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Project Summary

Lower Rio Grande Valley Transboundary Air Pollution Project (TAPP)

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The Lower Rio Grande Valley Transboundary Air Pollution Project (TAPP) was conducted by the U.S. Environmental Protection Agency (EPA), with the Texas Natural Resource Conservation Commission (TNRCC), to determine if transboundary transport of air pollutants was occurring in the Lower Rio Grande Valley (hereinafter called "the Valley") and, if so, the extent. Monitoring was conducted for one year at three fixed sites very close to the U.S.-Mexican border. Inhalable particles, chemical elements, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), and pesticides were measured. At each site data was also collected on short-term variations in the concentration of fine inhalable particles to assess episodic emissions that may have crossed the border. Meteorological measurements were also performed.

Overall air quality in the Brownsville area of the Valley was good; the vast majority of air pollutants were lower than or comparable to reference values as well as to monitoring data collected in other areas. Transboundary transport of air pollution plumes did not appear to cause noticeable deterioration of air quality. During the study period, the dominance of sea breezes from the Gulf of Mexico was largely responsible for clean air conditions in the Brownsville area of the Valley. A full assessment of possible impacts from transboundary air pollution was limited since air monitoring was restricted to the U.S. side of the border and emissions from air pollution sources were not measured. Still, the TAPP establishes a baseline for future air monitoring studies in the Valley.

This Project Summary was developed by EPA to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction (Background)

In 1996, the U.S.-Mexico Border XXI Program was developed as a five-year binational plan to address

transboundary environmental problems along the border. One such project under the Environmental Health Workgroup of the Border XXI Program was known as the Lower Rio Grande Valley Transboundary Air Pollution Project (TAPP). The air sampling protocol was based on results and analyses from the Lower Rio Grande Valley Environmental Scoping Study (LRGVESS) presented as a community report and published in a Special Issue of a scientific journal, *Environment International* (Volume 23, Number 5, 1997). Among its multi-media and residential sampling efforts, one component in LRGVESS was air sampling at a fixed site near the border with Mexico. A lesson learned from that study was that more information was needed concerning exposure to air contaminants from cross-border activities. To that end, the TAPP was developed to determine whether or not transboundary transport of air pollution occurs in the Valley and, if so, to what extent. The study involved air sampling for one year in three locations where transboundary air pollution could be measured if it were occurring. The sites were in or near the Valley city of Brownsville, Texas. Air measurements and meteorological data similar to those collected in the LRGVESS were acquired at each TAPP site. At each site, data were also obtained on short-term variations in the concentration of fine inhalable particles to assess episodic emissions. Precipitation measurements were also performed.

The data were compared to TNRCC Effects Screening Levels (ESLs) and to data collected in other areas to assess general air pollution impacts in and near Brownsville. ESLs have been defined as comparison values for constituents in air and are not ambient air standards. In addition to other analyses detailed in the Project Report, wind sector analyses and chemical tracer analyses were performed. These were done to determine the potential extent of transboundary air transport of pollutants during the sampling period and to identify possible transboundary air pollution sources.

Procedure (How the Information Was Collected)

Figure 1 shows the location of the air sampling sites. Although the sites were primarily impacted by nearby sources, their proximity to the border provided an opportunity to determine potential transboundary transport of air pollutants.

Air sampling included the following: **1)** mass of fine inhalable particles less than 2.5 micrometers abbreviated as $PM_{2.5}$ (a micrometer is one-thousandth of a millimeter), **2)** mass of coarse inhalable particles of 2.5 to 10 micrometers ($PM_{2.5-10}$), **3)** chemical elements in $PM_{2.5}$ and $PM_{2.5-10}$, **4)** particulate carbon, **5)** volatile organic compounds (VOCs), **6)** polycyclic aromatic hydrocarbons (PAHs), and **7)** pesticides. Meteorological parameters were also measured at each site. Particles were measured since they can be produced by many sources such as garbage incineration, road construction, agricultural burning and fertilizer/pesticide applications, industrial operations, and diesel fuel burning from trucks. $PM_{2.5}$ was measured because these particles have a greater potential to be lodged in the lung than particles with a larger diameter. VOCs were measured since they are associated with gasoline and other petroleum products, industrial chemicals, and even plants. PAHs and carbon were measured because they are found in soot and emissions associated with combustion activities. Since farming is a major activity in the Valley, pesticides were also measured. Precipitation (rainfall) measurements for metals, PAHs, and pesticides were also done. While most of the air pollutants were sampled for a 24-hour period day-to-day, additional sampling for fine inhalable particles was done on a real-time basis using 1-hour averages; these measurements were performed to determine short-term variations in emission impacts associated with air pollution episodes or other incidents.

