Some Questions and Strategies for Oil/Gas Prospecting Process North Antrim 2013

First I think you should read this rather sobering and worrying set of information form the US Environmental Protection Agency It outlines info on waste from Oil/Gas Drilling and resulting dangers:
http://www.epa.gov/radiation/tenorm/oilandgas.html#howmuchradiation
(I have included some extracts from this site in the texts below as well.)
Web-link to PDF fact sheet for local communities on questions they should be asking! (USA)
http://ohioline.osu.edu/cd-fact/pdf/1282.pdf

"Beginning to Answer Questions about the Impacts of Natural Gas Development

Because there are long-term consequences of natural gas development, it is crucial to identify related issues of concern and to explore options for managing its positive and negative impacts.

One part of this process is to become informed about the natural gas industry and the drilling process. It is important to seek information about the types of impacts the industry could have on your community. It is also important to learn about the regulatory structure —who regulates which components of the process, how that regulation occurs, and how concerns and complaints are handled.

A second part of the process is to look internally. Consider the role that municipal, county, and township officials, community groups, and individuals can play in monitoring and shaping community and environmental impacts. Examples of this role *include land use regulations, municipal and local financial policy, capital improvement, environmental agencies etc. (text changed by BC here)*

Natural Gas Drilling: Action Steps for Residents, Local Leaders, and Officials

Become more aware of . . .

- the natural gas development process and its timeframes:
  - leasing (4–6 months)
  - exploration/seismic testing (4 months)
  - site preparation and drilling (4–8 weeks)
  - site reclamation (2 weeks)
  - extraction and transport (5–40 years)
  - maintenance over the life of the well (5–40 years)
  - closure
- the potential impacts (positive and negative) of natural gas development:
  - environmental
  - economic
  - cultural
  - municipal services and infrastructure
  - land use
  - community

Oil and Gas Production Wastes!

The geologic formations that contain oil and gas deposits also contain naturally-occurring radionuclides, which are referred to as "NORM" (Naturally-Occurring Radioactive Materials):

% uranium (and its decay products)
% thorium (and decay products)
% radium (and decay products)
% lead-210

Geologists have recognized their presence since the early 1930s and use it as a method for finding deposits (Ma87).

Much of the petroleum in the earth's crust was created at the site of ancients seas by the decay of sea life. As a result, petroleum deposits often occur in aquifers containing brine (salt water). Radionuclides, along with other minerals that are dissolved in the brine, precipitate (separate and settle) out forming various wastes at the surface:

% mineral scales inside pipes
% sludges
% contaminated equipment or components
% produced waters.

Because the extraction process concentrates the naturally occurring radionuclides and exposes them to the surface environment and human contact, these wastes are classified as TENORM.

How are drilling wastes produced?

The briney solution contained in reservoirs of oil and gas is known as "formation water." During drilling, a mixture of oil, gas, and formation water is pumped to the surface. The water is separated from the oil and gas into tanks or pits, where it is referred to as "produced water." As the oil and gas in the reservoir are removed, more of what is pumped to the surface is formation water. Consequently, declining oil fields generate more produced water.

While uranium and thorium are are not soluble in water, their radioactive decay product, radium, and some of its decay products are somewhat soluble. Radium and its decay products may dissolve in the brine. They may remain in solution or settle out to form sludges, which accumulate in tanks and pits, or mineral scales, which form inside pipes and drilling equipment.

How much radiation is in the wastes?

Because radium levels in the soil and rocks vary greatly, so do their concentrations in scales and sludges. Radiation levels may vary from background soil levels to as high as several hundred nanoCuries per gram. The variation depends on several factors:

% concentration and identity of the radionuclides
% chemistry of the geologic formation
% characteristics of the production process (McA88).

The table below shows the range of activities in these wastes:

Wastes	Radiation Level [pCi/g]		
	low	**average**	**high**
Produced Water [pCi/l]	0.1	NA	9,000
Pipe/Tank Scale [pCi/g]	<0.25	<200	>100,000

The Radiation in TENORM Summary Table provides a range of reported concentrations, and average concentration measurements of NORM associated with various waste types and materials.

Waste Types and Amounts

Each year the petroleum industry generates around 150,000 cubic meters (260,000 metric tons) of waste including produced water, scales, sludges, and contaminated equipment. The amount produced at any one oil reserve varies and depends on several factors:

% geological location
% formation conditions
% type of production operation
% age of the production well.

An estimated 30 percent of domestic oil and gas wells produce some TENORM (McA88). In surveys of production wells in 13 states, the percent reporting high concentrations of radionuclides in the wells ranged from 90 percent in Mississippi to none or only a few in Colorado, South Dakota, and Wyoming (McA88). However, 20 to 100 percent of the facilities in every state reported some TENORM in heater/treaters.

Produced Waters *(Water recovered from the well hole, pumping and fracking processes is known as 'Produced Waters' - BC entry.)*

The radioactivity levels in produced waters are generally low, but the volumes are large. The ratio of produced water to oil is approximately 10 barrels of produced water per barrel of oil. According to the American Petroleum Institute (API), more than 18 billion barrels of waste fluids from oil and gas production are generated annually in the United States.

