type. Large-scale organizations also give rise to the kind of environment that can result in the formation of new persistent systems. It is possible that, while being formed, states depend for their impetus on the accumulated energy of persistent peoples. A proposition for consideration is that states tend to dissipate the energy of peoples after transforming that energy into state-level integrations, and then regularly break down in the absence of mechanisms for maintaining human motivations in the large-scale organizations that they generate.

References and Notes

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NEWS AND COMMENT

Lead in the Air: Industry Weight on Academy Panel Challenged

A major report on the health effects of airborne lead, released by the National Academy of Sciences in September, has become the focus of a controversy over the academy's use of industry employees on its advisory panels to the Environmental Protection Agency (EPA). Critics in the environmental sciences community, including two prominent researchers who contributed to the report on lead, question the neutrality of the panel that wrote it and accuse the academy of giving scientists in the lead industry an excessively free hand in shaping the report, which was meant to serve as background for the EPA's regulatory policy on lead.

The academy, in turn, insists that industry is often the best source of essential expertise, and that when industry scientists serve on its advisory panels they are simply expected to rise above their allegiances to employers and to put aside their biases.

The report in question was written by an ad hoc Panel on Lead of the Committee on Biologic Effects of Atmospheric Pollutants (BEAP), a part of the National Research Council. The lead panel's report is the first of a series of similar surveys and evaluations of the literature on selected pollutants—which may eventually number as many as 20—being conducted by the NRC under contract to the EPA. Compiled over an 8-month period from July 1970 to February 1971, the report has been widely commended for its thoroughness in reviewing the literature on lead. The point of controversy is the panel's interpretation of the collected mass of information.

Early in its planning, the panel decided that, in order to place airborne lead in a proper perspective, it would have to expand the scope of its discussion and consider the effects of lead at far higher levels than those found in urban air. This was necessary, the panel said in its preface, "because lead attributable to emission and dispersion into general ambient air has no known harmful effects." From this premise, the panel worked its way through some 600 references to conclude that lead concentrations currently found in the nation's air pose no known hazard to the general population. Although the panel noted that some groups of workers and children in inner-city neighborhoods might potentially be at risk, it found that the amount of lead in the air of most major cities "has not changed greatly" in the past 15 years.

To judge from press releases issued in the wake of the NRC report, the lead industry was delighted with what it perceived as a clean bill of health from the National Academy of Sciences. The Ethyl Corporation, a major producer of lead additives for gasoline (the principal source of lead in the ambient air) took the report's conclusions as vindication of its contention that antiknock additives in no way "endanger the public health or welfare," and are therefore not subject to control on those grounds.

EPA officials, who had hoped that the report would furnish the scientific underpinnings for a national air quality standard to control lead (which would require evidence of a danger to health or welfare) showed considerably less exuberance.

The EPA still plans to announce in mid-December the first federal controls on leaded gasoline since the antiknock additives were introduced in 1923. At the least, EPA officials say, they expect to require that oil companies begin selling one grade of unleaded gasoline by 1974, with the expectation that the market for leaded gas would disappear of its own accord 8 to 10 years thereafter.* Backed with sufficient evidence of its hazard to health, EPA officials say they could also impose a national air quality standard for lead—a more severe measure that would speed the demise of leaded gasoline by 3 to 4 years. But they indicate, somewhat grudgingly, that the academy report has made such a standard harder than ever to justify. "It is a conservative document . . . we would like to have seen a little more enthusiasm for getting the lead out," one source in the Air

* Amendments to the federal Clean Air Act in 1970 permit the EPA to control fuel additives if these are shown to impair the operation of pollution control devices. Beginning in 1974, new cars are expected to use catalytic mufflers to reduce smog-generating emissions. Particles of lead in the exhaust degrade catalysts intended for use in the mufflers.

Programs Office said. Another confided that the academy panel "pretty well pulled the rug out from under us."

Eighteen scientists had a hand in writing the lead report's eight chapters and seven appendices. During their service on the panel, 4 of the 18 authors were employed either by the E. I. duPont de Nemours Company or by the Ethyl Corporation, which together produce most of the approximately 260,000 tons of lead additives burned each year in the United States. Names of the authors were not linked to their specific contributions in the 200 advance copies of the lead report issued in September, but they will be in an edition to be published early next year. According to Louise Marshall, the NRC staff officer who assisted the panel, part of the first chapter, dealing with lead in the ecosystem, was written by Gary Ter Haar, of Ethyl; part of chapter 7, a discussion of nonbiological effects of lead, was written by John M. Pierrard, of duPont; and the first appendix, on measurement of the size of airborne particles, was the work of Kamran Habibi, of duPont.

A contribution far more substantial than these, however, was made by Gordon J. Stopps, a duPont researcher whose views on the hazards of airborne lead have long been taken as representative of the industry's position. Stopps wrote the sixth chapter, which dealt with the role in air pollution of lead additives themselves, as opposed to their combustion products. He also wrote the report's discussion of "epidemiology of lead in adults," a topic of particular interest to the EPA. Stopps has since left duPont and moved to the Canadian Department of Health in Toronto.

