

# The University of Iowa

EDITOR: Jessica Schroeder

AIChE Spring 2021

## Advisor's Corner

By: Prof. David Murhammer, Professor and AIChE Student Chapter Advisor

Greetings to Hawkeye Chemical Engineers!! Most of our departmental courses were held in person during the Spring 2021 semester, except for Chemical Engineering Professional Seminar (CBE:3000) that was held via Zoom. The combination of relatively small class size (~40 to 50 students) and larger classrooms (~100+ student chairs) allowed for social distancing in the classroom during the COVID-19 pandemic. Face masks were required for students and faculty in the classrooms. The lectures were recorded and/or offered via Zoom for the benefit of students who did not feel comfortable attending class in person. The students and faculty are looking forward to having all courses (including CBE:3000) in person in the fall without face mask requirements.

The 2021 AIChE Mid-America Regional Student Conference was hosted by the University of Nebraska and held virtually on April 16 & 17. The University of Iowa had three teams participate in the ChemE Jeopardy competition. Two of these teams won their semi-final games and participated in the championship game. These teams finished first and second in the competition, with the winning team (Dimitri Gatzios, Mason Lyons, Collin Sindt, Darrell Smith) qualifying to defend their national championship at the AIChE Annual Student conference being held in person November 5-8 at Boston, Massachusetts. The University of Iowa also had a student, Deven Aman, present his research in the Student Technical Presentation competition at the regional conference. Deven finished third in the competition. Congratulations to Deven and the ChemE Jeopardy teams!

This Spring 2021 issue of our AIChE Student Chapter Newsletter begins with an article about the Tinker Process Safety Prize competition that was generously sponsored by alumnus Sharon Tinker. This issue also includes articles about (i) the Omega Chi Epsilon Trash Crawl, (ii) an undergraduate research experience, (iii) chemical engineering curriculum changes, (iv) peer mentor program update, and (v) a student co-op at Tapemark.

Thanks for reading! Comments about the newsletter content can be sent to me at david-murhammer@uiowa.edu.



## University of Iowa American Institute of Chemical Engineers

### INSIDE THIS ISSUE:

Tinker Process Safety Prize	2-3
OXE Trash Crawl	4
Research	4-5
New Curriculum Changes	5
Peer Mentor Program Updates	6
Co-Op with Tapemark	6-7
Acknowledgments	8



## Tinker Process Safety Prize — Anthony Shirazi

The Tinker Process Safety Prize is a competition arranged by Iowa alumnus Sharon Tinker, along with the help of Dr. Murhammer and Dr. Guymon. Tinker, who made her career working in process safety at Exxon Mobil, created the competition to further emphasize the importance of understanding and prioritizing process safety. Occurring each winter, chemical engineering students who had just completed Dr. Murhammer's Chemical Process Safety course are invited to compete for the prize. This year saw the largest participation since its inception three years ago, with nine students in contention. All students were awarded a small monetary prize and book about process safety for completing the requirements, and additional prizes were awarded for placing. First place received \$1000 and each of the runners-up received \$500. Additionally, the top three finishers will be sent to the National Spring AIChE meeting at the expense of the department.

The competition itself comprised of three components: a written report discussing an incident investigated by the Chemical Safety and Hazard Investigation Board (CSB), a poster presentation on the incident and the student's grade in the Chemical Process Safety Course. This year, the poster presentation was replaced by a PowerPoint presentation conducted over zoom because of the pandemic. Each student's written report and presentation were assessed by a panel of judges consisting of Sharon Tinker and several members of the Advisory Board. Following the presentations held on February 26<sup>th</sup>, judges deliberated over the results of the competition and I was awarded first place for my work with the Hayes Lemmerz International Dust Explosions and Fire.

The main process at the Hayes Lemmerz manufacturing plant was the production of cast aluminum automotive wheels. However, the incident at this plant was a result of a process installed to recover and use the excess aluminum removed after casting. This system collected the excess aluminum and milled the scraps into small chips, which were then sent to a centrifuge and a kiln dryer to remove the oil on the chips used in the initial cutting step. During this processing, a significant amount of alumi-

num dust was generated. While much of this dust was pulled into a dust collection system just outside of the facility, some of the dust escaped and accumulated on surfaces throughout the plant, which were not cleaned by the workers of the plant. The CSB believe that the incident in question occurred when an ignition source contacted fine dust in the dust collection system, resulting in a dust explosion. The pressure wave from this initial explosion then propagated back through the dust collector and into the facility, where it lofted and ignited the accumulated dust, generating a fireball that blew open the roof and started several fires. Because of the damage during the explosion, the CSB were unable to ascertain the exact ignition source. In their report, the CSB recommended that Hayes Lemmerz design a better system to recycle the aluminum scraps that does not generate as much dust, provide regular training on dust explosions and fires for its employees and develop written procedures for plant reviews. After studying the incident and the investigation by the CSB, I also recommended that Hayes Lemmerz conduct further research on aluminum dust in order to better design relief venting and other safety devices to minimize the consequences if another incident were to occur.

