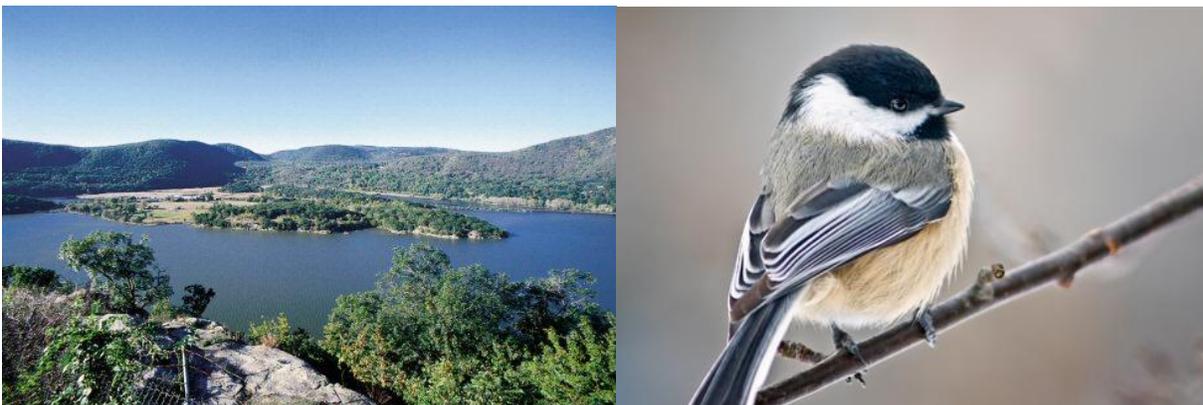


## **Current News**

### **Contaminants may cause birds to sing a different tune**

In some environments songbirds exhibit inconsistency in their songs which may be caused by non-lethal levels of contaminants that persist in the sediments of the Hudson River region. Biologists studied songbirds that nest along the Hudson River valley, a region with legacy levels of PCBs as a result of decades of electronics manufacturing upriver. Polychlorinated biphenyls (PCBs) are synthetic chemical pollutants with demonstrated detrimental toxic and developmental effects on humans and wildlife. In an article published in the journal *PLOS ONE*, researchers at Cornell University's Laboratory of Ornithology report that in some environments, songbirds exhibit inconsistency in their songs which may be caused by non-lethal levels of contaminants that persist in the sediments of the Hudson River region. The research reported in "The Effect of Polychlorinated Biphenyls on the Song of Two Passerine Species," was funded by New York Sea Grant, a joint program of the State University of New York, Cornell University and the National Oceanic and Atmospheric Administration.

Lead author Dr. Sara DeLeon, working with principal investigator Dr. Timothy J. DeVoogd and co-investigator Dr. Andre A. Dhondt, studied songbirds that nest along the Hudson River valley, a region with legacy levels of PCBs as a result of decades of electronics manufacturing upriver. Polychlorinated biphenyls (PCBs) are synthetic chemical pollutants with demonstrated detrimental toxic and developmental effects on humans and wildlife. This type of dedicated field research can tease out the impact of organic contaminants in the environment on creatures that are known to all of us. Sara and colleagues are drawing the connections between contaminant, animal behavior and, ultimately, a population's health. Songbirds feed their young PCB-contaminated aquatic insects as their main food source. Some birds continue eating insects throughout life, thus increasing PCB ingestion if they live in contaminated areas. The research team non-lethally investigated total PCB loads, congener specific PCB profiles, and songs of black-capped chickadees (*Parus atricapillus*) and song sparrows (*Melospiza melodia*) along a historical PCB gradient at the Hudson River in New York State.



Key among the team's findings is that song disruption is tied to specific types of PCBs -- there are 209 variations, differentiated by the positioning and number of chlorine atoms. DeLeon tested 41 of these variations to isolate their effects. The research findings indicate that black-capped chickadees and song sparrows have higher total blood PCBs in regions with higher historic PCB contamination. The two bird species varied substantially in their congener-specific PCB profiles; within sites, song sparrows showed a significantly higher proportion of lower chlorinated PCBs, while black-capped chickadees had higher proportions of highly chlorinated PCBs. Analysis of blood samples from black-capped chickadees showed greater variability in song with a change in the "glissando" ratio of the first note of their two-note song, "fee-bee, fee-bee." Song sparrows, with much longer songs, also showed 'high performance trills' that may be the result of other types of PCB molecules that are less toxic. In areas of PCB pollution, the species-specific identity signal in black-capped chickadee song varied significantly, while variation in song sparrow trill performance was best predicted by the mono-ortho PCB load.

Thus, PCBs may affect song production, an important component of communication in birds, the authors report. In conclusion, "The ramifications of changes in song quality for bird populations may extend the toxic effects of environmental PCB pollution." This research is of great interest to stakeholders in the Hudson Valley as the effects of PCBs, even non-lethal ones, continue to be discovered. Effects of PCBs are extremely complicated. What this demonstrates is that most previous PCB studies may not give us the whole picture because they did not look at the specific type of PCB involved but just measured overall levels. What Sara did was not easy. She found effects on the song and wanted to do more than just document that there was an effect, but to isolate what was causing it. Contaminants last a long time and are pervasive. The researchers took that into account when they studied species in these disturbed environments and how environmental changes are affecting them.

