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URANIUM ENRICHMENT

GAO's Views on DOE's New Laser Enrichment Technology--AVLIS

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Before the
Subcommittee on Energy Research and Development
Committee on Science, Space, and Technology
House of Representatives

Madam Chairman and Members of the Subcommittee:

We are pleased to present our views on the Department of Energy's (DOE) program to develop a new uranium enrichment technology--the atomic vapor laser isotope separation process (AVLIS). Our views are drawn from GAO's ongoing review of AVLIS, in which we are looking at the technical, program, and market issues that need to be addressed before an AVLIS plant is built.

DOE's January 1990 AVLIS demonstration and deployment plan outlined DOE's efforts to (1) demonstrate the technology by September 1992; (2) begin construction in 1993, if the Congress authorizes building a plant; and (3) have an AVLIS plant begin enriching uranium by 1997. However, the administration's recently proposed 1992 budget anticipates that a new government enrichment corporation and/or the private sector, not DOE, will build the AVLIS plant. Therefore, the budget provides funds for completing the demonstration of the AVLIS technology but does not contemplate funding program activities, such as site selection, that must be completed before a plant can be built.

In summary, we identified a number of steps that must be completed before an AVLIS plant can be built.

-- The AVLIS process must be adequately demonstrated with full-scale equipment and convincing cost projections must be developed. In addition, the processes for efficiently

integrating an AVLIS plant, which will use and produce uranium metal, with existing nuclear fuel companies, which use uranium gas, must be demonstrated. If DOE's demonstration ends in 1992 as planned, several unanswered technical questions will prevent DOE from completing a definitive cost analysis, which the government corporation or a private company will need before it decides whether or not to invest in a plant.

-- Program activities, such as selecting a site and completing the plant licensing process, that must be completed before a plant is built, could take many years. Accordingly, a new government corporation, if and when it is formed, would have to complete these activities before building a plant.

-- A market analysis that updates and expands DOE's existing analysis should be completed before any decision is made about building an AVLIS plant. Such an analysis needs to consider the impact of possible new nuclear plants and competitors' sales strategies.

Completion of the demonstration project is needed to keep future AVLIS deployment options, such as construction by a new government corporation or a technology transfer agreement with a private company, open. The technical and related cost and market information developed by completing the demonstration would enhance

a new government corporation's ability to deploy AVLIS in a timely and efficient manner and assist private investors in making sound decisions about building a commercially viable plant. However, the Congress should recognize that DOE will not be able to completely address all remaining deployment issues by the end of 1992.

Before I discuss these issues in more detail, I will briefly describe DOE's current enrichment program and the AVLIS technology.

BACKGROUND

Since 1969, the federal government has enriched uranium for use as fuel in commercial nuclear power reactors at gaseous diffusion plants, built in the 1940s and 1950s for defense purposes. Currently, DOE's program faces financial difficulties caused by growing competition from foreign suppliers and many other problems, such as the need to clean up the plants to meet environmental requirements and the need to collect funds to decommission the plants when they are no longer needed.

In 1973, DOE's Lawrence Livermore National Laboratory began conducting research on AVLIS. An AVLIS plant will enrich uranium for commercial reactors using (1) lasers that charge the specific uranium atoms needed to sustain nuclear reactions and (2) separators that vaporize natural uranium metal and then collect the

charged atoms on electromagnetic plates. Subsequently, the enriched metal will be processed and shipped to nuclear fuel companies, that will fabricate it into reactor fuel.

In 1985, DOE decided that an AVLIS plant would eventually replace its energy intensive gaseous diffusion plants because the agency expected an AVLIS plant to produce enriched uranium at less than half the cost of the existing plants--perhaps, as low as $25 per production unit, compared to DOE's current cost of about $70 to $80 per unit. However, DOE will have to continue operating part of one diffusion plant even if an AVLIS plant is built, because the AVLIS plant, as currently designed, would not be able to produce the highly enriched uranium needed for defense purposes. DOE officials believe that its two operating gaseous diffusion plants can continue to operate for 20 or more years.

For the past several years, the administration has proposed and GAO has supported the creation of a government corporation that would assume responsibility for the DOE enrichment program, including AVLIS. DOE officials believe that a government corporation would better manage the existing program in a competitive market. They also believe that a government corporation is a necessary first step toward the long-term goal of transferring the program to the private sector. Under the administration's proposal, the new corporation would take over DOE's operating enrichment plants and be responsible for supplying

enriched uranium for defense needs, as well as DOE's commercial customers.

A NUMBER OF TECHNICAL PROBLEMS MUST BE ADDRESSED TO REDUCE AVLIS COST UNCERTAINTIES

The Lawrence Livermore Laboratory has effectively demonstrated the AVLIS technology using laboratory-scale equipment and independent technical experts hired by DOE to critique the AVLIS program believe that DOE's ongoing demonstration program will also prove that the technology works using full-scale equipment. However, those same experts agree that the demonstration will not provide definitive cost information by 1992, as originally anticipated in DOE's 1990 demonstration plan, because some remaining technical issues could have significant cost implications. For example, although the Lawrence Livermore Laboratory is continually improving laser performance, DOE does not expect to develop or operate by 1992, lasers that are as powerful and efficient as those projected for use in the AVLIS plant. Laser efficiency is a key cost element for an AVLIS plant. Further, the demonstration program will not actually enrich uranium until mid-1992. This will not provide enough time to operate the full-scale separators long enough to determine optimal materials and maintenance requirements before the scheduled end of the demonstration project.

