

### Contents

Dispersant doubts	1
Chlorine incident	3
Crushing clinkers	5
Macnab Lacey prize	7
New energy centre	8
“Most employable”	9
Memorial lecture	10
NOPSEMA appt	10

A view of the site of the Deepwater Horizon spill, taken 30 June 2010. PHOTO: CC FLICKR <BIT.LY/1YxJl11>

## Doubts over deep water dispersant use

In 2010, as the ruptured wellhead left behind by the sunken Deepwater Horizon rig spewed plumes of petroleum into the Gulf of Mexico, BP formed a plan to inject a toxic dispersant through a hose into the source of the spill.

Now, a University of Western Australia (UWA) chemical engineer's research has brought the efficacy of the direct injection approach into question.

The dispersant, Corexit, is typically sprayed on surface oil slicks, causing the oil to emulsify and sink so that it cannot accumulate on coastlines. More than 4000 m<sup>3</sup> of Corexit was sprayed onto the Gulf from aeroplanes and ships to quell the spill.

However, some 2920 m<sup>3</sup> of the dispersant was

also released directly into the undersea plumes, 1500 m beneath the surface. It was hoped the Corexit would turn the submerged oil into a fine mist lacking the buoyancy to bubble up to the surface: a “novel approach”, according to a 2010 BP report prepared for the US Bureau of Ocean Energy Management, Regulation and Enforcement.

Corexit is known to be toxic, and is banned in the UK due to concerns about adverse health effects on workers. In the wake of the incident, a study from the Georgia Institute of Technology and the Autonomous University of Aguascalientes reported that Corexit used during the BP oil spill had actually increased the toxicity of the oil by up to 52 times.



**The high pressure sapphire visual autoclave is used to study hydrate plug formation and characterise crude oils.** PHOTO: MATTHEW GALLIGAN/UWA

Assoc Prof Zachary Aman, of UWA's School of Mechanical and Chemical Engineering, has partnered with Assoc Prof Claire Paris, an oceanographer at the University of Miami, to simulate the conditions characterising deep water oil blowouts in an effort to inform future clean-up and remediation efforts. The research paper will be published in the May edition of *Chemical Engineering Science*.

The formation of oil-in-water dispersions is a critical step during blowouts and is a determining factor in the migration of oil through the water, according to Aman and Paris.

The researchers placed oil in a sapphire autoclave and monitored it using a high speed, high resolution camera, to evaluate how droplets form at varying turbulent conditions and under high pressure.

The results suggest that the deep water conditions create a natural dispersion mechanism for oil droplets. This leads to an effect similar to the application of chemical dispersants at the source.

"This is the first time we've been able to visually monitor how droplets break up and coalesce in these deep water conditions," Aman said. "These results suggest there is a range of natural turbulence conditions in which crude oil may naturally disperse as small particles that are about 10 times the width of a human hair."

The laboratory results were applied in a computer simulation of the Deepwater Horizon blowout. In the simulation, the team tracked



**BOARD**

- |  |  |
|--|--|
| <b>John McGagh</b> (Chair)               | <b>Alex Lubansky</b> (WA)                                  |
| <b>Rose Amal</b> (Deputy Chair)          | <b>Lindsay Mallen</b> (Chair Professional Formation Forum) |
| <b>Paul Taranto</b> (Honorary treasurer) | <b>Ainslie Just</b> (Deputy Professional Formation Forum)  |
| <b>Brett Mahar</b> (Vic)                 | <b>Glen Corder</b> (Technical policy director)             |
| <b>Dominique Vagi</b> (NSW)              |  |
| <b>Allyson Black</b> (Qld)               |  |
| <b>Tom Pitcher</b> (SA)                  |  |

**Director Australasia: Peter Slane**

Level 7, 455 Bourke Street  
Melbourne VIC 3000  
phone 03 9642 4494 fax 03 9642 4495  
email pslane@icheme.org

