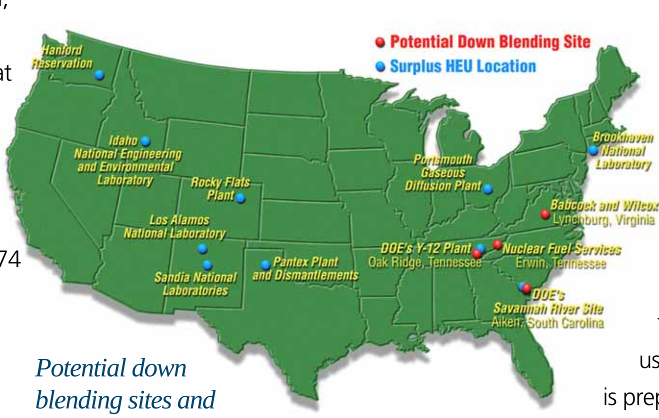
CITB OAK RIDGE

VOL. 3, NO. 2 APRIL 2002

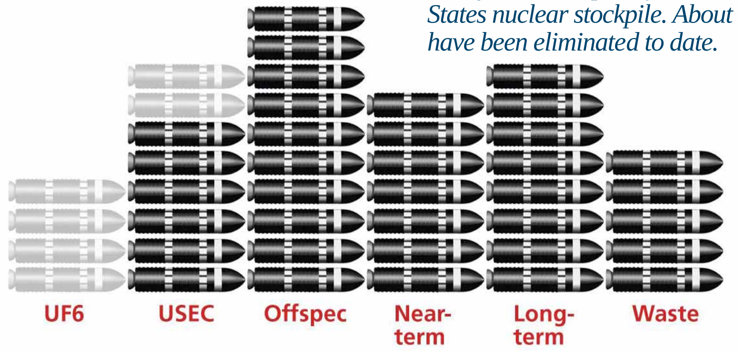
The U.S. Surplus Highly Enriched Uranium Disposition Program

The end of the Cold War left a legacy of weapons-capable fissile material in the United States. As a commitment to nonproliferation, on March 1, 1995, the President announced that approximately 200 metric tons of fissile material was excess to national security needs. Of this, approximately 174 metric tons was highly enriched uranium (HEU) that could theoretically produce nearly 4,300 nuclear warheads. However, by down blending that HEU to low-enriched uranium (LEU), we could use this material to produce enough electricity for every household in the United States for a full year. Congress asked the U.S. Department of Energy (DOE) Office of Fissile Materials Disposition (NA-26) to oversee the disposition of the surplus fissile material, and, in 1997, DOE established the Highly Enriched Uranium Disposition Program Office at the Oak Ridge Y-12 National Security Complex and gave it primary responsibility for planning and coordinating activities necessary to ensure the timely disposition of the excess HEU.



Potential down blending sites and surplus HEU locations

The purpose of the HEU disposition program is to make surplus HEU unusable for weapons and to dispose of it in a safe, secure, and environmentally acceptable manner. Because of the huge amount of recoverable energy stored in the HEU and its great economic value, DOE plans to convert approximately 85% (more than 155 MTU) of the surplus HEU to commercial or research reactor fuel. The remaining 15% of the surplus HEU is not usable for commercial-grade fuel and will be disposed of as waste.



The HEU Disposition Program will forever remove uranium equivalent to nearly 4300 weapons from the United States nuclear stockpile. About 600 have been eliminated to date.

