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Analysis of Regulatory Options to Reduce Ethylene Oxide Emissions in Southern Louisiana

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Capstone

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Table of Contents

Executive Summary

Toxic chemicals are dangerous when exposed directly to humans but are often vital for the production of goods and services. Ethylene Oxide is a carcinogenic gas used as a commercial sterilizer and emitted during the manufacturing process of common household goods. The term fence-line communities describes the residents living adjacent to facilities emitting toxic chemicals into the air. Several predominately minority, low-income fence-line communities in Southern Louisiana are exposed to higher than average levels of Ethylene Oxide from nearby manufacturing facilities. This raises environmental justice and overall public health concerns in the area. The Environmental Protection Agency (EPA) is charged with protecting the environment and human health within the United States. Under the Clean Air Act, the agency must establish regulations for toxic air pollutants used in manufacturing.

Regulations surrounding EtO are changing due to a recent study indicating the chemical has a higher associated cancer risk than previously thought. Industrial emitters believe the new cancer risk estimate is overly conservative and community members fear the regulation is not conservative enough. Ethylene Oxide exposure and associated cancer risk is an ongoing problem for Southern Louisiana communities and current regulatory measures have not brought emission levels to what the EPA deems sufficient for the protection of public health. The following analysis will evaluate policy alternatives for Ethylene Oxide regulation using effectiveness, political feasibility, and technical feasibility as measurement criteria. Alternatives will then be evaluated on these criteria and a policy recommendation made. The recommendation could be used to guide the future direction of Ethylene Oxide regulation. Before developing potential policy alternatives, a brief explanation of Ethylene Oxide and its usage, associated cancer risk, environmental justice concerns, and status of the policy will be outlined.

Ethylene Oxide

Ethylene Oxide (EtO) is colorless and has no smell unless present in very concentrated levels, making the detection of the gas nearly impossible to individuals who face daily exposure. The chemical is an effective sterilizer for equipment that cannot be heated or gotten wet and an estimated 50% of American medical devices are sterilized using EtO (EPA Jan 24, 2022). The chemical is also used to sterilize 32% of spices produced in the US as well as many other food products (EPA Dec 15 2021d). In addition, EtO is a chemical component used to create compounds necessary for the production of household products including antifreeze, textiles, and detergent (EPA Dec 15 2021a). In nature, EtO can be found in plant tissues as a growth regulator for developmental phases (Golden and Williams 2014). Despite its natural occurrence and benefits to society, EtO can also create a serious health risk when inhaled by humans.

Potential Carcinogen

The National Cancer Institute characterizes Ethylene Oxide as a known carcinogen if entering the body through inhalation. The same properties that make EtO an effective sterilizer, disruption of DNA and cellular decay, increase the likelihood of cancer for exposed individuals. EtO has been linked to lymphoma, leukemia, stomach, and breast cancer (National Cancer Institute 2018, EPA Dec 15 2021a). The EPA does not currently believe EtO to cause any adverse health impacts to individuals when present in low quantities. However, the long-term, higher than average exposure faced by Southern Louisiana communities is assumed to contribute to the increased cancer rates in the area.

Workers at local manufacturing plants are exposed to even higher levels of EtO and have an increased cancer risk. In addition, workers with short-term exposure to higher levels of EtO

may experience “headaches, dizziness, nausea, fatigue, respiratory irritation (such as couching, shortness of breath, wheezing) and, in some case vomiting and other types of gastrointestinal distress” (EPA Dec 15, 2021a). The chemical may also pose a larger risk to children who are more susceptible to mutagens due to their rapidly growing bodies and high rates of cellular division (EPA Dec 15 2021a). The National Air Toxics Assessment (NATA) is a screening tool used to estimate risk of developing cancer from exposure to toxic air pollutants. Using this tool, it is clear to see a concentration of cancer risk in the Southern Louisiana region (Appendix A2; EPA Jan 20, 2022). The high rates of cancer are likely a result of EtO and many other air toxics released into the community’s air each year.

In 2021, the EPA released a report detailing increased risk of cancer due to EtO exposure in communities surrounding BCP Ingredients, Taminco US, Union Carbide, Sasol Chemicals, and Evonik-Reserve (Rimer 2021, Appendix A1, B3-B8). Data in the reports came from the 2018 National Emissions Inventory (NEI), a report released every three years based on data provided primarily by emitting sources and state evaluations. The analysis of this data was conducted through a combination of the Human Exposure Model (HEM) and the American Meteorological Society/EPA Regulatory Model (AERMOD) to determine the dispersal of EtO and associated community health risks (Rimer 2021). The usage of these models allows the data to account for typical air patterns, Census population data, and elevation changes that may affect dispersal.

The Integrated Risk Information System (IRIS) database contains externally peer reviewed information on the level and duration of EtO exposure and the estimated health impacts. The estimates of cancer risk were modeled using these IRIS values assuming for linear low-dose exposure (Rimer 2021). Cancer risk was then estimated for every census block in a

50km radius of the emitting facility. Results are reported as increased cancer risk of #-in-1 million and are used to determine the increased number of individuals to develop cancer during a 70 year lifetime from EtO exposure per every million individuals, using estimated exposure levels from the census block with the greatest amount of pollution. The EPA determines an excess amount of risk resulting in a 100-in-1 million or less to be within the "acceptable" range (Rimer 2021). Of the five EtO emitting facilities overviewed in this paper, three exceed this acceptable exposure limit (Table 2).

Facility Name	Location	Maximum Individual Lifetime Cancer Risk (in 1 million)
BCP Ingredients	St. Gabriel, LA	10
Taminco US (Eastman Corp.)	St. Gabriel, LA	30
Union Carbide Corp., St. Charles Operations	Taft, LA	700
Sasol Chemicals (USA) – Lake Charles Complex	Westlake, LA	300
Air Products Performance Manufacturing Inc. – Reserve Plan (Evonik)	Reserve, LA	600

Table 2. 2021 Estimates of excess cancer risk reported in units of additional individuals per one million to develop cancer over a lifetime (Rimer 2021).

Environmental Justice

The placement of new industrial plants, landfills, and other noxious facilities and often contented by local communities. This can be explained by the Not In My Back Yard phenomenon (NIMBY). NIMBY-ism describes the tendency for property owners to be generally disinterested in the location of noxious facilities, so long as they are not "in their backyard" (Kinder 2022). These undesirable facilities may decrease property value and quality of life or can simply be an eye-sore that generates public outcry. The term was first used in the 1970's as

opposition grew in response to the construction of nuclear power stations and can be applied similarly to EtO emitting facilities (Kinder 2022). Facilities emitting carcinogenic chemicals such as EtO face stark opposition wherever they try to break ground on new development. In the face of such opposition, industrial polluters tend position themselves in low-income minority areas that have less political power to resist (Erikson 2016). This same trend has been followed in the placement of numerous industrial plants in Southern Louisiana surrounding low-income, minority communities. The communities are not only exposed to EtO but many other carcinogenic chemicals and activists have nicknamed their region "Cancer Alley".

According to the 2020 decennial census conducted by the United States Census Bureau, the averages found from Southern Louisiana communities directly affected by EtO emissions have a lower median annual income than the national average and a higher poverty rate and percentage of black individuals than the national average (U.S. Census 2020; Table 1).

Parish	Population	Median Annual Income	Black Alone Percentage	Poverty Rate
Iberville	30,241	$50,161	48.4%	23.7%
Calcasieu	205,282	$52,866	25.8%	16.6%
St. James	20,192	$51,603	48.8%	13.0%
St. John the Baptist	42,477	$57,429	58.4%	16.9%
St. Charles	52,780	$69,019	26.5%	11.3%
Average	**70,194**	**$56,216**	**41.6%**	**16.3%**
United States	**331,449,281**	**$62,843**	**13.4%**	**11%**

Table 1. Table detailing the population, median annual income, percentage of population whose ethnicity is African American alone, and poverty rate of the affected Southern Louisiana Parishes.

The close proximity to industry has direct negative health outcomes on these communities. In minor cases air pollution can case dizziness, asthma, and respiratory distress among other symptoms. In more serious cases residents who have faced chronic, long-term exposure to toxic chemicals are more likely to develop cancer (EPA Dec 15 2021a). For example, St. John parish has 47 times the national average of estimated cancer risk from air pollution and the EPA blames 12% of that total risk on EtO alone (CCOSJ 2020). In addition, a recent Harvard Study found that individuals suffering from long-term exposure to air pollution are more likely to have fatal cases of COVID-19 (Wu et al. 2020). This data is in congruence with the communities in this analysis who have suffered some of the nation's highest rates of death in response to COVID-19 (CCOSJ 2020).

The environmental justice concerns present in the affected Southern Louisiana are described as environmental racism by a wide range of audiences from the local community all the way to the United Nations who stated:

> This form of environmental racism poses serious and disproportionate threats to the enjoyment of several human rights of its [the communities] largely African American residents, including the right to equality and non-discrimination, the right to life, the right to health, right to an adequate standard of living and cultural rights (UN 2021).

In a short documentary presented by NBA all-star Stephen Curry, a native of the area named Robert notes that he wishes to be "with the rest of his family, despite all of that", speaking in the middle of a cemetery surrounded by the tombs of his mother, sister, brother, uncle, and nephew, and great nieces and nephews (Curry 2021). In addition to historical and familial ties to the area, many residents do not have the financial capability to relocate.

