



# Health Effects of Pesticides

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# What is a pesticide?

As defined by the US Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1970:

“any substance intended for preventing, destroying, repelling, or mitigating any insects, rodents, nematodes, fungi, weeds, or any other forms of life declared to be pests.”

# Who is exposed to pesticides?

- In early 1990s, nationwide survey found urinary metabolites of chlorpyrifos and parathion in 82% and 41% of those tested.
- An average of 12 different pesticides per home measured in carpet dust and average of 11 pesticides in indoor air (non-agricultural households)

Hill RH, Head SL Jr, Baker S. *Pesticide residues in urine of adults living in the United States: reference range concentrations.* Environ Res 71:99-108 (1995)

# How are we exposed?

- Home & garden
  - Accidental or deliberate ingestion
  - Residues on food, house dust, carpets, furniture, pets

Children more at risk due to smaller size, developing systems, higher exposure to food/soil/water/air by body weight

# Common causes of poisoning

- Suicide attempt
- Placing pesticide in wrong container
- Not following instructions for use
- Unauthorized dealer or unlicensed applicator
- Misapplication



# Pesticide classes

- Insecticides
  - Organophosphates
  - Carbamates
  - Botanicals
  - Organochlorines
  - Inorganics
- Repellants
- Herbicides
  - Chlorphenoxy
  - Paraquat, diquat
- Fungicides
- Rodenticides
- Fumigants

# Organophosphates (OPs) and Carbamates





## Cholinesterase-Inhibiting Insecticides

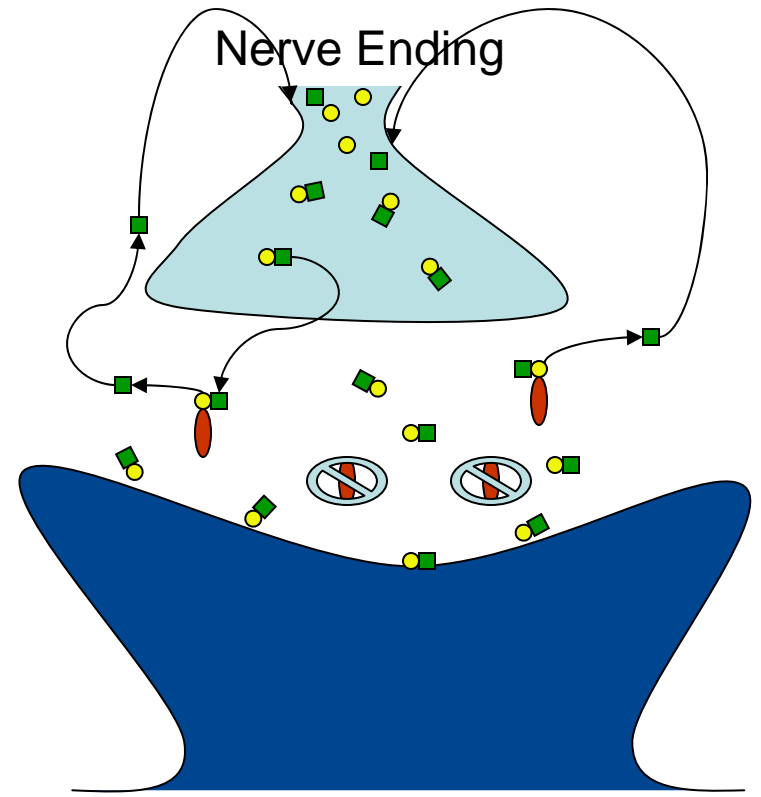
- one of the largest and most important classes of insecticides

OPs: parathion, malathion, diazinon

Carbamates: Aldicarb

# Mechanism of action of OPs and carbamates

- Acetylcholine 
- Cholinesterase 
- Choline 
- Enzyme inhibition 



Neuromuscular Junction

# Symptoms of OP poisoning

- ***DUMBELS***
  - diarrhea
  - urination
  - miosis
  - bronchospasm
  - emesis
  - lacrimation
  - salivation



