KENTUCKY LANDFARM

OPERATOR CERTIFICATION

MANUAL

Kentucky Department for Environmental Protection

Division of Compliance Assistance

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Certification and Licensing Program

Mission
Promote responsible environmental stewardship.

Goal
Provide operators with the basic knowledge required to manage drinking water, wastewater and solid waste systems.

The Division of Compliance Assistance offers free compliance assistance. Our services are available to all individuals, communities and businesses regulated by the Kentucky Department for Environmental Protection. We want to help you succeed!

Phone number and Website for regulatory, technical or operational concerns
502-564-0323
dca.ky.gov

Other programs administered by the Division of Compliance Assistance:

Kentucky Excel Program
Kentucky Brownfield Program
Kentucky Environmental Compliance Assistance Program

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Chapter 1: LANDFARM OPERATOR CERTIFICATION

Chapter 1 Objectives

1. Understand the requirements and certification processes for landfarm operators.
2. Understand and be able to apply the Kentucky regulations relating to the certification requirements for solid and special waste operations.
3. Understand the importance of professional conduct for certified operators.

Introduction

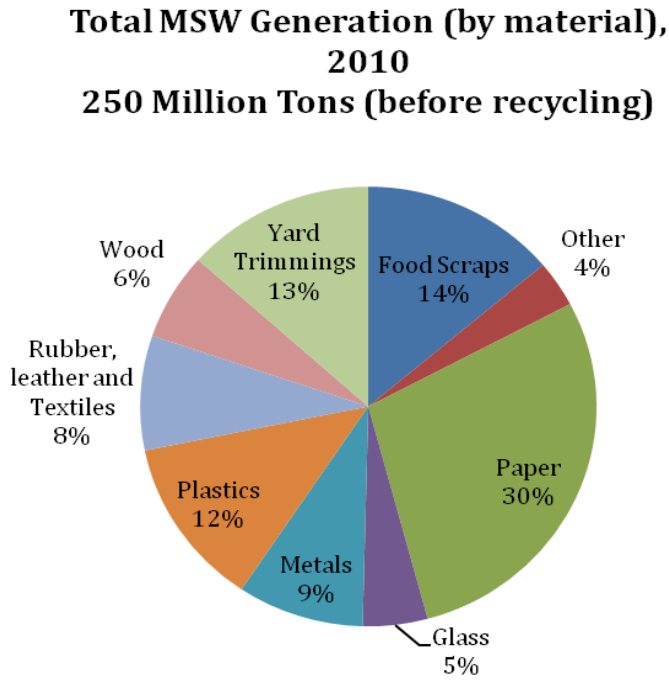
Some method of waste disposal has been a necessity throughout mankind's existence. However, in earlier ages, because of lower population over the earth's surface, nature was able to recycle mankind's waste, rendering it into reusable material and nutrients for plant growth. With the advent of industrial society and concentration of populations in cities and towns, along with the increased production of paper and packaging materials, mankind has created a solid waste disposal problem. As a result, alternatives and new ideas for solid waste treatment and disposal must be considered. Landfarming is one such viable management alternative to landfill disposal.

Landfarming (or land applying) is the regulatory term used to define the application of wastes to land for the purpose of beneficial reuse and disposal that does not alter land topography nor disturb the soil **below three feet from the surface**. Landfarming also functions as a waste treatment process. Because each landfarming operation represents a unique combination of wastes, soil, cropping system and monitoring, a unique set of conditions or parameters must be prepared for each system. This unique combination must be evaluated within the current regulations while considering the environment, the landfarming system and monitoring schedules.

Results from the 2010 U.S. EPA survey (see Figure 1.1 below) suggest several alarming statistics:

- In general, three to five pounds of solid waste are generated nationally per capita per day.
- In Kentucky, it has been estimated that residential and commercial waste generated is **4.67 pounds per capita per day**.
- A community with a population of 40,000 would generate over 93 tons of waste per day or 34,000 tons per year.
- Each county in Kentucky has developed a solid waste management plan with the goal of **reducing by 25% the amount of solid waste annually going to landfills**.
- Landfarming is one important means to achieve this goal since the material is beneficially recycled for plant and soil enrichment.
- In the United States, roughly 16,500 municipal wastewater treatment plants produce over eight million dry tons of biosolids every year.
- Approximately 66,000+ (based upon 1995 survey) dry tons of municipal wastewater treatment solids are generated annually in Kentucky.

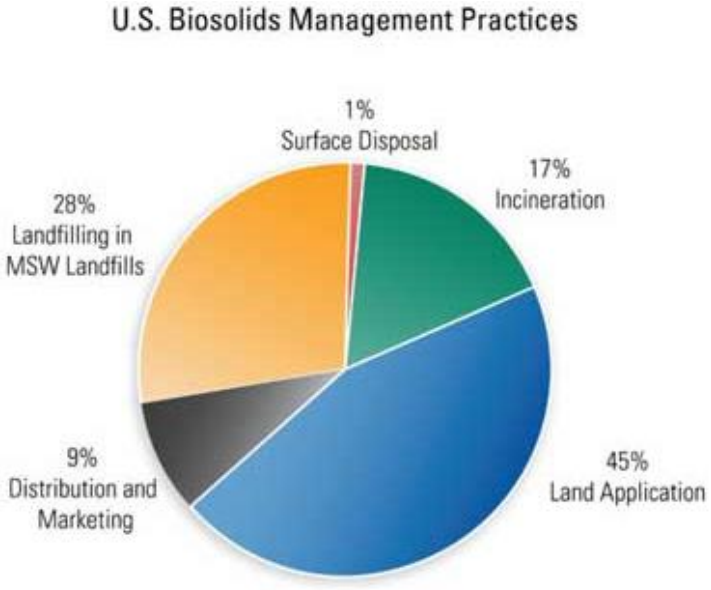
Figure 1.1. Municipal Solid Waste Generation in the United States



Source: *U.S.EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010.*

Figure 1.2 provides a graphical representation of biosolids management practices in the United States (2006).

Figure 1.2 U.S. Biosolids Management Practices in the United States



"Biosolids Management: Options, Opportunities & Challenges", NACWA

Anytime a waste material is applied to the land, it is viewed as part of a recycling effort or beneficial reuse of a waste. Land application of wastes benefits agriculture, the environment and society. Agriculture benefits as wastes improve the physical condition of the soil and supplies nutrients for crop production.

- The environment benefits as this reduces the concentration of nutrients handled by waste treatment facilities.
- Society benefits from a reduced need for landfill space and in having wastes applied in a safe and effective manner.

Landfarming (or land application) also has many additional benefits that include:

- Recycling nutrients from waste.
- Improving soil conditions by **increasing** organic matter and improving soil structure.
- Supplementing or replacing commercial fertilizer.
- Preserving landfill space by reusing beneficial material.
- Lower cost treatment alternative for organic waste.

Landfarming (land applying) offers the obvious benefits of **resource efficiency** and enhancing soil properties from many organic wastes that would otherwise be landfilled. It takes knowledgeable, conscientious people to address the broad array of concepts critical to successfully manage a landfarming operation. Any Kentucky Landfarm (or land application) operator must be certified by the Kentucky Division of Compliance Assistance (DCA), Certification and Licensing Branch.

Landfarm Operator Certification

This requirement is put into place to assure both the public and the regulatory agency that adequately trained personnel are on site to assure correct and safe operation of the facility. All permitted landfarm facilities must have at least one certified operator. The Division of Compliance Assistance (DCA) is responsible for the certification of landfarm operators. DCA will provide at least one scheduled training session each year. Certification is obtained by:

- Meeting minimum education and experience requirements
- Submitting the appropriate forms and fee
- Passing the certification examination with at least a 70%

No person shall be eligible for examination for certification unless that person completes the appropriate training course provided by the cabinet, unless the Cabinet accepts an alternative training program. The regulations (Appendix B) require that an individual seeking landfarm certification shall have a High School Diploma or GED **and** one (1) year of acceptable operation of a landfarming or composting facility. If an applicant does not meet the education and experience requirements, the cabinet may consider substitutions.

Each landfarming facility shall have a certified landfarming operator, and the facility shall not be operated in the absence of a certified operator. If the certified landfarming operator is scheduled to be away from the facility for more than 14 days during operation, the permittee must notify the Cabinet of his/her absence at least 10 days ahead of the absence. Eligibility can be based on education and experience. Operators must have at least one year of experience at a landfarm and pass a training course and exam. The certification lasts for a 5 year period. This notice will specify the person to be an interim operator. The Cabinet will evaluate the proposed interim operator's qualifications; approve, conditionally approve or deny the permittees request for designation of the interim operator; identify the length of time the interim operator may operate the facility and specify any special conditions.

Certification Renewal or Maintenance

- A certification shall be issued for a period of five (5) years at the end of which the certification shall expire (unless revoked).
- Renewal procedures and requirements shall be the same as those for a new certification.
- Certificates shall be prominently displayed at the facility office and the certified operator shall be able to present their wallet card and/or certificate during an inspection.

Standards of Professional Conduct for Certified Operators

In order to safeguard the life, health, and welfare of the public and the environment and to establish and maintain a high standard of integrity in the certified operator profession, standards of professional conduct apply to persons certified in accordance with solid waste regulations (401 KAR 47:070) or special waste regulations (401 KAR 45:090). The cabinet may revoke the certification of an operator if it is determined that the operator:

- Has practiced fraud or deception;
- Has failed to perform his duties as required by state regulations;
- Has failed to use reasonable care and judgment in performance of his duties under state regulations; or
- Has knowingly or willfully violated the requirements of any state or federal regulation.

Individuals who have had their certification revoked shall be ineligible for future recertification.

This chapter presented an overview of the requirements and certification processes for landfarm operators, the Kentucky regulations relating to the certification requirements for landfarm operations, and the importance of professional conduct for certified operators. The next chapter will describe the regulatory framework associated with landfarming in Kentucky, identify the waste types and associated permits, and explain the permitting process.

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Chapter 2: REGULATION OVERVIEW AND PERMITTING PROCESS

Chapter 2 Objectives

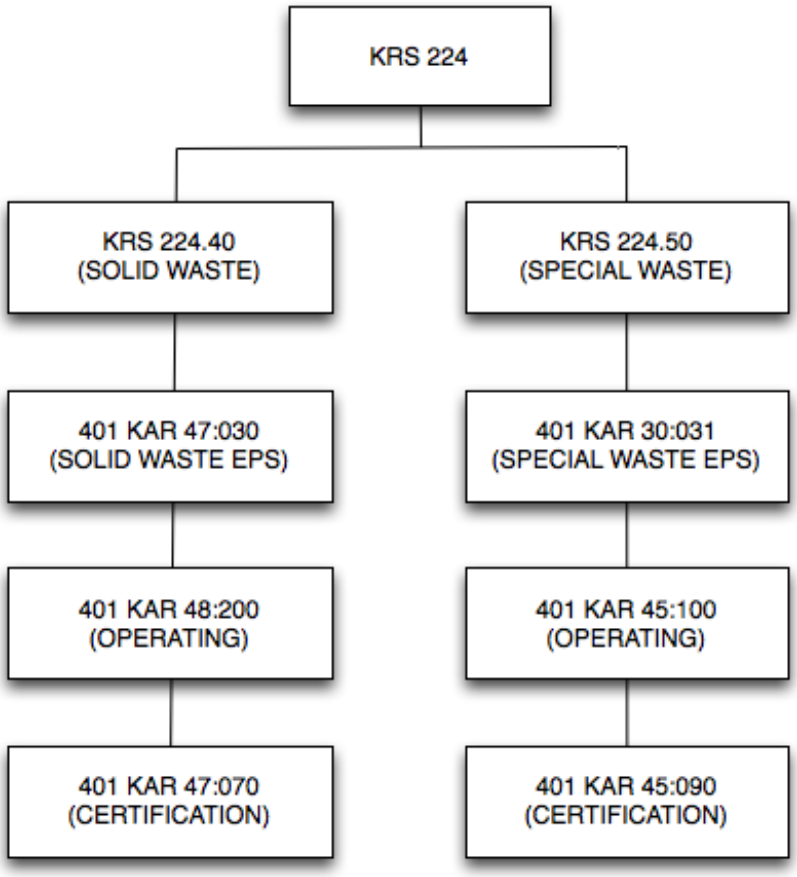
1. Understand the regulatory framework associated with landfarming in Kentucky.
2. Distinguish between solid and special waste types.
3. Understand the general permitting processes associated with solid and special waste types.
4. Explain the regulations associated with both solid and special waste landfarm facilities.
5. Understand the type of permit required for the different types of material being accepted.
6. Understand solid and special waste landfarm permit requirements.

Understanding the laws and regulations associated with landfarming and waste management can be confusing. Everything begins with the laws that are also referred to as the Kentucky Revised Statutes (KRS). The terms "laws" and "statutes" are frequently used interchangeably. The Kentucky laws (KRS) are established by the Legislature. The laws that pertain to landfarming and waste management are specifically contained in KRS 224 that authorizes the Cabinet to develop regulations that govern landfarming facilities and requires operator certification.

The Energy and Environment Cabinet develops Kentucky Administrative Regulations (KAR) in response to the legal mandates outlined in KRS 224. The Kentucky Administrative Regulations (KAR) provide specific details related to each of the general requirements stipulated by Kentucky Revised Statutes (KRS).

The foundation of the regulations for managing solid and special wastes, developed by the Cabinet, is the Environmental Performance Standards (EPS). These standards provide the "commandments" for protection of human health and the environment in Kentucky. The EPS contain standards pertaining to groundwater and surface water protection, disease control, odors, soil contamination, etc. These standards apply to **any** solid or special waste facility in Kentucky including landfarm facilities. Figure 2.1 provides a graphical representation for understanding the Kentucky Regulatory Framework—beginning with Kentucky Revised Statutes (KRS) related to solid and special waste and moving through to Kentucky Administrative Regulations (KAR) and related Environmental Performance Standards (EPS).

Figure 2.1. Kentucky Regulatory Framework



With a working understanding of the regulatory framework, we can move to a discussion of the different types of waste and the regulations pertaining to each.

Waste Types

In general, waste is categorized as either hazardous or non-hazardous. Non-hazardous wastes are further broken down into (a) special waste and (b) solid waste. Because hazardous waste is not suitable for landfarming, the remainder of the training will focus on **special waste** (including water and waste water treatment sludges) and **solid waste** (including food processing residuals and industrial by-products that are not wastewater residuals) and the regulations associated with each type of waste. Specific statutory definitions are included in the Glossary.

Operators must manage their waste in a manner consistent with federal and state laws that protect human health and the environment. Landfarm operators applying municipal wastewater treatment solids must also comply with federal rule 40 CFR 503. This rule is not described in detail in this manual but must be followed if applicable. The state of Kentucky does not have delegated authority to enforce the federal rule. It is the

responsibility of the entity land applying municipal wastewater treatment solids to understand and comply with this rule.

While it goes beyond the scope of this manual to address all of the specific regulations, it is important that all operators understand the general processes associated with both solid and special wastes. The permitting process is described below

Permitting Process

All facilities or sites involved in landfarming special or solid wastes must have a permit. The permitting process for operation of a landfarm facility differs for solid waste and special waste landfarm facilities. **Special waste** landfarm facilities that land apply wastewater treatment sludges are required to obtain a **formal permit.** Other special waste may qualify as a **Registered Permit-by-Rule. Solid waste** landfarm facilities, which handle materials such as food processing residuals and industrial by-products may qualify as a **Registered Permit-by-Rule** or require a **formal permit.**

Because it is likely that most course attendees have already obtained a landfarm permit, this section will briefly discuss the types of permits and the process involved in obtaining a permit from the Cabinet. For attendees that do not yet have a permit, additional information can be obtained by contacting the Division of Compliance Assistance, or the Division of Waste Management. (see Appendix C).

Fees

Privately owned and operated landfarming facilities are subject to permit fees. However, special Waste RPBRs (sludge giveaway, storage/treatment, and beneficial reuse) are not subject to permit fees. Political subdivisions (municipalities, governments, special districts) in the Commonwealth of Kentucky are also exempt. Each application to the Cabinet, other than from political subdivisions, must be accompanied by the appropriate fee.

Fees for landfarming special and solid wastes are specifically listed in 401 KAR 45:250 and 401 KAR 47:090, respectively, of the current regulations. A copy can be located by visiting the Legislative Research Commission's website: http://www.lrc.ky.gov/kar/titles.htm.

Special Waste

Special wastes are those materials of high volume and low hazard that remain after intermediate or final processing of materials by an individual, business, industry, or municipality.

Special wastes are specified by KRS 224.50-760; include "mining wastes, utility wastes (fly ash, bottom ash, scrubber sludge), waste from coal gasification facilities (vitrified

coarse solid residues, prilled or blocked sulfur) approved by the cabinet based on submittal of appropriate testing demonstrating that the wastes are of low hazard, sludge from water treatment facilities, sludge from wastewater treatment facilities, cement kiln dust, gas and oil drilling muds, and oil production brines." The cabinet may designate other materials special waste based on the regulatory requirements of 401 KAR 45:210.

> NOTE: **Domestic septage**, the liquid and solids removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar works that receive only domestic sewage, are **NOT** special wastes. In Kentucky, domestic septage and grease trap residues are regulated by the Public Health Department in the Cabinet for Health and Family Services. Persons who wish to land apply these wastes must obtain a permit from the local Health Department and are not required to obtain Landfarming Operator certification or any permits or authorization from the Division of Waste Management.

As previously stated, **special waste** landfarm facilities that land apply wastewater treatment sludges are required to obtain a **formal permit.** The permitting procedures and standards for special wastes are established in 401 KAR Chapter 45 (see Appendix B). For land application of municipal wastewater sludge, a federal permit may also be required. Contact U.S. EPA Region IV for further guidance.

Formal Permit

Notice of Intent to Apply

The Notice of Intent (DEP 7021A) is a form submitted by a person, business or municipality to indicate their intent to apply for a permit. To begin the formal permitting process, the Notice of Intent is submitted to the Cabinet. The Cabinet may be contacted at the following address or by visiting http://www.waste.ky.gov to obtain the necessary form:

Division of Waste Management
300 Sower Blvd.
Frankfort, KY 40601
Telephone: (502) 564-6716

Upon review of the Notice of Intent, the applicant will be notified as to what type of permit application will be required. The Cabinet classifies a special waste landfarming facility as either a Type A or Type B depending on the following criteria of **volume** and **chemical analysis** of the special waste:

Type A

Greater than 250,000 gallons of liquid waste or 250 tons of dewatered waste per calendar year regardless of chemical analysis of waste.

Type B

Less than 250,000 gallons of liquid waste or 250 tons of dewatered waste per calendar year and concentrations of heavy metals not to exceed parameters listed below.

Table 2.1 Waste Classifications of Heavy Metal Concentrations for **Special Waste** by Permit Type

	Concentration (ppm or mg/kg)	
Chemical Element	**Type A**	**Type B**
Cadmium	>10	≤10
Copper	>450	≤450
Lead	>250	≤250
Nickel	>50	≤50
Zinc	>900	≤900

Should a review of future analytical data indicate the type B levels are being exceeded, the Cabinet *may* reclassify the facility type.

For facilities to which the federal regulations apply, additional metals referred to as "pollutants" must be evaluated. The Cabinet will consider the federal pollutant limits when determining facility type.

Application for a Formal Permit

Once the Notice of Intent has been reviewed and accepted by the Division, an application for a formal permit (DEP 7021B) can be prepared and submitted. The formal permitting process (as it applies to Type A facilities) is described below and includes submittal of a complete application (401 KAR 45:030), public information procedures (401 KAR 45:050), application review (401 KAR 45:100), financial assurance requirements (401 KAR 45:080), surface and groundwater monitoring plan (401 KAR 45:160), and permit issuance or denial.

Type B facilities may be exempt from requirements related to publishing a public notice, posting of financial assurance, and the monitoring of groundwater and surface water.

Upon review of the application, the Cabinet will determine if the application is complete. If incomplete, the Cabinet will outline the deficiencies and the applicant will be given time to provide the requested materials or information.

The permit application must include form DEP 7094J "Past Performance Information" March 1992) which can be obtained from the Cabinet. The purpose of the form is to determine whether a history of violations exists and applies to both public and private entities. The Cabinet may deny a permit if the severity of previous violations warrant such action.

When the Cabinet determines the application to be complete, the applicant shall publish a public notice (Type A permits) supplied by the Cabinet in the newspaper with local coverage of the proposed site. The general public will be given 30 days from the date of publication to submit comments and/or request a public meeting based on interest and the need for information on the proposed landfarming site.

After the public meeting, the Cabinet will proceed to review the application. The personnel in the Cabinet may use comments received during the public information process to assist in making a decision on the application.

Following a review of the application, supporting materials, and any other available materials, the Cabinet will make a preliminary determination to issue, or deny the permit.

If the Cabinet makes a preliminary determination to issue the permit, a draft permit shall be prepared containing the proposed design and operational specifications. If the Cabinet makes a preliminary determination to deny the permit application, it shall issue a notice of intent to deny.

When the applicant is notified that either a draft permit or a modified draft permit has been issued, the permit applicant shall publish a public notice, supplied by the Cabinet, in the local newspaper. The general public will be given 30 days following the publication date for a public comment period and to request a formal public hearing before an appointed hearing officer.

After the close of the public comment period, the Cabinet has 30 days to respond to all comments submitted in writing or presented at the hearing. Upon completion of the hearing process, the Cabinet shall issue a decision to either issue or deny the permit. If the Cabinet makes a preliminary determination to modify a permit, a modified draft permit shall be prepared containing the proposed changes in design and operational specifications. A Cabinet representative may inspect the site within 30 days to verify that the applicant has

developed the site according to plans approved for the permit.

With the satisfactory completion of all factors under the draft permit, the Cabinet will issue a formal permit for operation of the landfarming site for a term not to exceed ten (10) years. The Cabinet may review the conditions of the permit after five years and modify the permit if necessary.

Other permitting standards for special waste permits include modification, suspension, revocation, and transfer of permits. Guidelines for these actions are found in 401 KAR 45:040.

Additional Permits

There are several additional types of permits that may be issued by the Cabinet depending on the particular waste, intention and nature of the proposed waste management practices.

Registered Permit-by-Rule

This permit category is a registration process used by the Cabinet for certain special waste facilities. They will have a permit following a complete registration by the owner or operator that involved required form submission, review, and acknowledgment. The complete process involves specifying the special waste, sources, amount to be handled, storage, and methods of treatment, mixing and disposal. Some facilities that may require a registered permit-by-rule related to landfarming include (401 KAR 45:070):

1) Beneficial re-use of special waste (***not*** to include municipal wastewater treatment solids).
2) Facilities engaged in the sludge giveaway (public entities only).
3) Facilities storing and treating special waste not specified in the section on permit-by- rule.

When the registered permit-by-rule has been acknowledged by the Cabinet, it is expected that the facility will comply with the environmental performance standards (401 KAR 30:031). Special waste registered permits-by-rule must receive written approval before operation may begin. Anytime the permit holder wishes to include a new waste, change capacity or change the processes for storage, treatment, reuse, or final disposal of the special wastes at the facility, they **must** submit a revised registration form to the Cabinet.

Permit-by-Rule

Facilities or sites are granted this type of permit through specific wording in the regulations. Facilities declared to have this type of permit do *not* have to make application or register with the Cabinet. Temporary storage of special waste is an example of an activity that is provided for in the permit-by-rule regulation (401 KAR 45:060). Other regulatory

programs that may apply include storm water monitoring as well as preparation and implementation of a groundwater protection plan under regulations enforced by the Division of Water. **Permit-by-rule facilities must also comply with the Environmental Performance Standards (EPS).**

Emergency Permit

The Cabinet may issue an emergency permit that allows for the management of special waste when emergency conditions exist that pose an imminent threat to human health or the environment (401 KAR 45:135). This type of permit may only be issued when the immediate need to store, process or dispose of the special waste greatly outweighs the time required to process a required permit more directly related to the classification of the waste.

