

U.S. House of Representatives Subcommittee on Investigations and Oversight,  
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“Caught by Surprise: Causes and Consequences of the Helium-3 Supply Crisis”

Testimony of:

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**Introduction**

Chairman Miller, Ranking member Broun, and members of the Committee, my name is Richard Arsenault and I am the Director of Health, Safety, Security and Environment along with being the Corporate Radiation Safety Officer for ThruBit LLC (ThruBit Logging Solutions) which is a Shell Technology Ventures Fund 1 BV Portfolio company formed in 2005. Today we offer complete logging solutions based on a unique patented “through the bit” deployment technique that provides significant advantages in many applications. We are a small company taking this new technology from proof of concept to commercial introduction with aspirations to grow into a much larger company. I have been involved in the Oil Well Logging industry since 1979 starting out as an Open Hole Wireline Engineer in West Texas and later got involved in the early stages of Logging While Drilling in 1982.

## **Well Logging**

Every well requires formation evaluation; well logging is a key part of this evaluation. The quality and accuracy of data is key to decide and ascertain if the well is a producer or dry hole. This evaluation supports and drives:

- Production Estimations,
- Well Economics,
- Reserve calculations
- Corporate and Government Energy Assets,
- Overall market fundamentals

It supports ability to commit to long term projects with less than certain payback. Provides support for filing Company's statement of reserves. Helps value royalty payments back to state and federal government and drives legislation.

The US is most affected:

- ½ of worlds activity
- ¼ of world consumption
- < 5% of world reserves
- Greatest need for immediate continuity of supply

## **Neutron Logging**

Wells can be logged by Wireline Logging or Logging-While-Drilling (LWD). There are a number of formation measurements that are taken when a well is logged. Neutron logging is one of the primary measurements taken when a well is logged. The neutron measurement provides the hydrogen located in the pore space of the formation and the porosity is determined from neutron counting rates in the

detectors within the logging tool. The neutron measurement is a primary gas indicator which helps delineate gas and oil producing zones along with providing the porosity of the formation.

Both Wireline and LWD tools will in most cases have a “Long Space” and “Short Space” Helium-3 Detector which are located at different distances from the radioactive sources mounted in the logging tool. The Helium-3 detectors are used with either an Americium-241 Beryllium or Californium-252 radioactive source.

The importance of Helium-3 supply to the oil and gas industry is critical and crosses into numerous sectors of the industry. Helium-3 gas is used in almost the entire neutron detectors incorporated into downhole tools in our industry. The neutron count rate measurement, from which the porosity measurement is derived, is used in all oil and gas reservoir evaluations. Even small errors in the neutron measurement can make the difference in whether a reservoir is commercially viable or not.

It is difficult for our industry to determine the number of neutron detectors used in our course of business, especially since the neutron detector is used in open and cased hole compensated neutrons, single detector neutrons and other devices in our industry. There are numerous large well logging companies in the U.S. that also operate internationally along with medium to small size companies throughout the U.S. Each of these companies incorporates the use of He-3 neutron detectors in their tools. With the downturn in our industry over the last two years, most existing companies have been able to utilize existing tool stocks for replacement detectors and spare parts, which have lessened the impact over these years, but will eventually deplete the stock within those companies. They will be forced to buy additional detectors as the industry expands, for both new tools and for replacements in older tools. The detectors do have a limited life expectancy on the average of about 5 years depending on the downhole conditions they are exposed. So they do need to be replaced periodically to keep the tools working correctly. Companies introducing new technologies for logging wells, such as ThruBit, are limited to what is already available in house to build

tools and what they can find available by the detectors suppliers with long leads time and a substantially higher price.

### **Pricing and Availability of He-3 Detectors**

We have personally seen almost a 3 times price increase and a quoted lead time of almost 6 months for delivery in an order recently placed this year. I have also received reports from others in the industry of pricing increases reported on neutron detectors in the 3 to 10 times range due to the Helium-3 shortage. Pricing is not the only issue, but availability is also key. Lead times of 6-8 months have been reported. There have been reports of some detectors not being available due to the lack of Helium-3.

