help explain how specific waste streams are generated. The summary should also include a detailed description of all violations found.

After completing the entry phase of the inspection, the inspector will request to be shown all process areas where hazardous or potentially hazardous waste are generated, stored, treated, or disposed. The inspector will conduct a walk-through of the plant and grounds. There may be disposal areas, either solid or hazardous waste, that are not easily visible on a general walk-through of the process areas. Careful observation of all manufacturing processes may

reveal a potentially hazardous waste, which the facility representative has neglected to review with the inspector. Examples of such wastes include those discharged to the sewer such as metal-treatment rinse waters, or liquids contained in tanks that may only be generated every few years. The inspector should not let the facility representative rush or guide the inspection in any way. The inspector should follow all facility safety guidelines at all times and should not proceed to any area of the facility without a facility representative.

After inspecting the process areas of the facility, the inspector will review the documents required to be maintained on-site (i.e. waste reports, waste determination forms, manifests, land disposal restriction notices, annual reports, biennial reports, service contracts, Safety Data Sheets, training records, etc.). After completing the document review, the inspector should inquire as to whether additional facility personnel need to be present for the exit briefing. The exit briefing will include the review of all hazardous, or potentially hazardous wastes generated; their generation rate, the amount presently in storage, and their disposal methods. A notice of Compliance/Non-Compliance (NOC/NC) will be given to the facility representative during the exit briefing or mailed to the facility within 10 business days. In some cases, it may be impracticable to issue a NOC/NC at the time of the inspection. In these cases, a letter outlining the violations will be issued to the facility within 10 days of the inspection.

If the NOC/NC is provided to the facility representative during the exit briefing, the inspector will discuss all items that were not in compliance with state or federal regulations. The NOC/NC will provide a deadline for the facility to correct all items out of compliance and address any inspector comments or concerns. The inspector is given latitude in setting this deadline, but usually within 30 to 60 days, depending on the circumstances. If the facility is in compliance with all applicable regulations, they will be given a NOC/NC that will indicate that no violations were identified during the inspection. It should also be explained to the facility that reports are reviewed by BWM and that additional violations may be issued.

During the exit briefing, the inspector should also provide references to any applicable guidance documents the facility representative can use to correct deficiencies discovered during the inspection. The inspector will review any commitments the facility representative has made to supply the inspector with documents or test results and answer any questions the facility may have. Due to the extremely complex nature of the hazardous waste program, the inspector should not feel obliged to provide an immediate answer to all questions. A promise to obtain the correct answer to a question and provide this information to the facility representative at a later date fulfills the inspector's responsibility. A copy of the inspection report shall be supplied to the facility upon request.

3.0 SAMPLE COLLECTION

During the inspection, it may be necessary for the inspector to collect samples of a waste stream. Samples may be collected to determine if an unknown waste is hazardous, or to verify the results of analyses previously conducted by the facility. Samples may also be collected for other reasons not discussed in this document.

Procedures for the collection of any waste sample should be in strict accordance with the Standard Operating Procedure (SOP) BWM-005 for Waste Sampling. Environmental media samples collected during a facility inspection shall be in accordance with the applicable procedures listed in Appendix A of the Bureau of Environmental Remediation Standard Operating Procedures.

4.0 POST-INSPECTION PROCEDURES

The completed NOC/NC or letter and inspection checklist/summary will be organized into a report in the following manner:

- CMEL forms (only to be provided to the Compliance and Enforcement Unit Chief)
- NOC/NC or letter given or sent to the facility.
- Inspection checklist(s);
- Inspection summary
- Photographic logs;
- Supporting documentation.

The inspection report should be completed and revised by the district inspector and submitted to the Compliance & Enforcement, Waste Reduction & Assistance Section Chief within 30 days of the inspection date. A copy of these documents should be forwarded to the Compliance and Enforcement Unit Chief. A copy of these documents should also be maintained in the district waste files. Whenever an inspector conducts a RCRA inspection in a district other than their own, a copy of the letter and the entire inspection form should be forwarded to the district office for the district in which the facility is located. The report will be further reviewed by BWM staff before becoming final and available for public review.

STANDARD OPERATING PROCEDURE BWM-005

GUIDELINES FOR WASTE SAMPLING

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SOP No. BWM-005
GUIDELINES FOR WASTE SAMPLING

1.0 INTRODUCTION

In general, samples collected from waste materials or contaminated media must be representative of all the material or media being sampled. Sampling situations vary widely. Therefore, no universal sampling procedure can be assigned for all potential scenarios. Rather, several procedures will be outlined for collecting representative samples from different types of wastes in various states and receptacles.

The following steps should be taken prior to undertaking a sampling event:

- Research available background information about the waste (composition, form, concentration, etc.).
- Determine equipment and procedural needs for safe sampling.
- Consider proper locations for sampling.
- Determine the volume of samples to be taken.
- Review procedures for sample collection.
- Review procedures for containing and handling samples.
- Review chain-of-custody procedures.
- Identify necessary packaging, labeling, and shipping requirements.
- Schedule sample analyses with the laboratory.
- Review your sampling kit to ensure that all necessary equipment is included, as listed in Section III.

In some cases, it may be appropriate to conduct a preliminary survey of the facility prior to sampling. This would consist of a brief site visit and survey during which safety requirements of the site would be ascertained and a sampling plan developed by the program/project manager, or the inspector.

2.0 SAMPLING PLAN

If a sampling plan is developed, it should at a minimum include: purpose for the sampling; proposed procedures for sampling, including the type, depth, and number of samples; proposed locations of the samples (including site drawing if available); type of analyses for each sample (including type of container and amount of sample required for each test); and data review procedures.

3.0 SAMPLING EQUIPMENT

As a general rule, sampling equipment used should be disposable. Dippers, scoops, and similar devices for solids samples should be placed in plastic bags for later disposal or cleanup. Liquid samples from barrels or tanks should be withdrawn in inert tubing such as glass, and the tubing should then, if practical, be broken and abandoned within the barrel or tank. If incineration or

recycling of the barrel contents is contemplated, the tubing should be placed in another suitable receptacle for disposal.

In cases where sampling equipment is reusable, decontamination of the equipment is necessary to avoid cross-contamination. Sampling equipment must be thoroughly cleaned with either soap and water or solvent.

In general, metal sample containers should not be used on hazardous waste site investigations, but if used they must be grounded, preferably to the drum or tank being sampled, while sample transfer is accomplished. All metal containers used should be stainless steel. Ambient air sampling on hazardous waste sites must be accomplished with spark-free equipment if explosive vapors are present (sampling equipment can be a spark source).

The following is a list of sampling equipment. The list is subdivided into six sections: sampling equipment, testing equipment, shipping and packing equipment, documentation equipment, and other equipment. The following sections will discuss the application of the listed equipment.

<u>Sampling Equipment</u>

- Appropriate PPE (gloves, Tyvek, booties, face shield, etc.)
- Sample containers (plastic and glass), caps, liners (check with laboratory)
- Soil samplers (auger, scoop, steel spoon, shovels, etc.) (All stainless steel)
- Non-sparking bung wrench
- Wrench for loosening bolts on open-head drum rings
- Colli-Wasa (liquid drum sampler)
- Pans (plastic and aluminum)
- Box Knife
- Bailer

<u>Field Testing Equipment</u>

- pH paper or pH meter
- water level indicator
- Conductivity meter

<u>Shipping and Packing Equipment</u>

- Vermiculite or equivalent packing material Plastic bags
- Sample labels
- Tape (Clear and Duct)
- Picnic coolers
- Ice packs
- String or flexible wire
- Zipper-type plastic bags (gallon size)

<u>Documentation Equipment</u>

- Water proof felt tip pen
- Chain of custody forms
- Custody seals
- Field notebook
- Digital camera and/or other imaging device

Decontamination Equipment

- Spray bottle with Alconox/water solution
- Spray bottle with water distilled/deionized water
- Alconox or Liquinox (detergent)
- Paper towels

Other Equipment

- Nylon rope
- Plastic covers/ground cloth
- First Aid kit
- Bug spray (do not store with containers or decontamination equipment)
- Sunscreen (do not store with containers or decontamination equipment)
- Hand-wipes

4.0 SAMPLING PROCEDURES

Wastes encountered during an inspection are commonly multi-phase mixtures and can be stored in receptacles of different sizes and shapes. No single series of sampling points can be specified for all types of receptacles.

The following procedures are recommended for sampling wastes in various media and types of receptacles. These procedures will need to be modified to meet the site-specific conditions and objectives. Receptacles (i.e., drums, tanks, etc.) should only be sampled when necessary to meet enforcement or clean-up requirements.

4.1 Sampling a Drum

Opening of drums or other sealed receptacles may be hazardous to sampling personnel unless proper procedures are followed. Gases can be released, or pressurized liquids can be expelled.

A bulging drum usually indicates that it is under high pressure and should not be sampled until the pressure can be safely relieved. A heavily corroded or rusted drum can readily rupture and spill its contents when disturbed and should not be sampled. Opening the bung of a drum can produce a spark that might detonate an explosive gas mixture in the drum.

Drums should not be moved or opened unless it can be determined beyond a reasonable doubt that the drum being moved is structurally sound. Drums standing on end, with bung up, should be opened by bung wrench. Drums on sides may be opened similarly if it is possible to safely rotate the drum so that the bung is high.

The following procedures should be observed:

- Choose a drum whose bung is up. (Drums with the bung on the top should be upright. Drums with bungs on the side should be lying on the side with the bung up.)

- Slowly loosen the bung allowing any gas pressure to release. Remove the bung and collect a sample through the bunghole with a disposable glass tube, which should be broken off

afterwards and left in the drums, if possible.

- Replace the bung in the barrel after collecting a sample.

When there is more than one drum of wastes to be sampled at a site, choose an appropriate method to establish representative sampling points.

4.2 Sampling a Vacuum Truck

Sampling a vacuum truck requires opening a drain plug or collecting a sample from the tank hatch using glass tubing, suction hose, or dipper. In some trucks obtaining a sample requires climbing access rungs to the tank hatch. These situations present accessibility problems to the sample collector. For safety reasons, two persons performing the sampling is preferred, with one person collecting samples and the other person there to hand the sampling device to the sampler, to stand ready with the sample container, and to aid in case of any problems. The sample collector positions themselves to collect samples only after the truck driver has opened the tank hatch. The tank is usually under pressure or vacuum. The driver should open the hatch slowly to release pressure or to break the vacuum.

The following procedures are recommended:

- Let the truck driver open the tank hatch.
- Using protective sampling gear, assume a stable stance on the tank catwalk or access rung to the hatch.
- Collect a sample through the hatch opening with a glass tube, which should be removed and disposed of properly.
- If the tank truck is not horizontal, take one additional sample each from the rear and front clean-out hatches and combine all three samples in the same sample container.
- When necessary, carefully take a sediment sample from the tank through the drain spigot.

4.3 Sampling a Barrel, Fiberdrum, Can, Bags, or Sacks Containing Powder or Granular Waste

Dry powdered or granular wastes tend to generate airborne particles when the containers are disturbed. This may be a safety consideration. The containers must be opened slowly. The barrels, fiberdrums, and cans must be positioned upright. If possible, sample sacks or bags in the position you find them. Standing them upright might rupture the bags or sacks.

The following procedures are to be used:

Collect a sample from the container with the appropriate sampling device. Withdraw samples through the center of the receptacle and, if appropriate, at different points diagonally opposite the point of entry to try to obtain a composite of the entire container.

4.4 Sampling a Pond

Storage or evaporation ponds for hazardous waste vary greatly in size from a few meters in diameter to a hundred meters. Collecting representative samples from large ponds may be considerably expensive and risky if any samples are desired beyond 3.5 meters from the bank. The value of the information sought must be worth the risk and expense involved in collecting the samples. However, in many situations, a pond sampler is sufficient for collecting representative sludge and water samples as far as 3.5 meters from the bank.

After observing all recommended safety procedures, the following procedures are recommended:

Divide the surface area of the pond into an imaginary grid and determine the number and locations of grid sections necessary for obtaining representative samples. If possible, the vertical distribution of hazardous waste constituents within the pond should be evaluated by collecting three samples from each grid section. Samples from each grid section should be collected near the surface, at mid-depth (or at center), and at the bottom of the pond. Collect samples as described above from each grid section selected for sampling. If appropriate, combine samples from equal depths into composite samples.

4.5 Sampling a Waste Pile

A waste pile can range from a small heap to a large aggregate of wastes. The wastes are predominantly solid and can be mixtures of powders, granules, and large chunks.

If possible, take samples from at least three different points of the waste pile:

1) Near the top of the pile,
2) Around the pile near the center height, and
3) Near the base of the pile.

Additional samples may be required depending on the size of the pile and the reasons for sampling.

4.6 Sampling a Storage Tank

Sampling a storage tank usually requires climbing to the top of the tank through a narrow vertical or spiral stairway while wearing protective equipment and carrying sampling paraphernalia. This sampling should be conducted by no less than a two-person team. A representative of the company who should open the sampling hole that is usually located on the tank roof should accompany the sample collector.

If possible, collect one sample each from the upper, middle, and lower sections of the tank. If desired and appropriate, combine the samples in one container and submit it as a composite sample.

4.7 Sampling Contaminated Media

Groundwater, surface water, soils and sediments can all become contaminated. Standard operating procedures for sampling of these media are presented in the appendices of the BER portion of the Division of Environment QMP.

5.0 SAMPLE VOLUME, ORDER, AND PRESERVATION

A sufficient volume of sample must be collected, so that it is adequate in size for all needs, including laboratory analysis, and splitting with other organizations involved, etc. In collecting liquid waste samples in drums, vacuum trucks, or similar containers, 1,000 ml of a sample is usually sufficient. Hazardous wastes usually contain high concentrations of the hazardous components, so only a small aliquot of the sample is used for analysis.

When sampling contaminated media, the size and material of necessary sample containers varies greatly depending upon the media sampled, the analysis desired, and the specific laboratory that will perform the analysis. Check with laboratory personnel prior to the sampling event to ensure the proper containers are taken to the field.

The proper method for sample preservation will depend upon the type of media sampled and the requested analysis. Preservation methods can include both chemical and physical measures. Check with laboratory personnel prior to the sampling event to determine the necessary preservation methods.

All samples should be taken in the proper order if possible. The proper order will be from the area of least suspected concentration to the area with the most suspected concentration. Also, when a given sample will be analyzed for several parameters (i.e. volatiles, metals, semi-volatiles, etc.), the sample containers should be filled as follows: volatiles, semivolatiles, pesticides and herbicides, miscellaneous inorganics (pH, conductivity, total solids, etc.), and then metals.

6.0 FIELD DUPLICATE SAMPLES

The purpose of field duplicate samples is to confirm that consistent sample collection technique is being performed. If applicable, pre-select sampling locations where duplicate samples will be collected. All field duplicate samples will be collected with the same equipment as the original sample. Duplicate samples must be collected and analyzed in exactly the same manner as the original samples.

7.0 SPLIT SAMPLES

Before collecting waste or media samples, an inspector should always offer the facility representative the opportunity to ‘split’ the sample for analysis by Kansas certified laboratory of their choosing. Aliquots of the collected sample should be given to the permittee or regulated facility, if requested. In most circumstances, the permittee or regulated facility should provide their own sample containers. If they do not have the appropriate container, then the inspector should provide a container.

STANDARD OPERATING PROCEDURE BWM-006

SAMPLE CHAIN OF CUSTODY PROCEDURES

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3.0	FIELD CUSTODY CONSIDERATIONS	32
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SOP No. BWM-006

SAMPLE CHAIN OF CUSTODY PROCEDURES

1.0. INTRODUCTION

After collection and identification, all samples shall be maintained under chain of custody procedures. If the sample collected is to be split with the owner or operator of the site or with other regulatory agencies, it should be allocated into similar sample containers. Sample labels with identical information should be attached to each of the samples and marked as "split". The requesting official may be required to supply the appropriate containers.

Each person involved with the sample must know chain of custody procedures. Due to the evidentiary nature of sample-collecting investigations, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. To maintain and document sample possession, chain of custody procedures must be followed.

2.0. SAMPLE CUSTODY

A sample is under custody if: a) it is in the sampler’s actual possession; or b) it is in the sampler's view, after being in their physical possession; or c) it was in the sampler's physical possession and then they locked it up to prevent tampering; d) it is in a designated and identified secured area, or e) if the sample is secured with tamper resistant Custody Seals while in storage.

3.0. FIELD CUSTODY CONSIDERATIONS

As few people as possible should handle the samples. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched.

4.0. TRANSFER OF CUSTODY AND SHIPMENT

- A sample collection form that contains the chain of custody record must accompany samples. When transferring the possession of samples, the individuals relinquishing and receiving will sign and date the sample collection form. This form documents transfer of custody from the sampler to another person, to a mobile laboratory, or to the permanent laboratory.

- Whenever samples are split with a facility or government agency, a separate chain of custody record should be prepared for those samples and marked to indicate with whom the samples are being split.

- Sample collection forms showing identification of the contents should accompany all

packages. The original form will accompany the shipment, and the inspector should retain a copy.

- If sent by a common carrier, a bill of lading should be used. Receipts for bills of lading should be retained as part of the permanent documentation.

STANDARD OPERATING PROCEDURE BWM-008

USE OF DIGITAL CAMERAS FOR RCRA INSPECTIONS

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SOP No. BWM-008
USE OF DIGITAL IMAGING DEVICES FOR RCRA INSPECTIONS

1.0 INTRODUCTION

1.1 Purpose

To assure that consistent and reliable standards exist and are adhered to by all technical staff performing investigations and inspections requiring image documentation. This document discusses the protocol and rationale for using a camera or other digital imaging device for documentation. It also sets forth minimum requirements for image documentation to ensure the credibility of digital images and videos, and provides suggested practices related to digital image capture and technology.

1.2 Program Scope

A sharp, clearly lit image is often only second to the inspector's personal observation of the subject when it comes to documenting activities and compliance issues during a facility inspection. For several years, the Bureau of Waste Management (BWM) has relied solely on digital cameras rather than silver-halide film photography for visual documentation. Recent technological advances have allowed for other digital imaging devices to emerge. Devices such as tablet computers and smart phones are capable of capturing both still images and video. This SOP shall apply to all image and video documentation collected in the course of any RCRA solid or hazardous waste inspection.

2.0 USE OF PHOTOGRAPHIC FORMATS

2.1 Silver-Halide Film Cameras

Traditional silver-halide film cameras are not to be used on a routine basis to document field inspections. Exceptions to this rule are the use of "disposable" 35mm cameras when a digital imaging device is not available or is malfunctioning. The facility image log on page 33 shall be used to document the image number, location, orientation, date, and time.

2.2 Digital Imaging Devices

Each KDHE office shall make digital imaging devices (devices) available for documentation of field inspections. The device must use a unique file identifier, time, and date stamp. It is not necessary that the time and date stamp appear on the printed image, only that they are recorded when the image is captured. This device can be a camera, tablet computer, smart phone, or other appropriate device. Unless extraordinary circumstances do not allow, images should only be collected on agency-owned devices, not personal devices. If a device cannot record the image with a time and date stamp, this information must be documented at the time the image is captured. This information should be documented in the facility image log provided on page 33.

3.0 IMAGING REQUIREMENTS

3.1 Image Accuracy

Digital images have several advantages to traditional silver-halide film photographs, including the ability to instantly review images taken during the inspection. This is useful, when an image does not accurately represent what was observed by the inspector. Inspectors are able to review, delete, and recapture an image if necessary during an inspection. All staff must be familiar with the operation of the digital imaging device(s) before proceeding with an inspection. If the image is used as evidence in an enforcement case, the BWM personnel present when the image was captured may be asked to verify the authenticity of the image, how it was acquired, its relevance to the case, and how it corroborates testimony as to the issues which may be disputed in the case.

3.2 Image Composition

Images should be taken of every violation or questionable item/event found during an inspection. The three most common mistakes to avoid in providing image documentation are too few images, poor quality images, and lack of subject identification in images. Image documentation should tell the story with as little need for narrative as possible. This is done by capturing three types of images in a series.

The “establishing shot” is an image taken from a distance that shows not only the subject, but also one or several permanent landmarks that can be used for reference in establishing the exact location of the subject. It may be necessary in some cases to take several “establishing shots” or acquire geographic coordinate information to correctly establish the reference location of the subject matter. Additional location description of the subject shall be provided by the inspector in the report if necessary.

The “subject shot” should emphasize a specific object or event. Sometimes it will be taken in a series so that all sides of the subject can be viewed.

Lastly, a “detail shot” may be needed to provide further information about the item or event in question. Close-ups may be readily obtained by using the zoom or macro functions commonly available on most digital imaging devices. Inspectors will follow manufacturers’ instructions for these specific digital imaging device functions.

All three “shots” may not be necessary in every scenario, but the images must be of sufficient quality to document any violation or deficiency observed during the inspection. Inspectors shall document the series of “shots” in the facility image log on page 33.

4.0 ESTABLISHING PROPER CHAIN OF CUSTODY

4.1 Before the Inspection

Verify that the camera has sufficient battery life for the inspection and that spare batteries are included in the supplies. Also verify that the date, time, filename, and other applicable settings

are correct. Ensure that there is enough storage media for the anticipated number of photographs to be taken.