The first runner-up in the competition was Jared Parr. Parr studied the Xcel Energy Company Hydroelectric Tunnel Fire incident. In this incident, a crew of industrial painters from RPI Coating, Inc. were hired to apply a new epoxy coating to the interior of a penstock (an enclosed pipe that delivers water to the turbines) at Xcel Energy's Cabin Creek hydroelectric plant. To do this, workers were equipped with sprayers to apply the coating. To periodically clean the sprayers, the crew would flush them with methyl ethyl ketone (MEK). As a result, they brought a large supply of MEK with them into the penstock. During one of these cleanings, MEK vapors were produced and ignited, likely by a static spark produced during flow through the non-conductive hose. The flash fire quickly spread, consuming the MEK and epoxy brought into the penstock, and cutting off five workers from the exit. (Continued on next page)

## Tinker Process Safety Prize — Anthony Shirazi

Emergency responders were called onto the scene but did not have the equipment necessary to cull the fire located 1000 feet into the penstock. By the time additional rescue teams managed to put out the fire, the five workers had died from asphyxiation. Following their investigation, the CSB found many concerns that led to this disaster. Prior to the incident, Xcel failed to assess the dangers of the coating process in their safety analysis. Additionally, they awarded the project to RPI Coatings because they underbid their competition, despite their poor safety record. Furthermore, the penstock is classified as a permit-required confined space, which requires increased ventilation and monitoring of the air quality. Neither of these requirements were met by Xcel. The CSB further recommended that heated, conductive hoses be used for the sprayers to prevent clogging and static discharges. Additionally, large amounts of epoxy and MEK should not be stored in the penstock during the spraying. Following his study of the incident, Parr concluded that the recommendations provided by the CSB were adequate to prevent future incidents, though he also suggested that an emergency exit should be installed.

The second runner-up was Nina Laskowiecki. Laskowiecki analyzed the NDK Crystal Inc. Explosion with Offsite Fatality incident. At this facility in Belvidere, Illinois, NDK were using eight vertical high-pressure vessels to produce synthetic quartz crystals. The incident occurred when one of the vessels suddenly and violently erupted, releasing superheated liquid and shooting fragments of the vessel, damaging nearby structures and resulting in the death of a truck driver. The CSB investigation found strong evidence of cracking on the vessel, which was attributed to a stress corrosion cracking mechanism. This type of cracking occurs when large amounts of stress are applied in a corrosive environment. In the case of this incident, high pressure coupled with sodium hydroxide solution resulted in the cracking. This disaster was the cause of several factors. First, the City of Belvidere allowed NDK to build its plant near a residential area, which ultimately resulted in the death of the truck driver. Second, NDK were aware of stress corrosion cracking and used an acmite coating to attempt to prevent this mechanism from occur-

ring. However, they failed to verify if this coating was effective, nor did they conduct annual inspections to ascertain the vessel maintained its integrity as recommended by the manufacturer. Compounding on this, the Illinois Board of Boiler and Pressure Vessel Safety failed to enforce such inspections. Finally, NDK had been made aware that cracking was occurring in four of its vessels but chose to ignore this warning and continued to operate. Following her project, Laskowiecki reiterates that while safety is mainly the responsibility of the company, it is also the responsibility of the government to enforce measures to ensure the safety of its people.

I had a wonderful experience participating in this competition. Reading the CSB investigation report and conducting further research on my incident taught me more about the importance of process safety, as well as the types of considerations necessary to ensure a process is safe. This project also allowed me to greatly improve my confidence in writing and presenting technical information. I would again like to thank Sharon Tinker for continuing to arrange this competition and I highly encourage next years' students to compete. You won't regret it.



2021 Tinker Process Safety Prize Participates

## OXE Trash Crawl — Mason Lyons

Omega Chi Epsilon, OXE, is a service based academic fraternity for Chemical Engineers which hosts events like a trip to Wilson's Orchard, making liquid nitrogen ice cream, help sessions, and now a trash crawl. The event was hosted by the University of Iowa Environmental Coalition as a (photo) competition of the day's haul between participating orgs. Arguably, OXE picked up the most trash on the day, according to the pictures, but was given honorable mention due to our late submission. The wonderful members who aided in cleaning up Mother Earth were Collin Haught, Sam Country, Payton Biddle, Josh Halverson, Sam Fiegen, Marie Ohlinger, Nolan Burson, Edgar Salinas, and Mason Lyons. They used their time on a gorgeous Sunday afternoon to clean up around the west side residence halls and along the river. Notably, they liberated wrappers, cans,

cups, cigarette butts, and even half a bike from the grips of environmental consolidation. The results were 9 bags of trash, a cleaner campus, and a group of joyous chemEs with newfound vitamin D. The org is looking forward to participating in this event again next year!



