Evaluating the Effectiveness of BMPs to Reduce Hg and PCB Loads from Urban Runoff

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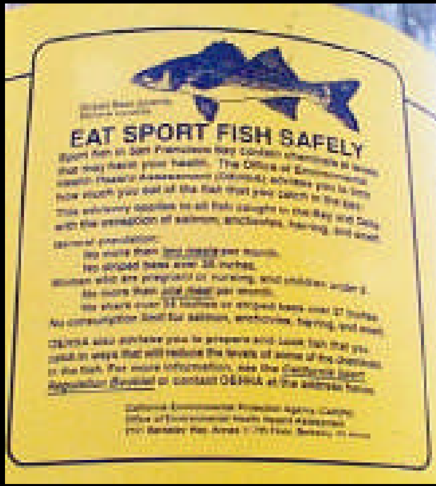
What started it all?

Office of Environmental Health Hazard Assessment (OEHHA)

- 1994 fish consumption advisory in relation to Hg and PCBs in fish

- 1999 Updated in relation to Hg



Bans

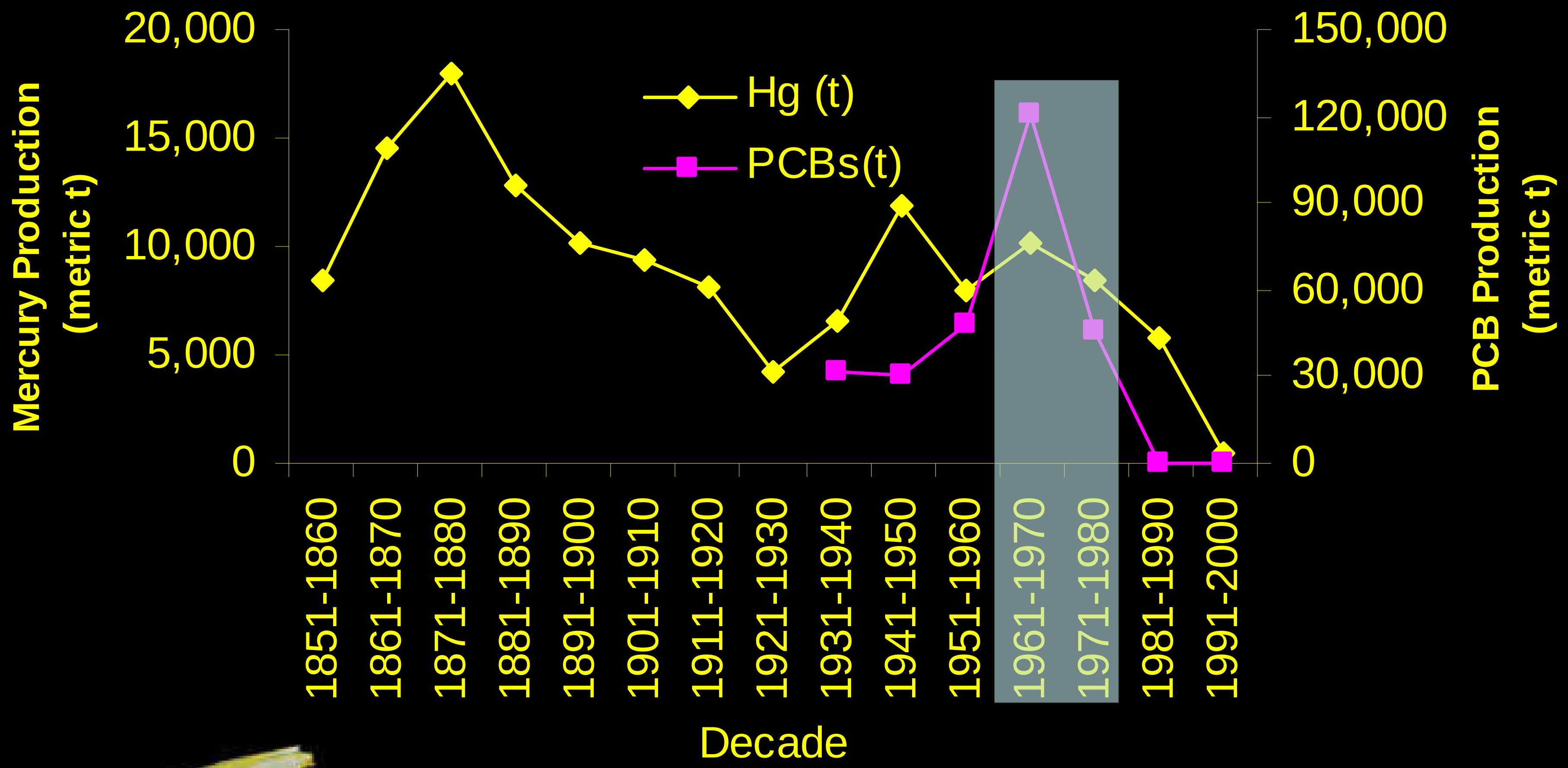
PCBs

- 1974: Dissipative open-ended applications
- 1977: U.S production
- 1979: Importation

Mercury

- 1991: Hg use in latex paint
- 1991: Hg use in batteries reduced to 0.025%
- 2003: Dental insurance alternatives
- 2005: Hg switches in California
- 2005: Hg switch use in vehicles

National Production History



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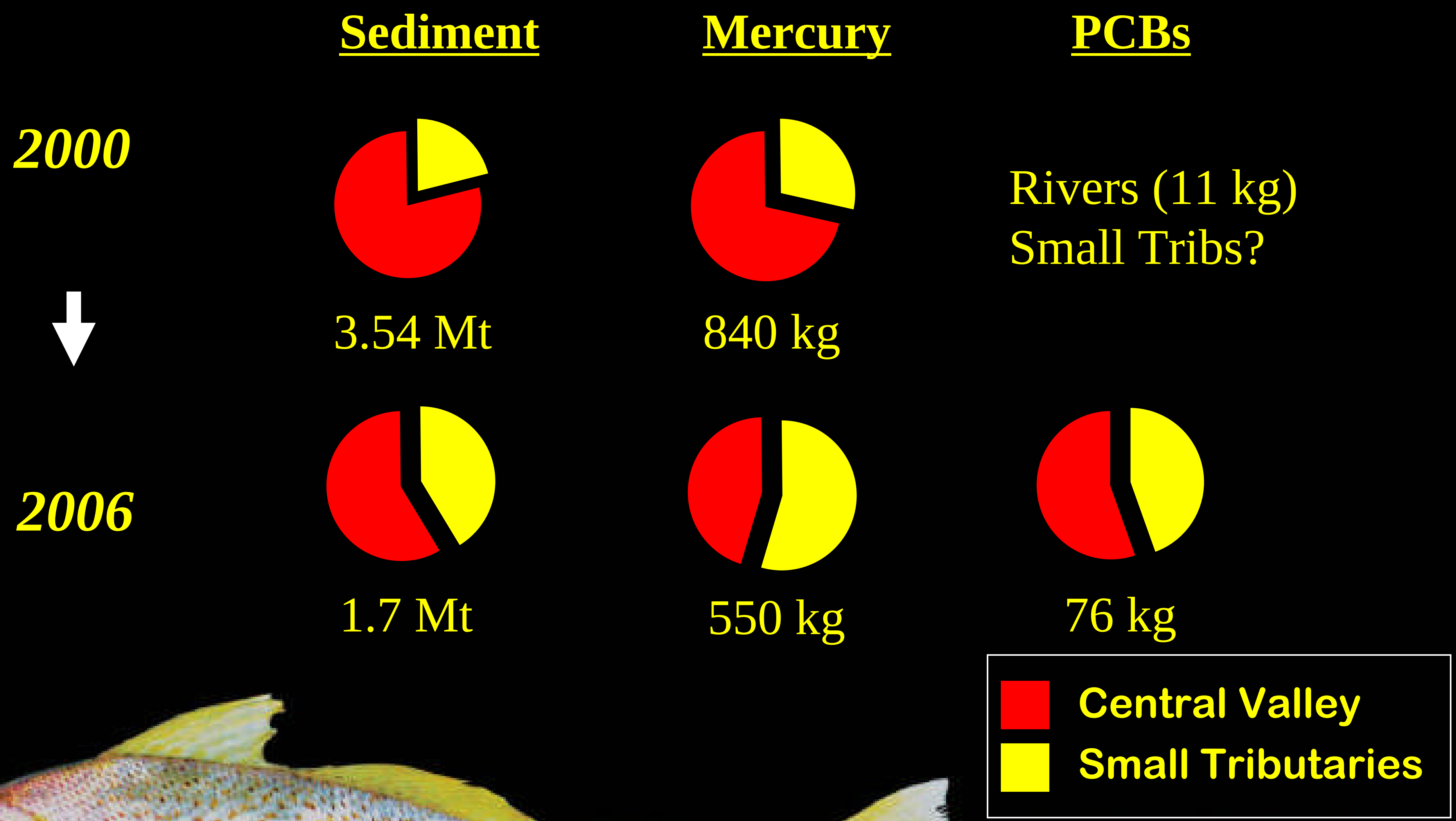
Changing Understanding of Supply



