Helium and carbon dioxide

What and where is the potential?

By Sam A. Rushing, Advanced Cryogenics, Ltd.

While this **gas**world supplement is primarily dedicated to the subject of helium, I am describing opportunities in the carbon dioxide (CO_2) industry, with insight into the Air Products helium recovery operation from a natural CO_2 stream located in Colorado. Generally speaking, methane rich streams are the usual source for the recovery of helium, not carbon dioxide, at least with respect to sources which are commercially operating. In general terms, on a global scale, the location, recovery and production of helium supplies are a challenge, and the presence of helium is very small.

This precludes (natural) gas processing facilities which often employ MEA (monoethanolamine) or other amine solvents for the recovery or separation of CO_2 from methane; in this specific case, this is a CO_2 source type which has applications for both captive (like EOR) and merchant market destinations. The specific natural gas processing source for CO_2 in the markets would require the correct feedgas chemistry and market economics to make sense.

Then, when thinking of natural gas fields, most do not contain sufficient helium or any helium at all for commercial recovery. The US BLM (Bureau of Land Management) holds many of the US helium reserves, around the Texas Panhandle area. On the other end of the spectrum, if we lived on the moon, there would be abundant supplies of helium. And fortunately, for the US, it is still considered to be the largest helium producer globally, by many accounts.

Sourcing and production in the US is largely found in the West Texas region; along with regionally located Kansas and Oklahoma. Many feel the supplies of helium is finite, and the Air Products supply in Doe Canyon, Colorado is unique as the exception to this, sourcing not from methane, as with the BLM reserves. Managing future supplies is, however, challenging.

With the Air Products Doe Canyon helium plant, as with most other gases sold to the markets, the helium is liquefied onsite, when recovered from the CO_2. And unique to this recovery and liquefaction process, Air Products is using liquid nitrogen as a refrigerant, somewhat like the use of anhydrous ammonia as a refrigerant in the liquefaction of carbon dioxide production; due to the properties of helium, a very cold nitrogen is used rather than a refrigerant which cannot achieve such cold temps, such as ammonia in this CO_2 production case.

Since helium is found in the BLM methane fields, generally in Northwestern Texas, and perhaps extending regionally outside of the BLM properties, it could perhaps be more likely found in other regional gas fields too, such as in other natural CO_2 fields or wells. I am not aware of any significant helium presence in the greater CO_2 natural reserves regionally, but this is inconclusive. When speaking of the greater regional CO_2 natural fields, the CO_2 Bravo Dome in New Mexico is perhaps the most well known, then in Colorado, sources from Sheep Mountain and McElmo Dome reserves supply enhanced oil recovery (EOR) into the Permian Basin. However, again, I am not aware of helium content available in these reserves which is recoverable via a technology such as the Air Products Doe Canyon example; in many ways, this may be unique.

I might also say that it could be a good idea for the gas companies to examine the raw gas specs within the greater region for the potential of viable helium recovery, if in fact such a presence exists. Current day merchant market regional CO_2 sources from natural reserves include the Reliant Gases facility in New Mexico, and the Linde plant in Albert, New Mexico. Then, further in the greater region, as to merchant plants from natural reserves, Praxair has its Walden, Colorado facility. Heading west in the greater region is Reliant's St. John, Arizona plant, and the source operated by Ferus in Price, Utah. These natural sources are all in the greater region for both EOR and merchant supply, however, there is no concurrent recovery of helium, to my knowledge.

More helium availability?

Further, toward this end, as I look at various raw gas samplings from my database, I am not finding helium content in such natural CO_2 regionally. Perhaps this source for Air Products in Colorado is unique; however, as matter of course, should the gas companies seek more helium and should the recovery be →

affordable, then I suggest the gas concerns take a fresh look at such opportunities – particularly in this region.

As for other source types, I am not aware of helium content to be a specific opportunity. Of course, helium is very limited globally, and the US happens to be the leading source for this precious commodity; and again, I recommend those seeking the product take a fresh look at such an opportunity, via examinatio of raw gas specifications. I am not thinking a model such as the Air Products source in Doe Canyon will necessarily be the new source type of the future; this is probably regionally specific, and perhaps well-specific in its content and recoverability.