Produced waters contain levels of radium and its decay products that are concentrated, but the concentrations vary from site to site. In general, produced waters are re-injected into deep wells or are discharged into non-potable coastal waters.

Scale

Scale is composed primarily of insoluble barium, calcium, and strontium compounds that precipitate from the produced water due to changes in temperature and pressure. Radium is chemically similar to these elements and as a result is incorporated into the scales. Concentrations of Radium-226 (Ra-226) are generally higher than those of Ra-228.

Scales are normally found on the inside of piping and tubing. The API found that the highest concentrations of radioactivity are in the scale in wellhead piping and in production piping near the wellhead. Concentrations were as high as tens of thousands of picocuries per gram. However, the largest volumes of scale occur in three areas:

% water lines associated with separators, (separate gas from the oil and water)
% heater treaters (divide the oil and water phases)
% gas dehydrators, where scale deposits as thick as four inches may accumulate .

Chemical scale inhibitors may be applied to the piping complexes to prevent scales from slowing the oil extraction process. If the scales contain TENORM, the radiation will remain in solution and eventually be passed on to the produced waters.

Approximately 100 tons of scale per oil well are generated annually in the United States. As the oil in a reservoir dwindles and more water is pumped out with the oil, the amount of scale increases. In some cases brine is introduced into the formation to enhance recovery; this also increases scale formation.

The average radium concentration in scale has been estimated to be 480 pCi/g. It can be much higher (as high as 400,000 pCi/g) or lower depending on regional geology.

Sludge

Sludge is composed of dissolved solids which precipitate from produced water as its temperature and pressure change. Sludge generally consists of oily, loose material often containing silica compounds, but may also contain large amounts of barium. Dried sludge, with a low oil content, looks and feels similar to soil.

Oil production processes generate an estimated 230,000 MT or five million ft^3 (141 cubic meters) of TENORM sludge each year. API has determined that most sludge settles out of the production stream and remains in the oil stock and water storage tanks.

Like contaminated scale, sludge contains more Ra-226 than Ra-228. The average concentration of radium in sludges is estimated to be 75 pCi/g. This may vary considerably from site to site. Although the concentration of radiation is lower in sludges than in scales, sludges are more soluble and therefore more readily released to the environment. As a result they pose a higher risk of exposure.

The concentration of lead-210 (Pb-210) is usually relatively low in hard scales but may be more than 27,000 pCi/g in lead deposits and sludge.

Contaminated Equipment

Oil drilling rig.(click for larger image.)

TENORM contamination levels in equipment varied widely among types of equipment and geographic region. The geographic areas with the highest equipment readings were northern Texas and the gulf coast crescent from southern Louisiana and Mississippi to the Florida panhandle. Very low levels of TENORM were found in California, Utah, Wyoming, Colorado, and northern Kansas.

According to an API industry-wide survey, approximately 64 percent of the gas producing equipment and 57 percent of the oil production equipment showed radioactivity at or near background levels. TENORM radioactivity levels tend to be highest in water handling equipment. Average exposure levels for this equipment were between 30 to 40 micro Roentgens per hour (μR/hr), which is about 5 times background. Gas processing equipment with the highest levels include the reflux pumps, propane pumps and tanks, other pumps, and product lines. Average radiation levels for this equipment as between 30 to 70 μR/hr. Exposures from some oil production and gas processing equipment exceeded 1 mR/hr.

Gas plant processing equipment is generally contaminated on the surface by lead-210 (Pb-210). However, TENORM may also accumulate in gas plant equipment from radon (Rn-222) gas decay. Radon gas is highly mobile. It originates in underground formations and dissolves in the organic petroleum areas of the gas plant. It concentrates mainly in the more volatile propane and ethane fractions of the gas.

Gas plant scales differ from oil production scales, typically consisting of radon decay products which accumulate on the interior surfaces of plant equipment. Radon itself decays quickly, (its half-life is 3.8 days). As a result, the only radionuclides that affect disposal are the radon decay products polonium-210 (Po-210) and lead-210. Polonium-210 is an alpha emitter with a half-life of 140 days. Pb-210 is a weak beta and gamma emitter with a half-life of 22 years.

Disposal and Reuse: Past Practices

Recycling of Metals

Before the accumulation of TENORM in oil production equipment was recognized, contaminated materials were occasionally recycled for use in making steel products:

% load-supporting beams in house construction
% plumbing for culinary water
% fencing materials
% awning supports
% practice welding material in class rooms.

Disposal of Wastes

When sludge fouling in water and oil storage tanks became a problem, the tanks were drained and the sludge disposed of in waste pits:

% **Burn pits**Earthen pits were previously used for temporary storage an periodic burning of non-hazardous oil field wastes collected from tanks and other equipment.

% **Brine pits**Lined and/or earthen pits were previously used for storing produced water and other nonhazardous oil field wastes, hydrocarbon storage brine, or mining wastes. In this case, TENORM in the water will concentrate in the bottom sludges or residual salts of the ponds. Thus, the pond sediments pose a potential radiological health risk. The radionuclides in these soils have been reported to be in the range from 270 to 1100 pCi/g.

