AGENCY RESPONSES

IDENTIFYING TOXICS OF CONCERN

December 6, 2006

Purpose: Help focus our Toxics Work Group on:

- Specific contaminants of concern
- Media to sample
- Appropriate sample timing
- Geographic scope

USGS science for a changing world

Mt. Hood from Estacada, Oregon

Multi-Agency Program Findings

- **SPMDs (Passive Water Samplers)**
  - **USGS 1997/98; Ecology 2003/04 ; USGS 2005**
    - **PCBs: highest in tributaries --Johnson Cr., Willamette R., Multnomah Channel, Columbia Slough, Lake River (urban influences) & Wenatche R.**
    - **PCBs: detected in main stem, concentrations lower in relation to tributaries, highest at Columbia City and attenuate on down main stem to Bradwood (PCBs concentrations appear to be diluted in the absence of additional sources)**
    - **Current data suggest that sources of PCBs in the lower Willamette/Portland/Vancouver area appear to be locally derived & PCB 'total' transport exceeds 'dissolved' transport.**
    - **The more toxic "non-ortho congeners" (37,81,77,126) were detected in Willamette, Johnson Cr., and Columbia City. Rarely detected upstream of Portland, except for congener no. 37 in the Wenatchee. R.**

Clackamas River

- SPMDs (Passive Water Samplers) –cont.
  - USGS 1997/98; Ecology 2003/04; USGS 2005
    - DDTs: detected most commonly in metabolite forms (p-p'-DDE& p-p'DDD)
      - Yakima R. is a major agricultural source.
      - Willamette R., Johnson Cr., Wenatche R., and Snake R. are moderate sources
      - Columbia Sl., Willamette R., & Multnomah Ch., are all major sources affected the Columbia River a Columbia City, down stream of Multnomah Ch.
    - Dieldrin, Lindane: sources are from agricultural activities primarily above Bonneville Dam; concentrations decrease on down the main stem Columbia R.

- **SPMDs (Passive Water Samplers) –cont.**
  - **USGS 1997/98; Ecology 2003/04; USGS 2005**
    - **PCDDs and PCDFs: toxic 2,3,7,8-tetrachlorodibenzo-p-dioxin not detected;**
      - **Main stem in the Portland/Vancouver area was low; slight spike down steam of Columbia City (RM 82); pattern similar for PCDFs**
      - **Tributaries in Portland/Vancouver (Willamette R. & Johnson Cr., plus the Yakima R. were high; patterns similar for PCDFs (except Johnson Cr, were PCDFs were very high).**

USGS --Lower Columbia River

- **Surface Water (dissolved & suspended contaminants)**
  - **USGS 1994, WRIR 95-4294 (Bi-State Study)**
  - **Trace Elements (dissolved forms)**
    - **Arsenic: (human carcinogen, w/upstream source)**
      - **Detected at 15 of 16 main stem sites**
      - **Detected at none of the tribs below Bonneville Dam**
    - **Chromium, detected at all main stem sites**
    - **Copper, detected at all main stem & most tributaries**
  - **How are trace elements transported?**
    - **Dissolved phases dominate for: As, Ba, Cr, & Cu**
    - **Suspended phases dominate for: Al, Fe, & Mn**
      - **Transported predominantly by winter-high flows**
  - **Sources**
    - **Lower Columbia (Ag, Ni, and Sb**
    - **Above Bonneville Dam (As, and Zn)**

USGS –Lower Columbia River –cont.

