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Tuesday, December 17, 2024, 6:00 PM

AIChE Membership is Not Required to attend any meetings

"Nuclear Power Accident Analysis"

The Sanctuary Restaurant, DoubleTree Hilton Hotel by Rockside Road

6200 Quarry Lane, Independence, OH 44131, 216-901-7852

https://investor.vistracorp.com/2023-09-29-Vistra-Receives-Nuclear-Regulatory-Commission-Operate-Three-Energy-Harbor-Nuclear-Plants

ABSTRACT: Nuclear power plants are complex and intimidating machines. Based on the potential for component failures, nuclear power plants are designed to cope with a wide range of potential operational transients. These include minor equipment failure to extensive postulated accidents. Previous lectures have exposed the audience to different types of reactor designs, new reactor technology and reactor systems designed to maintain reactor safety. This lecture will go into the various abnormal operational transients and infrequent events that are postulated to occur. Additional analysis present will demonstrate that reactors are designed to cope with special events and severe accidents. This lecture will reinforce that modern nuclear reactors remain safe under all postulated conditions.

BIOGRAPHIES:

Andrew Ohrablo is the Life Cycle Management Fleet Engineer for Vistra Corporation. Mr. Ohrablo has been involved for over 35 years in the nuclear power field. Mr. Ohrablo started his nuclear career with the United States Navy in 1987. After training as a nuclear electrician, he was stationed on the USS Enterprise and served till 1993. Following his time in the Navy, Mr. Ohrablo returned to school at the Ohio State University. He transferred to the University of Wisconsin at Madison and received his Bachelor of Science Degree in Nuclear Engineering in 1998. Mr. Ohrablo's thesis was on the design of a Liquid Sodium Cooled Fast Breeder Reactor. He then began a career in the civilian nuclear power field as a Shift Technical Engineer at the Cooper Nuclear Station in Brownville, Nebraska. In 2008 he completed Senior Reactor Operator License Class and received his Nuclear Regulatory License effective March 27th, 2008. Senior Reactor Operator License Class is a 15 to 18-month instruction course that goes over the design, operation and accident response for a specific nuclear power plant. In 2014 he returned home to Ohio to work at the Perry Nuclear Power Plant as a Work Week Manager. Additional positions he has held at Perry include Maintenance Electrical Engineer, Maintenance Engineering Supervisor and Maintenance Support Supervisor.

Mr. Ohrablo looks forward to sharing an entertaining and educational evening with you.

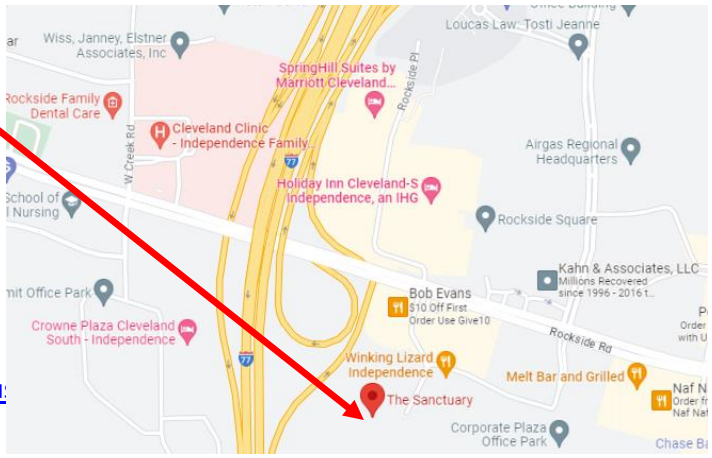
For those attending this event, a Professional Development Hour Certificate (1 PDH) will be sent to you in the following days by Joe Yurko.

Meeting Location:
6200 Quarry Lane
Independence, OH 44131
216-901-7852

The Sanctuary Restaurant *(see map below)*
6:00 – 7:00 pm: Social Gathering
7:00 – 8:00 pm: Dinner
8:00 – 9:00 pm: Presentation with Q & A

Dinner: Non-Students: All ordering from menu
Students: $5 each

Menu:
http://places.singleplatform.com/shulas-steak-hou



RSVP Required with Joseph Yurko and AIChE at: yurkojoe5@gmail.com

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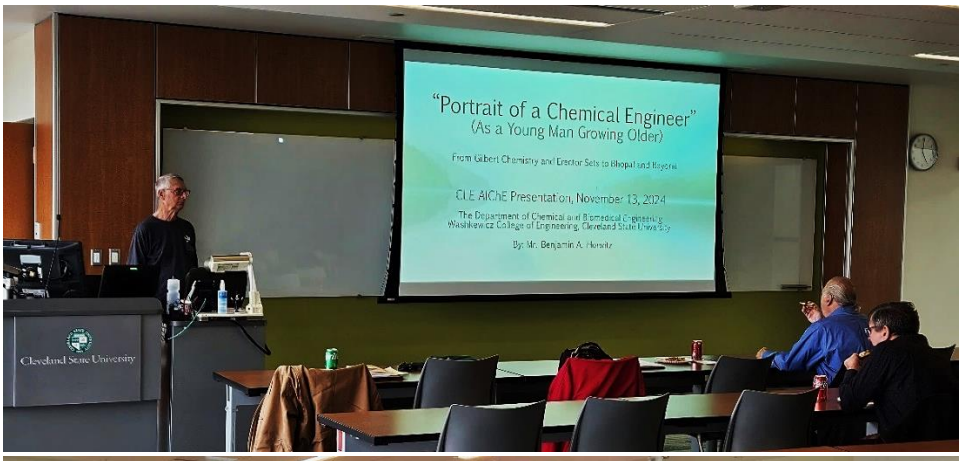
PROCESS SAFETY FUNDAMENTALS, 3-Part Series Seminar in October

(Left, above) 3-Part lecture series on Process Safety Management (PSM) with Management of Change (MOC), includes a Chemical Safety Board investigation (OSHA & NFPA focus) of a sugar dust explosion and two-case study workshops.

