CHESAPEAKE ENVIRONMENTAL PROTECTION ASSOCIATION, INC.
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NEWSLETTER **Fall 2014**

PRESIDENT'S MESSAGE

By Al Tucker, President, 2014

Dilemma! That's the situation the Board of Trustees (BOT) often finds itself in, when certain environmental issues close to home arise. A dilemma unfortunately arises when we feel that we have to choose the least offensive course of action from a group of equally distasteful alternatives. The CEPA BOT may always agree on the ends, but often , we disagree on the means. Hence, a dilemma, about which reasons CEPA should support an environmental issue.

We are a small organization that primarily focuses on educating the public about what we think are important topics not recognized by either government or other leading environmental organizations. That means that we don't want to waste our efforts on issues that are marginal or have marginal outcomes in favor of serious underlying conditions that are not being addressed. Yet, sometimes it is not clear that an issue is marginal until you have spent more time analyzing it. Often this lack of clarity is brought about by the diversity of opinion raised by other like-minded organizations. Each organization sees different issues as the priorities. A case in point is the question, "does CEPA have an opinion about the construction of the liquefaction plant at Cove Point?". It would seem like it should be a priority topic for CEPA. It would encourage fracking that has the potential to pollute both ground and surface water in Maryland. Since the availability of source water (both ground and surface drinking water) is a signature issue for us, we decided to examine it closely.

The opposition to building the Cove Point natural gas liquefaction plant and export terminal had us look more closely at issues raised by other organizations. The underlying issue is that natural gas is one of the most potent greenhouse gases, but burning it significantly contributes more CO_2, which is a much longer-lasting greenhouse gas. However, the diversity of opposition to Cove Point was and is fractured (please excuse the unfortunate choice of word here).

The opposition is divided into small groups, obscuring the priority of any single issue. There are several factions: those who did "not [want it] in my backyard" (NIMBY), those who expect contamination of the Bay, those who oppose "fracking" and contamination of groundwater, those who think leaking methane will be an atmospheric catastrophe, and so on. Are we worried about the plant and terminal because they will affect the Bay?, counties?, the State?, or the nation? Ask people in the street and they will probably say "all of the above." However, this diversity of opposition does not allow the priority issue to emerge and gain traction.

Since our BOT is composed of scientists, lawyers, physicians and experienced policy makers, we often find ourselves in the same dilemma as everyone else, and the discussion about Cove Point was no exception. The engineers think that it's a problem that can be fixed and that methane contamination of the atmosphere will not be a major issue. Those who look at it from a local socio-economic view don't agree. The impact on local communities could be extensive from destruction of roads, to air pollution, probability of chemical spills, truck accidents on narrow roads, and overuse of local water.

CEPA has had presentations from Dominion, the owner of Cove Point, and from the University of Maryland study group, who prepared the report on Best Management Practices for Shale Gas Development in Maryland[1]. Dominion said that the ship traffic will not be greater than what they are permitted. They will not need new pipelines to Cove Point and they will utilize their existing footprint to install the liquefaction plant. Over the years since the facility was constructed the market for importing natural gas never really materialized. Neighbors and bay users soon became accustomed to the two ships visits per year, or almost no activity at the facility. Hence, the idea of more ship traffic is abhorrent. Unfortunately, the original permit settled that argument long ago. As a result Dominion claims that it will not use additional land and thus they will not affect their current forest easement that buffers the property.

Safety is always an issue, but they argue that the risk of problems is low. Your level of risk tolerance may be significantly different from mine, but the consensus of risk tolerance is controlled by our regulatory bodies. What about the impact on global warming? Well, Dominion argues that if Cove Point does not export gas, the Marcellus gas will go down the pipeline to Louisiana. Hence there will be no net impact on global warming. What about the NIMBY folks? Unfortunately, they will be outvoted by the rest of Calvert County, who will welcome the $40 million dollars of tax revenue per year.

What about the impact on groundwater caused by the additional equipment at Cove Point? It is estimated that they will use the same amount as 600 homes, or about 3% of Calvert County's groundwater. However, they will withdraw it

from an aquifer that is deeper than that used by the local community. Dominion claims that their existing wells are adequate, and no new wells will be needed. But this will be just one more straw drinking from a limited supply of water. The real obstacle here is we don't know how much water is available in the aquifer system. It's difficult to oppose an issue armed with only vague uncertainty.

