Research DIGEST

A new study conducted by scientists at the Department of Energy's **Pacific Northwest National Laboratory** and the University of California, Irvine, has revealed that tiny wind-blown sea salt particles drifting into the atmosphere participate in a chemical reaction that may have impacts on climate and acid rain. Sulfur dioxide is a byproduct of burning fossil fuels containing sulfur. It is also formed when naturally emitted sulfur-containing compounds react in the atmosphere. In the air, sulfur dioxide is converted to sulfuric acid, a major component of acid rain. The study indicates that sea salt particles will absorb more sulfur dioxide and convert it to sulfuric acid more rapidly than previously thought. The research, published in the July 3, 2003, online issue of *Science Express*, could have substantial implications for increasing the accuracy of climate models. (Staci Maloof, 509-372-6313)

By applying basic equipment similar to that used to eliminate microbes in water treatment plants, two chemical engineers at the Department of Energy's National Energy Technology Laboratory (NETL) have patented a process, termed GP-254, to remove high levels of mercury from flue gas emitted from coal fired power plants. Researchers Evan Granite, shown with the GP-254 Process test rig, and Henry Pennline found that more than 70 percent of the elemental mercury in simulated flue gases can be removed as mercurous sulfate and mercuric oxide. They used 253.7 nm ultraviolet light to induce photochemical reactions of mercury with components of the flue gas. As a next step, Granite and Pennline plan to test the GP-254 Process using a real slip stream of flue gas in NETL's 500-lb/hr pilot-scale combustion facility. Inquiries about potential applications have been received from government, industry, and research organizations. A paper describing the process has appeared in *Industrial & Engineering Chemistry Research*, a publication of the American Chemical Society.

Few people have characterized a two-stroke engine as a clean-burning engine. From snowmobiles and chain saws to gas-powered lawn trimmers, the strong scent of exhaust fumes is all too familiar. But the fumes could be significantly reduced if a concept developed by researchers at the Department of Energy's **Idaho National Engineering and Environmental Laboratory** pans out. The concept involves a small separator that will remove unburned oil and gas from the engine exhaust without compromising engine performance. The separator will be located in the exhaust system or the muffler exhaust area. The exhaust gas will spin at a high rate, centrifugally separating the heavy oil, fuel and particulates from the lighter gaseous combustion products. The heavy constituents will be burned in an afterburner or captured and removed for recycling or disposal. The researchers look forward to moving to the next level of development. (John Walsh, 208-526-8646)

Researchers at the Department of Energy's **Brookhaven National Laboratory**, who previously found reduced levels of the enzyme monoamine oxidase B (MAO B) in the brains of smokers, have found that the enzyme level in peripheral organs—the kidneys, heart, lungs, and spleen—is also affected by smoking. This crucial enzyme breaks down neurotransmitters and dietary amines, and too much or too little MAO B can adversely affect health and even personality. The scientists administered MAO B-specific binding radiotracers labeled with carbon-11 to 12 smokers and performed whole-body positron emission tomography (PET) scans to measure the level of MAO B in various organs. Comparing the results with those from a group of eight nonsmokers, the scientists found that MAO B activity in the peripheral organs was significantly reduced in the smokers relative to the nonsmokers. Reductions ranged from 33 to 46 percent. (Karen McNulty Walsh, 631-344-8350)

The Department of Energy's (DOE) **Argonne National Laboratory** is collaborating with the National Aeronautics and Space Administration (NASA) to develop a method of inspecting the leading edge thermal protection system for space shuttle wings. Researchers in Argonne's Energy Technology Division have been conducting tests on the wings since April 2003 and are working to meet an early fall deadline to provide their best potential investigation methods. "NASA invited us to work on this very short-term effort because we have been working on inspection methods for ceramics funded by DOE for 20 years," said Argonne's Bill Ellingson. "We have the knowledge base for…ceramics at high temperatures." The leading edge of the wing and nose cap of the space shuttle are composed of reinforced carbon-carbon material, a ceramic composite that is extremely tough at high temperatures. The researchers have intentionally put flaws in NASA samples and successfully detected them using their proposed inspection methods. (Donna Jones Pelkie, 630-252-5501) ❖