The University of Iowa

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AIChE Spring 2017

Advisor's Corner

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

Greetings to Hawkeye Chemical Engineers!! This Spring 2017 issue of our AIChE Student Chapter Newsletter begins with an article about strategies for success in the very challenging chemical engineering curriculum. This issue also contains articles about the new addition to the Seamans Center, Society of Women Engineers, University of Iowa ChemE Car, the new "Be Creative" course requirement, and a co-op experience at Cargill. This issue also contains five topical papers from the Chemical Process Safety course. There articles are opinion pieces about the potential defunding of the Chemical Safety Board, Inherently Safer Design and Chemical Regulation in the United States.

This issue concludes with a series of photos from the AIChE Student Mid-America Regional Conference held at the University of Tulsa (Tulsa, Oklahoma) and the Senior Banquet at which the graduating seniors were recognized and honored. I attended the regional conference, held March 31st and April 1st, with 30 of our students. We had two ChemE Jeopardy Teams competing (one of these teams, consisting of Madeline Hess, Corinne Andresen, Thomas Chase and Tyler Chlystun, received 2nd place) and three paper contest presenters (one of our students, Renae Kurpius, received 3rd place).

University of Iowa
American Institute of
Chemical Engineers

INSIDE THIS ISSUE:

A Crash Course in Chemical Engineering Coursework

By: Elizabeth Zimmerman

As a chemical engineering undergraduate you may be familiar with the feeling of being tired, stressed and wondering how you could possibly get through the week. While it is true that nothing good comes easy, there are ways to minimize this stress and succeed while doing it. The first thing you should begin doing is boycotting procrastination. This method works best if it is the beginning of the semester when the workload is low and you have time to work ahead. As a general rule of thumb if you have the information you need to start an assignment, you should. Your planner can be an excellent asset in planning ahead and can work as an alarm system as to when you should get started on bigger things assigned very far in advance. Instead of just writing the date of your tests in your planner, a week prior, write yourself a note to begin studying. This way even if you are behind schedule in other aspects of your school work and do not get to begin studying on the assigned date you still have plenty of time. For large projects it may be helpful to lay out major landmarks and give yourself "due dates" on those as you go.

The next most important thing in chemical engineering is to recognize and utilize your resources. Notes from class, a "to-know" sheet for an exam, slides, your textbook, these are all things you know of, but are probably not using to the best of your ability. For classes that are mostly memorization based the best way to utilize your resources is to skim the text ahead of time and understand key terms. When you attend lecture and take notes they will be more meaningful to you if you already know major concepts. When test time rolls around combine notes from class, slides, and other information your professor has specifically noted will be vital to your success into one giant notes sheet and condense the sheet by writing and re-writing until you are a master. The best way to test your knowledge of your notes sheet is to be able to recite it to a friend. In problem based classes compile all useful examples such as in class examples, homework, quiz, and text problems and continue to work through them until you can recite all the steps to completion from memory and work through the problems like a pro.

More important than those resources are the resources of your peers and professors. This may be the most important piece of advice so use it now and use it often, surround yourself with people who have a drive for success and work hard. Chemical engineering is more than being smart, you need to be driven and have passion for your coursework. Find a group of people who are intelligent, kind and motivated and utilize each other. This is most successful when your group of individuals is diverse in their ideas, methods of madness and preference of classes. Commonly, what one person may struggle with, another person will understand in great depth and vis versa. Reach out to your chemE groupies and ask for help when you need it. They will benefit from explaining and you will benefit from learning. As a more obvious note, get on your professors good side and listen to what they say closely. Your professors are filled with knowledge, help, hints and tricks for their course. You should treat them with upmost respect, ask them questions often and utilize them during the office hours as much as you can.

Be efficient. When it comes down to it, you may not have the time to study in advance every time. A week may come up where you have three projects, two presentations, three exams and four homework assignments and you could not have possibly planned ahead. In this scenario the best thing you can do is to be efficient. Put your phone and other distractions away while you study, as this will maximize the effects of learning and minimize the time you need to focus. It is tempting to study material and practice problems that you already understand but realize this will not allow you to gain the broad range of knowledge you need. Focus on what is uncomfortable and difficult in the subject material to best learn all topics. This is true in life as well, branch out and try things that might make you uncomfortable, it's the recipe to growing as a person.

A Crash Course in Chemical Engineering Coursework (continued)

By: Elizabeth Zimmerman

In short, know that procrastination today is a sure fire way to be stressed tomorrow, come up with your best method to study, treat your peers, both friends and professor, well as they will save your grade and possibly your life, and tap into your inner Carnot Cycle (be efficient). Be willing to help your friends as teaching them material will benefit both of you and learn how to listen. Stay focused on long-term goals, as they will motivate you to continue through the hardest parts of your chemE journey. Be honest in everything that you do and be ready to take full responsibility for everything you put your name on. Most of all, be kind to yourself and even if you cannot reach the goals you set out to always be proud of your best work. Put your best effort forward, put yourself out there, meet people, learn, grow and have fun – remember it is only four years – sometimes.