Policy Background

EtO, like all other hazardous air pollutants, is regulated at the federal level by the EPA and these regulations are overseen by state environmental offices. Before potential alternatives can be considered a background of the current regulation, enforcement measures, and relevant stakeholders is provided below.

Policy Process

Before any new law is introduced there must first be a societal need for that law and the same can be said for environmental regulations. After the EPA investigates a potential threat to public health and the environment, the agency will make the determination if a regulation is necessary (EPA Sept 28, 2021). Next, a regulation will be drafted and posted to the Federal Register and available for public opinion for 60 days. The agency will take public comments into consideration and publish a final ruling that is codified in the Code of Federal Regulations (EPA Sept 28, 2021). Aside from the 60 day public comment period, there is no time limit for the duration of other regulation formulation steps, allowing the process to take years in certain cases. Policy formulation can be extended when the agency must perform extensive research into the threat at hand or through jerrymandering requests for additional information by industrial representatives. Activists lament the duration of this process as the threat to their health persists during the formation of policy to protect them. After initial research, first draft, and public comment period, the final rule will be filed and remain in place until sufficient evidence is provided for to make an update.

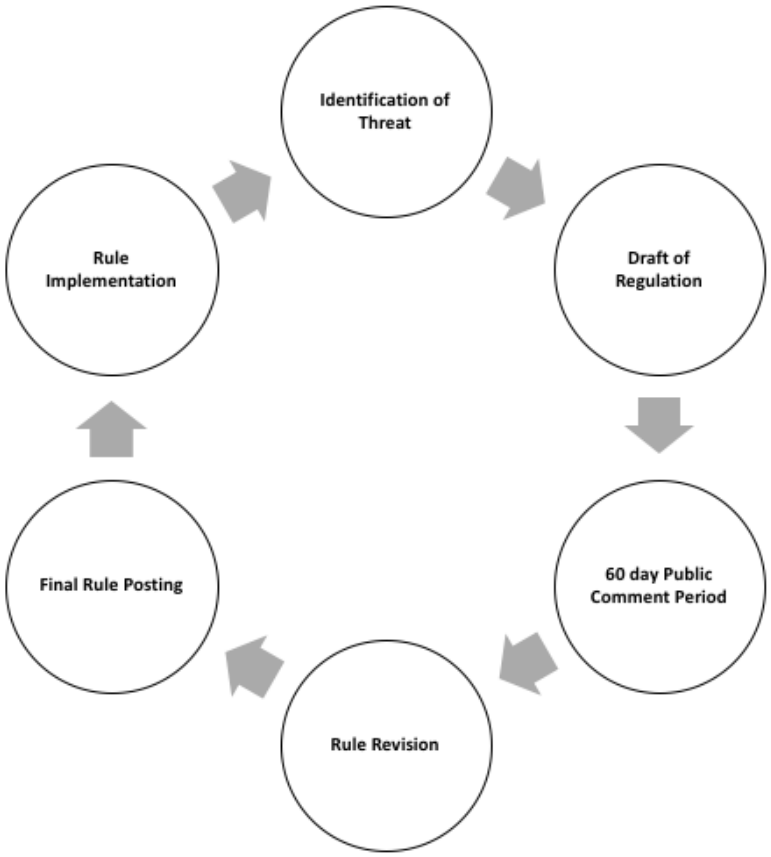

Figure 1. Diagram illustrating the policy process behind creation of federal environmental policy.

Regulatory Power

The Clean Air Act was first passed in 1963 and is housed under Title 42, Chapter 85 of the United States Code, a codification of permanent laws of the United States that is updated every six years by the House of Representatives Office of the Law Revision Counsel (United States Publishing Office 2021). The act entered the code following the same process as any other United States law by first being passed by Congress and then signed into action by the President. The Clean Air Act gives the EPA the power to interpret the law into regulations for establishing National Ambient Air Quality Standards (NAAQS) to protect citizens from harmful pollutants (EPA Sept 28, 2021).

In 1990 the Clean Air Act's Air Toxics Program was revised to expand the regulatory power of the law. Before its passing, the EPA was only allowed to regulate air toxics based on their risk to public health and limit human exposure with an ample margin of safety. This allowed the agency to only regulate 8 of the 187 known air toxins due to uncertainty on a "safe-level" of exposure for these other toxins. The Amendments to the Act required the EPA to identify major sources, those emitters releasing 10 tons per year of a single toxin or 25 tons per year of any combination of toxins. The EPA was also required to establish standards based on the average pounds of toxins limited from emissions by the best 12% off emissions reducing facilities (EPA Sept 28 2021; EPA 1995; Appendix B1, B2). The Maximum Achievable Control Technologies (MACT) used by these standard setting facilities are then permissible for use by other facilities to achieve the floor requirement for reduced emissions.

The standards developed from this process for stationary emitting sources are called National Emission Standards for Hazardous Air Pollutants (NESHAP). NESHAP requires major sources to undergo an initial performance test monitored by the EPA, self-reporting of monitoring data of control devices determined during the initial evaluation, and a full compliance evaluation by the state or regional EPA office biannually (EPA March 1, 2022). Monitoring may be required periodically or continuously depending on the permitting guidelines for each facility.

Ethylene Oxide is now one of 187 toxic air pollutants that the agency regulates. However, the agency does not have ambient air quality standards for these pollutants but instead develops standards with the maximum degree of reduction in emissions (EPA Dec 15, 2021). Developing regulations first accounts for MACT, or the requirement for emitters to use the best technologies available to the industry while taking into account reasonable cost burden. These technologies can include reduction or elimination of emissions through process changes, substitution of

materials, enclosure of system processes, capture and treatment of fugitive emissions, or increased efficiency of operational standards (U.S.C. Title 42 2013). Thus, the EPA regulates only the amount of emissions allowed per facility, not the type of equipment used to combat emissions. The second phase requires the agency to consider health risks of remaining emissions and determine whether MACT standards are sufficient to protect human health (EPA Dec 15, 2021).

Enforcement

Despite the power behind the law being federal, the majority of enforcement is carried out by state offices, in this case the Louisiana Department of Environmental Quality (LDEQ). The LDEQ participates in enforcement through permitting and compliance evaluations.

A full compliance evaluation includes the following:

> A review of all required reports and the underlying records; an assessment of air pollution control devices and operating conditions; observing visible emissions; a review of facility records and operating logs; an assessment of process parameters, such as feed rates, raw material compositions, and process rates; and a stack test if there is no other way to determine compliance with the emission limits (EPA July 13 2021).

In addition, all states must have State Implementation Plans (SIPs) in place to detail their processes for ensuring attainment of regulatory standard levels (EPA Sept 28, 2021). They are also responsible for issuing operating, general, interstate air quality, and deterioration permits (EPA Feb 11, 2022). States are permitted to have more stringent regulations that EPA requires but the state of Louisiana currently does not have any such regulations in place. Federal help can

come through the form of technical assistance of a federally run Air Toxics Clearinghouse and Center within the state, grant funding, and regulatory guidance (U.S.C. Title 42 2013).

The EPA has a limited budget and therefore has a limited number of staff members and projects it can reasonably take on, limiting the effectiveness of air quality control. During FY2020-2021, the Office of the Inspector General identified eight Top Management Challenges for the EPA, half of which directly or indirectly related to staffing issues. These four challenges include compliance with internal control requirements, overseeing states implementation of EPA programs, improving a workload analysis on efficiency in accomplishing the agency's mission, and fulfilling mandated reporting requirements (EPA July 21, 2020). The Clean Air Act Amendments of 1990 increased the number of sources regulated by the EPA to over 35,000 major source and 350,000 minor source polluters (Rosenbaum 2011). Not only does the EPA lack the resources to monitor all of these sites, the states are also unequip to maintain proper monitoring and rely on self-reporting from emitters.

Status of the Policy

Southern Louisiana communities have entered a policy window in which they have garnered attention of the EPA due to recent changes in assumed toxicity of EtO (Kingdon 2010). Beginning in 2016, the EPA started to reexamine its NESHAP around EtO. In September of 2019, the agency began collecting information about potential technology available to emitters and issued an Advance Notice of Proposed Rulemaking in December of the same year, allowing for public comment and alerting industry of potential changes to standards (EPA Jan 24, 2022). Before a new standard can be considered the EPA must gain a better understanding of concentrations of EtO near emitting facilities and ambient air. Initial research found elevated

levels of EtO downwind of emitting facilities, but also found the chemical at lower levels in ambient air around the country. Further data collection indicated that 0.2 to 0.4 micrograms per cubic meter, a level the agency does not believe at this time to pose harm to human health, are present in air samples collected from sites without EtO emitting facilities in the area (EPA Jan 24, 2022).

In August of 2020, the EPA finalized amendments for NESHAP standards concerning EtO and other miscellaneous organic chemicals (MON) from the manufacturing industry, known as the 2020 MON final rule. This ruling came after the EPA determined current regulation not to bring EtO emission within an acceptable risk range set by the agency (National Archives 2020). The ruling has been summarized by the EPA as establishing emissions limits and creating standards for new and existing pieces of equipment (EPA Feb 22, 2022). In addition, these amendments contained elevations for the estimated cancer risk associated with EtO and required reduction of equipment leaks and additional requirements for processing vents and storage tanks. National emissions of EtO are expected to drop by approximately 1,520 pounds annually following implementation of the rule (EPA Jan 24, 2022).