The first complaint about the authors' affiliations was lodged with the academy by Harriet Hardy in the summer of 1970, shortly after the panel first convened. Long associated with M.I.T. and Massachusetts General Hospital, she was one of two preeminent figures in the field of metal poisoning who were asked by the academy to serve as anonymous, outside reviewers of the lead report as it progressed through several drafts. The other outside reviewer was Robert A. Kehoe, an emeritus professor at the University of Cincinnati's Kettering Laboratory. A medical consultant to the Ethyl Corporation since the late 1920's, Kehoe had the distinction of being cited in the lead panel's list of references a dozen times, more than any other researcher.

In her letter to the academy, Hardy protested that the list of authors was "top heavy" with industry scientists in general and with Stopps in particular. Tsaihwa J. Chow, a research chemist at Scripps Institution of Oceanography at La Jolla, and a contributor to the report's first chapter, filed a similar complaint this past August, soon after he learned of Stopps' contribution. Chow said that even if Stopps were not biased, his association with the panel as an industry scientist would damage the report's credibility.

Both Hardy and Chow were told that it was academy policy to draw experts from wherever they might reside, without regard to affiliation. Elaborating on this policy, Marshall told *Science* that the issue of conflict of interest was discussed in the first BEAP committee meeting in the spring of 1970. She said academy officers "made it clear that committee and panel members were being asked to serve as scientists and not as representatives of their organizations." Moreover, she said, it was the academy's experience that industry scientists "tend to lean over backwards to be fair."

Hardy and other critics of the lead report remain unconvinced, however, that declarations of neutrality mean very much. "How could he be neutral?" she said of Stopps, in a telephone interview last week. "He has written and written for years that there's nothing harmful about tetraethyl lead. . . . It's just not possible for him to act purely as a scientist." She said that the academy seemed naive in its use of industry scientists and noted that "it's a queer thing that they haven't learned what other government agencies have about the objectivity of industry."

For his part, Stopps points out that he was the only industrial scientist actively involved in the panel's deliberations. "It's flattering that someone might think I could sway that group," he said in a telephone conversation. "But given that ratio, it's highly unlikely that one person could railroad the whole panel." Nevertheless, he said, allegations of conflict of interest are not to be lightly dismissed. "It is a sensitive issue, and obviously the academy has to decide on some sort of industry and nonindustry ratio," he said.

Reports turned out by the National Research Council go through an elaborate system of internal review aimed at sifting out inaccuracies, faulty logic, editorial awkwardnesses, and, presumably, bias. The lead report was no exception. Each of its four drafts was examined by the full BEAP committee, by professional staff at the academy, and by a special reports review committee headed by George B. Kistiakowsky, vice president of the academy.

Along the way, many editorial changes were made in the report, even though critiques generated in the review mill are not formally binding on the panel. But what did not change along the way, in the view of Paul B. Hammond, the chairman of the panel, was the report's reflection of the panel's attitudes toward the hazards of lead or the lack thereof. Hammond, a University of Minnesota veterinarian, said his group took pride in its independence. He said changes inflicted on its work were "mostly editorial," not philosophical. Harriet Hardy concurs: "I can see individual viewpoints coming through, including Stopps'," she said.

An academy public affairs officer said said that seemingly the most effective means of compensating for the biases of advisory panels is simply to strive for a balance of opposing philosophies. As he expressed it, "Whether this is naive or not, the feeling is that, if a panel is balanced, then a person with any conflict of interest will not carry undue weight."

In Hardy and Kehoe, the academy struck something of a balance between left- and right-wing views of lead pollution. But no such balance was apparent within the panel itself; in the opinion of members who were contacted, there was no identifiable "environmentalist" among them who might have served as a counterpoise to industry's weight.

Critics in the environmental health community point to at least two respected researchers who might have filled that role. Oddly enough, both were among some 50 nominees considered for membership on the panel by the academy staff, and both were pointedly rejected. One was John Goldsmith, the head of the California Health Department's epidemiology unit. He served on a previous NRC committee that studied carbon monoxide pollution, and he is noted for having described a regression line associating concentrations of lead in human blood with those in the surrounding air. This relation was of central interest to the lead panel, although industry scientists insist that it does not apply to amounts of lead commonly found in urban air.

The other rejected environmentalist was Henry A. Schroeder, head of Dartmouth College's Trace Metals Labora-

tory. He is noted for pioneering studies of environmental lead in human tissue and for discovering evidence that Americans take in more lead than they excrete. Both Goldsmith and Schroeder are cited in the 300-page body of the report, but neither was invited to contribute directly to the project.

Their rejection was apparently for reasons that had little to do with their credentials. Academy staff were reluctant to discuss the matter, but it was learned that some staff members of the academy regarded the two men as incompatible with the rest of the panel and as potentially "disruptive." Colleagues of the two vigorously dispute this opinion.†

Paul Hammond, the chairman, confirmed that "the word I got was that they were unacceptable. But I left all that up to the academy staff. All I wanted was the most competent people."

