U.S. House of Representatives
Committee on Science & Technology
Subcommittee on Investigations & Oversight

HEARING CHARTER

Caught by Surprise:
Causes and Consequences of the Helium-3 Supply Crisis

Thursday, April 22, 2010
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

Purpose

The Subcommittee on Investigations and Oversight meets on April 22, 2010, to examine the causes and consequences of the Helium-3 supply crisis. Helium-3 (He-3) is a rare, non-radioactive gas that has been produced in both the United States and Russia as a by-product of nuclear weapons development. Tritium, which helps boost the yield of nuclear weapons, decays into Helium-3 gas after approximately 12 ½ years. The gas was produced as a consequence of tritium production by the defense programs of the Department of Energy (DOE). As a valuable commodity, it was packaged, managed and sold through DOE's Isotope Program in the Office of Nuclear Energy (though the Isotope program was moved to the Office of Science in a reorganization during FY2009).

Background

Helium-3 has wide-ranging applications as a neutron detector for nuclear safeguards, nonproliferation and homeland security purposes because it is able to detect neutron-emitting radioactive isotopes, such as plutonium, a key ingredient in certain types of nuclear weapons. Currently, almost 80 percent of its use is for safeguards and security purposes worldwide. It is also broadly used in cryogenics, including low-temperature physics; quantum computing; neutron scattering facilities; oil and gas exploration; lasers; gyroscopes; and medical lung imaging research.

During the Cold War, the U.S. had a steady supply of He-3 gas resulting from weapons production, but tritium production was halted in 1988. In the wake of the 9/11 terrorist attacks, however, the desire for radiation portal monitors and other nuclear detection equipment exploded. The Department of Homeland Security, for example, initiated a program to install more than 1,400 radiation portal monitors at ports and border crossings and also to supply smaller detectors to state and local governments. This enormous new demand came just as the available supply of Helium-3 was diminishing because of a reduction in nuclear weapons production. By early 2009, the total demand for helium was over 213,000 liters, and the supply was 45,000 liters.

The Department of Energy is the sole U.S. supplier of He-3 as part of its management of the nuclear weapons stockpile. They are also a key consumer of the gas because of their nuclear weapons detection program (the DOE Megaports and Second Line of Defense programs distribute PVT radiation portal monitors and other smaller detectors to nations around the world) and because of their support for spallation neutron sources. As the key supplier of He-3, as well as a consumer of the gas and a partner with agencies such as DHS and DOD in nuclear security, DOE was in a position to see the disconnect between an expanding demand and a declining supply. However, DOE failed to see the problem until the He-3 stockpile was nearly expended. This guaranteed that the He-3 shortage would become a crisis, rather than a smoothly managed transition to conserving and allocating supply to the highest use and obtaining alternative technologies.

It wasn't until late in 2008 that the Helium-3 supply shortage began to be identified as an issue by DOE when DNDO suppliers of He3 and other non-safeguards users could not obtain enough He-3 for their work. The last major allocation of He-3 had occurred in 2008 when DOE set aside 35,000 liters for the Spallation Neutron Source, an advanced neutron science research center at DOE's Oak Ridge National Laboratory in Tennessee which the Department spent over $1 billion to construct.

By January of 2009, an inter-agency phone conference between DNDO and DOE occurred in which DOE established restrictions on the use of He-3. DNDO agreed to develop priorities for He-3 use and initiate a working group on the issue; DOE said it would start investigating alternatives. In the wake of that meeting, an interagency task force developed with participation by DNDO, DOE and the Department of Defense. That task force first met in March 2009. In the discussion that ensued, total annual government and non-governmental demand for FY2009 was projected as in excess of 213,000 liters. The total available stockpile was, at that time, just 45,000 liters. Out years show similar levels of demand while annual production was projected at 8,000 liters. As an appreciation of the scope of the problem developed among the key participants, other agencies were invited to participate. Work quickly began on allocation of He-3 for FY 09 and 10, research on alternatives and investigation of possible sources of additional He-3, such as obtaining tritium from Candu reactors in Canada, Argentina and other countries to harvest He-3 and recycling and re-use of existing He-3. The entire process was "elevated" to the National Security Council when the DOD staffer heading up their He-3 effort was detailed to the NSC.

