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THE GULF WAR'S AFTERMATH

Kuwait Unveils Plan to Treat Festering Desert Wound

LONDON—Ten years after the Gulf War ended, Kuwait's deserts are still drenched in crude oil, most of it spilled as Iraqi invaders beat a hasty retreat. Now the country is about to embark on a belated $1 billion effort to tackle the ecological calamity in one of the biggest environmental remediation projects ever attempted. "It's a living laboratory of a type mankind has never seen before," says Paul Kostecki of the University of Massachusetts, Amherst.

Despite its considerable wealth, Kuwait has made little headway in cleaning up its oil-contaminated deserts. An estimated 250 million gallons of oil—more than 20 times the amount spilled by the *Exxon Valdez* oil tanker off Alaska in 1989—despoiled one-third of the land. Kuwaiti scientists claim that wildlife took a heavy hit, particularly in the National Park of Kuwait, where the national flower, the arfaj (*Rhanterum epapposum*), was wiped out; it's now being replanted. Speaking here last week at the International Congress on Petroleum Contaminated Soils, Sediments and Water, Kuwait's oil minister, Adel Al-Sabeeh, asserted that his nation's oil industry has committed more than $630 million on projects related to health, safety, and the environment. However, Kuwaiti researchers counter that cleanup efforts have so far dealt only with contamination that impedes oil extraction. All told, they insist, only $13 million has been spent in the past decade to examine the true scope of the oil's harm.

A delay in sopping up the crude was inevitable: Kuwait spent the first 6 months just putting out oil fires set by retreating Iraqi forces. Some also see the psychological factors of an aggrieved nation at play. "If somebody breaks into your car, you wait for them to pay," says Andy Kwarteng of the Kuwait Institute for Scientific Research (KISR) in Kuwait City, which will oversee the environmental reparations budget.

But the wait is over. In June, the United Nations Compensation Committee awarded Kuwait $108.9 million in reparations from U.N.-controlled Iraqi oil sales to be spent on addressing the environmental fallout from the Gulf War (*Science*, 29 June, p. 2411). First up is a 5-year project to catalog the environmental ills, followed by a remediation estimated to cost more than $1 billion.

Any remediation efforts must be tailored to Kuwait's desert environment and the unprecedented extent of the contamination. Although the *Valdez* spill was a disaster in its own right, waves helped break up the slick to allow petroleum-eating bacteria to consume tons of oil, thus partly mitigating the harm to Alaska's coastal ecosystem. In soil, by contrast, adhesion and weathering make crude oil more stubborn, while a desert's dryness tends to deter natural degradation.

Ecological conflagration. Kuwait's deserts, drenched in oil since the Gulf War, are finally getting some serious attention.

Short on funds, the KISR so far has carried out only two pilot remediation projects. In one, Nader Al-Awadi's team from KISR, working with Japan's Petroleum Energy Center, showed how to remove 94% of hydrocarbons from soil underneath lakes of oil now covering 49 km^2 of Kuwait. It is not a delicate process: The soil is excavated and washed with kerosene, piled up, and then pumped with air and water to nourish oil-eating microbes. If this process were used to treat all 70 million cubic meters of soil affected by oil lakes, it would cost $1.3 billion, says Al-Awadi. And that's leaving out contaminants such as soot and hardened tar mats, which cover a wider area but are deemed less serious ecological threats.

One novel project stems from the high concentration of petroleum in some of the spills. Researchers have proposed using the oily sand to pave roughly 5000 kilometers' worth of roads. In other words, when life gives you asphalt, make a highway.

Kuwait's bioremediation windfall "could provide an incredible amount of research," says Kostecki, executive director of the U.S.-based Association for Environmental Health and Sciences, which sponsored the London conference. And although Kuwait has skimped so far, outside experts say the country's leadership has experienced a change of heart. "They don't really care about the cost," insists Farouk El-Baz, director of the Center for Remote Sensing at Boston University. "If they can find a way, they will clean it up." —**BEN SHOUSE**

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COSMOLOGY

Changing Constants Cause Controversy

The times, they are a-changin', and so are the fundamental constants of physics, an international group of physicists reports. After analyzing light from distant quasars, the team has concluded that the fine-structure constant, which is related to the speed of light, has shifted over time. The claim is extremely controversial, but scientists are taking it seriously—if skeptically.

The fine-structure constant is an amalgamation of the speed of light, the charge of the electron, and the quantum-mechanical number known as Planck's constant. Combined, these values give a measure of the inherent strength of electromagnetic interactions, such as those that bind an electron to an atom. Like the speed of light, it is thought to be immutable: approximately 1/137. But in the 27 August edition of *Physical Review Letters*, a team of astronomers and physicists presents evidence that the fine-structure constant was different in the early universe. "One thing is clear. If it's correct, it's fantastically important," says John Bahcall, an

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