The Upcoming Seamans Center

By: Eastyn Fitzgibbon

The University of Iowa's College of Engineering has experienced incredible growth in recent years. In 2015, 2,165 undergraduates were enrolled in the college, an 80% increase from 2005, and a 50% increase from the last 5 years alone. Additionally, the College spent $54 million on research in 2015, a 64% increase from 2004. In order to accommodate the growing numbers of engineering students, a $37 million, 65,000-square-foot addition will be annexed to the Seamans Center.

The new addition aims to foster and maintain the momentum that faculty and students already feel within the College. The annex will accommodate the desperate need for larger classrooms by including two large classrooms for general use. Beyond creating additional space, the College seeks to create a better atmosphere for collaborative learning, and will include state-of-the-art, digitally-enabled classrooms designed for team-based education. There will also be larger study spaces integrated throughout the building, again in hopes of fostering an atmosphere of collaboration. Additionally, a state-of-the-art fluids laboratory will be included, in order to help Iowa maintain its leadership in this area.

Of particular note in the new addition is a hands-on design studio, where students can work on team projects from their freshman year onwards. The design studio will be in the center of the building, and enclosed only in transparent glass walls. Students can watch on from around the college, and this space will also include more area to display completed projects from past students. According to Professor Julie Jessop, this design studio will allow students to "walk by and see the excitement that's happening in this classroom." Engineering Problem Solving I and Senior Design classes will both be held in this design studio.

According to Dean Alec Scranton, the project will also house research facilities for "water sustainability, the Iowa Flood Center, advanced manufacturing, digital human system integration, nanomaterials, and renewable energy systems." All of which are expected to enrich the research community at the Seamans Center, as well as contribute to the state's economy and improve overall quality of life. In this focus on sustainability, the annex will include ample green space, enhanced water recycling with active water filtration pods, and possibly even photovoltaics.

Progress on the construction project can be viewed anytime online with the Annex Construction Cameras on the College of Engineering's website. The construction is scheduled to be completed in Fall of 2017, and is expected to help the College thrive for years to come.

An artist's rendering of the completed project.

Society of Women Engineers

By: Jacquelyn Ricke

Women are an underrepresented group in engineering. Nationally, the engineering field is approximately 20% women. This number has increased very little in the past two decades, while many other male-dominated fields have seen rising numbers of women. At the University of Iowa, we are proud to be above the national average for women in engineering, at closer to 30%. This is, in part, due to the strong support system present in both the College of Engineering and the University as a whole. The Society of Women Engineers (SWE) was established almost 50 years ago and has been one of these central support systems since. I am a junior chemical engineering major and the current President of SWE. I was the Fundraising Chair last year and will be the Vice President Internal next year. SWE has been very beneficial to me in both my professional and social life, and can be whatever its members choose to make of it.

SWE has multiple facets that allow members to choose what they would like to get out of their experience. There are some members who are most interested in the social aspect. They attend social events, big and small, and always bring great energy to the group. Mentor Groups were also formed this year in conjunction with our social events to provide major-specific help to underclassmen. They allow the younger members to get to know upperclassmen in a social, stress-free environment and ask questions about items of concern. These group meetings often take the form of a trip to Yotopia, Molly's Cupcakes, or dinner at a restaurant downtown. Other members in SWE particularly enjoy the professional development aspects. We try to have at least one of these events per month, where a professional comes to talk to the group, generally about their company as well as a topic of interest to the section. In addition to these events, SWE participates in many different volunteering and outreach events each year, which allows us to make an impact on our community.

Each spring, SWE hosts an event called High School Conference (HSC). Up to 50 high school women from all around come to the campus on a Friday evening and learn about the opportunities in engineering. Additionally, discipline specific presentations and laboratory tours allow the women to gain more insight on which major best fits them and what to expect if they choose to come to Iowa. For those who have decided they are going to come to Iowa for engineering already, this event allows them to meet other women who will be in their classes. This eases the stress of the initial transition, and can be an invaluable experience. We coordinate the event so that the women can then choose to go to the Explore Engineering @ Iowa day on the Saturday of the same trip. This allows them to learn about the College of Engineering from the Student Ambassadors so they can see both perspectives.

We collaborate with other organizations for many of our events, such as the East Central Iowa Professional SWE Section; Women in Science and Engineering (WiSE); The Society of Hispanic Professional Engineers (SHPE); The National Society of Black Engineers (NSBE); out in Science, Technology, Engineering, and Mathematics (oSTEM); The Institute of Industrial and Systems Engineers (IISE); The Office of Outreach, Admissions, Scholarships, and Inclusion Services (OASIS); Women in Business (WIB); UI Museum of Natural History; The American Cancer Society's Hope Lodge; The Iowa Raptor Project; and more. We are so grateful for the opportunities these organizations and others have given us to make a difference in our community.

