



# ISCO NEWSLETTER

The Newsletter of the International Spill Response Community

Issue 368, 21 January 2013

[info@spillcontrol.org](mailto:info@spillcontrol.org) <http://www.spillcontrol.org>

## QUICK FINDER

Click on these links

[CONSULTANTS](#)

[EQUIPMENT & MATERIALS](#)

[RESPONSE ORGANISATIONS](#)

[TRAINING PROVIDERS](#)

Clicking on a company name or banner advertisement will display the advertiser's website.

## GET THE ISCO NEWSLETTER

[Join the ISCO Newsletter Mailing List](#)

## BECOME A MEMBER OF ISCO

ISCO aims to raise worldwide preparedness and co-operation in response to oil and chemical spills, to promote technical development and professional competency, and to provide a focus for making the knowledge and experience of spill control professionals available to IMO, UNEP, EC and other organisations.

There are many benefits for you in becoming a member and joining ISCO is not expensive.

[Application Form](#)

## PROFESSIONAL MEMBERSHIP

Advance your career by gaining Professional Recognition

Professional recognition is a visible mark of quality, competence and commitment, and can give you a significant advantage in today's competitive environment.

All who have the relevant qualifications and the required level of experience can apply for Professional Membership of ISCO. The organization offers independent validation and integrity. Each grade of membership reflects an individual's professional training, experience and qualifications.

You can apply for Student Membership, Associate Membership (AMISCO), Membership (MISCO) or Fellowship (FISCO).

[All about Professional Membership](#)

[Application Form](#)



Cairns Convention Centre  
Queensland, Australia  
8 - 12 April 2013

[www.spillcon.com](http://www.spillcon.com)



## International news

### SPILLCON 2013 IS ONLY 8 WEEKS AWAY

Preparations are well underway for Spillcon 2013, the international oil spill preparedness and response conference for the Asia-Pacific region.



Spillcon 2013 will be held 8 – 12 April in the heart of the Asia-Pacific region in the vibrant tropical Queensland city of Cairns which is surrounded by the Great Barrier Reef and rainforests. The conference and exhibition will be at the Cairns Convention Centre.

The conference program and exhibition promises to bring delegates the latest in oil spill response and preparedness. Current session topics include:

- |   |                        |
|---|------------------------|
| Preventing and preparing for marine pollution | Cost recovery          |
| Response - Case study on the CV Rena          | Science and technology |
| Hazardous and noxious substances              | Impact assessment      |
| Preparedness – Global, regional and local     | Response issues        |
| Preparedness in the Asia Pacific region       | Maritime salvage       |

Also back by popular demand in 2013 is the On-Water Display. During this demonstration, all delegates will have the opportunity to observe on-water spill response equipment in practice.

Distinguished attendees will include the Secretary General of the IMO, the Director of IOPC, the Managing Director of ITOPF and the President of ISCO. Early bird discounts will be available until 25 February. [More info](#)

## International news (continued)

### NATIONS AGREE ON LEGALLY BINDING MERCURY RULES

January 19 - More than 140 countries have agreed on a set of legally binding measures to curb mercury pollution, at UN talks.

Delegates in Geneva approved measures to control the use of the highly toxic metal in order to reduce the amount of mercury released into the environment. Mercury can produce a range of adverse human health effects, including permanent damage to the nervous system. *BBC News* [Read more](#)

## Incident reports

### AUSTRALIA: CHEMICAL SPILL FORCES PLANT EVACUATION

January 3 - More than half a tonne of chemicals have been spilled at an Amcor site in Preston, forcing workers to evacuate.

About 25 firefighters arrived at the Bell Street scene at about 2.30pm, where three different chemical products had been accidentally released. The chemicals were quickly contained but had already produced a gas that Metropolitan Fire Brigade commander Martin Braid said had the potential to be toxic when combined. *The Age* [Read more](#) [Thanks to Don Johnston of ISCO Industry Partner, DG & Hazmat Group]

### COLOMBIA TRIES TO CONTAIN OIL SPILL AFTER REBELS BOMB PIPELINE

January 4 - Colombia's state-controlled oil company Ecopetrol (EC, ECOPELROL.BO) said Friday it's trying to contain an oil spill in northern Colombia after rebels attacked the country's second-longest crude oil pipeline.

Ecopetrol "has implemented its contingency plan to control the oil that has spilled into the Margua river," the company said in a statement. "Ecopetrol emphatically rejects these terrorist attacks that impact the environment." *Fox Business* [Read more](#)

### NIGERIA: UPDATE - MOBIL YET TO CLEAN UP OIL SPILL ON IBENO SHORELINE

January 8 - About three weeks after oil spill was reported within the Qua Iboe oil fields being operated by Mobil Producing Nigeria Unlimited in Ibeno Local Government Area of Akwa Ibom State, the cleanup of the contaminated Atlantic shoreline is yet to be carried out.

Already, residents of Ibeno coastal settlement, which hosts the Qua Iboe fields, said the marine environment had been left at the mercy of tidal waves spreading the crude deposits farther along the coastline.

