Our Border Environment: Water and Air Pollution

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Communities surrounding the US–Mexico border are at the crossroads of commercial and noncommercial traffic flows. Successful examples of the North American multilateral relationship among the United States, Mexico, and Canada—including agreements such as the United States–Mexico–Canada Agreement—have resulted in an increase of 164 percent in total trade between the United States and Mexico over the last seventeen years.

While greater integration between the United States and Mexico has generated significant economic and population growth in both countries, border communities currently experience negative externalities stemming from new and existing environmental stressors. More specifically, commercial and noncommercial vehicles sitting idle for extended periods at ports of entry deteriorate the air and water quality of border communities, directly impacting the health of residents. This report presents the major issues associated with air and water pollution at ports of entry along the US–Mexico border, and best practices to mitigate their impact.

AIR QUALITY IN BORDER COMMUNITIES

A sharp increase in international trade between the United States and Mexico over the past several decades has resulted in exponential growth in commercial and noncommercial vehicle density at the US–Mexico border. The increase in volume of vehicles attempting to cross the border has generated delays in border-crossing times, meaning that commercial and noncommercial vehicles frequently sit idle for hours, becoming the principle source of nitrogen oxides (NOx) and other particulates such as PM2.5 (particulate matter 2.5 micrometers or less in diameter) emitted into the atmosphere at ports of entry.[1]

While the implementation of certain policies, such as new diesel standards for vehicles,[2] have successfully reduced air pollutants at certain ports of entry, traffic delays continue to negatively contribute to environmental outcomes in border communities. For instance, commercial vehichles regularly experience longer wait times at the border due to heightened and duplicated inspection mechanisms,[3] ultimately producing eleven times more pollutants than noncommercial vehicles.[4] Given that successful clearance of the US–Mexico border requires authorization from customs authorities in both nations, joint action to coordinate and interact more efficiently has the potential to reduce congestion and, consequently, pollution.[5]

Figure 1 illustrates the process for northbound commercial traffic to successfully cross the border. First, Mexican authorities inspect and verify export documentation. Once across the border, US Customs and Border Protection (CBP) prepares a secondary inspection using Vehicle and Cargo Inspection System (VACIS), X-ray scans, and additional electronic screening by the Federal Motor Carrier Safety Administration (FMCSA). After completing these steps, and at the discretion of the customs officials, commercial vehicles may be directed to a state safety inspection facility for visual inspection before proceeding and completing the border-crossing process.[6]

A case study by the US Department of Transportation (DoT) at the El Paso Ysleta-Zaragoza port of entry showed that joint inspections and enhanced collaboration at the border helped reduce wait times and, as a consequence, mitigate pollutants released into

1 T. Ramani, R. Jaikumar, A. Trueblood, I. Uwak, S. Vallamsundar, N. Johnson, and J. Zietsman, "Emissions from US–Mexico Border Crossings: Assessing Affected Populations in El Paso, Texas," *Journal of Transport and Health* (2018): S22-S23, https://www.sciencedirect.com/science/article/pii/S2214140518302639.

2 The US EPA began regulating sulfur levels in diesel fuel in 1993 and, in 2006, began to phase in more stringent regulations to lower the amoung of sulfur in diesel fuel to fifteen parts per million.

