SOIL **Sampling Point:** SP6U

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type*	Loc**	Texture	Remarks
0-12	10YR 2/1	100					Loam	
12-15	10YR 3/1	100					Sandy loam	
15-20	2.5Y 4/1	100					Sand	
20-24	7.5YR 2.5/2	100					Sandy loam	
24-30	10YR 5/3	100					Sand	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains
**Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:

___ Histisol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Depleted Below Dark Surface (A11
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) (**LRR R, MLRA 149B**)
___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**
___ Loamy Mucky Mineral (F1) (**LRR K, L**)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils:

___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**
___ Coast Prairie Redox (A16) (**LRR K, L, R**)
___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
___ Dark Surface (S7) (**LRR K, L**
___ Polyvalue Below Surface (S8) (**LRR K, L**)
___ Thin Dark Surface (S9) (**LRR K, L**)
___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

*Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: NA
Depth (inches): _____

Hydric soil present? N

Remarks:
Soil does not meet technical criteria for hydric soil indicator. Sample point is within a cropped agricultural field and soil is disturbed.

Attachment B
Site Photographs

Photo 1 Typical farmed wetland area exhibiting stunted or stressed vegetation.

Photo 2 Typical farmed wetland area exhibiting stunted or stressed vegetation.

Photo 3 Typical farmed wetland area exhibiting stunted or stressed vegetation.

Photo 4 Typical farmed wetland area exhibiting stunted or stressed vegetation.

Appendix F

Flocculant Information

"Lou Koenig"
<LKoenig@zinkan.com>
11/14/2011 09:17 AM

To <sskallet@sehinc.com>
cc "Jim Zinkan" <JZinkan@zinkan.com>, "Pam Rushing" <PRushing@zinkan.com>, "Adam Pavlovich" <APavlovich@zinkan.com>, "Edward Zaragoza"
bcc
Subject O'B Floc AD 605 XX and CSH 661 Environmental Compatibility

History: This message has been replied to and forwarded.

Dear Shanna,

Both of these products O'B Floc AD 605 XX and CSH 661 are used to treat drinking water. As such they are very widely used, well known by environmental authorities and very safe. In other cases they are used to clean up water before discharge. These polymers react with the solids and are permanently bound to them. So they are not discharged into the environment. These products do not bioaccumulate and have no environmental impact. I have attached MSDS and a separate toxicological and ecological summary sheet. I have also included a pamphlet on the very safe process of producing acrylamide for the O'B FLOC 605XX with enzymes.
Hope this helps,

Sincerely,

Louis J. Koenig Jr.
Chemist

Please consider the environment before printing this email.

Zinkan Enterprises Inc.
1919 Case Parkway North
Twinsburg OH 44087

800-229-6801
330-425-8202 Fax


PA0610 MSDS O'B FLOC AD-605XX.pdf


PC0661 MSDS.pdf


O'B FLOC CS 661TOX & ECO.pdf


O'B FLOC AD-605XXTOX & ECO.pdf


Enzymatically Produced Acrylamide.pdf

ZINKAN ENTERPRISES INCORPORATED

MATERIAL SAFETY DATA SHEET

1. Identification of the Product and the Company

O'B FLOC AD-605XX

Zinkan Enterprises, Inc.

1919 Case Parkway North

Twinsburg, Ohio 44087

Tel: 1-800-229-6801 Fax: 1-330-425-8202

Emergency Contact: Infotrac 1-800-535-5053

2. Composition/ Information On Ingredients

Components	CAS Number	OSHA/PEL	ACGIH/TLV	Weight

3. Hazards Identification

Anionic water-soluble polymer.

4. First Aid Measures

Inhalation: Move to fresh air

Skin Contact: Wash off immediately with soap and plenty of water Remove contaminated clothing

Eye Contact: Rinse thoroughly with plenty of water. In case of persistent eye irritation, consult a physician.

Ingestion: The product is not considered toxic based on studies on Laboratory animals.

5. Fire-Fighting Measures

Suitable extinguishing media: Base selection on source of fire.

Special fire-fighting precautions: Aqueous solutions or powders that become wet render Surfaces extremely slippery

Protective equipment for firefighters: Self-contained breathing apparatus and protective clothing

6. Accidental Release Measures

Personal precautions: No special precautions required.

Environmental precautions: Do not contaminate water

Methods for cleaning up: Clean up material promptly by sweeping or vacuuming Flush traces away with water

7. Handling and Storage

Handling: Avoid contact with skin and eyes. Ensure there is adequate ventilation Do not smoke. Do not breathe dust.

Storage: Keep container closed when not in use. Make sure there is adequate ventilation. Keep in cool dry place

8. Exposure Controls/ Personal Protection

Engineering controls: Use local exhaust if dusting occurs Natural ventilation is adequate in absence of dusts.

Personal Protection Equipment

Respiratory Protection: Dust masks are recommended when concentration of total dust is more than 10 mg/m3

Hand Protection: Rubber gloves.

Eye Protection: Safety glasses with side-shields. Do not wear contact lenses.

Skin Protection: Chemical resistant apron or suit if splashing of solution is likely

Hygiene Measures: Wash hands before breaks and immediately after handling product. Handle in accordance with good industrial hygiene and safety practice

9. Physical and Chemical Properties

Form: Granular solid.

Color: White

Odor: No odor.

pH: 4-9 @ 5 g/l.

Melting Point (°C): Not applicable

Flash Point (°C): Does not flash.

Autoignition Temperature (°C): Does not ignite

Vapor Pressure (mm Hg): Same as water.

Water Solubility: Complete.

10. Stability and Reactivity

Stability: Product is stable, no hazardous polymerization will occur
Oxidizing agents may cause exothermic reactions

Hazardous Decomposition products: Thermal decomposition may produce: carbon oxides (COx), nitrogen oxides (NOx)

11. Toxicological Information

Acute Toxicity

Oral: LD50/oral/rat > 5000 mg/kg.

Dermal: The results of testing on rabbits showed this material to be non-toxic even at high dose levels.

Inhalation: This product is not expected to be toxic by inhalation

Irritation

Skin: The results of testing on rabbits showed material to be non-irritating to the skin

Eyes: May cause eye irritation with susceptible persons

Sensitization: The results of testing on guinea pigs showed this product to be non-sensitizing.

Chronic Toxicity: Two-year feeding study on rats and dogs revealed no adverse health effects

12. Ecological Information

Fish: LC50/Danio rerio/96 hr > 100 mg/L (OECD 203) (Based on results obtained from tests of analogous products.)

Algae: IC50/Scenedesmus subspicatus/72hr > 100 mg/L (OECD 201) (Based on results obtained from tests of analogous products.)

Daphnia: EC50 /Daphnia magna/48 hr > 100 mg/L (OECD 202) (Based on results obtained from tests of analogous products.)

Bioaccumulation: Does not bioaccumulate

Persistence/ Degradability: Not readily biodegradable.

13. Disposal Considerations

Waste from residues/ Unused products: In accordance with federal, state and local regulations

Contaminated Packaging: Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations

14. Transport Information

Not regulated by DOT, IATA, IMDG. Cleaning compound Dry NMFC: 48580 03

15. Regulatory Information

All components of this product are on the TSCA and DSL inventories.

WHMIS (CANADA):	Not Regulated
RCRA status:	Not a hazardous waste
Hazardous waste number:	Not applicable
Reportable quantity (40 CFR 302):	Not applicable
Threshold planning quantity (40 CFR 355):	Not applicable
California Proposition 65 information:	The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986: This product contains a chemical(s) known Reportable quantity (40 CFR 302) : to the State of California to cause cancer : residual Acrylamide

HMIS & NFPA Ratings	HMIS	NFPA
Health:	1	1
Flammability:	1	1
Reactivity:	0	0
Personal Protection:	B	

16. Other Information

Person to contact: **Regulatory Affairs Manager**

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release, and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process unless specified in the text.