- **Surface Water (dissolved & suspended contaminants)**
  - **USGS 1994, WRIR 95-4294**
  - **Current Use Pesticides and Metabolites**
    - **20 of the 47 sought for pesticides were detected**
    - **All 20 were found at least once in the Willamette**
    - **Atrazine, metochlor, and simazine found most frequently**
      - **Highest concentrations in Willamette**
      - **Found in 85 to 90 percent of Willamette samples**
      - **Spring-time peaks coincide with application**
      - **Affect conc. In Multnomah Ch., and main stem**


Relevant Finding of Toxics from the USGS National Water Quality Assessment Program

USGS –National Water Quality Assessment

- **Yakima River –1987/91**
  - **Resident fish contaminants (DDT & metabolites, chlordane related compounds, dieldrin, toxaphene, PAHs & mercury)**
  - **Arsenic found in 43 percent of surface water samples**
  - **DDT & metabolites, dieldrin, diazinon, and parathion in surface water most frequently exceed aquatic life criteria**
  - **Cd, Cr, Cu, Pb, Ag, and Zn in surface water exceeded aquatic life screening values.**
  - **Geologic enrichment contributes to elevated concentrations of Sb, AS, Cr, Cu, Hg, Ni, Se, & Zn in streambed sediment**
  - **Anthropogenic enrichment contributes to elevated concentrations of Sb, Cd, Cu, Pb, Hg, Se, & Zn**

USGS –National Water Quality Assessment

- **Yakima River –1999/2000**
  - **Agricultural runoff is a source of dissolved arsenic**
  - **Legacy pesticides**
    - **DDT & metabolites, dieldrin, & heptacnlor epoxide, exceeded aquatic life criteria**
      - **DDT transport is associated with suspended sediment**
  - **Current use pesticides & common mixtures**
    - **Common mixture detected**
      - **Azinphos-methyl & 2,4-D: Atazine & 2,4-D; Diuron & 2,4-D**
        - Suspected carcinogens and endocrine disruptors
    - Common pesticides detected
      - 2,4,-D, Azinphos-methyl, atrazine, diuron, dicamba, bentazon, terbacil, myclobutanil, carbaryl, EPTC…
  - **Pesticides not always detected in proportion to mass applied.**

USGS –National Water Quality Assessment

- **Willamette River –1991/1995**
  - Current use pesticides (dissolved in water)
    - Atrazine, simazine, metolachlor, DEA, diuron, and diazinon were detected in more than 50% of the surface water samples.
      - 49 of 86 pesticides: agricultural areas
      - 25 of 86 pesticides: urban areas
      - Herbicides detected at twice as often as insecticides in urban and agricultural areas
      - Highest concentrations were generally found in agricultural areas
  - PCDDS & PCDFs (in streambed sediment)
    -

USGS –National Water Quality Assessment

- **Willamette River –1991/1995 –cont.**
  - **PCDDS & PCDFs (in streambed sediment)**
    - **The extremely toxic congener ‘2,3,7,8-TCDD was rarely detected.**
      - **The OCDD congener, a 1,000 times less toxic than 2,3,7,8-TCDD, accounted for about 80% of the PCDD & PCDF occurrence in sediment.**
      - **A-3 Channel in Eugene and Middle Fourth Lake near Albany are down stream of industrial areas and exceeded there TCDD threshold for fish toxicity.**
      - **Detections at agricultural sites and urban sites reflect levels in atmospheric deposition**

USGS –National Water Quality Assessment

- **Willamette River –1991/1995 –cont.**
  - **PCDDS & PCDFs (in fish)**
    - **The extremely toxic congener '2,3,7,8-TCDD' was found more commonly in fish.**
      - **At 50% of sites sampled, the 2,3,7,8-chlorinated congeners & TCDD in fish, exceeded concentrations in streambed sediment.**
      - **No resident fish exceeded the USEPA threshold for risk to predator fish**
      - **Highest concentrations found in Carp and Sculpin in Portland Harbor and in Johnson Creek**

USGS –National Water Quality Assessment

- **Willamette River –1991/1995 –cont.**
  - **Organochlorine pesticides**
    - **4,4'-DDE at 45% of streambed sediment sites**
      - **Largest concentrations (Johnson Creek)**
    - **4,4'-DDE at 63% of aquatic biota sites**
    - **Exceedences most commonly attributed to DDT metabolites, chlordane, dieldrin, and PCBs**
  - **PCBS**
    - **PCBs at 11% of streambed sediment sites**
    - **PCBS at 32% of aquatic biota sites**
      - **All PCBs were associated with streams affected by 'strong-urban influences'**