Disposal and Reuse: Current Practices

Recycling of Metals

Now that the petroleum industry is aware of the potential for contamination, they take a number of precautions before recycling:

% Loads of scrap metal are surveyed for hidden radioactive sources and TENORM.
% Piping and equipment are cleaned before release for recycling at smelters.
% Pollution control devices, such as filters and bubblers, are installed in smelter stacks to reduce airborne radiation releases.

Although much of the NORM-contaminated equipment is presently stored in controlled areas, some companies are now cleaning the equipment and proposing to store it at designated disposal sites.

Waste disposal

The average concentration of the radium in the oil and gas wastes at offsite and onsite disposal facilities is approximately 120 pCi/g.

Sludges containing elevated TENORM are now dewatered and held in storage tanks for later disposal.

Produced waters are now generally reinjected into deep wells or, in the case of offshore production facilities, are discharged into non-potable coastal waters. No added radiological risks appear to be associated with this disposal method as long as the radioactive material carried by the produced water is returned in the same or lower concentration to the formations from which it was derived. As of 1992 there are 166,000 injection wells in 31 states.

Pipes contaminated with scale are cleaned at pipe yards either by sandblasting them with high pressure water or by scraping out the scale with a rotating drill bit. The removed scale is then placed in drums and stored for later disposal.

Contaminated equipment may either be cleaned and reused by the petroleum industry; disposed; or, if radiation levels are sufficiently reduced, sold for recycle. If equipment cannot be further decontaminated to acceptable levels, it is sent to a landfill licensed to accept NORM materials.

In some cases contaminated steel may be reprocessed via smelting. During the smelting process molten steel separates from the NORM which vaporizes and is released as a gas. If the steel mill has pollution control equipment, most of the NORM is trapped in the baghouses and scrubbers. A typical smelting operation is capable of capturing 99 percent of the particulate releases.

Exposure Risks

TENORM contamination in oil production waste came to the attention of industry and government in 1986 when, during routine well work in Mississippi, barium sulfate scale in tubing was found to contain elevated levels of levels of radium-226, and thorium-232.

Because of concerns that some pipes may have contaminated the surrounding environment, radiological surveys were conducted by EPA's Eastern Environmental Radiation Facility. These surveys showed that some equipment and disposal locations exhibited external radiation levels above 2 mR/hr and radium-226 soil contamination above 1,000 pCi/g. Some contamination had also washed into a nearby pond and drainage ditch at one site, as well as into an agricultural field with subsequent uptake of radium by vegetation.

Because TENORM contaminated wastes in oil and gas production operations were not properly recognized in the past, disposal of these wastes may have resulted in environmental contamination in and around production and disposal facilities. Surface disposal of radioactive sludge/scale, and produced water (as practiced in the past) may lead to ground and surface water contamination.

Those at risk include:

% oil/radiation waste disposal workers
% nearby residents/office workers.

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Oil/Radiation Waste Disposal Workers

Disposal workers include those who work directly on top of uncovered waste sites**.** Potential risks assessed for these workers include exposures due to direct gamma radiation and radioactive dust inhalation. In addition, they may inhale radon gas which is released during drilling and produced by the decay of radium, raising their risk of lung cancer. Workers following safety guidance will reduce their total on-site radiation exposure.

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Nearby Residents/Office Workers

Risks evaluated for members of the public working or residing within 100 meters of a disposal site are similar to those of disposal workers. They include: direct gamma radiation, inhalation of contaminated dust, inhalation of downwind radon, ingestion of contaminated well water, ingestion of food contaminated by well water, and ingestion of food contaminated by dust deposition.

Risks analyzed for the general population within a 50 mile radius of the disposal site include exposures from the downwind transport of re-suspended particulates and radon, and exposures arising from ingestion of river water contaminated via the groundwater pathway and surface runoff. Downwind exposures include inhalation of re-suspended particulates, ingestion of food contaminated by deposition of re-suspended particulates, and inhalation of radon gas.

Individuals working inside an office building inadvertently constructed on an abandoned NORM waste pile also face the threat of radiation exposure. Potential risks assessed for the onsite individual include exposures from direct gamma radiation, dust inhalation, and indoor radon inhalation.

% What you can do to protect yourself: U.S. Environmental Protection AgencyAt this site you will find information on how to reduce total on-site radiation exposure at oil and gas drilling facilities.

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What is Being Done About These Wastes

The problem of TENORM contamination is now known to be widespread, occurring in oil and gas production facilities throughout the world. It has become a subject of attention in the United States and in other countries. In response to this concern, facilities in the U.S. and Europe have been characterizing the nature and extent of TENORM in oil and gas pipe scale, evaluating the potential for exposure to workers and the public, and developing methods for properly managing these low specific-activity wastes.

Both the oil and gas industry and state regulatory agencies are currently examining and regulating TENORM in oil and gas production facilities. The API has sponsored studies to characterize accumulations of TENORM in oil field equipment and to evaluate methods for its disposal. The API has also formed an Ad Hoc Committee on Low Specific-Activity (LSA) Scale and has prepared a draft measurement protocol for identifying producing areas where NORM scale is known to exist. The Part N Subcommittee of the Conference of Radiation Control Program Directors has been working since 1983 to develop model state regulations (Part N of Suggested State Regulations for Control of Radiation) for the control of NORM. While these regulations are intended to apply generally to all NORM-containing materials, several parts would apply specifically to oil and gas industry pipe scale.

