Potential Impacts of the Expanded Iroquois Compressor Station in Brookfield, CT

Prepared for Sierra Club, CT

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About the authors of this report

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Executive Summary

The following report addresses the potential public health implications of Iroquois Gas Transmission System's proposed ExC Project. The project revolves around the substantial increase in capacity at several compressor stations along the Iroquois Pipeline, including one in Brookfield, Connecticut. The Federal Energy Regulatory Commission (FERC) has reviewed the overall project's justification and plan and has approved it. This report provides a counter-argument -- that there could be consequential health risks produced if the project goes forward.

Members of the Brookfield community, as well as advocacy groups, have concerns that risks to public health have not been adequately addressed; that the community will not be protected from harm should the project go forward. A particular concern in the community is the proximity of the site to the Whisconier Middle School. It is well documented that healthy children are more vulnerable to air contaminants than healthy adults.

The States of Connecticut and New York have the opportunity to question the case for public health protection presented by FERC and Iroquois. The states can then decide whether the goal of increased natural gas supply to ConEd and National Grid outweighs the emission exposures produced in the community. In this report, we argue that the projected 'insignificant air quality impacts' on the Brookfield community are inadequate and the risks to residents are real.

For public agencies to protect human health, they need standards that are sensitive to and consistent with the known routes of exposure, the duration and frequency of exposures, the nature of chemical ss, tissue repair rates, plausible target organs, and the increased sensitivity of susceptible populations. Air monitoring efforts must be complex enough to account for the actual mechanisms at work in the exposure-receptor relationship. They must also be sufficiently robust to measure fine-grained, hour-to-hour variability in air concentrations.

Section 1 introduces the context for thinking about the Brookfield expansion and the community which will be affected by it.

Section 2 profiles the emissions from compressor stations – how emissions are released and what they contain. Emissions include combustion emissions; fugitive emissions, which are leaks and other uncontrolled or under-controlled releases from the equipment; and pipeline emissions resulting from what are called *blowdowns*. These are large releases of methane and other gases that are in the pipeline near the compressor station. Blowdown emissions can be at an immense scale and are primarily methane but also may contain ethane, propane, butane, nitrogen, carbon dioxide, hydrogen sulfide and other Hazardous Air Pollutants. Emission sites at a compressor station include the compressors themselves, but also emergency generators, tanks, cooling units, other equipment.

Section 3 provides a short discussion about the National Ambient Air Quality Standards (NAAQS) and the role they play in deciding whether a large emission-producing project should

go forward. NAAQS are regulatory limits intended to produce "an adequate margin of safety" in air quality. The NAAQS are routinely used for this type of infrastructure evaluation but, in fact, they are a blunt tool intended to protect regional air quality, while being mindful that industries must – for the most part – be capable of achieving the standards. They were not designed for hyper-local protection adjacent to industrial activity. They are not truly health protective.

Section 4 presents the projected emissions from the Brookfield compressor expansion, relying on FERC documents, a human health risk assessment, and Iroquois's application materials. While there will be construction emissions, the focus is placed primarily on the operational emissions, which would be expected to go on for years. Emissions from the site include the NAAQS Criteria Pollutants of particulate matter ($PM_{2.5}$ and PM_{10}), ground level ozone (O_3), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), as well as a long list of Volatile Organic Compounds, and other Hazardous Air Pollutants.

Section 5 moves from the emissions expected to be released at the compressor station to the community exposures to those emissions. In this section we expand on the importance of the timing, contents, and volume of emissions the community will be exposed to, explaining that short-term peaks of emissions can have serious public health impacts but are rarely considered by companies and public decisionmakers. Instead, emissions are generally averaged over long periods of time and considered to be relatively benign. This section also highlights the known health risks from the gases and chemicals emitted. For instance, health risks in the short term from VOCs include eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reaction, nausea, and memory impairment. Effects from long-term exposure include loss of coordination and damage to the liver, kidney, and central nervous system as well as elevated risk of cancer. Health effects from particulate matter affect both the respiratory and cardiovascular systems. Inhalation of PM2.5 can cause decreased lung function, aggravate asthma symptoms, cause nonfatal heart attacks and high blood pressure.

Section 6 takes a brief look at Environmental Justice considerations.

Section 7 contains a conclusion and recommendations for before a final decision is made and in the event that the permit is granted. They are provided here as well.

Before a decision is made, there should be:

- A study of the impact on the school specifically, accounting for children's vulnerabilities and the fact that guidelines for air toxics do not often take into consideration that children's bodies will react differently than will adults.
- A study on the feasibility and pros and cons of electric-powered site for Brookfield specifically, along with implementation of other emission reduction technologies as described by EPA Star Program.
- An assessment of current and projected ground level ozone concentrations
- Provide answers to questions raised about the Human Health Risk Assessment

If the project goes forward, the state should:

- Establish an alert system for blowdowns or other large emissions and/or noise events.
- Put emergency plans in place, including a way to quickly evacuate the students and staff from the Middle School, as well as the immediate neighborhood of High Meadow Lane, Hunting Ridge and Fox Tail Lane.
- Request that school administrators keep records of students' health issues while at school and make those (de-identified) data available to CT DEEP.
- Institute a fence line monitoring protocol strategy that includes monitors at cardinal points around the site with real time, publicly available data reporting.
- Require best practices to ensure that effective emissions control and reduction measures are kept up to date.
- Consider developing public health education and promotion initiatives to educate the community on known health risks associated with living near a compressor station.

It is worth bearing in mind, when considering the analysis of the Iroquois ExC Project, that it runs counter to the goals of the Connecticut Department of Energy & Environmental Protection. Goal number one for CT DEEP states, "We are actively addressing climate change by advancing emission reduction strategies that support an affordable, reliable, and clean energy economy, and integrating science-based adaption and resilience planning into our stewardship of natural resources, state and utility infrastructure and operations, and our efforts to protect public health and safety."[1]

I. Introduction

Based on years of research on public health risks posed by natural gas infrastructure, a 2023 peer-reviewed journal article states

> Air pollution released by compressors is known to have significant negative health and environmental impacts to neighboring communities. Exhaust from combustion within compressor units is the major source of the air pollution, emitting chemicals that include volatile organic compounds (VOCs), nitrogen oxide compounds (NO_x), and particulate matter. Exposure to these air pollutants can be harmful to human respiratory, cardiovascular, and neurological systems and increase human mortality rates. Additionally, NO_x and VOCs react in the atmosphere to produce ozone, which aggravates human respiratory conditions like asthma.

