The University of Iowa

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AIChE SPRING 2013

Advisor's Corner

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

Greetings to Hawkeye Chemical Engineers!! This Spring 2013 issue of our AIChE Student Chapter Newsletter begins with an article about the 2013 AIChE Mid-America Regional Student Conference held in April at the University of Oklahoma in Norman that was attended by many of our students. I am very pleased to announce that our ChemE Jeopardy team won the regional championship and will represent the Mid-America Region in the national competition being held at the 2013 AIChE Annual Student Conference in San Francisco in early November. This issue also contains an article about the 2014 AIChE Mid-America Regional Student Conference that is being hosted by the University of Iowa. This is a major event for our AIChE Student Chapter since we only host this event once every 12 years. Furthermore, this issue contains three articles about recent cooperative educational experiences of our students at PotashCorp Aurora, Cargill, and International Paper, respectively. Finally, this issue contains five student-written topical papers from our Chemical Process Safety course. Three of these topical papers address the issue of protecting chemical plants from terrorists, while the other two topical papers discuss the need to update the current chemical regulations in the United States, i.e., the 1976 Toxic Substance Control Act.

University of Iowa American Institute of Chemical Engineers

INSIDE THIS ISSUE:

2013 AIChE Mid-America Regional Student Conference

By: Emily Zelnio - Junior Chemical Engineer, Newsletter Editor of AIChE Student Chapter

The 2013 AIChE Mid-America Regional Student Conference was held in Norman, Oklahoma on April 19-20. Students from 11 Chemical Engineering programs in the Mid-America Region attended the conference, including 18 students and the advisor from The University of Iowa Department of Chemical and Biochemical Engineering. The conference had many fun and professional development activities, including the Chem-E-Car competition, Chem-E-Car Poster competition, a student research presentation competition, and ChemE jeopardy.

Our chapter participated in the Chem-E-Car and Chem-E-Car Poster Competitions. While our Chem-E-Car finished 9th among the 10 competing cars, we were able to walk away with the "Spirit of Competition" award. For the first time since 1990 (according to Prof. Murhammer), we did not have any student participating in the research presentation competition.

Since our ChemE Jeopardy team won the 2012 Regional Competition and represented the region in the 2012 national competition, it was our goal to again place first at the Regional Conference in order to continue the new tradition. We had two teams, "Hawkeye Black" and "Hawkeye Gold" competing in the competition. Each of these teams won their respective preliminary matches and qualified for the final round. In the end, the "Hawkeye Black" team finished 1st among the 9 competing teams and qualified to represent the Mid-America region in the 2013 National Competition being held in San Francisco in early November. The "Hawkeye Gold" team placed 3rd. The members of the "Hawkeye Black" team were senior Ben Ungs, and juniors Nick Schickel, Matt Taylor, and Austin Hangartner. The "Hawkeye Gold" team members were juniors Tyler Latcham and Ian Smith and sophomores, Danny Yocius and Jake Crome.

Overall, this conference was a huge success and those that participated greatly benefited from all aspects of the trip. The 2013 AIChE Annual Student Conference will be held in November in San Francisco, where we will participate in the ChemE Jeopardy competition since we placed first at Regionals. Participating and attending these events at Nationals will give us the opportunity to experience numerous invaluable networking and professional development opportunities. This will also help prepare us to host the 2014 AIChE Mid-America Regional Student Conference being held April 11-12 at the University of Iowa.

University of Iowa Chemical Engineering students in Norman, OK at the 2013 AIChE Mid-America Regional Student Conference.

Hosting the 2014 AIChE Mid-America Regional Student Conference in Iowa City

By: Ian Smith - Junior Chemical Engineer, Webmaster of AIChE Student Chapter

The 2014 AIChE Mid America Regional Student Conference will be held in Iowa City on April 11-12. The planning process began recently during a meeting of the Conference Co-Coordinators, Austin Hangartner and Ian Smith, with the AIChE Student Chapter Advisor Prof. David Murhammer.

The Seamans Center for the Engineering Arts and Sciences will be the primary building used to host events during the 2014 AIChE Mid-America Regional Student Conference.

The conference will include the Chem-E-Car Competition, the Chem-E-Car Poster Competition, the Student Research Presentation Competition, and the Chem-E Jeopardy Competition. There will also be an opening student mixer on Friday night and a closing banquet on Saturday evening that will include a keynote speaker, award presentations and entertainment.

