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April 6, 2017

Via web submission: https://www.ferc.gov/docs-filing/efiling.asp

To: Federal Energy Regulatory Commission (FERC)
Washington, DC

Re: Draft Environmental Impact Statement (DEIS) for the Atlantic Coast Pipeline Project Application (Project)

Docket Numbers:
CP15-554-000
CP15-554-001
CP15-555-000
CP15-556-000

Dear FERC:

I am an environmental attorney familiar with the requirements of the National Environmental Policy Act (NEPA) and other environmental laws. My professional work has included the evaluation of Environmental Impact Statements for energy projects, including scrutiny for compliance with federal laws.

I submit this comment letter on my own behalf. I have a direct, cognizable interest in the matter concerning this Project for at least three reasons, without limitation: 1) I will be personally impacted by specific climate change impacts foreseeably resulting from the Project; 2) As a resident of Charlottesville, VA, I will be impacted in my health and in the health of my family (including my wife and my 8-year old son) by the harmful decline in air quality resulting from this Project and from its impacts on air quality in the Commonwealth of Virginia, and 3) as an owner of land in Fluvanna County bordering on Buckingham County, I will be directly impacted by the damage to the environment and to the economy from the siting and operation of the compressor station which the Project would locate in the rural town of Buckingham, VA.

Please include this comment letter together with any exhibits which may be attached hereto in the Record of Decision for the Project. All documents referenced herein and any exhibits to this document are incorporated herein by reference in their entirety.

Thank you for your consideration of these comments. For the reasons that follow, among others, **the DEIS is wholly deficient as a matter of law and must be re-written to conform with legal requirements**.

1. Overview

The Project would cause permanent and irreparable harm to local and global environments and would violate the Public Trust. Further, it would not advance any legitimate economic interests that cannot be achieved through other less environmentally destructive alternatives, such as renewable energy sources. The DEIS, however, conveniently and completely omits such alternatives, in violation of law. The Project would needlessly exacerbate an already critical state of climate disintegration. This is because it will ramp up production and distribution of polluting fossil fuels. The result will be the likely passing of global climate "tipping points" without any possibility that humanity will be able to reverse these impacts. This horrific and irreversible environmental result, however, is neither identified nor analyzed in the DEIS, in violation of law.

Further, the DEIS for the Project violates the requirements set forth in NEPA and other laws with respect to environmental justice. The DEIS, moreover, is fundamentally infected with numerous procedural and informational deficiencies in violation of NEPA, the Administrative Procedures Act (APA), and the public's due process rights, as outlined below. Together, these factors (among others) constitute an overwhelming mandate, both substantively and procedurally, that the ACP permit application be denied and that its legally deficient DEIS be rejected and set aside.

2. The Project Fails to Present a Reasonable Range of Alternatives, in Violation of Law.

The No Action Alternative in this DEIS is wholly insufficient and contains unwarranted assumptions. Simply put, the No Action Alternative does not even mention renewables. Its conclusion that fossil fuel energy sources would increase without the Project is arbitrary and capricious. The DEIS must be rewritten to include a No Action Alternative that acknowledges the reality of renewable energy development into the future. Furthermore, the DEIS must contain a Renewable Energy Alternative. The DEIS cannot hide behind an insufficient and inaccurate project purpose (stated as promoting natural gas supplies, which is actually a means to the broader purpose of supplying energy in the broader sense) in an effort to ignore the obvious and critical Alternative of a full renewable energy build-out in place of fossil fuel development.

2. The DEIS Violates the Law by Misrepresenting and Ignoring the Damage to the Environment and to Human Health from the Project.

NEPA contains a number of standards which this DEIS fails to meet including, without limitation, the following:

- A DEIS must demonstrate that a lead agency will "use all practicable means and measures … to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans." (*See* 42 USC § 4331(a).)

- NEPA requires that federal agencies prepare a "detailed statement"—known as an environmental impact statement—for all "major Federal actions significantly affecting the quality of the human environment." (42 U.S.C. § 4332.) The environmental impact statement, or "EIS," is intended to create an open, informed, and public decision-making process that insures "that environmental information is available to public officials and

citizens before decisions are made and before actions are taken" and "to help public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment." (40 C.F.R. § 1500.1.)

- Agencies must insure the professional integrity, including scientific integrity, of the discussion and analysis in an EIS. (40 C.F.R. § 1502.24.) The information in an EIS must be of high quality, as accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. (40 C.F.R. §§ 1500.1(b))

- The evaluation of mitigation measures is an essential component of an EIS. A federal agency is required to evaluate possible mitigation measures in defining the scope of the EIS, in examining impacts of the proposed action and alternatives, and in explaining its ultimate decision. (*See* 40 C.F.R. §§ 1502.14(f), 1502.16(h), 1505.2(c), 1508.25(b).)

- Lead agencies are required by NEPA to "…[r]igorously explore and objectively evaluate all reasonable alternatives…" (40 C.F.R. § 1502.14(a).)

- Courts may reverse the decision of approval of a Project "if the agency relied on factors Congress did not intend it to consider, entirely failed to consider an important aspect of the problem, offered an explanation that ran counter to the evidence before the agency, or offered one that is so implausible that it could not be ascribed to a difference in view or the product of agency expertise. (W. Radio Servs. Co. v. Espy, 79 F.3d 896, 900 (9th Cir. 1996))

- Furthermore, when an agency has taken action without observance of the procedure required by law, that action will be set aside. Idaho Sporting Cong., Inc. v. Alexander, 222 F.3d 562, 567-68 (9th Cir. 2000).

- The CEQ regulations define "cumulative impact" as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 C.F.R. § 1508.7.)

As set forth below, The DEIS falls short in fulfilling these and other requirements under the law.

3. The DEIS Violates NEPA by Failing to Provide "a thorough discussion of measures to mitigate the adverse environmental impacts of [the] proposed action".

NEPA requires "that mitigation be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated…" (Robertson v. Methow Valley Citizens Council, 490 US 332, 352 (1989). While NEPA has been held not to require that actual mitigation measures be adopted or implemented, NEPA does require that mitigation measures *addressing* the possible environmental consequences of an action be at least *identified*. (*Id.*) This has not been done. The DEIS identifies neither the potential environmental consequences (outlined above, among

others) of the action nor mitigation measures or alternatives (such as renewable energy development) to address those consequences.

In addition to identifying mitigation measures capable of addressing environmental impacts, moreover, NEPA requires "that an agency prepare a detailed statement on 'any adverse environmental effects which cannot be avoided should the proposal be implemented,' 42 U. S. C. § 4332(C)(ii)… ." (*Id*. at 351-352.) In other words, the SEIS must identify environmental effects which cannot be mitigated. The proposed action will result in environmental consequences which are not capable of mitigation. The DEIS's attempt to disclose such effects is drastically incomplete. This offends the fundamental purpose of NEPA to inform the public of options to avoid the most costly environmental impacts should it wish to do so. Courts have emphasized the importance of thus informing the public of the most costly environmental effects of a project, and this DEIS egregiously ignores this requirement by simply ignoring many of the most costly and serious adverse consequences of approving the ACP pipeline:

> …[O]mission of a reasonably complete discussion of possible mitigation measures would undermine the "action-forcing" function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects. An adverse effect that can be fully remedied by, for example, an inconsequential public expenditure is certainly not as serious as a similar *effect that can only be modestly ameliorated through the commitment of vast public and private resources.* Recognizing the importance of such a discussion in guaranteeing that the `agency has taken a "hard look" at the environmental consequences of proposed federal action, CEQ regulations require that the agency discuss possible mitigation measures in defining the scope of the EIS, 40 CFR § 1508.25(b) (1987), in discussing alternatives to the proposed action, § 1502.14(f), and consequences of that action, § 1502.16(h), and in explaining its ultimate decision, § 1505.2(c).
>
> (*Id*. at 352, underlining and asterisks added)

Hence, the DEIS violates NEPA by failing to "ensure that important effects will not be overlooked or underestimated only to be discovered after resources have been committed or the die otherwise cast." (*Id*. at 349) The DEIS, moreover, fails to "serve a larger informational role … [to provide] assurance that the agency 'has indeed considered environmental concerns in its decisionmaking process,' …, and, perhaps more significantly, provide a springboard for public comment." (*Id*.) Of course, there is no need for a DEIS to provide mitigation measures for effects that will not result from the Project. However, the authors of the DEIS apparently thought they would be able to get away with pretending that the plethora of impacts herein discussed will not result from the Project. This degree of error must not be rewarded with an approval; rather, this DEIS should be sent back to the drawing board to be entirely rewritten in compliance with the law.

From this perspective, perhaps one of the most severe deficiencies in the DEIS is its failure to provide a legally adequate analysis of the impacts of Low Frequency Noise from compressor stations.

Low Frequency Noise

The DEIS contains the following statement:

> In 1974, the EPA published its *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. This document provides information for state and local governments to use in developing their own ambient noise standards. The EPA has indicated that an Ldn of 55 dBA protects the public from indoor and outdoor activity interference. We have adopted this criterion and used it to evaluate to potential noise impacts from the proposed projects at pre-existing NSAs such as schools, hospitals, and residences.
>
> (DEIS, p. 4-459.)

For the reasons that follow, among others, this criterion and the study on which it is based is fully inadequate as a basis for impact and mitigation analysis. For one thing, the 1974 study is out of date. Moreover, a 55dBA threshold in no way represents a reasonable threshold of significance; as shown below with respect to LFN, it cannot and does not mitigate the impacts of LFN to a level of insignificance. And because the DEIS fails even to identify with any degree of sufficiency the impacts of LFN, it utterly fails to provide anything remotely sufficient as mitigation.

The DEIS, purports to argue that there will be no significant impacts from the LFN generated by compressor stations associated with the Project. It admits that "FERC regulations require that no perceptible increase in vibration may occur as a result of compressor station operation." (DEIS, p. 4-459, 469.) The DEIS goes on to state:

> The proposed compressor units at all compressor stations, including Compressor Station 2, would be combustion turbines. As such, we do not expect there to be an issue with vibration, as it is more characteristic of reciprocating engines. Through FERC's dispute resolution service helpline, we are aware that induced vibration, or a low frequency sound from compressor stations, has occurred at a limited number of natural gas facilities in the over 300,000 miles of transmission pipeline in the United States. However, we are unaware of widescale cases of low frequency noise from natural gas transmission facilities. With hundreds of thousands of residents near natural gas pipelines and compressor stations, we have seen no system evidence that natural gas pipelines or compressor stations are inducing noise effects on local residences. This appears to be an isolated issue that continues to be addressed through the dispute resolution service and landowner helpline.
>
> (DEIS, p. 4-469.)