And,

> Compressor stations can have a significant effect on local air quality; in some rural environments, emissions from compressor stations can account for 98%–99% of VOC ozone precursors and 57%–61% of NO_x ozone precursors. The main chemical emissions … are noteworthy because of their roles in two major forms of air pollution: smog and PM.[2]

The purpose of the expansion at the Brookfield compressor station (the Enhancement by Compression Project) is to provide increased natural gas transportation service for the energy companies, Con Ed and National Grid, to distribute the gas to New York City and Long Island. The Federal Energy Regulatory Commission (FERC) Environmental Assessment and Environmental Impact Statement, along with a Health Risk Assessment commissioned by the Iroquois Gas Transmission System, converge on the conclusion that the expansion will produce additional emissions, but its impact on the community will not be significant.

This report questions that conclusion and highlights the risks posed by the expansion project. It presents a deep and critical dive into the arguments produced by Iroquois and FERC as they defend the expansion of the Brookfield compressor station and ExC Project proposed by Iroquois. Iroquois requested authorization from FERC to expand natural gas transmission facilities in New York and Connecticut. FERC's mission is to "[a]ssist consumers in obtaining reliable, safe, secure, and economically efficient energy services at a reasonable cost through appropriate regulatory and market means, and collaborative efforts."[3] FERC is focused on the safety and integrity of the pipelines and the fuel products. It is not a public health agency.

Iroquois plans to add two large gas-fired turbine compressors, an emergency generator, and several smaller components to its existing Brookfield site, expanding its footprint. Emissions from the expanded site can travel great distances, but what is especially concerning is the area immediately surrounding the Brookfield Compressor station, which includes a middle school and homes. After commenting on emissions regulated by the EPA under the National Ambient Air Quality Standards and a long list of Hazardous Air Pollutants, Iroquois and FERC conclude

that “the [expanded] compressor station poses no significant risk.” It is now up to the State of Connecticut to decide whether it agrees and grants Iroquois the permits it is seeking from the state.

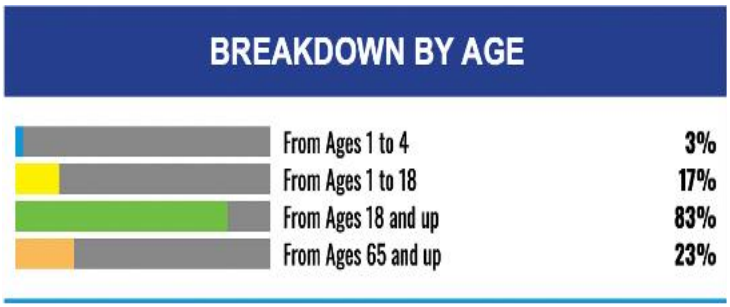
The purpose of this report is to clarify what emissions will be produced by the expanded compressor station and what public health impacts they may have; and to raise questions that should be answered by the state before the project can move forward. The residents of Brookfield do not individually benefit from the gas that will be moving, in significant volume, through the community but they will bear the brunt of the risks. They will be exposed to scores of chemicals, gases, and particles some of which pose cardio-vascular, respiratory, reproductive, and neurologic risks. Additionally, some are known or suspected carcinogens.

We conclude by raising important questions about the project, providing recommendations should the expansion proceed, and questioning the value of expanding natural gas infrastructure in the first place.

2. Community

A group of experts in the field of natural gas production and transport have said that setback distances from what is called a Title V compressor station (meaning a particularly large polluter – more on this later in the report) should be at least 3 km or 1.8 miles from any occupied building.[4]

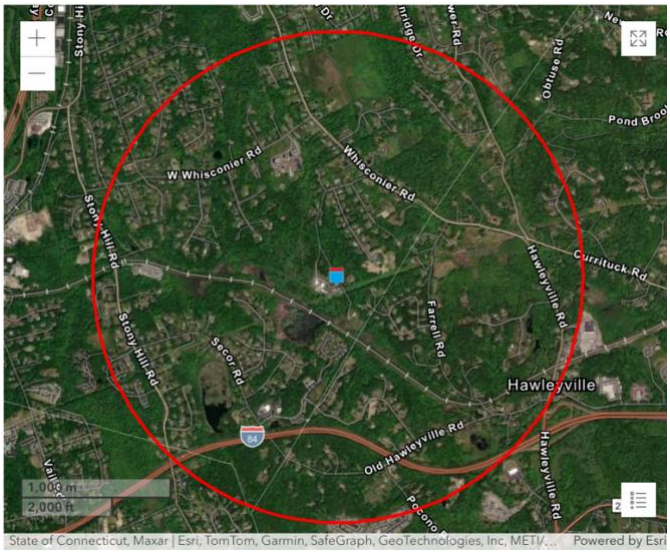
Within one mile of the compressor site, we see the following demographics[5]:



Within a 1-mile radius, according to the EPA, there are about 2,000 people and about 800 housing units. This population includes 125 children under five, 549 minors (17 and younger), and 293 adults 65 years and older. These are all categories of what are considered sensitive populations; that is, more vulnerable to air pollution impacts than healthy adults 18 to 54 years old.[6]

While the property line surrounding the Brookfield compressor station has not changed, the fence line will be expanded and therefore would be closer to the immediate community than it

had been. The site is approximately 1,000 feet from nearby homes and approximately 1,900 feet from the Whisconier Middle School (both distances are less than a quarter-mile). There are 790 students in grades 5-8 and 70 equivalent full-time teachers. The school enrolls 21% economically disadvantaged students with 28.1% minority enrollment.[7]



Brookfield residents should be assured that, should there be an emergency, the town and region are prepared to protect them from harm. A compressor station emergency can come in the form of a large or particularly toxic release, an explosion on the site, an explosion at a nearby pipeline, or a fire. The town does have its own safety officials and public health department. They also have an emergency plan. According to the Town of Brookfield website,

> The primary mission of the Brookfield Health Department Is to create a healthy environment for its' citizens; through the promotion of essential public health endeavors; through the prevention of the spread of disease, premature death, illness and disability, and, through the protection of the community through emergency preparedness planning, disease surveillance and public health hazard mitigation.[8]

Any safety and emergency plans in place must be revisited should this expansion move forward. One of the most important safety actions will be the ability to quickly evacuate the children and staff of the Middle School and the immediate three road neighborhood that share only one way in and one way out via High Meadow Lane.