Certain conditions affect the issuance, duration and operation for an emergency permit. An emergency permit:

1) Shall be given orally or in writing but if given orally, a written request must be forwarded to the Cabinet within five days.
2) The duration shall not exceed 90 days.
3) All operations conducted for the duration of the permit shall be conducted within the limits of the environmental performance standards (401 KAR 30:031).

Research, Development and Demonstration Permit

This category of permit may be issued by the Cabinet for a special waste or facility that seeks to demonstrate an unproven technology related to either the waste or to handling, treatment or disposal. It is suited for unusual waste streams or innovative processes. Requests for this type of permit are handled on a case-by-case basis. The request is made on form DEP 7094B entitled "Application for a Research and Demonstration Permit" and must demonstrate criteria stipulated in 401 KAR 45:135.

Research, development and demonstration permits may be issued for a period of up to 2 years and may be renewed one time for another 2-year period. All environmental performance standards (401 KAR 45:030) **must** be followed. Financial assurance requirements as specified in 401 KAR 45:080 must be met.

Solid Waste

As previously stated, **solid waste** landfarm facilities handle materials such as food processing residuals and industrial by-products. These facilities may qualify as a **Registered Permit-by-Rule** or require a **formal permit.** Permitting procedures and types of permits for landfarming solid wastes are similar to special wastes. Solid waste landfarming facilities are classified as either a Class I, Class II, or Class III. These procedures are specifically covered in 401 KAR Chapters 47 and 48 and are outlined below.

Formal Permit

a) A formal permit is required for Class II and Class III solid waste as described in 401 KAR 48:200.

b) Notice of Intent to Apply (Form DEP 7065)

c) Application for a Landfarming Facility Permit (Form DEP 7064) and Applicant Disclosure Statement (Form DEP 7087) are submitted to the Cabinet following determination of classification.

d) Cabinet determines application completeness.

e) Cabinet makes determination to issue or deny permit.

f) If recommendation is to issue, applicant publishes public notice in local paper.

g) Waiting period for hearing request – 30 days.

h) Administrative hearing held if requested.

i) Cabinet issues or denies permit.

Other Permits **(401 KAR 47:080)**

a) Registered permit-by-rule

b) Permit-by-rule

c) Emergency permit

d) Research, development and demonstration permit

Solid Waste Permitting Process

Solid waste landfarming facilities are classified as described below.

Class I Solid Waste Permit-By-Rule

Class I solid waste landfarm facilities must register with the Division of Waste Management by completing and submitting an application form (DEP 7059) for a Registered Permit-by-Rule for a Solid Waste Landfarm Facility. The application process begins with a public notice (401 KAR 47:110). **The operation must comply at all times with the Environmental Performance Standards set forth in 401 KAR 47:030** (see Appendix for

Complete EPS). The registrant must also ensure that the operation complies with any local land use regulations and/or zoning ordinances. A permit from the Division of Waste Management does not relieve the permittee from the responsibility of obtaining any other permits, licenses, or approvals required by this Division or other state and local agencies.

While an operator may commence operations after five business days (after submittal to the Cabinet), registrants often prefer to wait to begin operations until the state responds to their registration with written approval (in order to avoid the possibility of receiving a notice of violation due to critical omissions in the application). There are no permitting fees for municipal and county government facilities for this type of registration. Application fees for private facilities as well as annual renewal fees are stipulated in 401 KAR 47:090. A public meeting may occur if the Division receives a request for a meeting because of the public notice. Additionally, any person who feels they are aggrieved by the operation of the landfarm facility may petition the Division to demand a hearing that could result in modification or revocation of the registration. Therefore, the applicant may want to consider conducting a public meeting if it is thought that the proposed operation might be controversial to the public, even if the Division does not initiate such a meeting.

Annual reports are required to be submitted to the Division and must be on a form approved by the Division (DEP 7048 Special Waste; DEP 7064 Solid Waste).

The registrant may make modifications to the approved registration, such as adding another source of material, by submitting a revised registration to the Division. The Division may also make modifications after approval if such modifications are determined necessary to provide adequate protection to human health and the environment. A solid waste landfarm Registered Permit-by-Rule lasts for the life of the facility unless revoked. When the facility is no longer in operation, the permittee must send a request to the Division for closure.

Class II and Class III Solid Waste Formal Permit

The Cabinet classifies any landfarm facility based upon the volume and characterization of the material to be land applied. As a result the Cabinet may determine that the activity requires a formal permit (Class II or Class III) instead of a Registered Permit-by-Rule (Class I). A Class II permit is required for any landfarm facility that manages materials with heavy metal concentrations that exceed Class I (see Table 2.2). A Class II permit is required for facilities that exceed Class II heavy metal concentrations. Class II landfarms must conduct surface water monitoring and may be required to monitor groundwater. Class III landfarms must monitor both surface water and groundwater.

Table 2.2 Waste Classifications of Heavy Metal Concentrations for **Solid Waste** by Permit Type

Parameters for Class I Concentration

Chemical Element	Concentration (ppm or mg/kg)
Cadmium	≤ 10
Copper	≤ 450
Lead	≤ 250
Nickel	≤ 50
Zinc	≤ 900

Parameters for Class II Concentration

Chemical Element	Concentration (ppm or mg/kg)
Cadmium	>10 AND ≤ 30
Copper	>450 AND ≤ 900
Lead	>250 AND ≤ 500
Nickel	>50 AND ≤ 100
Zinc	>900 AND ≤ 1800

Parameters for Class III Concentration

Chemical Element	Concentration (ppm or mg/kg)
Cadmium	>30
Copper	>900
Lead	>500
Nickel	>100
Zinc	>1800

Permitting procedures and types of permits for landfarming solid wastes are similar to special wastes. These procedures are outlined as a matter of information.

1. ***Formal permit process for Class II and Class III Permits***
    1) Notice of Intent to Apply (Form DEP 7065)
    2) Application for a Landfarming Facility Permit (Form DEP 7064) and Applicant Disclosure Statement (Form DEP 7087) are submitted to the Cabinet following determination of classification.
    3) Cabinet determines application completeness
    4) Cabinet makes determination to issue or deny permit.
    5) If recommendation is to issue, applicant publishes public notice in local paper.

6) Waiting period for hearing request – 30 days.
7) Administrative hearing held if requested.
8) Cabinet issues or denies permit.

2. Registered Permit-by-Rule permit process for Class I Permits

The solid waste registered permit-by-rule (RPBR) process differs from the special waste RPBR in that a public notice is required and the operation may commence 5 business days after the application is submitted, without written authorization by the Cabinet.

Special and Solid Waste Permit Renewal

As previously stated, the Division shall review the conditions of a formal permit after five years and modify the permit as necessary. An application to renew a construction and/or operation permit shall be submitted to the Division at least 180 days before expiration of the permit. Persons applying for renewal of both, a solid waste permit or a special waste permit shall use the Application for the Renewal of a Formal Permit form (DEP 7095).

Closure

Landfarming facilities may be closed when waste is no longer available, upon expiration of the permit, or when violations of either environmental performance standards or other applicable regulations have occurred. After permanently ceasing operations of a formally permitted landfarming facility, the closure report shall be submitted to the Division. Details for special waste facilities are specified in 401 KAR 45:100 Section 4. Details for solid waste facilities are specified in 401 KAR 48:200, Section 10.

Post-closure monitoring may be required for certain facilities. Type A facilities shall commence a two-year post-closure monitoring and maintenance period starting the first day after the facility permanently ceases accepting waste. The owner or operator shall conduct groundwater and surface water monitoring as required by the facility's approved groundwater and surface water monitoring plan, and the terms of the operating permit. Type B facilities are not subject to the post-closure monitoring requirements. However, a two-year right of re-entry condition is necessary.

At the conclusion of the two-year post-closure period, the permittee shall submit a certification that post-closure is complete and that the site or facility complies with all post-closure requirements. Any environmental remediation or corrective action for groundwater contamination shall be performed by the permittee before the Division certifies the composting facility’s post-closure. Upon certification, the Division shall release the financial assurance bond.

Regulatory Overview

Regulations for landfarming follow two important principles:

(1) To provide overall environmental safety in reducing any potential harmful

effects from wastes; and

(2) To maintain a consistent recognition of limits for the land to adequately process wastes. This is accomplished by having minimum requirements, establishing site evaluation and system operating requirements, and maintaining monitoring requirements for both the environment and the landfarming system.

This manual is written specifically for the state of Kentucky. On July 20, 1993, federal rules went into effect, which regulates use and disposal of sewage sludge. This rule (40 CFR 503) has certain requirements, which are not included or incorporated in Kentucky's sludge management program. If you generate, treat, dispose, incinerate, or beneficially reuse sewage sludge in Kentucky, you must comply with both state and federal rules. This manual discusses some requirements of the 503 rule, but is not intended as a complete guide.

The two predominate land-applied **special waste** types are water and wastewater treatment sludges.

1. Sludge – Water treatment

Water treatment sludge, also referred to as water treatment residuals, consists of the solids and associated liquids removed during production of potable water supplied to private or municipal drinking water systems. Water treatment facilities remove suspended and dissolved solids from water taken from rivers, lakes, or underground sources during the production of potable water.

Since the water treatment residuals generally contain very low amounts of organic matter, the need for treatment to reduce pathogen levels is usually not necessary. Water treatment residuals may also contain trace elements, or micronutrients, beneficial to plant growth and low levels of heavy metals (cadmium, chromium, copper, nickel, lead, and zinc). These solids typically contain low levels of macronutrients beneficial to crops.

2a. Sludge – Wastewater treatment (Domestic Biosolids)

Wastewater sludge (also known as wastewater solids or biosolids) are solids generated by the treatment of wastewater to reduce or remove biological, physical and chemical contaminants before discharging the treated wastewater. Typical wastewater sludges are required to meet regulatory levels of treatment to reduce pathogens and vector attraction reduction (volatile solids) before they are suitable for land application.

Wastewater sludges are typically treated either aerobically or anaerobically. Both treatment methods are acceptable for material to be land applied. Other methods of achieving these regulatory treatment standards may include lime stabilization or heat drying among others.

2b. Sludge – Wastewater treatment (Other Industrial Special Wastes)

Industrial wastewater treatment by-products including solids from food processing facilities, distillery wastes, poultry and other animal processing, and other wastewater-derived solids.

2c. Other Special Wastes

Other types of waste products may be land applied. These include, but are not limited to, fly ash, lime scrubber sludge, fluidized bed combustion waste (FBCW), gas and oil drilling mud, and oil production brines (see Appendix E). These wastes may include contaminants of concern that are not addressed by regulation and must be considered on a case-by-case basis. If you have any of the special waste types listed here, please contact the Division of Waste Management for guidance on how to proceed.

Solid Waste

Solid wastes, as defined by Kentucky statutes (KRS 224.01-010(31) (a)) is any discarded material that is not hazardous waste, special waste, coal mining waste or agricultural waste. "Solid waste", as defined, includes liquids and contained gasses. For the full definition, refer to the glossary in Appendix A.

By federal law, an exemption is also provided for solid or dissolved material in domestic or industrial water or wastewater treatment systems while in process, treatment or storage units (lagoons) subject to Kentucky Pollutant Discharge Elimination System (KPDES) permitting requirements. It is important to understand that **when such units are no longer under a KPDES permit or a Kentucky No Discharge Operating Permit (KNDOP), the exemption no longer applies, and those units become subject to waste regulations and permitting requirements**. This applies to both special and solid wastes as defined in the Commonwealth.

The so-called "agricultural waste exemption" applies only to manure, crop and crop residue "*when placed on the soil for return to the soil as fertilizers or soil conditioners."* Special wastes are <u>not</u> a subset of solid wastes, a common misperception.

Most solid wastes that are land applied are food processing residuals and industrial by-products that are not wastewater residuals. These wastes include liquid and solid wastes from various food preparation plants including:

- whey from cheese making and rejected milk from milk processing;
- starch, peels and rejects from potato chips;
- trimmings and rejects of vegetables and fruits from restaurants and grocery stores;
- pomace from fruit processing;
- tomato pulp from sauces and catsup;

- wood processing wastes;
- hulls and skins from peanut processing;
- dust and hulls from coffee grinding and oil seed extraction; and
- spent media from drug and food supplement manufacturing.

1. Food Wastes

Food wastes are the results of food production and processing, or food supplement processing. As most food wastes are relatively unprocessed, there is a concern for the high biochemical oxygen demand (BOD) levels contained in these wastes. In some cases (whey, potato starch and milk), BOD limits should determine the application rates unless nitrogen or other elements limit land application to lesser rates. On the other hand, some materials (potato peels, cucumber parts, vegetable trimmings, peanut hulls, and oil seed hulls) represent crop residues that are easily land applied. In addition, some of these materials are useful in composting operations because they are relatively easily decomposed.

In addition to the standard waste analysis required by regulation, additional parameters such as BOD, salts, oil and grease, may be necessary to determine suitability of these products for land application.

2. Other Solid Wastes

Some solid wastes, such as sawdust, wood chips and leaves, due to their low potential to create nuisance conditions or cause environmental harm, may be land applied under the Permit-by-Rule provisions of Kentucky solid waste regulations. When allowed as a permit-by- rule beneficial reuse, no written application or written authorization is required. In some cases, the person applying the waste, or the waste generator, the land owner or even county officials may require written authorization from the state, in which case an application may be made requesting a Beneficial Use Determination.

All permit-by-rule activities must comply with the Environmental Performance Standards (EPS). For example, unless incorporated by disc or plow, land application in a 100-year floodplain is prohibited. Setbacks from streams or other Waters of the Commonwealth should also be observed, as wash out by rain into the water would be a violation of the EPS.

Chapter 3: LANDFARM SITING COMPONENTS

Chapter 3 Objectives

(1) Identify and explain the importance of soil, plant and regulatory factors as they relate to site selection.
(2) Describe the regulatory siting requirements.
(3) Understand the importance for using a soil survey report and USGS topographical map as it relates to site selection.
(4) Describe how the Kentucky environmental performance standards apply to landfarm siting.

Introduction

When sewage sludge or other waste is land applied, sunlight and soil microorganisms help destroy any pathogens (disease-causing organisms) that may be in the waste. Ultraviolet light and microorganisms will also break down many potentially toxic organic substances. Various soil physical and chemical properties will trap heavy metals and retain nutrients. However, the land has a limit to its capacity to treat waste. The landfarming system must be designed to work within this capacity. Selecting suitable land for landfarming is the first step in ensuring a successful operation.

The purpose of this chapter is to provide a brief introduction to the general siting requirements and essential components of landfarms. We assume most participants in this course will be employed on a working permitted landfarm (for more details about siting requirements and regulations related to permitting a landfarm facility contact the Solid Waste Branch of the Division of Waste Management).

Site Selection

Site selection can be one of the most important decisions made in a land application program. Any land site on which a suitable vegetative cover or crop can be grown or produced using agricultural practices holds potential for beneficial use of waste materials. Distinguishing more suitable sites from less suitable sites will be discussed in this section. The more suitable sites can accept wastes in nearly any form and with few restrictions on application timing other than those imposed by the growing plants.

Poor site selection can increase costs due to inefficiency, environmental problems and public opposition (both initially and after startup). Less suitable sites may restrict the type or form of waste, the method of application, and the timing of the application. These sites are likely to be more difficult to manage because storage or alternative disposal methods may be needed due to seasonal restrictions. Additional management practices may also be required to address issues such as slopes, surface water features (e.g., farm ponds), high water tables, and restrictive soil layers.

Site selection involves the recognition of soil, plant and regulatory factors that will be addressed in this section. Soil factors will be discussed to act as guides in selecting potential sites. Regulatory factors will be listed in order to relay the restrictions imposed during the selection process.

Soil Suitability

The ideal soil should be deep, well-drained, and silt loam textured. It should have a black or dark brown colored surface, and reddish-brown or yellowish-brown subsoil. It should not be mottled with gray to a depth of 40 inches. The subsoil should have no restrictive layers within 40 inches. The structure should be stable, and the soils should have a low shrink-swell potential.

The ideal soil should allow water to enter and pass through easily, but not too fast. The infiltration rate should be moderate to rapid, and the permeability should be moderately slow to moderately rapid throughout. This soil should be nearly level to very gently rolling with slopes between 0 and 3%. The site must not be on an active floodplain.

Very few soils qualify as ideal for waste application. Most depart in at least a small way, for at least one of the critical properties. Those soils that have only a few small departures are still suitable for land application of wastes; their limitation can be overcome easily with a minimum of special management practices. The soil property information is contained in a soil survey report of an area. These reports are published cooperatively by the Natural Resources Conservation Service (formerly the Soil Conservation Service), the University of Kentucky, and the Kentucky Division of Conservation. When evaluating potential sites and soils at those sites, evaluation should begin by locating the site on a soil survey report and USGS topographic map. The soil survey contains information that is used to evaluate site suitability including the following:

a) Soil types that are present at the potential landfarming site;
b) Soil textures and soil horizons present;
c) Presence of restrictive layers (e.g., fragipans, claypans);
d) Soil depth to bedrock;
e) Soil permeability and infiltration.

Regulatory Site Restrictions

There are a few site and soil factors that are specified for evaluating potential land application sites in Kentucky. These specified factors are contained in the Kentucky Administrative Regulations (KAR) dealing with siting requirements for landfarming special waste (401 KAR 45:100) and solid waste (401 KAR 48:200). These factors may reduce or limit the land area available at a potential site.

The following are regulatory siting requirements:

a) The site cannot be located within a 100-year flood plain unless the waste is to be injected or incorporated.
b) The site must have soil that is at least 4 ft. deep over such restrictive layers as bedrock, and the seasonal high water table.
c) The soil is not suitable if the permeability rate is less than 0.2 in. per hr. or greater than 6 in. per hr. Suitable soils would include the following permeability classes: moderately slow, moderate, and moderately rapid.
d) The slope can be no greater than 15% for any soil area used for land application.
e) Buffer zones must be maintained between a land feature, object or structure and the land application area. These minimum buffer distances between the land application area and the listed feature are as follows depending on the method of land application.

Buffer zones for SPECIAL WASTES (401 KAR 45:100)

Application Method

Structure or Object	Subsurface injection or incorporation	Surface application
Residences & Occupied building	200ft.	300ft.
Water well	200ft.	300ft.
Surface water body	200ft.	300ft.
Karst feature	200ft.	300ft.
Perennial stream	200ft.	300ft.
Intermittent stream	30ft.	50ft.
Ephemeral stream	30ft.	50ft.
Property line	30ft.	50ft.
Public road	30ft.	50ft.

At this time, landfarming solid wastes require slightly different distances for buffer zones as follows:

Buffer zones for SOLID WASTES (401 KAR 48:200)

Application Method

Structure or Object	Subsurface injection	All other means of application
Residences & Occupied building	250ft.	500ft.
Drinking water well	250ft.	500ft.
Surface water body	250ft.	500ft.
Intermittent stream	250ft.	500ft.
Karst feature	250ft.	500ft.
Public road	30ft.	50ft.
Ephemeral stream	30ft.	50ft.
Property line	30ft.	50ft.

Procedures for Site Evaluation

An on-site visit may require the help of personnel from the Natural Resources Conservation Service (NRCS) located in your county, or the services of a consultant who may be involved in permit preparation. The published soil survey reports are excellent tools for site evaluation. However, soil survey reports cannot and should not replace a physical on-site evaluation.

During the on-site visit, the soil properties should be determined and recorded on a map of the area. Also, there should be identification of structures, objects and land features that are to be located on the map. Then buffer zones should be marked on the map and in the field.

A geologic investigation related to groundwater must also be conducted. This process is the basis of developing a groundwater assurance plan that must be submitted in addition to the soils information. This investigation begins with obtaining a geologic map of the area (available from the Kentucky Geological Survey).

Other siting considerations may include nuisances, vectors, food chain restrictions and other issues that are part of the Environmental Performance Standards (EPS). The most relevant issues described in the EPS are listed below:

a) **floodplain location**- no waste shall restrict flows or holding capacity of the 100-year floodplain.
b) **effects on endangered species**- no facility shall have a negative impact on endangered species or habitats
c) **surface water pollution**- no facility shall discharge pollutants that violate water quality standards.
d) **groundwater contamination**- no facility shall contaminate an underground source of drinking water beyond the allowed maximum contaminant levels.
e) **food chain crops**- there are special requirements for cadmium.
f) **disease vectors**- these requirements apply to wastewater residuals and require a process to significantly reduce pathogens.
g) **polychlorinated biphenyls** (PCBs) - PCBs in waste to be land applied may not be higher than 1 milligram per kilogram.
h) **public nuisance**- no public nuisance due to odor or tracking of waste on public roads.
i) wetland designation- sites may not be located in wetlands
j) **karst terrain**- sites mat not contaminate karst terrain

Note: **Just because something is legal (or in compliance) does not mean that you will not be hearing from disgruntled neighbors.**

Chapter 4: OPERATING YOUR LANDFARM

Chapter 4 Objectives

1. Explain required sampling and waste analysis.
2. Describe the importance of soil testing.
3. Understand waste application restrictions.
4. Understand the importance of recordkeeping.

MATERIAL TESTING, SAMPLING & ANALYSIS

Any waste material that is to be landfarmed must be analyzed for several chemical and physical parameters to determine its suitability for land application. This information will also allow calculation of application rates for landfarming. Proper sampling procedures (sample collection) are imperative to your landfarm operation and compliance. This chapter describes the process of materials testing, sampling, and analysis.

Characterization of a waste material is the first step that must be taken before the material is considered for land application. Obtaining a representative sample is imperative to accurately characterize the waste material. The sample must be collected close to the time of the application so as to be as representative as possible of the applied material.

Regulatory Parameters

The following list provides the minimum regulatory required parameters for any waste material:

% Total solids	Total copper (Cu)	% Ammonium nitrogen
% Total phosphorus (P)	Total lead (Pb)	pH
% Total (Kjeldahl) nitrogen (N)	Total polychlorinated biphenyls (PCB's)	Total chromium (Cr)
% Nitrate nitrogen	% Volatile solids	Total nickel (Ni)
Total cadmium (Cd)	% total potassium (K)	Total zinc (Zn)

If the waste is domestic sewage sludge, waste analysis must also include total arsenic (As), total mercury (Hg), total molybdenum (Mo), and total selenium (Se), to meet federal requirements.

In some cases the Division may require additional parameters in order to completely characterize a unique waste material to determine its acceptability for landfarming.

Metal concentration values shall be determined and reported on a dry weight basis (or mg/kg). Lab reports will frequently provide both the "as received" wet weight (mg/L) as well as the converted dry weight (mg/kg). If the lab report does not contain the dry weight conversion, simply divide the milligrams/liter (mg/L) by % total solids/100 to obtain the dry weight analysis. See the example below:

Copper 10mg/L @ 20% total solids ("as received" weight)
10mg/L ÷ (20% ÷ 100) = 2 mg/kg (dry weight)
Metal concentrations will determine the classification and lifespan of your landfarm. In most cases, nitrogen (N) will determine the annual application rates.

Pathogen and Vector Demonstration

Material that is to be land applied must be demonstrated to contain a safe level of pathogenic organisms as well as a reduced potential to attract disease vectors and create odors. Pathogens are the organisms that cause disease and may include bacteria, fungi, protozoans, viruses, etc. Vectors are the organisms (e.g., flies, rats, etc.) that spread pathogens between animals and humans.

Currently, Kentucky does not have specific regulatory guidelines on methods to test for pathogen levels or vector attraction reduction. State regulations incorporate the former federal rule standards for meeting a Process to Significantly Reduce Pathogens (PSRP), or Process to Further Reduce Pathogens (PFRP). PSRP treatment is the minimum required level of pathogen reduction for land application of wastes. Several PSRP and PFRP methods are related to the design and operation of domestic sewage treatment facilities and are not adaptable to other materials such as poultry processing or other food industry wastes. However, current federal regulations provide several strategies and metrics for testing pathogens and vectors that are commonly accepted by the Division. The most commonly utilized demonstration options have been discussed below.

