Department of
BIOPRODUCTS AND
BIOSYSTEMS ENGINEERING

UNIVERSITY OF MINNESOTA
Driven to Discover℠

2022 Senior Capstone Presentations

Bioproducts and Biosystems Engineering (BBE)

&

Sustainable Systems Management (SSM)

April 27, 2022

3:00 pm to 5:00 pm (In Person & via Zoom)

Welcome to the Senior Capstone Final Presentations!

Presentations will be live in person and via Zoom. Each room will have a separate Zoom link. Presentations are about 20 minutes with an additional 5 minutes for questions. To access the presentation simply click on the room in the Schedule at a Glance below.

We would appreciate your feedback on these senior presentations. You can find the Review Form links under the Schedule at a Glance, or under each project's detailed schedule. Thank you for assisting with this important part of the department's program.

If you have questions, contact the BBE 4502 instructor team (schmi071@umn.edu), or the SSM 4506 instructor team (hunt0416@umn.edu, jinzn@umn.edu).

Start Time	Schedule at a Glance: Meet in room or click the room link below at designated time to join that presentation!				
Location	North Star Ballroom (BBE)	Cherrywood Room (BBE)	Conference Room 202 (BBE)	Minnesota Commons 102 (SSM)	Conference Room 108 (SSM)
3:00p	Protein Filtration	Isolation Dam	Two Stage Digester	Minnesota Pollution Control Agency	SunOpta
3:30p	Perfect Egg	Coulee River Trail	Intensive Agriculture	Concordia Language Villages	Maya Biosphere Reserve
4:00p	Top Ply Cleaning	Stormflow Monitoring	Cheese Dust Measurement	Southern Minnesota Beet Sugar Cooperative	
Review Forms	BBE Review form			SSM Review Form	

Complete schedule of presentations with descriptions on the following pages

BBE integrates engineering, science, technology, and management for the sustainable use of renewable resources and enhancement of the environment.

Start Time	Detailed Schedule
3:00p North Star	**Protein Filtration** **Team C Members: Anna Healy, Maddi Johnson, Luke Peichel, Darshan Shah** ***Industry Sponsor: HBW Solutions Inc., Brian Weathers, Impossible Foods, Michael Speer*** ***Challenge Summary:*** HBW Solutions, Inc. does process design work for the pharmaceutical and food industries. This team will design a protein filtration system. The design will include filter sizing and all ancillary equipment around the filter. The team may need to develop a hydraulic model of the filter system. BBE Review form
3:00p Cherrywood	**Rum River Isolation Dam** **Team E Members: Caitlin Caswell, Leanna Markovics, Sam Schwieger, Jackie Shimota** ***Industry Sponsor: Minnesota Department of Transportation. Dwayne Stenlund*** ***Challenge Summary:*** A TH10 bridge over the Rum River must be replaced. The team is expected to determine options for working within a water-free riverbed, allow river flow and recreational use during all (or at least most of the time when safe) bridge construction staged operations. The team must develop a cost effective climate resilient temporary in-water isolation design for each operation from demolition of the existing bridge to construction of two new bridges, calculate water bearing loads of the water isolation techniques to points of failure, write examples construction specifications, develop example details (hand or CADD) suitable for communication of means and methods, estimate costs of various isolation options, and design a contingency plan for a flood condition (or safety criteria for when to vacate the work area). BBE Review form
3:00p Room 202	**Two Stage Anaerobic Digester** **Team H Members: Treasure Agbonkhese, Cassondra Cavegn, Ronald Schroeder, Shahar Tsameret** ***Industry Sponsor: Johnson Engineering Group. Matt Johnson*** **Challenge Summary:** Johnson Engineering Group (JEG) is an engineering consulting firm in Windom, MN. JEG is working with the owners of a 1700 cow dairy family dairy operation near Princeton MN. The farm owners are considering installing a two-stage digester design based on preliminary pilot scale testing by Johnson Engineering Group. The two-stage digester is expected to increase methane production and hopefully, producing hydrogen. The team is expected to develop a two-stage digester design, size related equipment and analyze process flows through and from the digester. BBE Review form