Apart from questions of its membership, the lead panel has given rise to accusations that it had a pro-industry bias—or at least the appearance of one—by virtue of its curious selection and treatment of data from an important government-industry study of lead in the air of seven U.S. cities. The panel only indirectly acknowledged the existence of one set of data from the study, which runs counter to the panel's conclusion that airborne lead concentrations have not, for the most part, changed greatly in 15 years. But the panel made explicit reference to other data from the same study indicating that—as the lead industry contends—no meaningful relation exists between lead in blood and lead in the surrounding air.

National Survey

The data in question come from the so-called "seven cities study," one of the most extensive surveys of lead in the air and in human populations ever conducted. Begun in 1968 and still not quite completed, the seven cities study is the sole enterprise of the Joint Government-Industry Subcommittee for Surveillance of Air and Population Lead Levels. The subcommittee is a unit of the Lead Liason Committee, one of the many industry advisory groups to federal agencies (in this case, to the EPA). Chairman of the subcommitte is Robert J. M. Horton, an EPA scientist who served as the agency's observer in meetings of the academy lead panel. Stopps, of duPont, was also a member.

† Informed that this was to be reported, an academy officer recanted, saying the two had been passed over because one was in ill health and the other was being saved for another appointment.

In November 1970, the subcommittee reversed a prior policy of not releasing any data from the seven cities study to anyone, and made public two sets of data gathered in Los Angeles, Philadelphia, and Cincinnati. One set dealt with concentrations of lead in the air and the other with concentrations in the blood. The academy report explicitly summarized the latter, noting that:

"In a preliminary examination of data from a more recent study [than one conducted in 1961–63] involving 1441 women, no relation could be detected between exposure to lead in the ambient air (0.17 to 3.39 micrograms per cubic meter) and blood lead."

The source was described not as the seven cities study but as a personal communication from one L. B. Tepper. He is project director of the study, at the Kettering Laboratory.

The other set of data released in November showed that, during the 1960's, airborne lead increased at 17 of 19 measuring stations in the three cities described. Increases at Los Angeles sites ranged from 33 to 64 percent above values measured at the same sites in 1961–62; from 2 to 36 percent in Philadelphia; and from 13 to 33 percent in Cincinnati. In its most direct reference to this information, the academy report states that:

"Preliminary data on samples taken in 1968–69 from the same sites as in 1961–62 indicate that air lead concentrations at some individual sites are higher than in 1961–62."

Writing about changes in air-lead levels in his chapter of conclusions, Hammond said, "We are, in short, not dealing with a rapidly shifting scene in this respect. However, more recent information is not in complete agreement with this conclusion and may slightly modify it." Hammond went on to note that the data in question could be properly considered only if the lead panel were reconvened.

In his August letter of protest, Chow, whose own published research suggests a rapidly escalating amount of airborne lead in the San Diego area, asked the academy to reconvene the panel as Hammond suggested. In denying his request, Louise Marshall replied that the air-lead data had become available to the academy only last April, 6 weeks after the lead panel's final meeting. Thus, she said, it was beyond the panel's mission even to acknowledge its existence. Besides Chow, Delbert C. Barth, the chairman of the Lead Liason Committee and EPA's contract manager for the academy study, said he too was puzzled at the report's selectivity.

The explanation, according to Hammond, is that the lead panel received the blood-lead data from EPA's Robert Horton promptly in November but did not become aware of the air-lead data until April. "In November, I did get data on the women," he recalls. "But neither I nor Louise Marshall remember receiving the aerometric data on the three cities until April. But Horton said he sent it."

A similar mixup occurred when the lead subcommittee decided to release its information last November, just before the California Air Resources Board was to hold hearings on a proposal by the California Health Department to adopt a statewide limit on airborne lead. State health authorities, John Goldsmith chief among them, had asked for an advance look at the data but received no reply from the lead subcommittee. The Ethyl Corporation, however, did have an advance look at the data. Howard Hesselberg, one of Ethyl's two representatives on the Lead Liason Committee, used the data at the California hearings to support his company's contention that the standard was unjustified. The standard was later adopted. Delbert Barth, who said he was out of the country when the data were initially released says, "The situation would have been handled differently had I been there."

In the overview, there appears to be no evidence that the lead panel's biases, whether real or illusory, were deliberate. More likely, they are an expression of the academy's innate conservatism and the product of a lingering 19th century faith in the virtue of industry and the impartiality of scientists.

When the old National Air Pollution Control Administration (now part of the EPA) signed its contract with the academy last year to procure advice on pollutants, it did so in order to counter industry criticism that the background papers it was using to justify ambient air quality standards were faulty. In turning to the academy, it may be that conservatism was the price the old NAPCA and the new EPA paid for credibility. Nevertheless, EPA officials say they still feel free to accept or reject the academy's interpretation of the literature it compiles. As Irwin Auerbach, of the Office of Air Programs puts it, "We can use the bulk of the lead report or we can reject it if we feel it's slanted. But bias is not the sort of thing you expect to come from the National Academy of Sciences."—ROBERT GILLETTE