He-4 Status and Perspectives at OSTP

Dr. Gerald C. Blazey

Assistant Director for Physical Sciences

Office of Science and Technology Policy

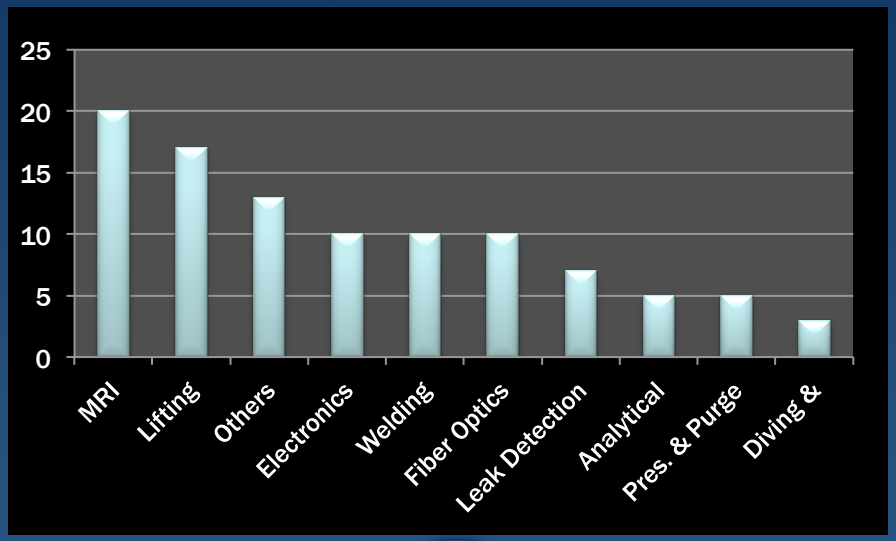
Executive Office of the President

2nd Workshop on Isotope Federal Supply and Demand

September 19, 2013

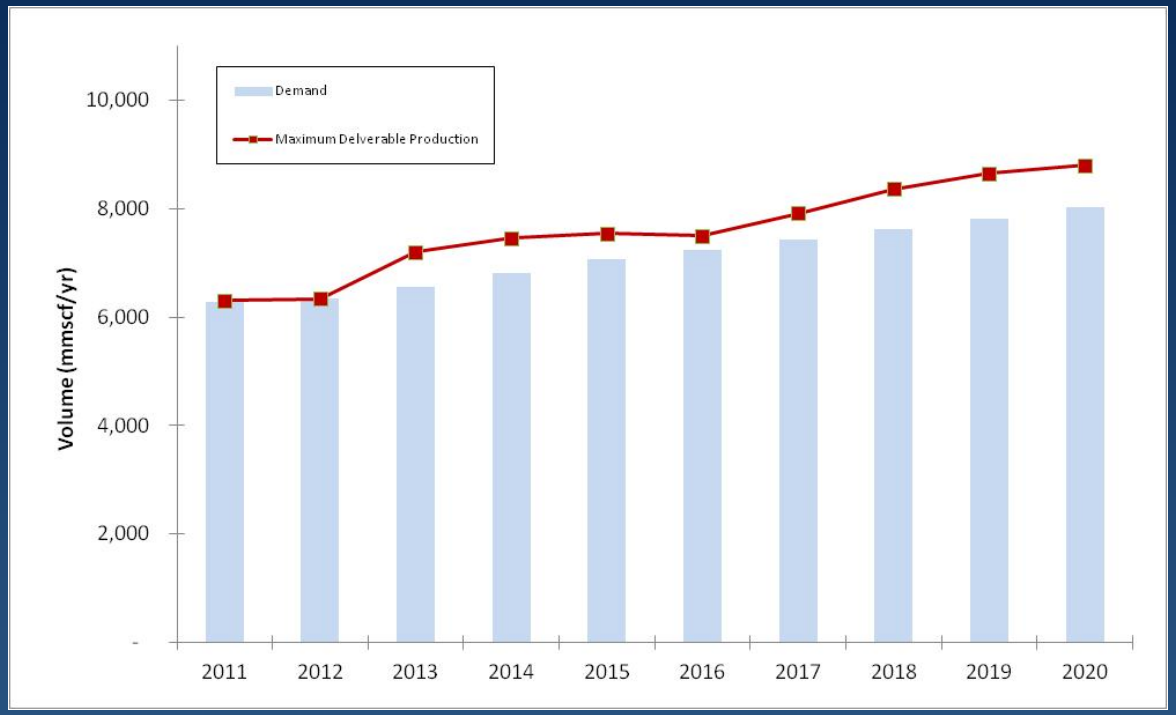
Helium-4 Origins and Uses

- Source(s)
  - Radioactive decay product trapped in natural gas.
  - Highly enriched wells carry a few percent, typically tenths of a percent.
  - First discovered in USA in 1904 in Dexter, KS
  - Extracted commercially by low-temperature fractional distillation.
  - U.S., Algeria, Qatar, Russian, Australia, Poland
- Uses