Many states with oil and gas production facilities are currently creating their own NORM regulations. For example, the State of Louisiana has regulations for NORM in scales and sludges from oil and gas production that differ from the Part N model regulations, where the State of Texas has NORM regulations similar to Part N regulations.

Resources

Sector Notebook Project – Oil and Gas Extraction (PDF) (41 pp, 444K About PDF) 2000. U.S. Environmental Protection Agency, Office of Enforcement and Compliance Assurance*This document provides a description of the oil and gas extraction process, how to comply with EPA's health and the environmental laws and techniques for pollution prevention.*

Potential Health Hazards Associated with Handling Pipe Used in Oil and Gas Production 26 January 1989. OSHA Hazard Information Bulletins. U.S. Department of Labor, Occupational Safety and Health Administration*This document warns workers of possible inhalation or ingestion of radioactive material in cutting and welding oil and gas pipes.*

About TENORM

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TENORM is produced when radionuclides that occur naturally in ores, soils, water, or other natural materials are concentrated or exposed to the environment by activities, such as uranium mining or sewage treament.

Radioactive materials can be classified under two broad headings:

% man-made
% naturally occurring radioactive materials (NORM).

Natural Occuring Radioactive materials can be re-distributed inside the Earth's Crust. Redistribution has also occurred as a result of weathering, sedimentation, and chemical interactions in the crust. **As a consequence of these processes, potassium-40 and the uranium and thorium series nuclides have tended to concentrate in certain minerals and certain geologic formations.** For example, uranium in significantly elevated concentrations is associated with phosphate ores in three major locations in the U.S.: southeastern Idaho and parts of neighboring states, central Florida, and central Tennessee and northern Alabama. **Radionuclides from the uranium and thorium series are also associated in widely varying proportions in the crude oil and brine extracted from underground petroleum reservoirs.**

NORM wastes are the radioactive residues from the extraction, treatment, and purification of minerals, petroleum products, or other substances obtained from parent materials that may contain elevated concentrations of primordial radionuclides. They also include any radioactive material made more accessible by the actions of man. Each year, hundreds of millions of metric tons of NORM waste are generated from a wide variety of processes, ranging from uranium and phosphate mining to municipal drinking water treatment. Processes that produce NORM wastes analyzed in this study include uranium mining, phosphate and elemental phosphorus production, phosphate fertilizer production, coal ash generation, oil and gas production, drinking water treatment, metal mining and processing, and geothermal energy production. Primordial radionuclides present in the parent materials can become concentrated in the wastes during mining and beneficiation, mineral processing, oil and gas extraction, or various other processes. This results in radionuclide concentrations in NORM wastes that are often orders of magnitude higher than in the parent materials.

The exposure to individuals from NORM wastes occurs in three main ways. The first is associated with the normal onsite disposal of the waste in piles or stacks. This type of disposal can lead to groundwater contamination and to airborne releases of radioactive particulates and radon. The second is from the improper use and/or disposal of these wastes, such as for soil conditioning or fill dirt around homes. This can lead to build-up of radon gas in homes, direct exposure to individuals located nearby, contamination of soil and the crops growing in that soil, and groundwater contamination. The third way is the reuse of NORM-contaminated materials, such as in concrete aggregate, which could lead to increased radiation risks to members of the public in a variety of ways.

% Why is EPA concerned about TENORM?
% What EPA is Doing about TENORM?
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Why is EPA concerned about TENORM?

Many of the materials that are technically TENORM have only trace amounts of radiation and are part of our everyday landscape. However, some TENORM has very high concentrations of radionuclides that can result in elevated exposures to radiation.

EPA is concerned about TENORM for three reasons.

% It has the potential to cause elevated exposure to radiation.
% People may not be aware of TENORM materials and need information about them.
% Industries that generate these materials may need additional

guidance to help manage and dispose of them in ways that protect people and the environment and are economically sound.

EPA is working to coordinate all of its TENORM efforts with other federal agencies, state and tribal governments, industry and public interest organizations. Coordinating our projects in this way will help us see the problem as a whole and will allow us to work together to develop solutions more effectively both within the Agency and with stakeholders outside the Agency.

What EPA is Doing about TENORM?

EPA is working to understand the problem and to develop effective ways to protect humans and the environment from harmful exposure to the radiation in these materials. Because TENORM is produced by many industries in varying amounts and occurs in a wide variety of products, it is a particularly challenging problem in the U.S. Although EPA and others working on the problem already have learned a good deal about TENORM, we still do not understand fully all of the potential radiation exposure risks it presents to humans and the environment.

EPA is working on the problem in four ways:

% Studying the TENORM-producing industries to determine what's in the wastes from the industries and how much risk they pose.
% Identifying and studying existing TENORM sites to assemble a nation-wide view of the problem--where the wastes are, what's in them, and the risks they present.
% Developing and providing education and guidance for safely and economically controlling exposures to TENORM wastes.
% Working with other organizations that are also confronting the problem, including states, tribes, other federal agencies, industry and environmental groups, and international organizations.

