ESS backers are putting a brave face on the disappointing news. Peter Tindemans, chair of the ESS council, insists that the council's decision is actually a welcome sign. "There is broad support for neutrons, and I am certain the final assessment will be positive," he says. Others are less sanguine. ESS "is not dead in the water, but it certainly missed a major opportunity," says nuclear physicist Claus-Konrad Gelbke of Michigan State University in East Lansing.

The council's recommendations leave TESLA and other highly rated projects with one last hurdle: the German government's final decision on funding, which is expected in 2003. In contrast, Gelbke notes, ESS "is scrambling to get its feet on the ground."

–GRETCHEN VOGEL

BANGLADESH

Agricultural Pumping Linked to Arsenic

In Bangladesh, groundwater has been both a blessing and a curse. Irrigation wells have helped end deadly famines. Yet millions of other wells dug to provide safe drinking water are laced with arsenic from ancient sediments, endangering human health. Now one study suggests that pumping for irrigation might be at least partly to blame for the poisoned water, although the finding is controversial.

On page 1602, a team led by hydrologist Charles Harvey of the Massachusetts Institute of Technology concludes that agricultural pumping might influence the release of arsenic into drinking water. That could signal the need for deeper drinking-water wells. "This is really important" if true elsewhere in the country, says physical chemist Stephan Hug of the Swiss Federal Institute for Environmental Science and Technology (EAWAG) in Dübendorf. But Hug and other experts caution that the finding might not be broadly applicable.

Arsenic levels in some drinking-water wells are high enough to thicken and discolor skin and raise the risk of various cancers. One explanation for the presence of dissolved arsenic, suggested in the late 1990s, was that irrigation pumping lowered the water table, leading to oxidization of the arsenic-bearing pyrite. Researchers at the British Geological Survey and University College London (UCL) later disproved this idea. UCL researchers favor another geochemical mechanism: Organic material from buried peat has been reducing iron oxides and releasing arsenic into the water ever since the last ice age.

But Harvey suspected that irrigation must play a role. During the dry season, a tremendous amount of water is pumped from the ground; this water is later replaced by monsoonal rains and local surface water. The heightened circulation "clearly brings in and transports chemicals through the aquifer," Harvey explains. These compounds—say, carbon from sewage—could change water chemistry in a way that might trigger the release of arsenic from the sediments. To test the idea, he and colleagues at the Bangladesh University of Engineering and Technology in Dhaka and other institutions studied the groundwater chemistry in the Munshiganj District, outside Dhaka in southern Bangladesh, where many drinking-water wells are seriously contaminated.

The researchers drilled 15 new wells and then set out to alter groundwater chemistry as they suspect pumping does. In one case they injected water containing molasses, which is rich in organic carbon; arsenic levels increased substantially within days. Harvey suspects that the increase occurred because the organic carbon reduced and then dissolved the iron oxides that bear arsenic. In another experiment, injections of nitrate caused arsenic levels in the aquifer to plummet 80%, also within days. Nitrate oxidizes dissolved iron, Harvey explains, which then precipitates along with arsenic. The team believes that irrigation pumping might lower or raise arsenic levels by either mechanism, for example, by pulling in oxygenated water from sandy sediments or by drawing down organic carbon-rich water from ponds and channels.

CREDIT: C. HARVEY

Trigger. Irrigation pumping in Bangladesh can release arsenic into groundwater.

At the study site, the researchers believe that this latter mechanism has spiked the drinking water with arsenic. In the upper part of the aquifer, inorganic carbon and methane—byproducts of carbon-based reactions that liberate arsenic—are roughly 40 years old, about the same age as irrigation pumping. "The message is clear," comments Michael Berg, an environmental chemist at EAWAG. "If you pump a lot of

ScienceScope

Moving On Up A new NASA budget plan is good news for space station science and bad news for a next-generation space shuttle. The preliminary 5-year plan, presented to Congress last week, sets aside more money for biological and physical research on the orbiting laboratory. But it would also curtail work on a reusable spacecraft to replace the aging shuttle in favor of a more conventional small winged vehicle.

In the new scenario, NASA would fly five rather than four shuttle missions a year starting in 2006, allowing more research aboard both the shuttle and the station, and pump an additional $75 million into science payloads through 2007. Meanwhile, NASA would start work on the orbital space plane, which would ride aloft on an expendable launcher. The vehicle, which could be ready by 2010, would allow the station crew to accommodate seven astronauts rather than the current three, allowing more science to be done.

The plan won't cost more than NASA's current budget request, an important selling point for Congress. But some lawmakers want more information on crew size, the cost of research facilities, and shuttle maintenance. The last-minute request takes advantage of congressional inaction on NASA's 2003 budget.

Updates: Sonar and Fisheries Environmental groups challenging the deployment of a new U.S. Navy sonar have agreed to let the government conduct restricted tests. Last month, a federal judge in California blocked the Navy from testing the submarine-detection system in a 36-million-km^2 swath of the Pacific Ocean west of Hawaii, ruling that environmental regulators hadn't fully considered its impact on whales and other marine mammals (*Science*, 8 November, p. 1155). Under the deal reached last week, the Navy can run trials in a 2.5-million-km^2 slice of the contested region until next summer, when the judge expects to hear the full case.

In New England, conservationists, government officials, and the fishing industry last week asked a federal judge to delay imposing strict new catch limits pending resolution of the impact on population estimates of a misrigged research trawler (*Science*, 18 October, p. 515). Fishing groups claim that mismarked cables invalidated the estimates used to set new quotas, which are due to take effect next August. Government researchers disagree. Now, both sides want up to a year's delay to allow an independent review of the data.