At its core, the University of Iowa SWE section aims to be a support system for women in the College of Engineering. This support comes in many different forms, and our members are allowed to decide what works best for them. We believe that we are helping to develop well-rounded engineers, while simultaneously allowing the women to develop relationships with others like themselves. The student leadership and focus enables the section to grow and develop over time, adapting to the needs and wishes of the section. While the mission and goals of the section revolve around women students in the College of Engineering, we welcome everyone as members and at our events.

University of Iowa ChemE Car

By: Jacquelyn Ricke

The Chem-E-Car Competition is a staple at the American Institute of Chemical Engineers (AIChE) conferences since it was introduced in 1999. The University of Iowa AIChE section competed in this competition in its early years, but has not brought a car to the competition in approximately 8 years. Throughout the years since we have competed, several different design ideas were considered, but never brought to fruition. These designs have been lost over the years, so this year's ChemE Car team has focused on building a program which is well-documented and can be passed down to future years.

One of the key strengths of this year's ChemE Car team was a delegation of tasks. At the end of the fall semester, committee heads were chosen to oversee each aspect of the design team. These included safety, documentation, chassis, power system, and stopping mechanism. Then the ChemE Car coordinator, Tom Hodur, could oversee the entire group, schedule and conduct meetings, and do the other background administrative work. In prior semesters, the coordinator often tried to juggle too many tasks, and became discouraged when school work and prior commitments made it difficult to accomplish all of them. The hope is that this structure will allow the team to become more robust, impacting more undergraduate chemical engineering students in a meaningful way and allowing room for growth over multiple years.

The other key strength of the ChemE Car team this semester was the involvement of underclassmen and the strides made to ensure the club took ownership of its space and equipment. In the spring 2017 semester, sophomores were encouraged during seminar to join this club. Then, an initial meeting was held to update the new members on the rules of the competition, the progress the group had made thus far, and the goals for the team. At this meeting, the sophomore class schedule was taken into account, so meetings could be planned for times where the sophomore and junior members were both available and on campus. Additionally, the current committees and their responsibilities were explained, so the new members could choose to focus on the areas in which they are most passionate. This approach to new membership of underclassmen was different than had been seen the prior year, and it seemed to work well to engage this new class. This is promising for the future of the program and achievement of the goals the team has set for itself.

The ultimate goal is to have a car designed, built, and running by the end of the fall 2017 semester. Then, the safety documentation and poster can be completed in time to compete at the regional AIChE conference, and represent the University of Iowa well. A new coordinator has been elected from the sophomore class, Jenny Stevenson, as the current coordinator will be on co-op next semester. It is our hope that Jenny will be able to engage the current members, as well as draw in new ones next year, so the club can continue to grow and develop.

Be Creative Courses

By: Rachel Seibel, Jenny Stevenson, Kyle McCarthy and Allison Vaske

Beginning in Summer 2015, the College of Engineering implemented a new requirement for engineering students to fulfill their general education components. The Be Creative Education Component is a collaboration between art and engineering majors that allows students to work hand in hand with students from different majors and join forces to work on projects that combine each student's individual strengths. This program also allows the students to improve intellectually in areas to which they are not always exposed. Now, to hear some of the students who have benefitted from this program.

Jenny Stevenson:

"For my Be Creative, I decided to do Travel Writing, whilst traveling through Italy through the CIMBA study abroad program. The program allows Engineers to take some of the core classes while also going abroad for the Summer. This furthered my knowledge in my writing

Be Creative Courses (Continued)

By: Rachel Seibel, Jenny Stevenson, Kyle McCarthy, and Allison Vaske

ability and the world and aided in making me a more cultured and well rounded person."

Kyle McCarthy:

"Introduction to jewelry and metal arts was a great opportunity to express my creativity and bring it to life with metals. My teacher was knowledgeable and the friends I made outside of my normal engineering classes really brought a nice new perspective to life at Iowa. It was a good class and a great experience."

Allison Vaske:

"For my Be Creative requirement I decided to take graphic design. I believe this will further my career in engineering because it taught me how to effectively communicate my message in a creative and impactful way. It will help me excel when pitching ideas or presenting research posters. Overall it was a valuable experience."

This is program that will continue to benefit students for years to come.

My Experience as a Cargill Co-op

By: Tayler Whitters

After I accepted the position with Cargill as a co-op, I was fortunate to place my top three desired locations around the United States. I was ecstatic to learn that I would soon be placed in Fayetteville, North Carolina at a soybean plant, which de-hulls soybean shells and extracts oil for future products.

Initially I was equally anxious and eager upon arriving in Fayetteville, North Carolina. I had no idea what to expect entering into this opportunity, but I happily accepted that it could open new doors for me as a student and individual.

The first two weeks of my experience were spent learning the plant process. Where the soybeans came from, the stages they endured during the process, and what the final product was, as well as how the finished products were used. I was pretty quick to catch on so I was able to begin my first project, which was to install a new machine to make the process more efficient. I dug up blueprints of the currently installed machine and worked with specialized engineers to design the new machine. The project was on a timeline, therefore improving my time management skills. This sounds inevitable, although when you are working on others' schedules as well it can get intricate. Working alongside other engineers and designers strengthened my communication skills. Not only did I learn an abundant amount of information about the complex machine I was installing, but also how to speak professionally in that type of setting.