## Research — Nolan Burson

Hello! My name is Nolan Burson, and I am a third-year student in the chemical engineering department. Before I enrolled at the University of Iowa, I knew that I wanted to engage in some form of research while an undergrad. I became acquainted with the research opportunities the chemical engineer department at Ulowa had to offer while attending the freshman seminar (CBE:1000). It is here where I learned about Dr. Fiegel's lab. Due to a combination of events, including course loads and the pandemic, I did not join Dr. Fiegel's lab until the Fall of 2020.

When I joined the lab, the pandemic was still raging on in the world, and working in person would be hard. Instead, I took up a project virtually and ran computer simulations for the next six months. I was able to become acquainted with a powerful biological simulator, YASARA. The simulator's name is an acronym for "Yet Another Scientific Artificial Reality Application." In this program, I can simulate how the molecule would bind, move, and interact with other molecules in nature. This program allows me to run complex simulations on how a low molecular weight compound would bind to a protein receptor. The process was repeated

## Research (Continued)—Nolan Burson

numerous times with different compounds to determine how functional groups changed the binding energy of the compound-receptor complex. The binding energies of the simulations were then compared to literature values to validate the simulation's accuracy. This process proved to be cheaper and faster than crafting each new compound in the lab to run tests.

My project on the outside looks pretty biology-heavy but shows concepts seen in my regular

course work. Biochemical and Chemical Reaction Engineering have been the two major classes that have concepts that directly apply to my research. Enzyme/Protein development and reaction kinetics are utilized in the simulations and allow me to see direct applications of course work without getting out of my chair. I am still new to the research lab, but I am excited to continue my work and grow my skills as I plan for graduate work.

## New Curriculum Changes—Jessica Schroeder

This year the Chemical and Biochemical Engineering Department has decided to make a long-awaited change in its curriculum. For many years all disciplines across the college have been required to take the core classes: statics, circuits, and core thermodynamics. The various departments in the college have been considering dropping some of the core classes from their curriculum and this year they have finally decided to make that change. This change has been anticipated because some of the classes apply to some engineering disciplines more than others. While some departments such as the mechanical department have decided to keep all 3 core classes our department has decided to only require core thermodynamics for our students. The removal of statics and circuits allows the department to add more pertinent classes to our curriculum, thus better preparing our students for industry. One new class starting this fall is Computational Tools For Chemical Engineers (CBE:2110). CBE:2110 will be a new 2-hour course that will introduce students to Python programming and Microsoft Excel. Students will apply these tools to the solution of real life chemical engineering problems that they will encounter in their upper-level courses and after college as well. Although the department has decided to forgo the circuits requirement for students (it will be replaced in the curriculum with a 3-hour free elective), they do recognize the importance of circuits fundamentals and will incorporate some of those fundamentals in the Chemical Reaction Engineering/Separation Lab. Students will be able to have hands on experience with electrical circuits/instrumentation. Students

do not have hands on opportunities in the current core circuits course. This fall former Dean Alec Scranton will be joining Professor Murhammer in teaching the Chemical Reaction Engineering/Separation Lab.

In addition to the curriculum change the department has also added a new Elective Focus Area (EFA) called Safety and Health. Over the years the department has been praised for its safety program and many alumni of the department have taken jobs in safety consulting. With this in mind, the department wanted to create an EFA that would allow students to dive deeper into process and workplace safety. This EFA will incorporate many classes from the department of Occupational and Environmental Health (OEH), along with a new Advanced Process Safety course (CBE:4125). The classes students will take in the OEH department will help them dive deeper into topics such as hazardous waste and toxicology. Students will also have an opportunity to take a class called "Death at Work: Case Studies of Workplace Safety and Health". This course highlights the relevant physical, ergonomic, and social risk factors in various work environments. The new Advanced Chemical Process Safety course will be offered in the Spring semester of even years, starting in the Spring of 2022. Professor Murhammer is working with industry professionals and alumni in the creation of this class to highlight the importance of industry safety standards and common industry risk analysis techniques.