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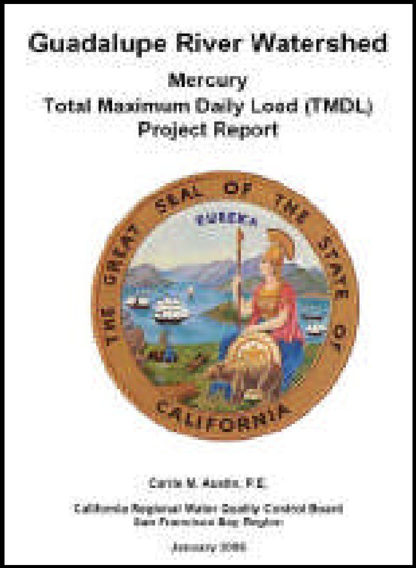
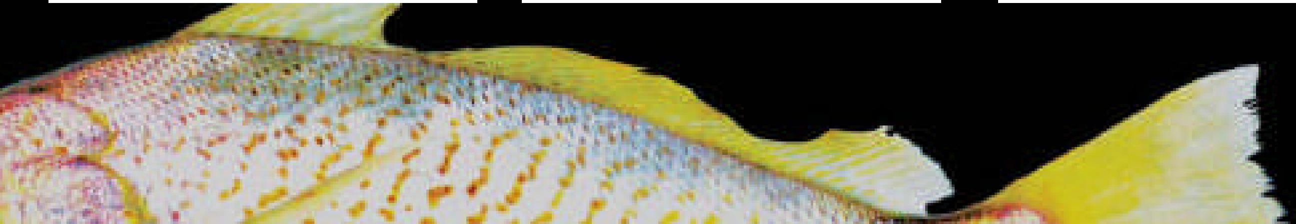
Regulatory Process

- 303(d) listings for PCBs and Hg
  - TMDL reports
  - Basin Plan amendments





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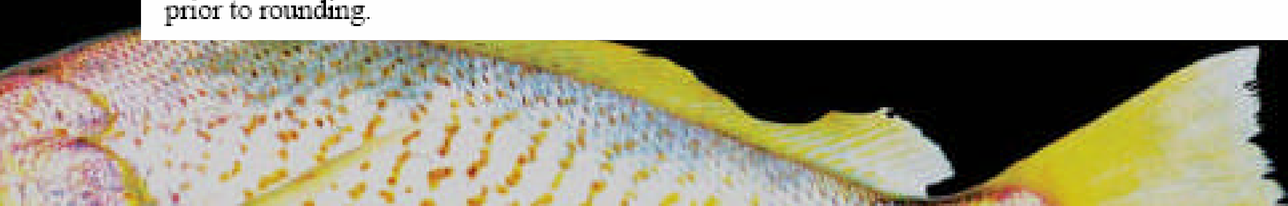
Hg Load Allocations

Source	2003 Mercury Load (kg/yr)	Allocation (kg/yr)	Reduction (%)[c]
Bed Erosion	460	220	53
Urban Storm Water Runoff	**160**	**82**	**48**
Atmospheric Deposition	27	27	0
Non-Urban Storm Water Runoff	25	25	0
Wastewater (municipal and industrial)	20	20	0
Dredging and Disposal[b]	net loss	0 ≤ ambient concentration	
Total	***1,220***	***706***	

[a] This load does not account for mercury captured in sediment removal programs conducted in the watershed.
[b] Sediment dredging and disposal often moves mercury-containing sediment from one part of the bay to another. The dredged sediment mercury concentration generally reflects ambient conditions in San Francisco Bay sediment. This allocation is concentration-based. The mercury concentration of dredged material disposed in the bay must be at or below the baywide ambient mercury concentration. This allocation will ensure that this source category continues to represent a net loss of mercury.
[c] The 2003 mercury load for each source is rounded from calculated values. The percent reduction for each source was calculated prior to rounding.



PCB Load Allocations

Source Catgory	Current PCBs Loads (kg/yr)	Proposed PCBs Loads (kg/yr)	Proposed Load Reductions (kg/yr)
Atmospheric	-7	-7	0
Delta	42	32	10 (76%)
Urban Storm Water Runoff	**34**	**2**	**94**
Dredged Material	12	1.4	11 (88%)
In-Bay PCBs "Hot Spots"	NQ	NQ	NQ
Total	**83**	**31**	**53**

NQ = Not Quantified

Urban Stormwater Managers are asking how?

- Where are the contaminated sites?

?

Urban Stormwater Managers are asking how?

- What about atmospheric deposition?

?

Urban Stormwater Managers are asking how?

- Will conventional source control, treatment control, or maintenance control work?

?

Urban Stormwater Managers are asking how?

?

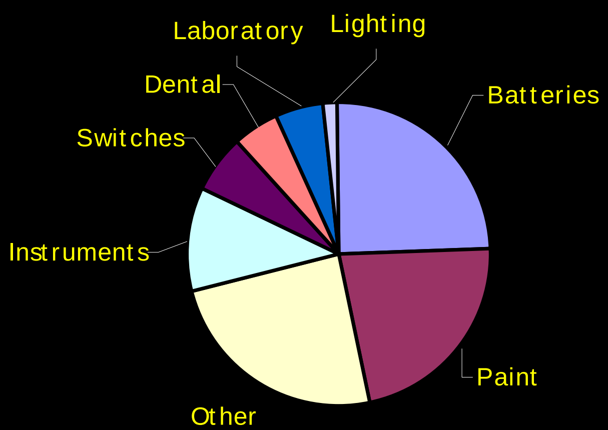
- If so – which practices and when and under what circumstances?

Urban Stormwater Managers are asking how?

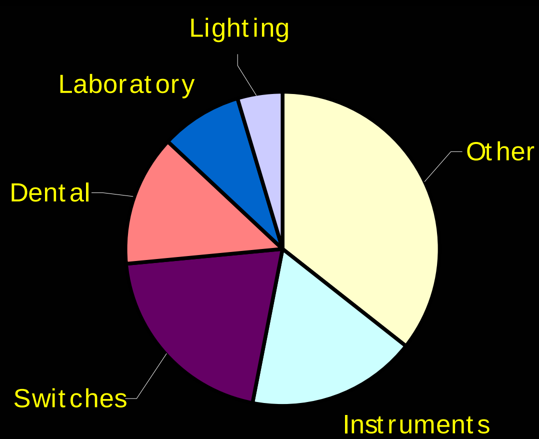
?