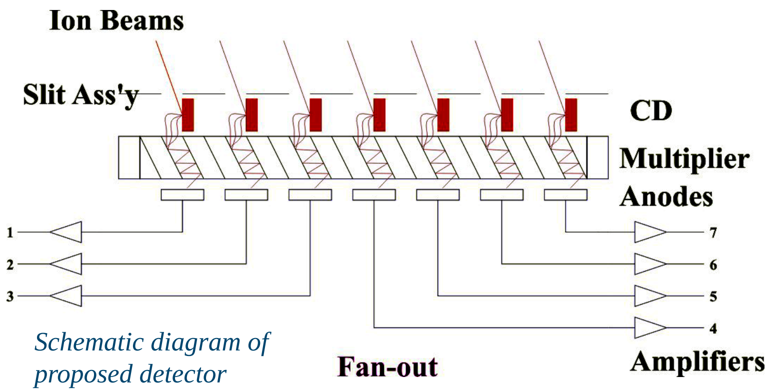
Because the surplus HEU exists in a variety of forms at 10 DOE sites across the United states and the schedule for weapons dismantlement and site cleanup operations is limited, disposition is taking place over an extended period. A substantial quantity of the HEU has already been converted to LEU reactor fuel. The remainder will be converted over the next several years. Fourteen metric tons of uranium in the form of highly enriched UF_6 have already been transferred to the United States Enrichment Corporation (USEC), and an additional 50 MTU are expected to be transferred over the next few years, pursuant to the USEC Privatization Act. An additional 30 to 40 MTU of off-specification material, not suitable for sale on the open market, will be transferred to the Tennessee Valley Authority for use in reactors through 2006. In the meantime, DOE is preparing detailed plans for the disposal of the remaining surplus HEU.

In the plans for down blending and disposal of this material, DOE is also aware of the potential this material has to affect the commercial uranium market in the United States. This is another reason the program work is being spread out over many years. Before any material can reach the commercial market, the Secretary of Energy must determine that its sale would not cause a significant disruption in the U.S. uranium market.

DOE Grand Challenge in Mass Spectrometry

Grand Challenges issued by the U.S. Department of Energy (DOE) are marked by two consistent traits: a tremendous payoff for success and a high risk of failure. The mass spectrometry Grand Challenge, issued in 1999 by NN-20 (now NA-22), called for development of the next-generation mass spectrometer detector. Mass spectrometers are hugely expensive instruments used to measure isotope ratios; in fact, they are the only instruments that can provide isotope ratio measurement on elements such as uranium and plutonium. Present detectors can only detect a small portion of the mass spectrometer's signal at one time, have to be replaced about once per year, and need to be adjusted continually. Because DOE's national laboratories make more isotope ratio measurements than the rest of world combined, the payoff for a better detector would be huge, even if it were limited to DOE.

Peter Todd of Oak Ridge National Laboratory (ORNL) and Jane Poths of Los Alamos National Laboratory proposed to construct a detector (see figure) that would measure most of the mass spectrometer's signals simultaneously, be approximately 100X more sensitive, about 100X faster than those currently used, and operate at least 10 years. Most importantly, the design of the electronics and multiplier would be integrated, an approach never taken before.



Schematic diagram of proposed detector

Almost two years into the project, the prototype electronics designed and fabricated at ORNL are in operation. With these electronics, up to eight ion beams can be measured simultaneously and completely independently. For the first time, the abundance of all the isotopes of a given element can be measured simultaneously, more rapidly, and with better precision. Moreover, the capability to measure the mass-separated ion beams in a mass spectrometer has widespread applicability to other types of mass spectral analyses because it allows analysis of two or more components simultaneously. According to Gary Heifje of Indiana University, this detector will lead to a new paradigm for all inorganic analyses by mass spectrometry.

The Institute of Materials Management (INMM)
announces its 43rd annual meeting June 23–27, 2002, Renaissance Orlando
Orlando, Florida, U.S.A.
http://www.inmm.org

Director's Note

The Center for International Threat Reduction (CITR) creates new opportunities for growth and development of nonproliferation work. Through our research and development expertise at the Oak Ridge National Laboratory, we support fuel cycle technology, sensor development, instrumentation, reactor operations, uranium enrichment technology, reprocessing technology, plutonium processing, and mass spectrometry technology. At the Y-12 National Security Complex, we provide precision machining, dimensional inspection, uranium processing and storage, special materials processing, and material accountability, control, and security. With the emphasis on homeland security and nonproliferation, we see opportunities for growth in biological weapons convention, chemical weapons convention, plutonium production reactors agreement, highly enriched uranium disposition, and other Department of Defense threat-reduction efforts.

— Robin White

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