This document was prepared by a Massachusetts resident who wishes to remain anonymous because he is employed in the energy/pipeline business. It contains a couple of dozen topics that individual towns could address by passing bylaws or ordinances that ban or raise the standards on particular issues. Example: typical hours for pipeline construction can be 24/7; a town could set limited hours of construction and ban construction on Sundays. There are topics relating to planning, board of health, conservation commission, fire, police, etc.

Other resources and background about the pipeline can be found at:

Massachusetts Pipeline Awareness Network
http://www.massplan.org/
NoFrackedGasInMass
http://www.nofrackedgasinmass.org/
Hilltown Community Rights (HCR)
Live in the Hilltowns? Keep up on news and events on the pipeline resistance by subscribing to the HCR email listserve:
http://ashfieldtalk.org/hilltown-community-rights/

NATURAL GAS PIPELINE PROJECTS
COMMUNITY TALKING POINTS

1. Introduction

Communities that are situated in the path of a proposed natural gas pipeline are usually unaware of all the myriad issues that come with a pipeline. Gas companies are not forthcoming on these topics as an educated public will at a minimum cause the costs of installing and operating the pipeline to increase. In some cases, environmental and operational questions have caused delays and cost increases that have led to the abandonment of planned pipeline extensions[1] by the pipeline company. In general, a community that is knowledgeable and is involved in the pipeline permitting process is not something the pipeline companies encourage. Communities that air the issues discussed here in advance of a pipeline being imposed have some chance of avoiding the pipeline and will be in a better position to negotiate for remediation or compensation on behalf of their constituents if the pipeline becomes a reality.

Some but not all of the local issues that each community and their governments should be aware of are covered in the list below:

1.1. Hours of Work during Construction

The bulk of the workers used on pipelines are specialists that will be brought in from elsewhere, generally from the deep south. As the pipeline company is paying for their room and board and because time is money and the seasonal window for installation is short, the work hours for pipeline construction are long. Twelve to sixteen hours day, six or seven days a week are common. Night work is not unusual if the project has fallen behind schedule. The use of heavy earth moving equipment and welding rigs during all available daylight hours can be disruptive to local residents. Local statutes on acceptable work hours, noise pollution and light pollution can be used to keep the disturbances within reasonable limits.

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[1] The Islander East project was to bring natural gas from Connecticut across Long Island Sound to Eastern Long Island was certificated by FERC. Spectra ultimately abandoned the project in the face of heavy public oppositions, permits delays and escalating project implementation costs. http://www.naturalgasintel.com/articles/69790-ferc-gives-islander-east-algonquin-another-two-years-to-build-related-pipe-projects

During select stages, operations are required to proceed 24 hours a day over several days. Hydrotesting and gassing in the pipeline are cases in point. In many cases, the pipelines will relocate affected residents and cover the cost of a hotel with additional compensation for the associated inconvenience. Local governments may want to get involved in the terms of such arrangements on behalf of their constituents. Individual residents that are accommodating get less consideration than residents that are more "prickly". An agreement negotiated by the local government would likely be more advantageous to local residents and save them having to haggle with the pipeline land representative. On the other hand, some people may enjoyment and therapeutic value in the haggling and giving the pipeline's representatives the gears.

1.2. Noise Pollution

Compressor stations are the preeminent noise sources for a pipeline's operations. Turbine engines (basically industrial jet engines) generate on the order of 140 dBA[2] [3] without air intake mufflers and exhaust mufflers. Pressure

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[2] The "A" weighted decibel scale is weighted to correspond to people's natural hearing recognition and is less sensitive to very low and very high frequencies that are harder for people to hear. The decibel is a logarithmic scale. As a logarithmic scale, each 3 dB is effectively a doubling of the sound energy level. A 3 dB increase in noise is generally considered to be the threshold for the human ear to notice a difference in noise levels.

[3]

dBA	Example	Home & Yard Appliances	Workshop & Construction
0	healthy hearing threshold		
10	a pin dropping		
20	rustling leaves		
30	Whisper		
40	babbling brook	computer	
50	light traffic	refrigerator	
60	conversational speech	air conditioner	
70	shower	dishwasher	
75	toilet flushing	vacuum cleaner	
80	alarm clock	garbage disposal	
85	passing diesel truck	snow blower	
90	squeeze toy	lawn mower	arc welder
95	inside subway car	food processor	belt sander
100	motorcycle (riding)		handheld drill
105	sporting event		table saw
110	rock band		jackhammer
115	emergency vehicle siren		riveter
120	Thunderclap		oxygen torch

regulating stations that cut pipeline pressure down to the lower pressures used in gas distribution systems can also be noisy, 120 dBA in extreme cases. Even above ground gas pipe emits a constant hissing sound when gas flow reaches the upper limits of 50 to 80 feet per second gas velocity.

There are three aspects to the noise generated by compressor stations, regulating stations, meter stations, ongoing operations and pipeline construction:

- **General noise** levels as measured in dBA. FERC guidelines for ongoing natural gas operations require equipment to generate no more than 55 dBA L_{dn}[4] at the nearest residence existing at the time of construction. This requirement does not cover impulsive noise generated by things like safety systems such as relief valves or non-routine events such as gas blowdowns at remote pipeline locations.

