

Costs of Ozone Nonattainment

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TAKEAWAYS: Should Corpus Christi fail to meet the EPA ozone standards, the area would face economic losses between \$600 million and \$1.7 billion each year. Such costs include explicit costs for construction permits, pollution controls, vehicle inspections, and educational programs; and losses of economic activity due to industrial and road construction delays, as well as lost industrial development opportunities.

This newsletter the findings of a [report](#) on the potential costs of ozone nonattainment in Corpus Christi. The study was initiated by the Coastal Bend Air Quality Partnership and funded by the Port of Corpus Christi Authority.

The report provides projections for the potential economic costs as a result of a hypothetical scenario of an ozone nonattainment designation based on the U.S. Environmental Protection Agency's National Ambient Air Quality Standards (NAAQS), as specified in the Clean Air Act of 1970.

Bear in mind that the study is not to assess the risk of ozone nonattainment. A consensus among community stakeholders holds that the area is currently not on the brink of nonattainment. From this perspective, the findings can alternatively be interpreted as identifiable economic benefits of taking voluntary actions or implementing preemptive policy measures in the past or the future in efforts to maintain the federal air quality attainment status and ultimately the overall quality of life among local residents.

Ozone

Instead of direct emissions, ground-level ozone is created indirectly by chemical reactions of nitrogen oxide (NOx) and volatile organic compounds (VOC) in the presence of sunlight. These chemicals are produced through a wide variety of human activities that are broadly classified as: (1) point sources like electric power plants, petroleum refineries and manufacturing facilities; (2) small-scale industrial, commercial and residential sources that generate emissions, such as air conditioning units; and (3) mobile sources that include vehicles and equipment that generate emissions.

In Corpus Christi, mobile sources are responsible for more

than half of the NOx emissions, whereas area sources account of the majority of VOC emissions. From these perspectives, it is important to pay as much attention to the impact of vehicle emissions on local air quality as to emissions from large industrial plants.

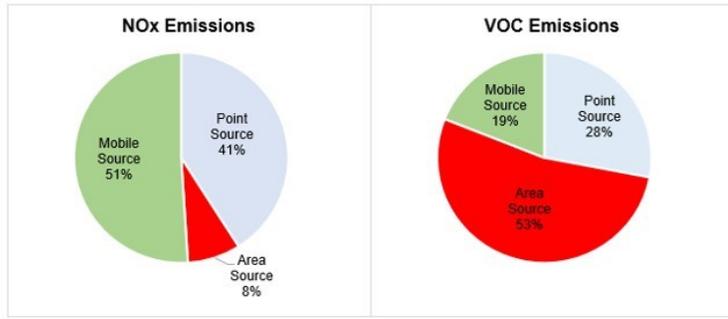
Corpus Christi has never been designated as an ozone nonattainment area. In fact, the ozone level has been trending down since 2011. Other than better fuel efficiency in new vehicle models and the effectiveness of emission controls among major industrial plants in the area, there have been increasing local efforts aimed at reducing emissions. The Coastal Bend Air Quality Partnership, a consortium of local community stakeholders, has spearheaded most voluntary emission reduction activities.

Ozone Nonattainment

The EPA requires each state to monitor ambient air quality and evaluate compliance to the NAAQS. The current standard for ground-level ozone is 70 parts per billion.

An accompanying table lists the six ozone nonattainment classifications based on the air quality levels that exceed the NAAQS. Dallas, Houston and San Antonio are now classified as "marginal" in their nonattainment status. It takes three years to attain the marginal nonattainment status, and six years to attain the moderate nonattainment status.

Depending on the level of nonattainment designation, different requirements are imposed with the goal of improving the air quality levels and returning to attainment status. These requirements are established through revisions to the State Implementation Plan.



Source: TCEQ Emissions Inventory, 2019.

One of the regulatory requirements is called “offset,” so that there is no net increase in air emissions in a given year. New emissions can occur through a new operation or the expansion of an existing emitter in the airshed. The amount of new projected pollutants introduced into the airshed must be offset or neutralized by reducing pollutants elsewhere in the airshed at the same amount, or by purchasing pollutant credits from an airshed emissions trading program. As a result, offsets translate into substantial additional costs for industrial and commercial facilities to expand in a nonattainment area.