4.2 During the Inspection

Digital devices have the advantage of allowing the image to reviewed by the inspector immediately to verify that important details are captured and field notes can be corroborated. Any poor-quality images can be deleted and shot again before scene conditions change. This is the only time when pictures may be deleted. Inspectors shall record the image number, date, time, weather conditions, image description on the Facility Image Log.

4.3 Report Preparation

Upon returning to the office, all images captured during the inspection shall be transferred from the digital device to the inspector's office computer. The images should be saved with other inspection documentation on the BWM shared drive in accordance with the programs record management procedures. All images are considered draft documentation until the inspection report is final and are not available for public viewing. Additionally, all images obtained during an inspection report as part of an enforcement case file are not available for public viewing until the case is settled.

If the image is used in an inspection report, memorandum, or in any other documentation, the following information shall be included with the image in the document: Date and time of image capture, direction faced by inspector, weather conditions, description of the image, and any other pertinent information.

The following statement shall be included in each report: "The digital images contained in this report were recorded directly to a secure electronic storage file on the bureau shared drive or portable media device (i.e. compact disc, dvd, flash drive, etc) prior to viewing on a computer system. KDHE certifies that such digital images are thus identical to the digital images taken during the inspection/investigation."

If it is necessary to enlarge, lighten, overlay an arrow, add text, or otherwise alter an image to provide greater clarification, create a copy and save it under a similar name, with indication that the image is modified, in the same secure digital storage file. If any changes are made to an image, they should be noted as part of the description of the image in the report. The inspector should be able to testify to the original image captured during the inspection and any alterations to the original image.

Facility Image Log

Facility name:_____
Facility I.D. number:_____
Imaging device:_____
Image format:_____
Image storage location:_____
Inspector: _____

Image Number	Date	Time	Weather	Direction Faced	Image Description

STANDARD OPERATING PROCEDURE BWM-010

GUIDELINES FOR CONDUCTING a GROUNDWATER MONITORING SYSTEM OPERATION AND MAINTENANCE (O&M) INSPECTION

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ATTACHMENT A: O&M Inspection Checklist (Parts I and II)

ATTACHMENT B: Post-Closure Care/Corrective Action System Guides

ATTACHMENT C: Monitoring Well Integrity Worksheet

ATTACHMENT D: O&M Report Photo Log Template

ATTACHMENT E: O&M Report Template

ATTACHMENT F: Common Technical Issues

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SOP No. BWM-010

GUIDELINES FOR CONDUCTING AN OPERATION AND MAINTENANCE (O&M) INSPECTION AT RCRA FACILITIES

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish uniform procedures and inspection guidance for conducting an Operation and Maintenance (O&M) inspection of groundwater monitoring, post-closure care, and/or corrective action system(s) at current or former hazardous waste management facilities in Kansas. An owner/operator is required to implement an O&M program based on applicable requirements under 40 CFR Parts 264, 265, and 270 of the Resource Conservation and Recovery Act (RCRA). KDHE conducts periodic inspections throughout the life-cycle of the project to assess effectiveness/sufficiency of the O&M program being implemented. From planning/preparation through post-inspection reporting, the following attachments include standardized forms/tools to be used as well as other helpful resource information:

Attachment A	O&M Inspection Checklist (Parts I and II)
Attachment B	Post-Closure Care/Corrective Action System Guides
Attachment C	Monitoring Well Integrity Worksheet
Attachment D	O&M Report Photo Log Template
Attachment E	O&M Report Template
Attachment F	Common Technical Issues

2.0 INTRODUCTION

Conventionally, an O&M inspection focuses on evaluation of groundwater monitoring system operation and maintenance activities. This SOP has been further expanded to contemplate post-closure care and corrective action needs. An O&M inspection is designed to achieve the following primary objectives:

- Determine whether groundwater samples collected in accordance with approved sampling and analysis plan (SAP), and/or applicable permit conditions.

- Determine whether sampling devices in working order and properly maintained as outlined in SAP and/or permit.

- Determine whether monitoring wells and piezometers/observation wells yield representative groundwater samples and reliable hydrogeologic data.

- Observe groundwater elevation data collection, verify direction of groundwater flow, and generally assess accuracy of information reported by facility since last O&M inspection.

- Identify deficiencies/areas of improvement in relation to current groundwater monitoring system.

- Identify issues or concerns to be assessed in future comprehensive groundwater monitoring evaluation (CME).
- Evaluate current operational condition of post-closure care and/or corrective action system(s).
- Verify other applicable regulatory requirements addressed for post-closure care and/or corrective action system(s).
- Assess efficiency and performance of post-closure care and/or corrective action system(s).
- Determine whether post-closure care and/or corrective action system goals achievable.
- Identify deficiencies/areas of improvement in relation to post-closure care and/or corrective action activities.

In order to accomplish the objectives identified above, the inspector will need to minimally complete Part I of the O&M inspection checklist to assess the groundwater monitoring system. In addition, to assess any post-closure care and/or corrective action system(s), Part II will need to be completed as well. The O&M inspection checklist (both parts) is included as Attachment A of this SOP. Separate guides for several common post-closure care/corrective action systems are available in Attachment B to not only assist in preparations for the O&M inspection, but to also serve as a general resource to facilitate the review of pertinent project-related workplan/design documents.

3.0 PRE-INSPECTION PROCEDURES

The inspector will perform coordination and scheduling of the O&M inspection with the facility contact person. Inspections are to be scheduled coincident with a regularly scheduled sampling event at the facility. Written notification should be sent to the facility at least 60 days in advance to facilitate planning by all involved in the sampling event. If requested by the facility, a copy of the O&M inspection checklist should be provided for informational purposes. Once the date has been set, as a courtesy, the inspector will notify EPA and KDHE District Office of the upcoming inspection. However, although not precluded, it is not anticipated that either will necessarily participate in the inspection.

Prior to conducting the O&M inspection, the inspector must thoroughly review the project files and RCRAInfo to develop a thorough understanding of the technical, regulatory, and enforcement aspects of the facility. The inspector will become familiar with the general facility status, and details related to the groundwater monitoring, post-closure care, and/or corrective action system(s). Prior to the inspection, as applicable, the inspector should review operating records, groundwater monitoring reports, previous inspection reports, permit applications, and site-specific hydrogeology/conceptual site model information, approved plans, and design/as-built information. Copies of certain items should be taken to the field for reference purposes (e.g., SAP, post-closure plan (PCP), O&M plan, facility layout, monitoring well location map,

process flow schematic, etc.).

The inspector will need to complete all pre-inspection items in the O&M inspection checklist before the scheduled inspection date (Attachment A). In addition, prior to the inspection date, the inspector must consult with the facility contact person regarding the health and safety procedures required by the facility. The inspector will then gather the appropriate health and safety equipment necessary for conducting the inspection, as well as containers and equipment needed for split-sample collection.

4.0 FIELD INSPECTION PROCEDURES

Upon arrival at the facility, the inspector should meet with the facility contact, properly identify themselves with KDHE identification credentials, and outline the purpose/scope of the inspection. The facility contact may accompany the inspector during the inspection.

Items to be discussed/verified during this initial meeting include the following:

- Tentative inspection priorities and schedule.
- Facility concerns or requirements during inspection (e.g., sign in/out, visitor passes, restricted areas, limitations on camera use, health and safety protocol, etc.).
- Anticipated procedural deficiencies based on pre-inspection review.

The inspector will perform the following tasks during the O&M inspection:

- Visually inspect all wells and piezometers (as time allows) noting evidence of significant damage or deterioration on monitoring well integrity worksheet included as Attachment C of this SOP.

- Observe techniques used by sampling crew as water level measurements obtained, wells purged, and groundwater samples collected.

- Document other items of concern or deficiencies associated with post-closure care and/or corrective action system(s).

- Create a photographic record of inspection using the O&M report photograph template included as Attachment D of this SOP.

- Obtain site-specific data for each well and piezometer inspected.

- Collect split samples.

Throughout the field inspection process, the inspector is required to complete the O&M inspection checklist and companion monitoring well integrity worksheet, as well as document field activities/conditions via a photographic record. Photographs taken should be correlated with specific line items on the O&M checklist.

Upon completion of all the tasks involved in the O&M inspection, an exit conference should be held with facility representatives as a means of providing a summary of preliminary inspection findings. All clear violations, as well as any significant concerns or deficiencies, noted during the inspection should be verbally conveyed to facility representatives at this time. A specific compliance schedule should be established by the inspector during the exit interview to address such violations (typically 30 to 60 days). In addition, the inspector and facility will develop a tentative timeline to address other significant concerns.

At a minimum, the inspector should emphasize the following during the exit conference or briefing:

- Assessment of monitoring well integrity observations, field measurement and sampling procedures, field documentation, and other issues pertinent to the groundwater monitoring program.

- Assessment of general condition and operation of post-closure care, and/or corrective action system(s).

- Specific technical recommendations to enhance or improve the quality of the facility's groundwater monitoring, post-closure care, and/or corrective action system(s).

- Any clear violations or specific regulatory requirements not being met by the facility with caveat that other recommendations or additional compliance issues may be identified following the inspection after further evaluation of the observations and procedures.

At this same time, a mechanism and timeline for obtaining the facility's analytical results and other field measurements from the sampling event should be established. Besides the report of analytical results from the laboratory, all of the raw analytical data from the analyses of the field samples and quality control samples should be obtained as soon as available in order to completely evaluate the quality of the results. In addition, if not obtained during the inspection, all field measurements should be obtained as recorded on field forms or field logbook.

Within ten days from the date of the inspection, the inspector should send an email to the facility summarizing the exit conference discussion including: (1) established compliance schedule to address violations within a set timeframe, and (2) tentative timeline to address other significant concerns/deficiencies. The inspector's email should afford the facility a limited time (e.g., five business days) to provide an email reply in case their recollection of the exit interview differs from the summary. The facility should be advised in this email of the expectation to provide email confirmation/documentation of actions taken to address significant concerns.

A generalized process for resolving O&M inspection issues from the point of the exit interview at the facility forward through post-inspection activities is depicted in Figure 1.

5.0 POST-INSPECTION PROCEDURES

Split samples obtained during the inspection should be delivered to the laboratory for analysis

the day of or the day after the inspection takes place. Chain-of-custody and sample preservation are critical activities at this stage.

Within 30 days of performing the inspection, the inspector will submit a completed Compliance, Monitoring, and Enforcement Log (CMEL) to designated staff authorized for RCRAInfo data entry. The intent of this initial RCRAInfo entry is to document the date of the inspection as well as any clear violations and corresponding compliance schedule dates. Specifically, these would be those violations noted during the inspection and conveyed to the facility during the exit interview and by subsequent email summary. The inspector should also indicate on the form that other violations and required actions will be determined and documented in RCRAInfo following final report issuance. Other deficiencies or agreed upon areas of improvement will be addressed/tracked separately to ensure appropriate resolution within a reasonable timeframe.

As part of O&M inspection report preparation, the inspector will need to complete the following tasks:

- Compare most recent water table/potentiometric surface map(s) with water level data obtained during the field inspection.

- Assess whether sampling crew deviated from SAP and/or permit.

- Identify deficiencies/areas of improvement in the maintenance of sampling devices, monitoring wells, piezometers, or compliance with post-closure care and/or corrective action requirements.

- Identify deficiencies/areas of improvement in the owner/operator's sampling program and/or operation and maintenance program.

Attachment E provides a template for all O&M inspection reports. The intent of this standardized template is to provide brief narrative descriptions and to utilize a numbered list format for all identified past inspection deficiencies/resolution, current deficiencies, and required actions/areas of improvement. In preparation of O&M inspection report tables and figures, the inspector should utilize readily available information, including already prepared tables and figures, from the most recently KDHE-approved workplan/report.

Deficiencies should be determined and clearly presented in the conclusions of the report. Deficiencies that are clearly inconsistent with a regulation, permit condition, order requirement or a KDHE-approved plan should be considered violations and distinguished as such in the report. It would also be appropriate to include a summary of violations in the conclusions/recommendations section. For all violations, the report should cite the corresponding regulation, permit condition, or order requirement in question along with a schedule for the facility's return to compliance. Attachment F of this SOP is included to assist the inspector in identifying common technical issues and determining whether violations of applicable regulations exist on a facility/site-specific basis. However, in addition to violations, the inspector may notice conditions for which citing a violation is not warranted, but the facility should improve upon to avoid future problems. For each deficiency that is not considered a

violation, these are to be classified as an area of improvement. KDHE should give a written recommendation in the report to address the specific area of improvement.

Professional judgment will need to be exercised to distinguish between violations and deficiencies/areas of improvement. One example of a deficiency that may/may not be a violation is a cracked concrete monitoring well pad. If the crack is a hairline fracture but no separation has occurred it is not a violation, but if separation of the broken pieces is enough to allow water to pass through, it is a violation. Another example would be the lack of a weep hole designed to allow any accumulated water to escape from inside the protective casing, where if trapped, it could freeze in cold weather causing the inner casing to break. KDHE recommends a weep hole for each well, but many wells do not have one and so this should only be identified as an area of improvement.

With the objective of issuing all final O&M reports and making required RCRAInfo entries by September 30, a copy of the complete draft report should be sent to EPA for a 45-day review period. During this same timeframe, the facility should be provided a redacted version of the draft report, specifically excluding the executive summary, any identified current deficiencies, required actions/areas of improvement, and conclusions/recommendations. Following this review period, the inspector will finalize the O&M report as deemed necessary based on comments received. By the end of September, the inspector should complete and send the final O&M report to EPA and the facility. KDHE's cover letter to the facility will emphasize correction of those deficiencies and/or violations within a specified time period. The facility will also be given a reasonable amount of time to address other identified non-violation deficiencies and areas of improvement. However, note that the facility is not necessarily required to act on or implement any specific recommendations made by KDHE to address non-violations or suggested areas of improvement. The emphasis should be on explaining the concern and providing recommendations to the facility for their consideration. Once the report is finalized, the inspector will submit a completed CMEL form (with violations identified) to the appropriate staff. The inspector will subsequently log onto RCRAInfo to verify that the data shows up as intended. Finally, as violations are corrected, the inspector must ensure RCRAInfo is further updated as needed which will require additional CMEL forms. For all non-violation deficiencies and/or agreed upon areas of improvement, the inspector will periodically verify the facility's progress towards addressing the identified issues.

6.0 REFERENCES

U.S. Environmental Protection Agency (USEPA), 1988, Operation and Maintenance Inspection Guide (RCRA Ground-Water Monitoring Systems), OSWER 9950.3.

USEPA, 1991, RCRA Comprehensive Ground Water Monitoring Evaluations (CME) and Operation & Maintenance (O&M) Inspections, EPA 9950.3FS.

USEPA, 1998, Field Applications of In Situ Remediation Technologies: Chemical Oxidation, EPA 542-R-98-008.

USEPA, 1998, Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in

Ground Water, EPA/600/R-98/128.

USEPA, 1999, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites, OSWER 9200.4-17P.

USEPA, 2000 (revised), Engineered Approaches to In Situ Bioremediation of Chlorinated Solvents: Fundamentals and Field Applications, EPA 542-R-00-008.

USEPA, 2001, Operation and Maintenance in the Superfund Program, EPA 540-F-01-004.

USEPA, 2002, Elements for Effective Management of Operating Pump and Treat Systems, EPA 542-R-02-009.

USEPA, 2002, Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers, EPA 542-S-02-001.

USEPA, 2004, Performance Monitoring of MNA Remedies for VOCs in Ground Water, EPA/600/R-04/027.

USEPA, 2004, Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action, EPA 530-R-04-030.

USEPA, 2005, Cost-Effective Design of Pump and Treat Systems, EPA 542-R-05-008.

USEPA, 2005, O&M Report Template for Ground Water Remedies (With Emphasis on Pump and Treat Systems, EPA 542-R-05-010.

USEPA, 2008, Recommended Annual O&M/Remedy Evaluation Checklist, OSWER 9355.0-87.

USEPA, 2008, Recommended Annual O&M/Remedy Evaluation Checklist for Contaminated Sediment Remedies, OSWER 9355.0-118.

USEPA, 2011, Fact Sheet on Evapotranspiration Cover Systems for Waste Containment, EPA 542-F-11-001.

USEPA, 2013, Remediation Optimization: Definition, Scope and Approach, EPA 542-R-13-008.

USEPA (Region 4), 2013, Guidance – Design and Installation of Monitoring Wells, SESDGUID-101-R1.

USEPA (Region 4), 2013, Operating Procedure – Groundwater Sampling, SESDPROC-301-R3.

Figure 1
Resolution of O&M Inspection Issues

O&M Inspection Exit Conference
- Summarize preliminary findings
- Identify any violations and significant concerns
- Establish compliance schedule to address violations
- Recommend facility address significant concerns before next sampling event
- Develop tentative timeline with facility to address significant concerns

⇩

Within 10 days from inspection, send email to facility summarizing exit conference and identifying significant concerns with timeline and/or violations with compliance schedule to address

⇩

Throughout process, accept email transmittals from facility providing confirmation/ documentation of actions taken to address significant concerns and/or violations

⇩

RCRAInfo (via CMEL within 30 days from inspection)
- Enter date of inspection
- Violations/required actions, if any, will be documented in RCRAInfo

⇩

KDHE sends draft report to EPA and facility for 45-day review (redacted version-only goes to facility for review)

⇩

KDHE sends final report to EPA and facility
- Include compliance schedule, as needed, for correction of violations/deficiencies
- Offer meeting/teleconference to discuss compliance schedule and other recommended areas of improvement
- Request facility document all actions taken to correct violations/deficiencies when next routine reporting occurs

⇩

RCRAInfo (via CMEL within 30 days from report finalization)
- Enter determined violations/required actions as documented in final O&M report
- Verify progress towards achieving compliance and enter date(s) of return to compliance

⇩

For all non-violation deficiencies and/or agreed upon areas of improvement, periodically verify facility progress towards addressing those issues

ATTACHMENT A

O&M Inspection Checklist

O&M Inspection Checklist (Part I)

Groundwater Monitoring System

Kansas Department of Health and Environment
Operation and Maintenance Inspection Checklist
Bureau of Waste Management

Part I
Groundwater Monitoring System

Facility Name	
Street Address	
City/County	
EPA ID	
Inspection Date(s)	
Controlling Document and Effective Date	

General Instructions: Instructions embedded in this checklist are italicized to make readily distinguishable. Acronyms used are listed at the end of this checklist.

Section 1: KDHE pre-inspection

Instruction: Complete all office preparation prior to inspection.

A. Provide list of items to be inspected (i.e., number of monitoring wells, remedial systems, SWMUs, etc.) Click here to enter text.
B. Send notification letter to facility of upcoming inspection *(recommend sending at least 60 days in advance of inspection)*
i. Date Sent: Click here to enter text.
C. Indicate document date (or revision date) and date of KDHE's approval of the following:

Document type	**Document date**	**Approval letter date**	**Notes**
SAP (or equivalent)			
PCP (or equivalent)			
Prior year AGWMR (or equivalent)			
O&M Plan (or equivalent)			
Other (indicate)			

Describe any other plan modification approvals (verbal or written) which affect implementation of groundwater monitoring, post-closure care, and/or corrective action system(s) at the facility:
Click here to enter text.
D. The facility is currently implementing one or more of the following *(select all that apply)*:

Type	Select
Detection monitoring program	☐
Compliance monitoring program	☐
Post-closure care (waste containment system)	☐
RCRA corrective action (investigation)	☐
RCRA corrective action (interim measure implementation)	☐
RCRA corrective action (remedy implementation)	☐
RCRA corrective action (long-term or performance monitoring)	☐
Other (indicate) Click here to enter text.	☐

E. Samples are collected at following frequency: Choose an item. *[Detail in Table 4 of O&M Report.]*
Click here to enter text.

Yes No NA

F. Is groundwater flow rate/direction in all aquifers determined according to approved plan? Notes: Click here to enter text. ☐☐☐

Aquifer	General direction of groundwater flow (based on recent reporting)	Estimated flow rate (based on recent reporting)

G. Is AGWMR (and other required reports) being submitted according to approved plan? ☐☐☐

H. In most recent report, is groundwater quality tabulated at each monitoring well to determine statistically significant increases? ☐☐☐

I. Does the most recent AGWMR include an evaluation of any changes necessary to protect human health (migrating plume, increasing groundwater concentrations) and suggested responses? ☐☐☐

J. List past deficiencies/areas of improvement from most recent inspection; indicate whether outstanding or the date returned to compliance/resolved.

Past deficiencies/areas of improvement	Outstanding or date returned to compliance/resolved

K. List any known sources outside of waste management area or facility boundaries that could cause fluctuations in water table and/or influence direction of groundwater flow.

Click here to enter text.

	Yes	No	NA
L. Does the SAP list, indicate or describe the following?			
i. Original measured depth of each well.	☐	☐	☐
ii. Required frequency of measuring total well depths.	☐	☐	☐
iii. Static water level measurement techniques.	☐	☐	☐
iv. Procedures to follow if immiscible layers are detected, including specific methods for sampling.	☐	☐	☐
v. Types of sample containers to be used.	☐	☐	☐
vi. Field analysis methods.	☐	☐	☐
vii. Decision criteria for replacement of wells and sampling equipment.	☐	☐	☐
viii. Schedules for performing groundwater monitoring O&M activities.	☐	☐	☐
M. Has field/sampling equipment for inspection (e.g., camera, field notebook, permanent marker, nitrile gloves, sample containers, cooler, chain-of-custody, etc.) been gathered?	☐	☐	☐
N. Have facility health and safety requirements been determined prior to inspection date?	☐	☐	☐

O. List required health and safety equipment (e.g., protective eyewear, steel-toed boots, hardhat, etc.):

Click here to enter text.