Throughout my experience in North Carolina with Cargill, I completed multiple projects. By the end of the 8-month co-op, I had not only learned the de-hulling plant process, but also the soybean refining . I installed a meal grinder, increasing the processes efficiency. I had demolished a room containing asbestos, working with many health administrators and contractors to make the plant a safer work area. I redesigned a testing lab using ergonomics to make testing easier and more efficient for the plant operators. I redesigned the warehouse and strategically moved an old warehouse to a new warehouse using new high density cabinets. Throughout my experience at Cargill I was allowed to finish multiple projects totaling $2 million.

When leaving North Carolina, I had gained knowledge of machinery, professionalism, communication skills, and types of different processes and operations. This was especially helpful coming back to a full schedule of classes. I still use background knowledge learned from my co-op and can apply real world situations to classroom problems. It also gave me valuable insight on what I would like to do for my career pathway, and what I do not want to carry out as a career. Ultimately, having the opportunity to participate in a co-op as a sophomore was extremely worthwhile and I recommend it to all students.

Safety Topical Paper: Defunding of the Chemical Safety Board

By: Rachel Kessler

Next year's budget proposal has been made by President Trump which includes funding cuts for 19 independent agencies. One such cut is for the federal funding of the Chemical Safety Board (CSB) (Birnbaum, 2017). The CSB is an agency whose main focus is the investigation of accidents occurring on chemical plants and refineries and making public the issues and mistakes made by those involved in the accident (Birnbaum, 2017). The board then provides educational tools based on the findings of these investigations which are used countless times by chemical plants all over the United States in order to make facilities increasingly safer. The CSB should not be defunded because it requires such a small portion of U.S. federal funds, determines root causes of major industrial accidents, and most importantly, ensures a safer future for those working in the manufacturing industry.

The CSB's annual funding of $11 million is small portion of the U.S. budget and is well worth the taxpayer cost. In 2015, the U.S. federal budget totaled $3.8 trillion, meaning the total funding for the CSB entailed a $3x10^{-6}$ fraction of the U.S. federal budget while more than half of all discretionary spending was used for funding of the military (Federal Budget 101, 2015). In order to save money, the U.S. government should cut money from programs which already receive large portions of the federal budget in order to keep smaller independent agencies, such as the CSB, intact. Although it is a miniscule portion of the budget, the CSB is an agency whose duties are essential and not performed by any other such agency.

The CSB has noted that of the 19 agencies proposed for defunding, it is the only safety-related program (Chemical Safety Board, 2017). The CSB provides key investigations in order to determine the root cause of industrial incidents. In April 2013, the CSB investigated a case of a detonation of 30 tons of ammonium nitrate in a fertilizer storage facility in Texas, which killed 15 and damaged 150 surrounding homes and buildings. Because of this investigation, the dangers of ammonium nitrate storage were brought to light and the zoning issues which resulted in properties built too close to the facility were solved with the help of the CSB recommendations. Had this investigation never taken place, these findings may have never been determined (Chemical Safety Board, 2017). The CSB is a non-regulatory agency, meaning they cannot offer penalizations of businesses; instead, the investigations are transparent and the findings are open to the public (Chemical Safety Board, 2017). Because of this, the CSB does not cost industry any money. Plants and refineries can review their findings and determine whether or not to take action in order to improve the safety of their facility. These investigations are vital in the understanding of industrial incidents and their root causes.

The CSB allows for safer working and living conditions for the future. The board has investigated over 130 incidents, from which 788 safety recommendations have been made. Of those investigations, 78% have been closed (Chemical Safety Board, 2017). Additionally, their products including safety reports, recommendations, and videos are used regularly in teaching and training in all aspects of the chemical industry. The board has educational tools and recommendations for laborers, first responders, community leaders, and more. Their video program has video products which have been viewed over 6 million times (Chemical Safety Board, 2017). Although the CSB is not a regulatory agency, it is clear that their safety resources and recommendations are being put to use in order to reduce the number of incidents which occur in industry.

The CSB saves American companies more money and lives than it costs the American government. At such a small fraction of the U.S. federal budget, it is not worth defunding the agency to cut costs. With its investigations and safety recommendations, the CSB saves countless lives in its resources for accident prevention. As a result, cutting the funding for the Chemical Safety Board is a mistake and will result in preventable industrial incidents occurring more frequently.

Safety Topical Paper: Defunding of the Chemical Safety Board (Continued)

By: Rachel Kessler

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Safety Topical Paper: Inherently Safer Deisgn

By: Sarah Keith

Inherently safer design was coined by British chemical engineer Trevor Kletz in the late 1970's. The simple concept holds that it is better to design processes that eliminate chemical plant hazards at the beginning than to engineer "add-on" technologies later and try to control them (Johnson). In the early 2000's debates raged over how to make America safer, specifically the chemical industry, after the terrorist attacks on 9/11. They talked about having more guards, more inspections, or even doing away with chemicals and processes most likely to be a danger to people. As the debates continued, the idea of inherently safer design came to the forefront. The concept was a way to make the industry safer without inherently hindering the business. While not every process can be made safer, the idea became a common solution to hazard reduction, with benefits going far beyond just stopping terrorists.

