

Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995 and 2000

CEC/SMOC

**Workshop on Reductions in
Environmental Releases of
Dioxins, Furans, and Hexachlorobenzene**

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Monterrey, Mexico

Goals Of the US Inventory

- Support to Policy Community
 - Contribute to risk management priority setting and strategy development
 - Monitor trends and evaluate program effectiveness
- Support to Research Community
 - Contribute to research and source identification priority setting and strategy development
 - Support quantitative linking of sources to exposure

Objectives of National Dioxin Release Inventory

- Provide a systematic approach for evaluating the overall state of knowledge of dioxin sources
- Identify areas where additional source testing is needed
- Present a qualitative listing of known and potential dioxin sources
- Where data is sufficient, make quantitative estimates of individual release categories
- Provide a clear understanding of the uncertainty associated with quantitative estimates
- Conduct periodic inventories to track progress in reducing environmental releases.
- Serve as a congener specific data base to support air transport modeling
- Communicate a fully transparent estimate calculation supported by a publicly accessible data base

Inventory Boundaries and Characteristics

- Include all dioxin like compounds (WHO TEF)
- Estimate annual releases calculated for specified years (1987, 1995, 2000)
- Include all releases to the circulation environment for the specified years.
- Calculate facility specific estimates aggregated to source categories
- Place priority on using measured emissions from individual facilities rather than generic emission factors

Taxonomy of Sources

- **Combustion**
- **Metal Smelting, Refining, Processing**
- **Chemical Manufacturing**
- **Biological and Photochemical Processes**
- **Reservoir Sources**

Combustion and Incineration Sources

- **Municipal Solid Waste Incineration**
- **Hospital Waste Incineration**
- **Hazardous Waste Incineration**
- **Cement Kilns Burning and Not Burning Hazardous Waste**
- **Burning Of Various Fuels, E.G., Coal, Wood, Petroleum**
- **Uncontrolled Burning Of Waste**

Metal Smelting and Refining/Processing

- **Iron Ore Sintering**
- **Steel Production**
- **Smelting Operations**
 - **Primary**
Pb, Zn, Cu, Mg, Ti
 - **Secondary**
Al, Cu
- **Scrap Metal Recovery**

Chemical Manufacturing/Processing

- **Chlorine Bleached Wood Pulp**
- **Chlorophenols, E.G., Pcp**
- **Chlorobenzenes**
- **Chlorinated Aliphatic Compounds (EDC, PVC)**
- **Halogenated Diphenyl Ethers**
- **Pesticides, E.G., 2,4-d**
- **Chlorine Manufacturing**
- **Dyes, Pigments**

Biological and Photochemical Processes

- **Microbial Dechlorination; Photolysis**

Reservoir Sources

- **Places which Contain Previously Formed CDDs and CDFs and Have the Potential for Redistribution and Circulation in the Environment**
- **Soils, Sediments, Vegetation, PCP-treated Wood**

Level Of Confidence In The Release Estimates

	Rating	Emission Factor	Activity Level
A	High	Based on a large number of tested sources.	Based on measured data.
B	Medium	Moderately comprehensive in terms of # of sources tested.	Estimated using survey data.
C	Low	Based on a very limited number of sources tested.	Estimated using expert judgment
D	Preliminary	Based on inadequate data. Very limited # of tested sources.	Inadequate data.
E	Not quantifiable	No EF can be derived. Total lack of reliable information.	Unknown

