Helium Find Thaws the Cold Fusion Trail

An unpublished finding that cold fusion experiments apparently created helium has rekindled debate about the still-unexplained and controversial phenomenon.

Two years ago, reports of nuclear reactions occurring at room temperature sparked scientific furor over the validity of the results and the ideas behind the findings, some of which could not be replicated and hinted at sloppy science (SN: 4/1/89, p.196; 4/8/90, p.212). Many researchers, the federal government and the public eventually became disenchanted, writing off the cold fusion phenomenon as a boondoggle best buried in the literature.

But not everyone gave up. And now, Navy and academic chemists say their results add weight to the claim that cold fusion can occur. In an article accepted last month for publication this spring in the JOURNAL OF ELECTROANALYTICAL CHEMISTRY AND INTERFACIAL ELECTROCHEMISTRY, the investigators report that they detected helium in gases released during cold fusion reactions. Experts have long sought to verify helium release because it is one possible product of cold fusion.

B.F. Bush and J.J. Lagowski of the University of Texas in Austin and Melvin H. Miles and G.S. Ostrom of the Naval Weapons Center in China Lake, Calif., say the helium levels they measured correlate roughly with the amount of heat generated by the fusion reaction.

"I would call this the most startling finding since that first announcement [of cold fusion] by Pons and Fleischmann," says Fritz Will, director of the National Cold Fusion Institute at the University of Utah in Salt Lake City. "If this stands up, it will be revolutionary."

Fusion occurs when the nuclei of two light atoms, such as hydrogen, merge to form a single heavy nucleus and release lots of energy – the same kind of energy that powers thermonuclear weapons and makes the sun shine. For their experiments, Bush and his co-workers ran an electrical current through heavy water containing a palladium rod. The flow of current causes the water to break into its hydrogen isotope and oxygen components. The hydrogen isotope, called deuterium, collects at the palladium electrode and compresses into the rod's crystal lattice structure. And there cold fusion supposedly occurs.

Skeptics argue that proof of fusion requires two pieces of evidence: excess heat and some fusion product. Too often, they say, such "products" turn out to be contaminants. For example, the helium that exists in air and other substances has thus far confounded researchers' efforts to show that cold fusion experiments have produced helium.

But Bush and Miles say they designed their experiment to prevent any contamination. This design, as well as control tests, makes them confident that the experiment generated the gas and that their results proved fusion occurred, they say. To detect the the helium, they used a sensitive analytical technique called mass spectrometry. "The results are rock solid," says Bush, who has studied air-sensitive materials for almost a decade and who now works at the Naval Weapons Center. "When excess heat was observed, helium was present. When there was no excess heat, helium was not present."

Those who believe in cold fusion are quite excited. "It's a world-turning experiment, a lollapalooza," says John O'M. Bockris, a physical chemist who has researched cold fusion at Texas A&M University in College Station.

Metallurgist Nathan J. Hoffman cautions, however, that the presence of helium doesn't necessarily guarantee that fusion has occurred. Helium can diffuse through glass or be trapped during rod formation and then released as the palladium cracks during or after exposure to electrical currents, says Hoffman, a cold fusion investigator at the Energy Department's Energy Technology Engineering Center in Canoga Park, Calif. But he adds: "The experiments they are doing are what needs to be done."

Other scientists question different aspects of the work. "It just violates all that we know about nuclear physics," says John R. Huizenga, a nuclear chemist at the University of Rochester in New York. He says the reported reaction produced too much heat for the amount of helium detected. "You have to have some sort of miracle to get that," Huizenga contends.

Then, too, according to accepted nuclear theory, fusion should yield one or a combination of three pairs of products: a helium isotope and neutrons, tritium and protons, and helium and gamma rays. Huizenga criticizes the new work because the scientists did not try to measure the release of gamma rays. In addition, he says, fusion usually generates much more of the first two pairs of products than of helium, yet the investigators detected no helium isotope. "When you have a pyramid of surprises, you have to wonder," he told SCIENCE NEWS.

On the other hand, a few theoreticians have suggested that cold fusion does not follow accepted fusion theory and that its major product could be helium, Will says. Miles says that dental film placed near the experimental apparatus was exposed during the reaction, possibly indicating the presence of gamma rays.

