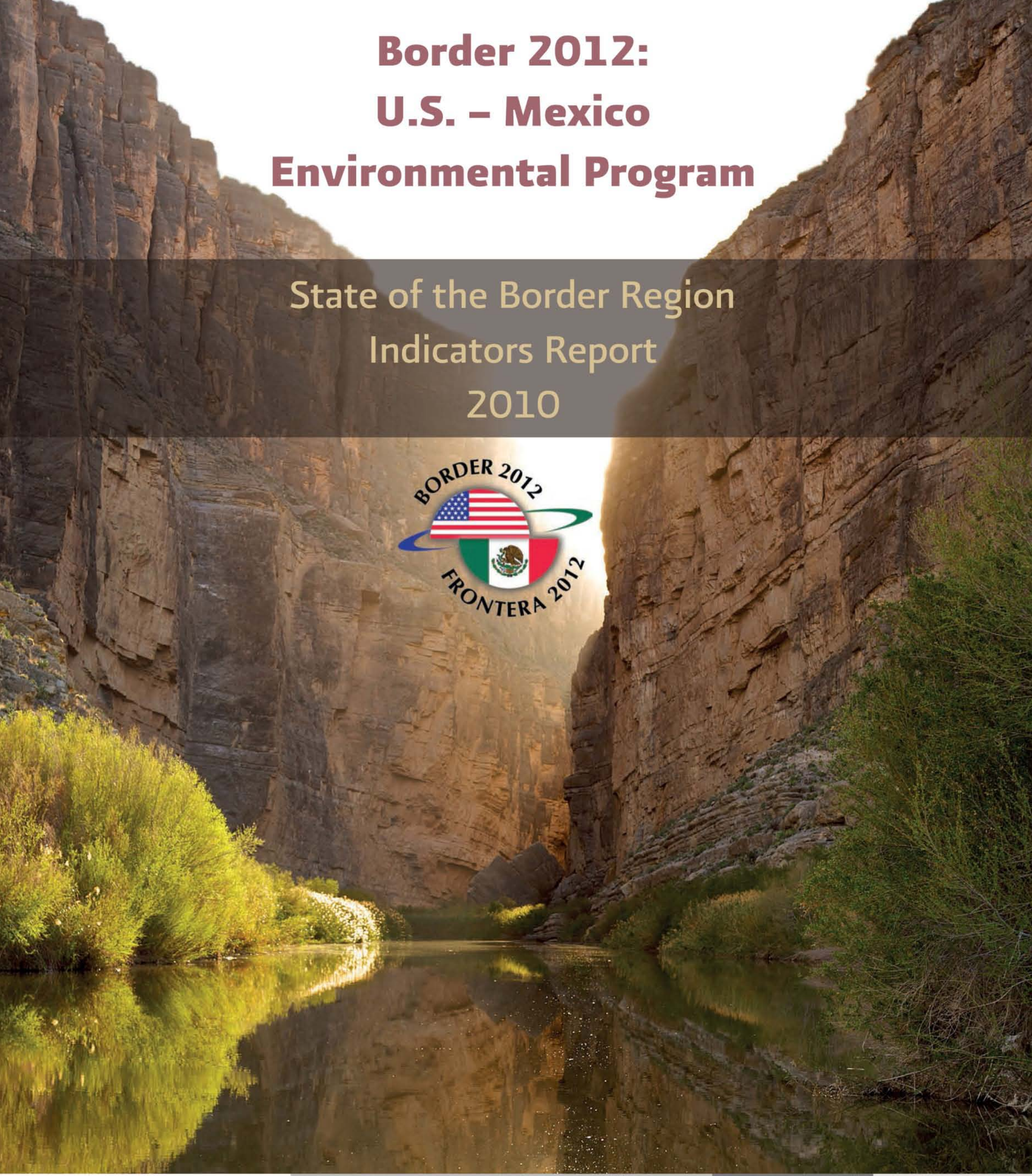
Border 2012: U.S. – Mexico Environmental Program

State of the Border Region Indicators Report 2010



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Acknowledgements

This report benefits from the contributions, review, and suggestions of many staff at EPA, SEMARNAT, border region tribes and indigenous communities, and other federal, state, and local agencies in the U.S. and Mexico. Particular thanks go to representatives of Border 2012 coordinating bodies that provided leadership in the development and refinement of indicators in their areas of expertise.

We hope that this report will be informative to a broad range of audiences in the border region. And, we hope that it will be useful in charting the future course of binational efforts to improve the environmental quality of the border region, and in so doing, the health and quality of life of those who call the border region home.

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SEMARNAT
Secretaría de Medio Ambiente y Recursos Naturales

United States Environmental Protection Agency

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1. REPORT OVERVIEW

Border 2012 Goals

1. Reduce water contamination
2. Reduce air pollution
3. Reduce land contamination
4. Improve environmental health
5. Enhance joint readiness for environmental response
6. Improve environmental performance

Each of the Border 2012 goals is represented by specific objectives and sub-objectives related to specific border environmental and health issues.

State of the Border Region 2010 provides information on the status and trends of environmental quality and environmental health in the U.S.-Mexico border region. In doing so, it also illustrates progress made under the U.S.-Mexico Border 2012 program and identifies areas for further binational work beyond 2012.

This report builds on the flagship 2005 *State of the Border Region* report. It updates many of the indicators first reported in 2005, adds new indicators, and includes place-specific highlights that could become border-wide indicators in the future. As with the 2005 report, this report is structured around the six goals of Border 2012 with chapters on water, air, land, environmental readiness and response, and enforcement and compliance. Indicators that support Border 2012's additional goal, environmental health, cut across the other five goals and are included throughout the report in the most appropriate chapter.

The indicator and highlight information is presented with brief data source information below each indicator or highlight. Complete underlying data and details on indicator data sources are available in a companion document, *State of the Border Region 2010: Indicator Metadata and Data Tables*.

Border 2012

Border 2012 is a ten-year cooperative program initiated in 2002 and designed "to protect the environment and public health in the U.S.-Mexico border region, consistent with the principles of sustainable development." Through Border 2012, federal, state, tribal and local institutions and agencies collaboratively work to produce prioritized and sustained actions that consider the needs of border communities. The actions implemented under Border 2012 are guided through a series of results-oriented goals and objectives, and measured by environmental and performance indicators. Border 2012's goals and objectives were updated in 2008 through a mid-course refinement process designed to target Border 2012 activities in the last five years of the program.

Border 2012 is the latest cooperative initiative implemented under the 1983 La Paz Agreement. It builds on the previous efforts, particularly Border XXI, which marked the first binational effort to develop environmental indicators for the border region.

Border Program Timeline

Border Indicators Task Force

This report was developed by the Border Indicators Task Force (BITF). Created in 2003, the BITF works with Border 2012 coordinating bodies to develop environmental and performance indicators for the border region. The BITF supports the program's guiding principles to "achieve concrete, measurable results" and "measure program progress through development of environmental and public health-based indicators." The BITF supports the national coordinators, border-wide coordinating bodies, regional workgroups, and other stakeholders by assessing the state of the border region and relating ambient environmental and health conditions to the activities of Border 2012. It helps ensure that Border 2012 can demonstrate progress toward meeting the program's ambitious binational goals and objectives. The BITF is led by representatives of the United States' national environmental agency, the Environmental Protection Agency (EPA) and Mexico's national environmental agency, Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). Co-chairs from EPA and SEMARNAT work with BITF members that represent many Border 2012 partners, including federal, state, and local agencies, U.S. tribes, Mexican indigenous communities, and stakeholders.

How were indicators developed for this report?

The starting point for indicators included in this report was the 2005 *State of the Border Region* report. The 2005 report acknowledged the challenges of developing binational indicators and noted that indicators would be refined and added as the coverage and comparability of data improved over time. This 2010 report represents an additional step forward in developing high-quality, comparable, and useful indicators for the border region.

A key guiding principle in developing the indicators for this report was that the indicators should be as relevant as possible to the work of achieving Border 2012 goals and objectives. An aspirational goal of the indicator development process was to have at least one indicator related to each of the twenty Border 2012 objectives (as updated through the Border 2012 mid-course refinement process). To help accomplish that goal, the BITF undertook a planning process that sought to align border indicators more closely with Border 2012 goals and objectives.

Launched in late 2007, the planning process engaged Border 2012 coordinating bodies and other stakeholders in identifying new or refined indicators. To guide these conversations, the BITF used "indicator opportunity tables" to identify opportunities to create new indicators (or refine existing ones) that measure pressures, needs, outputs, and/or outcomes related to Border 2012 goals and objectives. This process led to several new or revised indicators.

Types of Indicators

Pressure: Indicators that describe human activities that place stresses on the environment.

Example: Increase in cross-border trade

Need: Indicators that inform our understanding of the magnitude or type of need for a programmatic response.

Example: Number of diesel trucks crossing the border each year

Output: Indicators that measure activities, products, or services resulting from a project or program.

Example: Number of diesel truck emissions reduction retrofits in the border region

Outcome: Indicators that measure changes in the state of the environment or the effects of environmental conditions on human and/or ecological health.

Example: Reductions in border region diesel emissions or improvements in air quality

The indicator development process focused on identifying comparable binational data that were specific to the border region (defined as 100 km north and south of the international border). In many cases, data sources and policies differed enough between the U.S. and Mexico that separate but related indicators needed to be reported for both countries. Data specific to the border region were not always available. If they were available, they often were reported at the municipal or county-level or even at the level of U.S. and Mexico border states, requiring data aggregation or interpretation in order to describe the border region.

In some cases, data on desired indicators were not available border-wide at all. In some of these cases, the BITF developed place-specific highlights to describe status, trends, or Border 2012 activities in particular areas. Although these highlights currently provide less information than indicators, they are included in order to present a more holistic picture of the border region and to encourage future development of these highlights into indicators suitable for binational reporting.

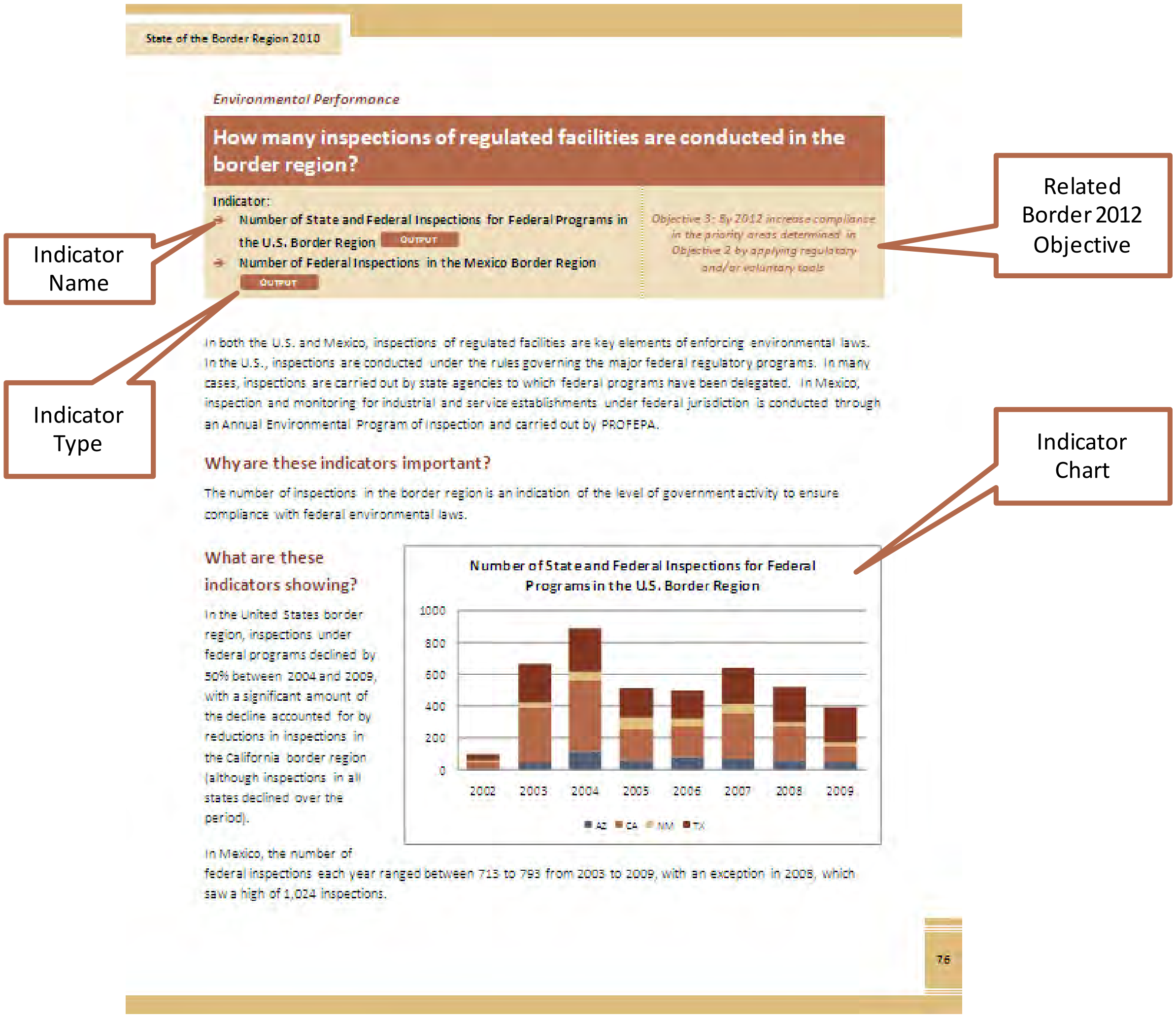
What indicators are included and how are they described?

The first chapter of the report focuses on general information about the border region's population, economy, and climate. It provides the context for many of the current environmental and health challenges in the region. The five chapters that follow present indicators related to specific Border 2012 program goals and objectives.

The graphic on the next page illustrates how indicators are presented in the report. Indicators are grouped according to questions. Each indicator is accompanied by a reference to the indicator type, derived from indicator opportunity tables (e.g., pressure, need, output, or outcome). For each indicator, the report includes a chart or table to accompany the indicator text. The report identifies the most relevant Border 2012 objective or sub-objective for each group of indicators. Additionally, each indicator description addresses the questions:

- Why is this indicator important?
- What is this indicator showing?
- What influences this indicator and what can be done in the future?
- What technical considerations are important for understanding this indicator and its limitations?

The Border Indicators Task Force hopes that you find this report informative and useful and invites your feedback on future indicators to help measure environmental quality and environmental health in the border region.



State of the Border Region 2010

Environmental Performance

How many inspections of regulated facilities are conducted in the border region?

Indicator:
- Number of State and Federal Inspections for Federal Programs in the U.S. Border Region OUTPUT
- Number of Federal Inspections in the Mexico Border Region OUTPUT

Objective 3: By 2012 increase compliance in the priority areas determined in Objective 2 by applying regulatory and/or voluntary tools

In both the U.S. and Mexico, inspections of regulated facilities are key elements of enforcing environmental laws. In the U.S., inspections are conducted under the rules governing the major federal regulatory programs. In many cases, inspections are carried out by state agencies to which federal programs have been delegated. In Mexico, inspection and monitoring for industrial and service establishments under federal jurisdiction is conducted through an Annual Environmental Program of Inspection and carried out by PROFEPA.

Why are these indicators important?

The number of inspections in the border region is an indication of the level of government activity to ensure compliance with federal environmental laws.

What are these indicators showing?

In the United States border region, inspections under federal programs declined by 50% between 2004 and 2009, with a significant amount of the decline accounted for by reductions in inspections in the California border region (although inspections in all states declined over the period).

In Mexico, the number of federal inspections each year ranged between 715 to 793 from 2003 to 2009, with an exception in 2005, which saw a high of 1,024 inspections.

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2. THE U.S.-MEXICO BORDER REGION

The U.S.-Mexico border region, as defined by the 1983 La Paz Agreement, is the area within 100 kilometers (about 62.5 miles) on either side of the U.S.-Mexico border. It extends 3,141 km (1,952 miles) from the Gulf of Mexico on the east to the Pacific Ocean on the west. The region is comprised of 10 states (4 U.S. and 6 Mexican), which are organized through the Border 2012 program into four Border Regional Workgroups. The region is also home to 26 federally recognized tribes in the U.S., and a number of indigenous communities in Mexico. The Border 2012 program recognizes 15 "sister city" pairs along the border, which are adjacent U.S. and Mexico border cities that share significant social and economic ties.

U.S.-Mexico Border Region

Source: Natural Earth dataset

Although divided by an international border, the region is connected by historical, cultural, family, and economic ties. It is also united by shared air and water resources, habitats, and climates that do not observe political boundaries. These connections create common cause for the people living in the border region to sustain and improve their shared environment.

The region's environmental quality and environmental health are influenced by trends in population, the economy, and industrial activity. These forces have created some of the challenges being addressed by current Border 2012 activities, and they will continue to create new challenges for managing environmental quality and improving environmental health in the region.

This overview of the U.S.-Mexico border region includes sections on:

- Border region population and population growth projections
- Trends in economic integration and cross-border movement
- Border region biodiversity
- Environmental releases from facilities in the border region
- Impacts of climate change on the border region

U.S.-Mexico Border Region

What are the population trends in the border region?

Indicators:

- **Border Region Population and Forecast Population Growth: 2005-2030** PRESSURE
- **Census and Projected Border Region Population (U.S.): 2005-2010** PRESSURE
- **Comparison of Population Projections (Mexico): 2005-2030** PRESSURE

Between 1983 and 2005, the border region population grew from 6.9 million people to just over 13 million people. The most recent population projections for the region—also reported in the 2005 *State of the Border Region* report—estimate that the region's population will grow to 16-25 million people by 2030.

Ninety percent of the border population resides in 15 paired inter-dependent sister cities, and the remaining 10% live in smaller tribal and indigenous communities or in rural areas. Over 40% of the region's population resides in the California-Baja California region, which is home to the major border cities of San Diego, Tijuana, and Mexicali.

Population Density (2000)

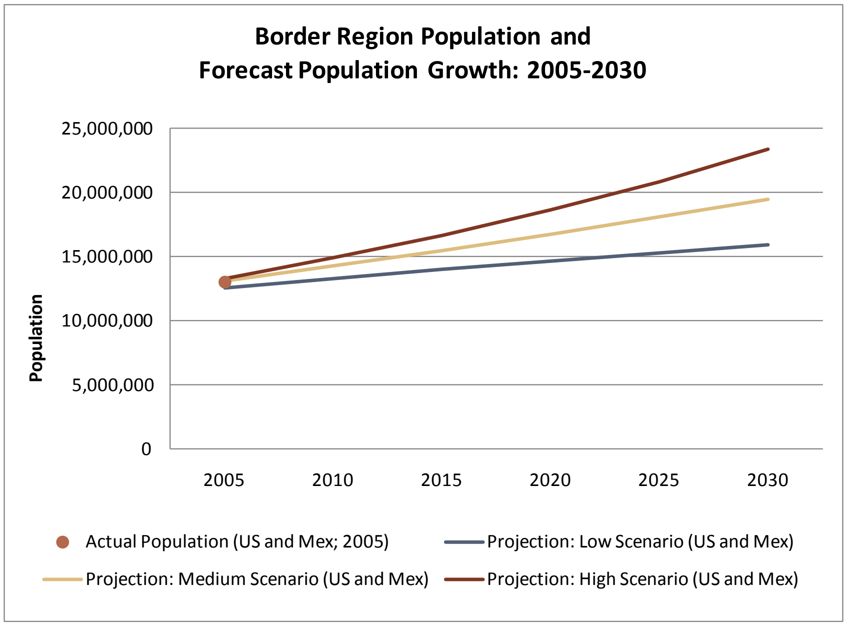
Source: Center for International Earth Science Information Network (CIESIN, and Centro Internacional de Agricultura Tropical (CIAT). 2005. Gridded Population of the World Version 3 (GPWv3), SEDAC, Columbia University, Palisades, NY.

Why are these indicators important?

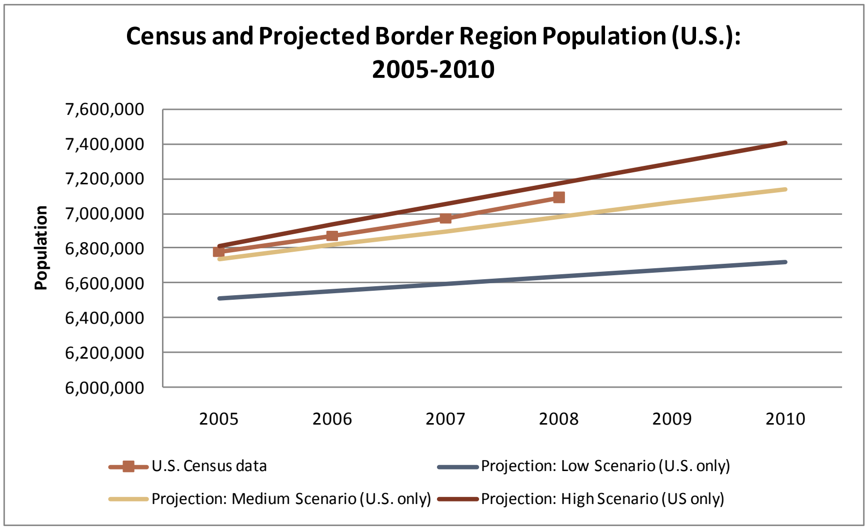
Population growth in the region puts pressure on air, water, and land. It also creates additional demand for services—such as water supply and wastewater treatment—to ensure a safe and healthy living environment. Growth puts pressure on surrounding land and habitat. In metropolitan areas, growth creates regional concentrations of air emissions—particularly from transportation sources—and heightens demand on drinking water and wastewater infrastructure. In rural areas, growth creates new challenges to provide services to isolated populations, colonias (i.e., unincorporated communities or settlements in rural areas as well as adjacent to cities and towns), and to tribal and indigenous communities, which may have substandard housing and unsafe drinking water or wastewater systems.

What are the indicators showing?

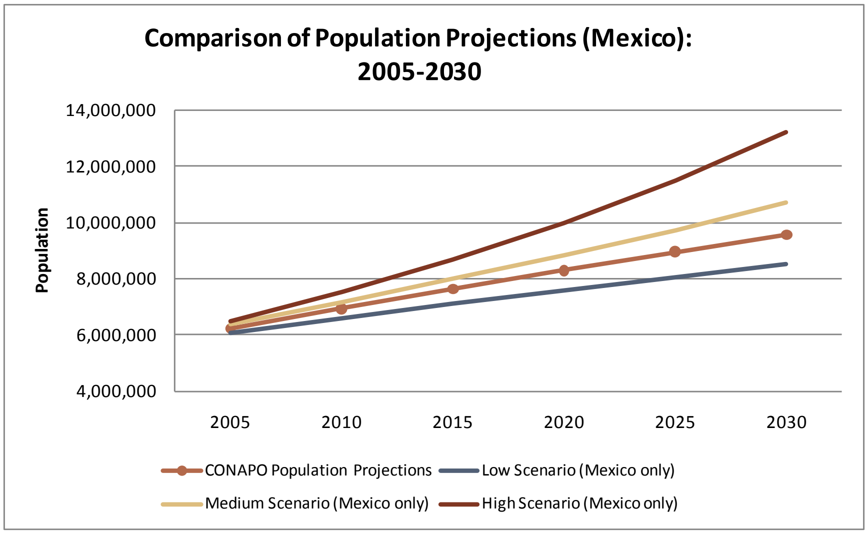
The most recent population data available from census agencies in the U.S. and Mexico show the population of the border region is consistent with the starting point for growth paths estimated in a 2003 study by Peach and Williams. The most recent year for which there is official census data for both the U.S. and Mexico is 2005, and it shows a regional population of 13 million. Several more years of actual population data will be needed to understand if the regional population as a whole is on a high, medium, or low growth path.



Census data for the U.S., which is available through 2008, suggest that the U.S. side of the border region may be on a path between the medium and high Peach and Williams scenarios.



Official population projections for the Mexico border region from Consejo Nacional de Población (CONAPO) for the period 2005–2030 suggest that Mexico's border region may grow on a path between the medium and low Peach and Williams scenarios.



What influences these indicators and what can be done in the future?

Population growth is a function of birth rates, death rates, and net migration. For the border region, migration is a key factor as people move to the urbanized and industrialized areas of northern Mexico and to major U.S. metropolitan areas such as San Diego and El Paso.

Technical considerations

Current population statistics in the U.S. and Mexico are estimates developed by the respective countries' census agencies. Both the U.S. and Mexico are implementing a complete national census in 2010, which will provide an update on population and demographic data. Estimates of border region population are based on county-level data in the U.S. and data on municipalities in Mexico. Some border counties in the U.S. extend beyond the 100 km border region (which will tend to over-count the region's population).

Data sources

J. Peach and J. Williams. 2003. "Population Dynamics of the U.S.-Mexican Border Region." Unpublished, forthcoming SCERP Monograph. San Diego: SCERP/SDSU Press

U.S. Census, Annual Estimates of the Resident Population for Counties of CA, AZ, NM, TX

INEGI, Indicadores demográficos - por municipio, 2005

CONAPO, 2005-2030 projections

U.S.-Mexico Border Region

What are the trends in economic integration and cross-border trade?

Indicators:

- **Value of U.S. and Mexico Trade** PRESSURE
- **Value of Land-based Freight Movement Across the U.S.-Mexico Border** PRESSURE
- **Number of Northbound Truck Crossings at the U.S.-Mexico Border Per Year** PRESSURE
- **Number of Northbound Passenger Vehicle Crossings at the U.S.-Mexico Border Per Year** PRESSURE

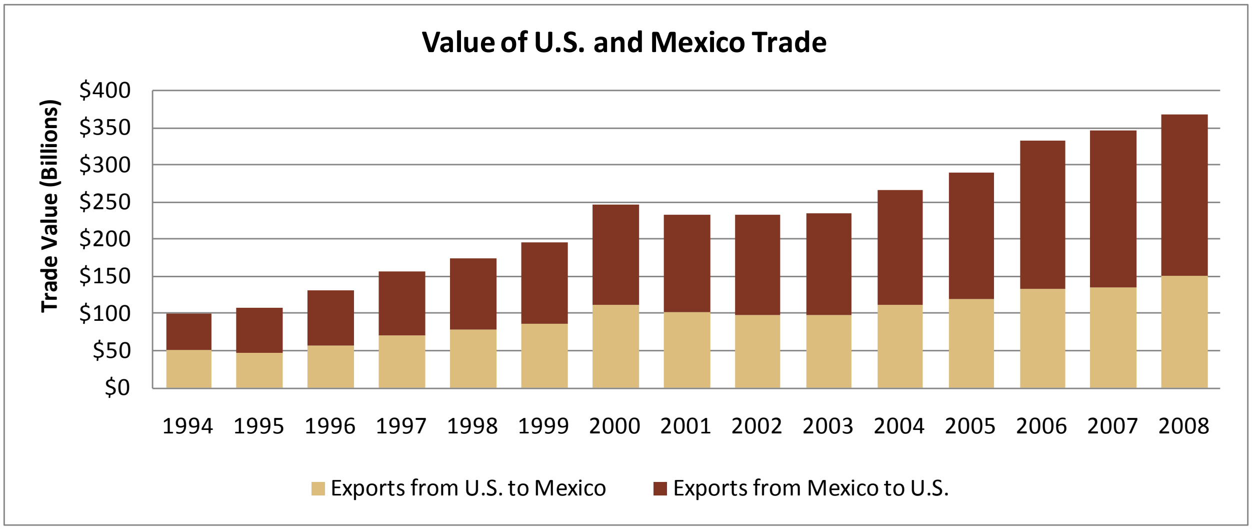
The economy and the environment of the border region are influenced by cross-border trade and the cross-border movement of people more than any other region of the U.S. or Mexico. Trade between the U.S. and Mexico has been substantially increasing over the past 10 years. This economic activity is especially associated with the growth of manufacturing and industrial facilities in the border region, which has furthered the exchange of products, leading to increased border crossings by trucks. Consequently, trade can contribute to elevated vehicular emissions and reduced air quality for residents on both sides of the border.

Why are these indicators important?

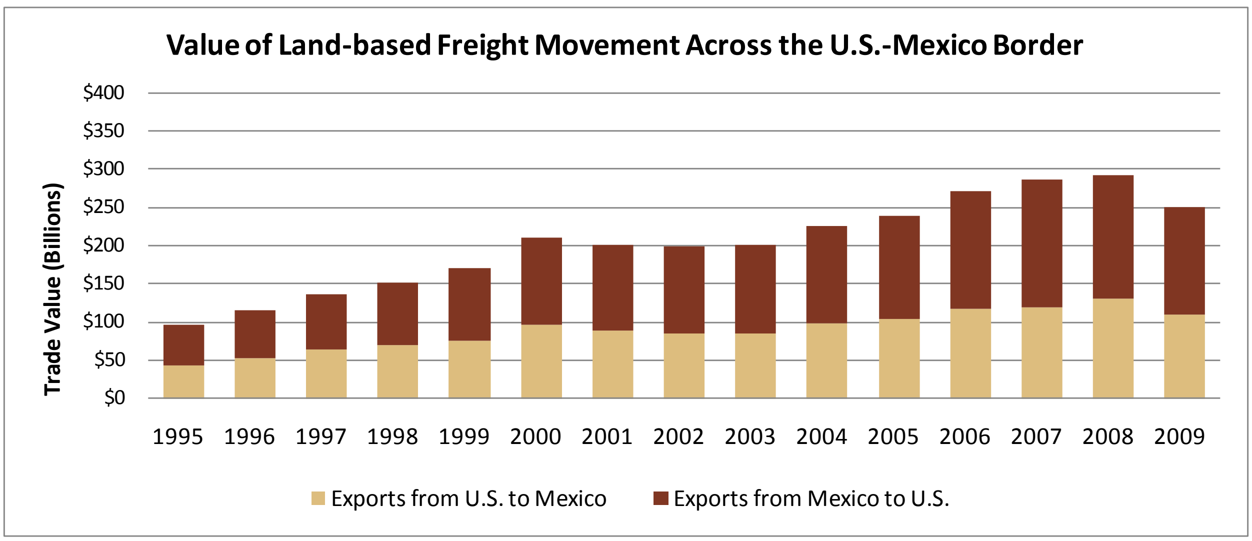
The region's economic and social integration contributes significantly to its vitality, supporting economic sectors that depend on trade and empowering residents that routinely cross the border for work, education, and family. However, economic integration also puts pressure on the region's environment by driving industrial and commercial growth and focusing the direct consequences of the transport of goods and people on the region's air. For example, trucks carrying manufactured goods from Mexico into the U.S. often idle at northbound border crossings, leading to concentrated local diesel emissions.