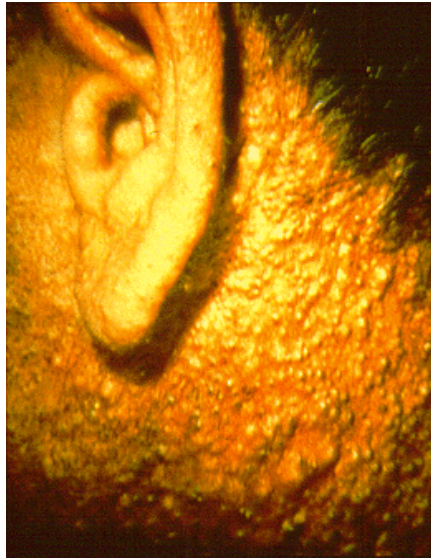
[www.sehondrugs.nl/.../ogen\\_miosis.html](http://www.sehondrugs.nl/.../ogen_miosis.html)

# Organochlorine pesticides

- Three major types of organochlorine insecticides:
  - Dichlorodiphenylethanes: DDT, DDD
  - Chlorinated Cyclodienes: Dieldrin, Heptachlor, Chlordane
  - Chlorinated Benzenes & Cyclohexanes: Lindane (Kwell), Mirex, Chlordecone (Kepone)
- High lipophilicity, chemically stable
- Metabolic degradation is slow: persistent in the environment, long half-life
- Most have been banned in the US.

# Dermatologic effects of chlorinated pesticides

- Chloracne



# Organochlorine health effects

- Acute: paresthesias, ataxia, dizziness, headache, n/v, lethargy, tremors, seizures
- Chronic: muscle weakness, anorexia, hyperexcitability, insomnia, seizures, rash, memory loss, infertility

# Botanicals



- Pyrethrum and Pyrethrin Insecticides
  - Oleoresin extract of Chrysanthemum
  - Cause a rapid paralytic “knockdown” effects on insects
  - Not absorbed dermally (inhalation exposure)
  - Used for scabies
  - Cause nerve excitability in humans
  - Dermal and respiratory allergens/irritants

# Rodenticides

- Anticoagulants – bleeding
- Nerve toxicity agents
- Hypercalcemics
- Zinc phosphide – severe irritation, diarrhea, coma

# Herbicides

- Diquat, Paraquat (Ortho Spot Weed and Grass Killer, Scotty's Weed and Grass Killer) – severely toxic: seizures, airway injury, lung damage
- Chlorphenoxy (2,4-D) – skin and mucous membrane irritation, vomiting, confusion
- Glyphosphate (Roundup) – skin irritation, eye irritation, upper respiratory tract irritation

# Chronic Health Effects: Cancer

- Farmers
  - associations (higher incidence) for Hodgkin lymphoma, NHL, multiple myeloma, leukemia, prostate & brain cancers
- Applicators
  - stomach cancer among migrant & seasonal farm workers
  - NHL, brain & prostate cancer among golf course superintendents



# Chronic Health Effects: Cancer

- Agricultural Health Study
  - initiated in 1994; IA & NC
  - farmers, private & commercial pesticide applicators and their spouses (n > 89K)
  - significant findings:
    - prostate cancer among farmers & commercial applicators
    - melanoma among female spouses
    - ovarian cancer among female applicators

Cancer Incidence in the Agricultural Health Study. Alavanja MCR et al. Scand J Work Environ Health 31(S1): 39-45, 2005.

# Chronic Health Effects

- Neurotoxicity: memory loss, polyneuropathy, Parkinson's Disease

# Male Reproductive Toxicity

- Dibromochloropropane (DBCP / Nemagon)
  - nematicide used in U.S. until 1977
  - male workers at Dow Chemical plant
    - decreased sperm count
    - sterile