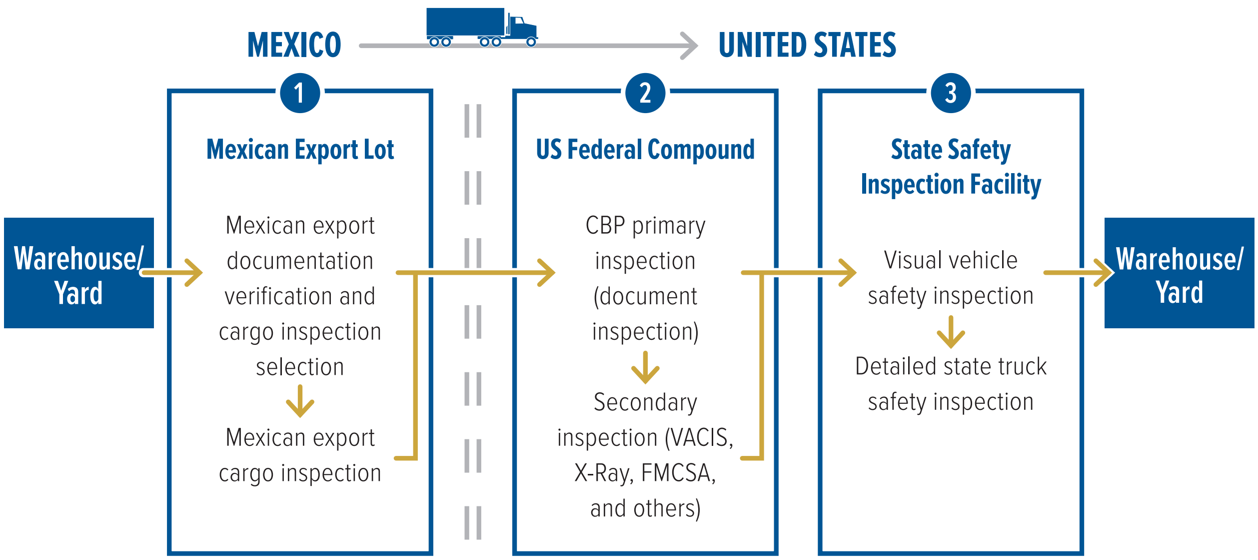
3 Commission for Environmental Cooperation, *Reducing Air Pollution at Land Ports of Entry: Recommendations for Canada, Mexico and the United States*, Commission for Environmental Cooperation, 2016, http://www.cec.org/files/documents/publications/11656-reducing-air-pollution-land-ports-entry-recommendations-canada-mexico-and-united-en.pdf.

4 F. Gladstone, D. Livrman, R. Alejandro Sanchez Rodriguez, and A.D. Morales Sanots, "NAFTA and Environment after 25 Years: A Retrospective Analysis of the US–Mexico Border," *Environmental Science and Policy* 119 (2021): 18–33, https://liverman.faculty.arizona.edu/sites/liverman.faculty.arizona.edu/files/2021-06/Gladstone%20Liverman%20Sanchez%20and%20Morales%202020%20NAFTA.pdf.

5 Commission for Environmental Cooperation, *Reducing Air Pollution at Land Ports of Entry*.

6 J.C. Villa, "Status of US-Mexico Commercial Border Crossing Process: Analysis of Recent Studies and Research," *Transportation Research Record: Journal of the Transportation Research Board* 1966 (2006): 10-15.

Figure 1. Commercial Traffic Crossings Inspection Process



SOURCE: J.C. Villa, "Status of US-Mexico Commercial Border Crossing Process: Analysis of Recent Studies and Research," Transportation Research Record: Journal of the Transportation Research Board 1966 (2006): 10-15.

the atmosphere.[7] The study analyzed scenarios to evaluate their impacts on NOx and PM2.5 emissions.

The first scenario studied was "No Delay," which showed a hypothetical situation where vehicles were not required to stop at ports of entry. No inspections resulted in zero congestion and delays. The DoT then studied a "No Action" scenario, and used average daily emissions for the El Paso Ysleta-Zaragoza port of entry in 2010. The third scenario, "Privately Owned Vehicle (POV Action)," predicted emission levels if vehicles were redirected from general-purpose lanes to the expedited Secure Electronic Network for Travelers Rapid Inspection lanes. The final scenario, the "Commercial Vehicle Strategy," estimated emissions if US and Mexican cargo inspections were combined to eliminate the queuing and delays associated with duplicative inspections.[8]

The results in Figure 2 show that the final scenario generated the least air pollutants, considering the necessity of border inspections and the impossibility of the "No Delay" scenario. On the other hand, the "No-Action" scenario produced the greatest level of pollutants, with approximately 216.1 total NOx lbs/day (186.5 NOx lbs/day for commercial vehicles and 29.6 NOx lbs/day for noncommercial vehicles) and 15 total PM2.5 lbs/day (13.8 PM2.5 lbs/day for commercial vehicles and 1.2 PM2.5 lbs/day for noncommercial vehicles). The DoT found that the stop-and-go nature of each inspection stop resulted in additional idling time, whose emissions represent as much as 5 percent of controllable emissions at a given port of entry.

