

LAND APPLICATION OF FOOD PROCESSING BY-PRODUCT SOLIDS

Fact Sheet

WPDES Permit No. WI-0057665-04

June 2007

A. Background and Rationale

Food processing by-products are regulated by chapter NR 214, Wis. Adm. Code, entitled "Land Treatment of Industrial Liquid Waste, By-product Solids and Sludges". The regulation of food processing by-product solids is necessary because experience has shown that improper management of these by-products can lead to surface water or groundwater pollution. The Department is responsible for approving the suitability of sites used for land application of these by-products and to protect the groundwater from contamination.

Sweet corn cobs, leaves and husks are, by far, the largest volume of animal or vegetable processing by-product land spread under this permit. Much of this material is stored in silage stacks for later feeding to animals. However, due to several reasons, such as the high cost of constructing a storage site to NR 213 design specifications, the over supply of silage feed, or unsuitability of the product, the generator may wish to dispose of the by-product by direct application to the soil. Other examples of food processing by-products from the vegetable processing industry are peelings from potatoes, carrots, beets and onions, cabbage leaves and cores from sauerkraut processing, snap bean tips, and solid particles screened from wastewater. From the meat processing industry, a common by-product is paunch manure, which is the stomach contents of slaughtered animals. Fruit processing by-product examples are pits and waste fruit. All of these wastes can have beneficial use as a fertilizer and/or a soil conditioner if they are properly managed and are evenly distributed over the land.

NR 518, Landspreading of Solid Waste, exempts vegetable waste specifically and has a general exemption for non-detrimental wastes applied as a soil conditioner or fertilizer. The wastes regulated by this general permit must be exempt from NR 518 and this is the case for those described above.

Chapter 283, Wis. Statutes, authorizes the Department to issue a general permit for discharge from specified categories or classes of point sources if they are not a significant contributor of pollution. The general permit is enforceable. Also the general permit can be withdrawn if the point source is not in compliance with terms and conditions of the general permit. The Department also may withdraw a discharge from the coverage of a general WPDES permit and issue an individual WPDES permit on its own motion, or upon the petition of any general permittee, any affected state, or 5 or more persons affected by the disposal practices of the general permittee.

It is not the intent of the Department that this general permit be used for contract haulers servicing multiple industrial customers generating similarly characterized wastewater. In the event that a contract hauler land applies similar waste for multiple industries a specific permit will be issued as practicable. The general permit may be used as an interim regulatory tool until a specific permit may be issued, however each industrial source needs to be designated in the management plan and tracked with a distinct sample point number for accurate measurement of the loadings to the site. As customers are modified, the management plan shall be so amended. The customer name need not be identified in the management plan but other necessary information that characterizes the waste is required.

A by-products management plan can be submitted after coverage under the general permit is authorized by the Department as long as the plan is submitted within 60 days of the permittee initiating land application activities. This allows first time dischargers sufficient time to gather samples, have them analyzed, and calculate which substance is the critical limiting pollutant. For dischargers that already have the necessary analysis information, a management plan must be submitted prior to land application activities are initiated.

B. Discharges Eligible for the General Permit

This general permit is intended to be issued for the continuous or seasonal direct land application of small volumes of food processing by-products or for short-term land application of larger volumes of by-product. This general permit will also be available for the Department to use for urgent requests to land apply by-products due to unexpected problems. Prior to issuance of the general permit or, within 2 months of initiating land application activities, the permittee must develop and follow a management plan approved by this Department.

The following situations are examples of how this general permit can be used to regulate land application.

1. Interim Regulation.

Until such time as the Department can issue, reissue or modify site specific permits for entities that land apply food processing by-products, this general permit can be used as interim regulation. An independent contractor that manages the disposal of by-products may be covered under this permit in this case. In all cases, the permittee must develop and follow a management plan approved by this Department.

2. Land Application of Small Volumes of Food Processing By-products.

If a food processor has a small quantity of by-product that can be land applied with a low potential for environmental harm, it can be regulated with the general permit. This situation might arise if the food processor, such as a potato chip or onion ring processor, discharges process wastewater to a publicly owned treatment works and has no other WPDES permit.