What are these indicators showing?

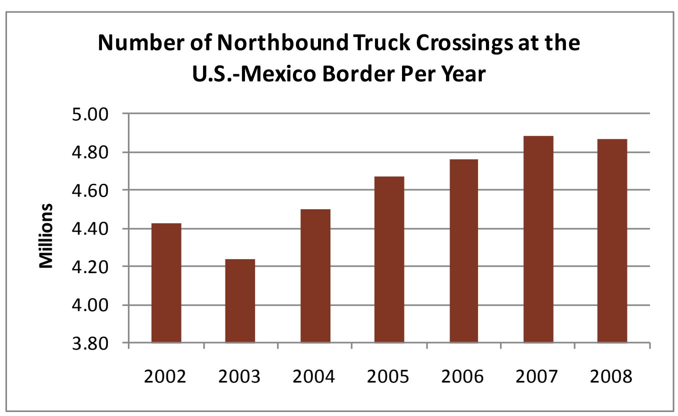
The total actual value of merchandise trade (both exports and imports to and from the U.S. and Mexico) in 2008 was $367 billion—a 266% increase since 1994. Although these values are not indexed for inflation, inflation increased by less than 50% over this time period.

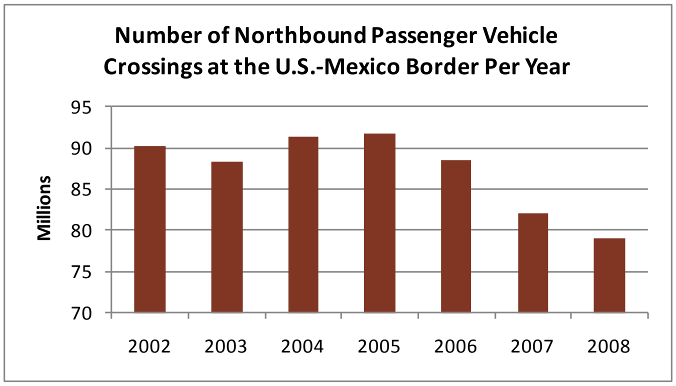


Although not all of this trade passed by land directly through the border region, a significant portion of it did. In 2008, for example, the total value of exports from Mexico to the U.S. was $216 billion. Of this, $140 billion was land-based freight coming through the border region.



Much of the freight crossing the border travels via long haul trucks or drayage trucks (i.e., short haul vehicles that cross the border frequently) that often wait idling at the border before crossing. In 2008 there were nearly 4.9 million such northbound truck trips across the border. The number of northbound truck trips has increased by 10% since 2002.





Also crossing the border are buses and passenger vehicles, which totaled 79 million northbound trips at border crossings in 2008. Trips via bus and passenger vehicle have declined 12% since 2002—partly a reflection of tighter border security since September 11, 2001.

What influences these indicators and what can be done in the future?

All of these indicators are measures of economic integration between the U.S. and Mexico and the overall level of economic activity in the region and between the countries as a whole. Declines in economic activity in either country can contribute to reduced trade between both countries. As noted, other factors—such as tighter border security—can impact cross-border movement.

Technical considerations

Data are only available for northbound border crossings because they are collected at U.S. customs facilities for vehicles and people coming into the U.S. Ideally, similar data would be available for southbound trips as well. Data on the value of trade are not indexed for inflation, but—as noted above—the growth in trade has far outpaced inflation over the period described.

Data sources

U.S. Department of Commerce, International Trade Administration, TradeStatsExpress

U.S. Department of Transportation, Bureau of Transportation Statistics

U.S.-Mexico Border Region

Highlight: Border Eco-regions and Biodiversity

The U.S.-Mexico border region is highly diverse in terms of habitats and the species they sustain, including many rare and locally distinct species. Population growth and economic development put pressure on border region habitats through fragmentation and degradation. Some Border 2012 programs, such as improvements to water quality and waste management, can help improve habitat.

According to the International Union for the Conservation of Nature and Natural Resources (IUCN), four primary types of habitat compose most of the U.S.-Mexico border region: [1]

- California Coastal Sage & Chaparral (red)—Encompassing the western part of Southern California and Northern Baja California, this region of coastal plains, terraces, and foothills has a high diversity of different types of habitats and a high level of species diversity and endemism. It hosts 150 to 200 species of butterflies alone.

- Sonoran Desert (dark pink)—Stretching north through the states of Sonora and Eastern Baja California into Arizona and California's Imperial Valley, this region has the highest diversity of vegetation (560 plant species) of any desert region in the world and a large number of species of mammals, reptiles, birds, and amphibians.
- Chihuahuan Desert (light pink)—This large region stretches from the Western Sierra Madre mountains (which separate it from the Sonoran Desert) through southeastern Arizona, southern New Mexico, northern Chihuahuan and Coahuila and west Texas to the Eastern Sierra Madre. Bounded by mountains on its flanks, the Chihuahua Desert has supported the evolution of many endemic plants and other species. It contains some of the last remaining populations of Mexican prairie dogs, wild American bison and pronghorn antelope.
- Tamaulipan Mezquital (tan)—This region follows the Rio Grande from the Eastern Tip of Coahuila through southern Texas and the northern portions of Nuevo Leon and Tamaulipas to the Gulf of Mexico. It is made up of a diverse collection of grass and brush lands, dunes, and tidal flats. This region is one of the priority areas worldwide for the preservation of cacti and other succulents.

Within these habitats there are over 6,500 animal and plant species. The range of many of these species includes both sides of the U.S. and Mexico border region. Mexico's Comisión Nacional Para el Conocimiento y Uso de la Biodiversidad (National Commission for the Understanding and Use of Biodiversity, CONABIO) maintains a National Biodiversity Information System on animal and plant species throughout the country. Based on CONABIO's data, Mexico's 100 kilometer border region is home to:

- 4,052 species of plants
- 44 species of fungi
- 454 species of invertebrates (mostly crustaceans)
- 44 species of amphibians

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[1] Habitat descriptions correspond to eco-regions, which are defined by the World Wildlife Fund as "relatively large units of land that contain a distinct assemblage of natural communities and species, with boundaries that approximate the original extent of the natural communities prior to major land use change" (see: http://www.worldwildlife.org/science/wildfinder/).

- 184 species of reptiles
- 1,467 species of birds
- 175 species of mammals

The main threats to species in the border region are habitat destruction and habitat fragmentation from development and urbanization—primarily near the coasts and around major border crossing cities—as well as cattle ranching and agriculture. Changes in climate are also expected to affect the range and prevalence of species.

In accordance with Mexico's core biodiversity law (NOM-059-SEMARNAT-2001), 235 species found in the border region are classified in a risk category. Of these, 85 are considered endangered under Mexico law. In the U.S., 148 species found in border counties are listed as endangered under the U.S. Endangered Species Act.

Sources

World Wildlife Fund, Wildfinder dataset: http://www.worldwildlife.org/science/wildfinder

Patricia Koleff, Andrés Lira-Noriega, Tania Urquiza and Eduardo Morales, "Priorities for Biodiversity Conservation in Mexico's Northern Border" in Cordova, A. & C. de la Parra (Eds.) 2007. *A Barrier to our Shared Environment. The Border Fence between the United States and Mexico*. Semarnat, INE, El Colegio de la Frontera Norte & The Southwest Consortium for Environmental Research & Policy. Mexico.

U.S. Fish and Wildlife Service:

- AZ, NM, TX endangered species data: U.S. Fish & Wildlife Service Southeast Region: http://www.fws.gov/southwest/es/EndangeredSpecies/lists/
- CA (San Diego, Imperial) endangered species data: U.S. Fish & Wildlife Service: http://www.fws.gov/endangered/

U.S.-Mexico Border Region

How many facilities in the border region are releasing toxic pollutants—and how much?

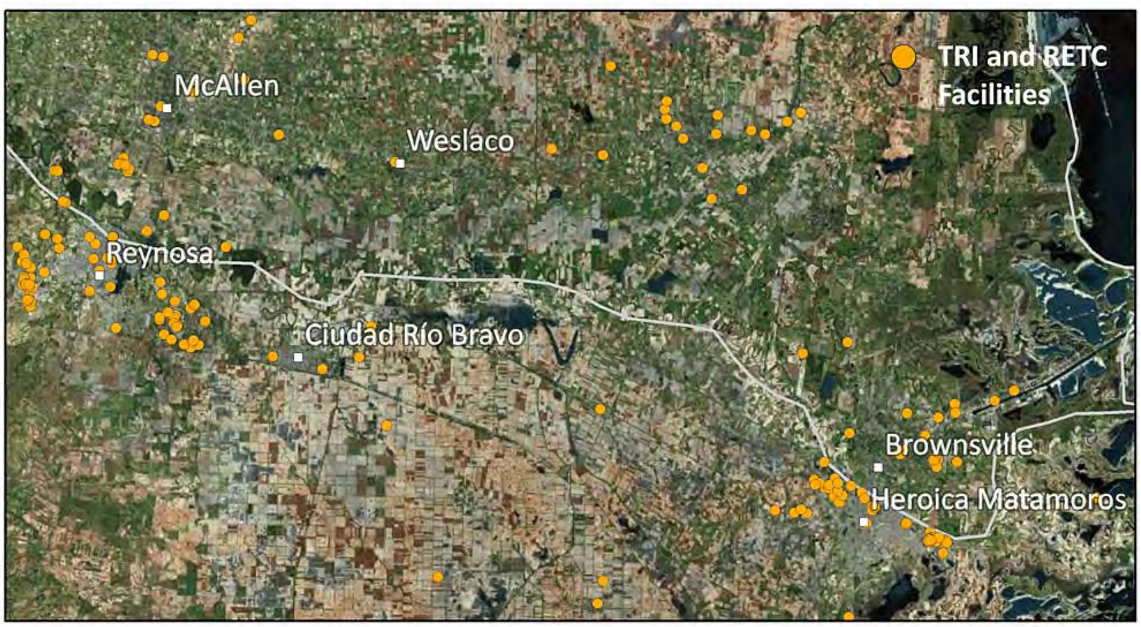
Indicators:

- **Number of Facilities in the Border Region Reporting Toxic Releases under Pollutant Release and Transfer Registries** PRESSURE
- **Total Toxic Releases from Reporting Facilities in the Border Region** PRESSURE

Although the border region economy is diverse, some of the economic activity involves industrial activities that release pollutants to the region's air, water, and land. Both the U.S. and Mexico have programs that require facilities releasing pollutants above a threshold amount to report on these releases every year. The programs, which go by the internationally-recognized term "pollutant release and transfer registries," are the *Toxics Release Inventory* (TRI) in the U.S. and the *Registro de Emisiones y Transferencia de Contaminantes* (RETC) in Mexico. Although there are some differences in the facilities and pollutants covered by the two programs (making it difficult to integrate data across the border), together they provide insights into the number of facilities releasing pollutants to air, water, and land and the quantity of these releases.

Aerial View of TRI and RETC Facilities on the Tamaulipas-Texas Border

Reporting facilities are represented by orange circles



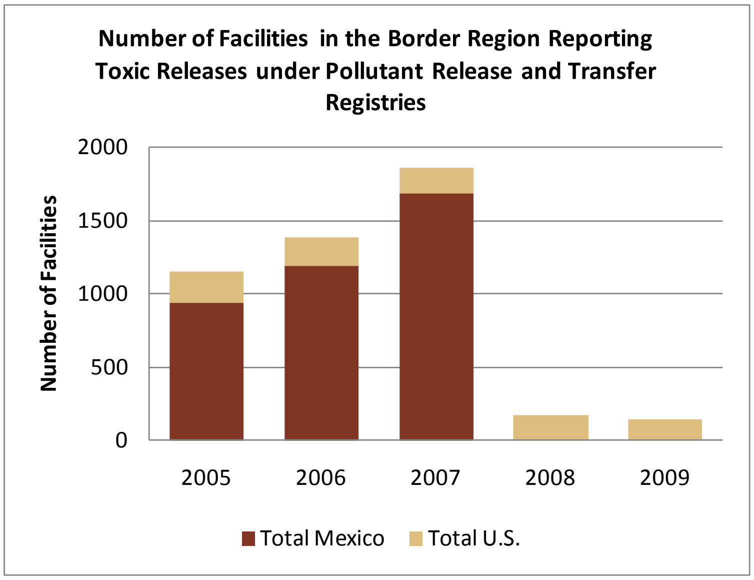
Source: EPA, Toxics Release Inventory, (2009); SEMARNAT, Registro de Emisiones y Transferencias de Contaminantes (2007). Bing Maps Aerial Imagery, 2010 Microsoft Corporation.

Why are these indicators important?

Facilities that report under the TRI and RETC programs have to estimate and report the amounts of toxic chemicals released on-site (to air, water, and land) and the amount transferred off-site for disposal. Most of these releases are legal and covered under permits obtained by the facilities under each country's environmental laws. The releases do not all contribute to risk to humans or the environment if, for example, they do not involve any human exposure to these chemical releases. However, the number of facilities and the quantity of emissions are general indicators of the demands that such releases place on the environment and human health, on local infrastructure, and on regulatory agencies.

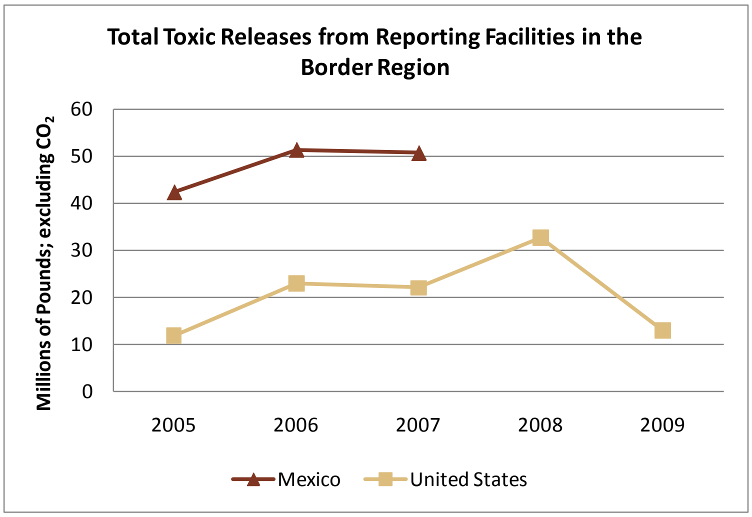
What are these indicators showing?

Over 1,800 facilities in the border region reported under either TRI or RETC in 2007 (the latest year for which both countries have available data). There are many more RETC facilities than TRI facilities in the border region, which is in part a reflection of the fact that Mexico's border region is more industrialized than that of the U.S. (owing in part to the large number of maquiladora industries in Mexico). It is also a reflection of different reporting industries and reporting thresholds between programs.



The number of facilities reporting in the Mexico border region has grown steadily since 2005, although this may be a reflection of the program's maturation and expansion rather than growth in the number of emitting facilities. The highest percentage of reporting industries in all of the U.S. and Mexico border states is in the Mexican state of Tamaulipas (over 40% of all border region facilities), where the area around Gulf of Mexico ports is highly industrialized.

The number of TRI facilities filing reports on the U.S. side of the border declined from 213 to 145 between 2005 and 2009. This decline may, at least in part, be due to an economic downturn that occurred during the same period. Declining economic conditions tend to reduce industrial activity and therefore the number of facilities reporting releases. There may be other reasons, however, that contributed to this decline.



Total toxic releases from TRI and RETC facilities grew from 2005 to 2006 and stabilized from 2006 to 2007. In the U.S. (for which more recent data are available), releases rose again in 2008 and then dropped in 2009 to around 2005 levels. The higher overall level of releases in Mexico is likely due to the larger number of reporting facilities. It is important to note that release data represented in the chart for Mexico exclude emissions of carbon dioxide (CO_2) because these emissions are not reported under TRI in the U.S., and the volume of CO_2 emissions reported by RETC facilities masks the volume of emissions of all other RETC pollutants. Excluding CO_2 makes the results of TRI and RETC more comparable and focused on toxic releases.

What influences these indicators and what can be done in the future?

These indicators are influenced by both the number of facilities that release pollutants above a certain threshold and the amount of releases. The presence of these facilities in the border region is largely driven by economic trends and policies, such as the establishment of *maquiladoras* as encouraged by U.S.-Mexico trade agreements and other policies. Effective environmental policies and infrastructure are important for ensuring that the kinds of releases reported under TRI and RETC do not pose unacceptable risks to border region residents and the environment.

Technical considerations

As noted above, the total number of pounds released does not indicate either uncontrolled, illegal emissions or risk. At the same time, it does not represent all of the releases of covered pollutants because both countries have reporting thresholds below which facilities are not required to report. Therefore, these data would not reflect cumulative releases from many small or mobile sources. Also, Mexico and the U.S. differ in the pollutants reported and applicable reporting thresholds. A major difference between the two countries' programs is that RETC includes CO_2 emissions and TRI does not (as noted, data reported here exclude CO_2 emissions to make the two programs more comparable). However, the U.S. established monitoring requirements for large greenhouse gas emitters in 2009, and these data will become available soon (although not through TRI).

Data sources

EPA, Toxics Release Inventory, TRI.net (2009 data release)

SEMARNAT, RETC data website (Border region facilities identified by EPA Office of Environmental Information)

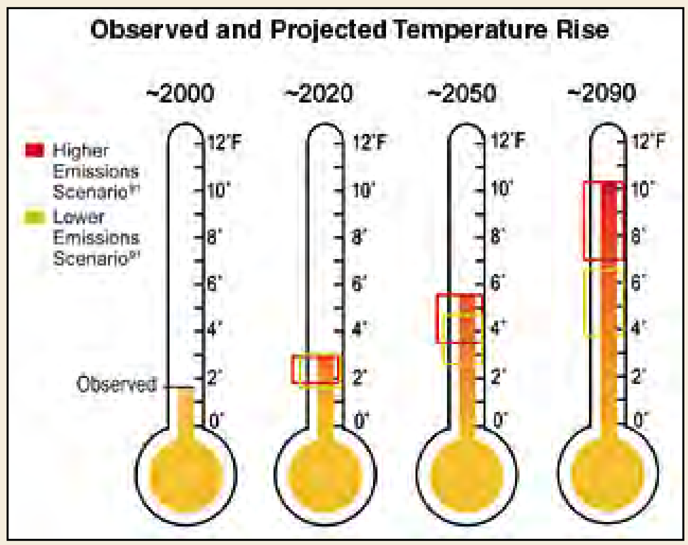
U.S.-Mexico Border Region

Highlight: How is a Changing Climate Affecting the Border Region?

The arid landscape of much of the border region is a defining feature of its ecosystems, economy, and history. In particular, the lack of water—and the demand for it—drives regional development, politics, and even culture. Actual and anticipated changes in climate—from both natural fluctuations and human activity—can compound the challenges for the region.

Measured and forecasted data on temperature, precipitation, and other factors provide a picture of the extent of change being experienced in the region now and anticipated changes in the future.

For example, the U.S. Global Change Research Program reports that the average temperature of the American Southwest (including California, Nevada, Utah, Colorado, Arizona, New Mexico, and part of Texas) has increased around 1.5 degrees Fahrenheit (0.8 degrees Celsius) from a 1960–1979 baseline.[2] Estimated further increases in average temperatures by 2090 range from 4–10 degrees Fahrenheit (3.2–5.6 degrees Celsius) above the baseline (see graphic at right). Increases in temperature can directly affect human health in a region already dominated by high temperatures, and it can also affect ecosystems through drought, fires, invasive species, and pests.

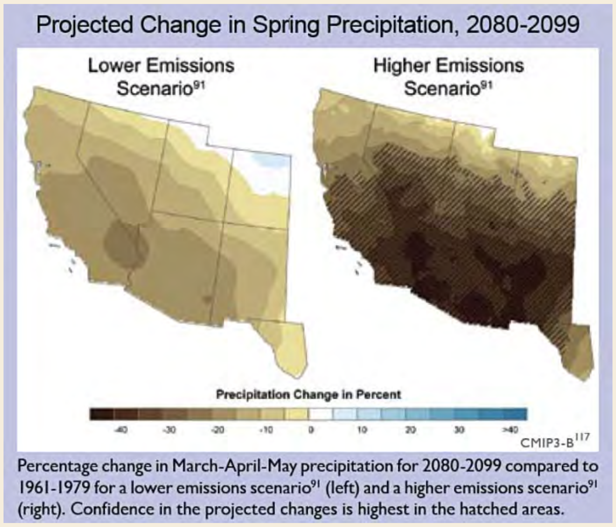


Source: U.S. Global Change Research Program. Temperatures are for the Southwest U.S. The brackets in thermometers indicate estimated ranges of model projections—the program notes that higher or lower outcomes are possible

Rising temperatures also decrease upstream mountain snowpack and precipitation, which feed border region rivers and reservoirs and provide critical sources of water for human consumption, ecosystem health, agriculture, energy, and other uses in the border region. The Global Change Research Program notes that water supplies in the region are already stressed and that "water supplies are projected to become increasingly scarce, calling for trade-offs among competing uses, and potentially leading to conflict." The figure below shows the U.S. Global Change Research Program's illustration of projected changes in spring precipitation in the U.S. Southwest—a critical source of water for reservoirs. The darker brown areas near the border indicate the largest decrease in rainfall.

In a seeming paradox, climate change can also increase risks of winter floods as precipitation patterns shift. In coastal areas, especially the Gulf of Mexico, climate change may be driving increased hurricane activity with sometimes devastating effects on coastal communities.

[2] See: http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/regional-climate-change-impacts/southwest

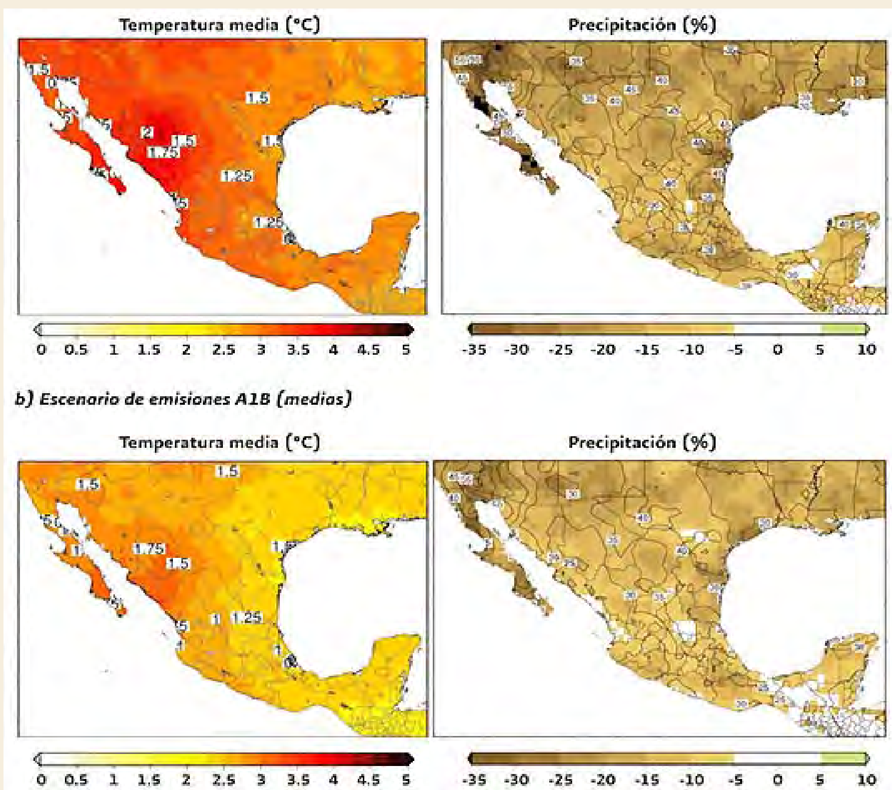


Percentage change in March-April-May precipitation for 2080-2099 compared to 1961-1979 for a lower emissions scenario[91] (left) and a higher emissions scenario[91] (right). Confidence in the projected changes is highest in the hatched areas.

Source: U.S. Global Change Research Program.

Analysis of the impacts of climate change in Mexico also project increases in regional temperature and declines in precipitation. A 2009 report released by SEMARNAT on the impact of climate change on Mexico's economy between the present and 2100 concluded that all scenarios analyzed would result in an increase in average temperatures. The report predicted higher relative warming in the north and northwest of the country (i.e., the border region). The graphic below illustrates the results of two scenarios (numbers represent increases in temperature and percent declines in rainfall). The scenario represented at the top of the graphic is based on assumptions of rapid economic growth and globalization. It results in a 2.5-4.0 °C increase in temperature and 5.7-18% decline in precipitation country-wide. The scenario represented at the bottom of the graphic is based on slower, more regional economic growth. It results in a 1.5-3.0 °C increase in temperature and a 3.5-15% decline in precipitation country-wide. In each case, some of the largest impacts on temperature and precipitation are in the northern border region.

Projected Temperature and Precipitation Increases from Climate Change in Mexico

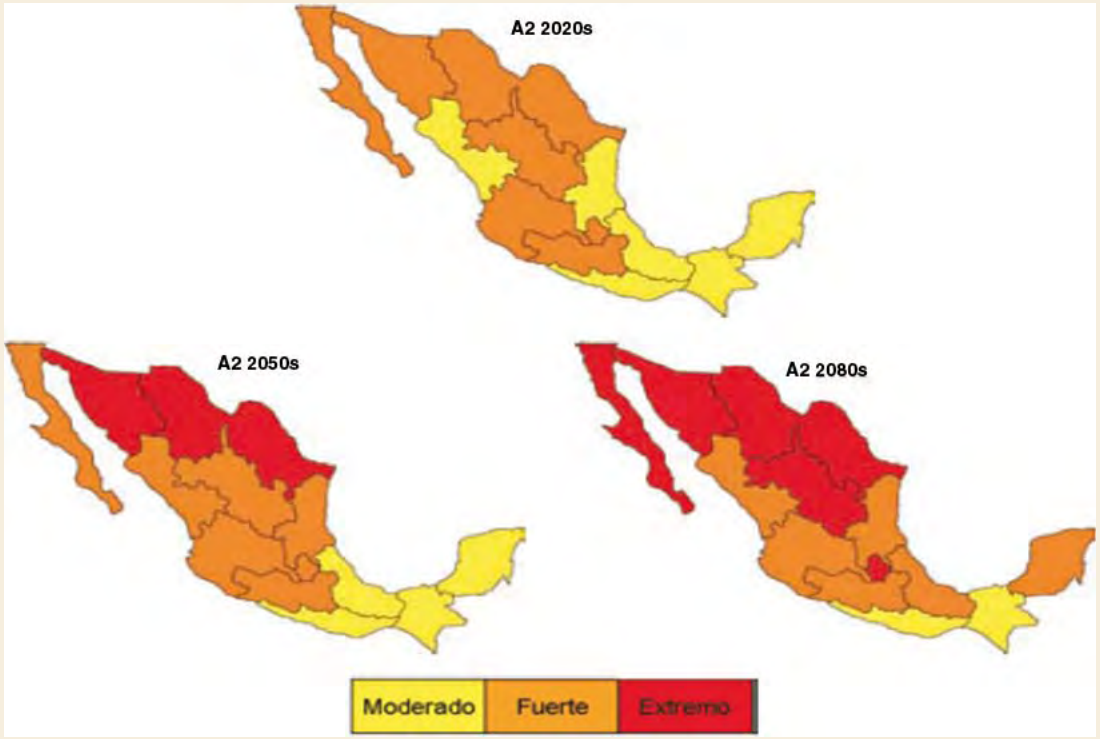


Source: SEMARNAT, *The Economics of Climate Change in Mexico*

SEMARNAT predicts that increases in temperatures and declines in precipitation will lead to a significant increase in hydrologic stress for the region in terms of per capita supply of water. The water vulnerability index below shows increasing vulnerability in most Mexican border states by 2050 and extreme vulnerability in all border states by 2080.

Water Availability Impact of Climate Change in Mexico

Vulnerability index reflecting water availability and quality for decades 2020s, 2050s and 2080s



Source: INE. "Evaluación de la afectación de la calidad del agua en cuerpos superficiales y subterráneos por efecto de la variabilidad y el cambio climático y su impacto en la biodiversidad, agricultura, salud, turismo e industria." 2008. In: INE-Semarnat. "México: Cuarta Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático." México. 2009.