Contributors: Michael Balter, David Malakoff, Andrew Lawler

groundwater in such areas, arsenic release can be triggered." He has observed a similar pattern in Vietnam.

Elsewhere in Bangladesh, however, other factors appear to be more important in releasing arsenic than irrigation pumping. Geochemist Alexander van Geen of the Lamont-Doherty Earth Observatory in Palisades, New York, and his colleagues have found high levels of arsenic in water that's more than 40 years old, suggesting that irrigation pumping hasn't been involved. And arsenic contamination is less of a problem in the northwestern part of the country, where much farm water is pumped, adds John MacArthur of UCL. Harvey chalks up the inconsistencies to different sediment chemistry and says that his study area in Munshiganj is typical of southern Bangladesh: "I see no reason why the same process can't happen in other places."

Arsenic levels at the study site begin to pass muster at about 160 meters, which suggests that deeper wells could reduce the arsenic problem. But that's an expensive option in one of the poorest countries in the world. Other near-term strategies include developing filtration techniques and trying to persuade villagers to switch to more distant shallow wells that are still safe.

–ERIK STOKSTAD

ENERGY RESEARCH

Industry Invests Big in Stanford Project

An international consortium of energy companies intends to pump up to $225 million over the next decade into a climate change and energy project led by Stanford University in Palo Alto, California. Researchers say they are stunned by the size and scope of the effort to study ways to reduce global warming, which will examine everything from carbon sequestration to the economics of substituting hydrogen fuel for oil, coal, and natural gas. "This is one of the grand challenges of the century," says Lynn Orr, a petroleum engineer at Stanford, who will lead the project.

Although energy companies have long funded academic research programs, the scale and structure of the effort are unprecedented. Stanford and industry officials say that the data derived from the effort will be publicly available and that an independent advisory board will help chart the project's direction. "Absolutely nothing is off the table; we want all areas addressed," says Frank Sprow, vice president for safety, health, and environment at ExxonMobil, which will provide the single largest chunk of funding. Even skeptics of industry welcome a broad research effort. "This is an acknowledgement that global warming is a problem they can no longer ignore," says Dan Lashof of the Natural Resources Defense Council in Washington, D.C.

ExxonMobil will contribute $100 million to the project, and General Electric and E.ON, an energy provider based in Düsseldorf, Germany, will provide $50 million each. Schlumberger, a global oil-drilling equipment company, will pitch in $25 million. University officials will be in charge of handing out $20 million during the project's first 3 years, roughly half to Stanford researchers and the remainder primarily to other academic scientists; company researchers are not eligible. The university will hold title to any patents, although the funding sponsors will have a short period to negotiate licenses before the discoveries are up for grabs. The first funding likely won't begin flowing until the end of next year.

The project grew out of discussions between Stanford and Schlumberger about geological sequestration, or the injecting of carbon into the ground to prevent its release in the atmosphere. "This could be a big operation, potentially almost the same size as the oil industry today," says Philippe Lacour-Gayet, a physicist and chief scientist at the Schlumber-Doll Research division of Schlumberger. The project's scope grew as other corporations became involved.

Orr says that the scientific and engineering agenda has yet to be finalized but that the focus will be on ways to lower greenhouse emissions in the short run while exploring how to convert the world's energy system to less polluting fuels and technologies. That includes cheaper methods of generating hydrogen, more efficient burning of hydrocarbons, and other alternatives ranging from solar to fusion energy.

Companies were attracted to Stanford because of its strengths in earth sciences and engineering and its tradition of interdisciplinary work, say industry representatives. Outside energy experts add that the university's stature should ease fears that the project will be tilted toward a hydrocarbon-biased approach. "If you wanted to buy a university to do your bidding, you wouldn't pick Stanford," says John Holdren, an environmental science and policy professor at Harvard University. Orr agrees: "We will never give up the right to decide what we work on. We're not at all concerned about undue influence."

ExxonMobil managers say they hope the research lessons can be applied to developing as well as developed countries. But Sprow adds that the project doesn't mean oil has no future. "This is a terrific opportunity to see if oil can be used in a way that's more benign," he says. Whatever turns up, Sprow and his consortium colleagues are betting big bucks that the research will help them cope with changes in their business as well as in the global environment.

–ANDREW LAWLER

CREDIT: BILL ROSS/CORBIS

Clearing the air? An oil-industry consortium hopes Stanford research on ameliorating global warming will also stimulate the next generation of energy production.

NATIONAL SCIENCE FOUNDATION

Congress OK's Budget Doubling, At Last

Some straightforward political horse-trading paved the way for the National Science Foundation (NSF) to achieve one of its most cherished goals last week: a congressional promise to double the agency's budget in 5 years.

Science lobbyists have spent years arguing that the recent ramp-up for the National Institutes of Health should be balanced by a similar boost for NSF. Last month Congress appeared ready to sign off on the idea as part of a reauthorization of NSF's programs, but then Senator Jon Kyl (R–AZ) applied a last-minute hold on the bill as it was about to go before the full Senate (*Science*, 25 October, p. 719). The real objection, however, came from the White House Office of Management and Budget (OMB), which felt that doubling was a crude budgeting tool and clashed with its efforts to hold down domestic spending. The parliamentary maneuver infuriated Senate Democrats, who complained that they had been blind-sided.

But House members who had passed a similar bill in June didn't give up. They spoke with OMB officials, who quickly offered a compromise: a 5-year bill that made the last 2 years contingent on a review by OMB of NSF's progress in meeting a series of management goals that are part of a presidential good-