Green light for laser uranium enrichment

A laser technique for separating uranium isotopes to produce enriched uranium is the Department of Energy's choice for large-scale testing as a candidate to replace the current gaseous diffusion process. The decision means that over the next eight years more than $500 million in research and development funds will go into "atomic vapor laser isotope separation" rather than into either of two other competing approaches. This separation process, developed at the Lawrence Livermore National Laboratory in Livermore, Calif., is potentially the most economical method for uranium enrichment, according to a recent, seven-month evaluation of the three processes.

The other two processes are the "plasma separation process," developed by TRW, Inc., of Redondo Beach, Calif., and the "molecular laser isotope separation process," developed at the Los Alamos National Laboratory in New Mexico.

James I. Davis, Livermore project leader, says, "Current gaseous diffusion plants consume a lot of electric power. The idea of displacing those plants and freeing that electric power for other uses is a big benefit."

In the atomic vapor process, an electron beam vaporizes uranium metal. The vapor, consisting of two uranium isotopes, U-235 and U-238, flows into a collector where a finely tuned laser beam ionizes U-235 atoms, but not U-238 atoms. An electromagnetic pulse kicks the ionized atoms onto a collector plate. The process is designed to raise the amount of U-235 present from 0.7 percent by weight in natural uranium to the 3 percent level needed for use as light-water nuclear reactor fuel.

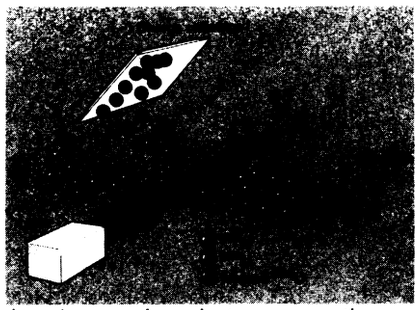
The researchers chose high-power copper-vapor lasers, which radiate green and yellow light, for the system. Because these frequencies of light are not the proper frequencies for efficient ionization, the copper lasers, in turn, pump light into a dye laser, which can be tuned to the correct frequencies. "One of the important factors in this process was a proof that we could generate and control these very precise frequencies and to have extremely efficient ionization," says Davis. This was accomplished during the last year.

The evaluation board rated each of the competing processes on the basis of proposed designs for a development module and a production plant, expected process performance and risk, relative economic potential and overall program management capabilities. Although the Livermore process was the clear winner, the board raised questions about some aspects of the design, particularly about thermal control in the vaporization stage. Despite these problems, Davis says, "There wasn't any question about it working in the long term. The questions were details of design."

The Energy Department is planning to continue funding some aspects of the plasma separation process research, at a reduced level, in order to make use of a new superconducting magnet now operating at the TRW facility. This research may lead to other applications for the method. At Los Alamos, the research group will disband, but there is some hope that the method developed there may have value in separating plutonium isotopes.

The Livermore group's immediate concern is to gather all the data necessary and to refine the design to overcome the shortcomings in order to proceed with the pilot plant. A quarter-scale facility is under construction at Livermore. This will provide design information for the full-scale plant, which will probably be built at Oak Ridge, Tenn.

Meanwhile, the Energy Department is funding an advanced gas centrifuge technique for enriching uranium. By 1990, both the gas centrifuge and laser separation experimental facilities should be in full swing, and the department then will decide which technique it believes is ultimately more efficient and economical.



Lawrence Livermore National Laboratory

Atomic vapor laser isotope separation.

Davis says, "One of our real excitements in this is that we'll get this laser technology up to sufficient scale that it can be considered for broader commercial and industrial applications. Very few companies can afford the kind of technology investment dollars that we will be getting here out of this program."

Davis's chief concern is that the project will not get sufficient funding to meet the schedule and objectives. Davis says, "The physics of the project is somewhat sophisticated; the individual pieces of technology are not that sophisticated, but there are lots of them." —*I. Peterson*

EPA may weaken carbon monoxide rules

The Environmental Protection Agency plans to relax national ambient air quality standards for carbon monoxide, according to two agency documents made public last week. The documents — a proposed final rule and memorandum to EPA Administrator Anne Gorsuch urging adoption of the rule — outline a plan to increase from one to five the number of days that the current CO standard — 9 parts per million averaged over eight hours — may be exceeded every year. This would be equivalent to raising the standard from 9 to 12 ppm, states the EPA memorandum.

"By burying this relaxation in the jargon of exceedances, the ultimate result — the effective average increase in the CO standard by 33 percent—is less apparent," charged Rep. Ron Wyden (D-Ore.) at the May 5 press conference, sponsored by four members of Congress and representatives of the American Heart Association, American Lung Association and American Public Health Association.

Carbon monoxide, a colorless, odorless gas emitted by all automobiles and trucks, is harmful to human health because it binds easily with the blood's hemoglobin, displacing oxygen in the process. It is particularly dangerous for people suffering from cardiovascular disease because it limits the amount of oxygen reaching the heart muscle. If enacted, the EPA proposal will result in "more pain and physical restriction" for 7.7 million Americans with heart disease, said Kevin Cooper, a Medical College of Virginia physician speaking on behalf of the public health organizations at the press conference.

Terry F. Yosie, acting director of EPA's Science Advisory Board, disagrees. He says that the proposal would result in maximum blood carboxyhemoglobin (COHb) levels no higher than 2.5 percent. In 1980, EPA's Clean Air Scientific Advisory Committee concluded that COHb levels were not critical until they reached between 2.7 and 2.9 percent. "The proposal still incorporates a 0.2 percent margin of safety," Yosie told SCIENCE NEWS.

However, "EPA is openly ignoring the most recent studies on the health impacts of CO," said Rep. Timothy Wirth (D-Colo.). He referred specifically to a 1979 study (funded by EPA and published in the AMERICAN HEART JOURNAL in 1981) by Wilbert Aronow of the University of California, showing that COHb levels of just 2 percent produce observable symptoms in heart disease sufferers. These are far lower symptom levels than any previous studies have shown.

EPA has made no decision on the proposal yet, emphasizes Yosie. "This is a draft and it is not official." Even if Gorsuch approves the rule, however, it may not be enacted immediately. While a 1980 first draft of the CO standard update was released for public comment, a change in the number of exceedances allowed was not mentioned in it. "This is the most significant part of the proposal," says David Doniger of the Natural Resources Defense Council. "If it goes through without being aired for public comment, EPA will find itself facing some lawsuits." —*L. Tangley*