Since the release of the 2020 MON final rule, there has been pushback from industry who disagree with the EPA's claims that EtO poses a greater risk to cancer than previously believed. The industrial emitters prefer the lower estimated risk value given by the Texas Commission on Environmental Quality (TCEQ). Following proper procedure, the EPA is undergoing reconsideration of the ruling following petitions to do so. However, the EPA does not intend on proposing any changes to the risk value used in the MON ruling because the agency believes the data used to be the best available science (EPA Jan 26, 2022).

The ruling above is in regard to industrial manufacturing plants that emit ethylene oxide as a byproduct of their production of other chemical components. A separate ruling governs facilities using EtO for commercial grade sterilization. This rule was established in 1994 and last updated in 2006. The agency is currently undergoing a technology review of this rule and is examining developments in available control technologies and best practices since the last update (EPA Dec 15, 2021d). EPA is gathering data from commercial sterilizers through Information Collection Requests (ICR) under the Clean Air Act. These requests include self-reporting through questionnaires and the most recent responses were collected in November 2021 and are now under review (EPA Jan 26, 2022).

The EPA is also working to reduce the workplace hazard of EtO via inhalation by potentially labeling EtO a pesticide. Pesticides are governed under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and are required to have proper labeling on containers detailing safe levels and durations of usage (EPA Dec 15, 2021d). This elevation of importance came after the EPA's Office of Pesticide Program determined that EtO poses health risks following inhalation for workers in 2020. If EtO is labeled a pesticide it may decrease the amount of time workers can spend in contact with the chemical per day and increase standards of personal protective equipment necessary for handling. In addition, the EPA is continuing research into ambient EtO levels around the country. However, the agency lacks confidence in current technology to detect EtO near the minimum level of concentrations that measuring devices can detect (EPA Feb 22, 2022).

Stakeholders

Stakeholders play an important role in the development of any policy and EtO regulation is no different. One avenue for stakeholders to voice their opinions comes during public opinion periods. The EPA must allow time for public comment on any change of air quality rules and must respond to all substantial comments on the topic (EPA Dec 15, 2021). Stakeholders may include, but are not limited to, community groups, industrial emitters, private scientific bodies, or the government. The figure below illustrates the different stakeholder groups and the relevant players within those groups.

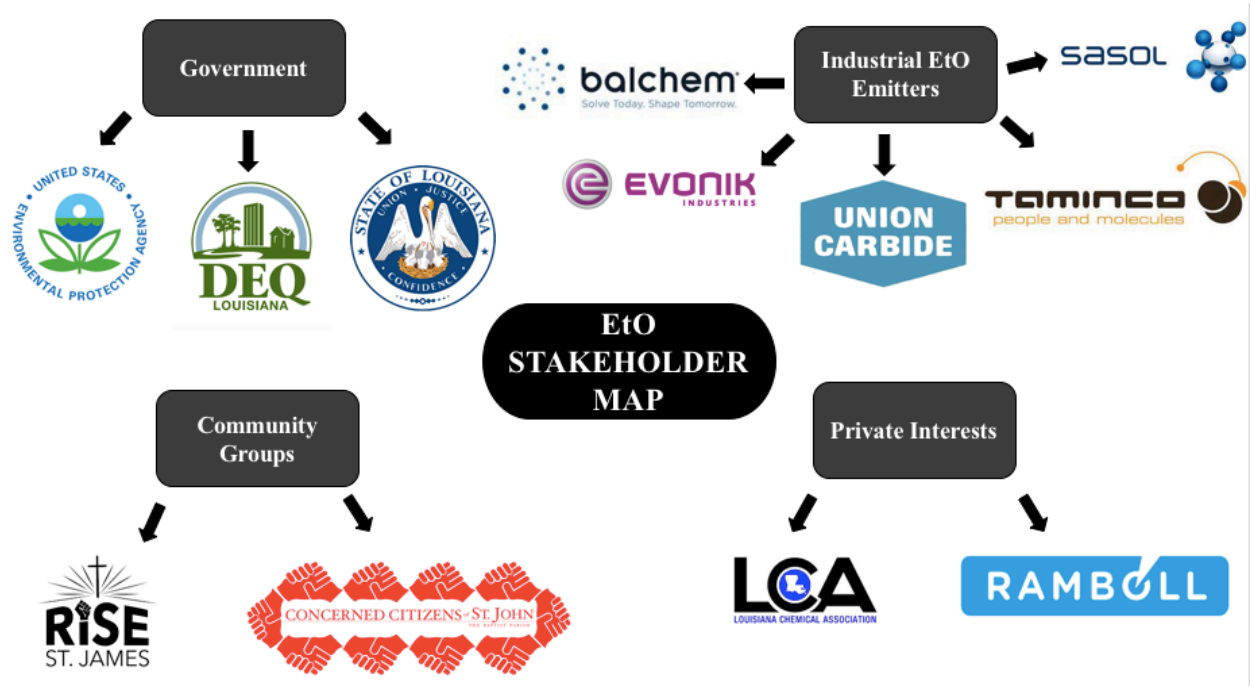

Figure 2. Map of stakeholders with an interest in EtO policy change.

Community Groups

During May 2021, the EPA hosted an Ethylene Oxide 101 virtual webinar for interested members of affected Southern Louisiana communities detailing the basic facts behind EtO use and cancer risk. Throughout the summer the EPA also hosted community meetings with

interested stakeholders and residents detailing the EtO emissions of particular facilities in the area and informed residents of the new data indicating an increase in cancer risk from previously believed values. Communities involved included those surrounding BCP Ingredients, Evonik-Reserve, Sasol, Taminco, and Union Carbide (EPA Feb 11, 2022). Members of affected parishes, representatives from the industrial polluters, attorneys from national climate groups, teachers, 350 New Orleans, Sierra Club, Healthy Gulf, Coming Clean, and the Louisiana Environmental Action Network (LEAN) were all in attendance at these meetings.

Communities in the affected areas have a deep distrust of government and have concerns regarding transparency. Despite the efforts put forth by the EPA during these sessions, a journalist from the Intercept provided comments from community members who were still left uncertain (Lerner 2021). For example, community member's distrust was increased by the agency's decision to allow representatives from the emitting facilities to speak and provide "misinformation" during the meetings. In addition, residents are suspicious of self-reported emissions levels presented during the meetings. The journalist also pointed out that community-meetings were held more than a year after the EPA Inspector General had informed the agency of its failure to alert these local communities of their exposure EtO(Lerner 2021).

Notwithstanding the delay in timing, federal recognition of community level problems does not occur regularly. As mentioned previously, the issue has also been picked up by the United Nations and celebrities such as Stephen Curry. Community groups in the area recognize the unique window for change in regulatory policy that has opened during this period of increased awareness and hope to see regulations strengthened.

Concerned Citizens of St. John

Citizens of St. John parish are exposed to EtO directly by Evonik chemicals and indirectly by any pollution crossing parish boundaries. The organization Concerned Citizens of St. John, created in response to toxic air pollutants in the area, was formed in 2016 and is led by Robert Taylor and Mary Hampton. The citizens who make up the organization live in a Census track with 92% of the population being African American and the pollution related cancer risk is "nearly 50 times higher than the national average and more than 10 times the EPA's acceptable limit" (CCOSJ 2020). The group seeks relocation of schools and hospitals near heavy pollution sites and feels as if the EPA and state government has failed to protect their community's health.

Robert Taylor spoke on behalf of the organization during an August 24, 2021 community meeting and expressed community wide concerns about compounding impacts from EtO facilities in the area and the close proximity of Evonik to schools and neighborhoods (EPA Oct 5, 2021a). The group is also working with LEAN and the Sierra Club by formally issuing a complaint for declaratory and injunctive relief against EPA administrator, Michael Regan, through their federal district court. In this complaint the organizers are pushing for increased and timely implementation of the Clean Air Act (CCOSJ, LEAN, and Sierra Club v. Michael Regan 2021).

Rise St. James.

St. James Parish is, a faith based grassroots organization, nestled between EtO producers in both East and West neighbor counties. Founder, and recipient of 2021's Goldman Environmental Prize, Sharon Lavigne notes that a more accurate name of the area may be "Death Row" instead of "Cancer Alley" due to the financial entrapment of residents who feel as if they are waiting for pollutants to adversely affect their health (Rise St. James 2022). Notably, this

grassroots organization rallied community opposition to stop the construction of a new $1.25 billion plastics plant in the area in 2019 and is currently working for the same result against another multibillion dollar plastics plant. Given the success of this organization, they can be viewed as policy entrepreneurs who have successfully stopped change in their area.

Other Affected Parishes.

St. Charles Parish is home to Union Carbide; BCP Ingredients, and Taminco are located within Iberville Parish; and Calcasieu Parish houses Sasol. During an August 12, 2020 EPA-community meeting, Reginald Grace spoke on behalf of the Iberville community and voiced concerns of government agency transparency, proximity of the facilities to schools, and how EtO emissions will affect residents with underlying health concerns (EPA Aug 23, 2021). Another presenter, Tyrone Williams asked the EPA to remove enforcement power from the LDEQ and to conduct enforcement measures through the federal agency.

In addition, Mr. Williams advocated for financial compensation for affected community members and lamented the language around EPA regulations pertaining “acceptable” levels of risk. He explained the feeling of community that one life lost due to chemical exposure is unacceptable (EPA Aug 23, 2021). During another EPA-community meeting, Christine Bennett expressed distress over the topic of general education about the facility’s toxicity and not how to stop emission of EtO or shut down the emitters causing her community harm (EPA Feb 10, 2022). She went on to lament about the mixture of chemicals the community is exposed to and how the value of community’s health has been diminished by the value of the dollar.