TOXICOLOGICAL INFORMATION

Acute toxicity

- Oral : LD50/oral/rat > 5000 mg/kg

- Dermal : The results of testing on rabbits showed this material to be non-toxic even at high dose levels.

- Inhalation : The product is not expected to be toxic by inhalation.

Irritation

- Skin : The results of testing on rabbits showed this material to be non-irritating to the skin.

- Eyes : Testing conducted according to the Draize technique showed the material produces no corneal or iridial effects and only slight transitory conjuctival effects similar to those which all granular materials have on conjuctivae.

Sensitization : The results of testing on guinea pigs showed this material to be non-sensitizing.

Chronic toxicity : A two-year feeding study on rats did not reveal adverse health effects. A two-year feeding study on dogs did not reveal adverse health effects.

ECOLOGICAL INFORMATION

- Fish LC50/Danio rerio/96 hr > 100 mg/L (OECD 203) (Based on results obtained from tests of analogous products.)

- Algae : IC50/Scenedesmus subspicatus/72hr > 100 mg/L (OECD 201) (Based on results obtained from tests of analogous products.)

- Daphnia : EC50 /Daphnia magna/48 hr > 100 mg/L (OECD 202) (Based on results obtained from tests of analogous products.)

Bioaccumulation : Does not bioaccumulate.

Persistence / degradability : Not readily biodegradable.

MATERIAL SAFETY DATA SHEET

1. IDENTIFICATION OF THE PRODUCT AND THE COMPANY

O'B FLOC CSH-661

Supplier :

ZINKAN ENTERPRISES, INC

1919 CASE PARKWAY NORTH

TWINSBURG, OHIO 44087

Tel :800-229-6801 Fax : 330-425-8202

2. COMPOSITION/INFORMATION ON INGREDIENTS

Identification of the preparation : Cationic polymer in solution

Identification of the substance :

3. HAZARDS IDENTIFICATION

Spills produce extremely slippery surfaces.
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

4. FIRST AID MEASURES

Inhalation : Move to fresh air.

Skin contact : Wash with water and soap as a precaution. In case of persistent skin irritation, consult a physician.

Eye contact : Rinse thoroughly with plenty of water, also under the eyelids. In case of persistent eye irritation, consult a physician.

Ingestion : The product is not considered toxic based on studies on laboratory animals.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media : Water, water spray, foam, carbon dioxide (CO2), dry powder

Fire extinguishing agents to avoid : None

Special fire-fighting precautions : Spills produce extremely slippery surfaces.

Protective equipment for firefighters : No special protective equipment required.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions : No special precautions required.

Environmental precautions : Do not contaminate water.

Methods for cleaning up : Do not flush with water. Dam up. Soak up with inert absorbent material. If liquid has been spilled in large quantities clean up promptly by scoop or vacuum. Keep in suitable and closed containers for disposal. After cleaning, flush away traces with water.

7. HANDLING AND STORAGE

Handling : Avoid contact with skin and eyes. When preparing the working solution ensure there is adequate ventilation. When using do not smoke.

Storage : Keep in a dry, cool place (0 - 30°C). Keep away from heat and sources of ignition. Freezing will affect the physical condition and may damage the material.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering controls : Use local exhaust if misting occurs. Natural ventilation is adequate in absence of mists.

Personal protection equipment

- ***Respiratory protection :*** In case of insufficient ventilation wear suitable respiratory equipment.
- ***Hand protection :*** Rubber gloves.
- ***Eye protection :*** Safety glasses with side-shields. Do not wear contact lenses.
- ***Skin protection :*** Chemical resistant apron or protective suit if splashing or contact with solution is likely.

Hygiene measures : Wash hands before breaks and at the end of workday. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Form : liquid

Color : clear yellow liquid

pH : 5.0 - 9.0 for product series. See Technical Bulletin for specific value.

Flash point (°C) : >100°C

Autoignition temperature (°C) : >200°C

Vapour pressure (mm Hg) : No data available

Bulk density : See Technical Bulletin

Water solubility : Completely miscible

Viscosity (mPa s) : See Technical Bulletin

10. STABILITY AND REACTIVITY

Stability : Product is stable, No hazardous polymerization will occur..

Oxidizing agents may cause exothermic reactions.

Hazardous decomposition products : No decomposition if stored and applied as directed. Burning of the dried material can produce : hydrogen chloride gas, nitrogen oxides (NOx) carbon oxides.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

- Oral : LD50/oral/rat > 2000 mg/kg (estimated)

- Dermal : LD50/dermal/rat > 2000 mg/kg (estimated)

- Inhalation : The product is not expected to be toxic by inhalation.

Irritation

- Skin : Testing conducted on rabbits according to the Draize technique showed the material to be mildly irritating to the skin.

- Eyes : Testing conducted according to the Draize technique showed the material produces no corneal or iridial effects and only slight conjuctival effects.

Sensitization : Not sensitizing.

Chronic toxicity : NOEL/oral/rat/90days = 2000 mg/kg

Other information : Not mutagenic in AMES Test. Not mutagenic in micronucleus test on mice.

12. ECOLOGICAL INFORMATION

Ecotoxicity:

The effects of this product on aquatic organisms are rapidly and significantly mitigated by the presence of dissolved organic carbon in the aquatic environment.

- Fish LC50/Danio rerio/96 hr > 10 mg/l (OECD 203)

- Algae : Algal inhibition tests are not appropriate. The flocculating characteristics of the product interfere directly in the test medium preventing homogenous distribution which invalidates the test.

- Daphnia : EC50/Daphnia magna/48 hr > 10 mg/l (OECD 202)

Bioaccumulation : Does not bioaccumulate.

Persistence / degradability : Not readily biodegradable.

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products : In accordance with federal, state and local regulations.

Contaminated packaging : Rinse empty containers with water and use the rinse water to prepare the working solution. Can be landfilled or incinerated, when in compliance with local regulations.

14. TRANSPORT INFORMATION

Not regulated by DOT.

15. REGULATORY INFORMATION

All components of this product are on the TSCA and DSL inventories.

RCRA status : Not a hazardous waste.

Hazardous waste number : Not applicable

Reportable quantity (40 CFR 302) : Not applicable

Threshold planning quantity (40 CFR 355) Not applicable

California Proposition 65 information : Not applicable

HMIS & NFPA Ratings	HMIS	NFPA
Health :	1	1
Flammability :	0	0
Reactivity :	0	0

16. OTHER INFORMATION

Person to contact : Regulatory Affairs Manager

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Bioaccumulation : Does not bioaccumulate.

SNF HOLDING COMPANY

ONE CHEMICAL PLANT ROAD • RICEBORO, GEORGIA 31323

ENZYMATICALLY PRODUCED ACRYLAMIDE

Improving the environment, an additional benefit of building a better product

Scott Ramey & George Tichenor, Ph.D.