3. Short Term or One-Time Disposal.

Food processors will sometimes need to dispose of by-products due to some unexpected event. This might include such things as substandard or spoiled product, loss of their regular by-product market, an over-supply of raw material or a change in their processing method. The general permit is appropriate to regulate these types of land application events regardless of volume, if they occur as short-term events and are land applied in accordance with a Department approved management plan. However if the event occurs for the entire processing season, or for more than one season, it should be regulated as an outfall in a specific WPDES permit.

C. Information To Be Submitted

The general permit can only be used in situations where the land application of food processing by-products is a low risk of environmental contamination. To make this determination, the Department will require the general permit applicant to submit information about the by-product source and the land application management plan. The Department may request that this information be submitted on a wastewater discharge information summary. In addition, the permittee will need to submit a by-product management plan in accordance with s. NR 214.17. The plan must have the following information:

1. Process generating the by-product.

The permittee must identify the raw products, the finished products, and the kinds of processes that result in the by-product. In many cases this will simply be the inedible parts of a fruit or vegetable such as the husks and cobs from sweet corn or the leaves and cores from cabbage. In other cases it will be solid material screened from process wastewater such as discarded corn kernels from sweet corn processing. The more difficult situation will be when chemicals are used as part of the process and become mixed with the by-product. One example is the use of caustic soda (sodium hydroxide) to peel vegetables. (Note: A hot peel process may be an alternative with less chemical use.) It is important to have the permittee declare all chemicals used in the process that may get mixed into the by-product.

2. By-product Analysis.

The permittee must collect a representative sample of the by-product solid and analyze for percent solids, Total Kjeldahl Nitrogen (TKN), chloride and phosphorus. In addition, analysis results should be evaluated for any chemicals used in the process and likely to be found in the by-product. The annual total nitrogen loading amount should be equal to or less than the cover crop needs. The carbon-to-nitrogen ratio is also important in determining loading rates; if the carbon concentration is high it can tie up the nitrogen and make it unavailable to plants in the first year of application. The permittee is encouraged to determine the carbon to nitrogen ratio for their waste to help determine the nitrogen release profile. The permittee shall propose a tons-per-year loading rate that meets the land application requirements based on the by-product characteristics and lab analysis results. An appropriate by-product solids loading rate must be specified in the approved management plan.

3. By-product Storage and Transportation.

The permittee must provide a description of the by-product handling system from the generating site to the land application field. This shall include the equipment used to move the material to the loading spot and whether water is added as a transport media. Temporary storage or loading sites, if used, must be described. If a temporary stacking pad is used, the size, shape, material, type of soil under and around the pad and the depth to groundwater and bedrock are to be included. If leachate is generated, the management of this liquid waste must be explained. If a tank is used for storage, provide the size, shape, materials of construction, and location of the tank in relation to the factory. If the tank is buried, provide information on depth, type of soil, and depth to groundwater or bedrock. If the tank has a vent, manhole, or high-level alarm, these shall be described. Also describe the method of loading or pumping the leachate into the hauling vehicle.

Describe the hauling vehicle with particular attention to how the vehicle will be water-tight to avoid spilling or dripping on the public roads.

The distribution of by-product evenly on the field is important. The material may be land applied directly from the hauling vehicle or it maybe transferred to another type of applicator. The plan shall discuss the actual application device and method. Sometimes truckloads of by-product are stored in the field to be land applied with a tractor or end-loader. These piles must be land applied within 72 hours in accordance with NR 214.

All solid by-products will need to be mixed or incorporated into the soil at some point so that the organic material will become mixed with the soil. As long as there are no nuisance conditions related to surface decomposition of the by-products, incorporation does not have to be done immediately and may be accomplished as part of the normal agricultural soil tillage.

