

USFDA ASSESSMENT OF EXPOSURE TO 2,3,7,8-TCDD AND 2,3,7,8-TCDF FROM FOODS CONTACTING BLEACHED PAPER PRODUCTS.

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ABSTRACT

Migration studies with paper food-contact articles thought to represent the greatest potential for exposure to 2,3,7,8-TCDD/TCDF showed that measurable migration occurred with all articles tested. The USFDA combined these results with food consumption estimates to evaluate potential exposure to 2,3,7,8-TCDD/TCDF contaminants.

INTRODUCTION

In 1987, a cooperative screening study of five paper mills conducted by the USEPA and The National Council of the Paper Industry for Air and Stream Improvement (NCASI) demonstrated that 2,3,7,8-TCDD/TCDF are formed during chlorine bleaching of wood pulp. Residues of these contaminants were found to be present in bleached wood pulp, water effluent and sludge. The USFDA along with other regulatory agencies evaluated potential exposure to 2,3,7,8-TCDD/TCDF from cellulose derivatives produced from chlorine bleached pulp. The culmination of these efforts in April 1990 has been an integrated assessment of exposure and risk for dioxin congeners resulting from chlorine bleaching of wood pulp. This presentation will cover one component of USFDA's contribution to this effort, the assessment of consumer exposure from paper food-contact articles.

USFDA's contribution was based on information developed primarily by the U.S. paper industry, i.e., NCASI and the American Paper Institute (API). These organizations worked cooperatively with the USFDA and coordinated the development of information

needed by the USFDA for assessing consumer exposure to 2,3,7,8-TCDD/TCDF from a wide range of paper products.

EXPERIMENTAL

When USFDA addressed this issue detailed information was lacking on (1) which mills made bleached paper used in food-contact applications, (2) the levels of 2,3,7,8-TCDD/TCDF that were likely to be present in pulp or food-contact paper produced at these mills, (3) the end uses of paper products with food, and (4) the likely levels of migration of these contaminants during food contact.

In order to begin addressing the various data gaps and the enormous paper market, USFDA requested the paper industry to provide information that could be used to assess (1) which food-contact articles had the greatest potential for contaminating food with dioxin congeners and (2) which food-contact situations needed to be the subject of detailed migration studies. The USFDA, after reviewing the information provided by the paper industry, identified to the paper industry those articles thought to present the greatest potential for dietary exposure to 2,3,7,8-TCDD/TCDF. These **high priority** articles would require migration test data in order to develop reasonable estimates of exposure.

In response to USFDA's concerns, the paper industry conducted migration tests for coffee filters, cartons for milk, cream and juice, heavy cup stock for coffee and soup, dual ovenable trays, paper plates, and microwave popcorn. The migration tests were conducted in triplicate using representative articles under conditions thought to represent actual use conditions, or in some instances, the most extreme conditions of use. Actual foods were used for all of the tests. Since full congener analyses of bleached wood pulp, conducted by NCASI, had shown that between 93-100% of the dioxin toxic equivalents (TEQ)¹ in the pulp were accounted for by 2,3,7,8-TCDD/TCDF, the analytical methods supporting the migration studies² focused on measuring these two

congeners and 1,2,7,8-TCDF, a relatively non-toxic congener that is thought to serve as a marker residue for chlorine bleached pulp. Spiking and recovery studies were used to validate all of the analytical findings.

RESULTS AND DISCUSSION

All of the paper articles subjected to migration testing were observed to yield detectable levels of transfer of dioxin congeners to test foods. Dioxin TEQ levels in the test articles ranged from ≤ 2 -24 ppt. Dioxin TEQ migration levels to foods (corrected for background contamination) ranged from ≤ 1 ppq (coffee cups) to 140 ppq (paper plates). In the case of milk cartons, migration of the dioxin congeners to refrigerated milk was observed to follow a square root of time relationship, suggesting that the transfer follows Fickian diffusion kinetics. The temperature of the foods, their composition, the nature of the paper article, as well as the level of dioxin congeners were all found to influence the extent of transfer to test foods. USFDA used the results of these migration studies and the weighted mean levels of 2,3,7,8-TCDD/TCDF in bleached pulp for all manufacturers of each of the paper articles for estimating the likely levels of 2,3,7,8-TCDD/TCDF in food contacting each of the articles.

In order to estimate probable exposure to dioxin congeners, USFDA combined the observed migration levels with estimates of the amount of food consumed each day that might have been in contact with each of the paper articles studied. Available nationally representative food consumption data bases provide only a limited amount of information on whether foods are sold, held, heated, cooked, or served in contact with different types of packaging materials. Thus, USFDA made the conservative assumption that food consumption patterns reflected in these data bases also reflect the food consumption patterns of foods that might contact paper articles containing 2,3,7,8-TCDD/TCDF. In essence, this approach assumes that all of the food consumed by an individual has contacted the paper article of interest prior to consumption. Taking this approach, USFDA estimated exposures for individuals who were high consumers of

foods from individual food-contact articles (e.g., milk cartons-2.0 pg/p/day, coffee filters-2.0 pg/p/day, coffee cups-0.5 pg/p/day, paper plates-10 pg/p/day, and microwave popcorn-1.4 pg/p/day) and exposures for individuals who consumed an average amount of food from all paper food-contact articles (i.e., 9.1 pg/p/day). Considering that this assessment of exposure employed a number of conservative assumptions and used pulp dioxin TEQ levels that were determined prior to recent extensive reductions, it is expected that actual consumer exposures from paper food-contact articles are less than these estimates.

References

1. North Atlantic Treaty Organization. Pilot Study on International Information Exchange on Dioxins and Related Compounds, Report No. 178.
2. NCASI Technical Bulletin No. 551. NCASI Procedures for the Preparation and Isomer Specific Analysis of Pulp and Paper Industry Samples for 2,3,7,8-TCDD and 2,3,7,8-TCDF.