  Many communities have noise statutes that are significantly below the FERC standard. dBA noise level issues are usually associated with compressor stations, regulating stations, occasionally with meter stations and intermittently when high pressure gas is released to atmosphere for operational reasons anywhere along the pipeline.

- **Pure tones**, even when they are well below the generally mandated noise level, are easily perceived by the human ear and tend to be extremely

125	balloon popping
130	peak stadium crowd noise
135	air raid siren
140	jet engine at takeoff
145	Firecracker
150	fighter jet launch
155	cap gun
160	Shotgun
165	.357 magnum revolver
170	safety airbag
175	howitzer cannon
180	rocket launch
194	sound waves become shock waves

[4] L_{dn} is a mathematical treatment that looks at both daytime and nighttime noise levels and penalizes nighttime noise by 10 dB. A uniform and continuous level noise generated over a 24 hour period would need to measure instantaneously at 48.6 dBA to meet the requirements of a 55 dBA L_{dn} statute.

invasive and annoying. Pure tones are not explicitly regulated by FERC. Many communities have statutes that address pure tone noise generation. Pure tone issues are generally restricted to compressor stations, and regulating stations.

- **Low frequency noise** that falls below the range of the dBA scale can still be perceived by humans but as a rumble or by secondary effects such as the vibration of buildings, rattling of dishes or pressure in the chest. The dBC sound scale is generally used to quantify low frequency noise. Low frequency noise is not explicitly regulated by FERC. Many communities have statutes that address low frequency noise propagation. Low frequency noise issues are usually restricted to compressor stations. Both turbine and reciprocating engine driven compressors are subject to this issue. Low frequency noise is difficult to predict and difficult to remediate.

Noise statutes that dictate noise limits at the property line are generally favored by communities as it prevents the proponent from projecting noise pollution into property owned by others. Protecting adjacent land from noise pollution helps to preserve its value and utility. In general, pipeline companies will comply with local noise ordinances that are reasonable and can be achieved using reasonably available proven technologies. From the pipeline's perspective, the added cost of building a quieter compressor station or regulating station is usually less expensive than a court challenge and the associated time delays likely to be involved in stream rolling a reasonably written local noise ordinance. FERC also frowns upon the pipelines using their status as a federally sanctioned undertaking to override local ordinances that are reasonable and which are not show stoppers. A few thousand extra dollars spent on higher quality engine intake and exhaust mufflers, better sound proof building walls, pipe acoustic lagging and building ventilation mufflers goes a long way in making these facilities quiet. The key is to identify the noise requirements early in the design process, not after the noise complaints start rolling in.

Communities that are being targeted for compressor stations or regulating stations would be well served to develop comprehensive noise ordinances for use during the site permit process.

1.3. Light Pollution

Light pollution is one of the most common complaints associated with meter, regulating and compressor stations located in rural areas. It is also one of the easiest to solve if it is identified as an issue early in the facility's design. Many localities have statutes governing light pollution and lighting efficiency for industrial installations.

The goal of the facility designers is to have sufficient light levels at all times to support video security systems, to support safe egress of personnel in an emergency, as required by code, and to support maintenance work when personnel are on site. The fact that most facilities spend large amounts of time unmanned provides an opportunity to reduce light pollution in most circumstances.

Common lighting management arrangements include:

- For general security lighting, motion activated general area or entranceway lighting.
- For security cameras and safe egress, use of low light cameras in conjunction with limited downward facing low wattage lighting (1500 lumens) over doorways tied to dusk/dawn sensors.
- When occasional outdoor night time maintenance activities are in progress in established yard areas at compressor, meter and regulating stations, yard area down facing lighting used only when activities are ongoing.
- In the event emergency conditions are detected by the computer control systems, lighting that is forced on by the station control systems but is otherwise not active.
- Use of high efficiency LED lighting for interior and exterior spaces.

The lighting control is generally managed by the same computer control system that manages the facility's operations. A well designed lighting system requires only computer programming changes to modify how the lighting system operates in various situations or to accommodate lighting change requests made by local residents.

1.4. ROW Access

At each road crossing there will be access to the pipeline ROW (right of way) from the road edge. Pipeline companies will generally try to discourage unauthorized vehicular access to the ROW although the pipeline does need the ability to access the ROW with their own vehicles. They will erect steel gates and use large boulders and trees to restrict access to the ROW except by company trucks that have a key to the gate.

In spite of these efforts, ATV's, dirt bikes and even four wheel vehicles will find their way onto the pipeline ROW. Off road enthusiasts are very resourceful in defeating the gates and barriers constructed by the pipeline company.

Similarly, it is not uncommon to find that trash and old appliances get dumped on the pipeline ROW or at the ROW access gates. In both cases, localities should have a clear understand with the pipeline company about who is responsible for maintenance of the ROW access points and clean up of any damage or trash.

Some communities insist that access gates at the pipeline ROW be provided with paved aprons at the road edge to minimize the tracking of mud and stones onto the paved road by pipeline company trucks that have been on the ROW.

Many communities also require the construction companies used by the pipeline to post a bond against any road damage caused by the heavy loads of pipe and very large and heavy earth moving equipment and side booms used. The bonds also provide leverage to ensure that open road crossings are completed to the satisfaction of the local authorities. The companies are also generally held responsible for any damages caused by mud and stones dragged onto paved roads from the ROW's.