Section 2: Sampling team preparation

Instruction: Upon site arrival, verify sampling team has completed preparation.

Yes No NA

A. Are sampling equipment maintenance schedules followed per SAP? ☐☐☐

B. Are adequate inventory of sampling equipment and sampling devices available for monitoring event? ☐☐☐

C. Has sampling team adequately prepared and checked all equipment prior to mobilization? ☐☐☐

D. Was all equipment cleaned prior to initial use? ☐☐☐

E. Was electronic water level indicator conductivity checked with clean (not distilled) water prior to field work to verify closed circuit? ☐☐☐

F. Were field instruments properly calibrated and calibrations recorded in field logbook? ☐☐☐

Detail calibration information in table below:

Equipment name	Model number	Calibration method	Frequency

G. Does sampling team have a copy of following documents available in field?

i. SAP ☐☐☐

ii. PCP ☐☐☐

iii. QAPP ☐☐☐

iv. AGWMR ☐☐☐

H. Were all field measurements properly recorded in field logbook and/or appropriate field form? ☐☐☐

Section 3: Inspection of wells/systems

Instruction: Complete monitoring well integrity worksheet (SOP BWM-010 Attachment C) during inspection for each well visually inspected by KDHE and/or sampled in the presence of KDHE.

Any additional comments:
Click here to enter text.

Section 4: Pre-sample collection measurements

Instruction: To be filled out based on observations during the inspection.

A. Indicate the name, position/title and company affiliation for each member of the sampling team.

Name	Position/Title	Company affiliation

Yes No NA

B. Were clean disposable gloves worn during sampling?
TypeChoose an item. ☐☐☐

C. Were gloves changed before each sample or as needed? ☐☐☐

D. Were samples collected from least contaminated to most contaminated, or per SAP? ☐☐☐

E. Were static water levels and total well depths measured in accordance with SAP? ☐☐☐

F. Were well caps removed several minutes before measuring began to allow water level in wells to equilibrate to atmospheric pressure? ☐☐☐

G. Did sampling crew obtain organic vapor reading at the wellhead prior to SWL or TWD measurements? ☐☐☐

H. Is reference measuring point clearly marked on the inner casing material? ☐☐☐

I. Were static water level and total well depths measured from well reference measuring point? ☐☐☐

J. Were depth to groundwater and depth to the bottom of monitoring wells measured prior to sample collection? ☐☐☐

   i. Were depth to groundwater and depth to bottom of the monitoring well measured to nearest +/- 0.01 foot? ☐☐☐

   ii. Were measurements rechecked by taking two to three readings? ☐☐☐

   iii. Were water level measurements obtained in all wells consecutively within a 24-hour period prior to purging or sampling? ☐☐☐

   iv. Were date/time of measurement, reference point, measurement method, static water level, and total well depth recorded in field logbook and/or appropriate field form? ☐☐☐

K. Indicate what type of water level measuring device is used.
Click here to enter text.

L. Was measuring equipment properly cleaned between each monitoring well to prevent cross-contamination? ☐☐☐

If no, describe: Click here to enter text.

Section 5: Detection/sampling of immiscible layers

Instruction: To be filled out based on observations during the inspection.

	Yes	No	NA
A. Describe the equipment/procedures used to detect NAPL. Click here to enter text.			
B. Are any detected immiscible layers measured or sampled separately prior to well purging?	☐	☐	☐
C. Are procedures used to minimize mixing of immiscible layers with water soluble phases?	☐	☐	☐
D. Is immiscible layer thickness measured to the nearest +/- 0.01 foot?	☐	☐	☐
E. Were measurements verified by taking two to three readings?	☐	☐	☐
F. Did sampling team document in field logbook a description of immiscible layer including thickness, color, odor, viscosity, and type of product suspected? Describe: Click here to enter text.	☐	☐	☐

Section 6: Well purging and groundwater sample collection procedures

Instruction: To be filled out based on observations during the inspection.

A. Identify all monitoring well locations where sample collection procedures were evaluated/observed by KDHE:

Well ID	Date/time

B. Identify at least one monitoring well location where collection of an equipment blank and field blank was evaluated/observed:

Well ID	Date/time

	Yes	No	NA
C. Were wells purged in accordance with the approved SAP?	☐	☐	☐
☐ Well Volume Method (complete Subsection E below)			
☐ Low Flow Method (complete Subsection F below)			
☐ No Purge Method (complete Subsection G below)			
D. Were wells purged using dedicated equipment?	☐	☐	☐
E. Well Volume Method:			
i. Was volume of water in each well calculated in pre-sampling activities?	☐	☐	☐
ii. Did calculated volume include water within gravel pack?	☐	☐	☐
iii. Was a minimum of three to five well volumes removed prior to sample collection?	☐	☐	☐
iv. Were samples collected after three successive readings indicated water-quality parameters had stabilized within appropriate criteria?	☐	☐	☐
v. Describe how purge volume was measured. Click here to enter text.			
vi. Was same equipment used for both purging and sampling?	☐	☐	☐
vii. Was equipment constructed of inert materials? Specify material type. Click here to enter text.	☐	☐	☐

		Yes	No	NA
viii.	If a bailer used, was ball check-valve at bottom of bailer?	☐	☐	☐
ix.	If not a dedicated bailer, was disposable rope or string used at each well location?	☐	☐	☐
x.	Was bailer lowered gently into well to a point adjacent to well screen?	☐	☐	☐
xi.	Was care taken to avoid aeration/agitation of sample?	☐	☐	☐
xii.	If a pump used, did type of pump match target analytes? *(Some pumps can alter water quality through aeration and volatilization, biasing the sample results.)*	☐	☐	☐
xiii.	Was water level monitored during purging to ensure air does not enter pump?	☐	☐	☐
xiv.	Was appropriate pump rate maintained? Specify rate. Click here to enter text.	☐	☐	☐
xv.	If the pumping rate exceeded well recharge rate, was pump lowered further into well or pumping rate decreased?	☐	☐	☐
xvi.	Were samples collected immediately after purging without changing the position of pump or turning it off?	☐	☐	☐
xvii.	If a well purged dry, was well sampled within 24 hours but no sooner than two hours? Specify time interval. Click here to enter text.	☐	☐	☐
xviii.	Was all pumping equipment properly decontaminated between each well location? Describe: Click here to enter text.	☐	☐	☐

[SKIP TO SUBSECTION H]

F. Low Flow Method:

		Yes	No	NA
i.	Was a low-flow variable speed pump with flow controller used? *(Inertial pumps and grab sampling devices (e.g., bailer) cannot be used for low-flow sampling because of disturbance created in well.)*	☐	☐	☐
ii.	If a peristaltic pump used, was “straw method” used to collect VOC samples?	☐	☐	☐
iii.	Was tubing used that will not interact with contaminants in groundwater?	☐	☐	☐
iv.	Was discharge tubing length minimized to reduce changes in water temperature and alteration of water chemistry?	☐	☐	☐
v.	Were pump and tubing lowered gently into well to minimize disturbance of water column?	☐	☐	☐

Yes No NA

vi. For fully-penetrating wells in homogenous formations, was pump intake placed in the middle or slightly above the middle of the screened interval? ☐☐☐

vii. If water level intersects screened interval, was pump placed midway between the top of water column and bottom of well? ☐☐☐

viii. Was pumping rate similar to recovery rate of well based on amount of drawdown measured during purging? *(Drawdown should be no greater than 0.33 feet while performing low-flow purging and sampling.)* ☐☐☐

ix. If appropriate pumping rate unknown, was pump started at lowest rate and then slowly increased to determine highest pumping rate that can be used while maintaining stable drawdown? *(Low-flow rates typically in 0.1 to 0.5 L/min range but, for more permeable formations, a flow rate of 1 L/min is acceptable as long as water level can be stabilized while pumping.)* Specify optimum rate determined. Click here to enter text. ☐☐☐

x. Depending on hydraulic conductivity of formation, water levels should be measured every 30 seconds to every five minutes. Were water levels checked at referenced frequency? ☐☐☐

xi. Were samples collected after three successive readings indicated water-quality parameters had stabilized within appropriate criteria? ☐☐☐

[SKIP TO SUBSECTION H]

G. No Purge Method:

i. Were low-yielding monitoring wells purged to dryness and allowed to recover prior to sampling? ☐☐☐

ii. Specify type of no-purge sampling device used. Choose an item.

iii. Is no-purge sampling device used compatible with target analytes? ☐☐☐

iv. Were length of water column and well screen sufficient for use of no-purge sampling device? ☐☐☐

v. Was no-purge sampling device deployed within the screened portion of the well? Specify average deployment depth. Click here to enter text. ☐☐☐

vi. Was an appropriate amount of time allowed to pass after no-purge device deployment and collection of samples? *(Minimum recommended amount of time is two weeks but may be less in more*

Yes No NA

permeable formations.) Specify average time. Click here to enter text. ☐☐☐

vii. If a Hydrasleeve™ device used, was retrieval rate one foot per second or faster to ensure water enters the sleeve for sample collection? ☐☐☐

viii. Before discharging water from sleeve for sample collection, was extra water resting above check valve expelled? ☐☐☐

ix. Was total well depth measured after sample retrieved? ☐☐☐

H. Verify following special sample handling considerations:

i. Organic samples are not filtered. ☐☐☐

ii. VOC sample vials do not contain headspace or bubbles. ☐☐☐

iii. Samples for total metals analysis are unfiltered. ☐☐☐

iv. In addition to total metals, if samples for dissolved metals analysis are needed, a 0.45-micron filter is used. ☐☐☐

I. Did sampling start at least contaminated well and continue through most contaminated well? ☐☐☐

J. Are samples transferred directly from sampling device to sample container? ☐☐☐

K. Were wells sampled within a 24-hour period after purging? ☐☐☐

L. Was new bailer, rope or tubing used for each well? ☐☐☐

M. Were low-yield wells purged dry prior to sampling? ☐☐☐

N. Were high-yield wells purged to remove at least three well volumes prior to sampling? ☐☐☐

O. Was plastic sheeting placed around well to minimize contamination of equipment via direct contact with ground surface? ☐☐☐

P. If plastic sheeting not used, was care taken to ensure that hoses/lines were not placed on ground or other contaminated surfaces prior to insertion into monitoring well? ☐☐☐

Q. Were samples collected in order of most to least volatile? Please list the order in table below (e.g. volatiles, semi-volatiles, metals, etc.). ☐☐☐

1.	5.
2.	6.
3.	7.
4.	8.

	Yes	No	NA
R. Were bailer contents transferred to sample container with minimal agitation and aeration *(e.g., via bottom emptying device)*?	☐	☐	☐
S. Were bailers lowered slowly to prevent degassing of water?	☐	☐	☐
T. Were bladder pumps operated in a continuous manner to prevent sample aeration?	☐	☐	☐
U. Was sampling equipment clean and hoses/lines not placed on ground or other contaminated surfaces prior to insertion into well?	☐	☐	☐
V. If non-dedicated equipment used, was equipment disassembled and thoroughly cleaned between samples?	☐	☐	☐
W. If volatile samples taken with positive gas displacement bladder pump or other type of downhole pumping device, were pumping rates kept below 100 mL/min?	☐	☐	☐

Section 7: Field water-quality parameters/stabilization criteria

Instruction: To be filled out based on observations during the inspection.

Yes No NA

A. List the corresponding stabilization criteria for the field water-quality parameters in table below:

Specific conductance		Turbidity	
Dissolved Oxygen		pH	
Oxidation-reduction potential		Temperature	

Describe all equipment used: Click here to enter text.

B. Were buffer/calibration solution temperatures maintained close to temperature of groundwater? ☐☐☐

C. When calibrating for pH, was a minimum two-point calibration made? ☐☐☐

D. When calibrating for specific conductance, were both high and low conductivity standards used? ☐☐☐

E. Were water quality parameters measured using a flow-through cell to prevent unwanted exposure to atmosphere, particularly for air-sensitive parameters (e.g., dissolved oxygen and pH)? ☐☐☐

F. Was total capacity of flow-through cell small (300 – 1,000 mL) to maintain desirable turnover rate of water coming into cell? ☐☐☐

G. Did purge water enter flow-through cell from a bottom port and exit at the top? If not, describe: Click here to enter text. ☐☐☐

H. Was pump discharge line connected to the flow-through cell after flow rate controlled and any unwanted material cleared from line, typically in less than ten minutes? ☐☐☐

I. Was first set of water quality parameter measurements made after one complete volume of water passed through pumping apparatus with subsequent readings taken as additional volumes are removed? *Successive measurements should be completed at 3-5 minute intervals.* ☐☐☐

J. Were samples collected after three successive readings indicated the water-quality parameters stabilized within the appropriate criteria? ☐☐☐

K. Were flow rate, volume of water, and water-quality parameter measurements recorded in field logbook or field form? ☐☐☐

L. Describe protocol followed when stabilization criteria not achieved. Click here to enter text.

M. Was flow-through cell tubing completely full of water at all times? ☐☐☐

N. Was flow-through cell decontaminated between each well location? ☐☐☐

Yes No NA

O. Was new flow-through cell tubing used between each well location? ☐☐☐

Section 8: Equipment decontamination

Instruction: To be filled out based on observations during the inspection.

A. Was nonexpendable equipment decontaminated between sample locations? ☐☐☐

B. Describe decontamination procedures. Click here to enter text.

C. Was visible contamination removed with a metal or nylon brush and/or high pressure water spray? ☐☐☐

D. Was equipment washed with non-phosphate detergent (e.g., Alconox)? ☐☐☐

E. Was equipment rinsed with tap water and then given final deionized/distilled water rinse? ☐☐☐

F. Was source of tap water and deionized/distilled water used for decontamination documented? Click here to enter text.

G. Were field blanks used to verify quality of commercially available water? ☐☐☐

H. If site being sampled for constituents frequently occurring in chlorinated water supplies (e.g., THMs), was a rinse blank sample for VOC analysis obtained at least once during decontamination process? ☐☐☐

Section 9: Sample containers, labeling, and preservation methods

Instruction: To be filled out based on observations during the inspection.

	Yes	No	NA
A. Did sample labels identify project name, date/time of collection, sample identification number, depth, and name of collector? If no, describe any missing items. Click here to enter text.	☐	☐	☐
B. Did labels remain legible even when wet?	☐	☐	☐
C. Were samples immediately placed on ice and cooled to 4 degrees C after collection?	☐	☐	☐
D. Were VOC vials preserved with acid?	☐	☐	☐
E. Were other samples properly preserved?	☐	☐	☐
F. Did laboratory provide sample containers?	☐	☐	☐

Section 10: Quality control sample collection

Instruction: To be filled out based on observations during the inspection.

A. Identify in table below QA/QC samples collected to evaluate the reproducibility of collection procedures in accordance with SAP *(check those that apply)*.

QA/QC Type	Check	Well ID	Frequency	Done in accordance with SAP
Trip blank				
Duplicate sample				
Field blank				
Equipment blank				
Matrix spike/matrix spike duplicate				

	Yes	No	NA
B. Did one trip blank accompany each cooler containing VOC samples?	☐	☐	☐
C. Were separate equipment blanks collected for each type of non-dedicated sampling equipment used?	☐	☐	☐
D. Describe if any other quality control samples were collected. Click here to enter text.			
E. Were identities of quality control samples concealed from laboratory to ensure unbiased handling and analysis?	☐	☐	☐
F. Were quality control samples collected at a frequency of 1 in 20 samples per day, or a minimum of one per day, for each media sampled?	☐	☐	☐
G. Were split-samples collected by KDHE? If so, complete table below.	☐	☐	☐

Well ID	Sample type (VOCs, metals, etc.)

If split-samples collected, describe split-sample collection procedures. Click here to enter text.

Section 11: Chain of custody

Instruction: Periodically inspect in field and obtain final copy of chain-of-custody from facility.

	Yes	No	NA
A. Was sample form or chain-of-custody properly completed?	☐	☐	☐
B. Did sample form or chain-of-custody contain same information as sample container label?	☐	☐	☐
C. After collection and container labeling, was chain-of-custody maintained for each sample?	☐	☐	☐
D. Did person collecting samples in field maintain care and custody of the samples until transferred or properly relinquished?	☐	☐	☐
E. Were seals placed on shipping containers to ensure samples not altered in transit? Describe how containers sealed. Click here to enter text.	☐	☐	☐

F. Indicate the length of time between final sample collection to time of shipment and delivery at laboratory. Click here to enter text.

G. Indicate how samples were shipped (carrier). Click here to enter text.

H. Chain-of-custody record included the following *(check those that apply)*:

Sample ID		Parameters requested	
Signature of collector		Preservative used/filtered/unfiltered	
Date/time		Signatures of those in chain of custody	
Sample type		Date and signature of those handling the samples	
Well location		Duplicates, field blanks, equipment blanks, trip blanks	
Number and type of sample containers		Other: Click here to enter text.	

Section 12: Management of investigation-derived waste

Instruction: Observe sampling team in field and review facility documentation post-inspection.

	Yes	No	NA
A. Was purge water collected for storage and analysis?	☐	☐	☐
B. Were decontamination fluids collected for storage and analysis?	☐	☐	☐
C. Describe containerization and temporary storage of IDW pending analytical results. Click here to enter text.			
D. Were drums or other containers properly labeled (e.g., "Waste Awaiting Characterization")?	☐	☐	☐
E. Was IDW characterized at point of initial generation?	☐	☐	☐
F. Was sufficient historical data available to make waste determination?	☐	☐	☐
G. Describe disposal methods for contaminated clothing, disposable equipment, purge water and decontamination fluids. Click here to enter text.			

Section 13: Field documentation

Instruction: Indicate if the following information is recorded during sampling event.

A. The following information is recorded for each sampling event in logbook or field data sheet *(check those that apply)*:

Map or description of each monitoring well		Parameters requested	
Type of monitoring well sampled (stickup vs. flush mount)		Field analysis data	
Well purging procedures		Sample distribution and transport	
Date/time and weather during sampling		Unusual well recharge rates	
Well sampling sequence		Equipment malfunctions or problems	
Types of sample containers and ID numbers		Date, procedures, calibrations and maintenance performed on equipment	
Preservatives used		Other: Click here to enter text.	

Section 14: Quality assurance/quality control

Instruction: To complete after inspection.

	Yes	No	NA
A. Was sampling and analysis done according to procedures stated in approved QAPP?	☐	☐	☐
B. Were QA/QC samples used to correct data?	☐	☐	☐
C. Were approved statistical methods used to determine if any statistically significant increases are occurring?	☐	☐	☐

Section 15: Analytical methods, evaluation and validation of data

Instruction: To complete after inspection.

	Yes	No	NA
A. If field screening used, were confirmation samples collected for laboratory analysis? Specify percentage and laboratory. Click here to enter text.	☐	☐	☐
B. Was laboratory certified by KDHE Health and Environmental Laboratories for the specific analyses being performed?	☐	☐	☐
C. Were method detection and reporting limits sufficiently low to facilitate comparison to corresponding threshold levels?	☐	☐	☐
D. Were all samples analyzed within method holding times?	☐	☐	☐
E. Were any results flagged as unusable? Explain. Click here to enter text.	☐	☐	☐
F. Were field and laboratory data quality objectives met as specified in the SAP/QAPP?	☐	☐	☐
G. Were sample collection and handling procedures followed as specified in the SAP/QAPP?	☐	☐	☐

H. As applicable, mark those items below evaluated by laboratory.

Instrument calibration (initial and continuing)		Matrix spike/matrix spike duplicate	
Serial dilution		Internal performance standards	
GC/MS tuning		Reported detection limits	
Blanks		Laboratory control samples	
Surrogate recoveries		Interference check samples	
Duplicates		Sample preservation	
Overall system performance		Other: Click here to enter text.	

Section 16: Post-inspection data evaluation and brief summary

Instruction: To complete after inspection.

		Yes	No	NA
A.	Were split samples sent to laboratory for analysis?	☐	☐	☐
B.	Was O&M Report Table 3 completed to compare KDHE and facility analytical data, including relative percent differences?	☐	☐	☐
C.	Was O&M Report Table 2 completed to determine differences between total well depth measurements and "as built" well depths, and percent occlusion calculated?	☐	☐	☐
D.	Was inspection documented using CMEL form for entry into RCRAInfo?	☐	☐	☐
E.	Was a draft O&M inspection report sent to EPA and facility (with portions redacted) for comment?	☐	☐	☐
F.	Was a final O&M inspection report sent to EPA and facility?	☐	☐	☐
G.	Were deficiencies or enhancements identified to be repaired or completed in the maintenance of sampling devices, monitoring wells, piezometers, and/or corrective measures systems?	☐	☐	☐
H.	Were violations identified in the owner/operator's sampling and/or O&M program?	☐	☐	☐

[IF INSPECTION INCLUDES ASSESSMENT OF POST-CLOSURE CARE/CORRECTIVE ACTION SYSTEM(S), COMPLETE O&M INSPECTION CHECKLIST PART II.]