Helium-4 Supply and Demand Projections

- He-4 supply has been tight for a number of years, recently exacerbated by wildfires, low demand for natural gas, and slow commissioning of new production facilities.
- Market is relatively small, but complicated (much more on that!).
- Can expect future tight supplies since there is little excess capacity.



- Plot courtesy of J.R. Campbell & Associates, Industry Consultants

Some Helium History: The Federal Role

- Federal Helium Reserve
  - In 1925 Congress created a Federal Helium Program to ensure that helium would be available to the government for defense needs.
  - The Bureau of Mines constructed/operated a large helium extraction and purification plant north of Amarillo, Texas, went into operation in 1929.
  - From 1929 to 1960 the Federal government was the only domestic producer.
- Due to increasing federal demand, in 1960 Congress passed amendments to the *Helium Act*.
  - Provided incentives for private natural gas producers to strip helium from natural gas and sell it to the government.
  - The Secretary of the Interior was given authority to borrow money from the U.S. Treasury to buy helium.
  - Most of the helium was injected into the Federal Helium Reserve (FHR).

- The *1996 Helium Privatization Act* redefined the government's role in helium production
  - Federal demand for helium did not meet post-war expectations, and by the 1990s private demand for helium far exceeded Federal demand.
  - The Bureau of Land Management (BLM) was made responsible for operating the FHR and providing enriched crude helium to private refiners.
  - Federal users are assured a helium supply by an "in-kind" program, in which refiners/distributors provide helium and then request the same quantity from the FHR.

- An important technical note:
  - Processing of the helium found in natural gas occurs in two stages. In the first step, crude helium is extracted from the stream of natural gas to purity levels of at least 50%. In the second step, crude helium is purified to produce commercial Grade-A helium (99.997% purity or better). Helium sold by the BLM is 75-80% pure and is termed "enriched crude helium".

A Snap-shot: Domestic and Foreign Helium Production

- *Mineral Commodities Summaries 2012*, USGS
- *Selling the Nation's Helium Reserve*, NRC
- J.R. Campbell & Associates, Industry Consultants.

	2011 Supply (Bcf)	Known Increases in Nameplate Capacity (Bcf)
Domestic	**4.9**	**0.2**
Natural Gas	2.9	0.2
Federal Reserve	2.0	NA
Foreign	**1.5**	**1.8**
Worldwide	**6.4**	**2.0**
	2011 Demand (Bcf)	**Expected 2020 Demand (Bcf)**
Domestic	**2.3**	**2.5**
Foreign	**4.0**	**5.4**
Worldwide	**6.2**	**7.9**

An Estimate of Federal Helium Use: FHR 'in-kind' Helium

- CY2011/2012 Federal Usage
  - NASA = 77/56 mmcf
  - Navy/Army/Air Force = 11/9 mmcf
  - DOE = 25/21 mmcf
  - Other Federal 52/69 mmcf
  - Total 165/156 mmcf (**0.165/0.156 Bcf or ~7% of domestic demand**)
- Cost of Crude Helium = $10.05/10.05 M (refined cost ~x3 more)
- Does not count sales to small contractors, universities, etc…

Helium CY2012-CY2013: An interesting story at the intersection of physics and politics

- Current Situation:
  - The Dept. of Interior has determined that the statutory funding mechanism by which the BLM can operate the FHR ends when the debt to the Treasury incurred by purchasing helium and operating the FHR is retired. This will occur October 7, 2013.
  - DOI/BLM has sent a letter to refiners and agencies informing them of the shutdown.
- FY14 Impact
  - Projected Worldwide Demand = 6.8 Bcf
  - Projected Worldwide Supply (without FHR) = 5.8 Bcf
    - Existing Domestic Wells = 2.9 Bcf
    - Existing Foreign Wells = 1.5 Bcf
    - New Capacity (de-rated nameplate) = 1.3 Bcf
  - **The missing 1 Bcf is roughly one-sixth worldwide demand and two-fifths US demand.**
- Likelihood of shortages and price increases have been an impetus for:
  - Legislative action
  - Planning Federal usage.