Pathogen Reduction

40 CFR 503.32 Class B Alternative 1 – **Seven fecal coliform analysis** – is often the easiest, and least expensive, way to demonstrate pathogen reduction. This federal rule states that samples taken for pathogen analyses "shall be collected at the time the sewage sludge is used or disposed." While this sampling is required to be conducted only at the same frequency as other required parameters (anywhere from twice to twelve times per year depending on size of the facility under state regulations) the operator should schedule sampling events in a way that results are received immediately prior to land application whenever possible.

The US EPA manual "Control of Pathogens and Vector Attraction in Sewage Sludge" (EPA/625/R-92/013) recommends that the seven samples required for fecal coliform bacteria analysis be taken over a two week period to represent performance of the treatment facility over a range of conditions. (NOTE: Samples cannot be held for two weeks—instead, all samples must be **preserved** and **received by the lab within 24 hours** of collection). It is also recommended that sampling should be performed under worst-case conditions such as during winter when the climatic conditions are the most adverse. Most winters provide very few days of opportunity to land apply – if it's not raining or snowing the soil may be frozen or saturated – but by conducting at least one of the required fecal coliform 7-sample events in winter, you will have a higher level of assurance that the treatment system is capable of meeting the minimums all year around.

Vector Attraction Reduction

Vector Attraction Reduction (VAR) is normally achieved in the waste treatment process. The most common method to demonstrate VAR is the Specific Oxygen Uptake Rate (SOUR) test

(for aerobically treated material). As specified in the federal rule and adopted by Kentucky, the oxygen uptake rate of a waste must not be more that 1.5 milligrams of oxygen per hour per gram of total solids to be considered stable enough to be surface applied.

Another common method to meet VAR is to incorporate or inject material under the surface of the soil. Meeting VAR by this method requires that the material be incorporated no later than six hours after being applied to the land.

Less common, but also acceptable, is lime or alkaline stabilization by raising the pH of the material to 12.0 for two hours, and maintaining a pH of at least 11.5 for an additional 22 hours. All VAR methods are described in 40 CFR 503.33.

Sampling Procedures and Frequency

As previously mentioned, obtaining a representative sample is imperative to accurately characterize the waste material. The production/output (volume) will determine the number of required samples that must be collected annually (generally between 2 and 12). The greater the output, the greater the number of samples that are required to be collected. The sample must be collected as close to the time of the application so as to be as representative as possible of the applied material.

Operators should prepare a sampling plan and make sure employees who may conduct sampling have that information readily available. The sampling plan should provide for the following information:

- Sample collection locations
- Volumes of sample to be collected
- Sample compositing procedures
- Days and times of collection
- Required equipment including type and size of containers and preservatives needed
- Instructions for labeling samples and ensuring the chain of custody
- The list of parameters to be analyzed
- A list of contact persons and telephone numbers in case unexpected difficulties arise during sampling

All information pertinent to a sampling event should be recorded in a bound log book which includes, at a minimum, date, time and location of sample, names of the persons collecting the samples and date and time samples were shipped.

It is particularly important to use a Chain of Custody (COC) to establish documentation necessary to trace sample possession from the time of collection. A Chain of Custody should accompany every sample. If litigation should occur, such as a landowner or an adjacent landowner claiming health injury or damage to property, this record is necessary if the sample is to

be introduced as evidence. As a rule of thumb, the information recorded on the COC should be sufficient that the sampling event can be reconstruction without reliance on the memory of the sampler. Most laboratories will require a COC for any samples submitted and will provide these forms.

It is recommended that you verify with the Division that all necessary parameters have been included on the list, and that no unnecessary parameters are included. It is a common mistake that waste samples are analyzed for Toxicity Characteristic Leaching Procedure (TCLP), US EPA Method 1311, during regularly scheduled sampling. This is an expensive test that is *unnecessary* after initial characterization during the permitting process. Once it is established in baseline characterization that the material is not characteristically hazardous (i.e., not leaching unacceptable levels of toxic elements or compounds), the operator may use "generator knowledge" to waive future TCLP testing. TCLP analysis would only be requested again if new industrial dischargers are added to a municipal wastewater system, for example, or other significant process or input changes are made to the waste generating system.

Similarly, Polychlorinated Biphenyls (PCBs), which are specifically included in the list of required waste parameters in both special and solid waste landfarming regulations, should be included in analysis for waste characterization ***at the time the waste is being permitted***. Once these results demonstrate the absence of PCBs in the material, the operator may also waive this sampling requirement based on generator knowledge. Regulations banning PCBs have virtually eliminated this possible contaminant, not only in municipal wastewater solids, but also in most wastes suitable for land application.

Ideally, waste sampling events should occur ***immediately before the material is removed for land application***, while allowing time for lab results to be obtained and evaluated before spreading begins. Each sampling event should be at least 30 days apart to represent quality over a range of conditions. Depending on the frequency required of the facility (2 – 12 times/year), the operator should schedule sampling events so that results are as representative as possible at the time the material is applied to the land. So, rather than scheduling events strictly on a semi-annual, quarterly or monthly basis, for example quarterly sampling at the end of March, June, September and December, it is better to cluster sampling events in seasons when most land application is occurring, usually spring and fall. Sampling for lagoon systems may require a different schedule than a conventional wastewater treatment system. Contact the Division for an acceptable sampling plan.

The sample collection point or points should be specifically identified in the sampling plan and consistently used. As noted above, this point should be representative of the material as it is applied to the land.

It is strongly encouraged that laboratory reports be reviewed as soon as possible upon receipt. This is important for the following reasons:

1. Ensure that all required parameters were analyzed.
2. Check for any clerical errors in the report (e.g., facility name, type, etc.)
3. Compare data to previous reports to check for inconsistencies.
4. Detection limits should be equal to or less than regulatory limits.
5. Compare reported values against the regulatory limits.

If detected soon enough, inaccuracies and inconsistencies can be double-checked and corrected by having the laboratory re-analyze the sample. Depending upon the type of analysis being performed, the lab may hold samples for up to 30 days. For some parameters (e.g., fecal coliform, nutrients), additional samples will need to be collected.

Sample waste analyses reports for metals, nutrients, and pathogen reduction demonstration as well as an example chain of custody are provided below:

ESC
L·A·B S·C·I·E·N·C·E·S
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

January 23, 2013

Mr. Todd Stephens
H & A Resource Management,LLC
103 Fieldview Drive
Versailles, KY 40383

ESC Sample # : L567502-01

Date Received : March 30, 2012
Description :

Site ID :

Sample ID : DIGESTER 1 2 3

Project # : WWTP

Collected By :
Collection Date :

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Nitrate	9.4	1.0	390	41.	mg/kg	9056	04/03/12
Phosphate as P	38.	1.0	1600	41.	mg/kg	9056	04/03/12
Ammonia Nitrogen	58.	5.0	2400	200	mg/kg	350.1	04/06/12
pH	6.7		6.7		su	9045D	04/03/12
Kjeldahl Nitrogen, TKN	1200	100	49000	4100	mg/kg	351.2	04/06/12
Total Solids	2.43	0.100	2.43	0.100	%	2540G	04/03/12
Volatile Solids	60.	1.0	60.	1.0	% of TS	160.4	04/06/12
Mercury	RDL	0.020	RDL	0.82	mg/kg	7471	03/31/12
Arsenic	RDL	0.10	RDL	4.1	mg/kg	6010B	04/01/12
Cadmium	0.027	0.025	1.1	1.0	mg/kg	6010B	04/01/12
Chromium	0.69	0.050	28.	2.0	mg/kg	6010B	04/01/12
Copper	8.4	0.10	340	4.1	mg/kg	6010B	04/01/12
Lead	0.66	0.025	27.	1.0	mg/kg	6010B	04/01/12
Molybdenum	0.20	0.025	8.2	1.0	mg/kg	6010B	04/01/12
Nickel	0.60	0.10	25.	4.1	mg/kg	6010B	04/01/12
Potassium	110	2.5	4500	100	mg/kg	6010B	04/01/12
Selenium	0.14	0.10	5.8	4.1	mg/kg	6010B	04/01/12
Silver	0.74	0.050	30.	2.0	mg/kg	6010B	04/01/12
Zinc	16.	0.15	660	6.2	mg/kg	6010B	04/01/12

RDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
The reported analytical results relate only to the sample submitted.

Reported: 01/23/13 12:33 Revised: 01/23/13 17:35
L567502-01 (PH) - 6.7@18.7c

Examples used with permission by H&A Resource Management, LLC.

ESC LABORATORY SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

Mr. Todd Stephens
H & A Resource Management,LLC
103 Fieldview Drive
Versailles, KY 40383

January 23, 2013

Date Received : March 30, 2012
Description : Biosolids

Sample ID : DIGESTER 1 2 3

Collected By :
Collection Date : 03/29/12 11:15

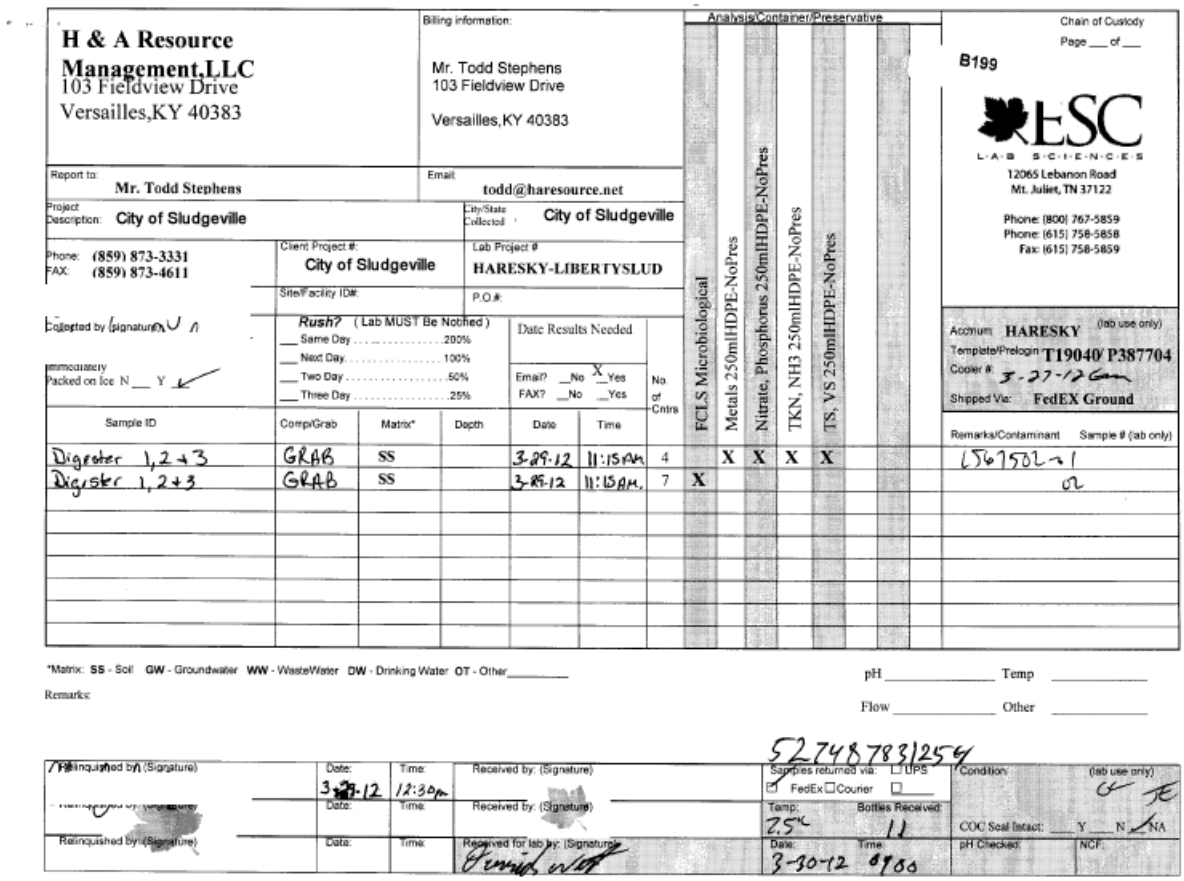
ESC Sample # : L567502-02

Site ID :

Project # : WWTP

Parameter	Result	Det. Limit	Units	Method	Date	Dil.
Fecal Coliform -Geom.Mean	<6000		col/g	9222D	03/30/12	100
Fecal Coliform -1	4200.0		col/g	9222D	03/30/12	100
Fecal Coliform -2	4200.0		col/g	9222D	03/30/12	100
Fecal Coliform -3	13000.		col/g	9222D	03/30/12	100
Fecal Coliform -4	8500.0		col/g	9222D	03/30/12	100
Fecal Coliform -5	<4200		col/g	9222D	03/30/12	100
Fecal Coliform -6	7700.0		col/g	9222D	03/30/12	100
Fecal Coliform -7	4200.0		col/g	9222D	03/30/12	100

RDL - Below Detection Limit
Det. Limit - Practical Quantitation Limit(PQL)
Note:
The reported analytical results relate only to the sample submitted.
This report shall not be reproduced, except in full, without the written approval from ESC.
.
Reported: 01/23/13 12:33 Revised: 01/23/13 17:36



H & A Resource Management,LLC
103 Fieldview Drive
Versailles,KY 40383

Billing information:
Mr. Todd Stephens
103 Fieldview Drive
Versailles,KY 40383

Analysis/Container/Preservative

Chain of Custody
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B199

ESC LAB SCIENCES
12065 Lebanon Road
Mt. Juliet, TN 37122
Phone: (800) 767-5859
Phone: (615) 758-5858
Fax: (615) 758-5859

Report to: Mr. Todd Stephens
Email: todd@haresource.net
Project Description: City of Sludgeville
City/State Collected: City of Sludgeville
Phone: (859) 873-3331
FAX: (859) 873-4611
Client Project #: City of Sludgeville
Lab Project #: HARESKY-LIBERTYSLUD
Site/Facility ID#:
P.O.#:
Collected by (signature):
Immediately Packed on Ice N___ Y ✓
Rush? (Lab MUST Be Notified)
___ Same Day 200%
___ Next Day 100%
___ Two Day 50%
___ Three Day 25%
Date Results Needed
Email? ___No X Yes
FAX? ___No ___Yes

Acctnum: HARESKY (lab use only)
Template/Prelogin: T19040/ P387704
Cooler #: 3-27-12 Gm
Shipped Via: FedEX Ground

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	FCLS Microbiological	Metals 250mlHDPE-NoPres	Nitrate, Phosphorus 250mlHDPE-NoPres	TKN, NH3 250mlHDPE-NoPres	TS, VS 250mlHDPE-NoPres			Remarks/Contaminant	Sample # (lab only)
Digester 1,2+3	GRAB	SS		3.29.12	11:15AM	4		X	X	X	X				L561502-01
Digester 1,2+3	GRAB	SS		3.29.12	11:15AM	7	X								02

*Matrix: SS - Soil GW - Groundwater WW - WasteWater DW - Drinking Water OT - Other_____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

527487831254

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Samples returned via: ☐ UPS ☑ FedEx ☐ Courier ☐	Condition: (lab use only)
	3-29-12	12:30p		Temp: 2.5°C Bottles Received: 11	COC Seal Intact: ___ Y ___ N ___ NA
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 3-30-12 Time: 0900	pH Checked: NCF:

Examples used with permission by H&A Resource Management, LLC.

Soil Sampling and Analysis

Soils at the site must be analyzed before land application begins. A sample should represent each individual permitted field (subplot). The soil sampling data will help to determine the lifespan of your facility, which is based upon the cation exchange capacity (CEC). Analyses will also provide details regarding soil pH, nutrients such as phosphorous and potassium, and baseline micronutrients (e.g., metals). Soil pH must be maintained at or greater than 6.5 prior to land application. Sample collection well in advance of land application will allow for any pH adjustment to be made via the addition of lime. Soil analysis will NOT provide a nitrogen concentration but it will provide data to be used for calculating recommended application rates.

Soil samples should be taken according to a plan approved by the Cabinet or as outlined in the University of Kentucky Publication "Taking Soil Test Samples" AGR-16. It is recommended that the sample be split into two subsamples. One subsample should be submitted to a contract private laboratory for analysis of cadmium, chromium, copper, nickel, lead, zinc and PCBs. The other subsample should be submitted to the local county Extension Service agent for agriculture to determine the analysis of soil pH, buffer pH, phosphorus, potassium, and CEC. This data will be used to determine nutrient and lime recommendations.

Metals results should be reported in mg/kg dry weight. The Extension Service results for extractable nutrients will be reported as pounds per acre and CEC will be reported as milliequivalents per 100 grams (me/100g) of soil. The Extension Service recommendations for nitrogen, phosphate and potash will be presented as lbs/acre of N, P_2O_5 and K_2O per acre, respectively. These recommendations are made using the soil test data and the proposed crop to be grown.

Soil sampling is required prior to land application and annually thereafter. If the subplot is not used in a particular year, samples are not required.

A sample Extension Service laboratory report is provided below:

From:	
WOODFORD COUNTY COOPERATIVE EXTENSION SERVICE 184 BEASLEY ROAD VERSAILLES, KY 40383-9558	**UK COOPERATIVE EXTENSION SERVICE** University of Kentucky – College of Agriculture **Soil Test Report** Lexington 859-257-2785 Princeton 270-365-7541 www.rs.uky.edu/soils

COUNTY SAMPLE NO.: 0393 **REPORT FORM:** A	To: H & A RESOURCE MANAGEMENT, 103 FIELDVIEW DRIVE VERSAILLES, KY 40383	T. Adam Probst (859)-873-4601 *CEA for Agriculture and Natural Resources*

Date	Owner Sample ID	Owner ID	County Code	UK Lab NO.
5/10/2013	G04	980031	239	19881

Nutrient	Lab Results	Level of Adequacy (Very Low / Low / Medium / High / Very High)	Calculated CEC Data	
Phosphorus (P)	57	>>>>>>>>>>>>>>>>>>>>>>>>>>>		
Potassium (K)	314	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	CEC (meg/100g):	16
Soil pH	6.3		%Base Sat.:	66
Buffer pH	6.8		%K:	3
Calcium (Ca)	3341		%Ca:	53
Magnesium (Mg)	372	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	%Mg:	10
Zinc (Zn)	4.3		%H:	35
Other Test				

Acres	Primary Crop	Primary Management	Primary Use	Previous Crop	Previous Management	Previous Use	Crop 2 Years Ago Tobacco	Soil Drainage
3.8	Cool Season Grass	Annual Top Dressing	Pasture	Cool Season Grass	Hay or Pasture > 4yrs.	Pasture		Moderately Well

RECOMMENDATIONS:	N	P2O5	K2O	LIME	Mg	Zn
	see comments below	30 lb/ac	None	None	None	None

N Y

EXTENSION AGENT NOTE:

The optimum time for N application to cool-season grass stands is between Feb 15 to Mar 15 (at spring greenup). Although this has past, broadcast 70 lb/A of DAP (18-46-0) and up to 80 lb/A urea, or 110 lb/A of ammonium nitrate from May 1 - 15.

For optimum growth in the fall, apply up to 175 lb/A urea, or 225 lb/A of ammonium nitrate from Aug 1-15. This will help promote fall growth, or give more production for stockpiling forage.

When topdressing nitrogen in the form of urea (46-0-0) between May 1 and Oct. 1, a urease inhibitor or incorporation is recommended to minimize nitrogen losses. Incorporation may be done through tillage, irrigation, or applying before a rainfall event. When using a urease inhibitor after May 1, nitrogen efficiency is similar to that of ammonium nitrate (34-0-0).

COMMENTS:

Mehlich III used for P, K, Ca, Mg, and Zn (lbs/acre). Crop response is highly probable with Very Low or Low soil levels, slight with Medium, and not likely with High or Very High. N, P2O5, K2O, Mg, and Zn recommendations are based on lbs of the nutrient. Fertilizer needed will depend on nutrient content in the fertilizer. Soil pH is calculated from 1 M KCl soil pH using: 0.91 x 1 M KCl soil pH + 1.34. 1 M KCl soil pH and Sikora II buffer pH are used for determining lime needs based on 100% effective lime. Lime quality in KY is defined by relative neutralizing value (RNV). RNVs for ag lime are determined by the KY Dept of Ag and are on the internet (publications at soils.rs.uky.edu).

TETANY PROBLEMS with cattle are sometimes encountered on straight grass pastures, particularly with nursing cows where grass pasture is the only source of feed. SUPPLEMENTAL FEEDING OF MAGNESIUM to nursing cows on such fields is recommended

Examples used with permission by H&A Resource Management, LLC.

A soil metal analysis report is provided below:

ESC LABORATORY SCIENCES
YOUR LAB OF CHOICE

12065 Lebanon Rd.
Mt. Juliet, TN 37122
(615) 758-5858
1-800-767-5859
Fax (615) 758-5859

Tax I.D. 62-0814289

Est. 1970

REPORT OF ANALYSIS

August 22,2012

Mr. Todd Stephens
H & A Resource Management,LLC
103 Fieldview Drive
Versailles, KY 40383

ESC Sample # : L590059-01

Date Received : August 15, 2012
Description : solids

Site ID :

Sample ID : RIESTER 3

Project # : Riester No 3

Collected By : SW
Collection Date : 08/13/12 00:00

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Total Solids	88.2	0.100	88.2	0.100	%	2540G	08/21/12
Mercury	0.078	0.020	0.088	0.023	mg/kg	7471	08/17/12
Arsenic	RDL	5.0	RDL	5.7	mg/kg	6010B	08/16/12
Cadmium	RDL	1.2	RDL	1.4	mg/kg	6010B	08/16/12
Chromium	21.	2.5	24.	2.8	mg/kg	6010B	08/16/12
Copper	26.	5.0	29.	5.7	mg/kg	6010B	08/16/12
Lead	32.	1.2	36.	1.4	mg/kg	6010B	08/16/12
Molybdenum	RDL	1.2	RDL	1.4	mg/kg	6010B	08/16/12
Nickel	20.	5.0	23.	5.7	mg/kg	6010B	08/16/12
Selenium	RDL	5.0	RDL	5.7	mg/kg	6010B	08/16/12
Zinc	68.	7.5	77.	8.5	mg/kg	6010B	08/16/12

RDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
The reported analytical results relate only to the sample submitted.

Reported: 08/21/12 18:05 Revised: 08/22/12 17:04

Waste Application Restrictions

Agronomic application rates are based upon the needs of the crop that will be grown on the permitted field (subplot). The nutrient recommendations of the crop will be provided by the Extension Service soil sample report. These recommendations are then compared to the analytical data from the material that will be land applied. Application rates MUST be at or below the agronomic rates. Other considerations

The Division provides a formula for calculating the agronomic application rate. Typically application rates are controlled by the nitrogen content of the applied material as well as the nitrogen needs of the crop. However the calculation also takes into account metals loading criteria. The actual application rate will be the lowest of the two (metals or nitrogen).

