C&EN news of the week

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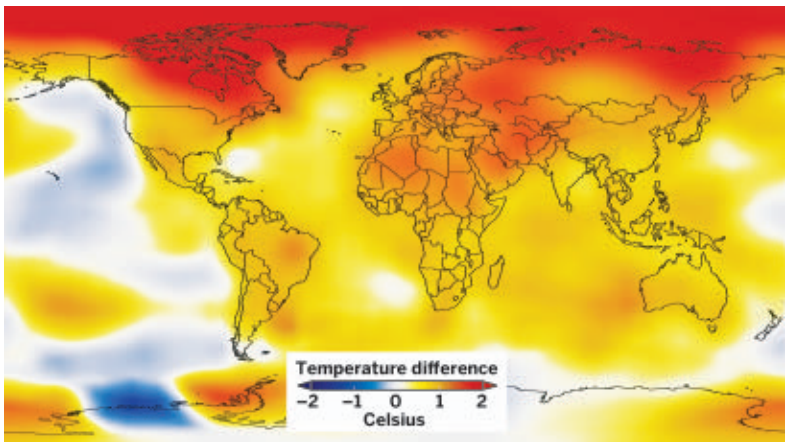
GLOBAL-WARMING WARNINGS

CLIMATE: Reports concur that human-induced changes are already leading to damaging environmental shifts

GLOBAL WARMING is occurring at record levels and is due to increasing atmospheric greenhouse gases generated by human activities, according to several new government scientific reports issued in recent weeks. The rapidity of greenhouse gas impacts will make projections and mitigation efforts increasingly difficult and will result in a drastic transformation of Earth's environment, the reports say.

In a related development, researchers are reporting that airborne black carbon particles—which are a component of soot—hold twice the warming potential as previously thought.

DISRUPTION This NASA map represents global temperature anomalies averaged from 2008 through 2012.



NASA GODDARD SCIENTIFIC VISUALIZATION STUDIO

Rising seas, heat waves, erratic and intense rainfall, storm surges, and droughts are among the effects accelerating climate changes now under way. That is one conclusion of a draft report by the National Climate Assessment & Development Advisory Committee, a 60-member federal advisory body established to advise the President and Congress on climate-change issues.

The draft assessment presents a grim picture of the ongoing impact from climate change. Looking to the future, the assessment warns of accelerating effects and the potential to reach a "tipping point" where cumulative climate extremes will exceed mitigation efforts.

The draft report, which is expected to be finalized in 2014, recommends active adaptation to a changing climate and a reduction in greenhouse gas emissions to avoid the worst cumulative climate-change impacts. It warns that scientists may no longer be able to use past climate conditions to predict future ones.

Meanwhile, analyses by the National Aeronautics & Space Administration and the National Oceanic & Atmospheric Administration show that 2012 was one of the 10 hottest years on record, on the basis of global average temperature.

Earth's global average temperature in 2012 was about 58.3 °F, NASA says, further noting that global average temperature has risen about 1.4 °F since record-keeping began in 1880.

Scientists from the federal agencies say the ranking of one year's global average temperature over another is less important than the fact that 2012's temperature is part of a warming trend that began in the late 1970s.

"What matters is this decade is warmer than the last decade, and that decade was warmer than the decade before," explains Gavin Schmidt, climatologist at NASA's Goddard Institute for Space Studies. "The planet is warming. The reason it's warming is because we are pumping increasing amounts of carbon dioxide into the atmosphere."

Another aspect of warming is the effect of airborne black carbon particles. A comprehensive analysis indicates that their climate-warming capability is double what was previously believed (*J. Geophys. Res.: Atmos.*, DOI: 10.1002/jgrd.50171).

Black carbon particles are aggregates of carbon spherules that are produced during combustion of carbon-based fuels. They directly influence climate by strongly absorbing sunlight. When deposited on snow or ice, they reduce the reflectivity of those surfaces and cause melting. Black carbon particles also change the formation and radiation absorptive or reflective properties of clouds, with mixed warming or cooling effects.

Researchers had estimated black carbon climate effects before, but the numbers had varied, says Tami C. Bond, the study's lead author and an engineering professor at the University of Illinois, Urbana-Champaign.

Given the large role black carbon plays in global warming and its shorter lifetime in the atmosphere compared with carbon dioxide and methane, controlling black carbon emissions could be "a short-term, immediate action that we can take to slow climate change," Bond says.