The potential economic costs of ozone nonattainment are described under the following three categories:

- Impact on local industry’s expansion and operations
- Transportation conformity costs
- Additional costs of educational programs and voluntary control measures

Local Industry Expansion and Operations

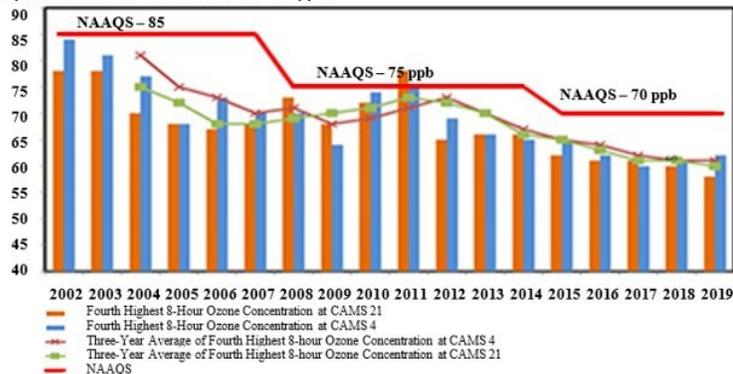
The first category of economic consequences is also known as general conformity, measured in terms of the costs associated with nonattainment new source review (NNSR) permitting rules, economic consequences of construction project delays, potential losses in firm expansion or relocation, and the costs of point source reductions in NOx and VOC.

New Source Review Permitting Costs

Under the new point source review requirements in a nonattainment area, firms that plan to expand its operations or relocate a new facility in the area may be required to conduct a conformity analysis. According to the Texas Commission on Environmental Quality, the potential costs of conducting conformity analysis for a construction permit are between \$100,000 and \$250,000.

Historically, the average number of permits per year was 50 for

Corpus Christi Area Ozone Concentration, ppb.



Source: Corpus Christi Air Quality Group, 2019.

the Corpus Christi metro area. The total costs of permitting per year equal the historical average number of permits times the alternative estimates of permitting costs. The total costs of permitting under a nonattainment designation ranges from about \$5 million to nearly \$14 million per year.

Construction Project Delays

In an area with nonattainment designation, major construction projects are required a more lengthy and stringent permitting process. Since a new source review permit could take up to 365 days, this delay potentially results in one year of lost business and wage earnings associated with the operation of the new facility.

The impact of construction delays in a given industry on economic activity is calculated by multiplying the average firm size, as measured by gross sales, by the yearly number of permits in its respective industry. Essentially, the estimated reductions in economic activity represent the impacts of a one-year delay in the construction project of a typical firm in different industries.

According to the study, construction project delays are projected to result in a total loss of \$273 million annually in the metro area under a marginal nonattainment designation, and \$303 million under a moderate nonattainment designation.

Firm Expansion or Relocation

When an area is designated as nonattainment, many local firms are required to install new emission control systems or engage in other activities to reduce emissions. Emissions control systems may cost more than \$1 million to install and additional staff to maintain. In addition, offsets may be prohibitively expensive for many firms to purchase, even if they are available. All these additional costs may affect firms’ decision to expand or relocate in a nonattainment area.

Since 2010, the Corpus Christi metro area has received more than \$52 billion in capital projects. Corpus Christi’s attainment status has been touted as one advantage for at least some of those corporate decisions to build industrial facilities in the area, as opposed to other nonattainment areas, such as Houston. It is therefore conceivable that some of those facilities would not have occurred in the current locations in Nueces or San Patricio County if the area were designated as nonattainment.

The study focuses on potential firm expansion and relocation in three industries with major point sources of air emissions: oil and gas extraction, petrochemical manufacturing, and steel and fabricated pipe manufacturing. These industries account for the majority of new capital construction in the area during the past decade. The utilities industry, which includes electric power generation, is also a major air pollution source, but public utilities are most likely not to relocate or expand due to a nonattainment designation.

In addition to new construction, it is also probable that additional permitting and construction costs due to nonattainment will prevent some existing industrial plants from expanding in the future. The study assumes that the potential loss from firm expansion in a particular industry is equivalent to one-third of the average firm capacity. The estimated potential losses from firms not expanding represents the low end of the range (\$555 million), while the estimated potential losses from firms relocating elsewhere represents the high end of the range (\$1.66 billion).