<u>Interviews with community members</u>

In talking with community members active in the fight against the expansion, we heard the following concerns:

- Venting will occur next to the Whisconier Middle School and students may have health impacts from the site.
- An emergency plan may not be adequate.
- Noise and vibration may impact people near the site.
- It's not just the compressor station expansion. There are aging pipelines that could be expanded and that would also put people at risk.
- Iroquois will not stop with this compressor expansion but are looking to buy more property in the surrounding area.
- This is area is a residential zone, not an industrial zone
- Electric-powered compressors would be safer for the community.
- There is concern about drinking water given that homes and the middle school are on well water.
- Neighbors of the compressor station already complain about "frequent" blowdowns.
- The current fence around the site is inadequate and does not enclose the whole facility. A new fence should be secure and complete.

3. Compressor Station Emissions

Emissions are released at various points on the compressor station property from several types of sources. Compressor station emissions from the ExC Project can be classified into two main categories: construction emissions for the expansion project and operational emissions thereafter. Operational emissions at the Brookfield Compressor Station are largely, but by no means entirely, combustion emissions from the natural gas-fired infrastructure. Combustion emissions from the compressor turbines can occur relatively consistently over a given year and their constituents and human health impacts have been studied extensively. Combustion emissions include carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), carbon

monoxide (CO), fine particulate matter (PM2.5 and PM10), sulfur dioxide (SO2), and nitrogen oxides (NOx) vented from the stack.

Additionally, within operational emissions there are three types of emissions that warrant individual attention – fugitives, blowdowns, and accidents. Fugitive emissions are uncontrolled or under-controlled releases of gases and other compounds from the site. They occur from equipment leaks and evaporative sources including from piping components such as valves, flanges, connectors, pressure and meters. Fugitive emissions can increase over time as machinery begins to wear.[9]

Another category of emissions result from *blowdowns*. A blowdown is a massive planned or unplanned release of pipeline gas at the compressor station. Pipelines carry primarily methane, but also may include ethane, propane, butane, nitrogen, carbon dioxide, hydrogen sulfide and other *Hazardous Air Pollutants* such as hexane, BTEX compounds, 2,2,4-trimethylpentane, and hydrogen sulfide. During a blowdown, a section of the pipeline is blocked off and its contents released out to the atmosphere (starting of course in the immediate area). Planned gas venting may be performed during normal operations and maintenance activities to ensure proper operation of the systems or can occur to release gas prior to performing work on the facilities. Unscheduled gas venting of the emergency shutdown system is an unplanned event and can occur at any time under an abnormal operating condition. Iroquois states that it will capture about 90% of emissions from *maintenance blowdowns*. It is not altogether clear what *maintenance blowdowns* cover but certainly not emergency or accidental releases and perhaps not releases of normal operations of regulating pressure. There are also likely releases from storage tanks, cooling plants, and other facilities on the site. Lastly, there are occasional accidents at compressor stations which can result in fire, air contaminants, and depending on the location, water contamination.

<u>Emissions Associated with an Expanded Compressor Station</u>

In this section, we provide the projected emissions of the Brookfield compressor station expansion as detailed in FERC's EA and EIS. We will put these projected emissions – the emissions constituents, concentrations, volume over time, and inhaled dose expected – in context by considering federal air quality guidelines, a Human Health Risk Assessment, background air quality, and research on select air contaminants and the health risks they pose.

Here are the proposed additions to the site:

1. Two new 12,000 hp natural gas fired turbines
2. Associated cooling, filter separators and other typical facilities connecting to existing 244-in-diameter mainline.
3. Install incremental cooling at Plant 2A to allow for compressed discharge gas to be cooled, prior to being compressed at the downstream new compressors
4. Replace existing turbine stacks on the existing compressor units
5. Add noise reduction measures (e.g., louvers, seals)
6. Expand the existing fence line within the property boundary

7. Add a new emergency generator to the site (the generator is not in the bulleted list of additions to the site in the reports)

Construction Emissions Provided in the EA and EIS

Construction emissions consist largely of diesel emissions. Diesel combustion exposure can have health consequences even after short-term exposures. Occupational health reports (OSHA and Mt. Sinai Selikoff Centers for Occupational Health) state that short term or acute exposures to diesel exhaust can lead to:

- Irritation of the eyes, nose and throat
- Lightheadedness, headaches, fatigue, and nausea
- Lung function changes which result in respiratory symptoms like coughing, mucus, and asthma attacks

Construction emissions overall are short-lived and occur for any new or modified site – be it a hospital, office complex, or fossil fuel infrastructure. The larger the project, however, the longer the period of emissions and risk to neighbors. The expansion of the Brookfield compressor site is expected to take many months. One of the biggest concerns about these emissions is the proximity to the Whisconier Middle School. Children are required by the state to be in school for a minimum of 180 days and 900 hours per school year. A typical school day is 6-7 hours, often followed by outdoor extracurricular activities. This will be an even greater concern when the site is operational, emitting nearly 24 hours/day, 7 days/week.

Operational Emissions Provided in the EA and EIS

The table below summarizes the projected operational emissions. Brookfield is highlighted in yellow.