(Right, above) Mike Galgoczy, PE (Chair of CLE AIChE) presented Gurmukh Bhatia, CPSA with CLE AIChE Letter of Appreciation for sharing his 40-year PSM & MOC expertise with attendees.

November CLE AIChE Meeting at CSU Washkewicz College of Engineering for a joint meeting with the CSU AIChE Student Section, “Portrait of a Chemical Engineer”



Ben Horwitz shared his career development from the Peace Corps, to Sohio, to HKF Process Engineering Manager, and to process simulations consultant.

Mike Galgoczy, PE awarding Ben Horwitz with an AIChE Thank You!

Cleveland Plain Dealer Newspaper Article (10/9/2024) Energy Section

By: Sean McDonnell, smcdonnell@cleveland.com

ENERGY

Could the Buckeye State go nuclear?

At Ohio's two nuclear plants along Lake Erie — this one in Perry northeast of Cleveland and one to the west near Oak Harbor — each could add about 600 megawatts of new nuclear power generation by building multiple small modular reactors on site, an Energy Department report says. The Plain Dealer

Sean McDonnell - smcdonnell@cleveland.com

Ohio's nuclear and coal plants could be part of a nuclear renaissance.

Artificial intelligence craves power, and shuttered nuclear reactors in Ohio's neighboring states have plans to restart to satisfy the country's growing appetite for electricity.

If nuclear power has a renaissance, Ohio is a prime location. Ohio could generate more electricity not just at its Perry and Davis-Besse nuclear plants, but also at eight coal power plants that could be retrofitted with nuclear reactors, according to a report last month from the U.S. Department of Energy.

It's been a long time since nuclear energy was embraced in the United States. Most of the U.S. nuclear fleet was built in the 1970s and 1980s, and only three new nuclear reactors

have been built in the U.S. since 1997. But with electricity demand projected to double, many think nuclear power will be embraced again.

"Man, it's a git-r-done type of moment," said Dale Vines, a longtime executive who's spent decades in the nuclear industry, including some work at Ohio's two nuclear plants.

That is, of course, if the demand for electricity justifies the hefty price tag.

"Nuclear seems like it might be having a renaissance of sorts, but that doesn't change the fact that there are extreme costs and hurdles to building a nuclear plant," said Matt Brakey, who heads the energy management firm Brakey Energy in Chagrin Falls.

In a report released Monday, the Energy Department said the U.S. could triple its nuclear capacity. In another report from September, the department said Ohio has room for roughly 13,200 more megawatts of nuclear generation, more than six times what Davis-Besse and Perry power plants produce today.

GROWING DEMAND

Electricity is going through a classic supply-and-demand problem. Although not the only reason, new data centers are a main culprit.

Big tech companies like Amazon, Google and Microsoft are building data centers across the U.S. and in Ohio. New Albany, a suburb of Columbus, has 17.

These large buildings — filled with computers, routers and other networking equipment — are the backbone of digital services, like AI and cryptocurrency. And they can use as much electricity as a small city.

Electricity demand has been flat in the U.S. for decades, but it is now expected to grow each year. Estimates vary, but in a report published Monday, the Energy Department said electricity demand could more than double by 2050.

The trend already is affecting residential electric bills. The PJM, which operates what's known as "the grid" across Ohio and 12 other states, saw huge price increases in recent auctions, partially because many power plants are closing.

"On paper it's a very attractive time to invest in new generation," Brakey said.

Several other things are expected to happen by 2050 that could exasperate the situation. Coal-fired power plants, because of regulations, will eventually need to find ways to either capture their emissions or shut down, said Ken Petersen, former president of the American Nuclear Society.

And many of the companies building data centers, like Big Tech firms, have also pledged to reduce their carbon footprints or be carbon neutral by 2050, said Grant Goodrich, executive director of Case Western Reserve University's Great Lakes Energy Institute.

Nuclear can generate carbon-free electricity. Wind and solar are part of the solution, but can't be the solution on their own, several experts told cleveland.com last week. That also means more eyes on nuclear power.

That demand for electricity is already causing two shuttered nuclear reactors to reopen. The utility that owns one of the Three Mile Island nuclear reactors near Harrisburg, Pennsylvania, has plans to restart it. Microsoft has agreed to buy the electricity for the next 20 years, according to the Associated Press.

The Palisades nuclear plant along Lake Michigan also plans to reopen, and the plant's owner told the Associated Press that it has "multi-decade" deals in place to sell power.

Nuclear has obvious hurdles, like costs, but experts tell cleveland.com that these long-term commitments make reopening old plants feasible. They could also be key to building new nuclear reactors.

BIG, SMALL AND SMALLER REACTORS

Nuclear reactors generally fall into three categories: large nuclear, small modular reactors — known as SMRs — and micro-reactors.

Large nuclear refers to what exists today at the Davis-Besse and Perry power plants. There are 94 of these reactors across the U.S. — mostly built in the 1970s and '80s. One of these reactors creates about 1,000 megawatts of power.

Then there are SMRs. These, in theory, could be built in factories and then assembled at the power plant — driving down costs. These smaller reactors can generate between 50 and 350 megawatts — but they can be combined at one location to create larger quantities of power. None have been built and finished in North America — yet. But the U.S. Navy has used them for 75 years.

Microreactors are even smaller, producing between one and 50 megawatts. These could be used for more niche applications, like in a rural community or near an industrial operation. But they probably wouldn't be used to retrofit an existing power plant.

CHANGES IN ATTITUDES

Attitudes around nuclear energy have changed drastically. In 2019, both Davis-Besse and Perry received bailouts as part of the now-infamous House Bill 6. Neither was seen as financially viable without subsidies.

Even a year ago, both Vines and Petersen said most of the focus was on small modular reactors, because they are cheaper to build upfront and more versatile than large nuclear.

But electricity demand is strong enough that large nuclear reactors, which are more costly upfront but cheaper in the long run, are again being considered, Vines and Petersen said.

The Energy Department's report from September suggests both could be used in Ohio.

At Ohio's two nuclear plants along Lake Erie — one in Perry northeast of Cleveland and one to the west near Oak Harbor — each could add about 600 megawatts of new nuclear power generation by building multiple small modular reactors on site, the report said.