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WORKSHEET FOR CALCULATING APPLICATION RATES

SUBPLOT #_____ CROP _____

SLUDGE COMPOSITION (Parameter in ppm ÷ 10,000 = %)

Total Kjeldahl Nitrogen (TKN) _____ ÷10,000=_____%

Ammonium Nitrogen (NH_4-N) _____ ÷10,000=_____%

Nitrate Nitrogen (NO_3-N) _____ ÷10,000=_____%

Total Phosphorus _____ ÷10,000=_____%

Total Potassium _____ ÷10,000=_____%

1. Percent Available Organic Nitrogen = (%TKN) - (%NH_4-N) - (%NO_3-N)

_____=(_____)-(_____)-(_____)

2. Available Nitrogen in waste:

(a) Incorporation:

(%NH_4Nx20) + (%NO_3Nx20) + (%available organic N x 4) = lbs. available N/ton

(_____x20) + (_____x20) + (_____x4) =

_____lbs. available N/ton

(b) Surface Application:

(%NH_4Nx10) + (%NO_3Nx20) + (%available organic N x 4) = lbs. available N/ton

(_____)x10) + (_____x20) + (_____x4) =

_____ lbs. =

_____lbs. available N/ton

3. Residual Nitrogen (N):_____

(Calculated Residual N by utilizing the formulas found on the Residual N worksheet)

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4. Annual Application Rate:

(a) (Crop N requirement - Residual N)/Acre ÷ lbs. available N/ton = Dry Tons/acre

_____-_____) ÷ _____ = _____ Dry Tons/acre

(B) 0.44 lbs. of available Cd/acre ÷ (mg./kg of Cd in sample X 0.002) = Dry Tons/acre

_____ ÷ (_____x0.002) = _____Dry Tons/acre

Annual Application Rate: (LOWER of (a) or (b).)

Annual Application Rate = _____.

5. Conversion Formula: Dry Tons to Wet Gallons

(Tons of sludge x 2000) ÷ (8.34x% solids in the sludge/100) = wet gallons/acre

(_____x2000)÷(8.34x_____) = _____wet gallons/acre.

6. Additional Phosphorous and Potassium needed:

(a) Phosphorus (P_2O_5) in waste:

Tons waste/acre (from 4a or 4b) x % P in waste x 45.8 = lbs. P_2O_5 added/acre

_____x_____x45.8 = _____lbs. P_2O_5 added/acre

(b) Additional P_2O_5 fertilizer needed:

Total phosphorous (P_2O_5) needed/acre -P_2O_5 added from sludge = lbs. P_2O_5/acre

_____-_____=_____lbs. of additional P_2O_5 needed/acre

* A negative answer means no additional P_2O_5 fertilizer is needed.

(c) Potassium (K_2O) in waste:

Tons waste (from 4a or 4b)/acre x % K in waste x 24 = lbs. K_2O added/acre

_____x_____x24=_____lbs.K_2O added/acre

12

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(d) Additional K_2O fertilizer needed:

Total K_2O needed/acre - K_2O added from sludge = lbs. K_2O/acre

_____ - _____ = _____ lbs. of additional/K_2O needed/acre

*A negative answer means no additional K_2O fertilizer is needed.

**Nitrogen Required - (lbs. available N/ton X maximum tons waste to be applied/acre) = lbs of additional fertilizer nitrogen applied. (additional nitrogen may be needed by fertilization if the annual application rate is limited by cadmium.

7. Maximum Amount of Waste Allowable per Acre:

Obtain maximum amount of Pb, Cd, Cu, Ni, and Zn allowed based on the Cation Exchange Capacity of the soil from 401 KAR 45:100 Section 10(23). If sludge has previously been applied, calculate the reamining lifetime limits by subtracting the total amount of each metal applied from the maximum allowed found in 401 KAR 45:100 Section 10 (23).

Cadmium (Cd):

Maximum Cd allowable/acre + (dry mg/kg of Cd in sample x0.002) = tons waste/acre

_____ +(_____ x0.002) = _____ tons waste/acre

Copper (Cu):

Maximum Cu allowable/acre + (dry mg/kg of Cu in sample x0.002) = tons waste/acre

_____ +(_____ x0.002) = _____ tons waste/acre

Lead (Pb):

Maximum Pb allowable/acre + (dry mg/kg of Pb in sample x0.002) = tons waste/acre

_____ +(_____ x0.002) = _____ tons waste/acre

Nickel (Ni):

Maximum Ni allowable/acre + (dry mg/kg of Ni in sample x0.002) = tons waste/acre

_____ +(_____ x0.002) = _____ tons waste/acre

Zinc (Zn):

Maximum Zn allowable/acre + (dry mg/kg of Zn in sample x0.002) = tons waste/acre

_____ +(_____ x0.002) = _____ tons waste/acre

The following regulatory restrictions are separated into three distinct categories: 1) crop restrictions, 2) weather restrictions, and 3) other application restrictions:

Crop Restrictions

- Leafy vegetables or root crops cannot be grown and harvested for human consumption within 12 months of the last waste application.
- Other crops cannot be grown and harvested for direct human consumption within 2 months of the last waste application. ***(For sewage sludge, the additional food crop restrictions of 40 CFR 503.32 (b)(5) may apply.)***

- Dairy animal grazing is prohibited within 6 months and other animal grazing is prohibited within 3 months of the last application.
- The annual application rate of cadmium (Cd) cannot exceed 0.44 pounds per acre.
- Food chain crops cannot be utilized in the cropping season when annual cadmium (Cd) application exceeds 0.44 pounds per acre.
- Tobacco cannot be harvested within 5 years of the last waste application if the annual cadmium (Cd) application exceeds 0.44 pounds per acre at any time during the life of the landfarming site.

Weather Restrictions

- Waste shall not be applied when the soil is frozen, snow-covered, ice-covered, water saturated, or during any precipitation event.
- Surface water or liquid waste ponding within the application area shall not occur.
- Both surface runoff and run-on shall be controlled.

Other Restrictions

- Surface application without incorporation can only be used where either vegetation or crop residue covers at least 75% of the land surface.
- Incorporation of wastes must occur within 48 hours if incorporation is included in the management plan. ***(Sewage sludge incorporated as a means of complying with 40 CFR 503.33 vector attraction reduction requirements must be incorporated within 6 hours).***
- All sludges must be processed to significantly reduce pathogens (PSRP) prior to land application.
- A certified landfarming operator shall be available at the landfarming site during application.
- Hazardous wastes or waste mixtures containing hazardous wastes cannot be landfarmed.
- Toxic wastes cannot be stored, treated or land applied at a landfarming facility.
- The general public shall be restricted from the waste application area during application and for at least 12 months after the last application unless the waste has undergone a Process to Further Reduce Pathogens (PFRP).
- Waste shall not be applied at rates in excess of those approved in the permit.
- No raw or un-stabilized waste shall be landfarmed.
- Surface waste applications shall not be greater than one-half (1/2) inch in average thickness.

RECORDKEEPING

The importance of good recordkeeping cannot be overstated. Whether you complete your own annual reports, or hand the paperwork over to someone else, if you discover incomplete log

sheets, or inaccurate or incomplete laboratory analysis reports in December, it will be too late to do anything about mistakes made in March.

Log Sheets

Log sheets must be used **every time** land application occurs. In most cases, keeping the log sheet in the truck or tractor cab, makes the most sense. Do not rely on memory!

Each load is a single entry into the log, noting date, time of day and application quantity, and the hauler's initials. An additional block for noting truck number, crop, problems (downtime, unusual conditions, etc.) is recommended. A new log sheet should be used for each subplot for each day. A sample land application log is provided below.

Land Application Log

City of _____ WWTP

Permit #: 000-00000

Farm/Field _____ Acreage _____

Date	Time	Application Quantity (Cu. Yds/Tons/Gallons)	Comments (Truck #, Crop, Downtime, Etc.)
Haulers Signature:			Date:

Annual Report

All landfarm facilities in KY, even those permitted as "Sludge Giveaway" or "Beneficial Reuse," must submit an annual report. As written into state regulations, annual reports are **required to be submitted** to the Division **sixty (60) days prior to the anniversary date** of the permit. Because the federal sewage sludge regulation requires calendar year reporting with annual reports due on **or before February 19 each year**, many permits, especially the most recent, will reflect that report due date. Some permits will have a report due date of March 1, somewhat

arbitrarily chosen by the Division to tie into the calendar year report concept, but allow some extra time (and an easier date to remember) for operators who must submit both federal and state annual reports.

If you have held a permit for several years and have a report due date base on the date the permit is issued, you are encouraged to contact the Division to request that it be changed. The Division is adopting the calendar year report concept, as it is believed to be the best way to capture information related to agricultural operations.

The Annual Report is especially important because it provides documentation of compliance with your permit. It describes all activities that have occurred during the previous year and includes what (total volume of material managed), where (where the material was applied; subplots used), when (specific dates and times), and why (crops grown or land use). In addition, the annual report must also include all logs, laboratory reports and any other data that was required by the Division and your permit.

Formal landfarming permits are also required to calculate metals loading (annual and cumulative). If your permit requires surface and/or groundwater monitoring, you will need to include surface water and/or groundwater monitoring reports. Example reports have been included in Appendix G.

Federal sewage sludge report note: Only "Class I sludge management facilities" are required to submit information to the US EPA. Class I facilities are all publicly owned treatment works (POTW) with a design flow rate equal to or greater than one million gallons per day, POTWs that serve a population of 10,000 or more people, or those with Industrial pretreatment programs. If you meet any one of these three criteria, you are required to report. For Kentucky operators, the reports must be delivered to the US EPA Region 4 office in Atlanta, Georgia. See 40 CFR 503.18.

Other Reports

Annual report requirements described above generally apply to other types of permits (e.g., sludge giveaway or beneficial reuse (RPBR)). However, due to the variety of materials that may be approved to be land applied, specific reporting requirements are often determined on a case-by-case basis. All reports MUST have current analyses and log sheets.

Chapter 5: OTHER LANDFARM CONSIDERATIONS

Chapter 5 Objectives

1. Understand the impact of equipment alternatives and their impact on productivity, maintenance, cost, and soil.
2. Understand the effects of land application on soil and crop management.
3. Understand the requirements and rationale of a landowner agreement.
4. Understand the requirements and importance of proper signage.
5. Understand the reasons, regulatory requirements, and limitations associated with temporary stockpiling.
6. Understand the potential hazards and safety considerations associated with land application facilities.

This chapter will outline other considerations that are integral to a successful landfarming operation. Some of the considerations include regulatory requirements while others are recommended best management practices.

Equipment

Utilizing the appropriate equipment to apply materials will not only make the operation more efficient but may also be necessary for proper agricultural practice. Obviously, different equipment will also be necessary depending on whether the material applied is in liquid or dewatered form.

Many different sizes and types of equipment are available for use. This equipment varies from low tech to high tech high production machines. Volume of material to be applied will also determine the equipment utilized as well as budgetary limitations.

Other conditions that may dictate the type of equipment used may be

- Compaction
- Production
- Injection

There is no regulatory requirement for equipment specifications, however there are specific regulations regarding the even consistent distribution of land applied materials (e.g., "no ponding"). The equipment to be used must be described in the permit application. If the Division determines that the equipment is not sufficient or if problems occur in the field (e.g., ponding, uneven or inconsistent distribution, etc.), the Division can require that modifications be made to existing equipment or that additional equipment be obtained.

EQUIPMENT TYPES AND PHOTOGRAPHS

Manure Spreader

Liquid Application

Injector

Surface Spreader

Soil and Crop Management

Growing season affects when biosolids or other materials can be applied and by what method. Nutrient requirements affect the amount of material that can be applied. Designing, implementing and evaluating a plan for land application of material requires working within the landowner's or site operator's existing management system and the limitations imposed by regulations affecting the land application process. Waste utilization may have some effect on crops to grow, the crop rotations to use, lime requirements of the area, and conservation practice needs of the area.

Crop management will dictate when a field is accessible, the frequency of waste applications, the expected amount of some nutrients that can be applied, and the application methods.

Some limitations may be imposed on landowners by other programs (e.g., Kentucky Agricultural Water Quality Act, the Conservation Reserve Program and various programs administered by the Natural Resources Conservation Service or the Farm Service Agency). Both the landowner and any person leasing any part of the farm should confer with any applicable programs that may impact the operation. Failure to do so may result in the landowner losing USDA program benefits on all land that they either own or lease.

An example of one of these scenarios is the Kentucky Agriculture Water Quality Act. This act requires a Nutrient Management Plan which limits phosphorous additions from any source--including waste materials—to soils that have existing phosphorous levels are above a certain limit, depending on each field's Phosphorus Risk Index. For some soils, the limit may be as low as 400 lbs/acre, at which point no additional phosphorus may be applied. Should you ignore this plan, the landowner may not be eligible to receive state and/or federal program benefits.

Cropping Considerations

Pasture and grasses for forage offer the greatest flexibility for land application as access is not as limited by the crop's growth stage. In many cases wastes can be applied whenever climatic and soil moisture conditions are favorable. The sod created by these crops also promotes infiltration, reduces erosion and enhances site trafficability.

Some disadvantages that should be considered include:

1) Wastes cannot be incorporated without damaging some percentage of the crop;
2) About 50% of the ammonium form of nitrogen is lost following surface application of wastes;
3) Some physical benefits of wastes cannot be fully realized with surface applications;
4) Subsurface injection of liquid wastes may temporarily disrupt an established sod; and

5) There is a waiting period between the last waste application and either animal grazing or hay harvesting.

Grain crops are well suited for waste application, although frequency of applications may be limited to the growing season. Applications are typically limited to spring before planting and late fall after harvest. With the necessity of reducing tillage for crop production, many land areas will be limited to surface applications of wastes without incorporation. In Kentucky, the fall application of wastes should only be utilized when cover crops or fall seeded small grain crops can be successfully seeded.

There are some restrictions (covered in the Regulations section) under certain conditions on the type of crops that can be grown on waste amended soils. These include direct food chain crops, those directly utilized by humans and those fed to animals, which in turn are consumed by humans. Table 5.1 outlines the harvesting and consumption restrictions that apply to both direct and indirect food chain crops**. These restrictions are for municipal wastewater biosolids as required by federal regulations**. State regulations also include crop and harvesting restrictions that may be applicable to other waste types as directed by the Division.

Table 5.1 ***Restrictions for the Harvesting of Crops and Turf, Grazing of Animals, and Public Access on Sites Where Class B Biosolids Are Applied***

Restrictions for the Harvesting of Crops and Turf, Grazing of Animals, and Public Access on Sites Where Class B Biosolids Are Applied

Restrictions for the harvesting of crops* and turf:

1. Food crops, feed crops, and fiber crops, whose edible parts do not touch the surface of the soil, shall not be harvested until *30 days* after biosolids application.
2. Food crops with harvested parts that touch the biosolids/soil mixture and are totally above ground shall not be harvested until *14 months* after application of biosolids.
3. Food crops with harvested parts below the land surface where biosolids remain on the land surface for 4 months or longer prior to incorporation into the soil shall not be harvested until *20 months* after biosolids application.
4. Food crops with harvested parts below the land surface where biosolids remain on the land surface for less than 4 months prior to incorporation shall not be harvested until *38 months* after biosolids application.
5. Turf grown on land where biosolids are applied shall not be harvested until *1 year* after application of the biosolids when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

Restriction for the grazing of animals:

1. Animals shall not be grazed on land until *30 days* after application of biosolids to the land.

Restrictions for public contact:

1. Access to land with a high potential for public exposure, such as a park or ballfield, is restricted for *1 year* after biosolids application. Examples of restricted access include posting with no trespassing signs, and fencing.
2. Access to land with a low potential for public exposure (e.g., private farmland) is restricted for *30 days* after biosolids application. An example of restricted access is remoteness.

* Examples of crops impacted by Class B pathogen requirements are listed in Figure 2-5.

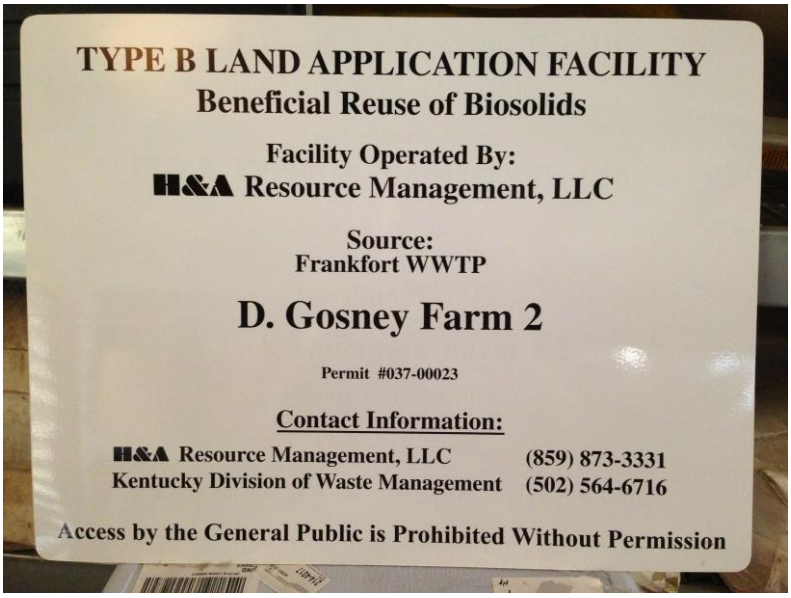
Lease (Consent) Agreement

The purpose of the lease agreement is to provide documentation that a landowner has given express permission to use the property for land application. In most cases, a lease agreement is only required for a full permit. The lease agreement contains language that specifies the responsibilities of both parties (i.e., the land applier and the landowner) as well as the regulatory requirements that must be followed.

Although not required by regulation for all waste management practices, it is highly recommended that a written agreement with a landowner be established before any type of waste placement occurs.

Signage

A sign **must** be posted at the entrance(s) to any landfarming site (401 KAR 48:200, 401 KAR 45:100). The purpose of the sign is to notify the general public of the activities that are occurring at the site. Information required for the sign includes **operator's name**, **generator(s) name**, **permit number, farm or site name,** and **contact phone numbers**. In addition, signs must restrict public access. For example, the sign could state: "access by the General Public is prohibited without permission." These signs must be readable at a distance of 100 feet.



The minimum requirement is that a sign must be posted at the entrance of each individual farm, not on each individual subplot within a farm

Access. Owners and operators of all solid waste and special waste sites or facilities must control public access (401 KAR 47:030, Section 11(3) for solid waste landfarms and 30:031 Section 10(3) for special waste landfarms). Both artificial and natural barriers may be used.

The owner or operator is also responsible for removing all debris, mud and waste from vehicles before they leave the site. They are also responsible for removing any landfarm debris, mud and waste from off-site roadways.

Temporary Stockpiling

During the operation of some facilities, stockpiling may be deemed useful. Acceptable stockpiling is the TEMPORARY placement of a solid material prior to land applying. Stockpiling is typically used as a management/operational practice during periods of inclement weather, crop removal, equipment maintenance, etc.

Any stockpiling is allowed as a Permit-By-Rule and is subject to the Environmental Performance Standards. Stockpiles must be located in a manner that will control public access, prevent runoff, and control other nuisance conditions. No stockpile may be located within the 100-year flood plain, karst terrain, or wetlands. Prior to stockpiling, it is recommended that you **contact your Division of Waste Management regional office**. Some stockpiling practices may require additional permitting through the Division of Water. You should contact the Surface Water Permits Branch of the Division of Water to determine if any of these are applicable.

Stockpiling should be TEMPORARY. The intent of stockpiling is only to stage the material prior to application. The Division considers temporary stockpiling as a period NOT TO EXCEED a period of 12 months. The stockpiling of biosolids for a period exceeding 30 days may require additional testing in accordance with federal regulations. Refer to the EPA STOCKPILING DOCUMENT for more information.

Safety

A safe workplace does not mean a workplace free of all risks. It does mean a workplace where every attempt is made, by all involved, to recognize and minimize hazards and to train each employee in the proper procedures to manage those hazards. OSHA regulations require employers to make employees aware of hazards they face in the workplace.

Landfarm operations will involve certain risks because of the potential for encounters with heavy equipment used in processing and application, vectors, pathogens, noise, dust, etc. Landfarm activities will involve risk, but those risks do not need to be unreasonable. This section addresses some of the most important safety basics.

Landfarm Operation Safety Programs

The day-to-day operations at a landfarm facility can be developed by evaluating the hazards encountered in the normal workday, developing procedures to reduce those hazards and implementing those procedures through a comprehensive safety program. We can generally divide associated hazards into three broad categories: these are biological, physical, and chemical. We will examine the biological hazard first.

Biological Hazards

Potential exposure to biological hazards is a possibility at landfarm facilities. Facilities that land apply municipal wastewater solids may encounter additional risk as the materials are of direct human origin and may contain some level of pathogenic organisms. It is important that all employees are aware of the possibility of exposure to biological hazards and the steps that should be taken to reduce potential risk.

For those people that apply wastewater biosolids, the Centers for Disease Control conducted a study of worker exposure and have created a guidance document with useful tips. However, the common-sense tips contained in the manual are useful for any material that is applied.

General guidelines for protection from biological hazards include:

1. Avoiding direct contact with suspect materials.
2. Wear latex or vinyl gloves, under work gloves, when in immediate contact with suspect materials.
3. Training for all personnel in blood borne pathogen protection.
4. Use of proper respiratory protection for personnel exposed to dust and debris in the processing of materials.
5. Employee availability to hand washing, shower and toilet facilities.

Physical Hazards

Physical hazards are common at all landfarm operations due to the presence of large equipment and the possibility of minor injuries such as cuts, strains, sprains, bruises and abrasions. These injuries occur because of slips and falls, improper lifting, careless operation of equipment, and improper use of hand or power tools. While these injuries are generally minor, serious injuries or deaths may result. Prolonged exposure to loud noises may damage hearing. Exposure to heat and cold may cause heat stroke or frost-bite; and, can lead to indirect effects such as fatigue, dizziness, and confusion which in turn can lead to accidents, injuries, and death.

General guidelines for protection from physical hazards include:

1. Use proper protective equipment such as hearing protection, hardhats, steel-toed boots, safety glasses and gloves;

2. Maintain equipment in safe working conditions: perform regular preventive maintenance on heavy equipment, replace frayed electrical cords on hand tools, replace broken handles on shovels, rakes, hammers, etc.

3. Keep guards properly adjusted and in place on rotating and moving equipment such as power

takeoffs.

4. Practice good housekeeping by keeping the work area clean and free of debris and excess water.

Chemical Safety

There is a potential for exposure to chemical hazards at land application facilities due to fuels or petroleum products and any chemicals used in the wastewater treatment process. You should familiarize yourself with these chemicals and take the necessary precautionary measures to reduce exposure. You should also have an emergency plan in the event of exposure to chemical hazards.

One way to determine the potential hazards of a chemical product is through the review of a material safety data sheet (MSDS). An employer must provide an MSDS for all hazardous materials on site and shall contain the following information:

1. The chemical manufacturer's name, address and emergency telephone number, the chemical name, trade name, and chemical formula.
2. The physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point).
3. The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity.
4. The health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical.
5. The primary route(s) of entry.
6. The OSHA permissible exposure limit, ACGIH Threshold Limit Value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available.
7. Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the MSDS, including appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks.
8. Any generally applicable control measures that are known to the chemical manufacturer, importer, or employers preparing the MSDS, such as appropriate engineering controls, work practices, or personal protective equipment.
9. Emergency and first aid procedures
10. The date of preparation of the MSDS or the date of the last change made.

Protection from Chemical Hazards

Once information on the chemical hazard has been obtained, the employer and employee can select the proper personal protective equipment. Hazardous materials may enter the body by

inhalation (most common), ingestion, absorption through the skin or eyes, or injection.

The primary ways workers are exposed include:

1. Failure to follow proper procedures or to use appropriate personal protective equipment;
2. Inadequate knowledge of the materials;
3. Failure to decontaminate yourself or your equipment; or
4. Carelessness: unprotected contact with hazardous materials; walking through puddles or into clouds of unknown vapors; consuming food, water or smoking cigarettes contaminated by contact with gloves, equipment or unwashed hands.

All facilities should create a safety plan of action that is available to all employees and reviewed regularly.

APPENDIX A: GLOSSARY

Active life – the period from the initial receipt of waste at a facility until certification of closure is received by the cabinet.

Agricultural waste – any non-hazardous waste resulting from the production and processing of on-the-farm agricultural products, including manures, pruning and crop residues.

Application – the form approved by the Cabinet for applying for a permit, including any additions, revisions or modification.

Authorized representative – the person responsible for the overall operation of a facility or an operational unit.