Sources

U.S. Global Change Research Program, *Regional Impacts: Southwest,* http://www.globalchange.gov/images/cir/pdf/southwest.pdf

SEMARNAT, *The Economics of Climate Change in Mexico*, 2009 http://www.semarnat.gob.mx/informacionambiental/Publicacion/Sintesis2009cambioclimatico.pdf

Israel Laguna Monroy (INE), "State Programs for Climate Change Action," Border 2012 Air Policy Forum, July 7, 2010

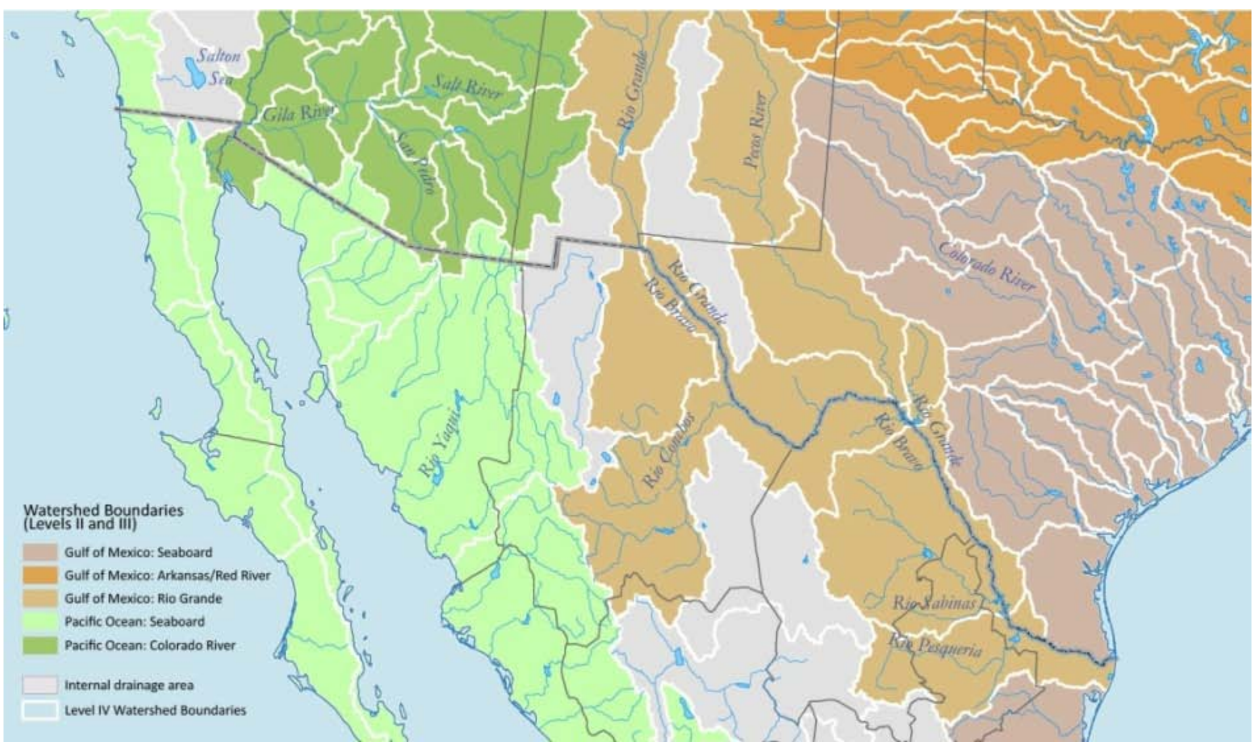
INE-Semarnat, "México: Cuarta Comunicación Nacional ante la Convención Marco de las Naciones Unidas sobre el Cambio Climático," México, 2009

3. WATER

Water is an extremely limited resource in many parts of the border region. Population growth—along with growth in agriculture and other economic activity—places increasing stress on water quantity and quality. Protecting the quality of rivers, oceans, and other water is important for ecological and human health in the region.

Developing infrastructure to deliver safe drinking water to people and to reduce untreated discharges to border region rivers, aquifers, and oceans has been a high priority of Border 2012 and previous binational environmental programs. In 1993, the Border Environment Cooperation Commission (BECC) and the North American Development Bank were created as an environmental side-agreement of the North American Free Trade Agreement to support the planning, development and financing of projects, including drinking water delivery and wastewater treatment, in the U.S.-Mexico Border region. Between 1993 and 2009, BECC certified a total of 167 environmental infrastructure projects—86 in Mexico and 81 in the U.S.—with an estimated total cost of more than $3.6 billion. Of these projects, 101 involved new or improved water and wastewater services. The certified wastewater projects, for example, represent the capacity to eliminate more than 350 million gallons per day of untreated or inadequately treated discharges. Funding has been provided by EPA, Mexico's Comisión Nacional del Agua (Federal Water Commission, CONAGUA), and local, state, binational and international agencies to make these critical investment projects more affordable. The leveraged efforts of these agencies have resulted in certified and funded projects that will collectively bring basic water and wastewater services to over 10.7 million people.

Watershed Boundaries



Source: INEGI, NR-CAN, USGS. 2010. CEC North American Atlas – Watersheds.

This chapter covers several aspects of providing access to safe drinking water and wastewater treatment and improving ambient water quality in the border region, including:

- Access to safe drinking water and adequate wastewater collection and treatment
- Reductions in pollutant loadings to surface water bodies
- Beach water quality
- Human health related to water quality

Reduce Water Contamination

Are homes in the U.S.-Mexico border region being connected to safe drinking water and wastewater treatment services?

Indicator:

- **Number of Unserved Homes Connected to Safe Drinking Water through the Border Water Infrastructure Program** OUTPUT
- **Number of Unserved Homes Connected to Wastewater Collection and Treatment Services through the Border Water Infrastructure Program** OUTPUT

Sub-Objective 1A: Promote the increase in the number of homes connected to a potable water supply beyond the original Border 2012 objective of 25%.

Sub-Objective 1B: Promote the increase in the number of homes connected to wastewater collection and treatment systems beyond the original Border 2012 objective of 25%.

Why are these indicators important?

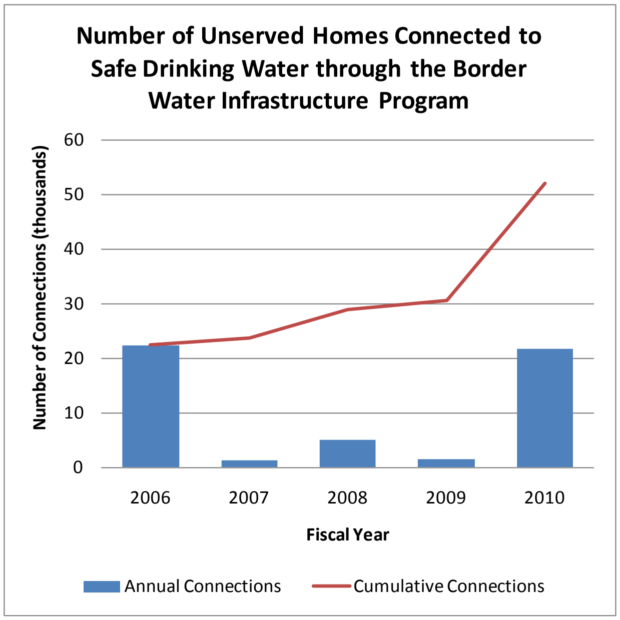
Access to safe drinking water and the protection of public and ecological health through adequate wastewater collection and treatment are key focus areas of Border 2012. Poor quality drinking water and inadequate wastewater collection and treatment can pose a serious risk of water-borne disease exposure and transmission.

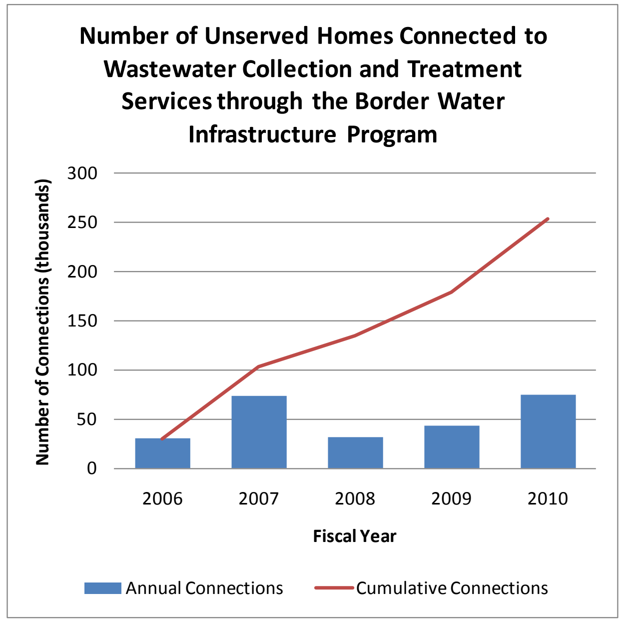
What are these indicators showing?

The Border 2012 program assessed the number of homes lacking service in the U.S.-Mexico border region in 2003. An estimated 98,575 border region homes in the U.S. and Mexico lacked safe drinking water, and an estimated 690,723 homes lacked adequate wastewater collection and treatment services. Many federal, state and local agencies have funded projects that improved the drinking water and wastewater services in this region. EPA's U.S.-Mexico Border Water Infrastructure Program (BWIP) funds drinking water and wastewater projects, recognizing that access to these basic public health services is of the highest priority. These high priority projects include extending safe drinking water and adequate wastewater services to existing communities lacking those services and providing critical drinking and wastewater system upgrades so that treatment levels meet U.S. and Mexican federal and state standards.

From its inception in 1995 through fiscal year 2010, the BWIP has funded 92 projects that serve 8.5 million border residents in the U.S. and Mexico. The total cost of these projects amounted to $1.7 billion. To make the projects affordable, they were financed with $560 million in EPA grants and over $1.1 billion from other sources. Many border communities are financially disadvantaged and cannot bear the debt burden necessary to rebuild water infrastructure through conventional assistance channels. Applications for drinking water and wastewater service funding submitted to the BWIP reflect the region's need. For fiscal year (FY) 2011/12 funding, the BWIP received 200 applications with total construction needs of $795 million. In the previous funding cycle for FY2009/10, 212 applications were received reflecting total construction needs of $1.1 billion dollars.

Significant progress is being made on connecting homes to essential drinking water and wastewater services. However, the total need for new and improved services is not completely known (see discussion later in this chapter). During the five-year period from FY2006 through FY2010, 44 BWIP-supported drinking water and wastewater infrastructure projects were completed. Thirty-five of these projects provided homes with first time access to drinking water and wastewater collection and treatment services while nine other projects improved drinking water and treated wastewater services. The figures below show annual and cumulative drinking water and wastewater connections that resulted from these projects. Cumulatively, an estimated 52,130 homes were connected to a safe community drinking water system, representing 53% of the homes identified in 2003 as lacking drinking water service. The 254,125 homes connected to adequate wastewater collection and treatment service during this same five-year period represent 37% of the homes identified in 2003 as lacking wastewater services.





What influences these indicators and what can be done in the future?

The number and size of projects leading to new drinking water and wastewater connections are influenced by the availability of funding and the number and quality of applications for infrastructure to meet community needs.

Technical considerations

Data on annual and cumulative drinking water connections represent piped service into the home. Data on annual and cumulative wastewater connections represent connections to wastewater collection and treatment.

Data sources

EPA, "Border 2012: U.S. Mexico Environmental Program" and "U.S.-Mexico Environmental Program: Border 2012 – A Mid-Course refinement (2008-2012)"

EPA U.S.-Mexico Border Program: National Water Program Performance Measure Results Reported Annually under the EPA National Water Program Strategic Plans for 2003-2008, 2006-2011 and 2011-2015 and the FY2010 Guidance

EPA, U.S.-Mexico Border Water Infrastructure Program

Reduce Water Contamination

Highlight: Water Infrastructure and Health in Indigenous Communities in Mexico

In 2007, two indigenous communities in Baja California received new drinking water systems with funding from Mexico's Commission for the Development of Indigenous People and the U.S. EPA's Border 2012 grant program. A recent study observed the associations between improved drinking water infrastructure and the incidence of illness.

What was the problem and how was it addressed?

In the indigenous communities of San Antonio Necua and San Jose de la Zorra, researchers measured water samples twice a month in the new and old water systems and in several household water storage containers. Samples were analyzed for the bacterial indicators E. coli and total coliform. During the same time period, environmental health surveys were administered every two weeks to families in the communities. The participants were asked about the types of drinking water sources being used, water transport methods, storage and disinfection practices, and health and illness data in the home.

What were the results?

The water quality samples and the surveys were analyzed and compared to previous studies that were conducted in the same communities before water infrastructure was upgraded. In comparison with previous data, both communities had significantly less indicator bacteria in samples taken from the new drinking water systems.

However, surveys revealed that people in one of the communities were facing increasing levels of gastrointestinal disease. Further investigation showed that this community was experiencing problems with its new system, and residents were getting water from both the old (contaminated) and new (uncontaminated) drinking water source. As a result, the state health agency intervened and brought in bottled water on a temporary basis and disinfection solution, which resulted in a significant decline in gastrointestinal illnesses.

In the other community, water quality samples revealed that although the water coming from the new source in this community was clean, the containers used to store the water inside the home were significantly contaminated and further intervention was needed.

How does this relate to the rest of the border region?

By measuring health outcomes such as gastrointestinal diseases along with water quality, this research was able to determine that more than just basic infrastructure improvements were needed to protect public health. The research also revealed that cultural practices and perceptions played an important role in transportation and consumption of drinking water in each of the communities. Indicators related to health and cultural practices could help us to gain a better understanding of the effectiveness of interventions and improve future projects. As evidenced by this research, improved infrastructure may be only one part of an integrated approach to improving access to safe drinking water.

Sources

Paula Stigler, "Water Quality as an Environmental Health Indicator in Two Baja California Indigenous Communities Associated with New Drinking Water Infrastructure," Master's Thesis, 2009.

Linda Reeves, "Safe Drinking Water for Baja California Indigenous communities," Border 2012 Regional Workgroup Newsletter: California/Baja California, Fall 2007.

Reduce Water Contamination

How much untreated and inadequately treated sewage is being removed from the border region environment?

Indicator:

➔ **Biochemical Oxygen Demand (BOD) from Untreated and Inadequately Treated Sewage Removed from the Environment through the Border Water Infrastructure Program** OUTCOME

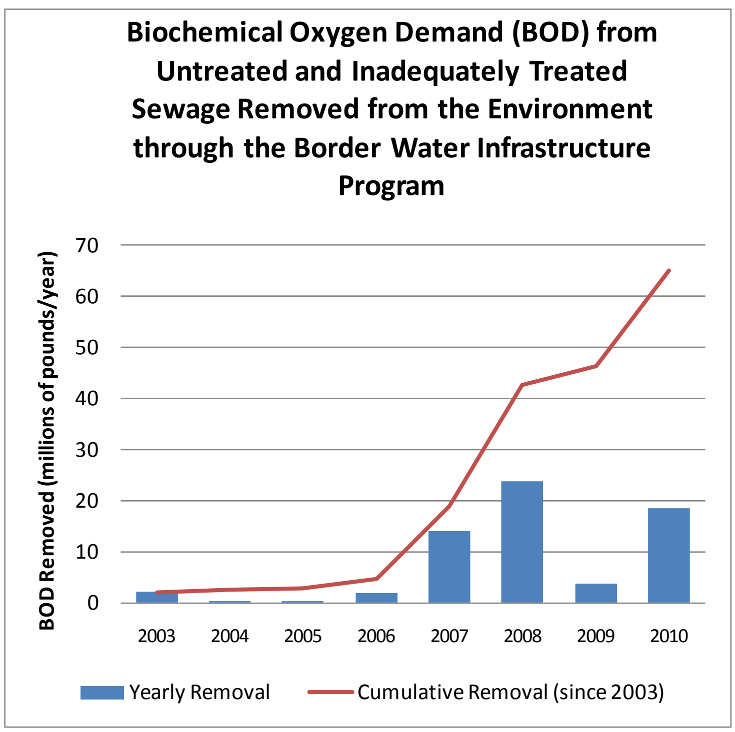
Sub-Objective 1B: Promote the increase in the number of homes connected to wastewater collection and treatment systems beyond the original Border 2012 objective of 25%.

Why is this indicator important?

A lack of wastewater service poses both a public health and environmental risk to communities. The powerful impacts of raw sewage discharges to a river or stream include pathogens that make the water unsafe for recreation or reuse, organic loads that deplete oxygen and choke aquatic life, and nutrients that lead to algal blooms. Inadequate systems discharge non-compliant wastewater effluent to impaired streams and rivers, which compounds the significant environmental degradation already present.

Wastewater collection and treatment projects can dramatically reduce contamination of rivers and surface waters by removing untreated or inadequately treated sewage discharges, providing environmental benefits as well as public health benefits. For every household that is hooked up to a collection and treatment system, roughly 200 gallons of raw sewage per day no longer flow into border region waterways.

What is this indicator showing?



The degree or strength of wastewater contamination can be expressed in terms of Biochemical Oxygen Demand (BOD). BOD is listed as a conventional pollutant in the U.S. Clean Water Act, and BOD water quality standards are set for rivers and streams in order to support beneficial uses such as swimming and fishing. Wastewater treatment effectiveness also can be measured in terms of the BOD loading removed as a result of treatment processes. Since 2003, more than 30 completed projects contributed to the cumulative removal of 65 million pounds per year of BOD that previously were discharged to the environment in the U.S.-Mexico Border area.

The Border region has a unique hydrologic landscape. The Colorado River flows from north to south linking the U.S. and Mexico. However, many rivers along the Border flow northward into the U.S. from Mexico (for example, the Tijuana River and New River in California and the Santa Cruz and San Pedro Rivers in Arizona) or, in the case of the Rio Grande in Texas, form the border itself.

Collaboration among U.S. partners and with Mexico to provide adequate wastewater collection and treatment has led to significant progress in reducing the discharge of raw sewage into the shared water bodies:

- For the Mexican cities of Juárez, Piedras Negras, Nuevo Laredo, Acuña, Ojinaga, Reynosa and Matamoros, all of which discharge wastewater to the Rio Grande, EPA BWIP projects have reduced the volume of discharged untreated sewage by 110 million gallons per day.
- The upgrade of the Nogales (Arizona) International Wastewater Treatment Plant, completed in 2009, has revitalized the upper Santa Cruz River in southern Arizona. The upgrade resulted in a more than 90% reduction of ammonia and turbidity in the Santa Cruz River, has significantly improved river water clarity, and has enhanced river aquatic habitat.
- The 2007 completion of a wastewater conveyance and treatment project in Mexicali, Baja California, reduced the amount of raw sewage flowing via the New River into Calexico, California and on to the Salton Sea by more than 15 million gallons per day, equivalent to the sewage produced by over 200,000 people. (The resulting dramatic improvement in the New River water quality is described in more detail as a highlight in this chapter.)

What influences this indicator and what can be done in the future?

The amount of BOD removed from wastewater is influenced by the ongoing operations of wastewater treatment plants in the border region and by new projects to address untreated or inadequately treated sewage. Continued effective operation of existing infrastructure and the construction of new facilities are influenced by the availability of funding and the number and quality of applications for infrastructure to meet community needs.

Technical considerations

Data on BOD loading removal reflect the results of some thirty completed projects that reduced untreated sewage discharges to the environment by connecting households to wastewater collection and treatment or improved the level of treatment of inadequately treated sewage prior to discharge.

Data sources

EPA, “Border 2012: U.S. Mexico Environmental Program” and “U.S.-Mexico Environmental Program: Border 2012 – A Mid-Course Refinement (2008-2012)”

EPA U.S.-Mexico Border Program: National Water Program Performance Measure Results Reported Annually under the EPA National Water Program Strategic Plans for 2003-2008, 2006-2011 and 2011-2015 and the FY2010 Guidance

EPA U.S.-Mexico Border Water Infrastructure Program

Reduce Water Contamination

Highlight: Improving Water Quality in the New River through Wastewater Treatment in Mexicali

The New River originates 20 river miles south of the U.S.-Mexico border. After crossing the border at Mexicali (Baja California) and Calexico (California), it travels 65 river miles northward before emptying into the Imperial Valley's Salton Sea. This transboundary river has been recognized as significantly polluted from urban waste and agricultural run-off since at least the 1940s. Large binational investments in wastewater infrastructure are now helping to clean it up.

What was the problem and how was it addressed?

Historically, a major contributor of pollution to the New River was untreated wastewater flows from the City of Mexicali, which accounted for approximately 10% of the river's flow at the border. Recognizing the need to reduce pollution from untreated wastewater, the U.S. and Mexico began collaborating in the mid-1990s on a series of infrastructure projects. Together, these projects repaired collector lines and pump stations, rehabilitated and upgraded existing water treatment plants, and constructed the new "Las Arenitas" wastewater treatment plant south of Mexicali. Total investment in new construction has exceeded $90 million.

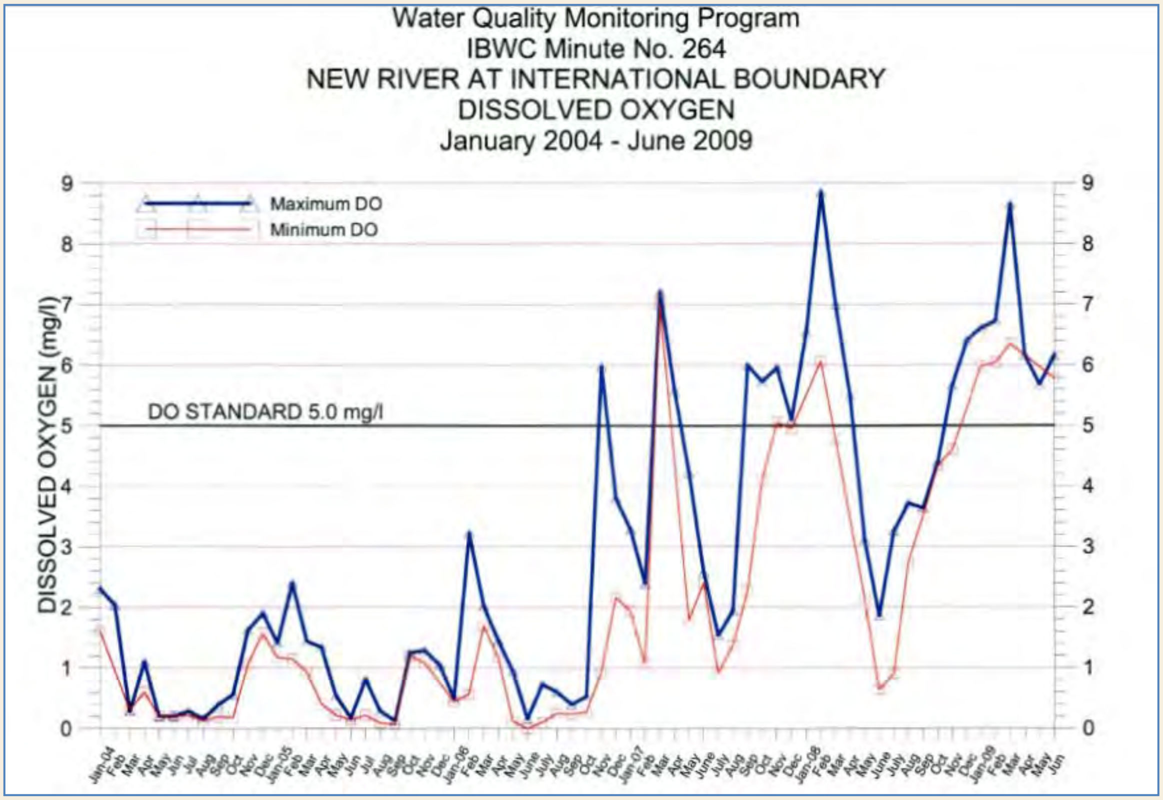
What were the results?

Binational wastewater treatment projects have improved the environmental conditions of the New River and Salton Sea and reduced public health risks in the U.S. and Mexico associated with raw sewage. These projects are benefiting an estimated 635,000 people. Over 40 million gallons (approximately 151.5 million liters) per day of untreated sewage are being removed from the New River. Complementary projects on the U.S. side of the border have further reduced discharges to the river.

Water quality sampling at the border by the California Regional Water Quality Control Board provides evidence of the benefits: the 12-month average measurement of dissolved oxygen in the river jumped from just above 1 mg/L to above 5 mg/L. (5 mg/L is California's water quality criterion for warm water aquatic habitat.) Although dissolved oxygen at times still drops below 5 mg/L during the summer months, dissolved oxygen levels have significantly improved and show an increasing trend.

Sampling reveals that levels of fecal coliform bacteria have dropped substantially with the opening of the Las Arenitas plant. However, levels of fecal coliform in the river still violate standards designed to protect human health.

As with other Mexican border communities, continued illicit wastewater discharges in Mexicali require ongoing attention from both the U.S. and Mexico to treat or prevent pollution.



How does this relate to the rest of the border region?

Although the New River is one of the more extreme cases of surface water pollution in the border region, it holds lessons for water pollution elsewhere on the border. The efforts on the New River show what can be accomplished when the stakeholders in the U.S. and Mexico collaborate on funding, technical assistance, planning and implementation to address critical water quality needs. Efforts along the New River also highlight continuing water quality challenges in the U.S.-Mexico border region.

Source

Doug Liden, EPA, Presentation "EPA's Efforts to Improve New River Water Quality," December 22, 2009

EPA, "City of Mexicali Wastewater Infrastructure Projects benefiting the New River," October 2009

Reduce Water Contamination

Do Mexico border communities have access to safe drinking water and wastewater services?

Indicator:

- **Percent of Mexico Population in Border Region Municipios with Piped Drinking Water to the Property**
  NEED
- **Percent of Mexico Population in Border Region Municipios with Wastewater Collection Services**
  NEED

Sub-Objective 1A: Promote the increase in the number of homes connected to a potable water supply beyond the original Border 2012 objective of 25%.

Sub-Objective 1B: Promote the increase in the number of homes connected to wastewater collection and treatment systems beyond the original Border 2012 objective of 25%.

Access to safe drinking water and the protection of public and ecological health through adequate wastewater collection and treatment are key focus areas of Border 2012. Border institutions have invested significant amounts of money in water infrastructure in Mexico's border region and have seen substantial gains in service coverage and capacity.

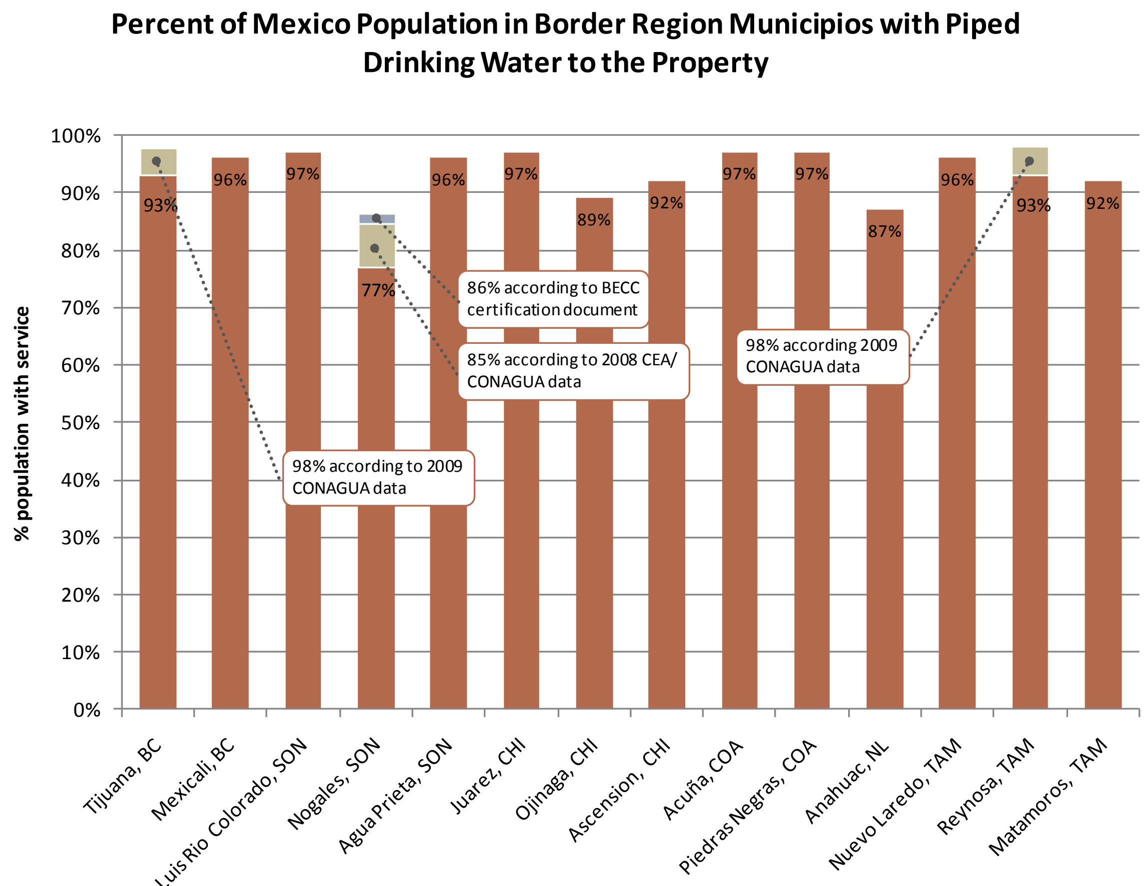
Data for 2005 collected by Mexico's national census agency, INEGI, show the percent of the population with drinking water and wastewater collection services in major border municipios. ("Municipio" defines an area that covers cities, outlying populated areas and rural areas, similar to counties in the U.S.). The INEGI wastewater collection data do not represent wastewater that is collected and treated. However, BECC and some other border institutions have compiled some data on wastewater treatment capacity in the border region as described below.

