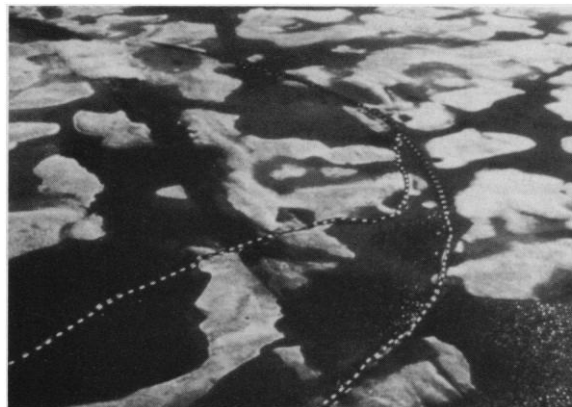


Icy Inferno: Researchers Plan Oil Blaze in Arctic

To test cleanup technologies in icy waters, oil companies are hoping to stage a conflagration off Alaska's northern coast

IT'S AN UNLIKELY SCENARIO: ALASKAN ENVIRONMENTAL agencies and oil industry officials pressing for an oil spill. But it may come to pass. In the summer of 1992, industry researchers hope to spill and set ablaze tens of thousands of gallons of crude oil in the ice-choked waters of the Beaufort Sea off Alaska's northern coast. Their purpose is benign: The researchers want to determine how well federal or industrial emergency response teams can deal with a future accidental oil spill in Arctic waters and learn whether fire can serve as an effective cleanup tool. First, however, they must convince federal and state regulators to sanction the test, and that's proving difficult.

With memories of the environmental carnage and billion-dollar cleanup of the wreck of the *Exxon Valdez* still fresh, spilling oil along the Alaskan coast would seem to be the last thing either environmental protectors or industry would want to do. But *Valdez* sensitized both camps to the threat posed by drilling in the Arctic and the possibility of a spill in Alaska's northern waters. Says oil response specialist Christopher Pace of the Alaska Department of Environmental Conservation (ADEC), "Our department's worst nightmare is a catastrophic spill in the Arctic."



Cleanup corral. A containment boom encircles oil and ice in the Beaufort Sea.

One reason for concern is that the standard approach to oil cleanup may not work in this area. Special hazards—the rough weather that often batters the Beaufort Sea, the darkness that envelops the area during most of the winter, and the ice—make it virtually impossible to deploy booms and collectors of the kind used for spills in warmer waters. "It's a harsh environment for responders to be in," says Philip L. Johnson, executive director of the Arctic Research Commission, which issued a policy statement last year calling for more research on oil spill prevention technol-

ogy in "ice-infested" water. "Generally, containment booms have been tried only in temperate waters," and data are scarce in the far north, says Jerry Imm, an environmental scientist with the Interior Department's Minerals Management Service.

The planned spill in the Beaufort Sea is an attempt to test alternative cleanup technologies. It is being sponsored by Alaska Clean Seas (ACS), a nonprofit organization composed of "all the major oil and gas companies operating in Alaska," says the organization's general manager, Norman Ingram. According to Ingram, ACS scientists hope to determine whether federal or industrial emergency response teams could burn off an accidental spill in Arctic waters instead of mopping it up. Oil cleanup organizations have staged several small-scale experimental Arctic spills in the past 20 years, some involving burning, but Pace and other scientists say a larger-scale study, like the one being planned by ACS, is needed to learn about

chemicals in the burning oil's plume and the threat they might pose to Alaska residents and cleanup workers. Burning off the spilled oil may be more efficient than cleaning it up mechanically (see box below), says Pace, but he warns, "In doing so, you escalate from an oil spill's damage to fish and wildlife to the smoke's damage to human health."

Local environmental officials have already given the project tentative approval. Residents of the North Slope Borough, the coastal region of Alaska bordering the Beaufort Sea, also have voiced support for the project.

How to Scrub an Arctic Oil Spill

Plans for an experimental oil spill in the Beaufort Sea call for a helicopter to drop gasoline on the floating oil and ignite it, creating a plume of black smoke loaded with hydrocarbons and gases. While cleaning up oil by burning it is not a new idea—it was first proposed and tested in the 1960s—it has rarely been used in practice, though scientists agree that in the icy Arctic waters, it probably is the most effective approach.

Questions remain, however, as to how safe the method is. A recent report by environmental scientists Merv Fingas and Nancy Laroche of Environment Canada has singled out airborne pollution as the dominant issue, noting that "the concern over atmospheric emissions remains the biggest barrier to the widespread use of burning." The greatest threat is posed by polyaromatic hydrocarbons, possible carcinogens that may latch onto soot particles and precipitate out of the plume. Other potentially harmful chemicals that may become airborne when oil burns on salt water are dibenzofurans and dioxins. Although

the soot and gases—mainly carbon dioxide, carbon monoxide, and sulfur dioxide—may have an unhealthy look, the study concludes that "work conducted to date has not shown that oil-spill burning results in serious air pollution."

In the Arctic, cleanup teams favor burning the oil over mechanical methods mainly because chunks of ice clog gears and suction cups, says Rich Ogar, a spill response consultant for ARCO Alaska, Inc. Ice also can pile up against a containment boom and allow oily water to escape. A frozen area of sea, on the other hand, can be a blessing to oil cleanup teams, says Ogar: "In that case, the saying goes, 'Ice is nice.' " Ice absorbs the oil, and cleanup teams scoop it up and ship it off to holding tanks, where the ice melts and the oil can be recovered or discarded. When conditions get really rough, however, neither burning the oil nor mechanical cleanup are feasible, says ADEC's Christopher Pace. "When it's really bad out," he says, "all we can do is sit back and watch."

■ R.S.