Table E.10-1 (Revision of EA Table B-13)
Summary of Annual Operational Emissions[a] (continued)

Facility	Criteria Pollutants (tpy)							CO_2e (Metric tpy)[b]
	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	VOC	HAPs	
Emissions reduction due to recovering existing facility blowdown and seal gas emissions[c,d]	--	--	--	--	--	-1.73	--	-985.93
Dover Total[e]	65.11	15.26	1.55	30.48	30.48	1.69	1.21	108,134.87
Brookfield Compressor Station								
Existing Station PTE	39.30	1.75	0.50	8.80	8.80	2.80	0.70	74,681.20
Proposed Compressor Turbine	24.50	1.65	0.01	6.80	6.80	0.02	0.70	80,973.43
Proposed Emergency Generator	0.02	0.03	<0.01	0.01	0.01	<0.01	0.02	75.48
Proposed Storage Tank	--	--	--	--	--	1.00	--	--
Proposed Fugitive Emissions[c]	--	--	--	--	--	0.10	--	276.69
Proposed Vented Blowdown Emissions[d]	--	--	--	--	--	0.06	--	166.92
Brookfield Total[e]	63.82	3.43	0.51	15.61	15.61	3.98	1.42	156,173.72
Milford Compressor Station[f]								
Existing Station PTE	48.9	47.6	0.6	32.6	32.6	14.1	1.0	74,258.33
TOTAL[e]	**234.58**	**115.90**	**3.87**	**99.24**	**99.24**	**21.30**	**4.53**	**423,077.46**

NOx = nitrogen oxide; CO = carbon monoxide; SO_2 = sulfur dioxide; PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 microns; $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 microns; VOC = volatile organic compounds; HAPs = hazardous air pollutants; CO_2e = carbon dioxide equivalents.

[a] The Project would not result in new combustion air emissions at Milford Compressor Station.

[b] Total CO_2e emissions are presented in metric tpy for comparison with the GHG reporting rule requirements. Emissions are estimated to be 423,077.46 metric tpy or 466,364.30 tpy.

[c] Fugitive emissions include those associated with piping components such as valves, flanges, connectors, pressure relief devices, and meters.

[d] Vented blowdown emissions include both regular and emergency station blowdowns. Blowdown volumes were estimated based on a three-year average of the blowdown emissions from the operating stations. Emergency blowdown emissions were calculated similarly but not adjusted for controls. Negative values are adjustments to existing facilities for the emissions controls that would be installed for the Project

[e] The numbers in this table have been rounded for presentation purposes. As a result, the totals may not reflect the sum of the addends.

[f] Operational emissions presented for the Milford Compressor Station are based on data presented in the original EA associated with Certification of this station and is available on eLibrary under accession no. 20080104-4000. CO2e emissions were not listed in the emissions table at that time. The turbine emissions reported in the original EA for this facility are consistent with detail reflected in current CTDEEP permit (numbers 105-0102 and 105-0103). CO_2e emissions are estimated based on the equipment specifications for the existing gas turbines and available EPA emissions factors (see table B-13 of the EA); emissions from other sources at the compressor station are not known, but are expected to be negligible relative to emissions from the turbines.

This presentation of the proposed emissions is notable for a couple of reasons. First, providing annual emissions in tons per year fails to capture the short-term high peaks in emissions which can last minutes, hours, or days; from accidents, blowdowns, or when the emergency generator is engaged.

In Connecticut an emergency generator is only permitted to run for 300 hours or 12.5 days per year. Presenting the tons per year of emissions of the emergency generator, in particular, means very little in terms of its impact on local air quality over a year, as it is not continuous but intense for short amounts of time leading to short term peak episodic exposures. Second, while ozone (O_3) is not an emission per se, it is the result of NO_2 and VOCs in the presence of sunlight. How much ozone is produced at the site is important from a public health perspective, as are NOx, SO_2, $PM_{2.5}$, VOCs, and HAPs; and it should have been reported (more on this further down). According to the American Lung Association ozone air pollution at ground level causes serious health problems by aggressively attacking lung tissue by reacting chemically with it.[10]

<u>Brookfield Compressor – Title V Facility</u>

Iroquois's Brookfield compressor station is a Title V facility. The compressor station is considered a *major source* of air pollutants and is required to have this permit. Connecticut, like all states, is required by the Clean Air Act Amendments of 1990 (CAAA) to develop a Title V operating permit program to permit *major sources* of air pollution. EPA defines major sources as facilities that emit, or have the potential to emit, any criteria pollutant or hazardous air

pollutant (HAP) at levels equal to or greater than a specified set of thresholds. They may vary depending on the attainment status of the geographic in which the facility is located.

Among the emission requirements for Title V facilities are that no owner or operator shall cause or allow the emission of any regulated air pollutant during each consecutive 12 month period to be equal to or exceed the following:

1. For any regulated air pollutant that is not a HAP, Volatile Organic Compound (VOC) or Nitrogen Oxides (NO_x): 50 tons
2. For any VOC or NO_x emitted in a severe ozone nonattainment area: 12.5 tons
3. For any single HAP: 5 tons
4. For any combination of HAPs: 12.5 tons

Since this project is in an EPA designated severe nonattainment area for the 2008 ozone NAAQS, the emission requirements for ozone precursors VOC and/or NOx are specifically applicable to the project and should not exceed 12.5 tpy for both pollutants. Brookfield Compressor Station is a Title V source because potential nitrogen oxides (NOx) emissions exceed the major source threshold. The total annual operational emissions for NOx at the Brookfield Compressor Station site including the additional turbines and emergency generator is estimated to be 68.82 TPY. Under state regulations (RCSA §22a-174) Brookfield is also considered an *area source* of hazardous air pollutants (HAPs).[11]

4. National Ambient Air Quality Standards (NAAQS)

The National Ambient Air Quality Standards (NAAQS) are an important regulatory tool and are intended to protect public health by limiting how much pollution can be found in a region. And they have been successful. They are also often considered the final word on whether a facility is overly polluting. NAAQS covers six pollutants, called *criteria pollutants*. They are NO_2, CO, PM_{10}, $PM_{2.5}$, SO_2, and O_3; and are known to cause significant human and/or environmental harm. The standards have been tightened at various points and in fact, in February 2024, the EPA strengthened standards for PM2.5 from 12 ug/m3 to 9 ug/m3 based on strong research. This brings the combined enhanced compressor station and background exposure of 8.55 ug/m3 much closer to the guideline.

In the EIS, we see that Iroquois conducted its own analysis of regional air quality for NO2, $PM_{2.5}$, PM_{10}, CO, and SO_2 using EPA's AERMOD program to model expected emissions. They reported that the model was developed in consultation with the CTDEEP. It estimates the predicted concentrations of these pollutants using assumptions consistent with EPA guidelines. Background concentrations from representative air monitors were then added to the predicted concentrations and the total was compared to the NAAQS. The results of the air quality modeling analysis are presented in Figure 2. They indicate that the combined total of background and the expanded compressor station would not exceed these national standards. There is more to the story, however, than considering NAAQS.