This analysis falls far short of legal sufficiency and must be discarded for an actual analysis. There is no evidence in support of the assertion that combustion engines produce less LFN than reciprocating engines. This informational deficiency is a blatant violation of NEPA. Moreover, combustion engines create a risk of failure and shorten the life of compressor systems. This in turn increases the risk of failure or explosion. Combustion instability can occur:

> When feedback is established between unsteady combustion and pressure perturbations in a combustion chamber. The mechanism is that the unsteady combustion generates pressure waves, which reflect at the boundaries of the combustor and the velocity or equivalence perturbation associated with these waves causes more unsteady combustion. If the phase relationship is suitable [...], self-excited oscillations grow. This leads to discrete tones at resonant frequencies associated with the acoustic characteristics of the combustor and can be accompanied by high noise levels and severe pressure oscillations that can cause structural damage to engine components [...]. The vibrations induced by the oscillations can cause fatigue cracking of combustor liners and reduce the lifetime of a combustor by a factor of two or more [...].[1]

The DEIS fails to identify or analyze this potential catastrophic risk and impacts from the failure of combustion engines, much less provide any mitigation therefor.

The statement, "[W]e are unaware of widescale cases of low frequency noise from natural gas transmission facilities" does not constitute analysis; rather, it is a conclusory statement unsupported by facts. Problems from LFN have been reported from Wyoming to Colorado to Texas to Pennsylvania to New York. NEPA requires that this EIS evaluate the impacts of this particular Project, and merely saying that FERC is "unaware" of impacts elsewhere is wholly elusive of its responsibilities under the law. Further, punting the issue to "dispute resolution" and a "landowner helpline" offends the basic premise of NEPA: to inform the public and policymakers about the impacts of Projects before the damage occurs. In the case of LFN, the damage is quite severe to human health, in fact potentially deadly. This must be addressed in the EIS. Further, a requirement that scientifically defensible measurements of LFN must be taken in the affected communities must be included in the EIS. In addition, this requirement to measure LFN in affected communities must be contained in a separate binding agreement with the applicant and be made a condition of approval.

Vibro-Acoustic Disease (VAD)

All compressor stations produce LFN. LFN has a clear record of causing serious human health hazards. For example, LFN created by compressor stations has been found to cause Vibroacoustic Disease (VAD). VAD in turn can lead to serious conditions from cardiovascular symptoms to decreased cognitive skills to ruptured ear drums. VAD has been described as a "whole-body, systemic pathology" marked by " 'depressions, increased irritability and aggressiveness, a tendency for isolation, and decreased cognitive skills,' among other symptoms."

VAD has also been associated in serious cases with rage reactions, epilepsy and suicide. Other effects of LFN include sleep deprivation, constriction of blood vessels, enlarged aorta, heart attacks, sexual dysfunction, head pain, nausea, and balance disorders ranging from dizziness to vertigo. Given the current state of the scientific literature, these are not only foreseeable but likely impacts of the operation of the compressor stations of the Project.

[1] A.P. Dowling, Y. Mahmoudi / Proceedings of the Combustion Institute 35 (2015) 67-68.

There is no mention in the DEIS of VAD. This shocking oversight must be corrected with a full analysis of VAD and its symptoms, the risks of VAD from compressor station LFN, and how mitigation measures will address the impacts of LFN to human health. For more information see Exhibits 1, 2, 3 and 5 below.

LFN Analysis

There are many aspects of the required LFN analysis which will require extensive research and work to bring up to speed for this Project. Here are just some of those aspects, without limitation.

- The 55dBA threshold for noise does not address the problem of LFN because the A-weighted scale is NOT the appropriate scale for measuring LFN; moreover, for audible noise, a 45 dBA threshold is achievable and has been recommended for a noise threshold. The DEIS fails to justify the 55 dBA threshold for noise. Table 4.11.2-4 fails to provide an A-weighted scale analysis for LFN. This deficiency must be corrected.
- The special circumstance of rural communities merits special examination given that, e.g., the Buckingham Compressor Station is proposed for a remote, rural community. As one study found, "residents located in very quiet rural environments are much more distressed by a new intrusive source of noise because of the loss of a formerly peaceful and tranquil sound environment."[2]
- The DEIS must include an analysis of the radius of impact from the LFN noise of compressor stations and how LFN will be mitigated to bring the impacts on human health to a level that is less than significant. If such mitigation is not possible the DEIS must disclose this so that human communities will be appraised, as required by NEPA.
- The DEIS must explain how a compressor station with a combined 55,000 ISO horsepower rating will produce LFN and other impacts that are either less than significant or will be mitigated to a level of less than significant.

4. The DEIS fails to Justify its Conclusions Regarding Air Quality.

Numerous aspects of the DEIS's air quality analysis are legally deficient. At p. 4-446, the DEIS assertst hat a general conformity analysis is not required for the ACP. This conclusion is unwarranted and lacks adequate support. Table 4.11.1-4 does not suffice to provide the needed support. And in any case,the DEIS admits that it does not provide the data used to reach its conclusion that a general conformity analysis is not applicable. (See footnote 26: "Atlantic and DTI provided estimated general conformity emissions and calculation in their FERC applications on September 18, 2015, and provided updated estimates on November 9, 2016, based on their new proposed construction schedules." Members of the public and stakeholders should be provided with this information in the DEIS; this informational deficiency violates NEPA and must be cured.

The DEIS states, "Background pollutant concentrations were estimated using existing ambient monitoring data for the region." (DEIS, p. 4-453.) However, this assertion is contradicted with respect to the Buckingham Compressor station: "Compressor Station 2: Annual NO2 background

[2] Noise Control Eng. J. **52** (4), 2004 Jul–Aug, p. 180.

value is represented using the Harrisonburg, VA monitor, which is the closest NO2 monitor to the site. However, 1-hour NO2 values are not available for this site, and so the next closest station in Roanoke, VA is used for the 1-hour value." There is no explanation given for why this compromise in attaining a baseline NO2 value for the Compressor site in Buckingham is sufficient, nor for why more site-specific data was not used to calculate the baseline. The flawed baseline analysis means that the impacts analysis is also flawed, and the DEIS must be cured so as to ensure the communities surrounding the Buckingham Compressor station that air quality standards will be obtained.

No explanation is given for why all the pollutants listed in Table 4.11.1-7 are not included in Table 4.11.1-10 or Table 4.11.1-11. The reader is left with the impression that model results were presented selectively, undermining the DEIS's conclusion that "ACP compressor stations would not cause or contribute to a violation of the NAAQS.' For this and other reasons, the DEIS must clarify with substantial and adequate evidence how the compressor stations will in fact not violate NAAQS. For more information on the many and varied forms of toxic emissions likely to result from this Project, and which are not adequately addressed in this DEIS, see Exhibits 4 and 6 below.

4. The DEIS Fails to Satisfy the Legal Mandate to Address Issues of Environmental Justice, in Violation of Law.

There is inadequate detail describing how the Project will impact communities of color or socioeconomically disadvantaged communities. These omissions fly in the face of Executive Order (EO) 12898 which requires, among other things, that "each Federal agency *shall* make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations …"[3]

The analysis contained in pages 4-411 to 4-413 fails to justify the conclusion that "there is no evidence that ACP or SHP would cause a disproportionate share of high and adverse environmental or socioeconomic impacts on any racial, ethnic, or socioeconomic group." The statement, "the operational noise attributable to the new compressor stations and compressor station modifications would be less than 55 Ldn at nearby NSAs, and the increase in the overall noise due to the new stations would be below the threshold considered perceptible to the human ear at most NSAs" is not supported by evidence in the EIS. Moreover, for the reasons stated above, LFN impacts on low-income and minority communities are not adequately analyzed. This deficiency is especially glaring in view of the fact that the Buckingham Compressor Station will impact nearby communities including the Union Hill community. These impacts must be disclosed and analyzed, and mitigation measures presented. This has not been done.

5. Virginia agencies should be included as Cooperating Agencies.

The DEIS lists Cooperating Agencies on p. 1 of the document. This list does not include any agencies from the Commonwealth of Virginia. This omission is perplexing, to put it mildly, given the extent of impacts the DEIS admits will befall many natural resources in the Commonwealth.

[3] Executive Order (EO) 12898, 59 Fed. Reg. 32 (February 16, 1994), Section 1-101, emphasis added. Found at http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf

For example, page ES-7 of the DEIS states that species conservation measures will be developed in consultation with the Virginia Department of Game and Inland Fisheries. Compliance with air quality standards will be administered by the State Air Pollution Control Board. However, apparently FERC has determined without consulting state officials that there is no need for a human health impact assessment as to the impacts of air pollution from the Project. (DEIS, p. 4-457.) The Virginia Department of Environmental Quality will undoubtedly be required to exercise its regulatory authority regarding many aspects of the Project. All these agencies, and any others applicable, should be Cooperating Agencies and should provide formal consultation for any subsequent environmental document associated with the Project.

6. **The following documents are included in this comment letter and are incorporated herein by reference in their entirety, and must be included in the Record of Decision for the Project.**

Thank you for your consideration of these comments.

Exhibits

1. Branco and Alvez-Pereira, "Vibroacoustic Disease" 2004
2. Alvez-Pereira and Branco, "Vibroacoustic disease: the need for a new attitude towards noise," CITIDEP & DCEA-FCT-UNL, 2000
3. Mall, Amy, "Live on tape: the dangerous noise emitted by natural gas compressor stations in neighborhoods," February 22, 2010
4. Hamilton, Mina, "More than A Pipeline: It's a Toxic Industrial Infrastructure," February 24, 2015
5. Earthworks, "Oil and Gas Noise"
6. Damascus Citizens for Sustainability, "Compressors on natural gas pipelines measured releasing high concentration plumes of gas," March 11, 2017

Exhibit 1. Branco and Alvez-Pereira, "Vibroacoustic Disease" 2004

http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2004;volume=6;issue=23;spage=3;epage=20;aulast=Castelo;type=0

ARTICLES
Year : 2004 | **Volume** : 6 | **Issue** : 23 | **Page** : 3--20
Vibroacoustic disease

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Vibroacoustic disease (VAD) is a whole-body, systemic pathology, characterized by the abnormal proliferation of extra-cellular matrices, and caused by excessive exposure to low frequency noise (LFN). VAD has been observed in LFN-exposed professionals, such as, aircraft technicians, commercial and military pilots and cabin crewmembers, ship machinists, restaurant workers, and disk-jockeys. VAD has also been observed in several populations exposed to environmental LFN. This report summarizes what is known to date on VAD, LFNinduced pathology, and related issues. In 1987, the first autopsy of a deceased VAD patient was performed. The extent of LFN-induced damage was overwhelming, and the information obtained is, still today, guiding many of the associated and ongoing research projects. In 1992, LFN-exposed animal models began to be studied in order to gain a deeper knowledge of how tissues respond to this acoustic stressor. In both human and animal models, LFN exposure causes thickening of cardiovascular structures. Indeed, pericardial thickening with no inflammatory process, and in the absence of diastolic dysfunction, is the hallmark of VAD. Depressions, increased irritability and aggressiveness, a tendency for isolation, and decreased cognitive skills are all part of the clinical picture of VAD. LFN is a demonstrated genotoxic agent, inducing an increased frequency of sister chromatid exchanges in both human and animal models. The occurrence of malignancies among LFN-exposed humans, and of metaplastic and displastic appearances in LFN-exposed animals, clearly corroborates the mutagenic outcome of LFN exposure. The inadequacy of currently established legislation regarding noise assessments is a powerful hindrance to scientific advancement. VAD can never be fully recognized as an occupational and environmental pathology unless the agent of disease - LFN - is acknowledged and properly evaluated. The worldwide suffering of LFN-exposed individuals is staggering and it is unethical to maintain this status quo.