# Numerous pesticides are known or suspected reproductive toxins

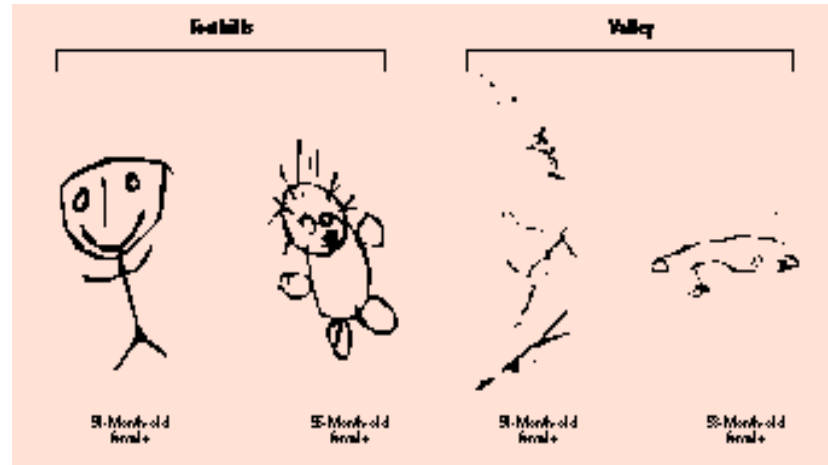
Pesticide class	Pregnancy outcome	Reference
OP pesticides	IUGR	Levario-Carrillo et al. <i>Relation between pesticide exposure and intrauterine growth retardation.</i> Chemosphere 2004
Chlorpyrophos	Low birth weight	Perera et al. <i>Effects of transplacental exposure to environmental pollutants on birth outcomes in a multiethnic population.</i> Environ Health Perspect 2003
Chlorphenoxy	Congenital anomalies	Garry et al. <i>Pesticide appliers, biocides, and birth defects in rural Minnesota.</i> Environ Health Perspect 1996
Triazine	IUGR	Munger et al. <i>Intrauterine growth retardation in Iowa communities with herbicide-contaminated drinking water supplies.</i> Environ Health Perspect 1997

# Health effects on children

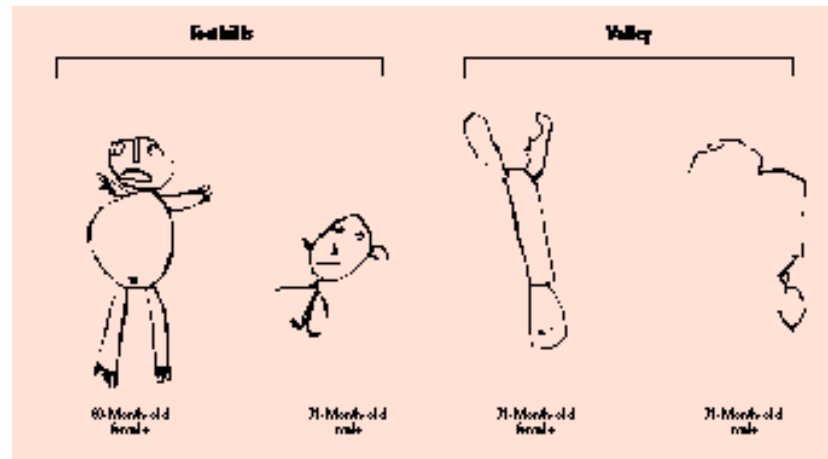


# Neurologic effects of pesticide exposure

- 4 year old Yaqui children



- 5 year old Yaqui children



Guillette 1998: EHP 106.

# Cases

# Organophosphates

- A family of four re-entered their home within 1 hour of fumigation with chlorpyrifos. The home was not ventilated prior to re-entry.
- They presented to a local ER a few hours later with a cholinergic syndrome: small pupils, lacrimation, salivation, wheezing, nausea, diarrhea, sweating.

# Organochlorines

- A 14 month old male crawled through a puddle of chlordane that a pesticide applicator had accidentally splashed inside the child's home.
- The child had a grand mal seizure at home and two more seizures in the emergency department.
- The child was decontaminated, treated with anticonvulsant medication, and had an uneventful recovery.

# Botanical Pesticides

- Schoolteacher c/o new onset hoarseness and chest tightness after her schoolroom had been sprayed with pyrethrin-containing pesticide.
- ENT exam was normal, chest exam revealed wheezes. Spirometry revealed an obstructive pattern.