Experts like Vines and Petersen say more large nuclear reactors could probably be built at Davis-Besse and Perry — especially since the original plans for the power plants were much larger. But the Energy Department report looks at what can be built with the existing infrastructure.

Cleveland.com reached out to Vistra, which now owns the two Ohio nuclear plants, for comment.

Additionally, at eight of Ohio's coal plants, the Energy Department suggests that much more nuclear power can be built.

At four coal plants that have already shut down, the Energy Department said there's the potential to use small modular reactors to retrofit them with 600 megawatts of nuclear capability — and 10 of these could be set up at the four power plants.

Or those sites could be used to build four large nuclear reactors that create 1,117 megawatts each.

That isn't all. At four coal power plants that are still running, the Energy Department said, there could be a similar conversion to nuclear power. Again, those plants could fit either 10 600-megawatt retrofits or four new large nuclear reactors.

The nuclear plants were easy to identify, but which specific coal plants weren't identified by name in the Energy Department report.

THE BIG PLANS OF YESTERYEAR

Ohio has just two nuclear reactors today, but at one time the plan was to build even more.

Davis-Besse has just one nuclear reactor. The original plans were to build a second and third reactor. Both were canceled in 1981. Perry had similar plans to build a second reactor, but that was canceled in 1994.

There were also plans to build two nuclear reactors near Berlin Heights, southeast of Sandusky, according to the Nuclear Regulatory Commission. These plans were canceled in 1980, and that land is now part of the Edison Woods Reserve.

Reactors across the U.S. were canceled, mostly because the supply and demand curve for electricity was opposite of what we see today, experts said.

The 1970s were a time of energy crisis in the U.S. that included events like the oil shock of 1973-74 and a similar oil crisis later that decade.

Goodrich said this prompted a focus on making all uses of electricity more efficient. But when oil production returned to normal, so did prices.

Then there was the near-disaster at Three Mile Island in 1979, closing one of the two reactors there. The other operated until 2019.

Before that disaster, building nuclear power plants cost hundreds of millions of dollars, Vines said. Because of the new regulations, projects swelled into the billion-dollar range.

A similar cycle happened in the 2010s, where nuclear was again getting a hard look, Vines said. But when fracking meant that natural gas was cheaper and more abundant, natural gas power plants once again made electricity cheap.

DAVIS-BESSE, PERRY HAVE A HEAD START

If officials wanted to revive their decades-old plans for Davis-Besse or Perry, any infrastructure that might exist would probably need to be redone, Vines said.

Some nuclear plants in the U.S. already are licensed to expand and could start building tomorrow. But according to the Energy Department's report, Ohio's two nuclear plants are not in that situation.

Still, both nuclear plants would have a head start, Vines said.

First, the environmental work at both plants has been done. Building a power plant means testing the soil, and investigating seismic activity and weather patterns. You need to know how much heat can be dissipated into the water. And you need evacuation plans.

Davis-Besse and Perry would have that mostly done, Vines said.

Second would be electrical infrastructure. Any power plant means building expensive substations and transmission lines. Davis-Besse and Perry also would have a head start on that front.

So, too, would existing coal plants. These locations would have a similar head start, and because they're already industrial sites, nuclear retrofits could be a way to reuse them, Goodrich said.

What Davis-Besse and Perry have, which coal power plants don't, is a community that's used to nuclear.

Vines said the people who live in those communities have now done so for decades. People living near a coal plant may not necessarily be as open to nuclear.

Underpinning all of this is cost, and timing.

Estimates vary, but building any new nuclear reactors from scratch, considering regulations and that much of this technology is new, would take a number of years.

The last two nuclear reactors to be built, Vogtle 3 and 4 in Georgia, took 15 years to build before opening in 2023 and 2024. They cost close to $31 billion, well above the initial estimates, according to the Associated Press.

No one has finished a small modular reactor, yet, although some projects are in progress.

There's also another problem in going first, Petersen said. Nuclear reactors will get cheaper to build over time.

"Nobody wants to be the first one to go build it, because it'll be more expensive," Petersen said. "But we all know that the 10th one will be a lot cheaper."

If the U.S. wants to hit its decarbonization goals, though, Vines said nuclear needs to be part of the solution. Which is why he, and others, think this time around nuclear will pick up steam.

Chemical Engineering Progress, CEP, Magazine ARTICLE, September 2024 ISSUE
The American Institute of Chemical Engineers (AIChE)

Emerging Voices: Is Nuclear Energy the Future of Batteries?

Update Section, Page 20

By: **Melanie Mesropian**

https://www.aiche.org/resources/publications/cep/2024/september/emerging-voices-nuclear-energy-future-batteries

A few months ago, I stumbled across an article that caught my attention. A Chinese start-up company, Betavolt, was able to produce a new battery that was capable of providing power for 50 years *(1)*. The interesting part is that during those 50 years, the battery is said to require zero charging and maintenance. This battery is known as a betavoltaic battery, a type of nuclear battery (also commonly referred to as an atomic battery) that is currently in pilot testing stages. As the name suggests, nuclear batteries utilize nuclear energy to generate electricity from the decay of a radioactive isotope. A groundbreaking technology of its time, nuclear power can potentially revolutionize battery systems as we know them today.

The inklings of nuclear power. A topic of discussion for the past century, nuclear power became a reality in the 1940s after the discovery of nuclear fission in the late 1930s. In 1942, the construction of the first nuclear reactor, Chicago Pile-1, was spearheaded by a group of scientists led by Enrico Fermi *(2)*. It wasn't until the 1950s and 60s, however, that nuclear batteries began receiving in-depth research for long-life use in space *(2)*.

There are two groups of nuclear batteries: thermal converters and non-thermal converters. Thermal converters utilize the heat generated from nuclear decay to produce electricity, while non-thermal converters generate electricity from emitted radiation from the nuclear decay directly.