Exhibit 2. Alvez-Pereira and Branco, "Vibroacoustic disease: the need for a new attitude towards noise," CITIDEP & DCEA-FCT-UNL, 2000

Public Participation and Information Technologies 1999 Chapter Nº 1

Published by CITIDEP & DCEA-FCT-UNL, edited by Pedro Ferraz de Abreu & João Joanaz de Melo © CITIDEP 2000

Vibroacoustic disease: the need for a new attitude towards noise

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ABSTRACT

Background. The importance of information technologies in public awareness of environmental issues is especially clear when a new occupational disease is identified. This is certainly the case with Vibroacoustic Disease (VAD), a whole-body noise-induced pathology, that is not particularly related to the ear. **The Problem**. The social and economic costs of VAD are staggering, and continuously aggravated by the fact that environmental noise assessments pay little attention to the noise that causes VAD - Low Frequency (LF) noise (* 500 Hz), focusing primarily on that which causes hearing impairment. An erroneous assumption justifies these incomplete noise assessment requirements: noise only affects the ear. Thus, all noise protection measures and evaluation procedures focus *exclusively* on the frequencies affecting the auditory system (* 500 Hz). **The Solution**. Physical protection against LF noise is not feasible, given the large wavelength of LF (in meters). Preventing the evolution of VAD to clinically severe stages *is* feasible. The requirements are twofold: a) entry-level and yearly echocardiogram of job-candidates and exposed individuals; b) education of workers, occupational physicians, and management. There is an urgent need to include LF in all noise assessments, and use prevention medicine against this ubiquitous environmental hazard. However, this can only be achieved with active participation of a well-informed public.

THE STATUS QUO

Noise pollution is often considered a contained problem because hearing protection devices are generally efficient, and legislation regarding noise-induced hearing loss is relatively effective. Additionally, common noise assessments are a fairly simple process, normally requiring a hand-held instrument that measures the sound pressure level (SPL) of the acoustic field, in decibels (dB). Permissible exposure levels are primarily based on the dB-level measurements, and are regulated on an hourly basis. Noise pollution is largely regarded as an agent that causes hearing loss and/or minor annoyance and discomfort. The notion that no other harmful organic effects can be attributed to noise exposure is widespread, and exceptions to this are few and far between (Alves-Pereira, 1999).

The human ear captures sound within a specific window of the acoustic spectrum, generally within the 20-20000 Hz range. However, it is most responsive to sounds within the mid-frequencies: 1000-10000 Hz. Noise exposure protection focuses primarily on these frequencies, because its goal is to prevent hearing loss. Acoustic phenomena within the low frequency (LF)

range (* 500 Hz) are also audible, but require a higher intensity to be perceived. Infrasound (* 20 Hz) is non-audible to humans; it is therefore considered to have no impact upon hearing loss, and consequently, environmental noise assessments within the infrasonic range are a rarity (Alves-Pereira, 1999). For the remainder of this report, LF noise will refer to acoustic phenomena within the 0-500 Hz range, hence infrasound is also included.

Hearing conservation programs are mandatory in most industrial occupations. Audiograms and tympanograms are commonly used tests to assess degree of hearing impairment and existence of noise intolerance. Professional deafness is normally established when a hearing deficit of 30dB is registered at 4 KHz. Physical, auricle protection devices (such as earplugs) are also employed to prevent professional hearing-loss. To adequately characterize an acoustic environment, both the dB-level and the frequency distribution should be known. With very few exceptions (Alves-Pereira, 1999), environmental noise assessments rarely include a frequency spectra analysis. When they are performed, it is usually for the sole purpose of choosing the best hearing protection device. Again, this established procedure is based on the assumption that noise only affects the auditory system. Thus, protection against noise focuses principally on the hearing function.

Extra-aural, whole-body, noise-induced pathology has been an ignored concept. Over the past decades, scientific investigation into this issue has been infrequent, and existing data is often regarded as inconclusive (Alves-Pereira, 1999). Difficulties arise when reports of noise assessments do not include a frequency spectrum analysis, and only the dB-levels of the acoustic fields are measured. This has led to an accumulation of parallel studies that cannot be compared because the descriptions of the acoustic environments are incomplete. Two environments may have similar dB-levels, but different frequency distributions. One may have the majority of the acoustic power concentrated in the mid-frequency bands, while the other may be predominantly within the LF range (infrasound is not assessed). When studying the effects of noise, it should be considered insufficient to only provide data on the dB-level of the acoustic phenomena. The frequency range to which whole-body organ systems respond is not the same as that for the auditory system. Thus it becomes very relevant whether the acoustic power is predominantly in the LF range or in the mid-frequency range.

In modern society, LF noise is ubiquitous; not only is it found in most industrial environments, but also in nearly all public transportation, numerous leisure activities, and many urban residential areas. The extent to which LF noise exposure is responsible for Public health problems is unknown.

The *status* quo concepts are that
a. noise only produces an organic effect on the auditory system;
b. evidence of noise-induced, extra-aural pathology is inconclusive; and
c. infrasound is non-relevant for noise-induced pathology.
These concepts can no longer be upheld.

VIBROACOUSTIC DISEASE

Vibroacoustic disease (VAD) is a noise-induced, whole-body pathology, of a systemic nature, caused by excessive and unmonitored exposure to LF noise. It has been identified in aeronautical technicians (GIMOGMA, 1984a), military pilots (Carmo *et* al, 1992 and Canas *et* al, 1993), commercial pilots and cabin crewmembers (Alves-Pereira *et* al, 1999), and disc-jockeys (Castelo

Branco, 1999 and Castelo Branco *et* al, 1999). VAD evolves over long-term noise exposure, in years, and can lead to severe medical conditions, such as cardiac infarcts (Castelo Branco, 1999 and Castelo Branco *et* al, 1999), stroke (Castelo Branco, 1999 and Castelo Branco *et* al, 1999), cancer (Silva *et* al, 1996 and Castelo Branco *et* al, 1999), epilepsy (Martinho Pimenta *et* al, 1999a), rage reactions (Castelo Branco *et* al, 1999), and suicide (Castelo Branco *et* al, 1999). When VAD was first identified in professional groups known to be exposed to noise, it was initially thought to be limited to the realm of occupational diseases. However, it has since been diagnosed in individuals exposed to noise in non-occupational settings, or in seemingly non-"noisy" environments (Castelo Branco *et* al, 1999). This rises the issue of LF noise-induced pathology to the domain ofPublic Health issues.

The evolution of VAD is classified by three stages based on years of noise-exposure - mild (1-3 yr), moderate (4-9 yr) and severe (10-15 yr). Please see Table I. This is a departure from current guidelines, which measure noise-exposure on an *hourly* basis. The classification of VAD stages was grounded on a study of 140 aeronautical workers, who had been selected from an initial group of 306 individuals (Castelo Branco, 1999). Selection criteria for this study population are given in Table II. LF noise is a stressor, and, as such, initial exposure causes disorders generally considered as "stress-related", such as gastrointestinal dysfunction or infections of the oropharynx. However, LF noise-specific features of VAD can be identified in the mild stage, such as thickened cardiac structures (Marciniak *et* al, 1999), increased frequency of sister chromatid exchanges (Silva *et* al, 1996), immunological changes (Castro *et* al, 1999), altered values of hemostasis and coagulation parameters (Crespo *et* al, 1988), and specific neurophysiological (Martinho Pimenta *et* al, 1999a, b and c; Pimenta *et* al, 1999) and cognitive (Gomes *et* al, 1999) changes. In the severe stages of VAD, as mentioned above, more serious disorders can develop.

There is an important feature that has prevailed among the many VAD studies performed over the years: a consistent amount of the noise-exposed workers (usually around 30% of the study population) did not develop severe stages of VAD (Castelo Branco, 1999). They exhibited milder symptoms, but never evolved to more critical medical conditions. It is suspected that survivorship bias may play a significant role. Future studies of physiological and homeostatic parameters may provide clues as to what differentiates LF noise-susceptible individuals from the non-susceptible.

VAD is essentially characterized by a proliferation of extra-cellular matrix. This means that blood vessels can become thicker, thus impeding the normal blood flow. Within the cardiac structures, the parietal pericardium and the mitral and aortic valves also become thickened. The most recent VAD studies have been suggesting that infrasound exposure may be crucial to the rate of evolution of VAD. Occupational exposure to infrasound is suspected to cause an increase in the rate of thickening of the pericardium and cardiac valves in commercial airline pilots over that of flight attendants (Alves-Pereira *et* al, 1999).

Among the most serious on-the-job consequences of untreated VAD are rage-reactions, epilepsy, and suicide. VAD patients do not have the usual suicidal profile: after the event, if unsuccessful, they remember nothing, and are confused about the entire episode (Castelo Branco *et a*l, 1999). Similarly, patients who suffer rage-reactions also appear confused and seem to remember nothing (Castelo Branco *et a*l, 1999). These events can have dire consequences if they occur on the job. Not only can other individuals be injured, but also costly sophisticated equipment could become irreparably damaged.

The nefarious effects of VAD in the workplace can be successfully controlled by prevention medicine, and avoided by adequate selection procedures. This can be preliminarily achieved with a relatively simple diagnostic method - the echocardiogram. Other diagnostic tests can confirm a diagnosis of VAD.

Diagnostic Tests for VAD

The echocardiogram is the diagnostic method of choice for a preliminary diagnosis of VAD (Araujo *et* al, 1989; Marciniak *et* al, 1999). Proliferation of extra-cellular matrix can be observed with various imaging techniques. The echocardiogram visualizes thickening of cardiac structures, namely the pericardium and heart valves. In severe cases, echo-Doppler imaging shows thickened carotid arteries, and transcranial Doppler shows abnormal cerebral blood flow (Albuquerque *et* al, 1991). These three diagnostic tools are non-invasive and are based on principles of ultrasound.

If the echocardiogram shows thickening of cardiac structures then other diagnostic tests are in order. Brainstem auditory evoked potentials (BAEP) measure the reaction time of the brain to auditory stimuli. In VAD patients, these recordings are altered in terms of amplitude and latency values (GIMOGMA, 1984b; Pimenta *et* al, 1999). BAEP are also a non-invasive medical procedure. A thorough neurological examination is useful to investigate whether other VAD-related signs or symptoms exist, such as balance disorders (Martinho Pimenta *et* al, 1999b), palmo-mental reflex (Martinho Pimenta *et* al, 1999c) or epilepsy (Martinho Pimenta *et* al, 1999a). The existence of brain lesions can be confirmed through magnetic resonance imaging (Cruz-Maurício *et* al, 1991 and Pimenta *et* al, 1999).