(Source: <http://www.sciencedaily.com/releases/2013/09/130918175547.htm>)

## **New catalyzer to avoid environmental pollution from chlorinated volatile organic compounds**

Researchers from the University of Alicante (UA) and the University of the Basque Country (UPV) have developed and patented a new catalyst that efficiently removes volatile organic compounds (VOCs), chlorinated in gas streams, pollutants involved in the destruction of the ozone layer and acts as greenhouse gases, in addition to having toxic effects in humans. This innovative technology, developed by the Research Groups in Carbon Materials and Environment (UA) and in Chemical Technologies for Environmental Sustainability (UPV), efficiently eliminates the chemical compound 1,2-dichloroethane (DCA), commonly known by its former name ethylene dichloride, often used in the industry and extremely harmful to the human health and the environment. The 1,2-dichloroethane is probably the most important chlorinated (VOCs) emitted in waste streams in chemical plants, as it is widely employed in the production of polyvinyl chloride, a plastic material whose world production is only surpassed by that of polyethylene. Although the process has reached its technological maturity at the industrial scale, at the output stream shows residual amounts of this compound that must be managed properly. Other less common uses of 1,2-dichloroethane are as a solvent in textile cleaning, degreasing of metal parts, dispersant of plastics and elastomers and as a chemical agent in formulations of paints and enamels. Just a few years ago, the most common way to remove VOCs was thermal incineration. However, the compliance with the legislation on VOC emissions has required significant improvements in the efficiency of treatment technologies. In this regard, catalytic oxidation has become important in recent years due its ability to destroy VOCs at temperatures below those used in thermal incineration, and a remarkable reduction in the formation of secondary pollutants (nitrogen oxides).

Furthermore, many of the catalysts engaged to VOC combustion are deactivated in a short time due to chlorine poisoning and stop working when used to remove chlorinated VOCs. There is, therefore, the need for catalysts allowing the destruction of volatile organochlorine, which do not undergo rapid deactivation in time and use. In this regard, researchers have designed a catalyst based on mixed oxides of cerium and praseodymium, highly efficient in the combustion of chlorinated volatile organic compounds, especially toxic 1,2-dichloroethane, which has high stability and durability in the reaction conditions. The system does not require high amounts of catalyst to fulfill its function properly, the technology does not generate secondary pollutants (nitrogen oxides) and also allows treatment of gaseous streams at low temperature (about 250°C) and all this with a low manufacturing cost because noble metals are not used in their manufacture. The technology has been successfully tested at laboratory demonstrating numerous and significant advantages over other existing devices on the market with similar goals.

(Source: <http://www.sciencedaily.com/releases/2013/09/130917090127.htm>)

## **New adsorbent is more effective and environmentally friendly for treating wastewater**

A new adsorbent for removing emerging contaminants from wastewater that is more effective, reusable and eco-friendly, has been developed. The researchers used cyclodextrins, a family of compounds made up of bound glucose (sugar) molecules, to develop their adsorbent material, which could have a positive impact on the water treatment, pharmaceutical, chemical and manufacturing industries. Cyclodextrins have an affinity for attracting organic compounds that is much higher than activated carbon, which is currently the most commonly used material by industry for removing wastewater contaminants. Activated carbon is very porous and water -- whether it be surface water, groundwater or wastewater -- contains a lot of natural organic matter. These are big molecules and when they hit the activated carbon, they block the pores which prevent the contaminant particles from getting inside. The new adsorbent has a cavity-like area in which they can trap the contaminants, which are made up of organic compounds.

By changing the functional groups on the glucose molecule, the size of the cavity can be increased or reduced. That means we can potentially manipulate this adsorbent substance to target and remove select contaminants, something that activated carbon cannot do. Although cyclodextrins are soluble, meaning they dissolve easily in water, the new adsorbent has been made insoluble by the researchers and can easily be attached as a thin coating to such surfaces as sand, glass, silica and filter paper. So far, the researchers have tested their new adsorbent material against such contaminants as steroid hormones, detergent compounds and bisphenol A in both lab water and discharged wastewater and found that it has removed more than 90 percent of the contaminants. This new adsorbent material has much less surface area than activated carbon, especially if you coat it on sand. But the results demonstrate that it has comparable, or even better, capacity than the activated carbon. And, it has the potential to be even more efficient by coating it on porous, high surface materials.



In addition to its effectiveness in removing contaminants, the new material's other benefit is that it can easily be regenerated and reused. A solvent such as methanol can be used to remove the contaminants or ozone can be used to destroy the trapped contaminants, both allowing the adsorbent material to be reused. So far, the researchers have tested several batches of the adsorbent material through four different cycles (use, clean, reuse) and it continues to work with the same effectiveness. In industry, once activated carbon has been used it will be either landfilled or it can be reactivated through a very energy-intensive and expensive process. The next step for the new adsorbent material is to do more extensive pilot testing.

(Source: <http://www.sciencedaily.com/releases/2013/09/130924174152.htm>)

### **Link between oil spill exposure and hematologic, hepatic toxicity**

A new study reports that workers exposed to crude oil and dispersants used during the Gulf oil spill cleanup display significantly altered blood profiles, liver enzymes, and somatic symptoms compared to an unexposed control group. Investigators found that platelet counts were significantly decreased in the exposed group, while both hemoglobin and hematocrit levels were notably increased. Their findings, reported in *The American Journal of Medicine*, suggest that oil spill cleanup workers are at risk for developing hepatic or blood-related disorders.

