Regulatory Determinations for the Third Drinking Water Contaminant Candidate List

Stakeholder Meeting

Washington D.C.

June 16th, 2011

USEPA

Office of Ground Water and Drinking Water

Regulatory Determination 3 Agenda

1. Provide Background
- Overview of SDWA Regulatory Processes
- Statutory criteria for Regulatory Determinations & Potential Outcomes
- Previous CCLs and Regulatory Determinations

2. Discuss Approach for Regulatory Determination 3 (RegDet 3)
- Approach to screen/identify potential contaminants for RegDet 3
- List of potential contaminants being evaluated further for RegDet 3
- Information considered in evaluating the three SDWA statutory criteria

3. Discuss Health & Occurrence Information for Specific Contaminants Being Evaluated for RegDet 3

4. Provide Next Steps and Discuss Remaining Questions

Overview of the SDWA Regulatory Processes, the Contaminant Candidate List (CCL) and Regulatory Determinations Process

Wynne Miller, USEPA

SDWA Regulatory Processes

Contaminant Candidate List (CCL) – List of unregulated contaminants that are known or may occur in drinking water; publish every 5 years.

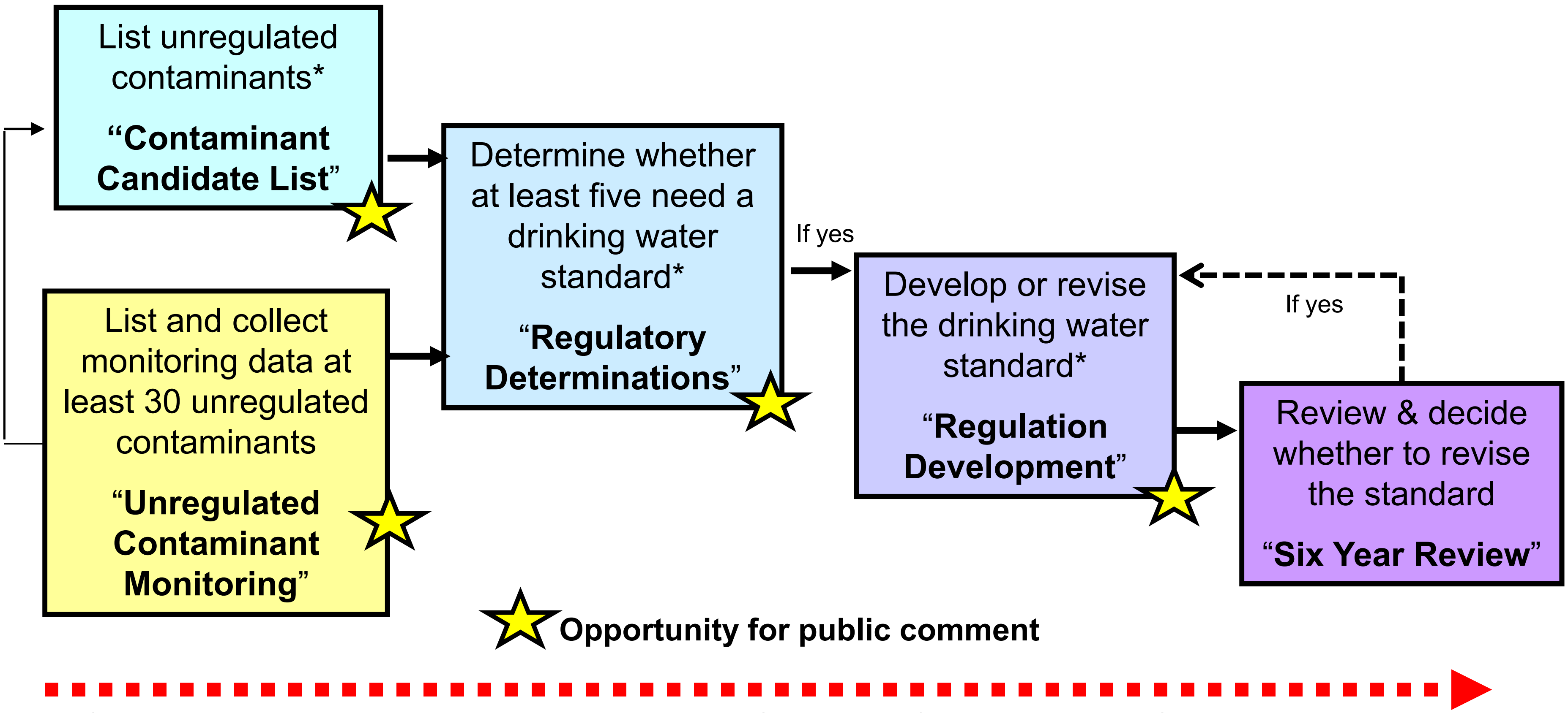
Regulatory Determinations – Decisions on whether to regulate CCL contaminants with a drinking water standard; make decisions on at least 5 every 5 years; Must consider 3 SDWA criteria. If decide to regulate, SDWA requires EPA to propose in 24 months and finalize in 18 months.

Unregulated Contaminant Monitoring – Process to monitor at least 30 different unregulated contaminants every 5 years.

Regulation Development - If regulate, SDWA requires that we evaluate/consider a number of factors in the standard setting process (health, analytical/treatment feasibility, costs/benefits, etc).

Six Year Review – Every 6 years, review and (if appropriate) revise the standard. Any revision must maintain or improve public health protection. If revise, we go through the regulation development process again and evaluate a number of factors.

General Flow of SDWA Regulatory Processes



*For these three stages, we like to have increased specificity and confidence in the type of supporting data used (e.g. health and occurrence). SDWA requires that we used best available data to make our decisions.

Three Regulatory Determination Criteria

SDWA requires EPA to consider the following criteria in evaluating whether to regulate a contaminant:

1) The contaminant may have an <u>adverse effect</u> on the health of persons;

2) The contaminant is <u>known to occur or there is substantial likelihood</u> that the contaminant will occur in public water systems with a frequency and at levels of public health concern; <u>and</u>

3) In the sole judgment of the Administrator, regulation of such contaminant presents a <u>meaningful opportunity</u> for health risk reduction for persons served by public water systems.

SDWA Section 1412(b)(1)

Potential Outcome of Determinations

- **No Regulatory Determination**
  - Insufficient data to assess contaminant on three criteria

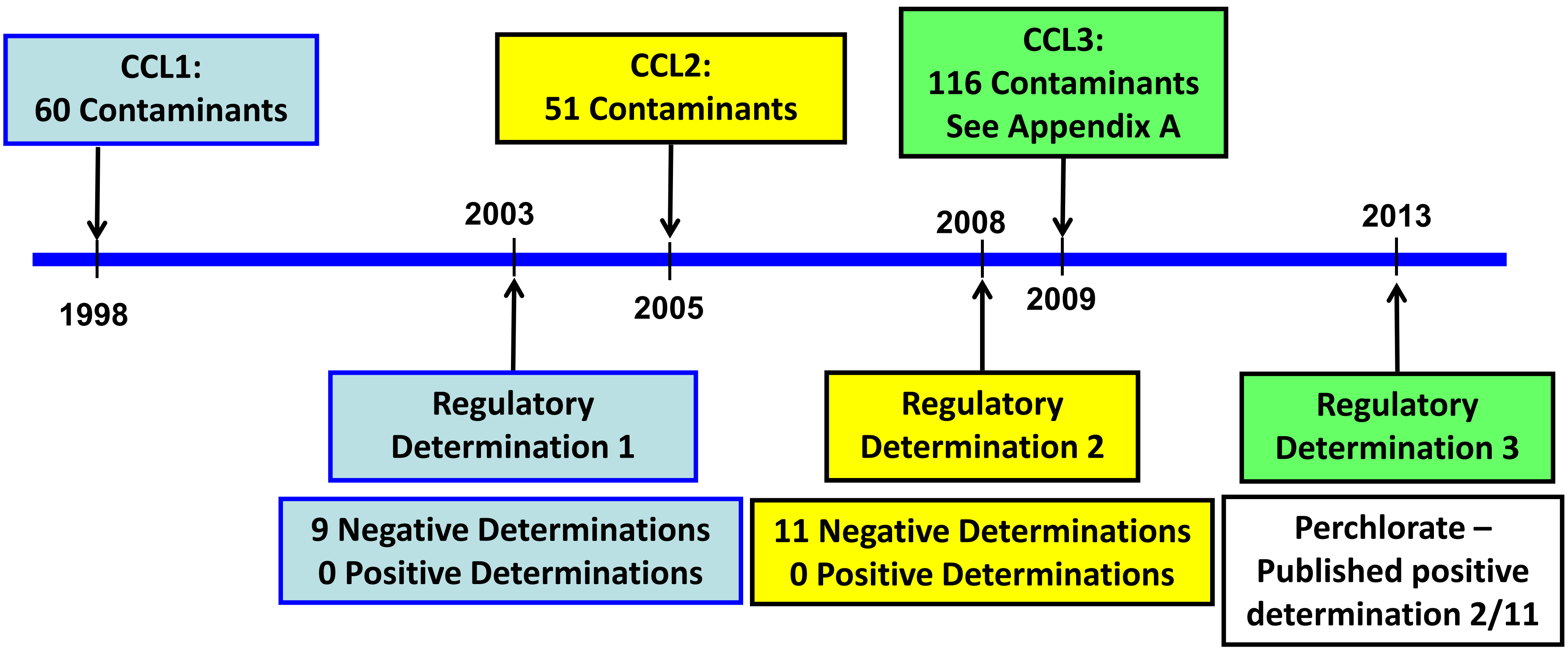
- **Positive Determination**
  - Answer "yes" decision for "all three" criteria
  - Begin process to develop a drinking water regulation