Why are these indicators important?

Water infrastructure protects human health from diseases related to poor drinking water quality and exposure to contaminated wastewater. Many diseases are linked to poor water quality, including cryptosporidiosis, E. coli infection, giardiasis, viral Hepatitis A, cholera, shigellosis, salmonellosis, and typhoid fever. At the same time, adequate wastewater collection and treatment infrastructure preserves the quality of rivers, oceans, and other surface water bodies.

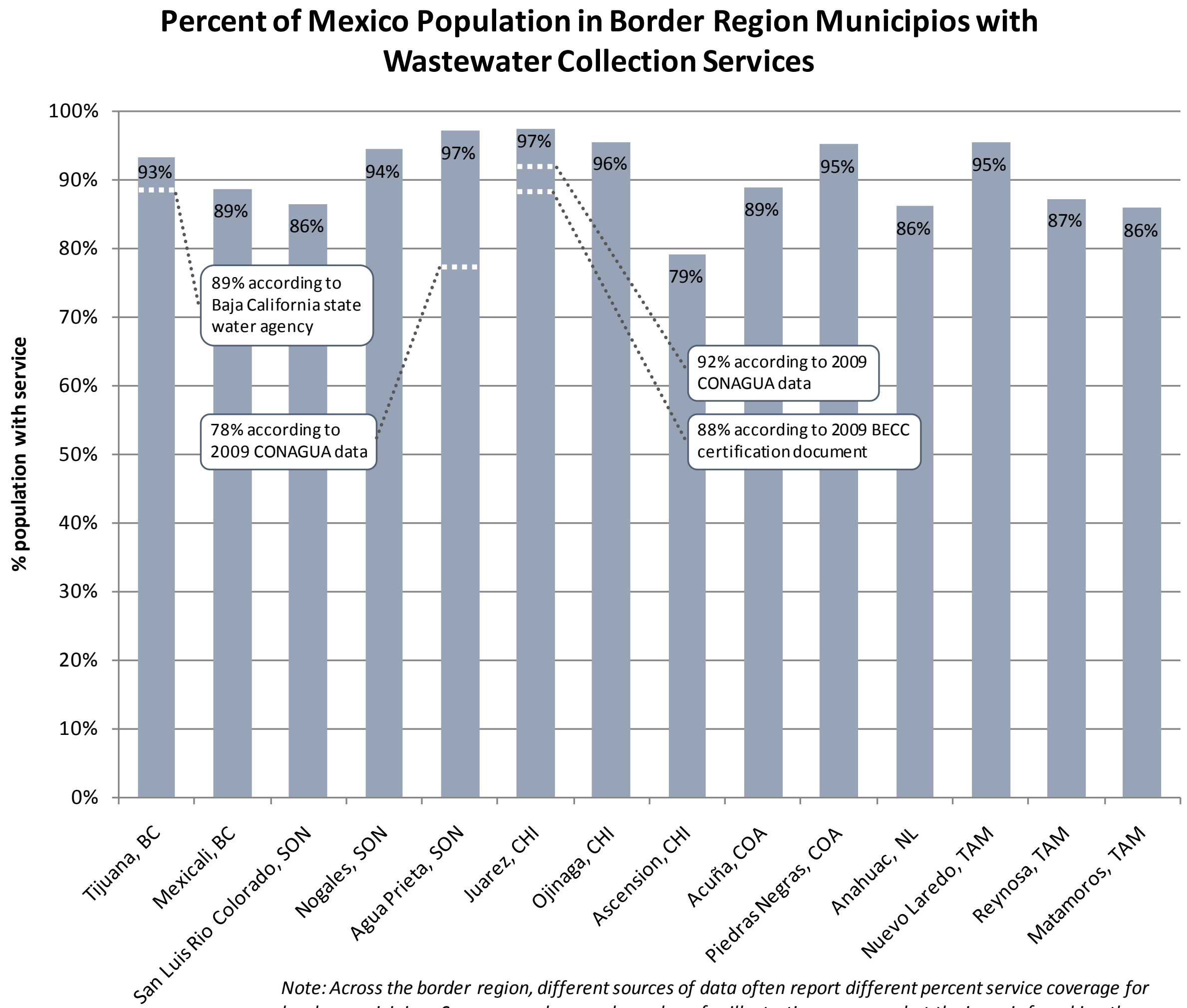
What are these indicators showing?

Based on the 2005 INEGI data for 14 major Mexican border municipios, the percent of the population with drinking water piped to the property—either directly to the house or to the lot—ranged from 77% in Nogales (Sonora) to 97% in San Luis Rio Colorado (Sonora), Juárez (Chihuahua), Acuña (Coahuila), and Piedras Negras (Coahuila). The population without service in these 14 municipios, according to the INEGI data, totaled over 240,000 people.



Note: Across the border region, different sources of data often report different percent service coverage for border municipios. Some examples are shown here for illustrative purposes, but the issue is found in other border municipios as well.

As illustrated in the graphic above, for some cities, different sources of data can show different percent levels of drinking water service (see data for the cities of Tijuana, Nogales, and Reynosa). For example, while the 2005 INEGI data show service coverage of 77% for Nogales, 2008 data from CONAGUA show 85% drinking water coverage. A recent BECC project certification document for Nogales showed 86% coverage. Similar variations in coverage statistics from different sources are found for other border municipalities. To understand why these data may differ, please see the highlight "What is in a Number? Understanding Border Region Water and Wastewater Service Coverage Data."



Note: Across the border region, different sources of data often report different percent service coverage for border municipios. Some examples are shown here for illustrative purposes, but the issue is found in other border municipios as well.

In these same Mexican border municipios, 2005 INEGI data show the percent of the population with wastewater collection services. INEGI data indicated that service coverage ranged from 79% in Ascensión (Chihuahua) to 97% in Agua Prieta (Sonora) and Juárez (Chihuahua). The population without service in these 14 municipios, according to the INEGI data, totaled over 340,000 people. It should be emphasized that these data represent collection, but not necessarily wastewater treatment. Some collected wastewater counted in these percentages may be discharged without treatment.

As with drinking water data, different sources often show different percent coverage for wastewater collection. For example, while INEGI data for Juárez show 97% wastewater collection coverage, a 2009 BECC certification document shows 88%. In Agua Prieta, Sonora, INEGI data show 97% coverage while CONAGUA data show 78% coverage.

In general, Mexico's border municipios have higher rates of drinking water service coverage than sewer collection coverage. There are, however, a few exceptions. In Nogales, for example, piped drinking water reached only 77% of the population in 2005 while sewage collection reached 94% of the population. Research by the BECC attributes this result to significant binational investment around that time in sewer infrastructure.

As noted above, border-wide data on wastewater collection and treatment in Mexico are not consistently available. BECC has compiled some data on wastewater treatment capacity for border municipalities as part of its effort to assess state needs for water infrastructure. These data suggest that at current capacity, over 785,000 people are without wastewater treatment in 14 border municipios.

Some municipio-specific data on wastewater treatment coverage are available in some cases at the state level. For example, Baja California's state water agency (the Comisión Estatal del Agua de Baja California) shows that 96% of the volume of the wastewater captured via collection systems in Tijuana and Rosarito is treated.

What influences these indicators and what can be done in the future?

The need for drinking water and wastewater infrastructure is driven by population growth in the border region—especially growth in areas where capacity is already lacking or inadequate. Significant industrial development has fueled regional job growth and population increases in Northern Mexico while ongoing southwesterly migration has boosted the population on the U.S. side of the border. Other factors that influence the need for (and location of) water and wastewater infrastructure include health considerations, the feasibility to extend services, and water reuse opportunities. An additional consideration is the need to balance demands for safe drinking water with other uses, such as agricultural, municipal, and/or industrial use.

Technical considerations

As noted, INEGI reports on drinking water service and wastewater collection service, but not wastewater treatment. INEGI defines drinking water services as: occupied homes with water piped to the property from the public centralized water system; the access point may be inside or outside of the house.

A number of technical considerations relate to the comparability of various sources of drinking water and wastewater, as described in the highlight "What is in a Number? Understanding Border Region Water and Wastewater Service Coverage Data."

Data sources

BECC, "Diagnóstico de Infraestructura Ambiental Básica para el estado de [estado]"

Comisión Estatal del Agua de Baja California, "Informe Mensual de Agosto 2010"

Comisión Estatal del Agua (Sonora) and CONAGUA, "Estadísticas del Agua en el Estado de Sonora, Edición 2008"

EPA, Regions 6 and 9 border programs

CONAGUA,"Situación del Subsector Agua Potable, Alcantarillado y Saneamiento, Edición 2009"

INEGI, Requerimiento Especial Núm. Control 9660 as reported in BECC, "Diagnóstico de Infraestructura Ambiental Básica para el estado de [estado]"

Programa Nacional de Infraestructura 2007-2012, as reported in BECC, "Diagnóstico de Infraestructura Ambiental Básica para el estado de [estado]"

Reduce Water Contamination

Highlight: What is in a Number? Understanding Border Region Water and Wastewater Service Coverage Data

What does it mean that a city has 98% drinking water coverage—or 75% or 50%? An accurate answer depends on the who, what, where, when, and how of the data:

- Who is described in the data—households or the number of people in the population?
- What types of connections (e.g., to a house, property, or community) are counted as "service"?
- Where is the boundary of the area described—the 100km border region, a border state or county, a city, a utility's service area, or some other geographical area?
- When were the data collected and what year(s) do they represent?
- How were the data collected—by household survey, by utility reporting or by some other means?

Different answers to these questions can lead to different pictures of service coverage—even for what seems to be the same city or area. For example, the INEGI data reported for the indicator "Percent of Mexico Population in Border Region Municipios with Piped Drinking Water to the Property" show drinking water service coverage for Mexicali (Baja California) at 96%. Mexico's national water agency, CONAGUA, in its 2009 annual water sector report, listed Mexicali's drinking water coverage as 99%. Several factors may explain the difference, such as:

- INEGI considers a house to have service if the connection is to the house or property, while CONAGUA also counts access to a public water intake or hydrant in the neighborhood as service;
- INEGI data are for the "municipio" of Mexicali (population approx. 908,000) while CONGUA data are for the geographically smaller and more urban "localidad" (population approx. 733,000);
- INEGI data are for 2005, while CONAGUA data are for 2008; and
- INEGI data were based on census surveys while CONAGUA data were self-reported by utilities.

Different reporting years, different definitions of geographical area, different sources and/or different definitions of service may all contribute to the apparent inconsistency in numbers.

For a given set of service connections, an over-counted population will also reduce the coverage percentage while an undercounted population will increase the coverage percentage. Accurate counts of population in the border region are a challenge due to the prevalence of unincorporated areas and informal settlements (e.g., colonias), and a transient population at the border which will tend to lead to undercounts of the actual population. Such an undercount would tend to increase the apparent coverage percentage for water and wastewater services.

Data can differ as well in the *assumptions* we make about them. For example, drinking water service coverage indicators reported in this document for both the U.S. and Mexico represent connections to centralized water systems. In Mexican municipios, we can assume that households that are not connected to centralized systems probably do not have access to safe drinking water. Residents in Mexico that are not connected to centralized systems may receive drinking water through water trucks, central community standpipes or taps, or through sub-standard water hoses. It is very rare to find a home with an individual well used for drinking water purposes. Similarly, Mexican residents that are not connected to centralized wastewater collection and treatment systems often use sub-standard sewage disposal practices such as latrines, septic tanks without drainfields and direct discharges to ditches. In U.S. counties, in contrast, it is quite common for households to be connected to a private well for drinking water rather than a centralized system, especially in rural areas. In most cases, these private wells provide high quality water.

Sources

Comisión Estatal del Agua de Baja California, "Informe Mensual de Agosto 2010," http://www.cea.gob.mx/indicadores.htm.

CONAGUA, "Situación del Subsector Agua Potable, Alcantarillado y Saneamiento, Edición 2009": http://www.conagua.gob.mx/CONAGUA07/Publicaciones/Publicaciones/LibroAnexosYTablas-Situaci%C3%B3nSAPAS.pdf.

INEGI, Requerimiento Especial Núm. Control 9660 as reported in BECC, "Diagnóstico de Infraestructura Ambiental Básica para el estado de Baja California."

Reduce Water Contamination

Do U.S. border communities have access to safe drinking water and wastewater services?

Indicator:

→ **Percent of Population in U.S. Border Counties with Connections to Centralized Water Systems**

NEED

Sub-Objective 1A: Promote the increase in the number of homes connected to a potable water supply beyond the original Border 2012 objective of 25%.

Sub-Objective 1B: Promote the increase in the number of homes connected to wastewater collection and treatment systems beyond the original Border 2012 objective of 25%.

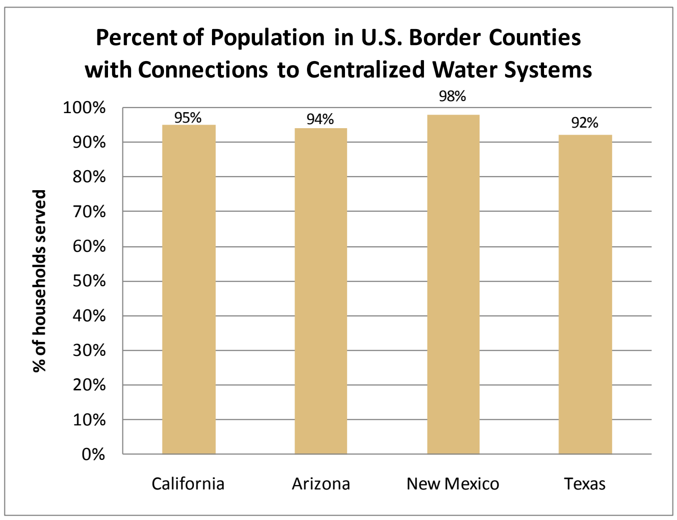
Just as it is in Mexico's border region, access to safe drinking water and wastewater collection and treatment is also an important focus of programs and institutions in the U.S. border region. The indicator that describes the percent of the population in the U.S. border region with connections to centralized water system describes how much of the U.S. border population has access to this source of safe drinking water. Currently, data are not available to develop a similar indicator for wastewater services, but information on future development of these data is described below.

Why is this indicator important?

Protecting human health from exposure through drinking water and contact with contaminated wastewater—as well as protecting water resources—are important drivers for regulatory and non-regulatory programs in the U.S. to ensure safe drinking water and adequate wastewater collection and treatment.

What is this indicator showing?

Data on the population served by connections to centralized drinking water systems above a certain size are reported to EPA's national Safe Drinking Water Information System (SDWIS). Data from SDWIS for U.S. border counties can be combined with county-level U.S. Census population data to approximate the percent of the population in these border counties with connections to centralized drinking water systems. (Note that this is only an approximation because of the way SDWIS counts population served; see "technical considerations" below.) When border county data are aggregated by state, they show percent coverage rates ranging from 92% in Texas' border counties to 98% in New Mexico's border counties.



Although SDWIS data can be used to approximate the population served by connections to centralized systems, it does not provide information about the water sources for people in households <u>not</u> connected to centralized systems (or, "public water systems" as defined under the Safe Drinking Water Act[3]). In many cases—especially in rural areas—households without system connections have their own wells or are connected to small water systems that do not meet the definition of a "public water system." These household or small water systems are not reported to SDWIS. As long as the water in wells or from small systems meets water quality standards, it can be considered safe. There are, however, no border-wide sources of data on populations served by private wells or small water systems. In the absence of this type of information, it would be wrong to assume that the "service gap" presents a clear need for additional centralized drinking water infrastructure.

What is the status of data on the population served by wastewater collection and treatment in the U.S. border region?

For this indicators report, adequate data on the percent of the population in U.S. border counties with wastewater collection and treatment services could not be reported. (For data on annual and cumulative *new* connections, please see indicators earlier in this chapter). EPA collects data on existing wastewater collection and treatment systems in the U.S. through the national Clean Watersheds Needs Survey (CWNS). The survey lists data provided by states on existing publicly-owned wastewater systems, the number of people served by each system, and a variety of other information about wastewater infrastructure needs.[4] This is a robust data set that is used to estimate nation-wide needs for investment in wastewater collection and treatment. However, the CWNS may not provide a complete picture of the number of people served by wastewater infrastructure in the border region because states are not required to report on all systems. As a result, states tend to report mainly on facilities that have financial needs (e.g., for major repairs, rehabilitation, or replacement) and on larger, centralized facilities. Smaller rural systems or decentralized residential systems (on-site or clustered) may be under-reported. The CWNS also does not include data on tribal or private systems. In aggregate, these data gaps mean that CWNS data, taken alone, would likely undercount the U.S. border region population with wastewater collection and treatment services.

BECC is in communication with EPA, states, and others to build on the information provided in the CWNS to assemble a more complete picture of wastewater services in the U.S. border region. This work is part of BECC's effort to document water, waste, and other infrastructure needs in the border region through state-by-state assessments and reports. However, BECC's work on reports for U.S. border states was not complete at the time of the publication of this indicators report. Future work on border indicators can incorporate this information from BECC as it becomes available.

What influences this indicator and what can be done in the future?

As in Mexico, the need for drinking water and wastewater collection and treatment infrastructure in the U.S. is driven by border region population growth and development patterns. It is also influenced by competing demands from agriculture, industry, and other sources of water demand.

[3] Under the Safe Drinking Water Act, the term "public water system" means a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals.

[4] Information and data on the CWNS is available at: http://water.epa.gov/scitech/datait/databases/cwns/index.cfm.

Technical considerations

The drinking water indicator measures the population served by connections to centralized water distribution systems. Although most of these connections are to residential homes and buildings, some are connections to commercial businesses, and the population served by those businesses is counted in the data. This will tend to over-estimate the percent of service coverage. At the same time, the water connection data do not include tribal populations served by systems on tribal lands or populations served by adequate private wells or small systems. This will tend to under-estimate the percent of the population with adequate access to drinking water. Overall, the net impact of these factors on the accuracy of the drinking water indicator is not known.

Data sources

EPA, SDWIS Drinking Water Data Waterhouse (July 2010)

U.S. Census Bureau, Population Division (March 2010 data release)

Reduce Water Contamination

Highlight: Water Quality and Health in the Juárez Valley, Mexico

What was the problem?

Pathogenic microorganisms in tap water, which can cause gastrointestinal diseases in humans, have impacted the health of people living in rural areas of the Juárez Valley in the state of Chihuahua, Mexico. A high incidence of parasites such as Giardia and Cryptosporidium are linked in the area to inadequate wastewater treatment infrastructure. Around two-thirds of wastewater from Ciudad Juárez is treated at two advanced primary treatment facilities, but one-third is discharged without treatment. Untreated water mixes with treated wastewater effluent, existing surface water in the Rio Grande, and other sources—and ultimately is used for farming in the Juárez Valley.

Comunidades del Valle de Juarez, Chihuahua

To better understand the link between water contamination and health in the valley, a team of researchers from border region universities and institutions undertook an epidemiological study of gastrointestinal diseases in the Juárez valley.[5]

What were the results?

The researchers identified several conclusions from their ongoing research, including:

- According to the epidemiological survey of households, 10–12% of children under five suffered from diarrhea.
- Ninety percent of houses used water from the tap water system. 72% used that water for food preparation and 45% for drinking water.

[5] The team was comprised of members from the Universidad Autónoma de Ciudad Juárez, Comisión de Cooperación Ecológica Fronteriza, Comisión Estatal para Protección contra Riesgos Sanitarios, Colegio de la Frontera Norte, and the Texas Agrilife Research & Extension Center at El Paso, Texas A&M University.

- Fifty-five percent of tap water samples tested positive for the parasites Cryptosporidium and/or Giardia. Researchers concluded that the presence of these parasites may be linked to the area's aquifer, distribution system, town storage systems, and the condition of pipes inside and outside homes.
- More than 56% of tap water samples tested positive for total coliform.

How is this being addressed?

Since 2005, eight wastewater collection and treatment projects benefitting eleven Juárez Valley communities have been funded under the Border Water Infrastructure Program. In addition, drinking water distribution projects were also funded for two of the eleven communities. Currently, there are three additional projects in development that will provide drinking water and wastewater services for two additional Juárez Valley communities. In total, thirteen communities are being served by new water infrastructure projects.

Sources

Juan P. Flores-Margez, Alberto Ramírez López, Baltazar Corral Díaz, Evangelina Olivas E., Aracely Salazar Monrreal, Roberto Hurtado Jiménez, Gilberto M. Lizárraga Bustamante, George D. Di Giovanni. "Microbial Pathogens in Tap Water at Rural Communities of North México."

Dr. Alberto Ramírez López, Dr. Juan Pedro Flores Márgez. "Gastrointestinal Diseases and Causal Effects in The Valle de Juárez, Chihuahua, México El Paso, Texas," June 16, 2010.

Reduce Water Contamination

How safe is the water at San Diego and Tijuana Beaches?

Indicator:

- **San Diego County Beach Advisories and Closures: Beach Mile Days** NEED
- **Binational International Boundary and Water Commission Shore Sampling: Elevated Fecal Indicator Bacteria** NEED

Sub-Objective 3A: Strengthen communication and coordination between U.S. and Mexico on coastal water quality monitoring and beach advisory/closure protocols.

The Southern California and Northern Baja California coast offers warm weather and expanses of sandy beaches that entice bathers, surfers, divers, and other water users to this part of the border region. However, potentially harmful bacteria flowing into coastal waters may pose a risk to the health of those seeking to enjoy ocean beaches.

Given the potential risks from contaminated surface water, San Diego County monitors the quality of border region beaches in California near the U.S.-Mexico border. Detection of contamination or other events (e.g., spills or heavy rainfall events) can lead to the posting of advisories or closing of the beaches.

In addition to the San Diego County monitoring program, a joint binational monitoring program involving the City of San Diego, the International Boundary and Water Commission (IBWC), and the Comisión Estatal de Servicios Públicos de Tijuana (CESPT) maintains an ocean monitoring program at sites at San Diego and Tijuana Beaches (henceforth, this monitoring program is referred to as the IBWC monitoring program). The monitoring program assesses water quality for the area surrounding San Diego's South Bay Ocean Outfall, which is approximately 3.5 miles offshore and which discharges treated water from the International Wastewater Treatment Plant (operated by the IBWC). This monitoring program includes eight shore sampling locations on the U.S. side of the border and three sampling locations at Tijuana beaches.

Both of these sources provide data for indicators of beach water quality in the San Diego-Tijuana area.

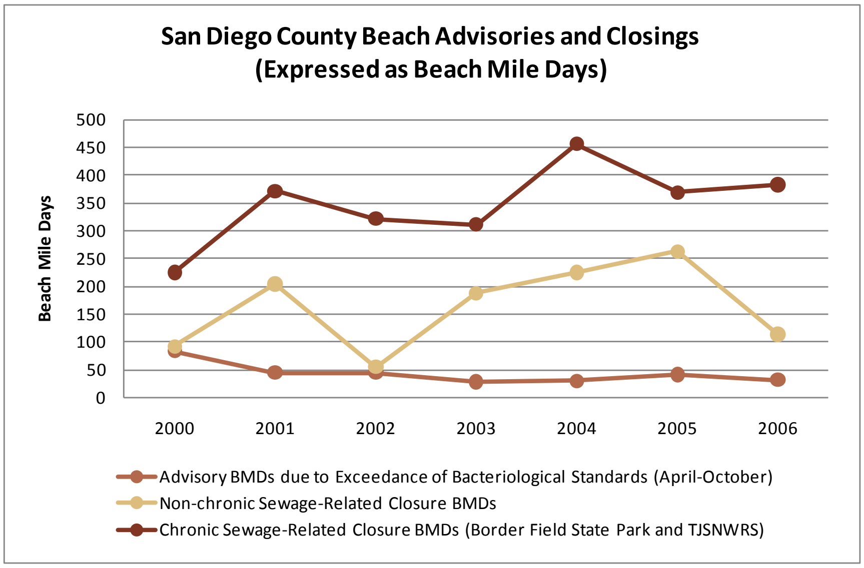
Why are these indicators important?

The proximity of San Diego and Tijuana beaches to major urban areas is part of their popularity, but it also means that these beaches are potentially vulnerable to contamination from many sources. Exposure to bacterial contaminants at beaches can cause immediate disease impacts, so effective ongoing monitoring and real-time advisories—and potentially closings—are important to ensure the safety of bathers.

What are the indicators showing?

Beach monitoring data for San Diego County and the IBWC monitoring program are presented separately because of differences in monitoring programs and reporting.

The County of San Diego monitors 52 miles of recreational shoreline year round, with enhanced monitoring locations during "beach season" from April to October. During this time, the County monitors 60 locations weekly. Based on sampling, the County posts beach advisories if bacteria exceed California state ocean water standards.[6] The County will also close beaches if there are significant sewage spills that threaten coastal water quality. San Diego reports its advisory and closure data in terms of "beach mile days," which are calculated by multiplying the number of days of a closure or advisory posting by the number of miles of beach posted or closed.



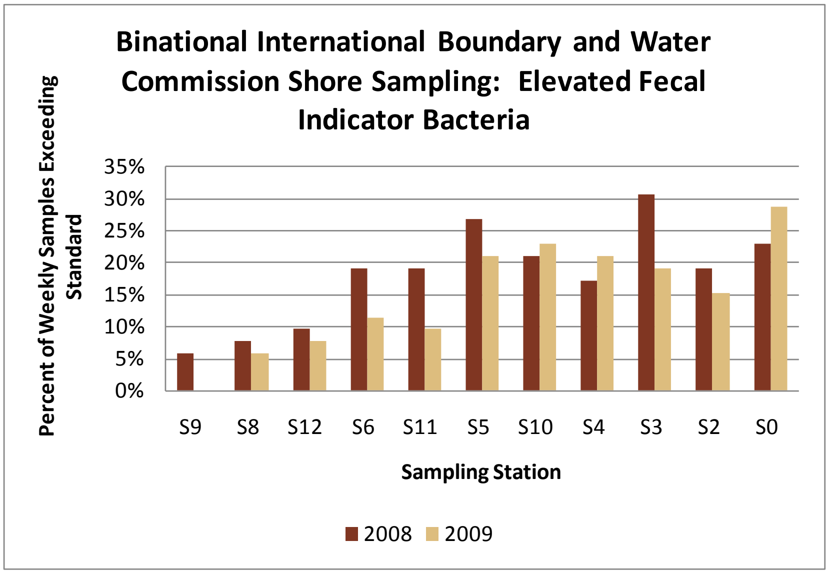
The graphic above shows San Diego County data broken out into three types of beach advisories or closings:

- **Advisory Beach Mile Days**. These data represent beaches on which the County posted advisories because water samples exceeded bacteriological standards.
- **Non-chronic Sewage-Related Closure Beach Mile Days**. These data represent beaches that were closed due to sewage spills, but are not considered "chronic" because closures at these beaches are infrequent.
- **Chronic Sewage-Related Closure Beach Miles Days**. These data represent beaches that are frequently closed due to sewage spills. These closures are all in the area of Border Field State Park and Tijuana Slough National Wildlife Refuge Shoreline, which are at the outlet of the Tijuana River adjacent to the border.

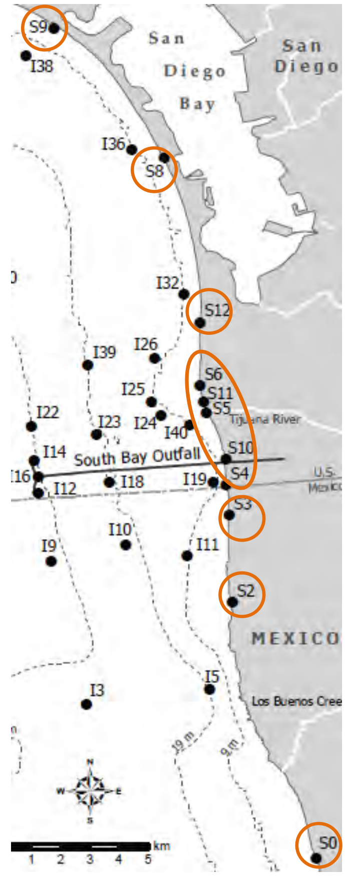
Over the period 2000-2006 (the last year for which San Diego County published annual reports under the program) there were fewer than 100 beach mile days each year posted with advisories due to exceedances of bacteriological standards. During that same period, there were between 225 and 456 beach mile days annually subject to chronic sewage-related closures. In addition, there were between 55 and 225 beach mile days of sewage-related closures elsewhere at San Diego beaches.

[6] San Diego County uses the State of California's ocean water standards. For single sample standards, they are: Total Coliforms—10,000 organisms per 100 milliliter sample; Fecal Coliforms—400 organisms per 100 milliliter sample; Enterococci—104 organisms per 100 milliliter sample; Fecal: Total ratio: >1,000 total coliforms if ratio exceeds 0.1.

Weekly sampling through the IBWC monitoring program at eight shore locations in the U.S. and three shore locations in Mexico showed that up to 31% of weekly samples per year at individual sampling locations exceeded standards for fecal indicator bacteria (FIB). (The FIB standard is a combined standard for enterococcus, fecal coliforms, and total coliforms).[7] The percent of samples exceeding standards dropped overall from 2008 to 2009 and dropped at most individual sampling locations as well. Sampling stations near San Diego's South Bay Outfall, the U.S.-Mexico Border, and along the northern Mexico coast had the highest number of exceedances when compared to the same FIB standards.