In April 2010, Deepwater Horizon, an offshore drilling rig owned by British Petroleum (BP) exploded, spewing over 200 million gallons of oil into the Gulf of Mexico. In order to break down the oil slick, BP used nearly 2 million gallons of dispersants like COREXIT, and an estimated 170,000 workers participated in the cleanup effort. Currently, COREXIT is banned in the United Kingdom because of its potential risk to cleanup workers. While other studies have identified a relationship between oil spills, dispersants, and human health, this new research from the University Cancer and Diagnostic Centers, Houston, TX, led by G. Kesava Reddy and Mark A. D'Andrea, focuses primarily on the link between oil spill exposure and hematologic and hepatic functions in subjects who had participated in the oil spill cleanup operation. The investigators looked at a total of 247 subjects between January 2010 and November 2012, with 117 subjects identified as exposed to the oil spill and dispersants by participating in the cleanup over the duration of three months. The unexposed control group of 130 subjects was comprised of people living at least 100 miles away from the Gulf coast of Louisiana. Using medical charts, demographic and clinical records, the team reviewed specific data points such as white blood cell (WBC) counts, platelet counts, hemoglobin, hematocrit, blood urea nitrogen (BUN), creatinine, serum beta-2 microglobulin, alkaline phosphatase (ALP), aspartate amino transferase (AST), and alanine amino transferase (ALT) for both groups.

While no significant differences were noted in the WBC counts of the two groups, the study did find that platelet counts were notably decreased in the oil spill exposed group. Also, BUN and creatinine levels were substantially lower in the exposed group, while hemoglobin and hematocrit levels were increased compared to the unexposed subjects. Furthermore, considered indicators of hepatic damage, the serum ALP, AST, and ALT levels in the exposed subjects were also elevated, suggesting that the exposed group may be at a higher risk for developing blood-related disorders. Phosphatases, amino transferases, and dehydrogenases play critical roles in biological processes. These enzymes are involved in detoxification, metabolism, and biosynthesis of energetic macromolecules that are important for different essential functions. Alterations in the levels of these enzymes result in biochemical impairment and lesions in the tissue and cellular function.

Participants also reported somatic symptoms, with headache reported most frequently, followed by shortness of breath, skin rash, cough, dizzy spells, fatigue, painful joints, night sweats, and chest pain. The health complaints reported by those involved in oil cleanup operations are consistent with the previously reported studies on major oil spills. However, the prevalence of symptoms appears to be higher in the present study compared with the earlier findings of other investigators. The investigators acknowledge that the lack of pre-disaster health data on the subjects involved in the study is the greatest limiting factor; however, the data collected have shown significant health effects on the cleanup workers. To knowledge of the researchers, no previous study has explored the effects of the oil spill specifically assessing the hematological and hepatic functions in oil spill cleanup workers. The results of this study indicate that oil spill exposure appears to play a role in the development of hematologic and hepatic toxicity. However, additional long-term follow-up studies are required to understand the clinical significance of the oil spill exposure.

(Source: <http://www.sciencedaily.com/releases/2013/09/130917090305.htm>)

## **Turning plastic bags into high-tech materials**

Researchers have developed a process for turning waste plastic bags into a high-tech nanomaterial. The innovative nanotechnology uses non-biodegradable plastic grocery bags to make 'carbon nanotube membranes' -- highly sophisticated and expensive materials with a variety of potential advanced applications including filtration, sensing, energy storage and a range of biomedical innovations. Non-biodegradable plastic bags are a serious menace to natural ecosystems and present a problem in terms of disposal. Transforming these waste materials through 'nanotechnological recycling' provides a potential solution for minimizing environmental pollution at the same time as producing high-added value products. Carbon nanotubes are tiny cylinders of carbon atoms, one nanometer in diameter (1/10,000 the diameter of a human hair). They are the strongest and stiffest materials yet discovered -- hundreds of times stronger than steel but six times lighter -- and their unique mechanical, electrical, thermal and transport properties present exciting opportunities for research and development. They are already used in a variety of industries including in electronics, sports equipment, long-lasting batteries, sensing devices and wind turbines.



The University of Adelaide's Nanotech Research Group has 'grown' the carbon nanotubes onto nanoporous alumina membranes. They used pieces of grocery plastic bags which were vaporized in a furnace to produce carbon layers that line the pores in the membrane to make the tiny cylinders (the carbon nanotubes). The idea was conceived and carried out by PhD student Tariq Altalhi. Initially the researchers used ethanol to produce the carbon nanotubes. But this student had the idea that any carbon source should be useable. The huge potential market for carbon nanotubes hinges on industry's ability to produce large quantities more cheaply and uniformly. Current synthesis methods usually involve complex processes and equipment, and most companies on the market measure production output in only several grams per day. In the laboratory, the researchers developed a new and simplified method of fabrication with controllable dimensions and shapes, and using a waste product as the carbon source. The process is also catalyst and solvent free, which means the plastic waste can be used without generating poisonous compounds.

(Source: <http://www.sciencedaily.com/releases/2013/09/130925102651.htm>)

### **Arsenic, mercury, selenium in Asian carp not a health concern to most, research shows**

Researchers at the Prairie Research Institute's Illinois Natural History Survey have found that overall, concentrations of arsenic, selenium, and mercury in bighead and silver carp from the lower Illinois River do not appear to be a health concern for a majority of human consumers. The full results of the study have been published in the journal *Chemosphere*. Average mercury concentration in fillets was below the US Food and Drug Administration Action Level and EPA Screening Value for Recreational Fishers, though some individual fish had mercury concentrations high enough to recommend limiting consumption by sensitive groups (children < 15 years and women of childbearing age) to 1 meal/week. Mercury concentrations were greater in bighead carp and were elevated in both species taken from the confluence of the Illinois and Mississippi rivers. These fish are low in mercury in comparison to many other commercially available fish. However, as always consumers need to make informed decisions about their food choices. Arsenic and selenium concentrations in bighead and silver carp fillets examined did not pose a risk to human consumers. Inorganic arsenic concentrations were undetectable and concentrations of selenium in carp fillets were well below the 1.5 mg/kg threshold for restricting the number of meals according to the US Environmental Protection Agency. Carp species, size and collection location should be considered in judging risks associated with uses of these fish taken from the Illinois River.