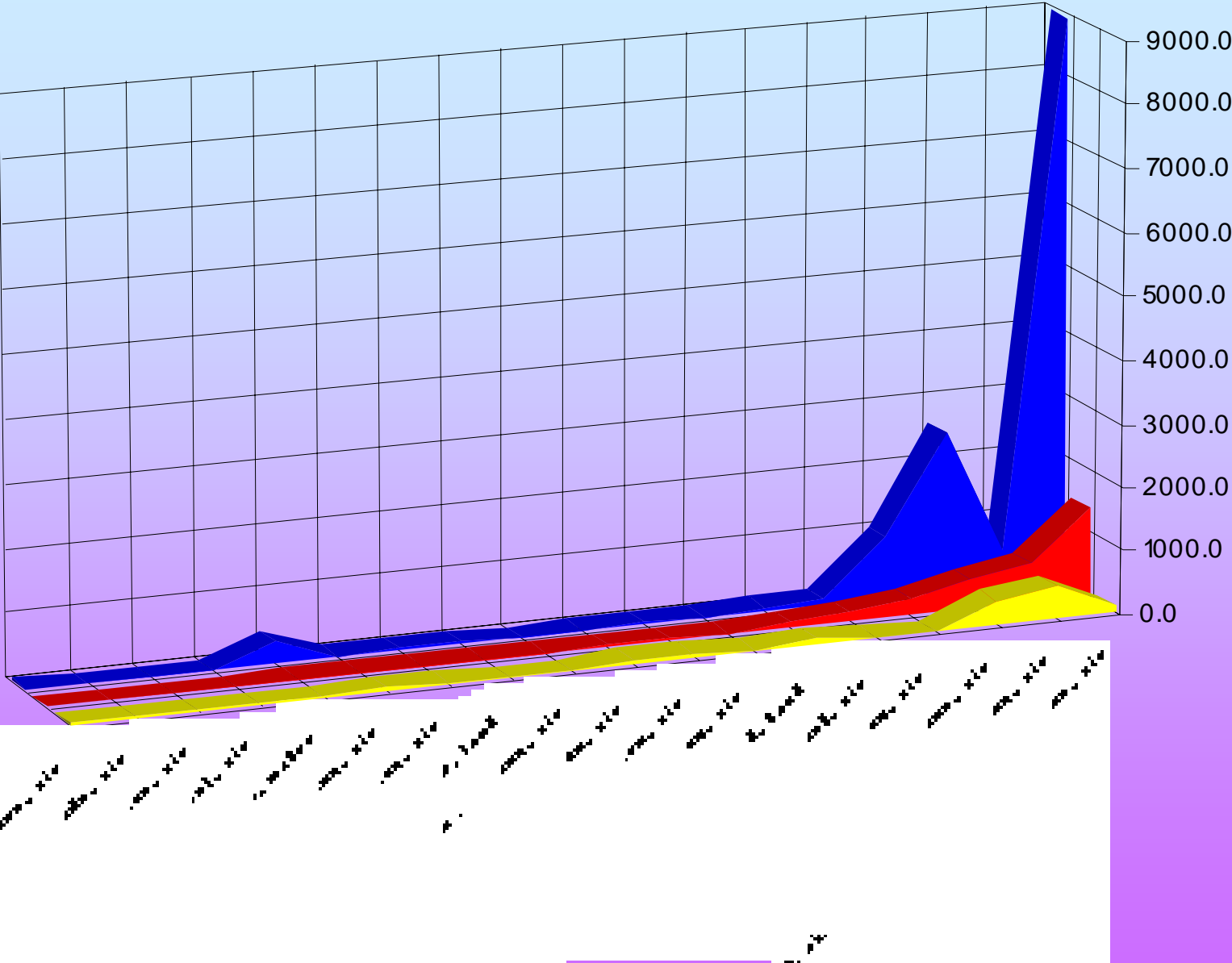
 = Included in the inventory estimates.

 = Not included in the inventory estimates.