IBWC Shore Sampling Locations



Map source: County of San Diego Department of Environmental Health, "San Diego County 2006 Beach Closure and Advisory Report."

What influences these indicators and what can be done in the future?

Analysis by San Diego County concluded that the largest contributor to beach advisories and closures was sewage-contaminated runoff from the Tijuana River, which is also consistent with the IBWC monitoring program results. Runoff events can affect several miles of shoreline and can last from days to weeks. The events are generally triggered by high rainfall, which brings high flows into the Tijuana River Estuary. Peak bacteria counts generally track rain events. A key step to improve beach water quality is to improve the water quality of the Tijuana River by reducing pollutant loadings to it. CESPT has recently completed two new wastewater treatment plants that will improve wastewater quality in the Tijuana River.

A key focus of Border 2012 is ensuring that public health is protected by alerting beachgoers when water is contaminated. This is an important element of the San Diego County monitoring program's beach notifications and closures program. In Tijuana, CESPT posts beach sampling data on its website. The data reported by CESPT comes from analysis of split samples taken during sampling events for the IBWC monitoring program. Increased transparency and publication of beach water quality data is highly consistent with Border 2012's objective to

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[7] City of San Diego samples are considered "elevated FIB" if any of the following are true: a) total coliform > 1000 colony forming units (CFU)/100 mL, b) fecal coliform > 400 CFU/100ml, or c) enterococcus >104CFU/100 mL.

"strengthen communication and coordination between U.S. and Mexico on coastal water quality monitoring and beach advisory/closure protocols."

Technical considerations

San Diego County and the IBWC monitoring programs have different monitoring regimes (e.g., frequency and methods) and different ways of reporting data (i.e., "beach mile days" vs. exceedance of standards). San Diego County also limited the scope of its annual reporting on beach closures after 2006 due to budget cuts.

Data sources

County of San Diego Department of Environmental Health, "San Diego County 2006 Beach Closure and Advisory Report"

City of San Diego, "Annual Receiving Waters Monitoring Report for the South Bay Ocean Outfall (South Bay Water Reclamation Plant)" 2008 and 2009 (Source for IBWC Monitoring Program data)

Reduce Water Contamination

How safe is the water at Mexico Border Region Beaches?

Indicator:

➔ **Percent of Mexico Border Beach Sampling Events Above Enterococcus Standard** NEED

Sub-Objective 3A: Strengthen communication and coordination between U.S. and Mexico on coastal water quality monitoring and beach advisory/closure protocols.

Since 2003, Mexico's Comisión Federal para la Protección contra Riesgos Sanitarios (Federal Commission for the Protection against Sanitary Risk, COFEPRIS), in collaboration with the Ministry of Tourism, SEMARNAT, and the Ministry of the Navy have monitored the sea water quality in numerous Mexican beaches along the Pacific Ocean, the Gulf of Mexico, and the Caribbean as part of the "Programa Integral de Playas Limpias." This program reports data on the number of monthly sampling events that exceed Mexico's bathing standard for enterococcus, which is a pathogen that is frequently used as an indicator of fecal contamination (e.g., from sewage spills or inadequate sewage systems). Enterococcus and other bacteria related to fecal contamination can cause a variety of infections and illness.

Why is this indicator important?

Clean and healthy beaches are important for protecting the health of residents and those visiting Mexico's tourist beaches and for supporting the economy of beach communities.

What is the indicator showing?

Mexico's COFEPRIS reports on monthly sampling results for enterococcus bacteria at several locations within the border region or easily accessible from it:

- Baja California: near Tijuana (three beaches), Rosarito (three beaches), Ensenada (ten beaches), and San Felipe (five beaches)
- Tamaulipas: near Matamoros (three beaches)
- Sonora: near Puerto Peñasco (five beaches).

Prior to June 30, 2010 Mexico's bathing standard for enterococcus bacteria was 500 organisms/100ml. Above this level, water was considered unhealthy for bathing. This is the standard used for this indicator. As of June 30, 2010, Mexico instituted a new bathing standard for enterococcus bacteria in which concentrations above 200 organisms/100ml are considered unhealthy for bathing; the California state standard is 104 organisms/100ml. See the highlight "How Water Quality Standards Affect Indicator Results" for an explanation of the role of standards in assessing water quality.

The monthly enterococcus monitoring at border region beaches in Mexico showed samples exceeding Mexico's 500 organisms/100ml standard only in the beaches at Rosarito, Baja California for the years 2003-2005. All other reported sampling events were below the standard at all other border region beaches.

Percent of Mexico Border Beach Sampling Events Above Enterococcus Standard

Beach	2003	2004	2005	2006	2007	2008
Tijuana, Baja California						
Tijuana I	0% (4)	0% (10)	0% (8)	0% (9)	0% (9)	0% (11)
Tijuana II	0% (4)	0% (10)	0% (8)	0% (9)	0% (10)	0% (11)
Tijuana III	0% (4)	0% (10)	0% (8)	0% (9)	0% (10)	0% (11)
Rosarito, Baja California						
Rosarito I	0% (4)	0% (10)	0% (8)	0% (9)	0% (10)	0% (11)
Rosarito II	25% (4)	10% (10)	12% (8)	0% (10)	0% (10)	0% (11)
Rosarito III	25% (4)	0% (10)	0% (8)	0% (9)	0% (10)	0% (11)
Ensenada, Baja California						
La Joya	--	--	--	0% (7)	0% (11)	0% (11)
El faro Beach	--	--	--	0% (7)	0% (11)	0% (11)
Mona Lisa	--	--	--	0% (7)	0% (11)	0% (11)
El Ciprés	--	--	--	0% (7)	0% (11)	0% (11)
Conalep #2	--	--	--	0% (7)	0% (11)	0% (11)
Conalep #1	--	--	--	0% (7)	0% (11)	0% (11)
Playa Hermosa	--	--	--	0% (7)	0% (11)	0% (11)
Playitas	--	--	--	0% (7)	0% (11)	0% (11)
San Miguel	--	--	--	0% (7)	0% (11)	0% (11)
La Misión	--	--	--	0% (7)	0% (11)	0% (11)
San Felipe, Baja California						
Los Faisanes	--	--	--	--	0% (5)	0% (4)
Burócratas	--	--	--	--	0% (5)	0% (4)
Dorado Ranch	--	--	--	--	0% (5)	0% (4)
Malecón	--	--	--	--	0% (5)	0% (4)
Bonita (Campo Rubens)	--	--	--	--	0% (5)	0% (4)
Tamaulipas						
Playa Bagdad I	--	--	0% (8)	0% (8)	0% (10)	0% (5)
Playa Bagdad II	--	--	0% (8)	0% (8)	0% (10)	0% (5)
Playa Bagdad III	--	--	0% (8)	0% (8)	0% (10)	0% (5)
Sonora						
Playa Hermosa	--	0% (3)	0% (6)	0% (7)	0% (10)	0% (10)
Playa Bonita	--	0% (3)	0% (6)	0% (7)	0% (10)	0% (10)
Sandy Beach	--	0% (3)	0% (6)	0% (7)	0% (10)	0% (10)
Golfo de Santa Clara 1	--	--	0% (5)	0% (7)	0% (9)	0% (11)
Golfo de Santa Clara 2	--	--	0% (4)	0% (7)	0% (9)	0% (11)

-- = no data; shaded boxes indicated years/locations where samples exceeded the standard. The number of samples is shown in parentheses.

What influences this indicator and what can be done in the future?

Beach water quality can be impacted by a number of factors, including outflows from rivers that contain contamination (especially during rain events), industrial or municipal outflows, and surface runoff.

Technical considerations

Many beaches are missing data for various months. More frequent sampling and/or sampling for other bacteriological contaminants might produce different results. The new bathing standard (established June 30, 2010) of 200 organisms/100ml for enterococcus may increase the number of sampling events that exceed the standard in the future.

Data source

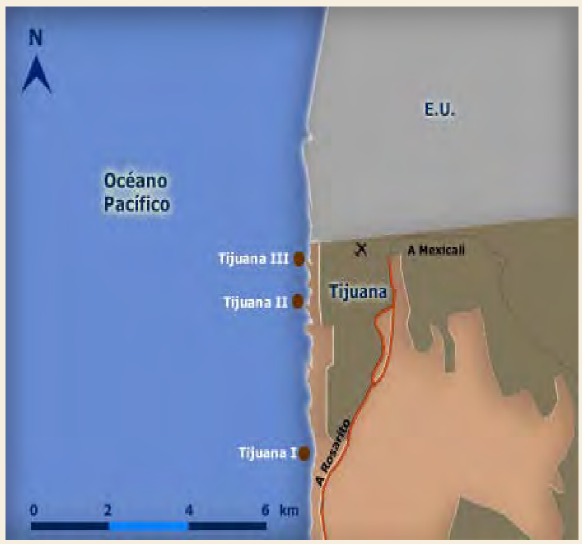
COFEPRIS (2009)

Reduce Water Contamination

Highlight: How Water Quality Standards Affect Indicator Results

Water quality indicators are often reported as the percent of samples that exceed a particular standard. But standards are not set in stone. They can differ across international borders and other jurisdictions, and they can differ over time as new policies are introduced. To show how the choice of standards can affect indicator results, this highlight illustrates how different water quality standards for enterococcus bacteria can affect indicators for Tijuana beach water quality and can help make results from different sampling efforts more comparable.

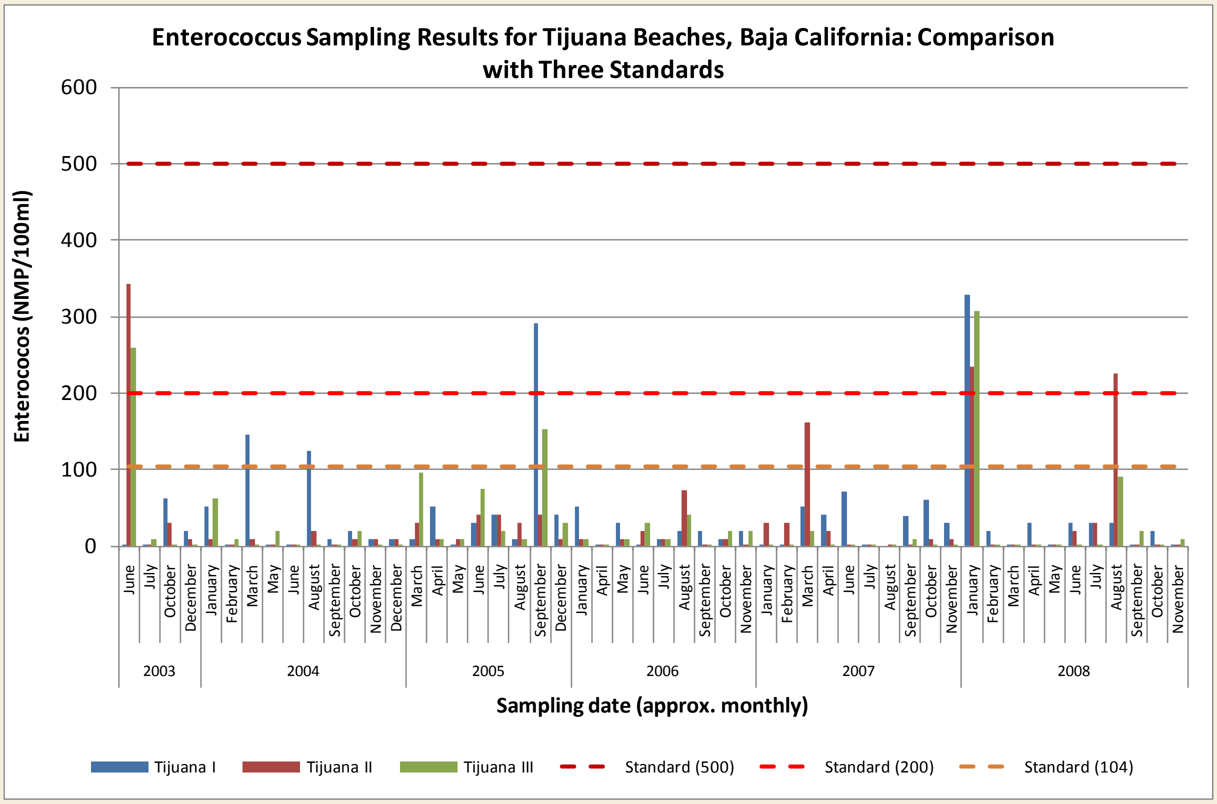
As represented in the indicator "Percent of Mexico Border Beach Sampling Events Above Enterococcus Standard," Mexico's national health agency COFEPRIS reports on beach water quality sampling (conducted approximately monthly) at three locations in Tijuana (see map below).



Source: COFEPRIS

To show the degree to which water samples from these three locations meet a range of water quality standards, the figure below shows sampling results compared to three different standards (represented as dotted horizontal lines on the figure):

- 500 organisms per 100ml of water—Mexico's enterococcus standard prior to June 30, 2010
- 200 organisms per 100ml of water—Mexico's enterococcus standard after June 20, 2010
- 104 organisms per 100ml of water—the California enterococcus standard used by San Diego



As shown in the figure, all of the samples are below the 500 organisms/100 ml standard. However, as the standard tightens to Mexico's new standard of 200 organisms/100 ml, some samples exceed it. Several more samples would exceed a 104 organisms/100ml standard. Clearly, an indicator expressed as the percent of water samples exceeding a standard would differ based on the standard used.

Understanding differences in standards can also help compare data from different sampling efforts. For example, adjusting for different standards can help compare the COFEPRIS beach monitoring data shown above to data collected at Tijuana beaches through the International Boundary and Water Commission (IBWC) monitoring program—a joint effort of the IBWC, the City of San Diego and Baja California's Comisión Estatal de Servicios Públicos (CESPT). The IBWC monitoring data are collected weekly at shore locations in San Diego and Tijuana and compared to an enterococcus standard of 104 organisms/100ml. (Related data from this sampling effort are represented in the indicator "Binational International Boundary and Water Commission Shore Sampling: Elevated Fecal Indicator Bacteria," along with a map of sampling locations.)

The table below shows results for two sampling locations at Tijuana beaches—one from COFEPRIS's sampling work and one from the IBWC monitoring program. Both sampling stations are at Tijuana beaches within approximately 1 km of the international border. The COFEPRIS data are collected approximately monthly, and the IBWC monitoring data are collected weekly. The table shows the percent of samples each year that would exceed three different enterococcus standards (500, 200, and 104 organisms per 100ml).

Percent of Samples Exceeding Standards at Two Tijuana Beach Sampling Locations

	2003	2004	2005	2006	2007	2008
COFEPRIS Monitoring Program (Location: Tijuana III; approximately monthly)						
Standard: 500 organisms/100ml	0%	0%	0%	0%	0%	0%
Standard: 200 organisms/100ml	25%	0%	0%	0%	0%	9%
Standard: 104 organisms/100ml	25%	0%	13%	0%	0%	9%
Number of samples	*4*	*10*	*8*	*9*	*10*	*11*
IBWC Monitoring Program (Location: Playas de Tijuana; station S3; weekly)						
Standard: 500 organisms/100ml	12%	8%	8%	4%	4%	3%
Standard: 200 organisms/100ml	10%	12%	12%	4%	6%	3%
Standard: 104 organisms/100ml	22%	14%	19%	8%	8%	10%
Number of samples	*50*	*51*	*52*	*52*	*52*	*39*

As shown in the table, the COFEPRIS samples generally show a lower percentage of exceedances at all levels of the standard. For example, at a standard of 500 organisms/100ml, the COFEPRIS data show no exceedances over all of the years, while the IBWC monitoring program data show annual exceedances from 3% (2008) to 12% (2003). However, the apparent difference in results between the two sampling locations diminishes as the standard decreases from 500 to 200 to 104 organisms/100ml. At a standard of 104 organisms per 100ml, for example, the results at the two sample locations are fairly similar for 2003 (25% vs. 22%), 2005 (13% vs. 19%), and 2008 (9% vs. 10%). Adjusting for different standards helps explain the relationship between these two data sets and provides more information about beach water quality in the region.

Sources

City of San Diego, "Annual Receiving Waters Monitoring Report for the South Bay Ocean Outfall (South Bay Water Reclamation Plant)" 2008 and 2009: http://www.sandiego.gov/mwwd/environment/reports.shtml (IBWC monitoring program data)

COFEPRIS (2009)

4. AIR

Air quality in the border region is impacted by pollutants from a number of sources. Motor vehicles, power plants, industrial facilities, agricultural operations, mining, dust from unpaved roads, and open burning of trash all affect urban and regional air quality along the U.S.-Mexico border. The most common and harmful pollutants from these sources include suspended particulate matter (PM_{10} and $PM_{2.5}$) and ground-level ozone.

Ozone is a photochemical oxidant and the major component of smog. It is formed through complex chemical reactions between precursor emissions of volatile organic compounds (VOCs) and oxides of nitrogen (NOx), which are emitted by transportation and industrial sources. It is reactive and damages lung tissue, reduces lung function, and increases sensitivity to other irritants.

Particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) consists of ground geologic material. Fine PM (diameter of 2.5 microns or less) or $PM_{2.5}$ consists of sulfates, nitrates, other gases, soot and finer ground geologic materials. Exposure to PM_{10} and $PM_{2.5}$ can cause impaired breathing, aggravation of respiratory and cardiovascular disease, and premature death. Recent studies have shown that fine-grained particulate matter may be a greater health risk because these particles are more easily inhaled into the lungs.

There is also increasing attention to emissions of greenhouse gases—such as carbon dioxide and methane—in the border region as well as to the impact of climate change on the border region.

The U.S. and Mexico continue to collaborate to help safeguard the health of border residents by protecting and improving shared air basins. The two governments—in partnership with border tribal, state, and local governments—have worked collaboratively to increase knowledge about pollution sources and impacts, establish monitoring networks in several key areas, develop emissions inventories, demonstrate the benefits of using cleaner fuels, retrofit diesel vehicles, collaborate on projects to reduce emissions, and build local capacity through training.

Although substantial gains have been made, air quality is still a major concern throughout the border region. The pressures associated with industrial and population growth, differences in governance and regulatory frameworks, and topographic and meteorological conditions combine to present a challenging context in which to address air quality management.

This chapter provides information on a number of aspects of air quality in the border region, including:

- Days exceeding particulate matter and ozone air quality standards
- Key activities to reduce air emissions (e.g., diesel truck retrofits)
- Policy responses to reduce emissions of greenhouse gases and adapt to a changing climate

Reduce Air Contamination

What is the quality of border region air compared to health standards?

Indicators:

→ **Number of Days Exceeding Air Quality Standards in Border Monitoring Areas** NEED

Objective 1. By 2012 or sooner, reduce air emissions as much as possible toward attainment of respective national ambient air quality standards, and reduce exposure in the border region.

Air quality standards are established in order to protect people from potential harmful exposures to air pollutants. Levels of air pollution that exceed a numeric standard are associated with potential impacts to human health. The quality of the air can be inferred by the number of days that a standard is exceeded within a monitored area. The most persistent and pervasive pollutants found in the border region are ozone and particulate matter (PM_{10}).

U.S. ozone and PM_{10} standards were used to calculate and illustrate indicators in this section. They are:

- Ozone: 0.080 ppm (daily 8 hour maximum standard)[8]
- PM_{10}: 150 µg/m^3 (24 hour average standard)

Mexico's standard for ozone is 0.080 ppm (daily 8 hour maximum standard). Mexico's standard for PM_{10} is 120 µg/m3 (24 hour average standard).

Data for these indicators come from five regional monitoring areas in the border region. One of these—Ciudad Juarez/El Paso—includes air monitoring data from both sides of the border. The other monitoring areas—San Diego, Imperial Valley, Nogales and Lower Rio Grande Valley—include only air monitoring data from the U.S. side of the border (see "Technical Considerations" below for a discussion of the air monitoring system in Mexico's border region).

[8] The current 8-hour U.S. standard for ozone is 0.075 ppm, but this standard has been stayed. The earlier U.S. standard of 0.080 ppm is used here to be consistent with data in past indicator reports and with Mexico's standard, which is 0.080 ppm.

Monitoring Locations for Ozone in the Border Region

Monitoring Locations for PM_{10} in the Border Region

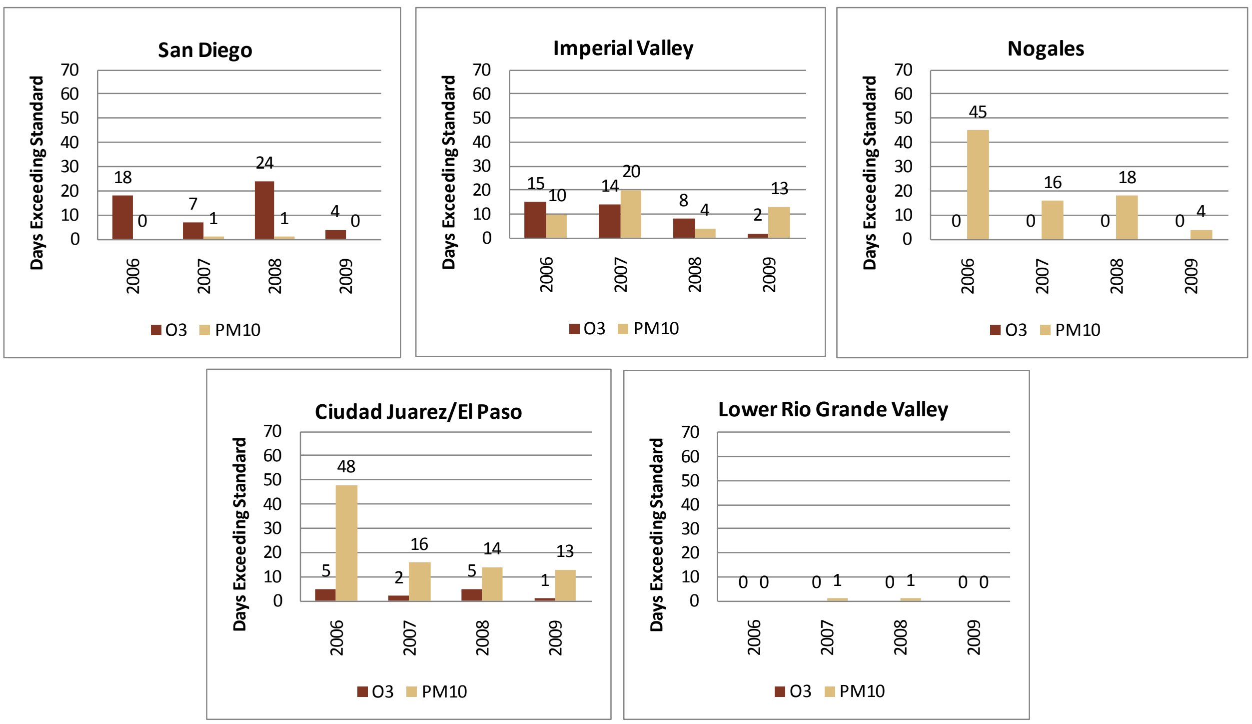
Why are these indicators important?

Ozone and particulate matter are the most prevalent air pollutants in the border region that are tracked because of their impacts on human health, the environment, and aesthetics (e.g., visibility).

What are these indicators showing?

Based on the analysis of the number of days exceeding the ozone standard (0.080 ppm) and PM_{10} standards (150 µg/m^3) from 2006-2009, air quality varies geographically. San Diego and Imperial Valley had the highest number of days exceeding the ozone standard. Imperial Valley, Nogales, and Ciudad Juarez/El Paso had the highest number of days exceeding the PM_{10} standard. In contrast, the Lower Rio Grande Valley had the fewest days exceeding air quality standards among the regions reported.

Number of Days Exceeding Air Quality Standards in Border Monitoring Areas



Note: Ciudad Juarez/El Paso monitoring areas include data from monitors in the U.S. and in Mexico; Nogales and Lower Rio Grande Valley monitoring areas only have monitors in the U.S.; for San Diego and Imperial Valley, only data from monitors in the U.S. are used because of quality assurance issues with the monitoring systems in Tijuana and Mexicali (see "Technical Considerations" below).

Data specifically from monitoring stations in Juarez illustrate how using a different set of air quality monitors and using different air quality standards can affect these indicators. Using Mexico's PM_{10} standard of 120 µg/m^3 (which is lower than the 150 µg/m^3 U.S. standard illustrated above), the number of days exceeding the PM_{10} standard in Juarez is 17, 13, 32, and 38 days for 2006-2009, respectively. Using Mexico's ozone standard of 0.08 ppm (which is the same as the U.S. standard), the number of days exceeding the ozone standard according to monitors in Juarez is 5, 1, 4, and zero days for 2006-2009, respectively.

What influences these indicators and what can be done in the future?

Ozone is formed through complex chemical reactions between precursor emissions of volatile organic compounds (VOC) and oxides of nitrogen (NOx), which are emitted by transportation and industrial sources. PM, which is fine grained geologic material, enters the air through both human caused and natural sources. These sources include agricultural processes, unpaved roadways, quarry and cement manufacturing, and incomplete combustion of diesel fuels. In some areas, dust storms that suspend fine particulates in the air can cause peak concentrations of PM_{10} as well.

A number of efforts are underway in the border region to reduce ozone and PM emissions through stricter standards on vehicle emissions, cleaner fuels, vehicle anti-idling programs, and other efforts. Some sources of PM_{10}, such as dust storms, are not amendable to control strategies. However some strategies, such as road paving, can control the suspension of particulates due to winds or vehicle use.

Technical Considerations

Data on PM_{10} and ozone come from EPA's system for tracking air quality data, the Air Quality System (AQS). The exceedances were calculated by adding the number of days above the standard on any site within each monitoring area; exceptional events were included in the calculation, and multiple exceedances on the same day within each monitoring area were counted as one.

Only data for one of the five monitoring areas come from monitors maintained in both the U.S. and Mexico (Ciudad Juarez/El Paso). Given the complexity of maintaining a binational network, data for some years and locations are incomplete.

The monitoring data from Tijuana and Mexicali were not included in this report because they do not meet the quality assurance standards generally used for determining compliance with air quality standards in the U.S. Many monitors in Tijuana and Mexicali have not been operating consistently since 2007, and the systems have not passed recent annual performance audits performed by EPA and the Instituto Nacional de Ecología (INE). The Secretaria de Protección al Ambiente in Baja California and INE are actively working to address the issues identified.

The indicators do not show concentrations of small size particulate matter (i.e., $PM_{2.5}$), which may be a significant issue in some border regions even if PM_{10} concentrations are relatively low.

Data Sources

EPA Air Quality System (AQS)

2005 *State of the Border Region* report

Reduce Air Contamination

What is being done to reduce diesel emissions from transportation in the border region?

Indicators:

- **Number of Diesel Truck Retrofits from Binational Projects in the Western Border Region** OUTPUT

Objective 1. By 2012 or sooner, reduce air emissions as much as possible toward attainment of respective national ambient air quality standards and reduce exposure in the border region.

Emissions from diesel engines are a significant source of air pollutants in the border region. In order to address the health threats posed by diesel emissions, the Good Neighbor Environmental Board (GNEB), a U.S. federal advisory panel on U.S.-Mexico border issues, recommended in its 2006 annual report that the U.S. and Mexico work collaboratively to reduce emissions from diesel trucks, buses, municipal and private fleets, and passenger vehicles.[9]

New diesel emissions standards adopted in the U.S. and Mexico for new heavy-duty engines are expected to have a dramatic effect on diesel emissions generally. However, heavy-duty vehicles already on the road aren't subject to the new standards. To address this existing heavy-duty fleet, several border region governments have focused attention on retrofitting diesel vehicles in their jurisdictions, including school buses, port-related drayage vehicles, and commercial fleets. For example, Texas retrofitted 482 school buses in Texas border counties between 2008 and 2010. In Arizona, 71 school buses were retrofitted during this same time period.

Another focus of work related to diesel emissions has been binational demonstration projects at California-Baja California and Arizona-Sonora border crossings to fund and evaluate retrofits of diesel trucks that regularly cross the U.S.-Mexico border.

Why is this indicator important?

Diesel engines contribute to emissions of carbon monoxide (CO), NOx, sulfur dioxide (SO2), VOCs, PM_{10} and $PM_{2.5}$. In addition, diesel exhaust contains 40 specific hazardous air pollutants. Among mobile sources of air pollution, heavy-duty diesel vehicles are a significant contributor of ambient particulate matter and, through their emissions of NOx, ground-level ozone.

In Mexico, the 1999 National Emissions Inventory estimated that light- and heavy-duty diesel vehicles accounted for approximately 19% of all NOx emissions, 3% of all CO, 1.5% of VOCs, 1.5% of $PM_{2.5}$, 1.2% of PM_{10}, and 0.15% of SOx emitted in Mexico.

Binational diesel vehicle retrofit projects are an important step in identifying the effectiveness of retrofit strategies in reducing diesel emissions in the border region given the unique patterns of cross-border travel and the characteristics of the drayage fleet that accounts for much border region truck activity. Identifying and demonstrating successful retrofit strategies will help encourage additional emissions control activities in the border region and beyond.