THISDAY recalled that several oil spill incidents had been recorded at the oil field on August 13, August 24, November 9, December 16 and December 19, 2012. *Equities.com* [Read more](#) [Thanks to Don Johnston of ISCO Industry Partner, DG & Hazmat Group]

### CHINA: DETAIL REPORT ON N CHINA CHEMICAL LEAK



Photo taken on Jan. 6, 2013 shows Shanxi Tianji Coal Chemical Group which is responsible for aniline leakage accident in Changzhi, north China's Shanxi Province. A flexible tube rupture at Shanxi Tianji Coal Chemical Group caused aniline to leak into the Zhuozhang River, the upper reaches of the Zhanghe River, on December 31. Aniline is a toxic chemical widely used as precursors in the manufacture of pigments, herbicides and other chemicals. Authorities in Shanxi said they received the report on Jan. 5, and that an emergency response had been initiated to stop the leak and clean up the pollutants. (Xinhua/Fan Minda)

January 6 - Nearly 9 tonnes of aniline leaked by a chemical plant in north China's Shanxi Province have ended up in the Zhuozhang River, affecting a downstream city in neighboring Hebei and Henan provinces.

Water in Yuecheng Reservoir and the Red Flag Canal of Anyang City in central China's Henan Province has been tested for excessive aniline and volatile phenol after the pollution in Shanxi, said an announcement released by Anyang municipal government. *People's Daily Online* [Read more](#)

## Incident reports (continued)

### CHINA: SHANGHAI PORT EXPOSED TO DANGEROUS CHEMICAL LEAK

January 14 - Four people have been arrested after C9, a hazardous petrochemical, contaminated the waters of a Shanghai port. The leak occurred last week due to improper loading of the chemical onto a cargo vessel at Shanghai's Jueshi port. Port workers reportedly failed to fully shut off a valve while loading the petrochemical, causing it to spill into the surrounding waters. It is still unclear how much of the chemical leaked into the water. *The Maritime Executive* [Read more](#)

---

### UK: ABU DHABI'S TAQA SHUTS DOWN NORTH SEA PRODUCTION PLATFORM AFTER OIL LEAK DISCOVERED



January 15 - Abu Dhabi National Energy Co (TAQA) confirmed the shutdown of one of its platforms in the UK North Sea, after discovering oil within a platform leg, however there was no environmental spill, the company said in a statement on Tuesday.

"TAQA can confirm that an indication of hydrocarbons was detected in one of the legs of the Cormorant Alpha platform in the northern UK North Sea on January 14," said the statement on the company's website. *gCaptain* [Read more](#)

#### Cormorant Alpha leak shuts down up to 27 UK oil fields

January 16 - A pipeline system servicing up to 27 oil fields has been shut down after a leak on the Cormorant Alpha platform, north-east of Shetland. The fields affected, and another eight

associated platforms, produce about 10% of the UK's oil output. Hydrocarbons were detected inside a leg of the Cormorant Alpha platform. *BBC News* [Read more](#)

---

### USA: TWO SUNKEN VESSELS RELEASE OIL, DIESEL ON WEST COAST

January 13 - Two sinking vessels deposited oil and [diesel fuel](#) in separate incidents this weekend on the West Coast, according to filings with the U.S. National Response Center.

One vessel released 50 barrels of diesel fuel while sinking on Lake Union in Seattle yesterday. Another leaked oil after sinking in San Francisco Bay near Brisbane, California, on Jan. 11. Booms were put in place in both cases to secure the surrounding area. *Bloomberg* [Read more](#)

---

### NEW ZEALAND: INVESTIGATION UNDERWAY INTO TIMARU OIL SPILL

January 15 - Court action will be taken against the person responsible for an oil spill in the Timaru Port. It took most of yesterday afternoon for an oil response team from Environment Canterbury to contain and clean up around 50 litres of light fuel oil which leaked from a boat. *The New Zealand Herald* [Read more](#) [Thanks to Don Johnston of ISCO Industry Partner, DG & Hazmat Group]

---

### PHILIPPINES: FPIC: MAKATI OIL SPILL CLEANUP 70 PERCENT COMPLETE

January 13 - The Lopez-owned First Philippine Holdings Corp. (FPIC) has said the cleanup of an oil spill at West Tower condominium in Makati City was 70 percent complete in response to a statement from the city government that remediation, not reopening its oil pipeline, should be its first concern. *Inquirer News* [Read more](#) [Thanks to Don Johnston of ISCO Industry Partner, DG & Hazmat Group]

---

### USA: TUG BOAT CARRYING 4,000 GALLONS OF DIESEL SINKS IN MISSISSIPPI RIVER; OFFICIALS SAY NO CHEMICALS LEAKED YET

January 17 - A tug boat carrying 4,000 gallons of diesel and 100 gallons of lube oil sunk in the Mississippi River around 5:30 p.m. Thursday, officials said. No one was on the vessel at the time and no injuries were reported, said U.S. Coast Guard Petty Officer Alex Washington. *The Times Picayune* [Read more](#)

---

## Other news

### USA: BP SEEKS \$3.4 BILLION REDUCTION IN FINES RELATED TO MACONDO DISASTER

January 12 - BP Plc is seeking a reduction of as much as \$3.4 billion in the fine it may have to pay for pollution caused by the 2010 Gulf of Mexico oil spill.

The company wants credit for collecting at least 800,000 barrels of spilled oil, according to a court filing. London-based BP is facing a maximum fine of more than \$20 billion, depending on how much the company is fined per barrel spilled. The request came as a federal judge in New Orleans approved the medical-benefits portion of a proposed \$7.8 billion partial settlement of spill-related claims. *gCaptain* [Read more](#)

### USA: FEDERAL JUDGE APPROVES BP GULF OIL SPILL MEDICAL SETTLEMENT

January 11 - The federal judge overseeing the **massive Gulf oil spill litigation** on Friday gave final approval to BP's medical settlement for cleanup workers and others who say they got sick from exposure to oil or dispersants in the wake of the accident.