Results and Discussion (Summary and Possible Explanations)

Overall, air pollution levels of chemicals measured in the TAPP were not unusually high nor of a persistent nature (Table 1). This indicated that air quality in the Brownsville area of the Valley was good. As discussed in the Project

Report, concentrations for the majority of air and precipitation pollutants were similar to or lower than data from samples collected in other areas. Air pollutants having higher concentrations than data sampled elsewhere were primarily VOCs from automobile and gasoline pollution.

Interpretation of the results was based upon how the information collected related to comparison values and/or information collected in other areas. As done in the LRGVESS, the TAPP results were compared with Effects Screening Levels (ESLs) developed by the TNRCC. ESLs are based on health effects data, odor nuisance potential, vegetation effects, or corrosion effects. ESLs are used for screening purposes and are not regulatory standards. The vast majority of air pollutants measured did not exceed the ESL; hence, adverse effects were not expected. It should be noted that an air pollutant level below the ESL is based on measurements during the monitoring period and does not mean that air pollution conditions in the future will remain the same. In a few random instances, one or a couple of the pollutant measurements met or slightly exceeded a reference value. Besides ESLs, other comparative data from exposure monitoring studies were used. These are also presented in Table 1; additional comparative data are presented in this study's project report. Of the more than 250 pollutants measured, only seven air pollutants had levels above the ESLs (Table 1). Of the approximately 2600 particle and VOC samples taken in this study, silver, 2-nitropropane, benzene, methylene chloride, and vinyl acetate exceeded the ESL only once and are not expected to result in any long-term adverse effects. While acrolein and methanol exceeded the ESL more than once, the collection of these pollutants using devices in this study is difficult. Hence, caution should be exercised when comparing this data to the ESLs. If an air pollutant exceeded the ESL, it does not necessarily mean there is a problem, but rather is an indication that further review is warranted. Further review may include additional sampling or consideration of ambient levels in the environment. As with all comparison values, ESLs undergo periodic review and revision to insure that they are based on current scientific literature.

Based on previous air pollution research, certain air pollutants can be considered as tracers for specific sources. This knowledge was applied in this study. The total particle chlorine levels encountered were probably associated with sea salts; the dominance of sea influences from the Gulf of Mexico was seen in much of the data. Elevated sulfur loadings were probably sulfates emitted by the nearby Gulf of Mexico, Laguna Madre and possible coal combustion sources.

Many of the elevated VOCs (benzene, methanol, 2-nitropropane, and methylene chloride) are found in solvents or can be emitted into the air by many sources (for example, benzene is also found in automobile emissions). Since measurements of emissions from sources on both sides of the border were not done, it was not possible to identify a specific source for VOCs. The inability to measure air quality on the Mexican side and to measure actual emissions from all major sources in the Valley, such as vehicles and industry, limited the ability to fully assess possible transboundary air pollution impacts.

The highest levels of silver occurred at Site 1; the highest levels of methylene chloride, and vinyl acetate were at Site 2. The maximum values for these pollutants came from the southeast direction. It is possible that these maximum levels came from man-made sources in Mexico or more immediate sources in the U.S.; it is also possible that higher wind velocities from this direction may have affected air pollutant levels. An additional reason could have been due to a greater chance of detecting a random event (i.e., an emission) from the southeast since winds predominate from that direction. Daily $PM_{2.5}$ data were highest from the southeast; approximately 50 percent of daily winds also came from that direction. This wind direction pattern was typical for almost all of the fine and coarse particle elements and most of the VOC data.