What about the issue of fracking in Maryland? Two more recent reports[2] issued by the state do not help to resolve the dilemma. The first, from the Department of Mining in MDE, reflects the current industry point of view, namely that engineering solutions will mitigate problems, and the second outlines the public health issues both direct and indirect that impact social and physical health. Each of these reports makes several recommendations, and, if they are implemented, the risks to safety and health may be low. However, these recommendations actually raise more uncertainty than they purport to resolve. Reading between the lines, there is the implication that these recommendations will require significant amounts of money to implement. It is not clear who will pay or how regulations will be developed to implement them. A third report[3] does a much better job of documenting the economic impact and the social upheaval in the western counties, especially Garrett County.

The real likelihood of drilling for gas in Maryland's Marcellus Shale is small, simply because of economics. Maryland's share of gas is not valuable because it is mostly "dry". The gas in West Virginia, Pennsylvania and New York is "wet". Wet gas contains butane, pentane, and mostly ethane. Ethane is a valuable feedstock for plastics. Natural Gas, then, is almost a by-product and its excess drives down its price. Thus, areas with only dry gas are not economically profitable to develop. Further complicating the economics of drilling is the fact that the Marcellus Shale in Maryland is extremely discontinuous, making it harder to be certain that any given well will be productive. The probability of a "dry" hole is much higher in Maryland than in any other state. Dry holes are extremely environmentally destructive and the cost of restoration may be higher than the cost of abandonment, which would leave the citizens of Maryland with the damaged environment.

Shale gas development leads to boom and bust. Maryland only has 1.69% of the Marcellus Shale gas, almost all in Garrett County. A typical well only produces for about 5 years and the estimate is that the peak gas period in Maryland would be over in 10 years. In the short term there would be economic benefits: higher paid workers, more jobs for local people, more housing, more tax income, etc. But at the end of the boom, there will be serious negative impacts, especially in Garrett County. In a decade, the high-income jobs will exit the county and leave low paying jobs. Currently, tourists and non-residents supply 80% of its revenue. The boomtown effect will suppress tourism and reduce property values around Deep Creek for decades.

Although the analysis shows a net zero outcome for Garrett County, I think these reports raise serious moral and ethical issues because the cost of implementing the recommendations will prevent most from ever being implemented. Those recommendations that are implemented most likely will benefit the industry and be paid for by the citizens of Maryland. If they are not implemented, we will be imposing a serious degradation of quality of life on Western Maryland. The short-term economic benefits will not really offset the long-term negative social effects imposed on residents.

So now it seems that a partial way out of this dilemma is clearer. Say NO TO FRACKING in Maryland! The socio-economic costs are too much for Western Marylanders to bear for so little return to the State as a whole.

As for Cove Point, I fear we may have lost the battle there; national priorities will trump anything that we have to say on the matter. Our hearts go out to the Cove Point neighbors directly affected, but I fear the decision foretells a lot about our future. The search for more energy will create these environmental hotspots and people living nearby will pay the price for you and me to feel more secure -- or is it to have a false sense of security. As you can see, the dilemma really doesn't go away, the topic just changes.

Methane, the principal component of natural gas, is one of the most potent greenhouse gasses and burning it produces CO_2 like any other fossil fuel. Bill Klepczynski and Gary Antonides, in the following articles, discuss some of the primary issues associated with methane and fracking. Bill's article discusses natural methane vents and whether methane could be a savior or the devil incarnate. Gary's article addresses the uncertainty of estimating and controlling the sources of methane in the atmosphere. In spite of increases in energy efficiency and other technological innovations, we are not going to impact global warming because the population is increasing and the demand for energy is increasing faster than technology can respond. As Gary has pointed out in his article, we have only 10 to 15 years to figure this dilemma out.

One of the best solutions is not openly discussed -- reducing the rate of population growth. This is a topic for a future newsletter and has major implications for Marylanders.

[1] "Recommended Best Management Practices for Marcellus Shale Gas Development in Maryland", Feb 18,2013 http://www.mde.state.md.us/programs/Land/mining/marcellus/Documents/Eshleman_Elmore_Final_BMP_Report_22113_Red.pdf

[2] MDE reports:

(1) "Potential Public Health Impacts of Natural Gas Development and Production in the Marcellus Shale in Western Maryland", http://www.marcellushealth.org/final-report.html , July 2014

(2) "Assessment of risks from unconventional gas well development in the Marcellus Shale of Western MD",http://www.mde.state.md.us/programs/Land/mining/marcellus/Documents/Complete_RA_for%20posting.pdf , Oct 3, 2014