Schools.

As stated by Mr. Williams, the facilities are located in close proximity to public primary schools. A report generated by the National Association for the Advancement of Colored People (NAACP) on public schools in St. John the Baptist parish recommended the school district relocate Fifth Ward Elementary and St. John STEM High School to other, less hazardous locations. In addition, Louisiana State University is conducting health studies on the emissions faced by students in the area (NAACP 2022). Parents of affected students have reason to be concerned due to the likelihood of increased risk for adolescents. Despite, the cancer risk posed by these industrial facilities, they do also provide social programs for the communities in the form of scholarships and training programs.

Industrial Polluters

This stakeholder analysis will only discuss focus on sites highlighted during EPA-community meetings, including Evonik Reserve, Union Carbide, BCP Ingredients, Taminco, and Sasol. It is important to note that outside of this analysis additional EtO emitting facilities, as well as facilities emitting multiple other carcinogens, are also in the area. Industrial representatives argue that EPA cancer estimates are too high and do not accurately reflect the average amount of exposure for community members. Despite the cancer risk posed by these facilities, they do generate jobs for the community and many of them also provide social programs for the area.

In addition, representatives from each facility expressed at EPA-community meetings their priority for public health and their personal incentives for a safe community for their families who also live nearby. Facilities are not sufficiently protecting human health if increased

risk of cancer is above the 100 additional cancer cases per one million individuals limit set by the EPA. Three of the five facilities listed below were exceeding this level in 2018. During the EPA-community meetings the agency described its plans to continue monitoring progress towards emissions reductions at facilities exceeding the limit.

Evonik-Reserve.

The Evonik-Reserve website welcomes you with messages of sustainability and links to learn more about their sustainable practices. However, the EPA reports Evonik Reserve's EtO emissions to contribute to 600-in-1 million excess incidences of cancer in the community, six times the 100-in-1 million level deemed acceptable by the agency (EPA Oct 5, 2021a, Appendix B4). A group of fourteen citizens living near the facility filed a lawsuit against the facility in 2021, in the Eastern District Court of Louisiana titled Ellis v. Evonik Corp. The plaintiffs either have contracted cancer or have a spouse who have contracted cancer and believe that EtO emissions from the facility caused this cancer (Casetext 2021). The case was dismissed by the judge due to legal technicalities, but the case does represent concrete community action against the facility.

Union Carbide.

Union Carbide is owned by The Dow Chemical Company and employs approximately 1,000 full time workers and 1,500 contractors. The site produces shampoo, detergent, brake fluid, pharmaceuticals, textiles, and other household items. The facility utilizes a Community Advisory Panel where community opinions can be heard and works with the local high school to provide leadership opportunities. The EPA reports Union Carbide to contribute to 700-in-1 million excess incidences of cancer in the community, seven times the 100-in-1 million level deemed acceptable by the agency (Appendix B5). During the August 19, 2021 community

meeting, Union Carbide detailed their plan to reduce emissions through equipment upgrades and updating emissions monitoring procedures, including the recent installation of a new water scrubber (EPA Oct 5, 2021b).

BCP Ingredients.

BCP Ingredients is a subsidiary of Balchem Corporation and uses EtO as an additive for chlorine chloride use to make animal nutrition products in the dairy, poultry, and swine industry as well as for companion animals. The facility described in the August 12, 2021 community meeting the installation of a new vent scrubber in January 2020 and the increased frequency of progress updates to their leak detection repair program (EPA Aug 23, 2021). The EPA reports BCP Ingredients to contribute to 10-in-1 million excess incidences of cancer in the community, below the 100-in-1 million level deemed acceptable by the agency (Appendix B6). In addition, BCP Ingredients implemented a Leak Detection and Repair Program in 2018 to combat human errors and simple technological fixes for accidental releases of EtO. The facility also installed a new scrubber at their exhaust sites in 2020 to further reduce emission levels.

Taminco.

Taminco utilizes EtO is owned by Eastman Chemical and manufactures an additive for water treatment, crop protection, personal care products, pharmaceuticals, plastic solvents, and insect repellent at the facility. During an August 12, 2021 community meeting the facility announced EtO emissions will increase in the future by 70 pounds per year due to the addition of a new production line (EPA Aug 23, 2021). The EPA reports Taminco to contribute to 30-in-1 million excess incidences of cancer in the community, below the 100-in-1 million level deemed acceptable by the agency (Appendix B7). Taminco has been founding members of two community groups including East Iberville Industry Community Panel and East Iberville

Industry Neighbor Companies. The facility also supports the community through sponsoring a local career center and scout troops as well as providing scholarships to Louisiana State University's College of Engineering.

Sasol.

The EPA reports Sasol to contribute to 300-in-1 million excess incidences of cancer in the community, above the 100-in-1 million level deemed sufficiently protective of human health by the agency (EPA Feb 10, 2022, Appendix B8). The Sasol ethylene oxide facility produces soap, shampoos, detergent, and personal cleaning items. During the EPA-community meeting, Sasol also had an opportunity to speak and described the facility's contribution of over $7 million to local schools and community organizations. The facility is also one of the largest and highest paying employers in the area to over 2,000 individuals and commissions Louisiana business to build their infrastructure.

Private Interests.

The Louisiana Chemical Association works as an intermediary between businesses and governmental agencies to ensure favorable conditions for chemical manufacturing and economic growth in the state (LCA 2022). LCA works to promote the expansion of petrochemical manufacturing in the state by providing a unified voice against overreaching legislative and regulatory action. One of the associations most notable initiatives is the Industrial Tax Exemption Program that incentives new companies to invest in the state by allowing the deferral of property taxes for 5-10 years while a facility is becoming established (LCA 2022).

In addition, private environmental consulting firms are hired by industrial facilities to provide third party opinions on the success of emission reduction techniques. For example, Ramboll has been used by EtO emitting facilities in Texas to provide an alternative source of

data analysis and risk estimate from that provided by the EPA (EPA Oct 5 2021c). During the EPA-community meeting held for Texas residents surrounding Indorama Ventures, the Ramboll scientist cast doubt on the EtO associated risk level proposed by the EPA. Consulting firms such as Ramboll are private firms hired by industrial interests and are viewed by residents as biased towards industry.

Government

The political environment at any given time is a large determinant in what types of policy alternatives are feasible. It is important to note that during the past two years the limited attention of local, state, and national level governments has necessarily devoted much of its time and resources towards battling the ongoing COVID-19 pandemic. In addition, the national government has been focused largely on the Russian invasion of Ukraine and how to increase domestic production of energy. Given the uncertain nature of the disease and global security it is uncertain how long these will impacts will last and if other issues, such as climate change and pollution, will be pushed to the wayside during the meantime.

Despite these uncertainties some trends can be expected to remain the same. For example, Democrats are likely to favor alternatives that promote environmental protection and Republicans are likely to favor alternative that incentivize economic growth and states' rights. For environmental policy, a traditional states' rights approach would involve each state setting environmental standards within its borders. However, this approach does not fit environmental policy perfectly as pollution has the ability to cross state boundaries. In addition to varying stances between political parties, the deep cultural divide between the two parties can be

reasonably expected to remain. Relevant government stakeholders for this analysis include the state of Louisiana and the environmental regulatory agency with jurisdiction within it.

Federal.

At the executive level, President Biden has given a spotlight to environmental justice issues and created the White House Environmental Justice Advisory Council (WHEJAC) through executive order. The WHEJAC has professionals from a wide variety of related backgrounds and will be used to advise the federal government's efforts towards addressing historic injustice and increasing monitoring of current issues (EPA April 6, 2022). Despite the recent increase of executive orders by the past several presidents, it is not probable that widespread environmental change will be enacted through this fashion. Such a decision would likely be highly controversial and face heavy opposition in courts. Aside from the ability of presidents to enact environmental change through executive orders, every president has an important role to play in agenda setting of national priorities and can impact environmental policy directly through the bully pulpit or their appointment of EPA Administrators.

Environmental Protection Agency.

Due to the inevitable change of administrator every four-eight years, the overall tone and focus of the EPA is highly variable. Current EPA administrator, Michael Regan, was appointed by President Biden and has heightened environmental justice to a top priority of the agency. Within the Agency each region has an Air and Radiation Division that is responsible for administering the Clean Air Act by developing policies and regulations for air pollutants. In addition, each region has a designated environmental justice coordinator that facilitates communications with affected communities, provides assistance for grant opportunities, and overall leads the regions environmental justice efforts. EPA's Region 6 Office of Communities,

Tribes, and Environmental Assessment serves the affected Louisiana communities and the Environmental Justice Coordinator is Gloria Vaughn. Ms. Vaughn works to coordinate the stakeholder meetings with affected communities and bridge the gaps between government, industry, and private citizens.

State.

States have the ability to set more stringent environmental regulations than the minimum set through federal environmental legislation. However, the state of Louisiana does not currently have any such measures in place for EtO emissions. This can be attributed to the states desire to foster economic development or the lack of political attention garnered by the affected communities. Any enactment of emission reduction legislation in excess of federal requirements would have to come from state elected officials and carried out by the LDEQ.

State Representation.