- How much will it cost?

1970



1997



Hg Uses

Use	1970 (% usage)	1997 (% usage)
Batteries	25	0
Paint	22	0
Other	22	36
Instruments	11	17
Switches	7	21
Dental	5	13
Laboratory	5	8
Lighting	2	5

Hg Uses

- Still about 7 metric t being imported into the Bay Area annually

- About 1% of the 1950-90 total

National PCB Uses

*Before bans in 1977

Class	(%)	10^6 kg
Controllable closed systems	60	385
Uncontrollable closed systems (nominally closed)	10	63
Dissipative (open-ended)	30	191
	100	640

PCB Uses

- Still >200,000 kg reported use in the Bay Area today
- About 2% of the 1950-90 total

Answering Management Questions

- Used a mass balance approach at the scale of the Bay Area
- Scaled national use to the Bay Area
  - Population
  - Land use
  - Used local information where available
- Estimated mass entering impervious surfaces and rivers, creeks and storm drains
  - Literature
  - Hydrological principals
  - Reasonable guesstimates

Hg in Batteries

- US battery demand 10 billion in 2002 growing by 6% annually

- Each modern battery contains ~0.025% Hg by weight

- Guesstimated between 1:1000 and 1:10,000 entered storm water

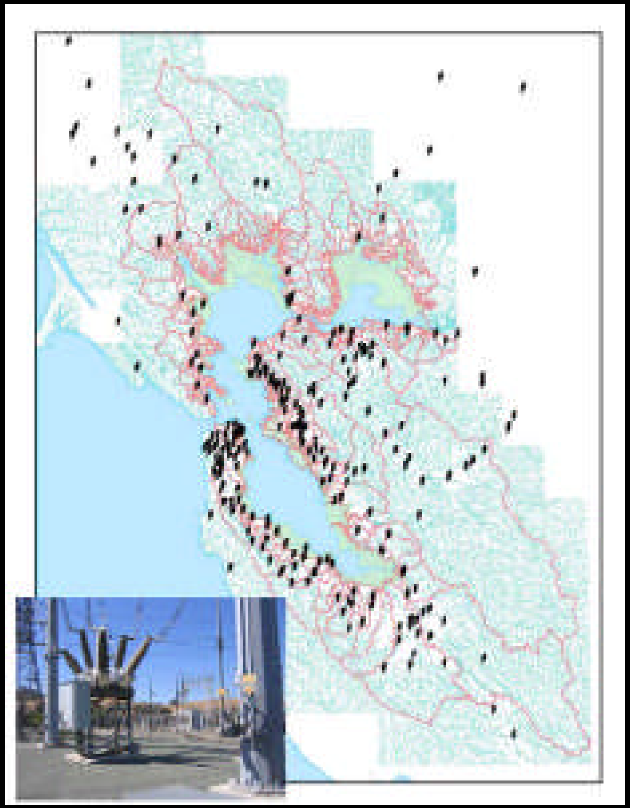
Hg in Paint

- Estimated paint use based on population
- Studies indicate 66% of use is released to the environment
- Assumed use life is 20 years before repaint

Fight mold with mercury

PCBs in Power Transmission and Use

- **Scaled use based on population**
- **2-3% transformers and large capacitors had leaks**
- **0.05-0.35% of the oil leaks out**
- **Used literature to estimate escape stormwater**



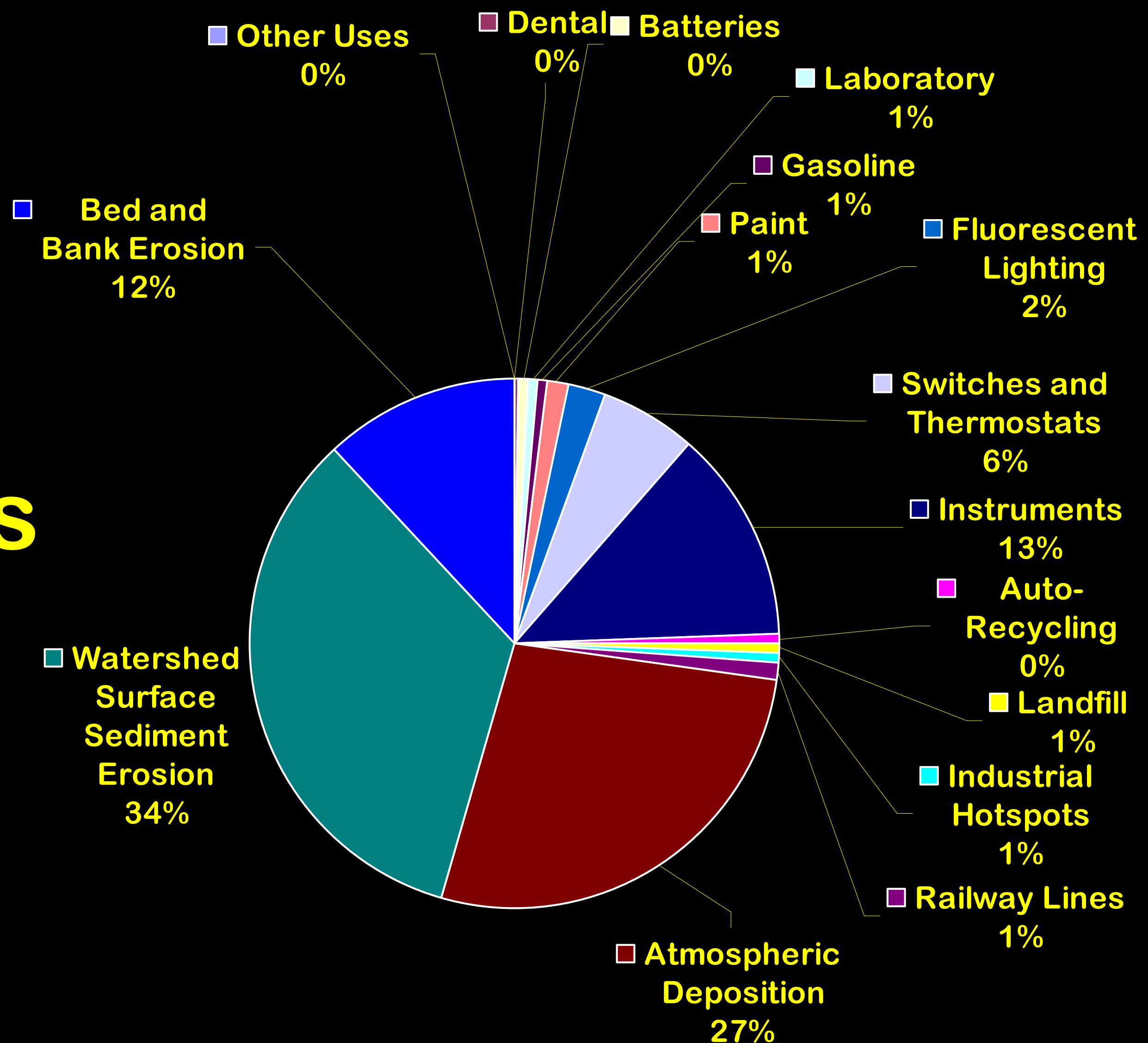
PG&E facilities

Railway Lines

- Oil used as a dust suppressant
- Used literature Hg and PCB soil concentrations
- Estimated erosion of soil based on literature