What are betavoltaic batteries? A betavoltaic battery is a type of non-thermal converter nuclear battery. Betavoltaics convert the energy emitted from the decay of a beta-particle-emitting radioisotope into electrical energy using a semiconductor *(3)*. Some of the most common beta particle sources are ^{63}Ni, ^{3}H (tritium), ^{147}Pm, and titanium tritide *(4)*. The beta electrons emitted from the radioactive decay hit the semiconductor body such as the p-n, p-i-n, or Schottky junction, resulting in impact ionization of the electrons, producing electron-hole pairs that produce electricity *(3)*.

Betavoltaic effects were first studied in 1953 by Paul Rappaport from Radio Corporation of America (RCA). He created a betavoltaic device that coupled semiconductors with ^{90}Sr-^{90}Y as the radioactive source. However, the first device had an efficiency of only 0.2% and degraded quickly due to radiation damage *(4)*.

It wasn't until the 1970s when Larry Olsen of City Labs was able to pioneer the first commercially available betavoltaic battery, using ^{147}Pm as the beta-emitting radioactive source and silicon p-n semiconductor junctions *(4)*. Dubbed Betacel, these batteries were used to power cardiac pacemakers that were implanted into patients during clinical trials. However, due to concerns of gamma radiation emitted from the ^{146}Pm contaminant of ^{147}Pm (although shielded from leaking into the human body), the stigma around nuclear power, and the rise of lithium batteries (and their low cost), Betacel dwindled away.

Today, betavoltaics that are offered include the Nano-Tritium batteries produced by City Labs and Firefli by Widetronix, suitable for microelectronics. Both batteries utilize tritium as their beta particle source which has a half-life of 12.32 years. Some of the early NanoTritium batteries developed over 15 years ago are still operating efficiently, with simulations indicating that they may even last for over 20 years. The battery produced by Betavolt uses ^{63}Ni and is smaller than a coin while delivering 100 microwatts of power and 3V *(1)*…

Human Activities are Fueling a Troubling Rise in Methane Emissions

Update Section, Page 6

https://www.aiche.org/resources/publications/cep/2024/november/cep-news-update/human-activities-are-fueling-troubling-rise-methane-emissions

Jackson, R. B., *et al.,* "Human Activities Now Fuel Two-Thirds of Global Methane Emissions," *Environmental Research Letters,* doi: 10.1088/1748-9326/ad6463 (Sept. 10, 2024).

National Academies of Sciences, Engineering, and Medicine, "A Research Agenda Toward Atmospheric Methane Removal," The National Academies Press, Washington, D.C., https://doi.org/10.17226/27157 (2024).

Methane emissions have risen faster over the past five years than in any other time in the historical record, new research finds. This research also posits that human activity is to blame for the release of at least two-thirds of this greenhouse gas.

Methane lasts in the atmosphere for around 12 years, on average, which is short compared to the hundreds to thousands of years lifespan of carbon dioxide. But methane is also more effective at trapping heat: Over a 100-year timeframe, methane is 28 times more potent than carbon, according to the Environmental Protection Agency, and over a 20-year timeframe, methane is 84 times more potent.

Despite increasing attention on methane emissions, a new estimate finds that annual methane emissions have increased by 15–20%, or 50–60 million tons, since 2000. Global anthropogenic methane emissions totalled approximately 384 million tons per year from 2018 to 2020.

"Human activities now release at least two-thirds of global methane emissions," says study leader Rob Jackson, an environmental scientist at Stanford Univ. "That percentage has gone up in the last few decades. Concentrations are also rising, and they have risen faster in the last five years than any time over the instrument record."

To understand the current trends in methane emissions, Jackson and his colleagues performed two estimates. One, a bottom-up estimate, combined global methane emissions inventories and biogeochemical models of natural sources. The second, a top-down estimate, depended on methane observations made from ground-based instruments and the European Space Agency's Greenhouse Gases Observing Satellite. The atmospheric estimate not only provides overall numbers, but also information on what latitudes emissions come from and what the sources of the emissions are. Different isotopic signatures are found in fossil-fuel sources vs. those from natural sources or agriculture.

The top-down and bottom-up estimates provide slightly different numbers, Jackson claims, with the top-down number providing a final verdict on how much methane the atmosphere holds. The bottom-up number misses some emissions, but provides detail on specific sources…

Converting Greenhouse Gases into Valuable Chemicals with Sunlight

Update Section, Page 12

https://www.aiche.org/resources/publications/cep/2024/november/cep-news-update/converting-greenhouse-gases-valuable-chemicals-sunlight

Su, H., *et al.,* "Photosynthesis of CH_3OH via Oxygen-Atom Grafting from CO_2 to CH_4 Enabled by AuPd/GaN," *Nature Communications,* doi: 10.1038/s41467-024-50801-3 (July 31, 2024).

Carbon dioxide and methane, two major greenhouse gases, can be converted to green methanol and carbon monoxide in a single step, new research finds.

Researchers led by Chao-Jun Li, a chemist at McGill Univ. in Canada, used the semiconductor gallium nitride studded with gold and palladium nanoparticles as a catalyst for the sunlight-driven reaction.

Co-converting methane and carbon dioxide into more valuable chemicals has long been of interest in the name of combating climate change and turning waste into something useable, notes Li, but previous attempts often required high temperatures or additional reactions. For example, dry reforming can convert these greenhouse gases into syngas, but for economic feasibility, the syngas must then be converted with additional steps into chemicals such as methanol (CH_3OH).

The new reaction removes the need for additional processing to get methanol as the final product. "For the first time, at room temperature, with light, you can generate this reaction," Li says.

Li and his team had been working with gallium nitride for over a decade when they found that this catalyst is efficient at splitting carbon-hydrogen bonds in methane at room temperature. With time, they also found that the same catalyst could split CO_2 into carbon monoxide and oxygen. By running both reactions simultaneously, the constituent molecules of the carbon dioxide and the methane naturally recombine into CH_3OH and CO, Li adds.

"This is a natural progression for us, because we have a similar catalyst for both, so why not put them together?" he says.