A blood test can provide information on the genotoxic (Silva *et* al, 1996), immune (Castro *et* al, 1999), and blood coagulation parameters (Crespo *et* al, 1988), all of which are altered in VAD patients. Lastly, CT scan of the lungs can identify lung focal fibrosis which has been seen in both non-smoker, LF noise-exposed workers (Reis Ferreira *et* al, 1999), and in LF noise-exposed animal models (Grande *et* al, 1999). The respiratory tract of small rodents, exposed to LF noise on an occupationally-simulated schedule (8 hours/day, weekends in silence), seems to be one of the main targets (Sousa Pereira *et* al, 1999a and b, and Oliveira *et* al, 1999), as well as the immune system (Águas *et* al, 1999a and b)

The audiogram measures the amount of hearing loss at specific frequencies. In VAD patients, losses in the lower frequencies are observed (Castelo Branco, 1999). Alone, losses in the LF ranges could be caused by a variety of LF noise-exposure patterns, for example, excessive use of portable cassette-players ("walkmans"). The audiogram does not assess whole-body effects of LF noise exposure, thus it is ineffective as a method to diagnose VAD.

THE PROBLEM

Noise is thought to only affect the auditory system. Thus, noise protection is focused principally on the frequencies of acoustic phenomena that are audible to humans. Consequently, infrasound is not considered.

Legislation for workers in "noisy" environments are based on hourly exposures and acoustic amplitude levels. For example, according to the United States Occupational Safety and Health Administration, a worker can be exposed to a 90 dB-level acoustic environment for 8 hours per

day (OHSA, 1995). No mention is made to the frequency bands that, together, compose the 90 dB level. Are they predominantly in the 20-500Hz range, or in the 1000-5000 Hz range? This is highly relevant information since different organ systems are susceptible to different acoustic frequencies. Within the 20-500Hz range, 8 hours a day of an acoustic field at a 90 dB amplitude can cause irreversible damage to several organ systems. However, frequency distribution analyses of the environment are generally only performed to determine the best hearing protection device. There seems to be no legislation for infrasound.

If this were a situation with light instead of sound, it would be like ignoring x-rays (merely a different frequency of visible light), simply because they can't be seen. Current LF noise protection is analogous to wearing dark glasses against these x-rays.

The long-term effects of LF noise on living systems is still a wide-open field of unknowns, and VAD is, as yet, unrecognized by current labor legislation. The primary reason is the lack of large-scale epidemiological studies. Past VAD studies have been limited to animal models, and small samples of 30, 45, 60, and 485 LF noise-exposed workers. The results obtained urgently warrant that large-scale epidemiological studies be undertaken, and medical communities, noise-exposed workers, and the public at large be promptly informed. The extent of LF noise-induced disease in the general population is unknown. Among noise-exposed workers it continues to be a mis-diagnosed pathology.
Current problems regarding noise-pollution can be summarized as follows:

a. The steadfast but erroneous concept that noise only causes damage to the ear;
b. Lack of legislation regarding LF noise exposure;
c. A workforce with increasing absenteeism, lowered productivity, and increased risk in the workplace;
d. Widespread effects of LF noise exposure among the general population are unknown;
e. Public awareness of the danger of LF noise exposure is close to non-existent.

THE SOLUTION

Recognition of a previously unacknowledged environmental stressor is always a traumatic event. Classifying LF noise as an agent of disease, and VAD an occupational pathology, will certainly cause some upheaval, especially since physical protection against LF noise is not a feasible option. The dimensions of acoustic barriers are directly related to the wave length of the acoustic phenomenon. Within the low frequency range, wave lengths can be on the order of meters. Hence, acoustic barriers would be too large to be practical. At present, the most successful way to avoid VAD is through methods of prevention medicine and employee selection procedures.

Among LF noise-exposed workers, VAD can be successfully prevented from reaching the severe stages if a yearly echocardiogram is administered to the noise-exposed workforce. Evolution of VAD can thus be followed, and severe stages of VAD can be avoided. When the effects of VAD-associated pathologies (See Table I) begin to accumulate, the employee should be removed from the noise environment and reassigned to a non-"noisy" worksite. Simultaneously, job applicants for "noisy" jobs should be screened for pre-existing LF noise exposure and/or VAD. Many popular leisure activities can impose large amounts of LF noise on the individual, such as rock concerts, dance clubs and motorized sports. If the echocardiogram reveals some thickening of cardiac structures, the applicant should be re-evaluated for the position. This is not discrimination.

Selection of individuals to work a particular job has been a common practice among many professions. For example, aircraft pilots must have 20/20 vision; sky-scraper window-washers and some construction workers cannot suffer from vertigo; pregnant women do not work with x-rays.

The consequences of the above paragraph are fully recognized. Disruption to established employer-employee practices will be significant. However, the undesirable alternative is an increasingly ill society and workforce. The development of disabilities requiring early retirement, or a change of career, can shatter the lives of many individuals. For example, to initiate a career path within a noise-environment job, only to be removed and possibly demoted within a few years is costly both to a company and to the employee, often instigating problems within the human resources and management departments, and with the individual's social and family life. Similarly, if a company spends time and resources to train individuals for certain noise-environment positions, the investment return might be null if the individual is only capable to work for a few years.

Moreover, according to Portuguese labor law, the employer is responsible for any pre-existing medical condition that is aggravated on-the-job. Since VAD is not legislated as an occupational disease, and LF noise is not recognized as an agent of disease, the burden of the medical costs of VAD patients is currently upon the governmental healthcare system. Furthermore, workers on sick leave, or who were forced into early retirement due to VAD-associated disorders are not eligible for any workers' compensation. Clearly, recognizing VAD as an occupational disease will bring some mayhem, but ignoring it will have disastrous consequences.

Proposed short-term solutions:

a. All environmental and/or occupational noise assessments should include a frequency distribution analysis, and evaluation of infrasound levels should be included in the acoustic evaluation;
b. General physicians should inquire about the individual's workplace as part of the initial interview;
c. Noise exposed workers should be made aware of the possible dangers of LF noise exposure, and should mention to their primary care physicians that they work in "noisy" environments.

Proposed long-term solutions:

a. Establishment of legislation requiring that all environmental and occupational noise assessments include a frequency distribution analysis, and infrasound evaluation;
b. Establishment of the echocardiogram as a mandatory yearly examination of all noise-exposed workers, and as a pre-requisite for applicants to jobs within "noisy" environments;
c. Establishment of LF noise as an agent of disease, and VAD as an occupational disease, so that appropriate compensation can be awarded to the many disabled workers.

THE NEED FOR PUBLIC INFORMATION

All the above information must be made public. It is no longer acceptable that individuals have their lives destroyed because of excessive LF noise exposure. Worse than undesirable, it is unethical to keep workers within "noisy" environments, and ignore the potentially devastating, whole-body, acoustic trauma.

LF noise environments abound in modern leisure activities; specifically, rock concerts, dance clubs and powerful car audio equipment, not to mention the ever so popular water jet skis and motorcycles. Just how widespread are the LF noise-induced disorders is unknown. The public must be informed immediately that excessive exposure to these "noisy" activities may limit their professional future.

An Anecdotal Story

In one of the VAD studies among employees of an aeronautical industry, one of the subjects initially chosen for the control group worked in the Technical Drawing Division certainly a quiet environment! As the VAD diagnostic tests progressed, his came up positive for the LF noise-induced disease. His mode of transportation to and from work, his current residential area, and his hobbies were all investigated, and, strangely enough, none suggested exposure to a LF noise source. Finally, during the last physical examination, in which he presented all the neurological signs of VAD, the baffled physician explained the situation to him. With a grin, the man said: "Noise?! I was exposed to a lot of noise when I was growing up. My parents owned and operated a water mill, and our house was right above it. I lived there until I was 26 years old." Unfortunately, the mill has since been deactivated, so noise assessments are no longer possible. Nevertheless, this 34 year old man was already manifesting signs and symptoms of a moderate stage of VAD (See Table I) (Castelo Branco *et* al, 1999). Luckily, he did not decide to become an airline pilot, an astronaut, a disc-jockey, nor a sound or aircraft technician or a shipmaster, for example. Had he done so, his condition at 34 years of age may have been much more serious, or even fatal.

Education of the public is crucial. Non-scientific literature on VAD is also important, and a feeble attempt has been made to fill this void (Paiva *et* al, 1998). Management and executive officers must be educated on the health implications of LF noise exposure on their workers. According to VAD studies mentioned above, approximately 70% of the population is susceptible to LF noise. This is all the more alarming since "noisy" environments do not seem to be having a tendency to decrease much on the contrary.

ACKNOWLEDGMENTS

The authors would like to thank all employees who voluntarily contributed and contribute to the advancement of knowledge on VAD; And also the team of scientists affiliated with the Center for Human Performance who non-gainfully collaborate on the

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Exhibit 3. Mall, Amy, "Live on tape: the dangerous noise emitted by natural gas compressor stations in neighborhoods," February 22, 2010

https://www.nrdc.org/experts/amy-mall/live-tape-dangerous-noise-emitted-natural-gas-compressor-stations-neighborhoods

Live on tape: the dangerous noise emitted by natural gas compressor stations in neighborhoods

February 22, 2010 Amy Mall

As I mentioned in a previous post, it's the season for film awards, so I am posting my nominees for some of the most compelling oil and gas pollution videos. Words cannot do justice to the environmental harm that is evident in these images.

Today's category: noise from natural gas compressor stations. According to the World Health Organization, noise can cause permanent medical conditions, such as hypertension and heart disease, hearing impairment, communication problems, sleep disturbance, cognitive effects such as memory problems, reduced performance, behavioral symptoms, and more. Low-frequency noise (LFN), also created by compressor stations, can also cause Vibroacoustic disease, leading to cardiovascular symptoms and decreased cognitive skills.

In other words, it is not just a nuisance. It is serious.

These issues are so important that there is actually a scientific Journal of Low Frequency Noise, Vibration and Active Control, and a Journal of Sound and Vibration.

These are not groundless worries. Individuals report health symptoms they have linked to natural gas compressor station noise, including ruptured ear drums.

Natural gas compressor stations are located all over the country, even where there are no wells, because they help move natural gas along the pipeline. They often run 24/7. Each state or locality has its own regulations. Some are not strong enough to protect their citizens.

With that, roll tape. You'll see how horrible this would be if it were in your own backyard. This video is thanks to Erin in Port Washington, Ohio, whose home is bordered by two compressor stations. As you can see, children live here.

Exhibit 4. Hamilton, Mina, "More than A Pipeline: It's a Toxic Industrial Infrastructure," February 24, 2015

http://nopipelies.org/compressor-stations/

MORE THAN A PIPELINE: IT'S A TOXIC INDUSTRIAL INFRASTRUCTURE

By Mina Hamilton

A little known aspect of gas pipelines is that they require large compressor stations to help concentrate and move the pressurized gas along.As compressor stations release large amounts of methane, plus other toxins, they contribute significantly to global warming. They are noisy, humming 24/7, and are subject to dangerous explosions and fires. At public meetings and during the Federal Energy Regulatory Commission application process, gas pipeline companies have not revealed the number, location and size of planned compressor stations.