## *Asian Carp in Illinois*

Introduced to control algae in retention ponds and wastewater treatment facilities, bighead and silver carp escaped into the Mississippi River during flooding and spread into the Illinois River and Missouri River watersheds. These two Asian carp species impact the ecosystem and fishing industry by outcompeting native fishes for resources. Additionally, their tendency to jump from the water when startled by boat motors has resulted in direct harm to humans, impacting the recreation industry. Commercial harvest of bighead and silver Asian carp species has been proposed as a means to contain the spread of the highly invasive fish. The Illinois River is connected to the Great Lakes via the Chicago Waterway System, leading to concern over potential impacts on the \$7 billion Great Lakes fisheries.

(Source: <http://www.sciencedaily.com/releases/2014/01/140128163459.htm>)

## **New method measures mercury vapor for the first time**

An investigation to find out how much mercury energy-saving lamps contain has been conducted. Seventy-five commercially available lamps were tested, with encouraging results -- as far as mercury content goes they all contain less than the maximum allowed by law. Every energy-saving lamp contains some mercury, a toxic metal which is added to help ignite the device. Nobody in Switzerland has ever investigated whether commercially available energy-saving lamps actually meet the legal requirements for the maximum amount of mercury permitted. And so far, worldwide, only the quantity of bound mercury in these lamps has been measured. To date, the gaseous mercury content has not been measured, even though it poses by far the greater health risk. In addition, in used lamps up to 80 per cent of the mercury content exists in the gaseous form, whereas in unused lamps this figure is only 5 per cent. Acting on behalf of the Swiss Federal Office for the Environment (FOEN), therefore, Empa scientists have developed a method which allows the quantities of mercury in its various forms to be determined. The environmental department selected Empa as the partner for this task because the institution possesses the necessary know-how to enable it to develop such analytical methods.

### *A first in the field of mercury analysis*

Figi succeeded in developing a simple but effective method of measuring the total amount of mercury in an energy-saving lamp. The entire lamp is immersed in a solution of potassium permanganate and then the glass envelope is broken open with a tool. Since the glass tube is evacuated, when the envelope is broken open the potassium permanganate solution is sucked in and immediately reacts with the mercury, binding to it so that it cannot escape. Subsequently, the quantity of gaseous mercury can be exactly determined using UV spectrometry. Figi separately measures the quantity of non-gaseous mercury in the lamp, which is usually in the form of a ball of amalgam (a compound of mercury, tin and zinc). To do this, the little metal balls are dissolved in concentrated nitric acid in a high-pressure incinerator at 250°C and under a pressure of 135bar. As a final step, the Empa scientist then measures the quantity of mercury adhering to the broken glass envelope. To this end the glass fragments are cooled to -197°C and pulverized in a ball mill. Due to the very low temperature the mercury does not evaporate, remaining attached to the pulverized glass where it can also be measured. Using this technique, Figi has evaluated the mercury content of 75 lamps, analysing five samples each of 15 different types of commercially available lamp. These included the "mini ball" variety (a typical household lamp shaped like an old-style light bulb), as well as linear and ring shaped lamps which are often used on ceilings and walls. Figi's measurements show that none of the tested lamps contains more mercury than is allowed by Swiss law, namely 2.5 milligrams for a lamp of less than 30 Watt.

### *Health effects caused by mercury*

According to the Swiss Federal Office of Public Health (FOPH), undamaged energy-saving lamps do not present any danger, as far as is currently known. However, mercury vapour can be emitted by broken lamps. This only represents a danger to health when large quantities of vaporized mercury are inhaled, which could for example happen if several linear-form energy-saving lamps, each containing up to 15 milligrams of mercury, were to break open in a small room. Mercury poisoning causes damage to the central nervous system, with symptoms including trembling, excitability, change of character and reduced short-term memory. When high concentrations are involved cramps and paralysis may develop.

### *What should you do when an energy-saving lamp breaks?*

- Open the windows and air the room for a good 15 minutes
- Use a cloth to carefully wipe up the glass shards, using sticky tape to gather any fine particles
- DO NOT use a vacuum cleaner as this will blow mercury vapour and particles into the air

- Place the glass shards, sticky tape and cloth in a glass jar with a screw top, seal it and take it to a recycling point

(Source: <http://www.sciencedaily.com/releases/2014/01/140131083402.htm>)

## Can bacteria combat oil spill disasters?

Scientists have decrypted the effectiveness of two types of bacteria, which could be used in the future to help combat oil spill disasters. *Alcanivorax borkumensis* converts hydrocarbons into fatty acids which then form along the cell membrane. New insights on the bacteria *Oleispira antarctica* are important to understand their adaptation to low temperatures and could help in mitigation strategies for oil spills in polar seas or the deep sea. Until now, chemicals have often been used to clean up oil disasters, to break up the oil/water emulsion, making oil more soluble and thus removing it from the surface water. According to data from the US Environmental Protection Agency (EPA) around seven million litres of such chemicals were used to combat oil pollution in the Gulf of Mexico, resulting from a spill of about 700,000 tons of crude oil into the sea from the offshore oil drilling platform "Deepwater Horizon" in 2010. Some of the most well-known of these were dispersants with the brand name Corexit -- developed following the notorious tanker accident of the Exxon Valdez in Alaska in 1989. These substances have been heavily criticised however because of their side effects on humans and the environment. In the context of the EU-project BACSIN, scientists from different countries have therefore been investigating alternatives.