This process continued under the new Interagency Policy Committee (IPC), chaired by staff at the NSC. The Subcommittee has been told that allocation decisions for 2010 have been completed; the gas is now being processed and will soon be provided to those who have been approved to receive it.

Impact of the Shortage

The domestic and global impact has been profound. The per-liter He-3 have skyrocketed from $200 to in excess of $2,000 per liter. (The Subcommittee has been told of one sale of Russian He-3 to a German firm at a price of $5,700 a liter.) The U.S. has essentially halted all exports of Helium-3 gas, and recently told the International Atomic Energy Agency (IAEA) that they will no longer be able to rely solely on the U.S. to provide them with He-3 gas for use in non-proliferation enforcement and verification actions. The Canadian government had to receive special permission from the U.S. prior to the Vancouver Olympics to permit the export of a He-3 mobile neutron detector for use at the Olympic Games.

For neutron scattering facilities that require tremendous amounts of Helium-3 gas, the situation is very grim. At least 15 of these multi-billion dollar research facilities are being or have been built in at least eight countries, including the U.S., United Kingdom, France, Germany, Switzerland, Japan, South Korea and China. By 2015, these facilities will require over 100,000 liters of He-3 gas, according to estimates provided to the Subcommittee. Most of those needs are unlikely to be met. There have been several international meetings of scientists discussing possible alternatives to He-3 for spallation neutron detection, but the research is in the very early stages.

Within the U.S. government, no program appears to have been more significantly affected than the Domestic Nuclear Detection Office's (DNDO's) Advanced Spectroscopic Portal (ASP) radiation monitor program, which relies on He-3 as its neutron detection source. The scale and scope of the Helium-3 crisis, however, and its impact on the ASP program in particular was not clearly known outside the government until the Investigations & Oversight Subcommittee held its second hearing on the ASP program on November 17, 2009. During that hearing, Dr. William Hagan, acting director of DNDO, testified that the Interagency Policy Committee had decided in September 2009 that He-3 would not be used radiation portal monitors. This was the first time the Subcommittee and the public were informed of the extent of the Helium-3 crisis. Surprisingly, even Raytheon, DNDO's prime contractor on the ASP program, did not become aware that a decision had been made to halt the supply of Helium-3 gas for their radiation portal monitors until they heard Dr. Hagan's testimony.

Summary

The shortage of He-3 was an inevitable consequence of a declining source from the U.S. nuclear weapons enterprise and a growing demand. However, the crisis and its jarring impacts were avoidable. With foresight on the part of DOE, the kinds of prioritization efforts now happening through the IPC could have started years ago. Research into alternatives to He-3 could have been well along to success, with some areas (such as portal monitor systems) lending themselves to alternatives more readily than others (cryogenics). In short, the stockpile could have been managed in a way that allowed for non-disruptive impacts to industry, researchers and the national security community. Instead, everyone is surprised and scrambling to identify alternatives, suspending their research and their production lines while hoping that a breakthrough in sources of He-3 or alternatives to He-3 happens very, very rapidly. The failure to manage the stockpile with an eye to demand, supply and future needs has had real consequences for many, many fields. Once the shortage became clear to all the key agencies, an interagency process that has laid out a rational guide to allocation and policies has emerged very quickly and appears to be well managed.

Witnesses

Panel I

Dr. William Hagan, *Acting Director, Domestic Nuclear Detection Office (DNDO), Department of Homeland Security (DHS)*

Dr. William Brinkman, *Director of the Office of Science, Department of Energy (DOE)*
(Dr. Brinkman will be accompanied by **Dr. Steven Aoki**, *Deputy Undersecretary of Energy for Counterterrorism and a Member of the White House He-3 Interagency Policy Committee (IPC) Steering Committee*.)

Panel II

Mr. Tom Anderson, *Product Manager, Reuter-Stokes Radiation Measurement Solutions, GE Energy*

Mr. Richard L. Arsenault, *Director of Health, Safety, Security and Environment, ThruBit LLC*

Dr. William Halperin, *John Evans Professor of Physics, Department of Physics, Northwestern University*

Dr. Jason C. Woods, *Assistant Professor, Radiology, Mallinckrodt Institute of Radiology, Biomedical MR Laboratory, Washington University in St. Louis and Program Director, Hyperpolarized Media MR Study Group, International Society for Magnetic Resonance in Medicine (ISMRM)*