S. HRG. 112–540

HELIUM STEWARDSHIP

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED TWELFTH CONGRESS

SECOND SESSION

TO

RECEIVE TESTIMONY ON S. 2374, THE HELIUM STEWARDSHIP ACT OF 2012

MAY 10, 2012

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HELIUM STEWARDSHIP

THURSDAY, MAY 10, 2012

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 9:33 a.m. in room SD–366, Dirksen Senate Office Building, Hon. Jeff Bingaman, chairman, presiding.

OPENING STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. OK. Let's start the hearing. This is a hearing on S. 2374, the Helium Stewardship Act of 2012.

Senator Barrasso, Senator Wyden, Senator Enzi, Senator Casey and I have all sponsored this legislation. It's a bipartisan bill that addresses the need for ongoing stewardship of the Nation's helium reserve in Amarillo, Texas. The helium reserve is not only an important domestic asset. It also provides nearly 30 percent of the world's helium.

Helium is a commodity that's frequently overlooked. Often only considered when people are purchasing balloons for parties. Let me just take a moment and highlight the importance of this commodity as well as the importance of the U.S. Helium Reserve in the world helium market.

Helium is critical to a wide range of industrial, scientific and medical markets including medical devices such as MRIs, industrial welding, high tech manufacturing of microchips and fiber optic cables, manufacturing of magnets for wind turbines, space exploration at NASA and many other important scientific research activities that are conducted at universities and laboratories throughout the country.

The current sales and management structure for the Helium Reserve is distorting the private helium market and threatening helium supplies for Federal, medical and scientific research and for private commercial applications. The low government sales price is also a barrier to developing private sources of helium. More importantly if Congress does not act, the helium program will disappear all together in less than 3 years leaving our hospitals and national labs and domestic manufacturers and helium producers without an adequate supply.

This bill addresses these issues by authorizing what we hope are prudent helium sales and management beyond 2015 and securing private access to Federal supplies.

It also will allow for the continued repayment of the national debt by selling helium at fair market prices. This will bolster the private helium sector, help to create long term jobs in this industrial sector and ensure the continued success of domestic manufacturers that use helium in their processes.

Finally S. 2374 will ensure secure access to helium for all of those who use it for research purposes. In particular, as the reserve is sold off there is a 15 year supply of helium that will be set aside for Federal researchers to guarantee continuity of research programs as we transition to purely private sources of helium.

The bill is based on input from the National Academies of Science, the Bureau of Land Management staff, the various scientific researchers, high tech manufacturers and the private helium industry.

I'll conclude by acknowledging the exceptional efforts of Allyson Anderson and Marcius Extavour, who are two former committee staffers, who worked diligently to help craft this important legislation.

Let me defer to Senator Murkowski for any comments she has.

[The prepared statement of Senator Casey follows:]

PREPARED STATEMENT OF HON. ROBERT P. CASEY, JR., U.S. SENATOR FROM PENNSYLVANIA

I would like to thank the Chairman and Ranking Member for allowing me to offer this statement. I am pleased to have at today's hearing two witnesses from Pennsylvania.

Walter Nelson is the Director of Helium Sourcing and Supply Chain with Air Products and Chemicals, which is based in Allentown, Pennsylvania. Air Products is one of the world's leading industrial gas companies and is the world's leader in supplying helium.

The other Pennsylvania witness on today's panel is Dr. Moses Chan, the Evan Pugh Professor at The Pennsylvania State University. Dr. Chan is a physicist who works with supersolid helium. He is also the Associate Director of Penn State's Materials Research Science & Engineering Center.

Helium makes countless children happy when they receive a floating balloon, but more importantly it makes MRIs easily accessible to medical patients, facilitates semiconductor manufacturers in making computer chips and assists scientists in performing research.

As we know, the statute that authorizes the nation's helium reserve expires at the end of 2014. However, Congress needs to act soon to ensure a continued stable market for the Nation's helium supply. I am a co-sponsor of S. 2374, the Helium Stewardship Act of 2012, which lays out a responsible resource management strategy for the Federal Helium Reserve.

I am hopeful that Congress will be able to ensure the continued operation of the Federal Helium Reserve so that this important material may continue to assist doctors, patients, scientists, manufacturers and all Americans. I believe this hearing is an important step in that direction. I thank the Chairman and Ranking Member for holding this hearing today and look forward to working with my colleagues to pass the Helium Stewardship Act.

STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

Senator MURKOWSKI. Thank you, Mr. Chairman. I will be brief as I want to yield my time to Senator Barrasso on this.

I think we recognize that while the issue of Federal helium reserve is an obscure one, the fact that we're here today does highlight for us the issue of what happens when we rely on the Federal Government to manage both its physical resources and financial resources in an efficient manner. Naturally, I'm sympathetic to the

goal of avoiding a gross price shock across the industries that rely on helium, particularly those in medical imaging, as you've noted. So I can't help but wonder whether the market wouldn't have settled into equilibrium long ago had government involvement not affected the price for all these years.

So I'm interested to hear about the bill and from the witnesses, who clearly have an interest in it.

Again, Mr. Chairman, with your blessing, I'd like to yield my time to Senator Barrasso to make sure he's got an opportunity to make a statement. This is an important bill for Wyoming and an important issue for the country.

So I thank you and with that can yield my time to Senator Barrasso.

STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR FROM WYOMING

Senator BARRASSO. Thank you, Senator Murkowski.

Thank you, Mr. Chairman, for your leadership on this critical piece of legislation. I think you've outlined it and capsulated it very well. I greatly appreciate the time that you and your staff have spent working on this bipartisan bill.

It's an important step forward to ensuring a stable and a predictable helium market. In 1996, Congress passed legislation which required the Secretary of Interior to sell off the helium in what is known as the Federal Helium Reserve. Now the Reserve is an underground geological formation which stores crude helium. It's located, as the Chairman has said, in Amarillo, Texas.

The Reserve is the one major, long term storage facility in the world. It accounts for about 30 percent of the world's supply of helium. This supply is essential to manufacturers and important technologies such as MRIs, semiconductors, microchips, fiber optic cables. It's also critical to the Defense Department, to NASA, to our national labs and to the larger scientific research community.

However, it's unclear whether this vital supply of helium will be available to sale over the next few years. Loss of this supply would cause a severe disruption in the helium market and significantly increase costs for American manufacturers. Our legislation, the Helium Stewardship Act of 2012, will ensure that this supply of helium remains available for sale.

Specifically it will extend the Secretary's authority to sell helium for use in the private sector until the Reserve reaches 3 billion cubic feet. I understand that that will take approximately 10 to 15 years.

Our bill will also encourage the exploration and production of alternative sources of helium such as those in Wyoming which has over 50 percent of the Nation's helium reserves.

For years the BLM has been selling helium from the Reserve at prices below much of the helium sold in the private market and because the Federal Helium Reserve accounts for such a large portion of the world's helium supply this BLM's below market prices are depressing the prices of helium in the private market.

As the National Academy of Science explained in the 2010 report, "Market forces that otherwise might encourage the development of additional sources of crude helium have lost their influence and the

incentives are weakened for users of refined helium to invest in conservation and reuse of refined helium."

The National Academy of Sciences also concluded that BLM's pricing policies no longer serve the interests of the U.S. taxpayers.

This legislation today will ensure that the American taxpayers get a fair return on the sale of helium from the Reserve. Specifically the bill will require the Secretary to sell helium at prices that approximate the crude helium price in the private market. This, in turn, will encourage the exploration and production of alternative sources of helium such as those in Wyoming as well as the conservation and reuse of this valuable resource.

In conclusion, Mr. Chairman, I'd like to once again thank the witnesses for their willingness to be here with us today.

Thank you, Mr. Chairman.

Thank you, Senator Murkowski.

I look forward to the testimony.

The CHAIRMAN. Alright. Thank you very much.

Why don't I introduce each of the witnesses here? Then we will hear your testimony.

First would be Mr. Timothy Spisak, who is the Deputy Assistant Director of Minerals and Realty Management in the BLM, in the Department of Interior.

Next is Dr. Moses Chan, who is the Evan Pugh Professor at Pennsylvania State University in University Park, Pennsylvania.

Tom Rauch, who is the Global Sourcing Manager for Services and Aftermarket Solutions in GE's Healthcare.

Mr. David Joyner, President of Air Liquide Helium America in Houston.

Mr. Walter Nelson, who is Director of Helium Sourcing and Supply Chain with Air Products and Chemicals.

Thank you all very much for being here. We look forward to hearing your views.

If each of you could take 5 or 6 minutes and give us the main points that you think we need to understand. We will include your full statements in the record as if read. Then we'll have some questions.

Mr. Spisak, why don't you go ahead?

STATEMENT OF TIMOTHY R. SPISAK, DEPUTY ASSISTANT DIRECTOR, MINERALS AND REALTY MANAGEMENT, BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR

Mr. SPISAK. Mr. Chairman and members of the committee, thank you for the opportunity to testify on S. 2374, the Helium Stewardship Act of 2012. This bill would make various changes to the Helium Privatization Act of 1996 including establishing a phased approach to drawing down the Federal Helium Reserve.

As indicated by a National Academies of Sciences report published in early 2010, the market for helium has proven more volatile than expected over the last 15 years. The current law's requirement that the Bureau of Land Management sell off nearly all the Federal Helium Reserve by 2015 could pose a threat to the availability of this important resource. The Department of the Interior supports the helium related provisions of the bill and welcomes the

opportunity to improve the management of this valuable commodity.

Helium is a critical, non-renewable, natural resource. The most common and economical way of capturing helium is by stripping it from the natural gas during production. The BLM plays a key role in the careful management and stewardship of the only significant, long term, storage facility for crude helium in the world, known as the Federal Helium Reserve which is located near Amarillo, Texas.

In 1960 Congress granted the Bureau of Mines the authority to borrow funds from the U.S. Treasury to purchase helium with the expectation that the proceeds from the future sales of helium would allow the Bureau of Mines to repay the borrowing. However, compound interest and the Federal demand rarely met the expectations underlying the repayment terms of the Treasury's loan.

In 1996, Congress passed the Helium Privatization Act which required the BLM to sell the vast majority of the stockpile of crude helium. Once the Reserve sell off sales began the BLM was to make a constant amount of helium available every year at a price based on the amount of remaining helium debt and the amount of helium in storage.

Today the BLM operates the Federal Helium Program with a primary goal of paying off the helium debt which the agency anticipates fully completing in fiscal year 2013 and providing the resource to meet public and private needs.

In 2000, the NAS published its first analysis of the impacts of the 1996 act. Its general finding then was that the act would not have a material impact on helium users.

In early 2010, the NAS released a follow up report on the BLM's management of the Helium Reserve and concluded that the Act's mandated sell off is negatively impacting the needs of both current and future users of helium in the United States.

S. 2374 addresses many of the concerns that the 2010 NAS report identified. Most importantly the bill will create a set of phased authorities for the BLM's management of the Helium Reserve. The Department supports this approach to gradually scale back the helium offered through the program.

The bill stipulates 3 phases to the draw down.

During the first two phases, the bill would require the Secretary to consult with the helium industry to determine the quantities, dates and conditions for the sales of helium. The Department would like to work with the sponsor and the committee on clarifying how this consultation process might occur.

Also under the bill in order to establish a fair market price for the crude helium, the Secretary would require all entities that are a party to a contract with the Secretary to disclose the weighted average price for crude helium and bulk helium transactions throughout the year. The Department looks forward to discussing this issue further with the sponsor and the committee.

Finally the bill would direct the Department of Energy to support research and development activities related to low BTU gas separation helium conservation. The Interior defers to DOE regarding the provisions of the bill pertaining to DOE research and development.

Thank you for the opportunity to present this testimony on S. 2374. I'll be happy to answer any questions that the committee may have.

[The prepared statement of Mr. Spisak follows:]

PREPARED STATEMENT OF TIMOTHY R. SPISAK, DEPUTY ASSISTANT DIRECTOR, MINERALS AND REALTY MANAGEMENT, BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR

Mr. Chairman and members of the Committee, thank you for the opportunity to testify on S. 2374, the Helium Stewardship Act of 2012, which makes various changes to the Helium Privatization Act of 1996, including establishing a phased approach to drawing down the Federal Helium Reserve. As indicated by a National Academies of Science (NAS) report published in early 2010, the market for helium has proven more volatile than expected over the last 15 years and current law's requirement that the Bureau of Land Management (BLM) sell-off nearly all of the Federal Helium Reserve by 2015 could pose a threat to the availability of this resource for future U.S. scientific, technical, biomedical, and national security users of helium. The Department supports the helium-related provisions of the bill and welcomes the opportunity to improve the management of this valuable commodity.

S. 2374 also includes a provision that extends for 2 years the royalty rate reduction provided for under the Soda Ash Royalty Rate Reduction Act of 2006, which expired in October 2011. The Department does not support an extension of the royalty rate reduction on soda ash, and cannot support this provision of the bill.

BACKGROUND

Helium is a critical, non-renewable natural resource that plays an important role in medical imaging, space exploration, military reconnaissance, fiber optics manufacturing, and underwater diving. The most common and economical way of capturing helium is by stripping it from natural gas during gas production. Geologic conditions in Texas, Oklahoma, and Kansas make the natural gas in these areas some of the most helium-rich in the United States, ranging from 0.5 to 1.5 percent of the gas extracted during production. The BLM plays a key role in the careful management and stewardship of the only significant long-term storage facility for crude helium in the world, known as the Federal Helium Reserve.

Because of helium's potential to lift military reconnaissance devices high above battlefields, the Federal government's interest in the resource dates back to World War I. Recognizing this key military use for helium, the Mineral Leasing Act of 1920 reserved to the Federal government all helium produced on Federal lands—a reservation that remains in effect today. After World War I, recognition of the potential for helium recovery in the Texas Panhandle, Western Oklahoma, and Kansas area (collectively, the "Hugoton" field) led to the development of the Federal helium program focused in that area. In 1929, the Bureau of Mines built the Amarillo Helium Plant and Cliffside Gasfield Facility near Amarillo, Texas, to produce helium-bearing natural gas from a naturally occurring geologic field known as the Bush Dome Reservoir.

After World War II, Federal use of helium shifted towards space exploration, and in 1960 Congress passed the Helium Amendment Act. This Act changed the program's mandate from exclusive government production of helium to conservation of the resource by encouraging private natural gas producers to sell extracted crude helium to the Federal government for storage in the Bush Dome Reservoir. The Act granted the Bureau of Mines the authority to borrow funds from the U.S. Treasury to purchase the helium, with the expectation that the proceeds from future sales of helium would allow the Bureau of Mines to repay the debt. This borrowing authority, established by Congress in lieu of a direct appropriation, required the Bureau of Mines to repay the loan by 1985. Subsequent legislation extended the deadline to 1995.

Federal demands for helium rarely, if ever, met the expectations underlying the terms of the Treasury's loan to the Bureau of Mines. When the 1995 deadline to pay off the debt arrived, the $252 million the Bureau had spent on privately-produced helium had increased to $1.3 billion (principal and interest), and the Bureau of Mines appeared to have little prospect of ever repaying the debt. In his 1995 State of the Union address, President Bill Clinton stated that it was his Administration's goal to privatize the Federal helium program.

Congress subsequently passed the Helium Privatization Act of 1996 (HPA), which required the BLM (which assumed jurisdiction over the program after the termi-

nation of the Bureau of Mines) to make available for sale the vast majority of the stockpile of crude helium. The mandate directed the BLM to begin selling helium as late as 2005, in order to avoid market disruption. The BLM was to make a consistent amount of helium available every year at a price based on the amount of remaining helium debt and the amount of helium in storage. When Congress passed the HPA, there was approximately 30.5 billion standard cubic feet (scf) of helium in storage in the Bush Dome Reservoir. The HPA mandated the BLM to make available for sale all of the helium in excess of a 600 million scf permanent reserve.

Additionally, the HPA required the BLM to cease all helium production, refining, and marketing activities to effectively privatize the refined helium market in the United States. Finally, the Act provided for the NAS to review the impacts of the 1996 Act. The NAS published its first study in 2000, and released a follow-up report in 2010.

THE BLM'S HELIUM OPERATIONS

The BLM currently operates the Federal helium program with a primary goal of paying off the "helium debt." To this end, the BLM has paid over $1.1 billion to the U.S. Treasury since 1995, a substantial step towards eliminating the helium debt, which the HPA froze at approximately $1.3 billion. During FY 2011, $210 million was paid toward the helium debt from reserve sales. The BLM anticipates full repayment of the helium debt in FY 2013. According to the HPA, once the helium debt is retired, the Helium Fund (used to fund the BLM's helium program operational expenses) would be dissolved and all future receipts would be deposited directly into the general fund of the U.S. Treasury.

The BLM's current helium program, with a workforce of 51 full-time equivalents (FTE), operates not only the original storage and pipeline system, but also a crude helium enrichment unit, owned by private industry refiners, that facilitates transmission of helium to private helium operations on the BLM's helium pipeline. The BLM is responsible for administering helium extracted from Federal resources, including management of fees and royalty contracts. These operations are not limited to the Hugoton gas field, but also occur in fields in Colorado, Wyoming, Utah, and any other state where producers extract helium from the Federal mineral estate. Additionally, the BLM is responsible for administering the sell-off of crude helium to private refiners. These sales make the most significant contributions toward paying off the helium debt. The agency also conducts domestic and, to a lesser extent, international helium resource evaluation and reserve tracking to determine the extent of available helium resources.

Another major part of BLM's helium program is the "In-Kind" program, which supplies helium to Federal agencies (e.g., the Department of Energy and NASA) for operations and/or research. Before the Helium Privatization Act, Congress required Federal agencies to purchase their helium supplies from the Bureau of Mines. Under the current In-Kind program, Federal agencies purchase all of their refined helium from private suppliers who, in turn, are required to purchase an equivalent amount of crude helium from the Federal Helium Reserve. In 2011, Federal agencies purchased $11 million of helium through the In-Kind program, up slightly from $10.8 million in 2010.

THE NATIONAL ACADEMY OF SCIENCES REPORTS

In 2000, the NAS published its first analysis of the impacts of the HPA. Its general finding was that the Act would not have an impact on helium users. Additionally, the NAS report concluded that because the price-setting mechanism was based on the amount of the helium debt, and not the market for helium, the government's significantly higher price would mean the helium refining industry would buy crude helium from the BLM only as a last resort for fulfilling private contracts. However, private helium refiners would still be required to purchase crude helium from the BLM under the In-Kind program.

Over the course of the last decade, however, it has become apparent that assumptions underlying the 2000 NAS Report were not accurate. First, the NAS's assumption that "[t]he price of helium [would] probably remain stable through at least 2010" has proven faulty. The market for helium has seen significant fluctuations on both the demand side—which dropped significantly in 2008 after peaking the prior year—and on the supply side, which experienced a significant decline in private supplies between 2006 and 2008. In the face of this volatility, prices for helium rose steadily over the course of the decade. By 2008, the market price for helium began to hover near the BLM's price, leading to greater withdrawals from the Federal Reserve than the 2000 NAS Report anticipated.

Another market impact that the 2000 NAS Report did not address was international supply and demand for helium. According to the U.S. Department of Commerce, domestic consumption of helium decreased 2.7 percent per year from 2000-2007, while exports to the Pacific Rim grew 6.8 percent annually, exceeding the 5.1 percent growth rate in Europe. The international market also experienced supply issues because of refining capacity problems at plants in Qatar and Algeria, which would normally help supply both Europe and Asia.

In early 2010, the NAS released a follow-up report on the BLM's management of the Helium Reserve. The report, entitled "Selling the Nation's Helium Reserve," focused on "whether the interests of the United States have been well served by the [HPA] and, in particular, whether selling off the helium reserve has had any adverse effect on U.S. scientific, technical, biomedical, and national security users of helium."

The 2010 NAS report, which identified some shortcomings of the 2000 report, takes a markedly different tone than the 2000 report. This change in approach reflects the volatility of the helium market over the last decade. The NAS report analyzes the relationship between supply and demand for helium on a domestic and international basis, as well as the BLM's management of the Federal Helium Reserve under the HPA. The report concludes that the HPA mandated sell-off is negatively impacting the needs of both current and future users of helium in the United States. This conclusion is the driving force behind a series of recommendations in the report directed at the BLM and the United States Congress.

S. 2374, THE HELIUM STEWARDSHIP ACT OF 2012

S. 2374 addresses many of the concerns that the 2010 NAS report identified regarding the Federal government's involvement in the helium market. Most importantly, the bill would create a set of phased authorities for the BLM's management of the Helium Reserve, establishing a "glide path" from the sales mandated under the HPA to a scenario where 3 billion scf of helium would be reserved solely for Federal users. This would accomplish the original goals of the HPA—the exit of the Federal government from the broader helium market and the paying off of the helium debt—while protecting long-term supply interests for the Federal government. The Department supports this approach to gradually scale back the Federal helium program.

The bill stipulates three phases to the drawdown: 1) "Business as Usual;" 2) "Maximizing Total Recovery of Helium;" and 3) "Access for Federal Users." The first phase would begin on the bill's date of enactment and end upon repayment of the helium debt. During this period, the BLM would be required to offer for sale, on an annual basis, at least as much helium as was offered for sale during FY 2012. The second phase would begin upon repayment of the helium debt and end when the volume of recoverable crude helium in the Federal Helium Reserve reaches 3 billion scf. Throughout this time, the BLM would balance factors involving long-term helium recovery, program management, market supply and demand, and demand of Federal users when determining the annual quantity of helium to offer for sale. The third phase would begin when the volume of recoverable crude helium in the Federal Helium Reserve reaches 3 billion scf and presumably last until all recoverable helium has been exhausted from the reserve. Once this phase begins, only Federal agencies and Federal research grant holders would be authorized to purchase helium from the reserve.

During the first two phases, the bill would require the Secretary to consult with the helium industry to determine quantities, dates, and conditions for sales of helium. The legislation, however, is silent on how this consultation would take place. The Department would like to work with the sponsor and the Committee on clarifying how the consultation process would occur.

Also under the bill, in order to establish a fair market price for crude helium, the Secretary would require all entities that are party to a contract with the Secretary for the acceptance, storage, and redelivery of crude helium to disclose the weighted average price for all their crude and bulk liquid helium transactions throughout the entire year. The legislation provides for the strict confidentiality of these numbers. However, while the confidentiality of the individual parties would be maintained, the ultimate result would still be a published price for crude helium. It has been one of the unintended consequences of the Helium Privatization Act that the BLM's published price for crude helium evolved into a market benchmark for the global price of helium. A key recommendation of the NAS report and the position of the Administration is that the drawdown of the Federal Helium Reserve should be done in such a way that it encourages market-based solutions to finding and developing additional helium resources. The Department looks forward to discussing this issue

further with the sponsor and the Committee. The Administration continues to evaluate any cost implications of this legislation.

In addition to provisions relating to the sale of crude helium, the bill would require the U.S. Geological Survey (USGS) to complete several reports and studies on helium, including national and global helium gas resource assessments. The Department would like to work with the sponsor and the Committee to address technical details regarding the assessments. It would also direct the Department of Energy to support research and development activities related to low-Btu gas separation and helium conservation. The Department of the Interior defers to the Department of Energy regarding the provisions of the bill pertaining to Department of Energy research and development.

SODA ASH ROYALTY EXTENSION

S. 2374 also extends for 2 years the royalty rate reduction provided for under the Soda Ash Royalty Rate Reduction Act of 2006, which expired in October 2011. This would apply an across-the-board reduction in the royalty rate on soda ash leases from an average of 5.6 percent to 2 percent. The Department does not support this provision of the bill.

As mandated by the 2006 Act, the BLM reported to Congress in the fall on the impact of the reduction over the previous 5 years, in the U.S. Department of the Interior Report to Congress: The Soda Ash Royalty Reduction Act of 2006. The report found that the Soda Ash Royalty Reduction Act of 2006 resulted in a substantial loss of royalty revenues to the Federal Government and the states which exceeded Congressional estimates at the time of enactment. The royalty rate reduction does not appear to have contributed in a significant way to the creation of new jobs within the industry, to increased exports, or to a notable increase in capital expenditures to enhance production. In addition, the royalty rate reduction appears to have influenced a shift of production away from state leases and private lands and onto Federal leases.

The report also found that, with regard to global competitiveness, U.S. production has remained stable at around 11 million tons since 2002, with exports stable at around 5 million tons since 2005. U.S. exports continue to account for over 40 percent of total world exports. In contrast, China's production has doubled since 2002, from approximately 10 million to approximately 20 million tons, while Chinese exports remain far below U.S. exports. Since 2002, world-wide production has risen from 37 million tons to 48 million tons in 2010.