**COLLEGE OF CHEMICAL ENGINEERS BOARD**

- |   |                                       |
|---|---------------------------------------|
| <b>Dr Leon Prentice</b> (Chair, NSW)      | <b>Peter Mauger</b> (SA)              |
| <b>Daniel Edge</b> (Deputy Chair, ACT)    | <b>Stephanie Pearce</b> (Tas)         |
| <b>Rob Burford</b> (Immediate Past Chair) | <b>Lars Anderberg</b> (Newcastle Rep) |
|   | <b>Debashis Raha</b> (Member)         |

**College contact: Desarae Wilmhurst**

11 National Circuit, Barton ACT 2600  
phone 02 6270 6121  
email DWilmhurst@engineersaustralia.org.au

**Published by Engineers Media**, a wholly owned subsidiary of Engineers Australia, Level 4, 2 Ernest Place, Crows Nest NSW 2065, PO Box 588 Crows Nest 1585, 02 9438 1533, for IChemE's Australia office and the Chemical College of Engineers Australia. The statements made or opinions expressed in this newsletter do not necessarily reflect the views of Engineers Australia or the Institution of Chemical Engineers.

**MANAGING EDITOR:** Tim Kannegieter **DEPUTY EDITOR:** Desi Corbett **EDITOR:** Callum Rhodes – chemical@engineersmedia.com.au

the oil droplets from 20 April 2010, the day of the spill, through to 15 July, when the well was capped. The droplets were also tracked for an additional 24 days after the cap was in place.

Based on the modelling, the researchers suggested the use of chemical dispersants such as Corexit may have reduced the mean oil droplet diameter from about 80 to 45  $\mu\text{m}$ . This would have reduced the amount of oil reaching the surface by only 3% at most. If the blowout had been in shallower water or at a lower rate of release, the impact of the dispersant may have been greater, they said.

"These results support our initial modelling work that the use of toxic dispersants at depth should not be a systematic oil spill response," Paris

said. "It could very well be unnecessary in some cases."

In addition to the implications for the use of chemical dispersants, Aman said the laboratory work would benefit Western Australia, given the number of offshore developments in the state.

The benefit lies in the ability to measure the size of crude oil droplets saturated with gas and dispersed, making it possible to assess the scale of potential damage at future blowout sites, according to Prof Michael Johns, deputy dean of Engineering, Computing and Mathematics at UWA.

"Developing the experimental equipment to measure dispersed oil particles represents a critical engineering challenge," Johns added. ■

## Chlorine overdose prompts upgrade

Engineers have identified the cause of a high chlorine incident involving a NSW town's water supply that occurred in March.

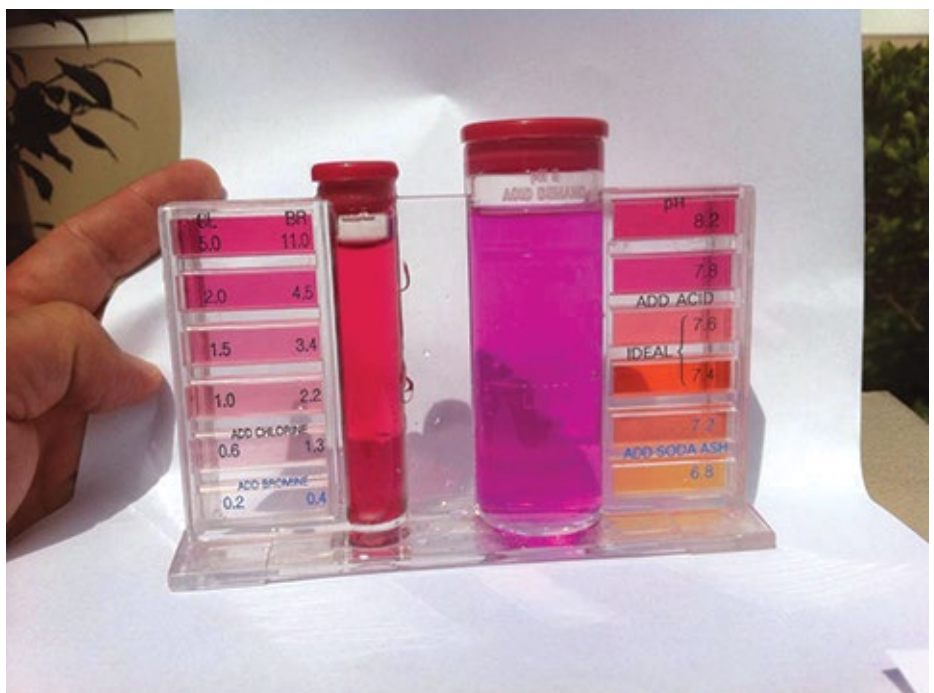
Independent water engineering investigators Hunter H2O, who are looking into the high chlorine incident in Gloucester last month, have provided a preliminary report to the management and board of MidCoast Water.