There are four paths for inherently safer designs. The first is minimize or intensify, this involves using smaller quantities of hazardous chemicals. An example is reducing inventories of in-process intermediates and raw materials or intensifying production by increasing reaction efficiencies. Next is substitute, replacing hazardous chemicals with safer ones, such as eliminating harmful solvents in paint coatings (Johnson). Moderate, shifting to safer processes and chemicals, also modifying facilities to limit impact of harmful chemical releases. The last is simplify, design facilities to eliminate unnecessarily complex operation, which would make errors less likely to occur and more forgiving. All of these paths would make a plant less of a target for a prospective terrorist, as well as provide safety benefits to its workers.

Unfortunately there is large opposition from the chemical industry against more government regulations. While I am usually against intrusive regulations that can bog down and hurt businesses, I think the US government has the right to require the chemical industry to try and protect against terrorists. National defense is the only mandatory function of the federal government. Article Four, Section Four of the Constitution states that the "United States shall guarantee to every State a republican form of government and shall protect each of them against invasion." (Talent). In other words, the federal government is mandated by the Constitution to provide for the common defense. I think that this obligation can fall into the realm of securing industrial facilities inside the US from the threat of terrorist attacks. Currently 3,471 facilities are regulated under the Department of Homeland Security (DHS) Chemical Facility Anti-Terrorism Standards program. The DHS stated that more than 3,000 facilities have "voluntarily removed, reduced, or modified their holding of chemicals of interest" since the program began in 2007 (Chemical Plants Improve Security). Many think that the DHS's rules are working

Safety Topical Paper: Safety Regulations in the US (Continued)

By: Sarah Keith

as companies try to make their facilities an unattractive target for terrorists. I think that the DHS's plan is called for and can help prevent more tragedies from happening in the US.

Dennis C. Hendershot, a senior engineer who has spent 32 years in industry said, "The first solution to a process safety problem should always be to get rid of the hazard, not control it." (Johnson). Many people in favor of safer design say there is a hierarchy in using the concept. It begins with removing the hazard, applying passive controls that limit the impact of an accident without human intervention, then active controls, and finally, if all else fails, adding more operating procedures (Johnson). Some benefits of safer design include greater efficiency, needing smaller inventories of intermediates, less complicated procedures, and not needing expensive active control systems (Johnson). These benefits are a great incentive to push the industry towards safer design.

Another aspect of inherently safer design is the EPA's Risk Management Plan (RMP), which was put into effect in 1990 as part of the Clean Air Act amendments. This rule requires facilities that use hazardous substances to develop a Risk Management Plan and submit them to the EPA every five years. Information required by the rule helps local fire, police, and emergency response personnel to prepare for and respond to chemical emergencies (Hess). Currently, the EPA is looking at updating its RMP regulations to expand the list of chemicals covered by the RMP program and requiring facilities to conduct safer technology and alternatives analyses (Hess).

There are mixed feelings about the EPA's plans, with industry mostly against it and some concerned citizens for it. The industry believes that the EPA has not demonstrated that anything is wrong with the current regulations and that there is not enough evidence to add any chemical to the list of regulated substances. Proponents for the change however, argue that the current regulations and regulated chemical lists are far too limited and should be changed to include chemicals that are explosive, reactive, or have a significant chance of causing a catastrophic accident (Hess). I agree that the RMP is a great way to help implement safer design into the industry and updating the rules would be a good idea.

As mentioned earlier, inherently safer design isn't always applicable for every situation, but where it can be implemented, it should be. The concept provides numerous benefits to civilians, workers, and the industry. There will always be the chance of an accident as long as humans are involved, but safer design helps make up for potential human mistakes and drastically mitigates the severity of an accident. The industry will almost always oppose regulation, and most of the time I agree with them, but in the case of national security I believe that inherently safer design should be implemented in the chemical industry.

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Safety Topical Paper: Chemical Regulation: What is the Best Approach for the US?

By: Jacquelyn Ricke

There has been much discussion revolving around chemical regulation in the United States since the passing of the Toxic Substances Control Act (TSCA) in 1976, but it has increased recently with the passing of The Frank R. Lautenberg Chemical Safety for the 21st Century Act, which is an overhaul of TSCA. Both the original and new laws give the power and responsibility of commercial chemical regulation to the Environmental Protection Agency (EPA). It is important to note that the Food and Drug Administration (FDA) has its own regulations, and the regulations of discussion here are for chemicals used in producing other goods, such as cleaning products, soaps, plastics, vehicles, and other commercial items (Hogue, 2016 B). The chemicals used in these household products are not nearly as strictly regulated as those in foods and drugs, which has been concerning cognizant consumers more in recent years. Additionally, the chemicals used in production and manufacturing may cause safety and environmental hazards for those in the surrounding community. With greater chemical regulations comes greater safety, both to those living in the vicinity of a plant or factory and those purchasing the finished products. Chemical regulation discourse primarily revolves around whether the overhaul of TSCA was enough, or if the US needs to adopt a more robust system like that in the European Union (EU). There, the European Chemical Agency (ECHA) enforces the Regulation, Evaluation, Authorization & Restriction of Chemicals (REACH) legislation. While REACH may seem to be a better chemical regulation system superficially, it is not the best approach for the US today. The recent passing of TSCA reforms and the lack of consensus around the true benefits of REACH support the notion that the US should wait several years before considering adding more chemical regulations.

