



Guidelines for managing industrial by-products from food, beverage and agro-industrial processing facilities

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Notice

This document is intended solely as guidance, and does not contain any mandatory requirements (except where requirements found in statute or administrative rule are referenced). This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the state of Minnesota or the Minnesota Pollution Control Agency. Any regulatory decisions made by the Minnesota Pollution Control Agency in any matter addressed by this guidance will be made by applying statutes and administrative rules to the relevant facts.

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Chapter 1. Background

Purpose and audience

What is industrial by-product?

An "Industrial By-Product" or "IBP" is a residual material resulting from industrial, commercial, mining, and agricultural operations that are not primary products and are not produced separately in the process. IBP is technically classified as solid waste.

Examples of IBPs include liquid or dewatered wastewater treatment sludges, wash water from food preparation industries, livestock truckwash wash water and solids, pretreatment solids settled from wastewater before discharging to a municipal wastewater system, whey from cheese processing, sweet corn silage, sweet corn silage leachate and ethanol by-products. Industries that produce IBPs which have characteristics may also be considered IBP.

Note: Biosolids generated from the treatment of municipal wastewater is not an IBP and is regulated separately from IBPs by state rule. Regulation and management requirements for biosolids are not addressed in this guidance. In addition, management of lime residuals and wood ash are regulated separately from other IBPs and are not addressed on this webpage. Refer to the Solid Waste Utilization page at <http://www.pca.state.mn.us/ktqh862> or the "Potable Water Treatment Plants" section of the Wastewater page at <http://www.pca.state.mn.us/gp0rb25> for more information on these topics.

In addition to other reuse and management options, IBP from food, beverage, and agro-industrial processing operations are good candidates to be managed via land application. IBP typically contains nutrients such as nitrogen, potassium, and phosphorus – the same nutrients found in commercially produced fertilizers. Reusing nutrients in the IBP by applying it to the land, as opposed to using a disposal method, is not only a sound and generally accepted business practice; it is a sound and generally accepted agricultural practice. Reusing nutrients by applying nutrient-containing IBP to the land saves water resources, reduces the amount of commercial fertilizer that would otherwise be purchased and applied to agricultural land, and replenishes the soil with nutrients that are taken up by plants and removed in the farming process.

The same nutrients that are beneficial to plants and soil can become pollutants if not applied properly, or if too much is applied. Application of nutrients to agricultural areas, either in the form of conventional fertilizers or by the reuse of nutrients from wastewaters, must be done in accordance with scientifically established agronomic rates to avoid contamination of ground and/or surface waters from these nutrients washing off the land (to surface water) or through the soil profile (to groundwater).

Limitation of the application rate and monitoring of soil and runoff is a proven way to ensure that the crops and the land is using the nutrients that are applied, thus avoiding contamination. This is done via the utilization of best management practices (BMPs), either in the context of permit conditions, or the application of guidelines for activities not requiring a permit.

Who is this manual for?

This guidance document is intended for use by persons or operations that generate IBP from a food, beverage or agro-industrial processing operation, and land apply the IBP. In addition, this guidance document is intended for internal Minnesota Pollution Control Agency (MPCA) staff and other governmental entities to aid them in understanding the regulatory framework under which IBP is regulated.

What is the purpose of this manual?

The purpose of this guidance document is to facilitate the proper management of IBP by providing assistance to project managers and governmental entities.

The guidelines in this document summarize the requirements and steps needed to properly land apply IBP.

The objectives of this guidance manual are to:

- Provide a consistent and understandable regulatory framework for managing IBP that is land applied
- Identify BMPs for IBP that is land applied without a permit

Acknowledgements

The principal authors of this guidance document are Byron Adams, Steve Stark and Julianne Rantala. Patricia Burford (past staff) authored the previous land application guidance document, which was used as a source document.

If you have questions or need assistance with the use of this document, contact the MPCA at 800-646-6247 (outstate) or 651-296-6300 (metro area). An electronic version of this document is available at the MPCA website at: <http://www.pca.state.mn.us/Oagxeaf>.

Chapter 2. Regulatory determination

Overview

Land application activities, as well as the management structures and areas for the storage of IBP prior to land application, have the potential to impact the environment. Stormwater runoff from management site(s) has the potential to pollute surface water when discharged to waters of the state. The management of IBP also has the potential to affect groundwater through on-land management methods, if not managed in consideration of environmental risk factors. Surface water discharges, though not common, can also occur, such as from tile line outlets, and can be a source of pollution, if not managed appropriately.

IBP managed via land application may produce a variety of regulated wastes, including:

- IBP to be land applied
- Wastewater from the land application site(s) and/or storage structures or areas, which may include tile line outlets
- Storage areas and/or structures for the management of IBP prior to land application
- Stormwater originating within the boundary management area(s)
- Stormwater originating outside of the boundary of the management area(s)

Other waste material

Industrial by-product, when not used for its intended purpose, used for animal feed, or used for fuel, is defined as a “waste” and “other waste material” by Minn. Stat. 115.01. It is therefore the duty of the MPCA, as set forth in Minn. Stat. 115.03, subd. 1(e), to regulate the management and disposal of IBP, as well as to regulate the discharge of any wastewater leaving the management site(s) associated with IBP.

The MPCA utilizes the regulatory controls of the National Pollutant Discharge Elimination System (NPDES) and/or the State Disposal System (SDS) permitting program, as described in this guidance document, to address the environmental issues associated with the management of IBP and discharges from IBP management site(s).

Except for specific situations, as described below and in the following section, a permit is required for the management of IBP in the state of Minnesota. The type of permit required will vary, depending on the origin of the IBP, whether effluent is being discharged, and how the IBP is being managed.

Do I need a permit?

Typically, a permit is required for land application of more than 50,000 gallons or 10 dry tons of IBP per year, or if there is storage of IBP at a volume that could create environmental concerns. Figure 1 below, describes the decision process for determining whether a permit is required, and what type of permit would likely be issued.

Figure 1. Decision map: Regulatory structure for industrial by-product.