The report determined the cause of the problem was due to the syphoning of hypochlorite into the clear water reservoir at the Gloucester Water Treatment Plant after the plant had shut down.

MidCoast Water only took over responsibility for the Gloucester Water Supply, which supplies water to around 1700 customers, from Gloucester Shire Council in mid-2011.

The Gloucester Water

Supply Scheme comprises a water treatment plant, three reservoirs, seven booster pump stations and one raw water pump station. It was originally built in the late 1930s and early 1940s, and underwent an upgrade in the 1980s. →



**A Gloucester hotel posted the results of a pool water testing kit used on its tap water, indicating elevated chlorine levels.**

PHOTO: ROUNDABOUT INN

The preliminary report from Hunter H2O indicates the configuration of the hypochlorite dosing system was the root cause of the syphoning issue, according to acting general manager Brendan Guiney.

He cited the report as stating, "the syphoning of the hypochlorite solution into the clear water plant also explains the intermittent nature of the discharge of highly chlorinated water into the water reticulation system."



*The preliminary report indicates the configuration of the hypochlorite dosing system was the root cause of the syphoning issue.*

It also revealed that the plant is now being operated manually with the chlorine dosing system being manually isolated after each run to ensure syphoning cannot reoccur. A range of other actions have also been completed to ensure a similar incident could not happen again.

These include the installation

of an online residual chlorine analyser at the plant monitoring treated water with the result recorded and alarmed. Daily visual operational checks noting chemical storage volumes are also being carried out,

according to Hunter H2O. The engineering company's full report is also expected to comment on MidCoast Water's incident response and make recommendations for improvements, according to Guiney. ■



Global Leader  
in Training For  
The Process  
Industries



It's Not What You Know, It's What You Don't Know

**Control and Operation of Centrifugal Gas Compressors**  
Perth - 13-15 May  
Darwin - 15-17 June  
Brisbane - 22-24 June  
Melbourne - 13-15 July