Available water holding capacity (AWHC) – the capacity of soils to hold water available for use by most plants. Also the difference before the moisture level at field capacity and the moisture level at wilting point expressed as inches of water per inch of soil depth.

Base flood – a flood that is equaled or exceeded once in 100 years, or has a 1 percent or greater chance of occurring.

Bedrock – the solid rock that underlies the soil.

Biological oxygen demand (BOD) – the demand for oxygen created by the ability of a waste or wastewater to support biological activity. Measured over a set time (5 days) under a specifically maintained temperature (68 F).

Cation – a positively charged ion in the soil or a solution.

Cation exchange capacity (CEC) – the sum of the exchangeable cations a soil can adsorb expressed in milliequivalents per 100 grams of soil.

Certified landfarming operator – a person who holds a valid certificate upon the successful completion of an approved training course and examination that is the individual responsible for ensuring compliance with all permit conditions at a landfarming facility and who is reasonably available to the site.

Closure – the time at which a waste treatment, storage or disposal facility permanently ceases to accept wastes.

Compost – solid waste which has undergone biological decomposition of organic matter, been disinfected using composting or similar technologies, been stabilized to a degree which is potentially beneficial to plant growth and which is approved for use or sale as a soil amendment, artificial topsoil, growing media amendment, or similar uses.

Construction permit – a formal permit issued by the Cabinet to an owner or operator of a waste site or facility that authorizes commencement of site preparation for waste disposal.

Contamination – the degradation of naturally occurring air, water, or soil quality either directly or indirectly as a result of human activity.

Contour – growing crops in which rows and tillage operations are conducted perpendicular to the land slope direction.

Crop rotation – the sequence of crops grown on a field over a number of cropping seasons.

Denitrification – conversion of nitrate to nitrogen gas.

Disposal – the discharge, deposit, injection, dumping, spilling, leaking, or placing of any waste into or on any land or water so that waste may enter the environment or be emitted into the air or discharged into any waters.

Drainage class – classifies the frequency and duration of soil saturation or partial saturation with water.

Facility – all contiguous land, structure, and land improvements used for treating, storing, or disposing of waste.

Field capacity – the moisture content of a soil, expressed as a percentage of oven dry weight, after the gravitational, or free water has drained from the soil.

Food chain crops – includes tobacco, crops grown for human consumption, and crops grown for feed for animals whose products are consumed by humans.

Formal permit – a permit issued by the Cabinet for waste facility operations after review of the designated application form and completion of requirements by the applicant.

Fragipan – a restrictive soil layer that is extremely dense and compact but is not cemented nor high in clay content.

Generator – any person, by site, whose act or process produces waste.

Gravel – an angular or rounded rock fragment up to 3 inches in diameter.

Groundwater – water in the zone of perennial saturation below the land surface.

Hydraulic conductivity – a quantitative measure of the rate of water movement through soil.

Immobilization – conversion of a chemical element from the inorganic form to organic form by bacteria, plants or animals; or the retention on the exchange complex of charged ions.

Internal soil drainage – the downward movement of water through the soil profile.

Karst terrain – a type of topography where limestone is present and is characterized by naturally occurring closed depressions or sink holes, caves, or disrupted surface drainage, and has well developed underground solution channels formed by limestone dissolution by moving, underground water.

Landfarming – the application of waste on or just below the land surface; will not alter the land topography, and will not disturb the soil below three feet from the surface.

Legume – a crop that forms a specific association with bacteria that are capable of transforming nitrogen gas into organic compounds that can provide nitrogen requirements of the plant.

Mineralization – the biochemical conversion of nitrogen from the organic form to the inorganic form.

Minimum tillage – soil preparation for seeding a crop while leaving more than 30 percent of the land surface covered by crop residue.

Monitoring – the act of systematically inspecting and collecting data on operational parameters or on the quality of the air, soil, groundwater, or surface water.

Nitrification – the biochemical conversion of ammonium nitrogen to nitrate nitrogen.

Organic matter (soil) – the relatively resistant fraction of residues and other organic products that forms during biological decomposition in the soil.

Pathogens – disease-causing organisms, such as certain bacteria, viruses, and parasites.

Ped– an aggregate of individual grains of sand, silt and clay into a single unit of soil structure.

Permeability – the rate that water moves through the soil.

Permittee – any person holding a valid permit issued by the Cabinet to manage, treat, store, or dispose of waste.

pH – a number value between 0 and 14 that indicates the acidity (<7) or alkalinity (>7) of a liquid, soil or waste.

Pollutant – means and includes dredged spoil, solid, waste, incinerator residue, sewage, sewage sludge, garbage, chemical, biological or radioactive materials, heat, wrecked or discarded equipment, rock, sand, soil, industrial, municipal or agricultural waste, and any substance resulting from the development, processing, or recovery of any natural resource.

Pores – spaces, or voids, between mineral grains and aggregates in the soil.

Proposed permit – document prepared by the Cabinet indicating the Cabinet's tentative

decision to issue or deny, modify, revoke or terminate a permit.

Publicly owned treatment works (POTW) – any device or system used in the treatment (including recycling and recovery) of municipal sewage or industrial liquid wastes which is owned by the Commonwealth or a political subdivision of the Commonwealth.

Recycling – any process by which materials that would otherwise become solid waste are collected, separated, or processed and reused to use in the form of raw materials or products including refuse – derived fuel.

Residual nitrogen – nitrogen that remains in the soil after crop harvest that is either immediately available or will become available to succeeding crops.

Restrictive layer – any soil horizon that is slowly or very slowly permeable and underlies more permeable soil horizons.

Run-off– any rainwater, leachate, or other liquid that drains overland from any part of a waste facility.

Run-on– any rainwater, leachate, or other liquid that drains overland onto any part of a waste facility.

Saturated zone – that part of the earth's crust containing groundwater in which all voids, large and small, are filled with liquid.

Shrink-swell potential – the tendency of a soil to change volume due to the grain or loss of moisture with the rating in proportion to the relative change based on a given volume of soil.

Sludge – any solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility exclusive of the treated effluent from a wastewater treatment plant or any other waste having similar characteristics and effects.

Soil – a natural body that develops in profile form in response to forces of climate and organisms acting on a parent material in a specific landscape position over a long period of time.

Soil amendment – anything added to the soil to improve its physical or chemical condition for plant growth.

Soil conditioner – any material added to soil to improve aggregation and the stability of structural soil aggregates.

Soil horizon – a layer of soil that is approximately parallel to the earth's surface whose descriptive characteristics are rather distinct from layers above or below.

Soil slope – the inclination of the land surface determined as feet of rise from the level per 100

feet of distance.

Soil structure – arrangement of individual grains of sand, silt, and clay into larger units called aggregates or peds and characterized by size, shape, and strength.

Soil texture – the amounts of sand, silt, and clay that make up a soil.

Solid waste – any garbage, refuse, sludge, and other discarded material (solid, semisolid, liquid, or contained gas) resulting from industrial, commercial, mining (excluding coal mining wastes, coal mining by-products, refuse and over burden), agricultural operations, and from community activities.

Surface impoundment – a whole or partial facility which may be a natural topographic depression, manmade excavation, or diked area formed primarily of earthen materials and designed to hold liquid wastes or the free liquids from wastes which is not an injection well.

Tillage pan – a compact, dense layer of soil at the base of the surface layer of a cultivated soil.

Traffic pan – a compacted layer beneath the soil surface of a cultivated soil resulting from the cumulative effects over time of driving over the soil with heavy equipment or when soil moisture content is very high.

Treatment zone – a soil area of the unsaturated zone of a land treatment unit within which wastes are degraded, decomposed, transformed, or immobilized.

Unsaturated flow – water movement through soil when the large pores are filled with air.

Vectors – organisms, such as rodents and insects that can spread disease by carrying and transferring pathogens (disease-causing organisms)

Water table – the top of the zone of water saturated soil classes as either perched, apparent, or artesian.

Wilting point – moisture content of a soil at which plants can no longer extract water.

Zone of incorporation – the depth to which the soil on a landfarm is plowed, tilled, or otherwise designed to receive waste.

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APPENDIX B: REGULATIONS

401 KAR 45:090. Special waste operator certification.

RELATES TO: KRS 224.01, 224.10, 224.40, 224.50

STATUTORY AUTHORITY: KRS 224.10-100, 224.40-100, 224.40-305, 224.40-605, 224.50-760

NECESSITY, FUNCTION, AND CONFORMITY: KRS Chapter 224 requires the cabinet to adopt administrative regulations for the management, processing, and disposal of special wastes. KRS 224.40- 305 requires persons who establish, conduct, operate, maintain or permit the use of a waste site or facility to obtain a permit. This chapter establishes the permitting standards for special waste sites or facilities, and the standards applicable to all special waste sites or facilities. This administrative regulation establishes the program for education, testing, and certification of operators of special landfarming sites or facilities in accordance with KRS 224.40-605.

Section 1. Applicability.

(1) The requirements of this administrative regulation apply to all special waste landfills, landfarms, and composting facilities operating under formal permits, as identified in 401 KA 45:020, Section 2(1)(a) and (b).

(2) The owner or operator shall ensure that all technical operations at the special waste site or facility are conducted by or under the direction of an individual with a valid certification under this administrative regulation. The landfill, landfarming, or composting operator shall be reasonably available at the site or facility during operation.

(3) The certified operator shall ensure that all operations are conducted in compliance with this chapter.

(4) A special waste site or facility permit may be revoked or subject to other enforcement actions upon violation of the requirements of this administrative regulation.

Section 2. Transition of Certification.

(1) Persons holding a valid certification for landfill manager, landfill operator, and landfarming operator under 401 KAR 47:070 shall be deemed to hold a valid certification under this chapter until the certification expires. At the time a certification expires, the certificate holder shall obtain special waste certification under this administrative regulation.

(2) Persons operating a special waste landfill who were not previously certified to operate a residual landfill under 401 KAR Chapter 47 shall obtain certification under this chapter within one (1) year of the effective date of this administrative regulation.

(3) Persons operating a special waste composting or landfarming site or facility shall

obtain certification within one (1) year of the effective date of this administrative regulation.

Section 3. General Provisions for Landfills.

(1) Each special waste landfill shall have a landfill operator certified in accordance with this administrative regulation.

(2) No special waste landfill shall operate in the absence of a certified operator without the appointment of an interim operator in accordance with Section 11 of this administrative regulation.

Section 4. General Provisions for Landfarming and Composting Facilities.

(1) Each landfarming or composting facility shall have an operator certified in accordance with this administrative regulation.

(2) No landfarming or composting facility shall operate in the absence of a certified operator without the appointment of an interim operator in accordance with Section 11 of this administrative regulation.

Section 5. Application for Certification.

(1) Persons desiring to be certified shall submit an application at least thirty (30) days prior to the scheduled training class. Applicants for training and examination shall use form DEP 6031 entitled "Application for Certification" (March 1992). The requirements contained in the application for certification are incorporated in this administrative regulation by reference. The application may be obtained from the Division of Waste Management, 14 Reilly Road, Frankfort, Kentucky 40601, (502) 564-6716, between the hours of 8 a.m. to 4:30 p.m., Eastern Time, Monday through Friday.

(2) The cabinet shall review applications and supporting documents, determine the eligibility of the applicant for examination, and notify the applicant of the determination.

(3) No person shall be eligible for examination for certification unless that person completes the appropriate training course provided by the cabinet, unless an alternative training program is accepted by the cabinet in accordance with Section 6 of this administrative regulation.

Section 6. Training Course Requirements.

(1) The cabinet shall provide training courses for individuals desiring to become certified. All applicants for certification shall be required to attend a training course provided by the cabinet, unless alternate training is accepted under subsection (3) of this section.

(2) The training course shall address the technical and legal aspects of the facility type

for which operator certification is sought.

(a) The training course for landfill operators shall include:

1. Permit application requirements for special waste landfills, including technical and administrative requirements;

2. Waste characterization;

3. Chemical and biologic reactions associated with the waste;

4. Hydrogeologic and engineering factors associated with the facility;

5. Operational requirements and achieving compliance with 401 KAR 30:031;

6. Duties and responsibilities associated with landfill management;

7. Requirements of this chapter as they apply to facility operation, including environmental monitoring, operations requirements, and maintaining compliance with 401 KAR 30:031;

8. Evaluating site suitability to receive wastes;

9. Environmental considerations in preventing violations of this chapter;

10. Maintaining equipment; and

11. Facility safety.

(b) The training course for landfarm and composting operators shall include:

1. Requirements of this chapter as they apply to facility operation and management;

2. Wastewater treatment processes;

3. Waste characterization;

4. Chemical and biological reactions associated with the waste;

5. Landfarming design and management;

6. Permit application requirements for special waste landfarms;

7. Environmental considerations in preventing violations of this chapter;

8. Achieving and maintaining compliance with 401 KAR 30:031;

9. Evaluating site suitability to receive waste;

10. Maintaining equipment;

11. Facility safety; and

12. Duties and responsibilities associated with operating a landfarm.

(3) The cabinet may accept alternate training courses, provided they result in a level of competence equivalent to that of participation in the cabinet's training course. It shall be the applicant's responsibility to submit documentation as the cabinet requires for an equivalency judgment of the alternate training course. This information shall contain at a minimum the following specifics: the course name; sponsoring agency; the date, location, and beginning and ending times of the course; a summary of the course content of sufficient detail to determine relevance and quality of the course; and a copy of the certificate received.

Section 7. Training and Examinations.

(1) After training is complete, time shall be set aside for the purpose of examinations to determine the knowledge and ability of the applicant.

(2) Separate examinations shall be prepared to cover basic differences in the duties and responsibilities for the operation of each category of special waste site or facility.

(3) Applicants who fail to pass an examination may reapply for the examination at a regularly scheduled examination or by appointment with the cabinet. The cabinet shall require the applicant to attend the training session again if the applicant fails to pass the examination in three (3) attempts.

Section 8. Education and Equivalencies.

(1) All applicants shall be evaluated by the cabinet as to education and experience as related to the appropriate category of special waste site or facility.

(2)(a) Applicants for landfill operator shall have completed high school, by graduation or by obtaining an equivalency certificate, and shall have a minimum of one (1) year of experience at a landfill facility.

(b) If an applicant for landfill operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years of experience in operating a landfill or experience in a related field such as heavy equipment operator, road construction, surface mining.

(3)(a) Applicants for landfarming or composting operator shall have completed high school, by graduation or by obtaining an equivalency certificate, and shall have a minimum of one (1) year of experience at a landfarming or composting facility.

(b) If an applicant for landfarming or composting operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years

of experience in operating a landfarming facility or experience in a related field such as wastewater treatment or water treatment in determining eligibility for examination on a year-for-year basis.

Section 9. Issuance of a Certificate.

(1) Certification may be issued to individuals upon meeting the minimum education requirements, work experience, and the course work requirements of this administrative regulation and passing the examination in accordance with Section 5 of this administrative regulation.

(2) Certification shall not be valid if obtained through fraud, deceit, or the submission of inaccurate data.

Section 10. Issuance of Certificate.

(1) A certification shall be issued for a period of five (5) years, at the end of which the certification shall expire, unless renewed. Renewal procedures and requirements shall be the same as those for a new certification.

(2) The certification of an operator whose employment at a special waste site or facility terminates shall remain valid until expiration or revocation of certification.

(3) Certificates shall be carried on the person of the certified operator during working hours at the facility, or shall be prominently displayed at the facility office.

(4)(a) The cabinet may revoke the certification of an operator if the operator:

1. Has practiced fraud or deception;

2. Has failed to perform his duties under this chapter;

3. Has failed to use reasonable care and judgement in performance of his duties under this chapter; or

4. Has knowingly or willfully violated the requirements of this chapter.

(b) Individuals who have had their certification revoked shall be ineligible for future recertification.

Section 11. Interim Operators.

(1) The permittee shall be responsible for actions of an interim operator. The permittee shall notify the cabinet in writing if the special waste site or facility will not have a certified operator for more than fourteen (14) consecutive operating days.

(2) Consecutive operating days, as used in subsection (1) of this section, shall be determined as any days:

(a) When the special waste site or facility accepts waste, operates equipment, or otherwise performs the business of special waste management; and

(b) That occur in sequence, regardless of whether nonoperating days such as weekends or holidays fall in between.

(3) The notification required by subsection (1) of this section shall be provided at least ten (10) days prior to an anticipated absence, and immediately upon discovery of an unanticipated absence. The notification shall contain:

(a) The name, address, and qualifications of the interim operator;

(b) The length of time for which the permittee seeks to have an interim operator rather than a certified operator; and

(c) Reasons for replacement of the certified operator with an interim operator.

(4) The cabinet shall evaluate the qualifications of the designated interim operator and shall notify the permittee of the cabinet's determination in writing within thirty (30) days of receipt of the permittee's notice. The determination shall:

(a) Approve, conditionally approve, or deny the permittee's request for designation of the interim operator;

(b) Identify the length of time an interim operator may operate the special waste site or facility; and

(c) Specify conditions as appropriate to the site and the interim operator's qualifications.

(5) An interim operator shall obtain certification under this administrative regulation within fifteen (15) months of becoming an interim operator.

(6) The cabinet may revoke the appointment of an interim operator in accordance with Section 10(4)(a) of this administrative regulation. Revocation shall render the person ineligible for operator certification under Section 10(4)(b) of this administrative regulation.

Section 12. Fees.

(1) Fees for application for certification shall be:

(a) $125 for application for certification as a landfill operator;

(b) $125 for certification as a landfarming or composting operator;

(c) Fifty (50) dollars for certification by reciprocity for all categories of operator; and

(d) $100 dollars for attendance at the certification training without taking the examination.

(2) Fees shall accompany applications and shall not be returned to those who do not qualify for a certificate. (18 Ky.R. 3094; Am. 3440; eff. 6-24-92.)

401 KAR 47:070. Operator certification.

RELATES TO: KRS 224.01, 224.10, 224.40, 224.43, 224.46, 224.70, 224.99

STATUTORY AUTHORITY: KRS 224.10-100, 224.40-605

NECESSITY, FUNCTION, AND CONFORMITY: KRS Chapter 224 requires the cabinet to adopt rules and administrative regulations for the management, processing or disposal of wastes. KRS 224.40-605 requires the cabinet to promulgate administrative regulations that establish standards and a certification program for operators of waste sites or facilities. This chapter establishes the permitting standards for solid waste sites or facilities, the standards applicable to all solid waste sites or facilities, and the standards for certification of operators. An overview of the permit program is found in Section 1 of 401 KAR 47:080. This administrative regulation establishes the program for education, testing, and certification of facility operators of solid waste sites or facilities.

Section 1. Definitions. The following are definitions as used in this administrative regulation:

(1) "Category of solid waste site or facility" means inert, residual, construction demolition debris, residential or contained landfill and includes landfarming facilities receiving Class I, II and III sludges or wastes.

(2) "Certificate" means a written document issued by the cabinet stating that the operator has met all requirements for certification.

(3) "Certified operator" means a solid waste site or facility operator who holds a valid certificate. The following are categories of certified operators:

(a) "Landfarming operator" means a certified operator who is the individual responsible for ensuring compliance with all permit conditions at a landfarming facility in accordance with 401 KAR 48:200, and who is reasonably available to the site;

(b) "Landfill operator" means a certified operator who is the individual responsible for the daily operating requirements identified in 401 KAR 47:120, 48,060, 48:090, or 48:170;

(c) "Landfill manager" means a certified operator who is the individual with primary responsibility for management and operation of the residential or contained or construction/demolition debris sanitary landfill to assure compliance with all permit conditions including direct responsibility for providing guidance to the landfill operator, or the permittee and the authority to commit financial resources allocated for proper operation; or

(d) "Interim operator" means the individual identified by the permittee as the replacement landfarming operator, landfill operator, or landfill manager in accordance with Section 12 of this administrative regulation.

Section 2. Applicability. (1) The requirements in this administrative regulation apply to all solid waste sites or facilities except as subsection (2) of this section provides otherwise. Each solid waste site or facility shall have at least one (1) operator certified in accordance with Section 3 (sanitary landfills) or Section 4 (landfarming facilities) of this administrative regulation, as appropriate to the category of solid waste site or facility.

(2) Residual landfills and facilities operating under a registered permit-by-rule or a permit-by-rule are excluded from the requirements of this administrative regulation, unless the cabinet requires operator certification as a condition of the permit. In deciding whether to require operator certification at a residual landfill, a site or facility with a registered permit-by-rule or a permit-by-rule, the cabinet shall consider:

(a) The characteristics of the waste stream;

(b) The characteristics of the site, including geology and hydrology; and

(c) The experience and qualifications of the operator.

(3) It shall be the responsibility of the permittee to ensure that the solid waste site or facility complies with the requirements of this administrative regulation.

Section 3. General Provisions for Landfills. (1) Each construction/demolition debris, residential and contained landfill shall have a certified operator who is a landfill operator and a landfill manager. The requirements of this subsection may be fulfilled by:

(a) One (1) individual who has been certified in accordance with Section 6 of this administrative regulation for both categories of certified operator (provided this individual meets the qualifications in Sections 1(3) and 11 of this administrative regulation); or

(b) Two (2) individuals who have been certified in accordance with Section 6 of this administrative regulation in each category of operator such that one (1) individual is certified as a landfill operator and one (1) individual is certified as a landfill manager.

(2) As provided in Section 2 of this administrative regulation, the cabinet may require as a permit condition that a residual landfill or a site or facility with a permit-by-rule or registered permit-by-rule shall have a certified operator who is a landfill operator or a landfill manager or both. The permit condition imposed shall reference all applicable operating administrative regulations and requirements for the specific category of sanitary landfill.

(3) In the event the certified operator who is the landfill operator is not physically at the facility during operating hours, either the landfill manager or an interim operator shall be designated responsible for daily site operation and shall be physically located on site. If an interim operator assumes responsibility for daily operation of the landfill, the requirements in Section 12 of this administrative regulation shall be met. (4) In carrying out its

responsibilities, the cabinet shall examine the qualifications of applicants for certification and maintain records of certification and a register of certified operators.

(5)(a) Except as provided in Section 2 of this administrative regulation, no landfill shall continue operation in the absence of a landfill operator on site for more than ten (10) consecutive operating days without appointment of a qualified interim operator in accordance with Section 12 of this administrative regulation or written approval from the cabinet.

(b) Except as provided in Section 2 of this administrative regulation, no landfill shall continue operation in the absence of a landfill manager for a period longer than thirty (30) consecutive operating days without appointment of a qualified interim operator in accordance with Section 12 of this administrative regulation or written approval from the cabinet.

Section 4. General Provisions for Landfarming Facilities. (1) Each landfarming facility shall have a landfarming operator certified in accordance with Section 6 of this administrative regulation.

(2) No landfarming facility shall continue operation in the absence of a landfarming operator for a period longer than five (5) consecutive working days without appointment of a qualified interim operator in accordance with Section 12 of this administrative regulation or written approval from the cabinet.

Section 5. Application for Certification. (1) An individual desiring to be certified shall file an application on a form provided by the cabinet at least thirty (30) days before beginning training for a scheduled examination.

(2) The applicant shall submit all information needed to determine eligibility of the applicant for examination and certification.

(3) The cabinet shall review applications and supporting documents, determine the eligibility of the applicant for examination and notify the applicant of the determination.

(4) No person shall be eligible for examination for certification unless that person completes the appropriate training class or classes provided by the cabinet, unless an alternative training program or certification program is accepted by the cabinet in accordance with Section 7(6) of this administrative regulation.

Section 6. Training Classes and Examinations. (1) The cabinet will provide training classes for the certified operator.

(2) Training sessions will be held at least annually at places and times set by the cabinet. The last day of each training session will be set aside for the purpose of examinations to determine the knowledge and ability of the applicant.

(3) Certification shall be conditioned on successful passage of a written examination, unless an alternative examination process is accepted by the cabinet.

(4) Separate examinations will be prepared to cover basic differences in the duties and responsibilities for the operation of each category of solid waste site or facility and each category of certified operator.