TENORM-Producing Industries

EPA is studying TENORM-producing industries in the United States to learn which aspects of the problem, including health and environmental risks, are unique to a given industry and which are common across all industries. The results of these studies will appear as a series of reports on individual industries and will be provided on this web site as they become available. Each report will contain the following information:

% generation of TENORM by the industry

% content of the material
% ways that people could be exposed to the industry's TENORM
% potential effects of exposure to materials from the industry
% how the industry handles or disposes of TENORM wastes.
Information on the following sources of TENORM is now available:

% Mining Wastes
% Energy Production Wastes
% Water Treatment Wastes
% TENORM in Consumer Products

Issues to be considered by Local Community & Questions for the Drilling Company/Prospecting Company or Survey Teams involved in the Exploration Processes and subsequent extraction of Oil/Gas Resources:

Try to get all correspondence and answers in writing and on company papers or with company representatives signatures at the least. Insist on all data and info in writing where possible!

It is vital to get to know who is involved! What companies are doing what work and what they are each then responsible for within the process(es). Who are the named Directors, Boards, etc.

Ask how these companies are funded… ask for their Company Accounts & Records if they will not say. Try to find out if they are funded by other bigger international Companies?... If so who will then be responsible, (or can be held responsible), for the site/location and environment after the drilling companies have gone or are finished, closed down etc. (The longer term responsibility for any environmental damage is of paramount consideration! So ultimately who will be responsible for any environmental damage in the longer term? Whe will pay for environmental damage, clean up, health bills, etc.) This information should/must be in writing!

It is also important to establish as early as possible if there is only going to be one well, at Ballinlea, or is it the first well of others planned for the North Antrim area?

It is important to get in writing what they expect the well to provide – oil or gas(es), and how this will be accessed and extracted. (I.e. is Fracking still an option and if yes what % chance that this will take place in the local area as well as across the broader North Antrim area.

1. Are they required to do and provide the results of pre-drilling water sampling? If not insist that this takes place.
2. When they test local water as part of the pre-drilling sampling process to establish water quality in the area, local water supplies and streams etc. you should be given a few weeks notice so as the local community/landowners etc can get their own samples done at the same time! Ask for at least two weeks notice so you can have another water company of <u>your</u> choice (that you will pay) to be present to do a "split sample". You will want to do the same in your post-drill sample. Ask them what "EPA Method" they will be using so you can make arrangements with your testing facility.
3. Ask for specifics on where their entry road will be, expected hours of use and volume of traffic.

4. Ask the drilling or Parent Company(ies)/Mother Companies to specify the expected time scale for the drilling, pumping, fracking and subsequent removal of oil and/or gas(es) at or from the local well head. Insist on best and worst case scenarios to give a fair estimate of the expectations to be met.
5. Ask the Companies involved, including the Parent Companies for a breakdown of environmental risks that could be reasonably expected in relation to the local drilling, fracking (if realistic), pumping processes and in relation to the local site and environmental conditions. In particular in relation to the local sites of Outstanding Natural Beuty, Marine Protection Zones, and Coastal Zones. Ask how the 'Saline Water' in the drilling samples form the local site at Ballinlea got into the strata being sampled? Then ask how they intend protecting the drill well, and to preserve well integrity afterwards. This is very important if they intend to Frack at the site!
5B. Then it is vital to ask about expected pollutnats and 'Tenorm' at the local site. (See 'Tenorm' mentioned later in this document for more info.). Ask how they propose to handle any and all 'Recdovered Water', 'Sludge' and all well pollutants at the site? How can they guarantee no environmental pollution will occur, nor any damage to local resident's health from the drilling or fracking processes? If they are unwilling to guarantee this I would be very worried!
6. Where do they plan to obtain the millions of gallons of water they will need to do the drilling and fracking? On one local site the driller put on their permit application that they needed approx. 100,000 gallons for <u>each</u> drilling and approximately 6 million for <u>each</u> well frack. So where will get this volume of water?

7. Where do they intend to store these millions of gallons of water? Are they planning a water impoundment? Freshwater only, or also wastewater? Since many of the drillers are now recycling water they use the wastewater impoundments. This greatly decreases the fresh water requirements. They just keep re-using the frack fluid. How long will the impoundment sit on the land or in the local property?
8) What guarantees will the Drilling Company, (Fracking Company), Prospecting Company, Head Office, Oil/Gas Company give in storing waste water(s) and polluted water(s) post drilling or Fracking processes? How long will they provide environmental protection for waste water, water run off, Frack water, drill water or any water imported onto the site or resulting from the drilling or fracking processes? (You may need to seek advice on longer term protection in relation to environmental control(s) in relation to local legislation and water protection. I.e which cpompanies will be held responsible if environmental hazards occur over time? Who will pick up the tab for such issues arising later, when drilling companies etc are gone and no longer exist!?)
9. During the frac and flare, (if appropriate for the local site!), will they consider putting your family in a hotel? Mention you have concerns over the VOC's that will be emitted from the flare. These emissions are very toxic!

