Toxicity and Exposure Assessment for Children's Health (TEACH): A Web Site on Environmental Toxicants Affecting Children's Health

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Introduction

The Toxicity and Exposure Assessment for Children's Health (TEACH) project seeks to complement existing informational tools on health risks to children from exposure to chemicals in the environment. TEACH consolidates children's health and related developmental toxicology information from the scientific literature and improves access to that information through an interactive Web site:

www.epa.gov/teach

The TEACH Internet Web site includes two main components for each TEACH chemical of concern:

--The **TEACH Database** contains summaries of research articles from peer-reviewed journals that pertain to early-life and childhood exposure and health effects.

--The **TEACH Chemical Summaries** highlight information from the TEACH Database and other U.S. Federal resources in a standardized format.

TEACH has been funded through the U.S. EPA Office of Children's Health Protection (OCHP).

Chemicals of Concern Listed in TEACH Database

2,4-Dichlorophenoxyacetic Acid	Dichlorvos	Nitrates and Nitrites
Arsenic	Formaldehyde	Permethrin and Resmethrin (Pyrethroids)
Atrazine	Manganese	Phthalates
Benzene	Mercury (Elemental)	Polychlorinated Biphenyls (PCBs)
Benzo(a)pyrene (BaP)	Mercury (Inorganic)	Trichloroethylene (TCE)
DEET	Mercury (Methylmercury and Ethylmercury)	Vinyl Chloride

Lead is not covered in TEACH. Information about lead exposure and health risks for children is provided by the U.S. EPA at the National Lead Information Network: www.epa.gov/lead.

The TEACH Database

The primary purpose of the TEACH Database is to summarize children's health-related articles from the recent scientific literature, and organize that information for a range of users. Studies included in the TEACH Database are generally restricted to developmental studies (from gametes to adolescence) from the peer-reviewed literature. The TEACH Database does not critically review or evaluate studies for scientific quality. The TEACH Database contains almost 2,000 summaries of articles published from January 1972 through December 2004 and is updated annually.

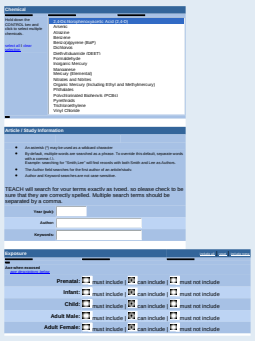
TEACH Database Query Parameters

The TEACH Database offers the ability to search using the following parameters:

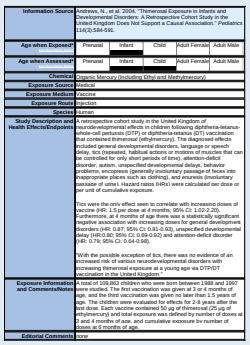
- one or more of the chemicals;
- first author;
- date of publication;
- keywords;
- exposure and assessment criteria.

Query Parameters

(partial list of parameters)