SNF HOLDING COMPANY

ONE CHEMICAL PLANT ROAD • RICEBORO, GEORGIA 31323

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ENZYMATICALLY PRODUCED ACRYLAMIDE

Improving the environment, an additional benefit of building a better product

Scott Ramey
SNF Holding Company
&
George Tichenor, Ph D
SNF Holding Company
One Chemical Plant Road
Riceboro, GA 31323

ABSTRACT

Ever-increasing requirements for performance improvements in clarification, thickening and dewatering of municipal and industrial sludges, place more emphasis on the chemical enhancement of liquids–solids separation This enhancement is commonly gained by using a polyacrylamide flocculant, also referred to as "polymer" Market trends in polymer sales seem to indicate the demand for higher molecular weight polymer products is following the growing restraints on wastewater treatment operations

There are multiple limiting factors in the production of high molecular weight polymer products; however, the most common is directly related to the quality of the acrylamide used for polymerization The traditional method of manufacturing acrylamide has always limited the achievable molecular weight and increased the polydispersity of polymers due to the use of high temperature and copper catalyst SNF Floerger (SNF), under license of Mitsubishi Rayon, has not only developed a method to increase the molecular weight of polymer products by utilizing a unique method of producing acrylamide, but in the process has commercialized the first enzymatically produced acrylamide, a more beneficial product, safer to produce

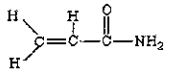
KEYWORDS

Acrylamide, Polyacrylamide, Polymer, Flocculant, Enzyme

INTRODUCTION

Estimated annual expenditures for polymer by U S municipal operations exceeds $120,000,000 These polymers are actually made up of acrylamide and various components copolymerized to produce unique features While acrylamide is also used in a number of consumer products, the product group we will simply refer to, as "polymers" is of particular interest in the operation of wastewater treatment facilities, whether municipal or industrial The estimated 2001 demand for acrylamide in the U S was just over 200,000,000 pounds

Acrylamide



Acrylamide-based polymers provide the important function of enhancing liquid-solid separation by inducing destabilized particles into aggregates we refer to as "flocs" This phase is called flocculation Polymers or flocculants are based on acrylamide because it is:

- Water soluble
- Produces high molecular weights
- Can be co polymerized
- Relatively inexpensive

The traditional method of producing acrylamide is the copper catalyzed reaction of acrylonitrile and water The conversion of acrylonitrile to acrylamide employs three sequential chemical reactors at high temperature (130° C) and pressure (4 bar) to give approximately 60%, 70% and 90% conversion, respectively Acrylamide and residual acrylonitrile flow from the reactors to a concentration unit to remove as much acrylonitrile as possible. The collected emission from this process, acrylonitrile, must be controlled using expensive scrubber equipment This process must be maintained under vacuum (55 mmHg) using steam jets and high temperature (95° C), which adversely causes some polymerization of acrylamide due to the liquid-vapor contact. The boiler required for this step has it's own emissions problems such as; NOx, VOC's. SO_2 and CO. Once the acrylonitrile has been removed, the acrylamide passes through ion exchange columns to remove residual copper The copper must be removed by ion exchange columns to eliminate the by-products formed when exposed to higher temperatures After a period of time the ion exchange columns can no longer be regenerated and must be replaced The copper catalyst is washed and regenerated with sulfuric acid that will release hydrogen to the atmosphere. Before the acrylamide product is transferred to storage, 25 ppm of Cu is added for stabilization To obtain a more pure acrylamide, a second ion exchange treatment is performed to remove some of the anionic impurities formed during the reaction These impurities become pollutants requiring additional treatment. Obviously, more details of this process exist; this is but a generalized explanation

DISCUSSION

The acrylamide produced in a traditional manner contains impurities, which reduce the ability to further increase the molecular weight of polyacrylamides and increases polydispersity The molecular weight and polydispersity of polyacrylamide are directly related to the purity of the acrylamide

Improvements to polymer products can have a direct impact to the clarification, thickening and dewatering operations of municipal and industrial wastewater treatment facilities Wastewater operations face increasingly strict regulations and standards We find facilities struggling to improve the performance of sludge thickening, dewatering and disposal This dewatering performance is measured by; capture rate, cake quality or dryness, throughput and operating cost Polymer is frequently looked to in improving performance and poor polymer performance can literally determine a wastewater treatment plant's success or failure

SLUDGE THICKENING AND DEWATERING EFFICIENCY

- Cake dryness is widely used as the determining factor for dewatering success The focus of the dewatering process is to produce the driest cake possible Facilities discharging cake not meeting cake dryness standards are penalized with additional hauling cost and, where applicable, additional landfill cost Polymer is used to assist sludge dewatering performance Typically the cost or penalty of not producing required cake solids far outweighs polymer cost. A polymer product capable of actually increasing cake solids is sold at a premium

- The efficiency of any dewatering machine to remove solids from the process flow is referred to as "capture rate" A belt filter press providing a 95% capture rate is removing 95% of the total suspended solids passed through the machine The remaining 5% TSS is lost to the machine effluent and returns to the treatment plant for additional treatment and thus additional cost Again, polymer products are employed to increase capture rate

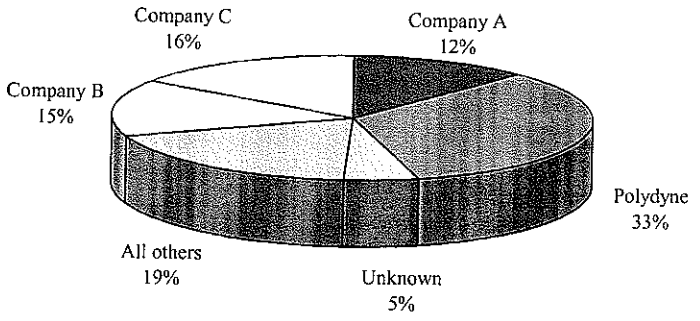
- The total amount of sludge processed by a machine while meeting all performance criteria is known as "throughput" Improved polymer performance commonly increases machine throughput Poor polymer performance will limit throughput and either require more dewatering units be placed on-line, more overtime hours for the operators or the unacceptable backlogging of solids to the plant

- The operating cost of the dewatering process is heavily influenced by polymer performance Not only does the simple cost of polymer and it's application play a factor but, more importantly, the performance or lack thereof affects the rate of recycled solids, number of machines required to process the plant's sludge, hauling cost for the sludge produced and disposal cost What may seem to be a small issue in the day-to-day operations can indeed have a dramatic impact on total plant cost.

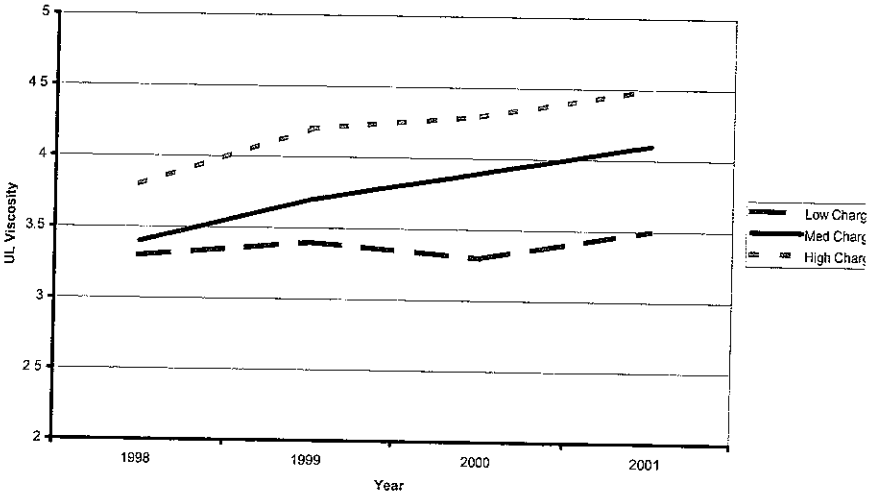
Technological advancements in the equipment used to dewater municipal biological sludge continue to make great gains in addressing all criteria previously discussed This is but one reason we have seen a growing interest in high-speed centrifugation While initial cost of this equipment, and increased polymer consumption has kept some facilities from using centrifuges, analysis will often prove that when higher cake solids are necessary or worthwhile, centrifugation becomes the dewatering method of choice Attempting to address the increase in polymer demand of centrifuges, chemical manufacturers have worked hard to develop new polymer products Further improvements that may reduce polymer consumption and improve dewatering and thickening performance will be of tremendous benefit to municipalities