The results presented in the table below also fail to report on predicted air quality impacts of ground level ozone, as a contributor to poorer air quality. This is a major oversight since Fairfield County is a nonattainment area for ground level ozone, which is expected to increase as a result of activities in the compressor station expansion. Nonattainment is defined as an area that does not meet all of the NAAQS levels. Since Fairfield County has not met this standard for ozone, the EPA has classified the whole of Fairfield County as being in moderate nonattainment from 2018 through 2024 for 8-Hour Ozone (2015) and severe 15 nonattainment from 2012 through 2024 for 8-Hour Ozone (2008).

Table B-14
Predicted Air Quality Impacts for the Project[a]

Facility / Pollutant	Average Period	NAAQS (µg/m³)	Facility Impact (µg/m³)	Background Concentration (µg/m³)	Facility Impact + Background (µg/m³)[b]
Brookfield Compressor Station					
NO_2	1-hour	188	32.97	103.5	136.47
	Annual	100	17.97	22.6	40.57
CO	1-hour	40,000	132	2,760	2,892
	8-hour	10,000	112	1,610	1,722
PM_{10}	24-hour	150	6.05	30	36.05
$PM_{2.5}$	24-hour	35	3.86	21	24.90
	Annual	12	0.85	7.7	8.55
SO_2	1-hour	196	0.32	10.5	10.82
	3-hour	1,300	1.85	10.5	12.35

Limits to the Utility of NAAQS

The NAAQS were not created to assess the air quality and safety in a small geographic area with fluctuating emissions. The NAAQS were designed to benchmark regional air quality; that is, whether the overall pollution level in a region, over time, is within the ambient air target zone EPA deems to provide an *adequate margin of safety*. EPA explains, "The *Clean Air Act* does not require EPA to establish primary NAAQS at a zero-risk level, but rather at a level that reduces risk sufficiently so as to protect public health with an adequate margin of safety. In all NAAQS reviews, EPA gives particular attention to exposures and associated health risks for at-risk populations. … Even in areas that meet the current standards, individual members of at-risk populations may at times experience health effects related to air pollution. They were not intended to regulate hyper-local conditions in proximity to an industrial site.[12]

As one example, the Agency for Toxic Substances and Disease Registry (ATSDR) June 2024 update of Guidance for Inhalation Exposures to Particulate Matter report states that:

> While regulatory values exist, such as U.S. EPA's National Ambient Air Quality Standards (NAAQS) for PM, their purpose is to set regulatory limits for … ambient air in the United States. However, as a general practice, ATSDR uses the most health-protective comparison value available for screening purposes. For PM, the most health-protective screening values established are the Air Quality Guidelines (AQGs) from the World Health Organization (WHO) in Geneva.[13]

Individual states can, and sometimes do, establish more conservative protections than the federal government.

Averaging Times and Dangerous Peaks

Current protocols used for assessing compliance with ambient air standards do not adequately determine the intensity, frequency and durations of the actual human exposures to the mixtures of toxic materials released regularly at UNGD sites, including compressor stations. The typically used periodic one-hour, 24-hour, and annual average measures can (and will) underestimate actual exposures.

Averaging over a year will wash out important higher spikes in emissions (thus exposures) that may occur at points throughout the year. These high spikes can put residents, especially susceptible groups, at risk for illnesses caused by air toxics. Even spikes lasting less than one hour (e.g., during a short blowdown) can have a significant health impact.

Summary points about NAAQS:

- NAAQS applies to six *criteria pollutants*. These are CO, Pb, NO_2, O_3, $PM_{2.5,}$ PM_{10}, and SO_2. There are many more produced at the compressor station.
- Being in compliance with NAAQS does not mean individuals or communities are fully protected from the impacts of a site's emissions.
- Emissions from compressor stations (including their ancillary on-site operations) do not occur uniformly over time. Most notably, they spike with use of emergency generators and blowdowns, but also with variable need for compression. For these reasons, it is important to take into consideration the averaging time used to calculate compliance for a given pollutant. If there is a consequential spike or a series of spikes in emissions, those will not be picked up in a long averaging time and can pose a different threat.
- When thinking about pollutant exposures to people in the community, it is important to take into consideration what those exposures will be at different distances from the site and for varied amounts of time.
- Public health is affected not only by emissions occurring over years, but also high bursts of emissions for short periods of time as little as under an hour
- Current protocols used for assessing compliance with ambient air standards do not adequately determine the intensity, frequency or durations of the actual human exposures to the mixtures of toxic materials released regularly at UNGD sites, including compressor stations.

- They aren't designed to fully account for the potential synergistic impacts of toxic air emissions.[14]

5. Health Risks

Characterization of Exposures

Emissions are only half of the public health equation. The other half is exposures – the fact that concentrations of pollutants travel off the site and into communities where people breathe them in. Susceptibility to exposure is highly variable from person to person, especially children, elderly persons, pregnant women, persons with pre-existing conditions or comorbidities.
It is well established that exposures to air pollution from compressor stations occur in their areas. As stated earlier, experts looking at the research on emissions and exposures to natural gas compressor stations found that community members up to two miles from a site could be impacted. Numerous studies have found associations from gas development facilities and health impacts. In a recent study, published in 2021, researchers conducted a 24-hour air sampling investigation to assess outdoor and indoor air contaminant levels at 4 homes near a compressor station in Jefferson County, Ohio. Among the three homes situated < 2 km from the compressor station, indoor benzene levels were 2-17 times greater than the Ohio Environmental Protection Agency indoor standard. Multiple other VOCs, including ethylbenzene, 1,2,4-trimethylbenzene, 1,2 dichloroethane, 1,3 butadiene, chloroform, and naphthalene also exceeded state standards for indoor concentrations.[15]