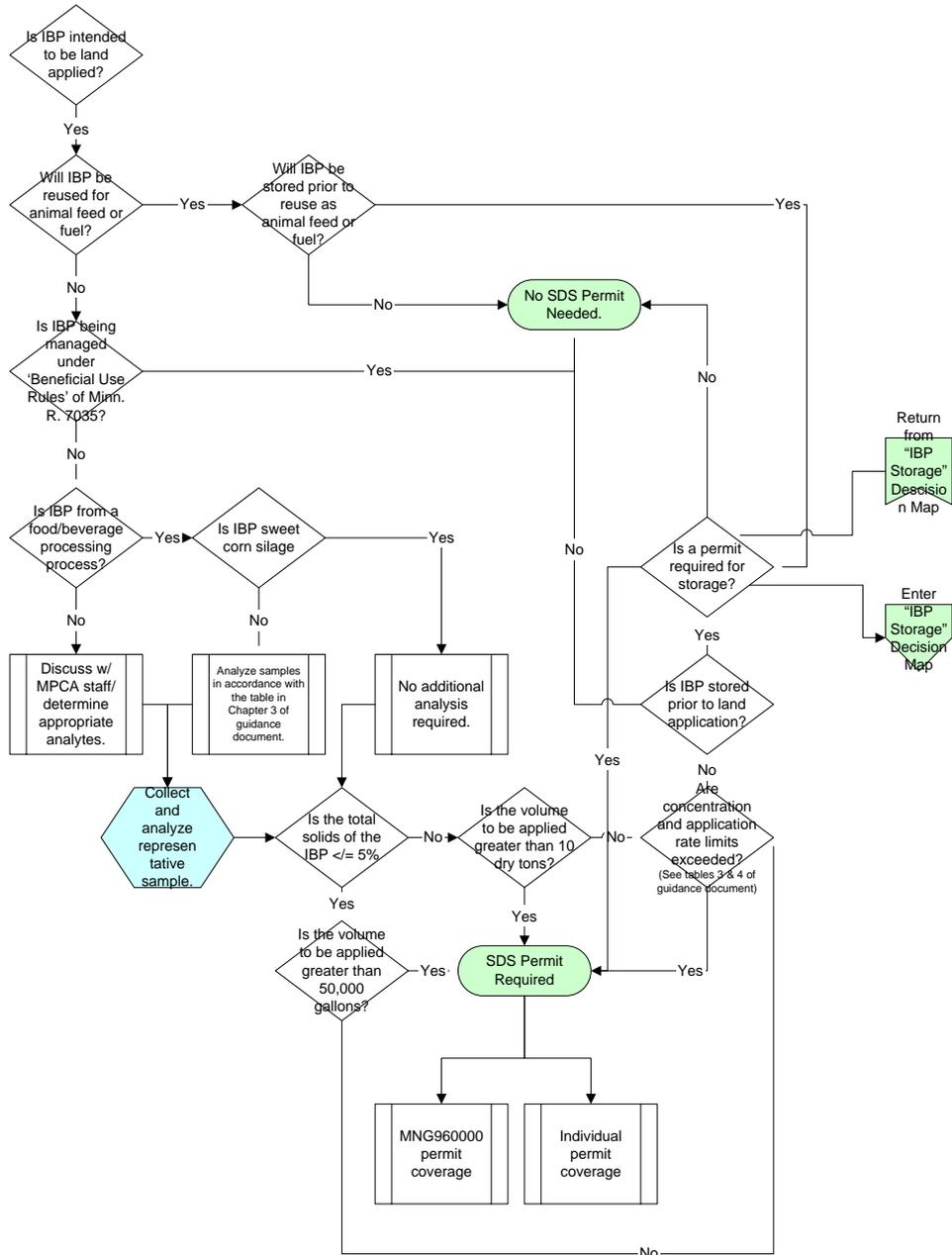
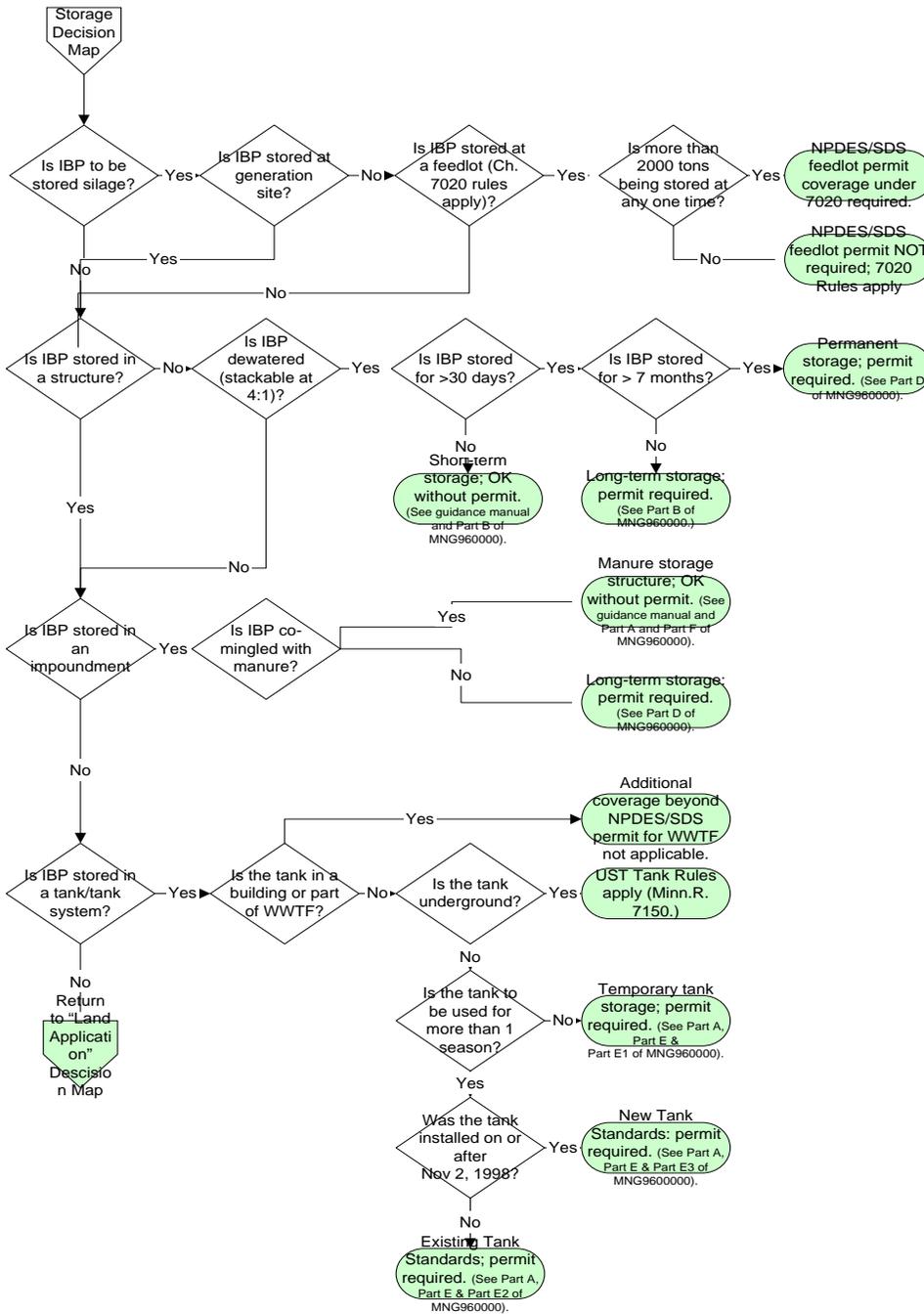


Figure 2, below, describes the decision process for determining the standards applicable to the storage of IBP in various settings. Depending on the length and method of storage, storage standards will vary. General permit MNG960000 is referenced in Figure 2 for simplicity in relaying the standards applicable to a situation. Even if the general permit is not applicable to a given situation, these standards would be incorporated into the permit language in the context of an individual permit.

Figure 2. Decision map: industrial by-product storage.



Types of permits

Permits issued for the land application of IBP and/or discharges of wastewater from management units are done under the authority of the SDS.