4. Land Application Sites.

Each site must be approved by the Department prior to use. The permittee must provide information to the Department to review the sites to determine compliance with the requirements of ch. NR 214. This will include a site approval request form (3400-53), a site map, a soil information sheet showing soil type, slope, and depth to groundwater and bedrock. A site map showing location of nearby wells, residences, waterways, and surface water shall be included. A proposed cover crop management and harvesting plan is necessary. Also state the proposed loading rate for each site and the loading and resting periods.

D. Site Approval Requirements

The general permit requires that all land application fields receiving industrial by-product solids be approved by the Department prior to using them. This is to be sure the by-products are being applied on sites that meet Department criteria and that we have a record of these sites. The permittee is required to provide all requested information on form 3400-53, along with other pertinent information that will allow Department staff to make a timely determination if the field is acceptable. The Department will provide a site approval that includes specific site restrictions that are based on ch. NR 214, Wis. Adm. Code. The general permit site requirements, such as separation distances, slopes and other criteria are taken directly from 214.17 and are as follows:

1. Land application sites shall have minimum separation distances of:
 - a. 500 feet from an inhabited dwelling except that this distance may be reduced to 200 feet if incorporated and the owner and occupant give their written consent.
 - b. 250 feet from any potable water supply well and 1000 feet from a well serving a community public water supply.
 - c. 200 feet from any surface water except that this may be reduced to 100 feet when a vegetative buffer strip of at least 20 feet in width is maintained between the site and the surface water.
 - d. 36 inches between the ground surface and bedrock or groundwater. The Department may approve (in the specific site approval letter) a reduced separation distance to a minimum of 18 inches on a case-by-case basis provided the rate of application is reduced. Also, this permit requires that by-product solids only be spread on these shallow soils during the warmer weather period of April to September each year. During this period, warmer temperatures allow actively growing crops to quickly absorb water and nutrients that are released as the soil bacteria decompose the by-product solids.
2. Land application sites may not be located in wetlands or in a floodway. Ch. NR 116, Wis. Adm. Code, defines floodway as the channel of a river or stream, and those portions of the floodplain adjoining the channel. Land application sites may be located in the floodplain (land which has been or may be covered by flood water during a flood) but the site may not be used when the floodplain is flooded.
3. Land application sites shall be limited to cultivated cropland, tree plantations, pasture, or hay land, except that other sites may be reviewed and approved by the Department (in the specific site approval) on a case-by-case basis.
4. Land application sites shall be limited to a slope of 12% or less when the ground is not frozen or snow covered. When the ground is frozen or snow covered, application shall be limited to sites with slopes up to 2%, except that sites with slopes of 2% to 6% may be approved by the Department (in the specific site approval) for winter application on a case-by-case basis.

E. Limits on the Application Rate of By-product Solids

Application rates are limited for chlorides to 340 lbs per acre every 2 years. Other application rate criteria are based on acceptable agricultural practices taking into account the total nitrogen level, carbon-to-nitrogen ratio, and the solids content of the by-product. The total pounds of nitrogen applied per acre per year is limited to the nitrogen needs of the cover crop minus any other nitrogen including fertilizer or manure added to the application site. Nitrogen applied can be calculated based on plant-available nitrogen as long as the release of nitrogen from the organic material is credited to future years. Cover crops must be removed each year.

Generally, vegetable by-products do not have high chloride concentrations. However there may be exceptions when the chloride loading restriction is the limiting parameter. Sodium may be a parameter of concern in caustic vegetable peelings. In these situations, the sodium loading rate needs to be limited to prevent alteration of the soil properties or groundwater contamination.