Many of the detected chemicals could have come from either side of the border. For example, of the five highest

methanol values, three came from the south and two came from the north. The three high levels from the south could have come from Mexico; the two high levels from the north could have come from the U.S. One exceedance of the ESL for methylene chloride occurred from the southeast. While transboundary influences occurring at Site 2 from either side of the border may be initially deduced from these observations, it should be noted that this site was one block west-northwest of a propane/butane filling station and this may have influenced some of the VOC data. The maximum values for benzene (at Site 1) and 2-nitropropane (at Site 2) came from the north.

The EPA has recently made $PM_{2.5}$ a criteria air pollutant. Criteria air pollutants are a group of very common air pollutants regulated by EPA on the basis of health effects. Although $PM_{2.5}$ data from this study cannot be directly compared with the revised National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ because of method and time-span differences, the annual average of the daily $PM_{2.5}$ data can still be used as an indication of this comparison. Briefly, the revised NAAQS for $PM_{2.5}$ mass is the three-year average of annual average $PM_{2.5}$, spatially averaged across an area (not yet defined). According to the EPA, the level of the three-year spatially averaged value should not exceed 15 $\mu g/m^3$. For the three sites the highest average of daily $PM_{2.5}$ values was 10.37 $\mu g/m^3$ (shown as 10370 ng/m^3 in Table 1) at Site 1. Thus, the annual means calculated for individual TAPP sites were at most only two-thirds of the NAAQS limit for $PM_{2.5}$. This indicates that the Valley air, during the study, was under the level of concern for $PM_{2.5}$.

Hourly averages of $PM_{2.5}$ measured on a real-time basis indicated highest levels coming from the south and southeast. As suggested for the daily $PM_{2.5}$ data, it is possible that these maximum levels were the result of man-made transboundary influences as well as other factors such as prevailing wind patterns discussed earlier. Local pollution events on certain days identified by site operators were examined with the hourly data. Although emission events may have occurred, it was found that these identified emission events had a minimal influence at the sites since the levels and patterns of hourly $PM_{2.5}$ data at all sites were similar. The similar daily pattern at all three sites indicated that regional influences, such as dusts or automobile traffic may have been dominant factors influencing short-term pollution levels.

Conclusions and Recommendations

1. Overall air quality in the Brownsville area of the Valley was good when compared to other data. Transboundary transport of air pollution did not appear to cause noticeable deterioration of air quality in the Valley.

2. The dominance of winds from the Gulf of Mexico was largely responsible for the clean air conditions in the Brownsville air shed.

3. The vast majority of air pollutants were generally lower or comparable to ESLs and monitoring data (shown in Project Report) at other urban and agricultural rural areas in Texas and elsewhere. The few observations of pollutants exceeding their ESLs appeared to be more the result of randomness in the data and/or local events than regional phenomena or transboundary plumes.

4. Short-term observations may have been influenced by transboundary transport of air pollution from the south and southeast. However, predominant wind flows came from the southeast and may have resulted in a greater opportunity for pollutants to come from these directions. Emission sources in the immediate location of the sites could have also influenced short-term observations. Without the ability to monitor air quality on the Mexican side and the inability to measure emissions from air pollution sources, it is difficult to ascertain the extent of this influence.

5. Any assessment of total

exposure from air pollution in the Valley would require a multi-media monitoring program similar to the LRGVESS.

6. The TAPP provides a baseline to assess future air quality conditions in the Valley. A multi-year monitoring effort of air quality and emission sources is necessary to assess trends in air quality. As shown in Figure 1, TNRCC is continuing to monitor air quality at Site 1 and other sites in the Valley to determine such trends.

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The complete report entitled "Lower Rio Grande Valley Transboundary Air Pollution Project (TAPP)"

(Order No.: PB99-146938; Cost: $51.00 subject to change) is available from:

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