1950s spur lines

Hg Entering Creeks Rivers and Storm Drains



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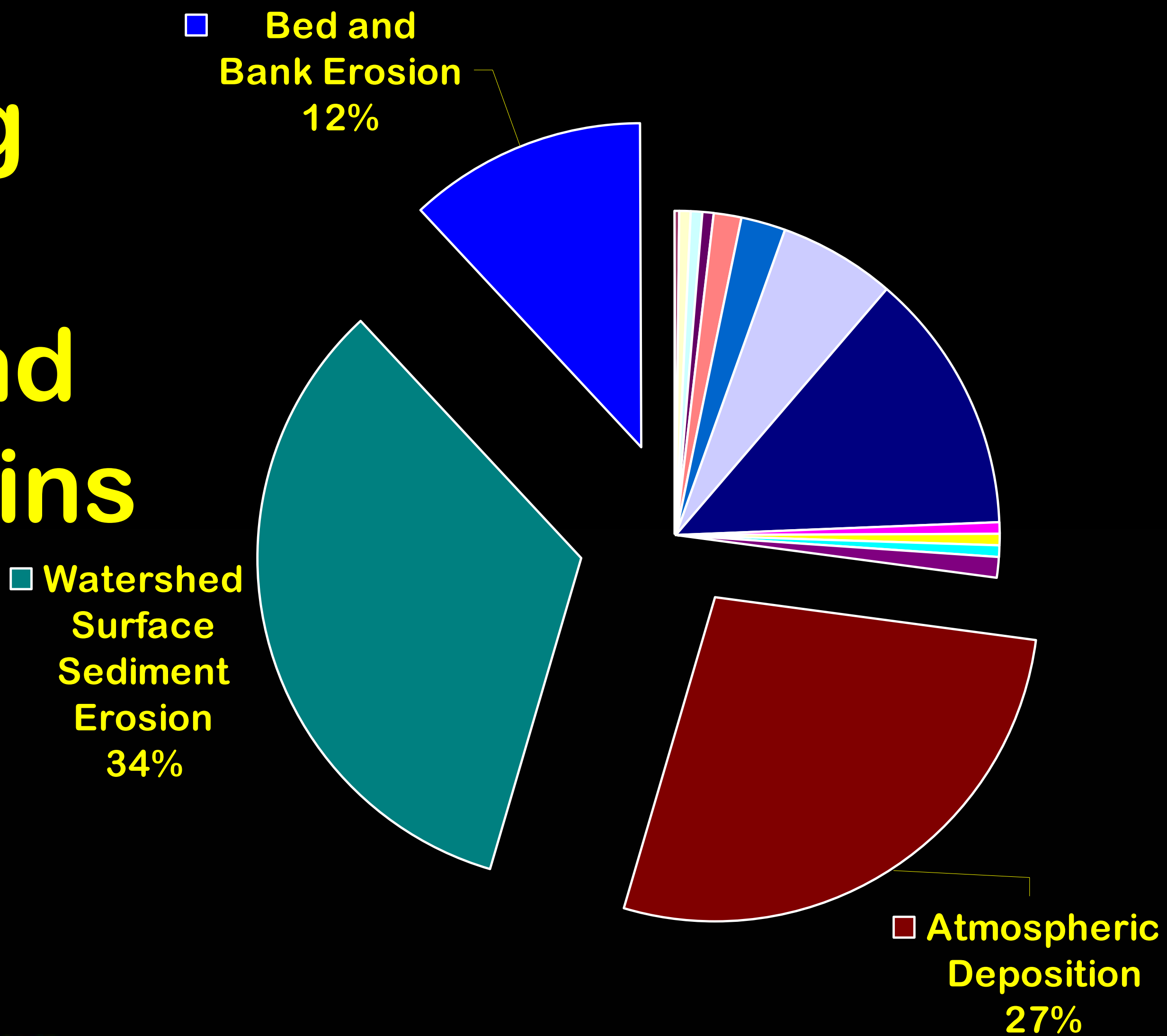
Hg Entering Creeks Rivers and Storm Drains