#	Outcome
1	✓
2	✓
3	✓

- **Negative Determination**
  - Answer "no" for "any one" of the three criteria
  - Do not develop a drinking water regulation
  - Developing a Health Advisory is a non-regulatory option

#	Outcome
1	✓
2	x
3	x

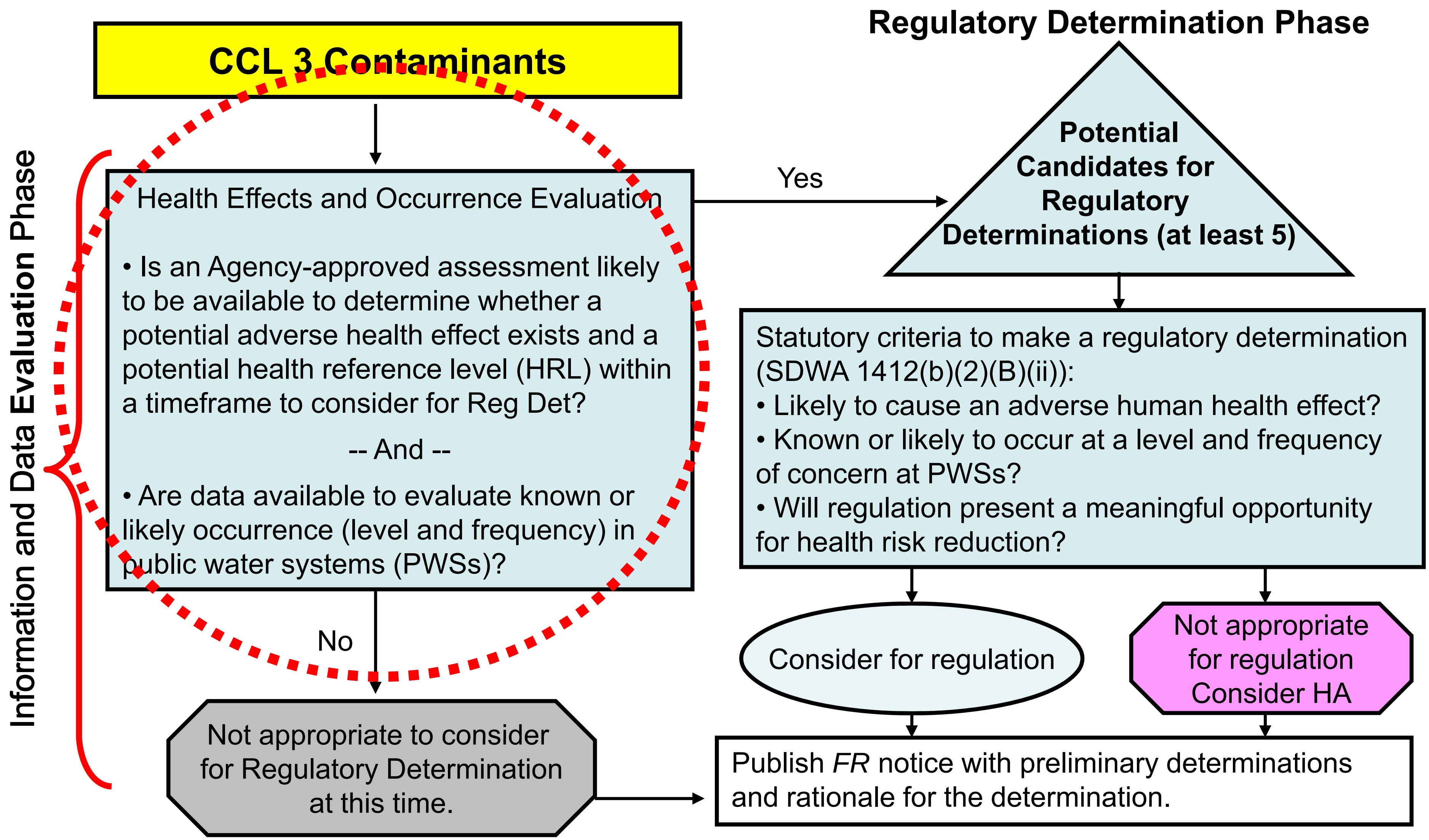
CCL & Regulatory Determinations Timeline



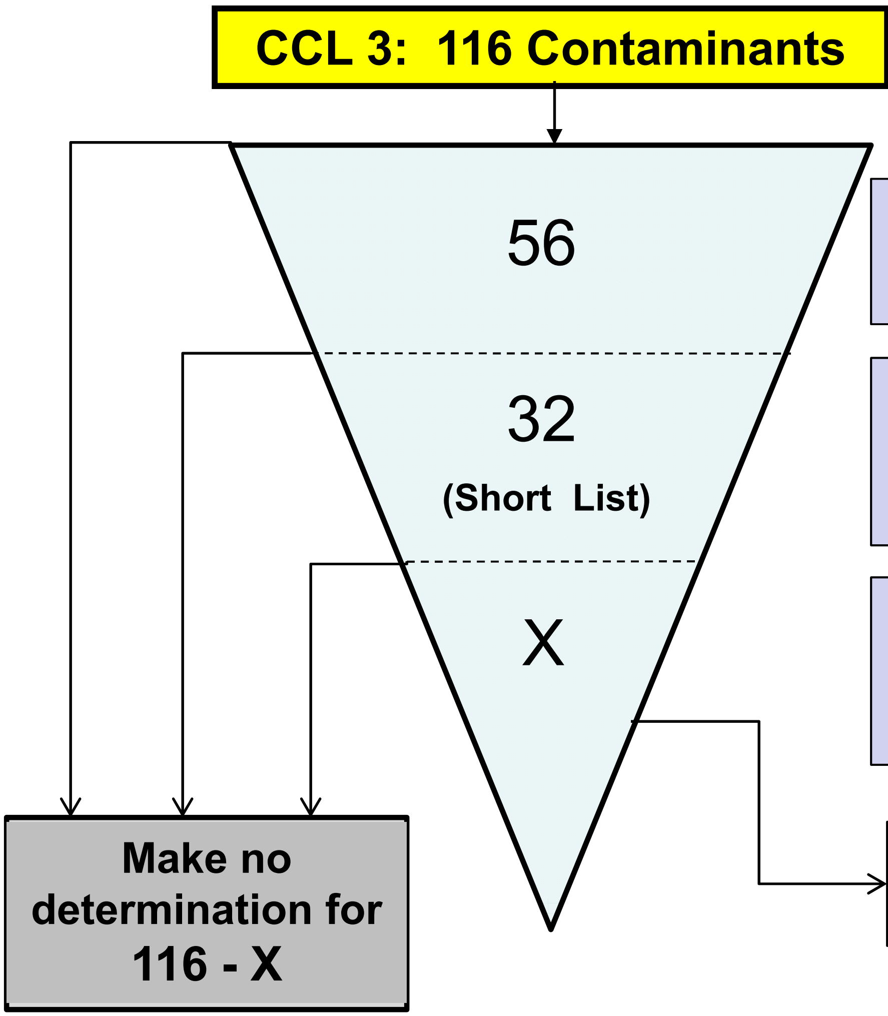
Overview of Approach Used to Evaluate Potential Contaminants for Regulatory Determinations 3

Zeno Bain, USEPA

Overall Approach Used to Evaluate CCL 3 Contaminants for Regulatory Determinations



RegDet 3 Prioritization Process



- Health effects assessment <u>may</u> be completed by 2011 AND
- National finished water occurrence data available OR
- Non-national finished water occurrence data available

- Health effects assessment <u>may</u> be completed by 2011 AND
- National finished water occurrence data available OR
- Non-national finished water occurrence data show some <u>levels</u> of potential public health concern