The settlement, approved by U.S. District Judge Carl Barbier, resolves claims with residents of beachfront and wetland areas who were made sick by the spill, and those injured or made ill as a result of cleanup work. Both groups now become eligible for payments for specific ailments. *The Times Picayune* [Read more](#)

### IRELAND: STATE BANS FRACKING UNTIL ENVIRONMENTAL TESTS ARE CARRIED OUT

January 12 - Drilling for natural gas located in bedrock deep below the surface will not be allowed until a number of scientific studies are completed.

The Government has ruled out the use of hydraulic fracturing, or fracking, until environmental chiefs complete in-depth research into the possible effects on the environment, Natural Resources Minister Fergus O'Dowd said. The Environmental Protection Agency (EPA) is to commission and fund three separate pieces of research to determine if damage will be caused by companies hoping to find gas buried underneath the soil. *Independent* [Read more](#)

### NIGERIA: LEAD POISONING: ZAMFARA AWAITING FG INTERVENTION



*Two years after the Lead poisoning disaster discovered in Zamfara state, the thousands of children affected are still needlessly suffering because the funds promised by the federal government for the treatment and clean-up of the Lead polluted villages is yet to be released. ABBA ABUBAKAR KABARA writes.*

January 13 - Thousands of children affected by Lead poison in Zamfara are still needlessly suffering as Federal government failed to release the promised N850m (\$4.4m) funds meant for treatment and remediation of Lead polluted villages in the state.

Medical and environmental experts like Médecins sans Frontières (Doctors without borders), Center for Disease Control (CDC) and many other donor partners have all come to the consensus that Nigerian government, particularly the ministries of mines, environment and health at both Federal and state levels must show more serious commitment to achieve success in curtailing further suffering and child death in Zamfara state. *Leadership* [Read more](#)

### CANADA: TANKERS TOO RISKY ON B.C.'S NORTH COAST, OIL-SPILL CONSULTANT SAYS

January 12 - A marine consultant involved in B.C. oil-spill issues for a quarter century says the risks of a tanker oil spill associated with Enbridge Northern Gateway are simply too great for the project to proceed.

Gerald Graham of Victoria-based Worldocean Consulting Ltd. said that calculations based on Enbridge's own research show there is a 8.7-to-14.1-per-cent chance of at least one tanker spill greater than 31,500 barrels over a 50-year period, depending on whether the pipeline has a 525,000 or 850,000 barrel per day capacity. "The consequences of a major oil spill along B.C.'s north coast ... could be catastrophic and irreversible," he says in a submission to the Joint Review Panel studying the Enbridge proposal. "Couple this potentially disastrous outcome with a one-in-seven chance of one or more major spills occurring, and the overall threat level posed by Northern Gateway becomes unacceptably high." *The Vancouver Sun* [Read more](#) [Thanks to Gerald Graham]

## Other news (continued)

### CHINA: OIL POLLUTION BIO-REMEDICATION RESEARCH ACHIEVES GREAT BREAKTHROUGH

January 14 - Scattering common-looking faint-yellow particles into oil-polluted seawater, and the oil disappeared and the seawater became crystal-clear dozens of hours later, which happened recently in a naval port of the Navy of the Chinese People's Liberation Army (PLA). The miracle-working particles are "oil-degrading bacteria" jointly developed by the Naval Medical Research Institute under the PLA Navy and Fudan University. The achievement was successfully tested in naval ports of the East China Sea, the North China Sea and the South China Sea respectively, and passed appraisal by experts recently in Beijing.

Starting with bio-remediation, researchers of the Naval Medical Research Institute under the PLA Navy successfully incubated and isolated highly-efficient oil-degrading bacterial strains and high-yield bio-surfactant bacterial strains from oil-polluted seawater, and succeeded in combining them and establishing highly-efficient oil-degrading colony of bacteria. *People's Daily Online* [Read more](#)

---

### ECUADOR: ECUADOREAN TRIBE WILL 'DIE FIGHTING' TO DEFEND RAINFOREST

January 13 - In what looks set to be one of the most one-sided struggles in the history of Amazon forest [conservation](#), an indigenous community of about 400 villagers is preparing to resist the Ecuadorean army and one of the biggest [oil](#) companies in South America.

The Kichwa tribe on Sani Isla, who were using blowpipes two generations ago, said they are ready to fight to the death to protect their territory, which covers 70,000 hectares of pristine rainforest.

Petroamazonas – the state-backed oil company – have told them it will begin prospecting on 15 January, backed by public security forces. Community members are launching a last-ditch legal battle to stop the state-run firm assisted by a [British businesswoman, who is married to the village shaman](#), and who was recently appointed to run the local eco lodge. *The Guardian* [Read more](#)

---

### BELLONA CALLS FOR EU MEMBER STATES TO MAINTAIN OIL SPILL RESPONSE GAP IN THE FORTHCOMING EU DIRECTIVE ON SAFETY OF OFFSHORE OIL AND GAS ACTIVITIES

While the negotiations between the Council and the Parliament on the offshore safety of oils and gas activities reach the final stages, the UK wants to remove reference to the 'oil spill response gap' introduced by the Parliament and inspired by the Alaskan State Law as a way to describe the degree of inability to intervene in case of emergency in extreme weather conditions. 'The EU must take cautious approach to offshore drilling in the Arctic. Current technology and extreme weather conditions prevent effective emergency response and put at risk this highly fragile ecosystem' says Paal Frisvold, Chairman of Bellona Europa. *Bellona* [Read more](#)

---

## ISCO news

### ISCO AT SPILLCON 2013

ISCO will be represented by David Usher (President) and Mary Ann Dalglish (Membership Secretary).