[3] "Impact Analysis of the Marcellus Shale Safe Drilling Initiative", http://www.mde.state.md.us/programs/Land/mining/marcellus/Documents/RESI_Marcellus_Shale_Report_Revised_FINAL.pdf , Sep 22, 2014

DIMENSIONS OF THE CHESAPEAKE

By Richard L. Dunn

Waste not, want not

Vignettes from Dorchester County and Korea. More than half a century ago a problem arose in Dorchester County, the county on the opposite side of Chesapeake Bay from Calvert County. Portions of the waterways, the Choptank River and particularly the Little Choptank, were closed to oyster harvesting due to high bacteria levels. The source of the problem was soon discovered. Human waste was being overtly or clandestinely released directly into streams and rivers. Years before enactment of the Federal Clean Water Act and without resort to court action under Maryland common law on riparian rights the problem was solved through publicity, combined action by concerned citizens using moral suasion, and action by the county health department. Septic systems were installed or brought up to standard. This kind of approach won't work everywhere. Dorchester had a small population of about 40,000 folks then, even fewer in the affected areas, and people knew their neighbors – they might not want to sue them but they were willing to talk to them.

Not many years later there was promise of more effective treatment of waste water. The Federal government authorized a major program for the construction of waste treatment plants. The catch is *authorized*. Funding to actually build treatment plants was slow in coming. Federal funding for environmental concerns will always compete with massive funding for popular entitlement programs of the welfare state and the second call on funds, national security. Both community initiatives and government funded action have their place in addressing environmental issues but neither individually nor collectively are such approaches likely to address all critical environmental concerns.

In the summer of 1950 the first American combat troops arrived in Korea to meet the North Korean invasion of the South. This was five years after the end of World War II and in the early stages of the Cold War. The first troops to arrive by air and sea came from stations in temperate Japan and were not well equipped either by virtue of their weapons or state of training to meet the advancing Communists. Upon arrival in Korea they were met by steamy heat and humidity and an overpowering stench. The stench was the result of human and animal waste being used to fertilize Korean rice patties. The effect on the troops was debilitating. Luckily for us we can only imagine. Ugh, human waste to fertilize our food supply! This is the "ick" factor of the subject. Human waste has been used as fertilizer in many parts of the world for centuries. If this paragraph has made you queasy read the rest of this article with caution.

Wasting waste. Nitrogen and phosphorous are in large measure responsible for the oxygen deprived "dead zones" which flare up in the Chesapeake Bay each year. Government regulations on reducing the nitrogen and phosphorous content of treated water released back into the watershed have become increasingly stringent. A state-of-the-art treatment system installed in my neighborhood on the Mayo Peninsula a couple decades ago cannot meet new standards and a project to pipe waste water underground and under the South River to Annapolis for more complete treatment will move from planning to construction in the not too distant future.

Almost everyone has heard of global warming. Many consider it a crisis; some even consider it a crisis that justifies action so extreme and rapid it could threaten ruinous taxation, high risk energy policies and economic dislocation. In contrast not many people have heard of phosphorous depletion or consider it a crisis. Based on current methods of extracting phosphorous from rock it is quite possible the world's supply of phosphorous will run out before predictions of the catastrophic effects of global warming take place. In any event, phosphorous depletion is real and most likely on the scale of a few decades rather than a few centuries. The obvious question is, so what?

The answer to "so what" is that phosphorous is essential to human life. Each of our bodies contain two or more pounds of phosphorous most of it is in our bones. Phosphorous is an essential building block of human DNA. Our food supply relies on phosphorous. Plants need phosphorous to grow. Much agricultural land lacks sufficient natural phosphorous to support intensive farming. Phosphorous is one of the key ingredients in plant fertilizer. It must be noted that Maryland is fortunate in that its soil has enough phosphorus for most agriculture, and, to keep the phosphorus in lawn fertilizer from running off into our waterways, it is actually banned in lawn fertilizer, as it is in several other states. Another key ingredient in fertilizer is nitrogen. Simply stated: run out of phosphorous and the world's food supply will rapidly shrink to starvation levels.

Nitrogen and phosphorous make up a two-edged sword harmful in one aspect; good, even essential in another. Urine makes up only about one-percent of the waste water that goes into a treatment plant but it contributes eighty-percent of the nitrogen and fifty plus percent of the phosphorous. Phosphorus is also a major component of solid waste.

