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THE RISKS AND BENEFITS FROM LEAD IN  
GASOLINE; EFFECT ON ENERGY USE AND THE  
ENVIRONMENT

Discussion\*

by

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Resek's paper<sup>1</sup> raises several interesting questions for energy policy-making, and highlights important methodological problems. The most immediate prerequisite for the application of cost-benefit techniques to public policy analysis is a generally acceptable method of translating qualitative measures of costs (or detrimental impacts) to some quantitative measure;<sup>2</sup> and, as noted by Resek for the lead example, this is considerably easier for such impacts as reduced crop yields than for impacts on human health. Nevertheless, countless recent studies have made the attempt of monetarizing health impacts in areas of policy analysis that are of comparable if not greater significance to the national economy, and also involving trade-offs between economic, environmental and energy goals. Good examples include Sagan's study of health costs in the coal mining industry (of relevance to the debate over fossil versus nuclear power generation);<sup>3</sup> Buehler's monetarization of the value of human life in connection with investments for flood control structures;<sup>4</sup> or more general attempts applying utility theoretical concepts to public policy analysis.<sup>5</sup>

However, such studies have two common characteristics; they tend to be controversial; and, in contrast to the question of automotive lead emissions, the cause and effect relationship is better understood, at least in qualitative terms. Indeed, in the case of lead, the major difficulty is that airborne lead is only one factor, and often a minor one at that, contributing to human lead intake. Except for children ingesting flakes of lead based paint, the largest source of lead exposure is food; the average adult ingests 200-300 micrograms of lead each day, of which 10 percent is absorbed into the bloodstream, with an average lead content of 10 to 30 micrograms per 100 grams of blood.<sup>6</sup> Attempts to establish a direct causal relationship between automotive lead emissions and health impact thus abound with methodological problems, and even

EPA acknowledged in 1973 that none of the scientific findings on lead, viewed individually, constituted conclusive evidence that airborne lead by itself was a hazard to human health.<sup>7</sup> However, the EPA position is that when considered together, the studies do indicate that airborne lead is a factor contributing to excessive lead exposure among urban populations. Note that the issue does not center on the health impact of lead, which is beyond dispute, but over the significance of airborne lead vis-à-vis other sources.

In assessing Resek's use of an econometric demand estimation model as a means for deriving the benefits of lead levels in gasoline, it should be remembered that estimates of price and income elasticity vary considerably, depending on their time perspective, geographic focus, and model specification. The short-run price elasticity for the U.S. in a recent Federal Energy Administration forecasting model was taken as  $-.16$ ;<sup>8</sup> whereas the long-run price elasticity for gasoline in a model of the World Oil Market is estimated by Kennedy as  $-0.82$ ,<sup>9</sup> with a diversity of intermediate values quoted by other researchers.<sup>10</sup> The problem as far as the United States is concerned is mainly a statistical one; multicollinearity in explanatory variables results in high standard error of estimates, and, even if a pooled time series--cross section model of the type used by Resek lessens such difficulty,<sup>11</sup> deficiencies in the data cause other problems of interpretation and specification. Such caveats should be interpreted less as criticisms of Resek's methodology as much as reminders to decision-makers who might use particular numerical estimates in support of a particular policy position.

In regard to other policy matters raised by Resek's paper, it should be noted that the EPA regulations promulgated under the Clean Air Act providing for a phased reduction in the lead content

of gasoline are presently before the Court of Appeals in a civil action by the Ethyl Corporation, a major manufacturer of lead additives.<sup>12</sup> In January of this year, the court invalidated the EPA regulations on two grounds; first, that there was insufficient evidence to support a finding that lead additives "endangered" the public health, and that regulations to ban the additives were thus an invalid exercise of administrative discretion;<sup>13</sup> and second, that the administrator made an error in judgement in determining that auto emissions contributed significantly to blood lead levels in adults and children. The court held that the administrator was required to show that air borne lead from auto exhausts contributes a "measurable increment of lead to the human body, and that this measurable increment causes a significant health hazard"; on reviewing the scientific evidence, however, the court found such a conclusion to be unreasonable.<sup>14</sup>

Not unexpectedly, EPA has appealed the 2-1 decision, and the case will be reheard by the Appeals Court en banc.<sup>15</sup> But regardless of the final outcome, the issue is ultimately whether in such situations the benefit of the doubt should be given to the public health, or to the right of private enterprise to manufacture and sell its products. In particular one should note that the relationship of automotive lead emissions to public health is much more tenuous than in other similar controversies where the evidence for a direct cause-and-effect relationship is more direct--as, for example, in the case of strict new standards governing exposure of workers in the plastics industry to vinyl chloride gas<sup>16</sup>--and this makes the formulation of public policy on the issue a much more complex problem.