The SDS Program is structured to provide permit coverage for regulated activities in one of two ways:

- Most commonly, an "individual permit" is developed to be specific to the activities and types of pollutants managed and/or discharged from the facility.
- Alternatively, if there are common pollutants and issues that create a similar discharge at a number of facilities, a single, "general" permit can be developed.

Permits that would require identical limits and monitoring are more appropriately controlled by general permits. The more complex the discharge, the more likely an individual permit will be required.

General permit

General permit number MNG960000 is in place to authorize the land application, as well as the storage of IBP prior to land application, of IBPs generated by food, beverage and agro-industrial processors.

Land application of a specific IBP may be appropriately covered by general permit number MNG960000 if the following conditions are true:

- The IBP is not a hazardous waste.
- The concentration of the analytes listed in Table 3, below, are not exceeded in the IBP.
- Annual application rates of the IBP does not cause the limits for the analytes specified in Table 4 to be exceeded.

* The following do not qualify for coverage under this permit:

- Egg shells managed in accordance with Minn. R. 7035.2860 (Beneficial Use Rules)
- IBPs from the processing of sugar beets
- Animal manures and paunch manure covered under Minn. R. 7020 (Feedlot Rules). Animal manures and paunch manure generated and land applied by an industry are not regulated by Minn. R. 7020, thus are authorized to land apply under this permit
- Dead animals
- Residuals from the treatment of drinking water or for conditioning of industrial process water managed in accordance with Minn. R. ch. 7035.2860 or covered under general permit MNG820000 or MNG640000 (water treatment plant general permits)
- Solid or liquid wastes generated at these facilities as part of other operations, such as vehicle maintenance, shipping, and cooling water

Table 3. Concentration limits for industrial by-products on a dry weight basis.

Analyte	Limit
Total Arsenic	41 mg/kg
Total Cadmium	39 mg/kg
Total Copper	1500 mg/kg
Total Lead	300 mg/kg
Total Mercury	5 mg/kg
Total Molybdenum	75 mg/kg
Total Nickel	420 mg/kg
Total Selenium	100 mg/kg
Total Zinc	2800 mg/kg

Analyte	Limit
Total Dioxin equivalents	10 parts per trillion
Total Polychlorinated biphenyls	6 mg/kg

Table 4. Annual application rate limits.

Analyte	Limit
Sodium	170 lb/acre/yr

Individual permit

An individual permit is developed for a specific project or site activity, with specific process wastewater, discharge location(s) and situation in mind.

If a permit is issued for the specific project or site activity, the permit will be unique to the project and provide specific terms and conditions that must be met to legally discharge pollutants to waters of the state as well as for any land application to be protective of the environment.

Applying for a permit

To apply for either general or individual permit coverage, a permit application consisting of the 'Transmittal Form' and the 'Attachment for Industrial By-Product Land Application' permit attachment form must be completed and submitted.

Current versions of permit application forms are maintained on the MPCA webpage located at: <http://www.pca.state.mn.us/enzq915>.

- Water Quality Transmittal Form (<http://www.pca.state.mn.us/index.php/view-document.html?gid=6275>)
- Attachment for Industrial By-Product Land Application (Type IV materials only) (<http://www.pca.state.mn.us/index.php/view-document.html?gid=7041>)

Once the application is received, MPCA staff review the application and determine whether the activity can be covered under the general permit or whether it needs to have individual permit coverage. If a specific activity does not meet the applicability criteria set forth in the general permit, coverage cannot be granted, and would have to be covered under an individual permit.

In the application process, the following type of information would be submitted for the respective management area(s) and/or project(s) to be covered by the permit:

- Description of the IBP and any management area(s)
- Description and status of receiving water
- The nature of the wastewater (what pollutant may be present)

These factors, as well as additional factors about the receiving water, (such as its water use class and level of attainment or impairment, and whether there are any endangered species), are reviewed to determine the appropriate pollutant limits and monitoring.

No permit required

As indicated by Figure 1, there are some scenarios for the management of IBP that do not require a permit. For example, if an IBP is used for its intended purpose, used for animal feed, used for fuel in accordance with applicable standards, or managed at a solid waste facility in accordance with applicable standards, an additional SDS permit for the generator of the waste is not required.

In addition, an IBP managed under the Solid Waste Utilization rules (Minn. R. 7035), or de minimus quantities of IBP that are land applied in accordance with BMPs, so as not to represent an environmental concern, are also not required to obtain an SDS permit for the activity.

If the MPCA finds that a particular facility, waste and/or situation involving land application activities are more appropriately covered by a permit, the MPCA reserves the right to require permit coverage in accordance with Minn. R. 7001.0030.

Beneficial use program

Minn. R. ch. 7035 contains provisions for the beneficial use of solid waste by assisting persons generating wastes in identifying beneficial uses for those wastes, rather than sending them to a landfill. The beneficial use of solid waste will save landfill capacity for materials that do not have alternative uses and reduce the amount of raw materials used in construction and other industries.

The solid waste utilization rules establish the following:

- Procedures by which persons who wish to explore a potential beneficial use can do so through a limited demonstration/research project even if the use is not allowed under present rules or permit conditions.
- A category of standing beneficial uses of wastes that do not require any regulatory contact or approval.
- Procedures whereby a person proposing a use not in the "standing" category can seek and obtain regulatory approval for that use through a beneficial use determination.
- Methods for characterizing the solid waste and the proposed use such that information about the proposed use can be shared with regulators and interested people.
- Standards for storage of solid waste prior to its beneficial use.
- A point in time when the designation of a material as a solid waste is removed and the material is no longer subject to solid waste regulation.

More information on the solid waste utilization rules can be found on the MPCA webpage located at: <http://www.pca.state.mn.us/tchy863>.

Land application of de minimus amounts

As indicated by Figure 1, small amounts of IBP may be land applied without a permit, provided that storage requiring permit coverage is not occurring.

For projects not requiring a permit, information pertaining to the project must be submitted to the MPCA for review, prior to initiation of land application activities. A Notification to Land Apply Industrial By-Product without a Permit (Notification) is used for this purpose. *Note: Notification to local authorities is also required prior to land application, which is discussed in more detail in the following chapter.*

Requirements for unpermitted land application activities

Notification

A Notification must be completed and submitted for all projects not requiring an MPCA permit and which are not covered by the Solid Waste Utilization rules/program. A Notification form must be submitted at least 30 days prior to the initiation of land application activities. In some cases, MPCA staff may be able to reduce the amount of time needed for MPCA review.

Within this 30 day timeframe, MPCA staff will review the Notification and either concur with the determination, or determine that a permit or additional information, such as additional sampling or monitoring, is required. If the MPCA concurs with your determination that a permit is not required, a formal response will not be sent; land application activity can commence at the end of the 30 day time period.

If, after review of the Notification submitted, the MPCA does not concur with your determination that a permit is not required for the project, the MPCA will notify you of this determination within the 30 day time period. Land application activity may not commence until the discrepancy has been resolved and a permit issued for the project, if required.

Current versions of land application publications are maintained on the MPCA webpage located at: <http://www.pca.state.mn.us/0agxeaf>.