Finally, the report found that overall domestic employment has not increased since passage of the Act. However, it is not readily apparent from the available data whether jobs have been maintained due to the royalty rate reduction in the face of the global economic downturn. Any analysis of the number of jobs maintained during the royalty reduction period is highly uncertain; employment levels in the industry depend on a number of factors, such as soda ash market conditions and employee productivity.

CONCLUSION

Thank you for the opportunity to present testimony on S. 2374. I would be happy to answer any questions the Committee may have.

The CHAIRMAN. Thank you very much.

Dr. Chan.

STATEMENT OF MOSES CHAN, PROFESSOR OF PHYSICS, PENN STATE UNIVERSITY, AND MEMBER, NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES

Mr. CHAN. Good morning.

Mr. Chairman, Ranking Member Murkowski, Senator Barrasso, I appreciate the opportunity to testify before you today. My name is Moses Chan. I'm a professor of Physics at Penn State University. I'm a member of the National Academy of Sciences.

I served on the committee that has been mentioned by a number of you in the convened part, the National Academy of Science and National Research Council, to address a number of questions regarding the current law that requires the selling off of the Federal

Helium Reserve. A report of the study was issued in 2010. Here's the report.

I will speak this morning, however, primarily from my perspective as a low temperature scientist. We, as a group, are interested in understanding the behavior of materials and electronic systems very close to absolute zero. Liquid helium provides the means and, in fact, the only means to cool it down to such temperature.

These studies are not as esoteric as they might seem. Indeed, I think, everyone in this room has benefited from research enabled by liquid helium. This is because much of the underlying physics that make things like cell phones, iPads, and laptops, possible were discovered and clarified in painstaking experiments that carried out under low temperature environments.

Magnetic resonance imaging or MRI is another example of a societal benefit that exists only as a result of ground breaking experiments carried out at low temperature. Indeed in order for MRI devices to work they must have a strong and extremely stable magnetic field. As you will hear later on, this is accomplished by immersing powerful superconducting magnets inside liquid helium.

These examples I have cited are only a small sample of low temperature experiments that have led to benefits to society. Ongoing research conducted with the help of liquid helium in our Nation's universities, in various government and industrial laboratories will, without a doubt, I'm sure, lead to new technology that will improve our children and grandchildren's lives and contribute to the economic well being of our fellow citizens. You noticed I didn't say about our lives because it takes some time for the research to reap benefit.

The scientific community actually uses a very small fraction of the helium in the world market. It's estimated to be only between two and 3 percent. However because of the nature of the experiments, we are extremely vulnerable to any interruption in the supply of helium.

If a shipment of helium, liquid helium, is late by just a couple of days and the graduate student is forced to warm up the experiment prematurely, weeks or even months of work will go down the drain. Since liquid helium is very cold and is boiling off all the time, it is not practical and it certainly not economical to try to stockpile large amounts of helium in anticipation of any late shipments.

The price of liquid helium is also another important issue for us. A typical helium scientist in a university runs, typically a very small research group, supported by modest research grants from the National Science Foundation, the Department of Energy or some other Federal agency. Liquid helium may account for up to 40 percent of the total budget of the grant. Therefore any substantial hike in the price will have a detrimental effect on the helium research community.

Unfortunately a price hike exceeding, actually for some researchers over 100 percent, namely the price rose from typical is 3 dollars and fifty cents per liquid liter to more than 8 dollars per liquid liter, and an interruption in supply lasting for more than a week did happen in 2006 and 2007. The interruption and price hike affected, rather widely, the research program in at least 40 univer-

sities and national laboratories. While there have not been any widespread supply problem in the years since 2007, the price of liquid helium has continued to rise.

The 2010 NAS/NRC report identified a number of problems with aspect with a straight line sell off of the Federal Helium Reserve required to take place by 2015. I have included the main recommendations of this report in my written testimony.

I'm extremely heartened to see that the Helium Stewardship Act is addressing many of the problems identified in the report. But I do want to take this opportunity to highlight the recommendations that directly affect the helium research community.

The report recommended that researchers with Federal grants be allowed to participate in that existing program or the in-kind program for government use of liquid helium that will give them priority when there is a helium shortage. I'm extremely pleased to see that the Stewardship Act responded positively to this recommendation.

The NAS/NRC report also recommended that funding agencies help researchers apply helium recycling equipment that brings the gas back to liquid that would reduce a long term need of helium requirement. Unfortunately it appears that because of limited funding, this recommendation has not been implemented to any significant degree.

I thank you for your attention. I will be happy to answer any questions.

[The prepared statement of Mr. Chan follows:]

PREPARED STATEMENT OF MOSES CHAN, PROFESSOR OF PHYSICS, PENN STATE UNIVERSITY, AND MEMBER, NATIONAL RESEARCH COUNCIL OF THE NATIONAL ACADEMIES

Good morning, Mr. Chairman, Ranking Member Murkowski, and members of the Committee. My name is Moses Chan. I am a Professor of Physics at Penn State University and a member of the National Research Council's Committee on Understanding the Impact of Selling the Helium Reserve.[1]

I will be discussing the study prepared by that committee as part of testimony on S. 2374, The Helium Stewardship Act of 2012. The study was commissioned by the Department of the Interior's Bureau of Land Management (BLM) and the principal task of our committee was to determine whether the sell-off of the nation's helium reserve as prescribed by law has had an adverse effect on the United States' scientific, technical, biomedical, and national security users of helium. Our committee concluded that the sell-off has had and will continue to have adverse effects and we developed a series of recommendations to address several outstanding issues with respect to the reserve.

To provide context for those recommendations, I will first give a brief overview of our critical helium needs, with a focus on the plight of the small research user community, and also discuss those uses where substitutes or conservation and recycling are possible. I will follow this with a discussion on several matters addressed in the report—helium supply issues, the federal helium reserve itself, and the sale of federally owned helium. My testimony will conclude with a discussion of the committee's major recommendations regarding the reserve and its management in the future.

USES OF HELIUM

Ready access to affordable helium is critical to many sectors in academe, industry and government and the range of those uses is quite impressive, enabling research

[1] The National Research Council is the operating arm of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology.

at the coldest of temperatures, weather monitoring, surveillance in areas of combat, and optical fiber production, among many other applications.

The diversity in uses for helium arises from its unique physical and chemical characteristics—specifically, its stable electronic configuration and low atomic mass. Among those unique characteristics are the temperatures at which helium undergoes phase transitions (liquefies and freezes). Helium has the lowest melting and boiling points of any element: It liquefies at 4.2 Kelvin and 1 atmosphere and solidifies only at extremely high pressures (25 atmospheres) and low temperatures (0.95 Kelvin). These characteristics have led to many cryogenic applications for helium; the largest single category of applications by percentage of helium consumed. These range from the efforts of individuals engaged in small-scale cryogenic research to large groups using high-energy accelerators and high-field magnets. All rely upon helium to conduct their research and because the federal government supports many of these researchers, it has a direct stake in their continued success. Cryogenic users also include segments of the medical profession, not only for biological research in devices such as superconducting quantum interference devices (SQUIDS), but also for diagnosis with tools such as magnetic resonance imaging (MRI) devices.

Helium's ability to remain liquid at extremely low temperatures also gives rise to its usage for purging and pressurizing systems and as such, helium is a critical component in our nation's space exploration and defense efforts. The National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) use significant amounts of helium, as it is the only gas that can be used to purge and pressurize the tanks and propulsion systems for rockets fueled by liquid hydrogen and oxygen.

Other uses rely on helium's lifting capabilities. As the second lightest element, gaseous helium is much lighter than air, causing it to be quite buoyant. When combined with helium's chemical inertness—especially when compared with the highly flammable alternative, hydrogen—its buoyancy makes helium an ideal lifting gas. NASA and the Department of Energy (DOE) use helium to support weather-related missions and various research and development programs funded by these agencies, both at government facilities and at universities. DOD also must have ready access to helium to operate the balloon-and dirigible-based surveillance systems needed for national security.

Other applications draw on other characteristics of helium—its relatively high thermal conductivity, low viscosity, and high ionization potential—either alone or in combination. These applications include welding, providing controlled atmospheres for manufacturing operations, and detecting leaks in equipment providing vacuum environments to science and industry. Table 1 summarizes the principal applications of helium and the share of use in the United States.

Small-Scale Researchers.—Among the events that triggered this study were soaring prices and limited supplies that characterized the refined helium market in the fall of both 2006 and 2007. The committee, composed of individuals from a wide range of professions—economists, business people, and scientists—noted that small-scale scientists were particularly hard hit by price shocks and interruptions in the supply of refined helium during that time. An informal poll conducted by committee members of approximately 40 research programs at universities and national laboratories that use helium indicated that shortages of liquid helium interrupted the helium supply for almost half of these programs, with some interruptions lasting for weeks at a time during the late summer and fall of both 2006 and 2007. For many of those scientists, losing access to helium, even temporarily, can have long-term negative repercussions for their research.

In general, the federal grant programs that support these researchers simply are not designed to cope with significant pricing shifts and other market volatilities experienced here. Grants typically are for a two to three year period and for a set amount that does not adjust if a principal expense of research such as helium significantly increases. Further, the relatively short duration of such grants, with no guaranty of renewal, effectively precludes these research programs from entering into long-term contracts that might at least partially reduce the risk of significant prices increases and shortages.

Domestic vs. foreign consumption.—The balance between domestic and foreign consumption of helium has shifted significantly in the past 15 years. Until the mid-1990s, substantially all helium production took place in the United States. This factor, combined with high shipping costs and limited availabilities, meant that until recently, the amount of helium consumed abroad was fairly small. In 1990, for example, 70 percent of worldwide helium consumption was in the United States.

Since 2000, the demand for helium in the United States has remained fairly constant but has grown significantly elsewhere, reducing the U.S. share of total con-

sumption. See Figure 1.* Foreign growth has been assisted by the opening of several helium-producing facilities outside the United States that will be discussed later in this testimony, as well as by improved capabilities in the short-term storage and handling of refined helium. This period also saw a significant increase in industrial applications, principally in semiconductor and optical fiber fabrication facilities outside the United States, and the shifting of industrial facilities that use helium from the United States to foreign countries. By 2007, United States helium consumption had dropped to below 50 percent of worldwide demand. Despite a slight downturn in overall demand for helium associated with the global recession in 2008-2009, the committee believed, based on recent trends, that foreign demand should continue to increase relative to demand in the United States.

Substitution, Conservation, Recovery.—For some applications, other gases can replace helium, but other applications rely critically on helium's unique properties and there are no alternatives. Applications in the first category, where substitutes for helium might exist, include these:

- Lifting.—For these uses, where low density is the only requirement, hydrogen is sometimes substituted if safety concerns can be met.
- Welding.—Here, chemical inertness is the key property. For processes such as gas tungsten arc welding—a critical process applicable to reactive metals such as stainless steel, titanium, aluminum, and others in high-value, high-reliability applications—Europe mostly uses argon, while the United States uses helium.
- Semiconductor and fiber optics manufacturing.—In these applications, high thermal conductivity is the important property. Often, hydrogen may be substituted.

In the above applications, economics, market conditions, availability, safety, and legislation can influence the choice among helium and other gases.

In contrast, other applications require the unique properties of helium, typically relying on the extremely low boiling point of liquid helium to achieve a desired result. These applications include the following:

- Purging/Pressurizing.—Entities such as NASA and DOD must purge and then pressurize liquid hydrogen (LH_2) and liquid oxygen (LO_X) rocket propulsion systems and fuel tanks that may be at liquid air temperatures or colder. Although gaseous hydrogen might have the right physical properties for use in LO_X systems, its reactivity with oxygen precludes its use. Nitrogen is not desirable because nitrogen might contaminate the LO_X. In LH_2 environments, all gases other than helium and hydrogen would freeze, clogging fuel lines and systems and rendering the rocket engines nonfunctional.
- Superconductivity.—All applications that employ superconducting magnets, including medical magnetic resonance imaging (MRI) machines, high energy accelerators and many high field magnets used in research, rely on the continued availability of helium. Current materials and technologies dictate that only helium can act as the crucial refrigerant to cool these materials below superconducting thresholds.
- Basic research.—Here, no other substance can be used as a refrigerant to achieve temperatures from 4.2 K above absolute zero down to millikelvins.

SUPPLY OF HELIUM

Sources.—Helium is the second-most-abundant element in the universe, but its diffusive properties mean that atmospheric helium leaks into space, rendering it relatively scarce on Earth. At only 5.2 parts per million (ppm) in air, it is not economically feasible to extract helium from the atmosphere using current technology. Rather, the principal source of helium is natural gas fields. Helium nuclei (or alpha particles) are produced in the radioactive decay of heavy elements such as uranium and thorium, located in Earth's crust. While most of these helium atoms find their way to the surface and escape, a small fraction are trapped by the same impermeable rock strata that trap natural gas. Such natural gas usually consists primarily of methane and secondarily of ethane, propane, butane, and other hydrocarbons and various other contaminants, including H_2S, CO_2, and He.

There are three different situations in which helium contained in natural gas may be economically recovered:

- Helium may be extracted as a secondary product during the primary process of producing methane and natural gas liquids (NGLs) such as propane, ethane, butane, and benzene.

*Figures 1–3 have been retained in committee files.

- For natural gas fields that have sufficient concentrations of helium and other non-fuel gases such as sulfur and CO_2 to economically justify their extraction, the gas in those fields may be directly processed for the non-fuel constituents.
- Helium may be extracted during the production of liquefied natural gas (LNG), which consists primarily of liquefied methane.

For the first two recovery processes, current technology requires threshold concentrations of 0.3 percent helium before separation of the helium is commercially feasible. For the third process, the helium is extracted from the tail gases, the gases that remain after the methane has been liquefied. The helium concentration in those tail gases is much higher than in the original gas, allowing the economical extraction of helium even through the original natural gas might contain as little as 0.04 percent helium.

Figure 2 shows the principal domestic sources of helium. Historically, most helium in the United States has been recovered using the first method described above, as a byproduct of producing methane and natural gas liquids. Almost all of that helium has been produced in the mid-continental region around the Hugoton Field. As is described in later testimony, this is where the federal helium reserve system is located. The Hugoton Field is mature and the production of methane, NGL and secondary products such as helium from that field is expected to significantly decline over the next several years. In the last few decades, helium has been produced in Wyoming using the second method described above, where the natural gas is directly processed for its helium and other non-fuel content. Potential helium reserves have also been explored in the Four Corners area.

Outside of the United States, only small reserves of the first two sources of helium have been exploited and for many years, the rest of the world has relied upon the United States as their principal source of helium. Recently, the development of large LNG facilities has opened up new, potential sources of helium. The principal countries in which those facilities are being developed are Algeria, Qatar, and Russia, with smaller facilities coming online in Australia. These areas are expected to become increasingly more important sources of helium as the Hugoton and adjoining fields mature. See Figure 3.

Supply Chain.—After being refined, helium is transported to end users through a fairly complicated supply chain. In the United States, the helium typically is liquefied and delivered by refiners either to their transfill stations situated throughout the United States or to distributors of industrial gases. This transportation is handled using expensive domestic tanker trucks or bulk-liquid shipping containers standardized according to the International Organization for Standardization (ISO), each of which holds approximately 1.0 to 1.4 million cubic feet (MMcf) of helium. While some of the largest helium users contract directly with a refiner for their helium purchases and deliveries, most sales to end users are through the retail division of a refiner or a distributor. The refiners and distributors then repackage the helium, either in its liquid state into dewars—evacuated, multiwalled containers designed to hold liquid helium—of varying sizes or in its gaseous state into pressurized cylinders, tube-trailers, or other modules as needed by the end users.

FEDERAL POLICY REGARDING HELIUM

Helium has long been the subject of public policy deliberation and management, largely because of its many strategic uses and its unusual source. Shortly after natural gas fields containing helium were discovered at the beginning of the last century, the U.S. government recognized helium's potential importance to the nation's interests and placed its production and availability from federally owned mineral interests under strict governmental control. In the early years, helium principally was used for its lifting capability, as a safe alternative to highly flammable hydrogen. By the mid-1920s full-scale production facilities had been built and were being operated by the federal government to support its lighter-than-air aviation programs.

In the 1960s, helium's strategic value in cold war efforts was reflected in policies that resulted in the creation of the federal helium reserve. Although much of the infrastructure predates the cold war, the Federal Helium Reserve as a program began and currently consists of

- The Bush Dome reservoir, a naturally occurring underground structural dome in the Cliffside Field near Amarillo, Texas, where federally owned (and some privately owned) crude helium is stored;
- An extensive helium pipeline system running through Kansas, Oklahoma, and Texas (the Helium Pipeline) that connects crude helium extraction plants with each other, with helium refining facilities, and with the Bush Dome reservoir,

- Various wells, pumps and related equipment used to pressurize the Bush Dome reservoir, to place into and withdraw crude helium from it, and to operate other parts of the helium reserve.

The 1960s efforts also included inducements for private companies to develop helium extraction and refining facilities and to sell crude helium to the United States. The program was quite successful, resulting in the accumulation of approximately 35 billion cubic feet (Bcf) of helium by the mid 1970s. This amount was many times the 600 (750?) million cubic feet (MMcf) of helium then being consumed domestically (annually?) (globally) and so further purchases were suspended. The amount of helium maintained in the helium reserve remained fairly constant for the next 20 years.

The latest manifestation of public policy is expressed in the Helium Privatization Act of 1996 (1996 Act), which directs that substantially all of the helium accumulated as a result of those earlier policies be sold off by the year 2015, at prices sufficient to repay the federal government for its outlays associated with the helium program, plus interest.

Context of Current Study.—The last section of the 1996 Act called for the Secretary of the Interior to commission a study from the National Academies to determine whether disposal of federally owned helium pursuant to the 1996 Act would have a substantial adverse effect on critical interests of the country. The report that followed (2000 Report) found that because the helium market had been quite stable since the 1980s and the price at which federally owned helium must be sold under the 1996 Act was significantly higher than the price at which privately owned crude helium was then being sold, the sell off of the helium would not have a substantial adverse effect on critical users. The report predicted that the price of privately owned crude would gradually rise to the price at which federally owned helium was being offered, and until it reached that level very little federally owned helium would be purchased, given the availability of cheaper sources.

While the helium market remained fairly stable for several years after issuance of the 2000 Report, that report did not accurately predict the market's response to efforts to sell-off federally owned helium. In March 2003, when BLM first offered federally owned helium for sale, the entire 1.6 Bcf offered for sale was purchased. Rather than gradually rising, the prices for privately owned crude helium rapidly rose such that by 2007, those prices were on par with and often exceeded the legislatively prescribed price for federally owned helium. Retail prices for helium commensurably rose, more than doubling between 2003 and 2008. In addition, during the summer and fall of 2006 and 2007, the helium market encountered widespread shortfalls, with some of the interruptions lasting for weeks at a time.

The amount of federally owned helium being sold is enormous: at the time our report was issued in 2010, it was equivalent to approximately one-half of U.S. helium needs and almost one-third of global demand. One consequence is that the price of federally owned helium, which is set not by current market conditions but by the terms of the 1996 Act, dominates, if not actually controls, the price for crude helium worldwide.

Committee Findings, Recommendations.—As mentioned at the beginning of this testimony, the principal charge of our committee was to determine whether the sell-off of the nation's helium reserve as prescribed by law has had an adverse effect on the United States' scientific, technical, biomedical, and national security users of helium. In response to this charge, the committee determined that selling off the helium reserve, as required by the 1996 Act, has adversely affected critical users of helium and is not in the best interest of U.S. taxpayers or the country. The sell-down of federally owned helium, which had originally been purchased to meet the nation's critical needs, is coming at a time when demand for helium by critical and noncritical users has been significantly increasing, especially in foreign markets. If this path continues to be followed, within the next ten to fifteen years the United States will become a net importer of helium whose principal foreign sources of helium will be in the Middle East and Russia.

In addition, the pricing mandated by the 1996 Act has triggered significant increases in the price of crude helium, accompanied by equally significant increases in the prices paid by end users. Finally, the helium withdrawal schedule mandated by the 1996 Act is not an efficient or responsible reservoir management plan. If the reserve continues to be so managed, a national, essentially nonrenewable resource of increasing importance to research, industry, and national security will be dissipated.

The committee recommends several ways to address the outstanding issues. Several of its recommendations respond to the very large impact that selling off the reserve has had and is continuing to have on the helium market in general, including

a recommendation that procedures be put in place that open the price of federally owned helium to the market.

Another of the committee's concerns is that the drawdown schedule required by the 1996 Act, which dictates that the reserve helium be sold on a straight-line basis—the same amount must be sold each year until the reserve is substantially gone—is a wasteful way to draw down a reservoir. Because it is much more costly and more likely to leave significant amounts of helium unrecoverable than alternative drawdown scenarios, the committee recommends that this portion of the 1996 Act be revisited. In addition, given recent developments in the demand for and sources of helium (the principal new sources of helium will be in the Middle East and Russia, and if the sell-down continues, the United States will become a net importer of helium in the next 10 to 15 years), the committee recommends that Congress reconsider whether selling off substantially all federally owned helium is still in the nation's best interest.

The committee also addresses the needs of small-scale government-funded researchers who use helium, a group that has been hit particularly hard by sharp price rises and shortages that have characterized the helium market in recent times. This group was singled out mainly because such research is an important public enterprise and the funding mechanisms available to the researchers, typically grants on 3-year cycles for set amounts, do not allow them to respond to short-term fluctuations. These research programs should have some protection from the instabilities recently characterizing the helium market. Accordingly, the committee recommends that the researchers be allowed to participate in an existing program for government users of helium that would give them priority when there is a helium shortage. It also recommends that funding agencies help such researchers to acquire equipment that would reduce their net helium requirements. Implementing these recommendations would not subsidize such users nor would it require significant additional outlays: Indeed, over time, it would lead to the much more efficient use of the federal funds with which helium is purchased.

Because the helium market is rapidly changing and helium is critically important to many critical users, the committee includes recommendations that would facilitate long-range planning to meet the nation's helium needs, including the collection and dissemination of needed information and the formation of a standing committee to regularly assess whether national needs are being appropriately met. The remaining conclusions and recommendations consist of steps to help properly manage the helium reserve and protect this important national resource. The language of the committee's full recommendations is contained in the summary of the report, which is attached to this statement.

Finally, while noting that the question of how critical helium users in the United States will be assured a stable supply of helium in the future is beyond the scope of its charge, the committee points out that several important issues related to this topic remain unanswered. How will the large amounts of federally owned helium that remain after the mandated sell-off deadline in 2015 be managed after that date? Moreover, from a wider perspective, should a strategic helium reserve be maintained? These questions need to be answered in the near future, well before most federally owned helium is sold.

This concludes my testimony to the committee. Thank you for the opportunity to testify on this important topic. I would be happy to elaborate on any of my comments during the question and answer period.

ATTACHMENTS

TABLE 1 Helium Uses in the United States

Category	Representative Application	U.S. Share (%)
Cryogenics		28
	Magnetic resonance imagining	
	Fundamental science	
	Industrial cryogenic processing	
Pressurize/purge		26
	Space and defense rocket purging and pressurizing	
Welding		20
Controlled Atmospheres		13
	Optical fiber manufacturing	
	Semiconductor manufacturing	
Chromatography/ lifting gas/heat transfer		7
	Chromatography	
	Weather balloons	
	Military reconnaissance	
	Heat transfer in next-generation nuclear reactors	
	Party balloons	
Leak detection		4
Breathing mixtures	Commercial diving	2

SOURCE: USGS, 2007. These data are extrapolated from data in a USGS survey conducted by BLM personnel in 2003. Current shares are not known precisely but are expected to be approximately as shown.

SUMMARY FROM SELLING THE NATION'S HELIUM RESERVE

A REPORT OF THE NATIONAL RESEARCH COUNCIL

Ready access to affordable helium is critical to many sectors in academe, industry and government. Many scientists—from individuals engaged in small-scale cryogenic research to large groups using high-energy accelerators and high-field magnets—rely upon helium to conduct their research and because the federal government supports many of these researchers, it has a direct stake in their continued success. The medical profession also depends on helium, not only for biological research in devices such as superconducting quantum interference devices (SQUIDS), but also for diagnosis with tools such as magnetic resonance imaging (MRI) devices. Industrial applications for helium range from specialty welding to providing the environments in which semiconductor components and optical fiber are produced. Government agencies that require helium include the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD), as only helium can be used to purge and pressurize the tanks and propulsion systems for NASA and DOD's rockets fueled by liquid hydrogen and oxygen. NASA and the Department of Energy (DOE) also use helium to support weather-related missions and various research and development programs funded by these agencies, both at government facilities and at universities. Finally, DOD must have ready access to helium to oper-

ate the balloon-and dirigible-based surveillance systems needed for national security.