The state of Louisiana has been led by Democratic governor, John Bel Edwards, since 2016. The affected communities are represented in the United States House of Representatives by the state's second and sixth congressional districts (Appendix A3). The districting of the state has been fought by Democratic lawmakers and activists due to under representation of Black residents who make up a third of the state's population but can only reasonably attain representation in one of the state's six districts (Patterson 2022). The current districts are represented by Democrat Troy Carter, district two, and Republican Garret Graves, district six Democrat Troy Carter is the representative for district two and serves on the Transportation and Infrastructure and Small Business Committees. Representative Carter has sent representatives from his office to sit in on community meetings between the EPA and local residents.

Republican Garret Graves is the representative for district six and serves on the Transportation and Infrastructure and Natural Resources Committee.

Louisiana is represented in the United States Senate by Republicans Bill Cassidy and John Kennedy. Cassidy serves on the Energy and Natural Resources, Finance, Veterans Affairs, Joint Economic, and Health Education and Labor Pensions committees. Kennedy serves on the Appropriations, Banking Housing and Urban Affairs, Budget, Judiciary, and Small Business and Entrepreneurship committees. Both houses of the Louisiana state Congress are held by Republicans. Given the committee appointments of each member of Congress, Representative Graves and Senator Cassidy would have the strongest influence on implementation of environmental policy through their participation in the Natural Resources Committee. However, every elected official in the state has the potential to bring the issues of their community to the floor and can therefore be utilized by community members or industrial facilities as an avenue to stage the policy definition in a favorable manner.

Louisiana Department of Environmental Quality.

LDEQ is responsible in the state of Louisiana for carrying out regulations and issuing permits on behalf of the EPA. The department relies heavily on self-reported emissions data and requires emitters to submit an annual estimate to the Emissions Reporting and Inventory Center (ERIC). ERIC can be accessed on the LDEQ website and has been collecting air quality data for each parish and its associated emitting facilities and their pollutants in the state since 1984 (LDEQ 2022). The relationship and trust between the LDEQ and the citizens of the affected Louisiana parishes has been eroded over the years, as can be seen by a call from activists to remove enforcement power from the state department and into federal control.

Identification of Alternatives

The most transformative policy alternatives for emissions reductions of any chemical would be an outright ban, cap and trade, or emission taxation. However, these options lack politically feasibility and would be very costly due to the need of EtO in sterilization practices and the manufacturing of goods used daily. For the purposes of this policy analysis, a focus will be placed on more feasible alternatives such as the status quo, enactment of state level EtO policy, and federal mandate of continuous fence-line air monitoring by facilities. In most instances, local governments are not highly involved in air pollution regulation which is reflected by these alternatives which focus on state and federal routes for change.

Status Quo

Maintaining the Status Quo alternative would include keeping the ruling detailed in the Status of the Policy Section of determining standards for individual facilities. As previously mentioned, the current system relies on a top down approach of state level enforcement and monitoring of EPA regulations. For more information on the status of the policy, please refer to the policy background section beginning on page 8.

State Policy Enactment

States have the authority to create environmental regulation more stringent than the federal government if they see fit. Illinois passed legislation surrounding ethylene oxide emission, in Senate Bill 1852 or The Matt Haller Act, which was named after an air quality activist who passed away from cancer. was passed in the state of Illinois, sponsored by Illinois House Republicans, Jim Durkin and Deanne Mazzochi and signed into law by Democratic

governor J.B. Pritzker (Durkin 2019). Senate Bill 1852, or the Matt Haller Act, is summarized by its sponsors as holding the authority to:

> Prohibit the renewal of any permits for facilities that violate federal or state standards for ethylene oxide emissions … prohibit new ethylene oxide medical sterilization facilities from opening within 10 miles of a school or park in counties with more than 50,000 residents and 15 miles in counties with less than 50,000 residents … prohibits the use of ethylene oxide by any facility that has had egregious violations requiring a seal order

In addition, the Act states that EtO emissions must be reduced by 100% within 180 days after the legislation goes into effect (Senate Bill 1852 2019). The Matt Haller Act applies to commercial sterilizing facilities and EtO emissions in Southern Louisiana originate from manufacturing plants. If the state of Louisiana passed similar legislation the language could be changed to more accurately fit the needs of the community.

Fence-line Monitoring

One barrier to the effective regulation of EtO is that facilities do not have an accurate estimate of how many pounds of the chemical they released into the air each year. Community members have called for the use of fence line monitoring to obtain accurate year-round readings of Ethylene Oxide into the air. EPA regulation setting a mandate for fence-line monitoring of air quality around industrial EtO polluters would help clarify the amount of this carcinogen entering adjacent communities. In 2015, the EPA issued a similar rule requiring fence-line monitoring around petroleum refinery facilities for benzene, another known carcinogen (EPA Sept 10, 2021). The mandate of fence-line monitoring has been described by some environmental lawyers as the inevitable next step in air quality regulation for toxic chemicals (Hijazi 2021).

However, current permits require the set emission limits to be met using the MACT standards but do not require facilities to monitor emissions crossing their boundaries. Arguably,

one reason this practice has not yet been put into place is the previous lack of available technology in the area. However, in 2018 the EPA developed the SPOD (solar powered drop in place sensor) that can provide air quality data 24/7 (EPA, May 2018). The EPA did not patent this technology and has released details to the market for further development.

Currently, citizens are taking the lack of available data into their own hands, their action can be seen in the Louisiana Bucket Brigade. The nonprofit organization trains citizens use retrofitted buckets, approved by the EPA, to collect data of toxic emissions in their area (Louisiana Bucket Brigade 2022). The Bucket Brigade has experienced success in helping the community of St. James fight Formosa plastics. Despite the relative success of this monitoring, data collection of government mandated regulations should ideally not be burdened on affected communities.

Measurement Criteria

Each alternative will be given a determination of low, medium, or high in terms of effectiveness, political feasibility, and technical feasibility. After considering the alternatives against the measurement criteria a policy recommendation will be made.

Effectiveness

An important metric for gauging the success of any policy is how well the policy does at alleviating or eliminating the problem at hand, or the policy's overall effectiveness. Given the problem of high risks of cancer due to exposure to EtO in the affected communities, effectiveness of EtO policy could come in the form of a decrease EtO released by facilities and reduction of negative health outcomes. The status quo has been deemed by the EPA as not

protecting health at multiple facilities in the area and protested widely by community members by its inefficiencies and holes in transparency from the government and polluters. However, the 2020 MON ruling has not had time to come into full affect and could potentially further decrease EtO emissions. As previously mentioned, the EPA expects the new ruling to decrease national EtO emissions by approximately 1,520 pounds. While this is a substantial decrease, Evonik-Reserve reported emitting 1,662 pounds of EtO in 2018 alone (EPA Oct 5, 2021a). Thus, the status quo can be seen as relatively ineffective at reducing EtO emissions in the communities.

Due to the recency in which the Matt Haller Act was passed, it is difficult to determine how effective the regulation will be at reducing EtO. However, the Act has successfully closed the ethylene oxide production at Sterigenics, a commercial sterilization facility in Illinois. Therefore, the emissions from this facility have been reduced all the way to zero (CBS Interactive 2019). Assuming success of the law, EtO emissions could be nearly eliminated in the Southern Louisiana. But this legislation cannot be successfully implemented without obtaining accurate data from emitting facilities. The legislation requires that sterilization facilities conduct emission testing at all exhaust points once per year (Public Act 101-0022 2019). Currently obtaining accurate data of this nature and performing compliance evaluations is not achieved through the status quo. It could then be projected that implementation of more stringent policy would face difficulties.

Arguably, state legislation as described above or the status quo would benefit from 24/7 air monitoring data collected by a third party. SPOD technology would supplement existing self-reported data from facilities and could provide clarity on the volume of EtO crossing over into the communities and not being dissipated higher into the atmosphere. Increased accuracy of this data would alleviate any problems of transparency with reporting by emitting facilities and allow

toxicologists to provide community members with an accurate estimate of their increased risk of cancer due to exposure. Therefore, mandating the installation of fence-line monitoring technology would not possess any regulatory power and would not directly lead to the reduction of EtO in the area, reducing its effectiveness on its own.

Political Feasibility

The status quo will have a high level of political feasibility due to its current position of implementation. However, determination of feasibility for the alternative policy solutions will require further analysis. Partisan divide is a huge hinderance to passing policy at any level of government in America, environmental policy is no exception. As examined in the stakeholder analysis, the state of Louisiana, as well as their federal Congressmen, is held primarily by Republican politicians who are likely to favor an industry perspective. Federally, environmental regulation can either be passed through Congress or through Presidential executive order.

The location of financial burden of a policy is necessary to consider for any policy alternative. While considering the proposed alternatives, the point of view of a general American citizen will be taken. Currently, financial burden is placed on community members who are self-funding grassroots movements and their own data collection through bucket brigades. Both alternatives to the status quo would push this financial burden onto the emitting facilities. If the state of Louisiana passes policy similar to that of Louisiana facilities would have no choice but to reduce emissions through costly technological or operational advancement or close their doors. If the EPA mandates fence-line monitoring it would be the responsibility of emitters facilities to install proper equipment.