Acronym List

AGWMR	annual groundwater monitoring report
C	Celsius
CMEL	Compliance Monitoring Enforcement List
EPA	U.S. Environmental Protection Agency
ID	identification
IDW	investigation-derived waste
KDHE	Kansas Department of Health and Environment
L	liter
GC/MS	gas chromatograph/mass spectrometer
mL	milliliter
N/A	not applicable
NAPL	non-aqueous phase liquid
O&M	operation and maintenance
PCP	post-closure plan
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
SAP	sampling and analysis plan
SOP	standard operating procedure
SVOC	semi-volatile organic compound
SWL	static water level
THM	trihalomethane
TWD	total well depth
VOC	volatile organic compound

O&M Inspection Checklist (Part II)

Post-Closure Care/Corrective Action Systems

Kansas Department of Health and Environment
Operation and Maintenance Inspection Checklist
Bureau of Waste Management

Part II
Post-Closure Care/Corrective Action Systems

Facility Name	
Street Address	
City/County	
EPA ID	
Inspection Date(s)	

General Instructions: Instructions embedded in this checklist have been italicized to make readily distinguishable. Acronyms used are listed at the end of this checklist. For Part II, complete Section 1 and all those subsequent sections, as applicable. Use companion review guides to prepare for the inspection and to complete evaluation of system(s) upon return to the office.

Section 1: General

Instruction: Complete prior to or during inspection.

Yes No NA

A. Was post-closure care being implemented at time of inspection? ☐☐☐
   If yes, briefly describe status. Click here to enter text.
B. Identify type(s) of post-closure care unit(s): Choose an item.
   If other, indicate: Click here to enter text.
C. Was corrective action (i.e., interim measure and/or remedy) being implemented at time of inspection? ☐☐☐
   If yes, briefly describe status. Click here to enter text.
D. Identify type(s) of post-closure care and/or corrective action activity(ies) being implemented at facility in table below *[check all that apply]*:

Activity	Post-closure care	Corrective action	Complete review guide
Containment system			1
Institutional controls			2
Groundwater pump and treat/discharge			3
Monitored natural attenuation			4
Air sparge/soil vapor extraction			5
Insitu treatment			6

Other (specify)			7

E. Indicate average number of days active remedial system(s) in operation each year and average length of non-routine/unplanned downtime.
Click here to enter text.

[COMPLETE ALL SUBSEQUENT SECTION(S) AS APPLICABLE.]

Section 2: Containment Systems (N/A)

Instruction: Complete during inspection. Go to Section 3 if no containment system.

I. Complete the following assessment based on visual observation during site inspection
Instruction: Yes, No, N/A, Minor (where minor damage = no immediate repair required, but should be repaired within year, or sooner if conditions worsen), Major (where major damage = requires immediate repair)

Condition	Yes	No	N/A	Minor damage	Major damage
Bare areas or distressed vegetation					
Abnormal growth of weeds					
Side slopes in good condition					
Evidence of erosion/rilling					
Evidence of desiccation cracking					
Subsidence in cap/cover surface					
Evidence of standing water					
Evidence of burrowing activity					
Evidence of damage due to unauthorized access					
Positive drainage in all drainage swells					
Culverts intact and free of obstructions					
Leachate breakthrough observed					
Adequate access controls (e.g., fencing)					
Perimeter warning signs in place					
Overall condition of cap/cover *[circle one]*	Good	Fair	Poor		

Yes No NA

B. Does current use of property cause disturbance of final cover, liners, or other containment or monitoring systems? If yes, provide explanation. ☐☐☐
Click here to enter text.

C. Have any recent changes in groundwater production/land use occurred? ☐☐☐
If yes, provide explanation. Click here to enter text.

D. Are there any potential new receptors warranting further evaluation? ☐☐☐

Yes No NA

If yes, provide explanation. Click here to enter text.

E. Is monitoring equipment in operation and fully functional at time of inspection? ☐☐☐
If no, provide explanation. Click here to enter text.

F. Are there any new contaminant sources/releases that may affect remedy? ☐☐☐
If yes, provide explanation. Click here to enter text.

G. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events.* Click here to enter text.

Section 3: Institutional Controls (N/A)

Instruction: Complete during inspection. Go to Section 4 if no institutional controls.

M. Are institutional controls in place as expected and approved? ☐☐☐
If no, provide explanation. Click here to enter text.

N. Are institutional controls adequate to minimize potential for human exposure and to protect integrity of remedy? If no, provide explanation. ☐☐☐
Click here to enter text.

C. Have any recent changes in groundwater production/land use occurred? ☐☐☐
If yes, provide explanation. Click here to enter text.

D. Are there any potential new receptors warranting further evaluation? ☐☐☐
If yes, provide explanation. Click here to enter text.

E. Is monitoring equipment in operation and fully functional at time of inspection? ☐☐☐
If no, provide explanation. Click here to enter text.

F. Are there any new contaminant sources/releases that may affect remedy? ☐☐☐
If yes, provide explanation. Click here to enter text.

G. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events.* Click here to enter text.

Section 4: Groundwater Pump and Treat/Discharge (N/A)

Instruction: Complete during inspection. Go to Section 5 if no pump and treat system.

G. Identify groundwater remediation system(s) in place *[check all that apply]*:

System		Number of each
Groundwater recovery well	☐	
Interceptor trench	☐	

Dual phase extraction	☐	
Other Click here to enter text.	☐	

Yes No NA

H. Does as-built system configuration match approved design? ☐☐☐
If no, provide explanation. Click here to enter text.

I. Is recovery and/or treatment system operational at time of inspection? ☐☐☐
If no, provide explanation. Click here to enter text.

J. Is there evidence of fouling/plugging of treatment system? ☐☐☐
If no, provide explanation. Click here to enter text.

K. Is there evidence of release associated with recovery and/or treatment system? ☐☐☐
If yes, provide explanation. Click here to enter text.

L. Have any recent changes in groundwater production/land use occurred? ☐☐☐
If yes, provide explanation. Click here to enter text.

M. Are there any potential new receptors warranting further evaluation? ☐☐☐
If yes, provide explanation. Click here to enter text.

N. Is monitoring equipment in operation and fully functional at time of inspection? ☐☐☐
If no, provide explanation. Click here to enter text.

O. Are there any new contaminant sources/releases that may affect remedy? ☐☐☐
If yes, provide explanation. Click here to enter text.

K. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events.* Click here to enter text.

Section 5: Monitored Natural Attenuation (N/A)

Instruction: Complete during inspection. Go to Section 6 if no MNA remedy.

A. Identify associated O&M components of passive remediation system:

Groundwater monitoring	☐
Surface water monitoring	☐
Vapor intrusion monitoring	☐
Other Click here to enter text.	☐

B. Have any recent changes in groundwater production/land use occurred? ☐☐☐
If yes, provide explanation. Click here to enter text.

C. Are there any potential new receptors warranting further evaluation? ☐☐☐
If yes, provide explanation. Click here to enter text.

D. Is monitoring equipment in operation and fully functional at time of inspection? ☐☐☐

If no, provide explanation. Click here to enter text.

Yes No NA

E. Are there any new contaminant sources/releases that may affect remedy? ☐☐☐
If yes, provide explanation. Click here to enter text.

F. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events.* Click here to enter text.

Section 6: Air sparge/soil vapor extraction (N/A)

Instruction: Complete during inspection. Go to Section 7 if no AS/SVE remedy.

A. Identify whether individual or combined AS/SVE system(s).
Obtain copy of system layout diagram and include in inspection report.

Air sparge	☐
Soil vapor extraction	☐
Both	☐

B. Indicate number of AS injection wells in operation or standby mode. Indicate number of SVE extraction wells or trenches in operation or standby mode.

System	Number
Air sparge injection wells-operation	
Air sparge injection wells- standby mode	
SVE extraction wells -operation	
SVE extraction wells - standby mode	
SVE trenches-operation	
SVE trenches- standby mode	

C. Identify associated O&M components of AS/SVE remediation system:

System component inspection	☐
System component monitoring	☐
System component testing	☐
Groundwater monitoring	☐
Surface water monitoring	☐
Vapor intrusion monitoring	☐
Other Click here to enter text.	☐

	Yes	No	NA
D. Does as-built configuration match approved design? If no, provide explanation. Click here to enter text.	☐	☐	☐
E. Is system operational and fully functional at time of inspection? If no, provide explanation. Click here to enter text.	☐	☐	☐
F. Is monitoring equipment in operation and fully functional at time of inspection? If no, provide explanation. Click here to enter text.	☐	☐	☐
G. Is there evidence of excessive corrosion of blower/piping system components? If yes, provide explanation. Click here to enter text.	☐	☐	☐
H. Are blower flow rate, pressure, and discharge temperature measurements consistent with design parameters? If no, provide explanation. Click here to enter text.	☐	☐	☐
I. Are observed flow rates at each AS injection well consistent with design parameters? If no, provide explanation. Click here to enter text.	☐	☐	☐
J. Is thermal oxidizer operational characteristics (e.g., LEL history of feed gas, operating temperature, inlet flow, oxygen level in flue gas, fuel use) consistent with design parameters? If no, provide explanation. Click here to enter text.	☐	☐	☐
K. Is operational characteristics of carbon adsorber humidity controls (e.g., relative humidity data at adsorber inlet, adsorber operating temperature, carbon breakthrough, carbon change out history, operating velocity through adsorbers, adsorber discharge VOC data) consistent with equipment design parameters? If no, provide explanation. Click here to enter text.	☐	☐	☐
L. Have any recent changes in groundwater production/land use occurred? If yes, provide explanation. Click here to enter text.	☐	☐	☐
M. Are there any potential new receptors warranting further evaluation? If yes, provide explanation. Click here to enter text.	☐	☐	☐
N. Is there any new contaminant sources/releases that may affect remedy? If yes, provide explanation. Click here to enter text.	☐	☐	☐
O. Have any new buildings been constructed that may pose a vapor intrusion issue? If yes, provide explanation. Click here to enter text.	☐	☐	☐

P. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events.* Click here to enter text.

Section 7: Insitu treatment (N/A)

Instruction: Complete during inspection. Go to Section 8 if no insitu treatment.

Yes No NA

A. Indicate whether insitu bioremediation, chemical oxidation, or other (specify) system in operation. Click here to enter text.

B. Indicate number of injection wells. Click here to enter text.
Obtain copy of system layout diagram.

C. Is as-built configuration consistent with approved injection design? ☐☐☐
If no, briefly discuss design assumptions. Click here to enter text.

D. Have any recent changes in groundwater production/land use occurred? ☐☐☐
If yes, provide explanation. Click here to enter text.

E. Are there any potential new receptors warranting further evaluation? ☐☐☐
If yes, provide explanation. Click here to enter text.

F. Is there any new contaminant sources/releases that may affect remedy? ☐☐☐
If yes, provide explanation. Click here to enter text.

G. Is monitoring equipment in operation and fully functional at time of inspection? ☐☐☐
If no, provide explanation. Click here to enter text.

H. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events.* Click here to enter text.

Section 8: Other (N/A)

Instruction: Complete during inspection as applicable.

A. Describe other post-closure care/corrective action activity.
Prepare process flow diagram and/or obtain system layout diagram.
Click here to enter text.

B. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events.*
Click here to enter text.

C. Is monitoring equipment operational and fully functional during site visit? ☐☐☐

If no, provide explanation. Click here to enter text.

D. Have any recent changes in groundwater production/land use occurred? ☐☐☐
If yes, provide explanation. Click here to enter text.

E. Are there any new potential receptors warranting further evaluation? ☐☐☐
If yes, provide explanation. Click here to enter text.

F. Is there any new releases that may affect remedy? ☐☐☐
If yes, provide explanation. Click here to enter text.

Acronym List

AS	air sparge
EPA	U.S. Environmental Protection Agency
ID	identification
KDHE	Kansas Department of Health and Environment
LEL	lower explosive limit
MNA	monitored natural attenuation
N/A	not applicable
O&M	operation and maintenance
SVE	soil vapor extraction
VOC	volatile organic compound

ATTACHMENT B

Post-Closure Care/Corrective Action System Guides

Post-Closure Care/Corrective Action System Review Guide #1 Containment Systems

A. Identify containment system(s) in place below *[check all that apply]*:

System		Number of each
Cap/cover	☐	
Liner	☐	
Leachate detection	☐	
Leachate collection	☐	
Leachate management	☐	
Other Click here to enter text.	☐	

B. Identify associated O&M components *[check all that apply]*:

System component inspection/monitoring/testing	☐
Groundwater monitoring	☐
Surface water monitoring	☐
Vapor intrusion monitoring	☐
Leachate monitoring	☐
Other Click here to enter text.	☐

C. Identify general post-closure care and/or corrective action goals *[check all that apply]*:

i. Prevent direct contact with waste/contaminant source ☐

ii. Prevent migration from a waste/contaminant source to:

- Groundwater ☐
- Surface water ☐
- Soil ☐
- Sediment ☐
- Air (via wind-borne material) ☐
- Air (via volatilization) ☐
- Other Click here to enter text. ☐

iii. Prevent migration of contaminated groundwater ☐

iv. Restore groundwater to most beneficial use ☐

v. Prevent vapor intrusion or indoor air exposure ☐

vi. Other Click here to enter text.

D. Describe performance criteria against which progress is measured in attaining general project goals as identified in above. Specify frequency of measurement and reporting.Click here to enter text.
E. Identify inspection frequency/schedule and routine maintenance.
Click here to enter text.
F. Describe leachate collection, monitoring and management procedures.
Click here to enter text.

Post-Closure Care/Corrective Action System Review Guide #2 Institutional Controls

A. Identify each institutional control (media, objective or instrument) established or to be established. Click here to enter text.

B. Identify general post-closure care and/or corrective action goals *[check all that apply]*:

   i. Prevent direct contact with waste/contaminant source ☐

   ii. Prevent migration from a waste/contaminant source to:

      - Groundwater ☐
      - Surface water ☐
      - Soil ☐
      - Sediment ☐
      - Air (via wind-borne material) ☐
      - Air (via volatilization) ☐
      - Other Click here to enter text. ☐

   iii. Prevent migration of contaminated groundwater ☐

   iv. Restore groundwater to most beneficial use ☐

   v. Prevent vapor intrusion or indoor air exposure ☐

   vi. Other Click here to enter text.

C. Describe performance criteria against which progress is measured in attaining general project goals as identified in above. Specify frequency of measurement and reporting.
   Click here to enter text.

D. Identify inspection frequency/schedule and routine maintenance.
   Click here to enter text.

E. Identify party responsible for implementing institutional controls.
   Click here to enter text.

F. Assess need for institutional controls to remain in place.
   Click here to enter text.

G. Verify institutional controls adequate to minimize potential for human exposure and to protect integrity of remedy.
   Click here to enter text.

Post-Closure Care/Corrective Action System Review Guide #3 Groundwater Pump and Treat/Discharge

A. Identify groundwater remediation system(s) in place *[check all that apply]*:

System		Number of each
Groundwater recovery well	☐	
Interceptor trench	☐	
Dual phase extraction	☐	
Other Click here to enter text.	☐	

B. List target groundwater recovery depth interval(s).
Click here to enter text.

C. If recovered groundwater transported to off-site disposal facility, indicate whether hazardous or non-hazardous and identify designated facility.
Click here to enter text.

D. If recovered groundwater directed to POTW or discharged through NPDES permit without treatment, specify discharge mechanism.
Click here to enter text.

E. If recovered groundwater directed to POTW or discharged through NPDES permit after treatment, identify treatment train component(s) below *[check all that apply]*:

System		Number of each
oil/water separator	☐	
air stripper Click here to enter text.	☐	
UV/ozone; bioreactor	☐	
buffering	☐	
chemical oxidation	☐	
filtration	☐	
ion exchange	☐	
precipitation/coagulation/flocculation	☐	
adsorption/absorption	☐	
granulated activated carbon/liquid phase carbon adsorption	☐	
constructed wetland	☐	
physical separation	☐	
land application/beneficial reuse	☐	
Other Click here to enter text.	☐	

Review available process flow chart or prepare treatment train schematic.

F. Verify treatment system consistently meets required destruction and removal efficiencies, or performance goals. Click here to enter text.

G. If domestic sewage exclusion applies, describe means of conveyance and/or point of introduction into POTW sewer line. Click here to enter text.

H. If applicable, identify designated POTW facility and briefly describe POTW pre-treatment requirements. Click here to enter text.

I. Determine whether applicable hazardous waste management standards related to accumulation, transport, or management of hazardous waste (listed or characteristic) are met prior to introduction into POTW sewer line. Click here to enter text.

J. If applicable, describe any treatment residuals or sludge management. *If hazardous, obtain copy of most recent manifest.* Click here to enter text.

K. If NPDES-discharge exclusion applies, identify point of discharge and briefly describe NPDES permit requirements. Click here to enter text.

L. Identify associated O&M components of groundwater remediation system *[check all that apply]*:

System component inspection/monitoring/testing	☐
Groundwater monitoring	☐
Surface water monitoring	☐
Vapor intrusion monitoring	☐
Leachate monitoring	☐
Other Click here to enter text.	☐

M. Identify general post-closure care and/or corrective action goals *[check all that apply]*:

i. Prevent direct contact with waste/contaminant source ☐

ii. Prevent migration from a waste/contaminant source to:

- Groundwater ☐
- Surface water ☐
- Soil ☐
- Sediment ☐
- Air (via wind-borne material) ☐
- Air (via volatilization) ☐
- Other Click here to enter text. ☐

iii. Prevent migration of contaminated groundwater ☐

iv. Restore groundwater to most beneficial use ☐

v. Prevent vapor intrusion or indoor air exposure ☐

vi. Other Click here to enter text.

N. Describe performance criteria against which progress is measured in attaining general project goals as identified in above. Specify frequency of measurement and reporting.Click here to enter text.

O. Identify inspection frequency/schedule and routine maintenance.
Click here to enter text.

P. Describe steps taken to ensure proper maintenance and efficiency of equipment.
Click here to enter text.

Q. Determine whether approaches used to interpret groundwater monitoring data (e.g., concentration trends, contaminant distribution or plume maps/cross-sections, water table/potentiometric surface maps, etc.) provide sufficient information to assess performance of groundwater pump and treat/discharge remedy. Click here to enter text.

R. Evaluate whether target capture zone in groundwater accurately determined.
Click here to enter text.

S. Describe lines of evidence used to verify adequacy of capture to contain and/or remove subsurface contamination (e.g., flow budget and/or capture zone width calculations, water table/potentiometric surface maps, vertical gradients, concentration trends in wells within and beyond target capture zone, particle tracking/groundwater modeling, tracer testing, etc.).
Click here to enter text.

T. Describe any secondary contamination issues (e.g., resulting from mobilization of naturally-occurring elements/substances in present of site-related contamination, degradation byproducts). Click here to enter text.

U. Assess sufficiency of performance monitoring and/or O&M reports in terms of quality and frequency to facilitate determination of remedy effectiveness.
Click here to enter text.

V. Determine need for optimization evaluation of performance monitoring network in terms of parameters, sampling methods/frequency, and monitoring locations to enhance evaluation of remedy performance.
Click here to enter text.

W. Determine need for optimization evaluation of groundwater recovery locations and extraction rates. Click here to enter text.

X. Determine whether operational data suggest need to adjust pumping rates or total volume pumped, pulse-pump, or rebound test to speed overall remediation (i.e., when asymptotic conditions reached or cleanup goals achieved). Click here to enter text.

Y. Summarize date(s)/circumstance(s) of non-routine or unplanned downtime event(s).

Circumstance	Date(s)
Click here to enter text.	
Click here to enter text.	
Click here to enter text.	
Click here to enter text.	

Describe corrections/improvements made (or to be made) to minimize future downtime. Click here to enter text.

Z. Describe any major repairs to pump and treat system. Assess progress towards achieving remediation goals. Click here to enter text.

AA. Assess whether air emissions from system meet permit requirements. Click here to enter text.

BB. Assess whether effluent discharge met acceptance criteria for receiving facility or permit limits. Click here to enter text.

CC. Evaluate whether operational data/measurements consistent with design parameters based on process monitoring:

Parameter	Yes	No	N/A
Extraction rate			
Influent rate to treatment train			
Influent/effluent concentrations			
Mass loading to system			
Removal efficiency for each component			
Air/water ratio (air strippers)			
Materials usage (e.g., chemicals, granular activated carbon)			
Overall condition of system *[circle one]*	Good	Fair	Poor

Post-Closure Care/Corrective Action System Review Guide #4 Monitored Natural Attenuation

A. Describe data collected to verify MNA processes occurring in subsurface. Click here to enter text.
B. Indicate type(s) of reaction zone(s) determined present. Choose an item.
C. Identify associated O&M components of passive remediation system:

Groundwater monitoring	☐
Surface water monitoring	☐
Vapor intrusion monitoring	☐
Other Click here to enter text.	☐

D. Identify general post-closure care and/or corrective action goals *[check all that apply]*:
   i. Prevent direct contact with waste/contaminant source ☐
   ii. Prevent migration from a waste/contaminant source to:
      - Groundwater ☐
      - Surface water ☐
      - Soil ☐
      - Sediment ☐
      - Air (via wind-borne material) ☐
      - Air (via volatilization) ☐
      - Other Click here to enter text. ☐
   iii. Prevent migration of contaminated groundwater ☐
   iv. Restore groundwater to most beneficial use ☐
   v. Prevent vapor intrusion or indoor air exposure ☐
   vi. Other Click here to enter text.

