

MICHIGAN STATE UNIVERSITY

Rich Whiting
Vice President
Agricultural, Pet and Pellet Sales and Marketing

AMERICAN WOOD FIBERS

1-800-624-9663

email: rwhiting@awf.com

August 30, 2012

Dioxins in Wood Pulp Products

It is well recognized that 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and like compounds have a negative impact on a wide range of organ systems in many animal species. Therefore, dioxin testing was conducted by two independent laboratories on 28 unique wood pulp and paper products used as a bedding material for pets. The purpose of this testing was to identify wood pulp products containing dioxin or dioxin-like compounds that may render the final commercial product contaminated. We offer here an interpretation of their findings.

It is important to note that neither the authors of this document nor the Michigan State University Diagnostic Center for Population and Animal Health cannot attest to the quality of the testing performed by these independent analytical laboratories, but rather are interpreting the results provided by them at the request of American Wood Fibers. For the purposes of this review, therefore, the authors make the not unreasonable assumptions that the analytical methods of the labs and therefore their results are valid. However, the MSU DCPAH cannot be held liable for any inappropriate use made of the results of the independent laboratories mentioned below, nor for any such use made of our expressed opinions.

The two laboratories conducting the analyses were Summit Environmental Technologies and Pace Analytical. Summit Environmental Technologies conducted 8 tests while Pace Analytical conducted the remaining 20 tests. The method of analysis utilized by both laboratories is EPA Method 1613B. This method is the EPA method of choice for Safe Drinking Water Act (SDWA) compliance testing and to meet the effluent monitoring requirements of the Pulp and Paper Industry. The sum of dioxin and dioxin-like compounds present in these samples were reported as toxic equivalents (TEQ). Pace admits to using a NATO-derived convention (ITE factors or ITE TEQ) for TEQ in which only isomers with chlorines in the 2, 3, 7, and 8 positions were considered of toxicological concern. This approach has been found to make the most extensive use of the original toxicity database for chlorinated dibenzo-p-dioxins and is therefore considered the most reliable. The TEQ is therefore an estimate of the toxicological equivalence of a complex mixture to the most toxic known chlorinated dibenzo-p-dioxin 2,3,7,8-TCDD (1). TEQ



College of
Veterinary Medicine

Diagnostic Center
for Population
& Animal Health

4125 Beaumont Road
Lansing, MI 48910-8104

517.353.9053
FAX: 517.353.5096
animalhealth.msu.edu

MSU is an affirmative-action,
equal-opportunity employer.

values in the samples ranged from 0 to 1.1 ng/kg (part per trillion; ppt). Summit Laboratory reported 3/8 positive samples (range 0.003 to 0.409 ng/kg). Pace Analytical reported 12/20 positive samples (range 0.017 to 1.1 ng/kg).analyzed. The following compounds were present as components of the TEQs in the samples that reported positive: 1) 2,3,7,8-TCDF, 2) 1,2,3,4,6,7,8-HpCDF, 3) 1,2,3,4,6,7,8-HpCDD, 4) OCDD. In addition, other chemical variants, or isomers, were reported as totals of all chlorinated species for that substructure, including TCDF, TCDD, PeCDD, HxCDD, HpCDF, HpCDD. It is important to note that the predominant chemical species present in the pulp products were octachlorodibenzo-p-dioxins, heptachlorodibenzo-p-dioxins, heptachlorodibenzo-p-furans, tetrachlorodibenzo-p-dioxins, and tetrachlorodibenzo-p-furans. The less toxic octachlorinated and heptachlorinated chemical species were either the predominant chemical species present or equivalent in concentration to the more toxic tetrachlorinated chemical species. Moreover, 9 of the 15 positive samples were observed in reclaimed paper pulp products, with 6 / 9 having TEQs greater than 0.1 ppm. Only 2 other samples (byproduct paper and pelletized recycled newspaper) had a TEQ greater than 0.1 ppm. A majority of the byproduct paper and wood shaving samples were negative for dioxins.