The large compressor stations, part of every gas pipeline project, can include acres of industrial plant, plus buffer zones.1 At these stations gas is pressurized to move it along high-speed gas pipelines more efficiently. The stations are spaced every 30 to 70 miles, though sometimes they are much closer.

Compressor stations are significant contributors to global warming. During ventings known as "blow-downs" large quantities of methane are released to the atmosphere. In the first two decades after methane is released it is 79 to 105 times more powerful than CO2 at destabilizing the climate. (Source)

Compressor stations also leak methane via valves and gaskets that weaken and leak from corrosion and thermal stress. A recent study by Cornell University scientists Bob Howard and Anthony Ingraffea estimates leaks. They found that anywhere from 3.6% to 7.9% of unburned methane leaks out at gas wellheads and along pipeline infrastructure before reaching end users. (Source)

Compressor stations release huge amounts of toxins. These toxins include benzene, toluene, sulfuric oxide, and formaldehyde. Citizens within 1500 feet of compressor stations in PA, TX, LA and other states have suffered from nose bleeds, rashes, headaches, sore throats, dizziness and nausea.

A typical compressor(from FERC application for the Compressor Station in Reed, PA.) also emits 46.2 tons of nitrous oxide per year. An anesthetic for dental surgeries, nitrous oxide can cause numbness and mental impairment. It has a sickly sweet smell. Nitrous oxide and volatile organic compounds interact to produce ground level ozone. Ozone inhibits crop growth by up to 30%. Compressor stations emit radon-222. This radioactive gas precipitates out as radioactive polonium and lead. During blow-downs these toxins deposit in surrounding areas. Rowan, E.L. and Kraemer, T.F.,2012, Radon-222Content of natural gas samples from Upper and Middle Devonian sandstone and shale reservoirs in Pennsylvania: Preliminary data: US Geological Survey Open File Report 2012-1159. (Source)

Compressor stations are noisy. "Blow-downs" can last for two hours. The noise is comparable to a commercial jet taking off. Blow-downs are needed if a gas pipeline is taken off-line for maintenance, in the event of emergencies, or to accommodate fluctuating demand. They often occur in the middle of the night.(Source)

The sound of regular compressor station operation has been compared to four diesel locomotive engines running 24/7. Residents as far as a mile away can hear the racket. This humming can cause hearing impairment, learning disabilities and cardiovascular problems.

Compressor stations are dangerous. Since 2011, there have been explosions and fires at compressor stations in Lathrop, Pa, Brooklyn Township, PA, Montrose, PA, Branchville, NJ, Windsor, NY, Pinedale, WY, Marengo County, AL, Oaktown, IN, Langton, OK, Nine Mile Canyon in UT – among others. Explosions have required midnight evacuations of nearby residents, with people evacuated out to a one-mile radius.

Compressor stations are fully automated, without staff present. In emergencies local fire departments (often volunteer) must wait for gas pipeline crews to arrive from distant depots hours away.

Pipeline companies are not transparent regarding the location of planned compressor stations. For years it has been standard gas pipeline company policy not to reveal the location or specifications regarding planned compressor stations – until the last minute.

To mask the full environmental impact of a proposed line, gas pipeline companies sometimes do not include all planned compressors stations in initial Federal Energy Regulatory Commission (FERC) applications.

An example of this tactic is the case of the Millennium Pipeline and Compressor Station in Minisink, NY: Millennium put in its FERC application for the pipeline in 2006 and the compressor station application in 2011, five years later (Personal communication Pramilla Malick of Stop the Minisink Compressor Station). This type of segmentation is illegal, but remains an industry-wide practice (US Court of Appeals for the District of Columbia ruled on June 6, 2014 that segmentation is illegal and that FERC should not permit segmented applications. Whether Kinder Morgan or FERC will abide by this ruling is unclear. An application for non-contiguous sections of the Northeast Pipeline has been submitted to FERC by Kinder Morgan in the summer of 2014 – after said District Court ruling.).

1Mina Hamilton writes on environmental issues. Her articles have been published in Mother Jones, the Progressive, the Nation, and In These Times. She has been a Research Associate at Radioactive Waste Management Associates, was Co-Founder and Co-Director of the Sierra Club Radioactive Waste Campaign, and served on Greenpeace USA's Board of Directors. She can be reached at minaham@aol.com.

3/5 DeRuyter NY 8-12-14 — Dr. Larysa Dyrszka — Health Impacts of Compressor Stations

PENNSYLVANIA – Observation of the Button Road Compressor station, with FLIR camera

PENNSYLVANIA – Living with a compressor station, 2012

WYOMING – Compressor station fire and explosion, 2011

PENNSYLVANIA – Video presentation on hazards of compressor stations

Some examples of actual pigging operations

Articles on Compressor Stations and Their Hazards

New disturbing video from Minisink, NY

The people of Minisink, NY are about 2 months "ahead" of us, they have submitted the brief for the FERC appeal in court. Unfortunately for them, they were not as "lucky" as we are, and the gas company there has already gotten all the required permits, including the air quality permit. The company already has built the station within a few weeks, and is already starting to operate despite the ongoing court case! They have published a new video showing the emissions, which are actually invisible and can only be seen with special equipment.

Spectra Energy Steckman Ridge Natural Gas Compressor Station Gas and Oil Mist Release

This letter report summarizes the air dispersion and deposition modeling analysis conducted by Trinity Consultants (Trinity) in response to an emergency shutdown (ESD) in the compressor building at the Steckman Ridge, LP facility located at 1809 Rock Hill Church Road just east of Clearville, Pennsylvania. This ESD resulted in the contemporaneous depressurization of the whole system over about a 90 second period of time and the release of methane and lubricating oil in the form of oil mist particles from one or more ESD discharge points at the facility. Trinity was retained by Steckman Ridge, LP to perform a modeling analysis for the ESD for the purposes of discerning the likely path of the released oil mist, and determining the potential direction and distance to which oil mist may have propagated.
Read the full report article here

Brookfield homeowner fears sound waves may harm natural gas pipelines

 BROOKFIELD — Step into Steve Kohlhase's back yard on Dairy Farm Drive in Brookfield and the first thing you will notice is buzzing or humming sound that fills the air.

At first, a visitor might mistake the sound for an airplane flying overhead. But the sound remains constant, day and night, Kohlhase said. "I used to have trouble sleeping from it, until I figured a way to mask the sound," he said.

When he bought the house in 1994, Kohlhase didn't hear the noise. It wasn't until 2008 that the noise first surfaced, he said.

That's when the Shelton-based Iroquois Gas Transmission System built a compressor station on a sprawling, 80-acre site off High Meadow Road. The station, which houses two units that regulate the pressure of the natural gas flowing through the pipeline, is located less than a mile from Kohlhase's house across wooded wetland.

Read the full news article here

Evacuation near compressor station

Safety concerns, air contamination, noise, and impact on property values were among the objections sited by area residents who spoke out against the project before it was granted a license by the Federal Energy Regulatory Commission (FERC). At an August 2, 2012 hearing, residents pointed out that the compressor station is being built on a narrow, winding road that has only one means of egress in the winter. In emergencies, residents said, Millennium would be forced to rely on the Long Eddy Volunteer Fire Department in Sullivan County, which has only seven active members and lacks a foam truck like the one that had been used to put out a compressor station fire in the Broome County Town of Windsor earlier that summer. Another resident pointed out that the compressor station would release huge volumes of contaminants into the atmosphere, including formaldehyde, carbon monoxide, particulate matter, and cancer-causing volatile organic compounds. The methane released into the atmosphere by Millennium on Thursday night is a powerful greenhouse gas.

Read the full news article here

Low Frequency Noise and the Hazards of Living Near a Compressor Station!

I am more concerned about the LFN effect on humans. Especially when my grand children come to stay with us. I have suffered brain damage, heart damage, ruptured ear drum twice and now have a permanent hole in my ear drum and suffer from restless leg syndrome. I have lived in my home 21 years in near perfiect health before the compressor station came. It is 0.9 miles from our home. Our neighbors are suffering also including ruptured ear drums, vertigo, restless leg syndrome, incontinence in younger women. Men can become sterile also and suffer sexual dysfunction. All of these are symptoms of Vibro-Acoustic Disease (VAD) caused by LFN from compressor stations.

Read the full news article here

Dangers of Oil Mist in Gas Compressor Stations

It is not uncommon that gas transportation companies can report dozens of oil leaks per year in a single gas compression station facility and some of those leaks break into fire causing significant damage and production loss. Numerous industry studies have verified that both smoke and oil mist often precede flame and either may obscure or blind some optical flame detectors preventing fire warning and potentially leading to disaster.

Read the full news article here

LATEST COMPRESSOR STATIONS NEWS ARTICLES

Get Your Pipeline Out of My Yard

Homeowners, environmentalists, and the changing economics of natural gas are getting in the way of an industry's big dreams.

Source: *Get Your Pipeline Out of My Yard - Bloomberg*

Click here for the full post

NEXUS appeal heads to court Tuesday #StopSpectra

Three 9th District Court of Appeals judges are scheduled at noon to hear oral arguments from local landowners and NEXUS Gas Transmission LLC, a unit of Spectra Energy Corp. — a company that wants to survey the land of residents who have not granted permission to enter their property.

Source: *NEXUS appeal heads to court Tuesday — The Medina County Gazette*

Click here for the full post

SPECTRA States NO HEALTH EFFECTS From VENTING RAW GAS #StopSpectra

A homeowner in Yorktown got this notice that Spectra will be venting the gas from various valves along the pipeline" starting TOMORROW and lasting until next week.

Algonquin Gas Transmission, LLC
1490 Highland Avenue, Bldg. #4
Cheshire, CT 06410

866-873-2579 *toll free*
203-439-9370 *fax*

Spectra Energy Partners

NOTICE

April 8, 2016

Dear Landowner;

This notice is to inform you that Algonquin Gas Transmission, LLC ("AGT") is continuing its construction activities of its Algonquin Incremental Market Project, in which work is being done in accordance with all applicable governmental approvals.

In order to complete this work, we must conduct controlled releases of natural gas by opening various valves along the pipeline.

This activity is scheduled to take place Friday, April 15, 2016 through Wednesday, April 20, 2016.

As natural gas is released into the air, there will be a loud, rushing noise that may last several hours. The noise may be accompanied by an odor resulting from the odorant mercaptan, which is injected into the natural gas to make it recognizable for safety reasons.

Natural Gas is naturally odorless and is lighter than air. It will quickly rise and dissipate into the atmosphere. The odorant may linger for a few days as minute traces will separate from the natural gas that is released.

During the release, should you hear the noise or smell the odorant in natural gas, please know that there is no cause for alarm and there will be no danger whatsoever to persons or property in the area.

AGT representatives will be at these various valve sites to closely manage and monitor the controlled releases. Personnel and equipment will remain at the various valve sites until this activity is complete. Equipment will include portable air compressors, light stands and monitors that constantly measure the levels of natural gas.