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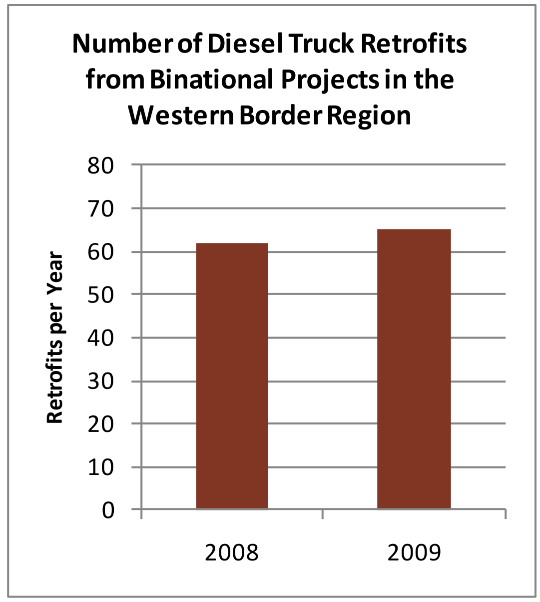
[9] Good Neighbor Environmental Board, *Ninth Report to the President and Congress of the U.S.: Air Quality and Transportation & Cultural and Natural Resources*, March 2006, available online at: http://www.epa.gov/ocem/gneb/gneb9threport/English-GNEB-9th-Report.pdf

What is the indicator showing?

In the California-Baja California and Arizona-Sonora region, 62 retrofits were implemented for binational projects completed in 2008, and 65 retrofits were implemented for binational projects that were completed in 2009. One hundred seventeen of these retrofits involved the installation of Diesel Oxidation Catalysts, and 10 involved installing a Diesel Particulate Filter. Activity centered on the Otay Mesa, Calexico East, and Nogales border crossings.



What influences this indicator and what can be done in the future?

The number of binational retrofit projects is largely a function of funding. The purpose of these projects is to demonstrate and test the effectiveness of retrofit technologies to provide the information base for much broader, private sector implementation of retrofits and turnover to cleaner fleets.

Technical considerations

This indicator reports the number of retrofits, rather than the emissions reductions due to retrofit technologies. Actual emissions reductions would depend on the characteristics of individual trucks and their patterns of use, which are data that are not available. It does not include information about other retrofits in the region, including private-sector investments in retrofits or projects in the region that were not binational in nature.

Data sources

Industrial Economics (IEc), "Analysis of Diesel Emissions in the U.S.-Mexico Border Region" (2007)

SEMARNAT, *INE, Inventario Nacional de Emisiones de México, 1999* (2006)

EPA, Region 9 data on retrofit projects

Reduce Air Contamination

What are border region states doing to reduce emissions of greenhouse gases and respond to a changing climate?

Indicators:

→ **Status of Border State Development of Greenhouse Gas Inventories, Forecasts, and Action Plans** OUTPUT

Objective 2. By 2012, build border greenhouse gas (GHG) information capacity using comparable methodologies and expand voluntary cost-effective programs for reduction of GHG emissions in the border area.

Why is this indicator important?

As a primarily arid region with high temperatures, scarce water, and unique ecosystems—as well as a region with coastal areas bordering on two of the world's major salt water systems—the border region is vulnerable to the impacts of a changing climate. Border states and cities—and their respective federal governments—have therefore focused increasing attention on reducing greenhouse gas (GHG) emissions. Border 2012 provides a forum for increased binational cooperation and attention toward reducing GHGs and adapting to a changing climate.

What is the indicator showing?

Since 2005, the U.S. states of California, New Mexico, and Arizona, and all of the Mexican border states have completed comprehensive GHG emissions inventories and forecasts. Texas completed a less detailed emissions inventory covering the years 1990–1999, which was released in 2002.[10]

Three out of the four U.S. border states—California, Arizona, and New Mexico—have developed climate action plans that specify GHG reduction targets for the state and a series of actions to achieve those targets. All three either have, or anticipate having, mandatory reporting programs to support the plans.

All of the Mexican border states also anticipate developing climate action plans as a follow-up to their GHG inventory development efforts. Mexico's Programas Estatales de Acción ante el Cambio Climático (State Program for Climate Change Action) is providing training and technical assistance to Mexican state governments to develop action plans in conjunction with academic institutions and stakeholders.

Status of Border State Development of Greenhouse Gas Inventories, Forecasts, and Action Plans

	Status of Inventory Publication	Status of Forecast Publication	Status of Action Plan Publication
United States			
California	Completed (2007)	Completed (2007)	Completed (2006)
Arizona	Completed (2005)	Completed (2005)	Completed (2006)
New Mexico	Completed (2006)	Completed (2006)	Completed (2006)
Texas	Completed (2002)	--	--

[10] Texas' inventory is described as a "streamlined" inventory that focused on key sources and sinks rather than a comprehensive list. The age, approach and level of detail of the inventory make it difficult to compare with more recent inventories in the border region. A brief description of the inventory is available at: http://epa.gov/climatechange/emissions/downloads/TXsummary_v2.PDF.

	Status of Inventory Publication	Status of Forecast Publication	Status of Action Plan Publication
Mexico			
Baja California	Completed (2007)	Completed (2007)	--
Sonora	Completed (2008)	Completed (2008)	--
Chihuahua	Recently completed (2010)	Recently completed (2010)	--
Coahuila	Recently completed (2010)	Recently completed (2010)	--
Tamaulipas	Recently completed (2010)	Recently completed (2010)	--
Nuevo Leon	Recently completed (2010)	Recently completed (2010)	--

-- *denotes plan not completed*

What influences this indicator and what can be done in the future?

Most border states have committed to developing GHG inventories, forecasts, and action plans. In the future, border states can work together to get a picture of border-wide emissions and to develop collaborative, and even region-wide, strategies for reducing GHG emissions.

Technical considerations

All of the border state inventories and forecasts done since 2005 have used methodologies consistent with the Intergovernmental Panel on Climate Change (IPCC) guidelines. However, there are some differences arising from data availability, whether states calculate emissions from electricity consumption vs. production,[11] and whether gross or net emissions were reported.[12] The inventories and forecasts for Arizona, New Mexico and all of the Mexican border states are methodologically similar because they used the same technical consultant.

Data sources

Israel Laguna Monroy (INE), "State Programs for Climate Change Action," Border 2012 Air Policy Forum (July 7, 2010)

Ross & Associates, "U.S.-Mexico Border Region Greenhouse Gas Inventories and Policy" (2009)

[11] A consumption-based approach counts emissions from all electricity used in the state, including within-state production and electricity imports.

[12] Gross emissions are the total emissions in the state while net estimates take into account the amount of CO_2 equivalent that has been removed from the atmosphere by the process of sequestration in carbon sinks (e.g., tree growth).

Reduce Air Contamination

What activities are reducing greenhouse gas emissions in the border region?

Indicators:

- **Actual and Potential Greenhouse Gas Emissions Reductions from Global Methane Initiative Projects in the Border Region** OUTCOME

Objective 2. By 2012, build border greenhouse gas (GHG) information capacity using comparable methodologies and expand voluntary cost-effective programs for reduction of GHG emissions in the border area.

The Global Methane Initiative is an international partnership to pursue cost-effective, near-term recovery of methane and use it as a clean energy source. It builds on the Methane to Markets program, which was launched in November 2004. The Initiative targets methane produced from landfills, underground coal mines, natural gas and oil systems, and agriculture.

The Global Methane Initiative currently has 38 country partners, including the U.S. and Mexico. Mexico and the U.S. signed a letter of cooperation in 2006 committing to collaborate on methane projects in Mexico, including working with local governments and the private sector. The two governments collaborated in developing the Mexico Landfill Gas (LFG) Model, which assesses the feasibility and benefits of collecting and using landfill gas for energy recovery.

Why is this indicator important?

Methane is a potent GHG if released to the atmosphere. However, it is also a valuable fuel source. Capturing methane and using it for fuel prevents it from reaching the atmosphere and also reduces consumption of other fuels.

What is the indicator showing?

Currently, there are three completed, ongoing, or planned Global Methane Initiative projects in the border region—two for landfills and one for a coal mine (see table). Together, they account for annual reductions of approximately 4.5 million metric tons CO_2 equivalent. Ideas for future projects promise additional annual reductions of around 800,000 metric tons CO_2 equivalent per year.

Actual and Potential Greenhouse Gas Emissions Reductions from Global Methane Initiative Projects

Project	Annualized GHG Reductions (tons of CO_2e/year)	Brief Description	Project Status
Nuevo Laredo Landfill, Tamualipas	81,883	Evaluation of the technical feasibility and the institutional and political framework of capturing and using methane gas. Site was selected for a pre-feasibility study, including a pump test evaluation.	Completed
Ensenada Landfill, Baja California	16,624	Evaluation of technical feasibility and the institutional and political framework of capturing and using methane gas. Site was selected for a pre-feasibility study, including a pump test evaluation.	Completed
Mimosa Mines, Sabinas Coal Basin, Coahuila	4,180,000	Recovery and utilization of coal mine methane.	Completed

Project	Annualized GHG Reductions (tons of CO_2e/year)	Brief Description	Project Status
Nogales Landfill, Sonora	163,493	Evaluation of the technical feasibility and the institutional and political framework of capturing and using methane gas. Site was selected for a pre-feasibility study, including a pump test evaluation.	Completed
Saltillo	85,972	Evaluation of the technical feasibility and the institutional and political framework of capturing and using methane gas. Site was selected for a pre-feasibility study, including a pump test evaluation.	Completed
Mimosa Mines, Palau City, Coahuila	606,630	Capture of coal mine methane from three mines for flaring and power generation. Project could generate approximately 7 MW of electricity.	Idea
Mimosa Mines, Palau, Coahuila	200,000	Advanced gob gas drainage at coal mine.	Idea

What influences this indicator and what can be done in the future?

Global Methane Initiative projects are funded by partners (e.g., the U.S. and Mexico) and/or by investments driven by international GHG agreements that allow entities to offset their emissions by purchasing reductions from projects such as these.

Technical considerations

Global Methane Initiative projects may constitute only a part of projects that result in reported emission reductions. For example, these projects may involve an initial feasibility study, but not an entire project.

Data sources

The Global Methane Initiative

SEMARNAT (2010) data on project status

5. LAND

Land in the border region can be impacted by air and water pollution, improper disposal of solid waste, and impacts from urban, industrial, and agricultural activities. The Border 2012 program focuses on land contamination from inadequate management and disposal of solid and hazardous waste and from inadequate clean-up of sites contaminated by hazardous waste. Through its focus on environmental health, Border 2012 also focuses attention on the application of pesticides to border region agricultural lands and the impact pesticides can have on the health of farm workers and others in the region.

This chapter provides indicators and highlights related to:

- Solid waste generation and disposal
- Hazardous waste management and cleanup
- Pesticide use and training

Land Contamination

How much solid waste is being generated in the border region and how much of it is adequately disposed of?

Indicators:

- **Per-Capita Municipal Solid Waste in U.S. Border States and Counties** NEED
- **Per-capita Daily Solid Waste Generation in Mexico Border States** NEED
- **Solid Waste Generation (tons/day) in Selected Mexico Border Municipalities** NEED
- **Percent Adequate Solid Waste Disposal in Mexico's 300 km Border Zone** OUTCOME

Sub-Objective 1B: By 2012, develop or identify capacity building materials for source reduction, recycling and management of municipal solid waste.

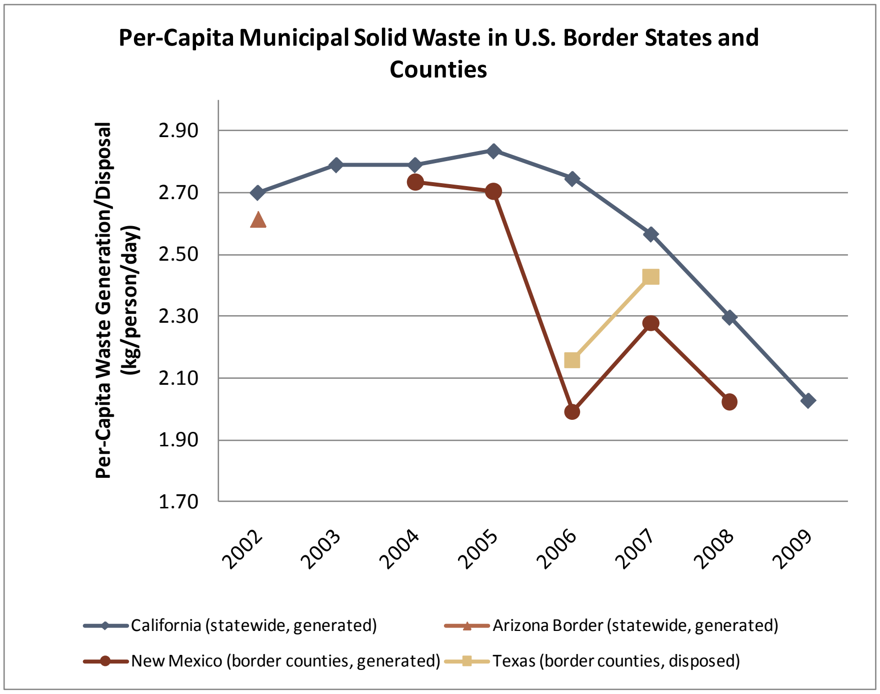
Solid waste generated by residents of the border region may be recycled, diverted to other uses, disposed of in adequately designed solid waste facilities, or disposed of improperly. To promote more environmentally sound solid waste disposal, programs can be developed to encourage recycling, diversion, and proper use of waste. Programs may also focus on reducing the production of solid waste by reducing waste generation at its source.

Why are these indicators important?

Reductions in the generation of solid waste, as well as recycling and adequate disposal all keep waste from being disposed of improperly. Improper disposal can contaminate land and water (especially when hazardous waste is mixed with solid waste), create nuisances such as odor and pests, and waste resources that might otherwise be diverted to productive use.

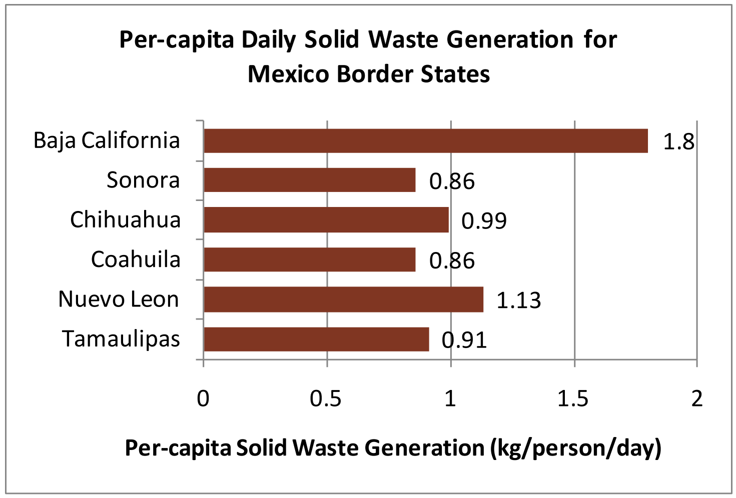
What are the indicators showing?

In the U.S., per-capita annual solid waste generation data are not available for all border counties. New Mexico provides county-level data on per-capita municipal solid waste generation, but California and Arizona only provide data at the state level. Texas provides county-level data, but it is for waste disposal rather than generation. Based on the data available, per-capita waste generation has declined since 2004 in California and New Mexico (where over 60% of the U.S. border region population

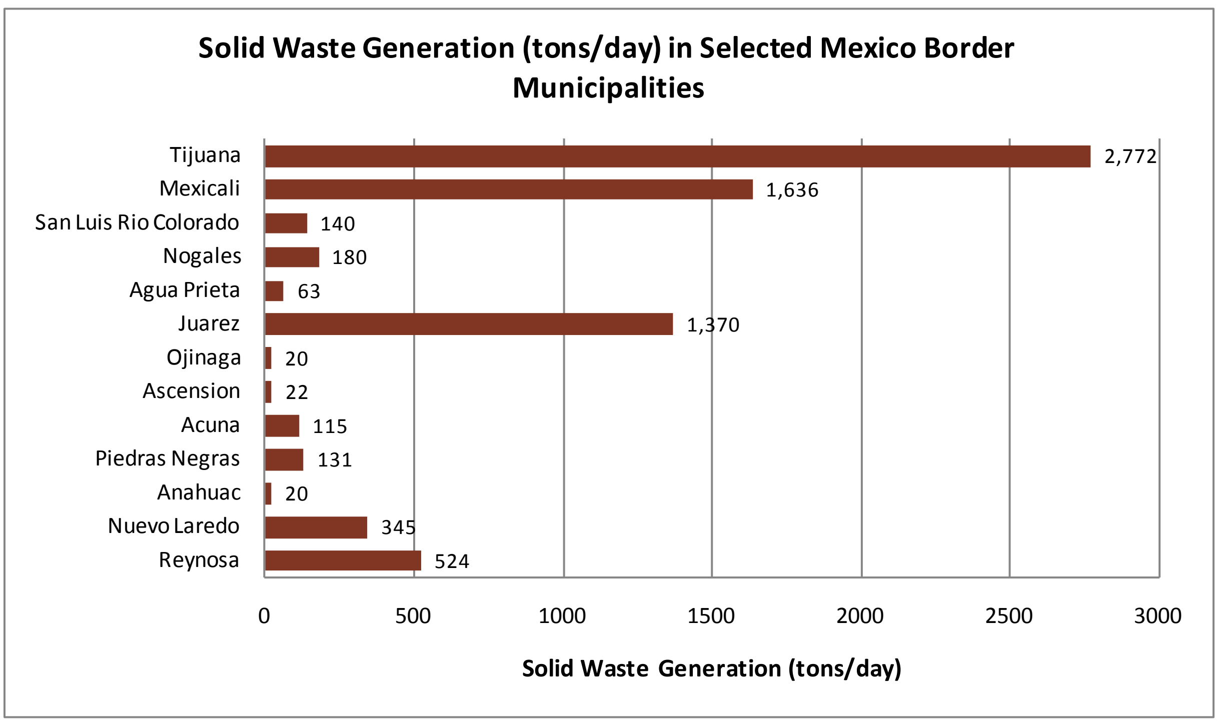


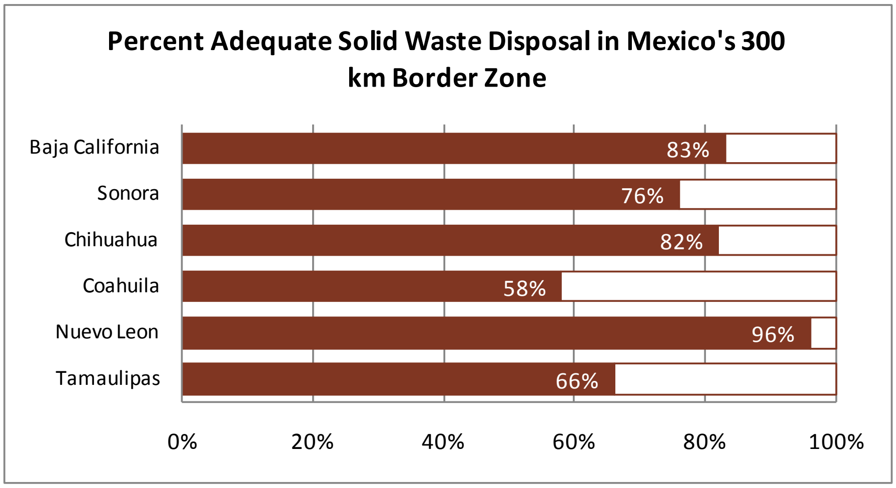
resides). Only one year of data is available for Arizona, so it is not possible to chart a trend. In Texas, per-capita disposal increased from 2006 to 2007, the years for which data are available. (In general, the amount of generation will be higher than the amount disposed because some generated waste will be recycled or otherwise diverted from disposal.)

For Mexico, BECC reports per-capita solid waste generation for Mexican border states (though not for the border region specifically). Although year-to-year trends are not available for Mexico, the data can be compared across Mexican border states and with U.S. border states. Baja California has the highest per-capita generation and Coahuila and Sonora have the lowest. All of these Mexican border states have per-capita waste generation rates that are lower than U.S. border states and counties based on data available.



For border cities in Mexico, Tijuana and Mexicali (both in Baja California) generate the highest total amount of solid waste per day—a result of higher per-capita generation and higher populations.





Although data on adequate disposal of solid waste in border municipalities are not available, there are data on the percent of solid waste that is adequately disposed of (as defined by Mexico's national social development agency SEDESOL) in the 300 km region south of the U.S. Mexico border (The 300 km border region is a focus area of the BECC, which publishes these data). This indicator shows that from 58% to 96% of solid waste goes to adequate disposal depending on the border state.

What influences these indicators and what can be done in the future?

The total amount of solid waste generated is a function of per-capita generation and population, while the amount disposed of properly is a function of the availability of adequate facilities, systems for collection and transport of waste, and behaviors and choices of individuals. A key focus of recent investment, especially in the Mexico border region, has been to build adequate solid waste disposal facilities. BECC estimates that 2.5 million residents of the border region (defined as 100 km from the border) do not have access to modern landfills. Other complementary efforts—such as programs to encourage waste reduction and recycling—are also important.

Technical Considerations

Solid waste data are reported in many different ways, not all of which are comparable. For example, Texas only reports on the quantity of waste that is disposed while other U.S. states and border counties report on waste generation, recycling, and disposal. Some states in the U.S. report annual data on total solid waste generation, which needs to be converted to per capita data based on census population figures. Also, some states report data annually while some report on a variable basis. For example, the most recent data for Arizona are from 2002, while there are annual data for California through 2009.

Finally, it is not known how much total waste is generated in the border region. Therefore, we cannot currently determine what portion is being effectively managed border-wide.

Data sources

California: Cal Recycle

Arizona: *2002 Recycling Program Report*

New Mexico: *New Mexico Solid Waste Annual Report* (for years 2004-2008)

Texas: *Municipal Solid Waste in Texas: A Year in Review 2006* (and 2007)

Mexico: BECC, "Diagnóstico de Infraestructura Ambiental Básica para el estado de [estado]"

Land Contamination

Highlight: Border Tribe's Measurement of Cleanup Results Creates the Building Blocks for Environmental Indicators

What was the problem and how was it addressed?

Some tribes located in the border region have significant problems with uncontrolled disposal of solid waste on tribal lands—often from sources beyond the tribe itself. The Tohono O'Odham Nation has been meeting this challenge by clearing waste, documenting dumping locations, and measuring results. This work demonstrates how local residents can generate and use information to understand and resolve environmental problems in their communities.

What were the results?

As part of a federally-funded grant project, the Tohono O'Odham Nation has been documenting and measuring results, including quantitative data on:

- Tons of material collected,
- The number of trash bags of discarded waste transferred to a landfill,
- Waste characterization to determine if waste material could be recycled,
- The number of abandoned vehicles crushed and sent to scrap metal markets for recycling, and
- The number of bikes brought back to a holding yard for future recycling or re-use.

To document this work, tribal staff tracked GPS coordinates for each cleanup location, the amount of waste removed and discarded, the number of monitoring visits, and the mileage and fuel costs for transporting waste. Their focus on measuring results yielded insights into the effectiveness of the removal strategy, including the likelihood that certain sites would remain clean or be littered again.

How does this relate to the rest of the border region?

The type of measurement done for this project creates the foundation for developing place-specific or border-wide environmental indicators that can track trends in environmental problems and their solutions. For example,

- Regularly collected information about waste locations (e.g., via digital photos and GPS coordinates) and/or more comprehensive data on the amount and nature of solid waste at a site can be used to track and communicate the magnitude and trend of waste problems over time.
- Data collected by multiple sources, such as tribes and federal, state and local agencies, can build a picture of the border-wide severity of solid waste problems and track changes in the location of dumps.
- Regularly collected data on how much material was cleaned up and disposed of could measure achievement of important tribal environmental goals and progress toward regional goals, such as Border 2012 goals to reduce land contamination.

This kind of indicator information can be useful for highlighting problems and obtaining and targeting resources to address them. Harnessing the power of measurement and indicators creation can help tribes and border communities track issues across a wide range of environmental problems, such as air quality, surface water quality, land degradation, and environmental health.

Land Contamination

Are scrap tire piles being cleaned up?

Indicators:

- **Number of Scrap Tires Removed During Clean Up at Two of the Largest, Selected Tire Piles in the Border Region**
  OUTCOME

Objective 3: By 2010, clean up three of the largest sites that contain abandoned waste tires in the U.S. Mexico border region, based on policies and programs developed in partnership with local governments.

Sub-Objective 3C: When practicable, clean up small tire piles, at least once in each of the four regional workgroup geographic areas.

Throughout the border region, millions of scrap tires have accumulated in a number of waste tire piles. There are 46 known tire piles in the border region, according to the Border 2012: U.S.-Mexico Border Scrap Tire Inventory Summary Report (May 2007).

The Mexican border region receives imports of millions of used tires from the U.S. that are imported for purposes of reuse. These used tires have a shorter lifespan than new tires because they are used tires with generally 15,000 to 30,000 km of wear.

Border 2012 has committed to clean up some of the border's largest tire piles along with at least one small pile in each of the four regional workgroup geographical areas.

Why is this indicator important?

Scrap tire piles pose significant environmental and health risks. Tire piles create breeding grounds for mosquitoes, rodents, and other vectors of disease, potentially increasing the incidence of malaria, dengue fever, and encephalitis diseases, such as West Nile Virus. Tire pile fires are also difficult to extinguish and can burn for months, emitting noxious fumes and generating liquid wastes that contaminate soil, groundwater, and surface water.

What is the indicator showing?

Two of the largest sites that contain abandoned waste tires in the U.S.-Mexico border region have been cleaned up, totaling 1,675,000 tires successfully removed. These two piles, INNOR and Centinela, were located in Mexicali. Tires removed from INNOR were transported to CEMEX's cement plant in Ensenada, and tires from Centinela were transported to CEMEX plants located in Ensenada and Hermosillo; in each case they were then co-processed as tire-derived fuel (TDF).

At least one small pile in each of the four regional workgroup geographical areas has also been fully cleaned up, demonstrating achievement of the Border 2012 sub-objective. The piles include:

Site	Regional Workgroup	Total Tires Removed
Tijuana, Baja California	Baja California-California	40,000
Hueco Tanks State Park, Texas	New Mexico-Texas-Chihuahua	250,000
Sabinas Hidalgo, Nuevo Leon	Texas-Coahuila-Nuevo Leon-Tamaulipas	8,000
San Luis Rio Colorado, Sonora	Arizona-Sonora	140,000

Along with these small piles, other large, medium and small tire piles have been removed with an overall total of 6,877,535 tires cleaned up from 2004–2009 in Mexico's border region. The majority of these tires were used as TDF for cement production, providing an energy source from waste.

Summary of Tire Pile Cleanups in Mexico's Border Region

Entity	2004	2005	2006	2007	2008	2009
Tijuana, BC	40,000	-	-	-	-	-
Mexicali, BC	425,000	918,600	239,650	30,900	36,000	40,800
San Luis R. Col., SON	-	-	30,000	110,000	-	-
Nogales, SON	-	-	-	-	45,000	55,000
Cd. Juárez, CHI	120,000	620,000	682,000	638,605	830,000	1,507,000
Piedras Negras, COA	-	-	59,160	195,840	-	-
Ciudad Acuña, COA	-	-	-	60,000	-	-
Región Carbon., COA	-	-	-	-	40,000	-
Torreón, COA	-	-	-	-	-	8,000
Región 5 Manantiales, COA	-	-	-	-	-	16,000
Matamoros, TAM	-	-	-	-	20,000	29,980
Reynosa, TAM	-	-	-	-	80,000	-
Annual TOTAL	585,000	1,538,600	1,010,810	1,035,345	1,051,000	1,656,780
TOTAL	6,877,535					

The data in this table include tires from the small piles in the previous table with the exception of Sabinas Hidalgo, Nuevo Leon

This success is due to the combined efforts of EPA, SEMARNAT, regional waste task forces, affected states, tribes, and industry.

What influences this indicator and what can be done in the future?

Funding is a key factor in cleaning up existing tire pile sites. Finding uses for old tires is a critical factor as well. Looking forward, an important area of focus is on preventing tire piles by creating alternative markets for used tires (See the highlight "Preventing Future Tire Piles"). Without development of these alternative markets, tire piles may continue to be created in the border region despite accomplishments in cleaning up existing large piles.

Technical considerations

Unfortunately, the total magnitude of the tire pile problem is unknown. The U.S.-Mexico Border Tire Inventory Summary Report (May 2007) is the first inventory to be completed of scrap tires for the entire U.S.-Mexico border region.[13] The report features a GIS map of scrap tires in the region. Although this report tried to accurately capture the number of scrap tires and scrap tire piles in the border region at that time, it is difficult to establish an estimate of the distribution or quantity of scrap tires in the border region. The number of tires at many sites fluctuates constantly and new tire piles continue to develop. Additionally, the exact number of tires at known locations is difficult to estimate.

[13] See: http://www.epa.gov/border2012/fora/waste-forum/tire-locus.html

Data sources

U.S.-Mexico Scrap Tire Action Plan

Tire pile cleanup data provided by U.S. EPA (ORCR) and SEMARNAT

Border Scrap Tire Integrated Management Initiative

Border 2012: U.S.-Mexico Border Scrap Tire Inventory. Summary Report

Land Contamination

Highlight: Preventing Future Tire Piles

What is the problem and how is it being addressed?

Millions of scrap tires contaminate the U.S.-Mexico border region, posing a serious threat to the environment and public health. Improperly managed in stockpiles, illegal dumps, and scattered along roadsides, scrap tires are a significant border solid waste problem. They are ideal breeding grounds for mosquitoes, rats and other disease vectors. Tire piles are also fire hazards. If they catch fire, they can generate air, water and land contamination.