1.5. Gas Releases

A lot has been written about gas leaks associated with fracking and with low pressure distribution systems and how these leaks are a significant source of GHG (Green House Gas) emissions and that the proposed added pipeline capacity could be offset by addressing these leaks. While these statements may be true, unintentional and systemic gas leakage on a high pressure pipeline are rare and generally short lived. Even the smallest leak at 1400 psi will announce itself loudly and be difficult to miss. On the other hand, intentional gas releases from a high pressure pipeline are routine and release significant amounts of gas when they occur.

The managed release of natural gas to atmosphere happens on both a routine basis and during planned outages. Such gas releases are generally covered by state statutes however their effect on residents, first responders and the environment can have local consequences. While gas is a commodity with value that pipelines try to avoid venting, it is in some circumstances easier and less expensive to vent the gas to the atmosphere than try to recapture the gas. Gas release scenarios can be grouped as follows:

- **Safety systems** at compressor station, meter stations and regulating stations will vent gas to atmosphere at a safe location in the event of a pressure excursion per federal code requirements. Such releases are generally infrequent, short lived, unmuffled and can be very noisy (140-150 dBA). Larger releases in this category are also reportable to PHMSA (Pipeline and Hazardous Materials Safety Administration). While there is limited influence that can be applied by local jurisdictions in the area of mandated safety relief systems, first responders should insist on a strong liaison program with the pipeline company and local gas distribution company (if any) that informs them of where such vents are located, how to respond if local residents report a loud roaring noise coming from such a facility and who to contact at the pipeline or local distribution company in the event of a gas release. Localities may also want advance warning of the testing of such safety systems so that local residents can be forewarned that loud noises will be occurring. In some cases, pipelines have been compelled to install silencing equipment on the safety vents at compressor stations and regulating stations.

  For safety reasons, compressors at compressor stations are routinely depressured when they are not in use. There is increasing pressure to install equipment that can recover the vented gas rather than release it to atmosphere. Localities with proposed compressor station should lobby the pipeline company as part of the site permitting process for minimized gas venting.

- **Equipment maintenance** activity anywhere along the pipeline system generally requires the gas pressure in the affected equipment to be vented. Possible activities include but are not limited to pigging, pipe repairs, valve maintenance, instrument calibration and compressor repairs. In some instances, long lengths of pipeline must be depressured for repairs. In several countries outside the US, Canada is one example, the direct release of methane to the atmosphere is discouraged in favor of flaring the gas. Flaring is preferred because the GHG impact of the CO2 produced by the flare is much less than the impact of unflared methane. A review of pipeline standard protocols on minimizing the amount of gas released, noise abatement and entrained liquid capture (see 1.6 below) are areas suitable for local intervention.

- **Valve actuators** that are used to cycle valves open and closed are often powered by gas pressure. Gas pressure is run through a pneumatic motor and vented to atmosphere as the valve opens and closes. Where electric power is readily available, such as at compressor stations, meter stations and regulating stations, electric motor driven actuators can be used. At remote locations such as the line break valves that are located every few miles along the pipeline, gas powered valve actuators may be the only viable option. Localities may want to review what type of valve actuators are planned for their area and where electric actuators cannot be used, insist that low emission gas actuators are selected. Low emission gas powered actuators are generally more expensive.

1.6. Condensate Liquid/PCB's

Natural gas is mostly methane but includes trace amounts of heavier hydrocarbons. Some of the heavier hydrocarbons that might normally be liquids travel in the gas stream as a vapor. Much as water travels as an invisible vapor in air and condenses out as dew on cool evenings, the heavier natural gas liquids evaporate into the gas stream and condense out of the gas stream when temperature and pressure conditions are right. The liquids tend to accumulate in low spots such as valve bodies and in pipe low spots in valleys.

Condensate in low lying areas can be picked up as slugs or even aerosolized during periods of extremely high gas velocity as might be generated by a large or rapid gas release or by heavy demand generated under very hot or very cold weather conditions. Locations such as compressor stations that vent gas routinely are often equipped with liquid knock out devices on vent lines to capture any liquids that travel with the blowdown gas. Some pipeline companies use portable liquid knock out equipment when large gas releases are planned at locations away from established blowdown sites. Local governments may wish to involve themselves and hold discussions with the pipeline management on the procedures used for routine gas releases at established sites or large planned releases at remote locations. These discussions should revolve around what measures are being taken to protect the local population and environment, prevention of aerosolized liquids, flaring versus direct gas release, noise mitigation, scheduling and advance notice and hazardous material handling procedures.

Up until the mid 1970's, the lubricating oil used at compressor stations contained a fire retardant chemical, PCB's[5] (polychlorinated biphenyl), that was later found to be highly toxic. These lubricating oils were occasionally released into the pipelines when internal compressor seals failed at compressor stations. The oil and its hazardous component migrated into the pipeline system and traveled with the naturally occurring gas liquids to all downstream pipelines. During the 1980's most affected pipelines signed consent decrees with the EPA for the cleanup of know spill locations and ongoing handling of recovered liquids or contaminated equipment and pipe removed from service. Over the intervening period, the levels of PCB's in the pipeline liquids and coating the interior face of the pipe have steadily declined. Despite the elapsed time, PCB hot spots are still encountered. As natural gas liquids condense and travel along the pipeline, they sweep the PCB with them. The PCB laden natural gas liquids will accumulate in low spots such as the cavity in a valve body. The natural gas liquids can later re-evaporate into the gas stream, leaving behind the PCB's, which do not evaporate. Repeated cycles of this process tend to concentrate the PCB's to levels that are significant.