The Lautenberg Act is still in the initial stages of its implementation, and it will be a long time before it is fully in effect. It is still a marked improvement over TSCA, though. One of the most impactful parts of the Act is the restoration of responsibility and power to EPA. While there was supposed power in TSCA, it was unreasonable for EPA to carry out the requirements for implementation of a regulation on a chemical, and they had not been able to regulate anything. Since EPA did not have much power, many states made their own regulations. Since this power to effectively regulate chemicals has been restored, if EPA completes evaluation of a chemical, its ruling must be accepted by all states (Hogue, 2016 B). Arguably the most interesting aspect of the reform was the support from seemingly opposed groups. Reform was initially called for by both environmental activists and many in the chemical industry, and the bill received bipartisan support in Congress (Hogue, 2016 A). The chemical companies' support of new regulation primarily stemmed from the uncertainty of the public. They are looking for higher regulation, so the EPA can say their products are safe for use and restore the trust of the currently skeptical public (Hogue, 2016 B).

The EU's REACH is often looked to as a standard the US should strive for. Implemented about 10 years before the Lautenberg Act, REACH contains all of the same regulations and more. The primary difference is the use of three lists: substances of very high concern (SVHC), the candidate list, and the Authoriation List. The SVHC list contains chemicals which are likely to be studied and regulated more intensely in the future. The candidate list contains substances in line to be very intensely studied and scrutinized. Finally, the Authorisation List contains chemicals which have been banned. Since the candidate list is publicly available, many companies feel pressure to begin searching for alternatives. Some have even eliminated, over time, the use of chemicals on the SVHC list (Scott, 2016).

There are a few concerns that arise when looking to implement a system more similar to REACH in the US. First, the Lautenberg Act is just in the starting stages of implementation. EPA was given many more responsibilities, and is

Safety Topical Paper: Chemical Regulation: What is the Best Approach for the US? (Continued)

By: Jacquelyn Ricke

still working to determine how to implement them all. Melanie Benesh, a legislative attorney for the Environmental Working Group, estimates it will take 35 years for the act to be fully implemented (Hogue, U.S. chemical regulation shifts, 2016). There are already many changes coming with the Lautenberg Act, and it would be best focus on implementing those first. If more resources become available, they should be used to finish implementation of these already-passed regulations first. Then, once that is in the final stages, sights can be set on passing newer, stricter rules which will be similar to REACH. If newer regulations were to be pushed forward today, there is a chance that they system would shock and the Lautenberg Act would not have a chance to make its impact.

An additional concern is that it appears that REACH may be driving industry outside of the EU and to countries such as China (Hogue, 2016 B). Not only does this take away jobs in the EU, but it introduces the potential for lower safety, environmental, and ethical standards. If the environment is harmed even more in a country with looser restrictions, it hurts everyone and is counterproductive. It is best to keep these companies in places where regulations are generally more strictly created and enforced, such as in the EU or the US.

Finally, there are mixed signals on whether REACH is actually affective. Thus far, nearly all of the supporting evidence is anecdotal and not data based. In a few distinct cases, there is a correlation between the passage of a chemical regulation and an increased number of patents for safer chemical alternatives. This was the case for "alternatives for certain hormone-disrupting phthalate plasticizers," where the number of patents increased from five to fifteen and later twenty per year when the EU passed REACH and then when they were identified as SVHCs (Scott, 2016). While this correlation occurred in one or a few instances, there are no data available to suggest that it is widespread or that the regulation was actually the change-driver. Additionally, over a third of small and medium-sized companies in the EU reported that REACH was hindering their innovation, while some large companies have stated it has no impact on them at all (Hogue, 2016 B). This unintended result is especially concerning to many in the US when discussing REACH, as many Americans consider themselves to be strong supports of small businesses and 88 percent of them view small businesses favorably (Shane, 2013).

Overall, it is still too early to tell if implementation of a program similar to REACH could be effective in the US. For this reason, it must be concluded that the US should focus its efforts on quickly and effectively implementing the Lautenberg Act, and revisit the topic of more reform in the future if it is deemed necessary. The Lautenberg Act is already an improvement to TSCA, and both EPA and the chemical industry need to be working hard together to meet the requirements of its changes. In time, the EPA's records will multiply, trust in commercial chemicals and the industry will grow, and the public will be safer.