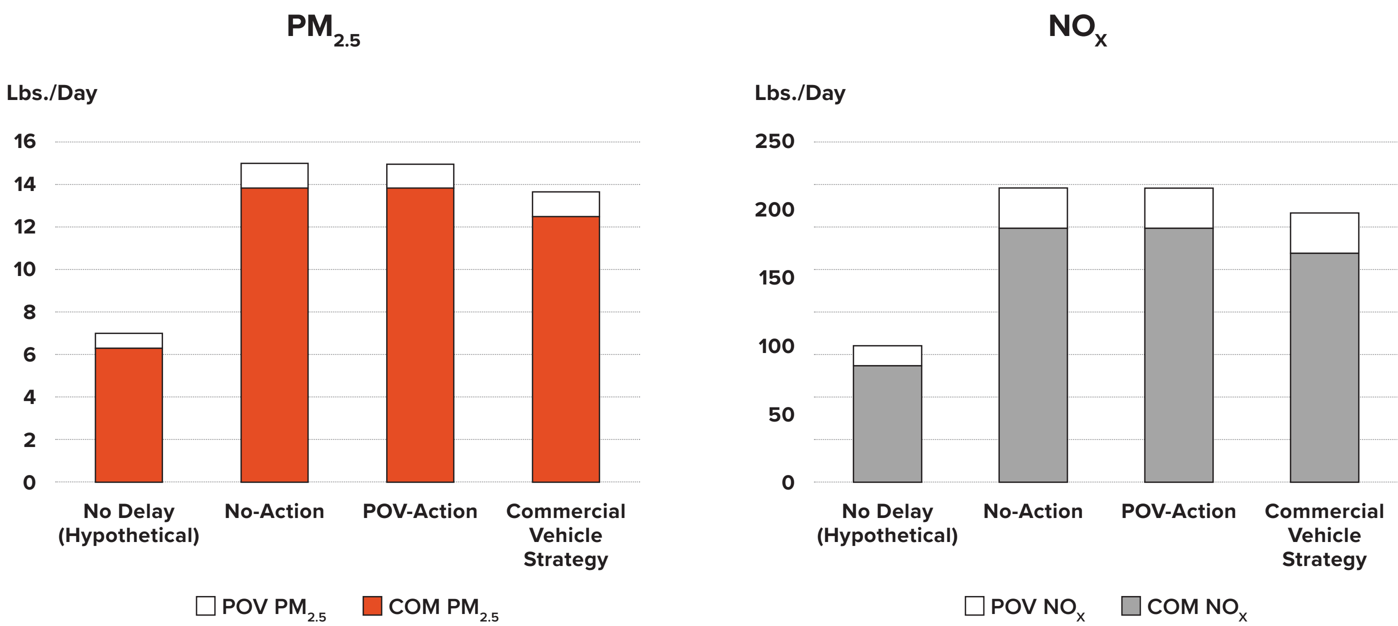
These results led the DoT to recommend a reduction in the total number of booths where physical inspection of documents is required by CBP, and an increase in joint inspection points between the United States and Mexico to reduce the duplication of inspection efforts. This strategy, where CBP officers and Mexican customs agents effectively collaborate to reduce double inspections, reduced daily commercial NOx emissions by 9.9 percent and reduced daily commercial PM 2.5 emissions by 9.7 percent.

Another case study in San Ysidro, California, indicated consistently higher daytime black carbon and ultrafine particle concentrations

7 Thomas P. Kear, James H. Wilson, and James J. Corbett, *United States–Mexico Land Ports of Entry Emission and Border Wait-Time*, US Department of Transportation, Federal Highway Administration, 2012, https://rosap.ntl.bts.gov/view/dot/23180.