Each locality and their first responders should have a clear understanding of the procedures used by the pipeline for the handling of liquids and contaminated pipe and fitting removed from service and may wish to have advance notice of such activities in their locality.

Pipeline companies will periodically insert "pigs" (tight fitting flexible plastic plugs) at "pig launchers" into the pipe to squeegee liquids out of the pipeline. Normal gas flow pushes the pig through the line. The pig and any liquids or pipe scale are captured and drained off at "pig traps" for proper disposal. Pig launchers are generally located at the start of a pipe line and the pig traps are located at the terminus of the pipeline. On long runs of cross country pipe, the pig traps and launchers are located every 25 to 50 miles. Pigging for cleaning is done on a periodic basis based on the pipeline company's standard operating procedures

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[5] Due to PCBs' environmental toxicity and classification as a persistent organic pollutant, PCB production was banned by the United States Congress in 1979 and by the Stockholm Convention on Persistent Organic Pollutants in 2001. According to the U.S. Environmental Protection Agency (EPA), PCBs cause cancer in animals and are probable human carcinogens. Concerns about the toxicity of PCBs are largely based on compounds within this group that share a structural similarity and toxic mode of action with dioxin. (Health Effects of PCB's. U.S. Environmental Protection Agency. January 31, 2013.)

but generally something like every year or two. Pigging operations are major sources of hazardous materials. Both the liquids removed and the pigs themselves after use may be contaminated with PCB's. Localities with pig receivers may wish to monitor or have advance warning of such pigging activities.

PCB's that travel with the high velocity vented gas and that are processed through a flare must be incinerated at very high temperatures in order to prevent the formation of dioxins. Requests to flare the gas as opposed to direct release of the gas should be tempered by the risks associated with the formation of dioxins that are generated by partial combustion of PCB's.

1.7. Water Body Crossings/Wetland Construction

At any point where the pipeline crosses a water body, state and federal regulations dictate that the method used to cross the water be approved by a number of agencies. The two major options are 1) various version of an open cut crossing or 2) directional drilling. For HDD (horizontal directional drilling) a pit is excavated at each side the water body (also see 1.23 Road Crossings), a horizontal hole is bored under a water body or road and the gas pipe is inserted through the hole. HDD's can be run for distances of a few miles however costs escalate quickly with longer bores. HDD is more expensive than an open cut process so pipeline companies try to avoid this technique where possible. HDD is generally reserved for larger water bodies. Based on the size, seasonality and flow rate of the smaller water bodies, the open cut procedure can be tweaked to reduce impact.

The procedures used for water body crossing are called out in documents labeled ESCAMP and BMP or something similar. (Erosion & Sedimentation Control and Agricultural Mitigation Plan and Best Management Practices) These documents are filed with FERC and become legally binding on the pipeline and their subcontractors.

As part of the FERC process, the pipeline will issue alignment sheets that will show an aerial representation of the pipeline route. The alignment sheets will call out which of the ESCAMP/BMP methods will be used at each water body crossing. Conservation commissions should review and comment on these during the FERC permitting process.

Beyond wetland issues, these ESCAMP/BMP documents also deal with silting of waterways, procedures for discharge of water from pipe trenches, storm water management, erosion prevention measures, restoration measures and post construction monitoring of revegetated areas.

Conservation commissions should ask for copies of these documents, ideally in advance of them being locked down by FERC, and pay special attention to the proposed procedures to ensure that all necessary “tweaks” appropriate to the local situation are in place to protect the local interests.

1.8. Invasive Species – Water Borne

Before the gas line is placed into service, it is pressure tested at 150% of its maximum allowable operating pressure using water. The water can be obtained from fire hydrants, ponds, streams or trucked in from an outside source. Taking large amounts of water from a stream or pond generally requires special permits obtained at the state level. The pipeline is generally tested in sections and the water is pushed along the pipeline using pigs to the next test segment. The used water is generally discharged back to a pond or stream. Discharge of large amounts of water also usually requires special state issued permits that specify water quality and testing requirements.

The migration of water along the pipeline means that invasive or foreign water borne flora and fauna can be transported across natural water shed boundaries. Local conservation commissions may wish to interject themselves into the water taking and water discharge permitting process to ensure that local interests are protected.

1.9. Invasive Species – Soil Borne

Pipeline installation is by its very nature a civil undertaking that consists primarily of moving soil around. The heavy equipment, delivery trucks, service trucks and even the pickup trucks used by workers along the ROW tend to carry a lot of soil in the tires and on the bodywork after having been elsewhere on a ROW under construction. Some of these trucks will arrive from many states away, others from further down the pipeline ROW. The mud on the trucks has the potential to carry invasive plant species from remote locations or from an infested area just down the road into an area that is not infested.

In some instances, pipeline contractors have been required to install and use truck wash stations to prevent the introduction or spreading of invasive species and vegetations between work sites. These requirements are generally called out in the ESCAMP documents. Localities may wish to insert themselves into the development process for these procedures and contribute their local knowledge.

1.10. Third Party Environmental Inspections

Pipeline companies are required by FERC to hire licensed third party environmental inspectors to verify that all the environmental conditions in the FERC certificate are followed. Inspections can be as frequent as daily. These third party inspectors often have stop work authority. Local conservation commission may want to participate in and follow along on these inspections.