Interpretation of these results needs to be approached cautiously. Dioxin and dioxin-like compounds are considered to be ubiquitous, particularly in more industrialized nations. These compounds arise from natural and manmade processes that lead to emissions and deposition throughout the environment. Human and animal exposures occur predominantly through food consumption and soil contact. Contact with dioxin-contaminated dust particulates is inevitable for wood pulp and paper products. The TEQ levels reported (0.003 to 1.1 ng/kg) for the wood pulp products tested are likely to be representative of background level environmental deposition of dioxins in soils at their point of origin. For example, in the State of Michigan dioxin levels in soil range from 0.4 ng/kg near the city of Gaylord to 35.0 ng/kg in the Seney Wildlife Refuge for a state average of 7.5 ng/kg (2). Therefore, wood pulp originating from the Seney Wildlife Refuge would be expected to have significantly greater amounts of dioxin-like compounds associated with it.

In summary, 13 products tested negative for dioxin and dioxin-like products. There is an inherent health benefit to minimizing cumulative dioxin exposures and such exposures should be avoided whenever practical. The presence of dioxins in the remaining 15 products represents levels that may be indicative of background environmental contamination present at their source. Based on the findings of this limited initial study, it is important to note that pet beddings made with reclaimed pulp fibers are more likely to contain detectable levels of dioxin than wood shavings or byproduct papers.

The levels summarized for these dioxin and dioxin-like products are generally too low to be associated with any acute toxic effects. However, the potential for inducing chronic or subchronic toxicities could be considered. The EPA Integrated Risk Information System (IRIS) [<http://www.epa.gov/IRIS/>] has a document summary on 2,3,7,8-Tetrachlorodibenzo-p-dioxin and currently lists an RfD or reference dose for human exposure to 2,3,7,8-TCDD of 7×10^{-10} mg/kg-day. The effects of chronic exposure are principally decreased sperm count and motility in men exposed to TCDD as boys. The RfD is the equivalent of oral exposure to 7×10^{-3} ng per day for a 10 kg animal, making the assumption that the human RfD is equally applicable to animals as well as humans. For a bedding material at 0.1 ng/kg, a roughly median value among the reported TEQ values, such an animal would have to orally consume 0.07 kg or 70 g daily in order to achieve this level of exposure. This behavior should be considered highly unlikely for the majority of consumers, and the far

more likely route of inhalation exposure would reduce the overall TCDD equivalents load by orders of magnitude. The EPA is still working on assessing the carcinogenicity risks of TCDD exposure, so similar calculations for cancer risk are currently not possible.

As a practical matter, it might be prudent for American Wood Fibers to restrict use of wood fibers to those below a selected cutoff TEQ value, say 0.5 ng/kg. That particular cutoff is likely to be conservative, and would have caused the rejection of four of the 28 analyzed specimens, or 14%.

We commend your company for being proactive in limiting animal exposure to toxic polychlorinated dibenzo-p-dioxins and -furans and feel certain that your ongoing monitoring program provides long term benefit to animal health.

References:

- 1) California Department of Toxic Substances Control, Office of the Science Advisor, Chapter 9, A Toxicity Equivalency Factor Procedure for Estimating 2,3,7,8-Tetrachlorodibenzo-p-dioxin Equivalents in Mixtures of Polychlorinated Dibenzofurans and Polychlorinated Dibenzofurans (1996)
<http://www.dtsc.ca.gov/AssessingRisk/upload/chap9.pdf>.
- 2) Michigan Background Dioxin Sample Locations and Results:
http://www.michigan.gov/documents/deq/deq-whm-hwp-mi-soil-bkgd-dioxin-data_251085_7.PDF



John P. Buchweitz, Ph.D.
Clinical Toxicologist
Michigan State University Diagnostic Center
For Population and Animal Health
Toxicology Section



Andreas F. Lehner, Ph.D.
Analytical Chemist
Michigan State University Diagnostic Center
For Population and Animal Health
Toxicology Section