The Federal Helium Reserve, managed by the Bureau of Land Management (BLM) of the U.S. Department of the Interior, is the only significant long-term storage facility for crude helium in the world and currently plays a critical role in satisfying not only our nation's helium needs but also the needs of the world. The federally owned crude helium now on deposit in the Reserve was purchased by the federal government as a strategic resource during the cold war. After the cold war, Congress enacted legislation (the Helium Privatization Act of 1996 referred to hereinafter as the 1996 Act) directing that substantially all of the federally owned helium in the Reserve be sold at prices sufficient to repay the federal government's outlays for the helium and the infrastructure, plus interest. The present report, called for by BLM, examines whether BLM's selling of this helium in the manner prescribed by law is having an adverse effect on U.S. users of helium and, if so, what steps should be taken to mitigate the harm.[2]

This report assesses the current status of the supply and demand for helium as well as the operation of the federal helium program. It concludes that current efforts to comply with legislative prescriptions have had and will continue to have negative impacts on the needs of both current and future users of helium in the United States. The sell-down of federally owned helium, which had originally been purchased to meet the nation's critical needs, is coming at a time when demand for helium by critical and noncritical users has been significantly increasing, especially in foreign markets. If this path continues to be followed, within the next ten to fifteen years the United States will become a net importer of helium whose principal foreign sources of helium will be in the Middle East and Russia. In addition, the pricing mandated by the 1996 Act has triggered significant increases in the price of crude helium, accompanied by equally significant increases in the prices paid by end users. Finally, the helium withdrawal schedule mandated by the 1996 Act is not an efficient or responsible reservoir management plan. If the reserve continues to be so managed, a national, essentially nonrenewable resource of increasing importance to research, industry, and national security will be dissipated.

FINDINGS AND RECOMMENDATIONS

SPECIFIC RECOMMENDATIONS FOR IMMEDIATE IMPROVEMENTS

To address these issues, the committee first lays out three specific recommendations for improving the federal helium program: changing the methods for pricing the helium being sold, committing more resources to managing the physical facilities at the Federal Helium Reserve, and providing assistance for small-scale scientists by expanding the sales program for government users to include them and promoting conservation and reuse by these users.

Pricing Mechanism

The 1996 Act set minimum selling prices, adjusted for inflation, for crude helium held by the BLM such that the sale of that helium at those prices would generate sufficient revenue to repay the federal government for what it originally spent to purchase the helium and to build the supporting infrastructure, plus interest. BLM has elected to sell its helium at those minimum prices. At the time of the 1996 Act, the minimum selling price was almost double the price being paid for privately owned crude helium. A market that had been stable for several decades prior to the sell-off of federally owned helium, experiencing neither drastic price increases nor shortages of supply,[3] began to change after BLM started to sell its crude helium. Almost immediately, privately sourced crude helium prices began to rise, and those prices continued to steadily increase so that they now meet or exceed BLM's price, and many of the sales contracts for private helium expressly tie future selling prices to BLM's price. Thus this legislatively set price for federally owned helium is now

[2] As discussed more fully in the section of Chapter 1 entitled "Review of the 2000 Report's Conclusions," the 1996 Act called for an Academy study to determine if such disposal would have a substantial adverse effect on U.S. interests. That study, The Impact of Selling the Federal Helium Reserve, published by the NRC in 2000 and referred to hereinafter as the 2000 Report, concluded that the 1996 Act would not substantially affect matters. While several of that study's findings remain valid, it did not correctly predict how the 1996 Act would impact prices or how the demand side of the helium market would grow, in part a response to the ready availability of helium arising from the sell-off of the Helium Reserve pursuant to the 1996 Act. These factors have significantly impacted the current market for helium.

[3] 2000 Report, page 9.

setting the price for crude helium, and there is no assurance that this price has any relationship to the current market value of that helium.

To the extent BLM's price is lower than the price the market would otherwise set for crude helium, this pricing mechanism could have several negative consequences: (1) it could lead to inaccurate market signals, increased consumption, and accelerated depletion of the Federal Helium Reserve; (2) it could retard efforts to conserve and develop alternative sources of crude helium, (3) it could result in transfers of taxpayer assets to private purchasers at below-market values—that is, it could amount to a taxpayer-financed subsidy for consumption of this scarce publicly owned resource; and (4) sales of federally owned crude helium could end up subsidizing exports of helium.

The managers of the Reserve should shift to a market-based pricing policy to improve the exploitation of this important national asset. The report notes that several mechanisms could be used to implement market-based pricing and thereby introduce competition, or the threat of it, to the process. However, one complicating factor is that before federally owned helium can be used, it must be refined, and the refining capacity linked to the Reserve is owned by four companies. The committee believes that market-based pricing of crude helium from the Reserve will require that purchasers other than those four companies have access to refining capacity linked to the Reserve. However, additional details on mechanisms to provide access to excess refining capacity and to attain the goal of market-based pricing of crude helium from the Reserve are beyond the committee's charge.

> Recommendation.—The Bureau of Land Management (BLM) should adopt policies that open its crude helium sales to a broader array of buyers and make the process for establishing the selling price of crude helium from the Federal Helium Reserve more transparent. Such policies are likely to require that BLM negotiate with the companies owning helium refining facilities connected to the helium pipeline the conditions under which unused refining capacity at those facilities will be made available to all buyers of federally owned crude helium, thereby allowing them to process the crude helium they purchase into refined helium for commercial sale.

Management of the Reserve

An additional aspect of the 1996 Act that has significant—and undesirable, in the judgment of this committee—implications for the overall management of the Helium Reserve is the Act's requirement that the sale of federally owned crude helium is to take place on a straight-line basis.[4] The mandated constant extraction rate conflicts with standard practices for the exploitation of this type of reservoir, which is that production rates vary over the economic life of a deposit, typically declining over time. Declining production rates and reservoir pressures delay encroachment of water from nearby aquifers and connected reservoirs, and promote the efficient drainage and recovery of the resource gas in place.

> Recommendation.—The BLM should develop and implement a long-term plan that incorporates appropriate technology and operating practices for delivering crude helium from the Reserve in the most cost-effective manner.

Assistance for Small-Scale Researchers

Among the events that triggered this study were the soaring prices and limited supplies that characterized the refined helium market in the fall of both 2006 and 2007. The committee, composed of individuals from a wide range of professions—economists, business people, and scientists—notes that small-scale scientists were particularly hard hit by price shocks and interruptions in the supply of refined helium during that time. An informal poll conducted by committee members of approximately 40 research programs at universities and national laboratories that use helium indicated that shortages of liquid helium interrupted the helium supply for almost half of these programs, with some interruptions lasting for weeks at a time during the late summer and fall of both 2006 and 2007. While anecdotal, these poll results provide clear indication that this community of users is directly impacted by general shortages of helium. For many of those scientists, losing access to helium, even temporarily, can have long-term negative repercussions for their research.

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[4] The law directs that crude helium from the reserve be offered for sale in such amounts as may be necessary to dispose of all helium in excess of 600,000,000 cubic feet on a straight-line basis between January 1, 2005 and January 1, 2015. Although BLM has offered helium for sale in the amounts required by the 1996 Act, not all such helium has been purchased and as a consequence significant amounts of federally owned helium will remain in the Federal Reserve after January 1, 2015. This is discussed in more detail in Chapter 5 in the section entitled "Sell-Down of Crude Helium Pursuant to 1996 Act."

In general, the federal grant programs that support these researchers simply are not designed to cope with the pricing shifts and other market volatilities experienced here. The grants typically are for a two to three year period and for a set amount that does not adjust if a principal expense of research such as helium significantly increases. Further, the relatively short duration of such grants, with no guaranty of renewal, effectively precludes these research programs from entering into long-term contracts that might at least partially reduce the risk of significant prices increases and shortages. Further, if BLM were to implement the market-based pricing mechanism recommended in this report, the retail price for helium may commensurably increase, which will have an even greater negative impact on those helium users.

These negative impacts could, however, be mitigated at least in part through a programmatic and policy change that would allow small users being supported by government contracts and grants to participate in a program[5]—commonly referred to as the in-kind program—operated by BLM for the sale of helium to federal agencies and their contracting agents. Under that program, qualified buyers purchase their refined helium indirectly from BLM on a cost-plus basis.[6] Notably, participants in the program have priority access to helium in times of shortages.[7] The committee believes that such an expansion of the in-kind program would eliminate supply concerns and many of the price fluctuations that have negatively affected federally funded researchers during the past few years. Further, such an extension would be without significant cost to the programs supporting these researchers and, indeed, should lead to a more efficient use of the federal funds being used to purchase helium.

> Recommendation.—The crude helium in-kind program and its associated customer priorities should be extended by the Bureau of Land Management, in cooperation with the main federal agencies not currently participating in the in-kind program—for example, the National Science Foundation, the National Institutes of Health, and the extramural grant programs of the Department of Energy—to research being funded in whole or in part by government grants.

In addition to recommending that these users be allowed to participate in the in-kind program, the committee believes that the conservation and reuse of helium by these users should be promoted by the agencies funding this research. Although adopting such a policy may be costly in the short-run, the committee judges that it would save money in the long-run and would help to reduce many of the negative effects of the price and supply disruptions referred to in the preceding discussion.

> Recommendation.—Federal agencies such as the Department of Energy, the National Science Foundation, the National Aeronautics and Space Administration and the Department of Defense, which support research using helium, should help researchers at U.S. universities and national laboratories acquire systems that recycle helium or reduce its consumption, including low-boil-off cryostats, modular liquefaction systems, and gaseous recovery systems.

The committee notes that because total U.S. research applications account for only 2 to 4 percent of all usage of refined helium in the United States, the negative effects of supply and price disruptions for the U.S. research community not currently participating in the in-kind program could be addressed at relatively low cost. Moreover, in the judgment of this committee, the benefits for the nation that would accrue from minimizing these disruptions would be substantial.

GENERAL RECOMMENDATIONS FOR MEETING U.S. HELIUM NEEDS

In addition to the specific recommendations just discussed, the committee sets out more general recommendations for how to best meet the nation's current and future helium needs. These include recommendations for (1) collecting and making available the information needed to more effectively manage the Federal Helium Reserve and to formulate future helium policy, and (2) initiating strategies to develop a more comprehensive long-term program for meeting the nation's helium needs.

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[5] The in-kind program is discussed in more detail in Chapter 5 in the section entitled "'In-Kind' Program of Crude Helium Distribution."

[6] As discussed more fully in the section of chapter 5 entitled "In-Kind Program of Crude Helium Distribution" the price is negotiated between the supplier and user and includes BLM's cost of crude helium plus refining and transportation costs and profits for the refiner and distributor.

[7] 50 U.S.C.A Section 167d (a);

Collection of Information

One of the difficulties encountered by this committee and the previous NRC committee that issued the 2000 Report was the lack of timely and sufficient information to evaluate the supply and demand sides of the helium market, especially non-U.S. supply and demand, and the operation of the Federal Helium Reserve. Such information is needed by those who formulate and carry out U.S. policies on helium in order to make good decisions.

Recommendation.—The Bureau of Land Management (BLM) should acquire, store, and make available to any interested party the data to fill gaps in (1) the modern seismic and geophysical log data for characterization of the Bush Dome reservoir, (2) information on the helium content of gas reservoirs throughout the world, including raw data, methodology, and economic assessment that would allow the classification of reserves contained in specific fields, and (3) trends in world demand. BLM or other agencies with the necessary expertise, such as the U.S. Geological Survey, should develop a forecast over the long term (10-15 years) of all U.S. demand for helium for scientific research and for space and military purposes.

Recommendation.—Unless expressly prohibited from doing so, Bureau of Land Management should publish its database on the helium concentrations in the more than 21,500 gas samples that have been measured throughout the world and provide its interpretations of gas sample analyses, especially those reflecting likely prospective fields for helium.

Long-Range Planning

Helium is critically important to many U.S. scientific, industrial, and national defense sectors. Further, the helium market is rapidly changing, as evidenced by the unforeseen developments on both the supply side and demand side of that market since the 2000 Report was released. Finally, because the Reserve is so large, steps undertaken in connection with it can have unintended consequences, the most pertinent being the effect of the pricing mechanism adopted by BLM pursuant to the 1996 Act on worldwide prices for helium. These considerations merit the development of a more permanent and sustained plan for managing this valuable resource.

In addition, the Federal Helium Reserve is a finite resource and so at some point in the future will be depleted. However, the helium needs of users in the in-kind program will continue. The BLM and the White House Office of Science and Technology Policy (OSTP) should develop a strategy to address these important future needs.

Recommendation.—The Bureau of Land Management should promptly investigate the feasibility of extending the Helium Pipeline to other fields with deposits of commercially available helium as a way of prolonging the productive life of the Helium Reserve and the refining facilities connected to it.

Recommendation.—The Bureau of Land Management (BLM) should form a standing committee with representation from all sectors of the helium market, including scientific and technological users, to regularly assess whether national needs are being appropriately met, to assist BLM in improving its operation of the Federal Helium Reserve, and to respond to other recommendations in this report.

Recommendation.—The Bureau of Land Management, in consultation with the Office of Science and Technology Policy and relevant congressional committees, should commission a study to determine the best method of delivering helium to the in-kind program, especially after the functional depletion of the Bush Dome reservoir, recognizing that this will not happen until well after 2015.

Recommendation.—The congressional committee or committees responsible for the federal helium program should reevaluate the policies behind the portions of the 1996 Act that call for the sale of substantially all federally-owned helium on a straight-line basis. It or they should then decide whether the national interest would be better served by adopting a different sell-down schedule and retaining a portion of the remaining helium as a strategic reserve, making this reserve available to critical users in times of sustained shortages or pursuant to other predetermined priority needs.

Conclusion

The committee notes that securing a stable and accessible helium supply in the future requires addressing several important issues that are beyond the scope of

this study. For example, the legislative framework for the operation of the federal helium program is silent on the management of the Federal Helium Reserve after January 1, 2015, the mandated date for disposal of substantially all federally owned crude helium. What is to be done with the remaining federally owned crude helium? How will BLM operations beyond 2015 be financed? Should the Reserve, either as a federal or a private entity, as appropriate, continue to exist after the BLM debt to the U.S. Treasury has been retired? While the committee supports maintaining a strategic reserve, addressing these issues requires the involvement of Congress and the broader federal science policy establishment because they go well beyond the reserve management responsibilities of BLM.

The CHAIRMAN. Thank you very much.

Mr. Rauch.

STATEMENT OF TOM RAUCH, GE HEALTHCARE GLOBAL SOURCING MANAGER

Mr. RAUCH. Good morning, Chairman Bingaman, Ranking Member Murkowski and members of the committee. It's a privilege to be here today to speak to you on this issue.

My name is Tom Rauch. I'm the Global Sourcing Manager within GE Healthcare supply chain. One of the things I'm responsible for is the supply of liquid helium used in advanced medical imaging.

GE Healthcare employs 22,000 people across the U.S. We employ people in all 50 states. Our broad expertise in advanced health care technology enables care providers to deliver better care to more people at a lower cost around the world.

I'm here to share with you the critical importance of helium to the medical imaging manufacturing industry, healthcare providers with whom we do business, most importantly the patients, who may use or will use helium as by nature of MRI technology in the future. Over the course of this hearing over 8,000 patients will undergo an MRI exam. My grandfather could have his stroke diagnosed. A mother could have her breast cancer diagnosed in its early stages. An MS patient could learn if the disease is advancing.

I'm also here today to express GE's support for the Helium Stewardship Act of 2012. I urge its swift passage. With your support we could avoid a situation where one-third of the current global supply of helium is cutoff resulting in a potentially severe health care access issue.

MRI is one of the most powerful diagnostic imaging tools in use today. It uses a magnetic field and radio frequency to take pictures of a person's internal anatomy. MRI technology is a relatively young technology. It's only about 30 years old. Its clinical applications are continuing to expand.

It allows physicians to see how organs work in real time. MRI is especially effective for imaging soft tissues like the brain, spine, liver and kidneys. As Senator Barrasso knows, the MRI is a preferred modality for taking detailed images of joints. The MRI is also becoming increasingly helpful in new areas such as breast, prostate and heart imaging.

Some quick stats about MRI imaging.

There's 2,000 jobs at GE Healthcare associated with MRI across the country.

Two hundred and twenty-one U.S. companies provide parts and components or services to the MRI business.

Fasco Factory and other manufacturing supplier jobs, healthcare workers, researchers, it's safe to say that hundreds of thousands of American jobs associated with MRI.

GE Healthcare manufactures MRI magnets at our facility in Florence, South Carolina. We ship about 1,000 magnets a year to sites all over the world. The key component in an MRI system is a powerful magnet. It needs to be super cooled to 4.2 Kelvin, which is about 452 degrees below zero Fahrenheit.

A tremendous amount of energy flow through the super conducting wire within the magnet. Liquid helium is the only element that's feasible for sufficient cooling it. There's currently no substitution, as you heard Dr. Chan allude to and for image quality keeping a magnet at a constant operating temperature is absolutely critical.

GE Healthcare uses roughly 5 and a half million liters of helium at our magnet facility in Florence, South Carolina. In it we dedicate another 6 million liters to servicing magnets in the field. MRIs in hospitals need to be regularly topped off. Over time depending on the age, model, location of the machine, we need to service these things in the field for which we rely on our partners and helium retailers to service via contract for GE.

As previous witnesses detailed the global helium supply has been constrained since mid 2011 and echoes similar situations from the recent past. The opportunities are here now for policymakers to avoid a supply crisis. Creation demand across the industries is fast outpacing the helium supply. This is reverberated throughout the healthcare industry where companies like GE work daily to protect providers and patients from the affects of a shortage.

The helium supply challenge is currently being managed in our installed base by filling MRIs with lesser amounts of helium at each service event. Now this is not an ideal solution because it calls for more frequent visits and ultimately leads to more down time for the equipment and ultimately interrupted care to the patient.

Lack of helium to service in MRI could cause a quench. A quench is when there's a rapid boil off of the helium that's inside of a magnet. There's no immediate patient safety risk. However, the magnet could sustain permanent damage in which it's a lengthy refurbishment process in which time care could be delayed or interrupted.

As far as actions that are being taken by GE. We're looking—as we look to a future where demand could certainly outpace supply, we've invested a million dollars in our facility in plant equipment in Florence, South Carolina over the past 5 years on things like more effective thermal transfer, helium recapturing systems. We also do some recovery of liquid helium in the gaseous form and sell it back to our partners as gas that can be used in welding.

We're also working in our global research facility on a more efficient magnet design for a long term solution where we ultimately are less reliant on liquid helium.

In conclusion, helium is important for healthcare manufacturing, the healthcare economy and most importantly, patients. Ensuring a stable supply of helium is a priority of the medical imaging industry, the Helium Stewardship Act of 2012 is a positive and needed step forward.

Chairman Bingaman and members of the committee, thank you again for providing GE Healthcare and the medical imaging industry the opportunity to speak on this topic. Thank you.

[The prepared statement of Mr. Rauch follows:]

PREPARED STATEMENT OF TOM RAUCH, GE HEALTHCARE GLOBAL SOURCING MANAGER

INTRODUCTION

Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee, it is a privilege to be here with you today.

My name is Tom Rauch, and I am GE Healthcare's Global Sourcing Manager for our Services and Aftermarket supply chain, which includes the supply of liquid helium used in advanced medical imaging technology.

GE Healthcare employs 22,000 people across the United States, with employees in all 50 states. Our broad expertise in medical imaging and information technologies, medical diagnostics, patient monitoring, drug discovery, biopharmaceuticals and performance solutions services help health care providers deliver better care to more people around the world at a lower cost.

I'm here to share with you the critical importance of helium to the medical imaging manufacturing industry, the health care providers with whom we do business, and by extension, the patients and families in communities throughout the country that have used or will use Magnetic Resonance Imaging (MRI) technology.

Over the course of this hearing over 8,000 patients will undergo an MRI exam.[1] A grandfather could have his stroke diagnosed; a mother could have her breast cancer diagnosed in its early stages; a multiple sclerosis (MS) patient could learn if the disease is advancing, and a college athlete could get a second opinion on her torn ACL.

I am also here today to express GE's support for the Helium Stewardship Act of 2012 and urge its swift passage. With your support, we can avoid a situation where one third of the current global supply of helium is cut off, resulting in a potentially severe health care access issue

MAGNETIC RESONANCE IMAGING

Magnetic Resonance Imaging, better known as MRI, is one of the most powerful diagnostic imaging tools in use today. MRI uses a magnetic field and radio frequency to take pictures of a patient's internal anatomy.

MRI technology is only 30 years old, and its clinical applications continue to expand. It allows physicians to see how organs are functioning in real time. The advantage of MRI over other forms of imaging is that it offers optimal contrast resolution between two or more areas of anatomy. It is especially effective for imaging soft tissues like the brain, spine, liver and kidneys. MRI is used in hospitals to help emergency physicians diagnose and characterize stroke and identify brain tumors. MRI is often used for the diagnosis and monitoring of multiple sclerosis (MS). And, as Sen. Barrasso knows, MRI is the preferred modality for detailed views of joints. MRI is becoming increasingly helpful in imaging areas like the breast, prostate and heart. All that said, MRI has many valuable medical applications and is integral to how many physicians practice modern medicine.

There are roughly 7,800 MRIs in America today. They can be found in academic medical centers, community hospitals, surgery centers and physician offices in every state. About 75,000 scans are performed on patients every day.

MRI is also a jobs engine. Over 1,900 jobs at GE Healthcare are associated with MRI, and MRI accounts for many thousands more jobs in the medical imaging manufacturing industry broadly. Two hundred twenty one supplier companies provide parts and components to our MRI business. Factoring in health care workers and researchers who work with and around MRI, it is safe to say that hundreds of thousands of American jobs are associated with MRI.

HELIUM AND MRI

GE Healthcare manufactures MRI magnets at our facility in Florence, South Carolina. We ship 1,000 MRI magnets a year from Florence all over the world.

[1] This and other MRI use statistics are derived from the Organization for Economic Cooperation and Development (OECD) Health Data 2011

The key component in an MRI system is a powerful magnet cooled to 4.2 kelvin, or 452 below zero Fahrenheit. Tremendous amounts of energy flow through the superconducting wire throughout the magnet. Liquid helium is the only element that is feasible for sufficiently cooling a magnet to the degree where the superconducting properties of the wire are realized. These superconducting properties enable the high field strength, stable, and uniform magnetic fields that make modern MRI systems possible.

Keeping a magnet at a constant operating temperature is critical. Depending on the type of MRI being produced, a machine needs anywhere from 4,000-10,000 liters of helium stored in a sealed vacuum system surrounding the magnet.

GE Healthcare uses roughly 5.5 million liters of helium a year at our South Carolina production facility. In addition, we dedicate six million liters a year servicing our MRI systems at hospitals and other sites across the nation. MRIs in hospitals need to be regularly replenished with helium in order to maintain a normal operating temperature. Depending on the age, model and location of the machine, MRIs need to be "topped off" with helium at least once per year—not unlike topping off the coolant in your car. To do this, GE contracts with helium retailers to deliver helium and related service to customers.

IMPACT OF HELIUM SUPPLY CONSTRAIN

As previous witnesses have detailed, the global helium supply has been constrained since mid-2011. This constraint echoes similar situations from the recent past. The opportunity is here now for policymakers to avoid a supply crisis and also deal with the underlying issues that have led us to this point. Increasing demand across industries is fast outpacing the current helium supply. This has reverberated throughout the health care industry where companies like GE work daily to protect providers and patients from the effects of a shortage.

The helium supply challenge is being managed in the installed base by filling MRIs with lesser amounts of helium per service visit. This is not an ideal solution, as it means more frequent servicing which increases equipment downtime and is ultimately less efficient in delivering care to patients.

If the supply constrain worsened it could be very harmful to patient care. If there were no helium available to properly service an MRI, a "quench", or sudden helium boil off could occur. While there is no immediate patient safety risk, a magnet could sustain permanent damage and may need to be replaced—an expensive and time consuming process. Replacing an MRI often involves a crane, street closures, and knocking down ceilings and walls of a care facility. During this time patients would not have access to MRI, and needed care is not delivered. Patients in need of MRI may be forced to drive long distances. MS, breast cancer, and other diagnoses could be delayed, or missed altogether, and the health care system would be deprived of one of its most valuable tools.