Border 2012 has taken a multifaceted approach through cleanup and prevention efforts to overcome the scrap tire problem. One preventive measure that Border 2012 has taken is the Tire Initiative Collaborative Effort. Through this effort, border states, municipalities and the tire industry are working together to address the scrap tire problem. At the state level, in August of 2008, the heads of all ten border state environmental agencies formally signed the Tire Initiative Letter of Understanding to support the Tire Initiative, an integrated, binational approach to scrap tire management.

At the 2008 XXVI Annual Border Governors Conference, a joint declaration was signed by governors of the border states to execute the Tire Initiative. At the 16th Border Legislative Conference on October 19, 2007, state legislators from the U.S. and Mexico expressed their support of the Tire Initiative.

At the city level, San Luis, Sonora was the first border city to agree to take steps to implement the Tire Initiative in 2007, and more municipalities since then have also signed on. The U.S. Rubber Manufacturers Association also signed a Tire Initiative Letter of Understanding in 2008.

What were the results?

Roughly 6.9 million of the border's tires were cleaned up from 2004–2009 by Border 2012 partners. The majority of these recovered tires were used as fuel in cement kilns. The removal of these tires and implementation of Border 2012's scrap tire preventive measures has resulted in reducing the risk of mosquito-borne diseases for populations located near the border along with reducing the number of tire fires.

Source

US-Mexico Border Scrap Tire Project Action Plans (September 2009); link:

http://www.epa.gov/usmexicoborder/fora/waste-forum/docs/10tires/BorderTireActionPlans9-14.pdf

Land Contamination

How many facilities manage hazardous waste in the border region?

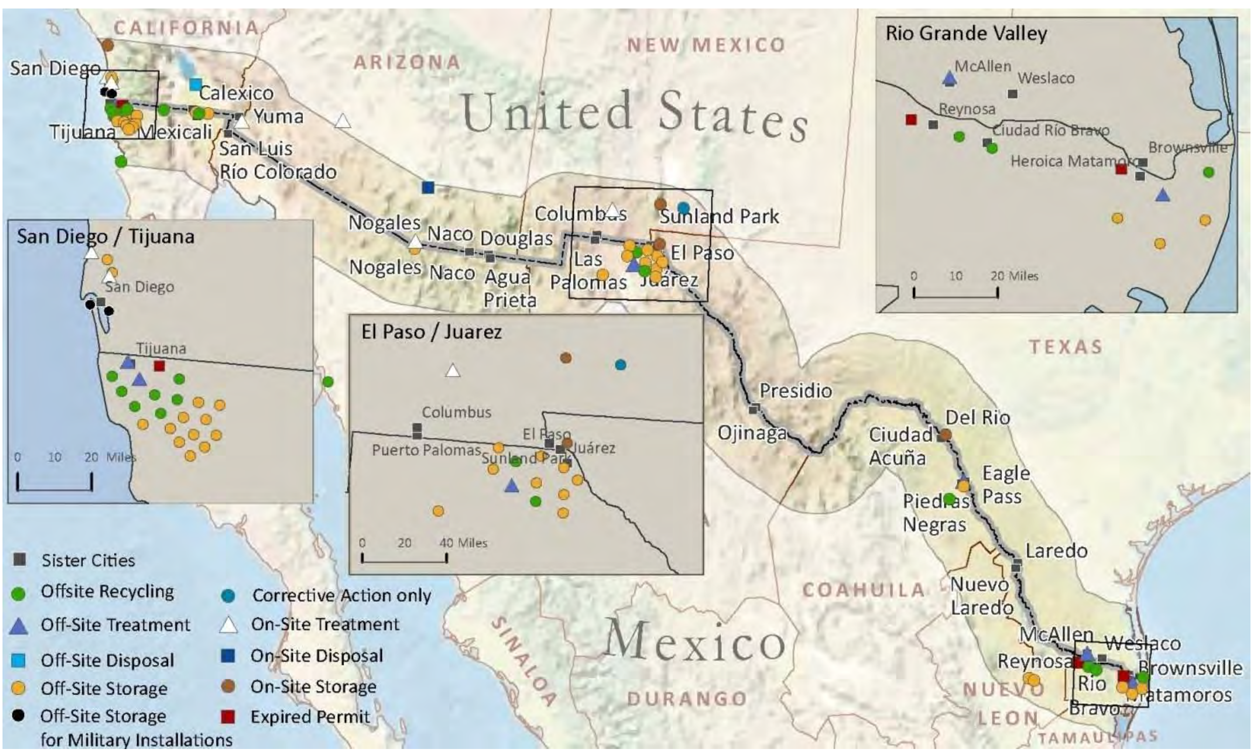
Indicators:

➔ **Number of Facilities Managing Hazardous Waste in the Border Region** PRESSURE

Sub-Objective 1-A: By 2012, develop or identify capacity building materials for source reduction, recycling and management of waste streams, for example: electronics waste and spent lead acid batteries.

Under the 1999 "Consultative Mechanism for the Exchange of Information on New and Existing Facilities for the Management of Hazardous and Radioactive Waste" agreement, the U.S. and Mexico exchange data on permitted hazardous and radioactive waste management facilities in the border region. Although the two countries have different regulatory regimes and definitions of hazardous facilities, in general these are facilities that treat, store, or dispose of hazardous or radioactive waste, including hazardous waste recycling. (In the U.S., for example, they are facilities with Resource Conservation and Recovery Act permits). The mechanism recognizes a shared binational interest in knowing how many facilities exist in the region and when new facilities come online without impeding the two countries' sovereignty regarding the siting and regulation of these facilities.

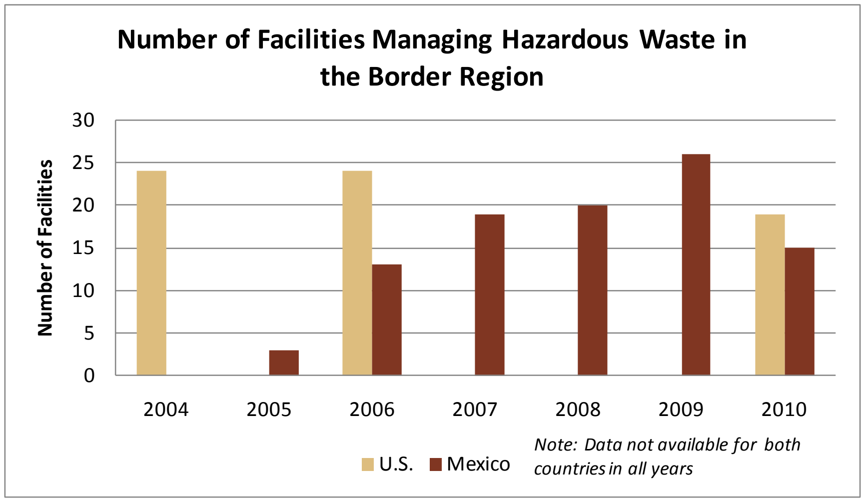
Hazardous Waste Sites (2003-2009)



Why is this indicator important?

The consultative mechanism was established in recognition of public concern in the U.S. and Mexico regarding past, current, and proposed hazardous waste storage, treatment and disposal facilities in the region. Although many facilities handle hazardous waste safely and appropriately, those that do not have adequate management practices can become the source of pollution and future cleanup sites.

What is the indicator showing?



In 2010, the U.S. and Mexico reported a total of 34 facilities permitted to handle hazardous waste in the border region—19 in the U.S. and 15 in Mexico. For the U.S., the number of facilities has declined since 2004. For Mexico, the number of facilities increased from 2005 (the first year data was available) to 2009 and then declined in 2010. (Note that the chart shows all of the facilities permitted between 2004 and 2009; not all of them are handling hazardous waste in 2010. Data are not available for both countries for all years).

A map of all reported facilities is shown above. Many of the facilities are clustered in three areas of the border region: San Diego/Tijuana, El-Paso/Juárez, and the Rio Grande Valley (McAllen/Brownsville/Matamoros).

What influences this indicator and what can be done in the future?

The number of facilities managing hazardous waste is a function of the overall level and type of economic activity in an area. In the future, it is important that Mexico and the U.S. continue to share information on facilities in the border area that manage hazardous waste.

Technical considerations

Mexico and the U.S. have different definitions for what constitutes a hazardous waste facility reportable under the consultative mechanism and different permitting programs. This indicator does not imply anything about whether a facility is handling waste appropriately or complying with hazardous waste rules.

Data sources

U.S. EPA, Office of Resource Conservation and Recovery, 2010

SEMARNAT. Dirección General de Gestión Integral de Materiales y Actividades Riesgosas. November, 2010

Land Contamination

Highlight: Cleanup of Metales y Derivados and Other Hazardous Waste Sites in the Border Region

What was the problem and how was it addressed?

Metales y Derivados, an abandoned lead smelter in Tijuana (Baja California), which became a toxic contaminated site, posed public health risks mainly due to air-borne lead. The site—owned and operated by a U.S. parent company—was active from 1986 until 1994 when it was shut down by Mexico's environmental enforcement agency, PROFEPA. However, neither the owner nor the Mexican government had funding or technical capacity available to clean up the site. Despite this, in 2004, Border 2012 partners began implementing a four-phase cleanup plan.

What were the results?

The site was cleaned up in the fall of 2008, becoming the first site to be cleaned by Border 2012 partners. It was among the first sites to be completed under Mexico's new hazardous waste site cleanup law.

The site assessment and cleanup were successful, with 2,000 tons of hazardous waste (including drums, sacks, and upper level contaminated soil) being removed. 42,000 tons of contaminated soil, waste, and debris were capped.

The project was conducted in collaboration with a binational Metales Technical Workgroup, which included government and community representatives and EPA as an advisory member. EPA provided a community involvement grant to the Environmental Health Coalition to retain their own engineering consultant to advise them during the capping process.

Plans are under way to revitalize the site, possibly by building a material testing laboratory or developing a site for green industry such as solar panel manufacturing.

Metales y Derivados was a landmark achievement for Mexico and Border 2012—and a model for other site cleanups in the border region.

Land Contamination

Highlight: Electronic Exchange of Import and Export Notice and Consent Information Between the United States and Mexico

What was the problem and how was it addressed?

Although Mexico has a prohibition on shipping hazardous waste from the U.S. to Mexico for disposal, Mexico—like many countries—does accept exports from other countries for recycling. Most of these exports involve electric arc furnace dust from small steel mills (mostly located in the southern U.S.), which is recycled at a facility in Mexico called Zinc Nacionál to recover zinc. Mexico exports some hazardous waste to the U.S. for disposal and recycling—mainly "returns" of hazardous waste to the U.S. from U.S.-owned maquiladora industries based in northern Mexico.

Both the U.S. and Mexico have separate systems for tracking the movement of hazardous waste within their respective countries. Hazardous waste crossing the border from Mexico into the U.S. needs a U.S. EPA hazardous waste manifest while the shipment is in the U.S.; Mexico has similar requirements.

Currently, countries share export requests (also known as notices) and consents to export with one another by sending paper copies through the mail or by fax, a process that generates hundreds of thousands of pages of documents each year. Led by the Commission for Environmental Cooperation Hazardous Waste Task Force, the U.S., Mexico, and Canada are working on a system to electronically exchange notice and consent data for hazardous waste exports and imports.

What are the expected results?

The electronic data exchange will convert the exporting country's data into a uniform format using common data standards and then send the data to the proposed importing country where it will be converted into the format used by that country. This approach will reduce burden, improve data quality, and help governments provide more timely and coherent information on what crosses their national borders.

Source

Commission for Environmental Cooperation, "Tracking Hazardous Waste," http://www.cec.org/files/pdf/ECONOMY/hazwaste%20tracking_en.pdf

Land Contamination

What is the volume of pesticides applied to land in the border region?

Indicator:

→ **Amount of Pesticides Used in U.S. Border Counties: California and Arizona** PRESSURE

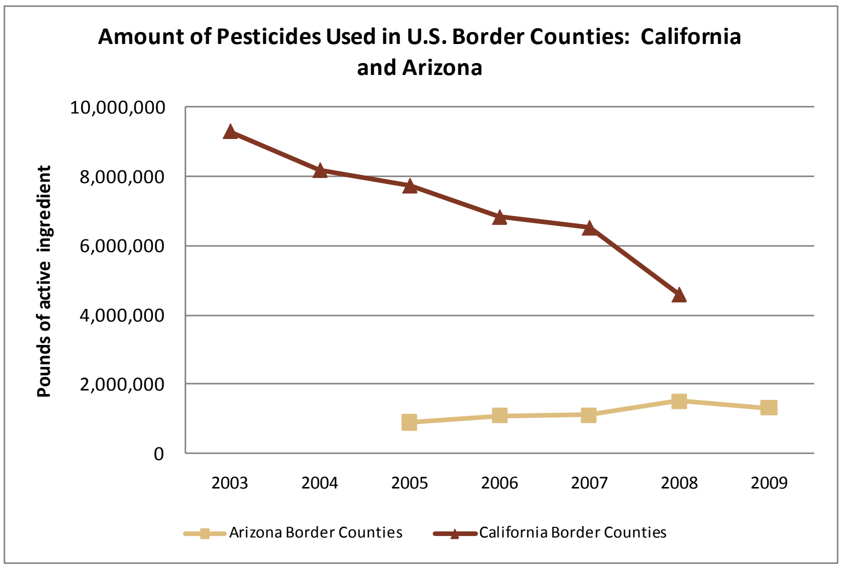
Health Objective 3B: By 2007, reduce pesticide exposure by training 36,000 farm workers on pesticide risks and safe handling, including ways to minimize exposure for families and children.

Pesticides are routinely applied to agricultural lands in the U.S.-Mexico border region. California and Arizona have significant agricultural industries in their border areas and both states maintain reporting systems that track pesticide use. Other U.S. and Mexico border states do not have comprehensive reporting systems and are not described here.

Why is this indicator important?

Pesticides must be used properly according to product label requirements in order to protect the health of farm workers and to reduce impacts to biodiversity, land and water resources. Although data on the total volume of pesticides applied do not correlate with health or environmental impacts, they do suggest the magnitude and trend of this potential stressor.

What is the indicator showing?



Data show that the amount of pesticides applied in Arizona border counties has increased by 46% from 2005 to 2009. In contrast, the amount applied in California border counties dropped by over 50% from 2003 to 2008 (the latest year for which data are available). The California State Department of Pesticide Regulation noted that dry winters and springs (which tend to diminish weed growth) and a shift from broad-based insecticides to newer products with more targeted uses account for some of the California declines.

What influences this indicator and what can be done in the future?

The amount of pesticide use is driven by the amount of agricultural land in a particular area, pest pressures, changes in preferred and available pesticides, economic conditions and choices about what crops to grow. Use of pesticides can be reduced through attention to appropriate use of non-pesticide alternatives, including integrated pest control.

Technical considerations

Only California and Arizona have annual use reporting systems that reliably track pesticide use data.

Data sources

California Department of Pesticides Regulation (CDPR), California Full Use Reporting System; California Pesticide Use by County

California Department of Pesticides Regulation, "DPR Reports Pesticide Use Declined Again in 2008" (January 7, 2010)

Arizona Department of Agriculture; Arizona Full Use Reporting System

Land Contamination

Highlight: Pesticide Training and its Effectiveness on Changing Worker Behavior

What percent of workers are getting trained in pesticide safety and do they implement what they are taught?

Training programs in the border region have been developed to teach workers about pesticide safety. Ensuring that these programs are effective requires assessment of the percentage of workers trained and determining whether they apply the lessons they are taught to their work.

Pesticide exposure can cause a variety of occupational illnesses in farm workers, including dermatitis, eye injuries, and respiratory illnesses. Proper training in pesticide handling and use can educate and therefore protect workers and their families from potential exposures and risks of adverse health effects. The U.S. has instituted a number of programs to train workers and instructors in ways to limit their exposure to pesticides. Pesticide safety training is required by the EPA Worker Protection Standard (WPS) for agricultural pesticides. The WPS is designed to protect employees on farms, forests, nurseries, and greenhouses from occupational exposures to agricultural pesticides through education and safety training, pesticide application notices, and access to medical assistance if necessary.

At regional WPS "Train the Trainer" events held in Arizona between 2005 and 2010, over 200 pesticide safety personnel were trained to provide appropriate education and training materials to agricultural workers and pesticide handlers in the U.S. border region. During the most recent workshop in April 2010, participants planned to train approximately 7,450 agricultural workers and 1,800 pesticide handlers each year. The workshop was held in both English and Spanish.

In Texas, the state Department of Agriculture has trained over 3,000 people in border counties[14] on safe pesticide handling since 2005.

In New Mexico, call-in data to the state Poison and Drug Information Center revealed that the highest rate of calls came statewide from the highly agricultural counties of Doña Ana, Hidalgo, and Luna. To better understand this, the New Mexico Department of Health conducted a study of pesticide training effectiveness in this area of the state. The objective of the study was to characterize farm workers' experiences, knowledge, beliefs, training, and practices regarding pesticide illness and exposure prevention.

What were the results from the New Mexico study?

A survey of farm workers, orally conducted by lay health workers in the field, revealed the following:

- 59% of men and 38% of women surveyed had received information on how to protect themselves from pesticide exposure.
- 57% of men and 32% of women had received pesticide exposure prevention training—of these, 26% of men and 12% of women could identify the training as Worker Protection Standard certified.
- Workers that had received training were significantly more likely to wear a long sleeve shirt and gloves (to reduce pesticide exposures) than workers without training.
- There is a lack of compliance by farmworker employers within New Mexico's border counties with training requirements as established by the WPS.

[14] This figure represents the number of people trained in Cameron, El Paso, Hidalgo, Hudspeth, Jeff Davis, Starr, Uvalde, Willacy, and Zavala counties.

How may these findings relate to the rest of the border region?

Considering the results of the survey in New Mexico border counties and the authors' conclusions, agricultural workers in the rest of the border region who receive training and education in accordance with the WPS are presumably more likely to adopt behaviors that reduce their potential exposures to pesticides than those workers who have not received this training.

The training gap of untrained workers in the New Mexico counties may also exist in other border region counties. This suggests those authorities responsible for training and employers need to continue their efforts to reach out to this transient labor force to provide training.

Source

New Mexico Department of Health, "Pesticide Exposure of Farm workers in Doña Ana, Hidalgo, and Luna Counties of New Mexico: A Report Based on Findings from a Survey of 202 Participants," http://www.nmborderhealth.org/documents/NMFarmworker_pest_surv2009.pdf

6. JOINT READINESS FOR ENVIRONMENTAL RESPONSE

Preparing for a possible emergency in the border region improves the probability that both countries can adequately respond to incidents and protect the environment and the public from hazards. Annex II of the 1983 La Paz Agreement on Cooperation for the Protection and Improvement of the Environment in the Border Area established the Mexico-U.S. Joint Contingency Plan (JCP) to provide a binational coordination mechanism for protecting human health and the environment and responding to significant chemical and oil contingencies or emergencies that affect the inland border area between the U.S. and Mexico. The La Paz Agreement also established the Joint Response Team (JRT), which has coordinating authorities for both Mexico and the U.S.

The JRT is composed of representatives from U.S. and Mexico federal, state and local agencies responsible for emergency prevention, preparedness, and response in the border region. It issued the first JCP in 1988, which was revised and updated in 1999 and again in 2008.

The work of the JRT is supported by a robust system for the binational notification of emergency response incidents, drills, and threats; local Emergency Response Plans developed jointly by sister cities along the border; certified training courses; and analyses of potential risks in the border region.

This chapter contains indicators on:

- Emergency incident notifications
- Sister city emergency response plan development
- Local Emergency Response Plan exercises and training

Joint Readiness and Response

How many chemical or oil emergency incidents have been reported in the border region?

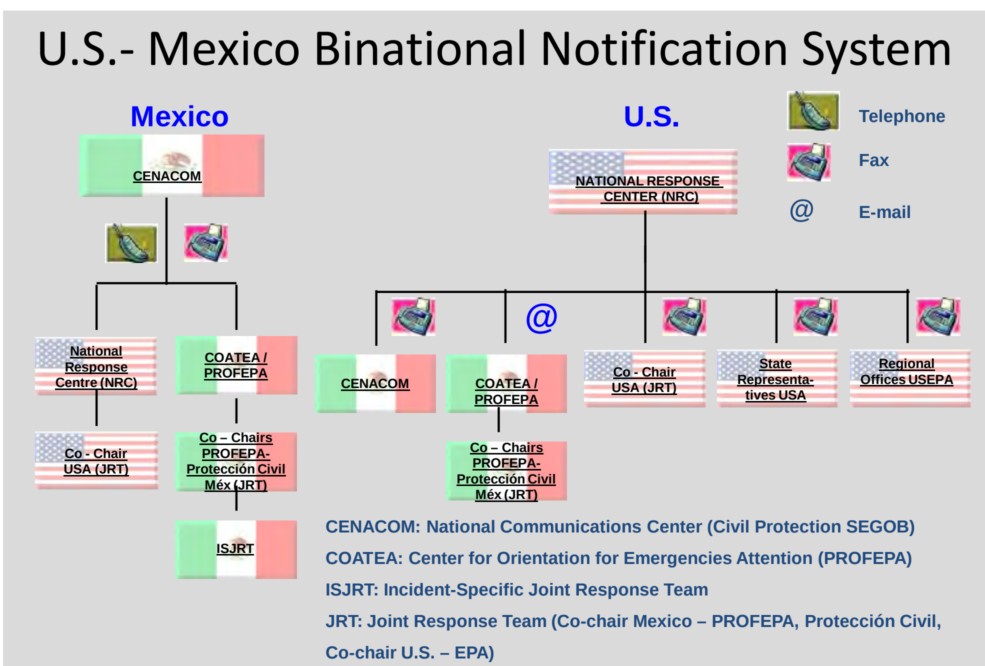
Indicator:

- **Number of Incident Notifications in the Border Region Received by the National Response Center (NRC)** OUTPUT
- **Number of Incident Notifications in the Border Region Received by COATEA/CENACOM** OUTPUT

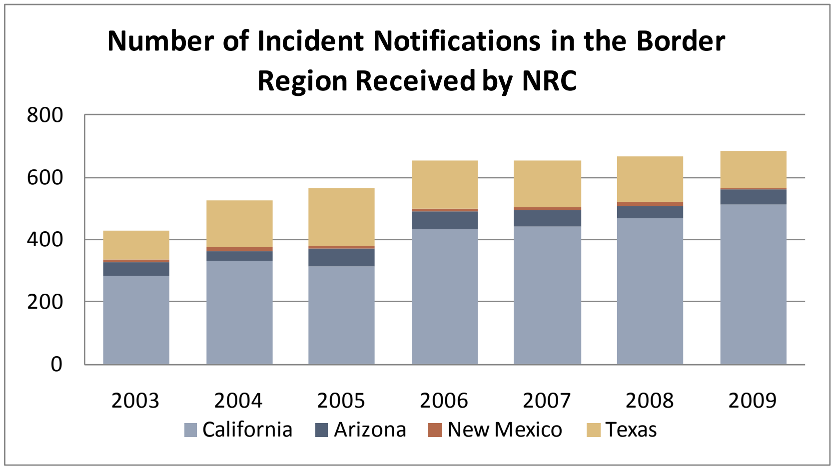
Sub-Objective 1A: By 2012, on an annual basis, continue to test and update the emergency notification mechanism between Mexico and the United States.

The JCP established a binational notification system that alerts agencies in the U.S. and Mexico about emergency response incidents and drills. Any actual or threatened incidents involving releases of chemicals from non-mobile machinery, refineries, manufacturing plants, and other fixed facilities that have the potential to affect the other country are reported.

Notifications—both for actual incidents and for drills—are received by the National Response Center (NRC) in the U.S. In Mexico, notifications are received by the Centro Nacional de Comunicaciones de México (National Communications Center, CENACOM), which is part of the Sistema Nacional de Protección Civil (Civil Protection). Notifications in Mexico are also received by the Centro de Orientación para la Atención de Emergencias Ambientales (Center for Environmental Emergencies, COATEA) of the Procuraduría Federal de Protección al Ambiente (Federal Attorney General for Environmental Protection, PROFEPA). In Mexico, Civil Protection takes the lead on emergency responses, while PROFEPA is responsible for inspection and enforcement. Both agencies work together during emergencies. CENACOM and NRC are available to receive notifications 24 hours a day, 7 days a week.



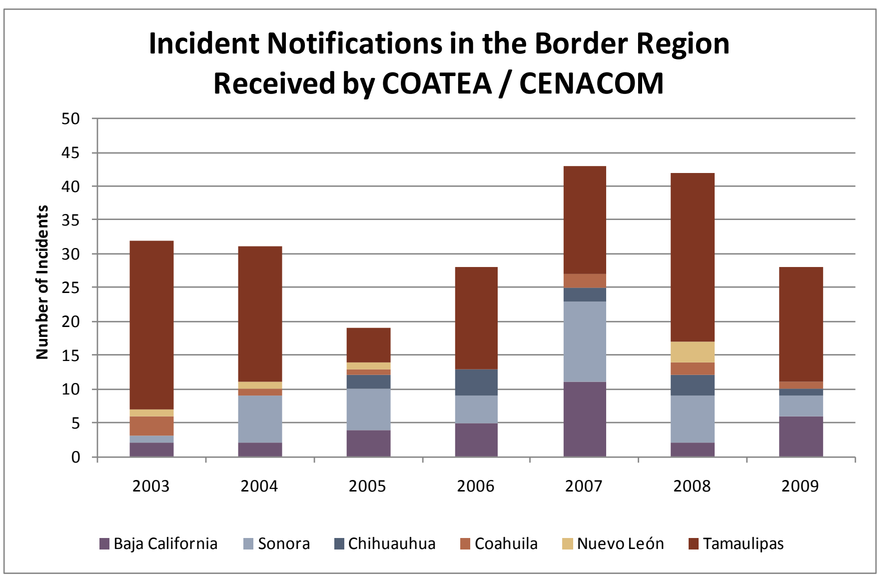
Why are these indicators important?



An adequate cross-border notification system is critical to a robust emergency response system so that local emergency responders can be alerted about actual or threatened emergencies. Upon receipt, notifications are responded to in an appropriate manner through the execution of local response plans (i.e., Sister City Plans) and/or the U.S.-Mexico Joint Contingency Plan. In some cases, local emergency responders are the first to respond to an incident, and if necessary, the JRT may be activated for significant events to provide support.

What are these indicators showing?

Incident notifications to the NRC have shown a steady increase since 2003. Even though these data may reflect an increase in the number of emergency incidents, they may also show that the notification system is more effectively being used for incidents that occur (that is, a higher percentage of incidents are being reported.) Data collected for the U.S. border areas of Texas and New Mexico by EPA Region 6 show that incidents reported in those areas between 1999 and 2009 resulted in 101 injuries, 25 deaths, and 27 evacuations or shelter in place events.



PROFEPA reports incident notifications received by COATEA/CENACOM for border sister cities in Mexico for the period 2003–2009. For this period, the average number of incident notifications per year was approximately 32, with increases in 2007 and 2008 (43 and 42 notifications, respectively). The highest number of incidents occurred in Tamaulipas (123 incidents over the 2003–2009 period), most of them (66 total) in the city of Reynosa.

What influences these indicators and what can be done in the future?

These indicators are influenced by both the number of incidents and the percentage of incidents that are reported. While much of the work on emergency response is aimed at reducing the number of incidents that occur (which would reduce this indicator), it is also important that incidents that do occur get reported (which could increase the indicator). Ideally these indicators should be complemented with the number of total incidents and the percentage of incidents that are notified.

Technical considerations

Data on the number of incident notifications to NRC, CENACOM, or COATEA provide only part of the picture of how many emergencies happen in the border region. It is not known how many incidents go unreported nor whether those that are notified are the most significant emergencies. Likewise, the NRC does not track how many incidents are responded to or whether the binational notification system triggered a response.

Data sources

U.S. National Response Center data provided by EPA, OSWER (2010)

Centro de Orientación para la Atención de Emergencias Ambientales (COATEA) (2010)

U.S. EPA Region 6. "EPA Region 6 Border Accidental Release Information: 1999-2009"

Joint Readiness and Response

Highlight: Sister Cities Plans Being Developed, Revised, and Implemented

What was the problem and how was it addressed?

All chemical and other hazardous incidents and/or emergencies affect the local community first. Acknowledging this, the Mexico-U.S. Joint Contingency Plan provided the foundation for establishing sister city Binational Emergency Response Plans. While the JCP focuses on chemical and oil incidents, the local Emergency Response Plans or sister city plans are being revised and updated to include all hazardous incidents. Fourteen sister city pairs were originally identified by the JCP along the U.S.-Mexico border. An additional sister city pair was added for Rio Bravo/Weslaco. Development and strengthening of these plans is an important objective of Border 2012.

The sister city Binational Emergency Response Plans provide local emergency response teams with a mechanism for addressing issues and concerns through cooperative measures and recommendations, including emergency response planning, exercises, and training.

What were the results?

As of 2009, all fifteen sister cities had Binational Emergency Response Plans in place. In 2008, an additional Tri-national Emergency Preparedness Plan was developed by the Tohono O'odham Tribe, Arizona and Mexico. Together, the plans cover roughly 90%[15] of the population of the border region.

Recently, some sister cities have updated their emergency response plans to reflect an "all hazards environmental response" approach and others are working on similar updates. The all-hazards planning approach focuses on developing capacities and capabilities that are critical to preparedness for a full spectrum of emergencies or disasters rather than separate plans for each specific type of emergency, such as a chemical and/or oil spill.