Is anyone doing anything about this? Yes, but…the efforts are scattered and small. Nationally both the Environmental Protection Agency and Department of Agriculture are sponsoring work in this area. Canada also has a relatively vigorous program. Most efforts to reclaim waste as fertilizer are pilot projects although a few commercially viable efforts are underway. On the small side is a student project at the University of New Hampshire where a "pee bus" was deployed near campus over several weekends and townsfolk and students encouraged to "donate your nitrogen" thus diverting urine from the town of Durham's waste water plant which had seen nitrogen spikes on weekends. A urine reuse effort in the town of Brattleboro, Vermont, is on a much larger scale. Fertilizer made from solid waste is sold commercially in Fayetteville, Arkansas. The relatively low level of commercial activity is probably a result of the fact that the critical nature of the phosphorous problem has remained below the public's radar screen and the whole waste recapture idea has the "ick"

factor to contend with. The above photo shows the contrast of growth with and without application of nitrogen fertilizer captured from urine.

Are there downsides to this? There were some early miscues that have tarnished the image of waste reuse. About twenty years ago an early effort used “bio sludge” as fertilizer in the northwest United States. Using damp sludge has a number of objectionable aspects to it. Soil will kill many pathogens contained in solid waste but wet soil is less effective in this regard than a dried material. In addition to phosphorous, samples of bio sludge contained significant amounts of aluminum and lesser amounts of barium, chromium, lithium, magnesium, and titanium. More recent operations have employed drying techniques resulting in “bio solids” that address objectionable features. Twenty tons of solid waste results in about three tons of fertilizer.

Extraction of phosphorous and nitrogen from urine also involves a sanitizing process. Sanitizing can be conducted in simple cost effective ways. Urine can be sanitized by containing it in a sealed tank for thirty days or heating it for thirty minutes in a solar pasteurizer. It takes about a thousand gallons of urine to produce enough fertilizer for one acre of hay crop.

Challenge and opportunity. This brief essay is perhaps little more than a thought teaser (albeit a serious one) to challenge readers to learn more about this subject. The Chesapeake Bay region is a potential beneficiary of additional study, technological developments, and commercial exploitation of waste reuse. Phosphorous and nitrogen are currently prime enemies of Bay health. On the other hand many of the counties that surround the Bay have significant agricultural economies. The potential depletion of phosphorous from rock sources, unless offset by exploitation of alternate sources, is potentially devastating to agriculture due to increasing cost of fertilizer. Nitrogen for fertilizer has also encountered price instability. Ultimately the unavailability of phosphorous will constitute a crisis on a global scale.

The Chesapeake Bay region would seem to be an excellent laboratory to test policies that encourage the study and development of waste reuse. Waste reuse has the potential to help solve current problems, bring economic benefits, and potentially avert a global disaster. Hopefully concerned individuals, public interest and environmental groups, governmental organizations and commercial interests will play a role in bringing phosphorous depletion and waste reuse up on the radar screen of decision makers and the public at large.

METHANE AND NATURAL GAS MINING

By Gary Antonides

In the last issue of the newsletter, we discussed the different claims associated with the proposed Cove Point natural gas export facility. While some claim the facility will promote fracking, others say the fracking will happen anyway. In either case, there will be fracking and we need to be aware of the associated issues. The major concerns are the contamination of groundwater and air pollution.

Groundwater can be contaminated by fracking fluids pumped into the ground as well as by the natural gas itself if the well is not properly sealed. While there are still risks, studies have found that the dangers to groundwater can be mitigated with sound engineering practices and adequate regulation, and that is true for both the fracking fluids and methane.

Air pollution occurs when there are gas leaks to the atmosphere, and the main problem there is its contribution to global warming. Natural gas is composed primarily of methane, but may also contain ethane, propane and heavier hydrocarbons, as well as small quantities of nitrogen, oxygen, carbon dioxide, sulfur compounds, and water. In the air it is the methane that is of concern. It is many times worse than carbon dioxide as far as global warming is concerned, although the effects don’t last nearly as long. Methane comprises about 9% of our greenhouse gas emissions. There are many ways that the gas can leak into the atmosphere.

http://thinkprogress.org/climate/2014/10/04/3576087/maryland-fracking-report-2/ states that a draft report by Maryland’s Department of Environment and Department of Natural Resources on the risks of fracking in Maryland has found little risk of drinking water contamination in the state (despite multiple reports of contamination from fracking in other states). The report ranked the risk of contamination of soil, ground water or surface water from a spill during most parts of the fracking process as “low.” It found that current state regulations and proposed “best practices” could reduce much of the risk of water contamination from fracking, and that in general, water contamination wasn’t high on the list of risks related to fracking. The report did, however, state that there’s a greater likelihood of water contamination by methane rather than fracking chemicals. The report assessed other risks as well, ranking air pollution risks from fracking as moderate to high.