Best management practices

In addition to submitting the Notification form, BMPs for the land application of IBP must be followed in order to qualify for a de minimus exclusion from the requirement to obtain a permit. Storage of IBP without a permit is very limited, as described by Chapter 5 of this document.

The balance of this document will describe the BMPs for land application of IBP.

Chapter 3. Characterization

Overview

An evaluation of the reasonable likelihood for a given pollutant to be present in the IBP must be made. A determination as to whether a pollutant has reasonable likelihood is done through a combination of empirical and technical evaluation of the IBP to be land applied, which includes your knowledge of the waste, the waste generation process, and sampling and analysis.

Sampling and analysis

Do I need to sample industrial by-product?

Before land applying an IBP, samples of each IBP intended to be land applied must be sampled to determine the level of nutrients and other pollutants present. Based on your knowledge of the waste and waste generation process, samples are tested for analytes (nutrients and other pollutants) that have a reasonable likelihood of being present in IBP that will be land applied. Once this initial evaluation is done, it does not need to be repeated, unless the volume or nature of the IBP to be land applied changes significantly. *Note: Although the complete characterization is done on a one-time basis, some analytes require tracking and monitoring on an on-going annual basis, and must be measured in the IBP land applied.*

Which analytes do I test for?

The analytical requirements for specific IBPs are indicated in Table 5. These analytes are listed by industry type and source of waste, based on the reasonable likelihood that a given pollutant will be present. These analytes most commonly limit the amount of IBP allowed for land application. If you have more than one IBP, each one must be sampled and analyzed.

To ensure that representative sampling is done, all pollutants with the reasonable likelihood of being present should be analyzed (refer to Table 6 for a list of additional analytes that may be required). To determine whether a particular pollutant has a reasonable likelihood, use your knowledge of the waste and waste generation process, as well as in consultation with MPCA staff; MPCA may also request additional analysis when the Notification is submitted or with the permit application. If there is a possibility that your IBP contains polychlorinated biphenyls (PCBs) or dioxin/furan compounds, these must also be analyzed for, and the test results discussed with the MPCA.

Table 5. Baseline analytical requirements for industrial by-products.

Analyte	Unit of Measure
Chloride, Dry Weight (as Cl)	mg/kg
Nitrogen, Kjeldahl, Total, Solid Fraction, Dry Weight ¹	Percent
Nitrogen, Ammonia, Dry Weight	Percent
pH, sludge	SU

Analyte	Unit of Measure
Phosphorus, Total	Percent
Sodium, Dry Weight (as Na)	mg/kg
Solids, Total	Percent
Solids, Total Volatile, Percent of Total	Percent
Oil and Grease, Total Recoverable (Hexane Extraction) ²	mg/kg

Analytical sampling of sweet corn silage is not required. This is because there is a wealth of sampling data and analysis that has been done in the past for this IBP.

Table 6. Additional analytical requirements.

Analyte	Unit of Measure
Total Arsenic	mg/kg
Total Boron	mg/kg
Total Cadmium	mg/kg
Total Calcium	mg/kg
Total Cobalt	mg/kg
Total Copper	mg/kg
Total Iron	mg/kg
Total Lead	mg/kg
Total Magnesium	mg/kg
Total Manganese	mg/kg
Total Mercury	mg/kg
Total Molybdenum	mg/kg
Total Nickel	mg/kg
Total Potassium	mg/kg
Total Selenium	mg/kg
Total Sulfur	mg/kg
Total Zinc	mg/kg
Total Dioxin equivalents	parts per trillion
Total Polychlorinated biphenyls	mg/kg

All analytical results should be reported on a dry weight basis; keep copies of the analysis results for your records.

How often do I have to test?

IBP that is land applied must be fully characterized before it is land applied the first time. After that, IBP to be land applied must be analyzed at least once per year.

The following analytes should be sampled annually:

- baseline analytes in Table 5
- additional analytes in Table 6 that have a reasonable likelihood of being present

How do I collect samples?

Samples for analysis must be collected and preserved in a way that provides a representative sample of the material that is actually land applied. This may require the collection of several sub-samples that are composited for analysis.

Collected samples are sent to a laboratory certified by the Minnesota Department of Health and/or registered by the MPCA for analysis. Whether or not you choose to gather your own samples and prepare them for analysis, or to hire an environmental professional to do this, samples must be collected in a manner that does not bias the outcome of the analytical results. For a detailed explanation of how to collect samples, refer to Chapter 5 of the MPCA document, "Land Application of Biosolids: A Manual for Minnesota (2001)." If you have additional questions about sampling procedures, contact your lab.

Chapter 4. Site selection and use

Determining site suitability

Requirements for site suitability and management practices protect public health, surface water and groundwater from components of concern in IBP, such as nutrients, pathogens and metals.

Sites proposed for use for land application of IBP must meet all of the criteria in this section in order to be used for the land application of IBP.

Soil suitability can be determined by obtaining information from soil surveys published by the Natural Resources Conservation Service (available on-line at <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm> or by characterization of the site by a state of Minnesota licensed soil scientist, or other qualified person, such as a Type IV certified land applicator. For a detailed explanation of how to read and evaluate county soil surveys, refer to Chapter 8 of the MPCA document, "Land Application of Biosolids: A Manual for Minnesota (2001)."

An application site will be considered suitable if the site is used for growing a crop which is harvested and removed during the cropping year that the IBP is land applied AND the restrictions on slope, separation distances, and crop restrictions (applicable to pathogen-containing IBPs), as described in this guidance, are maintained. If an individual permit specifies additional site suitability criteria, this must be followed, as well.

Type IV certified operator

If a permit is not required for land application activities, the MPCA recommends, but does not require, the land application be done by or under the supervision of a Type IV certified operator.

Land application activities requiring a permit however, must be done by or under the supervision of a Type IV certified land applicator.

Slope

Restrictions on slope allow IBP to maintain contact with soil and keep IBP where it is applied. This is necessary to ensure that IBP does not run off the land application site.

- The slope restrictions in Table 7 must be met for all sites used for land application of IBP.
- Winter application of IBP is restricted to sites with 0-2% slope.

Table 7. Slope restrictions for application sites where industrial by-product is applied.

Slope (percent)	Surface application	Injection or immediate incorporation
0 – 6	allowed	allowed
>6 – 12	not allowed	allowed
>12	not allowed	not allowed

Separation distances

Separation distances help prevent IBP from moving into surface waters or wetlands. In addition, separation distances and public access controls help prevent the public from coming into contact with the applied IBP.

The separation distances in Table 8 must be maintained on all land application sites.

Table 8. Minimum separation distances from the land application site.

Feature		Surface applied	Incorporated within 48 hours	Injected
Private drinking water supply wells		200	200	200
Public drinking water supply wells		1000	1000	1000
Down gradient lakes, rivers, streams, type 3, 4, and 5 wetlands, intermittent streams, or tile inlets connected to these surface water features ²	slope 0 % to 6 %	300	50	50
	slope 6 % to 12 %	not allowed	100	100
	winter (0 % to 2 %)	600	not applicable	not applicable
Grassed Water Ways ³	slope 0 % to 6 %	100	33	33
	slope 6 % to 12 %	not allowed	33	33

¹This distance may be reduced with written permission from all persons responsible for residential developments, places of recreation, and all persons inhabiting residence within the designated separation distance.