The most challenging aspect of planning the conference is fundraising from corporate sponsors and individuals. The expectation is that the conference will be attended by more than 250 students from the 12 chemical engineering programs in the Mid-America Region. The schools in this region are the University of Oklahoma (Norman), Oklahoma State University (Stillwater), the University of Tulsa (Tulsa), the University of Arkansas (Fayetteville), the University of Missouri (Columbia), the Missouri University of Science & Technology (Rolla), Washington University (St. Louis), the University of Nebraska (Lincoln), the University of Kansas (Lawrence), Kansas State University (Manhattan), Iowa State University (Ames), and the University of Iowa (Iowa City).

The Conference Coordinators are currently assembling committees for each of the major events to ensure that every event receives the necessary attention, thereby leading to a successful conference. The 2014 AIChE Mid-America Regional Student Conference will be a very busy and fun-filled weekend for the many chemical engineering students in attendance.

If you would like to contribute either financially and/or by serving as a judge (judges are needed for Chem-E-Car safety, Chem-E-Car posters, and the Student Research Presentations), then please contact either Austin Hangartner (austin-hangartner@uiowa.edu) or Prof. David Murhammer (david-murhammer@uiowa.edu).

The Old Capitol Building located in the middle of campus will be a highlight for many students traveling to Iowa City from throughout the Mid-America Region.

Sulfuric Acid Plant Operations Co-op

By: Pat Johnson - Junior Chemical Engineer

When I first took in the sheer size of the company where I would be working for the semester, I was both excited and intimidated. I am working for the company PotashCorp Aurora, locally known as PCS Phosphate, as a chemical operations/ production engineering intern in the Sulfuric Acid division of the jobsite. The whole jobsite is very large and consists of a 10 square mile phosphate strip mine and mill in the mining side. On the chemical side, there is an anhydrous ammonia production plant, purified solids and liquids production facilities, defluorinated phosphate (DFP) plant, three sulfuric acid plants and a water treatment plant, four phosphoric acid plants, and a silicon tetrafluoride (STF or SiF_4) plant. Since I am working in the sulfuric acid division, the bulk of my internship is spent in the three sulfuric acid plants and the water treatment plant; however, I have spent time completing a project in the DFP plant as well.

It is remarkable how the whole jobsite works together stepwise in a way where each plant produces products that are used for production of other products in additional plants down the line. Phosphate ore is mined and then transferred by slurry to the chemical plants. The slurry is then processed in the mill which separates the liquids from the ore and sends the ore to the DFP plant. The DFP plant roasts the ore in a kiln with other chemicals and then scrubs the gases with a chemical scrubber, which separates and purifies by-products such as hydrogen fluoride (HF) and phosphorus pentoxide (P_2O_5); the HF is sold to fluorinate water supplies in the area as well as being sent to the STF plant, while the P_2O_5 is used in the phosphoric acid production process. The phosphate ore then goes through calcination to separate more impurities in order to be sent to the fertilizer facilities as well as the phosphoric acid plants. The phosphoric acid plants sell acid to vendors such as Coca-Cola and other food/ drink companies, while the STF plant sells to computer production vendors; the gas used to make computer chips and motherboards.

Three sulfuric acid (H_2SO_4) plants produce industrial grade acid of 96.7 to 99% purity in order to sell as well as contribute to the process of phosphoric acid. Additionally, the water treatment plant provides reverse osmosis purified water to the sulfuric acid plants and to other branches of the jobsite.

My project consisted of updating the process and instrumentation diagrams (P&IDs) for the plant's different apparatuses and "redlining" the different changes that had been made in order to create up to date versions. These diagrams are much more extensive than flow diagrams; showing the different valves, pipes, instruments, and various other details that make up a piping system and/or process components. I have not taken an instrumentation or process engineering course, however, with the help of the water treatment operators, I was able to update all 35 P&IDs and understand the symbolism of piping, valves, and instrumentation panels. This knowledge will be helpful when taking process and instrumentation courses in the future.

"...apply my knowledge gained in the classroom to an industrial setting…"

Overall, I believe that this internship has been the best that I could have imagined. I was able to apply my knowledge gained in the classroom to projects and training in an industrial setting; gaining new knowledge that I will be able to take back to the classroom in the Fall. The skills gained when working hands-on and in the real world are invaluable for an engineering career and will give me greater confidence in the classroom to approach complicated tasks. I am very thankful that PCS Phosphate and The University of Iowa helped give me the opportunity to succeed in my future in chemical engineering.