10. How long do they anticipate the following processes will take?- (Ask for this in writing)

How long will it take for:

- The installation of the access the road(s).
- The Installation of the pad.
- The installation of the impoundment or water retainers/reservoirs.
- The installation of all Pumps, Storage Tanks, Well Head Machinery, Pipe works, and all mechanical installations.
- The collection of the water that would be required for the drilling process.
- The collection of the water requiredfor each of the fracks. (If appropriate at the local site.)
- The collection of the water requiredfor each flare. (If appropriate at the local site.)
- The well completion process (put on the well heads)
- The land restoration after drilling, pumping or fracing processes.

11. What does the driller do with the frack pit liner after the frack? In Parts of the USA they are allowed to bury the liner 18 inches below the surface. The liner may still have drilling materials in it. They can leave in the remnants of any solids brought to the surface during the frack, which could include radioactive materials! (As outlined above.)
11B. How will the Companies deal with fracked mayterials, 'Recovered Water', 'TENOR', Sludge, Solids and all waste materials resulting form the drilling, fracking and removal processes on site? (In writing!)
12. Any plans for a compressor station or processing facility on neighboring land?
13. (This may not be an issue!) - Ask your drilling company to put in writing that all of their employees and all of their sub-contractors employees have passed background checks and have no criminal record. Remind them that you are concerned for your children's safety and protection of your home.

Above questions and amended extracts taken from the following site:
http://www.marcellus-shale.us/before_you_lease.htm
http://www.epa.gov/radiation/tenorm/oilandgas.html

Extract from a USA Oil Company Document, (so perhaps best to read between the lines! But there are some good bits of info on safe well spacing, sizes, water volumes etc.):
The State of Ohio requires a minimum of 40-acres for a well drilled greater

than 4,000’ deep. If the well’s depth is between 2,000’ and 4,000’, Ohio requires at least 20 acres. Wells between 1,000’ and 2,000’ deep require 10 acres. The acreage block does not have to be a square, circle or rectangle, but all of the acreage must be contiguous (touching).Ohio also imposes setbacks of wells from properties that are not part of the drilling unit. The wellhead location must be at least 300’ from any property line not leased and included in the drilling unit in areas of 20-acre spacing and setback at least 500’ in areas requiring 40-acre spacing.Ohio also sets minimum distances between wells that target the same oil and gas producing formation. If the wells are more than 4,000’ deep, they must be at least 1,000’ apart. If they are between 2,000’ and 4,000’, wells must be at least 600’ apart.Wells and tank batteries must be located at least 100’ from any inhabited dwelling and at least 50’ from any road or railroad. However, new construction, though perhaps imprudent, is allowed right next to (no setback from) existing oil and gas wells and tank batteries.Oil and gas companies have additional considerations once it has been determined that compliance with state spacing requirements can be achieved. The first is access to a natural gas pipeline. Dominion East Ohio Gas and Columbia Gas operate the largest pipeline systems in northeastern Ohio. The well’s distance to the nearest pipeline is a factor in the well site decision.The surface topography of the land has a strong influence on the location of the well and tank battery. Wells cannot be drilled in ponds and streams, and wetlands in general. The desire to minimize creek crossings and heavily wooded areas also affects well site location decisions. Safe access to the well lease road from public roads is also a consideration. These surface issues are the primary reasons most oil and gas companies work with the landowner to find the best possible well location to satisfy the interests of all parties.

How is My Land Used During the Drilling and Completion of the Well The first step is an agreement between the owner of the land that will have the well and tank battery on it and the oil and gas company as to the location of all facilities. This enables a well plat location survey to be conducted. This well plat is part of the Ohio drilling permit application.When an Ohio drilling permit has been issued, it is valid for one year. The permit has “Special Permit Conditions” determined by the Division of Oil and Gas Resources Management based on the specific geology in the vicinity and on experience gained from nearby wells. There are more extensive permitting requirements for wells drilled in urban areas.The next step is constructing a safe entranceway to get equipment off the public roads and onto the drill site. The entranceway is extended by a lease road back to the wellhead location. Depending on the size of the drilling rig used to drill the well, the drill pad can range from .50 to 0.75 acres in size for a traditional.Drilling normally takes four to seven days, 24 x 7, and then the drilling rig leaves. A smaller service rig is used to complete the well by running the production tubing in the wellbore and performing other steps necessary to place the well in production.After completion, the well site is much smaller. The well head is in a fenced-in cage that ranges in size from 10’ x 10’ to 15’ by 30’ if a pumping unit is required. The tank battery must be at least 50’ from the wellhead. Depending on the number of production tanks required, the fenced-in tank battery ranges from 20’ x 30’ to 28’ x 50’. A lease road is maintained to the tank battery so that the oil buyer’s tank truck and other equipment to service the well can gain access to the well at anytime of the year.Natural gas is delivered to the gas utility by a gas sales line that runs from the tank battery to the nearest utility’s transportation or distribution pipeline. The pipeline is trenched in and buried below plow depth.However, if your lease is a No Surface Trespass Oil and Gas Lease, then there should be absolutely no use of your surface property, and the oil company should not set foot on your land while the new well is being constructed on another person’s.