One objective of the management plan is to have the permittee analyze their by-product and their land application sites and make a self-determination of which parameter is most limiting and what that appropriate loading rate will be. The following application rates are specified in the general permit:

1. Annual loading volumes and any short term loading restrictions for by-product solids application to the site may not exceed the volume specified in the approved management plan or in the site approval. These volumes will be determined in accordance with ch. NR 214, Wis. Adm. Code.
2. The total pounds of nitrogen applied per acre per year shall not exceed 165 pounds of total nitrogen per acre per year (based on the nitrogen uptake of the most common cover crop - field corn) minus any other nitrogen, including fertilizer or manure, added to the application site unless the Department specifies/accepts an alternate nitrogen loading amount for other cover crop nitrogen needs in the management plan approval.
3. The total pounds of chloride applied may not exceed 340 pounds per acre per two-year period.
4. In addition to the limitation on nitrogen, the total quantify of by-product solids applied to the soil shall be within acceptable agricultural practices in respect to the carbon-to-nitrogen ratio.

F. By-product Solids Land Application Program Requirements

The operating requirements in the general permit are the based on s. NR 214.17, Wis. Adm. Code. These regulations prohibit surface runoff of liquid contaminated by the by-product solids, leaching of contaminants to groundwater, and nuisance conditions (such as vector attraction or objectionable odors) caused by the on-site surface decomposition of the waste materials. The volume of by-product solids land applied must not alter the characteristics or structure of the soil such that the crop is adversely affected, erosion occurs, or permeability problems occur. If by-product solids are stockpiled on a land application field, the solids must be spread over the land surface within 72 hours. This means the stockpiled material must be evenly distributed to not exceed the approved tons/acre maximum loading rate (tons/acre). The by-product must eventually be plowed, disced, injected or otherwise incorporated into the surface soil layer as specified in the approved management plan. In many cases, it may be acceptable to incorporate the by-products into the soil during the next regular agricultural tillage. However, for some materials that have potential to produce nuisance conditions, incorporation shall be completed as soon as needed to prevent the development of nuisance conditions.

The by-product solid land application program must be operated in conformance with the by-product management plan approved by the Department. If significant operational changes are needed, the management plan must be amended by submitting a written request to the Department.

G. Monitoring and Reporting Requirements

1. The permittee will be required to keep a daily record of the volume of by-product land applied, the land area onto which it was applied identified by a DNR land application site number, total nitrogen and/or chloride loadings in pounds per acre, and the application rate in tons, cubic yards or gallons per acre. The daily spreading log shall be kept in the spreading vehicle for inspection by Department staff for 7 days after the waste was applied. The volume may be determined by actual measurement of the volume of the hauling vehicle or by some other volumetric measurement. These records shall be available for inspection by the Department for life of the permit or from three years following waste application, whichever is longer.
2. The by-products shall be analyzed for percent solids, Total Kjeldahl Nitrogen (TKN), chlorides and phosphorus. The permittee should also analyze for other known contaminants that could cause negative effects to the soil, cover crop or groundwater quality. Department staff can assist permittees to determine if a certain type of industrial process or chemical process additives would trigger a need for additional monitoring.

The sample frequency shall be daily for the discharge rate to land application, quarterly for percent solids, chloride and Total Kjeldahl Nitrogen, and annually for phosphorus.

3. Composite samples shall be collected which are representative of all the by-products being discharged. When the by-product is large pieces of solids, such as sweet corn cobs and husks, a larger sample shall be collected and ground to form a homogenous slurry for analysis.
4. The permittee shall submit annual analytical and land application reports on forms provided by the Department (3400-49 and 3400-55 respectively). The permittee will be required to calculate the annual nitrogen and/or chloride loading rate for each site. The reports must be signed by an appropriate official. The annual reports shall be submitted by January 31 of the year following the completed reporting period.
5. Since the wastewater general permit will be used for food processing by-products, the required analysis will provide the necessary soil loading information. However, it is the responsibility of the permittee to report any other raw materials, additives, or processes that may result in significant concentration of other parameters and to then analyze for these parameters.

