

# Environmental Impacts

Stakeholder Meeting

June 24-25, 2003



## Congressional directive

**The Administrator of the Environmental Protection Agency shall transmit to Congress a report summarizing:**

*... the extent of environmental impacts caused by municipal CSOs and SSOs*

## Definition of “environmental impact”

- **Water quality, aquatic life and aesthetic impacts that affect designated uses are considered to be environmental impacts.**
- **Human health impacts are examined in a separate presentation.**

## Components of presentation

- **Methodological approach**
- **What is in CSO and SSO discharges that causes environmental impacts?**
- **What are the results of national assessments of environmental impacts caused by CSOs and SSOs?**
- **What are the results of state and local government assessments of environmental impacts caused by CSOs and SSOs?**

## Methodological approach

- **Data sources**
  - ▶ **National assessments**
  - ▶ **State and local assessments**
  - ▶ **Literature and web searches**
  - ▶ **Interviews with state and municipal officials**
- **No original data collection**

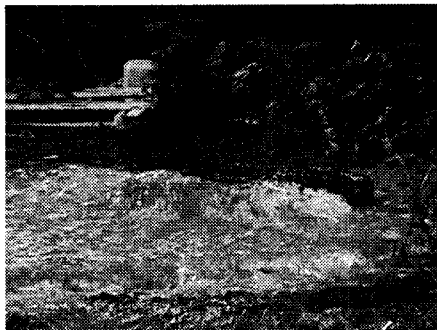
## Methodological approach

- **Data analysis**
  - ▶ **Characterize types of environmental impacts**
  - ▶ **Summarize, tabulate, and present extent of environmental impacts attributable to CSOs and SSOs in available assessments and reports**

## Methodological approach

### ● Data considerations

- ▶ CSOs and SSOs often occur in conjunction with other wet weather discharges.
- ▶ Impacts can be compounded by incremental impacts from other activities.



## What is in CSOs and SSOs that causes environmental impacts?

### ● CSOs and SSOs contain a variety of pollutants:

- ▶ Pathogens (bacteria, protozoa and viruses)
- ▶ Conventional pollutants (BOD, TSS, nutrients)
- ▶ Toxics (organic compounds and inorganic substances)
- ▶ Floatables (litter, trash, and sanitary products)

## What is in CSOs and SSOs that causes environmental impacts?

- CSOs and SSOs contain untreated sewage, and this gives them some similar characteristics.
- The addition of high volumes of storm water to CSOs can:
  - ▶ Dilute concentration of some pollutants (BOD)
  - ▶ Strengthen concentration of others (metals)
  - ▶ Add new pollutants (floatables)

## Typical composition of untreated sewage

Pollutant	Low Strength	Medium Strength	High Strength
TSS (mg/L)	120	210	400
BOD <sub>5</sub> (mg/L)	110	190	350
Total N as N (mg/L)	20	40	70
Total P as P (mg/L)	4	7	12
Oil & Grease (mg/L)	<100	100-400	>400

Source: Metcalf & Eddy, 2003

## Pathogens in untreated sewage

### ● Bacteria

- ▶ Bacteriodes
- ▶ Total coliform
- ▶ Fecal coliform
- ▶ *E. Coli*
- ▶ Enterococci
- ▶ Fecal streptococci
- ▶ Shigella
- ▶ Salmonella

### ● Protozoa, helminths, and viruses

- ▶ Cryptosporidium
- ▶ Entamoeba histalytica cysts
- ▶ Giardia lamblia cysts
- ▶ Ova
- ▶ Ascaris lumbricoides
- ▶ Enteric virus
- ▶ Coliphage