# Herbicides

- A 35 y.o. female purchased a gallon of herbicide from a vendor who had advertised in a local newspaper. The vendor did not provide any instructions regarding application.
- The woman applied the herbicide full strength on her lawn over 1 hour.
- She experienced a seizure during the application. She had no prior history of seizures and had a negative seizure workup.

# Repellants

- A 12 y.o. girl repeatedly applied a concentrated DEET formula to her skin and clothes over several days while on summer camp.
- Four days after the opening of camp, she suffered a grand mal seizure. She had no seizure history, no recurrence of seizures, and a subsequent seizure work-up was negative.

# Rodenticides

- A 2 y.o. ingested a white powder which was left under the sink by the building janitor.
- The child developed severe hypocalcemia and cardiac arrest.
- The janitor initially claimed that the material was boric acid purchased at a local hardware store. She later admitted that the material was sodium fluoride that she had purchased from a private vendor for use as a rodenticide.

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The Great Lakes Center for Children's Environmental Health was established in 1999 in partnership with the United States [Environmental Protection Agency \(EPA\)](#) and the [Agency for Toxic Substance and Disease Registry \(ATSDR\)](#) to promote and protect children's health through prevention, education, diagnosis and treatment of environmentally related diseases.

Our team of health professionals encompass diverse areas of expertise including medical toxicology, pediatrics, occupational/environmental medicine, emergency medicine, pulmonology and developmental pediatrics.

Our primary area of focus is Region V which includes the states of Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin. We are one of ten [Pediatric Environmental Health Speciality Units](#) across the country dedicated to children's environmental health issues.

The Great Lakes Center for Children's Environmental Health has three locations: 1) The University of Illinois at Chicago Medical Center, 2) The John H. Stroger Jr. Hospital in Chicago, and, 3) Cincinnati Children's Hospital.

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# Our Services

- Provide clinical consultations
  - Telephone consults free of charge to health care providers and families
  - Clinic visits at UIC, Stroger Hospital, Cincinnati Children's Hospital, Northwestern Children's Memorial Hospital
- Consult to public health and environmental agencies
- Train physicians, nurses, and other health professionals in children's environmental health
- Conduct health hazard evaluations

# Pediatric Environmental Health Clinics

- Staffed by:
  - Environmental medicine physician
  - Pediatrician or family physician
  - Medical toxicologist
  - Pediatric health nurse
  - Industrial hygienist

# Great Lakes Center for Children's Environmental Health



Region 5 Pediatric Environmental Health Specialty Unit (PEHSU)  
**(312) 636-0081 or (866) 967-7337**

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Chicago Consortium for Reproductive Environmental Health in Minority Communities



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## Welcome to CREHM

Consortium for Reproductive Environmental Health in Minority Communities (CREHM) is a group of environmental scientists, health professionals, community based organizations, and concerned citizens committed to reducing the risk of reproductive environmental health threats and improving quality of life in Chicago.



## What's New

- Chicago Consortium for Reproductive Environmental Health in Minority Communities (CREHM) receives grant for facilitation of Urban Medicine curriculum and organizational development!** Through funding granted by The Chicago Community Trust, CREHM in collaboration with the UIC College of Medicine will facilitate and provide public health and reproductive environmental health training and education for select students in the UIC Urban Medicine program. This track has been designed to produce physicians uniquely suited to facilitate, organize, and implement health promotion in the communities of their patients in underserved and underserved...

## Events:

Coming soon.

## Environmental Health News:



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**01/16/10 FDA does about-face on exposure to BPA.** Milwaukee Journal Sentinel, Wisconsin.