Cargill: Production Management Engineer Co-op Program

By: Samantha Marek - Junior Chemical Engineer

For my engineering co-op experience, I accepted the position of Production Management Engineer at Cargill in Cedar Rapids, Iowa. The job description entails many responsibilities and objectives such as gaining an understanding of the plant, process, and equipment by working with a diverse group of process areas and projects. It also involves developing effective strategies to design solutions to issues in the plant, while keeping safety, practicality and capital cost in mind. Another important aspect of the job is to learn about different environmental regulations for air emission points and sewer emission points. Safety in a plant/process environment is also a major point that Cargill has stressed throughout my first few weeks here, and they see it as another objective to teach their co-op engineers to think about it constantly, presenting it more of an attitude than a task.

A situation or task that I was engaged in was reporting the daily production numbers to the official records for the headquarters to analyze. The actions I took to do this were making sure to update all of the spreadsheets involved and then carefully entering the data into the website. Another task that I was involved in was doing the monthly summaries or updates for the refinery department that I worked in. I took different numbers from various aspects of the refinery process to compile the data into a single document that highlights the important information from the month.

Along with daily tasks and situations, I was also assigned to a few projects. A project that I was involved in was replacing pressure transmitters that had failed over the converter system. I had to research to find a transmitter that was more reliable in certain stream conditions, such as high pressure and low pH. Once that was done, I had to figure out what else was needed to install these transmitters. I received quotes from the manufacturer and ordered the parts through their system. I also entered work orders to explain what needs to be done and so that the preventative maintenance could be scheduled during a time where the converter system is shutdown.

A different project that I worked on is bypassing a tank in the process and sending the product to a filter that can be converted into a swing filter. This will allow it to process the recycle separate from new product to help meet and exceed the quality specifications more often. I have written a bid package to send to different piping contractors for the new piping to be installed, a bid package for electrical contractors to unwire and rewire new valves, and one for valve contractors for the new valves. After I received a firm bid from each company, I proposed the project to the board members to see if there was capital money to spend and also if they approved the project or had any constructive suggestions for it.

There have been a number of classes that I have taken at The University of Iowa that have been very useful in terms of this co-op experience. The number one course that I have used skills from has been Flow and Heat Exchange. The plant has many pumps, valves, pipes, and heat exchangers, all of which I had learned about through that specific class. The flow and pressure concepts are also very important and this was definitely a course that I was glad to have before the co-op.

Overall, I had a very good experience at Cargill, and I feel that The University of Iowa has prepared me very well in terms of problem solving, troubleshooting, and presenting real life applications.

"...The University of Iowa has prepared me very well in terms of problem solving, troubleshooting, and presenting on real life applications…"

Process Engineering in the Paper Industry

By Austin Hangartner - Junior Chemical Engineer– Conference Co-Coordinator of AIChE Student Chapter

This spring I worked as a process engineering intern in the manufacturing support department at International Paper: Cedar River Mill located in Cedar Rapids, Iowa. At the Cedar River Mill (CRM), 100% recycled containerboard is produced and shipped to box plants in the region. If you have ever deposited corrugated cardboard into City Carton's receptacles at Iowa City then that paper was most likely recycled at the Cedar River Mill.

The recycled paper process requires millions of gallons of water a day which means there is an obligation to lessen and eventually eliminate any environmental degradation caused by production. As a process engineer, it is our job to think outside the box and find ways to reduce and reuse our process water to decrease our environmental impact. A project that is currently underway is testing a new chemical company's water treatment process. The water treatment process uses reactive polymeric solutions that mix with the process water and flocculate microorganisms and decaying fiber fragments. These substances can contaminant the final paper product and increase the costs with treatment by the Cedar Rapid Water Pollution Control Facility. My role in this project has been managing the MSDS database and communicating with the contractor to maintain the policy that no chemical is brought on site without approval. Once the trial is in full motion, I will be running tests on the water feeds and effluents to determine the effectiveness and calculate the cost benefits of a full scale project.

INTERNATIONAL PAPER
From innovation to results.

"...given a problem and providing a solution regardless of academic background. This is engineering in the paper industry…"

Another project that I took a more leading role in was developing a Visual Basic Application (VBA) within Microsoft Excel that would assist mill control room operators in running day-to-day operations more consistently. This application integrates real time process data and compares them with a range of optimal process conditions to increase process reliability and paper quality. The program will be easily viewed by operators by utilizing a visual response to indicate bad, okay, and good process conditions. Respectively, red, yellow, and green will indicate to operators to take the appropriate action.