E. Describe performance criteria against which progress is measured in attaining general project goals as identified in above. Specify frequency of measurement and reporting. Click here to enter text.
F. Identify inspection frequency/schedule and routine maintenance. Click here to enter text.
G. Assess sufficiency of performance monitoring and/or O&M reports in terms of quality and frequency to facilitate determination of remedy effectiveness. Click here to enter text.
H. Determine whether approaches used to interpret groundwater monitoring data (e.g., concentration trends, contaminant distribution or plume

maps/cross-sections, water table/potentiometric surface maps, etc.) provide sufficient information to assess performance of groundwater pump and treat/discharge remedy. Click here to enter text.

I. Determine need for optimization evaluation of performance monitoring network in terms of parameters, sampling methods/frequency, and monitoring locations to enhance evaluation of remedy performance.
   Click here to enter text.
J. Identify recent changes in groundwater production/land use.
   Click here to enter text.
K. Identify any new potential receptors warranting further evaluation.
   Click here to enter text.
L. For newly identified or eliminated contaminant sources, describe impact on achieving remediation goals in reasonable timeframe.
   Click here to enter text.
M. Characterize change in horizontal extent of plume. Choose an item.
   Briefly describe nature and magnitude of change. Click here to enter text.
N. Characterize change in vertical extent of plume. Choose an item.
   Briefly describe nature and magnitude of change. Click here to enter text.
O. Characterize change/trend in maximum contaminant concentration(s).
   Choose an item.
   Briefly describe nature and magnitude of change and any apparent trends.
   Click here to enter text.
P. Determine whether change in groundwater flow rate or direction suggests need for reevaluation of monitoring frequency and location.
   Click here to enter text.
Q. Determine whether periodic pulses of residual contamination from vadose zone suggest need for additional monitoring locations.
   Click here to enter text.
R. Identify any potentially toxic and/or mobile transformation products resulting from MNA processes. Click here to enter text.
S. Determine whether general project goals remain realistic to attain.
   Click here to enter text.
T. Assess whether selected remedy is performing as intended and contingent remedy implementation needed.
   Click here to enter text.

Post-Closure Care/Corrective Action System Review Guide #5
Air Sparge/Soil Vapor Extraction

A. Identify whether individual or combined system(s).
Obtain copy of system layout diagram and include in inspection report.

Air sparge	☐
Soil vapor extraction	☐
Both	☐

B. Indicate number of AS injection wells in operation or standby mode. Indicate number of SVE extraction wells or trenches in operation or standby mode.

System	Number
Air sparge injection wells-operation	
Air sparge injection wells- standby mode	
SVE extraction wells -operation	
SVE extraction wells - standby mode	
SVE trenches-operation	
SVE trenches- standby mode	

C. Identify associated O&M components of AS/SVE remediation system:

System component inspection	☐
System component monitoring	☐
System component testing	☐
Groundwater monitoring	☐
Surface water monitoring	☐
Vapor intrusion monitoring	☐
Other Click here to enter text.	☐

D. Identify general post-closure care and/or corrective action goals *[check all that apply]*:

i. Prevent direct contact with waste/contaminant source ☐

ii. Prevent migration from a waste/contaminant source to:

- Groundwater ☐
- Surface water ☐
- Soil ☐
- Sediment ☐
- Air (via wind-borne material) ☐

- Air (via volatilization) ☐
- Other Click here to enter text. ☐

iii. Prevent migration of contaminated groundwater ☐

iv. Restore groundwater to most beneficial use ☐

v. Prevent vapor intrusion or indoor air exposure ☐

vi. Other Click here to enter text.

E. Describe performance criteria against which progress is measured in attaining general project goals as identified in above. Specify frequency of measurement and reporting.Click here to enter text.

F. Identify inspection frequency/schedule and routine maintenance. Click here to enter text.

G. Describe evidence of excessive corrosion of blower/piping system components.Click here to enter text.

H. Evaluate whether consistent operation of all blowers, water separators, valves, and piping components.Click here to enter text.

I. If blowers operated intermittently, determine if VOC concentrations increase after shut off. Click here to enter text.

J. Determine whether blower flow rate, pressure, and discharge temperature measurements consistent with design parameters.Click here to enter text.

K. Determine whether SVE system characteristics deviate consistently/frequently from operational expectations based on design parameters. Check all that apply:

Vapor flow rates at one or more extraction wells	☐
Vapor composition (VOCs, CO_2, O_2) at one or more extraction wells	☐
Flow at blower (prior to entry of any dilution air if used)	☐
Accumulation of water in water separator	☐
Other Click here to enter text.	☐

Discuss deviations/trends and causes for such.Click here to enter text.

L. Verify flow rates at each AS injection well consistently maintained within system design parameters. Click here to enter text.

M. Verify AS system measured dissolved oxygen concentrations consistently indicative of good air/water contact rate (i.e., concentrations near saturation).Click here to enter text.

N. Summarize date(s)/circumstance(s) of non-routine or unplanned downtime event(s). Describe corrections/improvements made (or to be made) to minimize future downtime.Click here to enter text.

O. Describe any major repairs to AS/SVE system. Assess progress towards achieving remediation goals.Click here to enter text.

P. Verify SVE system VOC control device consistently met performance and compliance monitoring requirements (e.g., permit emission limits). Click here to enter text.

Q. Verify VOC control system consistently met required destruction and removal efficiencies. Click here to enter text.

R. Verify thermal oxidizer operational characteristics (e.g., LEL history of feed gas, operating temperature, inlet flow, oxygen level in flue gas, fuel use) consistent with design parameters. Click here to enter text.

S. Verify operational characteristics of carbon adsorber humidity controls (e.g., relative humidity data at adsorber inlet, adsorber operating temperature, carbon breakthrough, carbon change out history, operating velocity through adsorbers, adsorber discharge VOC data) consistent with equipment design parameters. Click here to enter text.

T. Verify air emissions from system meet permit requirements. Click here to enter text.

U. Determine performance monitoring and/or O&M reports are of sufficient quality and frequency to determine remedy effectiveness. Click here to enter text.

V. Evaluate whether operational data suggest need to redistribute system flows or rebound test to speed overall remediation (i.e., reduce or eliminate flow to/from wells where removals reach asymptotic conditions or cleanup goals achieved) Click here to enter text..

W. Evaluate whether diffusion-limited VOC movement suggested by data and if operations should be modified to pulsing (intermittent mode). Click here to enter text.

X. Determine whether approaches used to interpret groundwater monitoring data (e.g., concentration trends, contaminant distribution or plume maps/cross-sections, water table/potentiometric surface maps, etc.) provide sufficient information to assess performance of AS/SVE remedy. Click here to enter text.

Y. Determine whether soil and/or groundwater data (e.g., VOC concentrations, groundwater elevations) suggest need to reevaluate other aspects of monitoring program (e.g., monitoring locations, test parameters) to account for new information/unforeseen circumstances. Click here to enter text.

Z. Assess whether reduced VOC removal rates warrant reduction in monitoring frequency. Click here to enter text.

AA. Determine whether reduced VOC recovery rates warrant elimination of VOC control device. Click here to enter text.

BB. Determine whether optimization evaluation of performance monitoring network in terms of parameters, sampling methods/frequency, and monitoring locations warranted to enhance evaluation of remedy performance. Click here to enter text.

CC. Assess recent changes in groundwater production/land use. Click here to enter text.

DD. Assess whether newly identified potential receptors warrant further evaluation.Click here to enter text.

EE. Assess evidence of unacceptable vapor intrusion in nearby structures.Click here to enter text.

FF. For newly identified or eliminated contaminant sources, describe impact on achieving remediation goals in reasonable timeframe. Click here to enter text.

GG. Characterize change in horizontal extent of plume. Choose an item. If changed, briefly describe nature and magnitude of change. Click here to enter text.

HH. Characterize change in vertical extent of plume. Choose an item. If changed, briefly describe nature and magnitude of change. Click here to enter text.

II. Characterize change/trend in maximum contaminant concentration(s). Choose an item. Briefly describe nature and magnitude of change and any apparent trends. Click here to enter text.

JJ. Evaluate whether change in groundwater flow rate or direction suggests need for reevaluation of monitoring frequency and location. Click here to enter text.

KK. Determine if change in off-gas characteristics. Click here to enter text.

LL. Evaluate whether periodic pulses of residual contamination from vadose zone suggests need for additional monitoring locations. Click here to enter text.

MM. Operational data indicates need to modify/optimize AS/SVE system as follows. Check all that apply:

Use intermittent operation	☐
Optimize flows to/from wells to promote increased removals	☐
Increase use of sparging to promote biodegradation	☐
Add new wells if contaminant movement towards areas outside system influence	☐

Other Click here to enter text.	☐

NN. Determine whether general project goals remain realistic to attain.
Click here to enter text.

OO. Determine whether selected remedy performing as intended and if need to consider contingent remedy implementation. Click here to enter text.

Post-Closure Care/Corrective Action System Review Guide #6 Insitu treatment

A. Indicate whether insitu bioremediation, chemical oxidation, or other (specify) system in operation. Click here to enter text.
B. Indicate if system design (e.g., injection well spacing) based on bench-scale treatability study or pilot testing and describe design assumptions. Click here to enter text.
C. Indicate number of injection wells. Click here to enter text.
Obtain copy of system layout diagram.
D. Describe if injection wells screened full vertical extent of plume. Click here to enter text.
E. Verify whether or not UIC permit application approved and, if so, indicate date approved. Click here to enter text.
F. Identify type(s) of reaction zone(s) determined present. Choose an item.
G. For insitu bioremediation, identify substrate (e.g., carbon source) injected and frequency of injection. Click here to enter text.
H. For insitu chemical oxidation, identify oxidant injected and frequency of injection. Click here to enter text.
I. Determine if there is sufficient contact or residence time. Click here to enter text.
J. Identify general post-closure care and/or corrective action goals *[check all that apply]*:

i. Prevent direct contact with waste/contaminant source ☐
ii. Prevent migration from a waste/contaminant source to:
   - Groundwater ☐
   - Surface water ☐
   - Soil ☐
   - Sediment ☐
   - Air (via wind-borne material) ☐
   - Air (via volatilization) ☐
   - Other Click here to enter text. ☐
iii. Prevent migration of contaminated groundwater ☐
iv. Restore groundwater to most beneficial use ☐
v. Prevent vapor intrusion or indoor air exposure ☐
vi. Other Click here to enter text.

K. Describe performance criteria against which progress is measured in attaining general project goals as identified in above. Specify frequency of measurement and reporting.

Click here to enter text.

L. Identify inspection frequency/schedule and routine maintenance.
Click here to enter text.

M. Determine whether approaches used to interpret groundwater monitoring data (e.g., concentration trends, contaminant distribution or plume maps/cross-sections, water table/potentiometric surface maps, etc.) provide sufficient information to assess performance of groundwater pump and treat/discharge remedy. Click here to enter text.

N. Determine whether soil and/or groundwater data (e.g., VOC concentrations, groundwater elevations) suggests need to reevaluate other aspects of monitoring program (e.g., monitoring locations, test parameters) to account for new information/unforeseen circumstances. Click here to enter text.

O. Determine whether optimization evaluation of performance monitoring network in terms of parameters, sampling methods/frequency, and monitoring locations warranted to enhance evaluation of remedy performance.
Click here to enter text.

P. Describe recent changes in groundwater production/land use.
Click here to enter text.

Q. Determine if newly identified potential receptors warrant further evaluation.
Click here to enter text.

R. Assess evidence of unacceptable vapor intrusion in nearby structures.
Click here to enter text.

S. For newly identified or eliminated contaminant sources eliminated, describe impact on achieving remediation goals in reasonable timeframe.
Click here to enter text.

T. Characterize change in horizontal extent of plume. Choose an item.
If changed, briefly describe nature and magnitude of change.
Click here to enter text.

U. Characterize change in vertical extent of plume. Choose an item.
If changed, briefly describe nature and magnitude of change.
Click here to enter text.

V. Characterize change/trend in maximum contaminant concentration(s).
Choose an item. Briefly describe nature and magnitude of change and any apparent trends. Click here to enter text.

W. Determine whether change in groundwater flow rate or direction suggests need for reevaluation of monitoring frequency and location.
Click here to enter text.

X. Determine whether general project goals remain realistic to attain.
Click here to enter text.

Y. Verify if insitu remedy not performing as intended and need to consider contingent remedy implementation. Click here to enter text.

Post-Closure Care/Corrective Action System Review Guide #7 Other

A. Describe other post-closure care/corrective action activity.
Prepare process flow diagram and/or obtain system layout diagram.
Click here to enter text.

B. List all site events since last evaluation that impact or may impact post-closure care/remedy performance. *Provide a chronology of events (e.g., site visits, equipment failures, shutdowns, vandalism, storm events); elaborate on significant site events*
Click here to enter text.

C. Identify general post-closure care and/or corrective action goals *[check all that apply]*:

i. Prevent direct contact with waste/contaminant source ☐
ii. Prevent migration from a waste/contaminant source to:
- Groundwater ☐
- Surface water ☐
- Soil ☐
- Sediment ☐
- Air (via wind-borne material) ☐
- Air (via volatilization) ☐
- Other Click here to enter text. ☐

iii. Prevent migration of contaminated groundwater ☐
iv. Restore groundwater to most beneficial use ☐
v. Prevent vapor intrusion or indoor air exposure ☐
vi. Other Click here to enter text.

D. Describe performance criteria against which progress is measured in attaining general project goals as identified in above. Specify frequency of measurement and reporting. . Click here to enter text.

E. Identify inspection frequency/schedule and routine maintenance. Click here to enter text.

F. Describe steps taken to ensure proper maintenance and efficiency of equipment.Click here to enter text.

G. Determine whether approaches used to interpret groundwater monitoring data (e.g., concentration trends, contaminant distribution or plume maps/cross-sections, water table/potentiometric surface maps, etc.) provide sufficient information to assess remedy performance. Click here to enter text.

H. Assess adequacy of baseline data and post-remedy data to perform statistical comparisons and evaluate remedy performance. Click here to enter text.

I. Determine whether remedial system performing as expected relative to remediation milestones and goals. Click here to enter text.
J. Determine whether treatment system consistently meets required destruction and removal efficiencies, or performance goals. Click here to enter text.
K. Evaluate whether monitoring data indicates trends/patterns consistent with remedial design expectations. Click here to enter text.
L. Describe whether downtime associated with non-routine O&M exceeded expectations. Click here to enter text.
M. Based on non-routine downtime and optimization considerations, describe whether system operations should be modified to improve remedy performance. Click here to enter text.
N. Evaluate whether routine maintenance activities are adequate to ensure reliable operation of remedial system. Click here to enter text.
O. Assess whether soil and/or groundwater data (e.g., VOC concentrations, groundwater elevations) suggest need to reevaluate other aspects of monitoring program (e.g., monitoring locations, test parameters) to account for new information/unforeseen circumstances. Click here to enter text.
P. Determine whether optimization evaluation of performance monitoring network in terms of parameters, sampling methods/frequency, and monitoring locations warranted to enhance evaluation of remedy performance. Click here to enter text.
Q. Identify recent changes in groundwater production/land use. Click here to enter text.
R. Identify any new potential receptors warranting further evaluation. Click here to enter text.
S. For newly identified or eliminated contaminant sources, describe impact on achieving remediation goals in reasonable timeframe. Click here to enter text.
T. Characterize change in horizontal extent of plume. Choose an item.
If changed, briefly describe nature and magnitude of change.
Click here to enter text.
U. Characterize change in vertical extent of plume. Choose an item.
If changed, briefly describe nature and magnitude of change. Click here to enter text.

V. Characterize change/trend in maximum contaminant concentration(s). Choose an item. Briefly describe nature and magnitude of change and any apparent trends. Click here to enter text.
W. Assess if change in groundwater flow rate or direction suggests need for reevaluation of monitoring frequency and location. Click here to enter text.
X. Determine whether general project goals remain realistic to attain. Click here to enter text.
Y. Determine whether selected remedy not performing as intended and need to consider contingent remedy implementation. Click here to enter text.

ATTACHMENT C

Monitoring Well Integrity Worksheet

Monitoring Well Integrity Worksheet

Well ID	Photo Number	Static Water Level (ft)	Total Well Depth (ft)	Product Level (ft)	Well Type (flushmount or stickup)	Lock in Place (Yes/No)	Protective Casing Condition* (Good/Bad)	Concrete Pad Condition** (Good/Bad)	Weep Hole (Yes/No)	Survey Elevation Mark (Yes/No)	Inner Casing Condition (Good/Bad)	Inner Protective Cap (Yes/No)	Split Samples (Yes/No)	Other

*Examples: evidence of collision damage, casing degradation, identification number legibility, etc.
**Examples: evidence of frost heave, well subsidence, cracking, etc.

Comments: _____

_____

ATTACHMENT D

O&M Report Photo Log Template

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
DIVISION OF ENVIRONMENT
BUREAU OF WASTE MANAGEMENT
Photos have not been altered except to change the size of the file

Site: Click here to enter text. EPAID: Click here to enter text.
Address: Click here to enter text. City: Click here to enter text.
County: Click here to enter text. Camera: Click here to enter text.
Legal: Click here to enter text. Taken by: Click here to enter text.

Photo Number: _____
Date: _____
Time: _____
Direction Faced: _____
Weather:

Description:

Photo Number: _____
Date: _____
Time: _____
Direction Faced: _____
Weather:

Description:

Photo Number: _____
Date: _____
Time: _____
Direction Faced: _____
Weather:

Description:

Photo Number: _____
Date: _____
Time: _____
Direction Faced: _____
Weather:

Description:

ATTACHMENT E

O&M Report Template

[Facility Owner/Operator]
[Facility Name]
[City], KS
EPA I.D. [KSXXXXXXXXXX]

Kansas Department of Health and Environment
Waste Management

1000 SW Jackson, Suite 320
Topeka, KS 66612-1366

[DRAFT/FINAL] GROUNDWATER MONITORING SYSTEM [POST-CLOSURE CARE/CORRECTIVE ACTION SYSTEM(S)] OPERATION & MAINTENANCE INSPECTION REPORT

[MONTH YEAR]

Prepared by
Hazardous Waste Permits Section
Bureau of Waste Management

EXECUTIVE SUMMARY

Tailor this example boilerplate language to your situation and expand as necessary to briefly describe post-closure and/or corrective action components of O&M inspection. Try to keep executive summary to one page.

The Kansas Department of Health and Environment (KDHE) conducts routine Operation & Maintenance (O&M) inspections to evaluate groundwater monitoring, post-closure care and/or corrective action system(s) at current or former hazardous waste management facilities in Kansas as regulated by the Resource Conservation and Recovery Act (RCRA). This O&M evaluation consists of a review of the site-wide groundwater monitoring activities at the [FACILITY/SITE NAME] in [CITY], Kansas. The information in this O&M inspection report was obtained from observations during the [MONTH DAY YEAR] sampling event, as well as historical information in KDHE files.

During the O&M inspection, KDHE reviewed operating records, evaluated the condition of the monitoring wells, and observed the techniques used by the sampling team as they measured water level, product level, and total well depths. KDHE representatives also observed well purging procedures, groundwater sample collection, and quality assurance/quality control (QA/QC) field procedures. In addition to observing and evaluating the sampling team's techniques and procedures, KDHE also obtained groundwater split samples at [NUMBER] monitoring wells. All split samples were analyzed by KDHE's laboratory for comparison with the facility's reported results.

Observation and review of the sampling procedures conducted during the inspection were evaluated with respect to the [DOCUMENT DATE AND NAME] and found to be adequate. Analytical results reported by the facility were found to be valid and consistent with KDHE laboratory results. Inspection of the regulated landfill confirmed that the facility is maintaining the unit in accordance with the facility's post-closure plan.

Overall, KDHE determined that operation and maintenance of the facility's groundwater monitoring system and regulated landfill is being conducted in accordance with the facility's post-closure plan and approved sampling and analysis plan with no violation or deficiency noted. In addition, operating records reviewed during the inspection were found to be complete and well organized.

Facility Name	
Street Address	
City, State	
EPA ID No.	
Date(s) of Inspection	

	Name	***Title***	***Affiliation***
KDHE Inspector(s)			
Facility Contact			
Others Present			

<u>Section 1: General Information</u>
General Facility – Description
ADD TEXT

Section 2: [Groundwater] Monitoring System

[Groundwater] Monitoring System – Description

ADD TEXT

[Groundwater] Monitoring System – Past Deficiencies and Resolution

Please use numbered list format.

ADD TEXT

[Groundwater] Monitoring System – Current Deficiencies

Please use numbered list format to the extent possible and/or insert summary table.

ADD TEXT

[Groundwater] Monitoring System – Required Actions/Areas of Improvement

Please use numbered list format to the extent possible.