Wanting to build that better polymer product, SNF Floerger reviewed internal sales data seeking trends in product demands Analysis of polyacrylamide products produced by SNF Floerger and sold to the U S municipal market demonstrates a trend in product specifications requested or required to meet customers' needs The municipal sales organization of SNF Floerger, Polydyne Inc., currently supplies about 33% of the U S municipal market polyacrylamide demand The sales trend, or better, product requirements of this large segment, will serve to demonstrate a trend in requirements

U.S. Municipal polyacrylamide sales distribution



Average UL Molecular Weight (Polydyne)

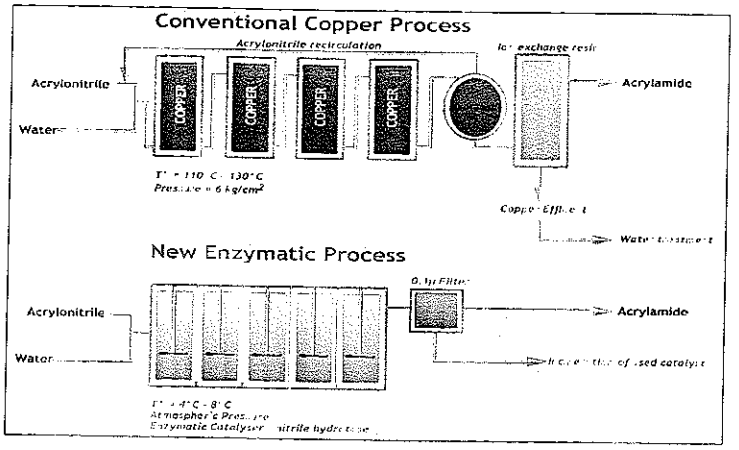


Reviewing the data it was noted that lower charge products (0-30% mol) are not being required in higher molecular weights to the degree we see in the higher charge products Medium (30%-50% mol) to high (50%+) charge products are in highest demand and constitute 70% of products sold

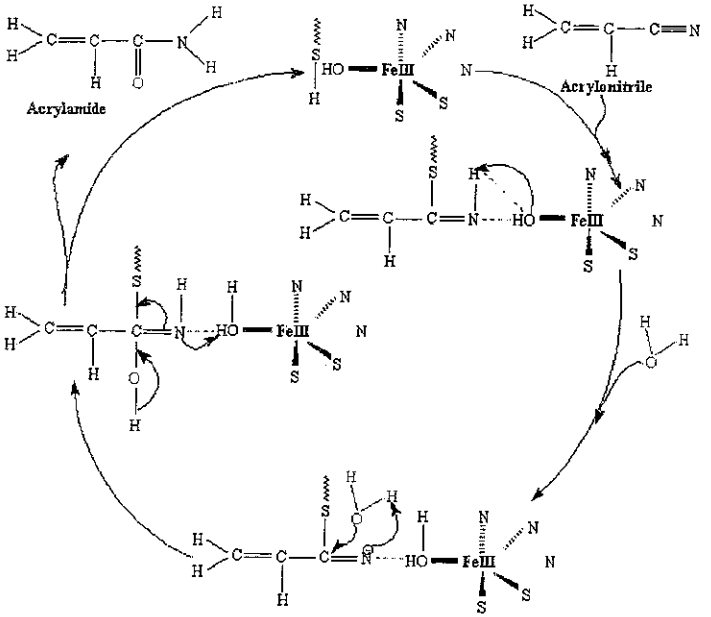
Since tracking of this data began in 1998, the requirement for polyacrylamides at increasingly higher molecular weights is demonstrated by analysis of product sales during that timeframe It is an easy assumption that other markets could benefit from the ability to produce higher molecular weights and better consistency Finding a method to build higher molecular weight products seemed the answer to meeting the demands of the marketplace Traditional acrylamide, due to impurities, would hinder producing such a product

In 1999, SNF began construction of seven plants that would manufacture high grade, high purity acrylamide using an enzymatic process A route for hydrolysis of acrylonitrile to acrylamide using the enzyme nitrile hydratase from Rhodococcus rhodochrous was developed The enzyme is immobilized in a copolymer and can produce acrylamide concentrations greater than 500 g/l The catalyst is sized small enough so there are no diffusional limitations

Enzymes are novel among catalysts in that they are capable of directing asymmetric transformations with complete selectivity under low temperature conditions Enzymatic conversions, such as acrylonitrile to give acrylamide in high optical purity, have few counterparts in traditional chemical catalysis such as the copper catalysis Unlike most chemical manufacturing catalysts, enzymes work in water, at ambient temperature and near neutral pH, thus eliminating all cross-linking by-products Enzymes are easy to dispose of since they are composed of biodegradable protein and emissions are insignificant Thus, enzymes are the ideal "green" catalyst, producing less waste and consuming far less energy



The enzyme SNF uses to convert acrylonitrile to acrylamide is not genetically altered and therefore not TSCA listed The enzyme is dead and presents no challenge to any other organic compounds and does not cause bioaugmentation to other species The enzyme is very specific to the geometrical configuration of acrylonitrile During conversion the enzyme (catalyst) produces a natural stabilizing agent Conversion is greater than 99 99%, which eliminates the need for concentration and stripping. The only utility required is chilled water to remove heat from the exothermic reaction



Graphic by: Woelsung Yi
Based on data from:
Yamada, H. and M. Kobayashi (1996) Nitrile hydratase and its application to industrial production of acrylamide Biosci Biotechnol Biochem 60:1391-1400

CONCLUSION

The U.S. municipal wastewater market for polyacrylamide flocculants has demonstrated a need for higher molecular weight products. Manufacturers of these products have been limited in their ability to produce higher molecular weights due to the poor quality of acrylamide available In addition, traditional methods of producing this acrylamide are inefficient, require large energy sources, produce a hazardous by-product, are known polluters of our environment and are somewhat dangerous to operate

The enzymatic production of acrylamide used by SNF Floerger produces the highest purity acrylamide mass-manufactured, and does so in a safe, reliable manner Energy is conserved and no hazardous waste is generated

The ability to eliminate hazardous waste and create a much safer work environment were reasons enough to make such a large-scale company wide conversion however, the ability to produce a higher quality polyacrylamide has made this venture a major success Polyacrylamide products can now be produced at higher molecular weights while, in general, all products produced by SNF Floerger have greatly improved in quality

For more information on how improved acrylamide quality can help your company, please contact SNF Holding Company at (912) 884-3366 or visit our website at www.snf.us

Appendix G

WisDOT Standard Specifications for Highway and Structure Construction (2012 Edition)

G-1 – Section 625: Topsoil and Salvaged Topsoil

G-2 – Section 627: Mulching

G-3 – Section 630: Seeding

G-1 – Section 625: Topsoil and Salvage Topsoil

SECTION 625 TOPSOIL AND SALVAGED TOPSOIL

625.1 Description

(1) This section describes furnishing, placing, spreading, and finishing humus-bearing soil, adapted to sustain plant life, commonly known as topsoil, from locations the contractor furnishes beyond the limits of the right-of-way.

(2) This section also describes removing topsoil from the sites of proposed roadway excavations and embankments in amounts and depths available and necessary to cover the work slopes. This work also includes reclamation, placing, spreading, and finishing of this topsoil.

625.2 Materials

(1) Topsoil consists of loam, sandy loam, silt loam, silty clay loam, or clay loam humus-bearing soils adapted to sustain plant life, and ensure this topsoil is in a Ph range of 6.0 to 7.0.

(2) Salvaged topsoil consists of the loam, sandy loam, silt loam, silty clay loam or clay loam humus-bearing soils available from overlying portions of areas to be occupied by the completed roadway.

625.3 Construction

625.3.1 Preparing the Roadway for Topsoil

(1) Undercut or underfill all areas designated to receive topsoil to a degree that if covered to the required depth with topsoil the finished work conforms to the required lines, grades, slopes and cross sections the plans and drawings show.

