

ELIMINATING OVERSIZING AND VALVE INSTABILITY (CHATTER)

By: Hans K. Fauske, D.Sc., Regent Advisor, Fauske & Associates, LLC (FAI)

Typical causes of chatter (instability and potential valve damage) include:

- Excessive inlet pressure loss (3% rule)
- Excessive back pressure (10% rule)
- Oversized valve



Considering Tempered Reactive Vapor Systems, given uncertainties related to vapor disengagement and two-phase flow regime, valve sizing based upon two-phase flow can lead to significant oversizing and the potential for valve instability.

In order to eliminate oversizing it is recommended to calculate the required vent area based upon all vapor venting evaluated at a practical relief set pressure well below MAWP. Also to be considered, there are finite number of standard valve-nozzle sizes to choose from, and the calculated vent area may not correspond exactly to one of these sizes. The practice to select the standard size nozzle area which is closest to the calculated value on the high side, may lead to potential oversizing of more than 50%. Here it is recommended to change this practice and select the relief set pressure resulting in vent area equal to the standard size nozzle on the low side.

Following the above recommended procedure based upon all vapor vent sizing, the valve is initially undersized and the pressure will continue to rise as the relief valve remains open, due to the occurrence of two-phase flow, but the resulting overpressure will not exceed MAWP.* The allowance of significant overpressure will have the following benefits:

- Assure the smallest valve size
- Eliminate oversizing and valve instability

In summary, to simply assure valve stability select the relief set pressure sufficiently below MAWP. In this regard, while plant people are reluctant to give up the practice of setting relief pressure equal to MAWP, it is time to change. Setting pressure relief activation for all reactive systems (vapor, gassy and hybrid) at practical level below MAWP, is always beneficial and does not violate any standards.

* Hans K. Fauske, "Revisiting DIERS Two-Phase Methodology for Reactive Systems Twenty Years Later," Process Safety Progress (Vol. 25, No. 3) 2006.



Dr. Hans K. Fauske is an original founding partner of Fauske & Associates, LLC and currently serves as Regent Advisor

Upcoming Events

- AHMP 2016 National Conference - Aug 28-31, Washington, DC
- Kärnteknik 2016 / Nuclear Technology 2016 - November 16-17, Sweden

Letter From the President



You may have noticed that customer service and satisfaction have been a frequent theme of my recent communications. We adhere to a simple business model at Fauske & Associates, LLC (FAI) - make safety a priority and exceed customer and partner expectations every time. The reason: customers are the backbone of our business. In keeping with this belief, I made customer service the focus of our company human performance growth in FY 2016.

The importance of providing excellent customer service and positive customer experiences (both internally and externally) is reinforced in every employee meeting and through a campaign introduced to employees with the start of our FY 2016. Each month our employees are provided a helpful reminder regarding the importance of working together to ensure customer's receive exceptional service from our entire organization. These reminders are also posted on our employee bulletin boards and our company welcome board. I have shared some of these with you below:



As you can see, at FAI we not only 'talk the talk' when it comes to customer service, we also 'walk the walk.' If you have a favorite customer service tip that you would like to share with me, I invite you to contact me directly at kfauske@fauske.com or (630) 887- 5224. We are always seeking to find ways to improve our service and welcome your feedback as part of the process.

Wishing you a safe and happy summer,

H. Kristian Fauske
President

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Statement of Purpose:

FAI's "Process Safety News" is intended to be a forum on recent advances in chemical process safety and FAI's current and related offerings in this area. It will address subscriber's concerns regarding issues and practices for relief system design as well as laboratory testing and techniques for process safety management.