Clean Air Act Ozone Planning and Control Requirements by Classification

Classification	Requirements	NSR offset ratio	Major source threshold
EXTREME (20 years to attain)	TRAFFIC CONGESTION CONTROLS (if appropriate) CLEAN FUELS REQUIREMENT FOR BOILERS	1.5 : 1 Extreme	10
SEVERE (15/17 years to attain)	PENALTY FEE PROGRAM FOR MAJOR SOURCES LOW VOC REFORMULATED GAS (as appropriate) VMT GROWTH DEMONSTRATION (& TCMs if needed)	1.3 : 1 Severe	25
SERIOUS (9 years to attain)	VMT DEMONSTRATION (& TCMs if needed) NSR REQUIREMENTS FOR EXISTING SOURCE MODS ENHANCED MONITORING PLAN CLEAN FUELS PROGRAM (if applicable)	1.2 : 1 Serious	50
MODERATE (6 years to attain)	MODELED DEMO OF ATTAINMENT MILESTONE DEMONSTRATIONS and CONTINGENCY MEASURES FOR RFP 3% ANNUAL RFP UNTIL ATTAINMENT ENHANCED I/M for larger population areas CONTINGENCY MEASURES FOR FAILURE TO ATTAIN Stage II Gasoline Vapor Recovery BASIC VEHICLE I/M for larger population areas 15% VOC ROP or 15% VOC/NOx RFP (OVER 6 YEARS)	1.15 : 1 Moderate	100
MARGINAL (3 years to attain)	VOC/NOx RACT for MAJOR/CTG SOURCES ATTAINMENT DEMONSTRATION TRANSPORTATION CONFORMITY DEMONSTRATION (MVERs) NONATTAINMENT NEW SOURCE REVIEW PROGRAM MAJOR SOURCE EMISSION STATEMENTS BASELINE EMISSION INVENTORY (EI) PERIODIC EMISSION INVENTORY UPDATES	1.1 : 1 Marginal	100

Source: EPA, Implementation of the 2015 National Ambient Air Quality Standards for Ozone: Nonattainment Area Classifications and State Implementation Plan Requirements, Federal Register, Vol. 81, No. 222, November 17, 2016.

Point Source Emission Reductions

An area designated as nonattainment with respect to ozone is required to perform specific types of NOx and VOC emission reductions. To ensure there's no increase in overall emissions in an area, each construction project needs to obtain emission offsets either within the same year, or at a greater than one ratio (1.1 for marginal nonattainment and 1.15 for moderate nonattainment).

In Corpus Christi, power plants and petroleum refineries are key industrial sources of ozone precursors. For marginal and moderate ozone nonattainment areas, a major source in the NNSR program is a facility with 100 tons per year emissions of ozone precursors.

According to the EPA's Regulatory Impact Analyses, the average cost of NOx controls ranges between \$1,200 to \$19,000 per ton, and the average cost of VOC controls ranges between \$1,200 to

Average Annual Potential Costs of Nonattainment on Corpus Christi MSA Industry (2020 \$)

	Marginal Nonattainment		Moderate Nonattainment	
	Low Estimate	High Estimate	Low Estimate	High Estimate
Cost of NNSR Permitting	\$186,222	\$465,556	\$186,299	\$465,748
Cost of Industrial Project Delays	\$10,111,927	\$10,111,927	\$10,111,927	\$10,111,927
Lost Firm Expansion/Relocation	\$554,785,332	\$1,664,355,997	\$554,785,332	\$1,664,355,997
Costs of Point Source Reduction	\$862,273	\$15,282,646	\$1,293,409	\$22,923,969
Total	\$565,945,755	\$1,690,216,126	\$566,376,968	\$1,697,857,641

\$25,000 per ton.

An ozone non-attainment area can also meet the "offset" requirements by implementing an emissions trading program, as in the Dallas and Houston metro areas. The EPA estimates are comparable to the historical Emission Reduction Credit Trade Data for the Dallas-Fort Worth area, but they are substantially lower than the trade costs for the Houston-Galveston-Brazoria metro area with fewer trades.

For the hypothetical nonattainment status, Corpus Christi is projected to incur as much as \$23 million in emission reduction costs each year under the moderate nonattainment designation.