625.3.2 Processing Topsoil or Salvaged Topsoil

(1) Mow topsoil procurement areas to a height of approximately 6 inches. Remove litter such as brush, rock, and other materials that will interfere with subsequent vegetation establishment.

(2) Strip off the humus-bearing soil. Take care to minimize removing the underlying sterile soil. Then stockpile the topsoil on the right-of-way or place it directly on the designated areas.

(3) Under the Salvaged Topsoil bid item, remove topsoil from excavation areas and the roadway foundation up to the quantity necessary to cover the slopes for the bid items of Salvaged Topsoil and Topsoil. Salvage topsoil from embankment areas outside the roadway foundation only if that additional material is required to cover the slopes.

(4) Use Salvaged Topsoil in excess of the contract quantity to replace contract quantities of Topsoil. Utilize excess topsoil on the project or dispose of as specified in 205.3.12.

625.3.3 Placing

(1) After preparing and finishing the areas designated for topsoil to the required lines, grades, slopes and cross section, place and spread the topsoil to a uniform depth as the plans show or the contract requires. If no depth is shown, place and spread the topsoil to a minimum depth of 4 inches in rural areas and a minimum depth of 6 inches in urban areas, or as the engineer designates.

(2) Break down all clods and lumps using the appropriate equipment to provide a uniformly textured soil.

(3) Where using either sod or seed mixture 40 ensure that, for the upper 2 inches, 100 percent of the material passes a one-inch sieve and at least 90 percent passes the No. 10 sieve.

(4) Remove rocks, twigs, foreign material, and clods that cannot be broken down. Dress the entire surface to present a uniform appearance. The engineer will not require rolling.

(5) If light sandy soils are covered with heavier clay bearing loam topsoil, then mix or blend the 2 types of soils to a more or less homogeneous mixture by using the appropriate equipment.

625.4 Measurement

625.4.1 Topsoil

(1) The department will measure Topsoil acceptably completed by the square yard or by the cubic yard, whichever the contract specifies.

(2) If the department measures by the square yard, the measured quantity shall equal the actual number of square yards of topsoiled area to the depth specified within the limits of construction designated on the plans, or in the contract, or as the engineer directs.

(3) If measured by the cubic yard, the department will measure material in the vehicle. If the contractor transports the material in vehicles not adapted for measurement, then the department will measure the

material in cubic yards of volume in its original position computed by the method of average end areas with no correction for curvature; or if the engineer elects, by the method of truncated prisms.

625.4.2 Salvaged Topsoil

(1) The department will measure Salvaged Topsoil by the square yard acceptably completed. The quantity measured for payment shall equal the actual number of square yards of area topsoiled to the depth specified within the limits of construction designated on the plans or in the contract, or as the engineer directs.

625.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
625.0100	Topsoil	SY
625.0105	Topsoil	CY
625.0500	Salvaged Topsoil	SY

625.5.1 Topsoil

(1) Payment for Topsoil is full compensation for providing, excavating, loading, hauling, and placing this material; and for undercutting excavations, or underfilling embankments necessary to receive this material. The department will make no allowance, adjustment, or measurement for payment under the Excavation bid items for undercutting cut sections, or underfilling embankments.

625.5.2 Salvaged Topsoil

(1) Payment for Salvaged Topsoil is full compensation for removing, stockpiling, reclaiming, hauling, and placing this material; and for undercutting excavations, or underfilling embankments necessary to receive this material. The department will make no deductions from the Excavation bid items for the quantities of Salvaged Topsoil material obtained from areas of cut sections. Additionally, the department will not measure or pay for the volumes of Salvaged Topsoil removed from sites of proposed embankments under the Excavation bid items, or make any allowance, adjustment, or measurement for payment under the Excavation bid items for undercutting cut sections, or underfilling embankments.

(2) If an area is damaged by erosion after partial acceptance, the department will pay for restoring topsoil in these areas at a unit price determined by multiplying the contract unit price bid for Salvaged Topsoil by 3, or absent that bid item in the contract, as the contract unit price bid for Topsoil multiplied by 3, The department will pay for restoration under the Restoration Post Acceptance Topsoil administrative item.

(3) The department will not pay for removing topsoil from outside the roadway foundation in embankment areas unless that material is necessary to cover the slopes.

G-2 – Section 627: Mulching

SECTION 627 MULCHING

627.1 Description

(1) This section describes furnishing, placing, and anchoring a mulch cover, usually in connection with seeding the surfaces of the roadway.

627.2 Materials

(1) Mulching material consists of straw or hay in an air-dry condition, wood excelsior fiber, wood chips, or other suitable material of a similar nature that the engineer approves, and is substantially free of noxious weed seeds and objectionable foreign matter.

(2) If using tackifier, the department will prequalify it before use. Select tackifiers from the department's erosion control product acceptability list (PAL). The contractor may obtain a copy of the PAL and the prequalification procedure for products not on the PAL from the department.

627.3 Construction

627.3.1 General

(1) Unless directed otherwise, place the mulch on the specified area within 2 days after completing the seeding.

(2) The contractor shall not perform mulching during periods of excessively high winds that might preclude proper mulch placement.

(3) Place the mulch loosely or open enough to allow some sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, conserve soil moisture, and prevent or reduce erosion.

(4) Maintain the mulched areas and repair all areas damaged by wind, erosion, traffic, fire or other causes before final or partial acceptance of the work.

627.3.2 Placing

(1) The contractor may perform the work as specified in one of the following ways: Method A, Method B, or Method C, or a combination of the 3, unless a specific method is specified in the contract.

627.3.2.1 Method A, Netting

(1) Uniformly spread the mulching material over the designated areas to a loose depth of 1/2 to 1 1/2 inches. Use a specific rate of application; dependent on the character of the material, that results in a cover conforming to the requirements specified above in 627.3.1. Loosen or make fluffy the mulch material from compacted bales before spreading in place. Unless directed otherwise, begin mulching at the top of the slopes and proceed downward.

(2) Securely anchor straw or hay mulch by using engineer-approved netting anchored to the ground with pegs or staples to prevent it from floating as the vegetation grows. Instead of this anchorage, the contractor may secure mulch by heavy biodegradable twine fastened by pegs or staples to form a grid with 6 to 10 feet spacing.

(3) The contractor may use department-approved erosion control mats, listed in the PAL, instead of separately applying mulch and netting.

627.3.2.2 Method B, Tackifier

(1) Treat straw or hay with a tackifier, blow from a machine, and uniformly deposit over designated areas in one operation. Place straw or hay uniformly over the area 1/2 to 1 inch deep, using 1/2 to 3 tons of mulch per acre. Mix and place tackifier according to the PAL. Within the above limits, the engineer will determine, on the job, the application rate of the mulch and the tackifier, and the engineer may vary the rates during mulching to produce the desired results. Use an engineer-approved machine to place the mulch that blows or ejects by constant air stream a controlled amount of mulch and applies a spray of tackifier to partially coat the straw or hay, sufficient to hold together and keep in place the deposited straw or hay. The contractor may apply the tackifier as an overspray in a separate operation after placing the straw or hay.

(2) Apply wood fiber, wood chips, or similar material with engineer-approved blowing machines, or other engineer-approved methods, that place a controlled amount of mulch uniformly over the area 1/2 to 1 1/2 inches deep. Treat areas receiving wood chip mulch, with one pound of available nitrogen per 1000 square feet before or after applying the chips.

(3) Throughout the process, feed the mulch material into the blowing machine to produce a constant and uniform ejection from the discharge spout, and operate in a position to produce mulch of uniform depth and coverage.

627.3.2.3 Method C, Crimping

(1) Spread the straw or hay mulch uniformly over the designated areas to a loose depth of 1/2 to 1 1/2 inches, using 1/2 to 3 tons of mulch per acre, by blowing from a machine, as specified in Method B, or by other engineer-approved methods.