What About Safety?Safety is important. Unsafe is very costly. Safety must be maintained from the time the initial entranceway is built until the well is plugged and abandoned at the end of its life. Before drilling can begin, The Division of Oil and Gas Resources Management requires a site inspection, approval of proposed drilling pit locations and identification signage to be placed in a highly visible place. In urban areas, a copy of the Ohio Drilling Permit and Special Permit Conditions are part of the posted safety signage. During drilling, access to the well construction site is limited to those contractors who are actively working on the well. Because the drilling is 24 x 7, there are always safety-conscious people on location. When the drilling rig leaves, all excavations are fenced in and a temporary gate may be placed to keep curious strangers from gaining access to the property.After the construction, the wellhead and tank battery are completely fenced in. In urban areas, regulations require an 8’ high fence around both. A permanent locked entranceway gate may be required by the State or requested by the landowner. Several warning signs (“No Smoking”; “No Trespassing”) are posted around the well site. The name of the company that operates the well and a 24-hour emergency telephone number are included in the required signage.In addition, the Ohio Department of Natural Resources requires a cash bond of $15,000 to be on deposit in Columbus in the event there is a situation that must be addressed, and the oil and gas operator is not complying with Division of Oil and Gas Resources Management rules and regulations.Finally, most oil and gas companies have general liability insurance policies in place with at least $1,000,000.00 in liability coverage. GonzOil maintains $3,000,000.00 in general liability insurance policies.

Is My Water Supply at Risk?Certainly not if you have a municipal water source and your water is piped in by a utility. GonzOil participates in the Ohio Utility Protection Service (OUPS), and we “Call Before We Dig” to avoid damaging any pre-existing water lines. If water is supplied from a water well, we take stronger preventive measures. First, a water sample is taken before any activities begin. This becomes the base line if, after drilling, there is a need to re-test the water quality from the water well. The Ohio drilling permit and Special Permit Conditions are developed with water safety a priority. The Division of Oil and Gas Resources Management employs professional hydrologists and geologists who determine the locations of the fresh water aquifers. Conditions to safeguard these aquifers must be adhered to while drilling, and a State Oil and Gas Inspector has the right to observe all critical phases of water protection.Oil and gas are valuable, and no oil company wants those sources of income to go anywhere except into the production tanks and pipelines that take them to market. The State of Ohio requires that dikes be constructed around all tanks that have the capacity to hold no less than 110% of the volume of the largest tank. In addition, there are many safety regulators and automatic shut off valves set in place to shut-in the well if operating conditions exceed the normal range. In addition to protecting surface and shallow potable water, the Division of Oil and Gas Resources Management requires an extensive cementing program to insure that the oil and gas coming up and through the well does not escape the production casing. Typically, the state drilling permit requires three separate cementing operations. The first is setting the 11.875” conductor casing into bedrock and cementing it in place. Depending on the amount of glacial till (overburden) and the depth of solid bedrock, conductor casing runs from 30’ to 350’ deep. Well operators are required to notify the local Oil and Gas Inspector when the conductor casing is being cemented in place. After the cement hardens, drilling resumes inside of the conductor casing until all potable water zones have been drilled through. At this point in the process, 8.625” surface casing is placed in the wellbore and cemented in place. Again, the local Oil and Gas Inspector is notified when the surface cement job will take place. The third cementing operation takes place when the well has been drilled to its total depth. At this time, the 4.5” production casing is run in the well and cemented in place. Again, the local Oil and Gas Inspector is given the opportunity to monitor the cementing of the production casing. The purpose of the three cement jobs is to force all production from the well to flow up and through the production casing and into the tank battery.

Once a Well is Placed into Production, What Kind of Traffic Can I Expect?
New wells take several weeks to work the bugs out of the operating cycle. Consequently, the well is likely to be visited by a well tender almost every day until the well settles into a smooth operating cycle. Typically, well tenders drive a 4x4 pickup truck and limit their work hours to daytime. There are several larger trucks that need to service the well from time to time. Our favorite is the oil tanker, usually a 30’ straight truck, not a semi. We hope it stops by every week! A smaller water truck also services the well by removing brine from the well and taking it to a state-approved injection well for reinjection into the ground. We hope this truck does not come too

often since this is a waste product, and we must pay to have it removed. The largest piece of equipment to access the well after it has been completed is a service rig. We hope to see a service rig less than once a year; however, we never know when a mechanical problem downhole will require a service rig to be placed over the wellbore. Finally, the State Oil and Gas Inspectors have the right and responsibility to visit the well occasionally to monitor safety and compliance issues. They usually drive a 4X4 SUV owned by the State of Ohio (i.e., you).

What Happens at the End of a Well's Life When a well is no longer profitable, it becomes a candidate for plugging. Most Clinton Sandstone wells have a commercial life of 15 to 20 years. As a general rule, wells are not allowed to sit idle for more than one year. When it comes time to plug the well, all surface equipment is removed along with as much production casing as possible (the portion not cemented in place). The well is then filled with cement to prevent oil and gas from coming up the plugged hole. This cementing operation can be from the top of the hole to the bottom of the hole, or with State permission, a series of cement plugs across any potable water zones. Buried pipelines are removed or filled with cement and left in place, based on the property owner's decision. Finally, the surface location is re-graded as closely as possible to its pre-drilling contours and reseeded. Typically, if another well is not drilled on the property within a short period of time, the acreage around the well is no longer held and the oil and gas lease expires.

