COMMENTS ON
"TESTS OF PCB RELEASES DURING BURNING ACTIVITIES AT
RAVENNA ARMY AMMUNITION PLANT
DRAFT PHASE 1 TEST PLAN"
Prepared for Citizens for Safe Water Around Badger
By
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Introduction

In response to questions about the safety of an open burn by Citizens for Safe Water Around Badger (CSWAB), the Army is conducting a series of experiments to evaluate the formation of a class of toxic compounds known as dioxins when PCB based paints are burned. The Phase 1 experiments are meant to evaluate the amount of PCBs released when the paints are exposed to high temperatures and to provide a starting point for further inquiry. The second phase of testing which is not described here will be designed to simulate real world conditions.

General Comments

The Test Plan is flawed in a number of ways from the outset. The stated objective of the study is to evaluate the release of PCBs from heated paint samples. However, the release of PCBs is only a secondary risk from the burn while the formation of dioxins is the main cause for concern. The design of the experiment is fortunately more tuned to the actual risks than the written objectives, but still contains many shortcomings. Many of these appear to stem from a lack of background research on the topic of PCB combustion. The Introduction of the plan makes no mention of the vast volume of literature compiled on the subject, and the entire plan suffers as a result. In its current form, the plan is not particularly detailed, which may also be related to a lack of research prior to its completion.

The most obvious problem of the experimental design is that it does not clearly state how many samples will be tested. The Experimental Design Section states that at least four samples (2 high concentration and 2 medium) will be tested in triplicate. The Army needs to be more specific about the number of samples used as this is one of the most influential aspects of experimental design and the number used could drastically affect the outcome of the experiment.

A more serious problem in the design of the experiment is that the same samples are to be measured at different temperatures over the course of an hour. This approach does not account for any PCB loss/dioxin creation at lower temperatures, and will measure the samples at a high temperature after the reactions that create dioxins from PCBs may have already occurred. The result

will almost certainly be one that implies higher temperatures cause lower dioxin emissions, when it is unclear if this is the case. In fact, dioxin formation has previously been observed in pyrolysis experiments with temperatures up to 900°C or 1,652°F (Rubey et al 1985). Dioxin formation is believed to begin occurring at 270°C or 518°F (Hutzinger et al, 1985). If the Army is to obtain accurate measurements, they should introduce fresh samples at each temperature. Without such a change, all but the samples taken at 400°F and possibly 600°F will be virtually meaningless. As it is currently designed, the experiment is only measuring the creation of dioxin created from the samples over a time period where gradual heating occurs. While useful to know, there are many other parameters involved in dioxin formation that the Army does not address.

Dioxin formation via the pyrolysis of PCBs is a very complicated process and can occur through a variety of pathways (Paasivirta et al, 1985). The experiment does not address a number of these variables such as oxygen levels or residence time. Available oxygen levels have been found to significantly influence the formation of dioxins during the exposure of PCBs to high temperatures (Erickson et al 1989, Sakai et al 1996). The current experimental design assumes “ambient air environment,” which may not be the case during an open burn. Residence time, or the length of time that the sample remains in the post combustion zone was found by Fängmark et al (1993) to be the most significant factor influencing dioxin formation. The Army’s experiment does not make any attempt to measure this parameter.

Another gap in the experimental design of the Army’s plan is the lack of sampling for compounds known to be intermediates of dioxin formation such as polychlorobenzens, chlorinated naphthalenes, and monomeric chlorophenols (Paasivirta et al, 1985). The presence of these compounds in air samples could indicate that further dioxin formation may occur in an actual burn, and would also assist the Army in its mass-balance calculations. In addition, some these compounds present health risks of their own and their formation rates should be measured for these reasons alone.

In summary, the Army’s plan to evaluate potential dioxin releases from the combustion of PCB based paint is inadequate to obtain the amount and types of information needed, and may in fact provide inaccurate results for higher temperature reactions. These flaws appear to stem from a lack of background research and in turn the absence of measurement for certain variables such as oxygen levels or residence time that significantly influence the chemical processes by which dioxins are formed. It is recommended that the Army redesign this experiment significantly before proceeding.

Literature Cited

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Citizens for Safe Water Around Badger (CSWAB) is working to mobilize and empower rural communities near Wisconsin's Badger Army Ammunition Plant in support of a sustainable future that will protect and restore the integrity of soil, water, air, and biological diversity.

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