October 20, 2014

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First St. NE
Washington, DC 20426

Dear Ms. Bose,

I have reviewed the proposed Dominion Project permit application, FERC Docket No. CP14-497, and submit these comments. Please accept my comments as an individual. I am a board-certified pediatrician, retired from active practice and with a current focus on health impacts of fossil fuels.

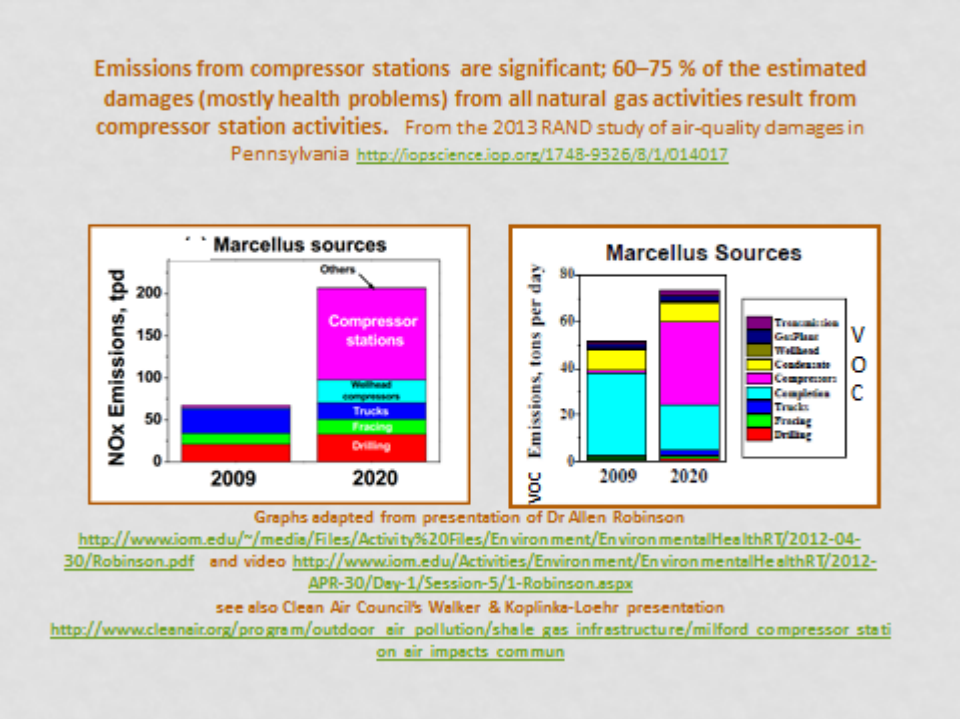
Overview

Compressors release combustion products, nitrogen oxide and volatile organic hydrocarbons. The combustion products combine with the volatile organic compounds and heat and sunlight to produce ground level ozone. The EPA has just issued a new report in which they recommend an even greater restriction on produced ozone, to 60-70 ppb, where the current standard is 75ppb.[1] (Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards, August 2014)

Accidents can occur at any point of gas production, with releases of air toxins.[2] [3]

Health and community impacts have been observed among residents living near gas infrastructure.[4]

[1] http://www.epa.gov/ttn/naaqs/standards/ozone/data/20140829pa.pdf
[2] Map of pipeline accidents at ProPublica: http://projects.propublica.org/pipelines/
[3] Earthjustice spills database: http://earthjustice.org/features/campaigns/fracking-across-the-united-states
[4] http://www.iom.edu/~/media/Files/Activity%20Files/Environment/EnvironmentalHealthRT/2012-04-30/Robinson.pdf and http://sape2016.files.wordpress.com/2013/10/air_quality_and_climate_impacts_of_shale_gas_operations.pdf and http://www.post-gazette.com/news/state/2013/10/06/Marcellus-gas-facilities-near-to-one-another-or-even-linked-are-evaluated-individually-for-pollution/stories/201310060050 and http://www.cleanair.org/program/outdoor_air_pollution/shale_gas_infrastructure/milford_compressor_station_air_impacts_commun



The volume of emissions from compressor stations is significant. The 2013 RAND study of air-quality damages in Pennsylvania has determined that 60–75 % of the estimated damages (most due to health problems) result from compressor station activities.[5]

Dr Allan Robinson of the Carnegie Mellon University estimates that the greatest nitrogen oxide and VOC emissions are from compressor stations.[6]

The following pollutants and other impacts could potentially affect the residents near the proposed Sheds compressor, and the residents have expressed concerns. They should be addressed in an expanded study which includes these specific topics of concern to the residents, and which have been addressed in the literature as presented below.

POLLUTANTS and the SOURCES

These are the components of natural gas and pipelines, and the sources of the emissions:[7] [8]

- Methane (CH_4)

[5] http://iopscience.iop.org/1748-9326/8/1/014017
[6] Graphs adapted from presentation of Allen Robinson http://www.iom.edu/~/media/Files/Activity%20Files/Environment/EnvironmentalHealthRT/2012-04-30/Robinson.pdf and video http://www.iom.edu/Activities/Environment/EnvironmentalHealthRT/2012-APR-30/Day-1/Session-5/1-Robinson.aspx and see also Clean Air Council's Walker & Koplinka-Loehr http://www.cleanair.org/program/outdoor_air_pollution/shale_gas_infrastructure/milford_compressor_station_air_impacts_commun
[7] http://www.edf.org/sites/default/files/9235_Barnett_Shale_Report.pdf
[8] http://www.epa.gov/airquality/oilandgas/pdfs/20120417presentation.pdf

- Light and heavy alkanes
- BTEX - Benzene, toluene, ethylbenzene, and xylene
- Hydrogen and carbonyl sulfides
- Sulfur Dioxide (SO2)
- Formaldehyde and other aldehydes
- Particulate matter (tiny soot-like particles)
- Carbon monoxide (CO)
- VOCs
- Radon, polonium and lead
- Polychlorinated Biphenyls (PCBs)

The infrastructure, including compressor stations, processing facilities, metering and regulating stations and diesel-powered trucks emit the pollutants[9] [10] [11] [12] listed here.

The exposure is cumulative[13] and costly[14].