8 Ibid.

Figure 2. 2010 Ysleta-Zaragoza Northbound Daily PM2.5 and NOx Emissions



NOTE: COM = commercial vehicle.
SOURCE: Cambridge Systematics, Inc.

at measurement sites near the San Ysidro port of entry.[9] Pollution concentrations were significantly higher during low wind speeds or when the wind was blowing from the port of entry toward San Ysidro, and highly correlated with the port of entry's northbound wait times. The study demonstrates that proximity to the port of entry may increase exposure to traffic-related pollutants for the local community, with wait times of northbound vehicles directly contributing to elevated pollution levels.[10]

New environmental stressors imposed on border communities also increase the difficulty of attaining and maintaining air pollution standards set forth by the United States Environmental Protection Agency (EPA). The DoT's Federal Highway Administration suggests that implementing emission reduction strategies on the border may help border regions attain the national standards set by the EPA. For instance, a joint cargo inspection initiative funded by the Border 2020 program at the Nogales-Mariposa port of entry found that reducing crossing times for northbound commercial vehicles reduced carbon dioxide and other particulate (PM10 and PM2.5)[11] emissions by nearly 85 percent.[12]

Border traffic exposures represent an environmental justice issue to nearby communities on both sides of the border and to border crossers at ports of entry. Bilateral action is needed to ensure a clean environment for border communities, particularly given the health implications that exposure to air pollution from cross-border traffic can generate in residents, including children, pregnant women, and persons with preexisting cardiac or respiratory conditions.[13]

9 Penelope J.E. Quintana, Jill J. Dumbauld, Lynelle Garnica, M. Zohir Chowdhury, José Velascosoltero, Arturo Mota-Raigoza, David Flores, et al. "Traffic-Related Air Pollution in the Community of San Ysidro, CA, in Relation to Northbound Vehicle Wait Times at the US–Mexico Border Port of Entry," *Atmospheric Environment* 88 (2014): 353-61, https://doi.org/10.1016/j.atmosenv.2014.01.009.

10 Ibid.

11 Particulate matter of 10 micrometers or less in diameter.

12 North American Research Partnership, *Quantifying Emission Reduction, Queue Reduction, and Delay Reduction Benefits from the Nogales Unified Cargo Processing Facility*, Border 2020 Program, North American Research Partnership, 2019, 1-47; M.P. Sullivan, "Increased Efficiency at Nogales Border Crossing Improves Air Quality, Public Health," US Environmental Protection Agency, News Release: Region 9, 2019, https://www.epa.gov/newsreleases/increased-efficiency-nogales-border-crossing-improves-air-quality-public-health.

13 M. Quintero-Nunez and G. Munoz Melende, "Risky Borders: Traffic Pollution and Health Effects at US–Mexican Port of Entry," *Journal of Boderlands Studies* 30, no. 3 (2015), https://www.researchgate.net/publication/281179252_Risky_Borders_Traffic_Pollution_and_Health_Effects_at_US-Mexican_Ports_of_Entry.

The Border 2020 initiative serves as a valuable example of bilateral collaboration and how organizations such as the EPA and its Mexican counterpart, *Secretaría de Medio Ambiente y Recursos Naturales*, can partner with local, state, and tribal/Indigenous communities to reduce negative environmental externalities at the border and reduce public health risks via a bottom-up approach for setting priorities and making decisions.[14]

WATER QUALITY AND AVAILABILITY IN BORDER COMMUNITIES

The United States and Mexico share several water sources, including the Rio Grande and Colorado Rivers. Border communities directly benefit from these natural resources. For instance, approximately 75 percent of the Rio Grande's flow is used for agricultural purposes in border communities. In El Paso specifically, groundwater resources such as the Hueco–Mesilla Bolsons aquifer provide the community with over 50 percent of its drinking water.[15] However, several factors, including pollution stemming from border usage, has decreased the community's access to clean and safe water.

Water pollution is an increasing danger to residents in the United States and Mexico. Sewage and trash that is not properly disposed of around the US–Mexico border has been seeping into bodies of water across the region. These consequences result from several pollutant sources, such as pipeline breaks, wastewater system deterioration, and stormwater drainage system scarcity.[16] The hazardous bacteria in polluted water imposes a significant health risk to public health and to terrestrial and acquatic wildlife.