1.11. Water Runoff/Water Quality

Pipelines are installed with a minimum of three feet of cover. For a 24 inch pipe that means that the bottom of the installation trench will be 5 to 6 feet below grade. For surface water, the major impacts on water quality revolve around trench dewatering during construction and ROW runoff, particularly until vegetation is reestablished. For well water, water quality issues can be caused if blasting is required to establish the pipe trench. Water issues are usually silting of surface water due to runoff and clouding of well water due to blasting.

In both cases, the pipelines are held responsible for water quality impacts by FERC. The trick is to prove that the water quality degradation is directly tied to the pipeline installation activity. Localities and residents are in stronger position to receive compensation or remediation services if there is baseline information on the water quality in advance of the construction activity.

Post construction water runoff characteristics will inevitably be different from preconstruction conditions. Land contours will be slightly different. Vegetation, water retention capacity and the concentration of precipitation runoff will all change to some extent. Most changes will be benign, others may pose issues. Landowners should be cognizant of the potential for runoff issues and immediately notify FERC, the pipeline and local agencies if they notice any problems.

1.12. Revegetation of the ROW

During construction, a construction ROW of between 50 and 100 feet or more will be cleared and churned to mud. The top soil and sub soil removed from the trench is piled to one side of the trench, while the other side is used for pipe fabrications, construction equipment and a travel way for vehicles.

After construction, pipelines are required by code to keep a permanent ROW, generally 50 feet, free of trees and other vegetation to facilitate periodic corrosion/leak surveys and weekly aerial surveys of the pipeline. Grass and other low growing plants are preferred in the cleared area. Dead vegetation is actually a good indication of a gas leak.

The extent of clearing can be negotiated based on the nature of the terrain and the soil. Some pipelines will allow as little as 10 feet wide to be maintained in a herbaceous state so long as trees within 15 feet of the pipeline that are greater than 15 feet in height are selectively cut and removed from the permanent right-of-way. When trees are removed, stumps can be left to stabilize the soil and be allowed to resprout. This approach is more expensive in terms of pipeline ROW maintenance costs. Localities may wish to lobby for less clearing along the ROW in selected area based on land use, soil type and terrain.

Localities may also want to negotiate the seed mix used to revegetate the ROW or where feasible ask that native plants be allowed to naturally reestablish themselves. The reseeding protocols are closely monitored by FERC.

1.13. Spill Prevention and Control Programs

Most of the heavy construction equipment used in pipeline construction uses high pressure hydraulic oil to actuate their tracks, blades and buckets. Most also run on diesel oil and must be fueled on the ROW. There also a myriad of small gasoline engines that contain gasoline and oil.

Each pipeline is required by FERC to have a protocol covering spill reporting and cleanup as well as refueling procedures. Refueling within 100 feet of water bodies is generally prohibited. Each piece of heavy equipment is often required to carry its own spill kit. The pipeline company is required to file a Spill Prevention and Containment Plan or similarly named document with FERC and adhere to procedures in that document. Local conservation commissions may wish to obtain advance copies of these documents and offer comments in advance of the document being accepted and locked down by FERC.

1.14. Cathodic Protection Systems

Buried steel pipe is subject to corrosion if not properly protected. Pipelines use a twofold system to protect the pipe. The first line of defense is that all buried steel components are coated with a heavy layer of an epoxy coating to prevent soil contacting the steel. To help ensure the integrity of the coating, only backfill that is free of rocks that might damage the coating are used to backfill the pipe.

The second layer of protection uses a mild DC voltage to protect the pipe in the event that the epoxy coating is compromised. Much in the same way that only the positive terminal of a car battery tends to corrodes while the negative terminal remains clean; the pipe is kept under an applied voltage that makes the steel pipe act like the cleaner negative terminal on a car battery. The role of the corroded positive terminal is filled by sacrificial zinc anodes buried periodically along the pipeline ROW some distance off the pipe.

The zinc anodes are generally installed in flat horizontal arrays called beds. Ideally, the anode beds should be located in soil that is always wet to maximize the soil's electrical conductivity. This requirement often places the preferred anode bed location in conflict with wetland protection efforts. It is possible to install the anode beds using horizontal directional drilling techniques with the drilling equipment standing off some distance from the wetlands. Vertical drilling can be used where the anodes are arranged in a vertical column when there is restricted space. Drilling in the anodes is more expensive and is avoided by the pipeline companies where possible.

The pipeline is inspected at regular intervals to verify that there is sufficient voltage gradient to protect the pipe in the event of a coating failure. In most cases, the natural galvanic potential between the steel in the pipeline and the zinc in the anode beds is sufficient to provide the voltage necessary to protect the pipe. In some locations, added voltage potential is applied to the system using low voltage DC transformers to compensate for poor soil conductivity or voltage being drained off through other underground structures such as steel agricultural drainage tiles. When added voltage is pumped into the system in agricultural areas, there is the potential for livestock to sense the voltage gradient in the ground and refuse to walk in the area of the pipeline or the anode beds. Although rare, farmers should be alert to this issue.