3:00p **Room 102**	**Environmental and Economic Assessment of Building Materials Management Methods** **Team Members: Kylie Differding, Haley Hansen, Kelly Martichuski, Carmen Prantil, Nicole Witt** ***Industry Sponsor: Minnesota Pollution Control Agency. Melissa Wenzel*** ***Challenge Summary:*** In partnership with the Minnesota Pollution Control Agency, students have assessed carbon emissions and economic impacts of different building material management methods for a UMN campus building, including renovation, deconstruction, or demolition. Students will analyze the financial costs, carbon costs/savings of materials lost/saved, and potential social impacts of each management method. SSM Review Form
3:00p **Room 108**	**Assessment of the Carbon Footprint of Aseptic and Refrigerated Plant-based Beverages** **Team Members: Domenico Diaz, Alexandra Larson, Nathan Lee, Lucy Mickus** ***Industry Sponsor: SunOpta. Megan Babb*** ***Challenge Summary:*** With Minnesota-based beverage and food manufacturing company SunOpta, students calculated the carbon footprint and energy consumption of the packaging, distribution, and retail of a shelf-stable aseptic plant-based beverage for comparison against a similar refrigerated product. SSM Review Form
3:30p **North Star**	**Perfect Egg Depositor** **Team B Members: Marissa Clauson, Madison King, Abby Reinert** ***Industry Sponsor: Michael Foods Inc. Charlie Schiappacasse*** ***Challenge Summary:*** Michael Foods Inc. (MFI) is a supplier of foodservice, food ingredient and retail offerings that help meet the dietary and ideological needs of all consumers. MFI produces a variety of precooked egg patty products. MFI would like to design the perfect depositor for its precooked egg production line. The depositor would have exceptional weight control, reasonable temperature restrictions, easy operation, variable depositing weights, and be able to incorporate particulates into the liquid egg stream just prior to depositing liquid egg. BBE Review form

3:30p Cherrywood	**Coulee River Trail Design** **Team F Members: Emilee Brandt, Jenae Carlson, Robert Glisky, Thomas Oberlander** ***Industry Sponsor: Emmons Olivier Resources. Paula Kalinosky*** ***Challenge Summary:*** Emmons and Olivier Resources is a water-centric engineering and environmental consulting firm. They are working with two non-profits, Coulee River Trails and Freedom Park. The team is expected to complete a feasibility study for the portion of the proposed Coulee River Trail System contained within the Magee Park Wilderness Area in Prescott, WI. The feasibility study will include a desktop assessment of existing site conditions, preliminary hydrologic and earthwork calculations, and preliminary sizing and design of stormwater BMPs and slope stabilization practices necessary to implement the trail project. The results of this study will provide valuable estimates and information that will be used by the Coulee River Trails and Friends of Freedom Park organizations to seek and apply for grant funding for the implementation phase of the trail project. BBE Review form
3:30p Room 202	**Assessment of Intensive Agriculture Impacts in Northwest Minnesota** **Team G Members: Victoria D'Amico, Katherine Tomaska, Gianna Turturillo, Anna Warmka** ***Industry Sponsor: Anishanaabe Agricultural Institute. Brianna Crowly*** ***Challenge Summary:*** This project will evaluate the impact of intensive agriculture on the Crow Wing River watershed in North Central MN. Impacts include water table changes due to irrigation and nitrate concentrations from fertilizer application on surface waters, groundwater quality (nitrate contamination), and aquatic ecosystems. The project will involve a general assessment of land use options in the region, how land uses are changing, water availability to support agricultural production and ecosystems. The project will use outputs from the groundwater model MODFLOW and the surface water/groundwater model SWAT in assessing land use change impacts on water quantity and water quality. BBE Review form
3:30p Room 102	**Assessing Energy Consumption and Renewable Energy Options for two Facilities of the Concordia Language Villages** **Team Members: Hope Marwede, Ryan Moody, Courtney O'Loughlin, Abe Zafft** ***Industry Sponsor: Concordia Language Villages. Mollie Nelson*** ***Challenge Summary:*** Using recent energy consumption and energy cost data for camp facility operations at the Norwegian and Spanish Villages, students analyzed the climate and economic impacts, and identified potential renewable energy strategies for two specific villages in northern Minnesota. SSM Review Form