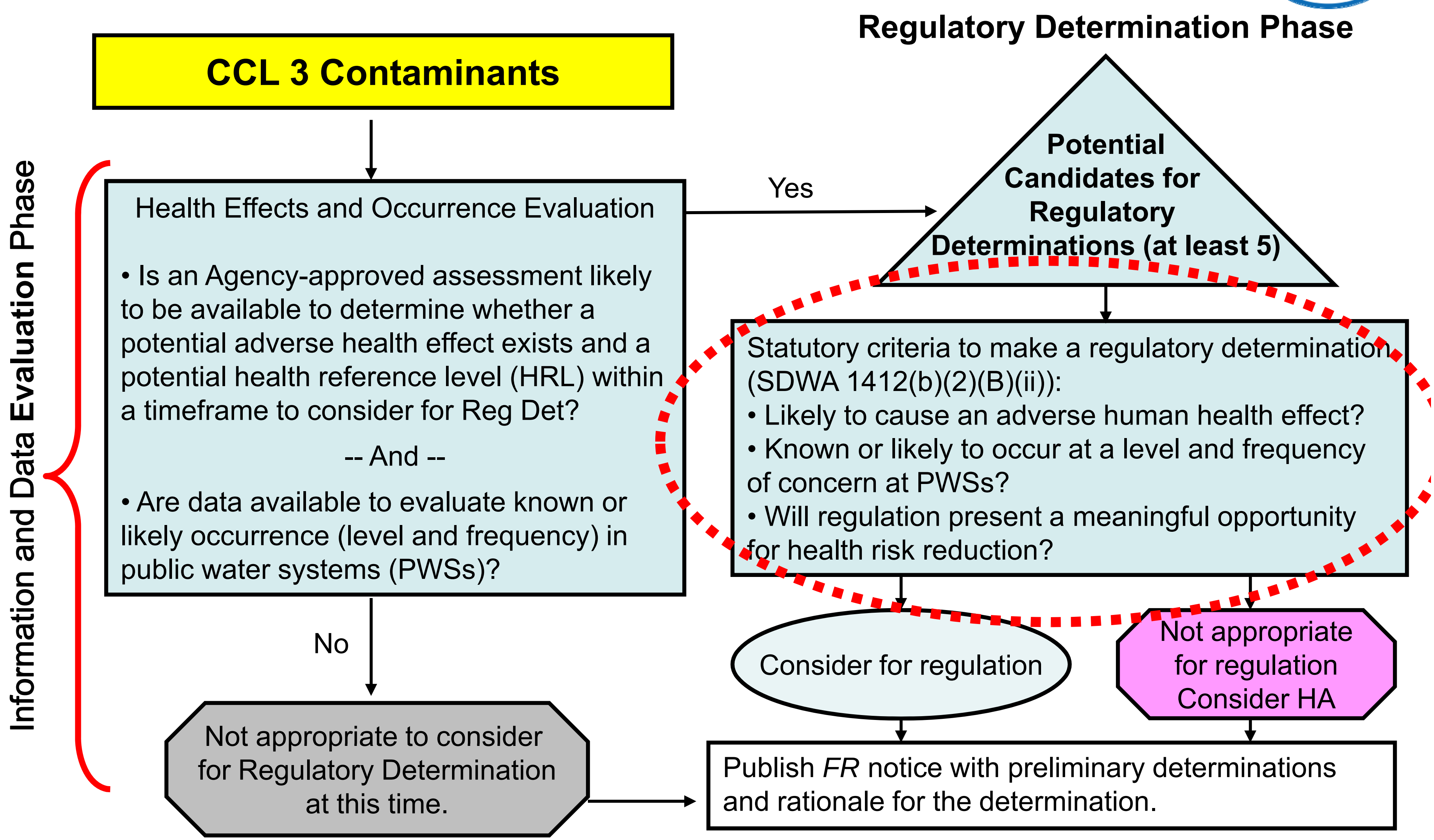
- Health effects assessment <u>will</u> be completed by 2011 AND
- National finished water occurrence data available OR
- Non-national finished water occurrence data demonstrating <u>levels and frequency</u> of potential public health concern

X Contaminants continue in the Regulatory Determination Process

Short List of Contaminants Being Considered and Evaluated Further for Regulatory Determinations 3

- Nitrosamines (5)
  - N-nitrosodimethylamine (NDMA)
  - N-nitrosodiethylamine (NDEA),
  - N-nitrosodi-n-propylamine (NDPA)
  - N-nitrosopyrrolidine (NPYR)
  - N-nitrosodiphenylamine (NDPhA)
- Chlorate
- Molybdenum
- Strontium
- Vanadium
- 1,1,1,2-Tetrachloroethane
- 1,2,3-Trichloropropane (TCP)
- 1,3-Dinitrobenzene
- 1,4-Dioxane
- Methyl Tertiary Butyl Ether (MTBE)
- Nitrobenzene
- PFOS and PFOA
- RDX
- Dimethoate
- Disulfoton
- Diuron
- Molinate
- Terbufos and Terbufos Sulfone
- Acetochlor & ESA and OA Degradates
- Alachlor ESA & OA Degradates
- Metolachlor & ESA and OA Degradates

Overall Approach Used to Evaluate CCL 3 Contaminants for Regulatory Determinations



Evaluation of Statutory Criteria

#	Statutory Criteria	Information To Consider During Evaluation
1	**Adverse effect on the health of humans?**	• Potential adverse health effect(s) (e.g. cancer, thyroid, liver damage) and level at which effect occurs (i.e. level of concern)
2	**Known or likely to occur in PWSs at a frequency and level of concern?**	• National monitoring data from PWSs and whether it occurs in drinking water at the health level of concern • Other sources of information (e.g. state water system data, levels in source waters, how much is used/produced, etc)
3	**Meaningful opportunity for health risk reduction for persons served by PWSs?**	Consider variety of factors which include: • Number of people who may be exposed to the contaminant from drinking water (served by PWSs) • Sensitive populations (e.g. children, elderly, compromised immune systems) • Extent of occurrence • Exposure from water versus other sources (e.g. food, air); primarily for non-cancer

Sources of Health Data and Information

- Identify recent or impending Agency risk assessment (IRIS,OPP and OW)
- Conduct literature searches (if older assessment)
- Identify the following:
  - Potential health effects
  - Reference Dose (RfD) or other non-cancer health value, and/or
  - Cancer slope factor
- Calculate benchmark value or health reference level to evaluate occurrence
  - Use 10^{-6} risk level for carcinogens
  - Use lifetime health advisory value for non-carcinogens along with a 20% relative source contribution (RSC)

- *Note: For today's meeting, using health values derived for the 2009 CCL3 since still evaluating the availability and sufficiency of health information for RegDet 3. Therefore, some health values could change. In addition, some are in the process of being updated.*

Sources of Occurrence Data and Information

- Unregulated Contaminant Monitoring Regulation (UCMR)
  - UCMR 1 Assessment (2001 – 2003)
  - UCMR 2 Assessment (2008 – 2010)
- Unregulated Contaminant Monitoring (UCM)
  - Round 1 (1988 – 1992)
  - Round 2 (1993 – 1997)
- National Inorganics and Radionuclides Survey (NIRS) (1984 – 1986)

- Occurrence results presented as the number/percent of systems with an analytical result > a specified concentration (e.g., > MRL (detection), > ½ HRL or HRL, etc.).

Sources of Occurrence Data and Information (cont.)

- State Data - Available on a contaminant specific basis
- DBP Information Collection Rule (ICR) - July 1997 – Dec 1998
- US Geological Survey
  - National Water Quality Assessment Program (NAWQA)
  - National Random & Focused Source Water Surveys (with AWWARF)
  - Special reports
- USDA Pesticide Data Program (PDP)
- Community Water System Surveys
- Consumer Confidence Reports
- Environmental Working Group data
- Toxics Release Inventory (TRI)
- Production Data (e.g. Chemical Update System/Inventory Update Reporting Program (CUS/IUR))
- OPP Reregistration Eligibility Document (RED)
  - Data from pesticide registrants
- Other specialized studies and literature

Drinking Water Strategy

Drinking Water Strategy
March 2010 Administrator Announcement

1. **Address contaminants as groups rather than one at a time.**
2. Foster development of new drinking water treatment technologies.
3. Use the authority of multiple statutes to help protect drinking water.
4. Partner with states to share more complete data from monitoring at public water systems.