² Intermittent stream means a drainage channel with definable banks that provides for runoff flow to any of the surface waters listed in the above table during snow melt or rainfall events.

³ Grassed waterways are natural or constructed and seeded to grass as protection against erosion. Separation distances are from the centerline of grassed waterways. For a grassed waterway which is wider than the separation distances required, application is allowed to the edge of the grass strip.

Additional requirements for industrial by-product containing pathogens

IBPs containing pathogens have additional separation distances and site restrictions which must be met. An IBP is assumed to contain pathogens when it contains sewage from sanitary waste facilities, such as sanitary waste that is not separated from industrial flows, or it contains waste streams known or likely to contain pathogens, including wastes containing blood, animal feces and raw meats. All requirements of this section must be met for these IBPs.

Soil texture

Soil must have the appropriate texture and structure to physically be able to filter and treat IBP, as well as to facilitate the chemical processes that take place in the soil.

The soil texture at the zone of by-product application must be fine sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, sandy clay, silty clay loam, silty clay, or clay.

Information about soil texture can be determined by obtaining information from soil surveys published by the Natural Resources Conservation Service (available on-line at <http://websoilsurvey.nrcs.usda.gov>), or by characterization of the site by a state of Minnesota licensed soil scientist or other qualified individual.

Depth to water table

Restrictions on depth to water table allow IBP to contact soil long enough so that the soil can act as a physical, chemical and biological filter.

- The depth to bedrock must be at least three feet, unless the soil is classified as a highly permeable soil, in which case the minimum depth is increased to five feet.
- The depth to the seasonal high water table must be at least three feet, unless the soil is classified as a highly permeable soil, in which case the minimum depth is increased to five feet.

On sites where tile drainage is installed, the depth to tile lines is considered the depth to the seasonal high water table. Tiling must be adequate to ensure the three-foot separation distance can be maintained. Maps of the tiling system must be provided indicating their depth and placement in the field. Water tables classified as perched or epi-saturated by the Natural Resources Conservation Service are not considered to be the seasonal high water table.

Separation distances

In addition to the separation distances specified in Table 8, the additional separation distances in Table 9 must be maintained from the application site.

Table 9. Additional separation distances for industrial by-product containing pathogens.

Separation distances (feet)			
Feature	Surface applied	Incorporated within 48 hours	Injected
Residences	200 ¹ feet	200 ¹ feet	100 feet
Residential development	600 ¹ feet	600 ¹ feet	300 feet
Public contact site	600 feet	600 feet	300 feet
Depth to bedrock	5 ² feet	5 ² feet	5 ² feet
Depth to seasonal high water Table or drain tile ³	5 ² feet	5 ² feet	5 ² feet

¹This distance may be reduced with written permission from all persons responsible for residential developments, places of recreation, and all persons inhabiting residence within the designated separation distance.

²The separation distance may be decreased to 3 feet if the soil is not classified as a “highly permeable soil”, as defined by the MNG960000 permit.

³The depth to subsurface drainage tiles shall be considered the depth to the seasonal high water table for sites that are designed according to Natural Resources Conservation Services engineering standards and criteria.

Crop restrictions/public access

Restrictions on crop harvest and public access to land application sites are described in Table 10. If necessary, the area must be posted to ensure these restrictions are being applied.

Table 10. Minimum duration between time of application of an industrial by-products containing pathogens and harvest, grazing, and public access to the site.

Crop types	Waiting period
Food crops whose harvested part may touch the soil/IBP mixture (melons, squash, tomatoes, etc.)	14 months
Food crops whose harvested parts grow in the soil (potatoes, carrots, etc.)	38 ¹ months
Feed, other food crops (field corn, sweet corn, etc.) hay, or fiber crop	30 days

Crop types	Waiting period
Grazing of animals	30 days
Public access to land ² high potential for exposure low potential for exposure	1 year 30 days

¹This can be reduced to a 20 month duration between application and harvest when the IBP is surface applied and stays on the soil surface four months or longer prior to incorporation into the soil.

²Lands with high potential for exposure are public contact sites, reclamation sites located in populated areas, turf farms, or plant nurseries. Lands with low potential for exposure are lands with infrequent public use and include areas such as agricultural land, forests, or reclamation sites located in an unpopulated area.

Soil testing at the land application site

Before a site can be used for the first time, the suitability of a proposed site must be determined to ensure that the soils are able to utilize the nutrients in the IBP, and that the geography of the site is amenable to land application.

Soils must be tested for the parameters in Table 11, below, for each site proposed for land application of IBP. Soil sampling is required both before the site is used for the first time, and within 12 months prior to each application, thereafter. If a site is not used during a cropping year, there is no need to sample the soil. A minimum of one composite sample per 40 acres or per site, whichever is greater, is required. If soils test above the limits in Table 3 or would cause an exceedance of the soil loading limits in Table 4, the site cannot be used for land application.

Table 11. Soil analysis requirements and associated limits.

Parameter	Units	Sample type	Limits
Soil Texture	USDA Class	composite ²	NA
Organic Matter	Percent	composite ²	NA
Phosphorus, Extractable in soil ¹	ppm	composite ²	200 ¹
Potassium, Exchangeable in Soil	ppm	composite ²	NA
pH	ppm	composite ²	NA
Salts, Water Soluble in Soil	mmhos/cm	composite ²	4

¹The soil test method used for extractable phosphorus in soil is either the Bray P-1 test, or the Olson test; the Olson procedure should be used if the soil pH is 7.4 or higher.

²The composite shall consist of a mixture of 15-20 sub-samples taken in the plow layer.

Notification to local authorities

Before land application activities are initiated within a county, city, or township for the first time, written notification to local officials – which includes either the county planning and zoning or solid waste officer (whichever is appropriate), and either the township clerk or mayor (depending on location of the site) – must be done.

Timing of notification

Notification must be provided at least 30 days before initiating land application activities. This notification period provide an opportunity for local officials to request additional information (copies of records, testing information, individual site information, etc.), inform the generator of the IBP about any ordinances they must comply with, and inform the generator of the IBP whether future notifications are necessary and if so how, when, and what information to submit.

Content of notification

Notifications must contain a description of how the IBP will be managed during land application, which includes staging, storage and response actions in the event of a spill, and a response section for the local official. If any changes in the management of the IBP described in the notification occur, the notification process must be repeated.

A sample letter to be used for notification purposes is included on the MPCA webpage located at: <http://www.pca.state.mn.us/0agxeaf>.

- Sample Notification Letter to Local Authorities for Land Application (land application without a permit) (<http://www.pca.state.mn.us/publications/wq-Indapp7-15.pdf>).
- Sample Notification Letter to Local Authorities for Land Application (land application with a permit) (<http://www.pca.state.mn.us/publications/wq-Indapp7-16.pdf>).

Notification to MPCA

Sites used for the land application of IBP are not “approved” by the MPCA, as they are for biosolids land application sites. For land application activities requiring a permit however, submittal of a Site Notification form at least 30 days prior to application of IBP at a particular site is required.