(2) Immediately after spreading, anchor the mulch in the soil by using a mulch crimper consisting of a series of dull, flat discs with notched edges. Space the 20 inch diameter discs at about 8 inch centers. Equip the crimper with a ballast compartment to allow adjusting the weight for depth control.

(3) Impress the mulch into the soil 1 1/2 to 2 1/2 inches deep in one pass of the crimper. The department will not allow mulch crimpers to operate on slopes so steep that damage to the mulch, seedbed, or soil occurs. Anchor the mulch on these areas by one of the following methods: Method A or Method B. Equip and operate tractors to minimize disturbing or displacing the soil. This process may require more than one pass of the crimper to ensure adequate anchoring of the mulch.

(4) The contractor shall not use Method C if it cannot impress the mulch to a minimum of 1 1/2 inch.

627.4 Measurement

(1) The department will measure Mulching acceptably completed by the square yard or by the ton, whichever the contract specifies.

(2) If measured by the square yard, the measured quantity equals the number of square yards of surface area that the contractor applied the mulch.

(3) If measured by the ton, the measured quantity equals the number of tons of mulch provided, placed, and acceptably completed.

(4) Tackifiers or nitrogen used for treating mulch are incidental to the cost of the work.

627.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
627.0200	Mulching	SY
627.0205	Mulching	TON

(2) Payment for Mulching is full compensation for providing all materials, including tackifiers or nitrogen; for all hauling, treating, placing, spreading, and anchoring of the mulch material; and for maintaining the work and repairing all damaged areas.

(3) If the contractor opts to use department-approved erosion control mats instead of separately applying mulch and netting, the department will pay for it at the contract unit price for Mulching only.

G-3 – Section 630: Seeding

SECTION 630 SEEDING

630.1 Description

(1) This section describes preparing seed beds and furnishing and sowing the required seed on slopes, appurtenances, and other areas, and on borrow pits and material disposal sites.

(2) This section also describes furnishing and sowing temporary seed mixture on the slopes and appurtenances of temporary embankments and roadways.

630.2 Materials

630.2.1 Seed

630.2.1.1 General Requirements

(1) Conform to the Wisconsin statutes and Wisconsin administrative code chapter ATCP 20 regarding noxious weed seed content and labeling.

(2) Use seed within one year of the test date appearing on the label.

(3) Seed mixtures 70, 70A, 75, and 80 contain wild type forbs and grasses. Wild type is defined as seed that is derived directly from native, wild stock, including seed that was wild collected and placed into production or has been harvested directly from native stands.

630.2.1.2 Purity and Germination

(1) Test seed according to the methods and procedures used for sampling and analyzing seed for purity, germination, and noxious weed seed content specified in the current edition of Rules for Testing Seed, published by the Association of Official Seed Analysts.

630.2.1.3 Inoculation

(1) Inoculate legume seed (white clover, red clover, ladino clover, alsike clover, alfalfa, empire birdsfoot trefoil, partridge pea, purple prairie clover, Canada tick-trefoil, and lupine) unless it has been pre-inoculated by the vendor. Follow the inoculation instructions that come with the culture purchases. If applying the seed according to method B, 630.3.3.2, treat seeds requiring inoculation with 5 times the amount of inoculant recommended in the instructions.

(2) Avoid exposure of the culture or inoculated seed to the sunlight, and in no case shall any exposure exceed 1/2 hour.

630.2.1.4 Storing Seed

(1) Store any seed delivered before use in a way that protects it from damage by heat, moisture, rodents, or other causes. Discard and replace any previously tested and accepted seed that becomes damaged.

630.2.1.5 Seed Mixtures

630.2.1.5.1 Right-of-Way

630.2.1.5.1.1 Permanent

####### 630.2.1.5.1.1.1 Composition

(1) Seed mixtures for use on the right-of-way and easements shall, unless specified otherwise, be composed of seeds of the purity, germination, and proportions, by weight, as given in the Table of Highway Seed Mixtures and the Table of Native Seed Mixtures.

(2) Use seed of the species and varieties listed below. If no variety is listed, there will be no restriction on the variety furnished, except as follows:

1. Species composed of pure live seed (PLS) shall contain no named or improved varieties. PLS shall be grown in Wisconsin or northern Illinois, northeastern Iowa, or eastern Minnesota. Seed produced out-of-state must be grown in one of the following counties:

1.1 From northern Illinois:

Boone	Bureau	Carroll	Cook	De Kalb	Du Page	Grundy
Henry	Jo Daviess	Kane	Kendall	Lake	La Salle	Lee
McHenry	Ogle	Putnam	Rock Island	Stevenson	Whiteside	Will
Winnebago						

1.2 From northeastern Iowa:

Allamakee	Benton	Black Hawk	Bremer	Buchanan	Cedar	Chickasaw
Clayton	Clinton	Delaware	Dubuque	Fayette	Floyd	Howard

Jackson	Johnson	Jones	Linn	Mitchell	Muscatine	Scott
Winneshiek						

1.3 From eastern Minnesota:

Aitkin	Anoka	Carlton	Carver	Chisago	Dakota	Dodge
Fillmore	Goodhue	Hennepin	Houston	Isanti	Kanabec	La Sueur
Mille Lacs	Mower	Olmsted	Pine	Ramsey	Rice	Scott
Sherburne	Steele	Wabasha	Washington	Winona	Wright	

2. PLS for seed mixtures 70, 70A, 75, and 80 shall be packaged separately by species and clearly labeled with the vendor's name, species common and botanical names, gross weight, percent PLS, year of harvest and any specialized treatments that have been applied to ensure or enhance germination. If PLS is not listed, determine PLS by multiplying the percent germination times the percent purity.
3. Minimum percent purity for native for species is 90 percent. If a listed species is not available, substitutions may be made with engineer's approval and must be documented.

(3) Mix native species at the project site. Clean and debeard seeds having awns or excessive hairs before mixing.

SPECIES COMMON NAME	SPECIES BOTANICAL NAME	ACCEPTABLE VARIETIES
Kentucky Bluegrass	Poa pratensis	Low Maintenance
Red Fescue	Festuca rubra	Creeping
Hard Fescue	Festuca ovina var. duriuscula	Improved
Tall Fescue	Festuca arundinacea	Improved turf type
Salt Grass	Puccinella distans	Fult's
	Puccinella distans	Salty
Redtop	Agrostis alba	
Timothy	Phleum pratense	
Canada Wild Rye[1]	Elymus canadensis	
Perennial Ryegrass	Lolium perenne	
Perennial Ryegrass	Lolium perenne	Improved Fine
Annual Ryegrass	Lolium multiflorum	
Alsike Clover	Trifolium hybridum	
Red Clover	Trifolium pratense	
White Clover	Trifolium repens	
Birdsfoot Trefoil	Lotus corniculatus	Empire
Japanese Millet	Echinochola crusgalli var. frumentacea	
Annual Oats	Avena sativa	
Alfalfa	Medicago sativa	
Bromegrass	Bromus inermis	
Orchardgrass	Dactylis glomerata	
Ladino Clover	Trifolium repens var. latum	Ladino
Agricultural Rye	Secale cereale	
Winter Wheat	Triticum aestivum	

[1] Pure live seed

TABLE OF HIGHWAY SEED MIXTURES

SPECIES	PURITY minimum %	GERMINATION minimum %	MIXTURE PROPORTIONS in percent				
			NO.10	NO.20	NO.30	NO.40	NO.60
Kentucky Bluegrass	98	85	40	6	10	35	
Red Fescue	97	85	25		30	20	
Hard Fescue	97	85		24	25	20	
Tall Fescue	98	85		40			
Salt Grass	98	85			10		
Redtop	92	85	5				
Timothy	98	90					12
Canada Wild Rye		PLS[1]					10
Perennial Ryegrass	97	90	20	30			
Improved Fine Perennial Ryegrass	96	85			15	25	
Annual Ryegrass	97	90					30
Alsike Clover	97	90					4
Red Clover	98	90					4
White Clover	95	90	10				
Birdsfoot Trefoil	95	80			10		
Japanese Millet	97	85					20
Annual Oats	98	90[1]					20

[1] Substitute winter wheat for annual oats in fall plantings started after September 1.