Outreach for Addressing Contaminants as Groups

- Informal Planning Meeting (June 7)
- 4 Listening Sessions
  - ✓ June 21 – Chicago, IL
  - ✓ Aug 11 – Cincinnati, OH
  - ✓ Aug 16 – Washington, DC
  - ✓ Aug 19 – Rancho Cucamonga, CA
- National Drinking Water Advisory Council Consultation (July 21)
- Web Dialogue (July 28-29) and Web Forum (July 2010 to Jan 2011)
- Stakeholder Meeting (Sept 21)
- ASDWA Annual Meeting (Oct 18-21)
- National Drinking Water Advisory Council Consultation (Dec 8 & 9)

What did we hear from outreach efforts?

- Public health protection should be of paramount importance.
- Consider the following:
  - Health effect endpoints in grouping of contaminants
  - Treatment feasibility to identify/address contaminant groups
  - Analytical methods and/or use surrogates
  - Occurrence and co-occurrence of contaminants
  - Addressing groups of contaminants at their source
- Evaluate approaches used by States and other countries.
- Consider non-regulatory approaches (e.g. health advisories).

Potential Factors & Preliminary Evaluation

- Sept 2010 DWS Stakeholder Meeting - Identified four factors to consider when evaluating groups:
  - Has similar health effect endpoint
  - Removed by common treatment or control processes
  - Measured by common analytical method(s)
  - [Known or likely occurrence and co-occurrence]
- "Promising" groups likely to have multiple factors in common.
- February 2011 – announced that EPA would evaluate carcinogenic Volatile Organic Compounds (cVOCs) as the first group for regulatory effort (several listed on CCL3 and included in today's discussion).
- Sept 2010 DWS Stakeholder Meeting – EPA indicated that we would evaluate nitrosamines as a group; addressing as part of RegDet 3.

Contaminants Being Considered and Evaluated for Regulatory Determinations 3

Zeno Bain, USEPA

- Nitrosamines
  - N-nitrosodimethylamine (NDMA)
  - N-nitrosodiethylamine (NDEA)
  - N-nitrosodi-n-propylamine (NDPA)
  - N-nitrosopyrrolidine (NPYR)
  - N-nitrosodiphenylamine (NDPhA)
- Chlorate

Nitrosamines: Background

Nitrosamines Considered during Development of CCL3	Included on CCL3	Monitored under UCMR2
N-nitrosodimethylamine (NDMA)	Yes	Yes
N-nitrosodiethylamine (NDEA)	Yes	Yes
N-nitrosodi-n-propylamine (NDPA)	Yes	Yes
N-nitrosopyrrolidine (NPYR)	Yes	Yes
N-nitrosodiphenylamine (NDPhA)	Yes	No
N-nitrosomethylethylamine (NMEA)	No	Yes
N-nitrosodi-n-butylamine (NDBA)	No	Yes

Nitrosamines: Background (cont.)

- Byproduct of manufacturing processes (e.g., rocket fuels, foods, beverages, & pesticides, etc.)
- Discharges of municipal wastewater
- By-products from water treatment, particularly disinfection with chloramines

CCL3 Health Reference Levels

Nitrosamine Compounds	IRIS Cancer Slope Factor (mg/kg/day)	CCL3 HRL: Cancer (ng/L)*
NDMA	51	0.7
NDEA	150	0.2
NPYR	2.1	20
NDPA	7.0	5
NDPhA	0.0049	7,100
NDBA	5.4	6
NMEA	22	2

* Based on 10^{-6} cancer risk level.

- 1986 IRIS Risk Assessment
- Revised Slope Factors will be developed for Regulatory Determination 3 following the EPA (2005) guidelines.
- Age Dependant Adjustment Factors (ADAF) will be applied in determining the unit risk for early life exposures

Nitrosamine: Cancer Health Effects

Nitrosamine Compounds	Tumors	Animals	Exposure routes
NDMA	Liver, lung, kidney, nasal cavity & bile duct	Rats, mice, hamsters, rabbits, guinea pigs	Oral
NDEA	Liver, esophageal, lung, tracheal, bronchial, forestomach & nasal cavity	Mice, hamsters, guinea pigs, rabbits, dogs, monkey	Oral
NPYR	Liver, testes, laryngeal, tracheal, & nasal	Rats, mice, hamsters	Oral & i.p.
NDBA	Liver, esophageal & bladder	Rats & mice	Oral
NMEA	Liver, esophageal, renal, lung & nasal	Rats & hamsters	Oral
NDPA	Liver, nasal cavity, esophagus, tongue, forestomach & lung	Rats & mice	Oral

Nitrosamines in the Diet

- Found in some food products
  - Cured meats and fish
  - Beer
  - Smoked products
- Can form endogenously by nitrosation of dietary amines
- Processing changes since the 1970's have resulted in
  - Reduced nitrate and nitrite for curing meat and fish
  - Addition of chemicals that inhibit formation
  - Better temperature controls when drying high protein foods
- Levels of dietary nitrosamines have decreased

NDMA: Levels Found in Foods

*Product	Year	Range	Mean
Cured Fish (ng/g)	1971	nd to 26	
	2001-2005		0.54 – 1.99
Cured Meat (ng/g)	1975	nd to 35	
	2004		7.3
Bacon (ng/g)	1973	nd to 30	
	1993-1994	nd to 3	
Cheese (ng/g)	1978	nd to 68	
	1995	nd to 0.84	0.28
Dried Milk (ng/g)	1981	0.45 to 4.2	1.69
	1995	nd to 0.18	
**Formula Powder (ng/g)	1980-1981		0.56
	1995		nd (<0.05)
Beer (ng/L)	1978-1979	nd to 78,000	
	2000-2006	nd to 660	

nd = non detect

*Table 3 from Schafer et al. (2010)

**Formula powder is a chart addition; Year 1980-1981 data: Fristachi and Rice (2007); Year 1995 data: Oliveira et al. (1995)

Nitrosamines: Occurrence
Detections in UCMR 2 as of March 1, 2011

Nitrosamine Compounds	MRL (ng/L)	#Samples* with Detection	#Systems* with Detection	Population Served with Detection
NDMA	2	1,787 (10%)	324 (27%)	~94M
NDEA	5	46 (0.3%)	26 (2.2%)	~13M
NPYR	2	41 (0.2%)	21 (1.8%)	~9M
NDBA	4	9 (0.05%)	5 (0.4%)	~2M
NMEA	3	3 (0.02%)	3 (0.3%)	~0.2M
NDPA	7	0	0	0

* Approximately 17,900 samples from 1,200 Public Water Systems

Nitrosamines: Occurrence (cont.)

Detections of Nitrosamines by Disinfectant Type

	#Samples with Detection	#Detections from Samples with Chlorine	#Detections from Samples with Chloramines	#Detections with Others or Unknown
NDMA	1,787	295 (up to 85 ng/L)	996 (up to 630 ng/L)	496 (up to 82 ng/L)
NDEA	46	27 (up to 50 ng/L)	9 (up to 100 ng/L)	10 (up to 8 ng/L)
NPYR	41	14 (up to 24 ng/L)	24 (up to 17 ng/L)	3 (up to 4 ng/L)
NDBA	9	9 (up to 21 ng/L)	0	0
NMEA	3	3 (up to 5 ng/L)	0	0

Nitrosamines: Occurrence (cont.)
State of California Drinking Water Data

Compounds	Monitoring Result
NDMA (2001-2007)	• 1,531 detections of 4,532 samples (34%) • 24 detections of 101 systems (24%) • All detections (Min detect = 1 ng/L) > HRL (0.7 ng/L)
NDEA (2001-2007)	• 1 detection (30 ng/L) in 106 samples of 14 systems • Detection > HRL (0.2 ng/L)
NPYR (2006-2007)	• No detections in 57 samples of 4 systems • Min detect = N/A
NDPA (1995-2007)*	• No detections in 439 samples of 55 systems • Min detect = N/A

* No detection of NDPA in one sample of one system in State of Illinois in 2005 (min detect=N/A)

Key Observations from UCMR2 Data (based on March, 2011 version)

- NDMA:
  - The predominant nitrosamine in DW (~26% of systems)
  - Detected ~3x more frequently in SW than GW
    - 4.3% vs 1.4% in chlorinating SW vs GW systems
    - 11.7% vs 38.6% in chloraminating SW vs GW systems
  - Detected ~10x more frequently in SW PWSs using chloramines vs. chlorine alone
  - Generally has higher detection rates and concentrations at max residence time location in distribution systems than at entry point
- Essentially no nitrosamine detections in GW systems without disinfection

Nitrosamines: Occurrence (cont.)

