

Reliability Assessment of 2, 3, 7, 8-tetrachlorodibenzo-*p*-dioxin and Toxic Equivalent Serum Dioxin Measurements from Persons Completing all Three Blood Collection Rounds in the Times Beach Dioxin Incinerator Exposure Study

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Introduction

In 1971, dioxin (2, 3, 7, 8-tetrachlorodibenzo-*p*-dioxin; TCDD) contaminated industrial sludge waste from a hexachlorophene production facility in Verona, Missouri was mixed with waste oil and sprayed for dust control on residential, commercial, and recreational areas of eastern Missouri. The 1990 Record of Decision (ROD) for the Times Beach Superfund Site and 26 other eastern Missouri dioxin sites called for thermal destruction of contaminated soils and other materials.⁽¹⁾ Approximately 265,000 tons of soil and other materials containing TCDD from the 27 eastern Missouri sites was burned at the Times Beach, Missouri Superfund Site during the period March 17, 1996 through June 21, 1997. Times Beach was formerly an incorporated city located in southwest St. Louis County, approximately 30 miles from the City of St. Louis. TCDD concentrations in the soil materials ranged from one part per billion (ppb) to approximately 3000 ppb.

Although community members in the vicinity of the former Times Beach, now Eureka, Missouri had numerous opportunities in the late 1980's to comment on the ROD, many local and eastern Missouri citizens grew increasingly concerned for their health and safety due to potential exposure to a hazardous waste incinerator. The Missouri Department of Health (DOH) has been actively involved in assessing risks to human health from environmental contaminants since the announcement of dioxin at Times Beach in December 1982. To assure the community and other citizens of the safety of this incineration process, the DOH continuously monitored activities related to this project. As implementation of the incineration grew closer, however, citizens grew more concerned about the project. Because an accurate biomarker of dioxin body burden is available and the collection of body fluids for determination of the biomarker is easily

accomplished, the DOH conducted an exposure study of persons residing in the vicinity of the Times Beach dioxin incinerator site. The intent of the study was to notify the community of its potential exposure in a relatively short time period after the incineration process began and to determine if concentrations of TCDD in community members significantly increased during the period of incinerator operation.

Methods

The intent of this study was to collect pre-, mid-, and post-incineration serum samples from a group of persons potentially exposed to emissions from a dioxin hazardous waste incinerator. From air dispersion and deposition modeling, the DOH determined a population potentially at risk of exposure. Based upon census tract information of this population contained in the 1990 U. S. Census data, the DOH chose a comparison population that was similar in socio-economic status. The comparison census tract is located in the city of Manchester, Missouri, approximately 15 miles west of the City of St. Louis. The census of the study and comparison areas, random sample population, recruitment procedures, and eligibility requirements are being described in a different report at Dioxin 98.

Participation by the 76 study and 74 comparison group members included three blood specimen collection rounds, answering a questionnaire, determination of height, weight and blood pressure, and donation of approximately 350 to 495 milliliters of whole blood. All blood collection was by trained professionals from the St. Louis University Medical Sciences Center during six consecutive clinic days in each round. Whole blood samples were processed by St. John's Hospital Laboratory, St. Louis. Serum TCDD, other congeners of dibenzodioxins and dibenzofurans, polychlorinated biphenyls (PCB), and lipid laboratory analyses on the serum specimens was performed by Division of Environmental Health Laboratory Sciences, Centers for Disease Control and Prevention using previously described methods.⁽²⁾ The limit of quantification for most all analyses was 0.8 parts per trillion on a lipid adjusted basis.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) and included descriptive and inferential statistical analysis.

Results

The middle blood sample, obtained four months after incineration began, was collected for use in assessing the possibility of community exposure within a relatively short time after initiation of the incineration process. Upon receipt of the first and second round serum results, the findings were analyzed for the range of the comparison group and the averages of both groups on TCDD only. The results of this limited analysis were reported in November 1996 to the community. A mean of 1.81 parts per trillion (ppt) for the first round and 1.24 ppt for the second round with a mean decrease of 0.57 ppt was reported

for the study group. The comparison group had similar findings on the first and second rounds with means of 1.43 ppt and 1.38 ppt and a mean decrease of 0.05 ppt. Community members opposing the incinerator rejected the findings and elicited comments from dioxin experts who disputed the results as impossible based upon the suspected half-life of TCDD. Comments from the experts served to assist the opposition faction in increasing community outrage against the incinerator process. This analysis grew from the citizen outrage after release of the two mean results and mean differences in each group.

We determined through review of the literature that a Ranch Hand Study report had a similar decrease in mean results of 7.75 ppt, using paired serum TCDD measurements on 46 veterans over a comparable time frame.⁽¹⁾ We chose to look at the differences between all three rounds to determine reliability.

However, overall results of that analysis cannot be reported at this time since our study is pending final peer review. Because of grant requirements the results and conclusions cannot be released until the peer review is completed through the Agency for Toxic Substances and Disease Registry. Completion of this process and release of the results to the participants is expected for mid-to late-June 1998. Therefore, the first actual public and scientific release of this comparison analysis will be during Dioxin 98. A complete copy of the analysis for Dioxin 98 attendees will be made available at the conference.

References

1. U. S. Environmental Protection Agency, Record of decision for final management of dioxin-contaminated soil and final disposition of structures and debris at Times Beach, Missouri and the Minker/Stout/Romaine Creek Site, Missouri, 1990.
2. Missouri Department of Health, Dioxin exposure study from incinerator emissions, Times Beach, Missouri protocol, 1994, 14.
3. Michalek JE, Tripathi RC, Kulkarni PM, and Pirkle JL, The reliability of the serum dioxin measurement in veterans of operation ranch hand, 1996, *J of Exp Ana and Env Epi*, Vol. 6, No. 3, 327-338.