TABLE OF NATIVE SEED MIXTURES

	SPECIES	SPECIES BOTANICAL NAME	PURITY & GERMINATION minimum %	MIXTURE PROPORTIONS in percent			
				NO. 70	NO. 70A	NO. 75	NO. 80
FORBES	Canada Anemone	*Anemone canadensis*	PLS	2			
	Butterflyweed	*Asclepias tuberosa*	PLS		2		
	New England Aster	*Aster novae-angliae*	PLS	2	2		
	Partridge-pea	*Chamaecrista (Cassia) fasciculata*	PLS		2		
	Purple Prairie Clover	*Dalea (Petalostemum) purpurea*	PLS	2	2	4	
	Canada Tick-trefoil	*Desmodium canadense*	PLS	2			
	Flowering Spurge	*Euphorbia corollata*	PLS		2		
	Wild Geranium	*Geranium maculatum*	PLS	2			
	Western Sunflower	*Helianthus occidentaalis*	PLS	3	2		
	Rough Blazingstar	*Liatris aspera*	PLS		2		
	Prairie Blazingstar	*Liatris pycnostachya*	PLS	2			
	Lupine	*Lupinus perennis*	PLS		3		
	Wild Bergamot	*Monarda fistulosa*	PLS	2			
	Horse Mint	*Monarda punctata*	PLS		2		
	Yellow Coneflower	*Ratibida pinnata*	PLS	2	2		
	Blackeyed Susan	*Rudbeckia hirta*	PLS			1	
	Showy Goldenrod	*Solidago speciosa*	PLS	2	2		
	Spiderwort	*Tradescantia ohiensis*	PLS	2	2		
	Golden Alexanders	*Zizia aurea*	PLS	2			
GRASSES	Big Bluestem	*Andropogon gerardi*	PLS	15	15	10	
	Sideoats Grama	*Bouteloua curtipendula*	PLS	15	20	20	25
	Canada Wildrye	*Elymus Canadensis*	PLS	15	15	35	23
	Slender Wheatgrass	*Elymus trachycaulus*	PLS				20
	Junegrass	*Koeleria macrantha*	PLS		5		
	Annual Ryegrass	*Lolium multiflorum*	[1]			10	10
	Switchgrass	*Panicum virgatum*	PLS				10
	Salt Grass	*Puccinella distans*	[1]				2
	Little Bluestem	*Schizachyrium (Andropogon) scoparium*	PLS	15	20	10	10
	Indiangrass	*Sorgastrum nutans*	PLS	15		10	
ALTERNATE FORBES	Sky Blue Aster	*Aster azureus*	PLS	[2]	[2]		
	White Wild Indigo	*Baptisia leucantha*	PLS	[2]	[2]		
	Pale Purple Coneflower	*Echinacea pallida*	PLS	[2]	[2]		
	White Prairie Clover	*Petalostemum candidum*	PLS	[2]	[2]		
	Stiff Goldenrod	*Solidago rigida*	PLS	[2]	[2]		
	Hoary Vervain	*Verbena stricta*	PLS	[2]	[2]		

[1] Provide the minimum purity and germination specified in 630.2.1.5.1.1.1(3) in the table of highway seed mixtures.

[2] The contractor may, if the engineer approves, substitute an alternate forb for a required forb that is not available using the same percentage as specified for the required forb. Use a different alternate forb for each unavailable required forb. Provide documentation showing that a required forb is not available before using an alternate.

630.2.1.5.1.1.2 Mixture

(1) The contractor shall select a seed mixture or mixtures that meet with the engineer's approval, and unless specified otherwise in the contract, shall conform to the following:

1. Use seed mixture No. 10 where average loam, heavy clay, or moist soils predominate.
2. Use seed mixture No. 20 where light, dry, well-drained, sandy, or gravelly soils predominate and for all high cut and fill slopes generally exceeding 6 to 8 feet, except where using No. 70.
3. Use seed mixture No. 10 or No. 20 on all ditches, inslopes, median areas, and low fills, except where using No. 30 or No. 70.
4. Use seed mixture No. 30 for medians and on slopes or ditches generally within 15 feet of the shoulder where a salt-tolerant turf is preferred.
5. Use seed mixture No. 40 in urban or other areas where a lawn type turf is preferred.
6. Use seed mixture No. 60 only on areas, the contract designates or the engineer specifies. Use it as a cover seeding for newly graded wet areas or as a nurse crop for specified wetland seed mixtures. The contractor shall not apply it to flooded areas.
7. Use seed mixture Nos. 70 and 70A on slopes and upland areas the contract designates or the engineer specifies. Use seed mixture No. 70 on loamy soils and seed mixture No. 70A on sandy soils.
8. Use seed mixture No. 75 where native grasses are desired for erosion control.
9. Use seed mixture No. 80 on inslopes where a salt tolerant seed mix containing native grasses is desired.

630.2.1.5.1.2 Temporary

(1) Under the Seeding Temporary bid item, use a temporary seed mixture conforming to 630.2.1.5.1.4. Use oats in spring and summer plantings. Use winter wheat or rye for fall plantings started after September 1.

630.2.1.5.1.3 Nurse Crop

(1) If seeding bare soil with either mixture 70, 70A, 75, or 80, include the work under the Seeding Nurse Crop bid item.

630.2.1.5.1.4 Borrow Pits and Material Disposal Sites

(1) For seeding borrow pits and material disposal sites beyond the right-of-way, use seed mixtures conforming to seed mixture 10, 20, 70, 70A, or 75 of 630.2.1.5.1.1 or a borrow pit mixture composed of seeds of the species, purity, germination and proportions, by weight as given below:

PERMANENT

SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Alfalfa	98	90
Bromegrass	85	85
Orchardgrass	80	85
Timothy	98	90
Red Clover	98	90
Alsike Clover	97	90
Ladino Clover	95	90
Kentucky Bluegrass	98	85
Birdsfoot Trefoil	95	80

TEMPORARY

SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Annual Oats	98	90
Agricultural Rye	97	85
Winter Wheat	95	90

NURSE CROP

SPECIES	% MINIMUM PURITY	% MINIMUM GERMINATION
Annual Oats	98	90

Annual Ryegrass	97	90
Winter Wheat	95	90

(2) For the borrow pit mixture use, by weight, 60 percent temporary species seeds and 40 percent permanent species seeds.

(3) For the temporary component, use any combination of temporary seeds listed in the table above.

(4) For the permanent component, use seeds from not more than 4 of the permanent species listed in the table above in any combination.

(5) When nurse crop is required for spring seeding before June 15, use annual oats. For fall seeding after October 15, use winter wheat, or annual ryegrass.

630.3 Construction

630.3.1 General

(1) If not protecting with a mulch cover, perform seeding, except Nos. 60, 70 and 70A mixtures at times of the year when temperature and moisture conditions are suitable for seeding, except during midsummer.

(2) Perform seeding, except Nos. 60, 70 and 70A mixtures, in conjunction with mulching as specified in section 627 at any time the engineer allows.

(3) The contractor may perform seeding of Nos. 60, 70 and 70A mixtures at any time soil conditions are suitable, except between June15 and October 15, unless the engineer allows otherwise.

(4) Perform seeding with the selected seed mixture, sown at the specified rate.

630.3.2 Preparation of Seed Bed

(1) Complete grading, shouldering, topsoiling, and fertilizing, if part of the work under contract, before permanent seeding, except the contractor may place the fertilizer and seed mixture in one operation if using equipment designed for the purpose.