Co-Occurrence of Nitrosamines with NDMA in UCMR2

Nitrosamine Compounds	#Samples with Detection	#Samples with NDMA Detection also	#Systems with Detection	#Systems with NDMA Detection also
NDEA	46	8 (17%)	26	7 (27%)
NPYR	41	19 (46%)	21	8 (28%)
NDBA	9	2 (22%)	5	1 (20%)
NMEA	3	3 (100%)	3	3 (100%)

Drinking Water Strategy
Group Consideration for Nitrosamines

Four DWS Factors	• All are carcinogens so likely MCLG could be set at zero • Can measure most using common analytical methods • Most have common treatment/control processes • Have some co-occurrence of NDMA with other nitrosamines
Public Health Benefit	• ~100M people served by systems with at least single detection of at least one of the nitrosamines • ~10M people served by systems that have co-occurring nitrosamines; potential for greater public health risk due to additivity of cancer risk • Controlling nitrosamines reduces exposure to other DBPs
Issues	• Exposure from food may be > drinking water for some age groups • Regulating nitrosamines could constrain chloramine use and make it more costly for some systems to comply with prior disinfection by-product rules

Chlorate: Background

- ClO_3^- (+5 oxidation state of chlorine atom)
- Chlorate salts are used in pesticides
  - Approximately 2.8 million lbs of sodium chlorate applied annually (OPP's 2006 RED)
- Chlorate can form during drinking water treatment
  - During liquid hypochlorite storage
  - Disinfection with chlorine dioxide

Chlorate: Health Effects

- 2006 OPP Risk Assessment
- Critical Effect: Thyroid gland follicular cell hypertrophy and mineralization
  - Based on a BMDL of 0.9 mg/kg/day for thyroid hypertrophy in adult rats (NTP, 2004)
  - RfD = 0.03 mg/kg/day UF=30
- Not likely to cause cancer at doses below those that alter thyroid hormone homeostasis (OPP, 2006)
- CCL3 HRL: 210 µg/L (non-cancer)
- Sensitive populations: those at risk for hemolytic anemia and individuals with compromised renal function

Chlorate: Occurrence

DBP ICR, July 1997-Dec 1998 (min detect = 20 µg/L)

Monitoring Location	Plants with Hypochlorite or chlorine dioxide*	#Samples	#samples ≥ 210 µg/L	#Plants w Samples	#Plants w Samples ≥ 210 µg/L
Plant Influent (Source Water)		749	4 (0.5%)	106	4 (3.8%)
Finished Water	Hypochlorite	298	42 (14%)	59	22 (37%)
	Chlorine Dioxide	384	88 (23%)	29	15 (52%)

* Based on the disinfectant type info. in Table of TUXUNPRO. Only included those plant months with a dose of hypochlorite or chlorine dioxide > 0.

- State of California 2001-2007 (min detect = 0.01 µg/L)
  - Detection > HRL (210 µg/L) in 10 of 45 systems (22.2%)

Chlorate: Occurrence (cont.)

Key Observations from ICR Data:

- Few detections in source water with levels > HRL
- Occurs frequently at levels > HRL in finished water
- Chlorine dioxide-treated water has more chlorate occurrence than hypochlorite-treated water
- Chlorate levels are not highly variable throughout distribution system when chlorine dioxide is used

EPA is reviewing recent surveys (AWWA, EPA-CWSS) that show substantial increases in the number of systems using disinfection practices associated with high levels of chlorate formation

* Proposed for UCMR 3 monitoring

Questions, Comments or Any Other Information to Share?

- Nitrosamines
  - N-nitrosodimethylamine (NDMA)
  - N-nitrosodiethylamine (NDEA)
  - N-nitrosodi-n-propylamine (NDPA)
  - N-nitrosopyrrolidine (NPYR)
  - N-nitrosodiphenylamine (NDPhA)
- Chlorate

Contaminants Being Considered and Evaluated for Regulatory Determinations 3

Melissa Simic, USEPA

- Molybdenum
- Strontium
- Vanadium

Molybdenum Background

- Various molybdenum compounds used in fertilizer, alloys, pigments, lubricants, fire retardants, catalysts, and other applications
- Naturally occurring element
- 37 molybdenum-containing compounds reported as produced/imported in 2006 (CUS)
  - Compounds produced/imported in greatest quantities were molybdenum and molybdenum trioxide (>1 billion lbs each)
- Industrial releases to surface water (TRI):
  - 45,828 lbs as molybdenum trioxide in 2008
  - Up from a low of 23,067 lbs in 2002
- Total industrial releases: ~1.5 million lbs in 2008 (TRI)
- Persistent in the environment, though form may change

Molybdenum: Health Effects

- 1991 IRIS Risk Assessment
- Critical Effect: increased serum uric acid
  - Based on a retrospective epidemiology study in humans with a estimated LOAEL of 0.14 mg/kg/day (Koval'skiy et al., 1961)
  - RfD = 0.005 mg/kg/day; UF = 30
- No IRIS cancer assessment - limited available studies do not suggest tumorigenic effects
- Essential dietary nutrient for humans
- CCL3 HRL: 35 µg/L (non-cancer)
- Sensitive populations:
  - Adults with a predisposition towards gout

Molybdenum: Occurrence

- NIRS, 1984-1986 (MRL = 6 µg/L):
  - Detections > HRL (35 µg/L) in 6 of 989 samples/systems (0.6%; 1M pop)
- California , 1995-2007 (min detect = 0.005 µg/L):
  - Detections > HRL in 6 of 161 systems (3.73%)
  - Detections > HRL in 17 of 2,287 samples (0.74%)
- Illinois, 1998-2005 (min detect = 2.5 µg/L):
  - Detections > HRL in 29 of 865 systems (3.4%)
  - Detections > HRL in 54 of 2k samples (2.8%)
- Ohio, 1999-2005 (min detect = 1 µg/L):
  - Detections > HRL (35 µg/L) in 2 of 26 systems (8%)
  - Detections > HRL in 4 of 76 samples (5%)

Molybdenum: Occurrence

- Wisconsin, 2001 (min detect = N/A):
  - No detections in 2 samples at 1 system
- USGS (Toccalino et al., 2010) (MRL = 0.06-1 µg/L)
  - Detections > HRL in 4 of 628 samples/systems (0.64%)

* Proposed for UCMR 3 monitoring

Strontium: Background

- Used in fertilizers, pyrotechnics, previously used in cathode-ray tube TVs; present in coal
- Mining in U.S. ceased in 1959. Annual imports of strontium minerals and compounds have steadily declined since 2001 to less than 10,000 metric tons
- Naturally occurs and enters water through weathering of rocks and soils, from atmospheric deposition, and from wastewater discharges
- 11 strontium-containing compounds reported as produced/imported in 2006 (CUS)
  - Strontium carbonate reported as produced/imported in the greatest quantity (10 million - <50 million lbs)
- Industrial releases: no TRI data
- Expected to have moderate to low mobility in soils (ATSDR, HSDB)

Strontium: Health Effects

- 1992 IRIS Risk Assessment
- Critical Effect = structural changes in growing bones, impaired calcification
  - Based on a 20-day oral study in young & adult rats; NOAEL = 190 mg/kg/day (Storey, 1961)
  - RfD = 0.6 mg/kg/day; UF = 300
- No IRIS cancer assessment - limited available studies; do not indicate tumorigenic effects
- CCL3 HRL: 4,200 µg/L (non-cancer)
- Sensitive populations:
  - Infants, children, and adolescents during the period of bone growth

Strontium: Occurrence

- NIRS, 1984-1986 (MRL = 1 µg/L):
  - Detections > HRL (4,200 µg/L) in 23 of 989 samples/systems (2.33%; 1.7M pop)
- Illinois, 1998-2005 (min detect = 71 µg/L):
  - Detections > HRL in 4 of 19 systems (21%)
  - Detections > HRL in 4 of 21 samples (19%)
- Ohio, 2000-2005 (min detect = 4 µg/L):
  - Detections > HRL in 6 of 32 systems (19%)
  - Detections > HRL in 17 of 77 samples (22%)
- Region 9 Tribes, 2003 (min detect = N/A):
  - No detections in 1 sample/system
- USGS (Toccalino et al., 2010) (min detect = 5.61 µg/L)
  - Detections > HRL in 40 of 503 samples/systems (8%)

* Proposed for UCMR 3 monitoring

Vanadium: Background

- Extracted from ores and recovered from petroleum and industrial solid wastes.
- Used primarily (92%) for metallurgical applications; also used in catalysts, lamps, paints and varnishes, flue-gas scrubbers, and photographic developers
- 11 vanadium compounds reported as produced/imported in 2006 (CUS)
  - Those produced/imported in greatest quantities were vanadium pentoxide and vanadium hydroxide oxide phosphate (both in range of 1-10 million lbs)
- Industrial releases to surface water in 2008 (TRI):
  - 7,790 lbs of vanadium (except alloys); up from a low of 616 lbs in 1998
  - 1.2 million lbs of vanadium compounds; up from low of 0.4 million lbs in 2006
- Total industrial releases in 2008 (TRI):
  - 2.3 million lbs of vanadium (except alloys); 42.8 million lbs of V compounds
- Also released to the environment through the weathering of rocks and soils
- Vanadium is more mobile in neutral and alkaline soils than in acidic soils