(5) Applicants who fail to pass an examination may reapply for the examination at a regularly scheduled examination or by appointment with the cabinet. The cabinet shall require the applicant to attend the training session again if the applicant fails to pass the examination in three (3) attempts.

(6) In the event an applicant fails to meet the requirements for certification, he may petition the cabinet for a one (1) time only "temporary hardship certification." The cabinet will then conduct an informal hearing at which evidence shall be presented by the applicant to support his hardship request. Each temporary hardship certification request shall be considered on a case-by-case basis under the following guidelines:

(a) Failure of the applicant to receive certification would leave a significant area of the state without adequate waste disposal service.

(b) The applicant has shown a good faith effort by attending all required training sessions and met all requirements except the applicant has failed in three (3) attempts to pass the examination.

(c) The applicant has shown, through cabinet inspections, a capability for satisfactory operation of the solid waste site or facility.

Section 7. Training Course Requirements. (1) All applicants for certification shall be required to attend a training course provided by the cabinet in accordance with KRS 224.844.

(2) The training course provided by the cabinet shall be designed to provide information as appropriate to the category of certified operator. At a minimum, the training course shall provide information which enables the certified operator to perform his duties in a knowledgeable and competent manner.

(3) Landfill managers shall be trained on:

(a) The requirements for permit application for the applicable category of sanitary landfill including ownership, zoning, chapter 109 district boards, geologic and hydrologic information and specific design details;

(b) Characteristics of the waste stream; the physical, chemical and biological reactions including the hydrogeologic interactions of a landfill; and measures that shall be employed to meet the environmental performance standards in 401 KAR 47:030 and all other

regulatory requirements; and

(c) Specific duties expected to be performed by individuals who are wholly responsible for the requirements associated with the operation of the applicable category of sanitary landfill permitted by the cabinet. These actions include at a minimum, the commitment of resources, oversight of operating personnel, and verification that site operation is in accordance with all provisions of the permit including technical documents.

(4) Landfill operators shall be trained on the requirements contained in the solid waste administrative regulations as they apply to daily site operation duties. These duties include judging indicators regarding a site's ability to receive wastes; judging waste characteristics for disposal acceptability; employing site equipment to maintain waste compaction, cover, and surface water management on a daily basis; maintaining equipment; maintaining site safety; and generally assuring compliance with the administrative regulations.

(5) Landfarming operators shall be trained on the Kentucky waste management program as it applies to landfarming; wastewater treatment processes; the nature and characteristics of sludges; the physical and chemical properties of sludges; landfarming design and management; environmental considerations; and the Kentucky waste management permit process. The permit process includes requirements for application, conditions for maintaining a permit in compliance with the application and administrative regulations, and amendments to the landfarming activity and associated permit.

(6) The cabinet shall provide the training course to applicants for certification. However, the cabinet may consider alternate training courses or certification programs provided they are equivalent to the content prescribed by the cabinet's training course. It shall be the applicant's responsibility to submit such documentation as the cabinet requires for an equivalency judgment of the alternate training course. This information shall contain at a minimum the following specifics: the course name; sponsoring agency; the date, location and the beginning and ending times of the course; a summary of the course content of sufficient detail to determine relevance and quality of the course; and a copy of the certificate received.

Section 8. Issuance of Certificates. (1) Upon passage of the examination the cabinet will issue a certificate to the applicant which will indicate the category of solid waste site or facility and the category of certified operator for which the operator is certified.

(2) Certified operators shall be recertified every five (5) years.

(3) Certificates will be issued to holders of certificates of another state if the training requirements of the issuing state are deemed comparable as specified in Section 7(6) of this administrative regulation and if the operator passes the cabinet's examination.

(4) The certificates of operators who terminate their employment at a solid waste site or

facility will remain valid until expiration or revocation of the certificate.

(5) Certificates shall be carried on the person of each certified operator during working hours at the facility or prominently displayed on site.

Section 9. Compliance Dates. (1) An operator who is not an appropriately certified operator and who assumes the responsibility of a certified operator shall immediately comply with the requirements in Section 12 of this administrative regulation; and

(2) Comply with the requirements in Section 6 of this administrative regulation within fifteen (15) months of assuming the responsibility.

Section 10. Revocation of Certificate. (1) The cabinet may revoke the certificate of an operator, following a cabinet hearing, when it determines that the operator has practiced fraud or deception, or that the operator has failed to perform an operator's duties including, but not limited to, failure to comply with permit conditions.

(2) The cabinet may revoke a certificate whenever the holder fails to use reasonable care and judgment in the performance of an operator's duties. No certificate shall be valid if obtained through fraud, deceit, or the submission of inaccurate data on qualifications.

(3) Individuals who have had their certificate revoked by the cabinet shall be ineligible for future recertification.

Section 11. Operator Qualifications: Education and Equivalencies. (1) All applicants shall be evaluated by the cabinet as to education, and experience as related to the appropriate category of solid waste site or facility.

(2)(a) Applicants for landfill operator shall have completed high school (by graduation or by obtaining an equivalency certificate) and shall have a minimum of one (1) year of experience at a landfill similar to the category of landfill for which certification is sought.

(b) If an applicant for landfill operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years of experience in operating a landfill or experience in a related field (i.e., heavy equipment operator, road construction, surface mining, etc.) in determining eligibility for examination on a year-for-year basis.

(3)(a) Applicants for landfill manager shall have completed high school (by graduation or by obtaining an equivalency certificate) and shall have:

1. A minimum of two (2) years administrative experience in a related field (i.e., waste management, wastewater treatment, etc.); or

2. A minimum of two (2) years of postsecondary education; or

3. A minimum of two (2) years of a combination of experience in a related field and postsecondary education.

(b) If an applicant for landfill manager does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the qualifications of the applicant on a case-by-case basis.

(4)(a) Applicants for landfarming operator shall have completed high school (by graduation or by obtaining an equivalency certificate) and shall have a minimum of one (1) year of experience at a landfarming facility.

(b) If an applicant for landfarming operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years of experience in operating a landfarming facility or experience in a related field (i.e., waste water treatment, water treatment, etc.) in determining eligibility for examination on a year for year basis.

Section 12. Interim Operators. (1) In accordance with the requirements in subsection (2) of this section, the permittee shall notify the cabinet in writing of the extended absence of a certified operator ten (10) days prior to an anticipated absence and immediately upon discovery of an extended absence due to an emergency or unanticipated circumstances. The notice from the permittee shall provide the cabinet with the following information:

(a) Name and qualifications of the individual intended to replace the certified operator; and

(b) The length of time for which the permittee seeks to have the interim operator fulfill the obligations of the certified operator.

(2) The permittee shall notify the cabinet of the extended absence when the operator or manager shall be absent for:

(a) More than ten (10) consecutive operating days for a landfill operator;

(b) More than thirty (30) consecutive operating days for a landfill manager; and

(c) More than five (5) consecutive operating days for a landfarming operator.

(3) Consecutive operating days as used in subsection (2) of this section shall be determined as any days:

(a) When the solid waste site or facility accepts waste, operates equipment or otherwise performs the business of solid waste management; and

(b) Which days occur in sequence regardless of whether non-operating days such as weekends or holidays fall in between

(4) The cabinet shall evaluate the qualifications of the designated interim operator and shall notify the permittee of the cabinet's determination in writing within thirty (30) days of

receipt of the permittee's notice. The determination shall:

(a) Approve or deny the permittee's request for designation of the interim operator;

(b) Identify the length of time the interim operator may operate the solid waste site or facility; and

(c) Specify conditions as appropriate to the site and the interim operator's qualifications.

Section 13. Permit Condition. As specified in Section 2 of this administrative regulation, every solid waste site or facility requiring a permit shall be operated by the operator certified pursuant to this administrative regulation. Pursuant to Sections 2 and 3 of this administrative regulation, maintaining the certified operator(s) shall be considered a permit condition, and the permit may be revoked, or penalties for permit violations sought as appropriate, upon violation of the requirements and duties established by this administrative regulation.

Section 14. Fees. (1) Fees for application for certification shall be:

(a) $125 for application for certification as a landfill operator;

(b) $125 for application for certification as a landfill manager;

(c) $150 for application for certification as both a landfill operator and a landfill manager when the application is made for certification for both categories at the same training session;

(d) $125 for application for certification as a landfarming operator; and

(e) Fifty (50) dollars for certification by reciprocity for all categories of operator.

(2) Fees shall accompany applications and will not be returned to those who do not qualify for a certificate. (Recodified from 401 KAR 2:111, 3-1-83; Am. 10 Ky.R. 172; eff. 12-2-83; 13 Ky.R. 913; 1228; eff.1-13-87; 16 Ky.R. 1642; 2174; eff. 5-8-90.)

APPENDIX C: CONTACTS

CONTACTS BY TOPIC

The Division of Compliance Assistance is now responsible for the implementation of the landfarm certification. The Division of Waste Management is still responsible for the permits, annual review and reporting requirements. The information below offers the reader a contact person for various areas of assistance.

Division of Compliance Assistance

Phone Number: 502-564-0323 *Fax Number: 844-213-0549*

Certification (training, testing & fees)	Veronica Roland
Compliance Assistance	Kari Johnson
Open records requests related to certification	DEP.KORA@ky.gov
Regulations related to certification	Jessica Wilhoite

Division of Waste Management

Phone Number: 502-564-6716 *Fax Number: 502-564-3492*

Technical assistance on permits	Danny Anderson
Landfarming, Composting & Beneficial Reuse	Robin Green
Annual review assistance	Mike Willis Jon Durbin
Solid Waste Landfills	Danny Anderson Ken Melton Charles Higginbotham
Forms and fees not related to certification; Bonding and reporting requirements	Jamie Nielsen Lawrie Green John Arnett Rachel Martin
Open records requests related to facilities	DEP.KORA@ky.gov
Regulations related to facility requirements	Jason Monarch
Complaints	Brian Osterman
Facility inspections	Jon Maybriar
Enforcement	Jeff Cummins

DWM Field Offices

Field Offices	Phone Number	Office Supervisor
Bowling Green	270-746-7475	Barbara Hankins
Columbia	270-384-4735	John Rogers
Florence	859-525-4923	Michael Fant
Frankfort	502-564-3358	Richard Thomas
Hazard	606-435-6022	Alex Sandlin
London	606-330-2080	Chase Whitis
Louisville	502-429-7120	Duke York
Madisonville	270-824-7532	Larry Tichenor
Morehead	606-783-8655	Karen Hall
Paducah	270-898-8468	Margie Williams

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APPENDIX D: GROUNDWATER PROTECTION PLANS

Groundwater Protection Plans

Revised January 25, 2012

Effective August 24, 1995, anyone engaged in activities that have the potential to pollute groundwater is required to develop and implement a Groundwater Protection Plan (GPP). This applies to all commercial businesses, municipal, county, and federal governments, and private citizens. Activities associated with composting operations and the land application of solid and special waste also require the development and implementation of a GPP.

A GPP identifies activities being conducted at your site that have the potential to pollute groundwater and states the protective practices (BMPs) that you will use to protect groundwater. The regulation requires the person responsible for implementing your GPP to review the entire GPP every three years. If no changes have occurred in activities or BMPs, the GPP may be recertified by signing and dating another Certification Statement. If changes have occurred the plan must be revised to address the modifications. The revised GPP must also have a newly signed Certification Statement. Be sure to keep your GPP updated as a DEP inspector can issue a Notice of Violation (NOV) if you are implementing an out-of-date GPP.

GPPs do not have to be approved to be implemented. In fact, GPPs are not required to be submitted for review and approval unless (1) they are called in by a Department for Environmental Protection (DEP) inspector, (2) they are called in by the Groundwater Section staff or GPP Program, or (3) they are required as part of an Agreed Order (Enforcement). GPPs can be voluntarily submitted to the Groundwater Section for review. Anyone from the public or DEP may ask to review your GPP. However, official approval of the GPP can be issued only by the Groundwater Section's GPP Program.

The GPP Program is operated out of the Groundwater Section of the Watershed Management Branch of the Kentucky Division of Water, 300 Sower Blvd., Frankfort KY 40601. The program coordinator may be contacted at (502) 564-3410.

Kentucky Administrative Regulation 401 KAR 5:037, The Groundwater Protection Plan Regulation, was promulgated in August 1994 as required by Kentucky Revised Statute 224. The guidance for developing a GPP for land application of solid and special waste or the mini- guidance for composting operations are included in this manual. They also may be downloaded, along with the regulation, from the program web site at http: //water.ky.gov. Click on Programs and the following links: Groundwater, Groundwater Protection, and Groundwater Protection Plans.

PREPARING A GROUNDWATER PROTECTION PLAN FOR LAND APPLICATION OF SOLID OR SPECIAL WASTE

Revised January 25, 2012

The Groundwater Protection Regulation, 401 KAR 5:037, requires anyone who conducts an activity having the potential to pollute groundwater to develop a Groundwater Protection Plan (GPP). A Groundwater Protection Plan identifies the activities being conducted at your site that have the potential to pollute groundwater and states the practices you will use that will prevent groundwater pollution. Section 2 of the regulation identifies the activities that require a GPP. Land application of sewage sludge is one of the activities identified under Section 2.

(1)(e) "Land treatment or land disposal of a pollutant," and

(1)(f) "Storing, treating, disposing, or related handling of hazardous waste, solid waste, or special waste in landfills, incinerators, surface impoundments, tanks, drums, or other containers, or in piles."

Your GPP must include all the activities occurring at your sites that are subject to 401 KAR 5:037. Read Section 2 thoroughly to determine if there are any regulated activities other than the two above. If so, include them in the GPP. The regulation may be downloaded at http://water.ky.gov/. Click on Programs, Groundwater, Groundwater Protection, Groundwater Protection Plans.

USING THE GUIDANCE

Follow the Guidance Format.

Follow the format provided in this guidance to develop your GPP. Using this format will assure that most, if not all, of the information necessary for adequate review is included. It also organizes the information so that anyone from the general public can follow your plan without needing additional explanation.

Use all Headings and Subheadings as stated in the Guidance.

Do not make up your own headings or subheadings. Use the headings and subheadings in the order provided in the guidance. Do not leave out headings.

Provide all Information requested in the Guidance, where applicable.

Be sure that you have provided the information requested. The review process is delayed when necessary information has been left out.

Contact the GPP Program if you need assistance or have any questions.

Call the Program Coordinator at (502) 564-3410.

WHEN YOU HAVE COMPLETED THE GPP

When you have completed your plan, review the draft to be sure that the GPP has addressed all the activities occurring at your site that are covered by the Groundwater Protection Regulation and that you have provided all the information, where applicable, for each section.

Implement your GPP!

To be in compliance with 401 KAR 5:037 the GPP must be implemented immediately following development. This applies to all GPPs, even if your GPP is in review by the Groundwater Section. Implementation is not dependent upon approval of the plan. If your GPP is in review, continue to implement the practices in the submitted GPP. If changes are required, then the new practices should be implemented.

Submitting the GPP

Submittal of a GPP for review by the Groundwater Section, Watershed Management Branch, is optional unless:

1. required as part of an Agreed Order.

2. stated by a DEP inspector as a requirement in a Notice of Violation

3. requested by letter by the Groundwater Section.

To submit a GPP for review, send one (1) copy of the GPP to Watershed Management Branch, Kentucky Division of Water, 300 Sower Blvd., Frankfort, Kentucky, 40601. You will receive a letter stating that the Watershed Management Branch has received your plan.

Your initial GPP submittal and any further drafts will not be returned. Be sure you keep a copy of each draft so that required changes can be made. The approved draft will be retained in the Division of Water (DOW) files. You will receive a letter stating the GPP has been approved.

It is not necessary to include the Groundwater Protection Regulation or this guidance document with the GPP when submitting it to the Groundwater Section for review.

FORMAT FOR GPP

SECTION A. <u>GENERAL INFORMATION</u>

1. <u>Name (if there is one) and Address of Land Application Facility</u>

--Name of street, or route number (NOT mailing address).

--Latitude and longitude location of land application facility entrance. If you need to obtain

latitude and longitude of your site, go to http://www.batchgeocode.com/lookup. Insert your address as directed.

--Name of County.

2. Person Developing GPP

--Name

--Address (business address, not home address unless business operates out of the home)

--Telephone Number (business phone, not home phone unless business operates out of the home).

3. Person Responsible for Implementing GPP

--Name

--Address (business address, not home address unless business operates out of the home).

-Telephone number

4. Location of Land Application Sites on Topographic Map

--Draw boundaries of sites on 8 ½ x 11 copy of the U.S. Geological Survey topographic quadrangle map. Only a United States Geological Survey topographic map will be accepted. Copy the 8 ½ x 11-inch section of the map that contains the location of the land application sites. Do not enlarge or reduce the size of the map. If that section does not have the name of the topographic quadrangle, please write it on the map.

SECTION B. ACTIVITIES THAT HAVE THE POTENTIAL TO POLLUTE GROUNDWATER

List all the activities performed in the storage of solid or special waste and the land application process that may possibly pollute groundwater. Some examples of the activities are:

- Storing waste in tank or lagoon prior to land incorporation.
- Unloading wastes from truck to storage tank or lagoon.
- Applying waste onto land surface or incorporating into soil.

List any other activities that require a GPP that are conducted at the site that are not part of the land application process.

SECTION C. PRACTICES SELECTED TO PROTECT GROUNDWATER

1. Provide protective practices for tanks or lagoon storing waste. What is done to prevent

and detect leaks?

2. Provide protective practices for cleaning up spills that may occur during the unloading of wastes from truck to storage tank.

3. Provide name(s) of Certified Landfarming Operator(s).

4. Provide certification number of operator(s).

5. This activity is regulated by permit from the Kentucky Division of Waste Management.

Provide permit number(s).

6. The Groundwater Section recognizes that requirements of 401 KAR 45:100, Section 6 is protective of groundwater. Therefore, the practices required by this regulation may be incorporated by reference.

Type the statement below as it is written.

All certified operators must sign the statement.

I (typed name) certify that the operation of this landfarm is in compliance with 401 KAR 45:100, Section 6.

Signature(s) and Date

SECTION D. IMPLEMENTATION SCHEDULE

The GPP must be implemented immediately. Implementation does not depend upon approval of the GPP. If you are already using the protective practices, just state so. If not, state the date by which you plan to use them. If you must order protective equipment or build secondary containment structures, and the cost is not part of your business's budget, the Groundwater Section will work with you on an acceptable time frame for completing the project. List what is to be done and give an estimated date when the project will be completed.

SECTION E. EMPLOYEE TRAINING

If you have employees working for you at the disposal site, they must be trained to follow the management practices listed in 401 KAR 45:100, Section 6, and any other protective practices in the GPP to prevent surface water and groundwater pollution.

Briefly describe how you train the employees, when they receive the training, and how often they receive refresher training. Be specific. For example, state initially on hire and twice a year or once a year after that. Stating "when needed" or "frequently" is not

acceptable.

SECTION F. INSPECTION SCHEDULE

The purpose of inspections is to insure that all the management practices are being followed and are working to prevent groundwater pollution.

The application site must be inspected to determine that the management practices are working. Inspection records must be kept to show that you are implementing your Groundwater Protection Plan (GPP). The records should be in the form of a checklist.

The checklist must include:

--the management practice.

--observations.

--is the management practice working? (yes, no)

--actions taken (If management practice was not working, note was done to correct the problem.).

--date, and

--place for person doing the inspection to sign his/her name.

You must also state how often inspections will take place. Again, be specific. State an exact time interval. Saying "when needed" or "frequently" is not acceptable.

SECTION G. CERTIFICATION STATEMENT

The person who can make the managerial and/or financial decisions required to implement your plan should be the one signing the certification statement.

Use the following statement just as it is:

I (typed name) certify that this Groundwater Protection Plan complies with the requirements of 401 KAR 5:037. I have read the plan and will implement its provisions.

Signature (hand signed) and Date

SECTION H. REVIEW LOCATION FOR GROUNDWATER PROTECTION PLAN

Section 4(7) of 401 KAR 5:037 provides for public inspection of Groundwater Protection Plans. GPPs must be retained and implemented at the site for which they are

developed. However, landfarms as a rule are not occupied 8 hours every day. The Groundwater Section recommends that you keep a copy of the GPP in the vehicle you use to access the landfarm. However, you must provide a place where the public may review your plan.

Even though approved GPPs are retained in the DOW files, you are not required to use the DOW in Frankfort as your site for public review. In fact, the Groundwater Section recommends that you use your office or place of business. This eliminates the requirement to send a recertified GPP every three years to the Ground-water Section. This does not mean, however, that you need not update your GPP.

The regulation requires you to review your entire GPP every three years. If no changes have occurred in responsible personnel, activities, or protective practices (BMPs), you may recertify your plan by signing and dating another certification statement under Section G. You must revise your plan at the time any changes occur, even if it has been less than three years since the last review. Contact the Watershed Management Branch when your GPP has been recertified or revised. If you must submit a revised plan, send it to Program Coordinator, Groundwater Protection Plan Program, Watershed Management Branch, Kentucky Division of Water, 300 Sower Blvd., Frankfort KY 40601.

If you have any questions about these matters, contact the Program Coordinator at (502) 564-3410.

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APPENDIX E: OTHER WASTE TYPES

Fly Ash

Fly ash is a fine material emitted into the smoke stack of coal fired boilers. These materials consist of bottom ash settled at the base of smoke stacks or ash accumulated by specially designed collectors to prevent release into the atmosphere. Fly ash properties vary greatly depending on the source and type of coal burned, and the type of ash collection system. For example, electrostatic precipitators produce very fine material. Fly ash contains low-levels of phosphorus, potassium, calcium, magnesium, sulfur, boron, molybdenum, and other micronutrients. Depending on the original coal source and collected system, fly ash has some value for neutralizing a soils pH. Fly ash can improve moisture-holding capacity and other physical properties of sandy or gravelly soils or mine spoils.

Fresh fly ash is initially toxic to plant growth due to its content of boron, molybdenum and high pH (alkaline) from the alkali metal oxides. When exposed to moisture, these unstable metals oxides form carbonates. This requires exposure of the fly ash to the atmosphere for stabilization prior to land application. This stabilization results in a reduction of salinity and prevents toxicity to plants. Fly ash contains low levels of all the heavy metals requiring a complete analysis including total boron, molybdenum and pH before land application.

Lime Scrubber Sludge

Lime scrubber sludge results from the scrubbing of sulfur dioxide from the stack gases of coal-fired power plants using a liquid suspension of finely ground limestone. Holding ponds remove the excess water from the lime scrubber sludge, resulting in solids content of about 50%. Further dewatering occurs very slowly in the ponds due to the fine particle size of the material. Lime scrubber sludge requires further stabilization before land application. Stabilization processes include adding more lime, fixing agents, sodium silicate, or cement, followed by further dewatering mechanically or in ponds.

Scrubber sludge may contain some fly ash depending on the type of coal burned, location of the fly ash collectors, and whether fly ash addition occurs before ponding and stabilization. The unstable material consists largely of calcium sulfite, unreacted lime, and fly ash components. The calcium sulfite reacts to become the more stable form of calcium sulfate.

Mixing of the fine particles contained in the dried limestone scrubber sludge and fertilization of the soil with nitrogen, phosphorus, and potassium can help support vegetative growth. Fresh unstable sludge may be toxic to plant growth due to the concentration of boron and high pH (basics conditions) resulting from the unreacted lime. Scrubber sludge has some liming value for soils depending on the content of unreacted lime and fly ash. Lime scrubber sludge contains levels of heavy metals requiring a complete chemical analysis including heavy metals, total boron, pH, and liming value from the unreacted calcium carbonate before land application.

Fluidized Bed Combustion Waste (FBCW)

Fluidized bed combustion waste (FBCW) occurs as fine coal dust burns in a bed of inert ash and ground limestone. Air injected at controlled rates suspends the bed (fluidized) where the ground limestone reacts with the sulfur dioxide produced during the coal combustion process.