The team fabricates the AuPd/GaN catalyst by stirring together powdered gallium nitride and gold and palladium nanoparticles. Gallium nitride is especially efficient at splitting the carbon-hydrogen bonds of methane, Li claims, while the AuPd-studded regions of the catalyst improve the efficiency of splitting the carbon dioxide. With exposure to light, the released oxygen atom from the carbon dioxide joins with the carbon and hydrogens from methane to form methanol, with carbon monoxide as a side product. The use of the nanoparticles balances the reaction rate to reduce the likelihood of the formation of other unwanted side products…

Chemical Engineering Progress, CEP, Magazine ARTICLE, November 2024 ISSUE
The American Institute of Chemical Engineers (AIChE)

What to Do with Captured Carbon

Emerging Voices Section, Page 20
By: **Colby Kaimanu Tinsley**
https://www.aiche.org/resources/publications/cep/2024/november/emerging-voices-what-do-captured-carbon

Carbon dioxide is a frustratingly inert molecule. The two carbon-oxygen covalent double bonds, with their 180-deg. bond angle and low-energy state, make it so that any process intended to transform CO_2 into a useful product faces a steep thermodynamic barrier. Unfortunately, atmospheric carbon is also the leading cause of global climate change, with humans releasing tens of billions of tons of the gas each year.

In the long term, direct air capture (DAC) systems could provide one possible route out of our climate quagmire. More traditional carbon capture systems, which scrub CO_2 from fluegas streams before it is released into the atmosphere, are installed in many coal fired power plants. Similar systems have been employed in steel and cement production facilities. However, the glut of CO_2 that is likely to accrue as the result of these expanding technologies leaves engineers with the new problem of what should be done with it.

The commonly espoused solution is to sequester the carbon underground, possibly using the spent subterranean reservoirs left after oil drilling. However, questions about containment integrity, difficulty understanding and quantifying storage volumes, unintended chemical reactions, and induced seismicity have slowed down the development of such carbon-sequestering projects and have sent engineers, at least for the time being, back to the drawing board. This article describes a few unique uses for carbon that intrepid chemical engineers have devised so far.

Fuels. With CO_2 being such an unreactive molecule, transforming it into a combustible fuel source is not a particularly intuitive solution. Surpassing the thermodynamic barrier to break the inert carbon-oxygen bond and create a combustible carbon-carbon bond requires vast amounts of energy. Considering that much of the energy used in such endothermic processes comes from the combustion of fossil fuels, converting CO_2 back into hydrocarbons could likely generate a net increase in atmospheric carbon. To solve this problem, engineers have pursued two possible solutions: synthesizing catalysts that can reduce the thermodynamic energy requirement or tapping renewable energy resources capable of powering the process…

UN climate meeting to focus on emissions, financing

Reports released ahead of COP29 spell out uphill battle to meet climate goals

by Leigh Krietsch Boerner

November 7, 2024 | A version of this story appeared in Volume 102, Issue 35
https://cen.acs.org/environment/climate-change/UN-climate-meeting-focus-emissions/102/i35

The 29th meeting of the United Nations Framework Convention on Climate Change starts Nov. 11 in Baku, Azerbaijan. The focus this year is on how to fund projects needed to meet goals of the Paris Agreement, which aims to cap global warming to avoid the worst impacts of climate change.

Ahead of the event, known as COP29, the UN released three reports—on greenhouse gas (GHG) emissions, plans to mitigate climate change, and countries' ability to adopt the plans—that take stock of how the world is doing in achieving those goals. In each of the reports, researchers found that limiting warming to the target 1.5 °C will be difficult if not impossible under current trajectories.

In the emissions report, released Oct. 24, researchers says that GHG emissions are on track to cause temperatures to rise 3.1 °C by the end of the century. "Limiting warming to 1.5 °C is virtually impossible," Anne Olhoff, chief climate adviser to the UN Environment Programme (UNEP) and the editor of the report, said at a press briefing.

Current pledges to lower GHGs are inadequate, Olhoff said. To limit warming to the higher 2 °C path, emissions would need to drop 28% by 2030 and 37% by 2035 compared with 2019 levels. That would mean shaving emissions by 7.5% every year, she said. And to meet these goals, the world needs a sixfold increase in financing by 2035, UNEP executive director Inger Andersen said at the briefing. "We seem to find money for conflict when we need it," she said. "This is the biggest conflict of all…"

Chemical Engineering Progress, CEP, Magazine ARTICLE, November 2024 ISSUE
The American Institute of Chemical Engineers (AIChE)

Spotlight on Safety: Remember the Event, Appreciate the Progress

Spotlight on Safety, Page 22

By: **John Herber**

https://www.aiche.org/resources/publications/cep/2024/november/spotlight-on-safety-remember-event-appreciate-progress

Sisyphus is a character in Greek mythology who is doomed by the gods to roll an immense boulder up a hill only to have it roll back down every time it nears the top (Figure 1). His punishment is to repeat this action for eternity. Those who work in process safety can relate to this character. Every day we struggle to move the process safety rock toward the goal of zero process safety incidents. It may appear that we are making little progress. However, we only need to look back to the causes of the grave events of the past to understand just how far process safety has come since the Bhopal gas tragedy 40 years ago, the Phillips 66 event 35 years ago, and unfortunately, many others.

Historical perspective

As an engineer who was practicing well before formal process safety programs existed, I can vividly see the improvements that have been made across all facets of process safety. Did we have operating procedures? Sure. Were they well written? They were passable at best. Did we conduct maintenance inspections? Of course; but did they have the frequency and rigor needed to prevent process safety events? Definitely not. I could extend this list across all elements of the U.S. Occupational Safety and Health Administration (OSHA) Process Safety Management (PSM) regulation. We were lacking in all areas of process safety, but especially in the management systems we rely upon today. This is not to condemn those who were operating plants at that time, but more to illustrate the journey we have traveled to date and to highlight the gaps that need to be addressed as we move the process safety rock further uphill.