**Mechanical Aspects of Centrifugal Gas Compressors**  
Brisbane - 10-11 September

 **Design and Operation of FPSOs**  
Perth - 12-14 October

**Subsea Systems**  
Perth - 15-16 October

**Floating LNG - Production Storage Offloading & Re-gasification**  
Perth - 19-20 October

 **Natural Gas Processing on Offshore Facilities**  
Perth - 21-23 October

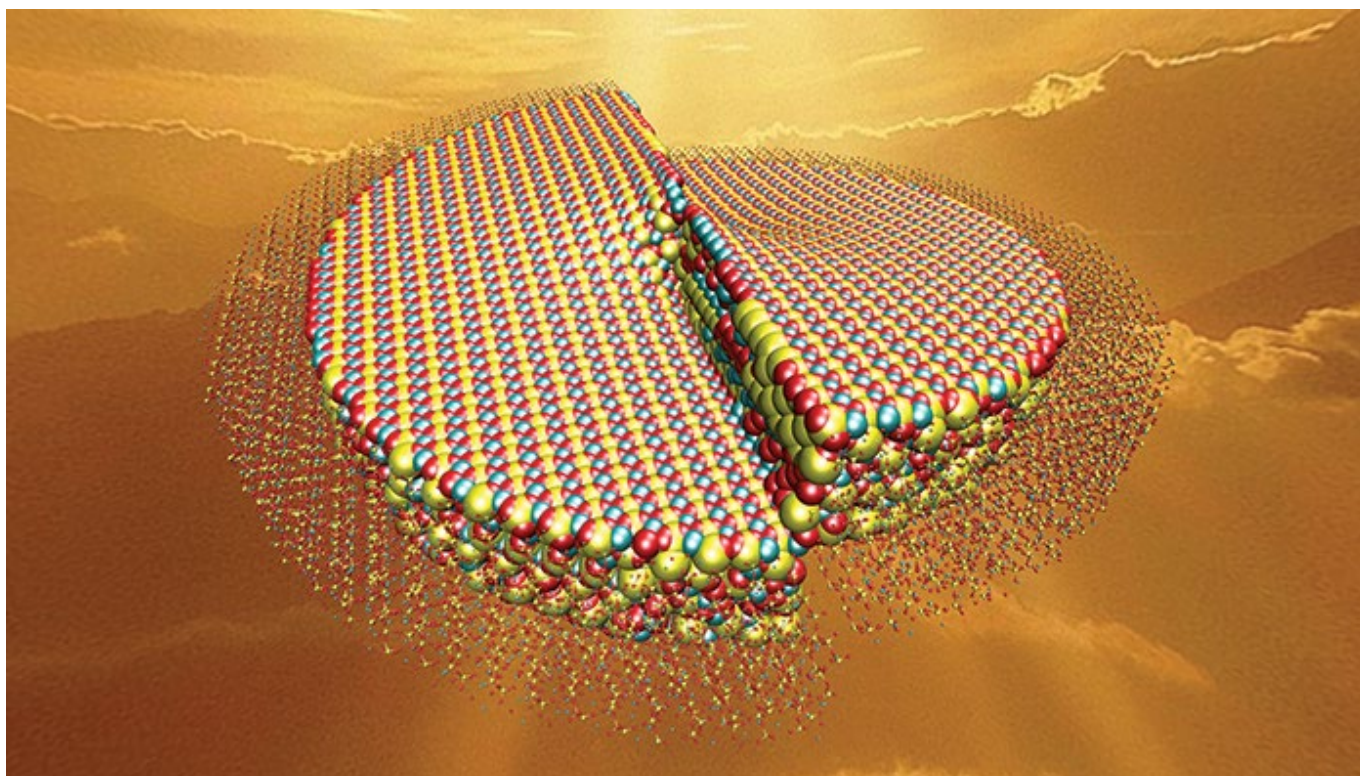
**Control, Operation and Design of Reciprocating Gas Compressors**  
Perth - 2-3 November  
Brisbane - 12-13 November

**LNG - A Technical Overview**  
Brisbane - 9-11 November

Full Course Schedule And Dates Available On Our Website

Please contact Daren Reid. 08 9355 5599. [daren.reid@esd-simulation.com](mailto:daren.reid@esd-simulation.com)

[www.esd-simulation.com](http://www.esd-simulation.com)



**A clinker with a screw dislocation.** PHOTO: SHAHSAVARI GROUP/RICE UNIVERSITY

## Crushing clinkers

**A** change to the way cement is manufactured could lead to significant energy savings, according to new research from Rice University in the US.

The research team, including Rice assistant professor of materials science and nanoengineering and of civil and environmental engineering Rouzbeh Shahsavari, has studied the crystal and atomic structures of 'clinkers' – round lumps of calcium silicate – in an attempt to find efficiencies in cement manufacture.

Clinkers for Portland cement, made by heating raw elements in a rotary kiln, are ground with other materials such as gypsum to produce cement for use in concrete and other applications. The more brittle the clinkers, the easier they are to grind.

An earlier study by Shahsavari and his colleagues noted that concrete manufacturing is responsible for 5-10% of the carbon dioxide released into the atmosphere worldwide. The grinding of clinkers currently accounts for around 10-12% of the energy required to make cement.

The researchers analysed the structures of five phases of clinkers, representing stages of cooling after the clinkers leave the kiln.

They focused on the internal stresses that make some phases more brittle than others. They also looked at unavoidable defects called screw dislocations, shear offsets in the raw materials that influence how well the powders mix with water – their reactivity – which determines the cement's ultimate strength.

The results show the clinkers were not only most brittle when hottest, but also the most reactive.