This internship has enlightened me on how diverse job tasks can be in the paper industry. One day you may be researching chemicals and their associated hazards. Another day you may be writing programs and learning code. That's what makes the job exciting though, given a problem and providing a solution regardless of academic background. This is engineering in the paper industry.

Should Inherently Safer Technology be mandated under CFATS?

By: Eric Sauter—Junior Chemical Engineer

Since the terrorist attacks of 9/11, chemical manufacturing facilities have come under heavy scrutiny as potential national security threats. In late 2006, Congress enacted the Department of Homeland Security Appropriations Act of 2007. In addition to establishing funding for the Department of Homeland Security (DHS), the law gave DHS the authority to regulate high-risk chemical facilities and directed DHS to develop chemical facility security regulations. The resulting regulation is known as the Chemical Facility Anti-Terrorism Standards (CFATS) program (Roberts, n.d.).

The rule established risk-based performance standards and requires that chemical facilities prepare Security Vulnerability Assessments (SVA), which identify risks, and to develop and implement Site Security Plans (SSP). Facilities are covered by the regulation if they possess a threshold quantity of a certain chemical, which are referred to as "chemicals of interest".

Recently, DHS has been criticized for widespread management problems that have hindered implementation of the program. In an internal memo that was leaked to the media in 2011, a high ranking CFATS official detailed deficiencies in SSP reviews, facility inspections and personnel issues. As of late 2012, only 84 of the roughly 4,400 covered facilities had approved SSP (Allmond, 2012).

In spite of the critical issues that have ensued after the implementation of the CFATS programs, there have been many calls for further regulation of the chemical industry. One such proposal calls for a mandate regarding the use of inherently safer technology (IST). IST is the concept of eliminating risk by designing facilities that substitute safer chemicals and processes. Such a mandate would allow DHS to potentially require changes in chemical processes, inputs or end products (Zuckerman, 2012).

However, the implementation of IST is more complicated than it might seem. Such upgrades are not always possible and often there are other factors to consider than security and cost. In addition, according to industry experts, substituted processes or chemicals may not always improve the security and safety of chemical facilities.

In his testimony to Congress, William Allmond explained, "IST is a process-related engineering concept, not a security one." He continues, "A reduction in hazard will reduce overall risk if, and only if, that hazard is not displaced to another time or location and it does not result in the creation of some new hazard" (Zuckerman, 2012). For example, when one expert was asked by Congress to give a feasible example of IST, he argued that alternative forms of fertilizers such as ammonia nitrate should be substituted for anhydrous ammonia, thereby reducing the risk of toxic terrorism (U.S. Senate, 2006). However, this expert failed to consider important safety risks from this change.

In 2013, a facility in West Texas that was storing approximately 270 tons of ammonium nitrate exploded, and the resulting blast killed 15 people and leveled an entire town (Guarino, 2013). If the advice from one expert was followed, although one risk would have be reduced, the overall security risk reduction would be marginalized due to the explosive properties of ammonia nitrate. It should also be noted that the tragedy in West Texas was not due to an act of terrorism but due to poor safety practice by the facility.

The required implementation of supposedly lower-risk chemicals also has the potential to increase business costs and place an increased burden on manufacturers. This is despite the fact that companies that wish to avoid a potential catastrophe already have a natural incentive to use the safest design possible. In fact, since creation of the program, more than 2,000 chemical facilities are no longer deemed high-risk due to voluntary risk-reduction measures (Zuckerman, 2012).

Currently, the legislation does not give DHS the authority to proscribe specific security measures such as IST. The law is designed only to require facilities to determine their own security plan. DHS has also shown its inability to carry out the existing legislature. Provisions such as requiring IST are only likely to complicate the process further and create unnecessary and damaging burdens on the chemical industry. For these reasons, Congress should reject calls for greater regulation and not increase the authority of DHS to require IST for chemical facilities.

"...Provisions such as requiring IST are only likely to complicate the process further...."