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Safety Topical Paper: Chemical Regulation-The Best Approach for the United States

By: Madison Murhammer

Although the United States has recently made great improvements to its 40-year-old chemical regulation policy, the country still has to make considerable progress in order to ensure that commercial chemicals are safe. Decades worth of chemical safety assessments need to be performed to ensure that all the hazardous chemicals are regulated further or banned from use in the United States. Further improvements must be made to the United States' current chemical regulation laws in order to align them with the European Union's (EU) policies, including providing funding for the development of less harmful chemicals.

The Toxic Substances Control Act (TSCA) was passed in 1976 and acted as the United States' key chemical regulation until June, 2016. There were many flaws with this legislation, which allowed companies to produce chemicals without performing any risk review to establish their safety. The Environmental Protection Agency (EPA), who enforced the TSCA, had limited power to take chemicals off the market. In order to obtain the toxicity data for a chemical, the EPA had to be able to provide evidence of the specific risks of the chemical, which posed a dilemma, because the EPA required the toxicity data in order to recover the necessary evidence. This allowed known dangerous chemicals to stay on the market, creating adverse health and environmental effects, because this paradox never allowed adjustments to be made. This law also allowed companies to argue that certain chemical information was a trade secret in order to suppress compromising data, including environmental issues and lethal toxicity statistics, from the public (Faby, 2016).

On June 22, 2016, the United States passed a revised chemical regulatory law, titled the Frank R. Lautenberg Chemical Safety for the 21st Century Act. This law requires that all marketable chemicals be fully evaluated by the EPA to guarantee that the health and environmental adverse effects are minimized. Many updates were made to improve the TSCA. One important change allows the EPA to request toxicity data from companies much more efficiently than with the old act, which required the EPA to document the actual risks of a chemical and follow a formal process which took years to complete. In addition, the EPA now must complete risk and safety reviews on all marketable chemicals, expected to take over 30 years. This means that all chemicals, whether they are dangerous or not, will remain on the market until their safety reviews are completed. Legislative attorney Melanie Benesh estimates that it will take 35 years for commercial chemicals to be thoroughly affected by the Lautenberg Act. This delay is just one of the many consequences of the TSCA's improper chemical regulations. Another important change makes it much more restrictive for companies to claim trade secrets. They must submit a formal document with evidence to support any supposed trade secrets. This creates a structure that is much more perspicuous, giving the public more information about potential hazards (Hogue, 2016).

Similar to the Lautenberg Act, the EU follows the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH) legislation for chemical regulation. Under this law, companies are required to register all the chemicals they produce or transport into the EU with the European Chemical Agency (ECHA). They must also supply toxicity data. Upon receiving this information, ECHA conducts an evaluation to conclude whether or not the risks associated with the chemical can be minimized. Chemicals with manageable risks are cleared for production in the EU. The more hazardous chemicals are then sorted into different classifications. For example, mutagenic and carcinogenic chemicals are labeled "substances of very high concern," which are saved for future review by ECHA to determine whether or not these substances should be put on the Authorization List. This list contains chemicals that are barred from being made or transported to the EU, due to their classified hazards (Scott, 2016). Critics believe REACH is slowing down innova-

Safety Topical Paper: Chemical Regulation-The Best Approach for the United States (Continued)

By: Madison Murhammer

tion. Some chemicals on the Authorization List do not have any known substitutes, which has forced companies to curb or even move production outside of the EU. However, ECHA has provided funding for the research to develop these safer substitutes for companies, supporting that this law will force the development of less harmful chemicals in the EU (Scott, 2016).

The EU REACH legislation has proved to be very powerful by effectively regulating and restricting over 1,000 chemicals from use in the EU (Chemical Inspection and Regulation Service, 2015) The United States' Lautenberg Act is very similar, but improvements should be made to this act to make it more similar to REACH. Most importantly, the EPA should follow in the ECHA's footsteps by providing the funding to develop less harmful chemical substitutes. A separate branch within the EPA should be created for the sole purpose of developing these safer substances, making sure that this funding is being used properly and these substances are being created efficiently. Creating these safer substitutes would reduce the negative health and environmental impacts of hazardous chemicals without the backlash from big companies that may rely on their use.

If the EPA wants effective chemical regulation, it is important that they introduce less harmful alternatives and force the development of these safer substances. The United States has made great progress towards the creation of acceptable chemical regulations, but there are appreciable changes that need to be made to ensure that the environment and citizens remain healthy. Advancements need to continually be applied to avoid the dangerous outcomes and ensure the country's safety for years to come.

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Safety Topical Paper: Proper Regulatory Implementation: The Inherently Safest Design

By: Corinne Andresen

West, Texas. A fertilizer plant explodes, killing fifteen and injuring 180. Anacortes, Washington (Hess and Johnson, 2014). A fire breaks out in a refinery, killing seven (Hess and Johnson, 2014). Accidents as deadly and dramatic as these catch public attention. The media raises voices and asks questions. How could these disasters have been prevented? And what is a solution that satisfies activists, the public, and industry?