Corporate Members (so far) listed as participating in the exhibition include Braemar Howells Ltd., Chatoyer Environmental, Desmi Ro-Clean, Fast Engineering Ltd., Lamor Corp., Maritim Miljo-Beredskap AS, and Swire Environmental Services.

---

### PROFESSIONAL RECOGNITION – NEW APPLICATIONS DEADLINE

All who have the relevant qualifications and the required level of experience can apply for Professional Membership of ISCO. The organization offers independent validation and integrity. Each grade of membership reflects an individual's professional training, experience and qualifications. Academic qualifications are not a requirement if applicants can demonstrate the necessary levels of competence through their experience, skills and professional development.

The key word is "professional" when applied to men and women who are making a success in their careers and have the necessary levels of knowledge and expertise. Professional recognition is a visible mark of quality, competence and commitment, and can offer a significant advantage in today's competitive environment.

The next deadline for submission of applications is 28 February, 2013 with the awards to be announced at the beginning of March.

Previous awards of FISCO, MISCO and AMISCO were announced in the ISCO Newsletter Issue 366 of 7 January 2013.

For more information about Professional Recognition, visit the ISCO website at <http://www.spillcontrol.org> click on "Membership" and select "Professional".



In this issue of the ISCO Newsletter we are printing No. 110 in a series of articles contributed by Dr Douglas Cormack.

Dr Douglas Cormack is an Honorary Fellow of ISCO. As the former Chief Scientist at the British Government's Marine Pollution Control Unit and head of the UK's first government agency, the Warren Spring Laboratory, Douglas is a well known and highly respected figure in the spill response community. He is the Chairman and a founder member of the [International Spill Accreditation Association](#)

**CHAPTER 110: KNOWLEDGE OF THE SEA EMPRESS INCIDENT**

No details are available on the viscosity of the *Sea Empress* pollutant as it changed with emulsion formation after each release or on the timings of the actual spraying operations with respect to these releases. It is therefore difficult to identify the ages of the emulsions and thus the efficiency of spraying them.

However, if we allow the efficiency to decrease from an initial dispersant : oil of 1 : 20 through 1 : 10 to 1 :5 as emulsification and weathering proceeded, and attempt to determine the age of that which was sprayed, we see that the first 2 tonnes of dispersant could not have been applied to the initial release until first light next day; that the second 2 tonnes could not have been applied to the 5000 tonnes before first light on the 18<sup>th</sup>; that the 31 (or 29) tonnes on the 18<sup>th</sup> could not have been applied to releases on the 18<sup>th</sup> but to those of the 15<sup>th</sup> and 17<sup>th</sup> because of the intervening hours of darkness; that this delay by darkness recurred with the release on the 17<sup>th</sup> and with the first releases on the 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup>; that on the latter three dates, dispersant was applied after weathering times of 12, to 24 hours; and that the last 65 (or 67) tonnes of dispersant on the 22<sup>nd</sup> could not have been applied to emulsions less than 24 hours old. On the other hand, the timing of the release on the 18<sup>th</sup>, and the second releases on the 19<sup>th</sup>, 20<sup>th</sup> and 21<sup>st</sup> suggest dispersant could have been added to relatively fresh oil, though very substantial accumulation of aged emulsion were on the sea surface at all times from the 18<sup>th</sup> onwards.

Thus, on this basis, we might estimate the amounts of the various releases remaining after dispersant treatments as recorded above, for the above efficiency ratios, as shown below (the bracketed values are those of official revision).

DATE (FEBRUARY)	TIME	TONNES RELEASED	DISPERSANT TONNAGE	DISPERSED TONNAGE			REMAINING TONNAGE
				1:20	1:10	1:5	
15	21.39	2000					
16			2		20		1980
17	23.24	5000	2		29		4980
18	11.58	2000	29	580			1420
19	00.19	5000					5000
19	12.43	8000	110	2200			5800
20	01.03	20000					20000
20	13.26	15000	57		570		14430
21	0145	10000					10000
21	14.08	5000	179		1790		3210
22			67			335	-335
<b>Totals</b>		<b>72,000</b>	<b>446</b>		<b>5515</b>		<b>66485</b>

Thus, I have applied the efficiency ratio of 1:10 to dispersant applied to night releases, the ratio of 1:20 to day release, these ratios being applicable 50:50 to dispersants applied to night and day releases on same date, and the ratio of 1:5 to the even more delayed dispersant application on 22 February. On this basis my estimate is that 6,125 tonnes of oil were dispersed by the 446 tonnes of applied dispersant, leaving 66,485 tonnes of oil to disperse naturally, to be recovered from water surfaces or to strand..

At this stage, with the slick thickness of 0.1mm being the basis of dispersant : oil ratio of 1 : 20, we see that 100 tonnes (m<sup>3</sup>) would have been present for each km<sup>2</sup> of sea surface; that 446 tonnes of dispersant would have been applied to 5,515 m<sup>3</sup> of oil covering an area totalling 55.15 km<sup>2</sup>, while 72,000 m<sup>3</sup> covered an aggregate area of 720 km<sup>2</sup>; that dispersants were only applied to 7.6% of the total oil released; that in dispersing an estimated 5,515 tonnes (m<sup>3</sup>), the dispersant tonnage was only 62% effective, thus exhibiting an effectiveness ratio of 1 : 12.4; and that even at a ratio of 1:20, it could not have dispersed more than 8,920 tonnes of oil. Nonetheless, those who fail to take account of natural dispersion have erroneously concluded from their estimates of stranded tonnage that dispersant effectiveness at this incident was 1 : 60, of which more anon.