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Publisher

Fauske & Associates, LLC

THEORETICAL HEAT OF REACTION AS AN EFFECTIVE PROCESS SAFETY ASSESSMENT TOOL

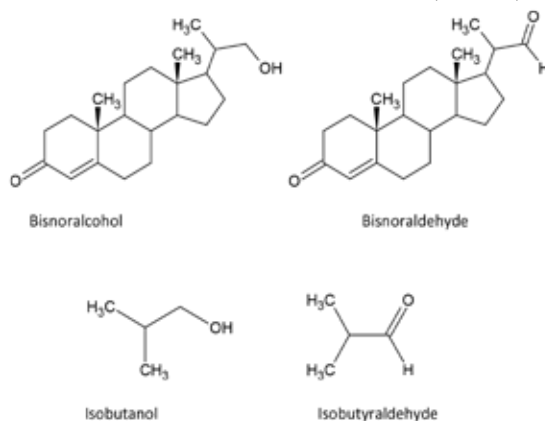
By: Donald J. Knoechel, Ph.D., Senior Consulting Engineer, Fauske & Associates, LLC

The paper by Weisenburger et. al.¹ presents a very comprehensive study on theoretical heat of reaction estimation versus measurement and outlines when calculations can be used and how. Most notably for any heat of reaction estimation to be sound, values for the enthalpy of formations of the species involved or representative model compounds in the appropriate physical state must be available or reasonably estimated. Of course a balanced chemical equation representing the process reaction of concern must be known, as well. When compiled, the pertinent heats of formation are combined according to equation 1

$$\Delta H_{rx} = \sum v \Delta H_{f, \text{products}} - \sum v \Delta H_{f, \text{reactants}} \quad (1)$$

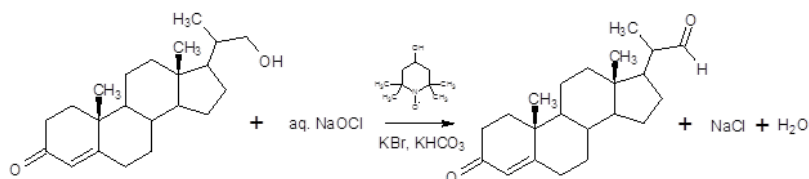
where v is the stoichiometric coefficient for the individual reactant or product in the balanced chemical equation.

Heats of formation can come from the literature whether they be for actual or model compounds. The more complex the molecule, however, the more unlikely a value for its heat of formation will be found. Rather, this is where model compounds can be effective surrogates for the actual compound. A model compound distills the more complex structure down to just its reacting moiety. For example, consider the oxidation of bisnoralcohol to bisnoraldehyde. We are only interested in the transformation taking place to the hydroxyl group branching off the D-ring (converting it to an aldehyde) and for practical purposes can ignore the rest of the molecule. As such, a model compound for the starting molecule could be isobutanol, and for the oxidized product, isobutyraldehyde.



Liquid phase heats of formation for these two model compounds are easily found in the literature.⁴ Of course one needs an oxidizing reagent and its corresponding

reduced by-products to fill out balanced equation. The TEMPO oxidation^{2,3} uses a stable nitroxyl radical, 4-hydroxy-TEMPO (TEMPO = 2,2,6,6-Tetramethylpiperidinyloxy) as a catalyst for oxidizing alcohols to either ketones or aldehydes. As 4-hydroxy-TEMPO is a catalyst, its heat of formation is not needed for the heat of reaction estimation. Rather, the heats of formation for the oxidant, aqueous bleach, sodium hypochlorite (aq. NaOCl) and the corresponding by-products of the oxidation, sodium chloride (NaCl) and water (H₂O) are required. The balanced chemical equation is shown below.



The entries in the table below tabulate the heats of formation for the participating model compounds, reagents and by-products used in the heat of reaction estimation together with the stoichiometric coefficient, phase (gas, liquid, solid, etc.) and the references where the values were found. The calculated heat of reaction is shown below as -259.0 kJ/mol.