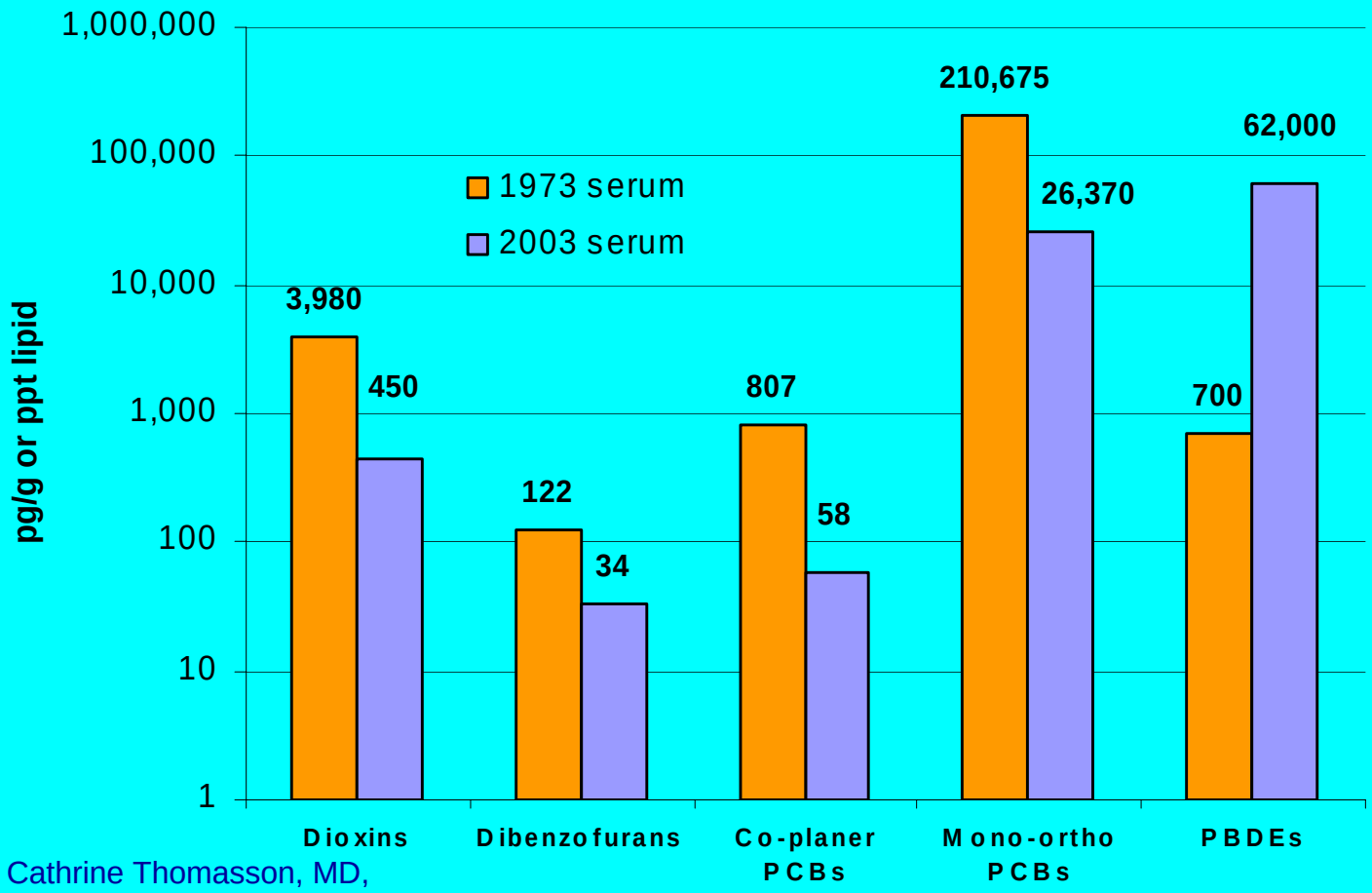
USGS, EP, & BPA Water Quality Monitoring