With respect to CO_2, the markets are enjoying slow, steady growth; short of the loss suffered some years ago in the CO_2–frac business. Oilfield-based CO_2 fracs once accounted for a fairly significant amount of tonnage in markets such as Alberta, Saskatchewan, the US Rockies, the Southwest, and Middle south to Southeast; and of course within this greater region where helium is found and produced. Today, most of the talk surrounds hydraulic fracturing rather than CO_2 fracs, and the combination of CO_2 and foam and sand proppants. On the other hand, there may be a return to CO_2 fracs versus hydraulic methods, due to the many problems surrounding water availability, recycling, and disposal, and lots of bad press with hydraulic fracturing.

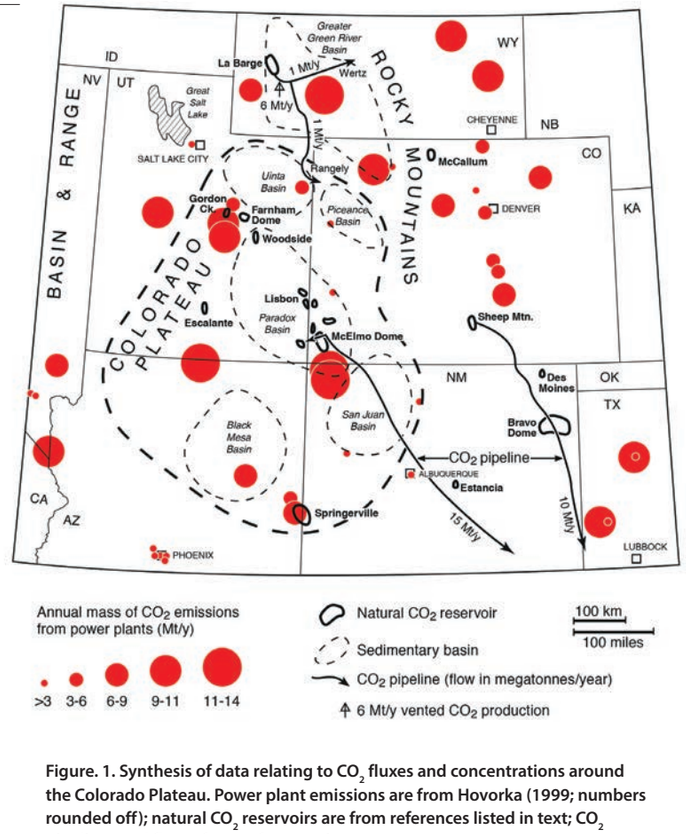

Figure. 1. Synthesis of data relating to CO_2 fluxes and concentrations around the Colorado Plateau. Power plant emissions are from Hovorka (1999; numbers rounded off); natural CO_2 reservoirs are from references listed in text; CO_2 pipelines and fluxes from references in text.

Beyond this application, there is a lot of press today with the use of CO_2 serving as building blocks in biofuels and downstream chemicals, via proprietary processes, such as that licensed by Joule Unlimited. The true results surrounding the feasibility and sustainability of these technologies are yet to be determined, in my view; and I am not a believer in such sustainability. Then, we have the practical and down to earth uses for CO_2 in the developed world, which are often highly driven by all forms of CO_2 food processing applications, including MAP (modified atmosphere packaging), CO_2 snow uses, dry ice pressing, liquid supply for cooling, and cryogenic freezing applications. When looking at the US in particular, it is rather extraordinary to see the very large CO_2 use for primarily meat (beef, pork, veal) and poultry processing, using CO_2 in all three phases; that being gas, liquid and solid (ice, snow). Then, a wide variety of industrial applications are growing at the rate associated with those industries served. Perhaps the best growth enjoyed by the CO_2 industry is food related, due to the old adage of 'we all need to eat'.

Conclusions

Even though helium and CO_2 are usually not subjects spoken of together, from a production and applications viewpoint, the case of the Air Products facility in Colorado sourcing helium production from a natural CO_2 source happens to be unique and perhaps one of a kind. Otherwise, it may be a good practice to examine, in particular, those sources of CO_2 regionally, as aforementioned above, for the potential of helium content.

With the data I have available, I believe this may be unique, however, perhaps there are new opportunities when looking at natural reserves of CO_2; probably regionally specific, if at all. This greater opportunity could perhaps exist, particularly with the correct geology and chemistry, and location – but drawing full conclusions is not available at this time. gw

ABOUT THE AUTHOR

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