Vanadium: Health Effects

- 1992 ATSDR Risk Assessment
- Critical effect = minor renal effects, increased plasma urea, mild structural tissue changes
  - Based on an oral study in rats; NOAEL = 0.3 mg/kg/day (Domingo et al., 1985)
  - MRL* = 0.003 mg/kg/day; UF = 100
- Vanadium pentoxide is associated with pulmonary tumors in an NTP (2002) inhalation study; clear evidence in mice and some evidence in male rats. (IRIS assessment in process)
- CCL 3 HRL = 21 µg/L (non-cancer)
- Sensitive populations: individuals with compromised renal systems

* MRL for ATSDR = Minimum Risk Level

Vanadium: Occurrence

- NIRS, 1984-1986 (MRL = 3 µg/L):
  - Detections > HRL (21 µg/L) in 17 of 989 samples/systems (1.7%; 2M pop)
- California, 1996-2007 (min detect = 0.002 µg/L):
  - Detections > HRL in 483 of 2,698 systems (18%)
  - Detections > HRL in 2,604 of 26k samples (10%)
- Illinois, 1998-2004 (min detect = N/A):
  - No detections in 19 samples at 17 systems
- Ohio, 1999-2005 (min detect = N/A):
  - No detections in 71 samples at 23 systems
- USGS (Toccalino et al., 2010) (MRL = 0.02- 5 µg/L):
  - Detections > HRL in 49 of 457 samples/systems (11%)

* Proposed for UCMR 3 monitoring

Questions, Comments or Any Other Information to Share?

- Molybdenum
- Strontium
- Vanadium

Contaminants Being Considered and Evaluated for Regulatory Determinations 3

Zeno Bain, USEPA

- 1,1,1,2-Tetrachloroethane
- 1,2,3-Trichloropropane (TCP)
- 1,3-Dinitrobenzene
- 1,4-Dioxane
- Methyl Tertiary Butyl Ether (MTBE)
- Nitrobenzene
- PFOS and PFOA
- RDX

1,1,1,2-Tetrachloroethane: Background

- An industrial chemical used in the production of other substances
- No natural sources
- Production: 1 million - 10 million lbs in 2002 (CUS)
  - Up from 10,000 - 500,000 lbs in 1994
- Industrial releases to surface water: 0 lbs in 2008 (TRI)
  - Down from high of 474 lbs in 2003
- Total industrial releases: 2,904 lbs in 2008 (TRI)
- Some physical and chemical properties indicate not very mobile in water but other properties predict moderate to high mobility
  - Projected half-life in water is 60 days (PBT Profiler)
  - Persistent in the environment (biodegrades sometimes/recalcitrant)

1,1,1,2-Tetrachloroethane: Health Effects

- 1987/9 IRIS Risk Assessment
- Critical Effect = Cancer; Hepatocellular adenomas & carcinomas
  - Based on 2 year chronic oral gavage NTP (1983) mice bioassay
  - Cancer slope factor = $(0.026\ mg/kg\text{-}day)^{-1}$
  - Possible human carcinogen (1986)
- Non-cancer effect = Histological changes in kidneys & livers
  - Based on chronic oral gavage rat study NTP (1983)
  - RfD = 0.03 mg/kg-day; LOAEL = 89.3 mg/kg-day; UF = 3,000
- CCL3 HRL: 1 µg/L (cancer); 210 µg/L (non-cancer)
- Sensitive populations: None

1,1,1,2-Tetrachloroethane: Occurrence

- UCM Round 1, 1988-1992 (min detect = 0.06 µg/L):
  - Detections > HRL (1 µg/L) in 9 of 17k systems (0.05%; 250k pop.)
  - Detections > HRL in 11 of 57k samples (0.02%)
- UCM Round 2, 1993-1997 (min detect = 0.2 µg/L):
  - Detections > HRL in 8 of 24k systems (0.03%; 125k pop.)
  - Detections > HRL in 11 of 98k samples (0.01%)
- California, 1995-2007 (min detect = 0.5 µg/L):
  - Detections > ½ HRL in 4 of 4k systems (0.1%)
  - Detections > ½ HRL in 6 of 116k samples (0.01%)
- Florida, 2004-2007 (min detect = 0.09 µg/L):
  - Detections in 1 of 27 systems (4%)
  - Detections in 2 of 1,764 samples (0.1%)
- Illinois, 1998-1999 (min detect = N/A):
  - No detections of 7 samples in 2 systems

1,1,1,2-Tetrachloroethane: Occurrence

- North Carolina, 1998-2005 (min detect = 0.5 µg/L):
  - Detections > HRL (1 µg/L) in 5 of 2,500 systems (0.2%)
  - Detections > HRL in 5 of 20k samples (0.03%)
- Ohio, 1998-2005 (min detect = 0.8 µg/L):
  - Detections > ½ HRL (0.5 µg/L) in 1 of 2,500 systems (0.04%)
  - Detections > ½ HRL in 1 of 9k samples (0.01%)
- Region 9 Tribes, 1998-2005 (min detect = N/A):
  - No detections of 1k samples in 285 systems
- South Dakota, 1990-2007 (min detect = N/A):
  - No detections of 1k samples in 281 systems
- Texas, 1998-2005 (min detect = N/A):
  - No detections of 36k samples in 6k systems

1,1,1,2-Tetrachloroethane: Occurrence

- Wisconsin, 1983-2009 (min detect = N/A):
  - No detections of 21k samples in 3k systems
- USGS data, 1993-2007 (Toccalino et al., 2010) (MRL ~0.2 µg/L):
  - No detections > ½ the HRL (0.5 µg/L) in 832 samples/systems
  - 3 detects total, all between 0.009 and 0.011 µg/L
- USGS data, 2002-2005 (Hopple et al., 2009 and Kingsbury et al., 2008) (min detect = N/A)
  - Phase 1: No detections of 368 samples
  - Phase 2: No detections in 142 samples

1,2,3-Trichloropropane: Background

- Used as a chemical intermediate and as a paint and varnish remover, solvent, and degreasing agent
- No natural sources
- Production: 0.5 million - 1 million lbs in 2002 (CUS)
  - Down from 10–50M lbs in 1986
- Industrial releases to surface water: 187 lbs in 2008 (TRI)
  - Down from 5,498 lbs in 2000 but up from 62 lbs reported in 1997
- Total industrial releases: 1,557 lbs in 2008 (TRI)
- Some physical and chemical properties indicate mobility and volatility in water and soil
  - Projected half-life in water is 38 days (PBT Profiler)
  - Persistent in the environment (biodegrades slowly with acclimation)

1,2,3-Trichloropropane: Health Effects

- RAISHE Risk Assessment (2007)
- Critical Effect = Cancer; multisite tumors in mice and rats (NTP, 1993)
  - Cancer Slope factor = 7 $(mg/kg/day)^{-1}$*
- Non-cancer effect = liver and kidney damage; decreased red blood cells
  - 120-day gavage study in rats (NTP, 1983)
  - RfD = 0.006 mg/kg/day; UF = 1000
- CCL3 HRL: 0.005 µg/L (cancer); 42 µg/L (non-cancer)
- Sensitive populations = pregnant women, individuals with liver or kidney problems

*The RAISHE slope factor used for CCL3 was removed from the database when the EPA IRIS (2009) assessment was completed.