Perhaps fearing heavier tanker traffic as oil drilling moves offshore, Jeslie Kaleak, the mayor of North Slope Borough, and other residents recently clamored for an experimental spill in a meeting of the U.S. Arctic Research Commission, a board created in 1985 to develop and review federal policy. Kaleak told *Science*, "I'm not convinced anyone can do an adequate cleanup job either offshore or onshore [in the] North Slope Borough."

Before the test can go ahead, however, the Environmental Protection Agency (EPA) must give its approval, and this may be slow in coming. The agency is split on the merits of the plan. "Conceptually it's a great idea," says Carl Lautenberger, an oil response spe-

cialist at EPA. "But I can't say the EPA's 100% behind this or 100% against it." The EPA is jittery because of the widespread environmental damage caused by the *Valdez*, which spilled about 11 million gallons of crude oil into Alaska's Prince William Sound, resulting in a flurry of litigation, part of which remains tied up in the courts. "We're worried about the unknown liabilities of [an experimental spill]," Lautenberger says. To share the liability, ACS is trying to land a federal agency—most likely the Minerals Management Service—as the experiment's co-sponsor.

It's not just at the federal level that ACS is having trouble convincing regulators to

let the test go ahead. In July, Alaska's Regional Response Team (ARRT), composed of 14 state and government agencies, denied an ACS request to conduct a much smaller "demonstration" spill in 1991 in the Chukchi Sea, which lies between Alaska and Siberia. Instead, ARRT gave only "conceptual approval" and called on ACS to submit its plans in "intricate detail."

Despite the uncertainties of a staged oil spill in the Beaufort Sea, regulators and industry officials agree it must be done, for the risks of not running the experiment could be worse. "The answers we might get from this experiment would be priceless," says Pace. ■ **RICHARD STONE**

Can Big Science Claim Credit for MRI?

Among physicists, devotees of "small science" have long been uneasy with big, capital-intensive experiments like the Superconducting Super Collider (SSC). Now some of them are irritated as well as uneasy: They believe the accelerator enthusiasts, in their lobbying effort for the SSC, have been laying claim to achievements that properly belong to small science. They are particularly upset by a public assertion that magnetic resonance imaging (MRI) is a direct spinoff of advances at Fermilab and stands to benefit further from work on the SSC.

The dispute, which flared behind the scenes and in congressional testimony through much of the spring and summer, began when Deputy Energy Secretary Henson Moore testified on 16 April before the Senate Energy Subcommittee on Energy Research and Development. "Already, high-energy physics related to the SSC has had industrial applications" in MRI and other technologies, he said. Not so, replied Harvard University physicist Nicholaas Bloembergen, a Nobel Prize-winning pioneer in the development of MRI whose testimony followed Moore's. Bloembergen, who is also president of the American Physical Society (APS), said of MRI and several other technologies cited by Moore: "I can assure you that these are spinoffs of small-scale science and not of the SSC."

Three days after the hearing, the conflict escalated. In a weekly electronic newsletter for APS members, Robert Park, director of the APS's Washington office, called Moore's spinoff comments "ill advised." That drew a sharp response from Richard Carrigan Jr., who heads Fermilab's Office of Research and Technology Applications. In a letter to Park on 6 May, he labeled Park's comment "vexing." Though he granted that Moore may have overstated MRI's debt to accelerator physics, Carrigan maintained that MRI "rests on a multi-legged pedestal" that includes some of the fundamental physics, image reconstruction techniques, and advances in superconducting wires developed in the course of high-energy physics research.

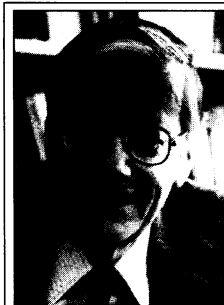
At that, Bloembergen re-entered the fray. In a fiery letter to Carrigan dated 21 May, he defended Park's "ill-advised" label for the MRI spinoff claim. "MRI would be alive and well today, even if Fermilab had never existed," thundered Bloembergen. "In the interest of the unity of physics...excessive claims by a particular subfield should be avoided. I hope that in the future the technical information that is permitted to filter to the top administrative echelons of the DOE is more carefully worded."

The behind-the-scenes dispute spilled out onto the floor of the House in the debate on the SSC held on 29 May. One skeptic, Dennis Eckart (D-OH), observed, "We have heard proponents tell us that the Superconducting Super Collider will cure everything except the heart-break of psoriasis. The fact of the matter is that the [SSC] will not make one person well in this country." Contention about the MRI claim sputtered on into the Senate debate on the SSC on 10 July. But the final word on MRI as a big-science spinoff came, according to some of

those present, the next day at a House Budget Committee task force meeting to set priorities for science funding. In testimony to the task force, Cornell University physicist Robert Richardson pointed out that MRI technology "is an outgrowth of research in many different disciplines"—the discovery of nuclear magnetic resonance at Harvard and Stanford Universities shortly after World War II; the development of methods for producing an image from nuclear magnetic resonance by Bloembergen and others; work by biochemists, doctors, mathematicians, and computer scientists; and 60 years of superconductivity development. Said Richardson: "it took an amazing number of research projects in many different research fields to produce this technology."

The dispute has now died down, but it may have deepened the skepticism that future spinoff claims for the SSC, the Space Station, and other big science projects will face in Congress. Rep. Jim Slattery (D-OH), an SSC opponent, calls for "a clearer understanding of what the spinoffs really are." In coming debates he and congressional colleagues trying to evaluate such claims will probably be getting more help from the research community. Says Richardson, "Scientists who know better should speak up." ■ **C. DAVID CHAFFEE**

C. David Chaffee is executive editor of Superconductor Week and Super Collider News, in Washington, D.C.



Bloembergen (left) and Carrigan.