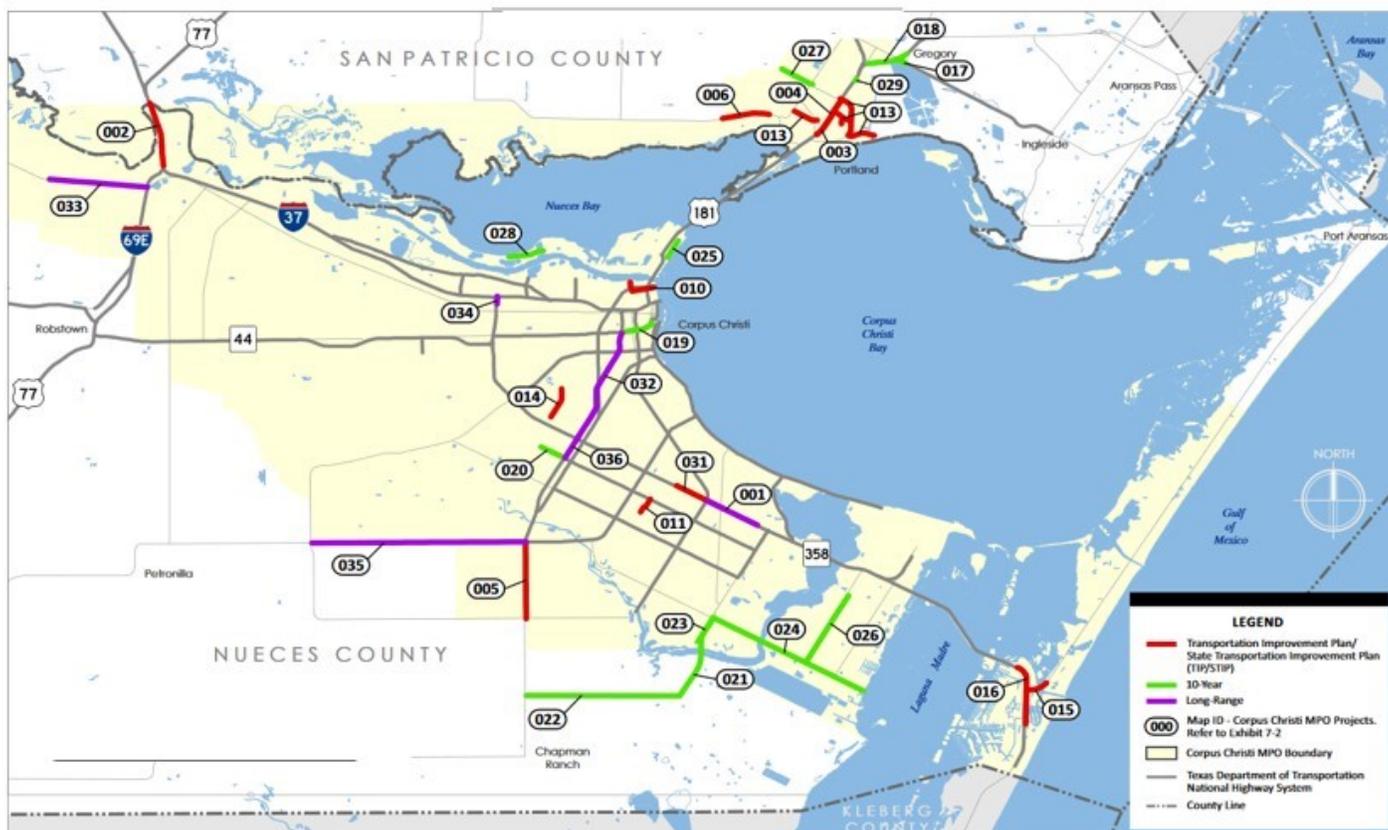
Overall Impact on Local Industry

The following table summarizes the annual impact on Corpus Christi's local industry associated with projected losses in future firm decisions to expand or relocate in the area as well as operations of existing firms due to a nonattainment designation. The range of potential costs on local industry is between \$0.56 million and \$1.69 million each year.

Reductions in economic activity, or gross regional product, due to a potential loss of industrial construction and expansion opportunities contribute to the bulk of the nonattainment designation's impacts on Corpus Christi's industry. Average Annual Potential Costs of Nonattainment on Corpus Christi MSA Industry (2020 \$)

Road Construction Delays

Map of Corpus Christi MPO 2020-2045 MTP



Source: Corpus Christi MPO.

The costs associated with transportation conformity are measured in terms of economic losses due to federally funded road construction delays and the costs associated with vehicle inspection fees. An ozone nonattainment designation would result in additional requirements in terms of environmental assessments for federally funded transportation projects.

The map on the previous page shows the locations of major road construction and improvement projects as part of the Corpus Christi Metropolitan Planning Organization's 2020-2045 Metropolitan Transportation Plan. The construction costs of these projects total \$1.83 billion.

These traffic improvement and roadway projects will enhance traffic flows in the Corpus Christi urban area. When one of these projects is completed, the typical travel time will reduce. The time savings for drivers translate into additional time for other activities.

Reducing vehicle idling time that would otherwise occur in congestion also results in less air pollution. From these perspectives, potential delays in federally funded road improvement projects due to ozone nonattainment will involve losses in potential economic benefits.