1 *The Rational Trinity: Imagination, Belief and Knowledge*, D.Cormack, Bright Pen 2010 available at [www.authorsonline.co.uk](http://www.authorsonline.co.uk)  
 2 *Response to Oil and Chemical Marine Pollution*, D. Cormack, Applied Science Publishers, 1983.  
 3 *Response to Marine Oil Pollution - Review and Assessment*, Douglas Cormack, Kluwer Academic Publishers, 1999.

RESPONSE TO INLAND OIL SPILLS – PART 5



**A short series of articles contributed by Mark Francis of Oil Spill Solutions** Mark Francis has been involved with the oil industry since 1975. He attended his first oil spill in 1976, the Tanker Elaine V incident. He became head of response for inland spills within the UK for British Petroleum E & P in 1980 for 10 years responding to well, storage tank and pipeline spills throughout the UK. Over the next 20 years he continued to build his international operations experience and has also specialised in spill response training, delivering IMO and other courses in more than 20 countries. Mark's website is at <http://www.oilspillsolutions.org>

Spills on Permeable Surfaces (continued) – Water-bearing Formations

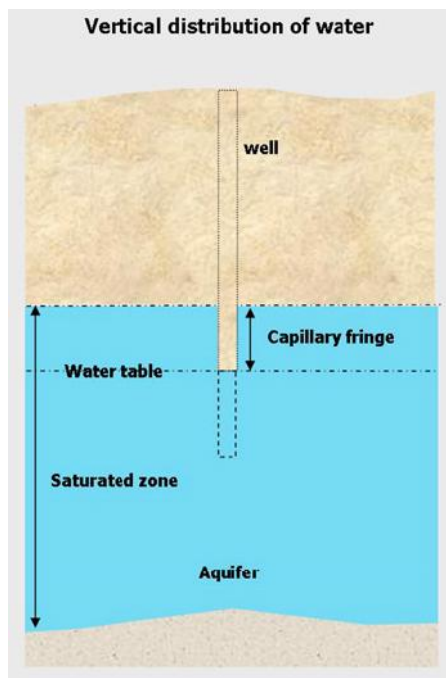
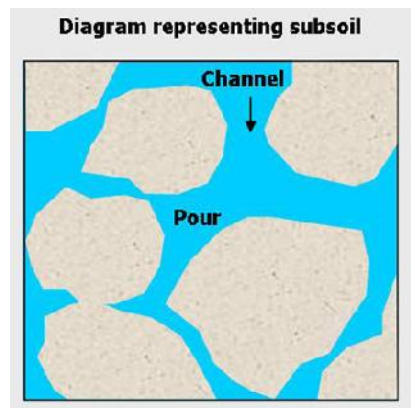
I copied the diagrams below from a CONCAWE publication of the late 70's

Soil and rock are made up of small fragments or grains separated by empty spaces or pores. More often than not the pores are connected by fine channels where groundwater may circulate.

The water content of the subsoil increases with depth; a distinction can be made between the unsaturated zone where the pores are only partly filled with water and the saturated zone where all pores are completely filled.

In the unsaturated zone, also referred to as the aeration zone or retention zone, the water is retained or suspended there by absorption over the surface of the grains and by capillary forces (meniscus effect) in the channels connecting the pores. The remainder of the porous space is filled with air, which is free to circulate. Within the water phase, the pressure is below atmospheric pressure.

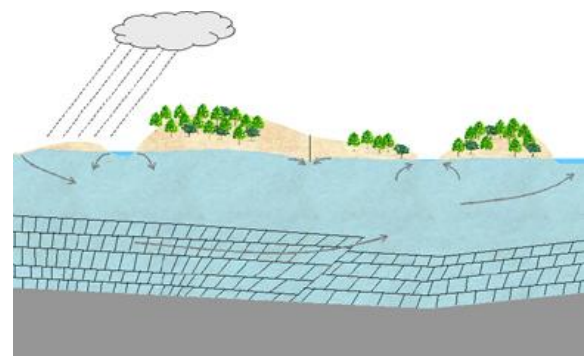
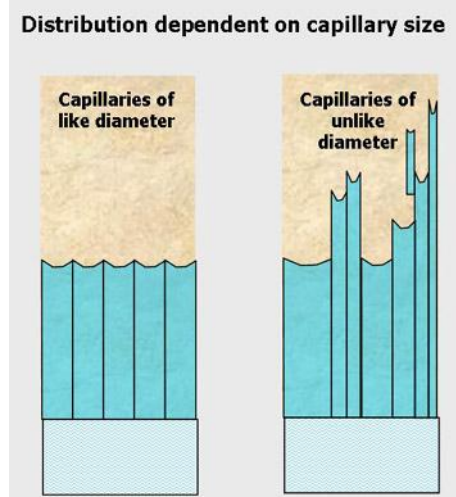
In the saturated zone, the pressure within the water phase increases with depth. The limit where the pressure is equal to the atmosphere is called the free surface and represents the water table or piezometric surface. It corresponds to the level of water in a well, i.e. static water level.



Above the water table and within the saturated zone is the capillary fringe where water is held by capillary suction. This zone may vary in thickness according to pore size in the sediment. The capillary rise will be at a maximum in the finest channels.

Capillary rise	inches	centimeters
Coarse sand	12	15
Medium sand	40	50
Fine sand	60	110
Silts or clays	175	250
Chalk	120	900

In real life the thickness of the capillary fringe may be expected to be constant in very homogenous mediums but may exhibit large variations for non-homogenous soils.