FBCW is a fine granular solid material containing calcium sulfite, unreacted lime, and metal oxides that result in extremely high pH levels. The metal oxides (metals and calcium oxide) convert to hydroxides in the presence of moisture and heat. Further changes occur as hydroxides (calcium oxide) react with carbon dioxide in the atmosphere forming carbonates that stabilize the material. Fresh FBCW has an extremely high pH due to the hydroxides, requiring careful handling and further processing to lower the pH. The calcium oxide requires stabilization (conversion to calcium carbonate) before land application. Un-stabilized FBCW should not be land applied due to the high pH.

Stabilized FBCW provides sulfur and calcium for plant growth and provides a good source of lime for adjusting soil pH depending on the percentage of unreacted lime. As the calcium sulfate and fly ash content increases, the ability to adjust soil pH decreases. The fine calcium carbonate provides an immediate liming value of about 10% with longer-term liming value of about 40%. Transportation costs will limit the use of FBCW as a liming material. Prior to land application, the material will need to have a complete chemical analysis including total boron, alkalinity and liming value.

Gas and Oil Drilling Mud

During the drilling of oil and gas wells, special fluids pumped down into the borehole lubricate and cool the drilling bit, float out the loose material, seal porous strata, and prevent the borehole from filling with water. Most drilling fluids (drilling muds) are commonly prepared by mixing different proportions of barite (barium sulfate), bentonite (type of clay), chrome lignosultonate, lignite, and sodium hydroxide. Most drilling muds contain trace elements, petroleum residue, salt-water components, and sources of alkalinity.

Most drilling mud (fluid) undergoes dewatering in catchment basins at the drilling site before handling. The material is handled as a solid (>20% solids), which may be processed onsite or transported to special treatment sites away from the drilling activity. Design and construction of these treatment areas confine the material, and allow inoculation with bacteria that convert the petroleum residues to simple organic compounds. Construction of these "cells" includes an underlying drain field that allows the leaching of soluble components out of the drilling mud. The insoluble components remain in the "cell" with the drilling mud. Removal of the drilling mud occurs when monitoring indicates that the petroleum residue concentration poses little or no hazard to the environment. The stabilized drilling mud is useful as industrial fill material. Prior to landfarming, drilling mud requires analysis for all required heavy metals plus total arsenic (As), barium (Ba) and mercury (Hg). In addition, analysis should be performed for total Polycyclic Aromatic Hydrocarbons (PAH's), also known as poly-aromatic hydrocarbons, and specialized organics

such as alkanes, chlorinated alkanes, and chlorinated aromatics.

7. Oil Production Brines

Oil production brines result from separation of water and oil during the drilling, pumping or extraction of oil from a well. Most of this material returns underground through injection wells following separation in a tank near the producing well. When an injection well is not available for handling the brines, the material falls under the special waste regulations.

Brines are very salty because they are composed largely of sodium-laden waters mixed with the oil underground. Due to the toxic effects that high sodium levels have on plants, there are application rate limitations for landfarming. Before landfarming, analyze this material for sodium, chlorine, alkalinity, and the required heavy metals. Sodium and chlorine content limit the application rates.

APPENDIX F: BASIC SOIL SCIENCE

Soil Properties

Site evaluation, selection and management all begin with an assessment of soil properties. These properties determine the physical, chemical and biological processes in soils that affect plant nutrient availability, heavy metal immobilization, waste utilization, and crop management.

A. Soil Properties

This section will be a general discussion of soil properties that influence the beneficial use of wastes. The information on soil properties in this section will help you understand how to evaluate potential landfarming sites and to appreciate the important role soil plays in proper waste management. The four roles of soil in waste treatment are to provide a medium for:

1) Plant root growth;

2) Water and nutrient entry, and movement;

3) Immobilization of metals and other chemicals; and

4) Biological activity to assimilate wastes.

An aerobic environment is necessary for plant growth and for the soil microbes that decompose organic residues and destroy pathogens. Aerobic environments occur when a favorable balance between air-filled pores and water-filled pores exists in the soil system. Soil management for beneficial use of wastes should strive to maintain aerobic conditions in the soil. Ideal soils have about 50% solids and 50% pore space. In Kentucky, one can expect the soil to be comprised of 48% mineral matter and 2% would be organic matter, 25% pore space filled with water and 25% unsaturated pore space.

The soil texture, soil structure, and soil water content affect the aerobic conditions in the soil. Loamy soils, common in most of Kentucky, have good soil structure that provides aerobic conditions. Some Kentucky soils may be more clay and have structure that tends to be less well aerated. Soils saturated with water for long periods tend to be anaerobic and are not favorable for normal decomposition of added wastes. Fragipan soils in some parts of Kentucky have impermeable horizons causing perched water tables that can also reduce the rate of decomposition. These conditions can lead to nutrients being lost into the environment, and rather than being used to grow a crop, they become pollutants.

Soil management for land application must control water movement over and through the soil in order to prevent contamination of surface water or groundwater. The potential for leaching increases as soil permeability and rainfall increase. Soils

that are less permeable or have a steeper slope will experience greater surface runoff.

Runoff occurs when the soil cannot absorb the rainfall. Surface runoff increases the potential for contamination of surface water bodies. The runoff potential depends on the soil slope, soil wetness, surface infiltration, and whether the soil is frozen. The amount of vegetative cover, rainfall intensity and use of soil conservation measures also affect the amount of runoff.

Soil can immobilize many metals and other elements or compounds contained in wastes. Soil pH and the cation exchange capacity (CEC) are the primary factors controlling immobilization. The CEC of a soil depends on amount of organic matter and the percentage and type of clay.

B. Collective Features of Soils

The collective features of soil are the result of the natural processes of soil formation and human activity. Such features determine the suitability of soil at a potential landfarming site. These features include texture, structure, color, mottling, horizons, and soil depth.

1) Soil Texture

Texture is a very important component of soil. It contributes heavily to a soils CEC, or Cation Exchange Capacity, due to their large surface area and generally negative charge. Soil texture refers to the soil's particle size distribution. Three particle size groups; sand, silt, and clay classify the soil texture. Sand particles feel gritty and are so large that each grain is visible.

Silt has a smooth feel like flour or cornstarch. Clay feels sticky when wet and is easily molded. Sand and silt do not contribute much to soil CEC as they have a smaller surface area in a given volume of soil. Clay particles are flat with a large surface area per unit volume, and therefore, make a large contribution to CEC.

Soil texture classifications include the term loam in addition to silt, sand and clay. Loam refers to easily worked, fertile soil, composed of clay, silt, and sand. A clay loam has a clay content of 25-40%, a silt loam has more than 70% silt, and a sand loam has between 50 and 70% sand. Loams heat up rapidly, drain neither too slowly nor too easily, and are well aerated. The percentage of each component makes up the determination of a soil and impacts the size and shape of soil pores which in turn impact water and air movement, root growth and microbial activity. Kentucky's predominantly silt loam soils are generally well-suited for landfarming.

Clay soils restrict air and water movement, and are difficult to work beyond ideal

moisture range. Driving heavy vehicles on clay soils when they are too wet can damage soil structure, reducing the ability of the soil to support a crop, retain nutrients and fix metals within the soil profile. "Heavy" or high clay soils are not allowed to be used for landfarming if permeability is less than 0.2 inches per hour.

Sandy soils drain rapidly, and can be worked over a wide range of soil moisture contents, but don't retain nutrients or metals well. Sandy soils can benefit by the addition of organic matter such as wastewater sludge, but are not allowed to be used for landfarming if permeability exceeds six inches per hour.

In summary, soil texture affects:

1) Porosity,
2) Water movement,
3) Aeration,
4) Water retention,
5) Organic matter,
6) Plant nutrition, and
7) Metal adsorption

2) Soil Structure

Soil structure refers to the aggregation of the individual particles of sand, silt, and clay into larger units called peds. Plant roots, soil organic matter, and clay particles provide the physical and chemical binding for the peds. The shape, size, and grade of peds characterize the soil structure. Granular peds are common in surface soils, which provide balanced air and water relations. Plates occur just below the surface in some soils. Due to their horizontal occurrence, these plates tend to restrict air and water movement.

Both blocky and prismatic peds are common in the subsoil, tending to provide large pores between peds (and smaller pores within peds) for more balanced air and water movement.

The texture of a soil cannot be effectively changed but structure can. attempts to modify structure by reduced tillage, addition of organic matter, etc. are valuable to create larger pores or air and water and improve the root zone. Soil structure can modify some of the undesirable effects of certain textures (usually higher clay content soils) by creating larger pores between peds that encourage air and water movement. Good structure means good aeration and a favorable balance between air and water containing pores. This balance

improves the soil environment for root growth and microbial activity.

Maintaining strong, stable peds is important in any good soil management strategy. Waste can be a valuable soil amendment as it adds organic matter that is vital to the formation and maintenance of good soil structure. In addition, waste application stimulates root growth that tends to bind particles together. Waste application is valuable in providing organic matter to improve soil structure particularly in heavily cropped soils prone to structural deterioration.

Clay tends to form tighter soils due to the chemical attraction. However, moderate amounts of clay tend to shrink and swell in response to wetting and drying, or freezing and thawing thus may help to loosen some soils.

3) Soil Color

Color provides important clues about the nature of the soils in the plant zone. Dark colors (browns) at varying depths below the surface usually mean favorable amounts of organic matter. Usually, the dark colors indicate higher levels of organic matter and a more productive and fertile soil. Since organic matter is a major factor in soil structure development, the darker the soil, the more stable and well-formed the peds.

Yellowish and reddish soil colors indicate a favorable air and water relationship. As plant roots and soil microbes remove oxygen from the soil pores, oxygen from the air above moves in to replace it. The iron oxide coatings on the soil particles cause these colors. Chemically, these coatings are the same as rust. Iron oxides are stable and, as long as good aeration predominates, these coatings remain and provide the dominant soil color. Well- aerated soils are ideal for plant growth, microbial activity, and provide beneficial conditions for assimilating wastes.

Gray colors at any depth indicate poor aeration due to long periods of wetness or water saturation. When soil pores are full of water, oxygen from the air cannot get into the soils. This creates an environment where the iron oxide coatings begin to change color from reddish or yellowish to gray and become more soluble. These soils tend to be more acidic and less fertile, slowing plant root growth and reducing plant production. Soils that have gray colors near the surface are poorly suited for waste application.

4) Soil Mottles

Some soils have spots, called mottles, of one color in a matrix of a different color, hence the term “mottled” soil. Some mottles appear as splotches of reddish-brown in a gray color. However, it is more common in Kentucky soils to have gray mottles in a reddish or yellowish matrix. Fluctuation of the water table in the soil causes mottling. When water levels are high, the soil pores are saturated and the iron oxide changes to a gray

color. As the water table lowers, air reenters the larger pores first, changing the gray color to reddish or yellowish. Soil around the smaller pores remains gray, thus giving the mottled appearance. By understanding these processes, observation of soil colors and particularly soil mottles (if present) can help determine the height and duration of water tables in soils. This information is an indication of internal soil drainage and has a direct application on assessing soil suitability for waste application.

5) Soil Horizons

A soil horizon is a layer of soil parallel to the surface of the earth. The distinct soil-forming properties define each horizon in terms of its texture, structure, color, and parent material. Together, all of the horizons (resembling layers in a layer cake) in a soil constitute a soil "profile." A soil profile description is a complete set of horizon descriptions for all horizons that occur in a soil.

Table 5 lists the master soil horizons. Additional transition horizons indicate zones of gradual change from one master horizon to another.

Table 5 – Master Soil Horizons

O	Litter layer
A	Dark colored surface horizon
E	Strongly leached horizon
B	Distinct subsoil horizon
C	Weathered parent material
R	Bedrock or shale

Some horizons in Kentucky soils are restrictive due to the specific properties of the horizon. Water and air cannot move into and through these restrictive layers as fast as it moves through the soil above these horizons. These layers also prevent normal downward root growth of many common agricultural crops. In most soils, these restrictive horizons create perched water tables during periods of high rainfall as indicated by either zones of all gray color or mottling of gray in a reddish or yellowish color. These include:

- **Claypans**: Horizons that have very high clay content, particularly in comparison to those horizons both above and below.
- **Fragipans**: Horizons that are very silty and very dense.

The presence of these layers may either severely limit or even disqualify potential sites for waste application due to the occurrence of perched water tables during some

seasons of the year. Soil profiles with restrictive layers used for waste application will have increased potential for water run-off due to the restricted downward movement of water. These sites often require conservation practices to manage run-off water.

6) Soil Depth

Soil depth refers to the total depth of the soil horizons above bedrock or shale. In Kentucky, several areas of the state have bedrock or shale close to the surface.

Table 6 - Soil Classification Based on Soil Depth.

Shallow	0 to 20 inches
Moderately deep	20 to 40 inches
Deep	more than 40 inches

These terms do not apply to depth to a restrictive horizon although, from a practical point of view, depth to a restrictive layer more accurately describes the potential rooting zone for most crops and for microbial activity to decompose applied wastes.

C. Soil Behavioral Properties

Several aspects of soil are difficult to measure directly in the field. However, inferences from laboratory measurements or field observations based on soil-forming properties help classify the soil characteristics. Some of the important soil behavioral properties important for land application of wastes include permeability, infiltration, internal drainage class, available water holding capacity, leaching potential, shrink-swell potential, trafficability, pH, nutrient availability, and heavy metal immobilization.

1) Permeability

Soil permeability is the rate that water moves through the soil. Permeability depends on the amount, size, shape, and arrangement of soil pores, and on the homogeneity of the pore relationships between soil horizons. Water moves through soils in response to both gravity and the attraction between water molecules and soil particle surfaces. Gravity moves water through large pores, while the attractive forces retain water films on surfaces of soil particles.

Since permeability is not directly measurable due to the complex pore structure, it is more convenient to determine hydraulic conductivity. Hydraulic conductivity is a measure of water flowing vertically in the soil. Relating the hydraulic conductivity measurement to soil texture, structure, and horizons provides the soil permeability classification. This classification contained in soil survey reports helps determine site suitability for land application of wastes.

Table 7 - Soil Classification Based on Soil Permeability.

Hydraulic Conductivity (in./hr.)	Permeability Class
<0.06	Very slow
0.06 – 0.20	Slow
0.20 – 0.60	Moderately slow
0.60 – 2.0	Moderately
2.0 – 6.0	Moderately rapid
6.0 – 20.0	Rapid
>20.0	Very rapid

2) Infiltration

Infiltration is the rate that water enters the soil through the surface. This depends primarily on the pore number, distribution, texture, and structure. Clearly, coarse-textured soils have much faster infiltration rates than fine-textured soils. Runoff potential is affected by surface infiltration, slope, temperature of the soil (frozen), and the amount of vegetative cover. Soils with restricted layers will have increased potential for water runoff due to the restrictive downward movement of water.

Table 8 - Soil Infiltration Rates Based on Soil Texture

Soil texture	Infiltration rate (in./hr.)
Sand	2.0 – 5.0
Loamy sand	1.0 – 1.5
Loam	0.5 – 0.75
Silt loam	0.2 – 0.3
Clay loam	0.15 – 0.3
Silty clay loam	0.1 – 0.2
Clay	0.05 – 0.15

Strong, stable peds at the soil surface create and maintain relatively large pores that encourage infiltration. High organic matter content at the surface helps maintain stable peds. The moisture content and permeability of the soil beneath the surface also affect

surface infiltration. Faster permeability allows soils to dry more quickly beneath the surface and increases infiltration.

Infiltration is important for land application of wastes because of its affect on water quality. Alone rapid infiltration is desirable but if coupled with rapid permeability there is a greater risk of groundwater contamination. This is particularly important when liquid wastes are applied, or when heavy rains follow any waste application. Slow infiltration is a more common problem in Kentucky. Slow infiltration increases surface water run-off and when combined with slope, can increase the potential for surface water contamination.

Following are three important management factors:

- Avoid driving on wet soils to prevent compaction of the soil surface that reduces infiltration and increases run-off.
- Keep organic matter high by adding wastes or other organic residues to the soil.
- Use sod-forming crops in rotation as much as possible**.**

3) Internal Drainage

Internal drainage refers to the ability of free water to move through a soil. Internal drainage is not the same as the permeability of a soil. Internal drainage class determinations occur based on the height that a water table raises in the soil and the length of time that the soil remains saturated.

Drainage affects soil temperature, as wet soils are cold soils. Biological processes that decompose wastes and release nitrogen for plant use do not operate as fast in cold soils. This can often delay the normal release of nitrogen from land-applied wastes, and can increase denitrification (gaseous loss of nitrogen). Denitrification reduces the efficiency of nitrogen supplied for plant growth.

Internal drainage also indicates the depth of soil available for plant root development and the uptake of soil nutrients. As these processes occur mainly in aerobic conditions, only the soil volume above the water table is available for waste utilization. Climate dictates the amount and frequency of rainfall, hence the frequency of high water tables. Direct observations of water table fluctuations seldom occur. A study of these conditions generally occurs during dry seasons using evidence of color and mottling to determine the height of the water table.

Table 9 lists internal drainage characteristics based on soil depths to which there is no evidence of gray colors or gray mottles.

Table 9 - Internal Drainage Characteristics Based on Depth to Mottles

Internal Drainage	Depth in Inches
Excessive & somewhat excessively drained	>40
Well-drained	30 – 40
Moderately well drained	20 – 30
Poorly drained	10 – 20
Very poorly drained	<10

4) Available Water Holding Capacity (AWHC)

Available water holding capacity refers to the amount of water that soils can store for plant use. Soil texture and structure influence AWHC depending on the number and size distribution of soil pores.

Because gravitational water passes through the large pores, draining out as soon as the water table drops, very little remains available for the plants. A soil is at field capacity when gravity has removed the excess water. Plants remove water easily when soils are at field capacity; however, with each increment of water removed it is harder for plants to remove the next increment.

When a soil is so dry that plants can remove no more water, the soil is at the wilting point. Water that remains in the soil at the wilting point is unavailable water.

AWHC is expressed as the number of inches of water that can be stored in the top 40-inches (or to the depth of root limiting layer) of the soil profile. Each soil texture class has a characteristic AWHC, expressed as inches of available water per inch of soil depth. Soil Survey Reports for each soil series and soil type mapped within the scope of the report contains information on AWHC. Ideally, soils selected for landfarming should have a high AWHC (>5.2- inches) in the upper 40-inches of soil.

5) Leaching Potential

Leaching refers to the downward movement of materials in solution carried by water passing through the soil. Leaching potential is a composite property based on interpretation of the soil's infiltration, permeability, AWHC, and hydraulic loading. Leaching potential balances all water inputs against all water losses. Inputs include rainfall,

irrigation, or liquid from wastes added to the soil. Losses include evaporation from the soil surface, transpiration by plants, and surface run-off. When inputs exceed losses, water passes through the soil (leaching). Leaching potential is high during periods of high rainfall with low potential evaporation and low during periods of low rainfall and active plant growth.

6) Trafficability

Trafficability refers to the soil's ability to support the weight of land application or farm equipment with a minimum of compaction or deterioration of soil structure. Trafficability is important because:

1) Compaction and rutting of the soil reduces infiltration and permeability;
2) Loss of traction can delay and increase the cost of waste application; and
3) Crops do not grow as well in compacted and rutted soil, and the potential for surface run-off is greater.

No soil management practice is more important than avoiding traffic when soil is too wet.

The resulting compaction can cause significant damage very difficult to correct.

Trafficability depends on soil texture, moisture content, and plant cover, with moisture content being the most important factor. All soils support weight when they are dry and lose stability when they are wet. Silt loam soils, such as in Kentucky, have the lowest stability when wet and are the most susceptible to compaction. Wait until silt loam soils are considerably less than field capacity before driving large equipment over the site.

If you are uncertain about current soil conditions, the county agricultural extension agent can help you determine when soil conditions are favorable. A good working relationship with the county agent can be an important component of a land application program.

7) Shrink – Swell Potential

Shrink-swell is the expanding and contracting of a high content clay soil. This typically is related to the type of clay present. To a greater or lesser degree, clays tend to expand when wet and shrink when dry. Modest shrink-swell activity is beneficial in forming a well-developed soil, and is important in overcoming some slight compaction problems. Most Soil Survey Reports contain information on the shrink-swell potential of soils mapped within the area. Any soil rated "high" requires careful management for waste utilization. When these soils become dry, they shrink to the point that deep, wide cracks form in the soil. Masses of soil between the cracks have such tiny pores that water penetrates only the large cracks. When these "high" rated soils become wet, the cracks close so tightly

that the soil becomes one large mass. These conditions decrease soil AWHC when dry, restrict permeability when wet, and provide a hostile environment for biological activity when either wet or dry. To overcome this limitation, continual addition, and incorporation of matter from wastes into the surface soil is necessary.

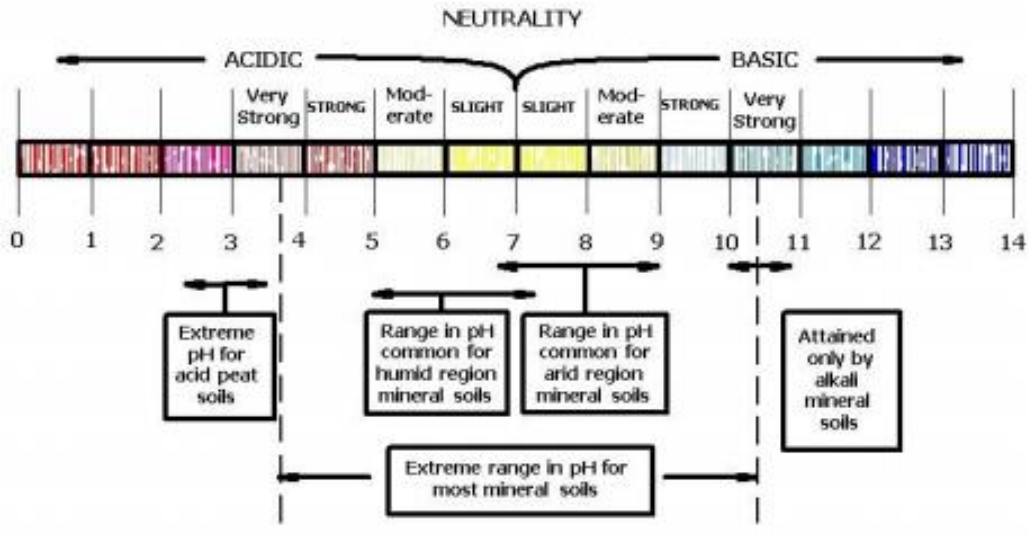
8) Soil pH

Soil pH is a measure of the degree of acid or base conditions of the soil. Technically, pH is a measure of the concentration of hydrogen ions in the soil solution. The pH scale runs from zero (0) to 14, with seven (7) being neutral. A pH lower than seven (7) indicate acidic soils while a pH greater than seven (7) indicate basic or alkaline soils. To measure soil pH accurately, use a pH meter in the laboratory. To measure the general indication of pH in the field, use color indicator papers.

Ultimately, you will need to determine soil pH at the intended site for waste application.

First, sample the soil following procedures listed in the Cooperative Extension Service publication AGR-16 (Taking Soil Test Samples). Onsite sampling and laboratory analysis is the only way to determine this important chemical property. **Figure 1** depicts the various pH levels of soil.