U.S. EPA in the U.S. and PROFEPA and Protección Civil in Mexico regularly conduct standardized emergency preparedness and response training to build capacity to respond to emergencies described and planned for among sister cities. Courses are attended by federal, local, state, regional and Tribal emergency response personnel. Often running for a full week, these bilingual courses cover topics such as risk management, hazardous materials training, decontamination procedures, and hospital mass casualty scenarios. Examples include:

- HAZMAT First Responder Operations: 23 Mexican Responders certified (October 2006)
- Emergency Response Guide for Transportation: 160 Responders trained (March 2007)
- Incident Command Systems and Integration with Emergency Operation Centers: 75 responders certified (March 2008)

In 2008, EPA signed an agreement with U.S Northern Command to expand training and capacity building in Mexico.

Sources

Border 2012. "Emergency Preparedness at the U.S.-Mexico Border: Sister City Plans."

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[15] This is the approximate percentage of the border region population living in border region Sister Cities, according to the Pan-American Health Organization .

Joint Readiness and Response

How are Sister City Binational Emergency Response Plans tested and improved?

Indicator:

➔ **Binational Sister City Joint Contingency Plan Exercises** OUTPUT

Sub-Objective 3A: By 2012, 75% of sister city joint contingency plans will be supplemented with preparedness and prevention related efforts, such as certified training, risk analysis, and capacity building.

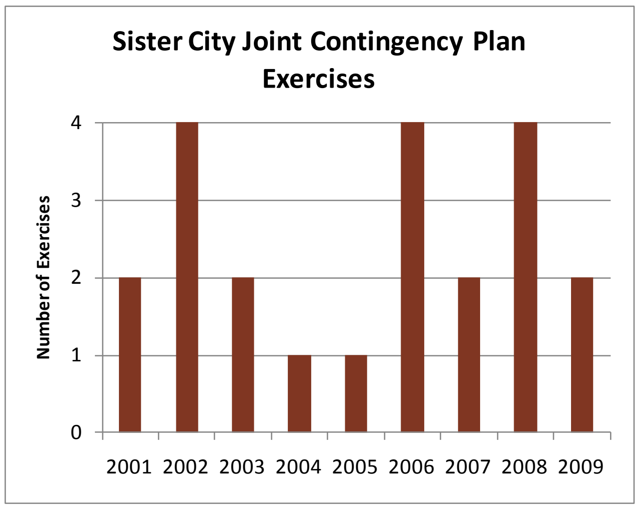
Emergency planning exercises are designed to test and improve Sister City Binational Emergency Response Plans and build capacity among federal, state, and local agencies and first responders in the U.S. and Mexico. These exercises focus on the most likely emergency scenarios. Agencies in charge simulate a response in the field or indoors. Also, phone advisory tests verify that all required parties receive adequate notification.

Why is this indicator important?

JCP exercises ensure that the JCP and the Sister City Binational Emergency Response Plans are up to date and can be implemented during emergencies. Results are used to prepare reports, which set the stage for plan revisions.

What is the indicator showing?

Since 2001, the U.S. and Mexico have conducted between one and four binational emergency response exercises annually. Some of these exercises involve multiple sister cities. Some of the exercises also involve multiple components, including simulated responses, full-scale responses, and tests of notification procedures.



What influences this indicator and what can be done in the future?

The number of exercises conducted is largely a function of funding and the capacity of emergency response personnel to host them and participate.

Technical considerations

Only binational exercises are captured in this indicator. Other state or local exercises are not included. Exercises that include multiple sister cities are counted as one exercise as are those that include multiple components (e.g., simulations, full scale, and notification).

Data sources

PROFEPA (2010)

Emergency Preparedness and Response Border wide Workgroup. "Revision y Adecuacion de los Indicadores Binacionales" (September 2008)

7. ENVIRONMENTAL PERFORMANCE THROUGH COMPLIANCE, ENFORCEMENT, POLLUTION PREVENTION, AND PROMOTION OF ENVIRONMENTAL STEWARDSHIP

Environmental regulatory programs on both sides of the border establish and enforce rules to limit pollutant discharges to air, water, and land, as well as to manage the generation, transportation, storage, and treatment of hazardous wastes. In addition to these regulatory programs, both the U.S. and Mexico have developed programs that encourage voluntary activities to protect human health and the environment that go beyond what is legally required. Border states, tribes, local governments and the federal government all play key roles in establishing and enforcing rules and promoting voluntary action.

This chapter focuses on both voluntary and regulatory programs. It includes indicators related to:

- Voluntary compliance programs
- Inspections of facilities
- Enforcement actions, penalties, and pollution reductions from enforcement activities

Environmental Performance

What are border region facilities doing to voluntarily reduce their impact on the environment?

Indicator:

→ **Number of Facilities Audited and Certified through the Industria Limpia Program in Mexico's Border Region** OUTPUT

Sub-Objective 1A: Continue promoting adoption of voluntary programs and pollution prevention by industry and in other sectors in both countries. Federal, state, and local initiatives may include the Industria Limpia program and others, and projects to green the supply chain.

Whether to promote "beyond compliance" activity or encourage adherence to environmental rules, voluntary programs provide facilities with information, technical assistance, public recognition, or regulatory incentives to help them reduce emissions to air, discharges to water, and transfer or disposal of waste.

Mexico's flagship voluntary program is Industria Limpia (also known as the Programa Nacional de Auditoría Ambiental), which was established in 1992 to assist facilities in reducing environmental impacts and complying with national laws. It is administered by PROFEPA. Facilities seeking to enter the program invite an auditor approved by PROFEPA to conduct a facility audit, which identifies what the facility needs to do to comply with environmental laws. Facilities sign an agreement (*Convenio de Concertación*) documenting an action plan to correct identified problems by a specified date. If a facility complies with the agreement, it is eligible to be certified under the program and is granted a two-year exemption from regulatory inspection. To be certified, a facility must have an Environmental Management System (EMS).

In the U.S., voluntary environmental management programs typically focus on providing incentives for companies for "beyond compliance activities." Some border states maintain such voluntary incentive programs, such as Clean Texas and Arizona Performance Track. Although eligibility differs from program to program, facilities must typically have good compliance records, an EMS, and other commitments to environmental stewardship.

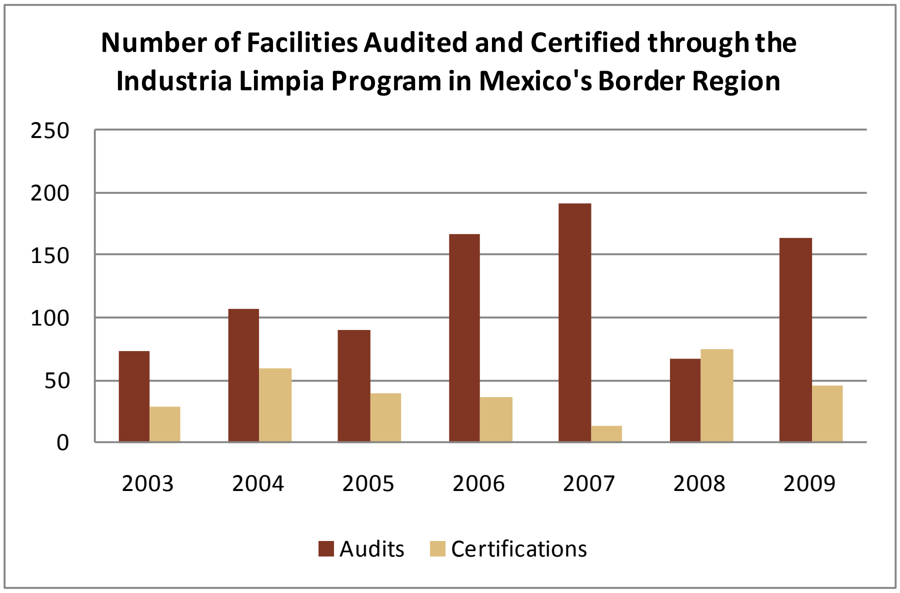
Mexico maintains extensive data on the Industria Limpia program, but the U.S. federal government and states do not maintain comprehensive data sets on voluntary environmental management efforts. The remainder of this description focuses on Mexico.

Why is this indicator important?

Facilities' participation in voluntary programs can reduce impacts on the border environment by encouraging compliance with environmental laws and/or providing incentives to go beyond compliance. Participation is also a sign that facilities are making an extra effort to improve environmental performance—in many cases because they are recognized by regulatory agencies or the public for doing so.

What is this indicator showing?

The figure below shows the number of audits and certifications annually in the border region under Mexico's Industria Limpia program. On average, there were 123 facilities audited and 43 facilities certified annually over the 2003–2009 period. Annual certifications in 2009 were 1.5 times the number of certifications in 2003 after a steady decline between 2004 and 2007. From 2003 to 2009 PROFEPA certified a total of 300 border region facilities as participants in the Industria Limpia program.



What influences this indicator and what can be done in the future?

Companies may participate in voluntary environmental programs for many reasons, including their own business needs, public recognition, or a corporate commitment to environmental stewardship. Maintaining or increasing access to the Industria Limpia program in Mexico, for example, can improve environmental performance in the border region if current and future member companies better comply with environmental laws.

Technical considerations

Voluntary programs in the U.S. and Mexico are designed differently and play different roles. Both countries have other federal or state voluntary programs—often with a specific sectoral or media focus—that are not represented in the data presented here.

Data sources

PROFEPA (2009 and 2010) for data on Industria Limpia audits and certifications

PROFEPA. "Auditoría Ambiental"

Blackman Alan, et al. "Voluntary Environmental Management in Developing Countries." RFF Discussion Paper (July 2007)

Environmental Performance

How many regulated facilities are in the border region?

Indicator:

➔ **Total Number of Facilities Regulated Under Federal Programs: U.S.-Mexico Border Region**

NEED

Objective 2: By 2009, determine the pollution sources in the border area that present risks to human health and the environment that are subject to regulation and set priorities for actions to lower the risk.

Many facilities in the U.S.-Mexico border region are regulated under U.S. and Mexican federal regulatory programs covering air pollution, water pollution, and waste. In the U.S., these facilities are regulated through permits issued under various statutes and statutory programs: the Clean Air Act or Clean Water Act for possible impacts to air and water; the Resource Conservation and Recovery Act for the generation, storage, treatment, or disposal of hazardous waste; and/or the Toxic Release Inventory for the reporting of pollutant releases.

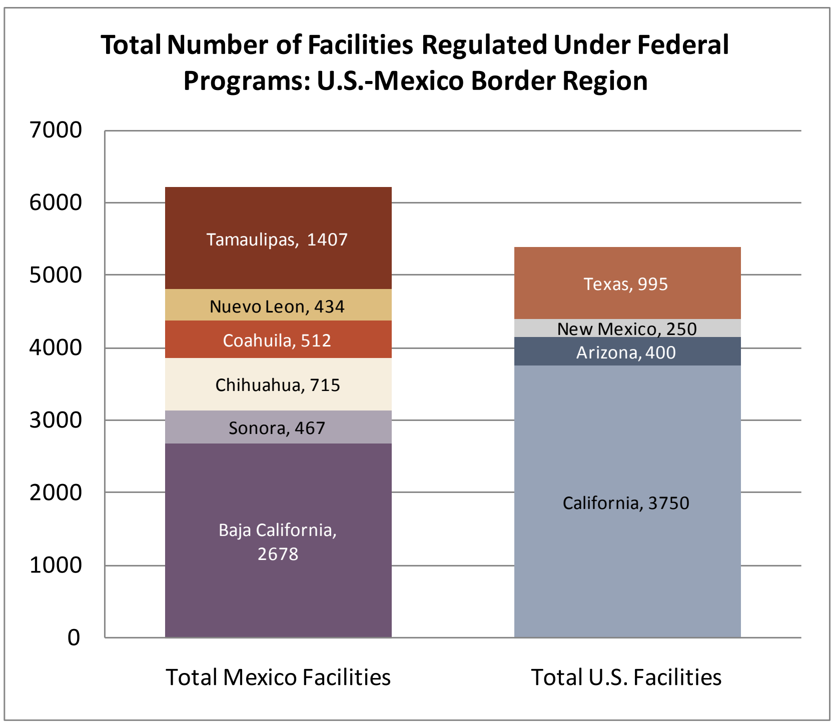
In Mexico, inspection and monitoring of industrial and service establishments under federal jurisdiction is conducted through an Annual Environmental Program of Inspection. As a result of inspections, facilities are classified as in compliance, in partial compliance, or out of compliance. This may result in a determination of whether violations are non-serious or serious, which may lead to temporary, partial, or total closure of facilities.

Why is this indicator important?

The number of federally regulated facilities in the region is an indicator of the size of industrial, manufacturing, and other sectors whose operations put pressure on environmental resources. It is also an indicator of the institutional demands on governments to issue permits, inspect operations, and enforce environmental rules.

What is the indicator showing?

There are over 11,500 regulated facilities in the U.S.-Mexico border region—approximately 6,200 in Mexico and approximately 5,400 in the U.S. The largest share of facilities is in the San Diego-Tijuana area of California and Baja California.



What influences this indicator and what can be done in the future?

The number of regulated facilities is a function of the scope of federal regulatory programs and the number of facilities that fall under these programs. Increases in industrial economic development will tend to increase the number of regulated facilities, while less economic development or economic shifts toward non-industrial sectors (e.g., service industries) will tend to reduce (or at least slow the growth of) such facilities. In the future, it is important for regulatory agencies in the border region to effectively identify facilities that should be regulated and ensure compliance through permitting, inspections, and other key elements of regulatory programs.

Technical considerations

The number of regulated facilities should not be taken as a proxy for the level of pollution in a region. All else equal, it is much better for a potentially polluting facility to be regulated than unregulated. Also, many other sources of pollution exist that are not included in this indicator, such as mobile transportation sources. At the same time, not all regulated facilities are counted here. Data for Mexico are only for federally-regulated facilities. U.S. data are for facilities regulated under federal programs, some of which are delegated to states, or local governments, but not for facilities that are only regulated under state or local programs.

Data sources

PROFEPA, 2010

EPA, ECHO online database

Environmental Performance

How many inspections of regulated facilities are conducted in the border region?

Indicator:

- **Number of State and Federal Inspections for Federal Programs in the U.S. Border Region** OUTPUT
- **Number of Federal Inspections in the Mexico Border Region** OUTPUT

Objective 3: By 2012 increase compliance in the priority areas determined in Objective 2 by applying regulatory and/or voluntary tools

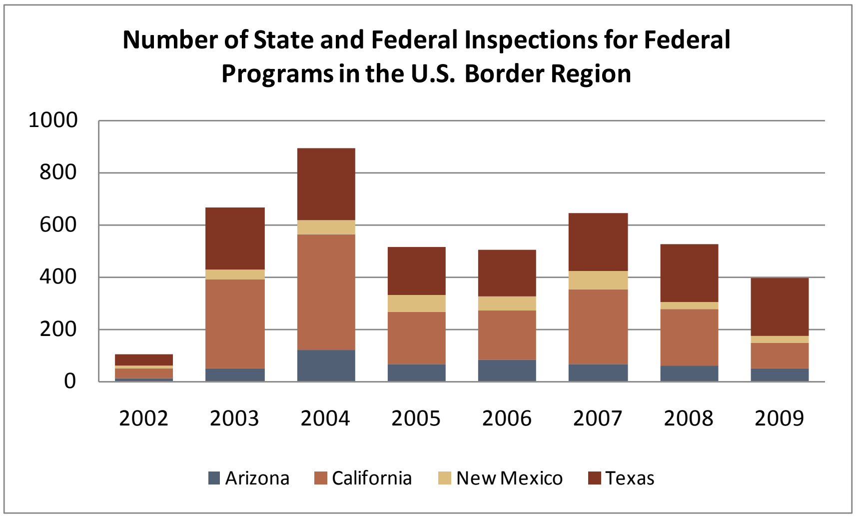
In both the U.S. and Mexico, inspections of regulated facilities are key tools for enforcing environmental laws. In the U.S., inspections are conducted under the rules governing the major federal regulatory programs. In many cases, inspections are carried out by state agencies to which federal programs have been delegated. In Mexico, inspection and monitoring for industrial and service establishments under federal jurisdiction are conducted through an Annual Environmental Program of Inspection and carried out by PROFEPA.

Why are these indicators important?

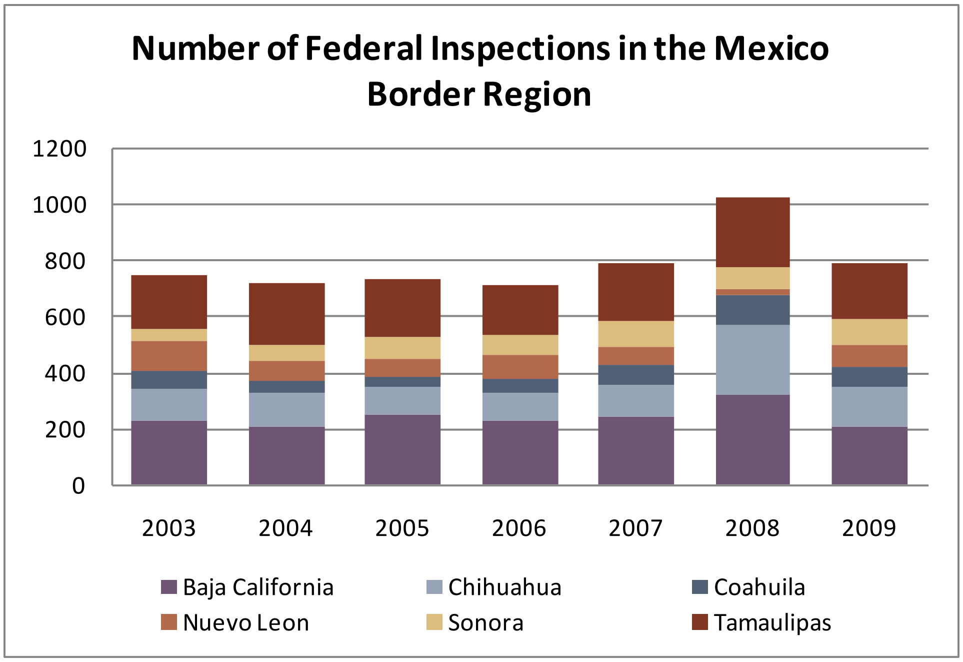
The number of inspections in the border region is an indication of the level of government activity to ensure compliance with federal environmental laws.

What are these indicators showing?

In the U.S. border region, inspections under federal programs declined by 50% between 2004 and 2009, with a significant amount of the decline accounted for by reductions in inspections in the California border region (although inspections in all states declined over the period).



In Mexico, the number of federal inspections each year ranged from 713 to 793 between 2003 and 2009, with an exception in 2008, which saw a high of 1,024 inspections.



What influences these indicators and what can be done in the future?

Assuming a stable base of regulated facilities, the number of inspections conducted annually is influenced by both agency priorities for inspection and by the resources available to conduct inspections. Declining agency budgets can mean less money to hire and pay inspectors and fewer inspections overall, which may be responsible for a decline in inspections in the U.S. in 2009 as a result of the economic downturn.

Technical considerations

In Mexico, facilities are either federally or state regulated—not both. Data from PROFEPA reported here are for federal inspections only. For the U.S., data are for “federally reportable” inspections which may be undertaken by state or federal inspectors. This may not include all state inspections of state-regulated facilities.

Data sources

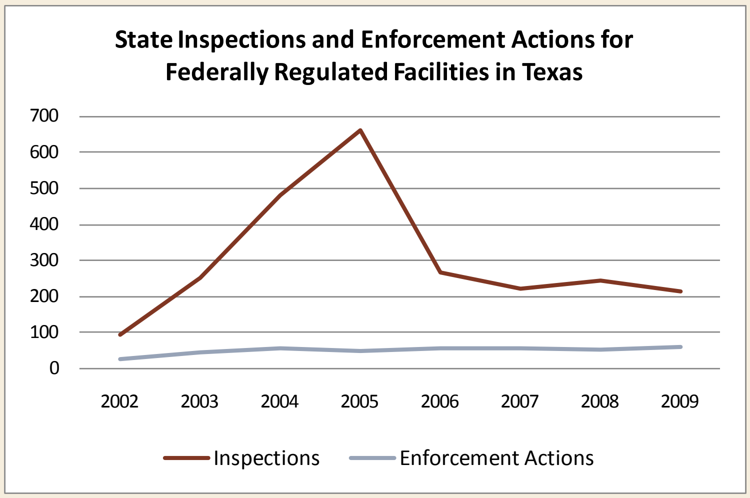
PROFEPA, 2010

EPA, OECA (2010) data provided based on EPA National Program data systems

U.S.-Mexico Border Region

Highlight: State Inspections and Enforcement Actions for Federally Regulated Facilities in Texas

Many U.S. states implement federal environmental regulatory programs, including conducting inspections and taking enforcement actions. Some of these state inspections are not recorded in federal databases, and they do not appear as part of the federal inspection statistics reported for the indicator "Number of State and Federal Inspections for Federal Programs in the U.S. Border Region." Similarly, some state enforcement actions are not reported to federal systems and are not counted in the indicator "Number of Federal Enforcement Actions in the U.S. Border Region."



This highlight illustrates the magnitude of state inspections and enforcement actions, which may not be reported in the other compliance indicators in this report. It shows the number of these activities conducted by Texas between 2002 and 2009 for the 995 federally-regulated facilities in Texas (as shown for the indicator "Total Number of Facilities Regulated Under Federal Programs: U.S.-Mexico Border Region"). During this period, Texas conducted between 92 inspections (in 2002) and 663 inspections (in 2005) annually of these facilities under federally delegated programs. The state undertook between 27 enforcement actions (in 2002) and 59 enforcement actions (in 2008) as well.

While the number of state enforcement activities in Texas has held steady in recent years, the number of state inspections has declined since the high in 2005.

Source

TCEQ databases, Consolidated Compliance and Enforcement Database (data downloaded and validated 10/27/2010 –11/2/2010)

Environmental Performance

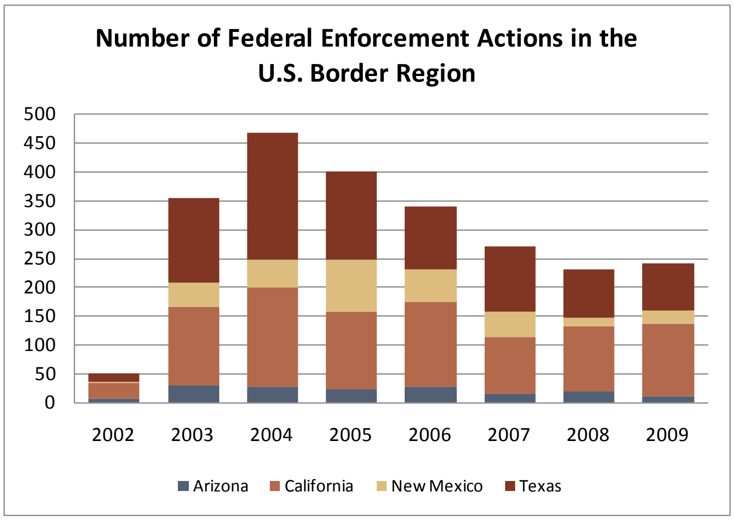
What happens when a facility violates environmental law in the United States?

Indicator:

- ➔ **Number of Federal Enforcement Actions in the U.S. Border Region** OUTPUT
- ➔ **Penalties in Number and Dollar Value in the U.S. Border Region** OUTPUT
- ➔ **Pollution Reduction from Federal Enforcement Actions in the U.S. Border Region** OUTCOME

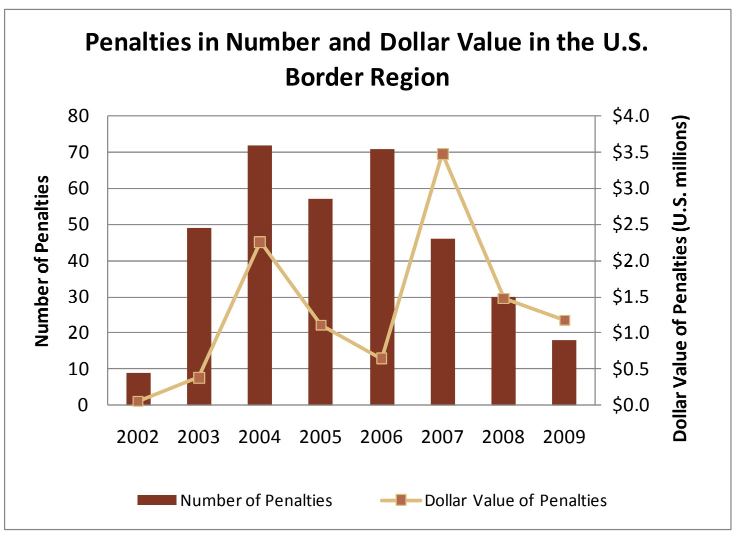
Objective 3: By 2012 increase compliance in the priority areas determined in Objective 2 by applying regulatory and/or voluntary tools

When a facility violates environmental law in the U.S., the regulating agency may impose actions to enforce compliance and may also impose monetary penalties and/or criminal sanctions. Formal enforcement actions in the U.S. may involve administrative (non-judicial) actions, or judicial actions that involve civil or criminal penalties. The amount of pollution reductions from enforcement actions depends upon the type of violation. Pollution reductions reported here include only those involving federal settlements of enforcement cases.



Why are these indicators important?

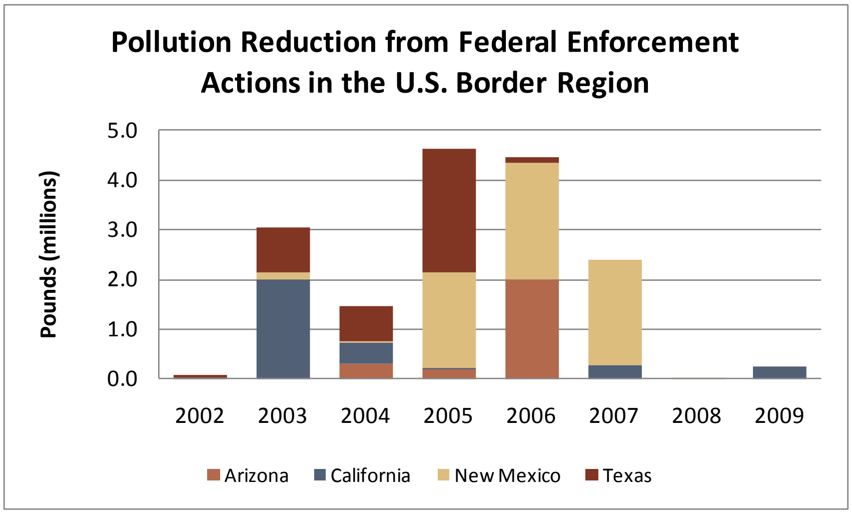
Enforcement actions, monetary penalties, and/or criminal sanctions deter violations of environmental laws and create an incentive for staying in compliance with environmental statutes and regulations. Penalties are designed to recover the economic benefit of noncompliance as well as reflect the seriousness of the violation.



What are these indicators showing?

Between 2004 and 2009, the number of enforcement actions in the U.S. border region declined by approximately 50%. The largest decline in enforcement activities came in Texas (although enforcement activity in all states declined over the period).

The number and dollar amount of penalties also generally declined from 2004 to 2009, although there were some exceptions (e.g., 2006 was a high year for the number of penalties; and the dollar value of penalties peaked in 2007).



There is no clear pattern in the amount of annual pollution reductions achieved from enforcement actions each year. 2005 and 2006 were very high years for the volume of pollution reduced while 2008 and 2009 were very low.

What influences these indicators and what can be done in the future?

Like data on inspections, data on enforcement actions, penalties and enforcement-related pollution reductions are a function of agency regulatory priorities and program capacity. Specific national, regional, or sector-based enforcement initiatives may result in higher or lower inspection, penalty, or pollution reduction figures on a yearly basis. One or more high-profile settlements in a particular state in a given year may significantly skew overall year-to-year results.

Technical considerations

Enforcement actions cannot be imposed unless a violation has occurred and has been detected by the regulatory agency. There is, however, not always a clear connection between a facility polluting the environment and compliance with the law because facilities may legally pollute under the conditions of a permit, and violations may not always result in releases of pollutants. When examining trends over time and differences among states, it is important to consider factors such as federal, state, and local environmental priorities; the number and type of facilities operating in each state; and other environmental management activities not reflected in this indicator, such as compliance assistance and informal enforcement actions (e.g. notices of violations). As noted above, individual enforcement actions that yield large pollution reductions or penalties may significantly contribute to enforcement results within that year, leading to a large impact on overall results.

U.S. data include both informal and formal enforcement actions. These are defined as follows:[16]

- *Informal response*. Agencies can simply notify the source about its violation and request that it come into compliance, without taking any further formal legal action. They may request that the source operator certify in writing that it has come into compliance.
- *Formal administrative enforcement*. Government agencies can also issue an administrative order to compel compliance, and in many cases can administratively impose a monetary penalty for past infractions.

[16] http://www.epa.gov/oecaerth/basics/enforcement.html

- *Formal civil/judicial enforcement*. EPA, through the U.S. Department of Justice, can initiate a civil lawsuit in the federal courts against a violator. Such a lawsuit may seek a court order compelling compliance and imposing a monetary penalty. Civil lawsuits are more cumbersome than formal administrative enforcement proceedings, but carry greater weight because the courts can enforce their own orders more effectively than can EPA. Similar avenues are available to most of the state agencies.

The approach EPA uses to calculate pollution reductions has changed over time. Recently, EPA has included more types of facilities in the calculation, which is likely to increase the total volume of pollution reductions.

Data source

EPA, OECA (2010) data provided based on EPA National Program data systems

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