112th Congress: "Helium Stewardship Act of 2012"

- Authorized continued operation of the FHR
  - Helium sold at market prices
  - After stored helium dropped to 3 Bcf, helium available only to Federal users and contractors
  - Would promote development and conservation.
- Was introduced as S.2374, then morphed to one of five titles in H.R. 4402.
- H.R. 4402 sent to Senate floor September 13, 2012 with a request for unanimous consent
- A number of holds → died with end of Session II.

113th Congress

- Bi-partisan support for action.
- H.R. 527 titled the "Responsible Helium Administration and Stewardship Act"
  - Passed April 26, 2013 by a vote of 394 to 1 (wrong button)
- S. 783 titled the "Helium Stewardship Act of 2013"
  - Referred to Committee April 23, 2013
  - Planned Unanimous Consent before August recess, delayed by a number of holds.

Broadly Similar

- Three Phases in Common:
  - Business as usual, sold by allotment to refiners.
  - A modified auction-based mechanism for selling He.
  - When 3 Bcf left in FHR, available for Federal Users only (about 10-15 yr supply).
- Maintained a two-tiered supply and pricing system for commercial sales and sales to Federal Users.
  - Federal Users have priority crude access, now more broadly defined as any Fed, contractor, grantee.
  - Refined helium price controls remain outside scope of legislation.
- Called for
  - a global and national resource assessment
  - a report on He-3 separation technologies

Major Differences

- Auction Mechanism
  - H.R. 527 preferred twice yearly auction >60% of FHR supply
  - S. 783 started with yearly auction of 10% of FHR supply, added 10%/year thereafter
- S.783 also
  - Promoted conservation
  - Requested a 20-year Federal acquisition strategy, lead by DOI in consultation with DOE, DOD, NSF, NIH, and NASA with usage prioritization.

Current Legislation

- Senate was considering H.R. 527, but amended.
- Has four phases
  - A: Allocation Transition: Business as usual for one year
  - B: Auction Implementation:
    - 10% of crude available in 2015, add 15% for the years 2016-2019, 100% thereafter
    - Ends when FHR contains 3 Bcf. (projected to occur sometime around 2018-2019)
  - C: Continued Access for Federal Users
  - D: Disposal of Assets

    Not later than 2 years after Phase C and not later than Sept 30, 2022

→ **In-kind helium would likely be available for seven or at most eight years.**

Other Sections

- Helium Gas Resource Assessment:
  - Due in two years
  - National helium supply, including He-3
  - Global helium supply, including He-3
  - Global and 10-year domestic demand
- Low-BTU gas separation and helium conservation
  - Membrane technology research
  - Helium separation technology
  - Low cost technologies fro recycling, reprocessing, and reusing
- Helium-3 Separation
  - Due in one year
  - Feasibility study on a facility to separate He-3 from crude helium or other sources of He-3

- **Federal Agency Helium Acquisition Strategy**
  - Due in two years
  - DOI, DOE, DOD, NSF, NASA, NIH
  - Assess consumption and demand
  - Provide a 20-year Federal acquisition strategy
  - Evaluate disposal date for FHR
  - Assess impact of price increases and mitigation strategies
  - Describe process for prioritization of uses in event of diminished supply.

Prospects*

- Current situation in Senate.
  - Yesterday bill was renumbered and renamed: S. 1513 *High Tech Jobs Protection Act*.
  - Was some indication last night would be brought to the floor.
- Once passed, goes to conference and both chambers must pass final version.
- Lots of effort in the next two weeks, but still a possibility of passage before Oct 1
- Note: appropriations not needed.
- As a "model" backup of sorts
  - House amendment to CR language provided for operation
  - Consideration of a CR on hold.

***N.B.*: Information likely outdated at any moment!**

Final Comments

- OSTP
  - Recognizes the need for and supports the legislation under consideration.
  - Naturally, we've been especially interested in the impact of legislation on science and technology .

- Main Takeaways
  - Independent of the legislative situation, supply and demand are matched, so market shortages are likely.
  - Should the FHR close down
    - Vendors suggest the impact will be felt within weeks.
    - Agencies might wish to start considering options.
  - With passage of legislation
    - In-kind helium will only be available for seven-eight years.
    - Information will be needed for the Federal Acquisition Strategy.
    - The yearly isotope survey requested information on quarterly demand, intended to assist BLM with planning for provision of helium.
    - Finally, plenty of evidence years are required to deal with supply issues, need to get started now. And this isn't the only orphaned isotope….