ACTIONS TAKEN BY GE

Increased demand and tightening supply have led GE to invest $1 million at our facility in South Carolina in an effort to increase helium efficiency. These efforts include investments in conservation technology and recycling methods to capture escaped gas for re-use. We have also jointly invested with our onsite helium industry partner in order to achieve a more efficient transfer of helium throughout the factory.

As well, researchers at GE's Global Research Centers are currently exploring the feasibility of new magnet designs that minimize the amount of helium needed as we look to a near future where the demand for helium could fast outpace supply.

CONCLUSION

Helium is a critical element in MRI. It is important for health care manufacturing and the health care economy, but it is most important for the patients who need access to MRI to diagnose stroke, tumors and other diseases.

As such, ensuring a stable supply of helium is a priority for the medical imaging industry. The Helium Stewardship Act of 2012 represents a step toward a solution as it allows the U.S. Government to continue drawing from helium reserves, while incentivizing more private development of helium supply.

Chairman Bingaman and members of the Committee, thank you again for providing GE Healthcare and the medical imaging industry the opportunity to speak on this important topic.

The CHAIRMAN. Thank you very much.

Mr. Joyner.

STATEMENT OF DAVID JOYNER, PRESIDENT, AIR LIQUIDE HELIUM AMERICA, INC

Mr. JOYNER. Chairman Bingaman, Ranking Member Murkowski and members of the committee, I appreciate the opportunity to testify today on S. 2374, the Helium Stewardship Act of 2012.

My name is David Joyner. I am the President of Air Liquide Helium America. As many of you are aware, American Air Liquide is one of the Nation's leading industrial gas companies headquartered in Houston, Texas employing over 5,000 workers in the United States in more than 200 different locations. Air Liquide is focused on technological innovation to help make our Nation's manufacturing and industrial sectors more efficient, environmentally friendly and productive.

To that end since 2007, Air Liquide has operated the Delaware Research and Technology Center, otherwise known as DRTC, which is specifically devoted to developing innovative applications for gas products and supporting helium specific initiatives as well such as gas recovery and re-liquefaction in support of these conservation efforts. We'd like to thank Senator Chris Coons for his strong and consistent support of technology innovation in Delaware and around the United States. A stable supply of helium is crucial both to our customers as well as to our research efforts at the DRTC. We're especially pleased that 2374 recognizes an area of our research which is the advanced membrane technology which could eventually lead to breakthroughs in future helium recovery and supply.

Regarding today's hearing Air Liquide is a major supplier of refined helium in the United States and globally to customers that range from companies on the cutting edge of the electronics industries to health researchers, automotive suppliers, laboratories and manufacturing facilities in the U.S. and all over the world. Accordingly I commend the hard work done by the members of the committee and the committee staff to ensure the reliability of the Nation's helium supply.

For today's hearing I'd like to confine my remarks to two issues that we see as important for the committee to consider in the current legislation, accessibility and pricing.

With regards to accessibility currently 94 percent of the domestically available crude volumes managed by the BLM Reserve is allocated to just 4 companies. The rest of the marketplace can then compete for the remaining 6 percent and attempt to also negotiate a necessary tolling agreement from one of the 4 refining companies. Without an agreement for the refiner to toll the crude cannot be used by the non-refiner or by an end user. So moreover given the worldwide supply demand balance of helium, individual market players will not be compelled to transfer tolling capacity to other players in the current structure.

So as the National Research Council's 2010 report on the BLM Reserve notes, "Given that the refining of the helium must take place at one of the facilities connected to the helium pipeline with limited number of potential processors of federally owned crude helium place significant restrictions on alternatives to the current sale procedures being followed by the BLM." In reacting to this

issue the NRC's report recommended that the BLM, adopt policies that open its crude helium sales to a broader array of buyers."

Air Liquide agrees with this recommendation and believes that S. 2374 should increase access to the BLM Reserve for non-refiners and encourage that refiner's toll an equivalent ratio of crude helium on behalf of the buyers. In exchange the refiners receive an appropriate tolling fee. Such a solution would expand the market, suppliers and benefit both the consumers and the Reserve by increased competition and more reliable supply chains.

As to pricing we understand the objective for the BLM to obtain accurate market pricing for helium. However, the original base pricing of the Federal helium started at below market levels as the NAS study suggested. The BLM, at the recommendation of that study is now making the sudden and unpredictable increases to adjust that base pricing up to market levels and incorporate additional fees that are for cost and circumstances that are very specific to just the BLM reserve operations.

So unfortunately the inclusion of these BLM specific factors into the crude price creates an issue because these global sourcing agreements at other sources beyond the BLM system use this change in the BLM crude price as a representation in their formulas to adjust the change in the value of helium and all of these other global sources. So if no action is taken to address this issue the result would be a distortion in the global market pricing.

So to prevent this we recommend that the separation of these fees, which were cited actually in the recent BLM announcement, as an enrichment factor and a conservation factor that also contribute to a helium production fund that are specific to the BLM Reserve system. To separate those fees from the BLM crude helium price so that the wholesale change in the pricing mechanism envisioned by the proposed legislation is still achieved but by clearing separating these non-market fees from the current BLM crude price that have no relation to the helium market as a whole. Private companies will still be able to adjust existing contracts in accordance with true market drivers and avoid what would be artificial increases at these other global sources which would then cause undo harm to end users as those pricing and costs are passed through.

So we believe that changes to the legislation discussed above are achievable and fully consistent with the intent underlined in the bill. I thank the committee for allowing me to testify and be happy to answer any questions you have.

[The prepared statement of Mr. Joyner follows:]

PREPARED STATEMENT OF DAVID JOYNER, PRESIDENT, AIR LIQUIDE HELIUM AMERICA, INC.

Mr. Chairman and Members of the Committee, I appreciate the opportunity to testify today on S. 2374, the Helium Stewardship Act of 2012. My name is David Joyner and I appear today on behalf of American Air Liquide, one of the Nation's leading industrial gas companies. Headquartered in Houston, Texas, American Air Liquide has over 5,000 employees in the United States in more than 200 different locations all over the country. For decades, Air Liquide has offered industrial gases and related services to the Nation's large industries, manufacturers, electronics and healthcare marketplaces. As a company, Air Liquide is focused on technological innovation to help make our Nation's manufacturing and industrial sectors more efficient, environmentally friendly and productive. To that end, since 2007, Air Liquide

has operated the Delaware Research and Technology Center (DRTC) which houses approximately one hundred employees specifically devoted to developing innovative applications for gas products in sectors such as electronics, healthcare, cosmetics, energy and food, as well as supporting helium specific initiatives such as recovery and re-liquefaction in support of conservation efforts. We would like to thank Senator Chris Coons for his strong and consistent support of technology innovation in Delaware and around the United States.

Most relevant to the topic of the Committee's hearing today, Air Liquide is a major supplier of refined helium in the United States and globally to customers that range from companies on the cutting edge of the electronics industry to health researchers, automotive suppliers, laboratories and manufacturing facilities all over the world. I have been with Air Liquide working in the industrial gas sector for over twenty years. For the last two of those years, I have served as the President of Air Liquide Helium America, Inc., our helium supply company. In this capacity, I have grown to appreciate the importance of helium—a non-renewable resource on our planet but one that's utility has only grown with the passage of time. I have also gained an in-depth understanding of the helium market both globally and domestically.

A stable supply of helium is crucial both to our customers as well as to our own research efforts at DRTC. We are especially pleased that S. 2374 recognizes and supports one of these areas of research—advanced membrane technology—which can eventually lead to breakthroughs in future helium recovery and supply.

As the Committee is aware, the issues surrounding the helium market are complex and the uses for helium—whether as part of magnetic resonance imaging (MRI), particle physics research, or airbags for the automotive sector—are of critical national importance. Accordingly, I commend the hard work done by the Members of this Committee and the Committee staff to ensure the reliability of our Nation's helium supply. For today's hearing, I would like to confine my remarks to two issues that we see as important as the Committee considers the current legislation: (1) accessibility and (2) pricing.

With regards to accessibility, currently 94 percent of the domestically available crude helium managed by the U.S. Department of Interior's Bureau of Land Management ("BLM") is allocated to just four companies. The rest of the marketplace is forced to compete for the remaining six percent and attempt to negotiate a reasonable agreement from one of the four refining companies—who are also direct marketers of helium like the non-refiners—to refine the crude helium (i.e. "toll") for their use. Without an agreement for the refiner to toll, the crude cannot be used by a non-refiner to be sold to an end-user. Moreover, given the worldwide supply/demand balance of helium, individual market players will not be compelled to transfer tolling capacity to other players in the current structure.

As to pricing, because the original base pricing of federal helium started at below market levels, the BLM, at the recommendation of the National Academy of Sciences ("NAS"), is now making unpredictable increases to adjust the base pricing up to market levels and to incorporate additional fees for costs that are specific only to the operation of the BLM reserve. Unfortunately, over the last several years, these increases have often been sudden, significant jumps, leading to an irregular domestic pricing mechanism. To complicate matters further, helium sourcing agreements beyond the closed BLM system reference the BLM crude price as an index for their own pricing formulas. This, in effect, drives up the price of helium for all consumers not only here in the United States but also around the world whenever the BLM crude price is readjusted. This contractual reality creates a system in which the global source prices increase in parallel with BLM prices and thus perpetually remain higher priced. If no action is taken to address this issue, this result would be contrary to the objective of triggering increased conservation of the BLM crude. To be clear, we understand the objective for the BLM to attain market pricing for helium, however, we recommend achieving that objective without artificially distorting market driven factors at other sources in the U.S. and around the world. This would ultimately result in artificially driving other sourcing prices above market pricing which will negatively impact consumers.

With minor tweaks to the current system, Air Liquide believes both of these issues can be addressed to the betterment of industry, consumers and society. Accordingly, we propose the following solutions to the two issues of (1) accessibility and (2) pricing.

I. ACCESSIBILITY OF THE U.S. HELIUM SUPPLY

The Federal Helium Reserve was created in 1925. As helium began to be recognized as critical to the Nation's defense industry, the United States accumulated a

large supply of the gas during the height of the Cold War. As previously stated, the supply of helium is non-renewable and the Federal Helium Reserve, managed by BLM, now produces nearly 50 percent of the helium in the domestic market and one-third of the helium used in the global market, making it a significant player and consumer in the world helium market.

As the Committee is aware, the helium stored at the Federal Helium Reserve is "crude" helium which must be refined before it is transported to end-users. The process of refining helium involves the transport of the crude helium from the Federal Helium Reserve through the Helium Pipeline—a system that runs through Kansas, Oklahoma, and Texas—to one of six refining facilities that are located on the pipeline where further purification and liquefaction takes place prior to redistribution to consumers. These six refining facilities are owned by just four companies. Thus, these four refiners have an almost exclusive use of 30 percent of the world's helium supply via the BLM reserve. As the National Research Council's 2010 report, Selling the Nation's Helium Reserve, (the "NRC 2010 Report") notes: "given that refining the helium must take place at one of the facilities connected to the Helium Pipeline, the limited number of potential processors of federally owned crude helium place significant restrictions on alternatives to the current sale procedures being followed by BLM." These restrictions include the fact that potential private bidders for BLM helium—outside of the four companies that own the refineries on the Helium Pipeline—are entirely dependent upon the ability to have these refiners process the BLM crude helium at a refinery on the Helium Pipeline in order to get the gas to end-users in the market. This system prevents an open market where outside companies can compete for the BLM crude helium for federal user's business as well as open market uses.

The consequences of the situation described above have important implications for domestic end-users of helium. Adopting a more market-based approach was recommended by the NRC 2010 Report which stated the following:

> The Bureau of Land Management (BLM) should adopt policies that open its crude helium sales to a broader array of buyers and make the process for establishing the selling price of crude helium from the Federal Helium Reserve more transparent. Such policies are likely to require that BLM negotiate with the companies owning helium refining facilities connected to the Helium Pipeline the conditions under which unused refining capacity at those facilities will be made available to all buyers of federally owned crude helium, thereby allowing them to process the crude helium they purchase into refined helium for commercial sale.

Utilizing this approach would result in a more accurate and transparent helium market and would benefit consumers by increasing the number of suppliers competing for the business of federal users and open market users. To attain these goals, we would recommend that S. 2374 include measures to open the Federal Helium Reserve to a wider range of buyers and establish policies to ensure greater access to crude helium exists within the market. In exchange for a suitable tolling fee paid to the refiners, non-refiners would therefore be able to buy BLM helium and, through arrangements with existing refiners, be able to utilize previously unavailable refining capacity at facilities on the Helium Pipeline.

One solution for increasing access may be to adjust the unusually high 94 percent helium allocation referenced earlier to a more reasonable distribution between refiners and non-refiners and requiring the refiners to toll an equivalent ratio of crude helium on the behalf of other buyers. This would allow the existing refiners on the pipeline to continue to benefit from their preferred status but would ensure the marketplace around them more accurately reacts to changing issues of supply and demand. In exchange, the refiners would receive an appropriate tolling fee. This solution would expand the number of suppliers competing for the business of consumers and federal users, meaning a more robust and competitive market place.

II. IMPLICATIONS OF BLM CRUDE PRICE FOR GLOBAL HELIUM CONTRACTS

As discussed briefly above, one of the central problems S. 2374 seeks to address is the current distortion between the price of helium sold by the Federal Helium Reserve and the actual price such helium would be sold for under normal market conditions. Under the provisions of the 1996 Helium Privatization Act, the BLM was directed to sell off the helium from the Federal Helium Reserve at a price solely designed to pay down the Reserve's existing debt. Clearly, this has had the impact of distorting the sales price of BLM helium in comparison to the actual market price which is set by domestic and global supply and demand. Another impact, resulting from the fact that BLM has historically and still today, represents the largest single

source of helium capacity in the world, is the widespread use of the "BLM crude price" as a benchmark in private helium sales contracts all over the world. To compensate for the artificially low benchmark price, as the NRC 2010 Report states, "[m]any if not all of the contract adjustments also include escalation terms that maintain the premium over BLM set in the adjusted price terms of the renegotiated crude contracts[.]"

The importance of this issue is that, while S. 2374 requires the Secretary of the Interior to adjust the price of helium from the Federal Helium Reserve, an increase in the BLM crude helium price in the existing format will trigger the escalation clauses in the sales contracts referenced above. The resulting increase in helium prices at other sources in the United States and around the world will be passed on to end-users who will be unduly harmed as an unintended consequence of a well-meaning change to the way BLM sells helium. An example of this downstream impact was recently seen when BLM announced an 11 percent increase for the BLM crude price in 2012 (the price increase in 2011 was just one percent). A BLM statement explained that the increase resulted from new pricing factors such as an "Enrichment Factor" and a "Conservation Factor" designed to encourage industry conservation of helium. The legislation indicates that proceeds are to be contributed to a Helium Production Fund that will be used to address investments required in the BLM infrastructure to maintain the needed production rates. Such costs are unique to the BLM source only and not relevant to other global sources, however, as a result of the price increase from these non-market factors and because the BLM crude price is used as a benchmark in helium contracts around the globe, most global sources of helium will now see an 11 percent price increase, despite the fact that they were already at or above the actual market price. The impact of this increase will be non-market driven cost increases to end-users in the United States and abroad.

To prevent this undesirable result, we recommend the separation of the "fees" cited recently by BLM—i.e. for Enrichment and Conservation, as well as the Helium Production Fund—from the BLM crude price to reflect the wholesale change in the pricing mechanism envisioned by the proposed legislation. By clearly separating the non-market fees from the current BLM crude price—which has no relation to the actual helium market—private companies will be able to adjust existing contracts in accordance with true market drivers and avoid the artificial increases causing undue harm to end-users. Such a solution would allow the BLM to collect the full revenue stream and ensure that the federally supported Reserve maintains its ability to operate effectively while protecting helium end-users domestically and around the world from dramatic and unpredictable swings in price. Consumers of the BLM Reserve would still be paying for its continued maintenance, operation, and upgrades through this fee structure but would be doing so in a way that is directly accountable to the federal government's investment. They would also be doing so through a fee system that the BLM itself has already begun to establish with its latest price increase. Similarly, consumers of other helium sources, both domestically and abroad, could be secure in the fact that simple supply and demand and business acumen will govern their price, not unrelated government actions that are specific to the BLM reserve and not relevant to other helium sources.

Once again, Air Liquide appreciates the Committee's attention to this important issue and supports this legislation's ultimate goal of ensuring the continuing viability of the Nation's helium supply. We believe the changes to the legislation discussed above are achievable and fully consistent with the intent underlying the bill. I thank the Committee for inviting me to testify, and I would be pleased to answer any questions you may have.

The CHAIRMAN. Thank you very much.

Mr. Nelson.

STATEMENT OF WALTER L. NELSON, DIRECTOR, HELIUM SOURCING & SUPPLY CHAIN, AIR PRODUCTS AND CHEMICALS, INC.

Mr. NELSON. Mr. Chairman, Ranking Member Murkowski, Senator Barrasso and Senator Risch, I appreciate the opportunity to testify before you today. My name is Walter Nelson, Director of Helium Sourcing with Air Products based in Allentown, Pennsylvania.

Today I would like to make a very important point. If Congress does not act within a year to pass the Stewardship Act of 2012, our

Nation will suffer a range of adverse consequences. Many walks of life which Americans depend on will be affected. Knowing they can get an MRI when needed. Semiconductor manufacturers and their customers knowing computer chips can be made without a glitch.

The same is true for making fiber optic cable. Scientists performing cutting edge research, let alone the colorful balloons commonly associated with helium. All of this will be disrupted if Congress does not act.

The statute for mandating the Nation's Helium Reserve expires in 2014. But in reality the day of reckoning will come in 2013 for reasons that I have explained in my written testimony. Without timely action there will be chaos in the helium supply in the United States that could cause major disruption in people's lives.

Imagine the impact on global markets if 30 percent of the world's oil reserves were off limits. The impact to the economy would be catastrophic. To those sectors of the U.S. economy that depend on helium, the impact would be equally catastrophic if no action is taken.

The answer is simple. With a few necessary tweaks, we believe this bill is the solution to preventing chaos in the helium market. Chances are you've heard little or nothing from your constituents about helium over the past 15 years. That's a good thing. With enacting of this bill the market should continue to function effectively and efficiently as it has since the creation of the Helium Federal Reserve.

Air Products is the largest helium refiner in the United States. We have collaborated with the U.S. Government from day one in developing the equipment necessary to support the Federal helium architecture. The BLM's pipeline infrastructure today supports industry by connecting the private helium plants to the Federal Helium Reserve at Cliffside. Without this pipeline system private industry would not be able to efficiently process the crude helium in the region. The BLM's pipeline system and the private helium plants, together, supply approximately two-thirds of the world helium supply.

The need for legislation arises from the fact that there still remains several years worth of recoverable helium in the Federal Reserve. However, once the statute expires there will be no funding mechanism for the BLM to continue operations. The bill would enable the BLM to continue helium production, perhaps even through 2020. This provides sufficient time for new private helium projects to become operational, replacing the helium currently supplied by the government.

If the bill were enacted as introduced there would be one major flaw. But it is one which we believe can be corrected. The proposed mechanism for establishing market price for helium is overly narrow and will not yield a price the taxpayers would consider fair.

The bill authorizes the Secretary to conduct a confidential survey collecting data from private industry in order to determine a market price. Air Products supports this approach. Our concern is that the language unnecessarily limits the data that the Secretary can request.

I've included specific recommendations in my written testimony. We look forward to working with the committee to get this right.

It appears that the key stakeholders in helium support your bill, Mr. Chairman. We have heard some issues being raised, however. I'd like to address them briefly.

One claim is that through Federal legislation Congress has established an oligopoly that prejudices companies without refineries on the BLM pipeline. We consider this to be nonsense. Companies with refineries on the pipeline made major investments to build these facilities.

No one guaranteed a return on their investment. These companies, including our products, took a risk. There was and remains nothing, absolutely nothing, stopping other companies from doing the same back then or to this day.

What we've heard is the absurd suggestion that Congress write into law a requirement that refiners relinquish spare capacity to process helium for others and set prices. It would be as if Hyundai asked Congress to provide in statute that General Motors would have to designate a certain percentage of its manufacturing capacity to Hyundai such that Hyundai could make cars without having to invest in its own plant. I can think of nothing more hostile to the bedrock principles of capitalism.

Those companies are in effect asking Congress to turn back the hands of time, relieving them of the consequences of their decisions not to invest in their own helium refining facilities. Congress doesn't do things like this. This is not an issue to be worked out. There is no work out of the differences between what's fair and unfair.

We've heard recently a support on a ban on helium exports which we now understand that this is off the table. That's a good thing because such a ban would violate international trade laws and would be misguided trade policy.

Let me wrap up with the following points.

Congress got it right in 1960 when they established the Federal Helium Reservoir. The system has worked well for decades.

Congress got it right again in 1996 by setting in motion a process for selling off the excess helium stored in the reservoir. End users have had helium when needed and with stable prices.

We believe that with a few changes recommended enactment of the bill would continue this tradition. But let the 1996 act expire. Without legislation helium will become a household term and not in a good way.

Doctors and patients needing MRIs will panic.

Advanced scientific research will stop.

Semiconductor and fiber optic cable manufacturers will be caught short.

The list goes on and on.

These problems will unfold by the end of 2013 if there is no mechanism in place to continue funding of the BLM's helium operations.

I appreciate the attention to this issue, Mr. Chairman. I hope that I have conveyed to the extent in which Congress must act or the consequences raised by helium will be real.

Thank you.

[The prepared statement of Mr. Nelson follows:]

PREPARED STATEMENT OF WALTER L. NELSON, DIRECTOR, HELIUM SOURCING & SUPPLY CHAIN, AIR PRODUCTS AND CHEMICALS, INC.

INTRODUCTION

Mr. Chairman, Ranking Member Murkowski, and members of the Committee, I appreciate the opportunity to testify before you today. My name is Walter Nelson, Director of Helium Sourcing and Supply Chain, with Air Products and Chemicals, based in Allentown, Pennsylvania, and one of the world's leading industrial gas companies.

I am well aware that helium seems like an odd subject for a hearing. For the reasons I will explain below, however, many walks of life on which Americans depend—knowing they can get an MRI when they need one, semiconductor manufacturers (and their customers) knowing that computer chips can be made without a hitch, scientists performing cutting-edge research, let alone the colorful balloons that we commonly associate with helium—will be disrupted if Congress does not act in this area. The statute that sets the framework for managing the nation's helium reserve expires at the end of 2014, but in fact the day of reckoning, under the statute, is likely to come by the end of 2013. If it does, there will be chaos in the helium supply in the United States that could cause major disruption in people's lives.

The solution is simple: with a few badly-needed tweaks, we believe that S. 2374, the Helium Stewardship Act of 2012, is the solution to prevent chaos in the helium market. Chances are you have heard little or nothing from constituents about helium over the past 15 years. That's a good thing. With enactment of S. 2374, chances are you still won't hear anything, a sure sign that the market will continue to function efficiently and effectively as it has since the creation of the Federal Helium Reserve. If, however, there are major changes in the system, and especially if Congress does not enact this extension of our tested helium system in the United States relatively soon, constituents may indeed start grumbling, and with good reason, reasons I will explain in a bit. The solution is straightforward, and does not cut on ideological or partisan lines. But time is not our friend here.

AIR PRODUCTS AND ITS BACKGROUND IN THE HELIUM MARKET

Air Products, with revenues of roughly $10 billion per year, is an American-owned global industrial gas company. The company provides hydrogen to oil refineries so they can make clean-burning gasoline, hydrogen for fuel cell cars and buses, liquid hydrogen for NASA's space launches, oxygen for patients in hospitals and to steel mills for use in blast furnaces, nitrogen to the semiconductor industry to make computer chips, and helium for blimps and party balloons. In short, its core business is helping major industries operate more cleanly and efficiently. Air Products has 18,000 employees in 40 countries.

Air Products maintains the world's largest helium production and distribution system. It is THE industry leader in the helium field. The Company's equipment processes more than half of the helium extracted from the earth globally, and it has pioneered many of the processes critical to getting helium from the ground to vital customers, such as extraction, production, distribution, and storage technologies used in the helium industry today. Air Products has experience second to none by virtue of the United States government's selection of Air Products to engineer and construct the first helium extraction units when the federal government began its helium conservation program in 1959. More recently, Air Products designed and constructed the helium enrichment plant in 2002 that supplies the Bureau of Land Management's helium pipeline system, which continues to operate to this day.