State policy creation would be applauded by community activists and fought by industry. Traditionally, Republican legislators would favor industrial growth and bipartisanship is increasingly rare, decreasing the likelihood that a similar bill would have success in Louisiana. However, the Matt Haller Bill was sponsored by two Republicans and had bipartisan backing, indicating that passing similar legislation in Louisiana could be achievable. Given the national attention around the topic and active grassroots community organizations, the appropriate policy window and policy entrepreneurs to make change could be on the horizon (Kingdon 2010). In addition, the affected communities have both Representative Graves and Senator Cassidy who hold placements on Natural Resource committees and could bring this topic to the floor.

SPOD technology may provide the already active community groups of the area with concrete data to take legislative action against polluters. In terms of political feasibility, this would increase favorability amongst fence-line communities and likely decrease favorability amongst industrial stakeholders who fear litigation fines. However, a federal mandate of fence-line monitoring at EtO emitting facilities would gain national attention and focus from a broader range of stakeholders due to the wide ranging affects.

Technical Feasibility

A policy may be politically feasibly but may still fail if technical feasibility is lacking. For environmental topics, technical feasibility could be the availability of technological solutions for the problem at hand or the availability of trained professional to operate the technology. The status quo of state implementation has yet to be fully achieved for the monitoring and enforcement of EPA requirements. Therefore, technical feasibility of any more stringent regulations may also face challenges. If the Louisiana legislation mimics that of Illinois it would

still rely heavily on self-reporting of emissions data by facilities. Thus, the LDEQ would not have to increase monitoring of facilities themselves but would have to rely on trustworthiness of emitters.

The EPA did not patent its SPOD technology and gave the idea to any interested developers on the market. Sensit Technologies now has a SPOD monitoring system on the market available for sale to industry (Appendix A4). The device offers real-time continuous monitoring of air quality data and provides data interpretation without the need to send samples to a laboratory. In addition, the device documents wind direction and speed to determine the origin of the gas in the air. The SPOD system would require at most one extra employee per site to collect and record analysis output by the device or could be incorporated into an existing position. Furthermore, the device runs on solar power and would not require an additional power source. Therefore, if the device is monitored by an existing employee at the plant, the only additional costs born to the facility would be purchasing and installation. In time there may also be additional manufacturers on the market with SPOD devices at lower prices or higher capability.

Overall

Technology is often touted as the most economical solution for dealing with environmental impacts from human pollution. However, technological advancements at industrial facilities are often expensive and may not be implemented without an external push. A combination of increased accuracy of air quality data and strengthened state level policy would provide the most effective measure to reduce cancer risk from EtO exposure in Southern Louisiana. However, politically due to limitations of public attention and bureaucracy the ability

of state or federal legislation to enact both of these alternatives at once is not likely possible. As previously mentioned, both federal and state focus have been occupied by international political stability and COVID response further limiting this availability.

In addition, industrial emitters have large political backing and would likely make the passing of one alternative challenging and two nearly impossible. However, industrial representatives would likely be more receptive to installing new monitoring technology than reducing emissions rates by 100%, increasing the political feasibility of fence-line monitoring over state legislation. Of the three alternatives, state policy change would have the greatest reduction of EtO emissions and has the relative feasibility to pass. Thus, if one alternative must be chosen, the creation of state policy against EtO would be preferable to solve the policy problem of increased cancer risk due to high levels of exposure of EtO. `

	Status Quo	**Fence-line Monitoring**	**State Policy**
Effectiveness	Low – this policy does not adequately protect health and is not fully enforced	Low – this policy would increase data on the topic but have no enforcement power	High – this policy would ensure highly cut back on EtO emissions tremendously
Political Feasibility	High – this policy is already in place	Medium – this policy would not directly cause industry change and could create jobs	Medium – this policy would be fought by industrial interests
Technical Feasibility	Medium – this policy is in place but is not fulfilled in its entirety	High – technology is available for this monitoring and could be installed at every facility	Medium – this policy would require more EPA and state presence than the status quo, which is already unmet

Figure 3. Illustrating the varying level of success at achieving the measurement criteria considering the three possible policy alternatives.

Limitations

This analysis is purely qualitative and does not take into account any benefits or costs of the products produced by the industrial facilities or implementation of the alternative policy suggestions. Additional limitations to this policy analysis include ambiguity within regulatory meaning, uncertainty of compounding effects of emissions in the area, and lacking national air quality data to determine varying levels of risk. The Clean Air Act Amendments of 1990 require for the emissions limitations of the best reducing facilities to be "averaged". The meaning of average is not explicitly stated within the amendments and a mean, median, or mode may be used to calculate the value and can potentially output highly variable results (EPA 1995). Depending on which method is used, the limitation may promote the usage of less efficient technology or the outermost limits of technological capabilities of control methods (Appendix B1, B2).

In addition to political ambiguity, there has not been a cumulative study done to access how individual's health is affected not only by EtO emitting facilities, but all of the facilities in the area releasing carcinogens into the air. In addition, cancer risk estimates given in the 2016 EPA risk values take into account current emissions rates without acknowledging the compounding risk of each year and the assumption that past emissions rates were much higher as a result of more lenient regulation. Thus, older individuals may actually be at a greater risk level than currently speculated.

Moreover, the NATA, the leading research into toxicity of air pollution data, was released in 2018 and reflects data collected in 2014, limiting its ability to reflect current conditions of air toxics within the country. However, it is the most comprehensive dataset of its kind and this initial release will be useful for establishing baseline data of toxins in the air. In

addition, the technology used to measure EtO is in its early stages and needs to be distributed throughout industry. Given the limitations in availability of accurate data of EtO emissions, it is difficult to determine a baseline to measure feature policy effectiveness on.

Conclusion

The number of communities with environmental justice concerns will likely continue to rise as populations grow and society searches for a way to deal with pollutants and waste. As public awareness for these concerns and available technology and toxicology information increases, affected Southern Louisiana communities are entering a policy window around the regulation of Ethylene Oxide. Following the analysis of the policy process, both a state level regulatory and a federally mandated technology based alternative were proposed. After alternatives were assessed in terms of effectiveness, political feasibility, and technical feasibility, creation of state level policy would have the singular greatest success at solving the policy problem. However, increased technology would also be needed in the future to provide accurate monitoring for the enforcement of the state level policy.

In the future, analysis can be done to focus on actions attainable locally to supplement regulatory efforts made at the state and federal levels. For example, the parishes of Southern Louisiana could pass local ordinances against the emission of EtO during hours in which children are at school. After analysis of the current policy and possible alternatives, it is clear that solving the problem of increased cancer risk in Southern Louisiana can be alleviated through the passing of state level policy but cannot be fully enforced without future improvement of monitoring emissions monitoring techniques.