As for pre-construction delays in building new industrial facilities, any delay in starting a road improvement or construction project would result in a potential loss of local economic activity or business that relies on a timely completion of that project.

The total economic costs associated with road construction delays include: (1) direct costs to travelers due to additional travel time, (2) increases in construction costs due to a delay, and (3) impact on economic activity due to a delay. Given the major road construction projects in Corpus Christi, the average annual cost associated with their delays is projected to be between \$22 million and \$27 million.

Vehicle Inspection and Repair Costs

An area of moderate nonattainment is required to implement the basic vehicle inspection and maintenance program. In this program, vehicles that are 2 to 24 years old with light or medium duty engines are required to get an on-board diagnostic emission inspection each year. In Texas, the current inspection fees are between \$11.5 per vehicle in El Paso and \$18.5 in the Dallas-Fort Worth and Houston areas.

Based on data on the area's registered vehicles, the requirement for vehicle inspections would result in a reduction in economic activity between \$5.8 million and \$9.3 million each year.

Educational and Outreach Programs

A non-attainment area is required to implement additional educational programs and incur additional costs in the Texas Emissions Reduction Plan (TERP) beyond those voluntary programs already taken.

Such costs are considered economic "losses," or waste to society, in the sense that the new programs might otherwise be unnecessary if local air quality is not a critical community issue and thus resources associated with those costs would otherwise be allocated to other activities, including leisure.

Over the period of marginal nonattainment, the Corpus Christi metro area is projected to incur \$115,397 each year in air quality educational programs, or more than half of the current budget of the Coastal Bend Air Quality Partnership programs.

Average Annual Potential Costs of Nonattainment in the Corpus Christi MSA (2020 \$)

	Marginal Nonattainment		Moderate Nonattainment	
	Low Estimate	High Estimate	Low Estimate	High Estimate
Impact on Local Industry	\$565,945,755	\$1,690,216,126	\$566,376,968	\$1,697,857,641
Losses due to Road Construction Delays	\$20,263,963	\$20,291,740	\$27,348,016	\$27,373,016
Vehicle Inspection Costs	—	—	\$5,769,684	\$9,281,666
Educational/Outreach Program Costs	\$123,474	\$123,474	\$261,148	\$261,148
Costs of Voluntary Control Measures	\$29,655	\$29,655	\$29,655	\$29,655
Total	\$586,362,847	\$1,710,660,996	\$599,785,472	\$1,734,803,126

Voluntary Control Measures

Under the Texas Emissions Reduction Plan (TERP), communities can apply for funding to pay for programs that reduce emissions from vehicles in the area. These programs include the Diesel Emission Reduction Incentive (DERI), Texas Clean Fleet (TCFP) Program, Texas Natural Gas Vehicle Grant Program (TNGVGP), and Drayage Truck Incentive Program (DTIP).

According to the study, a nonattainment designation would potentially result more than \$800,000 in costs for the area beyond the existing TERP programs.

Total Nonattainment Costs

Summing up the three categories of potential costs associated with ozone nonattainment, the Corpus Christi metro area is projected to face an economic loss between \$586 million and \$1.7 billion per year under the designation of marginal or moderate nonattainment. The high estimate is equivalent to about 5% of the area's gross regional product.

Within the Corpus Christi metro area, Nueces County is the most populated county with nearly 80% of the regional population. This county is projected to incur between \$0.5 billion and roughly \$1.5 billion each year if the metro area as a whole receives an ozone nonattainment designation.

The burden from the nonattainment designation is the highest for residents in Nueces County due in part to the county's relatively more employment and business opportunities that might potentially be lost.

However, even though most existing industrial activity that contributes to major air pollution sources occurs in Nueces and San Patricio Counties, a typical resident in Aransas County would still experience economic losses between \$560 and \$1,679 each year.

COVID-19: Quasi-Experiment

Either from the lens of the Corpus Christi metro area as a whole or an individual resident, the estimated economic costs of ozone nonattainment seem outrageous. But the depths of the COVID-19 pandemic offered fresh insight into what to lose in exchange for better air quality.

In April, vehicle travel in Corpus Christi reduced by 25%, according to [mobility data](#). During that period, ozone concentration in the area dropped by 12.5%, according to Houston Advanced Research Center. All this happened when businesses suffered a 27% revenue loss on average, according to a recent [business survey](#).

Drawing from these numbers, a back-of-envelope calculation indicates that to return an air quality level to that in April would cost more than \$7 billion worth in economic activity each year, substantially more than the estimated costs of nonattainment in the report.

Put simply, it is costly to restore the environment, once it is damaged.