One approach for example could be to stimulate oil-degrading bacteria in their growth or for example by making them easier to use by freeze-drying so that they can be sprayed more easily than powders over the oil slick. However, there are still lots of details that require fine-tuning before the day arrives when they can be used to combat damage from oil spills. The precautionary principle should therefore be given priority. No matter how concerted efforts are, nature will never completely return to its original state, not to mention the fact that the mitigation of environmental damage from oil spills is much more costly than its prevention. Oil-degrading bacteria are not a human invention. In fact, they have been around for millions of years. The only thing that is new is the quantity of oil being spilt in the sea from oil disasters. Therefore, science has been looking into novel ways to accelerate natural degradation processes. One focus has been on hydrocarbon-degrading bacteria -- so-called marine obligate hydrocarbonoclastic bacteria. These specialists at degrading hydrocarbons in marine ecosystems are able to degrade aliphatic hydrocarbons and use them as a source of energy. These bacteria are common in sea water all over the world, even if only in small quantities. If they come into contact with crude oil, then their population increases exponentially. A kind of bloom is formed, similar to those that we are familiar with from marine algae blooms. And yet, in spite of their important ecological meaning, still relatively little is known about the processes taking place in the cells of these bacteria. Headed by Dr. Hermann J. Heipieper, researchers from the UFZ have therefore been conducting detailed physiological and genomic analyses of the two reference strains of this group of bacteria (*Alcanivorax borkumensis* and *Oleispira antarctica*) that is tremendously versatile. This can be seen in particular by changes to the cell surface, by the way in which biologically oxidized aliphatic hydrocarbons are built into the cell membranes and by the regulation of genes to adapt to environmental stress.

*Alcanivorax borkumensis* is a marine bacterium, owing its name to the place where it was discovered -- the island of Borkum (in spite of its worldwide distribution). It is considered to be one of the most important organisms with the ability to degrade oil spills in marine systems. Nevertheless, up until now there had been a lack of information on the growth and physiology of these bacteria in relation to hydrocarbons with different chain lengths. The recent investigations found that the bacterium were particularly effective at processing alkanes with carbon chain lengths of between 12 and 19 carbon atoms. "The cell growth confirmed that this bacterium is not only able to take up the intermediates of fatty acids in its own body but also to convert them. By contrast, for the significantly colder polar seas or the deep sea *Oleispira* would be the more suitable bacterium. It can survive at temperatures around 5 degrees Celsius that are typical for example on the seabed of the Gulf of Mexico. With eleven protein crystal structures it has the largest quantity of structures under the cold-loving microorganisms and it clearly has more negative charges at the surface than microorganisms in moderate temperatures. Even if most of the enzymes of this bacterium no longer work optimally under cold weather conditions, they still work sufficiently to accelerate growth and outdo other competitors, if a hydrocarbon diet from crude oil suddenly becomes available. The persistence of these bacteria is proof of their ecological competitiveness in cold environments, therefore making them good candidates for the development of biotechnological solutions for oil pollution mitigation in polar regions. The new insights about the two bacteria are a small, but important step forward in the search for alternatives to the toxic dispersants that have been used so far.

(Source: <http://www.sciencedaily.com/releases/2013/09/130926102435.htm>)

## Policies

### **EPA moves hazardous waste e-manifest system forward**

The EPA has issued a final rule that it says is a crucial step in developing a national electronic manifest (e-Manifest) system, which will upgrade the current paper-based system of tracking hazardous waste to an electronic one. The final rule authorizes the use of e-Manifests to track hazardous wastes under the Resource Conservation and Recovery Act. This will allow the current process, which requires paper forms, to be streamlined and greatly reduce the millions of paper manifests produced each year. Once fully implemented, the national e-Manifest system will give emergency responders greater access about the types and sources of hazardous waste that are in transit between generator sites and waste management facilities. The Hazardous Waste Electronic Manifest Establishment Act requires the EPA to issue a regulation authorizing the use of electronic manifests as the legal equivalent of the current paper manifest forms used to track shipments of hazardous waste from a generator's site to the ultimate site of disposal. The EPA's goal is to promote the greatest possible use of electronic manifests.

The e-Manifest program is the vanguard of the agency-wide initiative to develop new tools to reduce the reporting burden on regulated entities, and provide the agency, states and the public with easier access to environmental data. The EPA estimates the national e-Manifest system will ultimately reduce the burden associated with preparing shipping manifests by between 300,000 and 700,000 hours, and result in cost savings of more than \$75 million per year for states and industry. The final rule will establish the legal and policy framework for using electronic manifests; however, several more steps will be needed before the e-Manifest program can be implemented. These include establishing the system and initial fee structure. This year, the EPA will work with states, industry and other stakeholders to develop plans for the many key aspects of the system and address concerns of intersystem compatibility. The agency will also begin developing the initial fee structure of the system, including implementation and compliance dates, through a rule-making.