Air Products decided to build its first helium refining plant over 30 years ago, and the plant, in Hansford County, Texas, is one of the first of its kind in the United States. The plant, designed and built by Air Products with proprietary technology, was first operational in 1982, expanded in 1985, and it continues to operate to this day. Air Products subsequently constructed two more helium refining plants adjacent to third party natural gas processing plants, both near Liberal, Kansas. At the time of completion, the second plant was the largest helium refining plant in the world. In 1995, Air Products became the first company to design and build a helium refining plant that used crude helium that had been extracted during the production of liquid natural gas. More recently Air Products, through a joint venture with Matheson, constructed a helium refining plant in Wyoming that is expected to become operational in 2012.

In short, Air Products is the most experienced company in the world to have designed, built, and operated large commercial helium refining plants. That said, there is nothing stopping any company from building its own helium refining plants near

the Bureau of Land Management's pipeline system in the United States, and indeed, several companies have done just that.

WHERE DOES HELIUM COME FROM?

Growing up, we never had to think about helium. It is at the party store if we want balloons. We see the helium-filled blimps at sporting events. Supplying helium, however, is anything but child's play. On earth helium is found in natural gas, and in only a few spots on the planet does helium exist in high enough concentrations to make it worthwhile to separate it from the natural gas.

There are no naturally-occurring underground reservoirs of pure helium. Helium is a rare gas and it only forms in locations where the radioactive decay of uranium occurs with the formation of natural gas. Not all natural gas fields contain helium. The largest natural gas fields that are known to contain helium, other than in the United States, are in Algeria, Qatar, Iran and Russia.

Air Products' role, like that of other industrial gas companies who are helium refiners, is to purchase crude helium both from the federal government and from energy companies that are extracting helium from natural gas. These helium refiners purify (clean up and remove contaminants), liquefy (cool to minus 452 degrees Fahrenheit so that the gas takes liquid form) and then transport and sell helium into the global retail market. Once helium is extracted, purified, and liquefied, it has a short shelf life of only 45 days before it begins to warm up and turn back into a gas, so Air Products has developed transportation technologies necessary to transport the liquid helium from the refining plant to market. Gardner Cryogenics, a subsidiary company of Air Products, has designed and constructed most of the liquid helium transportation and storage equipment used by the industry today.

For Air Products and every other industrial gas company in the United States, the Bureau of Land Management's pipeline and storage system are an integral part of this global supply chain and infrastructure. Disrupt the Bureau of Land Management's pipeline, and it would be as if two-thirds of the world's supply of oil was instantly pulled off the market—chaos would ensue, and the price would skyrocket.

THE HISTORY OF CONGRESS'S ROLE IN ASSURING SENSIBLE MANAGEMENT OF HELIUM SUPPLIES

Helium was first discovered in the United States in 1904 in Dexter, Kansas, in a natural gas deposit. The recognition of the significance of helium to the national defense and for research and medical purposes prompted Congress to pass the Helium Conservation Act of 1925. The first recovery and purification plant in the United States was located in Fort Worth, Texas, and produced helium in the 1920's, after which the Fort Worth plant was replaced in 1929 by a new plant located near Amarillo, Texas. From 1929 until 1960, the federal government was the only domestic producer of helium. The majority of the helium originally produced was used to support the Navy's rigid airship program, the precursor to today's blimps. During World War II, some helium was used in the Manhattan Project. Helium, in short, was vital to national defense.

After World War II, Congress advanced the cause of helium conservation through the Helium Act Amendments of 1960. Under the provisions of this law, the federal government contracted with five private operators who constructed nine crude helium recovery plants to extract helium from the natural gas that they were processing. Notably, Air Products constructed all nine of the original helium extraction units, a testament to the company's leadership in the field. The federal government then purchased all of the helium that was extracted and stored it in the Bush Dome, a geological structure within the Cliffside natural gas field located north of Amarillo, Texas. In 1973, after helium was stockpiled for 10 years in the Bush Dome, Congress decided that the United States government had enough helium in storage, and it canceled the extraction contracts.

In the early 1980's, private industry began to construct helium refining plants along BLM's pipeline, a 420 mile crude helium pipeline system that extends from northern Texas through the panhandle of Oklahoma and into Kansas, to produce high-purity gaseous and liquid helium from both private and federal crude helium supply. Between 1982 and 2000, private industry constructed six helium refining plants at different locations along BLM's pipeline system. In addition, these private companies began entering into storage contracts with the BLM to store helium in the Bush Dome, creating what became known as the BLM pipeline system, a system of helium operations unique to the United States where a series of helium extraction and refining plants are connected to a man-made helium reservoir by a very long interconnecting pipeline.

The federal government has had a long history of involvement in the helium industry, because of the perception that helium was a precious resource that should not be squandered. Under the Helium Conservation Act of 1925, the Bureau of Mines took over production of helium for military use. Under the Helium Act of 1937, the Bureau of Mines began to sell helium to private users for medical purposes, for diving, and other specialty uses. Under the Helium Acts Amendments of 1960, the Bureau of Mines was required to purchase helium from private industry under long term contracts (22 years long) at prices set by the United States government. One hundred percent of the helium purchased by the government was put into storage at the Bush Dome.

In 1973, the federal helium purchase contracts were terminated early because the federal government had accumulated more than enough helium for strategic uses as well as accumulating nearly one billion dollars of debt over the ten year conservation period to recover and store the helium. And most recently, under the Helium Privatization Act of 1996, BLM was directed to shut down and close the government-operated helium refining plant near Amarillo, Texas, and to offer for sale the 29+ billion cubic feet of crude helium stored in the Federal Helium Reserve to private industry. Congress also directed that BLM's helium reserves were to be offered for sale over a 15 year period to pay off the one billion dollar debt to the United States Treasury that was accumulated over 10 years during the helium conservation program.

The activities of BLM under the 1996 Act were also to be subject to review by the National Academy of Sciences. In 2000, NAS determined that BLM could sell off all the helium, except for 600,000 cubic feet to be left in the Federal Helium Reserve, without negatively impacting the helium market or national security. More recently, NAS issued a report in 2010 that included recommendations to the Secretary of Interior for improved management of the Federal Helium Reserve. The Academy's recommendations largely form the basis for S.2374 today.

THE FEDERAL HELIUM RESERVE IS ESSENTIAL TO A STABLE HELIUM MARKET

BLM today operates as a natural gas producer at the Cliffside field, where it extracts natural gas from wells, separates the gas, and then sells the natural gas and helium to private industry. BLM produces approximately two billion cubic feet of crude helium annually, which is about 30 percent of the worldwide supply. The BLM system consists of the Bush Dome, an underground storage reservoir where the United States government stockpiled helium during the conservation period and into which companies that have refined helium can deposit the helium until it is used; together with 25 natural gas wells that are used to extract natural gas from the ground and a gathering system of pipes which connects all the wells together; a helium enrichment plant to process the gas; and a 420 mile crude helium pipeline system that extends from northern Texas across the panhandle of Oklahoma and into Kansas.

The crude helium enrichment plant is operated by the BLM, but the plant is owned by an entity called the Cliffside Refiners Limited Partnership (CRLP), a partnership made up of helium refiners that owned facilities on the BLM pipeline in 2000. The CRLP partners include Air Products, Praxair, Linde (formerly the British Oxygen Company), and Colorado Industrial Gas (formerly owned by El Paso Energy and soon to be acquired by Kinder Morgan). The CRLP was formed in July 2000 as a way to allow the federal government to fulfill the requirements of the Helium Privatization Act of 1996. The CRLP invested over $26 million at the Cliffside field to fund design and construction of the crude helium enrichment plant. BLM operates the CRLP-owned plant today, enabling the sale of government helium and natural gas (methane, in this case) to private industry. The CRLP companies were honored for excellence by the Secretary of Interior in 2004.

The BLM pipeline infrastructure today supports private industry by connecting eight private crude helium extraction plants and six private liquid helium refining plants to the BLM's reservoir at Cliffside. Without this pipeline system, private industry would not be able to efficiently deliver crude helium from the extraction plants to the helium refining plants in the region. The BLM pipeline system and the private industry helium plants together supply approximately two-thirds of the worldwide helium supply.

SIZE OF THE GLOBAL HELIUM MARKET AND THE UNITED STATES' SHARE

The global helium market is estimated to be in excess of six billion cubic feet per year, with growth forecast in the range of three to five percent per year. The best estimates are that the United States has the largest demand, at 40 percent, followed by Asia with 26 percent, Europe at 22 percent, and the rest of world at 12 percent.

The price of helium in the market is a function of many variables. Using BLM's posted price for crude helium of $84.00 per thousand standard cubic feet for 2013, the market value of the worldwide crude helium produced would be in excess of $500 million per year.

Over 75 percent of the world's helium supply currently comes from the United States. Two-thirds of the worldwide supply uses the BLM pipeline system and 30 percent originates from the Federal Helium Reserve. The Helium Privatization Act of 1996 expires statutorily at the end of 2014, at which time there will be harsh repercussions on the global economy and on our way of life if there is no successor statute.

HELIUM IS ESSENTIAL IN MANY VITAL WALKS OF LIFE

Helium has certain properties that make it essential to modern life in many respects. It is lighter than air, which is why it is used not just in balloons and blimps but in other applications such as military communications and surveillance and lifting applications where cranes are impractical. Because it is such a small element, it is used in leak detection. Liquid helium is the coldest substance on earth so it is used to keep the electrical coils in magnetic imaging machines cold, as well as for special scientific research. Other properties of helium make it ideal for cooling fiber optics and specialized electronics.

Imagine what would happen to modern medicine if MRIs were not readily available. Helium is used in garden variety welding, so imagine a trip to the auto repair shop or any large manufacturer without the ability of workers to engage in welding. Without access to helium, manufacturers of fiber optic cable would not be able to use existing processes for making the cable that is the foundation of modern communications capacity. Semiconductor manufacturers would not be able to function without helium.

The BLM pipeline system supports approximately two-thirds of the world's supply, and allowing that system to expire by failing to enact successor legislation to the Helium Privatization Act of 1996 would produce a country without ready access to MRIs, the ability to manufacture semiconductors or fiber optic cable, or much or anything else that requires welding, among other highly essential processes, let alone more frivolous uses such as party balloons.

MAINTAINING INDEPENDENCE FROM FOREIGN SOURCES

In any conversation about energy, much is made of the need for the U.S. to be energy self-sufficient to the extent possible. That is true in connection with rare earth metals and other essential elements to maintaining our commerce and our standard of living. Helium is no different. Our country is blessed with helium, and we should be thankful that Congresses almost a century ago had the foresight to make sure that such an essential element was not frittered away.

If the BLM system was off limits to helium refiners because the governing statute was allowed to expire, the U.S. would not only face the calamity of a chaotic market, but also would be dependent on helium imports from foreign countries. No Congress would purposely make a decision that such dependency was a wise course of action, yet failing to enact a successor to the current helium statute would have exactly those implications.

ENACTMENT OF S. 2374 BY 2013 IS ESSENTIAL

S. 2374, the Helium Stewardship Act of 2012, would preserve a system that has accomplished important objectives: assuring supply to essential uses of helium, preserving a BLM system that has many moving parts that need to work as a whole, and at stable prices. We see no reason to tinker with the essential functioning of the BLM system. We have a couple recommended changes that we discuss below, but overall we believe that the status quo has worked just fine for the taxpayer and for the economy. But we don't have time to spare, and here's why.

The Helium Privatization Act of 1996 directed BLM to cease pure helium production and to sell off the helium remaining in the reservoir. The Act expires at the end of 2014. The best available modeling predicts that there will still be 10-12 billion cubic feet of recoverable helium remaining in the reservoir at the end of 2014. At current production rates of about two billion cubic feet per year, the reservoir could continue to produce helium for five to six more years.

This same modeling, however, has determined that the reservoir production rates will decline to approximately one billion cubic feet per year after 2014. As a result, the usable life of the reservoir will be extended to 2018 or perhaps even 2020. This is sufficient time for new planned helium projects to become operational, replacing the lost Federal Reserve helium, but unless there is a successor statute to the expir-

ing Helium Privatization Act of 1996, the BLM system will not be able to continue operations beyond December 31, 2014. To repeat: unless BLM has the authority to continue to operate the federal reservoir—which it won't if there is no successor statue—all of the helium that remains in the reserve will be inaccessible. That means that 30 percent of the worldwide supply will be essentially locked up, causing prices to skyrocket, some users with no ability to access helium, and chaos in the economic sectors that now rely on helium.

In fact, though, the time pressure is even worse. Under the statute, once BLM pays off the one billion dollar debt accumulated by the federal government during the helium conservation period, pursuant to the Helium Privatization Act of 1996 the self-funded United States Treasury account will be closed and BLM could then only continue operations with appropriated funds. Otherwise, there will be no funding mechanism to allow BLM to operate the federal reservoir or the 420 mile pipeline that acts as a vital supply chain for private industry. When the 1996 Act was written, Congress projected that the reservoir would be depleted by the end of 2014, when the Act expires. Helium was removed from the reservoir at rates lower than those projected at the time, however, which is why there remains helium to be managed and a successor statute necessary. Thus, the various walks of life that would come to a halt without helium would be affected not upon the expiration of the Helium Privatization Act of 1996 on December 31, 2014, but when there is no funding mechanism beyond 2013.

AN IMPORTANT CHANGE IS NECESSARY IN S. 2374 FOR ESTABLISHING A MARKET PRICE FOR HELIUM

If S. 2374 were enacted as introduced, there would be one major and perhaps fatal flaw, but it is one which we believe can be easily corrected. As introduced, we believe the mechanism for establishing a market price for helium is overly narrow, and will not yield a price that taxpayers would consider fair.

Air Products advocates the introduction of a market based pricing mechanism for the crude helium sold by BLM. On page eight of S. 2374, the Secretary of Interior is given authority to conduct a confidential survey and to collect data from private industry, which would be used in conjunction with federal helium royalty data, in order to help determine market pricing. Air Products supports this approach. Our concern with the language on page eight, however, is that the "inclusions" and "exclusions" stated for the survey are very prescriptive and unnecessarily limit what data the Department of Interior can request from industry, which will lead to incomplete information being used to determine the market price. In our opinion, these restrictions should be removed from the legislative language to allow all the helium market data to be collected; however, guidance must be established for the Department of Interior and BLM to ensure the market-based price methodology is sound and fair.

We strongly recommend that Congress make clear that the Department of Interior must follow specific principles when using the confidential survey data to establish the market price. First, the pricing considered must be for volumes of helium that are similar in size to those volumes currently offered for sale by the Secretary. Helium purchases of small volumes (those less than 75 million cubic feet per year) will attract spot pricing, which may be higher and therefore will distort the survey data. Second, the pricing considered must be limited to sourcing transactions where the helium is being purchased for the first time. Any prices for re-sale or wholesale helium in secondary or tertiary transactions must not be considered because these prices will include profit, which will also distort the survey data. Third, BLM has been publicly posting its crude helium price for over 15 years, and many of the helium sourcing contracts today are indexed directly or indirectly to BLM's posted price for crude helium. S. 2374 currently excludes from the survey any pricing data that is indexed to the posted crude helium price. This will severely limit the Secretary's access to information that is absolutely necessary to establish a market price. The confidential survey data must be comprehensive enough to characterize all pricing escalation indexes, including any index or reference to the BLM's posted price for conservation helium.

Clear guidance must be provided to the Department of Interior on which companies must be included in the survey, when the survey must be conducted, what data must be submitted, how the data must be classified, how the data should be interpreted, what the qualifications of the individuals to analyze the data must be, how confidentiality will be maintained, how to address non-compliance, and how to audit or validate the data to ensure falsification does not occur. Including all these requirements in the legislation is impractical. Instead, we recommend that the "inclusions" and "exclusions" section should be simplified and these details be incor-

porated into the Committee report and in all other reports accompanying this legislation. We look forward to working with the Committee to refine this important point.

ANSWERING POSSIBLE OBJECTIONS TO THE HELIUM STEWARDSHIP ACT OF 2012

The government serves an essential role

At a time when the federal government is looking to have the private sector take on functions previously handled by government, there could be some who might ask why a federal reservoir should exist at all. Why not just turn it all over to the private sector?

That was exactly the thinking of Congress in 1996, and the consequence was the Helium Privatization Act of 1996, which reflected Congress's support for privatization to the extent possible. Getting the government out of the helium business altogether, however, is no more possible today than it was in 1996. The 1996 statute directed BLM to cease pure helium production and marketing. This resulted in the closure of the United States helium production plant that previously sold helium directly into the private sector market. BLM was also directed to offer for sale the approximately 29+ billion cubic feet of crude helium that had been stored in the reservoir. This sale, however, could not happen overnight. The helium in the reservoir is mixed with natural gas, and it is a complex operation to manage the geologic dynamics of the reservoir as the gas is being extracted from the ground. If the valve was simply left wide open to deplete the entire supply at once, valuable helium would be stranded in the ground and never recovered.

Today, the federal government retains ownership and management of the reservoir, the production wells, the gathering system, and the 420 mile pipeline distribution system. The helium enrichment unit and pipeline compressor stations are owned by private industry, but they are operated by employees of BLM under contract to the CRLP, the consortium of private companies that refine the helium. In our opinion, BLM is the only entity that can oversee the drawdown of this strategic asset to the benefit of the government and private industry. Turning over BLM's functions to one or more private companies simply is not feasible.

Legislation should not mandate allocations of helium

Some have been heard to argue that BLM has set up what is essentially an oligopoly, and that others wishing to buy helium should simply be allowed to buy from the helium refiners for a fee set by statute. The answer is that any party can negotiate to buy helium from a refiner, but Congress should not insert itself into the middle of commercial transactions. Commercial arrangements are entered into all the time that allow those without helium refineries to buy agreed-upon quantities of helium from those that do have refineries. These are referred to as tolling arrangements. But surely it is not the role of Congress to pass statutes that force refiners to sell at a set price, or to force refiners to share their refining capacity with companies that chose not to build their own refinery.

The refiners made enormous investments at the time they built refineries on the BLM pipeline. Several industrial gas companies chose not to make such an investment. Those industrial gas companies that chose not to make similar investments presumably made what to them were sound business decisions, and spent their capital elsewhere. For Congress in 2012 to give those companies the ability to force the refiners to sell at a set price would be totally un-American and contrary to the basic principles of capitalism. Nothing in S. 2374 stands in the way of any company entering into a tolling arrangement at a mutually agreed-upon price.

The 1996 Act did not impose restrictions on who could purchase helium from the federal government. Any third party company that wanted to enter the helium refining business and purchase helium from the federal government could have made investments as early as 1996, and could do so to this very day and into the future. Surely, it is not the role of Congress to turn back the hands of time and allow companies that opted not to make such investments to enjoy the benefits accruing to those who did.

Neither the 1996 Act nor S. 2374 imposes any restrictions on who can purchase helium from the federal government. Instead, the Department of Interior, under Administrations of both parties, limits the sale of helium from the federal reservoir to what it calls "qualified buyers"—an entity that must have the ability to receive and process the crude helium sold by the government. Any company can enter the helium refining business with the requisite commitment of its resources. BLM's interest in selling to qualified buyers is to prevent companies from stockpiling crude helium. BLM determined that helium refiners were in the best position to process the

crude helium, which requires purification and liquefaction prior to being introduced into the helium wholesale or retail market.

Interestingly, BLM initially offered 90 percent of the helium in the reservoir to the refiners and left 10 percent as unallocated, to be purchased by companies that were not refiners. But there was very little demand for the unallocated portion. Since BLM's desire was not to sit on unnecessarily large quantities of helium in the reservoir, BLM raised the allocated amount to 94 percent. Any suggestion that this level poses an obstacle to any company wishing to purchase helium for its customers simply does not comport with the facts. S. 2374 does not set the allocation level; BLM does, and for reasons that benefit the U.S. taxpayer and the users of helium.

Banning exports of helium is contrary to free trade policy and likely illegal

Finally, some have suggested that there should be a ban on the export of helium. The United States currently supplies approximately 75 percent of the world's supply of helium. This helium goes into a global market. For instance, a company manufacturing magnetic imaging machines in the U.S. that supplies them globally requires helium to be shipped from the U.S. to wherever the equipment is placed in service abroad.

Banning the export of helium would not only appear to offend various trade laws and treaties, but it would invite foreign governments to forbid the export of precious materials that U.S. manufacturers need in their production processes. Enacting export restrictions makes no more sense here than it does in connection with other commodities that are in commerce throughout the world. Indeed it is likely that we will eventually be importing helium, so to ban exports now only invites retaliation.

CONCLUSION: THE TIME FOR CONGRESS TO ACT ON HELIUM IS NOW

Congress got it right when it established the federal helium reservoir and the surrounding infrastructure managed by BLM. The system has worked well for decades. Congress got it right yet again in the Helium Privatization Act of 1996 when it set in motion a process for selling off the helium previously captured in the federal reservoir. End users have had helium when they need it, and price and access have been stable. The public does not think much about helium—aside from party balloons and blimps—because the system has worked so well.

We believe that with the few changes we recommend to S. 2374, enactment of the Helium Stewardship Act of 2012 would continue this tradition of a system that works so well that hardly anyone even knows it exists. But let the 1996 Act expire without enactment of S. 2374, and helium will be a household term, and not in a good way. Doctors and patients needing MRIs will panic. Semiconductor manufacturers, the nation's leading exporters, will be caught short. And the list will go on. These problems will unfold by the end of 2013 if there is no mechanism in place to fund BLM's helium operations, and BLM will indeed be out of business regarding its management of the Cliffside reservoir unless Congress acts.

Air Products appreciates the opportunity to share its expertise with the Committee, and looks forward to working with the Senators and staff to make sure a bill is crafted that will spare the country needless problems. We will do whatever we can to see to it that this issue is addressed by Congress before catastrophe strikes.

The CHAIRMAN. OK. Thank you all very much.

Let me start with a few questions to Mr. Spisak first.

If we were to not reauthorize this reserve and Congress just let the current law expire what happens to the remaining helium?

Mr. SPISAK. Once the debt is paid off and the provisions of the Privatization Act is as we sell off the Helium Reserve and make payments. Once the debt is paid off, the Helium Fund, which is the revolving fund that holds the revenues from the program and allows for the program to run, would be dissolved. Any receipts from the program would go directly to the Treasury.

So the program would have to compete directly for appropriations within the appropriations process and get separate appropriations for it. Without appropriations it would be like if a typical appropriation doesn't get passed and you go through a government shutdown. You'd have a similar type of operation where you'd have

to shut down the wells and the plant and safe anything until such time that appropriations were made available to operate.

The CHAIRMAN. So unless Congress came along and specifically appropriated money for this purpose then you'd just shut it all down?

Mr. SPISAK. Correct. The difficulty with that is that the operations have generally set expenditures, but it can vary quite dramatically depending on operations of vessels or plant equipment needed to be changed. It would be very hard to predict a smooth appropriation from year to year.

The CHAIRMAN. How does the BLM determine the amount of helium to sell in any particular year and who the sales are to or how this is allocated if someone wants to buy more helium than they have historically purchased? Are they able to do that?

Who are the sales to or how is this allocated—if someone wants to buy more helium than they have historically purchased are they able to do that?

What's the situation?

Mr. SPISAK. First any Federal demands whether directly through Federal agencies or researchers have what we call an in kind sales. They can purchase as much as needed.

But after that, as part of the Privatization Act we were to start no later than 2005 to offer for sale helium from the Reserve on a straight line basis. That started in actually 2003. We determined at that time making allowances for how much in kind sales we would expect through 2015. We divided the remaining amount by 12 and came up with 2.1 billion cubic feet of helium.

So since 2003 we've been offering 2.1 billion cubic feet for the Reserve sell down portion of the Privatization Act.

The CHAIRMAN. How do you determine who to sell that to?

Mr. SPISAK. Generally we've been offering it in an allocated and unallocated. We came up with that methodology because we recognized that there was more installed refining capacity along the government's crude helium pipeline than the 2.1 bcf that we'd be offering for sale. So we wanted to ensure that the lion's share of the helium that was being offered was going to be there to be able to meet that capacity.

Then the remaining 10 percent was then offered for anybody else that might be interested in it. Generally speaking of the 2.1 Bcf or the allocated sales has been taken up most of the helium sold. There's been very little unallocated companies coming in to buy the unallocated amount.

Over the last several years that ratio was adjusted up to 94 percent.

The CHAIRMAN. Let me ask about the pricing of the helium that you folks sell. How is that occurring and what's the explanation for this price increase that has occurred here?

I guess in 2010 there was a 15 percent price increase. Could you explain that?

