Research Area: Product-Focused Research

Generally, research focusing on chlorine-specific products rests with the companies making these products. On occasion, manufacturers join together to pool their resources to sponsor research collaboratively. This section of the research plan addresses those questions where collaborative research initiatives can benefit the entire chlorine industry and the public.

To date, collaborative product-focused research has focused on the use of chlorine as a disinfectant and on related policy-oriented questions raised by the public, policy makers, customers, and activists.

Use Of Chlorine For Disinfection

The use of chlorine to disinfect drinking water is recognized as one of the most significant public health benefits in the history of the human race. In fact, Life Magazine reported, "The filtration of drinking water (plus the use of chlorine) is probably the most significant public health advance of the millennium."[1] While safe drinking water is critical to public health, questions about the use of water disinfectants remain Questions have arisen regarding the possible risks associated with chlorine disinfection byproducts (DBPs), primarily trihalomethanes (THMs) and haloacetic acids (HAAs). Early animal studies on chloroform demonstrated high dose carcinogenicity. From the 1970s to the mid 1990's, research and regulatory efforts have focused on potential DBP carcinogenicity. These concerns led EPA, with industry support, to promulgate the Stage I DBP rule in December 1998, reducing the total THMs Maximum Contaminant Level (MCL) from 100 ppb to 80 ppb and adding a 60 ppb MCL for haloacetic acids. In addition, ten years of research focusing on chloroform's mode of action and recommendations by the an expert panel convened by the International Life Sciences Institute has led EPA to conclude chloroform is unlikely to be carcinogenic below a certain dose range and that "this mechanism is expected to involve a dose-response relationship which is nonlinear and probably exhibits an exposure threshold."[2] Subsequently EPA is establishing an MCLG for chloroform in drinking water that is not expected to cause cancer at the low levels found in drinking water.

Although chloroform is the dominant disinfection byproduct, questions remain about the carcinogenicity of environmentally-relevant levels of other disinfection byproducts. To help answer these questions, in 1999, the RFHEE sponsored a study at the CIIT Health Institutes on the carcinogenicity of bromodichloromethane.

Some epidemiology studies suggest that disinfection byproducts may be related to adverse health effects. In a 1998 study, concerns were raised about potential links between bromodichloromethane, and a possible increased rate of miscarriages. This led to a call for more studies investigating DBPs and reproductive and developmental effects. Screening level toxicology studies indicated that very high exposures to DBPs may be associated with an increase in developmental and reproductive effects. Questions remained about whether environmental exposures, generally much lower than in standard toxicology studies, show similar effects. The Research Foundation, in response to

[1] Life Magazine, special edition on "The Millennium", Fall 1997.

[2] From the US EPA, Health Risk Assessment/Characterization of the Drinking Water Disinfection Byproduct Chloroform. p8., November 4, 1998.

research needs stated in EPA's Stage II DBP rule negotiations, funded four definitive studies: two developmental studies of bromodichloromethane and multi-generation reproductive toxicity studies on bromodichloromethane and dibromoacetic acid. These studies are critical to future DBP risk assessments under the Stage II DBP rule.

The epidemiological data has been erratic and inconclusive. Both positive and negative studies are in the literature and there is little scientific consensus of the weight of the evidence. One conclusion from these studies is that either there is no effect or that the effect is very small and hard to detect. Further evidence is needed, using improved studies to accurately adjust for the many confounding factors to resolve this issue.

Chlorine's use as a disinfectant goes far beyond its use in drinking water. The popular concept of recycling would not be economically feasible without the availability of chlorinated disinfectants for plastics and other materials used for food grade service. Routine uses of chlorinated disinfectants in our food processing systems (poultry, beef, etc.) help eliminate pathogens and keep our food safe. Chlorine-based sanitizers are also the disinfectant of choice for swimming pools throughout the world. Further, chlorinated compounds are used to kill water borne pathogens in wastewater prior to effluent discharge, thus providing an important health benefit.

Currently, added interest is focused on chemical products used in homes, schools, and other settings where children and prospective parents might be exposed. Questions arise about the possible health effects from concentrations present in these environments.

When making decisions about public health, shifting practices often means making choices between various options each of which has inherent advantages, disadvantages and risks. To decide between options, public health officials should compare the current practice with its risks and benefits against the alternative[s] and their risks and benefits. To support these types of decisions, scientific information that narrows scientific uncertainties inherent in theoretical default assumptions is needed

RESEARCH THEMES:

RFHEE intends to partner with governmental agencies and others to thoroughly examine and understand the benefits and risks associated with chlorine as a disinfectant, with a focus on supporting projects that:

1. Contribute to an improved understanding of the potential for reproductive and developmental effects associated with specific DBPs and with mixtures of disinfection byproducts at relevant levels of exposure. [Also see the mixtures chapter of this plan.]
2. Contribute to a better understanding of disinfectant efficacy, and/or process changes, which will lower the generation of disinfection byproducts.
3. Contribute to improved cancer risk assessments for disinfection byproducts.
4. Contribute to the improved understanding of exposure to disinfectants and disinfectant byproducts in homes [drinking water, food, pools, bleach, etc.].
5. Contribute to understanding the potential ecotoxicity of disinfectants and disinfection byproducts in wastewater, with a focus on shorter-lived chlorinated compounds, and on chronic, relevant exposure levels.

Candidate Projects

See separate list.