(Source: <http://www.environmentalleader.com/2014/01/16/epa-moves-hazardous-waste-e-manifest-system-forward/>)

### **EPA issues carbon capture rule**

The EPA issued a final rule that will help create a consistent national framework to ensure the safe and effective deployment of carbon capture and sequestration (CCS) technologies. CCS technologies allow carbon dioxide to be captured at stationary sources — like coal-fired power plants and large industrial operations — and injected underground for long-term storage in a process called geologic sequestration. The new rule clarifies that CO<sub>2</sub> streams captured from emission sources, injected underground via UIC Class VI wells approved for the purpose of geologic sequestration under the Safe Drinking Water Act, and meeting certain other conditions (for example, compliance with applicable transportation regulations), will be excluded from the EPA's hazardous waste regulations. The EPA also clarifies that CO<sub>2</sub> injected underground via UIC Class II wells for enhanced oil recovery (EOR) is not expected to be a waste management activity. The EPA concluded that the careful management of CO<sub>2</sub> streams under the specified conditions does not present a substantial risk to human health or the environment. The agency says this determination will help provide a clear pathway for the deployment of CCS technologies in a safe and environmentally protective manner while also ensuring protection of underground sources of drinking water.

Earlier the Department of Energy made available \$8 billion in loan guarantee authority to support carbon capture and other advanced fossil energy projects that avoid, reduce or sequester greenhouse gases. As the U.S. Administration continues to make the case — crucial for its carbon standards for power plants — that carbon capture is a bankable technology, arguments that carbon capture is unaffordable will likely be one of the biggest legal threats to the standards. The DOE announced it would invest nearly \$84 million in 18 projects to research second-generation technologies for carbon capture from coal-fired power plants.

(Source: <http://www.environmentalleader.com/2013/12/20/epa-issues-carbon-capture-rule/>)

### **Japan's waste policies show way for developing nations, UNEP says**

Japan's shift from reactive to preventive approaches provides a lesson for today's rapidly developing economies in how to deal with industrial wastes, according to a report by the United Nations Environment Programme. In the 1960s, Japan suffered environmental and public health crises from vast amounts of industrial and hazardous wastes, illegal dumping, air pollution and water contamination, UNEP says. Since then, the country has made many environmental improvements. Japan created policies to hold industries responsible for waste treatment and disposal, which created a waste market and fostered businesses in....

(Source: <http://www.environmentalleader.com/2014/03/13/japans-waste-policies-show-way-for-developing-nations-unep-says/>)

## **Greater chemical regulations urged**

Two scientists have proposed stricter rule to regulate industrial chemicals that they say are responsible for increased developmental disabilities detected in children. Neurodevelopmental disabilities, including autism, attention-deficit hyperactivity disorder, dyslexia, and other cognitive impairments, affect millions of children worldwide, and some diagnoses seem to be increasing in frequency. Industrial chemicals that injure the developing brain are among the known causes for this rise in prevalence. In the *Lancet Neurology* journal, Dr. Philippe Grandjean of the Harvard School of Public Health in Boston and Dr. Philip Landrigan of Mount Sinai School of Medicine in New York said they in 2006 identified five industrial chemicals as developmental neurotoxicants: lead, methylmercury, polychlorinated biphenyls, arsenic, and toluene. Since 2006, epidemiological studies have documented six additional developmental neurotoxicants—manganese, fluoride, chlorpyrifos, dichlorodiphenyltrichloroethane, tetrachloroethylene, and the polybrominated diphenyl ethers. Stricter rules are in force in the European Union, with the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). Similar restrictions are being urged worldwide. US chemical reporting ruled have been called flawed in a government report.

(Source: <http://www.environmentalleader.com/2014/02/24/greater-chemical-regulations-urged/>)

## **Oil recovery system enables EPA compliance**

Atlas Auto Crushers solved its waste oil problem and became compliant with EPA regulations by installing an oil-recovery system to reduce the amount of oil in its waste water, according to a case study. When Atlas Auto Crushers crushes junkers and strips them of their parts, despite removing oil from the engine, residual oil used to still leak and spread onto its lot, creating environmental concerns. In auto recycling, collecting and disposing hazardous waste is a major challenge and the EPA closely monitors industrial activity for environmental compliance. The Warren, Ohio-based business needed an uncomplicated, dependable recovery system that did not require supervision or maintenance and could withstand Ohio's severe winters and seasonal heavy rain. Water levels in the lot could rise very high and the company needed an oil recovery system that would function in varying levels of water without mechanical problems. In 1988, Atlas chose the Model 6V Brill oil-recovery system from Oil Skimmers, a Cleveland company. It has kept the company compliant with EPA regulations since then, aided by a winterization package that heats the oil to prevent it from solidifying in cold weather. The system is mounted on a cantilevered 8-foot broom and has a polyurethane tube that dips into the oil on the ground and sucks it up – it attracts only oil, not water. The tube is drawn back through blades that clean the oil off of it; then it dips back into the oil on the ground. The collected oil is stored in a tank and recycled.

According to Atlas Auto Crushers, the amount of water the system removes from waste oil is a major benefit, since it pays to have the oil removed from its facility and would rather not also pay for recyclers to haul away water. The broom mounting allows the company to reposition the system on different areas of the lot, conducting a systematic cleaning. Changes to how the EPA performs site assessment could increase costs, according to a report published last week by GlobeSt.com. The new standards are likely to create a greater emphasis on assessing contamination migration risk, expanding the definition of contamination to potentially cover vapor rather than just soil and groundwater.

(Source: <http://www.environmentalleader.com/2013/06/14/oil-recovery-system-enables-epa-compliance/>)

## **Sustainable waste and materials management: National policy and global perspective**

Waste generation and resource shortages have long been recognized as two of the greatest challenges human society is facing. In the early 1970s, the Club of Rome, a group of pioneering global thinkers, predicted in their milestone book *The Limits to Growth* that “if the present growth trends in world population...pollution ... and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years”. Since the 1970s, “sustainability” has become a key word in modern culture and has drawn a massive increase of attention. Many countries now consider sustainability a top priority of their national policies on waste and materials management. However, these policies tend to focus on each individual country and therefore may lack a global perspective.