The researchers say they did everything they could to ensure the validity of their results. Bush built a two-stage activated charcoal cryofilter to remove deuterium and all other gases except helium, and did six control experiments with regular water after the team detected helium in experiments with deuterium. "They [other scientists] should be able to reproduce this work if they are careful enough," he says. "But the effluent gas has to be handled perfectly."

Hoffman agrees that the experimenters' approach is sound. He suggests, however, that the researchers reverse the order of the tests, using the heavy water after the regular water, and make sure all other conditions are the same. This reordering would eliminate the possibility that cracking of the rod – caused by shutting down the reaction – had released all the trapped helium so that none remained when they did the control experiments. *– E. Pennisi*

Alzheimer's drug fails panel review

Despite some favorable testimony, an advisory panel has decided against recommending that the FDA approve the marketing of an experimental Alzheimer's drug. In announcing its conclusion last week, the panel cited a lack of convincing scientific evidence demonstrating the efficacy and safety of the drug, known as tetrahydroaminoacridine (THA). The decision means the compound's manufacturer, Warner-Lambert Co., must gather additional data before it can win FDA approval of the controversial drug to treat a disease for which no drug therapy now exists.

This isn't the first time questions about THA have surfaced. Psychiatrist William K. Summers of Arcadia, Calif., launched the THA saga in November 1986 with a report of dramatic improvement in 12 Alzheimer's patients who had taken the drug for about a year. Although researchers hailed THA as a major treatment breakthrough at the time, a subsequent FDA probe revealed serious flaws in the study (SN: 2/2/91, p.70).

Now, two new studies – one conducted by U.S. researchers and the other by British scientists – add mixed results to the growing file on THA.

Officials at Warner-Lambert, which helped sponsor the trials, presented unpublished results from those studies at

last week's advisory panel meeting in Rockville, Md. Although measures of cognitive ability showed that THA provided some clinical benefit in both trials, another type of cognitive test revealed no improvements from THA compared with placebo. After deliberating for nearly 14 hours, the FDA panel decided the slight improvements seen on some tests did not outweigh the drug's small but potentially serious threat of liver damage (SN: 11/7/87, p.292).

In one of the studies, led by Kenneth L. Davis at the Mount Sinai School of Medicine in New York City, investigators at 16 U.S. clinical centers randomly assigned 112 Alzheimer's patients to placebo and 103 to THA. Neither the researchers nor the volunteers knew who got the active drug. After six weeks, the team found that people on THA, compared with placebo recipients, scored an average of three points higher on the Alzheimer's Disease Assessment Scale, a test measuring memory, language and other thinking abilities that progressively fail among victims of the disease. While this difference was small, the researchers call it significant.

However, THA's performance faltered on the Clinical Global Impression of Change, a test commonly used to gauge the general state of psychiatric patients, including thinking skills. Scrutiny of those scores revealed no difference between THA treatment and placebo.

In the British study, a 29-week trial involving 92 people with Alzheimer's, researchers led by Raymond Levy of the Institute of Psychiatry in London randomly assigned half the participants to a placebo and the remainder to THA plus lecithin, a substance thought to boost THA's efficacy. Halfway through the trial, they switched the two groups so that people on the placebo got the active drug and vice versa. Using a test called the Mini-Mental State Examination, the investigators discovered that 44 percent of the volunteers improved their scores by three or more points after treatment. Only 11 percent showed a similar rise in scores after receiving the placebo.

Despite the varying results measured on different cognitive tests, some clinicians say their own experience has convinced them of THA's promise. Nancy L. Earl, a neurologist at Duke University in Durham, N.C., told the FDA panel that some of her patients with Alzheimer's show enhanced cognitive abilities with THA treatment. "I know that I saw significant improvement in some patients at my site," she said.

But such testimony remains purely anecdotal, and the FDA remains unswayed. Officials at the agency want to see more hard data proving THA's potency and safety before granting Warner-Lambert the go-ahead to market this treatment to an estimated 4 million people in the United States who suffer from Alzheimer's disease. — *K.A. Fackelmann*

Low-level radiation: Higher long-term risk?

A new study of workers at a federal research laboratory strengthens the evidence linking cancer with long-term exposure to low levels of ionizing radiation.

