# USER EXPERIENCE WITH SAPOLLUT

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In this paper, I will discuss 2 different aspects of the transportation and air quality relation at the regional level: first, experience that the Virginia Department of Highways and Transportation has had in using the SAPOLLUT air quality analysis emission program and second the adequacy of this approach in relating to the impacts of proposed transportation plans and programs on air quality.

The Federal Highway Administration manual (1) requires that land use planning, transportation planning, and air quality planning be coordinated annually through the local planning agency, the Virginia Department of Highways and Transportation, and the Virginia Air Pollution Control Board. Coordination and consistency determinations of the transportation plans and programs with the state implementation plan in most cases can only occur after a technical analysis has been performed that assesses the air quality impacts of the regional transportation network. Proposed improvements to the existing transportation network are called the urban transportation plans and programs.

The technical analysis used by the Virginia Department of Highways and Transportation in most of the major urban areas was the air quality analysis emissions program (SAPOLLUT) of the Federal Highway Administration manual (2) of August 1973. Other technical analyses and discussions assessing regional impacts resulted from consultation with the Virginia Air Pollution Control Board and the U.S. Environmental Protection Agency.

Of the 7 major urban areas in Virginia, a complete SAPOLLUT analysis was performed for only 5. A partial analysis was performed for 1 area, which is undergoing a level 2 review. The other area, northern Virginia, was studied by the Metropolitan Washington Council of Governments and underwent intensive examination with a regional carbon monoxide model as well as a total emission analysis.

In these areas where the complete SAPOLLUT analysis was carried out, emissions in kilograms per day were calculated for the 3 major transportation-related pollutants: carbon monoxide, hydrocarbons, and nitrogen oxides. Emissions were calculated for 3 functional types of highway facilities: freeways, arterials, and local streets. Finally, emissions for each pollutant and for each functional type of facility were calculated according to their location in the central business district, central city, and the suburb area of the study region.

A complete SAPOLLUT analysis was carried out for a base year in which most recent socioeconomic data had been used to verify transportation models. The target year for the transportation plans and programs was studied by assuming both target-year traffic on a completed target-year transportation system and target-year traffic on the base-year transportation system. An interim year was studied through interpolation of base-year and target-year vehicle miles of travel and by applying interim-year emission factors. The attainment year for the national ambient air quality standards, 1975, was chosen for the interim year.

Results of these analyses were incorporated into a report that also characterized the nature of transportation and air quality within not only the transportation study area

but also the air quality control region. A description of the plans and programs was presented as well as their location. The report also discussed the transportation models and their calibrations and prediction techniques. Air quality information for each pollutant such as the priority status, air quality maintenance status, and the maximum recorded concentrations specified in the state implementation plan was presented. In general terms, the interrelation of climatological, meteorological, and topographical parameters was related to the air quality of each region. Finally, the report summarized the models used in the analysis, the emission factors, and the methodologies used in assessing the air quality impacts of transportation systems.

The conclusions contained a consistency determination for the proposed plans and programs for each pollutant, thereby describing the consistency of the urban transportation plans and programs with the state implementation plan. The report also outlined the consultation that had occurred between the planning agencies, the Department of Highways and Transportation, and the Virginia Air Pollution Control Board in developing adequate technical procedures.

The major advantage of the SAPOLLUT methodology is that it allows pollutant emissions from various transportation alternatives to be compared by using an established data bank of transportation information. Furthermore, it could be used to determine whether changes in a transportation network will cause a change in the spatial distribution of pollutant emissions. Operationally, the SAPOLLUT procedures are fairly easy to incorporate and apply.

One of the most obvious shortcomings of the SAPOLLUT model is that the output results are expressed as total emissions in unit mass whereas the designated national ambient air quality standards are expressed as a concentration in micrograms per cubic meter. Therefore, no direct comparison of the air quality impact of the transportation network to the national standards could be made.

That portion of the output data that is most closely scrutinized is hydrocarbon emissions. Calculation of reductions in emissions between a base year and future years allows for comparison between values specified in the state implementation plan and reductions caused by alternate plans and programs. The results cannot be used to directly determine the magnitude, the location, or the quantity of violations of standards.

The resolution of the carbon monoxide information is not adequate within the central city, central business district, or suburb to allow identification of impacted sites or quantification for comparison with standards. This problem will be partially resolved when the SAPOLLUT model is linked to the APRAC-1A model. However, it may be most appropriate to simply identify potential hot spots at the systems level and then quantify their concentrations at the project level.

Nitrogen oxides are reactive in nature and cannot be estimated through use of the SAPOLLUT emission model. Furthermore, emissions are in total nitrogen oxides, and the national standard, an annual standard, is for nitrogen dioxide only. In addition, the results, like those for hydrocarbons, are in emission units and not in concentrations.

SAPOLLUT is basically a computerization of the Environmental Protection Agency emission factors. It interfaces transportation planning and air quality planning by using as input data from the standard FHWA urban transportation planning computer programs. The reliability of the results is, therefore, dependent on the accuracy of the input data as well as the emission factors.

The accuracy of the transportation data used as a basis for calculating air quality impacts lacks the required preciseness to be fully dependable. The level of sophistication of transportation planning procedures required by the air quality planning process falls short of being reliable enough to be used with confidence as a basis for calculations whose results will be compared to exact standards. Some consideration must be given to the deficiencies of a process calculating figures that are often held as impeccable. Application of the SAPOLLUT methodology is more appropriate for comparison of alternatives to one another than comparison of alternatives to absolute standards. Otherwise, more detailed information for a particular region should be obtained for directional split, percentage of heavy-duty vehicles, speeds, percentage of ADT by hour, and so on.

New emission factors will soon be officially released by the Environmental Protec-

tion Agency. These factors were developed for a complete vehicle trip and not specifically for vehicles on a particular highway link. Furthermore, the emission factors are valid only for vehicle speeds up to 45 mph (72 km/h). Taking the emission factor at 45 mph and using it for 45 to 55 mph (88 km/h) give conservative results. The combined effect of these 2 considerations could yield results that in some cases are significantly conservative. In addition, detailed information for 6 different vehicle types should be used for an accurate analysis with these emission factors. Such information is expensive and difficult to obtain with any reliance.

One application problem was specifically experienced by the Virginia Department of Highways and Transportation. The department was not able to use the capacity restraint process as suggested by special area analysis because of the operational computer expense and lack of detailed capacity information on the entire transportation network. Therefore, the department had to use the free assignment with network speeds.

## REFERENCES

1. Federal-Aid Highway Program Manual: Volume 7—Air Quality Guidelines. Federal Highway Administration, Chap. 7, Sec. 9.
2. Special Area Analysis. Urban Planning Division, Federal Highway Administration, final manual, Aug. 1973.