Query Results



Information Source	Andrews, N., et al. 2004. "Thimerosal Exposure in Infants and Developmental Disorders: A Retrospective Cohort Study in the United Kingdom Does Not Support a Causal Association." *Pediatrics* 114(5):584-591.
Age when Exposed[1]	Prenatal, Infant, Child, Adult Female, Adult Male
Age when Assessed[2]	Prenatal, Infant, Child, Adult Female, Adult Male
Chemical	Organic Mercury (Including Ethyl and Methylmercury)
Exposure Source	Medical
Exposure Medium	Vaccine
Exposure Route	Injection
Species	Human
Study Description and Health Effects/Endpoints	A retrospective cohort study in the United Kingdom of neurodevelopmental effects in children following diphtheria-tetanus-whole-cell pertussis (DTP) or diphtheria-tetanus (DT) vaccination that contained thimerosal (ethylmercury). The diagnosed effects included: attention-deficit disorder, autism, unspecified developmental delay, tics (repeated, habitual actions or motions of muscles that can be controlled for only short periods of time), attention-deficit disorder, autism, unspecified developmental delays, behavior problems, encopresis (generally involuntary passage of feces into inappropriate places such as clothing), and enuresis (involuntary passage of urine). Hazard ratios (HRs) were calculated ser dose or ser unit of cumulative exposure. Tics were the only effect seen to correlate with increasing doses of vaccine (HR: 1.5 per dose at 4 months; 95% CI: 1.02-2.20). Unspecified developmental delay was the only effect with significant negative association with increasing doses for general development disorders (HR: 0.87; 95% CI: 0.81-0.93), unspecified developmental delay (HR:0.80; 95% CI: 0.68-0.92) and attention-deficit disorder (HR: 0.79; 95% CI: 0.64-0.98). "With the possible exception of tics, there was no evidence of an increased risk of various neurodevelopmental disorders with increasing thimerosal exposure at a young age via DTP/DT vaccination in the United Kingdom."
Exposure Information and Comments/Notes	A total of 109,863 children who were born between 1988 and 1997 were studied. The first vaccination was given at 3 or 4 months of age, and the third vaccination was given no later than 1.5 years of age. The children were evaluated for effects for 2-8 years after the last dose. Each vaccine contained 50 µg of thimerosal (25 µg of ethylmercury) and total exposure was defined by number of doses at 3 and 4 months of age, and cumulative exposure by number of doses at 6 months of age.
Editorial Comments	none

The TEACH Chemical Summaries

Each TEACH Chemical Summary focuses on one TEACH chemical of concern. TEACH Chemical Summaries provide a compilation of information from U.S. EPA publications/Web sites, ATSDR publications/Web sites, and articles included in the TEACH Database. Additional Chemical Summaries will be posted in the upcoming months, with at least four more summaries to be posted by summer 2006.

Information in the Chemical Summaries

Introduction: overview of exposure and health effects for the chemical

Exposure: relative potential for exposure from several media

Toxicity Summary: summary of known health effects

Exposure and Toxicity Studies from the TEACH Database: summary of developmental studies listed in the Database

Considerations for Decision-Makers: information pertaining to risks

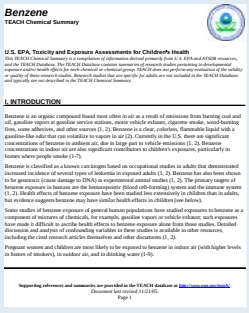
Toxicity Reference Values: list of current toxicity and reference values

Regulatory Information: current U.S. regulatory resources

Background on Chemical: chemical properties, and production/use details

References: references cited for all sections of the Chemical Summary

TEACH Chemical Summaries are 9-14 pages in length. Shown below are two sample pages from the Benzene Chemical Summary.



Benzene
TEACH Chemical Summary

U.S. EPA, Toxicity and Exposure Assessments for Children's Health

This TEACH Chemical Summary is a compilation of information derived primarily from U.S. EPA and ATSDR resources, and the TEACH Database. The TEACH Database contains summaries of research studies pertaining to developmental exposure and/or health effects for each chemical or chemical group. TEACH does not perform any evaluation of the validity or quality of these research studies. Research studies that are specific for adults are not included in the TEACH Database, and typically are not described in the TEACH Chemical Summary.

I. INTRODUCTION

Benzene is an organic compound found most often in air as a result of emissions from burning coal and oil, gasoline vapors at gasoline service stations, motor vehicle exhaust, cigarette smoke, wood-burning fires, some adhesives, and other sources (1, 2). Benzene is a clear, colorless, flammable liquid with a gasoline-like odor that can volatilize to vapors in air (2). Currently in the U.S. there are significant concentrations of benzene in ambient air, due in large part to vehicle emissions (1, 2). Benzene concentrations in indoor air are also significant contributors to children's exposures, particularly in homes where people smoke (1-7).