These are some of the health impacts associated with infrastructure emissions:

NOx is associated with respiratory disease. Low levels cause eye, nose, throat & lung irritation; coughing, shortness of breath; tiredness, nausea. High levels of exposure can seriously damage tissues in the throat and upper respiratory tract and trigger the build-up of fluid in the lungs. Additionally, nitrogen oxides also contribute to acid rain and can react with other pollutants to form ozone and particulate matter. [15] [16]

VOCs are neurotoxins, hepatotoxins, reproductive toxins, fetotoxins, and dermatotoxins. Short-term exposure to VOCs can irritate the respiratory tract and eyes and cause dizziness and headaches. Long-term exposure is linked to cancer and a number of adverse neurological, reproductive, and developmental effects. VOCs can also impact health by combining with nitrogen oxides to form ozone. [17] [18]

SO2 is associated with respiratory illness. At high exposure levels, sulfur dioxide can cause temporary breathing difficulty for people with asthma and long-term exposure to high levels of SO2 can cause respiratory illness and aggravate cardiovascular diseases. Sulfur dioxide also reacts with nitrogen oxides and other air pollutants to form particle pollution and acid rain, which damages forest and aquatic ecosystems. [19] [20]

Particulate matter also known as particle pollution, is made up of a mixture of solid particles and liquid droplets suspended in the air. While some particles such as dust and soot are large enough to be seen with the naked eye,

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[9] http://www.iom.edu/~/media/Files/Activity%20Files/Environment/EnvironmentalHealthRT/2012-04-30/Robinson.pdf and http://www.iom.edu/Activities/Environment/EnvironmentalHealthRT/2012-APR-30/Day-1/Session-5/1-Robinson.aspx
[10] http://sape2016.files.wordpress.com/2013/10/algonquin_incremental_market_project.pd
[11] http://courses.washington.edu/envir300/papers/Steinzor_et_al_2013.pdf
[12] http://sape2016.files.wordpress.com/2013/10/air_quality_and_climate_impacts_of_shale_gas_operations.pdf
[13] http://www.post-gazette.com/news/state/2013/10/06/Marcellus-gas-facilities-near-to-one-another-or-even-linked-are-evaluated-individually-for-pollution/stories/201310060050
[14] Litovitz, Curtright, 2013, "Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania". Access at http://iopscience.iop.org/1748-9326/8/1/014017/pdf/1748-9326_8_1_014017.pdf and also http://iopscience.iop.org/1748-9326/8/1/014017
[15] http://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=396&tid=69
[16] http://www.psr.org/environment-and-health/climate-change/air-pollution/air-pollutants.html
[17] http://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=396&tid=69
[18] http://www.psr.org/environment-and-health/climate-change/air-pollution/air-pollutants.html
[19] http://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=396&tid=69
[20] http://www.psr.org/environment-and-health/climate-change/air-pollution/air-pollutants.html

others are so tiny that they can only be viewed with the aid of a microscope. Produced primarily by the combustion of fossil fuels, particulate matter is one of the deadliest air pollutants. Each year, particle pollution causes an estimated 60,000 premature deaths. Fine particles are especially dangerous because they can bypass the body's natural defenses to lodge deep in the lungs where they can pass easily into the bloodstream.
It contributes disproportionately to human disease, and includes brain lesions resulting in neurobehavioral abnormalities.[21]

With small increases in airborne particulate matter exposure, human risks increase for the following:
• Cardiovascular disease-- heart attacks, strokes
• Respiratory disease-- asthma attacks, lung cancer
• Fetal and neonatal illness.
• Childhood illnesses: Pediatric allergies, ear/nose/throat and respiratory infections early in life, impaired lung development in children that affects lung function in adulthood, asthma, bronchiolitis, exacerbation of existing asthma and exacerbation of cystic fibrosis.
• Geriatric illnesses: Including exacerbation of chronic obstructive pulmonary disease, congestive heart failure, heart conduction disorders, myocardial infarction and coronary artery disease, and diabetes in the elderly. [22] [23]

Formaldehyde causes cancer.[24] It may cause the irritation of the respiratory tract which is a common complaint near compressor stations.

Polychlorinated Biphenyls (PCBs) Aging pipelines have been found to contain PCBs which the EPA began regulating in the 1970s.[25] However, the EPA is in the process of re-assessing those rules. [26] Cases of illegal dumping have been reported, which is of concern since PCBs could lead to a variety of illness, including damage to the immune system and fetuses, liver disease and chloracne, an acute form of skin rash, as well as cancer.[27] An independent report found that there is no way to completely eliminate PCBs from pipelines and processing facilities.[28] There should be a plan for monitoring since there is a chance that PCBs may accumulate in and around the proposed infrastructure.[29] [30]

Tons of pollutants, including formaldehyde, polycyclic aromatic hydrocarbons (PAH), benzene, styrene, toluene, xylene, hexane, acetone, and carbon tetrachloride could seep into the soil and the regional watersheds. [31]

(see Presentation by Matt Walker and Sam Koplinka-Loehr, Clean Air Council for Citizens Meeting on the Milford, PA compressor station on July 9, 2014). [32]

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[21] http://www.usatoday.com/story/news/nation/2014/06/09/air-pollution-autism-study/10226445/
[22] http://www.atsdr.cdc.gov/toxfaqs/TF.asp?id=396&tid=69
[23] http://www.psr.org/environment-and-health/climate-change/air-pollution/air-pollutants.html
[24] http://ntp.niehs.nih.gov/ntp/roc/twelfth/profiles/formaldehyde.pdf
[25] http://www.epa.gov/compliance/resources/publications/monitoring/tsca/manuals/pcbinspect/pcbinspectappg.pdf
[26] http://yosemite.epa.gov/opei/rulegate.nsf/byRIN/2070-AJ38#1
[27] http://www.nytimes.com/1987/02/26/us/pcb-dumping-by-4-pipelines-reported.html
[28] Papadopulos et al, 2010. PCBs in the Interstate Natural Gas Transmission System – Status and Trends. Access at http://www.ingaa.org/11885/Reports/10722.aspx and full report at http://www.ingaa.org/File.aspx?id=10753
[29] http://www.pca.state.mn.us/index.php/view-document.html?gid=17960
[30] http://www.ingaa.org/28.aspx?CFVreporttype=32
[31] http://www.picarro.com/resources/literature_publications/hydrocarbon_emissions_characterization_in_the_colorado_front_ran_0
[32] http://www.cleanair.org/program/outdoor_air_pollution/shale_gas_infrastructure/milford_compressor_station_air_impacts_commun

RADIOACTIVITY

For decades we have known shale to be radioactive.