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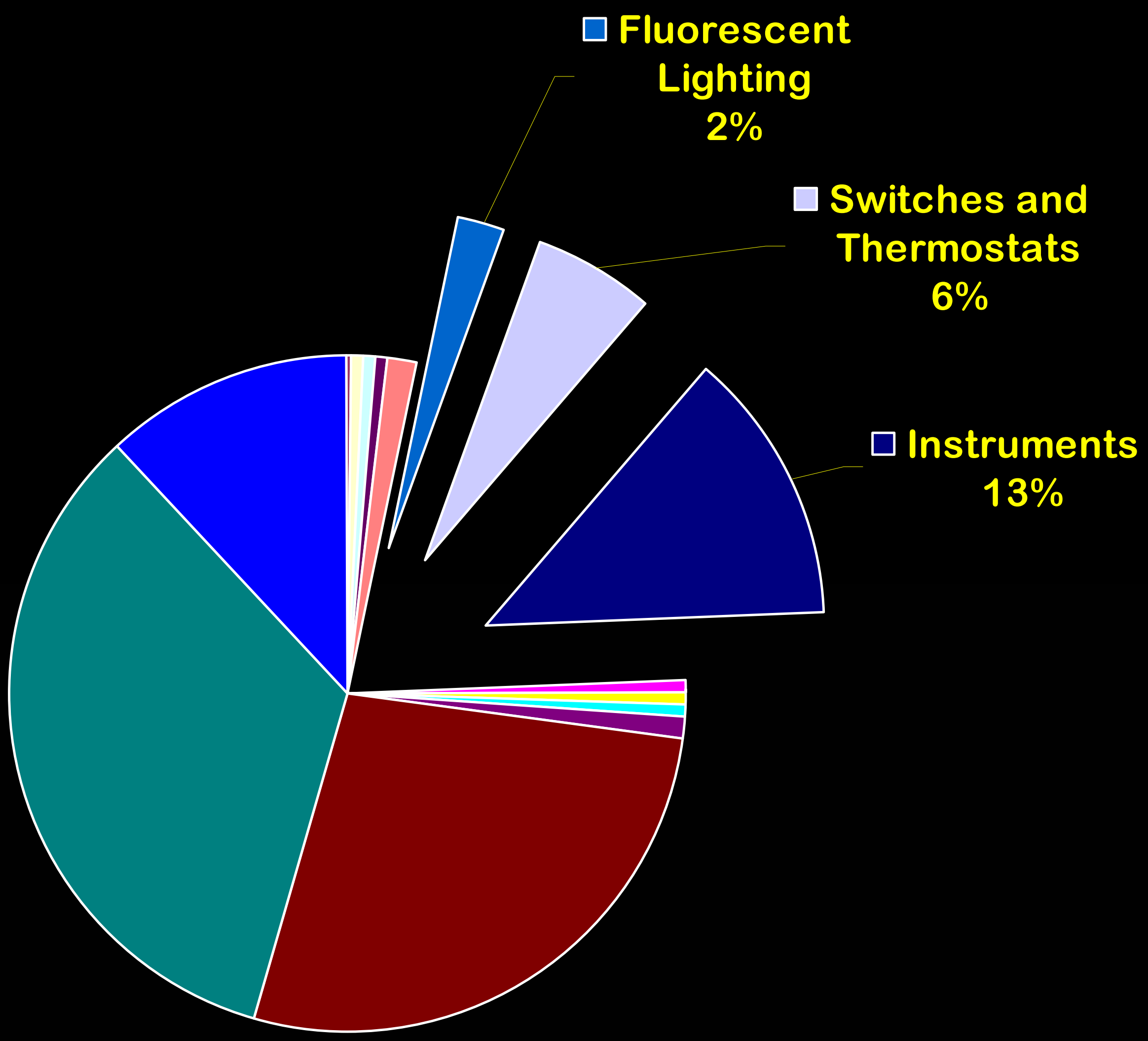
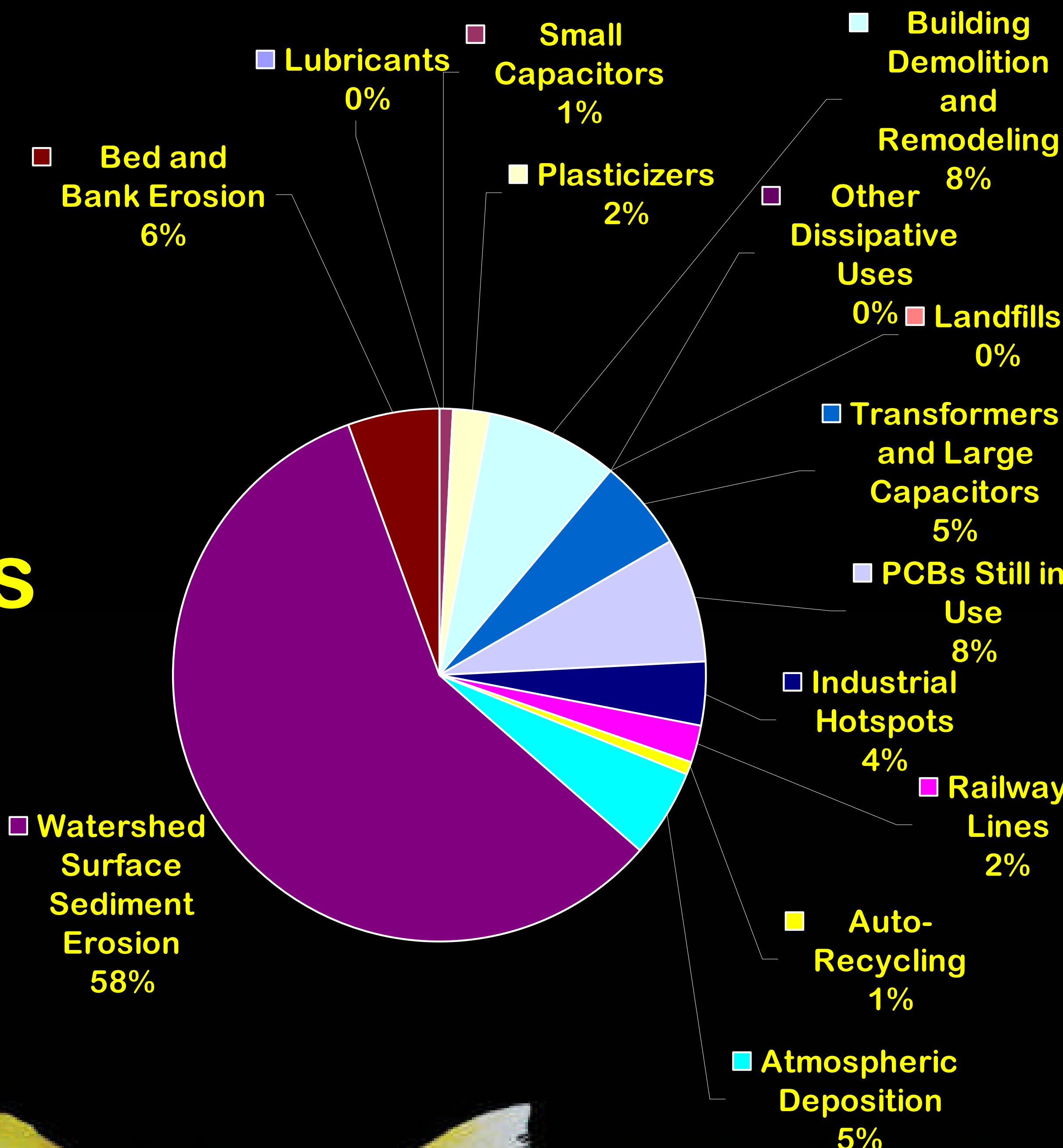


PCBs Entering Creeks Rivers and Storm Drains



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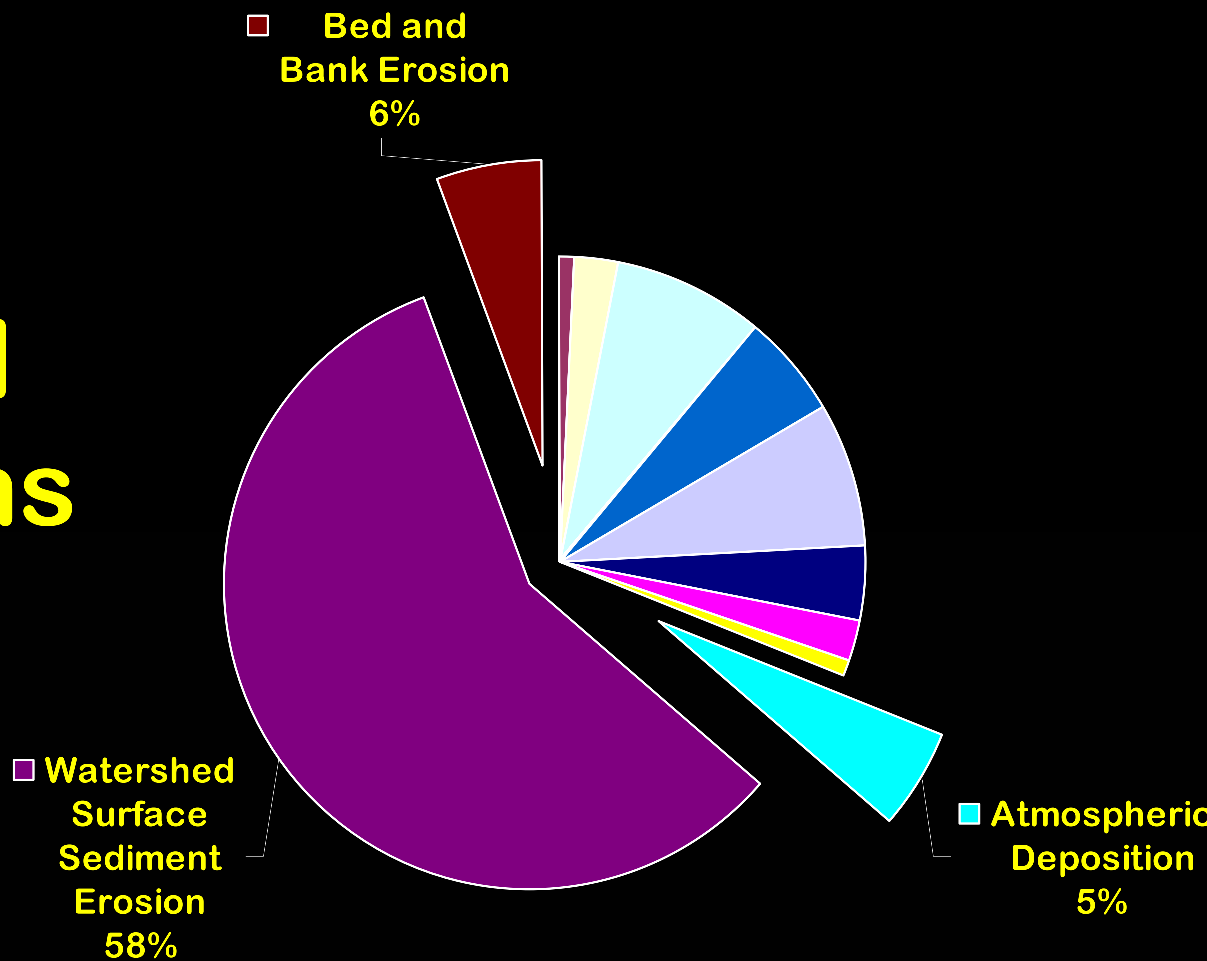

