

May Section Meeting: Challenges in Applying Process Safety Management (PSM) to Production Pilot Plants and Laboratories

This month's meeting will be hosted by Corden Pharma Colorado, Inc. (CPC). Corden Pharma has been following OSHA guidelines on Process safety management (PSM) of highly hazardous chemicals (29 CFR 1910.119) since the early 1990s. Through the years, we have identified or developed creative ways to assure compliance, especially when the lab-scale processes and equipment are not those commonly expected in the chemical industry. Extensive experience with small- and pilot-scale operations, and the dynamic nature of production in laboratories with the innovation it nurtures, facilitates such creativity. Using PSM as a tool to "do the right things right" has and will help CPC be successful in an increasingly competitive market. Our Boulder site has solidly implemented discipline to assure that it is following PSM, and CPC is poised and ready to share its experience and learnings to improve the safety and reliability of similar processes. These include in design and engineering, Mechanical Integrity, Process Hazard Analysis, and Process Safety Information.

The CPC site in Boulder includes at least eight production facilities. Six of these are production laboratories and pilot plants, with synthesizers and vessels of a few liters to a few thousand liters. All of the production process systems are connected to at least one of the site's bulk chemical tank farms, so even processes that are in lab hoods fall under the PSM rule. Because CPC manufactures a wide variety

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May Section Meeting

Topic: Challenges in Applying Process Safety Mgmt (PSM) to Production Pilot Plants and Laboratories

Speaker: Bruce D. Bullough

Date: Tuesday, May 21st

Time: 6:00-6:15 Check-in
6:15-6:30 Corden Security Video
6:30-7:30 Dinner
7:35-9:00 Tour

Location: Corden Pharma
2075 55th St, Boulder, CO

Cost: Members: \$20
(w/RSVP)* Non-Members: \$25
Students & Unemployed: \$10

Please RSVP by FRIDAY, May 17th, (early RSVPs are greatly appreciated!) indicating your name, phone number, and number of attendees. Please RSVP to Martin Vorum at rockyaiche@yahoo.com.

*Add \$5 for attending meeting without RSVP

IMPORTANT NOTE TO ATTENDEES: **Leather, closed toed shoes are required (no high heels, no soft soles), but CPC can supply hardhats and safety glasses. The plants (several on site) are on multiple floors with no elevators, and therefore cannot accommodate wheelchairs or crutches. You must be present for the security video at 6:15 to proceed on the tour.**

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of peptides and small molecule pharmaceuticals for many customers, process and plant configurations are seldom static; some process trains are in use for only a few weeks at a time.

CPC strongly supports PSM as good engineering and operating (and lab) practice, but there are certainly challenges to complying with the intent and purpose of PSM in a dynamic, laboratory-scale operation, where reactors and vessels are glassware, and the interconnecting piping can be short runs of polymer hose. Further, CPC facilities include large, production-scale equipment that are usually not considered lab equipment, such as High Pressure Liquid Chromatography columns, and where there is little recognized good engineering practice to follow.

Bruce graduated with a BSCHE in 1979 from the University of Utah. He has worked in smaller-scale, high risk production industries and sites, such as nuclear and radio-chemistry, pharmaceuticals, and specialty chemicals. He has also worked extensively in the food, data storage, gas pipeline, printing & graphic arts, municipal waste, and bio-energy industries. He has been in the role of process engineer, process and product development engineer, process design engineer, maintenance supervisor, plant manager, environmental engineer, and project engineer/manager on projects up to \$60M. He has done on-site project work in 33 U.S. states, two Canadian Provinces, and in Germany and Italy. He became formally involved in PSM in 1989 when working for 3M. PSM has been a major part of his work, regardless of his role, ever since.

Past AIChE experience: Local Section Secretary, Treasurer, Director; member of the National Continuing Education Committee; he is currently a member of the technical steering committee of the Center for Chemical Process Safety (only one of two members from Colorado).

IMPORTANT NOTE TO ATTENDEES: The visit to Corden's facility will include a plant tour and therefore has additional requirements and logistics beyond our typical meetings. As an operating facility, attendees will need to wear PPE and be able to safely walk around the facility. Leather, closed toed shoes are required (no high heels, no soft soles),

but CPC can supply hardhats and safety glasses. The plants (several on site) are on multiple floors with no elevators, and therefore cannot accommodate wheelchairs or crutches.

