RE-THINKING OUR APPROACH TO ADDRESSING EXPOSURE TO PBTs - NEW HAMPSHIRE'S DIOXIN REDUCTION INITIATIVE: A CASE STUDY

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Introduction

The New Hampshire Department of Environmental Services (DES) has long recognized the health risks posed by toxic pollutants and has been a national leader in reducing human exposure to these environmental contaminants. Over the past decade, DES has worked to reduce the levels of toxic pollutants in our air, water, and land through programs that include pollution control, waste minimization, resource recovery, and pollution prevention. According to EPA's Toxic Release Inventory[1], New Hampshire businesses have reduced their emissions of toxic chemicals to the environment by over 85% since the adoption of these initiatives.

Despite these important programs, results of recent biomonitoring studies[2] suggest that we may still have a long way to go in understanding and reducing our exposure to chemicals in our environment, particularly pollutants known as persistent bioaccumulative toxics (PBTs). Unlike other environmental pollutants, PBTs are generally emitted into the environment at very low or even non-detectable levels, but rather than become diluted, they tend to accumulate in the environment and build up in the tissues of animals and humans. Once they enter the environment, they do not break down and they transfer easily among the air, water, and land. They are difficult to control using conventional "end-of pipe" environmental control methods, their environmental impacts tend to be spread out over great distances, and their effects can be significant for many years.

Most of today's environmental control measures tend to focus on reducing the direct impact of chemicals on the air, water, or land in which they are released. For example, air pollution reduction programs typically focus on assuring that when a pollutant is released into the air, it does not pose an *inhalation* risk to people that breathe the air. Likewise, drinking water standards are based on assuring that contaminant levels in the water are *safe to drink*. However, these programs do not adequately address the health risks posed by PBTs that may be present at insignificant levels in the media in which they are released, but travel freely throughout the environment and concentrate in the food chain. Consequently, most human exposure to these chemicals is not a *direct* result of drinking contaminated water or breathing contaminated air, but rather *indirectly* through the consumption of foods in which they bioaccumulate.

Dioxin is one important PBT that has recently received renewed attention as a public health threat. Dioxin is now listed as a *known human carcinogen* by the U.S. Dept. of Health and Human Services, National Toxicology Program[3]. In addition, the US EPA's *DRAFT Dioxin Reassessment*[4] confirms that dioxin is a potent animal toxicant with the potential to produce a broad range of adverse effects in humans including reproductive effects, developmental effects, suppression of the immune system and cancer. The *DRAFT Reassessment* also concludes that the amount of dioxin found in the bodies of members of the general population (body burden) closely approaches the levels at which adverse effects are expected to occur, and that cancer risk from dioxin may exceed 1-in-1000 for some individuals.

Accordingly, environmental regulators may need to re-think their approach to effectively addressing pollutants such as dioxin and other PBTs. This paper presents a case study of the *New Hampshire Dioxin Reduction Strategy*[5] - New Hampshire's recent effort to proactively address

environmental and public health concerns regarding dioxin by quantifying and reducing dioxin releases from local sources within the state.

Methods and Material

The process of developing the New Hampshire Dioxin Reduction Strategy involved five main tasks:

- Define the term "dioxin" and summarize current science regarding dioxin origins, transport and fate in the environment,
- Review current understanding of dioxin exposure pathways, potential health impacts, and methods of risk management,
- Develop an inventory of sources and pathways by which dioxin enters New Hampshire's environment,
- Recommend actions to reduce the amount of anthropogenic dioxin released from New Hampshire sources, and
- Identify and take action to implement effective dioxin reduction efforts.

Brief descriptions of each of these tasks are provided below.

Dioxin Definition, Origins, Transport, Fate: DES recognized that "dioxin" is a term used to describe a broad category of pollutants with similar chemical structure, physical properties, and toxicological effects.   In order to assure that the *Strategy* would provide meaningful, useful and comparable data, DES reviewed current literature regarding common definitions of the term "dioxin", and agreed to define "dioxin" as the sum of the 2,3,7,8-TCDD toxic equivalents (TEQs) of the 17 toxic PCDD/PCDF congeners. DES also critically reviewed, summarized and reported current literature regarding the origins, transport and fate of dioxin in the environment.

Dioxin Exposure and Health Impacts: DES conducted a search of peer-reviewed literature on human exposure and health risks from dioxin. Summaries of the results from current literature were presented for Human Exposure, Health Effects, Fish Consumption Advisories, Risk Management, and Environmental Impacts.