Mr. SPISAK. Sure. It was basically when we first started pricing the helium, the crude helium was quite a bit higher than the private market for helium. That was back in 2003 and there about.

Through various shortages over the years the private price for crude helium exceeded that. We generally have been raising the

price for the crude helium at a CPI level. When we reinitiated having a National Academy's study the program in 2010, they recommended that we charge something closer to a market price.

In that first year (post 2010 NAS Study) we looked at a NASA that had both sales of Federal in kind helium and non-in kind helium. They told us they had about a $10 differential between the two. So in that year we added $10 to our open market price.

Last year we adjusted by consumer price index. But we still weren't satisfied that we were able to get enough information to accurately determine what the market price was. So what we did was we monetized on a per mcf basis costs associated with the plant efficiency and other factors. Those were those couple add-ons that we've added to the price this year.

What we believe is this process will be a more repeatable, transparent process of price calculation that folks can see going forward. But we certainly recognize the process that could be passed in the Stewardship Act may have an impact on that process.

The CHAIRMAN. Alright. That uses my time.

Senator Barrasso.

Senator BARRASSO. Thank you very much.

Just to follow a little bit with that, Mr. Spisak. I understand it's going to take a number of years for the Reserve to reach this 3 billion cubic foot. What's your assessment on when that might be? A decade or what are your thoughts?

Mr. SPISAK. We have done a quick look at it based on the timing of getting this legislation. We would expect the phase B or the second phase to be probably take us to about the year 2020. Because the first phase would be another 2.1 bcf, that would be next fiscal year.

We'd expect to maybe scale down in a couple years into offering about maybe 1 bcf. That would get us to about 2020. Then the phase 3 or the Federal demands only maybe to 2030.

Senator BARRASSO. There are a couple of private refineries, I think 6 private refineries, connected to the Reserve. Could you just give us a little explanation as to when those were built, under what circumstances and if there are legal obstacles for other companies to build new refineries?

Mr. SPISAK. I saw some of the other folk's testimony. I think they startup in various years generally with their crude helium extraction plans. But the refiners I think started in the 1970s and 1980s. Most of the plants were built during that time. There has been some expansion on capacity over the years.

We don't have any prohibition against new companies coming in. But there is a recognition that we've already oversubscribed in the amount of capacity associated with the pipeline.

Senator BARRASSO. Great.

Dr. Chan, as a low temperature scientist and in your testimony, your written testimony, you referred a little bit to the liquefied natural gas issue as well and wonder what your anticipation is in terms of LNG, export facilities proposed, you know, to be built here in the United States with our significant capacity for liquefied natural gas and is that going to serve as a new source of helium?

Mr. CHAN. Let me see if I understand what you're saying.

As you probably know that there are new supply coming online from Algiers and Qatar. The reason is that although they're among helium in their well. They are quite a bit lower than what the U.S. have in the Panhandle area. But they've become economically viable because they have to liquefy the natural gas in order to ship it to the residents.

In so doing then gas with even 0.1 percent of helium will be economically competitive. So it is my understanding that they will start, in fact they have started shipping, selling helium. So therefore, I guess it is reason—maybe it may happen in another 10 years or so that the U.S. becomes a net importer of helium.

Senator BARRASSO. But not for another decade, OK.

Mr. CHAN. Not for——

Senator BARRASSO. Great. Thank you.

Mr. CHAN. Probably at least.

Senator BARRASSO. Thanks.

Mr. CHAN. So therefore keeping the Helium Reserve operating will have a very stabilizing effect for the strategic use, for NASA, for defense.

Senator BARRASSO. Great.

Mr. CHAN. For scientific research.

Senator BARRASSO. Thank you.

Mr. Rauch, as you mentioned my career in orthopedic surgery we had an MRI in a facility in our medical group. It was a GE product. It worked very well. We know the importance of helium.

You're not the only company that makes this. But you talked about, what, 20,000 jobs in the health component. So it's a jobs issue. It's also a patient care issue.

I don't know if you wanted to elaborate a little bit about that?

Mr. RAUCH. Yes. Depending on where you live access can be an issue. I mean, Wyoming for an example. The population isn't centralized in a lot of big cities. So it may take you a month, maybe 3 weeks, to get in for a scheduled MRI.

If the service event couldn't happen because of a helium interruption or if the installation of a new magnet couldn't happen because of a delayed delivery patient care has to be rescheduled. Maybe another 3 to 4 weeks before you get in to—for maybe a needed scan and diagnosis then would be missed.

Senator BARRASSO. I think GE has a program working on helium efficiency, also conservation efforts. Could you explain a little bit about that?

Mr. RAUCH. Yes. It's really on two fronts. So we use about equally as much in the field as we do in our production, about 5 and a half in production, 6 million in the field, liters, liquid liters.

So there's a bigger opportunity for efficiency in our factory than there is in the field. The field builds are done by technicians with small containers, 500 liter doers.

In the factory we've invested money in recapturing equipment where as we vent liquid which turns into gas. We recapture it and warm it back up, recompress it. Actually sell it back to our partner onsite so they can sell it as welding gas.

We also are looking into re-liquification. We have also spent significant money in piping and more thermally efficient transfer. Also pre-cooling magnets with liquid nitrogen, so that it's already

down at lower temperatures to be more efficient when we fill it with helium the first time.

Senator BARRASSO. Thank you, Mr. Chairman. My time is expired.

The CHAIRMAN. Let me ask a few more questions of Mr. Spisak.

Are there currently supplies going into the Reserve?

Mr. SPISAK. Generally now, specifically the Reserve, the gas field, is all flowing out. There are still some sources within the Kansas Hugoton Oklahoma Panhandle fields that are producing crude helium, but they're generally being refined by the refining capacity along the pipeline. So the crude helium never makes it into storage in the field.

So generally everything is coming out of the field going north.

The CHAIRMAN. The decision then to eliminate the Reserve which is what Congress, I guess, determined to do, sell off the Reserve. That's a decision you think makes good sense?

Mr. SPISAK. Generally speaking the infrastructure that's there, the Reserve, the pipeline, the connectivity to the different plants allows helium that's produced from natural gas that doesn't drive the natural gas production. The natural gas production is driven by other factors so the associated helium produced, having the infrastructure there, allows for the helium to be stored in an efficient manner for use tomorrow, next week or next year. Not having the Reserve or the pipeline will change the complexity of how the industry functions going forward.

But there was a large stockpile that we're selling off. It's meeting demands both private and Federal. I think that's meeting that need.

The CHAIRMAN. But I guess I'm just looking forward 20 years it's wise for us not to have a reserve. Is it in your view or should we plan to have a reserve for the indefinite future to meet our various needs?

Mr. SPISAK. I think having that infrastructure there is something that does provide value. The level of the Reserve and at what level you would keep it, I think, is for other folks to determine, the people demanding it and how much is appropriate for the government to keep in a stockpile.

The CHAIRMAN. Tell me about tolling. Can you explain how the tolling works? Tolling fees?

Mr. SPISAK. I can tell you what I understand and then some others might want to chime in. But generally you have companies that have the refining capacity. Somebody that does not have an actual refinery along the pipeline, they will pay a fee to have their helium, their crude helium, refined and then delivered at their specification.

The CHAIRMAN. But this is not anything the BLM takes or is in involved in?

Mr. SPISAK. That's correct. We are not involved in that. We're aware of the arrangements. But it's between private and private.

We do keep up with the storage of the crude helium and generally the transfers will be made between the companies. They tell us to make a transfer and we make that transfer. But we may or may not know the reason for the transfer or the particulars behind what's going on between the companies.

The CHAIRMAN. Mr. Nelson, your company is involved in the tolling business. Could you explain how it works?

Mr. NELSON. Certainly, Senator Bingaman.

Air Products has tolled for competitors in the past. The process of tolling is whereby government crude helium is brought through the BLM pipeline system into one of our refining plants, purified, liquefied and then delivered to a customer who has purchased the liquid helium.

Today we are not tolling. There's a tightness in the supply/demand situation. We currently don't have any excess capacity to toll. So today there is no tolling taking place.

But again, we would toll if we had capacity. It would be a commercial negotiation that would take place between one of our competitors that wanted to toll and use the facilities that we have available. It's really a commercial negotiation. There's nothing in the legislation that prevents that discussion from taking place.

Mr. JOYNER. Mr. Chairman.

The CHAIRMAN. Mr. Joyner, did you have a comment?

Mr. JOYNER. Yes, thank you. If I could just add to that and maybe expand on Mr. Spisak's earlier comments.

The fact that the crude system from the BLM can only supply 50 percent of the capacity, of the refining capacity, that's already on the pipeline. Do there is no more ability for another refinery to come in because there's already too much capacity on that system to process the crude that the BLM infrastructure is able to supply. As Mr. Spisak mentioned, these refineries were built in the 1980s, I think prior to this 1996 Privatization Act, because they were refining crude from private extractors.

So the 1996 Act was an infrastructure from the government, the government's reserve, that then was offered up going to these refineries which again, already more capacity on the line than the BLM could supply. So for another player to come in at this stage what both with the rules in place with the allocation and just the infrastructure limits, it would be prohibitive to build another refinery at this stage.

So I think going back to NAS recommendations that this refining capacity be opened up to the other players in the market, you know, has merit for consideration for the committee.

The CHAIRMAN. Senator Barrasso, did you have additional questions?

Senator BARRASSO. No, thank you, Mr. Chairman.

The CHAIRMAN. Thank you all very much. I think it's been useful. We will try to see what we can do to move ahead with the legislation.

Thank you very much.

That will conclude our hearing.

[Whereupon, at 10:30 a.m. the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

RESPONSES OF TIMOTHY R. SPISAK TO QUESTIONS FROM SENATOR BARRASSO

Question 1. When did the Bureau of Land Management (BLM) stop accumulating crude helium? How much Federally-owned crude helium is currently in the Federal Helium Reserve?

Answer. The Federal government stopped accumulating helium in 1973 when the Federal helium program was still under the management of the Bureau of Mines. As of the beginning of FY 2012, there is a total of 16.18 billion standard cubic feet (scf) of Federally-owned helium in the Reserve. Of this total, 13.73 billion scf is conservation helium and 2.44 billion scf is in the native natural gas. Additionally, there is 1.15 billion scf of privately-owned helium in the Reserve.

Question 2. S. 2374 would extend the Secretary of the Interior's authority to sell Federally-owned crude helium from the Federal Helium Reserve for use in the private sector until the Reserve reaches 3 billion cubic feet. At that point, the Secretary would only be authorized to sell Federally-owned crude helium from the Reserve for use by Federal users.

A. When will the Reserve reach 3 billion cubic feet?

B. How long will 3 billion cubic feet meet the demand of Federal users as defined under S. 2374?

Answer. A. If S. 2374 were enacted, the BLM estimates that the Reserve would reach 3 billion scf in approximately 2021.

Answer. B. If S. 2374 were enacted, the BLM estimates that the 3 billion scf remaining in the Reserve would meet the demand of Federal users until approximately 2029.

Question 3. I understand that there are six private helium refineries connected to the Federal Helium Reserve. These refineries process the crude helium drawn from the Reserve.

A. Can you explain when these refineries were built and under what circumstances?

B. Are there any legal obstacles for other private entities to build new refineries connected to the Reserve? If so, what are those legal obstacles?

Answer. A. The six private helium refineries connected to the Reserve have always been private plants built and operated by the helium industry. The list below includes the year each plant was built, the name of the original company that built it, and the name of the company that currently owns and operates it.

YEAR BUILT	ORIGINAL COMPANY	CURRENT COMPANY
1965	Otis	Linde
1968	Jayhawk	Praxair
1979	Bushton	Praxair
1982	Sherhan	Air Products
1991	National	Air Products
1995	Keyes	DCP Midstream

Answer. B. The BLM is not aware of any legal obstacles that would prohibit other private entities from building new refineries connected to the Reserve.

Question 4. In your written testimony, you state that BLM anticipates full repayment of the helium debt in Fiscal Year 2013. You explain that the Helium Fund would then be dissolved and all future receipts would be deposited directly into the General Fund.

A. Once the helium debt is paid off, what are the impacts on the operation of the Reserve?

B. Will the Secretary be able to sell crude helium from the Reserve after the helium debt is paid off?

Answer. A. Once the helium debt is paid off and the Helium Production Fund is terminated, the BLM would have to undertake an orderly shutdown of the Reserve unless there is discretionary funding appropriated for crude helium sales and Reserve operations.

Answer. B. Current law (50 USC δ167d) provides indefinite authority for the Secretary to sell crude helium. However, current law (50 USC δ167d(e)(2)(A)) also terminates the Helium Production Fund upon repayment of the helium debt. Therefore, any continued crude helium sales and Reserve operations would have to be paid for with discretionary funding.

Question 5. In August of 2008, the Department of the Interior's Inspector General (IG) issued a report entitled, "Immediate Action Needed to Stop the Inappropriate Use of Cooperative Agreements in BLM's Helium Program." What steps, if any, has BLM taken to address the concerns raised and the recommendations made in the IG's report? Please submit as part of the hearing record BLM's formal response(s) to the IG's report.

Answer. On August 19, 2008, the Department of the Interior, Office of the Inspector General (OIG) issued a report entitled "Immediate Action Needed to Stop the Inappropriate Use of Cooperative Agreements in BLM's Helium Program." The BLM responded to this report with official memoranda dated September 19, 2008, and May 9, 2009, which are attached.*

On July 6, 2010, the Department of the Interior informed the OIG that the BLM had taken the necessary steps required to warrant closure of the recommendations contained in the 2008 OIG report, and that the Department of the Interior considered the report closed. The closure request memo and supporting documentation, which outline the rationale for the closure, are attached.*

RESPONSES OF TOM RAUCH TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. Where does GE get the Helium it needs?

Answer. We contract with Helium retailers around the world; our largest suppliers are Air Products and Praxair. These suppliers sell us bulk Helium as well as provide value added services for us such as filling magnets at hospital sites.

Question 2. What are the causes of the global Helium supply disruption in the past ten years?

Answer. Growth of demand outpacing growth of supply has been the root cause. A few key industry drivers are electronic component usage due to propagation of mobile/handheld devices, fiber optics due to growth in infrastructure build out in emerging markets, and MRI demand as emerging markets demand has grown as the technology has become more affordable.

Question 3. How have each of your businesses or livelihoods been impacted by these shortages?

Answer. We have been closely managing supply and in doing so have incurred extra cost burden as a result of a less efficient supply chain. We have bid on foreign surplus "spot market" Helium at significant cost premiums, and have had periods of idle capacity in our plant awaiting Helium deliveries.

Question 4. Are you concerned about price increases as a result of this legislation?

Answer. GE is always concerned with potential price increases for essential elements within the supply chain. Our priority however, remains ensuring access to helium both for the manufacturing and servicing of MRIs and the long-term sustainability of the global supply of helium.

Question 5. What will happen if Congress fails to reauthorize the Federal Helium Reserve?

Answer. If Congress fails to act, one-third of the global supply of helium will be removed from the marketplace overnight. This would likely result in steep price increases and a severe shortage of helium.

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*Attachments have been retained in committee files.

Question 6. What conservation and recycling technologies are available to conserve Helium? How affective are they? Who has access to them?

Answer. Our biggest opportunity to conserve is during magnet production; we have been able to reduce consumption on a per unit basis by 5% per year for the past 5 years. GE has invested heavily in the technology and engineering know how, and services from outside suppliers in areas of thermal transfer, Nitrogen pre-cooling, and gaseous recapture in order to make this possible. We have approached the helium situation with a mindset that every molecule counts.

Question 7. Will this Legislation help to stimulate production of helium by private natural gas producers so that reliable domestic supplies are available once the Federal Helium Reserve is depleted?

Answer. GE is hopeful that this legislation will put in place mechanisms that would lead to greater private sector development of helium resources.

RESPONSE OF TOM RAUCH TO QUESTION FROM SENATOR MURKOWSKI

Question 1. Dr. Chan's testimony mentioned the technological advantages of concentrating helium during the liquefaction of natural gas, and how several Middle Eastern countries were developing such LNG projects and could potentially become helium exporters.

Would the LNG projects currently being developed and planned domestically also be able to produce and refine helium?

Answer. Theoretically, yes. However, specialized equipment is needed to cool the LNG, siphon off the Helium, separate the other gasses off, then re-liquify it.

Question 1a. If these domestic LNG facilities would be able to produce helium, what quantities might be available? Would this be sufficient for current and projected domestic use?

Answer. It is hard to say; it depends on the size of LNG reserve and the concentration of Helium molecules contained within.

Question 1b. What capital investments and infrastructure build-out would be required to connect these domestic LNG facilities (which are typically on the coast at port locations to facilitate LNG exports) with current distribution lines to helium consumers? Can helium be easily transported by sea?

Answer. To put any new investment in context, the largest Helium infrastructure investment to date is the Qatar II plant. This was a $500 million dollar joint venture between Qatar Petroleum, Royal Dutch Shell, and Exxon Mobil.

Yes, Helium can be transported by sea in bulk when it is in a liquid state.

Question 1c. What sort of timeline would you anticipate for the availability of the LNG-derived helium supplies described above?

Answer. Based on the timeline of Qatar II plant, I would estimate 2-3 years from capital expenditure to production.

Question 1d. Do you believe that LNG-derived helium is going to be the major source of helium in the future? Or do you believe traditional extraction methods and/or conservation will be more important to supply security?

Answer. LNG based gas will certainly play a big role in the future, but short term and sustained conservation efforts by all users is also needed.

RESPONSES OF TOM RAUCH TO QUESTIONS FROM SENATOR BARRASSO

Question 1. In your written testimony, you discuss the importance of helium to Magnetic Resonance Imaging or MRI technology. You explain that helium is essential to cool the magnets used in MRI scanners. You go on to say that: "If the [helium] supply constrain worsened it could be very harmful to patient care." Would you please elaborate on the impacts of a helium shortage to patient care?

Answer. If a helium shortage reached the point at which MRI manufacturers and equipment servicers were not able to meet the needs of health care providers and patients, a health care access issue could arise. Hospitals that have ordered new MRIs would have to wait longer to install equipment, potentially forcing patients to seek care elsewhere, delay care, or forgo care. Existing MRIs would need to be serviced more frequently, causing disruption in patient care. If an existing MRI magnet runs out of helium, a magnet "quench" will occur, causing significant system down time during which patients at that care facility would not have access to scans. All of these scenarios could mean patients having to travel farther to access MRI and longer wait times for critical care. MRI patients currently face wait times longer than most other imaging modalities as it is.

Question 2. In your written testimony, you explain that GE Healthcare produces magnets for MRI scanners in South Carolina. You state that GE "uses roughly 5.5 million liters of helium a year at [its] South Carolina production facility." What

would be the impacts on the South Carolina production facility if the Federal Helium Reserve was taken offline?

Answer. There are currently 375 employees and roughly 100 contractors working at our manufacturing facility in Florence, SC. The major output of the plant is MRI magnets along with a few other MRI components. If the BLM Helium were suddenly unavailable in the marketplace, GE and presumably every other MRI manufacturer would likely not be able to meet a significant portion of the health care system demand.

Question 3. In your written testimony, you mention that GE Healthcare has "invest[ed] $1 million at [its] facility in South Carolina in an effort to increase helium efficiency." You explain that "researchers at GE's Global Research Centers are currently exploring the feasibility of new magnet designs that minimize the amount of helium needed." Would you please elaborate on GE's helium efficiency and conservation efforts?

Answer. Our biggest opportunity to conserve is during magnet production; we have been able to reduce consumption on a per unit basis by 5% per year for the past 5 years. GE has invested heavily in the technology and engineering know how, and services from outside suppliers in areas of thermal transfer, Nitrogen pre-cooling, and gaseous recapture in order to make this possible. We have approached the helium situation with a mindset that every molecule counts.

At our Global Research Center, our GE scientists are working on proprietary designs that significantly reduce the amount of Helium needed to cool and operate magnet, as well as researching the use of alternative superconducting materials to niobium-titanium wire and which may operate at warmer temps. These are long-term solutions, and will not be commercially available any time soon.

RESPONSES OF WALTER L. NELSON TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. What will happen if Congress fails to reauthorize the Federal Helium Reserve?

Answer. The BLM operations in Amarillo, TX will close shop and all helium production by the BLM will stop on 31 December 2014, or potentially as early as 1 October 2013 when then federal debt has been repaid and there is no funding mechanism to support BLM operations at Cliffside. As a result, 30% of the world's helium supply will be taken off the market, resulting in chaos for those industries that depend on helium.

Question 2. Will this Legislation help to stimulate production of helium by private natural gas producers so that reliable domestic supplies are available once the Federal Helium Reserve is depleted?

Answer. The legislation may have an indirect effect on the stimulation of helium production. As described in my written testimony, helium is a small part of the equation when determining if a natural gas project proceeds or not. The "energy play" project must stand on its own. With increasing pricing on helium and additional time to develop the new projects, new sources can be brought on line.

Question 3. What infrastructure improvements at the reserve are required to optimize continued responsible extraction of Helium for distribution and use? Would S. 2374 enable those improvements?

Answer. Yes. S2374 authorizes the use of funds from the Helium Production Fund for capital improvements, upgrades and maintenance necessary to continue and optimize the extraction of helium from the reservoir.

- Continued maintenance of the 25 wells and the gas gathering system
- Addition of compression equipment, which is necessary before 2014, to offset the declining pressure in the reservoir
- Addition of processing equipment by 2016 to handle the changing raw gas composition
- Construction of new equipment by 2016 to handle lower flow rates in the outer years

Question 4. What are the causes of the global Helium supply disruption in the past ten years?

Answer. The global helium supply system has been operating with utilization rates greater than 95%. Any disruption in natural gas supply, caused by coincident planned or unplanned outages at natural gas plants, will result in helium supply disruptions.

What caused the helium shortage in 2006-2007? Industry experienced an unprecedented period of planned and unplanned outages which created a shortfall in sup-

ply. In addition, new helium production capacity failed to materialize as expected to match modest growth.

What caused the current helium shortage in 2011-2012? The same story again this time but with slightly different actors. The industry experienced a series of planned and unplanned outages and the start-up of new natural gas projects have been delayed.

Question 5. How have each of your businesses or livelihoods been impacted by these shortages?

Answer. In 2007, Air Products was able to manage through the crisis by working closely with our customers to conserve helium, while limiting our supply exclusively to customers under contract. In 2012, Air Products was not able to supply our entire customer demand, which required us to declare Force Majeure and to allocate customers. These shortages have resulted in lost market share, revenue and profit.

Question 6. For non-federal reserve helium, how is that price determined?

Answer. Market bid or commercial negotiation.

RESPONSE OF WALTER L. NELSON TO QUESTION FROM SENATOR MURKOWSKI

Question 1. Dr. Chan's testimony mentioned the technological advantages of concentrating helium during the liquefaction of natural gas, and how several Middle Eastern countries were developing such LNG projects and could potentially become helium exporters.

Would the LNG projects currently being developed and planned domestically also be able to produce and refine helium?

Answer. Dr. Chan is absolutely correct. The equipment and processes used to liquefy natural gas can result in the concentration of helium molecules in the plant making helium extraction possible. If the natural gas feeding the LNG plant contains at least 300 parts per million (0.003%) of helium and the LNG plant is sufficiently large, it may be economically feasible to extract and refine the helium.

Question 1a. If these domestic LNG facilities would be able to produce helium, what quantities might be available? Would this be sufficient for current and projected domestic use?

Answer. There are a handful of domestic LNG projects in various stages of development in the United States, however we're not aware of any projects that are currently approved and on the books. The projects under consideration are called "conversion projects" where LNG liquefying equipment would be added to existing LNG receiving terminals. These terminals would become "bi-directional", capable of both receiving LNG as well as producing LNG for export. In the US there are currently 3 receiving terminals on the east coast and 11 receiving terminals in the gulf coast that could be amenable to LNG conversion and subsequent helium extraction. Unfortunately, these bi-directional LNG terminals will most likely process unconventional oil and gas or shale gas from geological structures that typically do not include helium. Not all natural gas contains helium.

Question 1b. What capital investments and infrastructure build-out would be required to connect these domestic LNG facilities (which are typically on the coast at port locations to facilitate LNG exports) with current distribution lines to helium consumers? Can helium be easily transported by sea?

Answer. The interstate natural gas pipeline infrastructure to/from these LNG terminals is already in place. Commercial contracts and incentives would be necessary to encourage the diversion of helium bearing natural gas specifically to the LNG terminals that had helium extraction capabilities. Depending on the size of the LNG facility, adding helium extraction could cost $20 to $30 million dollars. Again, depending on the plant size, a new helium refining plant could cost in excess of $100 million dollars.