Name of Compound or Model Molecule	Stoich. Coeff.	ΔH_f (kJ/mol)	Phase	Reference
Reactants				
Isobutanol	1	-334.7	Liquid	Pedley ⁴ pg 117
Sodium hypochlorite	1	-346.4	Aqueous (400 pts water)	NBS ⁵ pg 2-302
Products				
Isobutyraldehyde	1	-247.4	Liquid	Pedley ⁴ pg 117
Sodium Chloride	1	-406.9	Aqueous (400 pts water)	NBS ⁵ pg 2-302
Water	1	-285.8	Liquid	Pedley ⁴ pg 619
$\Delta H_{rx} = \sum (v \Delta H_{f, \text{products}} + \text{corrections}) - \sum (v \Delta H_{f, \text{reactants}} + \text{corrections}) =$				
-259.0 kJ/mol				

The reported heat of reaction for this process step as measured by reaction calorimetry is -295 kJ/mol for a recipe projecting an adiabatic temperature rise of +56°C.^{2,3} The estimate is within 12% of the actual heat of reaction. While the estimate calculates less exothermic than the measurement, in this case, the difference can be easily understood. The only available heat of formation value for aqueous sodium hypochlorite is a number corresponding to a bleach concentration of 1 part in 400 parts water (1% wt. NaOCl). Industrial sources of bleach are much more

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concentrated, anywhere from 4% to 17%.⁶ It is likely that the actual process uses a more concentrated solution of bleach. As the process is performed with a controlled addition of bleach to a reaction mass containing aqueous potassium bromide and sodium bicarbonate (as well as the substrate in dichloromethane), a not-insignificant heat of dilution of the concentrated bleach into the aqueous phase of the reaction mass would be realized and could easily account for the more exothermic actual heat of reaction compared to that calculated from the estimation using dilute bleach.

With an estimated heat of reaction in hand, a calculation of the adiabatic temperature rise for a loss of cooling scenario is possible given a process recipe using actual or approximated heat capacities for the reaction mass components. In the example above, the actual adiabatic temperature rise of +56°C calculated from the reaction calorimetry experiment would be lowered to +49°C if the estimated heat of reaction were applied to the same recipe.

From the stated process temperature of 0 to 10°C, if all the bleach was added at once, the adiabatic temperature rise (either 56°C or 49°C) would be capable of raising the temperature to the boiling point of dichloromethane (39.6°C) in a loss of cooling scenario potentially causing a release depending on condenser capacity. As such, the bleach is added in a controlled addition thus dynamically reducing the adiabatic potential as long as the addition is stopped if cooling is lost.

A reminder, however, that the adiabatic temperature rise calculation from either a theoretical or measured heat of reaction only allows for heat from the desired reaction to contribute to the temperature rise (if any). This calculated temperature rise differs from what one would measure experimentally in adiabatic calorimetry, for instance, as during such a test, further reactions may be initiated (with their own heat of reaction) when the actual rise in temperature is experienced and may contribute to a further increase in temperature. The other difference between theoretical calculation and experiment would be that normally the calculation would use standard values (at 25°C for instance) for heat capacity of individual reaction mass components or assume the heat capacity of the majority component (solvent) in calculating the thermal mass. In reaction calorimetry, heat capacities measured at actual reaction temperatures would be used. In adiabatic calorimetry, the experiment experiences the actual temperature rise and the corresponding real change in reaction mass heat capacity with temperature. As heat capacity usually increases with temperature, frequently a projected adiabatic potential will be higher than measured if the chemistry is performed at elevated temperatures.

Nevertheless, heat of reaction estimation, when possible, and properly done, can be an effective tool in assessing the safety of chemical processes. Fauske & Associates, LLC (FAI) is fully capable of performing these calculations and can help you determine whether they are sufficient for your need or stage of development. FAI can also carry out the more definitive reaction calorimetry and adiabatic calorimetry experiments if the process needs further understanding. If you have process scale up or safety concerns that require a heat of reaction estimation or reaction calorimetry, please contact Don Knoechel at knoechel@fauske.com or 630-887-5251 to discuss your process.

