May 9, 1975

Office of
Research and Development

Subject: Assuring that mobile source controls do not adversely effect public health: The oxidation catalytic converter issue

From: Assistant Administrator for Research and Development

To: Assistant Administrator for Air and Water Programs
Assistant Administrator for Planning and Management

My views of the technical aspects of this issue address the basic scientific problem, the available scientific facts and regulatory problems.

1. Basic scientific problem: Simply put, EPA must assure that environmental controls do not adversely effect public health or environmental quality. That is to say, that on balance our actions produce a net health benefit for the Nation.

2. Scientific facts: The use of catalytic converters to control carbon monoxide and hydrocarbon emissions will involve exposing the general population to low levels of the new pollutants platinum and palladium compounds, and to increased levels of more familiar pollutants, sulfuric acid and suspended particulate sulfates.

Exposures to platinum compounds are likely to range from 1/100 to 1/10 of the threshold limit value for platinum salts. Platinum compounds can be expected to aggravate asthma and pre-existing cardiorespiratory disease as could increased levels of suspended sulfate and acid aerosols. It is conceivable that the interactions of these pollutants might prove additive or synergistic. Platinum and palladium compounds may also act as co-carcinogens or cancer promoters. Platinum compounds have been used experimentally

as anti-cancer agents and it has been observed that most anti-cancer agents also have some ability to help induce cancers. We cannot assure that currently projected respiratory exposures to low levels of platinum accompanied by particulate polycyclic organic matter will not increase the risk for respiratory cancer. Other adverse health consequences are possible.

Suspended particulate sulfate and acid aerosol emissions from motor vehicles equipped with oxidation catalysts are increased significantly above similar emissions from vehicles not equipped with these catalysts. The best current average estimate of this probable increase is about .05 gm/mile measured as sulfate with a range of .02 gm/mile to 0.10/mile. Important sources of variability in both the amount emitted and the resulting ambient concentrations include methodology for sampling and measurement, sulfur content of gasoline, type of catalyst, age of catalyst, operating conditions, meterological dispersion factors, rate of conversion of sulfur dioxide to acid aerosols and suspended sulfates in the atmosphere and the proportion of vehicles which are equipped with catalytic converters.

Based on gaussian atmospheric dispersion models for highways, we estimate that peak hourly exposures to sulfuric acid and particulate sulfates under normal dispersion conditions would be increased by 2.4 to 3.5 ug/m^3 at 10 meters and .8 - 1.1 at 100 meters from an arterial highway. This assumes 25% of vehicle miles involve catalyst-equipped vehicles. Under worst case meterological conditions, those "base case" exposures would increase by an order of magnitude, i.e., 24 to 35 ug/m^3 at 10 meters and 8 to 11 ug/m^3 at 100 meters. For pedestrians in urban street canyons the "base case" exposure would increase by a factor of 3 to 5, i.e., 7.2 to 17.5 ug/m^3 at 10 meters and 2.4 to 5.5 ug/m^3 at 100 meters. Urban street canyons levels would be further increased under the most adverse meterological conditions. Drivers and passengers in these areas would also be exposed for short periods to high levels of sulfuric acid-suspended sulfate one meter from reading that ranged from 3.1 to 4.6 ug/m^3 as a base case to 31 to 46 ug/m^3.

Since fine particulate lead emissions from current vehicle population averages around .07 gm/mile and ranges from .05 gm to .10 gm/mile, one might also use observed lead levels as an indicator for levels of acid aerosols and suspended sulfates. Levels of lead

alongside freeways and in urban street canyons should be divided by four to simulate a 25% contribution by catalyst equipped motor vehicles. When this is done three hour levels of 4.5 to 9.5 ug/m^3 alongside freeways might be expected on an average day. In a downtown area, levels of 2.4 to 6.0 ug/m^3 would be predicted. Projected sulfate-acid aerosol exposures using this method indicate exposures alongside the freeway which overlap but are somewhat higher than those predicted for the edge of the freeway by the dispersion model. On the other hand, the "lead projection" estimate for downtown exposures is somewhat lower than the dispersion model estimate. In general, the degree of agreement strengthens my concern about increases in sulfuric acid-sulfate exposures.