At its most simple, toxicity of a chemical to the human body is determined by the concentration of the agent at the receptor where it acts. This concentration is determined by the intensity and duration of the exposure. All other physiological sequelae follow from the interaction between agent and receptor. Once a receptor is activated, a health event might be produced immediately or in as little as one to two hours.[16] [17] In some instances, where there is a high concentration of an agent, a single significant exposure can cause injury or illness. These result in acute health effects as is the case of an air contaminant-induced asthma event. On the other hand, after an initial exposure, future exposures might compound the impact of the first one, in time, producing a health effect. Repeated exposures will increase, for instance, the risk for ischemic heart disease.[18]

Researchers have evaluated the wisdom of looking at short spikes in exposures as compared to averages over longer periods of time. They have found that, for instance, maxima of hourly data, not 24-hour averages, better captured the risks to asthmatic children, stating, "it is expected that biologic responses may intensify with high peak excursions that overwhelm lung defense mechanisms." Others have written, "Temporal metrics that reflect peak pollution levels (e.g., 1-hour maximum) may be the most biologically relevant if the health effect is triggered by a high, short-term dose rather than a steady dose throughout the day. Peak concentrations … are frequently associated with episodic, local emission events, resulting in spatially heterogeneous concentrations…."[19]

Lastly, there is a problem of assessing risk of some chemicals. Many of the chemicals that have been identified at UNGD sites or nearby do not have established comparison values by which to measure their potential health effects. Even those that do have comparison values often rely on standards from the occupational health sector so are set for healthy adults. Healthy adults will be more resilient in the face of many chemicals than children will be.

Mixtures

There are many studies on negative health effects from exposure to one single type of pollutant or simple mixtures of common pollutants, but compressor stations emit more complex mixtures.[20] A mixture of chemicals can change how pollutants are taken up by the body, as well as how fast the body can clear them. This is particularly important because VOCs often react in the atmosphere and form different chemicals as secondary pollutants; when evaluating how a mixture of pollutants can change the severity of health effects, secondary pollutants also need to be considered. Another complication is the possibility for compounding effects from other nearby polluting sources. It is apparent that the health risks of pollution combine, and may compound, with multiple exposures, so a complete risk analysis for a community must consider cumulative health risks.[21]

Chemicals that reach the body interfere with metabolism and the uptake and release of other chemicals, be they vitally important biochemical produced and needed by the body or other environmental chemicals with potentially toxic effects. Some chemicals attack the same or similar target sites creating an additive effect. This is the case with chemicals of similar structure such as many in the class of VOCs. Some mixtures like PM and VOC act synergistically to increase the toxicity of the chemicals. Other chemicals released environmentally are rapidly absorbed and slowly excreted. These slowly excreted chemicals will interfere with subsequent actions of chemicals because the body has not yet cleared the effects from the earlier exposure.

Children and health impacts

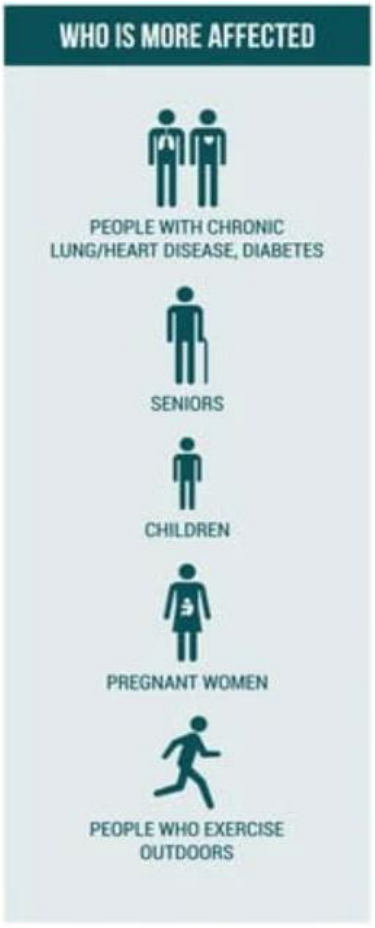
Exposures to various emissions from the expanded compressor station will be more readily taken up by children and they will be put at greater risk.

- Children accumulate more toxins in their bodies than adults.
- Children don't clear toxins from their bodies as efficiently as adults due to reasons related to growth and development.
- Children have higher breathing rates. When exposed to air contaminants, children breathe in more toxics per pound of body weight than adults.
- Children spend more time engaged in vigorous activity outside, so they breathe in more than they would sitting still.
- Children’s brains are still developing. Toxic agents used in shale gas development are known to interfere with brain development.[22]

Many studies confirm a range of adverse effects of air pollution on children's lung function and respiratory symptoms, especially for asthmatics. Recent studies have found statistically significant associations between the prevalence of childhood asthma or wheezing and living very close to high volume vehicle roadways.[23] Other research aimed specifically at children's $PM_{2.5}$ exposure has found that $PM_{2.5}$ and several of its components have important effects on hospital admissions for respiratory disease, especially pneumonia. The authors count among the sources for this exposure diesel exhaust, motor vehicle emissions, and fuel combustion processes.[24] While those living near the proposed Brookfield compressor station are not on what would be considered typical high volume vehicle roadways, during the construction phase of the project residents along the access roads will be exposed to heavy emissions. And even once the construction phase is completed and the expanded compressor station is up and running there are similarities in what Iroquois projects will emit and those emissions from high volume vehicle traffic.

<u>Other susceptible groups and sensitive populations[25]</u>

The term "sensitive" population subgroups, or "susceptible groups" is defined by the Agency for Toxic Substances and Disease Registry (ATSDR) as "people who are more sensitive to the effects of inhalation exposure to pollutants such as pregnant women, children, and older adults (≥65 years)."[26] Population subgroups that are especially sensitive often include people in the general population that have pre-existing respiratory (e.g., asthma, emphysema or chronic obstructive pulmonary disease (COPD)) or cardiovascular disease. Lower socioeconomic status groups are also at higher risk for adverse health outcomes from air pollution particularly exposure to elevated PM.



Studies also show that there are both $PM_{2.5}$ exposure and health risk disparities by race and ethnicity among minority populations, specifically Black populations (U.S. EPA 2022). The community around the Brookfield compressor station (1 mile radius) is composed of about 20% or one fifth people of color and 9% and just under one tenth low socio-economic status.