1.15. Staging Areas

The construction ROW is a long narrow strip of land that does not lend itself to storing the large amounts of pipe and other materials that are necessary to install a pipeline. For this reason, the pipelines may purchase but generally rent plots of land adjacent to roadways that can be used to receive and temporarily store miles of steel pipe, valves, construction supplies etc. Some of the construction supplies, such as gasoline or paint, may be present in sufficient quantities to trigger right to know and hazardous material storage statutes.

The staging areas can also be a source of noise and light pollution complaints as the staging areas will be active any time construction is active.

1.16. Hazardous Materials – Right to Know

Community right to know laws require any company to provide local first responders with all appropriate information on any hazardous materials that are present or likely to be present in the ongoing pipeline operations. For pipelines these will include natural gas, natural gas liquids, odorants, PCB's, hydraulic oils that are sometimes used in gas powered valve actuators and potentially pesticides or herbicides.

During construction there will also be radioactive isotopes used by licensed companies providing weld X-Ray inspection services. Blasting materials may also be used during construction in some circumstances. Construction is certain to include large quantities of hydraulic oil, diesel oil and gasoline in portable tanks.

After reviewing the list of materials, localities may wish to approach the pipeline for help with any special training or equipment necessary for first responders that might be drawn into incidents that may involve material on the right to know list.

1.17. Pipeline Personnel Response Time

Once a pipeline is completed and is in operation, pipeline operation is not a labour intensive undertaking. Central control rooms manned 24/7 located many states away are used to start and stop unmanned compressor stations and regulate gas pressures. Local personnel will be few and far between. Localities with a local distribution gas company will be in a better position to have trained personnel within reasonable travel distances. Localities that rely solely on an interstate pipeline for gas emergency situations will likely see longer emergency response times. The closest responder for an interstate pipeline company to an emergency situation at any given location can be some distance away. Response times are typically no more than an hour but can be greater in remote communities. As part of the first responder's liaison program with the pipeline, updated names, addresses and phone numbers of the local pipeline personnel should be reviewed and kept on record along with expected response times.

1.18. Odor

Natural gas in its raw state has little to no odor. Odorants in the form of ethyl mercaptan or methyl mercaptan are added to the gas stream to generate the "rotten egg" smell usually associated with natural gas. Natural gas in transmission systems can be unodorized or only lightly odourized depending on where the gas came from and what states it traveled through on its journey. Once the gas arrives at a local distribution system, odorization is required to be added to bring the gas odor up to code requirements for residential use.

Odorization equipment located at local distribution company meter stations is a frequent source of gas leak complaints. Any spill or leakage of the highly concentrated odorant is indistinguishable to the human nose from an actual gas leak. Specialized equipment such as a flammable gas detector can differentiate between a gas leak and an odorant leak. Localities may want to review the availability of gas detectors for their first responders so that they do not venture into an unodorized gas leak situation or respond inappropriately to a gas leak complaint that is actually an odourant leak. The cost of gas detectors, training on the use of the detectors along with their calibration and upkeep is not inexpensive. Localities that want to equip their first responders with such equipment and may want to look to the pipeline company for help in covering such costs.

Released natural gas is much lighter than air at atmospheric temperatures. As the gas is released, it cools as it is depressured making it less buoyant, but still marginally lighter than air. As the gas mixes with air, it warms and disperses to a point that it is too dilute to support combustion. Odorants on the other hand tend to be heavier than air. In certain conditions, generally cool foggy weather, the odorant can drop out of the gas plume and travel along the ground for some distance. In this instance, gas detectors are the only means to determine if the small of gas represents a real threat to public safety. First responders may not be comfortable taking a position on the danger of gas odour report given it is not their area of expertise. The response times promised by the pipeline may determine whether equipping and training local first responders in the use of gas detectors is appropriate.

1.19. First Responder Liaison Programs

Pipeline companies generally run liaison programs with local first responders to facilitate and coordinate emergency response activities. These programs can range from simply trading phone numbers to full on practice simulations. First responders have a lot of discretion in deciding what it takes to make them feel comfortable with the risks presented. Each locality should review their first responder capabilities with respect to some of the liabilities covered in this document and insist that the pipeline support the efforts necessary to close any gaps in equipment, hands on training or education.

1.20. Step/Touch Potential Electrocution Hazards

A pipeline running for any appreciable distance in close proximity will tend to pick up an electrical charge even though the pipe is underground. The cathodic protection systems (see section 1.14) used to protect the pipe from corrosion make it difficult for the pipe to drain the impressed voltage off to ground, allowing the voltage to rise to significant levels that can pose a personnel hazard.

The pipeline company is required to address this by modeling the impressed voltage and providing means to drain off the impressed voltage in manner that does not defeat the cathodic protection system. Where these voltage drain systems are not working properly, a person touching an above ground pipeline structure that has a voltage potential can become the best path to ground and suffer a serious electrical shock. The pipeline company will generally have safety procedures for personnel approaching any above ground pipeline structures such as line valves of fenced equipment enclosures to ensure that an electrocution hazard is not present. First responders in each community should be fully aware of the safety procedures necessary when approaching pipeline equipment and fenced enclosures.

1.21. Pipeline Class Location

Pipelines are built with a range of safety margins (called a design factor in the code) based on population density. There are four classes per federal statute DOT 49 CFR Part 192[6]. Section 192.5 covers how classes are determined and 192.111 covers the safety factor requirements. Higher design factor pipe requires either a thicker wall pipe if the steel strength is unchanged or higher strength steel or some combination of the two.