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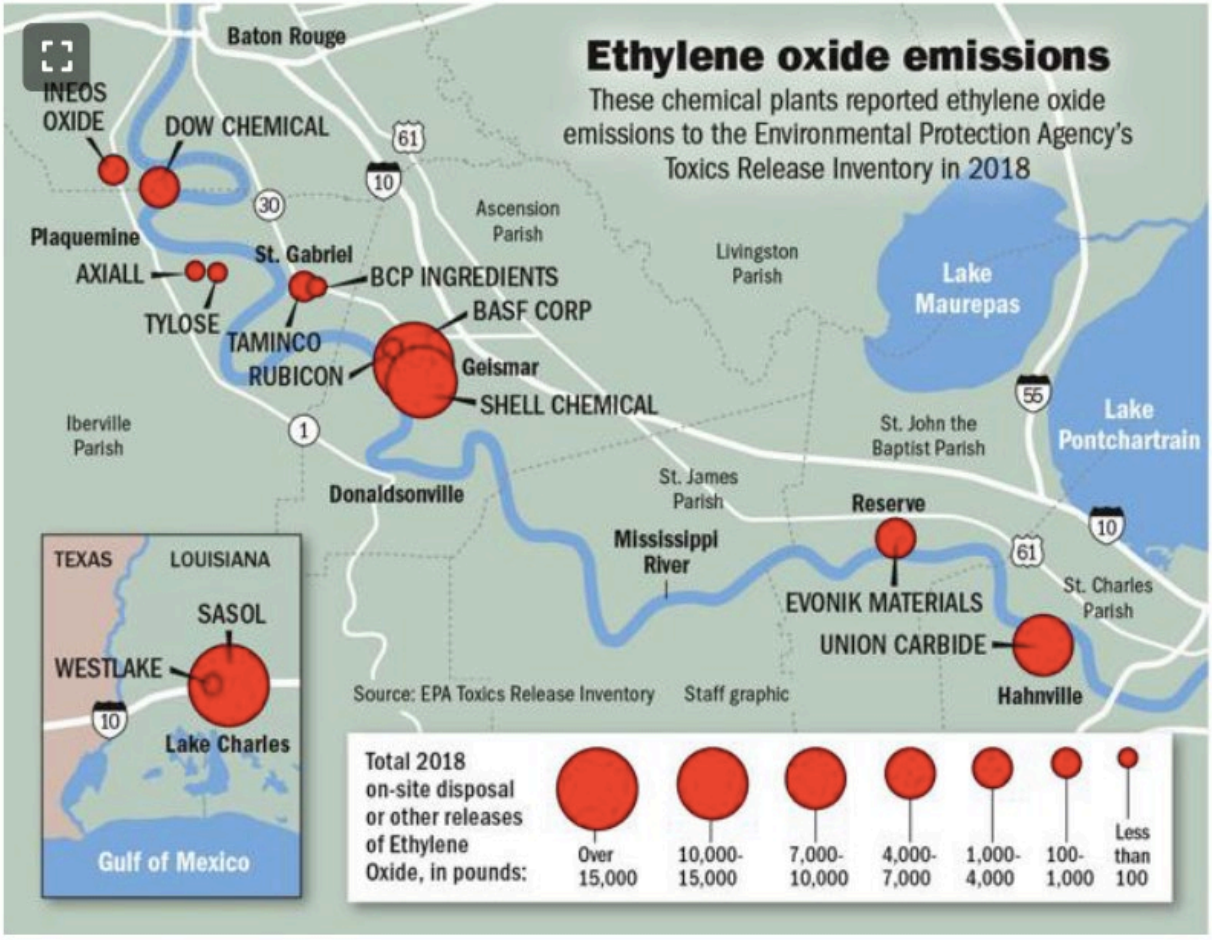
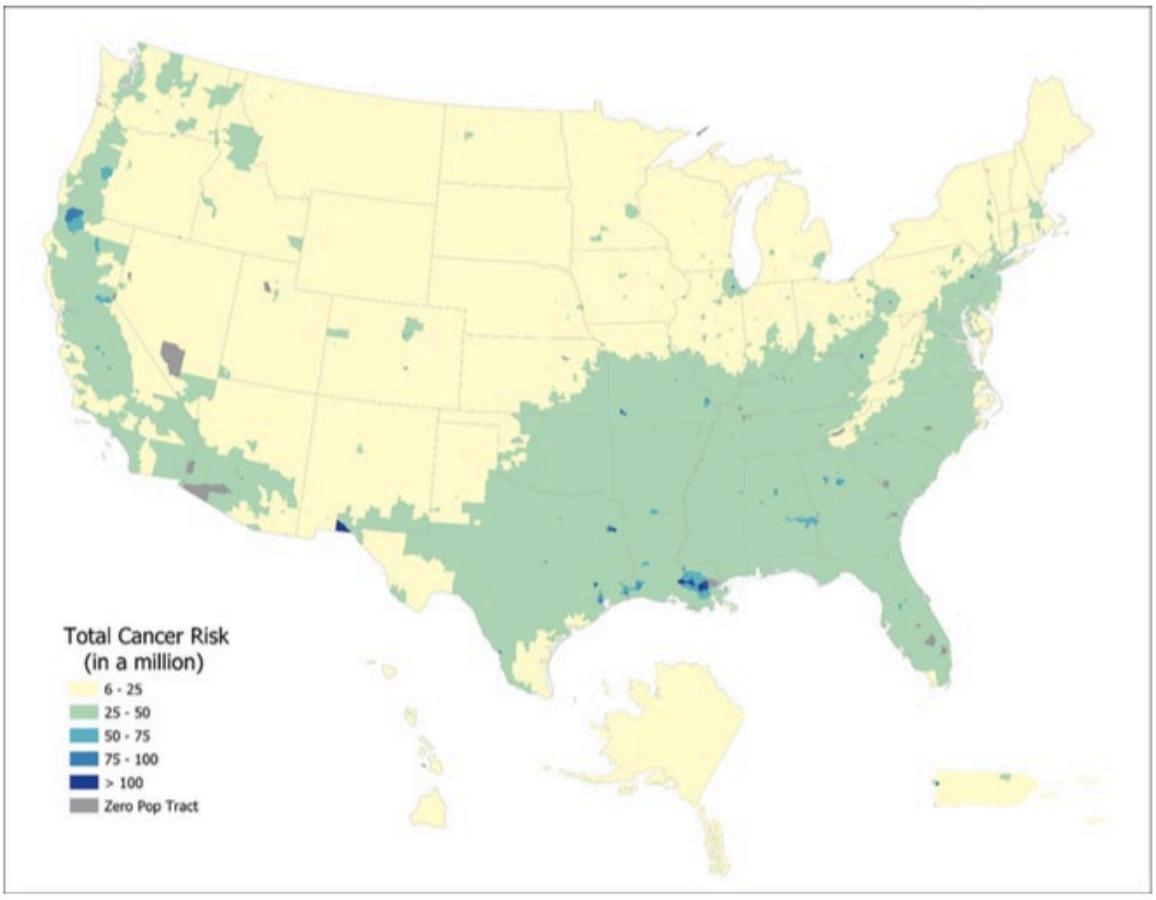
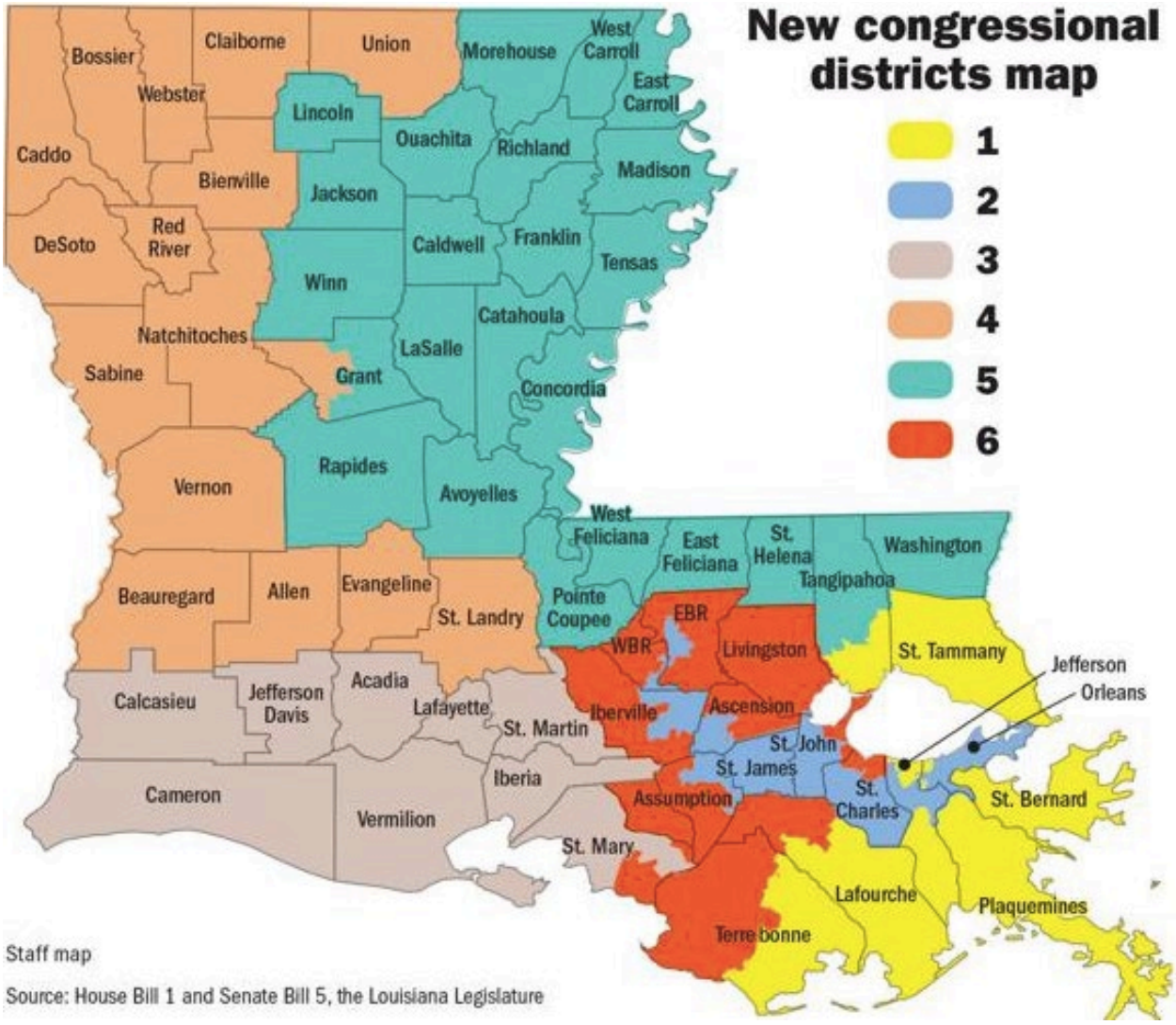
Appendix A – Maps and Figures



A1. Map of EtO emitting facilities in Southern Louisiana (Parker and Russell 2021).



A2. “US cancer risks from air toxics estimated by the 2014 NATA” (EPA Jan 20, 2022).



A3. Map of Congressional districts of Southern Louisiana (Patterson 2022).

SENSIT® SPOD

VOC EMMISSIONS AND AIR POLLUTANT MONITORING SYSTEM

A REMOTE AIR QUALITY MONITORING PLATFORM & POLLUTION DATA MANAGEMENT SYSTEM

The **SENSIT® SPOD** is a low-cost, solar-powered sensor system that combines wind and air pollutant concentration measurements to detect VOC emission plumes and help locate the source of emissions.

With a small footprint, the user-friendly **SENSIT® SPOD** is designed for near-fenceline applications where localized emissions may be present. This Next Generation Air Measurement (NGAM) sensor offers real-time continuous monitoring and direct-reading, without laboratory analysis at a lower cost than traditional methods.

The **SENSIT® SPOD** can be combined with automated sample collection hardware to collect evacuated canisters or sorption tubes for later quantitative analysis.

SENSIT® SPOD offers an optional Ultrasonic Anemometer for wind speed, direction, temperature, humidity, and pressure.