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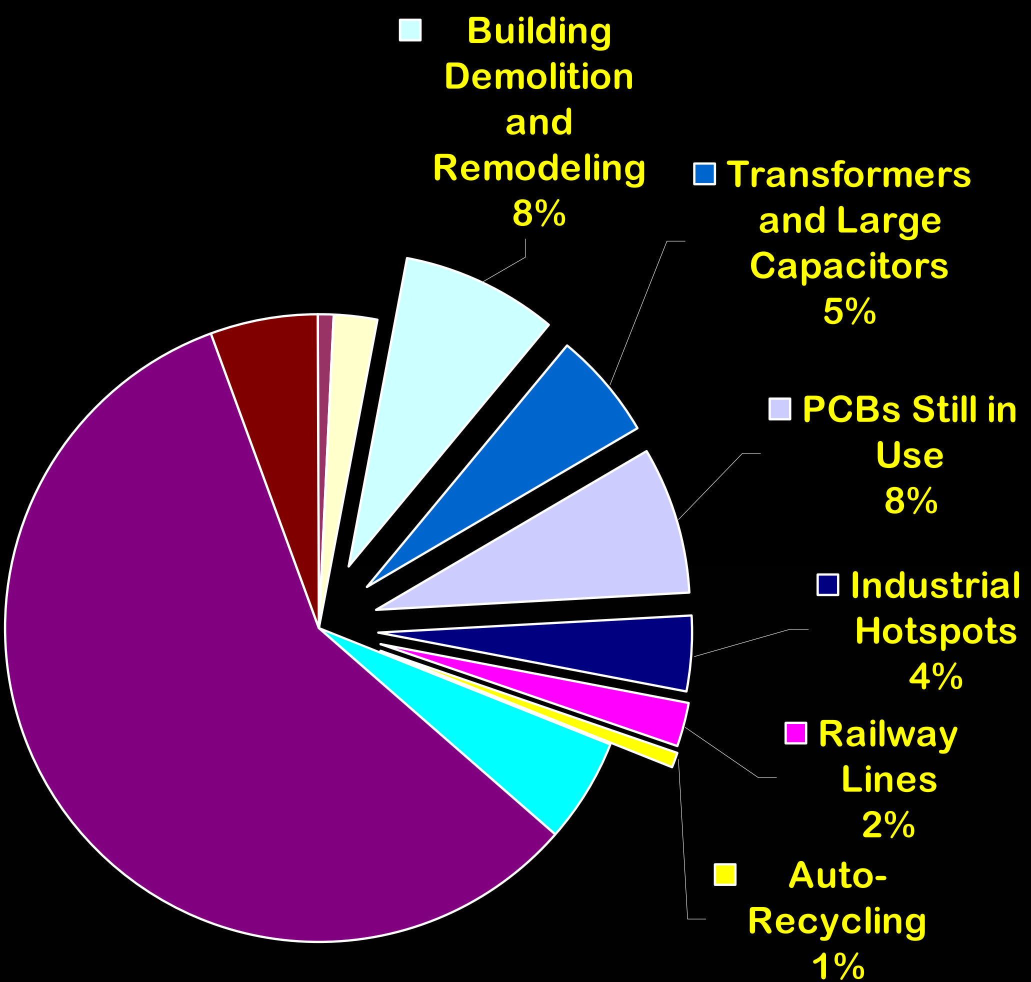
PCBs Entering Creeks Rivers and Storm Drains



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How is the Mass Distributed by Land Use?

Mercury

Land Use	Load (kg/yr)	Area[1] (km^2)	Unit Loading ($g/(km^2 \cdot yr)$)	Unit Loading Normalized on Open Space
Industrial	34	374	92	7
Commercial	30	404	74	6
Residential	39	1,726	22	2
Open/ Agriculture	52	4,147	12	1
Total	155			

How is the Mass Distributed by Land Use?

PCBs

Land Use	Load (kg/yr)	Area[1] (km^2)	Unit Loading ($g/(km^2 \cdot yr)$)	Unit Loading Normalized on Open Space
Industrial	18	374	48	16
Commercial	8	404	20	7
Residential	10	1,726	6	2
Open/ Agriculture	12	4,147	3	1
Total	49			

Modeling Load Reduction Scenarios

- Desktop analysis evaluating alternative control scenarios out to 2025
  - Source control
  - Treatment control
  - Maintenance activities

Scenarios Discussed To-date

- Increased recycling
- Street sweeping (changes)
- Street washing
- Drain inlet cleaning
- Channel desilting
- Redevelopment treatment
- Retrofit treatment
- Targeting contaminated areas
- Pump station diversion