If a permit is not required for land application activities, the MPCA does not require site notification of sites that will be used for land application of IBP.

Current versions of land application publications are maintained on the MPCA webpage located at: <http://www.pca.state.mn.us/0agxeaf>.

- Site Notification Form (<http://www.pca.state.mn.us/index.php/view-document.html?gid=6799>).

Chapter 5. Site management, limitations and restrictions

Loading limitations

Overview

The effects of IBP on crops and the environment rely on the ability of the manager of land application activities to accurately calculate the amount of IBP to apply to a particular parcel of land. Inaccurate calculations can lead to the over-application of nitrogen, sodium, metals and other pollutants which can harm the environment. Incorrect calculations can also result in the under-application of these components, which result in a lower-than-expected crop yield.

IBP must be land applied in a manner so as not to exceed the loading limits of Table 4. Table 12 provides a summary of loading limitations for the application of IBP.

Table 12. Summary of application rate limits.

Loading factor	Limit
Nitrogen	Varies – MANA (lb/acre/year)
Sodium	170 lb/acre/year
Daily Hydraulic Rate ¹ :	
Soil Texture Fine	10,000 gal/acre/day
Soil Texture Medium	15,000 gal/acre/day
Soil Texture Coarse	25,000 gal/acre/day
Winter Hydraulic Rate	15,000 gal/acre/winter

¹Fine, medium, and coarse textured soils are defined by the Department of Agriculture (USDA) textural classifications as [clay loam, silty clay loam, sandy clay, silty clay]; [loam, silt, silt loam, and sandy clay loam]; and [sand, loamy sand, and sandy loam, respectively].

Nitrogen

Annual nitrogen application rates must be based on what the crop needs during one growing season. The Maximum Allowable Nitrogen Application Rate (MANA) is based on recommendations from the University of Minnesota Extension Service. These recommendations are based on soil test results, realistic crop yield goals, and previously grown crops. This information is available from the MPCA or your extension agent.

Maximum allowable nitrogen application rates for selected crops which do not have University of Minnesota Extension Service recommendations for nitrogen are provided in Table 13. To calculate the maximum allowable rate of the IBP to meet the nitrogen limits, use the electronic Application Rate Calculator (Excel document) included on the MPCA land application webpage or the worksheet in the following section.

Table 13. Maximum allowable nitrogen application rates for selected crops.

Crop	Maximum allowable nitrogen application rates – when actual yields are not measured (lb/acre)	Maximum allowable nitrogen application rates – when actual yields are measured
Non-harvested vegetation, set aside acreage, cover crops ¹	50	–
Soybeans	–	3.5 lb Nitrogen x Bushel/acre yield goal
Alfalfa	200	50 lb Nitrogen x Tons/acre yield goal
Clover, alfalfa-grass, or clover-grass mixtures	100	50 lb Nitrogen x Tons/acre yield goal

¹This category does not include land used as pasture.

Sodium

Application rates of sodium are limited to 170 pounds per acre in any one cropping year. To calculate the maximum allowable rate of the IBP to meet the sodium limits, use the electronic Application Rate Calculator (Excel document) included on the MPCA land application webpage or the worksheet in the following section.

Hydraulic limitations

Hydraulic loading rates are set for liquid IBP to prevent ponding and runoff at land application sites. The rates vary based on the ability of the soil to drain the hydraulic volume, but do not supersede the nutrient loading rates. That is, hydraulic limits cannot be used to exceed other application rate limits for nutrients or metals.

The following limitations apply to liquid IBP:

- No more than 10,000 gallon/acre/day can be applied to soils that are clay loam, silty clay loam, sandy clay, and silty clay soils, with a maximum of 75,000 gallons/year.
- No more than 15,000 gallons/acre/day can be applied to soils that are loam, silt, silt loam, and sandy clay loam soils, with a maximum of 75,000 gallons/year.
- No more than 25,000 gallons/acre/day can be applied to soils that are sand, loamy sand, and sandy loam soils, with a maximum of 75,000 gallons/year.
- No more than 15,000 gallons/acre/winter can be applied during the time that soils are frozen or snow covered, so that incorporation or injection is not possible. Note: the winter application is also restricted to parcels with 0-2% slope.

Note: soil types identified above are classified using the USDA textural classifications found in County Soil Surveys. For a detailed explanation of how to read and evaluate county soil surveys, refer to the MPCA document, "Land Application of Biosolids: A Manual for Minnesota (2001)."

General best management practices

In addition to the selection of a suitable site; notification of local authorities; and, the proper calculation and application of the IBP so as to not exceed application rate limitations, there are some general BMPs that must be followed when land applying IBP.

These general BMPs are as follows:

1. An IBP must be immediately incorporated or injected on sites that are prone to flooding.
2. Application of IBP is not allowed on areas of a site ponded with water or liquid IBP.
3. Application of IBP is not allowed on areas that remain fallow for the entire cropping year. On sites where no crop is grown during the time period from July 1 through August 31, applications are limited to rates which supply no more than 50 pounds/acre of available nitrogen.
4. Liquid IBP must be injected or incorporated within 48 hours when applied on soil with a surface horizon permeability rate of less than 0.2 inches/hour.
5. IBP must not be applied by spraying from public roads or across road right of ways without prior written MPCA approval.
6. The application area must be clearly identified with flags, stakes, or other easily seen markers at the time of application to identify the site boundaries, separation distances, and unsuitable application areas within the site. Where site boundaries can be identified by field roads, fences, etc., identification is not necessary.
7. IBP must be uniformly distributed over the application area at the site used for land application.
8. Runoff of IBP from the application site is not allowed.
9. Significant surface ponding of liquid IBP is not allowed within six hours of the application.

These may not be the only measures necessary to prevent runoff of the material during the Spring thaw. Management tools such as installation of silt fences and berms, and planting of grass buffer strips may be required in order to meet the requirement that no runoff of the IBP from the application site is allowed.

Storage of industrial by-product

Storage of IBP without a permit for land application activities is very limited. The following types of storage are allowed if a permit is not needed for land application activities:

- Temporary storage at the land application site
- Transfer to manure storage structure
- Storage of sweet corn silage used for animal feed

For the purposes of this guidance, dewatered IBPs that are being spread concurrent with the unloading of bulk material on the land application site, and will not be stockpiled overnight, are not considered storage of an IBP. The term "dewatered" is defined in the glossary of this document.

Other storage of IBP is not allowed without a permit from the MPCA, even if a permit would not otherwise be required for land application activities. Contact MPCA staff for additional details.

Temporary storage

Storage of IBP that is dewatered is allowed under the following conditions:

- Storage must not exceed 30 days.
- Storage shall only occur on the land application site where the IBP will be applied.
- The quantity of IBP to be stored at an application site shall not exceed the quantity of material that can be applied to that site.

- Short-term storage shall not take place on land with a slope greater than two percent unless measures are taken to control water run-on and runoff from the stockpile and/or site.

Transfer to manure storage structures

Prior to use of a manure storage structure for the storage of IBP, written authorization from the county feedlot officer in delegated counties, or the county solid waste official in non-delegated counties, as well as the MPCA, must be obtained.