Existing health effects information and air monitoring data on ambient levels of suspended sulfates and sulfuric acid aerosols indicate that these pollutants are present at levels that adversely effect public health. Expensive sulfuric dioxide controls involving switching to low sulfur fuels and effluent controls are needed to achieve the primary ambient air quality standard. Such controls in large eastern cities have reduced suspended sulfate levels by about one-third, a reduction of 9 to 10 ug/m^3 in the annual average. Los Angeles Basin levels have also been reduced by about one-third (5 ug/m^3) as an annual average. The projected roadside and street canyon increments in the current average sulfate level in Los Angeles (10 ug/m^3) and in large midwestern or eastern cities (12-20 ug/m^3) would be substantial. For example, the "usual" peak hourly roadside (4.0 ug/m^3) and street canyon (6.5 ug/m^3) increments *added to the expected daily frequency distribution for sulfate levels in downtown Los Angeles would mean that 90 to 100% instead of 50% of days would exceed our best judgment estimates for the threshold for adverse effects on health.

Delaying use of converters for one year will not greatly effect projected reductions in ambient levels of carbon monoxide and photochemical oxidants. In fact, the differences are not likely to be detected by existing ambient air monitoring stations. Delaying use of catalytic converters for one year would allow EPA to be in a much

*Best judgment based on combining the two different projection methods - dispersion modelling and "lead projection."

converters for one year would allow EPA to be in a much better position to assure that significant adverse effects will not occur. Alternatively using vehicles equipped with oxidation catalysts for one or two years in a limited area of the country could allow assessment of these issues in a real world situation prior to general national usage. However, this course may not be without profound philosophical, legal and regulatory consequences.

3. Regulatory Problems: Besides the obvious problem of meeting legislatively specified mobile source emissions standards, four other regulatory problems should be considered: standards for non-regulated emissions from mobile sources, the requirement that mobile source control systems not emit new pollutants, the ambient air quality standard for sulfur dioxide and the stationary source standard for sulfuric acid.

The Clean Air Act authorizes EPA to set mobile source emissions standards for exhaust particulates (Section 202a). EPA can maintain its position as a firm regulator and avoid needless Congressional criticism by stating an intention to set such standards at the same time as an official position is taken on the oxidation catalyst issue. The use of stratified charge engines or rotary engines will probably cause the Agency to set particulate emissions standards in any case.

EPA mobile source emissions regulations state that control systems employed for legislatively regulated pollutants shall not themselves introduce new pollutants (Section 85.004b). Platinum and palladium compounds are new urban air pollutants.

EPA's primary ambient air quality standard for sulfur dioxide would not be scientifically defensible if mobile source control measures are allowed to increase exposures to suspended sulfates and acid aerosols. Hardly anyone in the scientific community believes that sulfur dioxide alone is detrimental to human health at ambient levels* However, almost everyone in the scientific community will agree that elevated levels of acid aerosols and fine particulate sulfates are harmful to health. Therefore, allowing substantial increases in acid aerosols

* A few of us believe sulfur dioxide can cause reflex laryngospasm, bronchospasm and decreased resistance to upper respiratory infections.

and suspended sulfates would be viewed by the scientific community as much more likely to endanger health than a modest relaxation in the primary ambient air quality standards and the related new source performance standards for sulfur dioxide.

EPA's stationary source regulations for sulfuric acid mist control would seem glaringly inconsistent with a mobile source control system that emitted significant amounts of sulfuric acid and suspended sulfates. This fact would probably not be overlooked by either industry or public interest groups.

4. Conclusion: If enhancement of air quality rests upon a need to protect public health, EPA should assure that use of the oxidation catalyst does not produce the opposite result. Until EPA can do so, catalytic converters should not be used extensively enough to increase population exposures to acid aerosols, suspended sulfates and noble metals and their compounds. If this requires that oxidation catalysts not be utilized in 1975 motor vehicle models, so be it. Environmental controls must be based upon sound scientific evidence and be as scientifically defensible as possible. At this time, the use of oxidation catalysts is not so based.

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