Please be advised that your local police and fire departments have been or will be notified of this activity. If you have any questions concerning this procedure please call our landowner hotline (866) 873-2579.

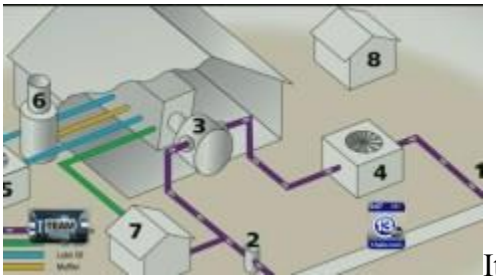
Very truly yours,

Edward C. Harney
Right of Way Project Manager
Engineering and Construction

Source: [Stop the Algonquin Pipeline Expansion (SAPE) Facebook page]

[Click here for the full post]

Lucas County Commissioners oppose compressor station



It's the night opponents of the compressor station in Waterville have been looking forward to for a long time. They finally laid out their case about how this proposed station would impact the health of the community.

Source: *Lucas County Commissioners oppose compressor station*

Click here for the full post

Residents voice concerns regarding Waterville compressor station


Many northwest Ohioans are concerned about a pipeline that could run through their backyards. Some supporters want to alleviate the demand for natural gas and create thousands of jobs while opponents have health concerns.

Source: *Residents voice concerns regarding Waterville compressor station*

Click here for the full post

Pipeline compressor station in southern Medina County comes under attack from Nexus opponents

 A proposed Nexus Pipeline compressor station in southern Medina County would pose a health threat and increased cancer risk to neighbors, according to experts hired by a grass-roots group.

Source: *Pipeline compressor station in southern Medina County comes under attack from Nexus opponents - Local - Ohio*

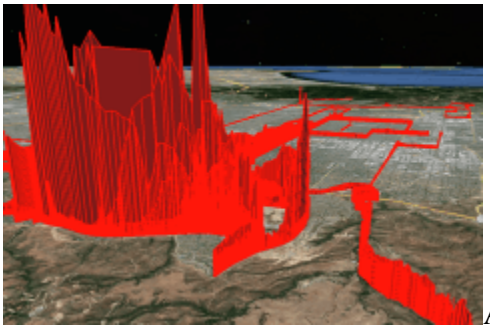
Click here for the full post

EPA Hearing - Nexus Compressor Station Medina Ohio

https://youtu.be/lS3yGRaiHvw

Click here for the full post

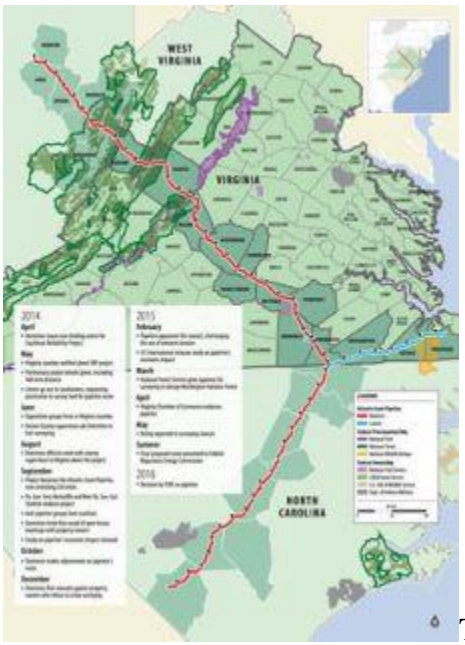
DANGER! Los Angeles Gas Well Leak "OUT OF CONTROL" - Entirely lost control of entire gas field, leaks everywhere!"

 A catastrophic disaster is now taking place outside of Los Angeles endangering hundreds of thousands of people. officials say they have "entirely lost control of the entire (gas) field" meaning explosive methane gas is now leaking from "many places." Workers at the scene of the Porter Ranch gas field in the Aliso Canyon say some of the leaks are so loud, the hissing sound can be heard 1/2 mile away.

Source: *DANGER! Los Angeles Gas Well Leak "OUT OF CONTROL" - Entirely lost control of entire gas field, leaks everywhere!"*

Click here for the full post

Forest service rejects proposed route of Atlantic Coast Pipeline - Local - The Daily Progress



The National Forest Service has told the builders of the Atlantic Coast Pipeline it must find alternatives to the proposed route.

Source: *Forest service rejects proposed route of Atlantic Coast Pipeline - Local - The Daily Progress*

Click here for the full post

Radioactive material reportedly now being released from massive gas blowout in LA

Byproduct of Uranium — Expert: "A lot" has been detected in area… Very dangerous… May be coming up from ground into people's homes

Source: *Seemorerocks: More on the LA gas leak*

Click here for the full post

COMPRESSOR STATION EXPLOSION RAISES CONCERNS - Natural Gas Watch.org

 An explosion at an Oasis Midstream Services, LLC compressor station located north of Watford City on Highway 1806 on Wednesday, Dec. 23, not only set off an automatic 911 call, but is raising concerns from McKenzie County officials as to the proximity that many oilfield structures are being built in regards to residential homes.

Source: *COMPRESSOR STATION EXPLOSION RAISES CONCERNS - Natural Gas Watch.org*

Click here for the full post

List of pipeline accidents in the United States in the 21st century

 Think gas pipeline failures are a rare occurrence? Think again. Here is a list of gas pipeline failures resulting in injuries/evacuations since 2000. 35 reported in 2015 alone

Source: *List of pipeline accidents in the United States in the 21st century - Wikipedia, the free encyclopedia*

Click here for the full post

Physicians Speak Out on the Health Effects of Fracked Gas Compressor Stations

Physicians Speak Out on the Health Effects of Fracked Gas Compressor Stations

Source: Physicians Speak out on Gas Compressor Stations

Click here for the full post

Fracking is 'Screwing Your Children and Grandchildren'

"there's no way to avoid the consequences... And yet politicians pretend not to hear it, or not to understand"

Source: *James Hansen: Fracking is 'Screwing Your Children and Grandchildren'*

Click here for the full post

Pipeline Safety Chief Says His Regulatory Process Is 'Kind of Dying' | InsideClimate News


Two stark numbers illustrate the challenge the administration faces in ensuring pipeline safety while pressing ahead with new pipeline projects: 135 federal inspectors oversee 2.6 million miles of pipeline, which means each inspector is responsible for almost enough pipe to circle the Earth.

Source: *Exclusive: Pipeline Safety Chief Says His Regulatory Process Is 'Kind of Dying' | InsideClimate News*

Click here for the full post

5. Earthworks, "Oil and Gas Noise"

https://www.earthworksaction.org/issues/detail/oil_and_gas_noise

Oil and Gas Noise

- Rationale for a 45 dBA residential noise standard
- Sources of noise
- Noise and its effects on human health
- Noise and its effects on wildlife

Noise from oil and gas development comes from a number of sources: truck traffic, drilling and completion activities, well pumps and compressors. For some landowners, noise from oil and gas operations is so loud or of such a different sound quality that it makes them feel as if they are living in an industrial zone.

For people who live in rural areas, the arrival of a new, industrial noise source can greatly disturb the natural environmental soundscape and has even driven some residents from their homes.

Landowners often complain about noise levels associated with natural gas compressors. The noise level varies with the size of the compressor and distance from the compressor; and it changes with shifts in wind direction and intensity. According to the Powder River Basin Resource Council, "Depending on the wind direction, the roar of a field compressor can be heard three to four miles from the site. Near the compressor stations, people need to shout to make themselves heard over the sound of the engines."

One Wyoming landowner has described compressor noise in this way:

Now comes the second phase. The dreadful noise generated by a nearby large compressor station. Noise that was so loud that our dog was too frightened to go outside to do his business without a lot of coaxing. Noise that sounds like a jet plane circling over your house for 24 hours a day. Noise that is constant. Noise that drives people to the breaking point. My neighbor called the sheriff, state officials and even the governor and was told nothing could be done about the noise. Like I said, the noise drives people to the breaking point, and my neighbor fired 17 rifle shots toward the station.
--Excerpted from CBM Destroys Retirement Dream.

How loud is oil and gas noise?

A study in La Plata County, Colorado, reported noise levels for a number of oil and gas activities:

Typical compressor station	50 dBA (375 feet from property boundary)

Pumping units	50 dBA (325 feet from well pad)
Fuel and water trucks	68 dBA (500 feet from source)
Crane for hoisting rigs	68 dBA (500 feet from source)
Concrete pump used during drilling	62 dBA (500 feet from source)
Average well construction site	65 dBA (500 feet from source)

The Bureau of Land Management (BLM) published different numbers. At 50 feet from the source, the measured noise levels were: well drilling - 83dBA; pump jack operations - 82 dBA; produced water injection facilities - 71 dBA; and gas compressor facilities - 89 dBA.[5]

In the same study, BLM also reported typical noise levels from construction equipment and oil and gas activity. These are presented in the chart below. Again, the sound levels were taken at a distance of 50 feet (15 meters). Estimates of noise attenuation at distances greater than 50 feet can be made by reducing noise levels by a factor of 6 dBA (A-weighted sound levels) for each doubling of distance. The actual noise levels experienced by a receptor, however, will depend on the distance between the receptor and the equipment, the topography, vegetation, and meteorological conditions (e.g., wind speed and direction, temperature, humidity).

Rationale for a 45 dBA (or lower) residential noise standard

In many residential neighborhoods, especially low density and rural areas, the nighttime noise level is very quiet. According to a Colorado-Based noise consultant, ambient noise levels in residential areas are frequently as low as 35 dBA during the nighttime, and are occasionally lower [6]. In these situations, if oil and gas facilities are allowed to emit noise at 45 dBA, the noise will be perceived by many as being twice as loud as the ambient noise in the area. In Alberta, Canada, it has been estimated that the ambient rural noise level is 35 dBA at night.

Noise standards of 45 dBA LEQ (nighttime) or lower are used in many jurisdictions that have oil and gas operations.

There are several jurisdictions that require oil and gas operators to meet a 45 decibel level during the night-time, in residential areas. Typically, noise measurements are taken outside, at a certain distance from or at the property line of the receiver (e.g., a house, hospital, etc.). These are called "receptor-based" noise standards. In some cases, noise measurements are taken a certain distance from the noise source ("source-based" standards). In 2005, Colorado amended its noise rule from a "receptor-based" to a "source-based" standard, requiring noise measurements to be taken 350 feet from the oil and gas noise source.

- **Alberta, Canada:** Alberta is a major oil and natural gas producing province in Canada. In Alberta, the Energy and Utilities Board has the responsibility for regulating noise from oil and gas operations. The EUB has produced what may be the most comprehensive noise regulations for the oil and gas industry across North America.

The EUB essentially has a sliding scale noise standard whereby acceptable noise levels vary with the ambient noise. For example, if a citizen lives in an area where ambient noise is low (e.g., where housing density and traffic noise are low), then the oil and gas operator must ensure that noise reaching the receptor is no louder than 40 dBA. In some instances, if the ambient noise is very low (e.g., 30 dBA), companies may be required to mitigate noise to even lower levels (e.g., 35 dBA).