How Does an Oil and Gas Well Affect the Value of My Property?A well can add value or reduce value. A well that is distributing nice royalty checks to the landowner enhances property values. However, as the well ages and production declines, this value is reduced unless offset by increasing oil and gas prices. Unsightly wells and production equipment can depreciate a property's value. Consequently, it is important to lease your property to an oil and gas company that takes pride in its facilities. The best way to determine that is to "see for yourself" by visiting some of the well operators' other wells, and it is always wise to ask for and follow up on a company's references.If the property receives free gas from a well on the premises, that is a significant improvement to the property's value. In recent years, it has cost most home owners thousands of dollars to heat their homes each season with gas from Dominion East Ohio Gas or Columbia Gas or gas suppliers using their pipelines.If the well on the property has been properly plugged and abandoned in compliance with Ohio law, there should be almost no **physical** evidence that there ever was a well on the property. And, the lease roads that may be left behind with the landowner's permission, can provide better access to parts of the acreage that would not have been accessible had the well not been drilled. *(They don not say what invisible evidence will be left behind though! BC)*

http://www.gonzoilinc.com/html/landowners.html

The following info is Web information By Frank A. Verrastro, Lisa Hyland, and Molly Walton

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Q1: Recent earthquake tremors centered on Youngstown, Ohio, have resurrected safety concerns related to hydraulic fracturing and shale gas extraction. Are the tremors related to fracking activity?

A1: Under the right conditions, every time pressure is applied or reduced from an underground rock formation there is at least a small risk of a seismic result. This is true in the case of mining activity, driving piles for bridge or building construction, drilling geothermal wells, or injecting fluids at high pressure in seismically active areas. According to the recent report by the Secretary of Energy Advisory Board Shale Gas Production Subcommittee, tiny micro earthquakes can be triggered during shale gas development; however, most of these are minuscule and pose no public health or safety hazard (see the subcommittee's *Second Ninety Day Report,* November 18, 2011, at http://www.shalegas.energy.gov/resources/111811_final_report.pdf). The recent seismic activity in Youngstown has been attributed to the injection of wastewater from nearby oil and gas drilling, not from fracking operations. Under EPA and state regulations, disposal of such wastewater requires injection in permitted Class II injection wells, an activity that has been going on for decades. In cases where large volumes of water are injected under pressure in seismically active areas, as the water enters fissures, it lubricates fault lines that can slip, causing tremors. The wells in question have been closed pending further investigation. Reports indicate that the sites have been accepting brine disposal since 2010, but that the injected volumes grew tremendously in 2011.

Q2: What can be done to reduce risk of seismic activity from the injection at wastewater wells?

A2: In the days immediately following the recent seismic activity in Youngstown, Ohio's Department of Natural Resources closed the injection well nearest the epicenter of the December 31 earthquake and also suspended activity at four other nearby injections wells to more fully evaluate the situation. That said, regulators and operators can take, and are already taking, a number of actions to reduce the future likelihood of seismic activity from wastewater injection, including assessing seismic risk when identifying or permitting injection sites, requiring seismic monitoring at active well sites, and limiting well pressure thresholds by decreasing the amount of water pumped into wells as well as the pressure at which it is pumped. Discussions are also under way about whether and how to handle the issue of large-volume injection at or near fault zones.

Q3: What other options exist for the disposal of wastewater?

A3: Wastewater from natural gas extraction cannot be discharged directly into waterways without undergoing treatment. The EPA is developing natural gas wastewater standards for water that is taken to wastewater treatment facilities as some plants are not properly equipped to handle the wastewater. Another important option is to recycle and re-use wastewater, thereby reducing the volumes that ultimately must be disposed of in injection wells. Technological advancements are increasingly making this cost-competitive option. In addition, firms are now developing and employing “green” frack components, finding better ways to treat and recycle liquids flow, and exploring ways to reduce the amount of water used in fracking operations through advanced minimization technologies—all of which could result in the generation of less wastewater (see the National Petroleum Council’s White Paper, “Management of Produced Water for Oil and Gas Wells,” at http://www.npc.org/Prudent_Development-Topic_Papers/2-17_Management_of_Produced_Water_Paper.pdf).

Frank A. Verrastro is senior vice president and director of the Energy and National Security Program at the Center for Strategic and International Studies (CSIS) in Washington, D.C. Lisa Hyland is research associate and program manager of the CSIS Energy and National Security Program. Molly Walton is research associate and program coordinator with the CSIS Energy and National Security Program.

http://www.shalegas.energy.gov/resources/111811_final_report.pdf

The following is a Web-link to PDF fact sheet for local communities on questions they should be asking! (USA)

http://ohioline.osu.edu/cd-fact/pdf/1282.pdf

Web-link to PDF on Fracking implications in strata and how variable a process this is:

http://www.spe.org/atce/2011/pages/schedule/tech_program/documents/spe145949%201.pdf .