To evaluate the greenhouse warming effect of gases, the quantity Global-warming potential (GWP) is used. The website en.wikipedia.org/wiki/Global-warming_potential defines GWP as a relative measure of how much heat a certain mass of a gas traps in the atmosphere, compared to the amount of heat trapped by the same mass of carbon dioxide. Different gases have “lives” of different lengths in the atmosphere. For example, the life of methane is about 10 years whereas the life of carbon dioxide is hundreds of years. Consequently, GWP is calculated over a specific time interval, commonly 20, 100 or 500 years. For example, the 20 year GWP of methane is 86, which means that if the same mass of methane and carbon dioxide were introduced into the atmosphere, the methane will trap 86 times more heat than the carbon dioxide over the next 20 years. The 100 year GWP of methane is 34. Commonly, 100 year GWPs are used by regulators.

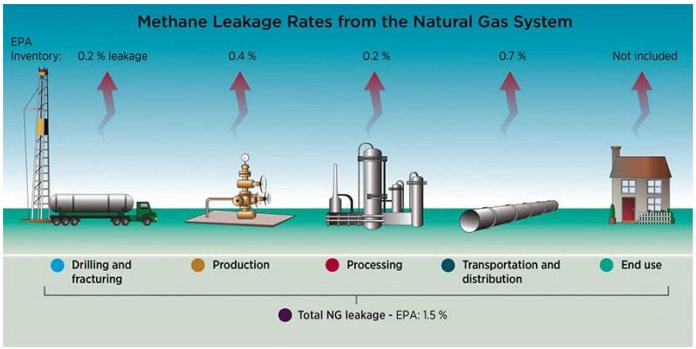
As bad as methane is, there are much worse gases. Fortunately, large amounts of these are not released into the atmosphere. The following data from the Intergovernmental Panel on Climate Change (IPCC) lists several gases:

GWP values and lifetimes from 2013 IPCC AR5 p714 (with climate-carbon feedbacks) [6]	Lifetime (years)	GWP time horizon	
		20 years	100 years
Methane	12.4	86	34
HFC-134a (hydrofluorocarbon)	13.4	3790	1550
CFC-11 (chlorofluorocarbon)	45.0	7020	5350
Nitrous oxide (N_2O)	121.0	268	298
Carbon tetrafluoride (CF_4)	50000	4950	7350

Practically speaking, there will be situations where we are able to choose between releasing methane to the atmosphere or burning it to release carbon dioxide. Burning would indeed reduce the global warming impact, but by a smaller factor than the one given in the table because the mass of methane burning is less than the mass of carbon dioxide released. If you burned 1 ton of methane which has a GWP of 34, after combustion you have 2.75 tons of CO_2, each of which has a GWP of 1. The effect of this burning is to reduce the global warming effect of the gas released in the ratio 34:2.75 or about 12.

There are controversies concerning the amount of methane released to the atmosphere. For example, an August report published by the University of Maryland and commissioned by Gov. Martin O'Malley had different findings from the DEP and DNR's report mentioned earlier, identifying high risks to air quality as well as moderately-high water-related risks. That report also contained a range of recommendations for reducing fracking-related risks.

Some studies do not agree with EPA estimates regarding the amount of methane leaking to our atmosphere from the oil and gas industry. http://rt.com/usa/methane-emissions-fracking-underestimated-epa-024/ provides the following figure showing how much leakage EPA assumes for each part of the natural gas system, relative to the amount of gas produced. Note that the total is 1.5%. But recent studies estimate that the methane leakage rate could be two to three times higher than that.



A new study published in the Proceedings of the National Academy of Sciences (PNAS) has 13 co-authors from several academic and research institutions, and used an aircraft to identify sources of methane and quantify emission rates in southwestern Pennsylvania in June 2012. The authors discovered that emissions rates per second were significantly higher than those estimated by the EPA for the same time period. The goal of the study was to find if the measurements of airborne methane differed from measurements taken at ground level. They flew a plane over *a 2,800 square kilometer area in southwestern Pennsylvania that included several active natural gas wells. Over a two-day period in June 2012, they detected up to 14 grams of methane per second per square kilometer. The EPA's estimate for the area is up to 4.6 grams of methane per second per square kilometer.* The researchers then traced the methane leaks back to their source; sometimes back to the individual wells at fracking sites in Pennsylvania's Marcellus Shale. Some sites *were in the drilling process, a preproduction stage not previously associated with high methane emissions."* The EPA released a statement in response to the PNAS study, saying they are aware of the discrepancies and working to alleviate them.