"Defects form naturally, and you cannot do anything about them," Shahsavari said. "But the more brittle the clinkers are, the better they are for grinding. We found that the initial phase out of the kiln is the most brittle, and that defects carry through to the powder."

The researchers have suggested this could lead manufacturers to consolidate processes to find energy savings in the grinding. ■

# IChemE Australasian training & events 2015

## May

Human Factors (Module 4)  
13 - 14 May, Perth, WA

Hazards Australasia 2015  
26 - 27 May, Brisbane, QLD

## June

Human Factors (Module 1)  
10 - 11 June, Melbourne, VIC

Layer of Protection Analysis  
15 - 16 June, Melbourne, VIC  
18 - 19 June, Adelaide, SA

Process Safety Awareness  
23 - 24 June, Perth, WA

Heat Integration  
30 June - 2 July, Melbourne, VIC

## July

HAZOP Study for Team Leaders & Team Members  
7 - 9 July, Melbourne, VIC

Fundamentals of Process Safety  
13 - 17 July, Brisbane, QLD

## August

Energy Cost Reduction  
4 August, Brisbane, QLD

Process Safety & the Board  
5 August, Melbourne, VIC

Human Factors Analysis Tools  
18 - 19 August, Melbourne, VIC

Fundamentals of Process Safety  
24 - 28 August, New Plymouth, NZ

## September

Human Factors (Module 2)  
16 - 17 September, Melbourne, VIC

APCChE 2015 Congress  
27 Sept - 1 Oct, Melbourne, VIC

International conference on Coal Science & Technology  
27 Sept - 1 Oct, Melbourne, VIC

## October

Fundamentals of Process Safety  
12 - 16 October, Melbourne, VIC

HAZOP Study for Team Leaders & Team Members  
20 - 22 October, Perth, WA

## November

HAZOP Awareness  
10 November, Brisbane, QLD

Chemical Engineering for Non-Chemical Engineers  
18 - 20 November, Perth, WA

Establishing & Maintaining a Safety Culture  
24 - 26 November, Brisbane, QLD

## In-company training

Could several of your colleagues benefit from the same course? Did you know IChemE offers in-house training as a cost effective solution? Choose a date and location that suits you, with the benefit of a tailor-made program to address the specific needs of your organisation. For further information:

[www.icheme.org/courses](http://www.icheme.org/courses)

Tel: +61 (0)3 9642 4494

Fax: +61 (0)3 9642 4495

Email: [austcourses@icheme.org](mailto:austcourses@icheme.org)

IChemE ADVANCING  
CHEMICAL  
ENGINEERING  
WORLDWIDE





(L-R) Dr Andrew Jamieson, Prof Karen Haggood, Richard Arthur, Makarios Wong, Kirilly Wagstaff, Daniel Wielechowski, Prof Gil Garnier and Assoc Prof Andrew Hoadley (missing: Jimmy Nguyen, Trang Truong). PHOTO: IChemE

## Students win Macnab Lacey prize

Undergraduate students at Monash University have been awarded the Macnab Lacey prize for their design project work on the development of sustainable process solutions for wood pulp waste.

The Macnab Lacey prize is a design award open to students in IChemE accredited courses across the globe.

A Monash team has now taken the prize two years in a row. This year's winning team comprised undergraduates Richard Arthur, Jimmy Nguyen, Trang Truong, Kirilly Wagstaff, Daniel Wielechowski and Makarios Wong.

The winning entry was a conceptual design to determine the feasibility of using black liquor (a lignin rich co-product of wood pulping resulting from paper production) as a renewable feedstock for producing ammonia.

Daniel Wielechowski said that even when the team thought it had reached a more sustainable solution, they found themselves redesigning the process as new ideas for industrial symbiosis emerged.

"Our ultimate goal was to implement a highly efficient process that would benefit the community and perform symbiotically with existing industries," Wielechowski explained.

"The sustainability thinking developed during the design project is now being applied in my work as a process engineer for recovery and power generation at [paper and board manufacturer] Visy Industries," he added.

Monash director of Chemical Engineering Prof Gil Garnier said that the sustainability challenge and a transformation of the industry landscape was shifting the focus of chemical engineering education at the university.