Figure 1: The pH Scale



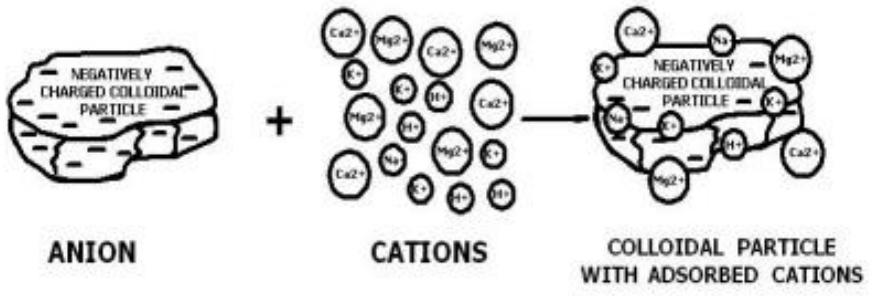
9) Nutrient Availability

The best way to determine availability of soil nutrients to growing crops is to take a soil sample following procedures listed in publication AGR-16 and have the sample analyzed in a laboratory using procedures adapted for Kentucky. Some nutrients such as potassium,

calcium, and magnesium carry a positive charge in the soil called cations. Others, such as phosphorus and nitrate, carry a negative charge called anions.

Clay particles and organic matter have a net negative charge in the soil and are therefore able to retain the positively charged ions (cations). The ability of a soil to hold these cations depends on the cation exchange capacity (CEC), which is a measure of the amount of negative sites available to attract the cations. The unit to describe the CEC value is milliequivalents per 100 grams soil (meq/100g.). CEC is not subject to large changes through the addition of organic matter. However, organic wastes applied to the soil can temporarily provide additional bonding sites for cations.

Figure 2: Soil Cation Exchange



The availability of nutrient anions depends mainly on their solubility in water and the rate of water movement in soil. Anion exchange capacity is not important in the retention of nitrate and phosphorus in the soil. Nitrate management with organic wastes depends on proper management of the organic nitrogen reservoir. The objective is to encourage conversion of organic nitrogen to nitrate nitrogen at times when plants are actively growing and able to utilize the nitrate. Phosphorus in soils either occurs as inorganic compounds or is in the organic form. These inorganic nutrient compounds are most available to plants when the soil pH is in the ideal range of 6 to 7. Organic matter decomposition slowly releases phosphorus into the environment.

10) Metal Immobilization

Metals of concern in land-applied waste include cadmium, chromium, copper, nickel, lead, zinc, molybdenum, boron, selenium, and arsenic. Of these, cadmium, chromium, copper, nickel, lead, and zinc are present as cations in the soil, while molybdenum, boron, selenium, and arsenic are anions. Many of these elements are toxic to plants, animals, and humans if present in large quantities either in the soil or in plant materials when consumed.

The objective is to immobilize these elements during the land application process in order to prevent high levels from becoming available for plant uptake. This is accomplished by:

1) Restricting the annual application rates of some metals

2) Restricting the total application of metals for the life of the site

3) Recognizing the agronomic limits of some other elements that may cause toxicity symptoms in plants and

4) By maintaining soil pH at 6.5 or above

Immobilization of some of the cations occurs through attachment to the cation exchange sites available in the soil. This requires that the CEC be determined for each land application, thus the ability of the soil to immobilize the metal cations. Analysis of the metal anions in each waste will determine the levels that will be land applied, and if there may be conditions for potential plant toxicity.

Soil pH also affects metal availability to plants. With the exception of molybdenum, most metals are more soluble in lower pH soils. To avoid high metal availability to plants, maintain the soil pH at 6.5 or above during and after waste application. pH level of 6.5 and above will promote the formation of insoluble metal compounds that immobilize most metals.

Most soils in Kentucky are normally acidic (lower than 6.5) and require regular sampling to determine soil pH. If pH adjustment is required, apply agricultural grade limestone at rates slightly higher than normally recommended for crop production. Before waste application, apply and incorporate lime to raise pH for maximum metal immobilization. After waste application begins, apply lime to maintain soil pH. In some instances where soils are acidic and incorporation is not possible, surface applied lime will require considerable time to change pH.

APPENDIX G: ANNUAL REPORT EXAMPLES

Energy and Environment Cabinet
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
200 Fair Oaks Lane
FRANKFORT, KENTUCKY 40601

ANNUAL LANDFARMING REVIEW
DEP 7048 (3/92)

GENERAL INSTRUCTIONS

SUBMISSIONS

Complete all required information at the top of each log sheet.

Application records will be inspected by the Division of Waste Management's Regional Office Personnel during landfarming-field inspections.

COVER .LEilickt

Annual Reviews must be submitted with a cover letter from the applicant including the applicant name, permit number, county, the year, proposed cropping plan, that this is an annual review, what is included (required information for subplot 1,2,3, ...), anything that has been left out and is forthcoming or any other points that will help clarify the enclosed information. Cover letter should be signed by the ranking elected official, principal executive officer, or/and other authorized person per 401 KAR 45:030 Section 10.

SLUDGE **ANALYSIS**

Include originals or copies of the actual sludge analysis from the laboratory. Applicant should inform labs that sludge should be analyzed wet and analysis reported in mg/1. Conversions from mg/1 to mg/kg should be calculated by dividing (1- solids/100) into mg/1.

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SURFACE AND GROUNDWATER ANALYSIS

Submit the original or copies of the original lab sheets for surface and groundwater analysis (if monitoring is required by your permit), clearly designating them as either surface and groundwater and the location as to correlate with what is shown in the original application.

ANNUAL LANDFARMING REVIEW

Complete this form using an average or your sludge analysis for the year (yearly, by-yearly, quarter or monthly) based on your sampling frequency required by your permit. You need only submit one copy of this form.

SLUDGE APPLICATION SUMMARY:

All Subplots which received sludge during the monitoring year should be listed along with the grand total sludge applied, the annual application rate per acre.and the approved rate per acre.

LANDFARMING APPLICATION LOG:

Begin a log sheet for each subplot by waste generator source on the date the sludge sample is submitted for analysis at the beginning of the monitoring year.. Record the date of application quantity, hauler's initials and date of corresponding sludge analysis.

On the date the next sludge sample is submitted for analysis, tally the grand total sludge applied and circle the total in red. Record the total application quantity and waste generator source on the metals historical sheet, and calculate the metals loading rate using Metals Concentraiton Conversion Sheet for each generator of sludge hauled during the monitoring period. Record the application quantity on the Nitrogen Utilization Sheet and calculate the nitrogen loading.

Continue to use the same log sheet(s) for the entire monitoring year. If more than one sheet is needed, label 1a, 1b, etc.

METALS CONCENTRATION CONVERSION SHEET:

Use the appropriate sheet (wet or dry sludge) based on the type sludge aplied.

METALS HISTORICAL:

Record answers calculated per monitoring period and total at the bottom of sheet.

RESIDUAL NITROGEN WORKSHEET:

You will need to complete this form even if it is the first year's application. Use the residual nitrogen calculated, on the worksheet for calculating application rates, but not on the nitrogen balance sheet (if first year). If sludge has been applied in the past, transfer these numbers to the nitrogen balance sheet.

NITROGEN BALANCE SHEET:

See "Residual Nitrogen Worksheet" above.

WORKSHEETS FOR CALCULATING APPLICATION RATES:

Complete this form using yearly averages brought over from the Landfarming Review Sheet. This sheet is used to calculate average application rate for the upcoming year for each subplot/crop.

SOIL ANALYSIS:

The last page for each subplot should be the soil analysis. Submit an original or copy of the original lab sheet for the particular subplot.

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Annual Landfarming Review

LANDFARMING SLUDGE DATA

Landfarming Permit # SW 020-00021 KPDES #_____

Permittees Name_____

Sludge Source LWTP

Address_____

City_____ State_____ Zip Code _____

SLUDGE QUALITY

1. Current yearly average sludge analysis (mean value of sludge analysis based on sampling frequency):

Date (s) of Sampling 03-12-2012

Type of Sample ☐Grab ☐Composite

pH	6.7	
%Total Solid	2.43 %	
%Volatile Solids	60 %	
%Total Potassium	_____ (ppm: 110 mg/kg)	110/0.0243 = 4,526.7 mg/kg * not 4400 in 100 report
%Total Phosphorus	0.16% = 1600/10,000 (ppm: 1600)	mg/kg
%Kjeldahl Nitrogen	4.9% (ppm: 49,000)	mg/kg
% Ammonium Nitrogen (NH_4-N)	0.24% (ppm: 2,400)	mg/kg
% Nitrate Nitrogen (NO_3-N)	0.039% (ppm: 390)	mg/kg
Cadmium (Cd)	0.027 mg/l	1.1 mg/kg
Copper (Cu)	8.4 mg/l	340 mg/kg
Lead (Pb)	0.66 mg/l	27 mg/kg
Nickel (Ni)	0.60 mg/l	24 mg/kg
Zinc (Zn)	16 mg/l	660 mg/kg
Chromium (Cr)	0.69 mg/l	28 mg/kg
Polychlorinated Biphenyls (PCBs)		— mg/kg

(Submit a copy of the actual lab analysis sheets)

2. Total estimated quantity of sludge generated this year (gallons or dry tons)_____

198,000 gal

4

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REPORT OF ANALYSIS

Mr. Todd Stephens
H & A Resource Management,LLC
103 Fieldview Drive
Versailles, KY 40383

April 06, 2012

Date Received : March 30, 2012
Description : Liberty Biosolids

Sample ID : DIGESTER 1 2 3

Collected By : Chasity Rodgers
Collection Date : 03/29/12 11:15

ESC Sample # : L567502-01

Site ID :

Project # : Liberty WWTP

Parameter	W.Result	RDL	D.Result	RDL	Units	Method	Date
Nitrate	9.4	1.0	390	41.	mg/kg	9056	04/03/12
Phosphate as P	38.	1.0	1600	41.	mg/kg	9056	04/03/12
Ammonia Nitrogen	58.	5.0	2400	200	mg/kg	350.1	04/06/12
pH	6.7		6.7		su	9045D	04/03/12
Kjeldahl Nitrogen, TKN	1200	100	49000	4100	mg/kg	351.2	04/06/12
Total Solids	2.43	0.100	2.43	0.100	%	2540G	04/03/12
Volatile Solids	60.	1.0	60.	1.0	% of TS	160.4	04/06/12
Mercury	BDL	0.020	BDL	0.82	mg/kg	7471	03/31/12
Arsenic	BDL	0.10	BDL	4.1	mg/kg	6010B	04/01/12
Cadmium	0.027	0.025	1.1	1.0	mg/kg	6010B	04/01/12
Chromium	0.69	0.050	28.	2.0	mg/kg	6010B	04/01/12
Copper	8.4	0.10	340	4.1	mg/kg	6010B	04/01/12
Lead	0.66	0.025	27.	1.0	mg/kg	6010B	04/01/12
Molybdenum	0.20	0.025	8.2	1.0	mg/kg	6010B	04/01/12
Nickel	0.60	0.10	24.	4.1	mg/kg	6010B	04/01/12
Potassium	110	2.5	4400	100	mg/kg	6010B	04/01/12
Selenium	0.14	0.10	5.8	4.1	mg/kg	6010B	04/01/12
Zinc	16.	0.15	660	6.2	mg/kg	6010B	04/01/12

BDL - Below Detection Limit
RDL - Detection Limit- Estimated Quantitation Limit(EQL)
Note:
The reported analytical results relate only to the sample submitted.

Reported: 04/06/12 17:09 Printed: 04/06/12 17:27
L567502-01 (PH) - 6.7@18.7c

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3. Name of Testing Laboratory_____

Mailing Address_____

City_____State_____ Zip Code _____

Phone (____)_____

(*Submit only 1 copy for entire package, however these numbers are used on pages 1,2,3 of "Worksheet for Calculating Application Rates" for each subplot.)

* p. 52 of Manual

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SLUDGE APPLICATION SUMMARY

Frequency of Sludge Analysis: (Circle One) Yearly, Bi-Yearly, Quarterly, Monthly

PERMIT NO.

SUB-PLOT NUMBER	GRAND TOTAL SLUDGE APPLIED (TONS OR GALLONS)	TOTAL AMOUNT PER ACRE (TONS OR GALLONS) *18.92 acres	APPROVED RATE PER ACRE (TONS OR GALLONS)
1	198,000 gal	10,465 gal/acre	

*ONLY INCLUDE ONE COPY FOR THE ENTIRE PACKAGE

6

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LANDFARMING APPLICATION LOG

WASTE GENERATOR SOURCE: WWTP

SUB-PLOT NUMBER: 1 **ACREAGE:** 18.92

MONITORING YEAR: 2012 **PERMIT NUMBER:** SW 000-00001

Date	Application Quantity	Hauler's Initials	Date of Analysis
	198,000		03-12-2012

7

1.65

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Metals Concentration Conversion

Liquid Sludge

Permit Number SW 000-00001 Sub-Plot Number 1

Cd	0.027	mg./1x8.34x(	198,000	gal/1,000,000gal.)=	0.044	lbs.of CdApplied
Cu	8.4	mg./1x8.34x(	"	gal/1,000,000gal.)=	13.86	lbs.of CuApplied
Pb	0.66	mg./1x8.34x(	"	gal/1,000,000gal.)=	1.09	lbs.of PbApplied
Ni	0.60	mg./1x8.34x(	"	gal/1,000,000gal.)=	0.99	lbs.of NiApplied
Zn	16	mg./1x8.34x(	"	gal/1,000,000gal.)=	26.4	lbs.of ZnApplied
Cd		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of CdApplied
Cu		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of CuApplied
Pb		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of PbApplied
Ni		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of NiApplied
Zn		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of ZnApplied
Cd		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of CdApplied
Cu		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of CuApplied
Pb		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of PbApplied
Ni		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of NiApplied
Zn		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of ZnApplied
Cd		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of CdApplied
Cu		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of CuApplied
Pb		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of PbApplied
Ni		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of NiApplied
Zn		mg./1x8.34x(		gal/1,000,000gal.)=		lbs.of ZnApplied

Lbs. of metal applied ÷ Subplot acreage = Lbs/. of metal/acre

#5 on p.12

$\frac{8.34 \text{ lbs}}{\text{gal}} \left(\frac{\text{ton}}{2000 \text{ lbs}}\right)\left(\frac{\% TS}{100}\right)$

$198{,}000 \text{ gal} \left[\frac{8.34 \text{ lbs}}{\text{gal}}\right]\left[\frac{\text{ton}}{2000 \text{ lbs}}\right]\left[\frac{\% TS}{100}\right] = 20.06$ dry tons

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Metals Concentration Conversion

Permit Number SLU 000-0001 **Sub-Plot Number** 1

Dry Sludge

Cd	1.1	mg./kg x	20.06	tons sludge x.002=	0.044	lbs.of Cd Applied
Cu	340	mg./kg x	"	tons sludge x.002=	13.6	lbs.of Cu Applied
Pb	27	mg./kg x	"	tons sludge x.002=	1.08	lbs.of Pb Applied
Ni	24	mg./kg x	"	tons sludge x.002=	0.96	lbs.of Ni Applied
Zn	660	mg./kg x	"	tons sludge x.002=	26.4	lbs.of Zn Applied
Cd		mg./kg x		tons sludge x.002=		lbs.of Cd Applied
Cu		mg./kg x		tons sludge x.002=		lbs.of Cu Applied
Pb		mg./kg x		tons sludge x.002=		lbs.of Pb Applied
Ni		mg./kg x		tons sludge x.002=		lbs.of Ni Applied
Zn		mg./kg x		tons sludge x.002=		lbs.of Zn Applied
Cd		mg./kg x		tons sludge x.002=		lbs.of Cd Applied
Cu		mg./kg x		tons sludge x.002=		lbs.of Cu Applied
Pb		mg./kg x		tons sludge x.002=		lbs.of Pb Applied
Ni		mg./kg x		tons sludge x.002=		lbs.of Ni Applied
Zn		mg./kg x		tons sludge x.002=		lbs.of Zn Applied
Cd		mg./kg x		tons sludge x.002=		lbs.of Cd Applied
Cu		mg./kg x		tons sludge x.002=		lbs.of Cu Applied
Pb		mg./kg x		tons sludge x.002=		lbs.of Pb Applied
Ni		mg./kg x		tons sludge x.002=		lbs.of Ni Applied
Zn		mg./kg x		tons sludge x.002=		lbs.of Zn Applied

lbs. of metal applied ÷ subplot acreage = lbs. of metal/acre

* ppm in mg/kg for % organic N. calc.

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WORKSHEET FOR CALCULATING APPLICATION RATES

SUBPLOT # 1 CROP _____

SLUDGE COMPOSITION (Parameter in ppm* ÷ 10,000 = %)

Total Kjeldahl Nitrogen (TKN)	49,000	÷10,000=	4.9 %
Ammonium Nitrogen (NH_4-N)	2,400	÷10,000=	0.24 %
Nitrate Nitrogen (NO_3-N)	390	÷10,000=	0.039 %
Total Phosphorus	1,600	÷10,000=	0.16 %
Total Potassium	4,400	÷10,000=	0.44 %

1. Percent Available Organic Nitrogen = (%TKN) - (%NH_4-N) - (%NO_3-N)

4.621 = (4.9) - (0.24) - (0.039)

2. Available Nitrogen in waste:

(a) Incorporation:

(%NH_4Nx20) + (%NO_3Nx20) + (%available organic N x 4) = lbs. available N/ton

(0.24 x20) + (0.039 x20) + (4.621 x4) =

18.76 lbs. available N/ton

(b) Surface Application:

(%NH_4Nx10) + (%NO_3Nx20) + (%available organic N x 4) = lbs. available N/ton

(0.24)x10) + (0.039 x20) + (4.621 x4) =

~~lbs.~~ =

21.66 lbs. available N/ton

3. Residual Nitrogen (N): _____

(Calculated Residual N by utilizing the formulas found on the Residual N worksheet)

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4. Annual Application Rate:

(a) (Crop N requirement - Residual N)/Acre ÷ lbs. available N/ton = Dry Tons/acre

(100 - 0) ÷ 21.66 = 4.62 Dry Tons/acre ✓

(B) 0.44 lbs. of available Cd/acre ÷ (mg./kg of Cd in sample X 0.002) = Dry Tons/acre

0.44 ÷ (1,1 x0.002) = 200 Dry Tons/acre

Annual Application Rate: (LOWER of (a) or (b).)

Annual Application Rate = 4.62.

5. Conversion Formula: Dry Tons to Wet Gallons

(Tons of sludge x 2000) ÷ (8.34x% solids in the sludge/100) = wet gallons/acre

(4.62 x2000)÷(8.34x 2.34/100) = 47,347 wet gallons/acre.

6. Additional Phosphorous and Potassium needed:

(a) Phosphorus (P_2O_5) in waste:

Tons waste/acre (from 4a or 4b) x % P in waste x 45.8 = lbs. P_2O_5 added/acre

4.62 x 0.16 x45.8 = 33.9 lbs. P_2O_5 added/acre

(b) Additional P_2O_5 fertilizer needed:

Total phosphorous (P_2O_5) needed/acre -P_2O_5 added from sludge = lbs. P_2O_5/acre

_____ - _____ = _____ lbs. of additional P_2O_5 needed/acre

* A negative answer means no additional P_2O_5 fertilizer is needed.

(c) Potassium (K_2O) in waste:

Tons waste (from 4a or 4b)/acre x % K in waste x 24 = lbs. K_2O added/acre

4.62 x 0.44 x24= 48.8 lbs.K_2O added/acre

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(d) Additional K_2O fertilizer needed:

Total K_2O needed/acre - K_2O added from sludge = lbs. K_2O/acre

_____ - _____ = _____ lbs. of additional/K_2O needed/acre

*A negative answer means no additional K_2O fertilizer is needed.

**Nitrogen Required - (lbs. available N/ton X maximum tons waste to be applied/acre) = lbs of additional fertilizer nitrogen applied. (additional nitrogen may be needed by fertilization if the annual application rate is limited by cadmium.

7. Maximum Amount of Waste Allowable per Acre:

Obtain maximum amount of Pb, Cd, Cu, Ni, and Zn allowed based on the Cation Exchange Capacity of the soil from 401 KAR 45:100 Section 10(23). If sludge has previously been applied, calculate the reamining lifetime limits by subtracting the total amount of each metal applied from the maximum allowed found in 401 KAR 45:100 Section 10 (23).

Cadmium (Cd):

Maximum Cd allowable/acre ÷ (dry mg/kg of Cd in sample x0.002) = tons waste/acre

4.46 ÷(1.1 x0.002) = 2,027 *tons waste/acre*

Copper (Cu):

Maximum Cu allowable/acre ÷ (dry mg/kg of Cu in sample x0.002) = tons waste/acre

125 ÷(340 x0.002) = 184 *tons waste/acre*

Lead (Pb):

Maximum Pb allowable/acre ÷ (dry mg/kg of Pb in sample x0.002) = tons waste/acre

500 ÷(27 x0.002) = 9,259 *tons waste/acre*

Nickel (Ni):

Maximum Ni allowable/acre ÷ (dry mg/kg of Ni in sample x0.002) = tons waste/acre

_____ ÷(_____ x0.002) = _____ *tons waste/acre*

Zinc (Zn):

Maximum Zn allowable/acre ÷ (dry mg/kg of Zn in sample x0.002) = tons waste/acre

250 ÷(660 x0.002) = 189 *tons waste/acre*

Life in Number of Years = Lowest amount from Item 7 in tons/acre ÷ tons waste applied/acre/year

184 ÷ 4.62 = 39.8 years

8. Number of years that waste can be applied:_____

CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure tht qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for such violations."

Signature of Authorized Agent_____Date_____

Name of Authorized Agent_____

Title_____

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N O T I C E
* * * * * *

Page 3 of DEP form 7048 (3/92), "Annual Landfarm Review", references a sheet entitled "Metals Historical" and another entitled "Nitrogen Balance Sheet"; however, those sheets were not included in the original printing of form 7048. Those sheets follow this notice, and include a sheet for metals data for the past year (Metals Historical: Annual), a year by year summary of metals data for the facility (Metals Historical: Lifetime), and a sheet with nitrogen calculations (Nitrogen Balance Sheet). These sheets are to be completed in accordance with the directions on page 3 of the form.

NITROGEN BALANCE SHEET
SUB-PLOT NUMBER:_____

Permit Holder Name:_____ Permit#:_____
Total Sub-Plot Acreage:_____Reporting Year:_____

(1) Date From-To	(2) Grand Total Sludge Applied Dry Ton	(3) Sludge Quantity Applied Dry Ton/ Acre	(4) Sludge Nitrogen Applied lbs./acre From, 2a or 2b on Worksheet for Calculating Application Rates Column #3	(5) Fertilizer Nitrogen Applied lbs./acre	(6) Residual Nitrogen Remaining lbs./acre (From Previous Residual Nitrogen Worksheet Years 1 and 2)	(7) Total Nitrogen Available lbs./acre (the sum of columns 4, 5, & 6)	(8) Crop(s) Grown	(9) Yield tons/ acre or by/acre	(10) Date(s) Har-vested or Grazed	(11) Nitrogen Removed lbs/acre	(12) Nitrogen Remaining lbs/acre (Column #7 minus Column #11)

METALS HISTORICAL
Lifetime
SUB-PLOT NUMBER:_____

Permit Holder Name:_____ Permit No._____
Total Sub-Plot Acreage:_____ Reporting Year_____

Year	Wastewater Source	Total Sludge Applied (Gallons or Tons)	Amount per Acre (Gallons or Tons)	Total Lbs. Applied (From Metals Conversion Sheet)					Rate in Lbs./Acre (Divide total lbs. by sub-plot acreage)					Soil pH (from annual soil analysis)	Lime Applied (tons/ acre/ year)
				Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn		
	Grand Total														

Annual

*SUB-PLOT NUMBER:*_____

*Permit Holder Name:*_____ *Permit No.*_____

*Total Sub-Plot Acreage:*_____ *Reporting Year*_____

Date From-To	*Wastewater Source*	*Total Sludge Applied (Gallons or Tons)*	*Amount per Acre (Gallons or Tons)*	*Total Lbs. Applied (From Metals Conversion Sheet)*					Rate in Lbs./Acre (Divide total lbs. by sub-plot acreage)					Soil pH (from annual soil analysis)	*Lime Applied (tons/ acre/ date)*
				Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn		
	Grand Total														

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