http://e360.yale.edu/feature/on_fracking_front_a_push_to_reduce_leaks_of_methane/2754/ reports that scientists, engineers, and government regulators are increasingly turning their attention to solving what they say is one of the chief environmental problems associated with fracking for natural gas and oil – significant leaks of methane from loose pipe flanges, leaky storage tanks, condenser valves stuck open, outdated compressors, inefficient pneumatic systems, corroded pipes, etc. Even among industry officials, there is agreement that getting control of methane emissions is an important issue. Solutions from government, industry, and academia are beginning to take shape. But analysts say that battling the problem must also involve both tighter regulations at the state and federal level, and a commitment from industry to make the large investments that will be necessary.

Last month, the Obama administration announced a plan to reduce methane emissions from a host of sources, including landfills, cattle, and the oil and gas industry. The EPA has pledged to identify approaches to cut so-called "fugitive" methane emissions from oil and gas drilling by this fall and to issue new rules by 2016.

Colorado, a major oil and gas producer, in February became the first state to impose regulations requiring producers to find and fix methane leaks. Even states such as Texas are examining whether to adopt tighter methane regulations. Some of the fixes will be expensive. One study found storage tanks to be a significant source of volatile organic compounds and methane emissions in Texas' Barnett Shale region. The fix would be "vapor recovery units" that prevent gas from volatilizing from the tanks. They cost around $100,000 each.

Complicating the challenge of achieving a significant reduction in methane emissions is the fact that the fracking boom continues to expand and that older equipment becomes more prone to problems. With close to 500,000 hydraulically fractured gas wells and hundreds of thousands of miles of pipelines, just evaluating the scope of the problem, let alone fixing all the leaks, will be difficult.

Determining how much methane is escaping during the fracking and processing of oil and gas is difficult. Estimates of methane emissions range from 1.5 percent to 9 percent of the gas produced. A paper published in *Science,* based on a review of more than 200 previous studies, concluded that leaks of methane from drilling sites were 50 percent higher than that estimated by the EPA.

Some companies such as Encana, a natural gas producer that has 4,000 gas wells in Colorado, started retrofitting outdated equipment prone to leaking, and installing technology to capture leaks at the wellhead before it was mandated in Colorado, said Doug Hock, a spokesman for the company. He

calls the new rules in Colorado "tough but reasonable" and says that they provide the industry with regulatory certainty .

Even if every state mirrored Colorado and every oil and gas company took steps such as Encana is taking, a significant amount of methane would still be leaking — much of it undetected, says Mark Zondlo, a professor of engineering at Princeton. That's because many leaks are caused by more erratic and episodic factors, such as a valve or storage-tank hatch suddenly stuck open. Hence the need for continuous measurements for leaks across large areas, Zondlo said.

Currently, many companies are using methane-leak detection tools, such as infrared cameras, but many are too labor-intensive and fail to find many leaks. Zondlo recently developed a methane sensor mounted on a remote–controlled aircraft built at the University of Texas at Dallas. In October, the aircraft was used to quantify emission rates from well pads and a compressor station in the Barnett Shale region. Zondlo has been partnering with other groups that also fly drones over fracking areas to detect leaks.

Robert B. Jackson, an ecologist and energy expert at Duke University, also has been testing drones to detect fugitive methane emissions. The main challenge, he says, is carrying a heavy camera or methane sensor for a reasonable amount of time. Engineers are trying to develop lighter sensors that will allow drones to stay in the air longer.

http://thinkprogress.org/climate/2013/10/02/2708911/fracking-ipcc-methane/ cites a report by the IPCC that says that methane is a more potent a greenhouse gas than we had previously realized. Last year they revised its GWP(100 year) for methane to 34, compared to their previous estimate of 25. Amazingly, the EPA has been using a GWP of 21, a figure that is nearly twenty years out of date. Back in April of 2012, the EPA said it was thinking about raising it — to 25.

Although the 100-year GWP is by far the most widely used, the IPCC says there is no scientific argument for selecting 100 years. Over a 20-year time frame, methane has a GWP of 86 (up from its previous estimate of 72). Given that we are approaching real, irreversible tipping points in the climate system, the IPCC says that climate studies should, at the very least, include analyses that use this 20-year time horizon.