The following restrictions apply to the storage of IBP in a manure storage structure:

- A maximum of 50,000 gallons per year, or 10% of the total volume of the structure – whichever is greater – is allowed to be transferred to the manure structure.
- Biological treatment lagoons cannot be used.
- A manure storage structure must maintain a minimum of three foot freeboard at all times.
- IBPs must be compatible with the structure and manure to prevent damage to the structure and changes in biological activity. Examples of problems associated with incompatible wastes are damage to concrete and soil liners, physical or chemical changes in the mixture which make it difficult to agitate or pump, cause odors and so forth.

Land application of the material stored in the manure storage structure must follow the requirements for manure application rates and management (Minn. R. 7020). Sampling and analysis of the mixture must occur prior to land application to determine allowable application rates. All parties with manure or IBP present in the storage structure are responsible for the proper management of the material.

To seek approval to use a manure storage structure for storage of an IBP, complete the Transfer to Manure Storage form and submit it to the county feedlot officer in delegated counties, or the county solid waste official in non-delegated counties. Once the form is signed by the county official, the completed form should be mailed to the MPCA. The Transfer to Manure Storage form is included on the MPCA webpage located at: <http://www.pca.state.mn.us/0agxeaf>.

- Transfer to Manure Storage Form (<http://www.pca.state.mn.us/index.php/view-document.html?gid=6851>).

Storage of sweet corn silage used as animal feed

Sweet corn silage is made available by vegetable processing plants to farmers for use as animal feed. Like field corn silage, it is a valuable feed product; however unlike field corn silage, it produces much more silage juice because it is harvested at a higher moisture content.

Sweet corn silage produces silage juice, which is a very acidic waste with a high nutrient content (high strength). Silage must be stored in a manner to be protective of the environment. Anyone that stores more than 1,000 tons of sweet corn silage on site at any one time is required to obtain an MPCA permit.

Using the following BMPs can prevent problems with sweet corn silage:

- Locate stockpiles on relatively flat areas in order to prevent accidental discharges of silage juice from moving quickly over land to waterways.
- Locate stockpiles on soils that have a minimum of three feet to the seasonal high water table and five feet to bedrock unless an impervious surface is used for the stockpile.
- Locate stockpiles a minimum of 100 feet from drinking water wells.
- Maintain safe distances from surface waters and wetlands as well as any features that discharge to them such as ditches, tile inlets, and intermittent streams.
- Collect all silage juice (leachate) that discharges during storage. It is necessary to manage the silage leachate in a manner that protects surface and groundwaters.

Additional information on storage of sweet corn silage is located on the MPCA webpage at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=3619>.

Calculation of loading rates

The accurate calculation of loading rates for the limiting nutrient in your IBP is very important in maintaining compliance with the requirements for land application. To calculate loading for nitrogen and sodium, refer to Figure 14.

For a detailed explanation of how to calculate loadings for land application, refer to Chapter 12 of the MPCA document, "Land Application of Biosolids: A Manual for Minnesota (2001)."

An electronic Application Rate Calculator (Excel document) to calculate loading rates is available on the MPCA land application webpage located at: <http://www.pca.state.mn.us/water/landapp.html>.

Figure 14. Application rate worksheet.

Analysis Results

Example:		Your Industrial By-Product:	
Total Solids	1.2 %	Total Solids	_____ %
Total Kjeldahl Nitrogen	3.3 %	Total Kjeldahl Nitrogen	_____ %
Total Sodium	1.5 %	Total Sodium	_____ %

Nitrogen in Your Industrial By-Product (IBP)	Example	Your IBP
Total Kjeldahl Nitrogen (% in decimal form).....	0.033	<input type="text"/>
X 2000 pounds / ton.....	X 2000	X <input type="text"/>
= Pounds of Nitrogen / T on of IBP.....	66.0 lb N/ton	= <input type="text"/> lb N/ton
Nitrogen Application Limit (lb/acre/yr).....	50 lb N/acre/yr	50 lb N/acre/yr
÷ Pounds of Nitrogen / T of IBP (from above).....	66.0 lb N/ton	÷ <input type="text"/> lb N/ton
= MAX RATE of IBP ALLOWED (based on N)	0.76 tons/acre	= <input type="text"/> tons/ acre

Sodium in Your Industrial By-Product (IBP)	Example	Your IBP
Total Sodium (% in decimal form).....	0.015	<input type="text"/>
X 2000 pounds / ton.....	X 2000	X <input type="text"/>
= Pounds of Sodium / T on of IBP.....	30 lb N / ton	= <input type="text"/> lb Na/ton
Sodium Application Limit (lb/acre/yr).....	170 lb Na / acre / yr	50 lb Na/acre/yr
÷ Pounds of Sodium / T of IBP (from above).....	30 lb Na / ton	÷ <input type="text"/> lb Na/ton
= MAX RATE of IBP ALLOWED (based on Sodium)	5.7 tons / acre	= <input type="text"/> tons/acre

Most Limiting Factor	Example	Yours
From the nitrogen and sodium tables above choose the value for Max Rate of IBP allowed which is lowest. This is the maximum rate of the IBP you can apply during a one year period.		
Maximum Rate of IBP Allowed (tons/acre).....	0.76 tons/acre	<input type="text"/> tons/acre
This is based on (Nitrogen or Sodium)?	Nitrogen	<input type="text"/>

Converting Maximum Rate of IBP Allowed to Gallons / Acre

	Example	Your IBP
Maximum Rate of IBP Allowed	0.76 tons/acre	<input type="text"/> tons/acre
X 240 (conversion factor).....	X 240	X <input type="text"/>
÷ Total Solids (% in decimal form).....	0.012 percent	÷ <input type="text"/> percent
= MAX Gallons / Acre Allowed / Year.....	15,200 gal/acre/yr	= <input type="text"/> gal/acre/yr

Equations for solid materials are available from MPCA on request.

Chapter 6. Record keeping and reporting

Annual reporting

If a permit is not required for land application activities, the MPCA does not require annual reporting.

For land application activities requiring a permit however, submittal of an Annual Report by December 31 for the previous cropping year is required. Annual reporting for Permittees must be done on an MPCA supplied form, or another MPCA approved form. Current versions of land application publications are maintained on the MPCA webpage located at: <http://www.pca.state.mn.us/0agxeaf>.

End user information

For each site used for land application of an IBP, the end user – if other than yourself – must be provided with the information necessary to ensure that – collectively, from all nutrient sources – a site is not receiving too many nutrients. An “end user” is the person that has accepted the IBP for their use as a soil amendment – usually a farmer.

Information the end user will need includes information such as actual nutrient application rates, any restrictions on the IBP use, crop restrictions, etc. The end user must be provided with this information in writing as soon as possible, and in no case more than six weeks after application has been completed. End users should take appropriate credits for all plant nutrients supplied by industrial and municipal by-products, manures, and fertilizers so that maximum allowable application rates are not exceeded.

Figure 15, below, is an example of a form that can be used to provide the required information to the end user.

Figure 15. Sample end user reporting form.