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Chemical Plant Security– Looking Toward Inherently Safer Design

By: Nick Schickel—Junior Chemical Engineer, Vice President of AIChE Student Chapter

As the chemical industry grows, and more and more chemical plants are put into use, observing the potential hazards that are growing with the industry begs the question: what are members of the industry, and the American government, doing to keep citizens of this country safe? The answer to this question, as with the answers to many similar questions regarding the actions of the government's stance on the chemical industry, is not in any way simple, but one thing is certain. Chemical plants need to understand and implement inherently safer design in every day proceedings. Inherently safer design consists of four parts including moderation, substitution, minimization, and simplification, and although each of these is arguably as important as any other, the first three parts cover inherent safety more than adequately, providing physical plant security is implemented as well (Crowl & Louvar, 2011). Thus, in building up the chemical industry, plants should integrate inherently safer design through moderation and substitution, minimization, and physical security.

Two of the easiest ways a chemical plant can introduce inherently safer design are modera-

tion and substitution. Moderation, according to Crowl and Louvar, is using milder conditions in reactors and other chemical or physical processes, and substitution describes using less hazardous chemicals in place of those used currently (2011). By decreasing temperatures and pressure to as near atmospheric conditions as feasible, there are significantly fewer opportunities for equipment to fail. Not only this, but runaway reactions are less likely to occur at lower temperatures, as it is generally easier to keep a system cooler if less heat is involved. Although it is important to keep plant equipment safe and in working order, it is more important still to view the broader aspects of moderation and substitution as they affect the workplace. By utilizing less toxic or flammable materials, employees are much less likely to suffer burns or the effects of acute toxicity. External to the plant, those living in the area around the facility would be able to rest assured that they could suffer no severe health affects should an explosion or release occur, if the plant was forced to use lower temperatures and pressures and less hazardous materials such as inert refrigerants like nitrogen in place of chlorofluorocarbons or flammable propane.

The next most feasible way a chemical plant can incorporate inherently safer design is through minimization. Minimization requires that a plant use smaller reaction vessels, smaller storage vessels, and overall keep less hazardous chemicals on hand (Crowl and Louvar, 2011). As the population of the world grows, so does the threat of terrorism. Although the chances of a chemical plant being targeted for use in a terrorist action are small, there have been cases in which such an event has taken place. In January 2013, militants seized a gas plant in Algeria, and its employees were held hostage as the attackers attempted to formulate a plan to decimate the facility using an explosion of the gas on hand (Kulish and Nossiter, 2013). Although the plant was never blown up, and casualties were kept to a number significantly smaller than otherwise would have been, the point of the story stands. It is possible for terrorists to use the contents of a chemical plant as a weapon. In order to prevent such situations from happening as planned by terrorists, the chemical industry needs to urge its members to decrease the stores of hazardous materials on site. Aside from terrorism, decreasing on-hand quantities could significantly decrease the effects of an explosion or chemical release, should these events occur.

"...there are growing concerns that the chemicals used for benefits may cause significant harm instead…"

Finally, to institute the most effective inherently safer design program, the chemical industry should be required to have high external security standards. Depending on the type of chemicals stored or used at a plant, that plant may have a higher chance of being targeted for use in terrorist actions. Every plant in the chemical industry should be graded based on the types of chemicals used, the types of reactions used, location, and potential damage to people and property if a serious explosion should occur. Once graded in all of these areas, plants can be placed onto watch lists depending on the chances of significant damage occurring. Those plants on watch lists should be required to construct physical barriers such as concrete walls or barbed wire fences around the entirety of the plant's land. Not only that, but security personnel should be hired to protect such plants on a twenty-four hour basis, and background checks should be completed on all current and future employees, as well as all visitors to the plant. With such security measures, the chances that someone with harmful intent will gain access to hazardous chemicals is kept to an absolute minimum, and instances such as the Algerian gas plant hostage situation are significantly less likely to occur (Kulish and Nossiter, 2013). Also, all chemical plants should be required to have annual inspections by the Department of Homeland Security, and chemical plants on the watch lists should be required to have inspections every six months, so that security measures and personnel can be certified.

With the growing chemical industry, fear of experienc-

ing severe devastation because of a chemical plant explosion or chemical release, whether accidental or by terrorist action, is ever increasing. As the industry is relied on more and more often to supply useful items to society, there are growing concerns that the chemicals used for such benefit may be able to cause significant harm instead. By understanding and implementing inherently safer design in all chemical plants, the industry can assure American citizens that the chances of such a disaster occurring are at a minimum. Inherently safer designs in chemical plants should include aspects of moderation of reaction conditions, substitution of hazardous chemicals, minimization of on-hand quantities, and implementation of physical security systems. Only by striving to attain all of these qualities can chemical plants hope to make the American chemical industry as safe as possible.