There is a short security video plus badging and sign-in process upfront (PSM contractor and visitor compliance). To expedite this process, we will show the security video as a group very first, so it is important that people arrive on time. Additionally, attendance will be limited to 33 people, so please RSVP early.

National Renewable Energy Laboratory (NREL) Employee of the Month

One of our local Rocky Mountain AIChE officers recently received the employee of the month award from NREL. Below is a reprint of the article from the NREL newsletter. Congratulations, Craig, for your recognized achievement!

Craig Turchi, Electricity, Resources and Building Systems Integration Center
Award Category—Exhibits Integrity

It is difficult to select only one category of the NREL values where Craig stands out, because he demonstrates all of them. However, "exhibits integrity" seems to fit best. Craig deserves this award because he has been quietly doing excellent work for our group, helping out group members and reaching out to the larger community outside of NREL. One thing that stands out about Craig is that day in day out, no matter how busy his work schedule gets (which sometimes gets to the point that would be overwhelming for most), he always produces high quality work, with all the t's crossed and i's dotted on every piece, even the most insignificant-seeming piece of paper work. In addition, Craig always takes time to help his coworkers. He is very responsive whenever anyone asks him for help. He clearly conveys his knowledge, or if he doesn't have all the answers, he gives specific lead on where to look. When a new employee was asked to give a technical talk in concentrating solar power before she had the appropriate background at a society meeting of which Craig was not a part, Craig spent his evening going to the meeting with her so he could be there to answer any questions that she would not yet know how to answer. Craig also maintains relationships with people outside of NREL in the renewable energy field. He has initiated successful collaborations with both professors and scientists in industry. He is also a leader in the local

chapter of the American Institute of Chemical Engineers. In addition to being involved with the larger science and engineering community, Craig is involved in our local community, routinely donating blood and volunteering at his church-sponsored soup kitchen. In summary, Craig modestly exemplifies NREL's values on a daily basis and is most deserving of an Employee-of-the-Month Award.

Judges Needed for Colorado School of Mine's Poster Contest

Colorado School of Mines' Department of Chemical and Biological Engineering hosts a summer undergraduate research program each year. We will have a poster session in August and would like to have local professionals as judges and attendees. Please take one minute to fill out the survey at the link below if you are interested in attending and/or judging the posters.

<https://docs.google.com/forms/d/1xZudUdM4dL2hODqR8UUFRIOlK-DzkY3I3aYtlhfeuac/viewform>

Winners Of the 58th Annual Colorado Science & Engineering Fair

The American Institute of Chemical Engineers, Rocky Mountain Section proudly announces the first and second prize winners in the Junior and Senior Divisions at the 58th Annual Colorado Science and Engineering Fair held at Colorado State University, Fort Collins, Colorado on April 11, 2013. Special thanks to our section members who served as judges: Michael Mutnan and Rebecca Sperot

JUNIOR DIVISION – FIRST PLACE, \$100

Project Title: Evaluating the Effect of Humidity on Insulation

Individual/Team Leader's Name: George Liu

School & City: The Classical Academy, Colorado Springs

Sponsor's Name: Candus Muir

Category: Energy & Transportation

Abstract— The purpose of this investigation is to determine how different insulations work under different humidity levels. I hypothesized that if the humidity levels (low, medium, and high) and insulations (fiber, denim, foil, and foam) are varied, then the fiber will be the most efficient in low humidity.

To compare the efficiency of different insulations, I defined Heat Transfer Rate (HTR) as the heat

American Institute of Chemical Engineers

transferred through one layer of insulation in unit time at unit temperature difference between the two sides of the insulation (Calories per second per °C). Since heat transferred can not be measured directly, I designed an Insulation Testing Apparatus (ITA) to measure the temperature changes on objects in ITA and calculate the HTRs for different insulations at different humidity levels. Then the HTRs were analyzed statistically.

The data collected and analysis supported my original hypothesis. Fiber works well for all humidity levels, but foil and foam are not affected by humidity. By comparing the random error ranges, it is evident that HTRs do have statistical differences for the most of combination cases of insulation and humidity; however, HTRs don't have statistical differences for some cases. Thus, I picked up two cases which do not have a statistical difference and performed more experiments and advanced statistical analysis in order to see if the HTRs actually have a statistical difference. By using the T-test, I successfully prove that HTRs have a statistical difference for the two selected cases. These findings have led me to conclude that:

1. Fiber works well for all levels of humidity. However, the efficiency decreases 43% in average when the humidity increases from 50% to 80%

2. Denim is a more environmental friendly insulation. In high humidity level, it is a good substitute for Fiber since their efficiency only has 5% difference in average at 80%RH.