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NFPA 652 AND WHAT IT MEANS FOR YOU – CLEARING THE FUD AROUND DHA'S

By: Mark Yukich, Sales & Business Development, Fauske & Associates, LLC (FAI)

By now, most of us have heard that NFPA 652 has been released, so what does that mean? The highlights are that you will be required to evaluate combustible dust hazards that may exist at your facilities by conducting a Dust Hazard Analysis or DHA within 3 years of NFPA 652's release date of October 2015. That means that NFPA 652 asks operators of facilities to identify combustion hazards involving dusts and powders and then implement needed protective measures and safeguards by October 2018. Please note that dusts, powders, flock, flyings and fibers are categorized into one general group as "dust." According to Susan Bershad, the NFPA staff liaison for the combustible dust technical committee, there are the following 3 fundamental principles in the standard: containing the fuel, controlling the ignition sources and limiting the spread of any combustion event. Those elements can be found by conducting a DHA, which will need to be revalidated at least every 5 years.

In NFPA 652, the term "Dust Hazard Analysis" or DHA is introduced. This is designed to differentiate from the more complex Process Hazard Analysis or PHA required by the OSHA Process Safety Management (PSM) program for the chemical process industry. Many print and electronic publications are spreading Fear, Uncertainty and Doubt (FUD) by mixing up the requirements for an OSHA PSM PHA with the less arduous DHA approach mentioned in NFPA 652. Industrial and academic experts in the area of combustible dust, fire and explosion safety guided the formation of NFPA 652. Its purpose is to give personnel a single source for information on the fundamentals of safe handling combustible dust and powders in an industrial setting. The standard also directs users to commodity specific standards such as the following which offer material and production specific guidance:

- NFPA 61 – Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
- NFPA 484 – Standard Combustible Metals
- NFPA 654 – Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids
- NFPA 664 – Wood Processing and Woodworking Facilities



The reason for an implementation deadline for the DHA is to encourage that proactive actions are taken in completing the assessment. According to Guy Colonna, NFPA division manager of industrial and chemical engineering, "The concern is if there's no timetable, it would never get done." Colonna went on to say, "The committee is not proposing a shutdown and redesign of every industrial facility where solids are handling and dust could be present. They're starting with saying: 'Do the DHA. See what it tells you.'"

Chemical Safety Board (CSB) Chairman, Vanessa Sutherland said, "Their internal practices are focused on minimizing the amount of accumulated dust, making sure it's less of a hazard, and also workers are kept up to date on new practices and consensus standards through NFPA." According to Sutherland, employers can take three actions to protect against combustible dust hazards:

- Review CSB Materials, including a safety video and investigation reports
- Review and adopt NFPA standards
- Pay greater attention to worker training and facility housekeeping

OSHA offers other combustible dust and ignition source control recommendations, as well as guidance on injury and damage control methods. The following are some key recommendations, presented in no particular order:

- Enforce a program that includes dust inspections, testing, housekeeping and control
- Use appropriate dust collection systems and filters
- Limit escape of dust from equipment or ventilation systems
- Use surfaces that limit dust accumulation and ease cleaning
- Regularly check for dust residue in all areas, including hidden locations
- Clean without creating dust clouds around ignition sources
- Operate vacuum cleaners certified for dust collection
- Use appropriate electrical equipment
- Keep heated surfaces and systems away from dust
- Create an emergency plan

The recently published OSHA fact sheet is provided on pages 9 and 10 for your reference.



2016 GEORGE WESTINGHOUSE SIGNATURE AWARD WINNERS



The 2016 George Westinghouse Signature Award (GWSA) from the Westinghouse Engineering Center of Excellence was awarded to Fauske & Associates, LLC employees (from left to right) Jens Conzen, Director of Plant Services, Kevin Ramsden, Chief Engineer and Damian Stefanczyk, Director of Thermal Hydraulics Services. The award was given to them for their Acoustic Vibration work at Port Washington Generating Station.