Example - Street Sweeping

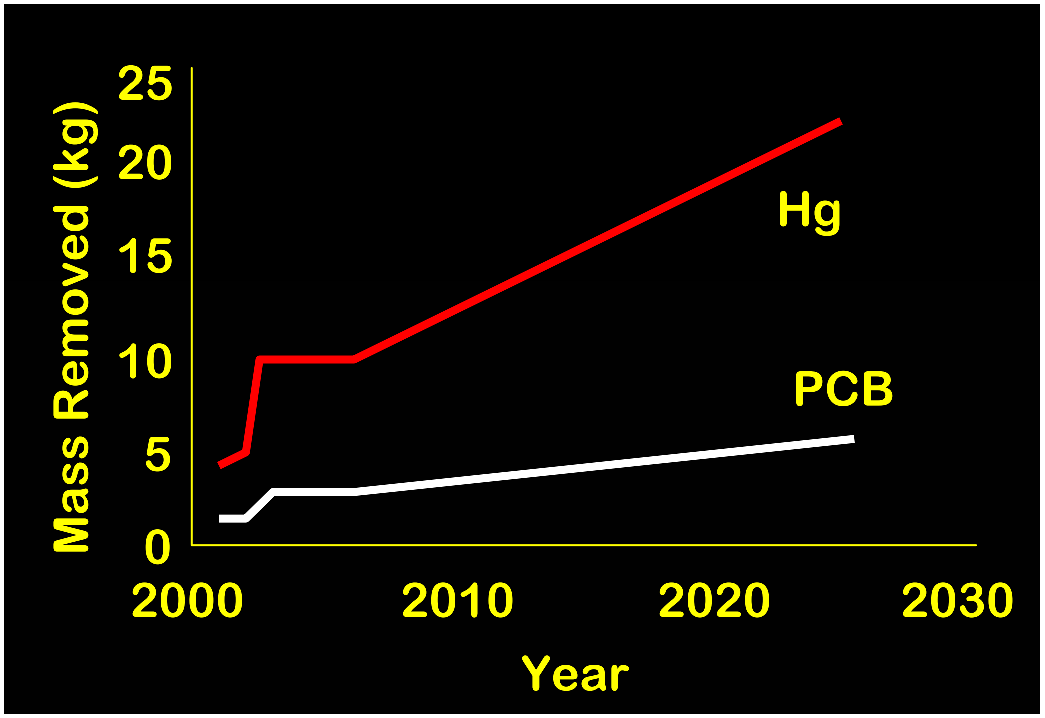
Preliminary – subject to change

- <u>Scenario</u>

- convert present fleet to high efficiency by 2025

- <u>Key assumption</u>

– assume improvement from 30% to 50% efficiency



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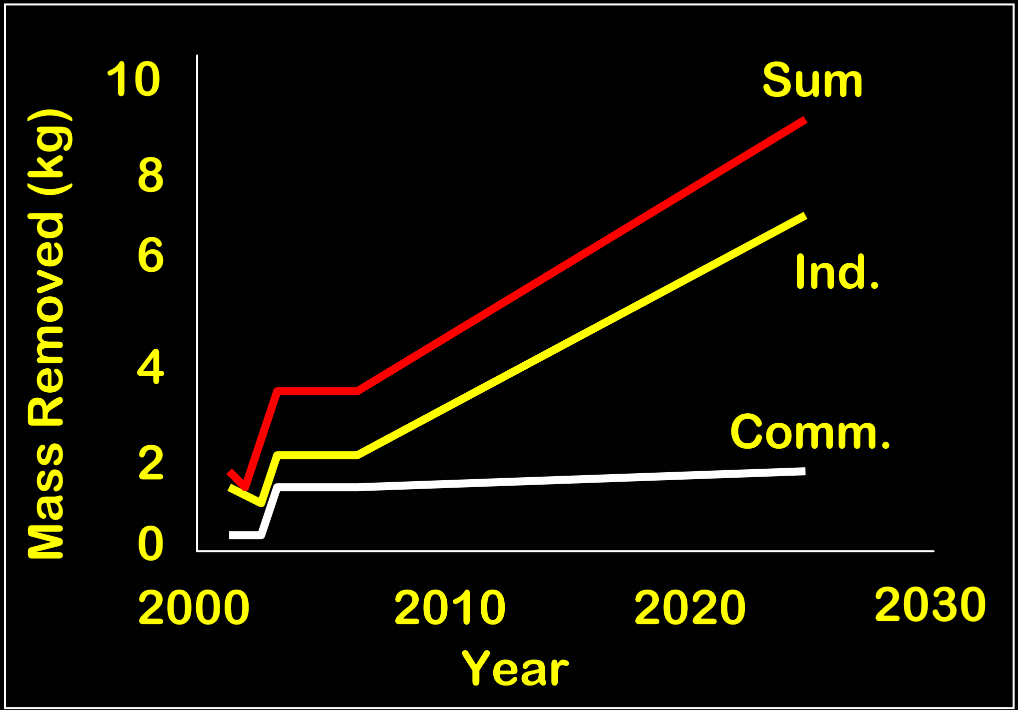
Example - Drain Inlet Cleaning – e.g. Hg

- <u>Scenario</u>
- Frequency increased from annual to biennial

- <u>Key Assumption</u>
- volume of material removed is proportional to area

Preliminary – subject to change



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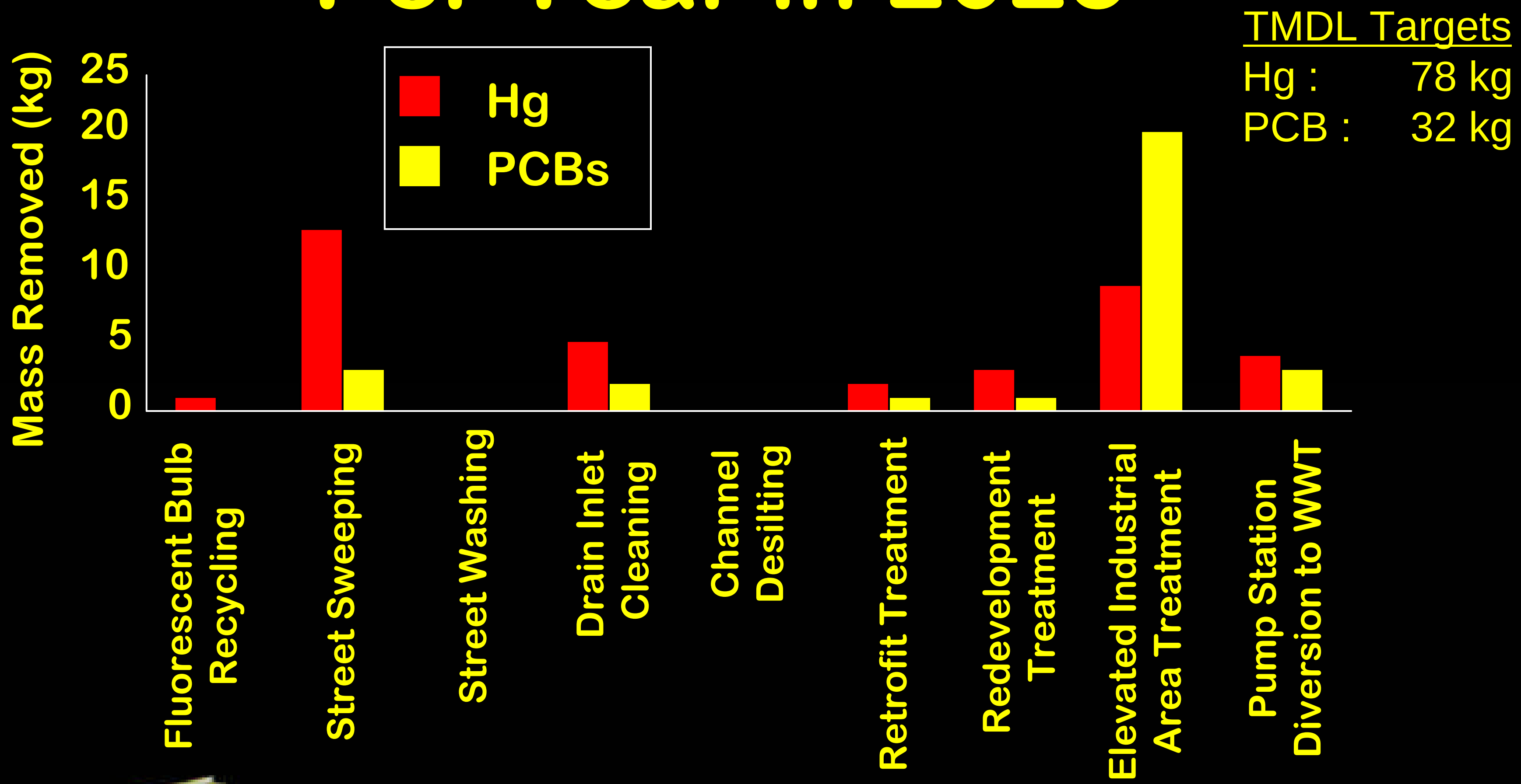
Mercury and PCBs Removed Per Year in 2025



Note Interim product – to be finalized in 2007

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Next Steps – Focused GIS Analysis