- As ambient noise conditions increase, the allowable noise level increases. The highest allowable level in a residential neighborhood is 56 dBA at night. This noise level applies when there are more than 160 dwellings in a quarter-mile radius, and there is a major traffic source (road, rail, air) within 30 m (90 feet) of any of the dwellings.
- World Bank: For onshore well sites, the recommended maximum noise level is 55 dB(A) and 45 dB(A) for day and night, respectively (measured at receptors or the edges of a property boundary, on an average hourly basis). These levels apply to residential, educational and institutional areas. Noise abatement measures should achieve either the levels state above or a maximum increase in background levels of 3 decibels (measured on the A scale) [i.e., dBA].
- Sacramento County, CA: Sacramento County is a significant producer of dry natural gas in California. In the county, the allowable noise level is 50 dBA L50 (daytime) and 45 dBA L50 (nighttime), measured at residential properties. This is according to the Noise Element Of The1993 County Of Sacramento General Plan.
- City of Longbeach, CA: The allowable exterior noise level in many parts of the city is 45 dBA (nighttime), according to the Longbeach city ordinances. Oil and gas operations must meet this standard, except during drilling and well servicing.

Examples of residential noise requirements of 45 dBA for oil and gas operations

	Measurement Location	Nighttime level (dBA)
World Bank - new oil and gas projects in residential areas	At receptors or edge of property boundary	45
Alberta, Canada - low traffic noise, low density housing med. traffic, med. density high traffic, high density	15 metres from a dwelling/receptor	 40 45 56
Sacramento County, CA	At residential property line	45

City of Longbeach, CA	At residential property line	45
Colorado	350 feet from noise source	45

45 dBA is achievable, even as close as 350 feet from the noise source

There are numerous examples that show that 40 - 45 dBA is achievable at 350 feet from the source. The City of Farmington, New Mexico uses "1 dBA over ambient" as a standard for all wells constructed in the city. In January of 2005, OGAP staff conducted sound measurements at well sites in the City of Farmington. Noise levels measured at 300 feet from the noise source varied from 39 to 49 dBA. It is estimated that if measurements had been taken at 350, these sound levels would have been in the range of 37 to 47 dBA. For more information, please download the OGAP/SJCA submission to the COGCC.

It is not cost prohibitive to achieve 45 dBA at 350 from the noise source

As part of its submission to the Colorado OIl and Gas Conservation Commission noise rule hearing, OGAP prepared a chart of noise mitigation cost estimates for oil and gas facilities that have achieved the 40-45 dBA noise level.

Sources of Noise

Noise from pumpjacks

A low-profile pumping unit can replace the conventional unit, which uses a 30- to 40-foot beam and looks like a giant, bobbing horse's head. The conventional pump is run on a gas- or diesel-powered engine, which is noisy and smelly. Alternatives to this large pump include using a pneumatic pumping device that doesn't require an engine, therefore, produces little or no noise. This pump stands about 10 to 15-feet tall. According to one company, pneumatic pumps will not function correctly if a lot of water is extracted while extracting methane gas. Consequently, when larger amounts of water are produced, an alterative to the standard beam pump is the progressive cavity pump. These pumps come in different shapes and sizes, and like the pneumatic pump, they can run on electric motors, and therefore, be much quieter than conventional pumps.

Vehicle Noise

Noise created by operators constantly driving in and out from the well pad to monitor well production can be mitigated using an automated monitoring system, which allows wells to be monitored remotely, e.g., from the company's office. Vehicle noise may also be controlled to some extent by limiting the hours that industry employees use residential roads for accessing wells (e.g., limiting vehicles to the hours of 7:00 a.m. to 9:00 p.m., except in emergency situations).

Engine noise

To mitigate noise impacts from engines, sound barriers made out steel and sound-absorbing insulation (i.e., NOT styrofoam) may be used. Sound barriers may be placed in an L-shape above the engine, and they extend past the sides of the engine. To reduce noise in sensitive areas, pumpjacks, engines, or well-site or field compressors may be entirely enclosed in a sound-insulated building.

Some engines can operate at a constant number of revolutions per minute (RPM), which reduces the often annoying fluctuating noise caused by engines that speed up and slow down. Mufflers, like those used for automobile engines, can be used to minimize engine noise. In noise sensitive situations, hospital-grade mufflers used in series can be more effective at reducing noise from engines.

In some situations, natural gas or diesel engines can be replaced with electric motors. These motors, if properly installed, tend to be much less noisy than their engine counterparts. The use of electrical motors depends on the availability of electricity, and whether or not a company is willing to run an electrical line to the site.

Compressor noise

Noise from compressors can be mitigated most effectively by treating each significant oise source: gas turbines or engines, compressors, exhaust outlets and air inlets, and cooling and ventilation fans. Abatement may involve changing the blades on fans, which can change the frequency of sound emitted, thereby removing the annoying tones. Engine noise can be muffled using automotive-type mufflers, or by housing the engines in acoustically insulated structures. Also, the entire compressor can be housed in an acoustically insulated building.

Cost of Mitigation

Some oil and gas opearators refuse to apply noise mitigation to their sites, using the excuse that mitigation is too expensive. If noise mitigation measures are installed when the site is constructed, rather than attempting to abate the noise after the equipment is installed, the costs are much more affordable. OGAP has compiled some examples of the costs of mitigation.

Noise and its Effects on Human Health

There are adverse physical and mental effects from noise. For example, prolonged periods of exposure to 65 dBA can cause mental and bodily fatigue. Furthermore, noise can affect the quantity and quality of sleep; cause permanent hearing damage; contribute to the development or aggravation of heart and circulatory diseases; and transform a person's initial annoyance into more extreme emotional responses and behavior.

Unfortunately, many of the health effects of noise due to oil and gas operations have not been scientifically documented. The lack of scientific study does not mean, however, that noise issues related to oil and gas are insignificant. The loud, continuous noise during the drilling phase; the loud short-term noises from flaring or hydraulic fracturing; the intermittent whine of poorly maintained pump jacks and other equipment; and the loud or low frequency noise from compressors are common complaints related to oil and gas development. Numerous citizens have

reported disruption of sleep and increased anxiety caused by noise from oil and gas developments.[10]

Noise and its Effects on Wildlife

Noise effects wildlife in a variety of different ways. It can cause the temporary or permanent displacement of animals and birds from particular areas. It can also have physiological effects that are detrimental to wildlife health.

The Draft Resource Management Plan for leasing federal lands in southern New Mexico states that in some cases, federally threatened and endangered wildlife species may be affected by elevated noise levels. For example:

- High noise levels potentially can mask communications by wildlife that are used to attract mates and defend territories.
- Increased noise and activity levels during construction and development could result in [bird] nest abandonment and decreased reproductive success if such activity occurs during the breeding season.

In the final Environmental Impact Statement for the Jonah natural gas field, the BLM stated that:

It is likely that noise already has contributed to the apparent decrease in wildlife use on and adjacent to the Jonah Infill Drilling Project Area (JIDPA), with observed decreases in raptor nesting activity and productivity, male greater sage-grouse lek attendance and sage-grouse nesting within the JIDPA having been reported over the past several years. Data also suggest that noise may contribute to disturbance and/or departure of greater sage-grouse from area leks. [13]

For more information:

ENDNOTES

[5] Bureau of Land Management. Oct.2000. *Draft RMPA/EIS for Federal Fluid Minerals Leasing and Development in Sierra and Otero Counties*. Page 4-29.

[6] McGregor, H.N. (Engineering Dynamics, Inc., Englewood, CO). *Propagation of Noise from Gas Compression Facilities Located in Mountainous Terrain.* (COGCC Noise Stakeholder Meeting Handout.)

[10] Clarren, Rebecca. "Status quo reigns in New Mexico," *High Country News.* Sept. 25, 2000. p. 10.

[13] BLM. Jan. 2006. *Final Environmental Impact Statement, Jonah Infill Drilling Project. Sublette County, WY*. Chapter. 4. p. 4-48.

Exhibit 6. Damascus Citizens for Sustainability, "Compressors on natural gas pipelines measured releasing high concentration plumes of gas," March 11, 2017

http://www.prleap.com/pr/253531/compressors-on-natural-gas-pipelines-measured

Compressors on natural gas pipelines measured releasing high concentration plumes of gas

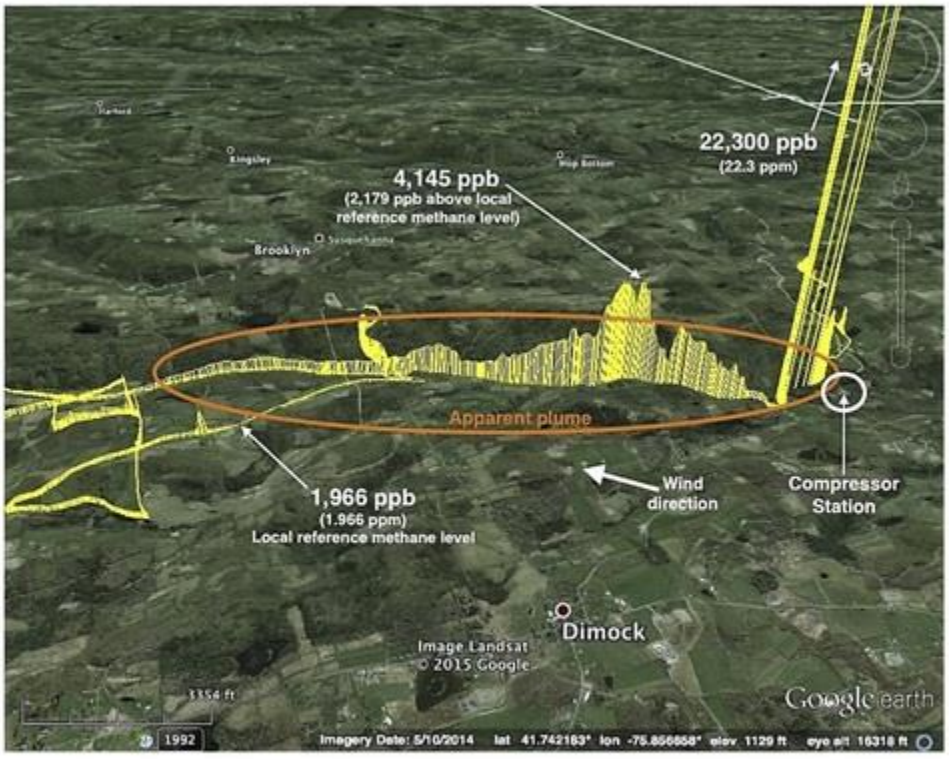


Fig. 4. Ambient methane measurements collected from a survey of area in Dimock, PA. Yellow lines indicate locations of methane measurements. The vertical height of each line is proportional to the elevation of the methane concentration at that location above the local reference methane level that day (1966 ppb). The highest methane level encountered in the Dimock area up to the time of this survey (22, 300 ppb) was encountered about 503 m downwind of the compressor station. Methane levels began to rise at the closest approach to the compressor station, about 750 ft (230 m), just prior to encountering the maximum methane level. An apparent plume extended for over 2 miles downwind in the Meshoppen Creek valley. Data indicated this plume may have been dissipating at the time of the survey as return survey passes along the margins of the plume encountered lower methane levels. (For interpretation of the references to colour in this figure, the reader is referred to the web version of this article.)