Source: Metcalf & Eddy, 2003

## Inorganic pollutants most often detected in untreated sewage

<i>Chemical</i>	<i>Detects</i>	<i>Median detected in ug/l</i>	<i>Recommended WQ acute criteria in ug/l</i>
<b>Zinc</b>	<b>72%</b>	140.0	<b>120</b>
<b>Copper</b>	<b>71%</b>	53.3	<b>13</b>
<b>Nickel</b>	<b>42%</b>	30.0	<b>470</b>
<b>Chromium</b>	<b>42%</b>	20.0	<b>570</b>
<b>Mercury</b>	<b>40%</b>	0.4	<b>1.4</b>
<b>Lead</b>	<b>37%</b>	16.0	<b>65</b>
<b>Silver</b>	<b>37%</b>	8.0	<b>3.2</b>
<b>Cadmium</b>	<b>28%</b>	4.0	<b>2.0</b>
<b>Arsenic</b>	<b>26%</b>	5.0	<b>340</b>
<b>Cyanide</b>	<b>24%</b>	22.5	<b>22</b>

Source: Ohio and Vermont pretreatment program data

### Organic pollutants most often detected in untreated sewage

<i>Chemical</i>	<i>Detects</i>	<i>Median detected in ug/l</i>	<i>Recommended 30-day WQ criteria in ug/l</i>
Chloroform	38%	6.0	470
Toluene	34%	7.2	200,000
Phenol	30%	20.0	4,600,000
Methylene chloride	13%	17.2	1,600
Di-n-butyl phthalate	13%	7.3	12,000
1,1,1-Trichloroethane	13%	7.2	42.0
Tetrachloroethylene	12%	6.0	8.85
Trichloroethylene	11%	7.6	81.0
Ethylbenzene	10%	5.2	29,000
Naphthalene	7%	5.3	n/a

Source: Ohio and Vermont pretreatment program data

### Floatable Material in CSO Discharges

<b>Item</b>	<b>% Volume</b>
Plastic and paper bags	12 to 26
Styrofoam	14 to 20
Plastic bottles	10 to 19
Glass bottles	3 to 4
Wood	3
Straws	<1 to 2
Cans	<1
Medical waste	<1

Source: EPA Demonstration Study, Newark, NJ

**What are the results of national assessments of environmental impacts caused by CSOs and SSOs?**

- **Data are not comprehensive.**
- **Some impacts and use impairment are attributed to CSOs and SSOs in national studies.**
  - ▶ **Beach closures and shellfish bed closures have been traced to CSOs.**
- **Personal hygiene items typically associated with sanitary sewage regularly wash up on beaches.**

**What are the results of national assessments of environmental impacts?**

- **The top three pollutants responsible for impairment of designated uses reported in EPA's National Water Quality Inventory Report 2002 are:**
  - ▶ **Bacteria**
  - ▶ **Dirt (TSS)**
  - ▶ **Nutrients**
- **All three are contained in CSOs and SSOs.**



## Leading pollutants/stressors causing water quality impairment

Rank	Rivers	Lakes	Estuaries
1	Pathogens	Nutrients	Metals
2	Siltation	Metals	Pesticides
3	Habitat Alteration	Siltation	Oxygen demand
4	Oxygen demand	Total dissolved solids	Pathogens
5	Nutrients	Oxygen demand	Toxic chemicals

Source: EPA's 2002 *National Water Quality Inventory*

## Impairment attributed to CSOs

- 1,446 sq miles of impaired estuaries cited CSOs as a source
  - ▶ 9% of assessed estuarine waters
- 56 miles of impaired lake shoreline attributed to CSOs
  - ▶ 1% of assessed lake shorelines
- CSOs were not cited as a leading cause of river and ocean impairment

Source: EPA's 2002 *National Water Quality Inventory*

## Examples of leading sources of water quality impairment

<b>State</b>	<b>Lakes, reservoirs and ponds</b>	<b>Rivers and streams</b>
<b>CT</b>	Atmospheric deposition, municipal point sources, urban runoff/storm sewers	Municipal point sources, urban runoff/storm sewers, hydromodification
<b>GA</b>	Urban runoff/storm sewers, municipal point sources	Urban runoff/storm sewers, municipal point sources, hydromodification
<b>IN</b>	Habitat modification	Unspecified nps, agriculture, urban runoff/storm sewers
<b>MI</b>	Atmospheric deposition, municipal point sources, agriculture	Agriculture, municipal point sources, urban runoff/storm sewers