"By aligning our taught programmes with industry's needs, our students will be more workplace ready on completion of their engineering studies," Garnier said.

Entries for the prize must demonstrate a sound understanding of fundamental chemical engineering principles, coupled with a strong focus on sustainability.

The competition is judged by experts from IChemE's Sustainability Special Interest Group. IChemE deputy president Dr Andrew Jamieson presented the prize.

Entries were received from Australia, Malaysia, Singapore and the UK, with the University of Manchester and Imperial College London being highly commended. ■

# Shining a light on chemical engineering

**A** new Energy Centre, launched by IChemE in March, is aimed at addressing the challenges in the rapidly evolving global energy landscape and the increasingly urgent problem of climate change, according to IChemE.

The centre will provide decision makers around the world with expert advice on energy issues, drawing on the expertise of the membership. It will also engage with energy policy debates and work with other science and engineering bodies to better inform the policy making process.

IChemE president Prof Geoff Maitland said he had set himself the goal of “shining a light on chemical engineering” for his presidential year.

“Nowhere has the light shone brighter than in the energy sector,” Maitland explained. “The energy challenges of the 21st century demand a systems thinking approach, an expertise right at the heart of chemical engineering, because without it and without radical action, these challenges would overwhelm us.”

The centre will provide expert evidence-based advice to policy makers around the world and highlight where chemical engineers are developing new and innovative solutions across the energy space, Maitland added.

At the launch, Prof Sir Mark Walport, chief scientific adviser to the UK government, welcomed the contribution of professional engineering institutions such as IChemE. He commended IChemE for providing the chemical engineering community with a coherent voice on such issues of critical importance to society.

Johan Samad, former chair of IChemE’s Malaysia Board, said the energy challenge posed the same question to all countries: how can we provide secure, affordable and low carbon energy to citizens?



**Prof Geoff Maitland speaking at the launch of the Energy Centre.** PHOTO: IChemE

“Each country will respond differently to this question,” Samad said. “On both the internal question about Malaysia’s energy mix, and on the broader global question of sustainability, chemical engineers have something to offer.”

In Brisbane, Prof Stef Simons, the newly appointed chair of the Energy Centre Board, set out the initial program for the centre. He said the voice of chemical engineering is currently missing from energy policy debates, and announced plans for the centre to launch its first report at the United Nations Climate Change Conference in Paris later this year. ■



# Australia's most employable student

**U**NSW chemical engineering student Tom Perfrement has been named Australia's most employable student in engineering and science entering the workforce, in the inaugural GradConnection Top 100 Awards.

The Top 100 Awards, established by recruitment agency GradConnection and Fusion Graduate Consultancy, aims to identify the top students entering the workforce across Arts & Law, Engineering & Science, Business & Commerce, Accounting & Finance, and Information Technology.

"This award is the culmination of a whole set of skills, as well as attitude, motivation and a drive to succeed," Perfrement, who holds a UNSW co-op scholarship in chemical engineering, said.

"Participating in the competition provided an ideal method to experience and practice standard recruitment procedures," he added.

Perfrement said throwing himself into a variety of different activities, including the UNSW Chemical Engineering Undergraduate Society, provided avenues to develop skills such as communication and negotiation.

"It helps to get lots of experience under your belt throughout your degree," he explained.

"I'm passionate about the water industry, particularly through the experience of working with Evoqua Water Technologies and Veolia Australia. Water security and supply of clean water is a growing concern. Increasing energy needs, particularly in developing countries, also leads to increased water usage," he said.

The top 100 were chosen from more than 2500 applications from across Australia. Students were assessed not only on academic results, but also on skills and experiences including leadership, volunteering, sports and work experience acquired during their degree.

