United States
Environmental Protection
Agency

Research and Development

Environmental Sciences Research
Laboratory
Research Triangle Park NC 27711

EPA-600/S3-83-103 Dec. 1983

EPA

Project Summary

Green River Air Quality Model Development—Related Studies, General Information and Bibliography

R. L. Drake

This report identifies meteorological and air quality data sources for the oil shale areas of Western Colorado, Eastern Utah and Southern Wyoming. The general and bibliographic information identified in this report consists of the material collected during 1980-1982 as part of the Green River Ambient Model Assessment Project: 1) generic information applicable to the oil shale areas, 2) general information for the Rocky Mountain West, and 3) information specific to the oil shale areas. The evaluation and analysis of these materials, although not exhaustive, has been sufficiently complete to gain a picture of the existing terrain, its surface cover, its meteorology and climate, and the chemical and visual quality of the atmosphere over the region. From this picture of the region, a list of information and data needs required of local and mesoscale air quality models for the Green River area has been derived.

This Project Summary was developed by EPA's Environmental Sciences Research Laboratory, Research Triangle Park, NC, 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

This report provides bibliographic and general information collected during 1980-1982 as part of the Green River Ambient Model Assessment (GRAMA) Project. The GRAMA Project's overall objective is to develop dispersion models for evaluating the air quality impacts of development in the region of the Green River Oil Shale deposits. The text of the report is divided into three main sections: background information, identification and evaluation of data and information sources, and research needs. Three appendices provide literature and data applicable to the oil shale area, information on land-surface forms, and information on terrain profiles and maps.

The background information section describes the region of interest, the oil shale tracts, and the companies and agencies involved in oil shale development. The location and extent of the oil shale reserves are discussed and the topography, meteorology and climate of the region are summarized. Finally, the air quality issues are discussed and a general framework is presented for the development of a modular air quality model. The data input requirements necessary for a comprehensive model are specified.

Section 2 identifies and evaluates information and data that had been collected for the mesoscale domain containing the oil shale deposits of Utah, Colorado and Wyoming. Terrain data, pollutant emission data, meteorological data, and air quality data are discussed.

The final section discusses the research needs considered important in assessing the pollutant carrying capacity over the oil shale region. Progress in meeting these research needs will lead to improved air quality modeling over the area. Research needs include:

1) determining the representativeness of existing upper air stations in the region,
2) conducting a thorough review, synthesis, and inventory of oil shale tract data,
3) accelerating research programs dealing with locally developed flows, temperature inversions, and scale interactions,
4) initiating research to study the coupling and decoupling of local flows with the upper air,
5) conducting investigations of convective boundary layer development over the region,
6) studying air pollutant diffusion in local and regional flows,
7) installing a network of meteorological and air quality monitoring sites, and
8) developing a coordinated research management plan.

Conclusions and Recommendations

The following summary items and conclusions result from the current study:

- This report summarizes the current knowledge of the terrain and its cover, the meteorology and climate, and the air quality and visual characteristics for the oil shale region of Colorado, Utah and Wyoming.
- This report shows the location of the major oil shale tracts in Colorado and Utah and lists the major companies and agencies (Federal, state and local) involved in the development of this resource.
- This report discusses the air quality issues important to the developers, regulators, interested parties, and the general public in the Green River Area. The issues include National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) regulations, state regulations, air quality related values over Class I areas, town growth, and global climate concerns (such as the airborne accumulation of CO_3).
- The components, or modules, of an air quality model are outlined and their data and information needs are discussed.
- To aid in the identification of relevant information and data, a bibliography containing 760 references and a special annotated bibliography containing 88 references are given as appendices to the report. Both bibliographies are organized according to topical areas, such as terrain data, meteorological data, chemistry data, and instrument systems.
- The information and data identified and evaluated in the main part of the report is divided into emissions, terrain, meteorology, and air quality data. In this discussion, 144 references are considered.
- A list of data and information needs for the Green River Area resulted from comparing our analysis of the above references to the air quality modeling requirements for this area. Based on the evaluation of information and data available for the Green River Area, a number of recommendations have been made for further study. These recommendations include:

1. Determining the seasonal "areas of influence" for the four upper air stations (Denver, Grand Junction, Salt Lake City, Lander) in the vicinity of the mesoscale domain.
2. Thoroughly reviewing, taking inventory, and synthesizing the available oil shale tract data and other pertinent data from the region to guide future research plans and air quality model development.
3. Establishing a long-term upper air station between the Piceance Basin and the Flat Tops Wilderness Area of Colorado.
4. Providing more valley meteorological stations in the White and Colorado drainages so that drainage winds throughout the area can be better predicted.
5. Promoting cooperation between the various agencies and companies taking meteorological and air quality data in the Green River Area.
6. Investigating the potential of transferring data from other major field programs throughout the country and the world to the oil shale area.
7. Setting up a priority system for carrying out the needed research.
8. Promoting a comprehensive meteorological and air quality field program for the oil shale area that can be used for model validation over diurnal and seasonal cycles.

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The complete report, entitled "Green River Air Quality Model Development—Related Studies, General Information and Bibliography," (Order No. PB 84-120 492; Cost: $32.50, subject to change) will be available only from:
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Research and Development

EPA-600/S3-83-104 Dec. 1983

EPA

Project Summary

Effect of Load Simulation on Auto Emissions and Model Performance

Peter Gabele and Richard Snow

A study was undertaken to examine the accuracy of an automobile emission rate model and the water brake dynamometer procedure used in the model's development. Using wheel torquemeters, actual road loads were recorded and later simulated with the vehicle on an electric dynamometer. Emissions results from tests using this load simulation were compared with results from tests using water brake simulation. Emission results were also compared to values predicted using the Environmental Protection Agency's Automobile Exhaust Emission Modal Analysis Model.

This Project Summary was developed by EPA's Environmental Sciences Research Laboratory, Research Triangle Park, NC, 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

Ambient air concentrations of CO within urban areas are often significantly higher than those predicted by dispersion models. Because CO is emitted predominantly by motor vehicles, models used to predict CO emission rates from groups or classes of motor vehicles could be contributing substantially to the shortfall and should be examined for inaccuracies. Two widely used models for estimating emissions are MOBILE2 and the Intersection Midblock Model (IMM). Both models employ the EPA Automobile Exhaust Emission Modal Model which is used to predict emissions for any given speed-time driving sequence. This "Modal Model" has been criticized because it was developed using precatalyst cars which were tested on water brake dynamometers.

In this study, the Modal Model is evaluated by measuring emission rates from a late model vehicle and comparing these with values predicted using the model. The effect of water brake dynamometer load simulation versus actual road load simulation on regulated emissions is also examined.

Conclusions and Recommendations

Investigation of the effect of dynamometer load characteristics upon regulated emission rates and an evaluation of the EPA Modal analysis Model were completed. Based upon the study's findings the following is concluded:

1. The load applied by the water brake and the tire rolling resistance losses on the dynamometer was approximately equal to the actual road load measured in highway tests.
2. Regulated emission rates for the Celebrity are not significantly different when tested using the water brake simulation versus actual road load simulation on an electric dynamometer.
3. The EPA Exhaust Emissions Modal Model is an inaccurate predictor of regulated emissions from the Celebrity.

The conclusions suggest that water brake dynamometers adequately simulate actual road loads for emissions test purposes. This should hold true for vehicles such as the Celebrity which have large inertia load components relative to aerodynamic load components. When the aerodynamic load component becomes a significant portion of the total road load, dynamometer absorbed power theoretically deviates with speed from the actual road load. The tendency for this occurrence, which makes simulation of road loads with water brake dynamometers more difficult, increases for extremely lightweight cars.

Because most data collected for use in MOBILE2 have been from vehicles roughly equal in size to or larger than the Celebrity, inaccuracies in load simulation have no significant effect on the accuracy of MOBILE2. However, should minicars (<2000 lb) ever occupy a significant percentage of the vehicle miles traveled (VMT), a re-evaluation of dynamometer load simulation will become necessary.

With regard to the Modal Model evaluation, results in tests on only one vehicle cannot in themselves disprove the model. This is true because the model was recommended for prediction of vehicle group emissions and not individual vehicle emissions. However, because high tech emission control systems have changed the relationship between vehicle speed and emissions since the model's development, the Modal Model should be updated.

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The complete report, entitled "Effect of Load Simulation on Auto Emissions and Model Performance," (Order No. PB 84-120 369; Cost: $8.50, subject to change) will be available only from:

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