- **Lower Columbia & Willamette R. --2004/05**
  - Pharmaceuticals in water (2 of 24)
    - acetaminophen (common pain reliever)
    - diphenhydramine (antihistamine)
  - Antibiotics in surface water (3 of 49)
    - Anhydroerythromycin (metabolite of erythromycin)
    - Trimethoprim (treats urinary tract infections)
  - Waste Water Compounds (8 of 54)
    - Endocrine Disrupters
      - Bisphenol-A (vinyl coatings, etc.)
      - Tri(2-chloroethyl)phosphate (PBDE flame retardant)
  - PBDEs on suspended sedmient (11 of 11)
    - Trace amounts detected at all sites
  - PBDEs in SPMDs
    - 10 of 11

USGS, EP, & BPA Water Quality Monitoring

- **Lower Columbia & Willamette R. --2004/05**
  - Trace Elements (dissolved in surface water)
    - As, Cr, Cu, & Pb
      -known or suspected endrocrine disruptors
  - PCBs on suspended sediment
    - 102 of 209 congeners at trace amounts
    - Most frequently detected in Willamette at Portland
  - PCBs in SPMDs
    - Detected at all sites in low-flow ‘August’ sampling

Trends of Toxin Levels

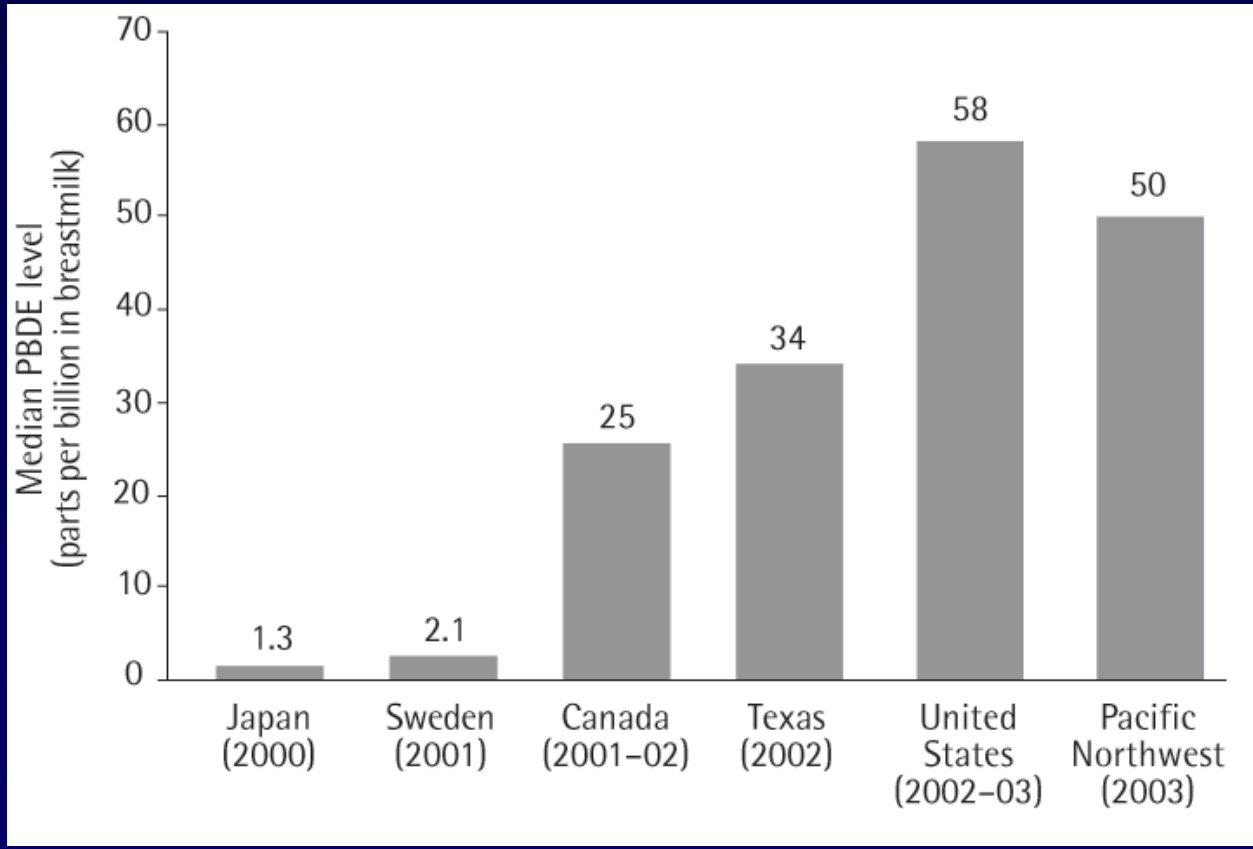


Cathrine Thomasson, MD,

http://www.oregonpsr.org/ppt/PBDE's%20the%2021st%20Century%20PCB2.ppt#256,1,PBDE's: the 21st Century PCB

PBDE levels in US and NW

- Where PBDEs are banned, levels in humans decrease



Flame Retardants in the Bodies of Pacific Northwest Residents: A Study on Toxic Body Burden, Northwest Environment Watch: September 29, 2004

Department of Ecology & USGS

- **Lower and Middle Columbia --2005**
  - **PBDEs in resident fish tissue (Ecology PBDE Study)**
    - **Congener's 47, 99, & 100 (which contain higher percentages of the most toxic Penta-BDE form) were detected.**
  - **PBDEs in SPMDs (USGS August 2005)**
    - **Congener's 47, 99, & 100 found at Warrendale, Willamette R. and Beaver Army Terminal**

U.S. Fish and Wildlife Service

- **Lower Columbia R. Bald Eagles - 1994/95**