Steve Wing, an epidemiologist at the University of North Carolina in Chapel Hill, headed the new study, which looked for statistical correlations between cause of death and the cumulative radiation exposures of nearly all white men hired by Oak Ridge (Tenn.) National Laboratory (ORNL) between 1943 and 1972. His team followed 8,318 men through 1984, by which time 18 percent had died.

The risk of dying from cancer increased by almost 5 percent for each rem of radiation exposure incurred over the course of employment at this Department of Energy (DOE) facility — at least a 10-fold greater risk than the Japanese atomic-bomb-survivor data would suggest, the researchers report in the March 20 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.

A previous analysis of the same ORNL population by several of Wing's coauthors failed to find a correlation between cancer risk and worker radiation exposures. Wing says his additional seven-year follow-up primarily explains the trend's emergence, and he suggests researchers should follow future populations longer than they have in the past.

Though the new analysis also identified a 63 percent higher leukemia death rate in the ORNL workers than in U.S. white males as a whole, leukemia risk did not increase consistently with radiation exposure, Wing notes. He speculates that exposure to some other toxic chemical may account for the high number of ORNL deaths from this disease.

The researchers also did not have smoking histories or the cause of death for some workers — factors that potentially weaken the findings, Wing says.

The new study took longer than usual to publish, Wing says, because its unexpected results prompted an in-depth review of his methods by DOE. Because the new results challenge a belief held by many epidemiologists — that low-level radiation does not cause cancer — "there was certainly a lot of concern about the findings," he says.

Such findings are not, however, unprecedented. In 1989, DOE provided the Senate Governmental Affairs Committee 14 studies reporting elevated cancer mortality rates among employees at nuclear facilities run by DOE and its predecessor agencies.

Epidemiologist Alice M. Stewart of the University of Birmingham in England says the findings by Wing's team resemble the increased cancer risks in radiation-exposed workers at DOE's Hanford facility in Richland, Wash., that she, Thomas F. Mancuso and George W. Kneale reported more than a decade ago (SN: 2/25/78, p.117).

Mancuso, a University of Pittsburgh epidemiologist, had worked under contract with the Atomic Energy Commission, one of DOE's predecessor agencies. Mancuso lost that contract in 1977 when he refused to support his contract officers' contention that the Hanford data showed no evidence for a cancer-radiation link (SN: 2/10/79, p.93).

Mancuso's dismissal is not the only case of DOE interference in epidemiologic studies of workers at its facilities. In the summer of 1989, the Senate Governmental Affairs Committee uncovered information showing that half of some 40 filing cabinets of ORNL workers' medical records in storage at Oak Ridge Associated Universities (ORAU) had been deliberately destroyed at some time after 1977, according to Robert Alvarez, a member of the committee's staff. The absence of these data could affect the statistical strength of the Wing team's study, Alvarez contends. (Although some of Wing's coauthors work at ORAU, Wing said he was unaware of the records' destruction.)

Finally, in February 1990, epidemiologist Gregg S. Wilkinson of the University of Texas in Galveston testified before a federal panel investigating DOE epidemiologic research that DOE officials pressured him not to publish findings linking cancer and exposure to plutonium at the Rocky Flats nuclear weapons plant outside Golden, Colo.

As these and other problems have come to light, many scientists and politicians have actively challenged DOE's objectivity in managing studies of its workers' health. On Jan. 8, responding in part to a 1989 hearing by the Senate's Governmental Affairs Committee, DOE agreed to turn over responsibility for worker-health studies to the Department of Health and Human Services.

"Complex Cleanup," a February report by the congressional Office of Technology Assessment, further recommends establishing independent federal investigatory teams to evaluate environmental health and safety at DOE defense facilities.

But because DOE will continue to control the kind of information researchers can collect, these measures represent only a partial solution, Alvarez contends. Researchers still have no way to ensure the accuracy and completeness of the information they receive from DOE, he notes.

In the past, DOE has been accused of attempting to cloak adverse worker-health impacts in "secrecy," acknowledged Paul L. Ziemer, the assistant DOE secretary for health and safety. At a March 19 press briefing on Wing's study, he said, "We're trying to make [such analyses] more open." — *W. Gibbons*