Dioxin Inventory Development: In order to quantify statewide dioxin releases and focus dioxin reduction efforts on major New Hampshire sources, DES conducted a comprehensive, statewide dioxin emissions inventory. The inventory was based on 1999 data using statewide source-specific information in combination with available emissions test data, as well as published EPA emission factors[6]. For source categories where no test data or published EPA emission factors were available, DES conducted a literature search to identify emissions data from published technical papers or those used by other agencies that could be directly applied to New Hampshire sources. The inventory ultimately quantified and ranked environmental dioxin releases to the air, water and land from 22 stationary, mobile and area source categories. The resulting emissions inventory database was reviewed by multiple stakeholders including EPA, environmental groups, public health organizations and affected businesses and industries in New Hampshire; and was the first comprehensive inventory of dioxin releases conducted by any state.

Dioxin Reduction Recommendations/Action Items: Following inventory development, DES worked with stakeholders to make more than 50 recommendations designed to substantially reduce dioxin releases from all identified source categories. Rather than focus on separate programs for air, water and waste, these recommendations integrated reduction strategies from all media into a unified effort that encompassed regulatory actions, voluntary initiatives, and public education and outreach activities designed to both prevent and control dioxin emissions. Recommendations were also made to identify source categories where further research was needed to enhance the accuracy of subsequent dioxin emissions inventory efforts.

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Dioxin Reduction Implementation: A broad-based PBT Task Force made up of stakeholders representing business, industry, public health, environmental, and community interests was created to prioritize those recommendations that would result in substantial dioxin reductions with the least degree of difficulty in the shortest amount of time. Using these criteria as a basis for selection, the Task Force agreed to focus initial dioxin reduction efforts on a short list of priority action items for immediate implementation.

Results and Discussion
The comprehensive dioxin emissions inventory for New Hampshire identified 22 major source categories of dioxin releases in the state, five of which accounted for over 80% of total dioxin releases. The five major source categories included:

1. hospital/medical/infectious waste incinerators (29%),
2. wood-fired boilers and utilities (20%),
3. residential burning of domestic waste (17%),
4. residential wood combustion (10%), and
5. mobile source fuel combustion (8%).

The PBT Task Force recommended prompt regulatory action to reduce dioxin from two source categories - medical waste incineration and backyard trash burning. In response, a new state rule regulating emissions of dioxin and mercury from hospital, medical and infectious waste incinerators (HMIWIs) was put in place. After implementation of this rule, six of NH's eight existing hospitals operating medical waste incinerators reduced their generation of medical waste to the point where it was no longer cost effective to operate their incinerators, and permanently shut them down; resulting in a 95% reduction in dioxin emissions from this source category. In addition, in 2001 the NH legislature enacted a new law, *RSA 125-N*, which authorized DES to establish a statewide dioxin reduction and control program, and as its first action, *prohibited the practice of residential open burning of household trash in the state*. The prohibition on residential trash burning took effect in January 2003 after an extensive outreach effort was undertaken by DES to educate the public regarding the new law and its public health implications. By addressing and acting on these and other dioxin source categories, DES estimates that statewide dioxin emissions have already been reduced by at least 30%, and will result in an overall reduction of over 50% in the next two years.

Conclusions
The *New Hampshire Dioxin Reduction Strategy* is a-first-in-the-nation attempt to directly address public health concerns regarding exposure to dioxin by comprehensively identifying and quantifying dioxin releases for sources within the state, and implementing actions to reduce human exposure. The success of these efforts can be attributed in part to collaborative, multi-stakeholder participation in identifying and implementing common-sense solutions with collateral environmental benefits. DES recognizes, however, that despite the success of the *Strategy* in reducing in-state dioxin releases, much of the dioxin that New Hampshire residents are exposed to is generated out of state and transported many miles before being deposited here. In addition, much of our exposure to dioxin is through our diet, and many of the foods that we eat are produced outside of the state. Consequently, dioxin exposure for New Hampshire residents cannot be addressed solely by controlling in-state dioxin releases; rather, it is apparent that we must seek similar national and even global solutions. As a result, DES hopes that by taking the initiative to reduce our own dioxin emissions, New Hampshire can set an example and assist others in addressing the public health and ecological threats of dioxin contamination everywhere.

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References

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[3] *Report on Carcinogens*, Tenth Edition; U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, December 2002.

[4] *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds.* US Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, DC; September, 2000

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