The GWSA honors and recognizes individuals and teams of employees who demonstrate the highest standards of excellence in the projects they complete in the previous fiscal year. Congratulations to Jens, Kevin and Damian!



Fauske & Associates, LLC Connected to the Community

Earth Day 2016



Fauske & Associates LLC (FAI) employees observed Earth Day 2016 by working to clean up garbage and other debris from the streets of our local community, Burr Ridge, IL.

FAI RECOGNIZED FOR OUTSTANDING FUNDRAISING FOR LOCAL KIWANIS



Kiwanis President Russ Smith and members of the Burr Ridge and Willowbrook Kiwanis club, treated Fauske & Associates LLC (FAI) employees to a cookout on June 28 to thank them for their outstanding contributions to the 2015 Kiwanis Peanut Days fundraiser. FAI raised nearly \$5000 during the campaign which will be used to support local charitable projects sponsored by Kiwanis.

FAUSKE & ASSOCIATES - THE NETHERLANDS OPENS!

By: AnnMarie Fauske, MBA, Customer Outreach & Digital Media Manager, Fauske & Associates, LLC (FAI)

July 4th marks an important holiday in the U.S. and is now also the official opening day of our Fauske & Associates (FAI) - The Netherlands location. This Thermal Hazards Laboratory is located in Geleen, the Netherlands, and will provide testing, engineering, and training services to our European clients.



"We are pleased to announce this new laboratory as it will help meet the direct needs of our many European clients," states Fauske & Associates, LLC President Kris Fauske. As global markets become increasingly focused on safety, the need for a local laboratory presence was evident. FAI's thermal hazards group will help to support process safety and scale-up questions using a variety of instruments and software tools."

Our thermal hazards testing laboratory will be able to determine reaction rates (including temperature and pressure rise rates) to assess how to safely handle materials and avoid runaway reactions. This data is important when considering processing, long-term storage or shipping of a material. FAI performs heat flow and adiabatic calorimetry using the following tools:

- Vent Sizing Package 2 (VSP2™)
- Advanced Reactive Systems Screening Tool (ARSST™)
- Thermal Activity Monitor (TAM)
- Seteram C80
- Accelerating Rate Calorimeter (ARC®)
- Differential Scanning Calorimeter (DSC)

To determine required cooling capacity, understand process changes and scale-up implications, FAI performs reaction calorimetry using:

- THT- RC
- Mettler-Toledo RC1
- ChemiSens CPA 202

To classify materials for transportation, FAI performs the following UN Transport tests:

- Class 4, Division 4.1 Flammable Solids
- Class 4, Division 4.2 Substances Liable to Spontaneous Combustion
- Class 4, Division 4.3 Dangerous When Wet
- Class 4, Division 5.1 Oxidizing Solids



Simon- Hans Niemann will be the Manager of the new laboratory. He has more than 25 years of engineering and process safety experience. He will be supported by Mr. Márton Harsányi, who was formerly the head of process safety scale-up at Zentiva, a Sanofi company. Collectively, they have many years of Process Safety Analyses, SHE-consultancy and HAZOP expertise.

In addition to managing the laboratory, providing training (ExELect Experimental Explosion Lecture), and interfacing with clients, the pair also have experience in:

- Designing, completing and coordinating all-round thermal safety and plant feasibility studies for technologies intended for scale up or technologies already in production
- Measuring heats of reaction and determining heat and gas generation rates by reaction calorimetry (RC1 + ReactIR, CALO 2310pro)
- Determining thermal stability and reaction kinetics for reaction mixtures and synthesis intermediates by adiabatic calorimetry (ARSST, VSP2, PHI TEC II), thermoanalytical equipment (DSC, HPDSC, TGA) and reaction kinetics simulation software (AKTS)

OSHA[®] FactSheet

Protecting Workers from Combustible Dust Explosion Hazards

Combustible dusts can fuel a flash fire or explosion when dispersed in a dust cloud. Workers in many industries who handle combustible solids may be exposed to combustible dust incidents that can cause catastrophic destruction, injuries and deaths. Employers and workers should take the steps below to control the fuel and prevent tragic consequences.