Source: EPA's 2002 National Water Quality Inventory

## Examples of leading sources of water quality impairment

<b>State</b>	<b>Estuaries</b>
<b>CA</b>	Industrial point sources, municipal point sources, agriculture
<b>CT</b>	Urban runoff/storm sewers, municipal point sources, NPS
<b>GA</b>	Municipal point sources, industrial point sources, urban runoff/storm sewers
<b>ME</b>	Municipal point sources, urban runoff/storm sewers, combined sewer overflows
<b>MD</b>	Natural sources, municipal point sources, industrial point sources
<b>MA</b>	Urban runoff/storm sewers, combined sewer overflows, contaminated sediments
<b>RI</b>	Urban runoff/storm sewers, municipal point sources, combined sewer overflows

Source: EPA's 2002 National Water Quality Inventory

## Leading sources of estuary impairment

- Municipal point sources (28%)
- Urban runoff/storm sewers (28%)
- Atmospheric deposition (23%)
- Industrial discharges (14%)
- Agriculture (14%)
- Land disposal of wastes (12%)
- CSOs (11%)

*Note: some estuaries report more than one leading source*

Source: EPA's 2001 *National Coastal Condition Report*

## Sources of pollution leading to beach advisories and closures

<b>Source</b>	<b>% of advisories or closures caused by source</b>
Unknown	43%
Storm water runoff	21% (37% of source-identified events)
Wildlife	11% (19%)
Other	9% (16%)
SSO and sewer line blockage/break	6% (11%)
Septic system	4% (7%)
Boat discharge	3% (5%)
POTW	2% (4%)
CSO	1% (2%)

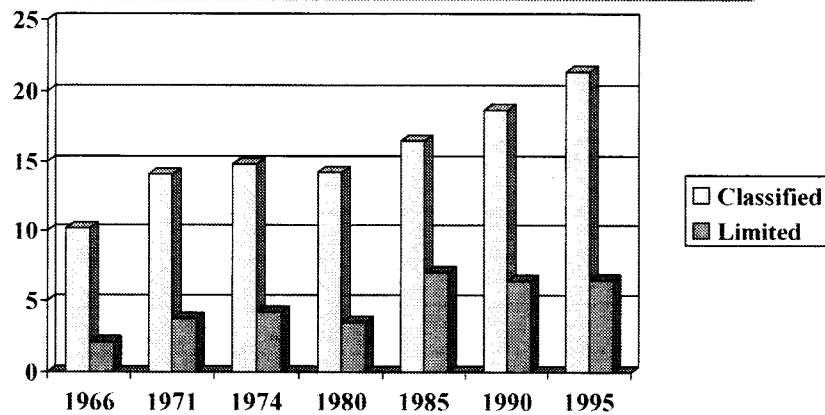
Source: EPA 2002 *BEACH Watch Program Report*

## NOAA's national shellfish register

- Periodic assessments of classified shellfish growing waters
- Classified waters are monitored by 21 coastal states, and include 1,222 estuaries
- Discontinued following 1995

Source: NOAA's 1995 National Shellfish Register

## Classified shellfish growing waters of US (millions of acres)



Source: NOAA's 1995 National Shellfish Register

## Pollution sources: shellfish harvest limitations

Pollution Source	1995
Urban runoff	40%
Upstream sources	39%
Wildlife	38%
Individual onsite WWTPs	32%
Public and private WWTPs	24%
Agricultural runoff	24%
Marinas	17%
Boating	13%
Industry	9%
CSOs	7%

*Note: shellfish beds can be impaired by more than one source*

## Top ten items: beach washup program

- Cigarette butts (24%)
- Plastic pieces (6%)
- Foamed plastic (6%)
- Plastic bags (6%)
- Paper (5%)
- Plastic caps/lids (5%)
- Glass pieces (4%)
- Straws (3%)
- Bottles (3%)
- Cans (3%)



Source: Center for Marine Conservation, 1998

## Examples of hygiene items collected during International Coast Cleanup

State	Condoms	Diapers	Syringes	Tampons/ Applicators
AL	113	115	91	145
CA	1,838	852	380	772
MA	309	258	64	821
MI	197	184	56	581
TX	507	567	194	335