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Chemical Plant Safety– Should Inherently Safer Design be Required?

By: Alison Stephan - Junior Chemical Engineer

Uncertainty regarding chemical plant safety in the United States makes for inadequate implementation of chemical safety regulations. The Department of Homeland Security (DHS) has been monitoring a chemical security regulatory program, Chemical Facility Anti-Terrorism Standards (CFATS), for seven years but has been faced with many dilemmas regarding the implementation of the processes (Allmond, 2012). Scrutiny of CFATS has opponents requesting new safety requirements for all chemical plants. The addition of new requirements would cause unnecessary spending for the chemical plants as well as the government agencies overseeing these facilities. Instead, the CFATS program should be utilized to its full potential and the legislation needs to be enforced in a more effective manner. Ultimately, chemical facilities should not be required to add inherently safer design systems to their plants.

The terrorist attacks of September 11th, 2001 sparked the desire for increased safeguarding of the nation's chemical plants against potential terrorist attacks (Hess, 2013). As a result, CFATS was enacted by Congress in 2007 to protect chemical facilities that produce or store threshold quantities of the approximately 300 chemicals that DHS has identified as chemicals of interest. The prevention of theft of the materials that could be used as weapons is another goal of this program (Hess, 2013). CFATS requires companies to submit a security assessment, on which the DHS can classify the facility based on potential risk associated with various parameter including safety, vulnerability, and personnel training and screening procedures. 'High-risk' facilities must complete a security vulnerability assessment (SVA) and construct a site security plan (SSP) that will outline how the company plans to reduce its risk for insecurity (Allmond, 2012).

Since the initiation of CFATS procedures, approximately 3,000 of the 7,000 chemical facilities in the U.S. originally flagged as high-risk plants have reduced their risk profile and have increased security spending (Hess, 2013). Approval for the remaining facilities has been more time consuming due to the fact that certain companies are required to provide more data regarding their plant security and safety procedures. To improve the process for authorizing SSP proposals, the American Chemis-

try Council aided the DHS in revising the security assessment constructed by the company. Better and quicker analysis of the company's current safety procedures and proposed security changes will drastically increase the effectiveness of the DHS and CFATS. Additionally, considerations should be made to create representatives for each company to communicate more effectively with DHS. Establishment of a permanent and more efficient program will successfully avoid the need for new inherently safer design installations for chemical facilities. The current safety designs are sufficient for most companies. Inherently safer design should be required for those companies who fail to pass the DHS and CFATS regulations. Requiring all companies to follow these procedures would be wasteful spending and would create a more hostile relationship between businesses and the government.

Currently, Congress renews DHS's authority over CFATS on a yearly basis (Allmond, 2012). In order to aid future facilities in enhancing their security procedures, regulatory certainty must be associated with the CFATS regulations (Moore, 2012). Requiring companies and government agencies to follow through with the current security programs in place will be much more effective in the long run when compared to potentially increasing required safety measures for all facilities. Streamlining the current program is the most cost-effective solution for increasing the security for chemical plants.

As with all government programs, deficiencies have been noted with the CFATS program procedure. Amendments to this procedure are currently of high importance, as the issue of chemical plant security is a major concern for all citizens. If after analysis it is proven that inherently safer design is necessary for plant security, then this option may be considered. Until then, the current legislation should be carried out to the full extent in order to achieve the best security enforcement with the least amount of spending. The following quote perfectly describes the attitude people should have regarding chemical plant security procedures, "the implementation of CFATS has been slow and sometimes contentious. However, there are no better alternatives, and some alternatives are much worse. DHS, Congress, and industry need to stay the course. Over time, CFATS will demonstrate its effectiveness" (Allmond, 2012).

"...As with all government programs, deficiencies have been noted with the CFATS program procedure…"

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Chemical Regulation– What is the Best Approach for the United States?

By: Megan Hall - Junior Chemical Engineer

In 1976 the Toxic Substances Control Act was enacted to set federal standards for chemical manufacturing. Since then, few additions have been made to the legislation making it a concern for public and environmental safety. The United States needs to update its current safety regulations to ensure not only the safety of the general population but also the environment. The European Community Regulation, with the passage of

REACH, has set a standard that the United States should aspire to reach for chemical safety. Changes should be made so that the public can be aware of potential hazards, and more chemicals including nanomaterials should be regulated. Many people think that by enacting more regulatory legislation the economy could be negatively affected by the loss of jobs; however, by doing nothing the economy may be even more dramatically affected by a trade embargo.