The economic and population growth that has occurred along the US–Mexico border has also resulted in the overexploitation of existing water reserves,[17] which has led to decreases in regional groundwater levels.[18] These shortages have led to the creation of entities to promote cooperation and resolve disputes between the United States and Mexico.[19] In 1994, the United States and Mexico created the International Boundary and Water Commission (IBWC), which upholds the guidelines set forth by the treaty for the utilization of waters of the Colorado and Tijuana Rivers and of the Rio Grande.

This treaty authorized both countries to construct, operate, and maintain dams on the main channel of the Rio Grande, and entrusts the IBWC to give preferential attention to all border sanitation problems.[20] The commission focuses on jointly managing the Colorado River's water and infrastructure, improving water availability during droughts, and restoring and protecting riverine ecosystems.[21] Today, it is developing a binational model for water management in the Rio Grande, part of a broader effort to improve reliability in Mexico's water deliveries.[22]

A solution to the alarming depletion of underground water and threats to river conservation is to align numerous binational institutions and agreements to ensure the proper conservation of water in the region.[23] National mandates, binational institutions, and proper coordination and cooperation are needed to ensure the continued conservation of the Hueco–Mesilla Bolsons aquifer,

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14 US Environmental Protection Agency and Secretaria de Medio Ambiente y Recursos Naturales, *Border 2020: U.S.-Mexico Environmental Program*," US Environmental Protection Agency and Secretaria de Medio Ambiente y Recursos Naturales, n.d., https://www.epa.gov/sites/default/files/documents/border2020summary_0.pdf.

15 "About the Rio Grande," International Boundary and Water Commission, n.d., https://www.ibwc.gov/crp/riogrande.htm.

16 "USMCA Tijuana River Watershed," US Environmental Protection Agency, November 21, 2021, https://www.epa.gov/sustainable-water-infrastructure/usmca-tijuana-river-watershed.

17 T.J. Bohn, E.R. Vivoni, G. Mascaro, and D.D. White, "Land and Water Use Changes in the US–Mexico Border Region, 1992-2011," *Environmental Research Letters* 13, no. 11 (2018), https://iopscience.iop.org/article/10.1088/1748-9326/aae53e.

18 Comisión Nacional del Agua, *Atlas del Agua en México,* Comisión Nacional del Agua, 2012, http://www.conagua.gob.mx/conagua07/publicaciones/publicaciones/sgp-36-12.pdf; K.L. Jacobs and J.M. Holway, "Managing for Sustainability in an Arid Climate: Lessons Learned from 20 Years of Groundwater Management in Arizona, USA," *Hydrogeology Journal* (2004): 52-65, https://link.springer.com/article/10.1007/s10040-003-0308-y.

19 Stephen P. Mumme, "Advancing Binational Cooperation in Transboundary Aquifer Management on the US–Mexico Border," *Colo. J. Int. Environ. Pol.* 16 (2005): 77-110; Aaron J. Douglas, "Social, Political, and Institutional Setting: Water Management Problems of the Rio Grande," *J. Water Resour. Plan Manage.* 135 (2009): 493-501, https://ascelibrary.org/doi/10.1061/%28ASCE%290733-9496%282009%29135%3A6%28493%29; "Arizona Water Resources Director Joins US & Mexico in Finalizing Epic CO River Agreement," Arizona Department of Water Resources, September 27, 2017, https://new.azwater.gov/news/articles/2017-27-09.

20 "Treaties between the US and Mexico," International Boundary and Water Commission, 2022, https://ibwc.gov/Treaties_Minutes/treaties.html.

21 US Congressional Research Service, *Sharing the Colorado River and the Rio Grande: Cooperation and Conflict with Mexico*, CRS Report prepared for Members and Committees of Congress, US Congressional Research Service, 2018, https://www.everycrsreport.com/files/20181212_R45430_1a2a332132bcacf6e72487ed6603faf9e4709070.pdf.