  - Contaminants in eggs:
    - Hg, PCDDs, PCDFs, PCBs, DDE, DDT, & PBDEs
    - DDE, PCBs, & dioxin-like compounds exceeded the “no-observable effects” threshold; eggs shell thinning was obsevred in many eggs
  - Productivity from RM 13 to 31 was the lowest among the reaches and was well below values considered normal.

U.S. Fish and Wildlife Service

- **Lower Columbia R. Double-Crested Cormorants - 1990/95**
  - Contaminants in eggs:
    - PCDDs, PCDFs, PCBs, DDE, DDT, & PBDEs
    - DDE, PCBs, & dioxin-like compounds were considerable higher in the lower Columbia R. in comparison to reference colony eggs.
    - These compounds approached or exceeded the “no-observable effects” threshold; eggs shell thinning was obsevred in many eggs
    - Contaminant in eggs from Rice Island exceeded those of East Sand Island

NOAA

- **Lower Columbia R. Ecosystem Monitoring Project – April-Sept. 2005**
  - Juvenile Chinook Salmon: (whole bodies)
    - Dietary exposure to PCBs, DDTs, PBDEs, PAHs
    - PCBs: high at the CR Beaver Army & Willamette. R.
    - PBDEs: high in the Willamette R.
    - Contaminants found in 'stomach contents' & 'whole bodies' were especially high in the Portland/Vancouver area
    - DDTs: somewhat uniform among sites
    - Salmon exposed to estrogenic compounds in Portland/Vancouver area
    - Cu and OP pesticides –Olfactory issues at some sites

NOAA

- **Lower Columbia R. Persistent Organic Pollutants in Outmigrant Juvenile Salmon –2001/02**
  - **Juvenile Chinook Salmon: (whole bodies)**
    - **DDT and PCBs were detected at the highest concentrations among the POPs**
    - **Average DDT concentrations were among the highest measured to date in the PNW**
    - **DDT and PCBs showed no clear attenuation pattern from the Willamette R. to the CR mount (age and size-class appeared to correlate however).**


Establishing a Toxics Monitoring Strategy can be Challenging!