The International Atomic Energy Agency and the International Commission of Radiation Protection have recommendations regarding radioactivity at oil and gas mining sites, and most countries which are members adhere to the recommendations. The US is a member but has instead exempted from federal oversight through RCRA (Resource Conservation and Recovery Act) the materials that come from down-hole which are, in many cases, radioactive. [33]

EPA region 3 reports that radium, measured as gross alpha and beta, in flowback water and produced waste in Pennsylvania wells is significantly higher than in other shales.

The following graphs are from a USGS report:[34]

Table 2. Ra-226, Ra-228, gross alpha, and gross beta activities measured in samples of produced water for wells listed in table 1. Analytical uncertainties are included when known

[TDS, total dissolved solids; mg/L, milligrams per liter; pCi/L, picocuries per liter; ND, not detected]

Well / Sample ID	TDS (mg/L)	Gross alpha (pCi/L)	+/–	Gross beta (pCi/L)	+/–	Ra-226 (pCi/L)	+/–	Ra-228 (pCi/L)	+/–	Total radium (pCi/L)	Ra-228/ Ra-226	Method, method codes
Source: PA DEP (2009–2010)												
1	54,000					436	32.2	121	8.2	556	0.28	SM2540C; EPA 904.0, 903.0
2	16,200	14	2	1,322	86	ND	1.8	ND	0.3			SM2540C; 7110C; EPA 900.0, 903.0, 904.0
3	333,000	19,220	2,843	7,944	1,320	50	1.3	37	3.3	87	0.73	SM2540C; EPA 900.0 903.0, 904.0
4	61,800	6,159	743	1,325	190	430	11.0	51	8.9	482	0.12	SM2540C; EPA 900.0, 903.0, 904.0
5.1	38,200	454	126	149	78	66	4.0	2.2	0.9	68	0.03	SM2540C; EPA 900.0, 903.0, 904.0
5.2	82,600	1,644	371	745	242	239	9.7	38	6.3	277	0.16	SM2540C; EPA 900.0, 903.0, 904.0
6		40,880	7,512	750	732	16,920	3,283	1,125	227	18,045	0.07	EPA 903.1, 904.0
7		21,960	4,074	980	757	11,120	2,204	1,287	261	12,407	0.12	EPA 903.1, 904.0
8	124,000					1,525	110	657	76	2,182	0.43	SM18 2540C; EPA 901.1 Mod.
9	284,000	11,810	2,482	1,060	759	4,184	789	1,074	202	5,258	0.26	SM20 2540C; EPA 903.1, 904.0
10	157,000					7,330	460	1,180	180	8,510	0.16	SM18 2540C; EPA 901.1 Mod.
11.1	157,000					951	86	703	69	1,654	0.74	SM18 2540C; EPA 901.1 Mod.
11.2	200,000					1,280	130	1,110	120	2,390	0.87	SM18 2540C; EPA 901.1 Mod.
12	183,000	7,530	1,141	2,683	372	562	26	648	67	1,210	1.15	SM18 2540C; EPA 900.0, 903.0, 904.0
13	358,000	10,356	2,186	11,595	723	892	32	2,589	128	3,481	2.90	SM18 2540C; EPA 900.0, 903.0, 904.0
14	1,470	ND	3	78	4	ND	0.31	ND	0.39	1.00		SM2540C; EPA 900.0, 903.0, 904.0
15	288,900	19,240		7,049		1,268		106		1,374	0.08	SM2540C
16	24,700	318	453	340	590	103	24	168	32	271	1.63	SM2540C; EPA 900.0Mod., 903.1, 904.0
17	88,500	3,640	1,004	ND	631	1,042	197	298	59	1,340	0.29	SM2540C; EPA 900.0Mod., 903.1, 904.0
18	116,000	2,320	800	2,077	929	1,037	200	515	97	1,552	0.50	SM2540C; EPA 900.0Mod., 903.1, 904.0
19	32,500	733	175	81	61	554	104	5.5	1.9	559	0.01	SM2540C; EPA 900.0Mod., 903.1, 904.0
20	45,400	845	213	379	116	66	4.05	1.4	0.3	67	0.02	SM2540C; EPA 900.0, 903.0, 904.0
21	46,460	820	249	505	140	76	2.7	23	2.4	99	0.30	SM2540C; EPA 900.0, 903.0, 904.0
22	47,800	585	163	536	83	36	1.75	2.7	0.2	39	0.08	SM2540C; EPA 900.0, 903.0, 904.0
23	125,100	2,103	631	1,574	335	229	6.8	56	6.5	285	0.25	SM2540C; EPA 900.0, 903.0, 904.0

[33] Recommendations from the International Atomic Energy Agency (IAEA) http://www-pub.iaea.org/MTCD/publications/PDF/TCS-40_web.pdf and
Federal exemption http://www.epa.gov/osw/nonhaz/industrial/special/oil/oil-gas.pdf

[34] http://pubs.usgs.gov/sir/2011/5135/pdf/sir2011-5135.pdf

Table 2. Ra-226, Ra-228, gross alpha, and gross beta activities measured in samples of produced water for wells listed in table 1. Analytical uncertainties are included when known.—Continued

[TDS, total dissolved solids; mg/L, milligrams per liter; pCi/L, picocuries per liter; ND, not detected]