Respectfully Submitted,

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Food Processing By-Products Management Plan Outline

Chapter NR 214, Wis. Adm. Code requires food processors that land apply by-product to develop a management plan. The code requires that each by-product application program owner or operator submit a management plan for optimizing system performance and demonstrating compliance with the requirements of the chapter. Following approval by the Department, the system must be operated in conformance with the management plan. If the facility wishes to operate differently than specified in the approved plan, a written request must be submitted to the Department for approval to amend the management plan. The plan must specify information on: by-product volumes and characteristics, description of all site locations, availability of storage, type of transportation and application vehicles, by-product application rates, contingency plans for periods of adverse weather, odor and nuisance abatement, and any other pertinent information. The management plan must be modified for each generator added or lost during the course of the permit. Generally a specific permit will be issued when multiple generators contract with a single permitted hauler, but the general permit may be used on an interim basis until such time as the specific permit is issued. In those situations a unique sample point shall be assigned to each by-product source to allow for effective tracking of land application loadings.

This document is a suggested management plan outline to assist the permittee with development a land application management plan for their operation. This document is intended solely as a suggested starting point and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. Any regulatory decisions made by the Department of Natural Resources in any matter related to a management plan approval will be made by applying the governing statutes and administrative rules to the relevant facts. Each item on the outline shall be adequately discussed in the management plan. If an item is omitted, the owner/operator shall have an explanation as to why the requested information is not relevant.

A. By-Product Source and Handling

1. Describe the industrial processes that generate the by-products. List the raw materials used and the products produced.
2. If the by-products are conditioned prior to disposal, describe the process used. This could be such things as mechanical or gravity dewatering, grinding, composting, or fermentation. List any chemicals used to aid conditioning.

B. By-Product Characteristics

1. A representative sample of by-product should be analyzed for percent solids, organic nitrogen, ammonia nitrogen, Total Kjeldahl Nitrogen (TKN), phosphorus, chlorides, potassium and the carbon-to-nitrogen ratio to provide a base for characterizing the waste material. Results shall be reported on a dry weight basis except for percent solids and pH.
2. If the by-products are not homogeneous such as sweet corn cobs and husks, a larger composite sample shall be collected and ground up to produce a representative sample.
3. Report the quantity of by-product to be disposed either on a daily, monthly, or annual basis.

C. By-Product Storage and Transportation

1. If a by-product storage structure is used, describe its size, shape, volume, and materials of construction.
2. Describe the method of loading the by-products onto the hauling vehicle and describe the type and capacity of the hauling vehicle.
3. Specify how the application vehicle will unload and apply the material evenly over the fields. Also specify if the trucks will be stored in piles in the field for land applying by another machine.
4. State how the total volume hauled will be measured and what kind of records will be kept.
5. Discuss what contingency plans have been developed in case of inclement weather.
6. Explain how the by-products will be incorporated into the soil. This can be done through normal agricultural tillage except when odors develop in which case incorporation must be completed within 72 hours.

D. By-Product Land Application Site Information

1. Show the location of each application site indicated on a site map such as a USDA soil survey map, the description of each soil type and slope and estimated depth to groundwater and bedrock must be included.
2. Provide either a site map, a USGS topographic map or aerial photograph with the proposed site outlined. Aerial photographs are generally available from the county Agricultural Stabilization and Conservation Service (ASCS) office.
3. Each site map shall clearly show (by cross hatching lines or some other means) exactly which areas have suitable conditions and are proposed for land application.
4. Describe the crops to be grown or the dominant vegetation on the application site and the anticipated harvest and removal schedule.
5. Describe adjacent land use, drainage, and land features associated with the site. Show the distance to wells, and streams.
6. Explain the ownership of the site, and the site number used for identification by the hauler.
7. Attach a copy of any land use agreement.
8. Estimate the total acreage to which the by-product will be applied.

E. By-Products Land Application Site Loading Information

1. Specify the total volume of wastewater that can be applied to reach the nitrogen needs of the crop. The nitrogen loading rate for field corn is provided in the general permit at 165 pounds per year. Appropriate alternate annual by-product loading rates can be approved in the management plan based on crop needs and available nitrogen.
2. Calculate the carbon-to-nitrogen ratio of the proposed loading rate and compare it to accepted agricultural practices.
3. Calculate per acre the loading rate of chloride (within 340 lbs/acre/two year period) and phosphorus.