Plume from a compressor near Dimock, PA. Over 10 times background at its peak, extended

over 2 miles into the Meshoppen Creek valley carrying methane and harmful air pollutants at elevated levels.
March 11, 2017 Business News
(PRLEAP.COM) **Damascus Citizens for Sustainability Study Proves Gas Plumes Exist from Compressor Stations on Pipelines. Characterization of methane plumes downwind of natural gas compressor stations in Pennsylvania and New York.**

March 11, 2017 - Narrowsburg, NY - A newly released original research study funded by grass roots environmental advocacy group Damascus Citizens for Sustainability (DCS) proves for the first time that compressors on gas transmission pipelines release emissions that spread downwind from their source in plumes of denser concentration. Residents living near these facilities have repeatedly reported such plumes and accompanying negative health effects, but until now their reports have been hard to confirm, as lax government regulations don't require site measurements for permitted facilities-despite the fact that the permits (based solely on estimates from engineering models) allow such facilities to emit tons of pollutants into the air each year.

The study was conducted by Bryce Payne and Bob Ackley, of Gas Safety,Inc., with A. Paige Wicker, Zacariah L. Hildenbrand, Doug D. Carlton Jr. and Kevin A. Schug, of the University of Texas at Arlington1. Measurements were made on public roads in the area of 9 compressors in Pennsylvania and New York. Compressors are needed about every 50 miles to push the gas along the pipelines, using turbines and usually pipeline gas driven motors; all those studied were gas driven.

The study reveals rogue methane a full mile from the compressor stations tested. Only methane was measured, but is a proxy for the mixture that is natural gas.
While these plumes are composed predominantly of the greenhouse gas methane, which accounts for 80 to over 90% of natural gas, they also can contain nitrogen oxides, particulate matter, sulfur dioxide, radon and volatile organic compounds, among other materials.

This DCS study is the first to measure the atmospheric movement of the hazardous release process in air near compressors, though there have been previous studies measuring natural-gas related contaminant plumes in water. For instance, a 2011 study of waste-water releases into Blacklick Creek from the Josephine Waste water treatment plant by Volz, which was repeated two years later by Jackson, proved the existence of plumes in water of higher concentration of chemicals from waste water plant releases.

Although actual measurements have not been taken before, engineering models have estimated that natural gas facilities release tons of pollutants, such as particulates, sulfur dioxide, nitrogen oxides, volatile organic compounds, carbon monoxide, formaldehyde, etc., into the air each year. These are materials that the facilities are allowed to release via the permits granted by the states, which assume instantaneous and complete mixing-meaning no plumes of higher concentrations. The DCS report provides proof that there are plumes, and confirms the reports of residents living near such facilities that they are subject to

concentrated plumes of contaminants in their air which may be responsible for the negative health affects they suffer from. Those effects include respiratory distress, nose bleeds, skin lesions, and neurological damage.

DCS's own field representatives have experienced such effects firsthand; attempts at alerting regulators, medical personnel, and local and state officials have not produced desired results. This study bolsters these reports with quantifiable evidence. DCS Director Barbara Arrindell said, "Those responsible for our public health must look at this data. While no news has been good news for the gas industry, DCS has continued to push for scientific data in an effort to expose what is seemingly obvious: gas drilling and related activities are not safe."

Preprint available in full here:
http://www.damascuscitizensforsustainability.org/2017/01/methane-plumes-downwind-natural-gas-compressor-stations/

and published paper here: Payne, B.F., et al., Characterization of methane plumes downwind of natural gas compressor stations in Pennsylvania and New York, Sci Total Environ (2016)http://dx.doi.org/10.1016/j.scitotenv.2016.12.082

CITATION:

Science of The Total Environment

Volume 580, 15 February 2017, Pages 1214–1221

Characterization of methane plumes downwind of natural gas compressor stations in Pennsylvania and New York

- Bryce F. Payne Jr[a, b, ,]
- Robert Ackley[a],
- A. Paige Wicker[b, c],
- Zacariah L. Hildenbrand[b, d],
- Doug D. Carlton Jr[b, c],
- Kevin A. Schug[b, c]

Show more

http://dx.doi.org/10.1016/j.scitotenv.2016.12.082

Damascus Citizens for Sustainability, a 501(c)3 non-profit, founded in 2008 in response to

the prospect of horizontal hydrofracking for natural gas in the Delaware River Valley, with a mission of preserving clean water, clean air, and a healthy environment as basic human rights. Since then, we have vastly expanded our network. Our thrust throughout has been to secure a ban of fracking in our own backyard, but also to help grassroots groups around the country and world to resist the incursion of drilling and associated activities in their areas and to promote a switch from all fossil fuels, including natural gas, to truly sustainable energy sources and gains in energy efficiency.

Contact: Barbara Arrindell, Director, DCS
dcs@DamascusCitizens.org
Office Phone: 845-252-6677
Contact Information
Barbara Arrindell
Damascus Citizens for Sustainabilit
845-252-6677

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http://www.damascuscitizensforsustainability.org/2017/01/methane-plumes-downwind-natural-gas-compressor-stations/

Methane Plumes Downwind of Natural Gas Compressor Stations

January 26, 2017
Here we present in situ measurements of ambient methane concentrations near multiple natural gas compressor stations in NY and PA
By Bryce F. Payne Jr, Robert Ackley, A. Paige Wicker, Zacariah L. Hildenbrand, Doug D. Carlton Jr, Kevin A. Schug, Science of the Total Environment, December 13, 2016

From the **DCS press release** on this original, DCS funded, research:

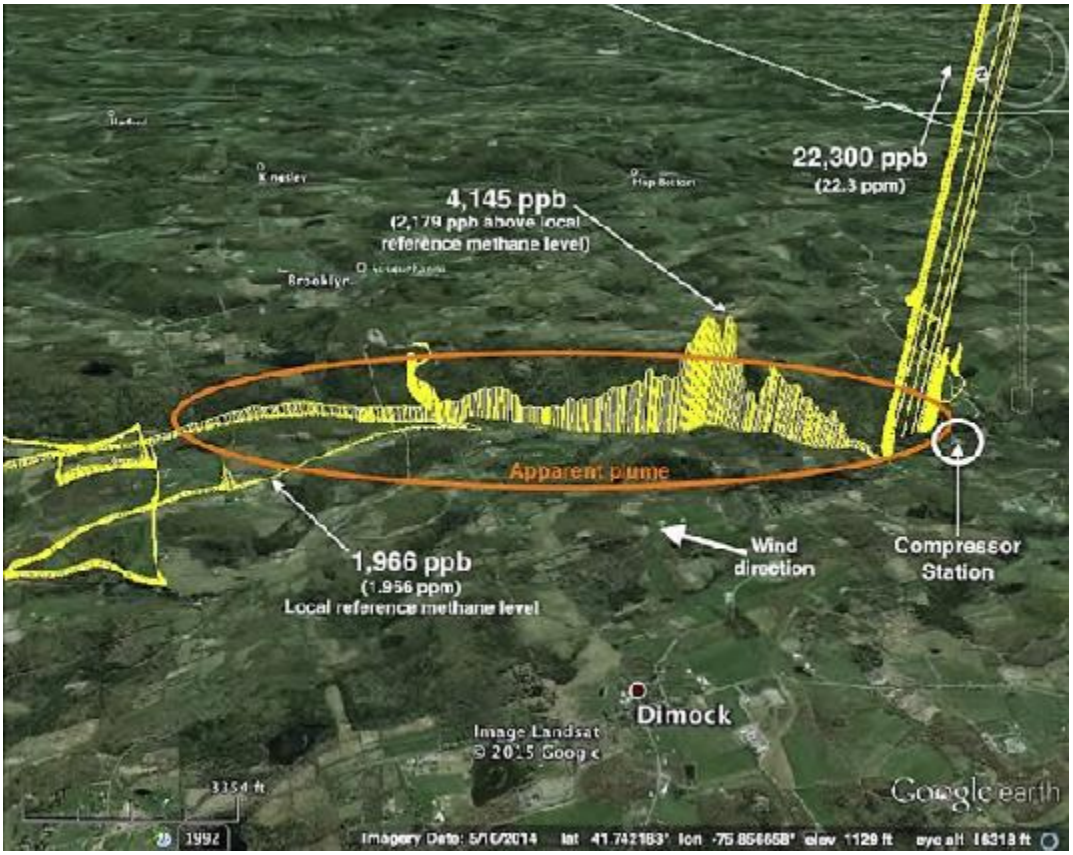
*A **newly released original research** study funded by grass roots environmental advocacy group Damascus Citizens for Sustainability (DCS) proves for the first time that **compressors on gas transmission pipelines release emissions that spread downwind from their source in plumes of denser concentration.** Residents living near these facilities have repeatedly reported such plumes and accompanying negative health effects, but until now their reports have been hard to confirm, as lax government regulations don't require site measurements for permitted facilities — despite the fact that the permits (based solely on estimates from engineering models) allow such facilities to emit tons of pollutants into the air each year.*

[View the study preprint as a pdf]
[Support for this research was provided by DCS]

Characterization of Methane Plumes Downwind of Natural Gas Compressor Stations in Pennsylvania and New York

Abstract

The extraction of unconventional oil and natural gas from shale energy reservoirs has raised concerns regarding upstream and midstream activities and their potential impacts on air quality. Here we present in situ measurements of ambient methane concentrations near multiple natural gas compressor stations in New York and Pennsylvania using cavity ring-down laser spectrometry coupled with global positioning system technology. These data reveal discernible methane plumes located proximally to compressor stations, which exhibit high variability in their methane emissions depending on the weather conditions and on-site activities. During atmospheric temperature inversions, when near-ground mixing of the atmosphere is limited or does not occur, residents and properties located within 1 mile of a compressor station can be exposed to rogue methane from these point sources. These data provide important insight into the characterization and potential for optimization of natural gas compressor station operations.



Ambient methane measurements, Dimock, PA

Conclusion

Our data indicate that compressor stations are likely sources of methane emissions and presumably co-emitted air contaminants, and can sporadically/episodically emit methane at relatively high levels. While these analyses provide significant insight into contamination events during specific periods in time, they are not sufficient to project how often high emissions occur, or to characterize basal emission rates. Nonetheless, these data provide an impetus for more thorough environmental investigations of natural gas infrastructure in general. It would seem appropriate, therefore, that if such facilities are to be permitted to release specified amounts of contaminants, those amounts should be actively measured and verified. Without measurement there can be no assurance that permit conditions are being met. Baseline measurements of methane emissions from compressor stations should be collected to better understand how midstream activities in the natural gas supply system contribute to overall anthropogenic emissions, while simultaneously aiding in the early detection of environmental contamination events, and guiding the subsequent improvement of natural gas infrastructure.