Reflecting on the past, we felt we were operating plants safely; however, we had no stated criteria for what “safely” meant. This left the risk criteria to be interpreted by whoever was in leadership at that time. Some leaders prioritized production over safety; I doubt that those leaders realized the dangers their actions and decisions created for their workers and their businesses. We were also fortunate to have many leaders who understood the hazards of the process and reinforced the systems needed to prevent incidents…

Chemical Engineering Progress, CEP, Magazine ARTICLE, November 2024 ISSUE
The American Institute of Chemical Engineers (AIChE)

The Bhopal Gas Tragedy — Part II: Pumps

Safety, Page 48

By: **Kenneth Bloch, Bruce K. Vaughen P.E.**

https://www.aiche.org/resources/publications/cep/2024/november/bhopal-gas-tragedy-part-ii-pumps

Adding multiple safeguards does not necessarily make a manufacturing operation safer. The Bhopal gas tragedy serves as an example of how the failure of a single pump can defeat multiple mitigative safety layers.

This is the second article in a three-part series that promotes a deeper understanding of the causes and lessons related to the Bhopal gas tragedy. The first article describes how incidents can occur when workers are conditioned to address chronic equipment or operating issues with workaround solutions *(1)*. It also introduces how a common cause failure hid the initiating contamination event responsible for the toxic gas release.

This article dives further into this topic by demonstrating how a seemingly inconsequential equipment failure in one area can affect safety system performance in other locations. This point is illustrated by comparing the actual observed safeguard performance at the Bhopal factory with what was expected by design.

Introduction

Union Carbide Corporation (UCC) provided Union Carbide India Limited (UCIL) with the design package for constructing the Bhopal factory's methyl isocyanate (MIC) process. The same safeguards that had proven effective in controlling the hazards related to MIC manufacturing and storage in the U.S. were included in the design package. The Bhopal factory was therefore equipped with safeguards deemed necessary to mitigate the impact of MIC contamination that could result in a thermal runaway reaction inside a MIC storage tank. These safeguards should have prevented the release of toxic MIC gas. However, none of the Bhopal factory's safeguards functioned on Dec. 3, 1984.

The sequence of events initiated by water contaminating MIC storage tank 610 ended in a scenario that is still recognized as history's worst industrial disaster 40 years later. The sheer magnitude of the Bhopal gas tragedy is somewhat more understandable considering that none of the safeguards installed to prevent the release or minimize its consequences were operational when the thermal runaway reaction occurred.

In chemical plants today, one method of assessing the effectiveness of safeguards is the hazard identification and risk analysis (HIRA) approach…

Chemical & Engineering News, C&EN Magazine ARTICLE, November 4, 2024 ISSUE
The American Chemical Society (ACS)

Hemlock awarded grant for polysilicon

by Matt Blois , Page 12
https://cen.acs.org/materials/electronic-materials/Hemlock-awarded-grant-polysilicon/102/i35

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Hemlock Semiconductor is set to receive a $325 million grant from the federal government through the CHIPS and Science Act to expand polysilicon production. If finalized, the grant would fund a new polysilicon plant at an existing site in Hemlock, Michigan. The company says the plant would primarily supply chipmakers. On a conference call, executives from Hemlock's parent company, Corning, said that they're still evaluating the cost of the project and that it wouldn't begin operating until 2027.

What's next for Kate the Chemist?

Kate Biberdorf heads to the University of Notre Dame to become the institution's first professor for the public understanding of science

by Dalmeet Singh Chawla, special to C&EN, Page 22

https://cen.acs.org/people/profiles/s-next-Kate-Chemist/102/i34

October 17, 2024 | A version of this story appeared in Volume 102, Issue 34

Kate Biberdorf knew she wanted to be a chemist from the age of 15. She attributes her decision to the passion of a high school teacher who had a knack for engaging students by running around the classroom and lighting things on fire.

But Biberdorf, now popularly known as Kate the Chemist, didn't know she wanted to become a science entertainer until her first year as a faculty member at the University of Texas at Austin.

"A month or so into the position, I realized that, because I wasn't running a research group, I had a lot of extra time on my hands, and I was getting bored quickly," Biberdorf recalls. "So I went to my boss and said, 'You've got to give me another job or I'm gonna quit.' "

That's what prompted the university's "Fun with Chemistry" outreach program, under which Biberdorf would visit local elementary schools and conduct chemistry demonstrations without any extra compensation. "It was my hustling phase," she says.

That hustle has paid off for Biberdorf. After 16 years studying and working in Texas, she recently moved to the University of Notre Dame to become the institution's first-ever professor for the public understanding of science.

The role will be significantly different from what Biberdorf did at UT Austin, where her whole job was to teach chemistry. Alongside that day job, every week she would visit up to four schools, engaging with more than 20,000 students a year. "My best year was 29,000 students, and that was a really good year, but I was very tired," she says. "When I'm breathing fire, and I often do it in Louboutin heels, people just take notice."

From there, other opportunities started to come Biberdorf's way. A university colleague asked her to appear on an episode of *We Are Austin* , a local morning TV show, where the host was promoting a science lecture.

Before Biberdorf knew it, she was invited to do segments on the show for Halloween, Christmas, and New Year's. Eventually, she wound up with an unpaid monthly science experiment slot, which she did for 4 years.

Then in 2018, Biberdorf received a call from Glenn Schwartz, the former publicist for the popular science communicator Bill Nye. "You're the next Bill Nye," Biberdorf remembers Schwartz telling her. After a week of meetings and sorting out logistics, Biberdorf rebranded herself as Kate the Chemist…

Chemical & Engineering News, C&EN Magazine ARTICLE, October 28, 2024 ISSUE
The American Chemical Society (ACS)

Turning tides for endotoxin testing

The drug industry may finally phase out using horseshoe crab blood. What took so long?

by Laurel Oldach, Page 27

October 28, 2024 | A version of this story appeared in Volume 102, Issue 34
https://cen.acs.org/safety/drug-safety/Turning-tides-endotoxin-testing/102/i34

At a recent meeting of the Parenteral Drug Association, where industry microbiologists discussed ways to make drugs without a trace of unwanted biological material, photos of horseshoe crabs danced across a screen between sessions. The sediment-snuffling arthropod with a dozen legs and a shell like a helmet may seem like an unlikely pairing with the sleek, highly engineered robotics of a pharmaceutical production line. But estuaries teeming with life and clean rooms where it should be all but absent are linked by their dependence on this animal.