Industry representatives say the methane leakage rate is at the low end of estimates, about 1.5 percent, placing industry second behind emissions attributed to livestock, said Katie Brown, spokesperson for Energy in Depth, a program of the Independent Petroleum Association of America. But to achieve climate benefits from natural gas relative to coal or fuel oil, environmental groups estimate the leakage rate during gas drilling must be below 1 percent (PNAS says about 3%). The best fracked wells appear to have low emissions of methane, but there are high-emitting wells that result in the vast majority of leakage. A NOAA study measured a stunning 6% to 12% methane leakage over one of the country's largest gas fields.

From the reports consulted, it appears that, if Maryland is to approve fracking, the technology for both detecting and limiting gas leaks needs to be improved first. Also, we need to more accurately determine the actual leakage rate where gas becomes better than coal. It bears repeating that natural gas from even the best fracked wells is still a climate-changing fossil fuel. According to studies by both the Center for American Progress and the Union of Concerned Scientists, if we are to avoid catastrophic warming, our natural gas consumption has to peak sometime in the next 10 to 15 years.

METHANE VENTS
By Bill Klepczynski

Natural gas hydrates are naturally occurring, crystalline, ice-like substances composed of gas molecules (methane, ethane, propane, etc.) held in cage-like ice structures of water molecules (clathrates). The formation and stability of these structures are constrained by a relatively narrow range of pressures and temperatures. Unlike the ice we're all familiar with that's derived entirely from water, gas hydrates are, in fact, highly flammable, a property that makes these crystalline structures both an attractive future energy source as well as a potential hazard.

Hydrates are a much more abundant source of natural gas than conventional deposits. According to the U.S. Geological Survey, global stocks of gas hydrates could account for at least 10 times the supply of conventional natural gas deposits, with between 100,000 and 300,000,000 trillion cubic feet of gas yet to be discovered. If these sources of natural gas could be safely, efficiently and cheaply mined, gas hydrates could potentially displace coal and oil as the top sources of the world's energy. But that's a big "if".

Although methane hydrates can be found in permafrost, the majority of the supply of gas hydrates can be found thousands of feet (at least 1,600 feet) below the sea's surface where the gas molecules crystallize amidst the cold and pressure of the ocean depths. Because of the depths at which these potential energy sources can be found, information is lacking regarding composition and volume of gas hydrates at different sites. Scientists believe that these hydrates tend to form along continental fault lines and have inferred sites where large supplies of natural gas hydrates can be found. This means that any effort to tap into this energy source is hampered by not knowing exactly where to look, what energy suppliers can expect to find or even the best way to exploit the resource.

As evidenced by the tragedy that occurred on the Deepwater Horizon rig, methane hydrates can be volatile and already present a danger to existing deep-sea oil drilling operations. Although oil companies used to shun deep-sea drilling around sites with gas hydrates, drilling into these areas has become an industry-wide practice over the last 10 to 15 years (Eric Niiler) and could lead to more of the kinds of disasters of the Deepwater Horizon variety. And that's just on existing rigs. Drilling operations intended to extract methane from hydrates would have to cope with the volatile nature of the gas and its expansion as it rises to the surface from a high-pressure to low-pressure environment.

Finally, methane (CH_4) is a greenhouse gas as is water vapor (H_2O), carbon dioxide (CO_2) and nitrous oxide (N_2O). Although it could lead to clean-burning energy, methane that escapes into the atmosphere is worse for the environment than carbon. To avoid an environmental catastrophe and also ensure an efficient extraction operation, efforts to tap into gas hydrates as an energy source would have to minimize leaks.

Three factors affect the degree to which any greenhouse gas will influence global warming:

a) its abundance in the atmosphere;
b) how long it stays in the atmosphere; and
c) its global-warming potential.

Carbon dioxide has a significant impact on global warming partly because of its abundance in the atmosphere: In 2011, CO2 composed 84 percent of U.S. greenhouse emissions, according to the EPA. Additionally, CO2 stays in the atmosphere for hundreds of years. However, methane is **about 34 times** more efficient at absorbing radiation than CO2 (this number has been revised several times) giving it a high global-warming potential (GWP) rating, even though it stays in the atmosphere only about 10 years. Though it is present in small concentrations, it traps heat very effectively. It must be noted that methane is also produced through agricultural practices including rice paddies and livestock manure management.