Well / Sample ID	TDS (mg/L)	Gross alpha (pCi/L)	+/–	Gross beta (pCi/L)	+/–	Ra-226 (pCi/L)	+/–	Ra-228 (pCi/L)	+/–	Total radium (pCi/L)	Ra-228/ Ra-226	Method, method codes
Source: NYSDEC (2009)												
24		70	48	7	54	0.163	0.20	0.029	0.22	0.192	0.175	
25		54.6	37	59	58	0.195	0.16	0.428	0.34	0.623	2.195	
26		3,914	813	715	202	1,779	343	201	39	1,980	0.113	
27.1		17,940	8,634	4,765	3,829	2,472	484	874	174	3,346	0.354	
27.2		3,968	1,102	618	599	7,885	1,568	234	51	8,119	0.030	
28	206,446	14,530	3,792	4,561	1,634	2,647	494	782	157	3,429	0.295	
29		9,426	2,065	2,780	879	4,049	807	826	160	4,875	0.204	
30		7,974	1,800	1,627	736	5,352	1,051	138	37	5,490	0.026	
31		10,970	2,363	1,170	701	6,125	1,225	516	99	6,641	0.084	
32		20,750	4,117	2,389	861	10,160	2,026	1,252	237	11,412	0.123	
33	205,102	18,330	3,694	ND	654	13,510	2,655	929	179	14,439	0.069	
34		16,550	3,355	1,323	711	15,140	2,989	957	181	16,097	0.063	
35		123,000	23,480	12,000	2,903	16,030	2,995	912	177	16,942	0.057	
Source: NYSDEC (1999)												
36						669	88	1,100	250	1,769	1.644	γ-spectrometry
37						402	68			402		γ-spectrometry
38						1,164	93	429	27	1,593	0.369	γ-spectrometry
39						398	64	234	182	632	0.588	γ-spectrometry
40						259	47			259		γ-spectrometry
41						409	60			409		γ-spectrometry
42						413	61	856	222	1,269	2.073	γ-spectrometry
43						260	43	703	194	963	2.704	γ-spectrometry
44						63	71			63		γ-spectrometry
45						169	86	565	254	734	3.343	γ-spectrometry
46						306	126	568	248	874	1.856	γ-spectrometry
47						175	100	255	179	430	1.457	γ-spectrometry
48								347	55	347		γ-spectrometry
49						290	50	460	172	750	1.586	γ-spectrometry

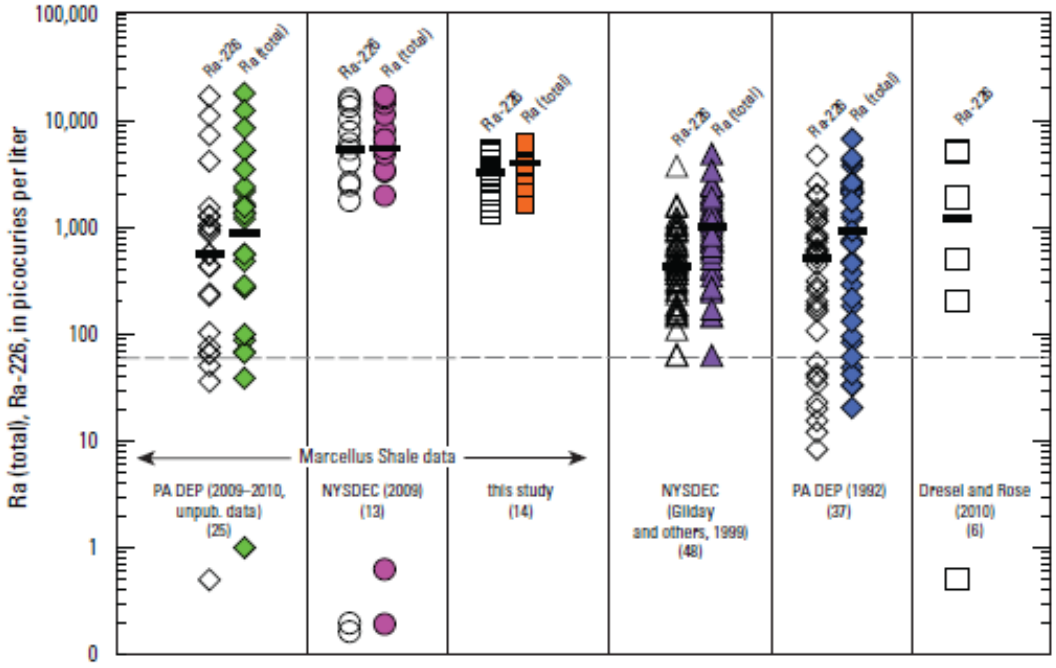


Figure 4. Measured activities for total radium (Ra-226 + Ra-228) and Ra-226 for each of the data sources used in the study. The three datasets for produced water from Marcellus Shale wells are shown on the left; the remaining three datasets are for non-Marcellus Shale wells. The number of points in each dataset is shown in parentheses, and the median values are plotted as heavy black lines. For reference, the dashed line shows the industrial effluent discharge limit (60 pCi/L) for Ra-226 (U.S. Nuclear Regulatory Commission, *http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/appb/Radium-226.html*).

The method measuring Radium 226 and 228 and their progeny has recently received scrutiny, and a new set of methods has been developed by the EPA[35]. The FPWHFO (flowback and produced water in hydraulic fracturing operations) matrix is considered to be a particularly challenging one due to its extremely high dissolved solids content and its complexity. This new method addresses that complexity.

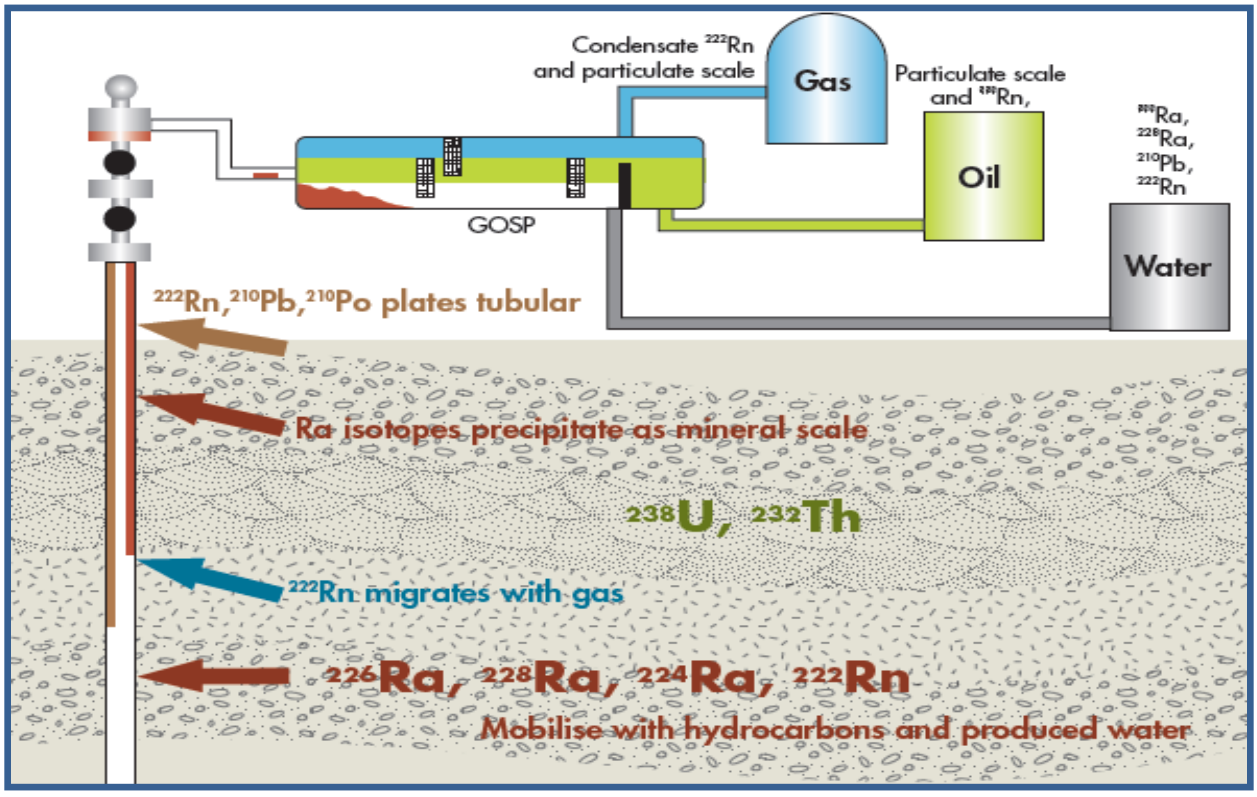
In brief, the calculations done using the older EPA methods have likely significantly underestimated the radium content of flowback and produced water. Please note that the methods used to detect radium in the USGS report[36] (EPA methods 903 and 904) have likely underestimated the radium content because of the high salinity in the samples.