1,2,3-Trichloropropane: Occurrence

- UCM Round 1, 1988-1992 (min detect = 0.1 µg/L):
  - Detections > HRL (0.005 µg/L) in 44 of 17k systems (0.3%; 14M pop.)
  - Detections > HRL in 76 of 57k samples (0.1%)
- UCM Round 2, 1993-1997 (min detect = 0.3 µg/L):
  - Detections > HRL in 19 of 24k systems (0.1%; 0.13M pop.)
  - Detections > HRL in 23 of 98k samples (0.02%)
- California, 1995-2007 (min detect = 0.001 µg/L)
  - Detections in 157 of 4k systems (4%)
  - Detections in 5k of 113k samples (4%)
- Florida, 2004-2007 (min detect = 1.9 µg/L)
  - Detections in 1 of 27 systems (4%)
  - Detections in 1 of 1,766 samples (0.1%)

1,2,3-Trichloropropane: Occurrence

- Illinois, 1998-2004 (min detect = 250 µg/L)
  – Detections in 4 of 6 systems (70%)
  – Detections in 4 of 11 samples (40%)
- North Carolina, 1998-2005 (min detect = 0.57 µg/L)
  – Detections in 5 of 2,493 systems (0.2%)
  – Detections in 18 of 20k samples (0.09%)
- Ohio, 1998-2005 (min detect = 0.5 µg/L)
  – Detections in 1 of 2,532 systems (0.04%)
  – Detections in 1 of 9,283 samples (0.01%)
- Region 9 Tribes, 1998-2005 (min detect = 1.8 µg/L)
  – Detections in 2 of 279 systems (0.7%)
  – Detections in 3 of 1,113 samples (0.3%)

1,2,3-Trichloropropane: Occurrence

- South Dakota, 1990-2007 (min detect = 0.67 µg/L)
  - Detections in 1 of 281 systems (0.4%)
  - Detections in 1 of 1k samples (0.1%)
- Texas, 1998-2005 (min detect = 13 µg/L)
  - Detections in 5 of 5,660 systems (0.1%)
  - Detections in 7 of 36k samples (0.02%)
- Wisconsin, 1983-2009 (min detect = 0.1 µg/L)
  - Detections in 12 of 3k systems (0.4%)
  - Detections in 12 of 20k samples (0.06%)

* Proposed for UCMR 3 monitoring

1,3-Dinitrobenzene: Background

- Used as an industrial chemical and in the production of other substances
- No natural sources
- Production: 10 - 50 million lbs in 1986 (CUS)
  - Data not reported for any other years
- Industrial releases to surface water: 2 lbs in 2008 (TRI)
  - Down from high of 816 lbs in 1997
- Totals industrial releases: 19,858 lbs in 2008 (TRI)
- Expected to be moderately to highly mobile in water, based on physical and chemical properties
  - Projected half-life in water is 38 days (PBT Profiler)
  - Moderately persistent in the environment (biodegrades slowly with acclimation)

1,3-Dinitrobenzene: Health Effects

- 1988 IRIS Risk Assessment
- Critical Effect = Increased spleen weight
  - Based on sub-chronic drinking water study in rats (1981)
  - Chronic oral RfD = 0.0001 mg/kg/day; NOAEL = 0.4 mg/kg-day; UF = 3,000
- Not classifiable as to human carcinogenicity (1986)
- CCL3 HRL: 0.7 µg/L (non-cancer)
- Sensitive populations:
  - Individuals with a genetic predisposition to methemoglobinemia and/or hemosiderosis
  - Males having other sperm production complications could also have increased sensitivity

1,3-Dinitrobenzene: Occurrence

- UCMR 2 Assessment Monitoring, 2008-2010 (MRL = 0.8 µg/L)
  - No detections of 31,710 samples in 4,115 systems
  - HRL (0.7 µg/L) is less than MRL
  - Sampling not yet complete (data current as of March 1, 2011)

1,4-Dioxane: Background

- Solvent or solvent stabilizer in the manufacture/processing of paper, cotton, textile products, automotive coolant, cosmetics, and shampoos
- No natural sources
- Production: 1 – 10 million lbs in 2006 (CUS)
  - Down from 10 – 50 million lbs in 1986
- Industrial releases to surface water: 41,014 lbs in 2008 (TRI)
  - Down from high of 196,375 lbs in 1997
- Total industrial releases: 203,798 lbs in 2008 (TRI)
- Expected to be moderately to highly mobile in water based on physical and chemical properties
  - Projected half-life in water is 15 days (PBT Profiler)
  - Moderately persistent in the environment (biodegrades slowly)

1,4-Dioxane: Health Effects

- 1988 IRIS Risk Assessment
- Critical Effect = Cancer; Nasal cavity and liver carcinomas in rodents
  - Based on 2 year drinking water study in male rats
  - Cancer Slope Factor = $(0.011 \text{ mg/kg-day})^{-1}$
- Non-cancer effect = Liver and kidney toxicity
  - Based on 2 yr chronic drinking water study in male rats (1974)
  - *MRL = 0.1 mg/kg-day, NOAEL = 9.6 mg/kg-day, UF = 100
- CCL3 HRL 3 µg/L (cancer); 700 µg/L (non-cancer)
- Sensitive populations: Children may be more sensitive to liver toxicity

*ATSDR Minimum Risk Level

1,4-Dioxane: Occurrence

- California, 1996-2007 (min detect = 0.001 µg/L)
  - Detections > HRL (3 µg/L) in 13 of 218 systems (6%)
  - Detections > HRL in 199 of 4,245 samples (5%)

* Proposed for UCMR 3 monitoring

Methyl Tertiary Butyl Ether (MTBE): Background

- Used as a gasoline additive and in the manufacture of isobutene as an extraction solvent
- No natural sources
- Production: > 1 billion lbs in 2006 (CUS)
  - Down from ~80 million barrels (1999) to <24 million barrels (2006) (USDOE)
- Industrial releases to surface water: 1,832 lbs in 2008 (TRI)
  - Down from 162,116 lbs in 1997
- Total industrial releases: 351,774 lbs in 2008 (TRI)
- Expected to be moderately to highly mobile in water, based on physical and chemical properties
  - Projected half-life in water is 15 days (PBT Profiler)
  - Moderately persistent in the environment (biodegrades slowly)

MTBE: Health Effects

- 1999 OEHHA(CA) risk assessment (IRIS assessment in progress)
- Critical Effect = Cancer; kidney adenomas/carcinomas & leydig cell tumors in male rats, leukemia & lymphomas in female rats
  - Based on a chronic drinking water study in rats
  - Cancer slope factor = $(0.0018 \text{ mg/kg-day})^{-1}$
- Non-cancer effect = Decreased blood urea nitrogen levels in liver
  - Based on 90 day gavage study in rats
  - *MRL = 0.3 mg/kg-day; LOAEL = 100 mg/kg-day
- CCL3 HRL: 19.4 µg/L (cancer); 2100 µg/L (non-cancer)
- Sensitive population: None
- 1997 Drinking Water Advisory
  - Recommends 20-40 ppb based on taste and odor which also provides protections from adverse health effects with a margin of safety

*ATSDR Minimum Risk Level

MTBE: Occurrence

- UCMR 1 Assessment Monitoring (MRL = 5 µg/L):
  - Detections > HRL (19.4 µg/L) in 5 of 4k systems (0.13%; 213k pop)
  - Detections > HRL in 5 of 34k samples (0.015%)
- California, 1995-2007 (min detect = 0.2 µg/L):
  - Detections > HRL in 19 of 4k systems (0.4%)
  - Detections > HRL in 542 of 134k samples (0.4%)
- Florida, 2004-2007 (min detect = 0.1 µg/L):
  - Detections > HRL in 1 of 31 systems (3%)
  - Detections > HRL in 26 of 2k samples (1%)
- Illinois, 1998-2005 (min detect = 0.5 µg/L):
  - Detections > ½ HRL (9.7 µg/L) in 2 of 1k systems (0.2%)
  - Detections > ½ HRL in 12 of 7k samples (0.2%)

MTBE: Occurrence

- Ohio, 1999-2005 (min detect = 0.5 µg/L):
  - Detections in 6 of 1k systems (0.5%); None > ½ HRL (9.7 µg/L)
  - Detections in 57 of 4k samples (1.5%); None > ½ HRL
- Region 9 Tribes, 1998-2005 (min detect = 9.8 µg/L):
  - Detections > ½ HRL in 1 of 219 systems (0.5%)
  - Detection > ½ HRL in 1 of 764 samples (0.1%)
- Texas, 1998-2005 (min detect = 0.5 µg/L):
  - Detections > HRL in 3 of 6k systems (0.05%)
  - Detection > HRL in 4 of 36k samples (0.01%)
- Wisconsin, 1991-2009 (min detect = 0.1 µg/L):
  - Detections > HRL in 4 of 1k systems (0.4%)
  - Detection > HRL in 22 of 4k samples (0.5%)
- USGS (Toccalino et al., 2010) (MRL = 0.05-0.2 µg/L):
  - No detections > HRL in 832 systems/samples

Nitrobenzene: Background

- Used in the production of aniline and for paint solvent, polishes, explosives, pesticides, and drugs
- No significant natural sources
- Production: >1 billion lbs in 2006 (CUS)
  - Reported at this level since 1990
  - >500 million – 1 billion in 1986
- Industrial releases to surface water: 189 lbs in 2008 (TRI)
  - Down from a high of 1,152 lbs in 1998, but up from a low of 20 lbs in 2005
- Total industrial releases: 487,627 lbs (TRI)
- Expected to be moderately to highly mobile in water, based on physical and chemical properties
  - Projected half-life in water is 15 days (PBT Profiler)
  - Not persistent in the environment (biodegrades fast with acclimation)