With current regulations companies do not need to tell the public specifically what chemicals are used in a confidential process (Hogue, 2013). This clause in the current Toxic Substance Control Act needs to be changed so that the public has a better idea of the chemicals that are used in process. Without this information, the public cannot make informed decisions on the products that they use daily. Environmental groups have expressed concern about the chemicals used in household products like dishwashing liquids and fabric softeners (Safe Chemicals Act Approved, 2013). Federal laws are lacking to protect the public to such an extent that states are putting in regulations to compensate. For example, New Jersey Senator Frank Lautenberg passed the Safe Chemicals Act of 2011that puts responsibility on the New Jersey Manufacturers to prove that the chemicals used are safe for the environment and public use (Safe Chemicals Act Approved, 2013). Public safety should be a top concern for the federal government and it should not fall on state legislation.

Currently there is no law that monitors the use of nanomaterials and the Environmental Protection Agency (EPA) is proposing that manufacturers provide the EPA with the production and safety data (Hogue, 2013). Nanomaterials are currently used in many applications already on the market and few tests have been completed. For example nanomaterials can be found in batteries, electronics, and car parts (Hickman, 2012). The European Community Regulation states that nanomaterials are not necessarily dangerous; however, there are still many uncertainties and substances should still be tested case-by-case (Nanomaterials, 2013). The uncertainties of a substance are what make it potentially dangerous and without testing every nanomaterial that is used could pose severe consequences to the environment and the public. For example, if nanomaterials are found to be hazardous to the environment in a few years, then the damage done could be irreversible.

The current Toxic Substances Control Act allows the EPA to oversee more than 83,000 chemicals (Summary of the Toxic Substances Control Act, 2013). Since 1976 when the Toxic Substances Control Act began only five chemicals from the “chemicals of concern list” have been banned because of the dangers to public and environmental safety (Wilson, 2009). This list contains chemicals which the EPA considers to be potentially dangerous to human health or the environment (Grossman, 2012). With the chemical industry constantly changing and new chemicals constantly being used, more should be under the watch of the EPA. Currently the EPA has been trying place eight more chemicals on this list since 2010 because the chemicals are known for hormone disruption (Hogue, 2013). Since the legislation has not passed the chemicals are not on a watch list. Without these chemicals being placed on a list stating that they are potential hazards, there is little rush for companies to replace the hazardous chemicals.

Many people do not want more legislation to pass because the changes could negatively affect the economy (Hogues, 2013). However, by increasing the laws more jobs would be produced within the EPA. If the EPA started conducting tests on more materials and approving processes, like the European Community Regulation currently does, jobs would be created in order to ensure quick response from the EPA. The European Community Regulation conducted a study showing that the chemical safety policies do not hurt the economy but actually have a slightly positive impact by producing more jobs (Environment and Employment, 2012). With an increase in jobs

and safety adding more legislation can have a positive impact on the economy.

If the legislation does not pass it could potentially have a large impact on the companies that currently do business with Europe. Currently the Toxic Substances Control Act does not have any regulations between the chemical producers and the chemical users whereas the European Community Regulation has a two way hazard analysis (Wilson, 2009). This is trouble for any company that takes part in transatlantic trade. Since 2007 the EU-US Transatlantic Economic Council has been meeting to try and resolve the regulatory gaps (International Issues, 2013). If these regulatory gaps continue to increase, it may become harder for the United States and Europe to do business together.

The EU REACH program has set the new standard in chemical safety and the United States has been slow to make the same strides. The United States should change the current Toxic Substances Control Act because the public deserves to know the potential danger of chemicals used in industry. Also, without any changes more nanomaterials and chemicals will be used when there are known and unknown material hazards. Lastly, changing the laws will produce more jobs and make trading with Europe easier. The United States needs to act quickly to compete with Europe's growing safety program.

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Chemical Regulation– What is the Best Approach for the United States?

By: Nick Glynn - Junior Chemical Engineer

In 1976 congress passed the Toxic Substance Control Act (TCSA). The TSCA granted the Environmental Protection Agency (EPA) the power to require businesses to report on, test, and restrict the use of chemical substances used in their production processes (Environmental Protection Agency, 2013). The TSCA also granted the EPA the power to create a chemicals of concern list. This list would publicly identify chemicals the EPA believes to be harmful to human health or the environment (Hogue, 2013). As of today, this list has not been created. This is mostly because creating a chemicals of concern list would not necessarily limit the usage of those chemicals (Hogue, 2013). Because public awareness of the potential harm of chemical substances and concern for the environment has grown over the past few decades it has become clear that the TSCA needs to be updated or replaced. However, no major updates to the TSCA have occurred since it first came into effect. The question then becomes, "What is the best way for the United States to modernize its approach to chemical regulation?"