(2) Just before seeding, work the area being seeded with discs, harrows, or other appropriate equipment to obtain a reasonably even and loose seedbed. Place topsoil as specified in 625.3.3.

630.3.3 Sowing

(1) Select the method of sowing from either method A, method B, method C, or an appropriate combination of methods A, B, and C. Obtain the engineer's approval for the sowing method and specific procedures used for each seed mixture used before sowing that mixture.

630.3.3.1 Method A

(1) Sow the selected seed mixture using equipment adapted to the purpose, or by scattering it uniformly over the areas to be seeded. Lightly rake or drag to cover the seed with approximately 1/4 inch of soil. After seeding, lightly roll or compact the areas using suitable equipment, preferably the cultipacker type, when the engineer judges the seedbed too loose, or if the seedbed contains clods that might reduce seed germination. The contractor shall not roll slopes steeper than 1:3.

(2) If scattering seed by hand, perform this work with satisfactory hand seeders and only when the air is calm enough to prevent seeds from blowing away.

630.3.3.2 Method B

(1) Sow or spread the seed upon the prepared bed using a stream or spray of water under pressure and operated from an engineer-approved machine designed for that purpose. Place the selected seed mixture and water into a tank, provided within the machine, in sufficient quantities that when spraying the seed on a given area it is uniformly spread at the required application rate. During this process, keep the tank contents stirred or agitated to provide uniform distribution. Spread the tank contents within one hour after adding the seed to the tank. The engineer will reject seed that remains mixed with the water for longer than one hour. The engineer will not require dragging or rolling.

630.3.3.3 Method C

(1) For spring seeding of seed mixtures 70 and 70A into existing ground cover, mow existing vegetation to 4 inches or less in height 2 to 4 weeks before seeding. Ten to 14 days after mowing, spray with vegetation control herbicide conforming to 632.2.12.

(2) For fall seeding of seed mixtures 70 and 70A into existing ground cover, mow existing vegetation to 4 inches or less in height 4 to 6 weeks before seeding. Ten to 14 days after mowing, spray with vegetation

control herbicide conforming to 632.2.12. Retreat with vegetation control herbicide 10 to 14 days after initial application if live vegetation persists.

(3) Seed with a rangeland type drill with one or more seed boxes that can be calibrated independently to deliver different sized seeds uniformly at the required rate and equipped with a rear-mounted press wheel for each seed drop tube. If seeding into existing vegetation or thatch, use a rangeland type drill equipped with a no-till attachment that can cut through the vegetation or thatch in front of the V disc and seed drop tube. If the configuration of the area to be seeded allows, apply seed at 1/2 the specified seed rate and apply the second 1/2 in a perpendicular direction.

630.3.3.4 Borrow Pits and Material Disposal Sites

(1) Seed borrow pits, and material disposal sites off the right-of-way, with the selected seed mixture specified in 630.2.1.5.1.4. Consult with the landowner or the landowner's agent when selecting the seed mixture.

630.3.3.5 Seeding Rates

630.3.3.5.1 Right-of-Way

(1) Use the following sowing rate for seeds in pounds per 1000 square feet:

- Seed mixture No. 10 at 1.5 pounds
- Seed mixture No. 20 at 3 pounds
- Seed mixture No. 30 at 2 pounds
- Seed mixture No. 40 at 2 pounds
- Seed mixture No. 60 at an equivalent seeding rate of 1.5 pounds[1]
- Seed mixture No. 70 or 70A at 0.4 pounds
- Seed mixture No. 75 at an equivalent seeding rate of 0.7 pounds[1]
- Seed mixture No. 80 at an equivalent seeding rate of 0.8 pounds[1]
- Temporary seeding at 3 pounds
- Nurse crop seeding at 0.8 pounds

[1] Determine the actual seeding rate by multiplying the equivalent seeding rate by the sum of the unadjusted and adjusted percentages of the various species in the seed mixtures as sown.

(2) The unadjusted percentage equals the minimum percent of purity and germination specified in the table of seed mixtures contained in 630.2.1.5.1.1.1 for the applicable species.

(3) Obtain the adjusted percentage for each of the PLS species by dividing the specified percentage of the species by the product of the percent of purity and the percent of germination for each of the PLS species as delivered.

630.3.3.5.2 Borrow Pits and Material Disposal Areas

(1) For seeding borrow pits and material disposal off the right-of-way, sow the seed mixtures specified in 630.2.1.5.1.4 at the following rates per pound per 1000 square feet:

- Seed mixture No. 10 at 0.75 pound
- Seed mixture No. 20 at 1 pound
- Seed mixture No. 70 or 70A at 0.4 pounds
- Seed mixture No 75 at 0.7 pounds
- Borrow pit mixture at 1.5 pounds

630.3.3.6 Establishment Period for Native Seeding

(1) During the growing season after planting seed mixture 70 or 70A, mow all seeded areas twice as the engineer directs. Mow vegetation back to 6 inches when it has reached a height of at least 12 inches.

(2) During the growing season after planting seed mixture 70 or 70A, eradicate the following species from the seeded areas as soon as they become evident:

SPECIES COMMON NAME	SPECIES BOTANICAL NAME
Musk thistle	Carduus nutans
Spotted knapweed	Centaurea maculosa
Canada thistle	Cirsium arvense
Bull thistle	Cirsium vulgare
Field bindweed	Convolvulus arvensis
Leafy spurge	Euphorbia esula
Sweetclover	Melilotus species
Wild parsnip	Pastinaca sativa

(3) Eradicate by hand pulling or by applying a vegetation control herbicide conforming to 632.2.12 to individual plants.

630.4 Measurement

(1) The department will measure the Seeding bid items by the pound acceptably completed.

(2) The department will measure quantities based on net weights of seed shipments, or on quantities weighed on department-approved scales the contractor furnishes.

(3) The department will make deductions for all quantities wasted or not actually incorporated in the work according to the contract.

(4) The department will determine the equivalent pounds of seed furnished and applied by dividing the actual pounds of seed applied by the sum of the unadjusted and adjusted percentages of the various species in the seed mixture sown.

(5) The department will use the unadjusted and adjusted percentages determined in 630.3.3.5.1.

630.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
630.0100 - 0199	Seeding (mixture)	LB
630.0200	Seeding Temporary	LB
630.0300	Seeding Borrow Pit	LB
630.0400	Seeding Nurse Crop	LB

(2) Payment for the Seeding bid items is full compensation for providing, handling, and storing all seed; for providing the required culture and inoculating seed as specified; and for preparing the seed bed, sowing, covering and firming the seed. If the landowner does not want the pit or material disposal site seeded, or seeded with any of the mixtures allowed, the department will not pay for fertilization or seeding of those areas.

Appendix H

Annual Operator Reporting

Annual Operator Reporting

Annual operating reports that satisfy the following requirements shall be submitted by the operator of nonmetallic mining sites (NR 135.36):

Contents – The annual report shall include the following:

1. The name and address of the operator.
2. The site legal description or parcel identification numbers.
3. The nonmetallic mine reclamation permit number.
4. The acreage currently affected by nonmetallic mining and not yet reclaimed
5. The amount of acreage that has been reclaimed to date, on a permanent basis and the amount reclaimed on an interim basis.
6. A plan, map, or diagram, drawn to scale, accurately showing the acreage described above.
7. The certification statement “I certify that this information is true and accurate, and that the nonmetallic mining site described herein complies with all conditions of the applicable nonmetallic mine reclamation permit and Wis. Admin. Code NR135” must be included.

Deadline – The annual report shall cover the activities on unreclaimed acreage for the previous calendar year and be submitted by January 31.

Annual reports shall be submitted by an operator for all active and intermittent mining sites to the regulatory authority for each calendar year until nonmetallic mining reclamation at the site is certified as completed pursuant to s. NR135.38 or at the time of release of financial assurance pursuant to s. NR135.40(7)