STANDARD FEATURES

- Real-time Continuous Monitoring (Local or Remote)
- Modular Wireless Data Transmission
- Durable, Weather Resistant Housing
- SD Card Data Backup
- Integrated Battery (Solar Ready)

APPLICATIONS

Oil and Gas Production	Fugitive and Process Emissions
Municipal Government Services	Hazardous Pollutants/Nuisance Odors
Industrial Health, Safety, & Compliance	Industrial Site Fenceline Emissions Monitoring
Environmental	Ground-level Ozone Precursors
Emergency Response	Spills, Leaks, Explosions

A4. Brochure from Diamond Scientific, retailer of SENSIT SPOD monitoring system (2019).

Appendix B - Charts

SOURCE	CONTROL TECHNOLGY	EMISSION REDUCTIONS
1	Fabric Filters	80%
2	Fabric Filters	80%
3	Wet Scrubbers	70%
4	Wet Scrubbers	70%

Example 1

B1. (EPA 1995). "In Example 1, the average emission limitation could be either 74 percent (the arithmetic mean) or 70 percent (both the median and mode). If EPA uses 74 percent to determine the MACT floor, the next most stringent technology would be fabric filters at 80 percent. Wet scrubbers would not meet the requirement and would have to be replaced with better control technology. If EPA uses 70 percent to determine the MACT floor, wet scrubbers would be the standard but not the maximum achievable control technology. Either wet scrubbers or fabric filters could be used. In this example, the arithmetic mean fits neither technology, and the median and mode promote the less desirable technology. If averaging was not required, both technologies would be acceptable."

SOURCE	CONTROL TECHNOLGY	EMISSION REDUCTIONS
1	Fabric Filters	90%
2	Fabric Filters	75%
3	Wet Scrubbers	75%
4	Wet Scrubbers	70%

Example 2

B2. (EPA 1995). "In Example 2, the average emission limitation would be 75 percent using either the arithmetic mean, median, or mode. In this situation, a 75 percent MACT floor matches two control technologies: Wet scrubbers that are used very well and fabric filters that are not used well. EPA can require that all existing sources either (1) achieve 75 percent emission reductions by using either fabric filters or wet scrubbers or (2) use fabric filters which is the better technology overall. In this example, the average emission reductions fits only the outermost conditions of two technologies. Again, if averaging was not required, both technologies would be acceptable.

Range of Lifetime Individual Cancer Risk from the LA Facilities (Chance in One Million) [a]	Number of People within 50 km of any Facility in Different Ranges for Lifetime Cancer Risk [b]					
	Total Population	White	African American	Native American	Other and Multiracial	Hispanic or Latino[c]
0 to < 1	1,434,603	832,238	441,233	4,028	59,678	97,426
1 to < 5	188,469	105,343	69,190	524	6,730	6,682
5 to < 10	46,147	31,942	10,755	83	1,257	2,109
10 to < 20	13,379	8,772	4,052	24	199	331
20 to < 30	9,363	5,581	3,295	30	121	336
30 to < 40	3,520	2,985	363	0	67	104
40 to < 50	2,051	1,280	525	0	76	169
50 to < 100	1,818	1,171	558	0	17	72
100 to < 200	3,381	2,339	936	46	16	43
200 to < 300	1,488	801	670	3	1	13
>= 300	349	155	192	0	0	2
Total Number	1,704,568	992,610	531,769	4,739	68,163	107,288

B3. Table detailing risk from individual risk from LA facilities (EPA June 24, 2021)

Table A-4. Evonik - Distribution of Cancer Risk for Racial and Ethnic Groups						
Range of Lifetime Individual Cancer Risk from Facility 5287111 (Chance in One Million) [a]	Number of People within 50 km of the Facility in Different Ranges for Lifetime Cancer Risk [b]					
	Total Population	White	African American	Native American	Other and Multiracial	Hispanic or Latino[c]
0 to < 1	784,063	480,149	197,414	2,913	32,818	70,769
1 to < 5	56,940	30,006	23,297	58	1,193	2,387
5 to < 10	8,712	2,031	5,970	0	300	411
10 to < 20	4,668	1,203	3,361	0	23	82
20 to < 30	3,386	1,083	2,246	0	14	42
30 to < 40	933	613	243	0	7	71
40 to < 50	1,185	551	460	0	13	161
50 to < 100	547	251	225	0	5	66
100 to < 200	311	125	186	0	0	0
200 to < 300	269	108	161	0	0	0
>= 300	229	92	137	0	0	0
Total Number	861,243	516,211	233,701	2,970	34,372	73,988
Average Risk (Chance in One Million)[a]	1	0.8	2	0.4	0.5	0.7

B4. Evonik Reserve risk levels (EPA June 24, 2021)

Table A-5. Union Carbide - Distribution of Cancer Risk for Racial and Ethnic Groups						
Range of Lifetime Individual Cancer Risk from Facility 7202911 (Chance in One Million) [a]	Number of People within 50 km of the Facility in Different Ranges for Lifetime Cancer Risk [b]					
	Total Population	White	African American	Native American	Other and Multiracial	Hispanic or Latino[c]
0 to < 1	0	0	0	0	0	0
1 to < 5	792,019	381,364	308,368	4,351	37,510	60,425
5 to < 10	194,355	112,498	42,610	483	9,213	29,551
10 to < 20	25,193	14,547	7,968	119	708	1,852
20 to < 30	35,277	12,386	19,618	6	1,294	1,973
30 to < 40	14,234	7,875	4,679	26	319	1,334
40 to < 50	5,847	3,824	1,505	4	17	496
50 to < 100	7,493	4,255	2,832	7	133	267
100 to < 200	4,301	3,424	751	51	30	46
200 to < 300	1,067	580	470	3	1	13
>= 300	112	56	54	0	0	2
Total Number	1,079,898	540,810	388,856	5,048	49,226	95,958
Average Risk (Chance in One Million)[a]	6	6	5	5	4	5

B5. Union Carbide risk levels (EPA June 24, 2021)

Table A-6. BCP Ingredients - Distribution of Cancer Risk for Racial and Ethnic Groups						
Range of Lifetime Individual Cancer Risk from Facility 220477451011 (Chance in One Million) [a]	Number of People within 50 km of the Facility in Different Ranges for Lifetime Cancer Risk [b]					
	Total Population	White	African American	Native American	Other and Multiracial	Hispanic or Latino[c]
0 to < 1	757,935	415,212	280,439	988	30,078	31,218
1 to < 5	976	257	679	0	2	37
5 to < 10	618	127	461	0	1	28
10 to < 20	0	0	0	0	0	0
20 to < 30	0	0	0	0	0	0
30 to < 40	0	0	0	0	0	0
40 to < 50	0	0	0	0	0	0
50 to < 100	0	0	0	0	0	0
100 to < 200	0	0	0	0	0	0
200 to < 300	0	0	0	0	0	0
>= 300	0	0	0	0	0	0
Total Number	759,529	415,597	281,579	988	30,082	31,284
Average Risk (Chance in One Million)[a]	0.03	0.03	0.04	0.03	0.02	0.03

B6. BCP Ingredients risk levels (EPA June 24, 2021)

Table A-7. Taminco - Distribution of Cancer Risk for Racial and Ethnic Groups						
Range of Lifetime Individual Cancer Risk from Facility 5504811 (Chance in One Million) [a]	Number of People within 50 km of the Facility in Different Ranges for Lifetime Cancer Risk [b]					
	Total Population	White	African American	Native American	Other and Multiracial	Hispanic or Latino[c]
0 to < 1	750,190	412,622	275,564	954	29,945	31,106
1 to < 5	7,828	2,223	5,299	32	139	135
5 to < 10	272	67	197	0	0	8
10 to < 20	230	61	159	0	1	10
20 to < 30	496	102	370	0	1	23
30 to < 40	19	4	14	0	0	1
40 to < 50	0	0	0	0	0	0
50 to < 100	0	0	0	0	0	0
100 to < 200	0	0	0	0	0	0
200 to < 300	0	0	0	0	0	0
>= 300	0	0	0	0	0	0
Total Number	759,035	415,079	281,602	986	30,086	31,282
Average Risk (Chance in One Million)[a]	0.1	0.09	0.1	0.1	0.08	0.1

B7. Taminco risk levels (EPA June 24, 2021)

Table A-8. Sasol Chemicals - Distribution of Cancer Risk for Racial and Ethnic Groups						
Range of Lifetime Individual Cancer Risk from Facility 8468011 (Chance in One Million) [a]	Number of People within 50 km of the Facility in Different Ranges for Lifetime Cancer Risk [b]					
	Total Population	White	African American	Native American	Other and Multiracial	Hispanic or Latino[c]
0 to < 1	72,036	55,743	10,447	333	2,109	3,404
1 to < 5	124,820	73,957	40,939	482	5,367	4,075
5 to < 10	36,890	29,764	4,407	83	957	1,678
10 to < 20	8,579	7,534	599	24	177	245
20 to < 30	5,271	4,339	535	30	105	262
30 to < 40	2,587	2,373	121	0	60	34
40 to < 50	847	725	51	0	63	8
50 to < 100	1,271	921	333	0	12	6
100 to < 200	333	235	98	0	0	0
200 to < 300	152	114	38	0	0	0
>= 300	8	7	1	0	0	0
Total Number	252,794	175,712	57,569	952	8,849	9,713
Average Risk (Chance in One Million)[a]	4	4	4	3	3	3

B8. Sasol risk levels (EPA June 24, 2021)