3. Two reflective insulation materials (Foam & Foil) can reduce both heat conduction and radiation. Unfortunately, they do not perform as efficiently as Fiber but their efficiency is not affected by humidity.

JUNIOR DIVISION – SECOND PLACE, \$75

Project Title: Mapping Air Pollution: Pueblo, Colorado

Individual/Team Leader's Name: Max Markuson DiPrince

School & City: Pueblo School for Arts and Sciences, Pueblo

Sponsor's Name: Lori Leyh

Category: Environmental Sciences

Abstract— The purpose of this experiment was to determine if certain areas of Pueblo, Colorado, have more air pollution than others. I hypothesized that areas of Pueblo, Colorado, with the most poverty will have higher rates of air pollution because they are located near industrial plants such as Evraz Steel mill, Comanche Power Plant, and GCC cement plant. For example, the air will be more polluted in Bessemer, a

part of town with a higher rate of poverty, than in the suburbs.

The experiment involved making Air Particulate Pollution Catchers (APPCs) to capture air particulates. I distributed 25 APPCs throughout the city of Pueblo. The APPCs were in the field for 11 days. I used a milligram scale to weigh the APPCs before and after to measure the collection of air particulates for each location. I then applied this data to a map to determine which parts of town had more air particulate pollution.

Parts of my hypothesis were supported. I found that the combination of poverty and industrial location had higher rates of air particulate pollution. The south side of Pueblo had the heaviest accumulation of air particulates. This part of town has industrial plants, higher rates of poverty and higher Latino-Hispanic population. It is important to note that industrial plants tend to be located in places with more poverty and with increased minority population. People in poverty tend to live near industrial areas because industries generally move into poorer neighborhoods and wealthier people generally do not move into areas with a lot of industry.

SENIOR DIVISION – FIRST PLACE, \$100

Project Title: Optimizing Energy Production through Wastewater Treatment: The Utilization of a Mediator-Less, Single Celled Microbial Fuel Cell

Individual/Team Leader's Name: Nurul MohdReza
School & City: Union Colony Preparatory School, Greeley

Sponsor's Name: Zabedah Saad

Category: Energy & Transportation

Abstract: Microbial fuel cells are of promising technology in the bio electrochemical field, but to produce sustainable amounts of energy, further experimentation on certain boundaries such as the type of inoculum need to be taken into consideration when constructing a viable fuel source. This study investigates the comparison of primary and secondary treated waste water in single-chambered microbial fuel cells. The effect of potassium ferricyanide, as a cathodic electron acceptor, was also tested to determine if there was a correlation between the chemical, the production of energy, and the treatment of water.

Four single-chambered microbial fuel cells were developed. Two of the containers contained 600 ml of either primary or secondary treated waste water depending on the fuel cell. Electrodes represented the anode and the cathode and consisted of carbon-cloth squares bounded by copper wire. Electrical parameters

along with chemical oxygen demand (COD) tests were recorded to determine the performance of the fuel cells.

After conducting t-Tests (assuming unequal variance), the results revealed that there were no significant differences between the two waste waters and the comparison of which inoculum performed best with the permeation of potassium ferricyanide. Power production was significant with the addition of the chemical oxidant, creating a maximum power output of 400 mW. COD removal efficiencies were also significant, producing a maximum of 83% substrate removal. With further knowledge of the working parameters within a fuel cell, this product can soon become a green bioenergy technology; therefore, reducing dependence on fossil fuels and protecting the environment.

SENIOR DIVISION – SECOND PLACE, \$75

Project Title: A Microbial Fuel Cell for People without Direct Access to Electricity

Individual/Team Leader's Name: Michael Brady
School & City: Cherry Creek High School, Greenwood Village

Sponsor's Name: Kevin Burns

Category: Energy & Transportation

Abstract: Providing an alternate means of generating energy from easily obtained resources, microbial fuel cells present a major opportunity as a renewable energy resource for those who do not have access to energy obtained in other forms. The cell needs only a source of waste water and another source of cleaner water to operate once it has been assembled, and produces electricity through a process in which bacteria break down sugar molecules to produce electrons and protons. In the experiment, various configurations of a microbial fuel cell were tested, and it was found that a way to cut off oxygen supply to the anode, along with a way to expose the cathode to oxygen was necessary for operation. In tests with multiple samples, an agar salt bridge and dialysis tubing were used as proton exchange membranes. Also different resistances were applied to the cell in order to find the highest stable current output and thus greatest power of the cell. The voltages and currents obtained from the cell turned out to be high enough to make the cell a viable solution for operation in places without electricity, as the cell could possibly provide enough electricity for dim LED lighting.