In summary, the issue of lead additives in gasoline typifies the complexity of decision-making in energy matters, in which

optimal public policy must be based on a very fine balance of competing interests and in the face of considerable uncertainty over the environmental and economic ramifications. Thus research efforts focussed on a clarification of such controversy should continue to be of interest to governmental decision-makers.

## Notes

1. R. Resek, "The Risks and Benefits from Lead in Gasoline; Effect on Energy Use and the Environment," Presented at International Conference on Regional Science, Energy and Environment, Katholieke Universiteit te Leuven, Belgium, May 22-24, 1975.
2. For a good overview of benefit cost analysis and policy making see R. H. Haverman et al., "Benefit-Cost and Policy Analysis," Aldine, Chicago, 1974.
3. L. A. Sagan, "Health Costs Associated with the Mining, Transport and Combustion of Coal in the Steam Electric Industry," Nature 250, (July 12, 1974) 107-111.
4. B. Buehler, "Monetary Values of Life and Health," Journal, Hydraulics Division, American Society of Civil Engineers 101, No. HY1, (Jan. 1975) 29-47.
5. J. Hirshleifer, T. Bergstrom and E. Rappaport, "Applying Cost-Benefit Concepts to Projects Which Alter Human Mortality," University of California at Los Angeles, School of Engineering and Applied Science, Report UCLA-ENG-7478, Nov. 1974. These citations are chosen more as exemplars of alternative analytical approaches than as a complete sample, as the literature in this area has grown significantly over the past few years.
6. 5 Environmental Law Reporter 2 10052-10056 (1975).
7. For a good review of the studies quoted by EPA as ground for its intention to impose gasoline lead reductions, see 5 Environmental Law Reporter 20109-20115 (1975).
8. W. W. Hogan, G. M. Lady and J. D. Pearson, "Petroleum Product Short Term Forecasting at FEA," Presented at National Petroleum Refiners Association Computer Conference, San Francisco, Calif., Nov. 1974.
9. M. Kennedy, "An Economic Model of the World Oil Market," Bell Journal of Economics and Management Science 5, No. 2 (Autumn 1974) 540.



10. M. S. Houthakker, P. K. Verleger and D. P. Sheehan, in "Dynamic Demand Analyses for Gasoline and Residential Electricity," American Journal of Agricultural Economics (1974), estimate a long-run price elasticity of -0.25.
11. Kennedy, see Note 9, supra.
12. Ethyl Corporation v. EPA (D.C. Circuit, Jan. 28, 1975) 5 Environmental Law Reporter 20096. Other petitioners, whose cases were consolidated into the Ethyl Corporation case for purposes of argument and decision, included PPG Industries, DuPont, NALCO Chemical and the National Petroleum Refiners Association.
13. The judicial basis for review of an agency action by the courts is the Administrative Procedure Act (5 U.S.C. 701, 1970), which allows judicial reversal or invalidation of an agency action found to be "arbitrary, capricious, and an abuse of discretion" or "unsupported by substantial evidence in a case subject to hearings" see, e.g., D. P. Cume and F. I. Goodman, "Judicial Review of Federal Action: Quest for the Optimum Forum," Columbia Law Review, Vol. 75, No. 1 (Jan. 1975)1-86.
14. One should note, however, the distinctions between this case and an earlier case (Amoco Oil Company et al. v. EPA, 501 F 2d 722), in which the same court upheld an EPA regulation that gas stations must provide unleaded gasoline; the evidence that lead destroyed the catalytic converter was uncontested, and therefore fully empowered EPA to take appropriate steps under a provision of the Clean Air Act that would give authority to regulate or control a fuel or fuel additive "... if emission products of such fuel or fuel additive will impair to a significant degree the performance of any emission control device or system which is in general use or which the administrator finds has been developed to a point where in reasonable time it would be in general use," (42 U.S.C. 1857, 1970).
15. Cases in the Circuit Appeals Courts in the U.S.A. are normally heard by 3 judges; the court may elect, however, to rehear a controversial case en banc, with all justices of that court present.
16. In that case, the Court of Appeals upheld strict new OSHA (Occupational Safety and Health Administration) standards--see Society of the Plastics Industry v. Occupational Safety and Health Administration, 5 Environmental Law Reporter 20157 (2nd Cir., Jan. 31, 1975).