Inventory of Sources of Dioxin in the United States-May, 2000	1987	1995	2000
	Emissions (g TEQdf-WHO98/yr)	Emissions (g TEQdf-WHO98/yr)	Emissions (g TEQdf-WHO98/yr)
Municipal Solid Waste Incineration, air	8905.0	1393.5	83.8
Backyard Barrel Burning, air	604.0	628.0	498.6
Medical Waste Incineration, air	2570.0	487.0	378.0
Secondary Copper Smelting, air	983.0	271.0	0.9
Cement Kilns (haz waste), air	117.8	156.1	18.8
Sewage Sludge/land applied, land	76.6	116.1	78.2
Residential Wood Burning, air	22.0	15.7	11.3
Coal-fired Utilities, air	50.9	60.9	69.5
Diesel Trucks, air	27.8	35.3	65.4
Secondary Aluminum Smelting, air	10.9	19.5	8.3
2,4-D, land	33.4	28.9	0.0
Iron Ore Sintering, air	32.7	28.0	27.6
Industrial Wood Burning, air	26.5	26.2	41.5
Bleached Pulp and Paper Mills, water	356.0	28.0	1.0
Cement Kilns (non-haz waste), air	12.7	16.6	17.2
Sewage Sludge Incineration, air	5.8	14.2	9.6
EDC/Vinyl chloride, air	NA	23.1	23.1
Oil-fired Utilities, air	26.1	18.0	9.0
Crematoria, air	5.8	14.2	9.6
Unleaded Gasoline, air	3.6	4.7	3.6
Hazardous Waste Incineration, air	5.0	5.8	3.2
Lightweight ag kilns, haz waste,air	3.3	2.4	1.9
Kraft Black Liquor Boilers, air	2.0	2.3	0.8
Petrol Refine Catalyst Reg., air	2.2	2.2	2.2
Leaded Gasoline, air	37.5	1.6	0.0
Secondary Lead Smelting, air	1.3	1.6	2.5
Paper Mill Sludge, land	14.1	2.0	0.1
Cigarette Smoke, air	1.0	0.8	0.4
EDC/Vinyl chloride, land	NA	1.4	1.4
EDC/Vinyl chloride, water	NA	11.2	5.5
Boilers/industrial furnaces, air	0.8	0.4	1.8
Tire Combustion , air	0.1	0.1	0.5
Drum Reclamation, air	0.1	0.1	0.1
TOTALS	13,965	3,442	1,422
Percent Reduction from 1987		75%	90%

Major US Dioxin Sources

1987
1995
2000



Poorly Characterized Sources

- **Ferrous and non-ferrous foundries**
- **Coke production**
- **Ceramic manufacturing**
- **Clay processing**
- **Asphalt mixing plants**
- **Primary magnesium**
- **Secondary steel electric arc furnaces**
- **TiO₂**
- **Wood stoves**
- **Forest fires**
- **Brush fires**
- **Range fires**
- **Ag burning**
- **Landfill fires**
- **Structural fires**
- **Municipal West treatment Facilities**
- **Rural soil erosion to water**
- **Urban runoff to surface water**
- **Utility poles and storage yards**
- **Landfill fugitive emissions**
- **Transformer storage yards**