ADD TEXT

Section 3: Post-Closure Care

Post-Closure Care – Description

ADD TEXT

Post-Closure Care – Past Deficiencies and Resolution

Please use numbered list format.

ADD TEXT

Post-Closure Care – Current Deficiencies

Please use numbered list format to the extent possible and/or insert summary table.

ADD TEXT

Post-Closure Care – Required Actions/Areas of Improvement

Please use numbered list format to the extent possible.

ADD TEXT

Section 4: Corrective Action

Corrective Action – Description

ADD TEXT

Corrective Action – Past Deficiencies and Resolution

Please use numbered list format.

ADD TEXT

Corrective Action – Current Deficiencies

Please use numbered list format to the extent possible and/or insert summary table.

ADD TEXT

Corrective Action – Required Actions/Areas of Improvement

Please use numbered list format to the extent possible.

ADD TEXT

Section 5: Conclusions and Recommendations

Other Comments/Recommendations

Please use numbered list format to the extent possible.

ADD TEXT

Conclusions

ADD TEXT

TABLES

1 – Top of Casing and Groundwater Surface Elevations

2 – Total Depths and Siltation Values

3 – Comparison of KDHE and [Facility] Analytical Data (with RPD)

4 – Sample Schedule

FIGURES

1 – Facility Location Map

2 – Monitoring Well Network Map

3 – Potentiometric Surface Map(s)

4 – Contaminant Distribution or Isoconcentration Map(s)

5 – Remedial System Layout or Process Flow Schematic

APPENDICES

A – O&M Inspection Checklist(s) (Parts I and II)

B – Monitoring Well Integrity Worksheet

C – Inspection Photographs

D – KDHE Field Logbook

E – [Facility] Field Logbook/Forms

F – KDHE Analytical Results

G – [Facility] Analytical Results

REFERENCES

ADD TEXT FOLLOWING THIS EXAMPLE:

1 – Annual Groundwater Monitoring Report, prepared by [Consultant] for [Facility], [YEAR].

ATTACHMENT F

Common Technical Issues

ATTACHMENT F

Common Technical Issues

This table presents examples of common technical issues that may constitute noncompliance on the part of an owner/operator. The project manager should use this table to identify deficiencies/areas of improvement and to assess whether or not a specific violation has occurred. Subject to unit/section management approval, violations will be determined on a site-specific basis before any entry is made in RCRAInfo.

Objective	Technical issue	Supporting citation(s)
Follow specified groundwater sample collection and analysis procedures	⌗ Failure to follow approved sampling and analysis plan ⌗ Failure to follow permit conditions ⌗ Failure to properly decontaminate equipment ⌗ Failure to properly purge well prior to sample collection ⌗ Failure to properly collect static water level measurements ⌗ Failure to collect samples within 24 hours of purging ⌗ Failure to use proper sampling devices, sample containers, or preservation/collection techniques ⌗ Failure to use laboratory certified by the State of Kansas for analyses performed	264.97(d) and (e) 264.98(f) 264.99(g)
		265.92(a)
Maintain an operating record	⌗ Failure to keep a written operating record at facility ⌗ Failure to maintain operating record covering all operation and maintenance activities for minimum of three years ⌗ Unable to produce complete operating record at time of inspection	264.73(a) and (b) 264.74(a)
		265.73(a) and (b) 265.74(a)
		270.30(h) 270.30(i)(2) 270.30(j)(2)

Implement suitable operation and maintenance program for groundwater monitoring, post-closure care, and/or corrective action systems	⌗ Failure to develop inventory of all sampling devices/purging equipment in use at facility including manufacturer's name, model number, and serial number ⌗ Failure to develop detailed operating, calibration and maintenance procedures for each sampling device ⌗ Failure to describe decision criteria to be used to replace or repair sampling equipment and/or monitoring wells ⌗ Failure to maintain schedules for performing operation and maintenance activities	264.15(b) 264.15(b)(1) 264.15(b)(2) 264.15(b)(3) 264.15(b)(4) 264.73(b)(6) 264.74(a) 264.97(c) 264.97(f) 264.98(e) 264.99(e)
	⌗ Failure to maintain groundwater monitoring records which provide information on: date/time/place of sample collection or measurement, individual(s) who perform sample collection or measurement, date(s) analyses performed, analytical methods or techniques used, and analytical results ⌗ Failure to maintain records of all monitoring information including all calibration and maintenance records ⌗ Failure to maintain records of	265.15(b) 265.15(b)(1) 265.15(b)(3) 265.15(b)(4) 265.73(b) 265.73(b)(5) 265.73(b)(6) 265.74(a) 265.92(d) 265.93(f) 265.94(a) 265.94(a)(1)

	monitoring information including determination of groundwater surface elevations ⌗ Failure to assess groundwater flow rate and direction in uppermost aquifer on annual basis ⌗ Failure to prepare accurate potentiometric surface maps ⌗ Failure to develop procedures to assess degradation of well casing ⌗ Failure to properly mark each well with ID number or surveyed reference mark ⌗ Failure to ensure well caps in place ⌗ Failure to survey all wells to same benchmark or survey data missing ⌗ Failure to maintain proper documentation on field forms or logbook	270.30(e) 270.30(j)(2) 270.30(j)(3)
Ensure continued integrity of individual wells in groundwater monitoring system	⌗ Evidence of siltation ⌗ Discrepancy in total depth in comparison to “as-built” ⌗ Evidence of cracked, corroded, or degraded condition ⌗ Evidence of burrowing activity ⌗ High pH level exhibited ⌗ Evidence of biofouling ⌗ Change in hydraulic performance characteristics ⌗ Evidence of improper well siting ⌗ Failure to replace wells as needed	264.97(a) 264.97(c)
		265.91(a) 265.91(c)
Continue to satisfy groundwater monitoring system design objectives	⌗ Evidence of improper well siting ⌗ Failure to replace wells as needed	264.97(a)
		265.91(a) and (c)
		270.30(e)

Collect groundwater samples properly	⌗ Failure to evacuate stagnant water from well before sampling ⌗ Failure to sample wells within reasonable amount of time after well evacuation ⌗ Inappropriate filtration of sample before analysis ⌗ Failure to use appropriate sampling device ⌗ Failure to use proper sample preservation techniques ⌗ Failure to use sample collection device of compatible material construction ⌗ Failure to clean non-dedicated sampling devices between sample locations ⌗ Improper use of sampling device such that sample quality affected ⌗ Improper handling of samples or inadequate sample volume collected ⌗ Failure to establish procedures for detecting/sampling immiscible layers ⌗ Failure to follow appropriate QA/QC procedures ⌗ Failure to use proper chain-of-custody procedures ⌗ Failure to use proper analytical method ⌗ Failure to meet acceptable stabilization criteria during well purging ⌗ Failure to use proper sample containers	265.90(a) 265.92(a) 265.93(d)(4)
		270.14(c)(4)
Maintain post-closure care system	⌗ Failure to maintain waste containment systems	264.117(a) thru (c)
	⌗ Failure to perform general post-closure requirements	265.117(a) thru (c)
Maintain corrective action system	⌗ Failure to perform general corrective action requirements	264.101

STANDARD OPERATING PROCEDURE BWM-011

GUIDELINES FOR CONDUCTING a COMPREHENSIVE GROUNDWATER MONITORING EVALUATION (CME)

TABLE OF CONTENTS

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3.0	GENERAL GUIDANCE	126

ATTACHMENT A: Hydrogeologic Assessment Guidance

ATTACHMENT B: CME Report Outline

ATTACHMENT C: List of Technical Inadequacies That May Constitute Violations

Concurrences and Approvals

Concurrences: Bureau of Waste Management

Name: Kenneth Powell
Title: Chief, Compliance & Enforcement, Waste Reduction & Assistance Section

Signature Ken Powell Date 2/26/2020

Name: Mindy Bowman
Title: Chief, Solid Waste Permits Section

Signature Mindy Bowman Date 2/26/2020

Name: Maura O'Halloran
Title: Chief, Hazardous Waste Permits Section

Signature Maura O'Halloran Date 2/27/2020

Approvals: Bureau of Waste Management

Name: Jason Koontz
Title: Quality Assurance Officer, Bureau of Waste Management

Signature Jason Koontz Date 2/27/2020

Name: Julie Coleman
Title: Director, Bureau of Waste Management

Signature Julie Coleman Date 2/27/2020

Approvals: Division of Environment

Name: Michelle Probasco
Title: Quality Assurance Officer, Division of Environment

Signature Michelle Probasco Date 2/27/2020

Name: Leo Henning
Title: Director, Division of Environment

Signature Leo Henning Date 2-28-2020

SOP No. BWM-011

STANDARD OPERATING PROCEDURE for a COMPREHENSIVE GROUNDWATER MONITORING EVALUATION (CME)

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish uniform procedures for performing a Comprehensive Groundwater Monitoring Evaluation (CME) at RCRA regulated facilities. A CME is required for the evaluation of a facility's RCRA compliance with 40 CFR, Parts 264 and 265 Subparts F, and 40 CFR 270.

2.0 INTRODUCTION

A comprehensive groundwater monitoring evaluation (CME) determines whether an owner or operator has a groundwater monitoring system in place that is adequately designed, operated, and maintained to detect releases or to define the rate and extent of contaminant migration from a RCRA unit where groundwater monitoring is required. Specifically, a CME is intended to assess:

a. The adequacy of the information on which the design of the groundwater monitoring system is based;
b. The adequacy of the groundwater monitoring system's design and construction; and
c. The adequacy of the groundwater monitoring system's operation

3.0 GENERAL GUIDANCE

A CME is comprised of two major components: an Operation and Maintenance (O&M) inspection and a Hydrogeologic Assessment (HGA).

a. The Operation and Maintenance (O&M) inspection evaluates how an owner or operator of a facility operates and maintains its RCRA groundwater monitoring system. Guidance for performing an O&M inspection may be found in the Standard Operating Procedure for Groundwater Monitoring System Operation and Maintenance (O&M) inspection document.

b. A Hydrogeologic Assessment (HGA) addresses the adequacy of the groundwater monitoring system's design and construction. The guide for performing such an assessment is described in detail in Attachment A. This assessment is an in-depth technical evaluation to determine the adequacy of the groundwater monitoring system. Due to the nature of this evaluation, qualified professionals with expertise in geology and/or hydrogeology must be involved to adequately perform these assessments.

The combined product of these two components results in the overall comprehensive groundwater evaluation of a facility's groundwater monitoring system and provides the basis for determining the compliance status and for developing future enforcement strategies to correct deficiencies. The actual end product of the CME process is a narrative report that summarizes the results of the

O&M inspection and HGA, and it consolidates all of the information into one package for use by permits and/or compliance personnel. The final CME report will identify the deficiencies of the groundwater monitoring system in meeting regulatory requirements and will list them in such a manner that the specific items can be incorporated directly into subsequent compliance orders if necessary. In addition to this SOP, a number of guidance documents from EPA are available online or in the BWM library for assistance in performing a CME (EPA's 1986 Draft Technical Enforcement Guidance Document (TEGD) is a very important reference), and referring to such guidance within the CME report is encouraged. For guidance on structuring a CME report, refer to Attachment B for an example of a KDHE final CME report outline.

Within 30 days of performing the inspection, the project manager needs to send a letter conveying preliminary findings of the inspection to the facility. At this time the RCRAInfo database is to be updated to list that the inspection was performed on the date of the field visit. The project manager should list any deficiencies that are included in the preliminary findings on the CMEL form, but should also indicate on the form that additional deficiencies may be determined prior to finalizing the report. Deficiencies that are clearly inconsistent with a regulation or a KDHE approved plan will be considered to be violations, and KDHE needs to communicate with the facility and schedule a date for the facility's return to compliance. The tables in Attachment C are provided to assist the project manager in determining whether violations of applicable regulations exist; however, in addition to violations, the inspector occasionally notices conditions for which citing a violation is not warranted, but the facility should improve upon to avoid future problems. For each deficiency that is not a violation, KDHE should give a written recommendation to correct the deficiency. For this second type of deficiency, the information needs to be listed on RCRAInfo, but only in the comments section, not under violations. Professional judgment will be necessary to a limited degree to distinguish between the types of deficiencies.

By the end of August of the fiscal year, a copy of the draft report will be sent to the EPA and a copy of the draft report will be sent to the facility (Any mention of deficiencies will be left absent in the facility's copy of the draft report.) for a thirty-day review period. Following the draft review period, the project manager will revise the draft CME report as necessary based on comments received, and prepare the final CME report. By the end of September, the project manager will have completed and sent the final CME report to the facility. A copy will be placed on file, another copy will be sent to the EPA. KDHE's cover letter to the facility will emphasize correction of those deficiencies within a specified time period. The project manager will take necessary steps to update the RCRAInfo database to list any deficiencies. The project manager will subsequently log onto RCRAInfo to verify that the data shows up as intended. Finally, as deficiencies are corrected, the project manager must ensure the database is further updated as determined necessary.

ATTACHMENT A

GUIDANCE and CHECKLISTS for CONDUCTING a HYDROGEOLOGIC ASSESSMENT of GROUNDWATER MONITORING SYSTEMS in COMPREHENSIVE MONITORING EVALUATIONS (CME)

1.0 PURPOSE

The purpose of this guidance is to support the standard operating procedure (SOP) for a comprehensive monitoring evaluation (CME) in conducting and reporting hydrogeologic assessments (HGAs) of groundwater monitoring systems at facilities regulated under RCRA.

2.0 INTRODUCTION

A hydrogeologic assessment (HGA) is a portion of the comprehensive monitoring evaluation (CME) process to determine the adequacy of a facility's groundwater monitoring system in meeting the requirements of RCRA. The HGA is an in-depth technical evaluation of the ground water monitoring system and therefore, qualified professionals with expertise in the areas of geology and/or hydrology are needed for its completion. This document has been compiled as a guide in order to assure completeness, accuracy and consistency in conducting and reporting HGAs. Specifically, this document is intended to provide sufficient guidance to the technical personnel who conduct HGAs so they will know:

- What information must be accumulated and included in the final report.
- What descriptions and summaries must be forwarded and included in the final report.
- What technical evaluations must be accomplished and addressed in the final report.
- What recommendations, as appropriate, must be developed and incorporated in the final report.
- What constitutes a complete technical evaluation.

Due to the complexity of the issues addressed during an HGA, specific guidance regarding many of the highly technical issues is beyond the scope of this assessment. This document should be used in conjunction with two versions of RCRA Groundwater Monitoring Technical Enforcement Guidance Document (draft), U.S. EPA, both September 1986 and November 1992.

The ultimate purpose of the HGA is to determine the adequacy of a facility's groundwater monitoring system (either installed or proposed) in meeting the regulatory requirements of 40 CFR Part 264, 265, and 270, as applicable. To this end, an HGA focuses on evaluating the adequacy of the information on which the monitoring system was based, and on the actual design and construction of the system.

3.0 SPECIFIC POLICIES

The ultimate goal of the CME process is to ensure that all of the corresponding groundwater monitoring systems at all facilities in Kansas are in compliance with the regulatory requirements of 40 CFR 264, 265, and 270, as applicable. To this end, all corresponding facilities with groundwater monitoring systems within Kansas will be evaluated as to adequacy through the CME process. The following specific policies will apply to all HGAs performed:

a) All in-place (installed monitoring systems, either for detection or assessment monitoring, will be evaluated based on their intended purpose. If a facility has both detection and assessment monitoring systems, the systems will be evaluated independently; i.e., a determination of adequacy of each system will be made.

b) For facilities with interim status and in assessment monitoring, any proposed groundwater quality assessment monitoring system (previously approved or not and/or under construction) will be evaluated independently of in-place detection monitoring system(s).

c) For facilities without an in-place monitoring system, the technical assessment will consist of an evaluation as detailed as the available data will allow. If a closure plan has been submitted and it contains a proposed groundwater monitoring system, adequacy of the proposed system will be evaluated on the basis of the technical assessment.

d) Any outline of a groundwater quality assessment program submitted in accordance with 40 CFR 265.93(a) will be evaluated based on the criteria contained in 265.93(a) (1)-(3).

e) For facilities that have submitted Part B permit applications, the review of a proposed monitoring program pursuant to 40 CFR 270.14(c) will be conducted as part of the permit application review process. If the permit application review process is underway and the review of a proposed monitoring system has been completed, the review should be utilized as a source document during the technical assessment.

4.0 INFORMATION ACCUMULATION

The initial step in the HGA process is the accumulation of information regarding the facility from a variety of sources. The accumulated information will be reviewed, categorized, interpreted, evaluated and assembled throughout the entire process and will be used as the basis for making technical decisions, conclusions, and recommendations. Specific information should be obtained about the facility relating to the past and present operations, basis for the monitoring system design, final monitoring system design, construction, and performance. This site-specific information will normally be obtained from such sources as the facility itself, EPA files, and KDHE files.

Although by no means complete, the following information should be accumulated:

- Processes that produce waste(s)
- Nature and volumes of the waste(s) produced

- Past and present treatment, storage, and/or disposal practices of the waste(s)
- History of the regulated unit(s); e.g., date(s) installed, expanded and/or modified; types of waste(s) managed in each unit; any releases, etc.
- Site maps
- Subsurface hydrology and geology including any drilling logs
- Topography (past and/or present)
- Man-made features which might affect groundwater flow
- Regional information collected by the owner/operator
- Previous studies of hydrology and geology
- Designs and studies of existing monitoring wells
- Laboratory results of any soil/rock samples during drilling operations
- Piezometer readings and water elevation measurements of wells
- Laboratory results of monitoring well samples
- Surveys

Specific information should be obtained from other sources (such as USGS, Kansas Geological Survey, U.S. Army Corps of Engineers, etc.) to augment the site-specific information obtained from or about the facility. Examples of commonly available information are:

- USGS topographic maps
- Aerial photographs
- Hydrogeologic information
- Regional geologic studies and information
- Well logs from water wells or other borings in the area around the facility

In order to obtain all information necessary to complete the evaluation, it is anticipated that at least one site visit will be required. The purpose and scope of the site visit will depend on the complexity of the facility and the availability of information about the site.

5.0 EVALUATION PROCESS

Since there are numerous factors that will greatly influence the evaluation process, there is no simple step-by-step approach that can be presented for conducting an HGA. Instead, the evaluation process is presented in terms of the specific elements that need to be considered.

In order for the evaluation to be complete and consistent, these items need to be assessed in detail. To assist in the evaluation process, three worksheets, which are attached, will be used to ensure that all appropriate items are assessed. The worksheets are titled "Characterization of Site Hydrogeology Worksheet," "Placement of Monitoring Wells Worksheet," and "Monitoring Well Design and Construction Worksheet."

A discussion of each element of the HGA is presented in more detail below:

a) Regulated unit(s) - A description of the regulated unit(s) at the facility which is(are) subject to the RCRA groundwater monitoring requirements will be obtained during the evaluation, An accurate site map showing the actual location(s) of the regulated unit(s) will also be obtained. In addition, the specific regulatory requirements (detection, assessment or permit requirements), which apply to each regulatory unit, will be determined.

b) Information utilized by the owner/operator - The adequacy of the information, which was utilized by the owner/operator as the basis for the monitoring system design, will be evaluated. Specifically, the evaluation of the adequacy of the owner/operator's information should answer the following two questions:

   - Did the owner/operator collect enough information to: 1) have an understanding sufficient to identify potential contamination pathways, and; 2) support the placement of wells capable of determining the facility's impact on the uppermost aquifer?

   - Did the owner/operator use appropriate techniques to collect and interpret the information used to support well placement?

   The project manager should specifically review the information that the owner/operator relied on in designing the monitoring system and ensure that the owner/operator properly interpreted and used the information. The project manager should develop their own interpretations of the data in order to make a comparison of the owner/operator's interpretation. Data interpretation techniques described in the TEGD may be used in this process. The project manager must make a clear determination as to the adequacy of the interpretation of the data, and to the adequacy of the use of the data in designing the monitoring system.

   Most of the hydrogeologic assessment involves the evaluation of the information collected and used by the owner/operator, and the development of independent interpretations of the

available information for comparing to and determining the adequacy of the owner/operator's interpretation of the data.

c) Characterization of the subsurface geology - In order to adequately define the subsurface geology of the site, the first step toward designing a monitoring system, the owner/operator should have performed a detailed investigation to identify the lithology and structural characteristics of the subsurface using direct methods supplemented by indirect methods. The project manager will review the investigatory techniques used by the owner/operator to ensure that they were adequate to define the subsurface geology of the site. The investigation must include the following direct techniques as a minimum:

- Soil borings
- Survey of existing geologic information
- Material tests (grain size analyses, standard penetration test, etc.)

At a minimum, the soil boring program must include:

- Some borings at a spacing no greater than 300 feet. Subsequent borings may be spaced farther apart if the results of initial borings spaced 300 feet apart indicate a subsurface geology of sufficient uniformity to justify the greater spacing. It may also be justified to perform the initial borings spaced greater than 300 feet. Whichever the case, the justification for greater spacing must be thoroughly evaluated to ensure it is valid.
- Several borings that are drilled to bedrock.
- Continuous sample cores logged by a qualified geologist for a sufficient fraction of the total borings. The project manager will determine whether or not a sufficient fraction was accomplished during the review and evaluation process.
- Accurate and complete boring logs that present all relevant data collected during the drilling process.

