10-Step Guide to Land Applying

Small amounts of industrial by-product generated from food, beverage and agro-industrial processing facilities

Who is this fact sheet for?

This fact sheet is intended for use by persons or operations that generate and land apply small amounts of industrial by-product (IBP) generated from food, beverage and agro-industrial processing, and have pre-determined that the land application activity does not require permit coverage. This fact sheet is not applicable to land application activities requiring a permit.

Consult with Minnesota Pollution Control Agency (MPCA) staff to determine whether a permit for land application is required. Typically, a permit is not required for land application of less than or equal to 50,000 gallons or 10 dry tons of IBP. Storage of IBP without a permit is limited, and a permit may be required even for these small volumes if loading and/or concentration limits may be exceeded, or if MPCA staff believes more oversight of the land application activity is needed.

If a permit is required for land application activities, refer to the MPCA land application webpage located at: http://www.pca.state.mn.us/0agxeaf.

Best Management Practices

Application of nutrients to agricultural areas, either in the form of conventional fertilizers or by the reuse of nutrients from IBP, 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).

Following the best management practices outlined in this fact sheet minimizes environmental risk in land applying small amounts of IBP through limitation of application rate, and the monitoring of soil to ensure that the crops and the land is using nutrients applied.

For more detailed information on these steps and additional land application topics, refer to the MPCA companion document to this fact sheet: *Guidelines for managing industrial by-products from food and beverage processing industries* (wq-lndapp2-03). Current versions of land application publications are maintained on the MPCA land application web page located at: http://www.pca.state.mn.us/0agxeaf.

Step 1: Analyze the industrial by-product to be land applied.

Industrial by-product 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.

Test a representative sample of each IBP to be land applied according to Table 1. Analytical sampling of sweet corn silage is not necessary.

Table 1. Baseline analytical requirements for industrial by-products.

Analyte	Unit of measure
Chloride, dry weight (as Cl)	mg/kg
Nitrogen, ammonia, dry weight	Percent
Nitrogen, kjeldahl, total, solid fraction, dry weight	Percent
pH, sludge	SU
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

[2] Oil and Grease, Total, in mg/kg should be tested for when present in IBP(s)

To ensure that representative sampling is done, all pollutants with the 'reasonable likelihood' of being present should be analyzed for, which means that additional analytical testing may be needed (see list potential analytes in Table 2, below). 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 (see Step 2). 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.

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

Table 2. 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

Step 2. Complete a "Notification to land apply industrial by-product without a permit" form.

A notification to land apply industrial by-product without a permit (Notification) form must be completed and submitted for all facilities not requiring an MPCA permit. This form is located electronically at: http://www.pca.state.mn.us/publications/wq-lndapp7-14.doc.

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 facility, 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.

Step 3. Determine the suitability of proposed site(s) for land application.

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.

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.

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 fact sheet, are maintained.

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 3 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 3. Slope restrictions for land application sites.

Slope (%)	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 4 must be maintained on all land application sites.

Table 4. 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 waterways[3]	Slope 0% to 6%	100	33	33
	Slope 6% to 12%	Not allowed	33	33

[1] This 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.

Step 3a. Additional suitability requirements for pathogen-containing industrial by-product.

Industrial by-products 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.

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.

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.

Separation distances. In addition to the separation distances specified in Table 4, the additional separation distances in Table 5 must be maintained from the application site.

Crop restrictions/public access. Restrictions on crop harvest and public access to land application sites are described in Table 6. If necessary, the area must be posted to ensure these restrictions are being applied.

Table 5. 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

[1]This 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]The separation distance may be decreased to three feet if the soil is not classified as a "highly permeable soil", as defined by the MNG960000 permit.
[3]The 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.

Table 6. Minimum duration between time of application of an industrial by-product 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
Grazing of animals	30 days
Public access to land[2]	
high potential for exposure	1 year
low potential for exposure	30 days

[1]This 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.
[2]Lands 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.

Step 4. Sample the soil at suitable land application site(s) that will be used during the upcoming cropping year (September 1 – August 31).

Soils must be tested for the parameters in Table 7, 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 three years 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.

Table 7. Soil analysis requirements and associated limits.

Parameter	**Units**	**Sample type**	**Limits**
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	Standard units	Composite[2]	NA
Salts, water soluble in soil	mmhos/cm	Composite[2]	4

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

Step 5. Notify local authorities at least 30 days before initiating land application in that jurisdiction.

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 provides 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 that can be used for notification purposes is included on the MPCA land application webpage located at: http://www.pca.state.mn.us/0agxeaf.

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

Step 6. Determine and calculate the allowable rate of application of the industrial by-product for each suitable site.

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 this section. Table 8 provides a summary of loading limitations for the application of IBP.

Nitrogen. Annual nitrogen application rates are restricted to what the crop needs during one growing season, based on the Maximum Allowable Nitrogen Application Rate (MANA) – which is set by 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.

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 nitrogen and sodium limits, use the electronic application rate calculator included on the MPCA land application web page located at: http://www.pca.state.mn.us/0agxeaf.

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.

Table 8. 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 Soil texture medium Soil texture coarse	 10,000 gal/acre/day 15,000 gal/acre/day 25,000 gal/acre/day
Winter hydraulic rate	15,000 gal/acre/winter

[1] Fine, 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].

Step 7. Follow general provisions for land applying industrial by-products.

There are some general provisions that must be followed when land applying IBP to prevent nutrients from washing off the land (to surface water) or through the soil profile (to groundwater), thereby avoiding contamination of ground and/or surface waters.

- An IBP must be immediately incorporated or injected on sites that are prone to flooding.
- Application of IBP is not allowed on areas of a site ponded with water or liquid IBP.
- Application of IBP is not allowed on areas that remain fallow for the entire cropping year.
- 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.
- IBP must not be applied by spraying from public roads or across road right of ways without prior written MPCA approval.
- 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.
- IBP must be uniformly distributed over the application area at the site used for land application.
- Runoff of IBP from the application site is not allowed.
- 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.

Step 8. Provide information to the end user, if other than yourself.

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 6 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.

Step 9. Record site information and application loadings to each suitable site.

The following records must be maintained at the facility for a minimum of three years after the land application activity:

- A copy of the Notification form submitted to the MPCA for land application activities.
- A copy of any notification letter submitted to local authorities (county and city/township).
- 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.
- 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.

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.

Step 10. Contact Minnesota Pollution Control Agency staff to answer your questions and provide assistance related to the management of your industrial by-product.

Additional information is available to help you properly manage your IBP.

Refer to the MPCA companion document to this fact sheet for detailed information on these steps and additional land application topics: *Guidelines for managing industrial by-products from food and beverage processing industries* (wq-Indapp2-03). An electronic version of this and other documents referenced in this fact sheet, as well as land application forms, are available at the MPCA land application webpage located at: http://www.pca.state.mn.us/0agxeaf.

If you have questions or need assistance with the use of this document, contact the MPCA's land application staff at: 800-657-3864 (outstate) or 651-296-6300 (metro area).