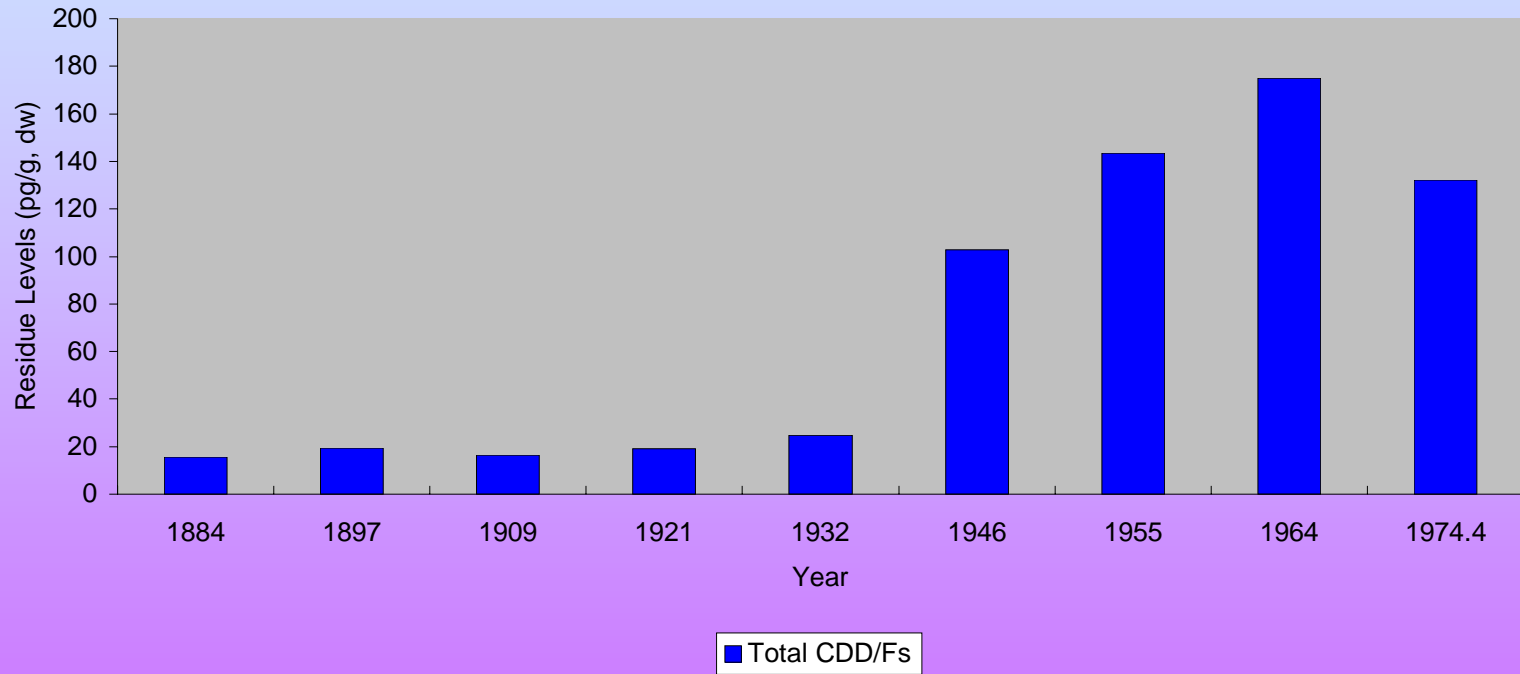
POTENTIAL SIGNIFICANCE OF UNCONTROLLED COMBUSTION

If other uncontrolled combustion sources, either collectively or individually, are of the same magnitude as barrel burning ...

Then releases from uncontrolled combustion may have played a much more important role historically than indicated by current inventories, based primarily on industrial sources.

20th Century Trend

Sediment Levels, Beaver Lake, Olympic Peninsula, WA
Non-detects = zero



UNCONTROLLED COMBUSTION

In non-industrial and developing countries, uncontrolled burning appears to be much more prevalent and is likely to dominate release for these countries and possibly total global releases.

What is less clear is whether uncontrolled combustion in non-industrialized countries can result in environmental or exposure levels similar to those found in industrialized nations.

Progress in characterizing these sources is of immediate policy relevance for both developed and developing nations.

Reservoir Sources

Old releases of dioxins that are temporarily stored in environmental compartments to later be reintroduced into the circulating environment:

- **Soil**
- **Sediment**
- **Biota**
- **Materials**

Reservoirs contribute as much as 50% to US general population exposure.

Reservoir Sources

- Given the magnitude of past releases and the persistence of dioxin-like compounds, it seems likely that existing reservoir sources could sustain their current level of exposure contribution for years/decades.
- If this is the case, then, even if we could eliminate all contemporary sources, exposure and subsequent risks could be sustained at about 50% of current levels for some time.
- Better quantifying the current exposure contribution made by reservoir sources, and gaining a better understanding of continued strength of these sources, would do much to facilitate long-term strategic planning for dioxin risk management.