Radon, a gas, has a short half-life (3.8 days) but among its progeny are lead and polonium, and these are toxic and have relatively long half-lives of 22.6 years and 138 days respectively. Lead causes neurologic and hematologic toxicity, and death; polonium causes cancer and death.[37] Radon and its radioactive decay products enter the body primarily through inhalation. Most of the radon is exhaled prior to radioactive decay but some of the solid radioactive polonium and lead remain in the lungs and may cause cancer.

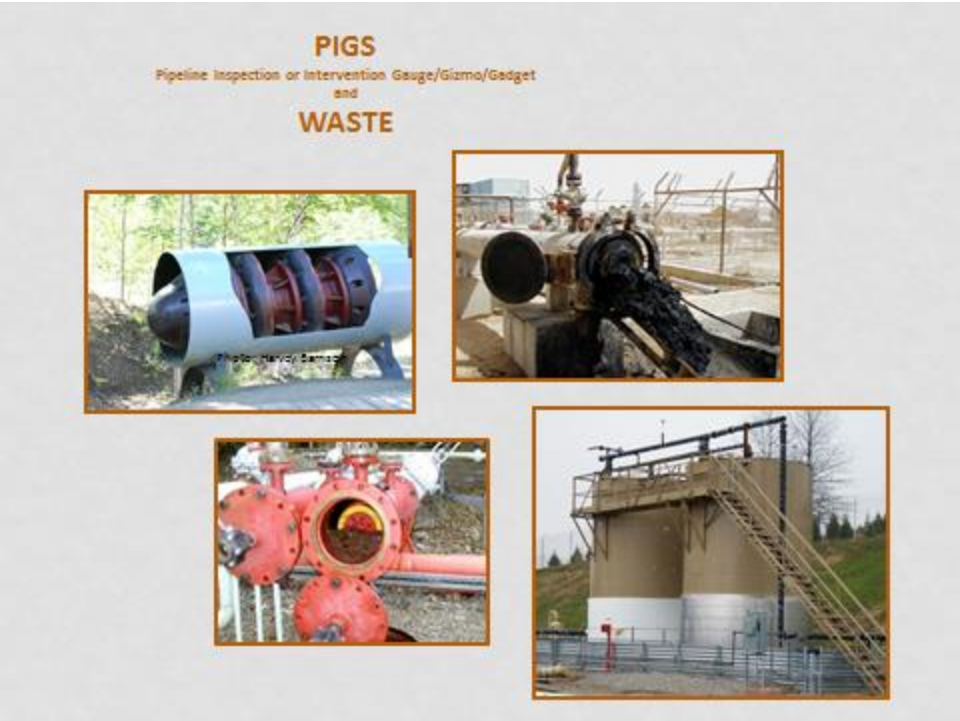
[35] http://www2.epa.gov/sites/production/files/2014-08/documents/epa-600-r-14-107_-_gross_alpha_-_gross_beta_508_km_08-08-2014.pdf
[36] http://pubs.usgs.gov/sir/2011/5135/pdf/sir2011-5135.pdf
[37] National Academy of Sciences 1988 report: Health Risks of Radon and Other Internally Deposited Alpha-Emitters: BEIR IV, page 5

The gas which flows through the pipeline carries gaseous radon with it, and as radon decays within the pipeline, the solid daughter elements, polonium and lead, accumulate along the interior of the pipes. There is a concern that the gas transiting, and being compressed and regulated, will have radioactivity levels which will be a risk not only to the workers at these stations and along the pipeline, but potentially also to the residents.

This is a description from the 2008 publication of the International Association of Oil & Gas Producers:
"During the production process, NORM flows with the oil, gas and water mixture and accumulates in scale, sludge and scrapings. It can also form a thin film on the interior surfaces of gas processing equipment and vessels. The level of NORM accumulation can vary substantially from one facility to another depending on geological formation, operational and other factors. To determine whether or not a facility has NORM contamination, NORM survey, sampling and analysis needs to be conducted. NORM may accumulate, *eg* at wellheads in the form of scale; at Gas/Oil Separation Plants (GOSP) in the form of sludge; and at gas plants the form of thin films as the result of radon gas decay.
"…radionuclides such as Lead-210 and Polonium-210 can … be found in pipelines scrapings as well as sludge accumulating in tank bottoms, gas/oil separators, dehydration vessels, liquid natural gas (LNG) storage tanks and in waste pits as well as in crude oil pipeline scrapings." -- OGP, "Guidelines for the management of Naturally Occurring Radioactive Material (NORM) in the oil & gas industry" International Association of Oil & Gas Producers, Report No. 412, September 2008.[38]
This graph from the same publication shows the origins of NORM, as well as where NORM can accumulate.