Control the Fuel (Dust) and Avoid Incidents

- **Capture** dust before it escapes into a work area by using properly designed, installed, approved and maintained dust collection systems.
- **Contain** dust within equipment, systems or rooms that are built and operated to safely handle combustible dust.
- **Clean** work areas, overhead surfaces and concealed spaces frequently and thoroughly using safe housekeeping methods to remove combustible dusts not captured or contained.



Key Responsibilities to Keep Workers Safe

Employers should determine whether dusts present in the workplace are explosible. If so, they must take proper precautions to protect workers against flash fires and explosions. Resources to help employers can be found at www.osha.gov/dsg/combustibledust.

Workers must be protected from combustible dust flash fire and explosion hazards. Supervisors should be notified if proper precautions have not been taken to protect workers from combustible dust hazards.

Examples of Potential Combustible Dust Materials

Agricultural cellulose corn egg white fertilizer flour powdered milk soy flour spices starch sugar tobacco wood flour	Carbonaceous charcoal coal lampblack lignite Metals aluminum iron magnesium titanium zirconium	Plastic epoxy resin melamine phenolic resin polyethylene polypropylene Other biosolids dyes pharmaceuticals rubber soap sulfur
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Some Dusts are Not Combustible

Certain materials in their pure chemical state will not form combustible dust, including cement, gypsum, limestone, sand and salt.

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Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.

- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For more information, see [OSHA's Workers page](#).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

For assistance, contact us. We can help. It's confidential.



www.osha.gov (800) 321-OSHA (6742)



U.S. Department of Labor

LONG-TERM EFFECT OF CORROSION ON FILTER FUNCTIONALITY

By: Peter Burelbach, Intern, Fauske & Associates, LLC (FAI)

I am currently studying mechanical engineering at the University of Iowa, and will be a junior this coming fall. One of my areas of interest is studying mechanical systems and how material properties can place limitations on a structural design. As a recently hired intern at Fauske and Associates, LLC (FAI) I have been able to work on a project that involves studying the vulnerability of specific materials, particularly when placed in a corrosive environment.

Much of today's infrastructure is constructed of metals, from skyscrapers to sewer pipes. Without proper maintenance and precautions, metals tend to corrode, leaving structures susceptible to failure. One such incident occurred when neglect was shown toward properly maintaining an oil tanker named Erika. In 1999, this Maltese freighter broke up and sank approximately 70 kilometers off the coast of France. Estimates show that 19,800 of the 30,000 gallons of oil in the ship were spilled, more than the whole world spilled in 1998 combined. This had a drastic effect not only on marine life, but also the French economy, through declines in fishing, trade, and tourism.



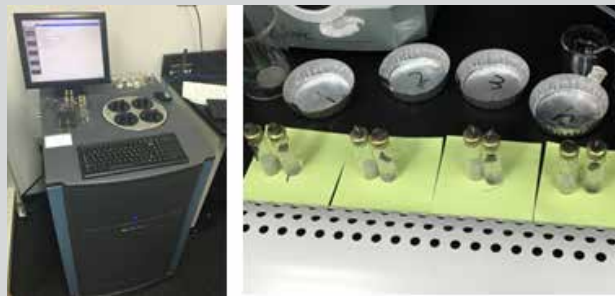
After investigation of the disaster, it was determined that disregard of material degradation due to corrosion was the main culprit in the ship's destruction during a storm. In the early 1990's, inspectors found that water tight doors would not close, several rusted holes were visible, and that the whole ship in general was in poor shape; however, the ship was still cleared to sail. Among other issues, such as deficient firefighting and inert gas systems, proper preventative measures were not taken to deal with the corrosion, which ultimately led to its sinking.