The United Kingdom (UK) Department for Environment, Food and Rural Affairs (Defra), in a White Paper entitled “Government Review of Waste Policy in England 2011” published June 14, 2011, sets out actions to achieve an ambitious goal of “zero waste economy”. This commitment may be partly attributed to England's recent success in boosting its waste recycling rate. In 2010/11, England's household waste recycling rate reached 40%, representing a

significant increase from 11% in 2000/01. The commercial and industrial recycling rate is 52%, up from 42% in 2002/03. This increase of recycling rate is astonishing when compared to that in the United States where the municipal solid waste recycling rate only increased by 5% over a decade, reaching 34% in 2010. A large portion of UK's recycled materials are exported to other countries, primarily countries in the Far East. Currently the UK exports 15 million tonnes of recycled materials, which is equivalent to approximately 32% of the total household and commercial waste. While cheering for greatly improved recycling practice in the UK, we may ignore certain adverse effects associated with it, for instance, waste and contamination transfer. The UK is exporting 80% of its low-grade mixed papers, but only 20% of its high grade paper. Because low-grade mixed paper tends to carry a larger percentage of unusable content, a significant portion of recycled content may end up as waste in importing countries. This issue intensifies as recycling rate increases because paper fibers become too short for paper-making after six times of reuse. Approximately 6% of recycled paper fiber may be unusable in paper-making when recycling rate reaches 50%, but nearly 20% could be unusable if recycling rate reaches 75%. In addition, low-grade mixed papers contain various contaminants that end up in polluted wastewater. Due to less stringent environmental safeguards at export destinations, this can lead to a wider spread of pollution and more exposure to the population. The most notable example of contamination transfer is in the recycling of e-waste. According to a 2005 report by the United Nations Environmental Programme, about 50–80% of e-waste collected in developed countries ends up in developing countries. A 2007 study by Wong et al. examined the contamination caused by e-waste recycling in Guiyu town in Southeast China, where over 200 individual workshops and nearly 100,000 migrant laborers worked on e-waste recycling. Toxic pollutants were found in Guiyu's air, soil, and water, at concentrations up to hundreds of times of those reported for U.S. urban areas and up to thousands of times of background soil values reported in literature.

Another often overlooked factor in the status quo recycling practice is emission from overseas transportation and processing. A recent meta-analysis shows that paper recycling can have a higher carbon footprint than incineration in 5 out of 15 scenarios, but "wins" in the remaining 10 scenarios. However, these existing studies, including a comprehensive study by the USEPA, have all assumed domestic transportation and processing of recyclables. This is understandable because data may not be available to allow for life cycle analysis that involves both exporting and importing countries, especially considering numerous small to middle sized paper mills exist in importing countries like China, and their emission as well as avoided emission (i.e., due to the use of recyclables versus virgin fibers) can be difficult to quantify. Nevertheless, we believe this research gap should and can be filled. In addition, when the UK government makes its efforts to reach England's goal of reducing 10 million tonnes of CO<sub>2</sub>equivalent by 2020 in waste management, it is important to account for additional life-cycle impacts associated with the exported recyclables.

Lastly, the exported recyclables can potentially distort domestic recycling systems of the importing countries. China is the destination of over 60% of UK's exported waste paper and nearly 90% of recovered plastics; however, China's domestic waste recycling rate is lower than most other countries. The low recycling rate in China can be partly attributed to the large amount of recyclable materials imported from developed countries. From another perspective, the landfill tax imposed in the UK, which is to be increased to £80/tonne in 2014/15, is equivalent to a subsidy to recycling that can potentially distort the recycling market in China. An indirect but more profound consequence of this distorted market may be a social norm and behavior pattern that do not support sustainable usage and recycling. Combined with the fast growing economy and a huge population, a low domestic recycling rate in China could present a risk to the sustainable development of the human society as a whole. Waste recycling has become a global business, and therefore the potential adverse effects described above can only be addressed with concerted effort from both exporting and importing countries. As many environmental problems have a trans-boundary nature, policy makers need to employ life cycle approaches that are based on global scale system boundaries. For instance, from a global perspective, sustainable waste and materials management policies in developed countries like the UK and the U.S. need to not only encourage the collection of more recyclables, but also promote domestic usage of collected recyclables. By doing so, significant environmental benefits can be achieved.

(Source: *Environ. Sci. Technol.*, 2012, 46 (5), pp 2494–2495)

## Abstracts

### **Distribution and speciation of metals (Cu, Zn, Cd, and Pb) in agricultural and non-agricultural soils near a stream upriver from the Pearl River, China**

The distribution and chemical speciation of typical metals (Cu, Zn, Cd and Pb) in agricultural and non-agricultural soils were investigated in the area of Nanpan River, upstream of the Pearl River. The investigated four metals

showed higher concentrations in agricultural soils than in non-agricultural soils, and the site located in factory district contained metals much higher than the other sampling sites. These observations suggested that human activities, such as water irrigation, fertilizer and pesticide applications might have a major impact on the distribution of metals. Metal speciation analysis presented that Cu, Zn and Cd were dominated by the residual fraction, while Pb was dominated by the reducible fraction. Because of the low mobility of the metals in the investigated area, no remarkable difference could be observed between upstream and downstream separated by the factory site.