[38] http://www.ogp.org.uk/pubs/412.pdf



As radon decays within the pipeline, the solid daughter elements, polonium and lead, accumulate along the pipes. PCBs and other contaminants such as black powder[39] and anaerobic microbials do as well [40] [41]. PIGs (Pipeline Inspection or Intervention Gauge/Gizmo/Gadget [42]) inspect or clean out the pipe, and become repositories of these toxins. These PIGs, with pipe film, black powder, bacteria, scale and sludge, must be removed from the pipeline, stored and eventually disposed.[43] [44] [45] [46] An industry video of cleaning (with PIGs) can be viewed here[47]

NORM materials may become an inhalation risk when the material is dislodged by mechanical forces, such as wire brushing, pipe rattling *etc*.[48]
At each step, precautions must be taken to avoid contaminating workers and residents.

COMMUNITY IMPACTS

- We know that there will be air impacts and possibly impacts on water and agricultural land.

[39] Baldwin, Richard M. "Black powder problem will yield to understanding, planning." Pipeline and Gas Industry 82 (1999): 109-112. http://muellerenvironmental.com/Documents/100-056-Black%20Powder.pdf and Baldwin, Richard M. "Black powder control starts locally, works back to source." *Pipeline & Gas Industry* (1999): 81-87. http://www.muellerenvironmental.com/Documents/100-058%20Black%20Powder2.pdf
[40] Mueller, Fred, and Mark Null. "Impurities in the Gas Stream." Mueller Environmental Designs, Inc. Technical Document, 2005. http://www.muellerenvironmental.com/public/ProductDocuments.aspx
[41] Zhu, Xiang Y., John Lubeck, and John J. Kilbane. "Characterization of microbial communities in gas industry pipelines." Applied and environmental microbiology 69.9 (2003): 5354-5363. Access at http://aem.asm.org/content/69/9/5354.full.pdf
[42] http://en.wikipedia.org/wiki/Pigging)
[43] http://www.rigzone.com/training/insight.asp?insight_id=310&c_id=19
[44] http://www.pigtek.com/advanced_pipeline_cleaning.php
[45] Tsochatzidis, Nikolaos A., and Konstantinos E. Maroulis. "Methods help remove black powder from gas pipelines." Oil and Gas Journal 105.10 (2007): 52. http://www.desfa.gr/files/dimosieyseis/Tsochatzidis%26MaroulisOGJMar2007.pdf
[46] Lindner, Hubert. "A new cleaning approach for black powder removal." Pigging Products and Services Association, 2006. http://www.ppsa-online.com/papers/2006-Aberdeen-8-Lindner.Pdf
[47] http://www.cleanharbors.com/assets/downloads/videos/video-popup-pipeline-coating.html
[48] http://www.ogp.org.uk/pubs/412.pdf

- Homes near the compressor station may be de-valued.
- Tension within the community will rise.
- These factors can lead to stress and depression when the social fabric of the community unravels.
- Workers may be part of the community (or they may be brought in from Texas, Oklahoma, and Louisiana, etc) and they should be protected from hazards such as accidents, noise, radioactivity.
- A cornerstone of this industrialization is the truck traffic.
- It has been described that the gains are often in the form of a short-term boom for a few, but a resultant bust for the community follows.

NOISE

Noise can cause Vibro-Acoustic Disease which can lead to heart disease, neurological and gastrointestinal problems, as well as psychological issues.[49] Noise pollution raises the risk of heart attack and high blood pressure and cognitive deficits in children, and it can interfere with the ability to learn in children, as reported by the World Health Organization.[50]

There are adverse physical and mental effects from noise.[51] For example, prolonged periods of exposure to 65 dBA can cause mental and bodily fatigue. Noise can affect the quantity and quality of sleep; it can cause permanent hearing damage; and it can contribute to the development or aggravation of heart and circulatory diseases; and it can transform a person's initial annoyance into more extreme emotional responses and behavior.[52] One example of extreme and sometimes unexpected noise comes from blowdowns.[53]

[49] http://www.citidep.pt/papers/articles/alvesper.htm and http://www.fastcompany.com/1744151/air-pollution-causes-europeans-to-lose-16-million-years-of-healthy-living-annually-study

[50] http://www.euro.who.int/__data/assets/pdf_file/0008/136466/e94888.pdf

[51] http://www.earthworksaction.org/noiseresources.cfm#GENERALNOISE

[52] Marsh, A. 1999. University of Western Australia, School of Architecture and Fine Arts. Cited in East of Huajatolla Citizens Alliance. *Noise*

[53] http://www.transcanada.com/docs/Our_Responsibility/Blowdown_Notification_Factsheet.pdf

In these photos air emissions are visible with special infrared cameras. They cannot be seen with the naked eye.

The most common COMPLAINTS associated with O&G activities in people living near compressors include:

- Skin rash or irritation
- Eye irritation
- Gastrointestinal problems such as pain and nausea
- Respiratory problems such as difficulty breathing or cough
- Upper respiratory problems such as congestion, sore throat and nosebleeds
- Neurological problems such as headaches, movement disorders, dizziness
- Psychological problems such as anxiety, depression, stress, irritability

Long-term consequences include:

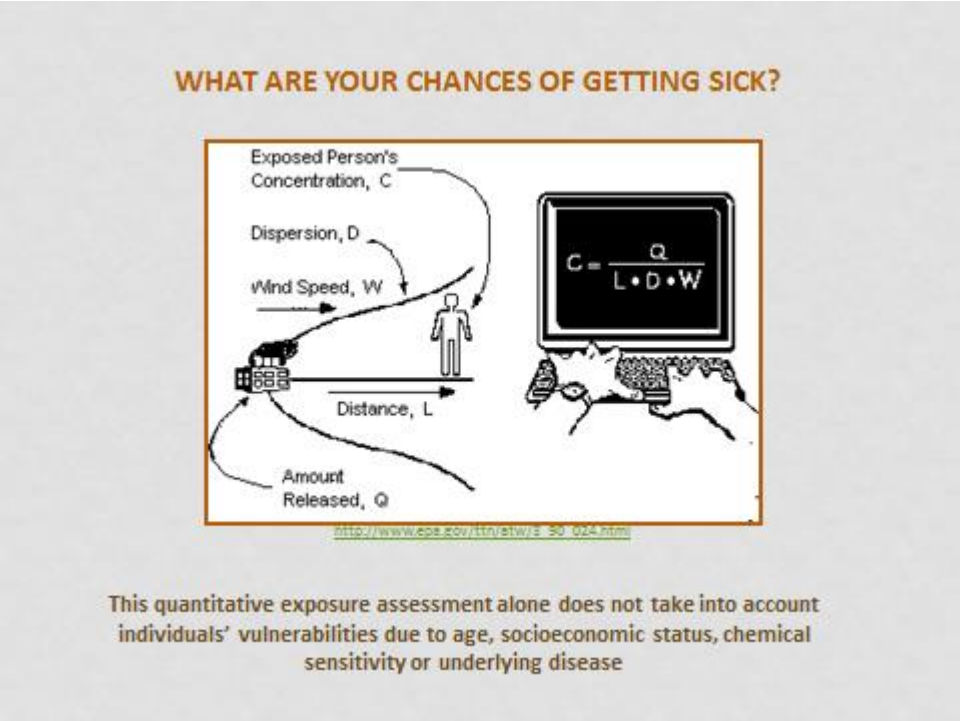
- Cardiovascular such as heart attack and high blood pressure
- Respiratory such as exacerbation of asthma, COPD
- Neurological such as stroke and cognitive deficits in children
- Birth defects
- Cancer
- Premature mortality