In its current form, the TSCA is too weak and ineffective to efficiently control the use of harmful chemical substances. The EPA has yet to create a chemicals of concern list. A proposal to officially create the list is currently under review by the White House Office of Management and Budget (OBM). Unfortunately, this proposal has been under review since May, 2010, and there are no indications that it will be released for implementation anytime in the near future (Hogue, 2013). Even though a chemicals of concern list would be beneficial to the public, it could prove to be problematic for American companies. Many businesses are concerned that a chemicals of concern list would harm the US economy because it does not do anything to regulate the usage of such substances (Hogue, 2013). It only identifies them.

While the proposal does not do anything to regulate chemicals that would be placed on the chemicals of concern list, it could have major effects on many chemical companies. Under current law, a company may hold back information related to the safety of the chemicals it uses by claiming that the chemical specifics are proprietary information. If the proposal is approved by the OBM, companies would be prohibited from using this claim for compounds about to be released to the market (Hogue, 2013). This aspect of the proposal would be a major step forward in increasing chemical safety in the United States. Still, the proposal as a whole is too weak of an approach to regulate the safety of chemical compounds.

In stark contrast to the proposal under review by the OBM is the European Union regulation Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). Under REACH, European companies must research the health effects of the chemical substances it imports and uses in manufacturing processes. Companies must report their effects to a public central database run by the European Chemicals Agency (European Commission, 2013). In addition, REACH aims to identify chemicals that could be used as a substitute to the most dangerous chemicals used in business practices.

Although REACH may seem like a revolutionary piece of legislation that should be used by other nations as a model for chemical safety regulation, it is important to note that it has several major flaws. One of the goals of REACH is to enhance innovation and competition of the European chemical industry (European Commission, 2013). However, the high costs of registering and conducting tests on chemical substances is proving to be so expensive that European chemical companies are moving the manufacturing of some products and chemical compounds outside of the European Union (EurActiv, 2013). This essentially kills the REACH goal of enhancing competitiveness of Euro-

pean chemical companies. Small businesses are also finding it hard to meet the financial burdens of REACH because the bill was designed for the operations of large companies with more resources (EurActiv, 2013).

On top of the enormous costs of registration and testing, phase three of REACH is impacting sustainability and technology efforts. Under REACH, materials that are intended for recycling are considered raw materials and are subject to registration (Simon, 2012). As a result, recycling companies must pay for testing and registration of all incoming materials that are to be recycled. These additional costs are deterring some companies from recycling. REACH is also harming the technology industry because of its application to rare earth metals which are generally only used in small quantities (Simon, 2012). From these problems it is clear that it would not be in the United States' best interest to pursue a REACH approach to chemical regulation.

If the current EPA proposal does not go far enough and a regulation system modeled after REACH goes too far, what is the approach the United States should adopt in improving chemical safety regulation? The solution may already be present in the United States Senate.

The Senate Environment & Public Works Committee passed a TSCA reform bill in 2012 that would allow the EPA to restrict the use of chemicals that cannot be proven safe. Like REACH, the chemical manufacturers would have to provide the safety information of their compounds (Erickson & Hogue, 2013). However, this bill was never brought to the floor for a vote. With the start of a new session of congress the committee is renewing efforts for TSCA reform legislation. Senator David Vitter has been working closely with "industry groups such as the American Chemistry Council and the Society of Chemical Manufacturers & Affiliates" to ensure that the bill will give the EPA the power it needs to effectively regulate chemical safety without imposing undue hardship on American companies (Erickson & Hogue, 2013).

The task of modernizing the TSCA to effectively regulate chemical safety in the United States will not be easy. The United States will need to work diligently to avoid a weak solution that will do too little, like the current EPA proposal. It will also be vital to avoid economically stifling costs for chemical research and testing that have proven to be problematic with REACH. Legislation currently under development is being drafted in conjunction with American industrial groups with the knowledge that the EPA must be granted more power if it is to effectively regulate the usage of potentially dangerous chemicals. It is therefore the best approach for the United States.

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The Spring 2013 junior class

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Your help is much appreciated!

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

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