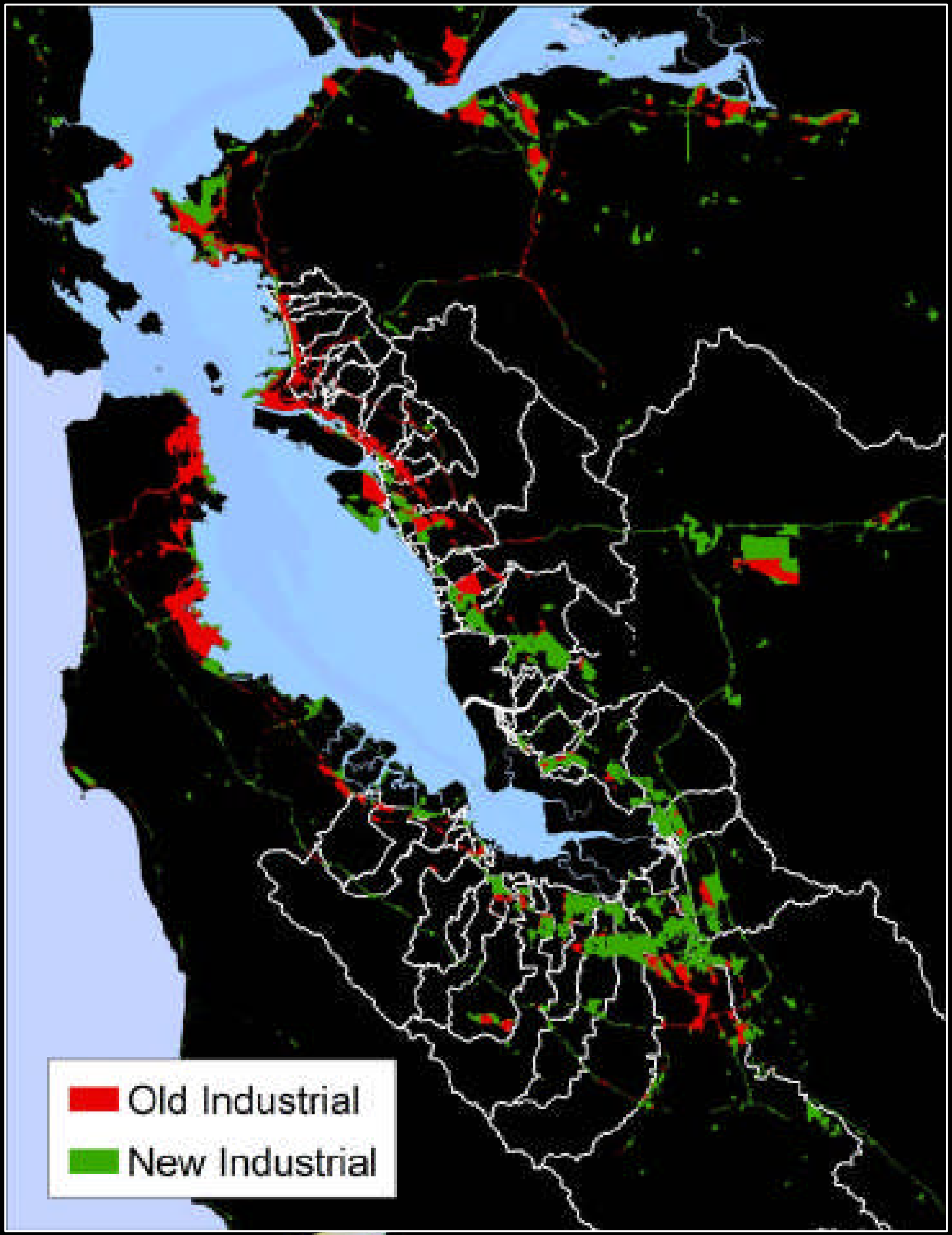
- Storm drains and storm-sewershed boundaries
- Land use (Ind., Comm., Res. Open/Ag.)
- Old Industrial v new industrial
- Known “hotspots” and “orange zones”
- PGE facilities
- Auto wreckers
- Railway lines
- Watershed sediment supply classification
- Stormwater pump stations
- Wastewater treatment facilities

Next Steps – Focused Sample Collection

- Reconnoiter hotspots and orange zones in selected watersheds to assess offsite soil movement
- Measure Hg and PCBs in urban soils
- Characterize sediment and water on a particle size basis (<25, 25-75, >75 microns)
  - Street dust, sweepings, and street wash-water
  - Runoff water

Old Industrial

Preliminary
subject to change



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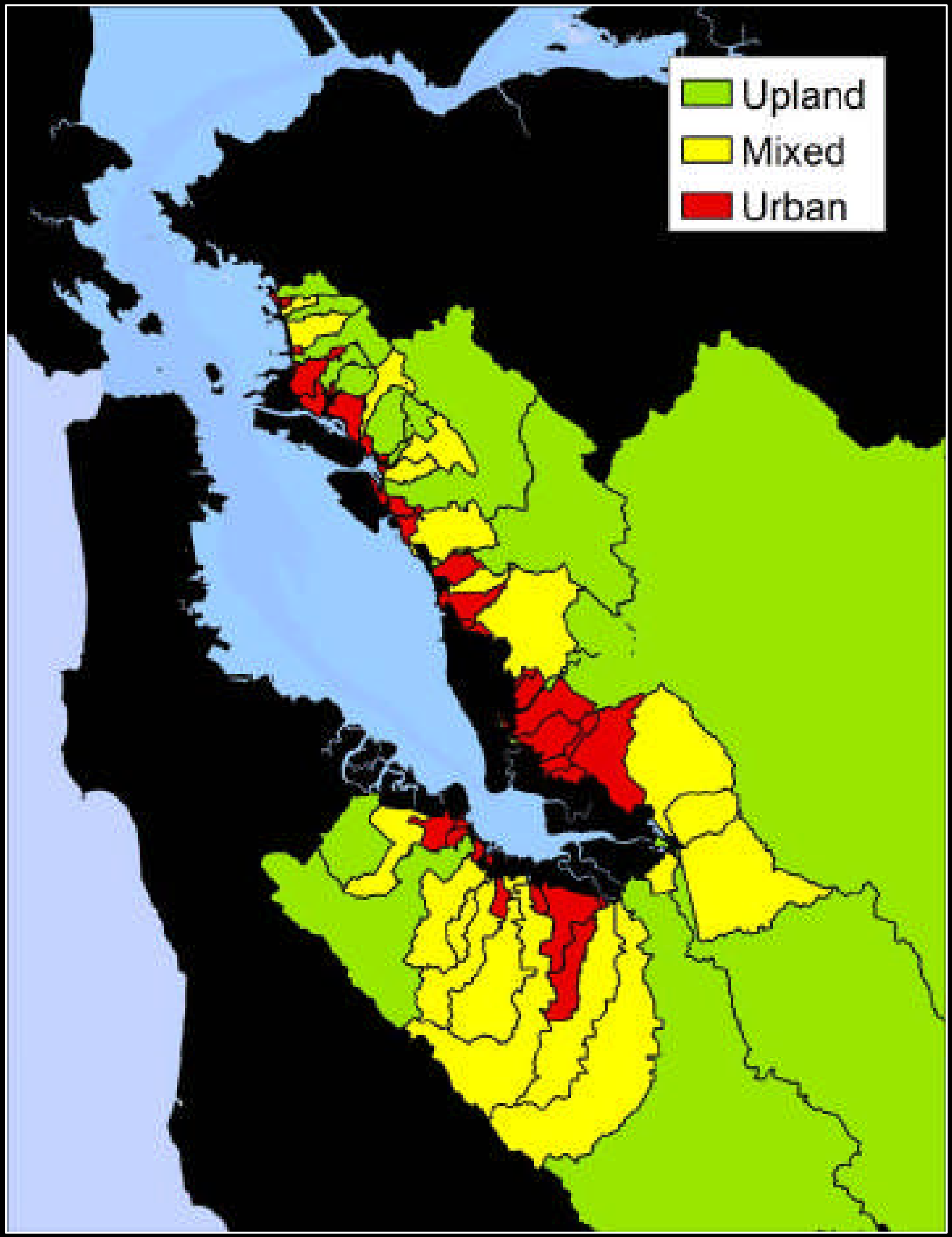
Dominant Sediment Supply Classification

Preliminary
subject to change



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- Funding
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  - Prop 13 BASMAA Stakeholder Group
  - Prop 13 Technical Advisory Committee