Pregnant women are especially sensitive to pollution. Health effects have been found in pregnant women from high particulate highway pollution. Such particle pollution "may provoke oxidative stress and inflammation, cause endocrine disruption, and impair oxygen transport across the placenta, all of which can potentially lead to or may be implicated in some low birth weight … and preterm births." The consequences do not stop with low birth weight and preterm births because these conditions can negatively affect health throughout childhood and into adulthood.[27]

Iroquois's Human Health Risk Assessment

Iroquois contracted with a consulting firm to quantify the potential health impacts of the expansion in a Human Health Risk Assessment (HHRA). It is part of Iroquois's case that it is safe to proceed. The HHRA Report focused attention on HAPs and based assessments on the operating parameters received from the manufacturers of the components and in fact, states, "Fugitive emissions and emissions associated with venting are considered insignificant compared to combustion emissions; therefore, the focus of this HHRA is solely on combustion emissions, specifically existing and proposed turbines and emergency generators." It would have been far better and more disclosing if they had included fugitives and venting. There are 0.1 ton (200 lbs.) of VOCs released as fugitives and one ton (or 2,000 lbs) emitted from the storage tank. There's not a good argument for leaving these and other vented emissions out of a risk assessment. As carried out by their consultant, Catalyst, however, they concluded that "current HAP emissions and those projected under the proposed Project are well below a level of health concern and do not pose an unacceptable chronic or acute risk to human health."

The consulting firm reports that in modeling the exposures in the community, it took into consideration an area from the fence line out "to point where impacts from the Project are no longer expected to be measurable." Was the determination of where the emissions would cease to be measurable set out ex ante or did they keep expanding the area until they predicted there would, in fact, be no measurable emissions? And in either case, what distance was that? Were those all averaged together to draw conclusions about the dispersion of emissions? How close compare to far?

Some of the "Chemicals of Concern" identified have missing data. For example, for toluene -- there's no IUR, adult or child cancer risk. But what is known about toluene that's not listed? It is known that the central nervous system is the primary target organ. Human studies have reported developmental effects, such as CNS dysfunction, attention deficits, and minor craniofacial and limb anomalies in children of pregnant women who were exposed to high levels. Looking at styrene, chronic exposure to styrene in humans results in effects on the central nervous system (CNS), such as headache, fatigue, weakness, and depression, CSN dysfunction, hearing loss, and peripheral neuropathy. Human studies are inconclusive on the reproductive and developmental effects of styrene; several studies did not report an increase in developmental effects in women who worked in the plastics industry, while an increased frequency of spontaneous abortions and decreased frequency of births were reported in another study. And several epidemiologic studies suggest there may be an association between styrene exposure and an increased risk of leukemia and lymphoma. However, the evidence is inconclusive due to confounding factors. EPA has not given a formal carcinogen classification to styrene.

Other specific questions raised after a critical review of the HHRA are: 1) Why, for chronic exposures and risk, do they only consider children as exposed for only six years? What if that was doubled to twelve years? For adults the reference point is 30 years. 2) What, exactly, are the full risks to children at the nearby middle school? 3) the table provided in the report uses

the label “turbine” and “generator.” It would be good to make sure that all turbines and generators are included in the figures provided. 4) Also, it would seem that a thorough HHRA would include criteria pollutants as well as the HAPs that they did include since criteria pollutants can also have acute and chronic health impacts. Generators are only permitted to run for 12.5 days per year. Could the HHRA provided a more nuanced picture of the risk that concentrated in a short time? 6) What if they included all emissions from the site?

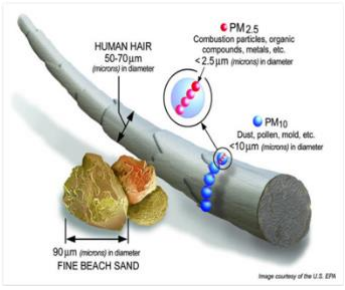
Carcinogens

Looking at the long list of “Chemicals of Concern” we see they included known and suspected carcinogens. We should bear in mind that according to the National Institute for Occupational Safety and Health, any level of exposure to a carcinogen can potentially increase cancer risk. The EPA and the International Agency for Research on Cancer also adhere to the principle that even minimal exposure to carcinogens can be harmful and recommend stringent measure to reduce risks.

Health Impacts of NAAQS pollutants provided by CT DEEP[28]

Ozone. Irritates the lungs and breathing passages, causing coughing and pain in the chest and throat. Increases susceptibility to respiratory infections and reduces the ability to exercise. Effects are more severe in children, the elderly and people with asthma and other respiratory ailments. Long-term exposure may lead to scarring of lung tissue and reduced lung efficiency.

$PM_{2.5}$. Aggravates existing heart and lung diseases, changes the body's defenses against inhaled materials and damages lung tissue. Lung impairment can persist for 2-3 weeks after exposure to high levels of particulate matter. Chemicals in and on particulates can also be toxic. Very fine particulates can be inhaled deeply into the lungs. When $PM_{2.5}$ reaches unhealthy levels, people with respiratory or heart disease, the elderly and children are most at risk.



NO_2. Short-term NO_2 exposures, ranging from 30 minutes to 24 hours, can produce adverse respiratory effects including increased asthma symptoms, more difficulty controlling asthma, and an increase in respiratory illnesses and symptoms. Studies also show a connection between short-term exposure and increased visits to emergency rooms and hospital admissions for respiratory illnesses, particularly in at risk populations including children, the elderly, and asthmatics.

SO_2. Aggravates existing lung diseases, especially bronchitis. Constricts the breathing passages, especially in people with asthma and people doing moderate to heavy exercise. Causes wheezing, shortness of breath, and coughing. High levels of particulates appear to worsen the effect of sulfur dioxide, and long-term exposures to both pollutants leads to higher rates of respiratory illness. When sulfur dioxide reaches unhealthy levels, people with asthma are most at risk. It is also the main contributor to acid rain and particulate pollution.