Children and pregnant women are particularly affected in adverse ways by environmental toxins[54]. Children are especially vulnerable to air pollution because their lungs continue to grow and enlarge until about age 18. Plus they breathe faster and are closer to the ground.[55] [56]

[54] CEH, 2013, http://www.ceh.org/legacy/storage/documents/Fracking/fracking_final-low-1.pdf
[55] World Health Organization http://www.who.int/ceh/capacity/Children_are_not_little_adults.pdf
[56] http://www.who.int/ceh/capacity/Indoor_Air_Pollution.pdf citing Moya J et al. Children's behavior and physiology and how it affects exposure to environmental contaminants. Pediatrics, 2004, 113:996. and American Academy of Pediatrics Committee on Environmental Health. Pediatric Environmental Health, 2nd ed. Etzel RA, Ed. Elk Grove Village, IL: American Academy of Pediatrics, 2003. and Children's Health and the Environment – A global perspective. A resource guide for the health sector, WHO, 2005.

Air pollution has also been shown to be associated with birth problems[57], lower IQ in babies born to mothers with polycyclic aromatic hydrocarbon exposure during pregnancy[58] [59] and learning disorders in exposed children.

Neurodevelopmental disorders such as autism, attention deficit disorder, dyslexia, and cerebral palsy affect one in six children worldwide, and are increasing in frequency. Industrial chemicals that injure the developing brain are among the known causes for this rise in prevalence. Co-authors of a paper just published in Lancet Neurology, Grandjean and Landrigan, write: "Exposure to these chemicals during early development can cause brain injury at levels much lower than those affecting adults, and the real impact on children's health is just beginning to be uncovered."[60]



An exposure assessment considers the chemical and can predict relative risk based on air models which take into account wind direction, quantity released, distance travelled, and dispersion.[61] However, this quantitative exposure assessment alone does not take into account individuals' vulnerabilities due to age, socioeconomic status, chemical sensitivity or underlying disease.

Besides the problem with the air model and exposure equation predicting who will get sick, there is a myriad of other reasons why we don't know who will get sick.

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[57] Wilhelm at UCLA report on air pollution and premature births http://www.environment.ucla.edu/reportcard/article.asp?parentid=1700

[58] Perera, 2009 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2864932/

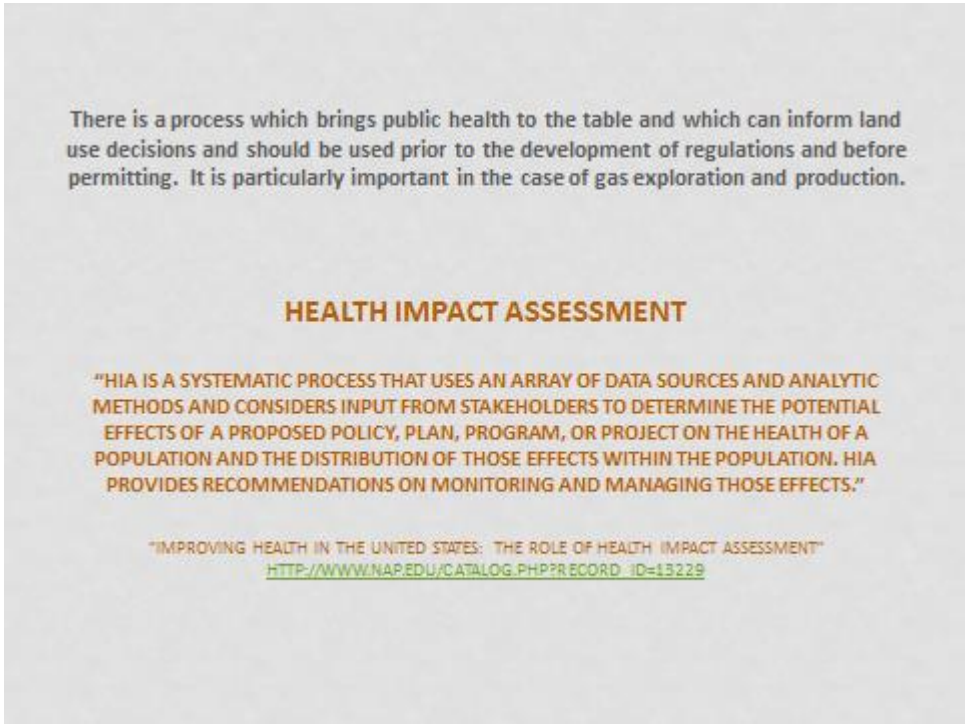
[59] Perera et al, 2006. Effect of prenatal exposure to airborne polycyclic aromatic hydrocarbons on neurodevelopment in the first 3 years of life among inner-city children. Environ Health Perspect. Doi:114(8):1287–1292. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1551985/

[60] Grandjean and Landrigan, "Neurobehavioural effects of developmental toxicity", Lancet Neurol 2014; 13: 330–38, doi:10.1016/S1474-4422(13)70278-3. Published Online February 15, 2014. Access online at http://download.thelancet.com/pdfs/journals/laneur/PIIS1474442213702783.pdf?id=baaj7wRR-UTIz8M5y3Zqu

[61] http://www.epa.gov/ttn/atw/3_90_024.html

- Most of the literature on health impacts has been published in the last 1-2 years, and usually not in the mainstream general medical literature, and the results have not been considered in the regulatory process
- Federal exemptions limit information at the national level. The oil and gas industry was granted exemptions from key provisions in the major federal statutes intended to protect human health and the environment.[62]
- Doctors are not adequately trained to recognize, nor do they have time to investigate, environmental exposures
- Community and environmental impacts need attention
- Vulnerable populations, especially children, have not been adequately addressed
- Worker safety needs attention (workers are parents and members of the community)
- Non-disclosure agreements prevent access to health information
- Comprehensive studies which include the infrastructure have not been done

Comprehensive health studies



Where there is political will to be advised by the results, there is a process that could bring public health to the table. However, it should be done prior to the development of regulations and before issuing permits. It is particularly important in the case of gas production because health impacts must be taken into account before deciding whether to go forward with this large land use decision.