Class Location	Design Factor
Class 1	72%
Class 2	60%
Class 3	50%
Class 4	40%

The class location is determined by the number of habitable buildings within a prescribed distance of the pipeline. The presence of schools, hospitals, prisons or place of public congregation will push the class to the higher design factors.

Pipelines are required to undertake period house count surveys to ensure that they comply with the regulations. If over time the population density increases along a pipeline to the point that a higher design factor is indicated, the pipeline has the option of lowering the operating pressure of the line or replacing the pipe with a more robust pipe.

For these reasons, the pipeline is often built to a higher standard than might be indicated by current housing counts. This provides the pipeline company some surety that they will not be required to upgrade the pipe in the near term. Local authorities may wish to engage is a discussion with the pipeline company around class location given their local knowledge of growth rates and town planning initiatives.

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6 http://www.phmsa.dot.gov/pv_obj_cache/pv_obj_id_349E5C164111D39CB3A5E8762EA8CF581FB50D00/filename/192%20Master%20_192-114_%20highlight.pdf

1.22. Line Break Valves/Isolation Valves

Pipelines locate valves periodically along the pipeline to allow small section of the pipeline to be isolated for maintenance. Valve spacing also factors in to how quickly a segment of line can be depressured in the event of an incident. The valves might be equipped with manual hand crank gear actuators, pneumatic gas powered actuators or electric motor driven actuators.

Some of the valves will be designated as line break valves or remotely controlled valves that can be automatically or remotely triggered in the event of a catastrophic failure of the pipeline. Generally, a remote central control room that monitors the company's entire pipeline system is used to determine whether a catastrophic failure has occurred and which line break valves should be triggered.

The use of line break valves is common in the industry but the location and spacing of the valves is subject to some latitude. The valves are generally located just outside area of high consequence such as major waterways, large population centers and major thoroughfares. False triggering of the valves can cause complications almost as serious as a line break so their installation is not without its downsides.

Localities and first responders should be aware of where the line valves and the remote or automatic line break valves are located and may want input into their proposed locations.

1.23. Fire Department Link

Most gas facilities such as meter stations, regulating stations and compressor stations have dedicated safety systems for the detection of over pressure conditions, gas leaks and fires. These systems are generally wired into the pipeline SCADA (Supervisory Control and Data Acquisition) system which is monitored remotely from the company's gas control center. Many localities also require that these same signals be transmitted to the local fire department over dedicated lines of communications. Local fire chiefs, as part of the local building and special use permits, have wide latitude in setting minimum requirements for how fire and public safety systems are designed, managed, maintained and how the resulting information is disseminated. As part of the building permit process, some localities even go so far as to stipulate the type and size of safety control measures such as high expansion foam systems, fire water requirements or dry chemical systems.

1.24. Road Crossings

At locations where a pipeline crosses a road, special precautions are taken and special construction methods are employed. Due to the potential of heavy trucks with high axel loads to transmit concentrated stresses into the pipe, these stress levels are subject to special calculations and the pipe is provided with protection that is not typically required in cross country areas. When required, there are a number of approaches to providing enhanced protection for the pipe. Multiple solutions can be used together.

- Sleeving the pipe involves running the gas pipe inside a larger steel pipe that extends well past the road edge. The sleeve pipe serves to protect the gas carry pipe from stress and also serves to convey any gas that might be released in the event of a pipe wall failure to the edges of the roadway where it is less likely to cause injury. The sleeve pipe is usually vented at both ends through a "candy cane". This method is being used less and less because the sleeve pipe can actually promote corrosion of the interior gas carrying pipe.

- Subsurface concrete slabs located above the gas pipe are sometimes used to distribute concentrated loads across a larger area and prevent concentrated loads from impinging on the pipe. The slab can be extended beyond the road edge to protect against third party damage to the pipe during road construction and any adjacent utility corridor activity.

- Deeper cover over the pipe works much like a subsurface concrete slab. Point loads at the road surface propagate in a cone shaped fashion as they project into the soil. Deeper pipe allows any heavy loads to be dissipated across a larger area before reaching the pipe.

- Heavier walled pipe or higher strength steel can be used to increase the load bearing capacity of the pipe wall and allow it to withstand the added external stresses.

In the last three cases, the presence of rock adjacent to the pipe can defeat the stress reduction measures if the rock comes into contact with the pipe causing a localized point load. Third party excavation activity is by far the most common cause of pipeline failures. Road crossing are an area where excavation activities are more likely to occur and cause damage to the pipeline. Local agencies may wish to review the design options considered by the pipeline and provide local input on road traffic and anticipated third party construction activity.

The construction of the road crossing is generally done using an open cut trench. Road plates can be used so that portions of the road remain passable. Road closing permits are generally required for this type of work. In the event that the road cannot be closed or support lane closures, such as is often the case with an interstate highway, the road crossing can be installed using horizontal directional drilling techniques. Where unfettered road access is critical to local health and safety, there is latitude to push for directional drilling.

1.25. Soil Displacement

The soil that is removed from the pipe trench is not always suitable to be returned to the trench due to the presence of rocks which can damage the epoxy coating used to prevent pipe corrosion. In such cases, suitable material may be imported to pad the pipeline. The imported material, along with the volume taken up by the pipe means that there will be more soil in the spoil pipe that will fit back into the trench. There are options such as trucking the excess soil off site for disposal or spreading the excess soil within the ROW. For agricultural land, the spreading of excess soil, preferably in a layer below the top soil, can change the surface contours.