That is poised to change. In November, US regulators will formally announce their acceptance of alternatives to a key test that ensures drug products are not contaminated. The new tests will use proteins produced in bioreactors rather than in wild horseshoe crabs.

The change was hard fought. Arguments played out in the technical literature and in expert committee meetings. The stakes included hundreds of millions of dollars in annual sales for the company with the most to lose from a switch and the professional reputations of a group of industry insiders who were fired from their volunteer jobs. Now it appears that the tide may be turning on endotoxin tests made from horseshoe crab blood—but it hasn't gone out just yet.

Limulus lysate

"Every human who has medical intervention has benefited from horseshoe crabs," says Glenn Gauvry, president of a horseshoe crab–focused nonprofit called the Ecological Research and Development Group. Any injected drug or implanted device is tested for endotoxins, which are signature glycolipids from the outer membranes of certain bacteria and can harm people even if no viable bacteria are present. Horseshoe crab blood contains a sensitive biosensor system that pharmaceutical companies use to detect those glycolipids.

And it's not used to test only products that go into humans. Veterinary medicines, water and raw materials, drug containers, media used to grow cells that produce biologics—all these and more are tested routinely. According to the endotoxin test vendor bioMérieux, market research suggests that 70 million–100 million endotoxin tests are conducted globally each year. That number is forecast to grow along with growth in demand for biological drugs, which require especially extensive testing.

According to Thomas Hartung, who directs the Center for Alternatives to Animal Testing at Johns Hopkins Bloomberg School of Public Health, endotoxin testing is worth between $500 million and $1.5 billion in the US annually. "It is a very big business," he says, and companies in the space are "aggressive" about protecting their interests.

The Atlantic States Marine Fisheries Commission estimates that about 700,000 crabs are collected in the US each year for biomedical use. Manufacturers disinfect the crabs and drain some of their hemolymph—the crab equivalent of blood, which happens to be blue. They then isolate and lyse blood cells, producing a reagent called limulus amoebocyte lysate, or LAL.

Though the crabs are later released, scientists estimate that between 4 and 30% later die. Environmentalists say that survivors may not be healthy enough to spawn—putting pressure on migratory birds that depend on the crabs' bountiful eggs.

Decades ago, Jeak Ling Ding and her colleagues at the National University of Singapore cloned the protein in horseshoe crab blood cells that senses lipopolysaccharides (*Mol. Mar. Biol. Biotechnol.* 1995, *4*, 90). Endotoxin assays based on that protein, known as recombinant factor C (rFC), have been sold by the company Lonza since 2003 and by bioMérieux since 2016…

Chemical & Engineering News, C&EN Magazine ARTICLE, October 28, 2024 ISSUE
The American Chemical Society (ACS)

Comment: Celebrating 80 years of the Petroleum Research Fund—a legacy of fundamental hydrocarbon research

by Marina A. Petrukhina, chair, ACS Committee on the Petroleum Research Fund, and Joerg C. Schlatterer, director, ACS Office of Research Grants, Page 35
October 28, 2024 | A version of this story appeared in Volume 102, Issue 34
https://cen.acs.org/acs-news/comment/Comment-Celebrating-80-years-Petroleum/102/i34

The Petroleum Research Fund (PRF) trust agreement celebrates its 80th anniversary this year, commemorating 7 decades of steadfast financial support for researchers. Established in 1944, the PRF has been instrumental in advancing the scientific understanding of hydrocarbons by funding fundamental research and fostering the next generation of professionals.

The genesis and mission of the American Chemical Society PRF

The PRF's origins date back to a US government–facilitated payment from seven major oil companies, which formed the PRF Trust. These companies provided the funds to establish an endowment dedicated to supporting fundamental research and education in the field of hydrocarbons. The American Chemical Society was chosen as the income recipient in 1944. In 2000, the "Agreement of Transfer of Trust creating the American Chemical Society Petroleum Research Fund" was signed, allowing ACS to manage the investments while adhering to the mandate: "The recipient shall use all funds . . . exclusively for advanced scientific education and fundamental research in the 'petroleum field,' which may include any field of pure science which in the judgment of [ACS] may afford a basis for subsequent research directly connected with the petroleum field."

The ACS PRF has remained true to this mission, providing essential funding to researchers, mainly at US universities and institutions. This commitment has made the ACS PRF a unique and invaluable resource within the scientific community.

Research support and impact

The ACS PRF supports a wide range of research areas that all contribute to the fundamental understanding of hydrocarbons as they relate to the petroleum field. These areas include chemical and petroleum engineering, chemical physics/physical chemistry, geochemistry and biogeochemical cycling, geology and geophysics, inorganic chemistry, materials science, physical organic chemistry, polymer science, surface science, and synthetic organic chemistry.

The PRF enables researchers to generate novel, preliminary data that can help secure substantial grants from agencies like the National Science Foundation and the Department of Energy. Notably, proposed projects must differ from applicants' previous work and do not require preliminary data for submission. By providing early-career researchers with funding, the PRF has fostered a new generation of scientists who will continue to explore the fundamental principles of hydrocarbon chemistry and beyond.

The impact of the ACS PRF on hydrocarbon research is profound. Since its inception, PRF has funded over 18,000 projects with more than $750 million, facilitating groundbreaking discoveries and significantly expanding our understanding of hydrocarbons. The knowledge generated by ACS PRF–funded research has not only advanced science but also laid the groundwork for innovations in energy production, catalysis, environmental protection, and materials science.

Four types of PRF grants support new investigators and established faculty at doctoral and undergraduate institutions…

Chemical & Engineering News, C&EN Magazine ARTICLE, November 4, 2024 ISSUE
The American Chemical Society (ACS)

The chemical enterprise braces for a second Trump presidency

Experts anticipate big changes in the life sciences and environmental policy

by Leigh Krietsch Boerner , Rowan Walrath, Page 14
November 7, 2024 | A version of this story appeared in Volume 102, Issue 35

https://cen.acs.org/policy/regulation/The-chemical-enterprise-braces-for-second-Trump-presidency/102/i35

With the dust settling after the US elections, chemists are trying to work out how a second Donald J. Trump presidency will affect their work and lives.