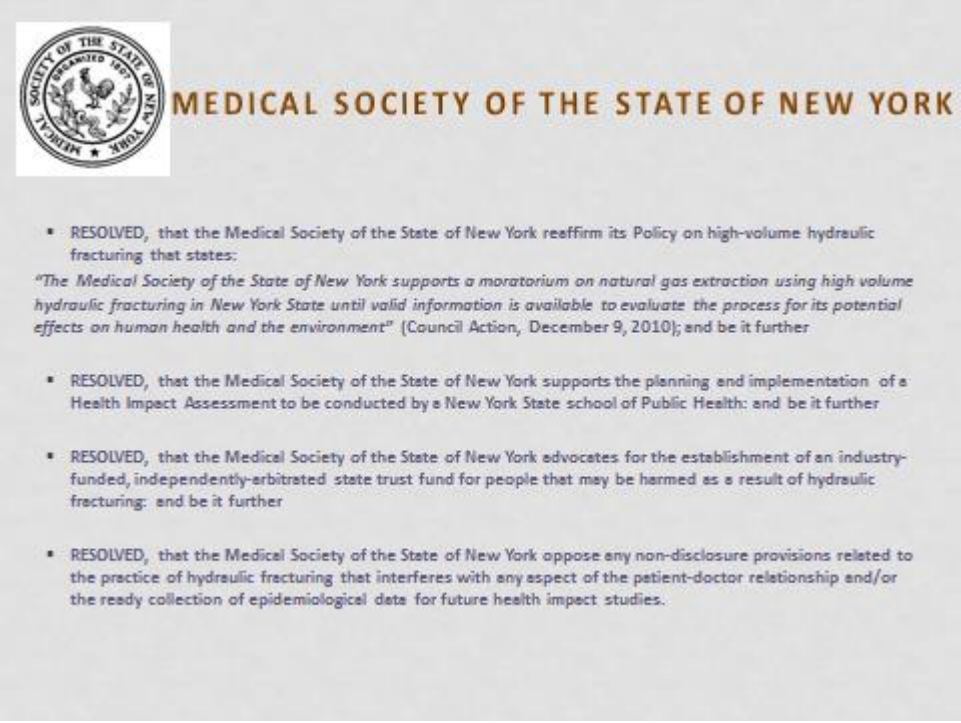
An HIA is a process which can be used in any land use decision to determine how human health will be impacted by the specific land use.

[62] http://www.earthworksaction.org/pubs/PetroleumExemptions1c.pdf and http://www.citizenscampaign.org/PDFs/cce_hvhf_wp_final.pdf

The practice of Health Impact Assessment (HIA) elevates the role of health in decision-making.
It can help create healthier communities by addressing the root causes of many health problems …and have demonstrated success in a variety of issue areas, ranging from land use and transportation to housing policies, labor standards, natural resource extraction, education and economic policies.

Characteristics of an HIA

- it's prospective, preventive and proactive
- do it before a policy or regulation is implemented
- It focuses on the health consequences of policies
- It identifies vulnerable groups and includes all stakeholders
- An HIA uses data sources that already exist and predicts the impact by considering direct and indirect health risks and solutions
- It is a decision support tool and not intended to simply evaluate a decision after it is made
- It offers recommendations for further study, and recommendations to improve health, and the lead advocates for those recommendations
- It has the potential to save healthcare costs in the long run[63]



The MSSNY has recommended the use of the HIA in gas development decisions.

They also recently passed a resolution supporting a policy that limits exposure to radon and its decay products and supporting legislation that protects the public health by ensuring that New York State is committed to reducing sources of excess radon emissions, and monitoring radon gas exposure levels to confirm that these radon gas levels do not exceed the recommended levels set by the EPA.

[63] http://www.nap.edu/catalog.php?record_id=13229

SUMMARY AND RECOMMENDATIONS

The permit application should provide a more complete evaluation of the potential health impacts.

Significant omissions include:

- Adequate attention to health impacts, including baseline health studies
- NORM management Plan
- Hazardous Materials Management Plan
- Resident concerns, including vulnerable populations

It is recommended that a revised, comprehensive and cumulative environmental impact study with a health impact assessment be conducted prior to making the decision about locating this compressor and other infrastructure. Evidence points to significant potential health issues and it would be wise to have all the information before making this decision.

That would include:

- Baseline measurements of air, methane and water, and continuous monitoring if compressor is approved.

And additionally:

- Cumulative emissions to include condensate tank emissions and fugitive methane;
- Best technologies;
- Electric compressor instead of gas-powered;
- Hazardous Materials Management Plan including plan for disposal of waste from condensate tanks and pipelines.

And a NORM management system which should include:

- Organizational responsibilities
- NORM monitoring requirements
- Workers' protection and training requirements
- Requirements to control NORM-contaminated equipment
- Requirements to prevent or minimize workplace contamination.

In addition to the references provided in the text, compendia of health impacts of oil & gas exploration, production and distribution are listed here, and should be studied and included as references:

- PSE for Healthy Energy PSE STUDY CITATION DATABASE on Shale Gas & Tight Oil Development http://www.psehealthyenergy.org/site/view/1180#sthash.CHp8vErJ.dpuf
- Concerned Health Professionals of NY Compendium http://concernedhealthny.org/compendium/
- Southwest Pennsylvania Environmental Health Project www.environmentalhealthproject.org

Larysa Dyrszka MD
Co-founder Concerned Health Professionals of NY
Lar917dy@gmail.com
PO Box 355
White Lake, NY 12786