The competition involved a rigorous selection process including written entries, online testing, video interviews, emotional intelligence tests and panel interviews. ■



**Tom Perfrement**

**EA BOOKS**

Order online at [www.eabooks.com.au](http://www.eabooks.com.au)



## What Went Wrong?

TREVOR KLETZ

RRP \$117 OUR PRICE \$77.27 + GST = \$85

2009 9781856175319 640pp

The 5th edition introduces new material on recent incidents, and introduces an extensive new section showing many accidents occur through simple miscommunication within the organisation, and how straightforward changes in design can often remove or reduce opportunities for human errors. The approach is to learn as deeply from previous experiences. Case histories illustrate what went wrong, why it went wrong and then guides readers in how to avoid similar tragedies.



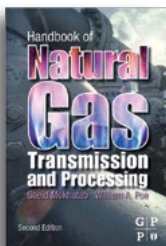
## Handbook of Natural Gas Transmission and Processing

SAEID MOKHATAB, WILLIAM POE

\$145.45 + GST = \$160

2015 9780128014998 628pp

Stay up to date on the natural gas market, especially in regard to new processes surrounding shale and unconventional gas. Reaffirm your fundamentals with revised chapters in this 3rd edition on basic concepts, treating, dehydration and sulfur recovery. There are two new chapters covering gas plant operations and how to properly perform steady state simulation within those gas plants.



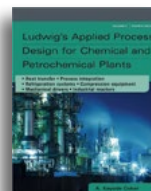
## Ludwig's Applied Process Design for Chemical and Petrochemical Plants, Vol 3

A K COKER

\$172.73 + GST = \$190

2015 9780750685245 1296pp

This 4th edition is a core reference for chemical, plant and process engineers and provides an unrivalled reference on methods, process fundamentals and supporting design data. New to this edition are expanded chapters on heat transfer; chapters on the design of shell and tube heat exchangers, double pipe heat exchangers, and air coolers; and batch heating and cooling of process fluids.



# ISC director appointed to NOPSEMA



**Trish Kerin**

The federal minister for industry and science, Ian Macfarlane, has appointed Trish Kerin, the current director of the IChemE Safety Centre (ISC), to serve on the Australian National Offshore Petroleum Safety and Environmental Management Authority's (NOPSEMA) board.

Kerin's engagement is for a three year term commencing this month.

The NOPSEMA board provides advice and makes recommendations on policy and strategic matters relating to health, safety and environmental management in the offshore petroleum regime. The board provides recommendations to the NOPSEMA CEO, the

minister for industry and science, the COAG Energy Council and relevant state and territory governments.

Kerin said the appointment recognises her knowledge and experience in process safety in high hazard industries and in the area of governance.

"The role will focus on process safety in Australia's oil and gas sector, which is a priority of NOPSEMA and the industry it serves," she said.

IChemE CEO David Brown said the role will provide added authority to Kerin's position as ISC director.

The ISC works to advance process safety across a wide range of process industries, exchanging knowledge and good practice and leading collaborative work among its member companies and organisations, according to IChemE. ■

## Inaugural memorial lecture

Process safety pioneer Trevor Kletz will be honoured at an inaugural memorial lecture at the Hazards Australasia 2015 conference, which will be held in Brisbane from 26-27 May 2015.

Dr M. Sam Mannan, director of the Mary Kay O'Connor Process Safety Centre at Texas A&M University, will lecture on the topic of 'Hazard recognition and evaluation: implementing the teachings of Trevor Kletz'.

Other guest speakers to share their lessons learned include Stephen Angus from Inmarsat Aviation; former BP refinery manager Kathy Hirschfeld; crisis communication expert Allan Briggs; and IChemE Safety Centre director Trish Kerin. Managing director of ACT Australia Susan Fleming will also lead a theatrical re-enactment of the Deepwater Horizon incident, as part of her Deepwater Safety Workshop at the event.

The conference will feature over 35 presentations from leading industry

practitioners, researchers and regulators and will host a trade show of process safety related products and services.

Topics covered at the conference include lessons learned from major hazard incidents; management of abnormal operations; process safety design and inherently safer design; regulatory compliance and legislation, human factors; asset integrity and extending the operation lifespan of infrastructure; safety management systems; education and training; and process safety key performance indicators.

Hazards Australasia 2015 will be a major event for those involved with process safety and risk management for chemical processing facilities, or other facilities dealing with hazardous materials.

To register, or to view the full conference programme, visit the [event website](#). ■