The project manager should also interpret the data generated to compare with the interpretation obtained by the owner/operator to ensure that the site has been accurately characterized. This can be accomplished by evaluating the presentations of the data generated from the investigation. The preferred methods for data presentation are:

- Narrative description of geology
- Geologic cross sections
- Geologic or soil map

- Boring logs

- Raw data and interpretive analysis of material tests.

d) Identification of groundwater pathways - As part of the hydrogeologic investigation conducted to characterize the site, the owner/operator must also adequately identify groundwater flow paths in addition to characterizing the subsurface geology. The project manager will review the investigatory techniques to ensure they were adequate to accurately identify the groundwater flow paths. In order to adequately identify the groundwater flow paths, the owner/operator must have:

- Established the direction of groundwater flow including both horizontal and vertical components of flow. (The project manager must give careful consideration to the need to examine the vertical component of flow during the evaluation process, because in some cases this aspect may not be needed.);

- Established the seasonal, temporal and artificially induced (i.e., off-site production well pumping, agricultural use) variations in groundwater flow; and

- Determined the hydraulic conductivities of the hydrogeologic units underlying the site.

At a minimum, the following direct techniques must have been included in the investigation:

- Installation of piezometers; water level measurements at different depths.

- Slug test and/or pump test.

The project manager should also interpret the data generated to compare with the interpretation obtained by the owner/operator to ensure the groundwater flow paths under the site have been accurately identified. This should be accomplished by evaluating the presentations of the data generated from the investigation. The preferred methods for data presentation are:

- Narrative description of groundwater with flow patterns

- Water table or potentiometric maps (plain view) with flow lines

- Hydrogeologic cross section.

e) Identification of uppermost aquifer, including connected aquifers - Since the owner/operator is required to monitor the uppermost aquifer, the adequacy of the

owner/operator's identification of the uppermost aquifer must be evaluated. The following tasks should be accomplished during this evaluation:

- Assess the adequacy and correctness of the information owner/operator relied on in identifying the uppermost aquifer.

- Assess the correctness of the owner/operator's identification of the uppermost aquifer.

f) Design and placement of monitoring wells - Evaluating the number and locations of monitoring wells is crucial to determining whether or not the monitoring system is adequate and meets the requirements of the regulations; i.e., the key determination of the HGA. It is critical that this determination and the basis for it be explained in detail.

1) Upgradient well(s) - The following specific tasks regarding upgradient well(s) will be accomplished:

- Examine the placement and design parameters of the upgradient well(s) and assess the adequacy of the well(s), either installed or proposed.

- Determine if any additional hydrogeologic investigations need to be performed before appropriate locations and design parameters can be accurately specified for upgradient wells at the facility.

The following questions should be answered regarding upgradient wells during this evaluation:

- Has the owner/operator located background wells far enough away from waste management areas to prevent contamination from the facility?

- Has the owner/operator installed enough wells, screened at appropriate depths, to adequately account for spatial variability in background water quality?

During this evaluation, the project manager should consider or determine the following:

- One background well may be adequate for a particular facility, but it is unusual. It will be left to the professional judgment of the individual conducting the HGA to determine the adequacy of the number and location.

- In most cases, depending on the type of statistical method used, the owner/operator should install 2 to 4 background monitoring wells in order to determine spatial variability for statistical analyses of background water quality.

- The upgradient well(s) should be screened at depths that correspond to the sampling points (geologic formations) in the downgradient wells.

- Wells screened over the entire thickness of the uppermost aquifer are usually not acceptable for RCRA monitoring purposes. Ten-foot screens are recommended by the TEGD, but appropriate screen lengths will be left to the judgment of the individual conducting the HGA.

- The individual performing the HGA will determine if upgradient well(s) are adequately installed and free of contamination by the unit(s) being monitored.

2) Downgradient wells - The evaluation of the placement and design of the downgradient wells (either installed or proposed) will be accomplished based on the purpose of the monitoring system (detection or assessment) and thus compared to the regulatory requirements.

   The following specific tasks regarding downgradient wells will be accomplished:

   - Examine the placement and design of the downgradient wells and assess the adequacy of the wells, either installed or proposed.

   - Independently determine, if possible, the appropriate locations and design parameters for the downgradient wells at the facility.

   - Identify any additional hydrogeologic investigations that should be required before appropriate locations and design parameters can be accurately specified for the downgradient wells at the facility.

   The following specific items regarding downgradient wells will be evaluated as to adequacy based on professional judgment and guidance contained in the TEGD:

   - Number of wells – Although three downgradient wells is the minimum requirement for some facilities, three downgradient wells may not be enough to detect or assess contamination from a unit or facility. Only in the simplest of geologic settings with very shallow water bearing layers above bedrock and a very small regulated unit, could three downgradient wells be considered sufficient. The evaluation must include the determination of the adequacy of the number of downgradient wells.

   - Spacing of wells - The adequacy of the spacing of the downgradient wells will be determined based on the recommended distance of 150 feet as contained in the TEGD. The project manager must relate any deviations from this benchmark criteria listed in the TEGD in order to ultimately determine the adequacy of the spacing of the downgradient wells.

- Location of wells - The placement of the downgradient wells must be evaluated in terms of their location relative to the regulated unit(s) and of their intended purpose; i.e., detection/compliance, or assessment/corrective action monitoring. For detection/compliance monitoring, the wells should be placed as near as practical to the regulated unit(s). How close must be determined by the project manager. For assessment/corrective action monitoring, the wells should be placed in order to determine the rate and extent of migration of hazardous waste and hazardous waste constituents in the groundwater and evaluate the effectiveness of the corrective action as applicable. The adequacy of the assessment/corrective action monitoring system relative to these criteria must be determined.

- Use of cluster wells - Based on the scenario of the site, the need for and use of cluster wells should be evaluated in regard to adequately monitoring the groundwater downgradient of the regulated unit(s). A determination of the adequacy of the use of cluster wells, either in place or proposed, must be made.

- Construction materials - The adequacy of the materials used in the construction of the wells will be assessed in terms of the materials effect(s) on the quality of groundwater samples (such as sorbing, leaching, or other interactions with the groundwater) and long-term structural integrity of the materials.

- Screen length - The adequacy of screen length in the downgradient wells will be determined based on the recommended length of 10 feet as contained in the TEGD. Based on the geologic setting and other site characterization factors, a determination as to the adequacy of the screen length must be made.

- Depth of screen interval - The adequacy of the screen interval depth must be determined based on site-specific conditions to ensure that the wells will adequately monitor the stratigraphic horizons most likely to serve as contaminant pathways.

Details of the groundwater monitoring system should be obtained and summarized for inclusion with the final report. At a minimum, the monitoring wells should be located on the site map, individual drilling logs , and the construction details of each well should be obtained.

6.0 REPORTING

The final report of the HGA will consist of a narrative and attachments to provide a complete description and evaluation of the groundwater monitoring system at a facility. The narrative portion will address all of the specific items evaluated and will provide overall summary conclusions. The following specific items will be addressed under appropriately titled sections of the report:

- Description of facility including operations, processes and products
- Description/locations of regulated unit(s) managing hazardous wastes and subject to groundwater monitoring
- Owner/operator information
- Characterization of subsurface geology of site and region
- Identification of groundwater pathways
- Identification of uppermost aquifer
- Placement of monitoring wells
- Description/location of monitoring system (in-place or proposed)

Specific conclusions regarding the adequacy of supporting data/information and data and of the monitoring well system will be stated. The following standardized summary conclusions will be utilized to summarize the hydrogeologic assessment and will be supported by discussions within the body of the report:

- For detection/compliance monitoring systems, one of the following conclusions should be reached based on the consideration and evaluation of all available information:
- The design and construction of the groundwater monitoring system <u>are</u> adequate to ensure that it will immediately detect any release from any of regulated units;
- The design and construction of the groundwater monitoring system <u>are not</u> adequate to ensure that it will immediately detect any release from the regulated units; or,
- The available information is not adequate to assess the adequacy of the design and construction of the groundwater monitoring system, and, therefore, the system is assumed to be inadequate.

For assessment/corrective action monitoring systems, one of the following conclusions should be reached based on the consideration and evaluation of all available information:

- The design and construction of the groundwater monitoring system are adequate to ensure that it will determine the rate and extent of migration of hazardous waste or hazardous waste constituents in the groundwater and the effectiveness of the corrective action as applicable.

- The design and construction of the groundwater monitoring system are not adequate to ensure that it will determine the rate and extent of migration of hazardous waste or hazardous waste constituents in the groundwater and the effectiveness of the corrective action as applicable.

- The available information is not adequate to assess the adequacy of the design and construction of the groundwater monitoring system, and, therefore, the system is assumed to be inadequate.

The specific attachments included with the report will depend on the complexity of the facility and the need for information to support the narrative discussions. In addition, specific attachments will be used to document that the guidance contained in the TEGD has been addressed during the evaluation.

The following documents are required to be included as attachments to the report:

- Site map showing the location(s) of regulated unit(s)

- All information relating to the hydrogeology of the site and regarding the design and performance of the groundwater monitoring system

- Site map showing the locations of the monitoring wells

- Drilling logs, if available

- Construction details of the monitoring wells

- Completed evaluation worksheets (see Attached)

Additional attachments may be included at the discretion of the project manager to support narrative discussions.

CHARACTERIZATION OF SITE HYDROGEOLOGY WORKSHEET

The following worksheets have been designed to assist the project manager in evaluating the program the owner/operator used in characterizing hydrogeologic conditions at the site. This series of worksheets have been compiled to parallel the information presented in Chapter 1 of the TEGD.

A.	REVIEW OF SITE HYDROGEOLOGIC INVESTIGATION TECHNIQUES

		YES	NO
A.1.	Did a Kansas Licensed Geologist perform the site investigation/data collection?	☐	☐
A.2.	Did the owner/operator survey the following regional data:		
	1. U.S.G.S. Maps?	☐	☐
	2. Water supply well logs?	☐	☐
	3. Other (specify)		
A.3.	Did the owner/operator use the following direct techniques in the hydrogeologic assessment?		
	1. Soil borings/rock cores?	☐	☐
	2. Materials test; e.g., grain size analyses, standard penetration test, etc.?	☐	☐
	3. Piezometer installation for water level measurements at different depths?	☐	☐
	4. Slug tests?	☐	☐
	5. Pump test?	☐	☐
	6. Geochemical analyses of soil samples?	☐	☐
	7. Other (specify):		
	Give a brief evaluation of the information.		
A.4.	Did the owner/operator use the following indirect techniques to supplement direct technique data:		
	1. Geophysical well logs?	☐	☐
	2. Tracer studies?	☐	☐
	3. Resistivity and/or electromagnetic conductance?	☐	☐
	4. Seismic Survey?	☐	☐
	5. Hydraulic conductivity measurements of cores?	☐	☐
	6. Aerial photography?	☐	☐
	7. Ground penetrating radar?	☐	☐
	8. Other (specify)		
	Give a brief evaluation of the information.		
A.5.	Did the owner/operator document and present the raw data from the site hydrogeologic assessment?	☐	☐
A.6.	Did the owner/operator document methods (criteria) used to correlate and analyze the information?	☐	☐

		YES	NO
A.7.	Did the owner/operator prepare the following:		
	1. Narrative description of geology? _____	☐	☐
	2. Geologic cross sections? _____	☐	☐
	3. Geologic and soil maps? _____	☐	☐
	4. Boring/coring logs? _____	☐	☐
	5. Structure contour maps of aquifer and aquitard? _____	☐	☐
	6. Narrative description of groundwater flows? _____	☐	☐
	7. Water table/potentiometric map? _____	☐	☐
	8. Hydrologic cross sections? _____	☐	☐
	Give a brief evaluation of the information. _____		
A.8.	Did the owner/operator obtain a regional map of the area and delineate the facility? _____	☐	☐
A.9.	If yes, does this map illustrate:		
	1. Surficial geology features? _____	☐	☐
	2. Streams, rivers, lakes, or wetlands near the facility? _____	☐	☐
	3. Discharging or recharging wells near the facility? _____	☐	☐
A.10.	Did the owner/operator obtain a regional hydrogeologic map? _____	☐	☐
A.11.	If yes, does this hydrogeologic map indicate:		
	1. Major areas of recharge/discharge? _____	☐	☐
	2. Regional groundwater flow direction? _____	☐	☐
	3. Potentiometric contours which are consistent with observed water level elevations? _____	☐	☐
	Give a brief evaluation of the information. _____		
A.12.	Did the owner/operator prepare a facility site map? _____	☐	☐
A.13.	If yes, does the site map show:		
	1. Regulated units of facility (e.g., landfill areas, impoundments)? _____	☐	☐
	2. Any seeps, springs, streams, ponds, or wetlands? _____	☐	☐
	3. Location of monitoring wells, soil borings, or test pits? _____	☐	☐
	4. How many regulated units does the facility have? _____		
	If more than one regulated unit then,		
	Does the waste management area encompass all regulated unites? _____	☐	☐
	Is a waste management area delineated for each regulated unit? _____	☐	☐
	Give a brief evaluation of the information. _____		

B.	CHARACTERIZATION OF SUBSURFACE GEOLOGY OF THE SITE

	YES	NO
B.1. Soil boring/test pit program:		
1. Were the soil borings/test pits performed under the supervision of a qualified professional?	☐	☐
2. Were the borings placed 300 feet apart?	☐	☐
3. If not, did the owner /operator provide documentation for selecting the spacing for borings?	☐	☐
4. Were the borings drilled to the depth of the first confining unit below the uppermost zone	☐	☐
of saturation or ten feet into bedrock?	☐	☐

Give a brief evaluation of the information. _____

_____

_____

_____

5. Indicate the method(s) of drilling:		
Auger (hollow or solid stem)	☐	☐
Mud rotary	☐	☐
Air rotary	☐	☐
Reverse rotary	☐	☐
Cable tool	☐	☐
Jetting	☐	☐
Other (specify)		
6. Were continuous sample cores taken?	☐	☐
7. How were the samples obtained?		
Split Spoon	☐	☐
Shelby tube	☐	☐
Rock coring	☐	☐
Ditch sampling	☐	☐
Other (specify)		
8. Were the continuous sample cores logged by a qualified geologist?	☐	☐

Give a brief evaluation of the information. _____

_____

_____

_____

9. Does the field boring log include the following information:		
Hole name/Number?	☐	☐
Date started and finished?	☐	☐
Geologist's name?	☐	☐
Driller's name?	☐	☐
Hole location (i.e., map and elevation)?	☐	☐
Drill rig type and bit/auger size?	☐	☐
Gross petrography (e.g., rock type of each geologic unit?	☐	☐
Gross mineralogy of each geologic unit?	☐	☐

	YES	NO
Gross structural interpretation of each geologic unit and structural features (e.g., fractures, gouge material, solution channels, buried streams or Valleys, identification of depositional material)? _____	☐	☐
Development of soil zones and vertical extent and description of soil type? _____	☐	☐
Depth of water bearing unit(s) and vertical extent of each? _____	☐	☐
Depth and reason for termination of borehole? _____	☐	☐
Depth and location of any contaminant encountered in borehole? _____	☐	☐
Sample location/number? _____	☐	☐
Percent sample recovery? _____	☐	☐
Narrative descriptions of		
Geologic observations? _____	☐	☐
Drilling Observations? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____

10. Were the following analytical tests performed on the core samples:

Mineralogy (e.g., microscopic test and x-ray diffraction)? _____	☐	☐
Petrographic analysis:		
Degree of crystallinity and cementation of matrix? _____	☐	☐
Degree of sorting, size fraction (i.e., sieving), textural variations? _____	☐	☐
Rock type(s)? _____	☐	☐
Soil type? _____	☐	☐
Approximate bulk geochemistry? _____	☐	☐
Existence of microstructures that may effect or indicate fluid flow? _____	☐	☐
Falling head test? _____	☐	☐
Static head tests? _____	☐	☐
Settling measurements? _____	☐	☐
Centrifuge tests? _____	☐	☐
Column drawings? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____

B.2. Verification of subsurface geological data

1. Has the owner/operator used indirect geophysical methods to supplement geological conditions between borehole locations? _____	☐	☐
2. Does the number of borings and analytical data indicate that the confining layer displays a low enough permeability to impede the migration of contaminants to any stratigraphically lower water-bearing units? _____	☐	☐
3. Is the confining layer laterally continuous across the entire site? _____	☐	☐
4. Did the owner/operator consider the chemical compatibility of the site-specific waste types and the geologic materials of the confining layers? _____	☐	☐
5. Did the geologic assessment address or provide means for resolution of any information gaps or geologic data? _____	☐	☐

	YES	NO
6. Does the laboratory data corroborate the field data for petrography? _____	☐	☐
7. Does the laboratory data corroborate the field data for mineralogy and subsurface geochemistry? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____

B.3. Presentation of geologic data

1. Did the owner/operator present at least four geologic cross sections of the site? _____	☐	☐
2. Do each of these cross sections:		
Identify the types and characteristics of the geologic materials present? _____	☐	☐
Define the contact zones between different geologic materials? _____	☐	☐
Note the zones of high permeability or fracture? _____	☐	☐
Give detailed borehole information including:		
Location of borehole? _____	☐	☐
Depth of termination? _____	☐	☐
Location of screen (if applicable)? _____	☐	☐
Depth of zone of saturation? _____	☐	☐
3. Did the owner/operator provide a topographic map? _____	☐	☐
4. Does the topographic map provide:		
Contours at a maximum interval of two-feet? _____	☐	☐
Locations and illustrations of man-made features (e.g., parking lots, _____	☐	☐
Factory buildings, drainage ditches, storm drains, pipelines, etc.)? _____	☐	☐
Descriptions of nearby water bodies? _____	☐	☐
Ddescriptions of off-site wells? _____	☐	☐
Site boundaries? _____	☐	☐
Individual RCRA units? _____	☐	☐
Delineation of the waste management area(s)? _____	☐	☐
Well and boring locations? _____	☐	☐
5. Did the owner/operator provide an aerial photograph depicting the site and adjacent off-site features? _____	☐	☐
6. Does the photograph clearly show surface water bodies, adjacent municipalities, and residences and are these clearly labeled? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____

C. IDENTIFICATION OF GROUNDWATER FLOWPATHS

		YES	NO
C.1.	Groundwater flow direction		
1.	Was the well casing height measured by a licensed surveyor to the nearest 0.01 feet? _____	☐	☐
2.	Were the well water level measurements taken within a 24-hour period? _____	☐	☐
3.	Were the well water level measurements taken to the nearest .01 feet? _____	☐	☐
4.	Were the well water levels allowed to stabilize after construction and development for a minimum of 24 hours prior to measurements? _____	☐	☐
5.	Was the water level information obtained from (check appropriate one):		
	Multiple piezometers placement in single boreholes? _____	☐	☐
	Vertically nested piezometers in closely spaced separate boreholes? _____	☐	☐
6.	Did the owner/operator provide construction detail for the piezometers? _____	☐	☐
7.	How were the static water levels measured (check method(s).		
	Electric water sounder _____	☐	☐
	Air line _____	☐	☐
	Other (explain) _____		
8.	Was the well water level measured in wells drilled to an equivalent depth below the saturated zone, or screened at an equivalent depth below the saturated zone? _____	☐	☐
9.	Has the owner/operator provided a site water table (potentiometric) contour map? _____	☐	☐
	If yes,		
	do the potentiometric contours appear logical based on topography and presented data? (consult water level data) _____	☐	☐
	are groundwater flowlines indicated? _____	☐	☐
	are static water levels shown? _____	☐	☐
	can hydraulic gradients be estimated? _____	☐	☐
10.	Did the owner/operator develop two, or more, hydrogeologic cross sections of the vertical flow component across the site? _____	☐	☐
11.	Do the owner/operator's flow nets include:		
	piezometer locations? _____	☐	☐
	depth of screening? _____	☐	☐
	width of screening? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____

C.2.	Seasonal and temporal fluctuations in groundwater level		
1.	Do fluctuations in static water levels occur? _____	☐	☐
	If yes, are the fluctuations caused by any of the following:		
	off-site well pumping _____	☐	☐
	tidal processes or other intermittent natural variations (e.g., river stage, etc) _____	☐	☐

	YES	NO
on-site well pumping	☐	☐
off-site, on-site construction or changing land use patterns	☐	☐
deep well injection	☐	☐
seasonal variations	☐	☐
other (specify)		

2. Has the owner/operator documented the source and patterns that contribute to or affect the groundwater flow below the waste management area? ☐ ☐

3. Do the water level fluctuations alter the general groundwater gradients and flow directions? ☐ ☐

4. Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone? ☐ ☐

5. Did the owner/operator implement means for gauging long term effects on water movement that may result from on-site or off-site construction or changes in land-use patterns? ☐ ☐

Give a brief evaluation of the information. _____

C.3. Hydraulic conductivity

1. How were hydraulic conductivities of the subsurface materials determined?
   - Single-well test (slug test)? ☐ ☐
   - Multiple-well test (pump test)? ☐ ☐

2. If a single-well test was conducted, was it done by adding or removing a known volume of water? ☐ ☐

3. If a single well test was conducted in highly permeable formation, was a pressure transducer and high-speed recording equipment used to record the rapidly changing water levels? ☐ ☐