Unfortunately, accident prevention is not as simple installing a single regulation. The chemical industry is already regulated. The Environmental Protection Agency (EPA) requires that facilities in possession of hazardous chemical create risk management plans (Hess, 2014). The Occupational Safety and Health Administration (OSHA) limits the toxic chemicals that workers may be exposed to (Hess and Johnson, 2014). The Chemical Facility Anti-Terrorism Standards (CFATS) requires that faculties handling potentially weaponizable chemical develop security plans (Hess, 2014). Though extant, current regulations do not prevent accidents, or even

Safety Topical Paper: Proper Regulatory Implementation: The Inherently Safest Design (Continued)

By: Corinne Andresen

reduce them to rare events (Hess and Johnson, 2014).

The Chemical Safety Board (CSB) suggests that a very specific type of regulation could reduce accident frequency (Hess and Johnson, 2014). It proposes mandating the adoption of inherently safer design (ISD). ISD is an engineering approach that focuses on risk prevention as opposed to risk management (Hess and Johnson, 2014). Instead of dealing with the aftermath of an accident, it seeks to reduce the potential for an accident to occur. On a more concrete level, ISD can take a number of forms. It can mean the replacement of pipes with a more corrosion-resistant material, even before corrosion has begun to cause problems. It can mean reducing a flammable reagent with a less flammable one, even if the flammable reagent is legal and commonly used. Such an approach requires frequent examination of facilities and an intimate knowledge of the processes involved (Hess and Johnson, 2014).

Though the CSB believes in the potential of ISD, not everyone agrees. Various industry representatives, such as the American Chemistry Council (ACC), argue that the mandatory ISD would provide a solution to the wrong problem (Hess, 2015.) Frequent accidents stem not from flawed policy, they argue, but from lack of enforcement of existing regulations (Hess, 2015.) They further argue that far-off bureaucrats are too removed from chemical plants. No regulator knows the processes as well as the operators. Let safety and design in be managed in-house (Hess, 2015).

In a world of conflicting paradigms and interests, the most practical and implementable solution pleases both parties. Fortunately, an example of mutually agreeable regulation already exists. Since its passage in 2007, CFATS has already encouraged over 700 facilities to adopt one of the most common principles of ISD – the substitution of hazardous chemicals for less hazardous ones (Hess, 2014).

The success of CFATS lies in its details. It requires manufactures to invest a certain amount of money in plant security – as long as they handle chemicals that could be used as weapons. If they switch to less weaponizable chemicals, they may exit the program and shake off the costly investment. In this case, inherently safer design comes with financial motivation (Hess and Johnson, 2014). Perhaps mandated ISD could follow similar lines. The EPA could require companies to invest a certain amount in risk management, but allow them to opt out of the investment if they prove they are regularly applying ISD to their facilities. It would provide a financial incentive for industry while simultaneously focusing on the "enforcement" that industrialists claim is the true cause of accidents.

In a perfect world, both industry and government would do everything possible to ensure that chemical manufacturing is safe. In the real world, regulation is necessary and solutions must be tolerable to all parties. The CFATS model proved to be a mutually agreeable compromise and a practical success. Providing a financial reward for ISD will ensure that this technique is actually implemented at chemical facilities.

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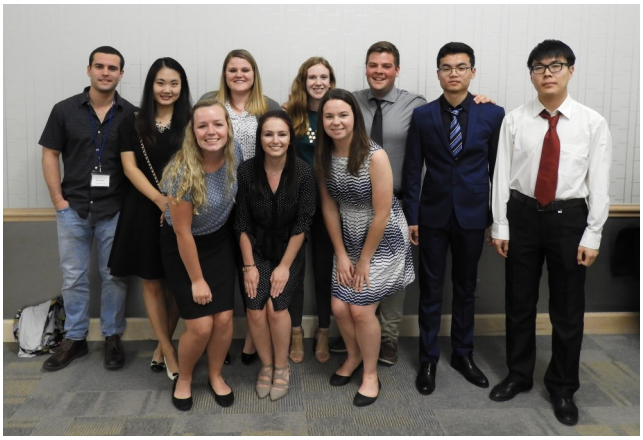
AIChE Student Regional Conference Spring 2017 in Tulsa Oklahoma in Photos

By: Rachel Seibel



A Bittersweet Farewell: Senior Banquet in Photos

By: Rachel Seibel

A Bittersweet Farewell: Senior Banquet in Photos (continued)

By: Rachel Seibel

Acknowledgements

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

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Editor-In-Chief Rachel Seibel would also like to thank the following people for their support and contributions to the Spring 2017 AIChE Student Chapter Newsletter:

Faculty Advisor: Prof. David Murhammer

Contributors: Elizabeth Zimmerman, Jacquelyn Ricke, Eastyn Fitzgibbon, Tayler Whitters, Jenny Stevenson, Kyle McCarthy, Allison Vaske, Rachel Kessler, Madison Murhammer, Corinne Andresen, Sarah Keith

Your help is much appreciated!

Interested in speaking at professional seminar? If so, then contact AIChE Student Chapter President at elizabeth-zimmerman@uiowa,edu or Student Chapter Advisor Prof. David Murhammer at david-murhammer@uiowa.edu for details and availability!

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