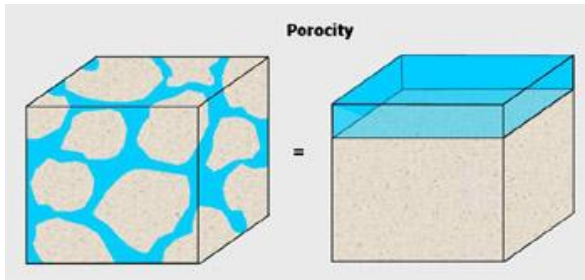
Within the saturated zone groundwater freely circulates and may be tapped by wells. This zone may be seen as a reservoir, the capacity of which is the total volume of the pores filled with water. The associated geology is called an aquifer, water bearing formation or groundwater reservoir.

## Special feature - Inland spills (continued)

### Types of aquifers:

- Strata made of rock where water circulates through fissures (cracks), e.g. fractured limestone.
- Strata made rock where water circulates through pores, e.g. sandstone.

In rock where water circulates through fissures, the rate of flow is much faster than in rock which has pores; consequently any pollution can spread with greater ease. In addition, the direction of flow is more erratic and more difficult to predict the progress since the characteristics of the terrain are more difficult to determine.



An aquifer acts as a storage reservoir and as a water carrying body. The two main parameters associated with these functions are their porosity and permeability. The porosity of an aquifer refers to the volume of void spaces compared with the total volume. It may range between 5% and 45%.

The permeability is a measure of the ease with which water flows through the formation. It is a function of the average diameter of the pores and the shape and orientation of the grains.

*To be continued*

## Special feature – In situ burning

### IN SITU BURNING: CHAPTER 2



A short series of articles on In Situ Burning contributed by Dr Merv Fingas of Spill Science, Edmonton, Alberta, Canada T6W 1J6 [fingasmerv@shaw.ca](mailto:fingasmerv@shaw.ca)

Merv Fingas MSc PhD worked for more than 35 years in the field of oil spill technology at Environment Canada's Environmental Technology Center in Ottawa, Ontario. As head of the Emergencies Science Division at the Centre, he conducted and managed research and development projects. He is currently working independently in Alberta. Dr Fingas is the Member of ISCO Council for Canada.

### Summary of the Serial

This is the second of a series of articles on in-situ burning of oil spills. This series will cover in-situ burning step-by-step and will present the latest in knowledge on the topic.

### 2 The Science of Burning

The fundamentals of in-situ burning are similar to that of any fire, namely that fuel, oxygen, and an ignition source are required.<sup>1,2</sup> Fuel is provided by the vaporization of oil. The vaporization of the oil must be sufficient to yield a steady-state burning, that is one in which the amount of vaporization is about the same as that consumed by the fire. Once an oil slick is burning, it burns at a rate of about 0.5 to 4 mm per minute.

This rate is limited by the amount of oxygen available and the heat radiated back to the oil. The oil burn rate is a function of the oil type as well as conditions such as the presence of ice. The 'steady-state' burning implies that the conditions noted above are met.<sup>1</sup> If not enough vapors are produced, the fire will either not start or will be quickly extinguished. The amount of vapors produced is dependent on the amount of heat radiated back to the oil.

This has been estimated to be about 2 to 3% of the heat from a fire for a pool fire.<sup>3,4</sup> If the oil slick is too thin, some of this heat is conducted to the water layer below it. Since most oils have the same insulation factor, most slicks must be about 0.5 to 3 mm thick to yield a quantitative burn. Once burning, the heat radiated back to the slick and the insulation is usually sufficient to allow combustion down to about 1 mm of oil. Figure 1 shows the burning of a heavy oil during the Deepwater Horizon incident.

If greater amounts of fuel are vaporized than can be burned, more soot is produced as a result of incomplete combustion, fuel droplets are released downwind or, more typically, small explosions or fireballs occur.<sup>5</sup> The latter phenomenon is often observed when gasoline or light crudes are burning. It has been shown that diesel fuel burns differently than other fuels, with a tendency to atomize, rather than vaporize. This results in an obvious and heavier soot formation.<sup>6</sup>





Figure 1 Oil being burned during the Deep Water Horizon incident within a fire-resistant boom. This oil burn has an area of about 800 square metres which implies that the fire is consuming about 5 tons per hour of the heavy oil. This burn was ignited using a home-made igniter with a flare and a plastic jar of diesel fuel.

Soot formation is an issue that has been studied by several scientists over many years.<sup>1,7,8</sup> Soot formation occurs by several processes. One common process is the aggregation of molecular species into larger compounds and another process is the partial combustion of fuels. Diesel fuels and kerosene are known to burn with more soot than most other fuels.<sup>9</sup> This is for several reasons, diesel fuel and kerosene can form droplets under heat and these droplets will often only burn partially, leaving carbonaceous material on the inside or even whole fuel with carbonaceous material or soot on the outside. Most other fuels will evaporate under the influence of heat and do not form significant amount of droplets such as diesel, kerosene or jet fuel.