Source: Ocean Conservancy, 2002

## Planned national assessments

- CSO outfall locations will be integrated with EPA's WATERS database; will allow CSO locations to be associated with:
  - ▶ 303(d) impaired reaches
  - ▶ Beach closures
  - ▶ Shellfish bed closures
  - ▶ Water supply intakes
  - ▶ Other sensitive areas

**What are the results of state and local assessments of environmental impacts caused by CSOs and SSOs?**

- **Data are collected inconsistently from state-to state, location-to-location.**
- **Evidence of some use impairment and impacts where data are collected and reported**
- **Finding and uncovering this evidence can be difficult and expensive.**

**What are the results of state and local assessments of environmental impacts?**

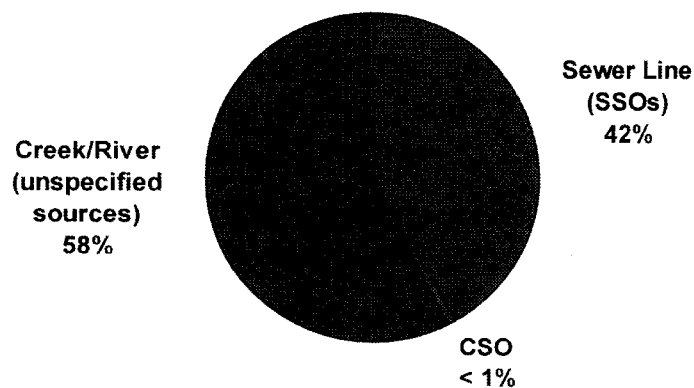
- **State and local government assessments of environmental impacts associated with CSOs and SSOs are not reported and tracked in a consistent manner**
- **Examples of environmental impacts that EPA has found are presented**
- **EPA continues to look for additional examples**

## Beach closures in California by county, 2000

<i>County</i>	<i>Incidences</i>	<i>Days</i>	<i>Primary SSO Cause(s)</i>
Los Angeles	7	45	Line break, blockage
Mendocino	1	15	Line break
Monterey	6	16	Line break, blockage
Orange	40	152	Blockage
San Diego	47	310	Sewage
San Mateo	9	217	Rain
San Luis Obispo	1	1	Blockage
Sonoma	2	4	Unknown
Ventura	4	12	Blockage