In addition, questions about how an AVLIS plant will be integrated with existing nuclear fuel companies will remain at the end of 1992. Existing fuel cycle companies currently convert uranium ore to a gas feed for DOE's existing enrichment plants and then fabricate enriched uranium gas produced by DOE's plants into fuel for nuclear utilities. Because the AVLIS plant will use uranium metal as a feed and also produce enriched uranium in a metal form, changes to the fuel cycle will be needed to accommodate an AVLIS plant. Although DOE did not begin to coordinate with fuel cycle companies until after 1985, it has identified processes it believes will allow the plant to effectively interact with existing fuel cycle companies. However, DOE will not have demonstrated these processes by 1992, nor will it have decided if and how it will transfer these processes to the private sector.

PROGRAM ISSUES NEED TO BE COMPLETED BEFORE AN AVLIS PLANT CAN BE BUILT

Our review also showed that a number of program activities that must be addressed before a plant is built may take a considerable amount of time. These program activities include selecting a plant site; completing a Nuclear Regulatory Commission (NRC) license review; and establishing an industrial access program to encourage private companies to participate in the program, with the objective of obtaining expertise for deploying the technology in a commercial plant. In particular, the process for the NRC license review could be very time-consuming. NRC has not yet

planned to direct any resources to an AVLIS license review. Further, according to NRC staff, such a review could take much longer than the 2 years DOE's plan anticipated, because very little data exists on the unique, new AVLIS technology. DOE officials also told us that selecting a site and preparing the required environmental impact statement may prove controversial and time-consuming.

Under its 1992 budget, DOE plans to cease all program activities for a future AVLIS plant. Accordingly, a government corporation, if and when it is formed, would have to complete them before building a plant.

MARKET CONDITIONS CLOUD THE FUTURE OF AVLIS

The current enrichment market is different from the one that existed when laser separation research began in 1973. Today, annual production capacity in Western countries exceeds demand by about 25 percent, and, if production by the Soviet Union is included, capacity exceeds demand by over 60 percent. In addition, only a few countries are building new nuclear power plants, and some energy experts do not expect any new U.S. plants to be completed until after the year 2010.

An updated and expanded analysis of the enrichment market will be needed to lay out the advantages and disadvantages of

building an AVLIS plant in order to attract private investors. Initial market analyses of a future AVLIS plant have had mixed results. The Lawrence Livermore National Laboratory reports that an AVLIS plant would save the current program $500 million to $800 million per year because of reduced production costs; therefore, the Laboratory has concluded that an AVLIS plant should be built as soon as possible. However, DOE's independent technical experts and others believe that the laboratory's estimates of $25 per production unit and $1 billion for construction are probably too low; further, the Laboratory's analyses did not consider dynamic market factors such as a continuing aggressive sales strategy by the Soviet Union. (Over the past several years, the Soviet Union has penetrated the U.S. market by offering enrichment services at less than half the cost of DOE's current $117 price.) DOE's initial market analyses that consider these factors suggest that under some conditions, an AVLIS plant would not increase sales enough to recover construction costs.

Further, the longer an AVLIS plant is delayed, the more a complete market analysis will have to consider the demand from future nuclear power plants to recover costs. New nuclear plants may or may not be built depending on how the nation resolves a growing demand for electricity and the environmental problems associated with coal- and gas-fired plants. However, DOE believes that lead time will be adequate to satisfy future enrichment demand. DOE estimates an AVLIS plant could be built in 4 to 5

years after needed program activities are completed, while, historically, building a commercial nuclear power plant has taken at least 8 to 10 years.

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In summary, we believe that completing the demonstration project would provide important information about the technical viability and cost of the plant and keep future AVLIS deployment options open. Completing the demonstration project would also reduce construction delays and increase the probability of private financing. Further, if the private sector supports the plant, DOE is more likely to reap a return on its past investment in AVLIS. However, the Congress should recognize that DOE may not be able to completely address all technical issues by the end of 1992, and a new government corporation, if formed, would have to complete program activities before building a plant.

We also note that the future of AVLIS cannot be debated separately from existing legislative attempts to restructure DOE's uranium enrichment program as a government corporation. We have long supported such legislation, which we believe would allow the program to be better managed in a competitive market. We also support DOE's goal to transfer AVLIS to a government corporation. This would require the new corporation to convince private financiers, instead of the Congress, to invest in AVLIS, which

would reduce the government's risk and help ensure that the decision to build an AVLIS plant is based on commercial concerns.

We hope our views and suggestions are useful to you. We would be pleased to respond to any questions you or other Members of the Subcommittee may have.