(Source: <http://www.sciencedirect.com/science/article/pii/S0269749113000596>)

### **Hydroxylated PBDEs and brominated phenolic compounds in particulate matters emitted during recycling of waste printed circuit boards in a typical e-waste workshop of South China**

The hydroxylated PBDEs (OH-PBDEs) and brominated phenolic compounds in aerosol samples from a printed circuit boards recycling workshop were characterized. The results show that OH-PBDEs, which are naturally occurring compounds or metabolism of PBDEs, could also be emitted from the e-waste recycling. Five OH-PBDEs, several unidentified mono-OH-PBDE and di-OH-PBDE congeners were detected. The concentration of  $\sum$ OH-PBDEs was 1.74–4.22 ng m<sup>-3</sup> (average of 2.66 ng m<sup>-3</sup>), with 6-OH-BDE-47 (0.329 ng m<sup>-3</sup>) as the most abundant identified congener. The total concentration of di- to tri-brominated phenols (BPs) was 18.8–32.0 ng m<sup>-3</sup> (average of 26.3 ng m<sup>-3</sup>) with 2,4,6-triBP as the most abundant congener. These findings suggest that the recycling of printed circuit boards represent a strong source of OH-PBDEs and BPs to the atmosphere. Additionally, some phenolic compounds including brominated bisphenol A, hydroxylated polybrominated biphenyl species and etc. were also identified.

(Source: <http://www.sciencedirect.com/science/article/pii/S0269749113000493>)

### **Experimental increase in availability of a PAH complex organic contamination from an aged contaminated soil: Consequences on biodegradation**

Although high PAH content and detection of PAH-degraders, the PAH biodegradation is limited in aged-contaminated soils due to low PAH availability (i.e., 1%). Here, we tried to experimentally increase the soil PAH availability by keeping both soil properties and contamination composition. Organic extract was first removed and then re-incorporated in the raw soil as fresh contaminants. Though drastic, this procedure only allowed a 6-time increase in the PAH availability suggesting that the organic constituents more than ageing were responsible for low availability. In the re-contaminated soil, the mineralization rate was twice more important, the proportion of 5–6 cycles PAH was higher indicating a preferential degradation of lower molecular weight PAH. The extraction treatment induced bacterial and fungal community structures modifications, *Pseudomonas* and *Fusarium solani* species were favoured, and the relative quantity of fungi increased. In re-contaminated soil the percentage of PAH-dioxygenase gene increased, with 10 times more Gram negative representatives.

(Source: <http://www.sciencedirect.com/science/article/pii/S0269749113000584>)

### **Atmospheric concentrations and potential sources of PCBs, PBDEs, and pesticides to Acadia National Park**

This study assessed concentrations and investigated potential source regions for PCBs, PBDEs, and organochlorine pesticides in Acadia National Park, Maine, USA. Back-trajectories and potential source contribution function (PSCF) values were used to map potential source areas for total-PCBs, BDE-47, and 10 organochlorine pesticides. The constructed PSCF maps showed that ANP receives high pollutant concentrations in air masses that travel along four main pathways: (1) from the SW along the eastern Atlantic seaboard, (2) from the WSW over St. Louis, and Columbus regions, (3) from the west over Chicago, and Toronto regions, and (4) from WNW to NNW over the Great Lakes, and Quebec regions. Transport of all studied pollutants were equally distributed between the first three pathways, with only minor contributions from the last pathway. This study concludes that the high-pollutant concentrations arriving at ANP do not exclusively originate from the major urban centers along the eastern Atlantic seaboard.

(Source: <http://www.sciencedirect.com/science/article/pii/S026974911300081X>)

### **Non-destructive techniques for biomonitoring of spatial, temporal, and demographic patterns of mercury bioaccumulation and maternal transfer in turtles**

Mercury (Hg) is a globally ubiquitous pollutant that has received much attention due to its toxicity to humans and wildlife. The development of non-destructive sampling techniques is a critical step for sustainable monitoring of Hg accumulation. We evaluated the efficacy of non-destructive sampling techniques and assessed spatial, temporal, and

demographic factors that influence Hg bioaccumulation in turtles. We collected muscle, blood, nail, and eggs from snapping turtles (*Chelydra serpentina*) inhabiting an Hg contaminated river. As predicted, all Hg tissue concentrations strongly and positively correlated with each other. Additionally, we validated our mathematical models against two additional Hg contaminated locations and found that tissue relationships developed from the validation sites did not significantly differ from those generated from the original sampling site. The models provided herein will be useful for a wide array of systems where biomonitoring of Hg in turtles needs to be accomplished in a conservation-minded fashion.

(Source: <http://www.sciencedirect.com/science/article/pii/S0269749113000948>)

### **Toxicity testing of dispersed oil requires adherence to standardized protocols to assess potential real world effects**

Recently, several researchers have attempted to address Deepwater Horizon incident environmental fate and effects issues using laboratory testing and extrapolation procedures that are not fully reliable measures for environmental assessments. The 2013 Rico-Martínez et al. publication utilized laboratory testing approaches that severely limit our ability to reliably extrapolate such results to meaningful real-world assessments. The authors did not adopt key methodological elements of oil and dispersed oil toxicity standards. Further, they drew real-world conclusions from static exposure tests without reporting actual exposure concentrations. Without this information, it is not possible to compare their results to other research or real spill events that measured and reported exposure concentrations. The 1990s' Chemical Response to Oil Spills: Ecological Effects Research Forum program was established to standardize and conduct exposure characterization in oil and dispersed oil aquatic toxicity testing (Aurand and Coelho, 2005). This commentary raises awareness regarding the necessity of standardized test protocols.

(Source: <http://www.sciencedirect.com/science/article/pii/S0269749113000705>)