THE IMPACT OF SCIENCE AND TECHNOLOGY ON THE RESOLUTION OF DIOXIN CONTROVERSIES

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ABSTRACT

The first public outcry on the dangers of "dioxin" occurred twenty years ago. Since that time a tremendous expenditure of human and financial resources has been devoted to scientific studies of the toxicology, environmental fate and human risks of the chlorinated dibenzo-p-dioxins and dibenzofurans. Today, the technology to detect and monitor these chemicals in our environment exceeds our ability to assess their biological significance. Experience has shown that we are not dealing with purely scientific problems but rather with sensitive and complicated political and social issues.

INTRODUCTION

Twenty years ago (1970) Courtney et al. published a short article in Science (168: 864-866) entitled "Teratogenic evaluation of 2,4,5-T". Although the article in itself was of scientific importance, it was the postscript added after galley proofs that proved to be of greater importance. The postscript noted that the herbicide contained 2,3,7,8- tetrachlorodibenzo-

p-dioxin (TCDD) as a contaminant, and that the teratologic observations may have been associated with the contaminant. The polarization within the scientific community over the biological risk of the "dioxin" contaminant was both swift and decisive. There were few neutral parties!

Confounding the resulting debates was the political and military sensitivity associated with the use of 2,4,5-T herbicide in "Agent Orange", a defoliant widely used in the Vietnam Conflict. While the American Press reported the teratogenicity of 2,4,5-T in laboratory animals, South Vietnamese newspapers published reports of birth defects in areas sprayed with Agent Orange. These reports elicited far-reaching reactions from governmental agencies, segments of the scientific community, and various emerging lay groups concerned with environmental health problems (4).

The dioxin controversy demonstrated how difficult it is to find solutions to environmental and public health problems. Proposed solutions have been costly (e.g., Seveso, Italy), the research has been complex (e.g., Agent Orange) and the risk assessments have not been easily explained to lay audiences (e.g., dioxins from municipal incinerators or in paper pulp). And lastly, the solutions to many of the environmental problems have required national and international cooperation(e.g., the contamination of the Great Lakes between Canada and the United States).

There have been many approaches to solving the various dioxin episodes:

* Media and publicity,
* Lawyers and litigation,
* Politics and money, and
* Reason and scientific data.

The first three of the approaches are the realities associated with difficult issues that have large social consequences; but only reason and scientific data can be the basis for eventual, lasting solutions.

In April 1973, the U.S. National Institute of Environmental Health Science sponsored the first major conference, the "Quail Roost" Conference, on dioxin with the purpose of assessing the status of the science and more clearly defining the researchable questions. At the time the term "dioxin" specified the 2,3,7,8-TCDD isomer. The progress the toxicologists had made in defining the extreme toxicity of 2,3,7,8-TCDD was overshadowed by the announcement of Baughman and Meselson that they had found dioxin in the parts-per-trillion concentrations in human and environmental samples from South Vietnam (1). The responsiblity of the chlorophenol industry and the government of the United States to fund analytical and epidemiologic studies was obvious.

The disposal of Agent Orange, the Missouri horse arena episode, the Seveso, Italy dioxin episode and the evacuation of Love Canal brought world-wide visibility to dioxins. In addition, controversies involving contamination of aquatic ecosystems, the chemistry of fires and the Binghamton office building contamination provided a never-ending stream of newpaper articles.

As a consequence of the massive funding for dioxin research the scientific community made remarkable progress in documenting the toxicity of not only 2,3,7,8-TCDD but also many of the other isomers of the chlorodibenzo-p-dioxins and dibenzofurans. The analytical chemists have advanced the technology to the point that they can now measure dioxin in human blood and in the environment at fentogram concentrations (1×10^{-15}g). The knowledge of patterns of morbidity, reproduction, and mortality in human populations generated from the numerous epidemologic

studies will serve as models and provide baseline data for years to come. In summary, significant advancements have been made in almost every field of science as a result of the intense interest in dioxins. The technologies developed for the cleanup operations in the Missouri, Seveso, and the Binghamton office building episodes have wide application to other situations.

Ferguson (2) reminds us that "Science certainly thrives on controversy and we need that controversy to move forward." As to whether science will resolve controversies, Gough (3) notes "...we are not dealing with purely scientific issues. The scientific conclusions, while very important to us to understand whether or not dioxin and Agent Orange cause disease, are less important to society than the decisions that are made in the courtroom and in the congressional hearing rooms." It can only be hoped that the decision-makers are wise enough to use science as a major contributor to the process.

REFERENCES

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