4. Since single well tests only measure hydraulic conductivity in a limited area, were enough tests run to ensure a representative measure of conductivity in each hydrogeologic unit? ☐ ☐

5. Is the owner/operator's slug test data (if applicable) consistent with existing geologic information (e.g., boring logs)? ☐ ☐

6. Were other hydraulic conductivity properties determined? ☐ ☐

7. If yes, provide any of the following data, if available:

   Transmissivity_____
   Storage coefficient _____
   Leakage _____
   Permeability _____
   Porosity_____
   Specific capacity_____
   Other (specify) _____

Give a brief evaluation of the information. _____

		YES	NO
C.4.	Identification of the uppermost aquifer		
	1. Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? _____	☐	☐
	If yes,		
	Are soil boring/test pit logs included? _____	☐	☐
	Are geologic cross-sections included? _____	☐	☐
	2. Is there evidence of confining (competent, unfractured, continuous, and low permeability) layers beneath the site? _____	☐	☐
	If yes,		
	Was continuity demonstrated through the evidence of lack of drawdown in the upper well when separate, closely-spaced wells (one screened at the uppermost part of the water table, and the other screened on the lower side of the confining layer) are pumped simultaneously? _____	☐	☐
	3. Was hydraulic conductivity of the confining unit determined to be less than 10^{-7} cm/sec by field test? _____	☐	☐
	4. Does potential for other hydraulic interconnection exist (e.g., lateral incontinuity between geologic units, facies changes, fracture zones, cross cutting structures, or chemical corrosion/alteration of geologic units by leachate)? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____

D. CONCLUSIONS

		YES	NO
D.1.	Subsurface geology _____		
	1. Has the subsurface geochemistry been adequately defined? _____	☐	☐
	2. Was the boring/coring program adequate to define subsurface geologic variation? _____	☐	☐
	3. Was the owner/operator's narrative description complete and accurate in its interpretation of the data? _____	☐	☐
	4. Does the geologic assessment address or provide means to resolve any information gaps? _____	☐	☐

Evaluate the completeness and adequacy of the information presented. _____
_____
_____
_____

D.2.	Groundwater flowpaths		
	1. Did the owner/operator adequately establish the horizontal and vertical components of groundwater flow? _____	☐	☐
	2. Were appropriate methods used to establish groundwater flowpaths? _____	☐	☐
	3. Did the owner/operator provide accurate documentation? _____	☐	☐
	4. Are the potentiometric surface measurements valid? _____	☐	☐

	YES	NO
5. Did the owner/operator adequately consider the seasonal and temporal effects on the groundwater? _____	☐	☐
6. Were sufficient hydraulic conductivity tests performed to document lateral and vertical variation in hydraulic conductivity below the site? _____	☐	☐

Evaluate the completeness and adequacy of the information presented. _____
_____
_____
_____

D.3. Uppermost aquifer

1. Did the owner/operator adequately define the uppermost aquifer? _____	☐	☐

Evaluate the completeness and adequacy of the information presented. _____
_____
_____
_____

PLACEMENT OF DETECTION MONITORING WELLS WORKSHEET

The following worksheets are designed to assist the project manager's evaluation of an owner/operator's approach for selecting the number, location, and depth of all detection phase monitoring wells. This series of worksheets has been compiled to closely track the information presented in Chapter 2 of the TEGD. The guide for the evaluation of an owner/operator's placement of monitoring wells is highly dependent upon a thorough characterization of the site hydrogeology as described in Chapter 1 of the TEGD and Appendix A.1 worksheets.

A.	PLACEMENT OF DOWNGRADIENT DETECTION

		YES	NO
A.1.	Are the groundwater monitoring wells or clusters located immediately adjacent to the waste management area? _____	☐	☐
A.2.	How far apart (i.e., what is the spacing?) between detection monitoring well locations? _____ _____ _____		
A.3.	Does the owner/operator provide a rationale for the location of each monitoring well or cluster? _____	☐	☐
A.4.	Did the owner/operator provide an explanation for the spacing of the groundwater monitoring wells? _____	☐	☐
A.5.	Has the owner/operator identified the vertical sampling interval(s) of each monitoring well or cluster, i.e., depth and thickness? _____	☐	☐
A.6.	Does the owner/operator provide an explanation for the depth and thickness of the vertical sampling interval(s) for each monitoring well or cluster? _____	☐	☐
A.7.	What length screens has the owner/operator employed in the groundwater monitoring wells on site?_____ _____ _____		
A.8.	Does the owner/operator provide an explanation for the screen length(s) chosen? _____	☐	☐
A.9.	Do the actual locations of monitoring wells or clusters correspond to those identified by the owner/operator? _____	☐	☐

Give brief evaluation of information _____
_____
_____
_____

B.	PLACEMENT OF UPGRADIENT MONITORING WELLS

		YES	NO
B.1.	Has the owner/operator documented the location of each upgradient monitoring well or cluster? _____	☐	☐
B.2.	Does the owner/operator provide an explanation for the location(s) of the upgradient monitoring wells? _____	☐	☐
B.3.	Has the owner/operator provided a rationale for the depth and thickness of the vertical sampling interval for each background monitoring well or cluster? _____	☐	☐

B.4. What length screens has the owner/operator employed in the background monitoring well(s)?_
_____
_____
_____

B.5.	Does the owner/operator provide an explanation for the screen length(s) chosen? _____	☐	☐
B.6.	Does the actual location of each background monitoring well or cluster correspond to that identified by the owner/operator? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____
_____

C.	CONCLUSIONS

		YES	NO
C.1.	Downgradient Wells		
	Do the location spacing, and vertical sampling interval(s) of the groundwater monitoring wells or clusters in the ground water monitoring system allow the immediate detection of a release of hazardous waste or constituents from the hazardous waste management area to the uppermost aquifer? _____	☐	☐
	If in assessment/corrective action monitoring, does the ground water monitoring system provide data sufficient to determine the extent of contamination and determine the effectiveness of corrective action activities? _____	☐	☐

Evaluate the completeness and adequacy of the information present_____
_____
_____
_____
_____
_____

	YES	NO
C.2. Upgradient Wells		
Do the location and vertical sampling interval(s) of the upgradient (background) groundwater monitoring wells ensure the capability of collection groundwater samples representative of upgradient (background) groundwater quality including any ambient heterogeneous chemical characteristics? _____	☐	☐

Evaluate the completeness and adequacy of the information present_____
_____
_____
_____
_____
_____

MONITORING WELL DESIGN AND CONSTRUCTION WORKSHEET

The following worksheets have been designed to assist the inspector in evaluation the techniques used by an owner/operator for designing and constructing monitoring wells. This series of worksheets has been compiled to parallel the information presented in Chapter 3 of the TEGD.

Complete the attached well construction summary sheet for each of the monitoring wells, unless similar documentation is already available from the owner/operator. Include the locations where the well intercepts changes in geological formation.

A.	DRILLING METHODS

		YES	NO
A.1.	What drilling method was used for the well?		
	Hollow-stem auger _____	☐	☐
	Solid-stem auger _____	☐	☐
	Mud rotary _____	☐	☐
	Air rotary _____	☐	☐
	Reverse rotary _____	☐	☐
	Cable tool _____	☐	☐
	Jetting _____	☐	☐
	Air drill with casing hammer _____	☐	☐
	Other (specify) _____		
A.2.	Were any cutting fluids (including water) or additives used during drilling? _____	☐	☐
	If yes, specify:		
	Type of drilling fluid _____		
	Source of water use _____		
	Foam _____		
	Polymers _____		
	Other _____		
A.3.	Was the cutting fluid, or additive, analyzed? _____	☐	☐
A.4.	Was the drilling equipment steam-cleaned prior to drilling the well? _____	☐	☐
A.5.	Was compressed air used during drilling? _____	☐	☐
	If yes, was the air treated to remove oil (e.g., filtered)? _____	☐	☐
A.6.	Did the owner/operator document the procedure used for establishing depth and slope of the water table? _____	☐	☐
	If yes, how was the location established? _____		

		YES	NO
A.7.	Formation samples		
	1. Were continuous formation sample cores collected during drilling? _____	☐	☐
	2. How were the samples obtained?		
	Split spoon _____	☐	☐
	Shelby tube _____	☐	☐
	Core drill _____	☐	☐
	Other (specify) _____		
	3. Indicate the frequency at which formation samples were collected _____		
	4. Identify if any physical and/or chemical tests were performed on the formation samples (specify) _____		
	Give a brief evaluation of the information. _____		

B. MONITORING WELL CONSTRUCTION MATERIALS

		Material	Diameter (ID/OD)	YES	NO
B.1.	Identify construction materials and diameters (ID/OD)				
	1. Primary Casing	_____	_____		
	2. Secondary or outside casing (double construction)	_____	_____		
	3. Screen	_____	_____		
B.2.	How are the sections of casing and screen connected?				
	Pipe sections threaded _____			☐	☐
	Couplings (friction) with adhesive or solvent _____			☐	☐
	Couplings (friction) with retainer screws _____			☐	☐
	Other (specify) _____				
B.3.	Were the materials steam-cleaned prior to installation? _____			☐	☐
	Give a brief evaluation of the information. _____				

C. WELL INTAKE DESIGN AND WELL DEVELOPMENT

		YES	NO
C.1.	Was a well intake screen installed? _____	☐	☐
	1. What is the length of the screen for the well? _____		
	2. Is the screen manufactured (instead of casing that was perforated by hand)? _____	☐	☐

		YES	NO
C.2.	Was filter pack installed? _____	☐	☐
	Has a turbidity measurement of the well water ever been made? _____	☐	☐
C.3.	Well development		
	What technique was used for well development?		
	Surge block _____	☐	☐
	Bailer _____	☐	☐
	Air surging _____	☐	☐
	Water pumping _____	☐	☐
	Other (specify) _____		

Give a brief evaluation of the information. _____
_____
_____
_____
_____

D. ANNULAR SPACE SEALS

		YES	NO
D.1.	1. What is the annular space in the saturated zone directly above the filter pack filled with?		
	Sodium bentonite (specify type) _____		
	Cement (specify neat or concrete) _____		
	Other (specify) _____		
	2. Was the seal installed by?		
	Dropping material down the open borehole and tamping _____		
	Dropping material down the inside of hollow-stem auger _____		
	Tremie pipe method _____		
	Other (specify) _____		
D.2.	Was a different seal used in the unsaturated zone? _____	☐	☐
	1. If yes, was this seal made with?		
	Sodium bentonite (specify type) _____	☐	☐
	Cement (specify neat or concrete) _____	☐	☐
	Other (specify) _____	☐	☐
	2. Was this seal installed by?		
	Dropping material down the hole and tamping _____	☐	☐
	Dropping material down the inside of hollow-stem auger _____	☐	☐
	Tremie pipe method _____	☐	☐
	Other (specify) _____		
D.3.	Is the upper portion of the borehole sealed with a concrete cap/pad/apron to prevent infiltration from the surface? _____	☐	☐

Give a brief evaluation of the information. _____
_____
_____
_____
_____

ATTACHMENT B

CME REPORT OUTLINE

EXECUTIVE SUMMARY

1.0 INTRODUCTION

2.0 FACILITY DESCRIPTION
- 2.1 Facility Description
- 2.2 Regulatory Status and History
- 2.3 Waste Management Unit(s)

3.0 HYDROGEOLOGIC SETTING
- 3.1 Summary of Efforts to Characterize Geology and Hydrogeology
- 3.2 Summary of Regional and Local Geology
- 3.3 Summary of Regional and Local Hydrogeology
- 3.4 Brief Conceptual Model of Ground Water Flow Including KDHE Comments and Concerns

4.0 GROUNDWATER MONITORING SYSTEM
- 4.1 Historical Development of Monitoring, Contamination, and Remediation
- 4.2 Detailed Description of Current System for Ground Water Monitoring and Remediation, Including KDHE Comments and Concerns

5.0 OPERATION AND MAINTENANCE INSPECTION
- 5.1 Participants
- 5.2 KDHE Comments on Sampling and Analysis Plan
- 5.3 KDHE Comments on Monitoring Well integrity
- 5.4 KDHE Comments on Groundwater Elevation and Total Depth Measurements
- 5.5 KDHE Comments on Monitoring Well Purging Procedures
- 5.6 KDHE Comments on Monitoring Well Sampling Procedures
- 5.7 KDHE Comments on Equipment Decontamination
- 5.8 KDHE Comments on Quality Assurance and Quality Control

6.0 DATA ANALYSIS
- 6.1 Statistical Analysis of Groundwater Quality Data
- 6.2 KDHE Comments on Data, Validation, and Reporting

7.0 CONCLUSIONS
- 7.1 KDHE Evaluation of Findings Including a Discussion of Past Deficiencies
- 7.2 Required Actions Based on KDHE Evaluation

FIGURES

Facility Location Map
Regulated Unit and Well Location Map
KDHE Groundwater Potentiometric Surface Map
Facility Groundwater Potentiometric Surface Map
Geologic Cross Section(s)
Geologic Map
Contaminant Plume Map
Other figures as needed

TABLES

Comparison of Measured Total Well Depths to Original Total Well Depths
Comparison of KDHE and Facility Analytical Data
Monitoring Well Construction Details
Other tables as needed

APPENDICES

Regulatory History from KDHE Files
RCRA Operation and Maintenance Inspection Checklist
Characterization of Site Hydrogeology Worksheet
Facility Records of Field Activities
Facility Groundwater Analytical Data
KDHE Groundwater Analytical Data
Photographs of Inspection

ATTACHMENT C

LIST OF TECHNICAL INADEQUACIES THAT MAY CONSTITUTE VIOLATIONS

(Adapted from OSWER 9950.2 CME Inspection Guide)

This table illustrates examples of situations that may constitute noncompliance on the part of the owner/operator. The enforcement official should apply this table in determining if a violation is warranted on a site-specific basis.

Regulatory Objectives	Examples of Technical Inadequacies That May Constitute Violations	Regulatory Citations
1. Uppermost Aquifer must be correctly identified.	• Failure to consider aquifers hydraulically interconnected to the uppermost aquifer	265.90(a) 265.91(a)(1) & (a)(2) 270.14(c)(2)
	• Incorrect identification of certain formations as confining layers or aquitards • Failure to use test drilling and/or soil borings to characterize subsurface hydrogeology	265.90(a) 295.91(a)(1) & (a)(2) 270.14(c)(2)
2. Ground-water flow directions and rates must be properly determined.	• Failure to use piezometers or wells to determine ground-water flow rates and directions (or failure to use a sufficient number of them)	265.90(a) 295.91(a)(1) & (a)(2) 270.14(c)(2)
	• Failure to consider temporal variations in water levels when establishing water flow directions (e.g. seasonal variations, short-term fluctuations due to pumping)	290.90(a) 295.91(a)(1) & (a)(2) 270.14(c)(2)
	• Failure to assess significance of vertical gradients when evaluating flow rates and directions.	265.90(a) 295.91(a)(1) & (a)(2) 270.14(c)(2)
	• Failure to use standard/consistent benchmarks when establishing water level elevations.	265.90(a) 265.91(a)(1)
	• Failure of the O/O to consider effect of local with drawl wells on ground-water flow direction	265.90(a) 265.91(a)(1)
	• Failure of the O/O to obtain sufficient water level measurement	265.90(a) 265.91(a)(1)

Regulatory Objectives	**Examples of Technical Inadequacies That May Constitute Violations**	**Regulatory Citations**
3. Background wells must be located so as to yield samples that are not affected by the facility.	• Failure of the O/O to consider the effect of local withdrawal wells on ground-water flow	265.90(a) 265.91(a)(1)
	• Failure of the O/O to obtain sufficient water level measurements	265.90(a) 265.91(a)(1)
	• Failure of the O/O to consider flow path of dense immiscibles in establishing up-gradient well locations	265.90(a) 265.91(a)(1)
4. Background wells must be constructed so as to yield samples that are representative of in-situ ground-water quality.	• Wells constructed of materials that may release or sorb constituents of concerns	265.90(a) 265.91(a)
	• Wells improperly sealed-contamination of sample is a concern	265.90(a) 265.91(a) 265.91(c)
	• Nested or multiple screen wells are used and it cannot be demonstrated that there has been no movement of ground water between strata	265.90(a) 265.91(a)(1) 265.91(a)(2)
	• Improper drilling methods were used, possibly contaminating the formation	265.90(a) 265.91(a)
	• Well intake packed with materials that may contaminate sample	265.90(a) 265.91(a) 265.91(c)

Regulatory Objectives	**Examples of Technical Inadequacies That May Constitute Violations**	**Regulatory Citations**
Background wells must be constructed so as to yield samples that are representative of in-situ ground-water quality. (continued)	• Well screens used are of an inappropriate length	265.90(a) 265.91(a)(1) 265.91(a)(2)
	• Wells developed using water other than formation water	265.90(a) 265.91(a)
	• Improper well development yielding samples with suspended sediments that may bias chemical analysis	265.90(a) 265.91(a)
	• Use of drilling muds or non-formation water during well construction that can bias results of samples collected from wells	265.90(a) 265.91(a)
5. Down-gradient monitoring wells must be located so as to ensure the immediate detection of any contamination migrating from the facility.	• Wells not placed immediately adjacent to waste management area	265.90(a) 265.91(a)(2)
	• Failure of O/O to consider potential pathways for dense immiscibles	265.90(a) 265.91(a)(2)
	• Inadequate vertical distribution of wells in thick or heavily stratified aquifer	265.90(a) 265.91(a)(2)
	• Inadequate horizontal distribution of wells in aquifers of varying hydraulic conductivity	265.90(a) 265.91(a)(2)
	• Likely pathways of contamination (e.g., buried stream channels, fractures, areas of high permeability) are not intersected by wells	265.90(a) 265.91(a)(2)
	• Well network covers uppermost but not interconnected aquifers	265.90(a) 265.91(a)(2)
6. Down-gradient monitoring wells must be constructed so as to yield samples that are representative of in-situ ground –water quality.	• See #4	

Regulatory Objectives	Examples of Technical Inadequacies That May Constitute Violations	Regulatory Citations
7. Samples from background and down-gradient wells collected and analyzed.	• Failure to evacuate stagnant water from the well before sampling	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Failure to sample wells within a reasonable amount of time after well evacuation	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Improper decisions regarding filtering or non-filtering of samples prior to analysis (e.g., use of filtration on samples to be analyzed for volatile organics)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Use of an inappropriate sampling device	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Use of improper sample preservation techniques	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Samples collected with a device that is constructed of materials that interfere with sample integrity	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Sample collected with non-dedicated sampling dedicated sampling device is not cleaned between sampling events	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Improper use of a sampling device such that sample quality is affected (e.g., degassing of sample caused by agitation of bailer)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)

Regulatory Objectives	Examples of Technical Inadequacies That May Constitute Violations	Regulatory Citations
Samples from background and down-gradient wells must be properly collected and analyzed. (continued)	• Improper handling of samples (e.g., failure to eliminate headspace from containers of samples to be analyzed for volatiles)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Failure of the sampling plan to establish procedures for sampling immiscibles (i.e., “floaters” and :sinkers”)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Failure to follow appropriate QA/QC procedures	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Failure to ensure sample integrity through the use of proper chain-of-custody procedures	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Failure to demonstrate suitability of methods used for sample analysis (other than those specified in SW-846)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Failure to perform analysis in the field on unstable parameters or constituents (e.g., pH, Eh, specific conductance, alkalinity, dissolve oxygen)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Use of sample containers that may interfere with sample quality (e.g., synthetic containers used with volatile samples)	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)
	• Failure to make proper use of sample blanks	265.90(a) 265.92(a) 265.93(d)(4) 270.14(c)(4)

Regulatory Objectives	**Examples of Technical Inadequacies That May Constitute Violations**	**Regulatory Citations**
8. In part 265 assessment monitoring the O/O must sample for the correct substances.	• Failure of the O/O's list of sampling parameters to include certain wastes that are listed in 261.24 or 261.33, unless adequate justification is provided	265.93(d)(4)
	• Failure of the O/O's list of sampling parameters to include Appendix VII constituents of all wastes listed under 261.31 and 261.32, unless adequate justification is provided	265.93(d)(4)
9. In defining the Appendix VIII makeup of a plume, the O/O must sample for the correct substances.	• Failure of the O/O's list of sampling parameters to include all Appendix VIII constituents, unless adequate justification is provided	270.14(c)(4)
	• Failure of sampling effort to identify areas outside the plume	265.93(d)(4) 270.14(c)(4)
10. In Part 265 assessment monitoring and in defining the Appendix VIII makeup of a plume the O/O must use appropriate sampling methodologies.	• Number of wells was insufficient to determine vertical and horizontal gradients in contaminant concentrations	265.93(d)(4) 270.14(c)(4)
	• Total reliance on indirect methods to characterize plume (e.g., electrical resistivity, borehole geophysics)	265.93(d)(4) 270.14(c)(4)
	• Failure of O/O to implement a monitoring program that is capable of detecting the existence of any plume that might emanate from the facility	270.14(c)(4)
11. Part B applicants who have either detected contamination or failed to implement an adequate Part 265 GWM program must determine with confidence whether a plume exists and must characterize any plume.	• Failure of O/O to sample both up-gradient and down-gradient wells for all Appendix VIII constituents See also items #1, #2	270.14(c)(4)