## Peer Mentor Program Update — Nina Laskowiecki

During the Spring of 2021, I had the honor to be the Vice President for AIChE's University of Iowa Student Chapter. One of the privileges this position includes is running the Peer Mentor-Mentee Program for the undergraduates in our department. The Peer Mentor-Mentee Program is an incredible opportunity for students to interact with people across year groups and to gain a surplus of advice, both academically and professionally. This program is one of the main reasons I decided to run for Vice President this past fall. When I joined the College of Engineering at the beginning of my second year, I was very nervous to collaborate with my classmates and I found myself going to my TAs with all my questions. While the CBE Department's TAs are an amazing outlet for information and advice, this really did not expose me to the full extent of what the department has to offer. This department gives you the chance to interact with some extraordinary peers that truly provide you with the encouragement and support to get you through this challenging degree.

The Mentors in this program are prepared and willing to help in several areas and with multiple tasks such as: viewing and suggesting changes/options for schedules which could make certain courses or semesters more manageable, considering

elective focus areas, discussing internships/co-ops, reviewing resumes, and helping students discover ways to get involved in the program or department. This past semester we had 28 mentors, comprised of juniors and seniors, paired with one or two of our 40 mentees, consisting of freshmen and sophomores. Each pairing met at least once a month to discuss any of the previously mentioned topics. The program also has member-specific events offered periodically throughout the semester. This past semester we had a virtual Get to Know One Another Event where mentors and mentees had the chance to interact with one another via zoom breakout rooms and a virtual Disney Trivia Night where we tested our Disney knowledge with a Kahoot.

This upcoming fall I am looking forward to moving events back to in person, adding more events to the program's calendar such as an Art Therapy Night, and spreading the word on this amazing opportunity to interact with your peers to the incoming freshman and sophomores starting their first classes in the CBE Department. I am extremely excited for all the potential this program has to offer both under and upperclassmen, and I already cannot wait to be back and planning events in the fall.

## Co-op with Tapemark— Hannah Chicchelly

From May to December 2020, I worked as a Co-op Process Engineer at Tapemark in West St. Paul, Minnesota. Tapemark is a Commercial Development Manufacturing Organization (CDMO) that specializes in transdermal, oral film, and unit-dose semi-solid pharmaceutical drug delivery processes. Tapemark serves clients as a CDMO and offers proprietary formulation technology platforms, such as Ion-ToPatch™ and Snaplicator™. Tapemark has two functioning buildings that make up the complex; one housing the mixing and coating portion of the projects, and the other housing the converting and packaging portion. At the beginning of the COVID-19

pandemic, several co-op students led and executed the production of antibacterial wipes for use in the company offices.

Since TapeMark is a smaller company, I was able to see every aspect of launching a pharmaceutical product, including converting engineering, R&D, quality inspection, lab analysis, and project management. During my time at Tapemark, I learned how to use SolidWorks and AutoCAD, drew piping designs, updated and wrote several set-up diagrams and standard operating procedures, updated building drawings, drew up a list of all the locations of solenoid valves that would need replac-

## Co-op with Tapemark (Continued)— Hannah Chicchelly

ing after a large storm backed up the compressed air pipe lines with water, performed burst testing, attended several weekly meetings, and oversaw cup shot testing for one of my projects.

I was assigned to work with the resident chemical engineer on four Snaplicator™ projects for a customer. Of the four projects, one product was extremely viscous, so we had to troubleshoot different pumping options. In essence, I lent my knowledge in fluid flow and heat and mass transfer to the project in the troubleshooting process. My favorite part of my experience at Tapemark was early-on exposure to the mixing and coating of a pharma product, and the overall sense of collaboration and teamwork that was the culture at Tapemark.

Overall, my co-op with Tapemark allowed exposure to working with almost every aspect of a project including both mix/coat and converting, as well as most all project lines at Tapemark. I especially valued my time at Tapemark with all the exposure I was granted that I might not have had at a very large company. I also would encourage anyone interested in a co-op to pursue one, as you gain more practical experience prior to graduation from a longer-term experience, and therefore are more valuable to a future employer.

## Follow us on LinkedIn

### **Attention Alumni**

There is now an IOWA Chemical Engineering Alumni LinkedIn page for you to join!

Its called [AICHE at the University of Iowa](#).

Check it out for more frequent IOWA ChemE news, we would love to see you there!



## Acknowledgements

Thank you to the AIChE Officers for their hard work and contributing efforts to make our AIChE Student Chapter a successful organization.

### Spring 2021 Officers:



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**Faculty Advisor:** Professor David Murhammer

**Contributors:** Nolan Burson, Nina Laskowiecki, Anthony Shirazi, Mason Lyons, and Hannah Chicchelly

***Your help is much appreciated!***

Interested in speaking at professional seminar? If so, then contact our Fall 2021 AIChE Student Chapter Vice President Nina Laskowiecki at [janina-laskowiecki@uiowa.edu](mailto:janina-laskowiecki@uiowa.edu) or Student Chapter Advisor Prof. David Murhammer at [david-murhammer@uiowa.edu](mailto:david-murhammer@uiowa.edu) for details and availability!