The amount of oil that can be removed in a given time depends the fuel and on the area covered by the oil. As mentioned above, most oil pools burn at a rate of about 1 to 4 mm per minute, which means that the depth of oil is reduced by that value of millimetres per minute. As a rule of thumb, oil burn rate is about 2,000 to 5,000 L/m<sup>2</sup>·day. Several tests have shown that this does not vary significantly with oil weathering but varies with oil type.<sup>1</sup> Emulsified oil may burn slower as its water content reduces the spreading rate and increases the heat requirement. Chatris and co-workers carried out a study on the burning rates of gasoline and diesel fuel and found that diesel fuel burned at a rate of 0.57 kg/m<sup>2</sup>/s or 2.9 mm/min and gasoline burned at 3.5 mm/min.<sup>1</sup> Burn rate depends on wind velocity to a small degree.<sup>10</sup>

The burn rate for gasoline was 0.002 g/cm<sup>2</sup>·s (equivalent to a pool regression rate of about 2 mm/min) at no wind velocity and this increased slightly and then returned to about the same rate at a wind velocity of 3 m/s. Fingas measured the small scale burn rate of several heavy fuels and found that burn rates for heavy fuels varied from 0.5 to 3 mm/min.<sup>11</sup> Buist et al. found that the burn rates for many crude oils in ice was between 1 to 2 mm/min, typically half of the rate when ice was not present.<sup>12</sup>

Historically, it was thought that the burn rates depended on scale size. The early work proposed a cyclic relationship between burn rate and pan diameter.<sup>3</sup> This theory was based on propositions about flame characteristics in the laminar flow region (0 to 10 cm), to the transition zone (10 to 100 cm), through to the turbulent flow regime (>100 cm). Since most tests and actual burns are greater than 100 cm in diameter, this theory may not be relevant to in-situ burning. Some authors reported an increase in burn rate with wind speed.<sup>3</sup> Some work reported an increase equal to 0.15 times the wind speed multiplied by the quiescent burn rate. This translates into about a two-fold increase in burn rate for a ten-fold increase in wind speed. Many studies have focused on flame dynamics and flame propagation.<sup>1</sup>

## References

- 1 Fingas, M., "In-situ Burning", Chapter 23, in *Oil Spill Science and Technology*, M. Fingas, Editor, Gulf Publishing Company, NY, NY, pp. 737-903, 2011
- 2 Evans, D.D., G.W. Mulholland, J.R. Lawson, E.J. Tennyson, P.A. Tebeau, M.F. Fingas, and J.R. Gould, Burning of Oil Spills, *IOSC*, 1991
- 3 Buist, I.A., S.L. Ross, B.K. Trudel, E. Taylor, T.G. Campbell, P.A. Westphal, M.R. Meyers, G.S. Ronza, A.A. Allen, and A.B. Nordvik, *The Science, Technology and Effects of Controlled Burning of Oil Spills at Sea*, MSRC Technical Report Number 94-013, 1994
- 4 Nakakuki, A., Heat Transfer in Pool Fires at a Certain Small Lip Height, *Combust. Flame*, 259, 2002
- 5 Xu, G., M. Ikegami, S. Honma, K. Ikeda, X. Ma, and H. Nagaishi, Burning Droplets of Heavy Oil Residual Blended with Diesel Light Oil: Distinction of Burning Phases, *Combust. Sci. Tech.*, 1, 2003
- 6 Fingas, M.F., F. Ackerman, P. Lambert, K. Li, Z. Wang, R. Nelson, M. Goldthorp, J. Mullin, L. Hannon, D. Wang, A. Steenkammer, S. Schuetz, R.D. Turpin, P.R. Campagna, and R. Hiltbrand, Emissions from Mesoscale In-Situ Oil (Diesel) Fires: The Mobile 1994 Experiments, *AMOP*, 907, 1996
- 7 Smooke, M.D., M.B. Long, B.C. Connelly, M.B. Colket, and R. J. Hall, Soot Formation in Laminar Diffusion Flames, 613, *Combust. Flame*, 613, 2005
- 8 Fingas, M.F., Soot Production From In-Situ Oil Fires: Review of the Literature and Calculation of Values from Experimental Spills, *AMOP*, in press, 2010
- 9 Dagaut, P., A. El Bakali and A. Ristori, The Combustion of Kerosene: Experimental Results and Kinetic Modelling Using 1- to 3- component Surrogate Model Fuels, *Fuel*, 944, 2006
- 10 Hu, L.H., S. Liu, W. Peng and R. Huo, Experimental Study on Burning Rates of Square/rectangular Gasoline and Methanol Pool Fires under

## Special feature – In situ burning (continued)

- Longitudinal Air Flow in a Wind Tunnel, *J. Haz. Mat.*, 972, 2009
- 11 Fingas, M.F. In-Situ Burning of Orimulsion: Small Scale Burns, *AMOP*, 809, 2002
- 12 Buist, I., D. Dickins, L. Majors, K. Linderman, et al., Tests to Determine the Limits to In-situ Burning of Thin Oil Slicks in Brash and Frazil Ice, *AMOP*, 629, 2003

To be continued

## Publications

### ISU REVIEW OF 2012 AND LOOKING AHEAD – POLLUTION PREVENTION AND RELATED ISSUES

An interesting article and well worth reading. Inter alia, it comments on Contractor Immunity (an issue raised in previous issues of this newsletter) – “Criminalisation of well-intentioned responders is a real concern and is in direct conflict with the goals of safer ships and cleaner seas. There are close links between the issues of criminalisation and lack of responder immunity for salvors and other emergency responders. Set in the context of pollution prevention efforts it is particularly troubling”. [Read more](#)

### RESPONDER IMMUNITY

An interesting article by Denis Bryant and Jim Shirley in MarineLink.com. Commenting on the post-Maconda ruling of the US District Court for the Eastern District of Louisiana – “This decision is important for reasons well beyond its impact on the manufacturer of a chemical dispersant and the various plaintiffs here. The reasoning so carefully laid out by the court extends to all those involved in oil spill response efforts under the direction of a FOSC, providing them with vitally needed assurance that third-party lawsuits will be brought directly against the Responsible Party and not against responders, be they Good Samaritans or OSROs, or, although not specifically mentioned by name, salvors or marine fire fighters. The decision also supports the large measure of authority of the FOSC as spelled out in OPA 90, eliminating much of the uncertainty about his or her decision-making power. These impacts clearly further the important national interests identified in the decision of ensuring that spill responses are efficient, coordinated, and effective”. [Read this article](#)