On the seafloor just off of the U.S. East Coast lies a barely known world, explorations of which bring continual surprises. As recently as the mid-2000s, practically no methane seeps (spots on the seafloor where gas leaks from the Earth's crust) were thought to exist off the East Coast. But in the past two years, additional studies have revealed a host of new areas of seafloor rich in seeps (Laura Brothers). New technologies have allowed scientists to keep locating new seeps, including one that may be the largest in the world. The findings have changed geologists' understanding of the processes taking place beneath the seafloor.

These newly discovered seafloor finds show that there is much more seafloor methane venting then we previously thought, and suggests that there are many more seeps out there that we don't know about (Brothers). An even larger, previously unknown vent was found off the coast of Virginia discovered near the Norfolk submarine canyon. That vent is the largest in the Atlantic, and possibly in all of the world's oceans (Ross).

Scientists locate the seeps by producing images of methane gas bubbles (and where they originate) using multi-beam sonar, which calculates the amount of time and distance it takes for sound waves to travel from the ship to the bubbles and back. The same technique also produces detailed imagery of the seafloor. Remotely operated vehicles can then be dispatched to bring back photos of the ocean bottom (Ross). All of these techniques are being used to document the gas seeps. The majority are located at a depth of about 1,640 feet, which is now at the upper limit of stability for gas hydrate. Warming of the ocean waters could cause this ice to melt and release gas (Adam Skarke). The gas hasn't been directly sampled but circumstantial evidence suggests it is methane.

Direct transfer of even a small fraction of the methane deposits to the atmosphere would have catastrophic effects on Earth's climate, a process that has been proposed as a driver of previous climate changes such as the end of the Ice Age. The new discovery off the coast of Virginia points to one of the best locations to critically evaluate the interplay of changing climate and oceanic methane.

Nevertheless, within the next 100 years or so, any major impact on the global climate from methane will come from methane emitted from tropical wetlands and human activities, not the oceans (David Archer). In the timescale of centuries to hundreds of thousands of years, gas hydrate is clearly significant. But in terms of the climate of the coming century, the actual forcing of climate from the rise in atmospheric methane will be small. However, any large scale mining of methane hydrates could change that conjecture.

This article has been composed by extracting and paraphrasing information from a number of articles on Methane Vents. Authors whose articles were used in composing this article were: Marc Lallanilla (Live Science), John Roach, Adam Skarke, (Mississippi State University), Carolyn Ruppel (U.S. Geological Survey's Gas Hydrates Project), Gerald Dickens (Rice University), John Kessler (University of Rochester), Steve Ross (University of North Carolina, Wilmington), and Sandra Brooke (Florida State University), and Talal Al-Khatib

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PROFILE OF A TRUSTEE

Sally Hornor

CEPA is pleased to welcome Dr. Sally Hornor as a new Trustee.

Sally's love of coastal ecosystems was no doubt inspired by the summers she spent growing up on Cape Cod. She majored in Biology at Goucher College (Towson MD) and spent college summers at Woods Hole Oceanographic Inst. in Woods Hole. She then went on to earn an MS in Microbiology and a Ph.D. in Ecology, both at the Univ. of Connecticut. She has since worked as an aquatic microbial ecologist in such diverse ecosystems as sewage sludge, bog lakes, rivers and the Chesapeake Bay watershed.

After a post-doc fellowship at SUNY Syracuse, Sally joined the faculty at Virginia Tech where she taught for six years. Sally and her husband, Tom Caperna, moved to Arnold MD in 1984 when Tom accepted a research scientist position at USDA in Beltsville. While raising two children, Sally taught part-time at Anne Arundel Community College and then joined the faculty full time in 1993, teaching primarily ecology and microbiology.
For the past 25 years, Sally has been the scientific director of Operation Clearwater, a program started 40 years ago by the Severn River Association to monitor the bacterial water quality of bathing beaches and marinas during the swimming season. She expanded this program in partnership with the Magothy River Association, the South River Federation, the West and Rhode Riverkeeper and the Advocates for Herring Bay so that bacterial water quality monitoring of all of the major tributaries in Anne Arundel County are included. She has also worked with the Severn River Association and the Magothy River Association to restore historic oyster bars and to encourage citizen science projects in water quality monitoring and monitoring of submerged aquatic vegetation. Sally is also on the board of the Severn River Commission and the Magothy River land Trust.

Childhood summers on Cape Cod also led to a love of boating, especially sailing and kayaking. Sally and her husband get out on the water as much as possible in the summer and enjoy cross country skiing in the winter. They enjoy traveling to visit wetlands and other diverse ecosystems as time permits. Their grown children now live in Baltimore and Virginia.

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