Benzene is classified as a known carcinogen based on occupational studies in adults that demonstrated increased incidence of several types of leukemia in exposed adults (1, 2). Benzene has also been shown to be genotoxic (cause damage to DNA) in experimental animal studies (1, 2). The primary targets of benzene exposure in humans are the hematopoietic (blood cell-forming) system and the immune system (1, 2). Adverse effects of benzene exposure have been observed in children rather than in adults, but evidence suggests benzene may have similar health effects in children (see below).

Some studies of benzene exposure of general human populations have studied exposures to benzene as a component of mixtures of chemicals, for example, gasoline vapors or vehicle exhaust; such exposures have made it difficult to ascribe health effects to benzene exposure alone from those studies. Detailed discussion and analysis of confounding variables in these studies is available in other resources, including the cited research articles themselves and other documents (1, 2).

Pregnant women and children are most likely to be exposed to benzene in indoor air (with higher levels in homes of smokers), in outdoor air, and in drinking water (1-9).

Supporting references and summaries are provided in the TEACH database at http://www.epa.gov/teach/
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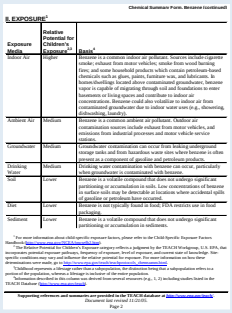

Chemical Summary Page, Benzene (continued)

II. EXPOSURE[1]

Exposure Media	Relative Potential for Children's Exposure[2]	Basis[3]
Indoor Air	Higher	Benzene is a common indoor air pollutant. Sources include cigarette smoke; exhaust from motor vehicles; smoke from wood burning fires; and some household products which contain petroleum-based chemicals such as glues, paints, furniture wax, and lubricants. In indoor air, benzene can be a significant contaminant. However, benzene vapor is capable of migrating through soil and foundations to enter basements or living spaces and contribute to indoor air concentrations. Benzene could also volatilize to indoor air from contaminated groundwater due to indoor water uses (e.g., showering, dishwashing, laundry).
Ambient Air	Medium	Benzene is a common ambient air pollutant. Outdoor air contamination sources include exhaust from motor vehicles, and emissions from industrial processes and motor vehicle service stations.
Groundwater	Medium	Groundwater contamination can occur from leaking underground storage tanks and from hazardous waste sites where benzene is often present as a component of gasoline and petroleum products.
Drinking Water	Medium	Contamination of drinking water supplies can occur, particularly when groundwater is contaminated with benzene.
Soil	Lower	Benzene is a volatile compound that does not undergo significant partitioning or accumulation in soils. Low concentrations of benzene in surface soils may be detectable at locations where accidental spills of gasoline or petroleum have occurred.
Diet	Lower	Benzene is not typically found in food. FDA restricts use in food packaging.
Sediment	Lower	Benzene is a volatile compound that does not undergo significant partitioning or accumulation in sediments.

[1] For more information about child-specific exposure factors, please refer to the Child-Specific Exposure Factors Handbook (http://www.epa.gov/ORD/ExposureFactors/)

[2] The Relative Potential for Children's Exposure category reflects a judgment by the TEACH Workgroup, U.S. EPA, that incorporates potential exposure pathways, frequency of exposure, level of exposure, and current state of knowledge. Site-specific conditions may vary and influence the relative potential for exposure. For more information on how these categories were defined, see the TEACH Chemical Summary Page, Benzene (introduction).

[3] Established exposures, a lifestage rather than a subpopulation, for distinction being that a subpopulation refers to a portion of the population, whereas a lifestage is inclusive of the entire population.
Information in the Basis column is derived from several resources (e.g., 1, 2) including studies listed in the TEACH Database (http://www.epa.gov/teach/).

Supporting references and summaries are provided in the TEACH database at http://www.epa.gov/teach/
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[1]U.S. EPA/Region 5
[2]U.S. EPA/Child and Aging Health Protection Division

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