3:30p **Room 108**	**Assessing Sustainable Palm Frond Supply Chain and Life-cycle Carbon Impacts from a Forest Concession in the Maya Biosphere Reserve, Guatemala** **Team Members: Armon Parsi, Olivia Richards, Priscilla Trinh, Jackson Wallerick** ***Industry Sponsor: Maya Biosphere Reserve. Dean Current*** ***Challenge Summary:*** Using existing management data of wild-harvested palm fronds, students characterized the existing supply chain from farm to consumer and calculated the associated carbon emissions and economic costs, including production, processing, and transportation from the Maya Reserve to US consumers. **SSM Review Form**
4:00p **North Star**	**Top Ply Cleaning** **Team A Members: Wyatte Chaffee, Noah Christian, Morgan Gasser, David Necas** ***Industry Sponsor: Liberty Paper Inc. Sentham Rajalingam*** ***Challenge Summary:*** Liberty Paper is one of the largest recyclers of corrugated material in the Midwest. Their state-of-the-art mill creates new linerboard (paper) for packaging by recycling old corrugated containers. This project involves a re-design of the top ply cleaners and how stock should be sent through the system. The top ply cleaners are used to clean the recycled fibers (1% solids) more so the side of the linerboard a customer sees is cleaner. The project is expected to involve the re-designing of piping, valves, rerouting some water, and analysis of mass balances for several flows. **BBE Review form**
4:00p **Cherrywood**	**Stormflow Monitoring** **Team H Members: Jackson Bohl, Alli Graper, Mattias Oddsson, Mia Piro** ***Industry Sponsor: Mississippi Watershed Management Organization. UDai Singh*** ***Challenge Summary:*** The team will be required to design a monitoring system to measure flow rate and water quality sampler for a watershed managed by the Mississippi Watershed Management Organization. The monitoring system needs to measure a range of flow rates and corresponding water quality data from rainfall and snowmelt events. The design needs to be evaluated using the hydraulic flume in the BAE laboratory before installation. **BBE Review form**

4:00p **Room 202**	**Cheese Dust Measurement** **Team D Members: Leta Albrecht, Joshua Goering, Emma Madaus, Rohan Padsalgaikar** ***Industry Sponsor: Land O'Lakes. Jonathan Anderson*** ***Challenge Summary:*** Land O'Lakes produces spray dried cheese-based powders for topical coating on Snack foods (ex. Potato Chips). These cheese powders present several challenges during the manufacturing process to produce cheese coated snack foods. Powders can clump, dust, or stick to and coat processing equipment and the environment. Spray dried cheese powders typically are combinations of cheese, dairy powders, starches / maltodextrins, salt, flow agent (silicon dioxide) . We will provide a range for typical attributes including moisture, fat, salt, and particle size. Land O'Lakes is requesting help to develop a method to predict the clumping or dusting of the powders. This test method will then be used to evaluate upstream production of these powders and mixes to help eliminate the problems. **BBE Review form**
4:00p **Room 102**	**Novel and Sustainable Technologies for Odor Control in a Sugar Beet Production System** **Team Members:** **Aaron Busch, Cole DeWeese, Margaret Keller, Timothy Reidell, Summer Somrock** ***Industry Sponsor: Southern Minnesota Beet Sugar Cooperative. Sagar Sunkavalli*** ***Challenge Summary:*** In partnership with the Southern Minnesota Beet Sugar Cooperative, students identified and analyzed environmentally and economically sustainable options for minimizing odors related to (H_2S) emissions in the beet sugar production system. **SSM Review Form**