As seen with the Erika disaster, it is imperative to anticipate the likelihood of failure of equipment in corrosive environments. Regularly inspecting metal equipment and performing maintenance/replacing materials are crucial to maintaining structural integrity. There are incidents, however, where periodic observation or replacement of the equipment is not feasible such as if the piece is in a difficult location to observe or is very expensive. In cases like this, selecting the best-suited material of construction and understanding the probability and effect of corrosion on functionality is crucial.

Currently, FAI is working on testing metal filter systems intended for use on nuclear waste containers. These filters are designed to safely vent flammable gas generated by the contained reactive material while also maintaining a high decontamination factor. As seen with Erika, critical attention to characterize the effect of corrosion is imperative, as corrosion products could clog the filter and lead to a gaseous build up or potentially an explosion. This project involves testing different filter materials for filter functionality before and after being exposed to a corrosive environment.

Critical filter characteristics such as diffusion coefficient and pressure drop are measured on as-received filter material. Additionally, the predicted corrosive substance and filter materials are tested in long-term heated baths (set to three different temperatures) to determine the effect of corrosion, specifically the resulting mass and porosity change, after discrete time intervals. These data are expected to demonstrate the effect on the filter material as a function of time and temperature. Then, using a simulated accelerated aging process, additional filter assemblies will be treated and the functionality testing will be repeated with the corroded filters to determine how corrosion reactions affect the filter characteristics. Based on these results, a safe operating standard can be suggested for the filter systems and the filter life can be estimated.

In order to develop a safe operating standard and to understand the imposed simulated accelerated aging process, additional information on the reactive system needs to be collected. By studying the rate of reaction between the filter and the corrosive substance in a controlled environment, temperature dependent kinetics can be inferred. A thermal activity monitor (TAM) is used to measure the heat flow due to the interaction between the filter and the corrosive substance under isothermal conditions. Tests at multiple temperatures can be performed with each test containing up to four sample cells and reference cells. Together, with the measured kinetics and changes observed in the long term aging tests, an estimate can be made as to how the filters would perform over the planned mission time under normal operating conditions.



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Once you have seen the various lists that are designed to assist you in starting the DHA process, you can get a good idea of what mitigation steps need to be implemented. However, you may still be in need of additional guidance that is specific to your process. A good place to start is developing a team of people that has a working knowledge in each individual phase of the process. Have them seek to answer six fundamental questions:

- What does “normal” look like for the process?
- What can go wrong with the process (and how)?
- How bad, and how likely, can that “event” be?
- What protections currently exist to avoid the “event”?
- What is the risk of continuing to operate the process as it stands now?
- Is additional protection warranted (if so, what)?

Ideally, you want to have one team member that is assigned the role of team lead and meeting facilitator who has experience conducting a hazard analysis. Once the review is completed you want to document the information obtained in the analysis. The goal is to move forward and continually walk through your process to ensure safety measures recommended are still in place or if any adjustment may be necessary. Another key component is to pass on the information gathered to your team, so that they know the hazard to be aware of and to ensure the safety measures are continually implemented after changes in personnel. In short, this is not a linear activity but a cyclical one that is repeated continually for the life of the process.

Taking on a DHA for your facility can be a daunting task, but it is one that is necessary to recognize any potential hazards. However, if you take it one process and one step at time, you can make your way towards having a safer operation. Fauske & Associates, LLC (FAI) and our On-Site Safety Team is available to assist you in navigating the DHA process. The bottom line is that you need to have a DHA completed by October of 2018, if you are handling material that is either combustible or explosive. The DHA should develop a plan of action to maintain good housekeeping, safety training to your employees and properly protected equipment and electrical components. Your employees are a great resource to utilize where safety measures may need to be explored. Take the proactive steps towards a safer operation in your facility today. And, it does not have to be complicated to be effective in reducing the combustible dust hazard risk in your process.