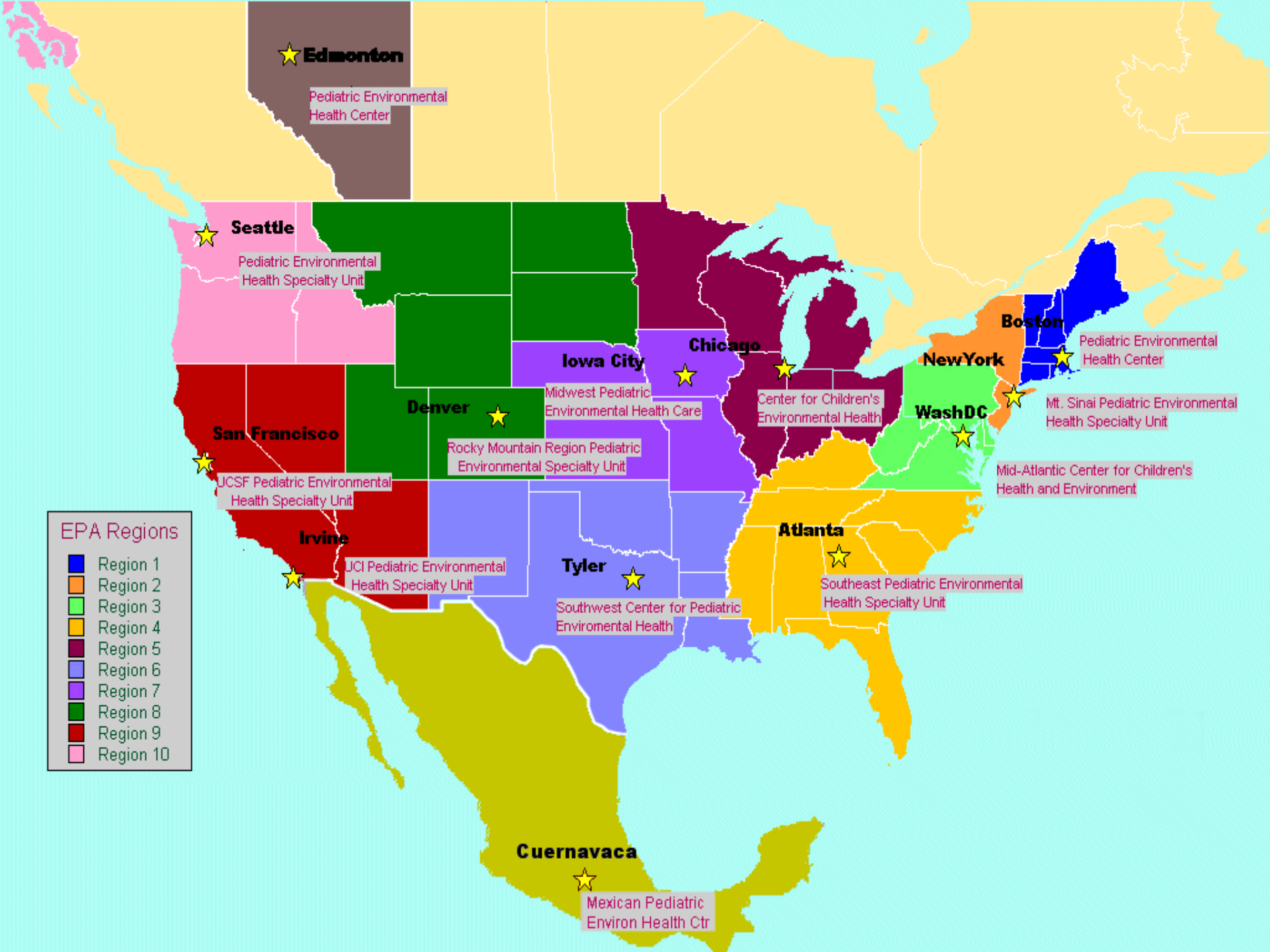
**01/15/10 Alcohol during pregnancy chemically alters fetal DNA.** New Scientist.

**01/15/10 Estrogen in birth**



# Who to Refer and How?

- Questions from health care professionals, families, and public health agencies regarding children's environmental health
- (866) 967-7337
- Call is taken by Ann Naughton, RN or Susan Buchanan, MD, MPH
- Case is referred to a resident or fellow who is supervised by an attending physician



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