The standard method to recover helium from LNG incorporates liquefaction of the Helium adjacent to the LNG facility. In this form the helium can be transported anywhere to meet customer needs.

Question 1c. What sort of timeline would you anticipate for the availability of the LNG-derived helium supplies described above?

Answer. There are a number of major new LNG-derived sources of helium which will likely be developed internationally. These include new projects in Australia, Qatar, Russia and Indonesia.

As stated earlier, there are currently no approved domestic projects on the books, so we predict that helium sourced from domestic LNG is probably at least 10 years into the future.

Question 1d. Do you believe that LNG-derived helium is going to be the major source of helium in the future? Or do you believe traditional extraction methods and/or conservation will be more important to supply security?

Answer. In the United States, the next largest source of helium will most probably come from the Riley Ridge WY or St. Johns NM fields where private industry is extracting both the natural gas as well as CO_2 which is used for enhanced oil recovery for depleting oil fields. We are not forecasting LNG technology to deliver large volumes of helium in the United States.

Outside the United States, LNG-derived helium is becoming very prevalent. We expect to see continued development of LNG-derived helium in geographic locations where the natural gas feeding large LNG plants contains helium in concentrations greater than 0.003%. Examples include Algeria, Qatar, Australia, Russia and Indonesia.

RESPONSES OF DAVID JOYNER TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. What will happen if Congress fails to reauthorize the Federal Helium Reserve?

Answer. Mr. Chairman, the Bureau of Land Management's ("BLM") Federal Helium Reserve currently supplies approximately 30 percent of the world's supply of helium. If the Federal Helium Reserve is not reauthorized, this helium will be eliminated from the marketplace causing a shortage of supply against consumer demand. Although other sources of helium are being developed around the world that will reduce the dependence upon the Federal Reserve, the output of these sources will not likely be adequate to fully offset the loss of supply from the Federal Reserve over time. This will inevitably cause shortages and have a downstream price impact on end-users such as medical facilities, research laboratories, and various manufacturing sectors.

Question 2. Will this Legislation help to stimulate production of helium by private natural gas producers so that reliable domestic supplies are available once the Federal Helium Reserve is depleted?

Answer. The Legislation will have a limited effect on the development of new sources of helium. The helium industry is already pursuing new sources of helium with the decline in rates of the Federal Helium Reserve and the decline in rates of the private Hugoton reserves, as well as the imminent depletion of the Federal Reserve. Despite this, the establishment of a more accurate market price for helium from the Federal Reserve will likely encourage the extraction of helium from other sources. It should be noted, however, that these alternate sources take years to develop and maintaining the continued supply of helium from the Federal Helium Reserve is important to allow time for these reserves to be developed.

Question 3. Did Air Liquide consider building a refinery on the pipeline after the 1996 legislation was passed? Did Air Liquide take any steps to ensure access to the reserve after the sell-off was initiated? What steps are you taking now to ensure your supply in the long-term after the reserve has been depleted?

Answer. It is important to note that, while the existing refineries took advantage of some government infrastructure, they were not constructed for the purpose of having exclusive future access to the Federal Helium Reserve. Most, if not all, were constructed prior to 1996 and were mainly justifiable based on purchasing helium from private producers as helium was extracted from natural gas production on a real time basis.

At the time the 1996 legislation was passed, private helium extraction rates were declining. Thus, when the 1996 legislation directed the BLM to sell off the helium from the Federal Helium Reserve, the companies with existing refineries on the Federal helium pipeline were in a windfall position enabling them to draw federal helium in addition to private helium without investment in the existing refineries. Conversely, non-refiners, such as Air Liquide, were in a heavily disadvantaged position against the refiners who already had refineries operating on the pipeline. Indeed, based on the current BLM allocation system, companies with existing refineries on the Federal helium pipeline are allocated 94 percent of the BLM helium available for sale while nonrefiners are allocated six percent. Additionally, in order to access that six percent, nonrefiners must rely upon the refiners (who are also their competitors in the helium market) for tolling (i.e. refining), particularly due to the fact that the BLM infrastructure is not capable of supplying any crude helium to an additional refinery. This fact is supported by the most recent invitation for offers issued by BLM which states: "the Crude Helium Refiners have refining capacity roughly double what can be supplied through the Annual Conservation Helium Sales. Although there are other crude helium supplies available to the Crude Helium Refiners, these supplies are declining each year." In other words, the pipeline cannot support further refining capacity and the existing refineries, put in place to take advantage of private crude helium supplies, are now being subsidized from the

government's Federal Helium Reserve to offset the reductions from the private resources.

This closed system is a bad deal for non-refiners and a bad deal for end users who do not benefit from fair and open market competition. As the National Research Council's 2010 report on the Federal Helium Reserve noted, "[t]hese market distortions have encouraged the extraction of crude helium from the [Federal Helium Reserve] and the exploitation for private profit of this reserve by a small number of firms having refineries connected to the publicly financed pipeline."

As stated above, there is a difference between six percent of BLM crude helium being allocated for non-refiners and the ability of non-refiners to utilize the allocation. Regardless of the percentage allocated for non-refiners, the allocation is useless, absent a guaranteed method for non-refiners to toll (i.e. refine) the helium. To enable the access of Air Liquide, to the six percent of the Federal Helium Reserve allocation set aside for non-refiners, Air Liquide has pursued tolling agreements with the refiners. Despite these efforts, only limited quantities on short term arrangements have been allowed by the refiners who have kept availability to the Federal Helium Reserve very limited. In this respect, it is crucial to understand that refining is only one step in the helium processing chain toward a completed product that can be sold to an end user. By not allowing access to this part of the chain (i.e. essentially blocking access to the Federal Helium Reserve), distortions are created in the helium market that ultimately cost end users.

The consequences of the situation described above have important implications for domestic end-users of helium. Adopting a more market-based approach was recommended by the National Research Council's 2010 Report on the Federal Helium Reserve which stated the following:

> The Bureau of Land Management (BLM) should adopt policies that open its crude helium sales to a broader array of buyers and make the process for establishing the selling price of crude helium from the Federal Helium Reserve more transparent. Such policies are likely to require that BLM negotiate with the companies owning helium refining facilities connected to the Helium Pipeline the conditions under which unused refining capacity at those facilities will be made available to all buyers of federally owned crude helium, thereby allowing them to process the crude helium they purchase into refined helium for commercial sale.

Utilizing this approach would result in a more accurate and transparent helium market and would benefit consumers by increasing the number of suppliers competing for the business of federal users and open market users. To attain these goals, Air Liquide would recommend that S. 2374 include measures to open the Federal Helium Reserve to a wider range of buyers and establish policies to ensure greater access to crude helium exists within the market. In exchange for a suitable tolling fee paid to the refiners, nonrefiners would therefore be able to buy BLM helium and, through arrangements with existing refiners, be able to utilize previously unavailable refining capacity at facilities on the Federal Helium Pipeline.

To address one of the criticisms leveled during the May 10, 2012 hearing, this proposal is not at all tantamount to the Federal government passing a statute requiring one car company to provide manufacturing space for a competing car company so that the competitor did not have to take on the expense of building its own facility. The analogy is fatally flawed because unlike the parts required for the manufacturing of motor vehicles, the United States government—taxpayers—own the crude helium in the Federal Helium Reserve, as well as the infrastructure to supply the helium which is not adequate to supply additional refineries. The Federal Helium Reserve is a critical government resource intended for the benefit of the entire country. As the National Research Center 2010 report noted, non-refiners are at a distinct disadvantage under the current system and this federal resource was not intended as a profit center for three private companies. In the auto industry, manufacturers compete against each other on an even playing field in a market governed by supply and demand. The public should expect no less from the management of the Federal Helium Reserve.

On the question of ensuring a stable supply of helium, Air Liquide has obtained a position in projects that may be developed in the United States. Such projects are largely dependent upon gas producer project development. Additionally, Air Liquide is also developing a large foreign helium source that will greatly reduce the need to export helium from the Federal Reserve. In this manner, Air Liquide's investment constitutes a major contribution towards conserving the Federal Helium Reserve.

Question 4. What are the causes of the global Helium supply disruption in the past ten years?

Answer. The helium market is complex and it is therefore difficult to link the recent disruption in the global helium market to a finite list of factors. It has been well documented that the global supply disruption in 2006 and 2007 was largely due to a loss of production capacity in the market. Importantly, as helium production is largely the result of natural gas production, many factors relating to the global market are outside the control of helium suppliers. For example, due to its relationship with helium extraction, demand for liquid natural gas ("LNG") demand drives LNG production rates and, consequently, helium production rates. Planned and unplanned downtime at these LNG or natural gas production sites causes helium shortages. An additional factor relates to the nature of helium, which is difficult to store. Helium is stored in specially designed containers developed to keep the product at cold temperatures (approximately -450 degrees) to avoid helium product losses. As the temperature of the helium unavoidably increases, the pressure rises as well. When the pressure reaches design limits, safety valves vent helium gas to reduce the pressure. These containers can only store the helium for 30 to 45 days before high losses are incurred. For these reasons, producers and suppliers have limited ability to store gaseous and liquid helium which reduces the ability for suppliers to maintain adequate supply during source interruptions. Thus, supply is only available to support demand for shorter term production curtailments.

Question 5. How have each of your businesses or livelihoods been impacted by these shortages?

Answer. As a company, Air Liquide is focused on technological innovation to help make our Nation's manufacturing and industrial sectors more efficient, environmentally friendly and productive. To that end, since 2007, Air Liquide has operated the Delaware Research and Technology Center ("DRTC") which houses approximately one hundred employees specifically devoted to developing innovative applications for gas products in sectors such as electronics, healthcare, cosmetics, energy and food, as well as supporting helium specific initiatives such as recovery and reliquefaction in support of conservation efforts. A long-term shortage of helium would jeopardize several research initiatives being undertaken at DRTC.

In addition to our own initiatives, Air Liquide is a major helium supplier. End users served by Air Liquide include medical facilities, research laboratories, and high-end electronics manufacturers. Any helium shortage impacts our ability to meet the needs of our customers.

Question 6. For non-federal reserve helium, how is that price determined?

Answer. Outside of the BLM pricing system, helium sources are priced according to commercially negotiated contracts in which all players compete on a level playing field. Once an initial base price is set, annual adjustments in price are typically based upon changes to the BLM crude helium price. In almost all non-BLM global helium sources, a gas producer owns and operates the helium refinery, thus the refined liquid helium is sold. This sets up a competitive situation where all companies have equal opportunity to negotiate for the refined helium. At the end of each contract term, a competitive situation exists that again opens the helium capacity up for equal access. This allows the open market drivers to set a new base market price.

As the Committee is aware, the current pricing system for BLM helium has historically been tied to paying down the debt of the Federal Helium Reserve. In addition, the BLM has more recently tied price increases to BLM-specific factors such as "Conservation" and "Enrichment", as well as contributions to the Helium Production Fund. Consideration of these non-market factors has made the BLM price inherently unpredictable and certainly unrelated to the actual market price for crude helium. Air Liquide remains concerned with the pricing system set forth in the proposed legislation since it will continue to allow BLM-specific factors to influence the BLM crude helium price. As global helium contracts are often indexed to the BLM crude helium price, these changes will distort the global market and force helium costs upward.

To prevent this undesirable result, Air Liquide recommends the separation of the "fees" cited recently by the BLM—i.e. for Enrichment and Conservation, as well one time step changes to adjust value from historical practices—from the BLM crude price to reflect the wholesale change in the pricing mechanism envisioned by the proposed legislation. By clearly separating the non-market fees from the current BLM crude price—which has no relation to the actual value of helium in the market—private companies will be able to adjust existing contracts in accordance with true market drivers and avoid the artificial increases causing undue harm to end-users. Such a solution would allow the BLM to collect the full revenue stream and ensure that the federally supported Federal Reserve maintains its ability to operate effectively for several years to come while protecting helium end-users domestically and around the world from dramatic and unpredictable swings in price. Consumers

of the BLM Reserve would still be paying for its continued maintenance, operation, and upgrades through this fee structure but would be doing so in a way that is directly accountable to the federal government's investment. They would also be doing so through a fee system that the BLM itself has already begun to establish with its latest price increase. Similarly, consumers of other helium sources, both domestically and abroad, could be secure in the fact that simple supply and demand and business acumen will govern their price, not unrelated government actions that are specific to the BLM reserve and not relevant to other helium sources.

RESPONSE OF DAVID JOYNER TO QUESTION FROM SENATOR MURKOWSKI

Question 1. Dr. Chan's testimony mentioned the technological advantages of concentrating helium during the liquefaction of natural gas, and how several Middle Eastern countries were developing such LNG projects and could potentially become helium exporters. Would the LNG projects currently being developed and planned domestically also be able to produce and refine helium?

Answer. To date, we have not received data sufficient for Air Liquide to evaluate the helium content in the projects discussed above. While helium can be extracted from LNG projects, helium does not always exist in natural gas production or helium content could be at levels too low to extract. The proposed legislation provides for the BLM to quantify all helium reserves and Air Liquide believes that attention should also focus on analyzing the helium content of these LNG projects.

Question 1a. If these domestic LNG facilities would be able to produce helium, what quantities might be available? Would this be sufficient for current and projected domestic use?

Answer. Without an appropriate gas analysis, the helium content of these projects cannot be confirmed. As a frame of reference, an LNG facility that would produce 400 MMscf/day of gross gas, and if the gas had an ssumed helium content of 0.3%, a helium extraction/liquefaction refinery could produce as much as 0.4 BCF per year. The annual domestic demand is currently estimated at approximately 2 BCF per year.

Question 1b. What capital investments and infrastructure build-out would be required to connect these domestic LNG facilities (which are typically on the coast at port locations to facilitate LNG exports) with current distribution lines to helium consumers? Can helium be easily transported by sea?

Answer. After appropriate analysis indicating a supply of helium, the main requirement would be land necessary to build a helium extraction/liquefaction facility right at the LNG terminals. This is the case since the crude helium could not be economically transported to any existing helium plants. Once the facilities were constructed, the crude helium would be liquefied and transported in specialized ISO Containers to various Transfill operations around the United States for distribution to customers.

Question 1c. What sort of timeline would you anticipate for the availability of the LNGderived helium supplies described above?

Answer. It is inherently difficult to estimate a timeline for large-scale projects like LNG terminals which are dependent on both economic and regulatory factors. Various LNG projects in the early developmental stage are projected to have on-stream dates in 2017 and beyond. Should viable quantities of helium exist, such helium could be developed concurrently.

Question 1d. Do you believe that LNG-derived helium is going to be the major source of helium in the future? Or do you believe traditional extraction methods and/or conservation will be more important to supply security?

Answer. Given the current demand for helium to support research, manufacturing, and other important sectors, Air Liquide believes that all avenues of helium production should be explored and, if viable, extracted. Although LNG-derived helium represents the largest individual sources of helium and are essential to meeting end user requirements, continued development of traditional extraction sources will enhance the reliability of the supply chain even though they are typically much smaller capacities.

RESPONSE OF DAVID JOYNER TO QUESTION FROM SENATOR BARRASSO

Question 1. I recognize that access to helium refining capacity at the Federal Helium Reserve is a high priority for you and other companies that distribute helium.

A. Can you help the Committee understand why Air Liquide has not invested in building refining capacity at the Reserve in the past?

B. Are there legal or any other obstacles to building additional refining capacity at the Reserve now? If so, what are those obstacles?

Answer. A. It is important to note that, while the existing refineries took advantage of some government infrastructure, they were not constructed for the purpose of having exclusive future access to the Federal Helium Reserve. Most, if not all, were constructed prior to 1996 and were mainly justifiable based on purchasing helium from private producers as helium was extracted from natural gas production on a real time basis.

At the time the 1996 legislation was passed, private helium extraction rates were declining. Thus, when the 1996 legislation directed the BLM to sell off the helium from the Federal Helium Reserve, the companies with existing refineries on the Federal helium pipeline were in a windfall position enabling them to draw federal helium in addition to private helium without investment in the existing refineries. Conversely, non-refiners, such as Air Liquide, were in a heavily disadvantaged position against the refiners who already had refineries operating on the pipeline. Indeed, based on the current BLM allocation system, companies with existing refineries on the Federal helium pipeline are allocated 94 percent of the BLM helium available for sale while non-refiners are allocated six percent. Additionally, in order to access that six percent, non-refiners must rely upon the refiners (who are also their competitors in the helium market) for tolling (i.e. refining), particularly due to the fact that the BLM infrastructure is not capable of supplying any crude helium to an additional refinery. This fact is supported by the most recent invitation for offers issued by BLM which states: "the Crude Helium Refiners have refining capacity roughly double what can be supplied through the Annual Conservation Helium Sales. Although there are other crude helium supplies available to the Crude Helium Refiners, these supplies are declining each year." In other words, the pipeline cannot support further refining capacity and the existing refineries, put in place to take advantage of private crude helium supplies, are now being subsidized from the government's Federal Helium Reserve to offset the reductions from the private resources.

The consequences of the situation described above have important implications for domestic end-users of helium. Adopting a more market-based approach was recommended by the National Research Council's 2010 Report on the Federal Helium Reserve which stated the following:

> The Bureau of Land Management (BLM) should adopt policies that open its crude helium sales to a broader array of buyers and make the process for establishing the selling price of crude helium from the Federal Helium Reserve more transparent. Such policies are likely to require that BLM negotiate with the companies owning helium refining facilities connected to the Helium Pipeline the conditions under which unused refining capacity at those facilities will be made available to all buyers of federally owned crude helium, thereby allowing them to process the crude helium they purchase into refined helium for commercial sale.

Utilizing this approach would result in a more accurate and transparent helium market and would benefit consumers by increasing the number of suppliers competing for the business of federal users and open market users. To attain these goals, we would recommend that S. 2374 include measures to open the Federal Helium Reserve to a wider range of buyers and establish policies to ensure greater access to crude helium exists within the market. In exchange for a suitable tolling fee paid to the refiners, non-refiners would therefore be able to buy BLM helium and, through arrangements with existing refiners, be able to utilize previously unavailable refining capacity at facilities on the Helium Pipeline.

To address one of the criticisms leveled during the May 10, 2012 hearing, this proposal is not at all tantamount to the Federal government passing a statute requiring one car company to provide manufacturing space for a competing car company so that the competitor did not have to take on the expense of building its own facility. The analogy is fatally flawed because unlike the parts required for the manufacturing of motor vehicles, the United States government—taxpayers—own the crude helium in the Federal Helium Reserve, as well as the infrastructure to supply the helium which is not adequate to supply additional refineries. The Federal Helium Reserve is a critical government resource intended for the benefit of the entire country. As the National Research Center 2010 report noted, non-refiners are at a distinct disadvantage under the current system and this federal resource was not intended as a profit center for three private companies. In the auto industry, manufacturers compete against each other on an even playing field in a market governed by supply and demand. The public should expect no less from the management of the Federal Helium Reserve.

Answer. B. As BLM Deputy Assistant Director for Minerals and Realty Management Timothy Spisak testified before the Committee on May 10, 2012, the amount

of capacity of the Federal Helium pipeline is already oversubscribed. Accordingly, the capacity does not currently exist to justify any investment in a new refinery connected to the Federal Helium Reserve.

RESPONSES OF MOSES CHAN TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. What will happen if Congress fails to reauthorize the Federal Helium Reserve?

Answer. The NRC committee believed that there could be uncertainty in supply and abrupt price hike in both the U.S. and world helium market if Congress failed to reauthorize the federal helium resserve.

Question 2. What are the causes of the global Helium supply disruption in the past ten years?

Answer. The committee was familiar with the occurrence of several disruptions in 2006-2007. It is my recollection that those supply disruptions were the result of nearly simultaneous maintenance efforts with respect to the helium enrichment unit at the federal helium reserve that took it out of service and a shutdown of the Wyoming site.

Question 3. How have each of your businesses or livelihoods been impacted by these shortages?

Answer. For scientific research using liquid helium, the shortages meant premature termination of a number of experiments. This means that the completion of some experiments carried out in government and industrial labs, as well as research sponsored by agencies such as DOE, NSF and DARPA, was delayed. These delays also had severe impact on the career of some graduate students and young scientists.

Question 4. Are you concerned about price increases as a result of this legislation?

Answer. Yes, since the costs of liquid helium often is a significant portion of the total expenses of the research grants in many laboratories.

Question 5. Are there any substitutes for Helium?

Answer. For the research scientist using helium in cryogenic research, there is no substitute.

Question 6. What conservation and recycling technologies are available to conserve Helium? How affective are they? Who has access to them?

Answer. Equipment to recycle boiled off helium gas back into liquid form exists. The cost of a larger system, including installation, ranges from $1,000,000 (which would liquefy about 20 liters per hour) to $2,000,000. A smaller unit that can liquefy about 20 liters a day will cost about $160,000. These can cut down the usage of helium by 90%.

It is also possible to acquire an attachment for a cryostat (for example, a dilution refrigerator) that automatically recycles helium gas back into its liquid form. The costs of these unites are about $150,000 and can cut down the usage of helium by nearly 100%.

Access is limited by their costs and the availability of funding. This is not considered to be a high priority, given limited budgets.

Question 7. Is the world going to run out of Helium? Other than stockpiling, what else can we be doing to gain access to additional supplies?

Answer. Information provided to the NRC committee indicated that there is roughly a 60 year supply, based upon known reserves of natural gas in which helium can be commercially separated. There might be other sources of natural gas where the amount of helium present is less than the 0.3% threshold at which it typically has been considered economically feasible to extract it from the gas. To extract helium from such sources will be more costly.

Question 8. Will this Legislation help to stimulate production of helium by private natural gas producers so that reliable domestic supplies are available once the Federal Helium Reserve is depleted?

Answer. Probably.

RESPONSES OF MOSES CHAN TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. Your written testimony mentioned the prospect of the United States becoming a helium importer, due in large part to the development of natural gas liquefaction facilities in several Middle Eastern countries and the relative ease of extracting and concentrating helium when preparing LNG. However, there are currently several large LNG projects at varying levels of planning and completion in North America.

Answer. Since LNG involves liquefaction of the natural gas, the further step of extracting helium from the 'tail' gases—what is left-over after liquefying the natural

gas—would be much cheaper than extracting it from the natural gas itself. So, it possibly would be economically feasible to extract helium from those sources. However, I do not know whether the natural gas in the LNG projects under consideration in North America has even the low concentrations of helium needed to make this extraction feasible or whether any companies are considering building the additional facilities needed to extract the helium from those tail gases.

Question 2. Would these facilities also be able to efficiently refine helium and provide domestic sources of the gas?

Answer. Please see above.

Question 3. Your testimony mentioned the technological advantages of concentrating helium during the liquefaction of natural gas, and how several Middle Eastern countries were developing such LNG projects and could potentially become helium exporters.

Would the LNG projects currently being developed and planned domestically also be able to produce and refine helium?

Answer. Please see answer to No 1.

Question 3a. If these domestic LNG facilities would be able to produce helium, what quantities might be available? Would this be sufficient for current and projected domestic use?

Answer. I have no knowledge about the helium content of those reserves.

Question 3b. What capital investments and infrastructure build-out would be required to connect these domestic LNG facilities (which are typically on the coast at port locations to facilitate LNG exports) with current distribution lines to helium consumers? Can helium be easily transported by sea?

Answer. This is beyond my expertise; I don't know the costs. As for transportation of helium by sea, that currently is taking place in liquid form, in refrigerated containers.

Question 3c. What sort of timeline would you anticipate for the availability of the LNG-derived helium supplies described above?

Answer. I do not know.

Question 3d. Do you believe that LNG-derived helium is going to be the major source of helium in the future? Or do you believe traditional extraction methods and/or conservation will be more important to supply security?

Answer. This mainly is an economic and geologic question and is beyond my expertise.

APPENDIX II

Additional Material Submitted for the Record

May 7, 2012.

Hon. JEFF BINGAMAN,
Chairman, Senate Committee on Energy and Natural Resources, 304 Dirksen Senate Office Building, Washington, DC.

Hon. LISA MURKOWSKI,
Ranking Member, Senate Committee on Energy and Natural Resources, 304 Dirksen Senate Office Building, Washington, DC.

DEAR CHAIRMAN BINGAMAN AND RANKING MEMBER MURKOWSKI: As a broad coalition of industrial, scientific and medical industry stakeholders, we are writing to express our support for the Helium Stewardship Act of 2012 (S.2374) introduced by Senators Bingaman, Barrasso, Wyden, and Enzi. Helium is a critical element used in numerous applications in our medical, industrial and scientific communities. This legislation is urgently needed to continue administering our federal helium program to maintain a reliable domestic supply and minimize market disruptions. Hundreds of thousands of jobs depend on reliable access to and stable pricing for helium.