### USA: SCBA SERVICE LIFE INDICATOR PERFORMANCE REQUIREMENT RULE

The SCBA remaining service life indicator performance requirement rule will be published in the Federal Register on January 14, 2013. A PDF version of the rule may be viewed at: <https://federalregister.gov/a/2013-00371> [Thanks to Paul Hausman, Hazmat 101 Group]

## Events

### INDONESIA: GLOBAL INITIATIVE SOUTH EAST ASIA (GI SEA) WORKSHOP AND LAUNCH EVENT

Jakarta, 20-21 March 2013. [More info](#)

### CHINA: THIRD WORLD CONFERENCE ON MARINE BIOTECHNOLOGY

Hangzhou, 23-25 September, 2013. The programme includes a session on Bioremediation and Restoration following on oil spills at sea. [More info](#)

### UK: OCEAN BUSINESS 2013

Southampton, 9-11 April, 2013. Ocean Business is a hands-on technology exhibition as it provides visitors with the chance to see systems first hand with more than **180 hours of live training and demonstration** sessions. There is also the two-day **Offshore Survey conference** to address the technical and business issues facing the global field of offshore surveying and **Ocean Careers** running over the entire three days, providing advice on career opportunities within the ocean technology, marine science and offshore industries. [More info](#)

### UK: 4<sup>th</sup> MARITIME SALVAGE AND CASUALTY RESPONSE CONFERENCE

London 4-5 September, 2013. **ACI's 4<sup>th</sup> Maritime Salvage & Casualty Response** will provide an in-depth look into salvage, towage and casualty response. The event will focus on the most current developments in operational response to a salvage situation and what impact these have had on the industry. Effective casualty response, as well as the latest legal and contractual issues will also be on the agenda. [More info](#)

## Events (continued)

### UAE, DUBAI: OFFSHORE ARABIA CONFERENCE AND EXHIBITION – CALL FOR PAPERS

Dubai, 3-5 March 2014. The **conference** Theme is Regional Oil Spill Prevention & Preparedness and you are invited to submit an abstract of your paper. [More info](#)

## Training

### WMU, MALMO, SWEDEN: M.SC. PROGRAM IN MARITIME AFFAIRS, ENTRY 2013

Entry 2013: Open for application. Full details of the program content and structure, as well as application procedures, fees and costs are available in the [Academic Handbook](#) and on the website [www.wmu.se](http://www.wmu.se). Interested candidates can [start their application here](#).

### DVD: LEARN HOW TO ORGANIZE YOUR EMERGENCY OPERATIONS CENTER TO MIRROR NIMS

DVD describes the function of the Emergency Operations Center and how it is staffed, organized and activated. Designed for federal, state, tribal and local emergency management personnel as well as private industry and disaster response organization personnel. The program also portrays how the EOC supports Incident Command during a response. [More info](#)

## New products

### NEW LEAK SEALING SYSTEM FROM THE RUPTURESEAL COMPANY

Glen Coxq writes "Several of your readers contacted me this month to say I need to be in your publication as a result of the article on plugging breaches and accidental ruptures. I invite you to visit our website to view a video to see how the RuptureSeal works. It safely seals ruptures fast!

Our product works so well, we want everyone to know about it because life safety and environmental protection is far too important for us not to do everything we can to protect them. Our product is available in the UK through RuptureSeal UK a subsidiary company of Portsmouth Aviation of Portsmouth UK" [Watch the video](#) More info at <http://www.ruptureseal.com>

### "SMARTBUND" DRIVE-OVER BUNDING

Smart bund is a modular system of pliable closed-cell foam, surrounded by PVC. Excellent barrier around machines to keep leaks and drips away from walkways. Use in warehouses or factory's on sealed surfaces. [More info](#)

### ABANAKI ADDS NEW LINE OF REMEDIATION SKIMMERS AND LEACHATE PUMPS

Abanaki Corporation ([www.abanaki.com](http://www.abanaki.com)), announces a new technology added to its groundwater remediation systems line. This new product line will include the PetroXtractor Active Membrane Skimmer, PetroXtractor Passive Membrane Skimmer, and Leach-Aid Landfill Pump, intended for use in remediation and leachate (landfill) applications. [More info](#)

## Company news

### ELASTEC/AMERICAN MARINE & KVICHAK MARINE INDUSTRIES FORM OSRV SALES & REPLACEMENT PARTS ALLIANCE

Elastec/American Marine, the manufacturer of pollution control equipment, and Kvichak Marine Industries (pronounced Kweejack), specialised in the design and manufacture of high performance aluminum workboats, have formed an alliance to better serve customers of MARCO Filterbelt™ skimmer systems and Kvichak/MARCO Oil Spill Recovery Vessels (OSRVs). More info from [lhenning@elastec.com](mailto:lhenning@elastec.com)

Legal disclaimer: Whilst ISCO takes every care to ensure that information published in this Newsletter is accurate unintentional mistakes can occur. If an error is brought to our attention, a correction will be printed in the next issue of this Newsletter. Products and services featured in the ISCO Newsletter and/or the ISCO website, including the International Directory of Spill Response Supplies and Services, have not been tested, approved or endorsed by ISCO. Any claims made by suppliers of products or services are solely those of the suppliers and ISCO does not accept any liability for their accuracy.