Information for Farmer

Land Owner: _____

Site Code: _____

Material Land Applied : _____

Rate Land Applied
(gallons or wet tons per acre) _____

Nitrogen Applied (lb/acre): _____ **MPCA Limit 50 lb/acre/year**

Sodium Applied (lb/acre): _____ **MPCA Limit 170 lb/acre/year**

Soil Test Results

Date Sampled:	MPCA Limit
Texture	None
Organic Matter (percent)	None
pH	None
Exchangeable Phosphorus (ppm)	200 ppm
Extractable Potassium (ppm)	None
Soluble Salts (mmhos/cm)	4 mmhos/cm

Company Name: _____

Contact Person Name: _____ Phone: _____

Record keeping requirements

At a minimum, the following records must be maintained at the Facility for a minimum of three years. Additional records are required for land application activities requiring permit coverage.

- A copy of the Notification form submitted to the MPCA for land application activities.
- A copy of any lab results and other analytical information pertaining to the IBP land applied or soil information at sites used for land application.
- A copy of any notification letter submitted to local authorities (county and city/township) for each site used for land application activity.
- Documentation of the site suitability determination made in compliance with this guidance, for each site being used for land application activity.
- Documentation of the loading calculations indicating the maximum allowable IBP application rate for each site being used during the current cropping year.
- A listing of all other industrial or municipal by-product, manures, septage, and fertilizers applied on the same site and their rates of application.
- Daily hauling records which indicate quantities transferred to storage or land applied with the storage or site location identified.
- A running total of the quantity of IBP applied on each site for the given cropping year.
- A copy of written information provided to each end user of the IBP.
- A copy of any Transfer to Manure Storage form completed and submitted to the MPCA for approval and correspondence related to approvals.

Records must be made available for review upon request by the MPCA. The retention period for these records can be extended by the MPCA in the event of permitting or compliance issued that need to be addressed.

Chapter 7. Glossary

“Available Nitrogen” means the nitrogen present in the IBP which is available for the plant to use during the cropping year.

“Cover Crop” means vegetation which is planted specifically to prevent soil erosion and to take up nutrients that may otherwise be lost before the next cropping year. This typically includes crops such as rye, oats, or other types of fast-growing vegetation. Cover crops, in general, are not harvested.

“Cropping Year” means a year beginning on September 1 of the year prior to the growing season and ending August 31 the year the crop is harvested. For example, the 1994 cropping year began September 1, 1993, and ended August 31, 1994.

“Dewatered IBP” means an IBP which can be handled as a dry material and when stacked has the ability to maintain a 4:1 slope.

“End User” means the person that has accepted the IBP for their use as a soil amendment.

“Fallow” means land which is not cropped throughout a cropping year and has a vegetative cover of less than 25 percent.

“Highly Permeable Soil” means soils whose soil leaching potentials are rated as severe, poor filter for soil pesticide loss, by the Natural Resources Conservation Service using the procedure found in part 620, Soil Interpretation Rating Guides of the United States Department of Agriculture-Natural Resources Conservation Service National Soils Survey Handbook.

“Immediately Incorporated” means incorporated into the soil with tillage within 48 hours after surface application of an IBP.

“IBP” has the same meaning as “solid waste” given in Minn. R. 7035.0300.

“Maximum Allowable Nitrogen Application Rate” means the maximum amount of available nitrogen which can be applied to a site during a single cropping year.

“Nitrogen” most of the IBPs from food and beverage processing contain nitrogen. Although, nitrogen is a plant nutrient, it is also a known surface water and groundwater contaminant. These guidelines require that IBP be applied at agronomic rates for nitrogen. This means nitrogen application rates must match the amount of nitrogen a crop can take up during one growing season.

“Odor” odor is a real concern many people have that live next to land application sites. It is also the most common land application complaint. Odor problems should be dealt with by treating the material to reduce the odors prior to land application. In some cases, odors can be managed by incorporating the material into the soil immediately after application or by injecting it. Odors are a nuisance for everyone and can attract animals to the land application site. Not dealing with odors can cause opposition to your land application activities and make you unwelcome in some communities. These guidelines do not have specific requirements related to odor; however, if odors are an issue at your facility, you will be required to manage them accordingly.

“Oils and Grease” if you are processing any types of meat, poultry, or dairy products, it is likely that your IBP contain fats or oils. Although, fats and oils are not usually a problem when land applied at reasonable rates, they are associated with odor problems and may require you to treat the material to stabilize it (compost, digest, lime stabilize, etc.) and/or inject or incorporate the material immediately.

“Pathogens” some IBPs contain disease causing organisms such as viruses, bacteria, and parasites. These organisms are called pathogens. IBP containing human sewage, or have waste streams that contain blood, animal feces, raw meat, etc. have the potential to contain pathogens and must be managed accordingly. These guidelines do not contain treatment requirements; however, do have restrictions on the types of crops that can be grown on a site where the IBP has been applied if it contains pathogens. There is a waiting period after application before specific crops can be grown.

“Perched Water Table” means the soil is saturated with water in one or more layers within 200 centimeters of the mineral soil surface and has one or more unsaturated layers with an upper boundary above 200 centimeters in depth below the saturated layer. The zone of saturation, i.e. the water table is perched on top of a relatively impermeable layer. The Natural Resources Conservation Service also classifies this as “epi-saturation”.

“pH” some food and beverage processing by-products are acidic or basic which can cause problems when directly applied to growing vegetation. These guidelines do not address this problem directly; however, if you have a material that is acidic or basic, you may have to neutralize the pH or apply the material before or after a crop is grown to prevent crop damage.

“Phosphorus” most IBP from food and beverage processing industries also contain large quantities of phosphorus. Phosphorus is a plant nutrient and a known surface water contaminant. To prevent phosphorus contamination of surface waters, these guidelines have soil phosphorus limits and criteria to prevent runoff of nutrients from the application site.

“Public Contact Site” means land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, and golf courses.

“Realistic Yield Goal” means the most recent five-year average of crop yields, excluding the worst year or the most recent three to five year average yield increased by ten percent. If the crop has never been grown, the yield goal can be determined based on information provided by the Natural Resources Conservation Service, county extension agent, or crop consultant.

“Sodium” sodium is a common concern in many food and beverage processing by-products. Sodium is a concern because it can destroy the soil’s structure and reduces its productivity. Once a soil is damaged by sodium it is very difficult to correct the problems which occur. These guidelines require that annual sodium application rates do not exceed 170 lb/acre to prevent damage to the soil from occurring.

"Traffic" many local officials are concerned about safety issues and extra wear and tear on roads that large hauling vehicles can cause. It is important not to ignore this concern. Although, not an environmental issue, it is a local issue that is important to consider and discuss prior to the time land application begins.

"Type IV Certified Operator or Inspector" means a person certified according to Minn. R. ch. 7048 for land application.

"Wetlands" means those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Constructed wetlands designed for wastewater treatment are not waters of the state. Wetlands must have the following attributes:

1. a predominance of hydric soils
2. inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support a prevalence of hydrophytic vegetation typically adapted for life in a saturated soil condition
3. under normal circumstances support a prevalence of such vegetation