Scientists in many corners are concerned—about their funding, about the politicization of their research areas, and about their intellectual freedom. Jennifer Jones, director of the Center for Science and Democracy at the Union of Concerned Scientists, says scientists in federal and state governments who work in politicized fields like climate change are worried that "their name is going on a list."

"President Trump has promised to fire government scientists and to dismantle scientific agencies," Jones says. "Without strong federal science, historically marginalized communities bear the brunt of policies that benefit corporate profit over people and communities."

A scientist in the federal government, who spoke to C&EN on the condition of anonymity because they fear retribution, worries that some government scientists "might just choose to throw in the towel." That would leave the federal government without the staff needed to assess data and enact evidence-based policies, the person says.

In the biotechnology and pharmaceutical industries, executives are eyeing the specter of leadership change at federal agencies. Trump will almost certainly remove Lina M. Khan as head of the Federal Trade Commission, a welcome shift for those who've criticized her approach to biotech mergers and acquisitions, particularly her agency's move to block Sanofi's planned purchase of the small drugmaker Maze Therapeutics last year. New appointees to the Department of Health and Human Services (HHS), the Food and Drug Administration, and the Centers for Medicare and Medicaid Services could also change how drugmakers approach regulation and pricing.

Some executives and analysts are concerned about former presidential candidate and vaccine conspiracy theory peddler Robert F. Kennedy Jr., whom Trump has said would "go wild" on health care in his administration. It's not clear what that means.

Trump transition cochair Howard Lutnick told Stat News that Kennedy will not head the HHS–contradicting what Kennedy told supporters last month—but he'd likely advise the Trump administration's public health strategy regardless. Ali Pashazadeh, CEO of the biotech consultancy Treehill Partners, says Kennedy's influence will come down to whether he "surrounds himself by the right people."

"The only constant will be change," Pashazadeh says.

And industries loathe change. On the eve of Election Day, Jeffrey Quillen, partner and cochair of the life sciences practice at the law firm Foley Hoag, told C&EN that many of his clients were hoping for a divided government, if only to stop a single party from enacting sweeping changes too suddenly.

“Either party that gets a clean sweep could actually do a lot of harm to the industry and the economy,” Quillen said.

Republicans have the White House and won control of the Senate. Whether the party retains control of the House of Representatives remained to be seen as of press time…

CLE AIChE: Cleveland Chapter

Fall 2024 – Spring 2025 Program Planning

(as of Nov2024)

Month	Topic, Speaker	Location	AIChE Officer Responsible
September 7, 2024 (6 PM)	Oktoberfest Social Event	German Central Farm, Parma	Joe Yurko, $7/guest admission + $ food & beverage free for CSU AIChE students. https://germancentralfoundation.com/oktoberfest
September 11, 2024 (Wednesday 2:30 – 3:30 PM)	Dr. Yu, CSU, IEEE Quantum Computer	CSU, Engineering CSU AIChE & IEEE Students	Joe Yurko & Dr. Gatica, Dr. Holland, Members: $10; Students: Free CLE AIChE: Pizzas & Beverages
October 10, 2024 (Thurs. 6 PM)	M.W. Wilson Company Steam Safety Class & Tour	M.W. Wilson Company 2579 Center Road Hinckley, OH 44233	Joe Yurko, Jeff Wilson, Dinner provided by M.W. Wilson Co.? M.W. Wilson Co.: 330-225-0663 https://www.wmsilsoncoinc.com .
October 2024 (6 PM) Wed. 16Oct2024 Wed. 30Oct2024 Wed. 06Nov2024	Chemical Process Safety Analysis Seminars: by Gurmukh Bhatia, CPSA	Strongsville Fire Dept. Ward 1 Community Rm 11297 Webster Road, Strongsville, OH 44136	Joe Yurko, Dinner cost is included in the seminar expense. Seminar expense: $25 per session with a total of 3 sessions. Certificates will be awarded for each class as well as a final certificate. sfd: 440-580-3210: HTTPS://WWW.STRONGSVILLE.ORG/DEPARTMENTS/FIRE-EMERGENCY-SERVICES/STATIONS-AND-EQUIPMENT
November 13, 2024 Wednesday (4:00 – 6:00 PM)	Benjamin A. Horwitz "Portrait of a Chemical Engineer" Career Discussion with students and professionals	CSU AIChE Section Joint Meeting, Washkewicz College of Engineering AIChE Chap	Joe Yurko, Dr. Gatica, Dr. Holland, CLE AIChE Meals: Professional members: $10; Students: Free CLE AIChE: Pizzas & Beverages
December 17, 2024 (6 PM)	Nuclear Power Accident Analysis, Speaking: Andrew Ohrablo	The Sanctuary, Rockside Road Independence, 44131	Joe Yurko, Dinner menu ordering for professional members; Students cost: $5 http://places.singleplatform.com/shulas-steak-house-8/menu#menu_5599999
January 2025 (6 PM)	SARTA Hydrogen Fuel Cell Bus Fleet Expansion Funding from DOE ARCH2 Award, Kirt Conrad CEO	Burntwood Tavern Montrose, Akron Rt.18 and I-77	Joe Yurko, Dinner menu ordering for professional members; Students cost: $5
February 2025 (6 PM)			
March 2025 (6 PM)	Benjamin A. Horwitz "The Good, The Bad, & The Ugly" Chemical Process Simulation algorithmic solutions	CSU AIChE Section Joint Meeting, Washkewicz College of Engineering AIChE Chap	Joe Yurko, Dr. Gatica, Dr. Holland, CLE AIChE Meals: Professional members: $10; Students: Free CLE AIChE: Pizzas & Beverages
April 2025 (6 PM)	NEOSEF Awards Banquet	CCPL Branch Library ?	Joe Spagnuolo, Moderator NEOSEF Students, CCPL Branch Library Dinner: Pizza, professional members: $10; Students: Free
May 2025 (6 PM)	Tour?		

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