Source: SWRCB's 2000 *California Beach Closure Report*

## Sources of contamination causing beach closures, California



Source: SWRCB's 2000 *California Beach Closure Report*

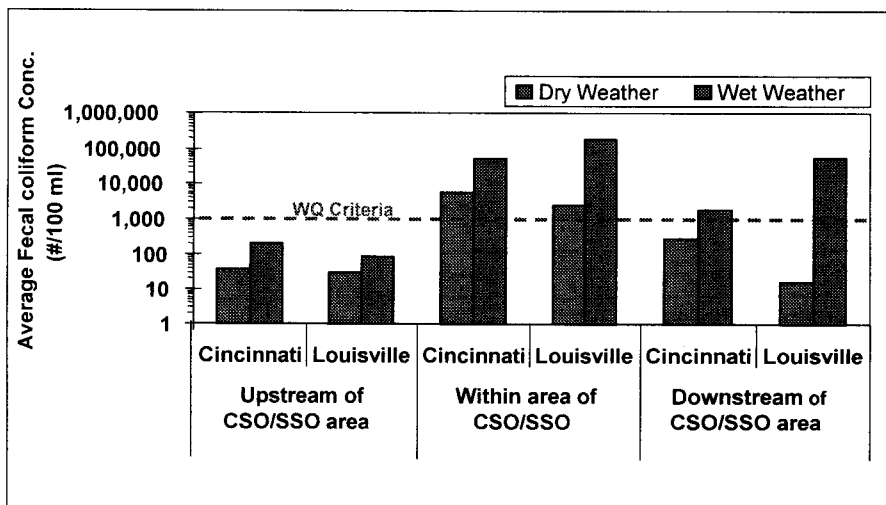


## SSO-related fish kills in North Carolina, 1997

<i>Impacted water</i>	<i># of fish killed</i>	<i>Volume (gallons)</i>	<i>Cause of SSO</i>
Tributary to Cokey Swamp	300	23,000	Unknown
Elerbee Creek	120	No estimate	Blockage
Tributary to Elerbee Creek	100	30,000	Mechanical / power failure
Swift/Mahlers Creek	1,000	1 million	Line break
Tributary to Northeast Creek	200	20,000	Line break
Coon Creek	3,500	1.2 million	Mechanical / power failure
Little Buffalo Creek	25	50,000	Unknown
Lovills Creek	3,099	No estimate	Sewage leak
East Beaverdam Creek	40	500,000	Line break

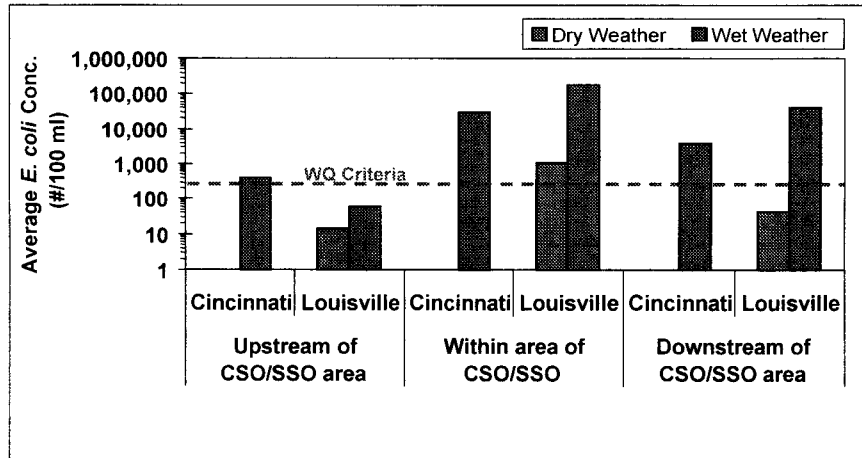
Source: NCDENR, 2001

## Fecal coliform levels in Ohio River, near Cincinnati, OH and Louisville, KY



Source: EPA/ORSANCO Demonstration Project

## *E. Coli* levels in Ohio River near Cincinnati, OH and Louisville, KY



Source: EPA/ORSANCO Demonstration Project

## Relative contributions of pollutant sources to water quality problems in Indianapolis

<b><i>Pollutant Source</i></b>	<b><i>Dissolved Oxygen Violations</i></b>	<b><i>Bacteria Violations</i></b>	<b><i>Aesthetic Problems</i></b>
CSO discharges	High	High	High
Upstream sources		Low	
Storm water		Low	High
WWTP bypass	High	High	
Thermal discharges	Low		
Dams	Low		
Septic tanks		Low	
Water withdrawal	Low		
Sediment oxygen demand	Low		

Source: City of Indianapolis, 2000

## Fish and aquatic life killed at Camp Pendleton, CA

- September 2000 SSO event
- Spill estimated to be 2.73 MG
- Duration estimated to be 8 days
- Dissolved oxygen dropped below 1.0 mg/l
- Impacted wildlife included:

320 dead fish	67 dead shrimp
169 dead clams	1 dead snail
1 dead bird	

Source: SWRCB, 2001

## Conclusions - pollutants

- CSOs and SSOs contain pollutants that cause impairments to designated uses, as reported in national assessments.
- CSOs and SSOs can be a principal cause of an environmental impact, or a contributing cause.

## Conclusions - data

- **National data are inconsistent in tracking CSOs and SSOs as a direct cause of impairment.**
  - ▶ CSOs are concentrated in a handful of states.
  - ▶ SSOs have not been tracked consistently and reported as a cause of impairment in most states.
  - ▶ Currently, SSOs are often tracked under the broader categories of municipal point sources or urban runoff/storm sewers.

## Conclusions - environmental impacts

- **While data are not comprehensive, some national quantifications of use impairment have been made.**
- **State and local examples of cause and effect exist where reporting and tracking is undertaken.**
- **Additional information on documented impacts would be appreciated.**