There is a big difference in application of detector technology to applications that are located on surface, exposed to ambient temperatures and pressures and are not moved or exposed to conditions involving shock and vibration. Detector technology used in down hole tools used for well logging are subjected to more stringent requirements just to survive the environment and meet the engineering requirements of the design.

Wireline Tools are operated at high temperature, have limited internal geometry to mount the detectors and experience medium shock and vibration. In the case of LWD tools they have all the same factors, but the shock and vibration is a lot higher. As result of the limited internal geometry small reliable detector packages are a must. In our particular case we have the smallest well logging tools in the industry with a 2-1/8" diameter tool. Any type of alternative technology would require the same or smaller foot print inside the tool. We could not go larger since we limited to our 2-1/8" diameter specification. We do not have the resources for an R&D effort to pursue another tool design with potential alternative detector technology.

### **Impact**

Being a small company bringing new technology to market is a challenge. We are in transition from a commercial introduction phase to commercialization with an aggressive plan to be a full blown viable and sustainable Formation Evaluation

Service Company. The Helium-3 detectors are all we have to put in our Neutron Porosity tools. We do not have a substitute detector for use in these well logging tools. It would take substantial development time (years) to pursue a substitute. We have neither the financial resources or R&D staff to pursue this effort. An extreme shortage or unavailability would be extremely detrimental in our ability to provide formation evaluation services and increase our tool fleet size allowing our company to grow. Other medium and small companies are in the same situation with a finite amount resources to pursue a pure R&D effort on alternatives. Some larger companies are looking at alternatives, but are finding the Boron Trifluoride with 1/7 the sensitivity of the Helium-3 type detectors will require increasing the activity of the Californium-252 or Americium-241 Beryllium source strengths.

### **Alternative to Helium-3**

The substitute for Helium-3 detectors, Boron Trifluoride (BF<sub>3</sub>), however it is much less sensitive to the thermal neutron detector as required by our industry. The majority of the sources used with neutron tools are Americium-241 Beryllium (Am-241Be), however, most recently due to Americium supplies being limited; more companies are utilizing Californium-252 (Cf-252) in its place. Most all of these sources are in the 5 Curie (with some older 3 Curie sources used in cased hole operations) up to 20 Curies. With the decreased sensitivity of Boron Trifluoride, the strength of these neutron sources would have to be increased to achieve the statistical results needed for industry.

There are other concerns with Boron Trifluoride. The USDOT has classified this gas as a hazardous material and cannot be shipped without a US DOT special permit. Shipping by air in the US also requires classifying it as Toxic Inhalation Class 2.3. For international shipment it is restricted to Cargo Only Aircraft and classified as Toxic Inhalation Hazard Class 2.3 and Corrosive Class 8. This provides for some packaging and logistic challenges moving tools with detectors with this type of gas in the detector. Not a good solution with the mobility required for well logging tools.

## **Conclusion**

Oil and gas exploration within the U.S. is a vital part of our national security and lessens our dependence on foreign oil and gas. The shortage of Helium-3 is starting to impact our entire industry. As rig counts increase and the request for well logging increases it will require more tools to be in service ready to go. Large companies can take stock piles of tools not in service during the slowdown in the last 2 years and put them back in service. Smaller companies will have less of a stock pile of tools not in service to pull from. With small companies such as ThruBit trying to increase our market penetration it creates an extra hardship limiting our ability to grow and bring our new technology to the market place.

Larger companies have the financial and human resources to pursue extensive research and development to look at potential alternatives in detector technologies. Smaller companies are not as fortunate - they cannot afford extensive research and development. Their commercial viability comes into question along with their ability to sustain their business. These smaller companies are also in a situation where they cannot afford the extensive research and development of looking at alternatives to their current supply of tools.

I want to personally thank you for the opportunity to discuss this important issue involving the Oil & Gas Well Services Industry today.