22 Ibid.

23 Jennifer Pitt, Daniel F. Luecke, Michael J. Cohen, Edward P. Glenn, and Carlos Valdés-Casillas, "Two Nations, One River: Managing Ecosystem Conservation in the Colorado River Delta," *Natural Resources Journal* 40, no. 4 (Fall 2000): 819-864, https://www.jstor.org/stable/24888561.

which, to date, is governed independently by Texas and the federal Mexican government.[24]

Map 1 illustrates the origin of the water coming from the Colorado River as it flows down to El Paso and ultimately into the Gulf of Mexico.

CONCLUSION

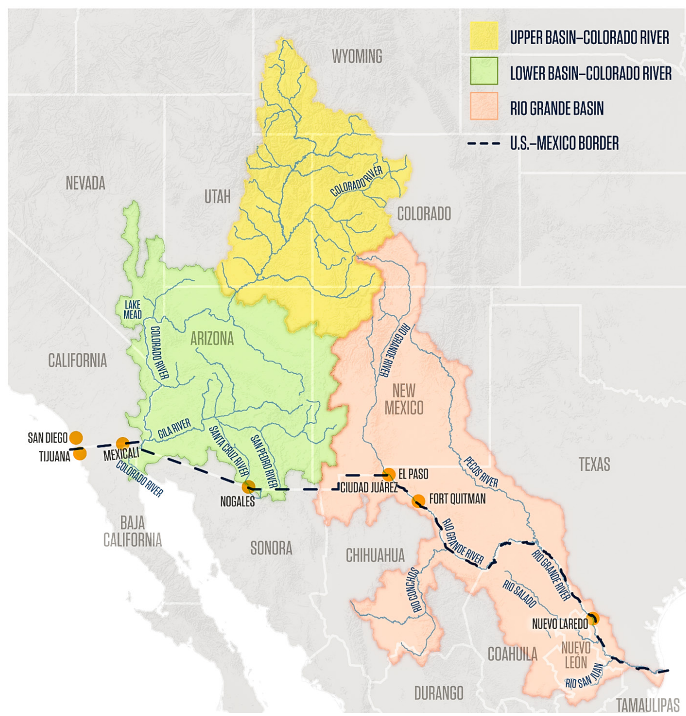
This report highlights the unintended consequences of increased wait times at the US–Mexico border in terms of increased air and water pollution. This by-product of increased economic activity presents real costs on border communities, and it is imperative that policymakers in both the United States and Mexico work collaboratively to reduce the negative environmental externalities in border regions.

Fortunately, policies addressing air pollution caused by commercial traffic have been implemented with some success. Such policies decreased nitrogen dioxide and PM2.5 emissions in El Paso and San Diego between 1990 and 2018. In Nogales, a joint cargo inspection program funded by the Border 2020 program resulted in the substantial reduction of crossing times for northbound commercial vehicles. These findings suggest that policies can be designed to successfully reduce the environmental impact of economic activity on the US–Mexico border. However, such efforts require support on both sides of the border.

The United States and Mexico's success at working collaboratively has also been corroborated by entities such as the North American Development Bank, which has been able to finance and support development and implementation of environmental projects as well as provide technical assistance for other infrastructure projects along the border.

However, there is still more to be done. Although balancing economic growth, international commerce, and security with environmental well-being is often challenging, collaboration among corresponding authorities can result in rapidly reaching joint goals. Similar to how the North American Free Trade Agreement proved that increased bilateral relationships accelerated economic growth and international commerce, it can be proved that collaborative efforts across the United States and Mexico can reduce the unintended consequences of this growth on air quality, water availability, and health in border communities.

Map 1. Colorado River Water System



SOURCE: Hunt Institute for Global Competitiveness.

24 Alex Mayer, Josiah Heyman, Alfredo Granados-Olivas, William Hargrove, Mathew Sanderson, Erica Martinez, Adrian Vazquez-Galvez, and Luis Carlos Alatorre-Cejudo, "Investigating Management of Transboundary Waters through Cooperation: A Serious Games Case Study of the Hueco Bolson Aquifer in Chihuahua, Mexico and Texas, U.S.," *Water* 13, no. 15 (2021): 2001. https://doi.org/10.3390/w13152001.