Agricultural operations should make a point of understanding how excess oil will be handled. In localities where soil can only be relocated to another site by permit, which also often includes oil testing for hazardous materials, such requirements should be made clear to the pipeline company.

1.26. Soil Compaction

The heavy equipment and construction activities associated with pipeline installation will compact the soil within the ROW. For agricultural and some other land uses, the soil compaction will make returning the land to its former use more difficult. Pipelines will undertake "decompaction" of soil where it is warranted. Agricultural operations and localities with conservation land may wish to stipulate where they would like to see decompaction used as part of the ROW remediation activities.

1.27. Crop Losses

During pipeline installation, crops within the ROW are usually destroyed. After the pipeline is installed and remediation is complete, farmers may find that crop yields within the ROW are lower than they used to be due to the soil disturbance, top soil mixing and changes in water runoff patterns. Pipelines will generally compensate farmers for such losses.

Having good records of the crop yields and crop values is important in obtaining fair compensation for any crop loss claims.

Farmers should keep an eye on the top soil segregation practices used during the pipeline's construction to ensure that top soil is not lost to mixing with subsoil or erosion of top soil spoil piles.

1.28. Agricultural Drainage Tile

Many agricultural fields are crisscrossed with drainage tile to help control soil water content. These drainage tiles will generally take a hit when the pipeline is installed. Pipeline companies are responsible for reestablishing such drainage tile systems. Finding the location of drainage tile after they have been disturbed, particularly with clay tiles is often difficult. Farmers should make any data available on drainage tile locations available to the pipeline company. In some cases, aerial photography or satellite imagery can be used to locate the drainage tiles.

Clay drainage tiles are easily damaged and can be easily missed during construction if not flagged in advance. They are easily replaced in kind after construction. Metal drainage tiles may pose a problem for the pipeline cathode protection system because they will siphon off the low voltage DC current applied to the pipe for corrosion protection. Some form of non-metallic drainage tile is generally preferred by the pipelines.

1.29. Unanticipated Cultural Resource Discovery Procedures

Each pipeline is required by FERC to have a protocol covering the discovery of unexpected cultural resources. Local historical and cultural commissions may wish to obtain advance copies of these documents and offer comments in advance of the document being accepted and locked down by FERC.

1.30. Power Generation from Compressor Station Waste Heat

Turbine powered compressor stations generate substantial amounts of waste heat. With the right equipment, that waste heat can be used to advantage to generate electricity.

As part of the EIS process, FERC typically requires pipeline companies to justify why waste heat recovery is not being considered as part of the compressor station design. New compressor stations generally do experience sufficient run time to justify such investments. The potential for a waste heat recovery plant will increase as the pipeline load factor increases after the first few years of the pipeline's operation. FERC also requires natural gas pipeline operators to publish updated data on their waste heat inventories on their electronic bulletin boards and to cooperate with third parties interested in harvesting the waste heat for power generation.

The basic parameters that make a compressor station attractive for waste heat recovery are:[7]

- Greater than 15,000 in installed horsepower
- Greater than 5,250 hours per year of operation
- Greater than 60% load factor while in operation

At full load, a net 100,000 HP compressor station (75 KW) with simple cycle gas turbines will use approximately 300,000 HP worth of natural gas as an input energy source. Approximately one third of the input energy goes into compressing the pipeline gas, one third of the input energy goes into moving and compressing the turbine combustion air and one third of the input energy is rejected as waste heat in the turbine exhaust stream. Turbine exhaust temperatures range from approximately 600 to 1100oF depending on turbine size and operating conditions.

Waste heat recovery for power generation is, for the most part, not popular with natural gas pipeline companies. The working knowledge to operate and maintain such equipment is typically not in their skill set. For these and reasons of safety, liability and operational simplicity, waste heat recovery facilities are usually

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Waste Energy Recovery Opportunities for Interstate Natural Gas Pipelines (February 2008) http://www.ingaa.org/File.aspx?id=6210 , Status of Waste Heat to Power Projects on Natural Gas Pipelines (2009) http://www.ingaa.org/File.aspx?id=9373

located adjacent to but “outside the fence” of the compressor station and operated by third parties that finance, build, and operate the waste heat recovery facility.

Any town that is faced with a compressor station being located in their jurisdiction needs to be aware of the potential for follow-on industrial development. There are several aspects to this potential:

- The waste heat recovery equipment will generate its own issues on noise and light pollution.

- Additional land may be consumed by the waste heat recovery equipment.

- The fluids used to absorb the waste heat in the turbine exhaust and transfer it to the power generation equipment can be hazardous. Ammonia or organic fluids such as propane are often used for such applications.

- The new facility will need to be tied into the grid and require the installation of high voltage power lines to access to closest major power grid corridor.

- The waste heat power facility may include fired equipment to supplement the waste heat recovered from the compressor station raising the issue of air quality impacts.

- As part of the permitting process, the town may be in a position to extract an advantageous position on the price paid for the waste heat and use that position to benefit from the power generation opportunity or get reduced cost power for town residents - when life deals you lemons, make lemonade. (See the INGAA references in footnote 7 for details on the pricing of waste heat.)