Health Effects from exposures to Volatile Organic Compounds (VOCs)

VOCs are a varied group of compounds which can range from having no known health effects to being highly toxic. Short-term exposure can cause eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reaction, nausea, and memory impairment. Long-term effects include loss of coordination and damage to the liver, kidney, and central nervous system. Some VOCs, such as benzene, formaldehyde, and styrene, are known or suspected carcinogens.[29]

The inhalation of the VOC, benzene, has been documented at compressor stations by the states of Pennsylvania and Texas. It produces a number of risks including

> [acute (short-term)] drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as known human carcinogen for all routes of exposure.[30]

Benzene poses a risk for cancer.[31] [32] There is growing evidence that benzene is associated with childhood leukemia. It affects the blood-forming system at low levels of occupational exposures, and there is no evidence of a threshold. It has been argued that "[t]here is probably no safe level of exposure to benzene, and all exposures constitute some risk in a linear, if not supralinear, and additive fashion.[33]

Another VOC that is detected near compressor stations is methylene chloride. According to the EPA

> The acute (short-term) effects of methylene chloride inhalation in humans consist mainly of nervous system effects including decreased visual, auditory, and motor functions, but these effects are reversible once exposure ceases. The effects of chronic (long-term) exposure to methylene chloride suggest that the central nervous system (CNS) is a potential target in humans and animals. Human data are inconclusive regarding methylene chloride and cancer. Animal studies have shown increases in liver and lung cancer and benign mammary gland tumors following the inhalation of methylene chloride.[34]

Lastly, the VOC formaldehyde is also considered a Hazardous Air Pollutant (HAP) by the US EPA (EPA).[35] Air exposures to formaldehyde target the lungs and mucous membranes and in the short-term can cause asthma-like symptoms, coughing, wheezing, and shortness of breath. The EPA classifies it as a probable human carcinogen.[36] The World Health Organization classifies it as carcinogenic to humans.[37] It has also been associated with childhood asthma.[38] The

California Office of Environmental Health Hazard assessment (OEHHA) has "identified formaldehyde as a Toxic Air Contaminant and gives it an inhalation Reference Exposure Level (REL) of 55 ug/m^3 for acute exposures and 9 ug/m^3 for both 8-hour and chronic exposures.[39] The acute REL is 74 ppb based on irritation of asthmatics.[40] It has also been linked with adverse pregnancy outcomes and reproductive and developmental toxicity.[41]

Noise and Vibration

The documents defending the expansion go to some length to try to assuage concerns about noise. There is some degree of noise produced by routine operations, and a huge degree of noise produced by blowdowns. We are not able, in this report, to speak to the efficacy of the sound-limiting technology that is proposed for the site. We do, however, recommend close monitoring should the project go forward (see Recommendations Section).

Uncertainties notwithstanding, research has demonstrated that chronic noise exposure can cause a wide array of health effects, including sleep disturbance, noise-induced hearing loss, cardiovascular disease and endocrine effects. The cardiovascular and endocrine effects appear to be associated with the sleep disruption and psychosocial stress of the chronic noise.[42] For additional information on noise, go to https://ehp.niehs.nih.gov/1307272/

6. Environmental Justice Concerns

The Brookfield communities surrounding the compressor station, under most definitions of the term, would not be identified as an *environmental justice community*. Environmental Justice communities are defined differently by different entities for different reasons. In essence, however, environmental justice communities are those that are burdened both socioeconomically and environmentally, often with a racial component. Communities and populations already at a resource disadvantage often have higher rates of existing health conditions and risks of future disease than the general population. It has been shown that being below the federal poverty line increases risk of mental illness, chronic diseases, increased mortality, and lower life expectancy. There is a great deal of research pointing to African Americans having higher rates of diseases such as hypertension, diabetes, heart disease, stroke, and cancer. These are likely multi-determined. Lastly, black women are more likely to experience poor birth outcomes than white women. Outcomes include infant mortality, preterm birth, and low birth weight. Black women also have a higher maternal mortality rate. On top of these disadvantages, exposure to air toxics can be even more dangerous.

We bring this up, not because Brookfield contains environmental justice communities per se, but because regardless of whether an area can be labeled as EJ, there are households, neighborhoods, individuals who do face disproportionate burdens due to income and/or race and they may be more exposed or vulnerable to environmental pollution. They may breathe in more air toxics where they live, work, or go to school.

7. Conclusions

The considerable expansion of the Brookfield compressor station, a site made of multiple industrial parts, will most certainly produce more air emissions which will disperse in the area and bring health risks to communities. The findings FERC used to OK the project fit a common pattern. They underestimate impact of the new total emissions by simplifying the whole assessment of how people on the ground are affected by their exposures to the air toxics produced. The expansion will not directly benefit the residents. It does not supply natural gas to their homes. It does not reduce the cost of natural gas to the residents. They will however, bear the risk.

Taking a further step back, it could be argued that a large investment in fossil fuel transport, does not in the long term benefit those in Brookfield … or anywhere. The expanded compressor station in Brookfield and the ExC Project will contribute even more greenhouse gasses (GHG) than the original compressor station. That GHG will be produced and will have impact upstream and downstream. It will have environmental, financial, social costs. Finally, it runs counter to the goals of the Connecticut Department of Energy & Environmental Protection. Goal number one for CT DEEP states, "We are actively addressing climate change by advancing emission reduction strategies that support an affordable, reliable, and clean energy economy, and integrating science-based adaption and resilience planning into our stewardship of natural resources, state and utility infrastructure and operations, and our efforts to protect public health and safety."[43]

Recommendations

Before a decision is made, there should be:

- A study of the impact on the school specifically, accounting for children's vulnerabilities and the fact that guidelines for air toxics do not often take into consideration that children's bodies will react differently than will adults.
- A study on the feasibility and pros and cons of an electric-powered site for Brookfield specifically, along with implementation of other emission reduction technologies as described by EPA Star Program.
- An assessment of current and projected ground level ozone concentrations
- Provide answers to questions raised about the Human Health Risk Assessment

If the project goes forward, the state should:

- Establish an alert system for blowdowns or other large emissions and/or noise events.
- Put emergency plans in place, including a way to quickly evacuate the students and staff from the Middle School.
- Request that school administrators keep records of students' health issues while at school and make those (de-identified) data available to CT DEEP.
- Institute a fence line monitoring protocol that includes monitors at cardinal points around the site with real time, publicly available data reporting.

- Require best practices to ensure that effective emissions control and reduction measures are kept up to date.
- Develop and make accessible public health education and promotion initiatives to educate the community on known health risks associated with living near a compressor station.

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