AIChE Meetings

2013

- June 11-13 2013 Process Development Symposium
Oak Brook, IL
- June 23-26 Massive Energy Storage for the Broader Use of Renewable Energy Sources
Newport Beach, CA
- July 15-17 First CCPS Australia-Oceania Conference on Process Safety
Perth, Australia
- August 11-15 ICOSSE 2013
Kingsgate Marriott, Cincinnati, OH
- Aug 12-14 5th Latin American Conference on Process Safety
Hilton Cartagena Colombia
- Aug 25-29 58th Annual Safety in Ammonia Plants & Related Facilities Symposium
Marriott Frankfurt Hotel, Germany

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The objectives of AIChE are to advance chemical engineering in theory and practice, to maintain a high professional standard among its members, and to serve society, particularly where chemical, engineering can contribute to the public interest.

AIChE Rocky Mountain is a public non-profit 501(c)(3) organizations and thus any and all donations are tax deductible.

Rocky Mountain AIChE News Publication Schedule

September 2013 issue

Articles due Wednesday, September 11th

Publish on Friday, September 13th

Meeting on Tuesday, September 17th

MEETING SCHEDULE

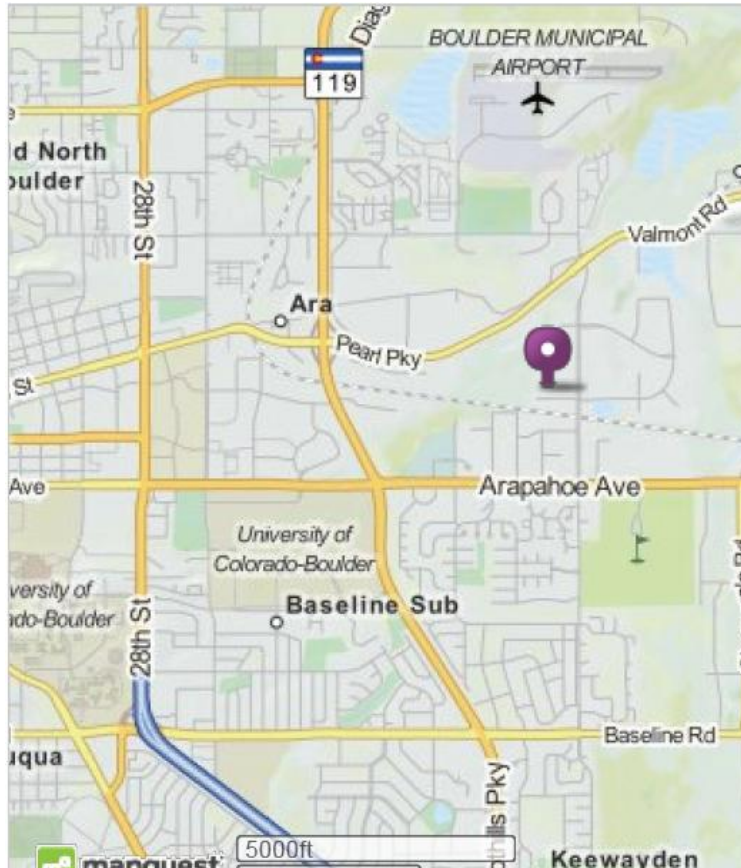
The Rocky Mountain District of AIChE generally meets the third Tuesday of every month, September through November and January through May.

Rocky Mountain AIChE News
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On the Web at:

<http://rockymtn.aiche.org>

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DIRECTIONS TO Corden Pharma:

From downtown Denver, travel north on I-25. Merge onto US-36 W via EXIT 217 on the left toward Westminster/Boulder. Exit onto CO-157 N/Foothills Pkwy toward CU Stadium. Turn right onto Arapahoe Ave/CO-7 S. Turn left onto 55th St. Make a U-turn at Milne Way and 2075 55th St. is on the right.