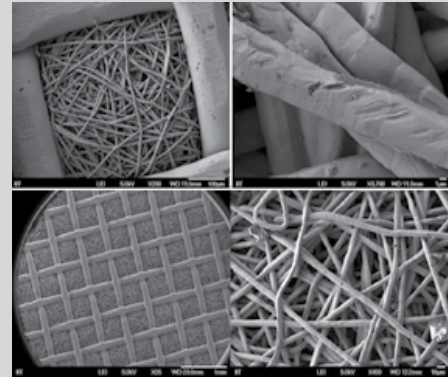
REFERENCES

- “NFPA GUIDE TO COMBUSTIBLE DUSTS,” AUTHORS WALTHER L. FRANK AND SAMUEL A. RODGERS
 “COMBUSTIBLE DUST: SMALL PARTICLES, BIG HAZARD,” SAFETY & HEALTH JANUARY 24, 2016
 “NFPA INTRODUCES NFPA 652 COMBUSTIBLE DUST STANDARD,” POWDER & BULK SOLIDS, JULY 27, 2015



Mark Yukich works with the FAI Sales team to support our combustible dust testing customers

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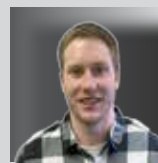


Furthermore, using a scanning electron microscope (SEM), detailed optical evidence can be collected on the filter materials as they undergo corrosive treatment to better understand what is occurring at the microscopic level. The SEM works by sending beams of electrons into a sample surface. The beams interact with the sample and the interaction can be interpreted as images. The photos above show the detail that can be collected on as-received samples of the filter material. These tests serve as a baseline for future corrosion tests.

By testing a variety of materials and structures and after analyzing the data collected from SEM imagery, kinetics and the change in filter functionality, suggestions can be made as to which material is optimal. Understanding what material is least likely to corrode, or determining if there is a noticeable difference between them at all, will help to guide selection of the most appropriate filter. The primary objective of this project is to help select the optimal filter based on performance, reliability, and safety, and to provide a reasonable estimate for the functional lifetime of a filter on a nuclear waste container.

REFERENCES

- “ENVIRONMENTAL CATASTROPHE: SINKING OF THE ERIKA.” ENVIRONMENTAL CATASTROPHE, SINKING OF THE ERIKA. N.P., N.D. WEB. 23 JUNE 2016.



Peter Burelbach is an intern working at FAI during the summer of 2016

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- Providing process safety classification of chemical processes and compounds
- Participating and leading Safety and Hazard Risk Evaluation and HAZOP studies
- Selecting and optimizing pharmaceutical processes intended for scale up and technological transfer to pilot plants in collaboration with API synthetic laboratories, API development laboratories and analytical department
- Providing Providing technological scale up and related optimization in pilot plant in cooperation with development laboratory, analytical department and process safety laboratory

States Fauske, "FAI has developed key instruments and engineering methods for solving process safety problems. As a world leader in nuclear, industrial and chemical solutions, we felt it important to take the next step and provide our European customers with access to a local lab and expertise to help as they scale their business".

FAI the Netherlands location is a branch of WEC UK Limited.



AnnMarie Fauske is Customer Outreach & Digital Media Manager at Fauske & Associates, LLC



Look for us

SOCIAL MEDIA

This Fall FAI will be in Atlanta, Houston and Chicago
 Presenting: *NFPA 652 - An Introduction to Dust Hazard Analysis*
 Location and time information coming soon
 please contact info@fauske.com

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Fauske & Associates, LLC (FAI) offers many courses that can be given on-site at client locations or at FAI's facilities.

A few of the course topics we offer:

• Combustible Dust Hazards	• Reactive Chemical Hazards
• Flammability	• Calorimetry Testing and Data Interpretation
• Electrostatics	• Emergency Relief System Design
• Safe Process Scale-Up	

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