Diesel engines and household wood and coal burning would be the best black carbon sources to control to limit warming, Bond says.—CHERYL HOGUE, JEFF JOHNSON & JYLLIAN KEMSLEY

ASTRAZENECA'S R&D OVERHAUL

PHARMACEUTICALS: Research head Martin Mackay is out in leadership shake-up

FACED WITH A WEAK new product pipeline and crushing patent losses, AstraZeneca's new CEO, Pascal Soriot, is shuffling his management team. The company's R&D chief, Martin Mackay, and its head of commercial operations, Tony Zook, are both out the door in the start of a shake-up that could also include a big acquisition.

Mackay will not be replaced. Rather, Soriot has enlisted three existing senior executives to oversee R&D: Mene Pangalos, a neuroscientist, will lead AstraZeneca's small-molecule drug discovery effort; Bahija Jallal, executive vice president of the firm's MedImmune subsidiary, will lead biologic drug development; and Briggs Morrison, a former Pfizer executive, will head late-stage development for both classes of drugs.

Mackay joined the company in 2010 from Pfizer, where he was head of R&D. He took on the daunting task of fixing an R&D group that had made a series of bad bets. Between 2012 and 2016, AstraZeneca will lose patent protection on four products that once represented more than $20 billion in annual sales. At the same time, the company has experienced a string of failures in late-stage clinical trials of new products.

Under Mackay's leadership, AstraZeneca cut its internal R&D operations to the bone, shedding 2,200 research jobs, shuttering several sites, and taking a "virtual" approach to neuroscience R&D. The company has added to its pipeline through partnerships and mergers and acquisitions (M&A), but industry watchers believe a large deal will be necessary to sustain revenues during the coming rough period. Soriot is expected to unveil his plans to investors on Jan. 31.

"Given AstraZeneca's shallow late-stage pipeline, we expect the new CEO to be particularly aggressive on M&A," Leerink Swann stock analyst Seamus Fernandez told investors in a research note. Large deals that immediately add to the company's profits would make the most sense, Fernandez wrote, noting that specialty drug firms Forest Laboratories or Shire would fit that bill.

In a separate R&D move, Roche has appointed John C. Reed as head of its drug discovery operation, known internally as pharma research and early development. Reed comes to Roche from Sanford-Burnham Medical Research Institute, where he was CEO.—LISA JARVIS

ASTRAZENECA (BOTH)

Mackay

Pangalos

MAKING TOXIC NANOTUBES SAFER

SAFETY: Chemical treatment renders asbestos-like nanotube bundles harmless

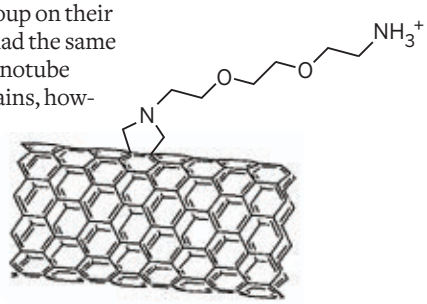
CHEMICALLY MODIFYING the surface of certain carbon nanotubes can reduce their asbestos-like toxicity, scientists report (*Angew. Chem. Int. Ed.*, DOI: 10.1002/anie.201207664). The finding could lead to safer nanotube-based products.

Nanoscientists were alarmed to learn in 2008 that multiwalled carbon nanotube fibers that are at least 20 μm in length trigger a toxic response in mice akin to what asbestos does. "The report scared the entire scientific community and still prompts skeptical attitudes whenever we talk about nanotubes for biological applications," says Maurizio Prato, a nanotube expert at Italy's University of Trieste.

So Prato, along with Alberto Bianco of France's National Center for Scientific Research and Kostas Kostarelos of University College London, set out to see whether potentially dangerous nanotubes could be transformed into safer material. They took the same nanotubes that researchers had previously shown to be dangerous and then covalently modified their surfaces.

To one group of nanotubes they added long alkyl chains and to another they added hydrophilic chains containing oxygen atoms and an amino group on their ends. In mice, the tubes with alkyl chains had the same type of asbestos-like toxicity as pristine nanotube fibers. The nanotubes with hydrophilic chains, however, appeared to be harmless.

"This type of chemical functionalization reaction led to better dispersion and broke bundled nanotubes apart, thereby reducing their effective length so they did not prompt a reaction like asbestos fibers," Bianco explains.



Chemically modified nanotube

Jun Kanno, a researcher at Japan's National Institute of Health Sciences who led one of the 2008 studies, is skeptical of the group's conclusions. He wonders whether the chemical functionalization process skims off the outer layers of the nanotubes and introduces structural defects that make them thinner and shorter, and therefore less toxic.

Prato and coworkers say only the surface of the nanotube is functionalized and that the dispersion of nanotube bundles is what reduces toxicity.—BETHANY HALFORD