Helium plays a vital role in a wide array of products in the industrial manufacturing, commercial, medical and government markets. Key uses include MRI scanners, semiconductors, fiber optic cable, space exploration, scientific research and welding. It is a non-renewable resource that naturally occurs in only a few places globally, and any reduction in supply could dramatically impact our markets and the availability of these and other important products and services. It is therefore imperative that a stable domestic resource of helium is sustained to keep our markets operating smoothly.

U.S. entities acquire much of their helium from the Federal Helium Reserve at the Bush Dome just outside of Amarillo, Texas. While operations stretch back to the 1960s, the Helium Privatization Act of 1996 was the last time that Congress considered this issue. When this statute expires in 2014, a significant portion of current global supply will no longer be accessible. In practical terms, this will happen sometime in 2013 when operating funds are projected to cease if action is not taken to reauthorize the Reserve.

The result of inaction will be to take 30% of the world's supply off the market, causing enormous dislocations in the affected industries and ripple effects beyond them—patients forced to travel long distances to find working MRIs, semiconductor manufacturers and other industrial and commercial businesses uncertain where they will turn for essential helium, creating new dependencies on unstable foreign sources. Essential scientific research could suffer major adverse impacts.

The Helium Stewardship Act of 2012 will authorize the continued management of the Reserve to ensure maximum helium recovery and value to the US Treasury and taxpayers. It does not authorize or require any new appropriations. Instead, it keeps the federal helium program revenue positive through continued crude helium sales from the federal stockpile. It would create certainty and stability in the helium markets for all stakeholders, federal and private alike.

In closing, we'd again like to reiterate our strong support. The Helium Stewardship Act will protect our economy and national security from unpredictable supply sources across the globe. It will ensure that a safe supply of domestic helium is available for many years to come.

Sincerely,

Right Scan Right Time; Air Products; America College of Radiology; APS Physics; Freescale; GE; FlobalFoundries; IBM; International Balloon Association; Intel; The Linde Group; Materials Research Society; Matheson Gas; Medical Imaging & Technology Alliance; Micron; NEMA; ON Semiconductor; Praxair; Samsung Austin Semiconductor;

Semiconductor Industry Association; Siemens; and Texas Instruments.

STATEMENT OF MATHESON GAS*

Summary of Matheson's Position

- Matheson supports passage of the Helium Stewardship Act of 2012 (S.2374), subject to certain revisions to the language related to the calculation of the market price for crude helium (CHE).
- As a "non-refiner", the most important issue addressed by S.2374 is the requirement that "Sales of crude helium by the Secretary shall be at prices. . .that approximate the crude helium price in the private market".
- The sale of CHE from the Federal stockpile at market prices is fair to the taxpayer and will facilitate fair competition between refiners, who have nearly exclusive access to the Federal stockpile and non-refiners, who have very limited access to the Federal reserve.
- Matheson's contention is that S.2374 must provide sufficient guidelines to ensure that the rule making process results in a reasonable calculation of market price.
  - —The intent of the S.2374 should be further clarified in the accompanying Committee Report
- The methodology prescribed in Section 6(d)(2) of S.2374 has technical flaws that would result in an over-estimation of the market price, creating a windfall for the energy companies who produce crude or refined liquid helium as well as an unwarranted step change in the cost incurred by helium consumers.
- Matheson believes that the language in S.2374 can be corrected by fairly minor modifications to the existing language.

CHE Market Price

Definition of "Market Price": Market Price is the price at which buyers and sellers are currently willing to enter into arm's length transactions

Key elements of a sound calculation of Market Price:

—Simple - As simple as possible
—Objective - Not overly dependent on human judgment
—Repeatable - Different people using the same data would come up with very similar results
—Based on readily accessible data
—Based on current/recent data - Pricing data from older transactions is irrelevant to a calculation of market price
—Includes enough data points to avoid distortion by unusual/outlier transactions
—Based on comparable transactions
—Not overly susceptible to manipulation
—Allows for "expert" review to ensure reasonability

Issue: Number Of Data Points vs Comparable Transactions

- Unfortunately, there are not enough CHE purchase and sale transactions (Level 1 Transactions) to provide enough data points for a valid calculation of the market price of CHE.
- It is necessary to compromise on the "comparability of transactions" to ensure the availability of a sufficient number of data points for the calculation of market price.
- To increase the number of data points, it is necessary to move further down the Helium Value Chain (see Chart on next slide).
  - —The next step down the Helium Value Chain is bulk liquid helium (LHE) sourcing transactions (Level 2 Transactions)
  - —The next step down the Helium Value Chain is bulk LHe resale/wholesale transactions (Level 3 Transactions)
- To the extent that Level 2 and Level 3 transactions are utilized in the calculation of market price, adjustments are necessary to improve the comparability of Level 2/3 transactions with CHE purchase/sale (Level 1) transactions.
- Without these adjustments, you will not have an "apples to apples" comparison of data points and will not have a technically sound calculation

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* Slides provided with this statement have been retained in committee files.

- The inclusion of end user transactions (Level 4) in the calculation of market price would make the calculation overly complicated, would add greatly to the administrative burden associated with data gathering and would increase the likelihood of an inaccurate calculation

*Helium Value Chain**

What Are The Problems With The Calculation Of Market Price Described In S.2374? (1 of 2)

MATHESON ISSUE #1

- Earlier drafts of the bill (SIL11195) only included large "sourcing" transactions in the calculation of market price for CHE
  - —Refiners' "wholesale/resale" transactions were specifically excluded from the calculation
  - —Small sourcing transactions (<75 MMCF/yr) were also excluded
- S.2374 includes wholesale/resale transactions for the sale of bulk LHE in quantities >20 MMCF/yr in the calculation, as well as sourcing transactions <75 MMCF/yr, but >20 MMCF/yr
- Since Refiners' sales of bulk LHE and small sourcing transactions include an extra layer of profit, they are inherently at higher prices than "sourcing" transactions
- Including these distributor level transactions in the calculation of market price on the same basis as large sourcing transactions would be the equivalent of mixing "apples and oranges"
  - —Would result in an over-estimate of the market price of CHE and a significant step change in the market price of helium for end users
  - —Would also result in a windfall for natural gas processors

What Are The Problems With The Calculation Of Market Price Described In S.2374? (2 of 2)

MATHESON ISSUE #2

- It is not necessary to exclude transactions indexed to the BLM posted price for CHE.
- Matheson believes that this exclusion was added to the draft in error.
- The intent of the language is that only prices in new transactions or newly renegotiated transactions would be included in the Secretary's survey.
- Prices adjusted periodically via indexation to the BLM's posted price or any other index do not represent new market prices and should be excluded from the Secretary's survey.
- For transactions where pricing is indexed to the BLM's posted price, the initial negotiated price should be included in the survey, while subsequent prices adjusted via indexation to the BLM posted price should be excluded from the survey.

MATHESON ISSUE #3

- Helium royalty data is a reflection of average sales prices rather than current market price and should be excluded from the Secretary's survey.

Recommended Revisions To S.2374

- Prices for wholesale/resale transactions and small sourcing transactions will need to be reduced to remove the extra layer of profit associated with those transactions and to enable a proper "apples to apples" comparison in the calculation of market price.
  - —Matheson recommends the insertion of a new Section 6(d)(2)(C):
    - "in consultation with the helium industry, the additional layer of profit derived from agreements for the resale of liquid helium or the sale of liquid helium in lesser than normal quantities for sourcing transactions."
- Matheson recommends the deletion of Section 6(d)(2)(B) which suggests that the Secretary should consider royalties from the sale of helium from Federal land in his determination of the market price. [Section 6(d)(2)(C) becomes Section 6(d)(2)(B)]

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*Graphic has been retained in committee files.

- Matheson recommends the deletion of Section 6(d)(4)(C)(ii).
- Matheson recommends that all references to "sourcing" transactions be changed to "sourcing and wholesale" transactions.

Other Issues—Access To The Reserve/Tolling

- Matheson is disappointed that S.2374 does not address the issue of third-party tolling by the Refiners
- Unless the Refiners are required to provide tolling services to non-refiners, the Federal stockpile and government helium business are essentially reserved for the Refiners
- Setting aside a modest percentage of Refiners' capacity for third-party tolling would increase the number of suppliers who would be able to compete for government business
- Matheson is willing to set this issue aside in the interest of getting a bill passed, provided that the bill includes guidelines for a sound calculation of market price

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STATEMENT OF JANE HOFFMAN, GLOBAL DIRECTOR, HELIUM & RARE GASES PRAXAIR, INC

Praxair, Inc. is an American multinational and the largest industrial gas company in North and South America and one of the largest worldwide. Praxair is headquartered in Danbury, Connecticut and its primary research and development facility is located in Tonawanda, New York. Praxair employs approximately 10,000 people in more than 500 facilities across the United States. The company manufactures, sells, and distributes atmospheric, process, and specialty gases. Praxair products, services, and technologies bring productivity and environmental benefits to a wide range of industries including aerospace, chemicals, food and beverage, electronics, healthcare, manufacturing, metals among others. With respect to helium, Praxair purchases crude helium from energy companies and the U.S. government and sells refined helium into the global retail market.

Praxair appreciates the opportunity to add to the discussion regarding the Helium Stewardship Act of 2012. The Helium Stewardship Act is necessary legislation to prevent a profound disruption in the global helium market, which will severely impact consumers, scientists, and employers.

My written testimony is based on my thirty-four year career with Praxair, the majority of which has been spent working in all aspect of the helium business, including operations, global supply chain, sourcing or product management.

I. THE HELIUM STEWARDSHIP ACT MUST BE PASSED NOW TO ENSURE PROPER MANAGEMENT OF THE NATIONAL HELIUM RESERVE

The Helium Privatization Act of 1996 expires on December 31, 2014. When the Privatization Act was enacted it was envisioned that the helium reserves would be sold off by the date of expiration. However, sufficient helium currently remains in the reserves such that the U.S. Bureau of Land Management (BLM) is able to continue to sell helium for several years post 2014.

The Act needs to be extended to ensure that the BLM can continue to operate the helium storage facility and sell helium to meet the needs of industry and the scientific community. While the amount of helium in the reserve is declining, modeling of the reservoir predict that 10-12 billion ft3 of recoverable crude helium will remain when the Privatization Act expires. This amount is sufficient volume to operate the system until sometime around 2020. The Act needs to be extended now. Uncertainty surrounding extension of the Act will lead to a winding down of operations, discontinuation of infrastructure improvements, minimal maintenance programs, and volatile supplies and pricing scenarios here and abroad.

The Helium Stewardship Act achieves three important goals. First, the Act reauthorizes the Federal Helium Reserve to ensure ongoing operations without federally appropriated funds. Second, it establishes an improved market-based pricing mechanism for the sale of helium from the Reserve. Third, it creates a larger Strategic Reserve for users of helium in critical defense, space, and scientific applications. The Act is broadly supported by refiners and end-users. See, Industry Support Letter to Senate Committee on Energy & Natural. Resources Chairman Jeff Bingaman and Ranking Member Lisa Murkowski, May 7, 2012 (Attachment A).*

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*See letter dated May 7, 2012, at the beginning of Appendix II.

II. THE GLOBAL HELIUM MARKET

Helium is a chemical element that is formed by the radioactive decay of heavy elements in the earth's crust and is found in certain natural gas fields where both gases formed together and are capped by impermeable rock. Helium concentrations in natural gas are very low (<1 %) and only a few natural gas formations hold helium in economically recoverable quantities. Today, it is relied upon by industrial, governmental, and academic researchers. It is used in the manufacturing of semiconductors and fiber optics as well as the operation of MRIs. It is used as a carrier gas for oxygen in synthetic breathing mixtures, brings lift to balloons, and is utilized in many other applications. End users, our customers, seek an adequate, reliable and consistent supply of helium and proper administration of the National Helium Reserve is an imperative to their commercial and academic needs.

As discussed in greater detail below, the BLM pipeline and storage system play an integral role in the global helium supply chain and infrastructure. The Helium Stewardship Act of 2012 is necessary to ensure continued BLM operations and infrastructure improvements to prevent significant disruptions in the global helium market.

Currently, six sources provide approximately 75-percent of the global helium supply. Approximately 30-percent of the global supply is produced in the U.S. by the BLM at its Cliffside Reservoir operation with another 30-percent being extracted from current U.S. natural gas production. The remaining sources, which make up the majority of global helium production, are located in Australia, Russia, Qatar, and Algeria.

As previously indicated, helium is a critical component in a variety of industrial, academic, and governmental applications. Our customers include, but are not limited to:

- Electronics: Helium creates environments necessary for manufacturing semiconducting devices.
- Fiber Optics: Gaseous helium is a critical consumable for producing the optical fibers in telecommunications cables.
- Medical: Liquid helium's low boiling point (-452°F or -269°C) makes it ideal for cooling the MRI magnets that create the magnetic field medical professionals need to develop detailed images of body tissue that can eliminate exploratory surgery and biopsies.
- Metals: As a result of its high arc temperature, high heat transfer, and inertness helium makes it possible for metallurgists to extract, smelt, and refine a variety of advanced materials, such as niobium, tantalum, titanium, and zirconium. In addition, welders use helium for welding materials with greater heat conductivity, such as aluminum and magnesium alloys.
- Aerospace: Helium plays a critical role in helping aerospace companies as well as the U.S. Government launch satellites and shuttles, As a result of its low solubility, low boiling point, and inertness, helium is vital for purging and pressurizing the liquid hydrogen fuel systems of rockets and spacecraft.
- Atmospheric Plasma: As a result of its inertness and high thermal conductivity, helium is used in the formation of low temperature atmospheric plasma. Plasma is used to modify chemical groups on surfaces, add coatings to materials, and clean surfaces for the aluminum, automotive, electronics, packaging, steel, printing, and textile industries.
- Aerostat / Balloons: Helium provides the lift to items such as simple party balloons as well as sophisticated aircraft and aerostats carrying weather forecasting instruments, television equipment and radar stations to communications relays.
- Diving: Commercial and research divers rely on gaseous helium as a carrier gas for oxygen in synthetic breathing mixtures.

The demand for helium has increased sharply out of the recession driven primarily by the increased demand in electronics, fiber optic manufacturing, and MRIs. Annual helium demand is now expected to grow at rates of 3-percent to 5-percent per annum. Much of the demand growth has been in the developing economies, but fiber optic manufacturing in the U.S., which remains the second largest producer, has been strong. Additionally, much of the end-market demand for electronics remains in the U.S. This is a natural part of an economy beginning to recover and should be expected. It should also be noted that much of the helium exported is used by U.S.-based end market companies in their operations in the developing economies through joint-ventures or affiliated companies.

There currently exists a helium supply-demand imbalance. This imbalance, however, is temporary and is not a result of the world running out of helium. It is rath-

er a result of multiple outages and operating reductions across the helium supply chain due to a confluence of events. This ranges from an extended outage due to unplanned maintenance at one of the world's largest private helium facilities in the United States to a dispute over the feedstock price and refinery ownership at another plant in Russia which resulted in the elimination of shipments for almost a year. In addition, production at the BLM has become less robust as the amount of helium in storage declines and the natural pressure of the storage field decreases. New helium projects, in the United States and abroad, are coming online slower than anticipated since they are connected to larger natural gas projects which have been impacted by economic, geopolitical or environmental factors unrelated to the demand for helium.

As stated above, it is important to understand that the world is not running out of helium. Significant resources exist around the world ensuring sufficient helium to meet anticipated demand for many years to come. To put it in perspective, the proven helium reserves known today are sufficient to meet today's helium production for over 100 years.

To continue to satisfy growing demand, the helium industry will need to develop these known reserves so that helium is available when needed. This is, of course, an ongoing process and while the industry wishes it could occur sooner, new production is anticipated as early as later this year. For example, two industrial gas companies will bring a helium plant on line in Wyoming and a much larger helium plant will start up next year in Qatar. The plant in Qatar—Qatar II as it is commonly called in the industry—will be the largest unit of its kind in the world and will represent 20-percent of today's industry capacity. This additional capacity will go a long way to eliminating the current supply-demand imbalance. The operation of this plant is a partnership between RasGas and QatarGas, with out-take dedicated to Air Liquide, a French industrial gas company who will be entitled to 50% of the helium volumes produced by the new unit with the other 50% split between German and Japanese helium companies. Assuming the plant reaches full operation as planned, there will be excess capacity in the system. Since it is anticipated that helium produced at this location will be primarily used to serve the Asian and European markets, exports of domestic helium purchased from the BLM to international end users and distributors will likely be reduced.

The U.S. remains the only country with storage capacity to allow for minimal disruptions should one of the large offshore plants have operational issues. This function of the BLM, the fly-wheel effect, has been of significant importance and must be sustained.

III. THE FEDERAL GOVERNMENT HAS HISTORICALLY PLAYED AN IMPORTANT ROLE IN THE HELIUM MARKET AND WILL CONTINUE TO DO SO DURING PRIVATIZATION

The Federal Helium Program was created in 1925 in order to guarantee the availability of helium for the purpose of national defense, specifically aircraft buoyancy. As a result, the United States Government constructed a helium extraction and purification plant outside of Amarillo, Texas that began operations in 1929. As the demand for helium increased, Congress responded by passing amendments to the Helium Program and in 1960, incentives were created to encourage private natural gas producers to separate crude helium from natural gas and sell it to the government. The majority of the crude helium purchased by the government was injected into the Federal Helium Reserve.

The 1960 amendments also required the government to set prices on the refined helium it sold for federal use directly or through the 602 distributor program to enable it to cover the Helium Program's costs and repay its debts. Federal reserves at that time were not sold for private use.

In 1973, the Federal government cancelled crude contracts with private extractors, thus ending the buildup of the reserve volumes. This action gave rise to the development of the private sector in purchasing, refining and marketing these crude volumes from private extractors. The BLM pipeline and storage system was available for a fee for private companies to store or inventory excess helium. This private storage was used by refiners to even the supply to their plants during times when extractor plants were not in operation.

In the 1990s, the private demand for helium became significantly greater than government demand because of advances in research, technology and medicine. In 1996, Congress passed the Helium Privatization Act which directed the BLM to shutdown federal helium refining operations and dismantle the facility by 1999. It also called for the sale of crude helium reserves to begin in the year 2005 and to be concluded by December 31, 2014. The Act provided minimum selling prices, adjusted for inflation, for crude helium so that adequate revenue was generated to

repay the government's investment in the Reserve and the construction costs of the related infrastructure.

While the Privatization Act envisioned the reserves to be sold by 2015, this has not yet occurred. Rather, reserves continue to exist such that the BLM can continue to sell helium for several more years.

IV. DOMESTIC REFINERS, DISTRIBUTORS & END USERS HAVE ACCESS TO THE NATIONAL HELIUM RESERVE THROUGH A VARIETY OF MECHANISMS INCLUDING ALLOCATED AND NON-ALLOCATED SALES & TOLLING AGREEMENTS

The BLM operates as a natural gas producer at the Cliffside Reservoir, outside of Amarillo Texas, and produces 2 billion ft^3/year of crude helium, which currently accounts for approximately 30-percent of the global supply. The BLM system consists of: the Bush Dome, an underground storage reservoir; a helium enrichment plant, which is a joint-venture between Air Products, Inc., El Paso, Linde Industrial Gases US, and Praxair, Inc.; and 420 miles of pipeline delivering helium to crude helium extraction plants and liquid helium refining plants in Texas, Oklahoma, and Kansas. Each of these companies made significant capital investment along the pipeline system as well as private extractors to develop the nation's helium capabilities.

Pursuant to the Helium Privatization Act, the BLM annually offers for sale a portion of the crude helium stored at the Reserve. The annual sales are managed in a manner intended to prevent helium market disruptions from occurring to end users; shortages of crude helium to refiners; and an oversupply of crude helium on the market for crude helium extractors. Each year, the BLM publishes an Invitation for Offer (IFO) which details the volume of helium available and the sale price.

The IFO also identifies the parties who are qualified to submit a purchase request for the crude helium. These include entities who: (1) operate helium purification plants within the U.S.; {2) operate crude helium extraction plants within the U.S.; (3) are wholesalers of pure helium; (4) purchase helium for resale within the U.S.; (5) are consumers of pure helium for resale within the U.S.; or (6) have a "tolling agreements" with a helium refiner.

The sales are conducted in two phases——Allocated Sales and Non-Allocated Sales. An Allocated Sale is that portion of the annual sale volume that is set aside for purchase by the crude helium refiners—entities with capabilities of refining crude helium, have connection points on the crude helium pipeline, and valid Helium Storage Contracts as of the date of the sale. The most recent IFO (October 2011-September 2012) provided that the helium available for the Allocated Sale phase would be 94-percent of the total volume sold. A Non-Allocated Sale is that portion of the annual sale volume that is offered to all remaining qualified buyers. Any portion of the sales volume not nominated in the Allocated Sales are offered as additional Non-Allocated Sales.

The Secretary is tasked with offering for sale at such time and quantities to meet the requirements of the 1996 Act with minimal market disruption. Crude helium sold during the allocated portion of the sale is intended for current consumption. By prioritizing volume to crude helium refiners, it ensures that refined product will be delivered to the retail market in real time. If this was not the case, there would be nothing to prevent a non-refiner from purchasing a large portion of the reserves and then holding the crude helium to manipulate the market price by creating shortages.

As a result of the refiners' respective capital investment decisions to construct helium refining plants connected to BLM operations as well as purchasing crude from private extractors, they are able to purchase crude helium in the Allocated Sale phase. This crude helium is refined and sold into the retail market through sales to distributors as well as sales directly to end users. It is important to note that the refiners on the BLM system have refining capacity roughly double what can be supplied through the government's annual sale. Accordingly, the refiners have and currently do enter into "tolling agreements" with qualified buyers who do not have refining capability. Under these privately negotiated tolling agreements, refiners agree to refine the crude helium owned by others. As Federal users of helium have first call on pipeline capacity, there is an incentive for refiners to enter into tolling agreements with Federal In-Kind suppliers allowing for non-refiners to equally participate in providing helium to Federal agencies and programs. The only regulatory restriction is that they hold a valid In-Kind sales contract with the BLM. Companies holding such contracts are listed on the BLM website as Authorized Federal Helium Suppliers and include non-refiners as well as distributors.

Records of crude sales, which are publicly available, show that some private non-refining companies have not taken full advantage of the access and opportunity to

purchase from the Federal Reserve. To be clear, tolling agreements with non-refining companies are in place and have been for much of the last decade. Praxair has such agreements in place while others may not. Further, some companies have established informal tolling arrangements, creating a backup system to ensure that customers receive the helium supply they rely upon. Finally, Praxair has the capacity to meet existing tolling agreements.

It is also evident from public records of private inventories that non-refiners may have taken advantage of these tolling arrangements with one or more refiners on the system to toll this crude into refined product for market. Such arrangements provide these non-refiners with access to helium refining capacity through commercial means.

V. WHILE THE HELIUM MARKET FUNCTIONS LIKE ANY GLOBALLY TRADED COMMODITY, ITS PRICE IS STRONGLY INFLUENCED BY THE FEDERAL GOVERNMENT

The price of crude helium produced by the Federal Helium Reserve is not established by traditional market conditions, but rather by the terms of the Helium Privatization Act. Since federally produced etude helium represents such a significant proportion of the global helium supply, the pricing of federal crude helium strongly influences the price for crude helium worldwide. In addition, many private sales contracts for helium tie future sales prices to the price of federally produced crude helium.

Consumers and customers have raised concerns about price increases since the 2008-2009 global economic downturn prompting calls for increased production and supply and limits on trade. As discussed above, the US government plays the most significant role in setting price and additional supplies coming online in both the United States and abroad will have a stabilizing impact on price and supply. Artificial government interventions, like limiting trade or driving down base pricing present unworkable policy choices.

VI. PROPER ADMINISTRATION OF THE NATIONAL HELIUM RESERVE REQUIRES CONGRESS TO ACT NOW TO PASS THE HELIUM STEWARDSHIP ACT

Failure to extend BLM operations and provide a funding mechanism to support continued operations and necessary infrastructure improvements will result in a greater than 30-percent reduction in global helium supply overnight including private crude which moves within the system. Inaction and/or mismanagement of the Helium Program will result in significant supply-chain disruptions that will adversely affect our quality of life. For this reason, Praxair strongly supports the Helium Stewardship Act as drafted and respectfully requests that the Act be promptly and favorably reported out of Committee.