Nitrobenzene: Health Effects

- 2009 IRIS Risk Assessment
- Critical Effect = Increased immature red blood cells & methemoglobinemia
  - Based on subchronic rat study (NTP, 1983)
  - RfD = 0.002 mg/kg-day; $BMDL_{10}$ = 1.8 mg/kg-day; UF = 1,000
- Likely a carcinogen (2005) for all exposure routes
  - No slope factor for the oral route
- CCL3 HRL: 14 µg/L (non-cancer)
- Sensitive populations:
  - Neonates
  - Persons prone to hereditary methemoglobinemia
  - Persons with decreased glucose-6-phosphate dehydrogenase activity

Nitrobenzene: Occurrence

- UCMR 1 Assessment Monitoring, 2001-2003 (MRL = 10 µg/L):
  - Detections > HRL (14 µg/L) in 2 of 4k systems (0.05%; 260k pop)
  - Detections > HRL in 2 of 33k samples (0.01%)
- UCMR 1 Screening Survey, 2001-2003 (MRL = 0.5 µg/L):
  - No detections in 2k samples of 295 systems
- California, 1995-2007 (min detect = 5 µg/L):
  - No detections > HRL in 11k samples of 546 systems
- Illinois, 1999-2005 (min detect = N/A):
  - No detections in 336 samples of 85 systems
- Ohio, 2000-2005 (min detect = N/A):
  - No detections in 3k samples of 1,134 systems

PFOS/PFOA: Background

- Used in industrial and consumer products mainly to repel dirt, water, and soil; photographic film; fire-fighting foams; floor polish; etching acid for circuit boards; in pesticides; home furnishings and leather; masking tape
- No natural sources
- Production: 10K-500K lbs for PFOS and PFOA in 2002 (CUS)
  - <500,000 lbs for PFOA in 2006 (PFOS not reported in 2006)
- Industrial releases: no data (TRI)
- Physical /chemical properties indicate not very mobile to very mobile
  - Projected biodegradation half-life for PFOA in water is 180 days (PBT Profiler)
  - Both are persistent in the environment (biodegrades sometimes/recalcitrant)

PFOS/PFOA: Health Effects

- PFOS: Critical Effect = Increases in thyroid-related hormones and high density lipoproteins in monkeys (Seacat et al., 2002)
  - Based on a NOAEL of 0.03 mg/kg-day
  - RfD-eq = 0.00003 mg/kg/day UF =default 1000
  - CCL3 HRL = 0.2 µg/L (non-cancer)
- PFOA: Critical Effect = Increase in maternal liver weight on female mice at term (Lau et al., 2006)
  - Based on a $BMDL_{10}$ = 0.46 mg/kg-day
  - RfD-eq = 0.00015 mg/kg/day UF= default 3000
  - CCL3 HRL = 1.1 µg/L (non-cancer)
- Suggestive evidence for cancer for both however some data to support non-linear modes of action; assessments not complete
- Sensitive populations: not yet completely characterized

PFOS/PFOA: Occurrence

- Tennessee River in Alabama, 2000:
  - PFOS: Detected in all 40 samples; Max (0.144 µg/L) > ½ HRL (0.1 µg/L); Min detect = 0.0168 µg/L
  - PFOA: Detected in 18 (45%) of 40 samples; Max (0.598 µg/L) > ½ HRL (0.55 µg/L); Min detect = 0.025 µg/L
- Lake Erie and Lake Ontario, 2003:
  - PFOS: Detected in all 16 samples; Max (0.121 µg/L) > ½ HRL (0.1 µg/L); Min detect = 0.011 µg/L
  - PFOA: Detected in all 16 samples; Max (0.070 µg/L) < ½ HRL (0.55 µg/L); Min detect = 0.015 µg/L

PFOS/PFOA: Occurrence

- Minnesota (public and private wells), 2004-2005:
  - PFOS: Detected in 6 (7%) of 85 wells; Max (1.4 μg/L) > HRL (0.2 μg/L); min detect = N/A
  - PFOA: Detected in 7 (8%) of 85 wells; Max (0.9 μg/L) < ½ HRL (0.55 μg/L); min detect = N/A
- New Jersey, 2006:
  - PFOS: Detected and quantitated in 2 (29%) of 7 finished water samples/systems; Max (0.014 μg/L) < ½ HRL (0.1 μg/L); Min detect < 0.004 μg/L
  - PFOA: Detected and quantitated in 4 (57%) of 7 samples/systems; Max (0.039 μg/L) < ½ HRL (0.55 μg/L) ; Min detect < 0.004 μg/L

PFOS/PFOA: Occurrence

- Little Hocking, OH, 2002-2005:
  - PFOS: No data
  - PFOA in distribution system: average concentrations ranging from 1.5 to 7.2 µg/L, all > HRL (1.1 µg/L); detection limit = 0.01 µg/L.
  - PFOA in local wells: concentrations ranging from <0.01 µg/L to 14 µg/L
- Upper Mississippi River Basin, 2008 (min detect = 0.001 µg/L):
  - PFOS: Detected and quantitated in 123 (71%) of 173 samples; Max (0.287 µg/L) > HRL (0.2 µg/L); Min detect = 0.001 µg/L
  - PFOA: Detected and quantitated in 126 (73%) of 173 samples; Max (0.125 µg/L) < ½ HRL (0.55 µg/L); Min detect = 0.001 µg/L

* Proposed for UCMR 3 monitoring

RDX: Background

- Used as an explosive by the U.S. military (superseded TNT as the primarily used explosive) and for some civilian uses
- No natural sources
- Production: 1 million – <10 million lbs in 2006 (CUS)
- Industrial Releases: No data (TRI)

RDX: Health Effects

- 1993 IRIS Risk Assessment
- Critical Effect = Cancer; hepatocellular carcinomas/adenomas
  - Based on 24-month study in mice (1984)
  - Cancer slope factor = $(0.11\ \text{mg/kg-day})^{-1}$
- Non-cancer effect = inflammation of the prostate
  - Based on 2-year rat feeding study
  - RfD = 0.003 mg/kg-day; NOEL = 0.3 mg/kg-day; UF = 100
- CCL3 HRL: 0.3 µg/L (cancer); 21 µg/L (non-cancer)
- Sensitive populations: None

RDX: Occurrence

- UCMR 2 Assessment Monitoring, 2008-2010 (MRL = 1 μg/L)
  - Detections > HRL (0.3 μg/L) in 3 of 4,115 systems (0.07%; 96k pop)
  - Sampling not yet complete (data current as of March 1, 2011)
- California, 2006 (min detect = N/A):
  - No detections in 1 sample at 1 system

Questions, Comments or Any Other Information to Share?

- 1,1,1,2-Tetrachloroethane
- 1,2,3-Trichloropropane (TCP)
- 1,3-Dinitrobenzene
- 1,4-Dioxane
- Methyl Tertiary Butyl Ether (MTBE)
- Nitrobenzene
- PFOS and PFOA
- RDX

Contaminants Being Considered and Evaluated for Regulatory Determinations 3

Guy Cole, USEPA

- Dimethoate
- Disulfoton
- Diuron
- Molinate
- Terbufos and Terbufos Sulfone

Dimethoate: Background

- Commonly used as an insecticide on field crops (e.g., wheat, alfalfa, corn, and cotton), orchard crops, vegetable crops, in forestry, and for residential purposes.
- Usage estimated at 1.8 million lbs in 2008 (OPP)
  - Up from 1986: 500,000 – 1 million lbs production/importation (CUS)
- Total industrial releases:15,561 lbs in 2008 (TRI)
- No natural sources
- Fate and Transport
  - Physical/chemical properties indicate very mobile in water
  - 36% partitions to water (modeled system of water, air, soil, and sediment)
  - Moderately persistent (biodegrades slowly with acclimation)

Dimethoate: Health Effects

- 2007 OPP Risk Assessment
- Critical Effect = Brain cholinesterase inhibition
  - 2-year chronic study in rats
  - Chronic oral RfD = 0.0022 mg/kg/day
- Possible human carcinogen ‘C’ (CARC 1991)
  - Equivocal hemolymphoreticular tumors in male B6C3F1 mice, and a weak response for combined spleen, skin, and lymph tumors in male Wistar rats.
- CCL3 HRL: 15.4 µg/L (non-cancer)
- Sensitive populations: None

Dimethoate: Occurrence

- UCMR 2 Assessment Monitoring, 2008-2010 (MRL = 0.7 µg/L)
  - No detections in 32k samples of 4,116 systems
  - Sampling not yet complete (data current as of March 1, 2011)
- USGS data, 2002-2005 (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.0061 µg/L)
  - Phase 1: No detections in 221 wells; 2 (1.4%) detections of 146 SW samples in 9 systems (max estimated at 0.009 µg/L); no detections > ½ HRL
  - Phase 2: No detections in 48 raw & finished GW samples

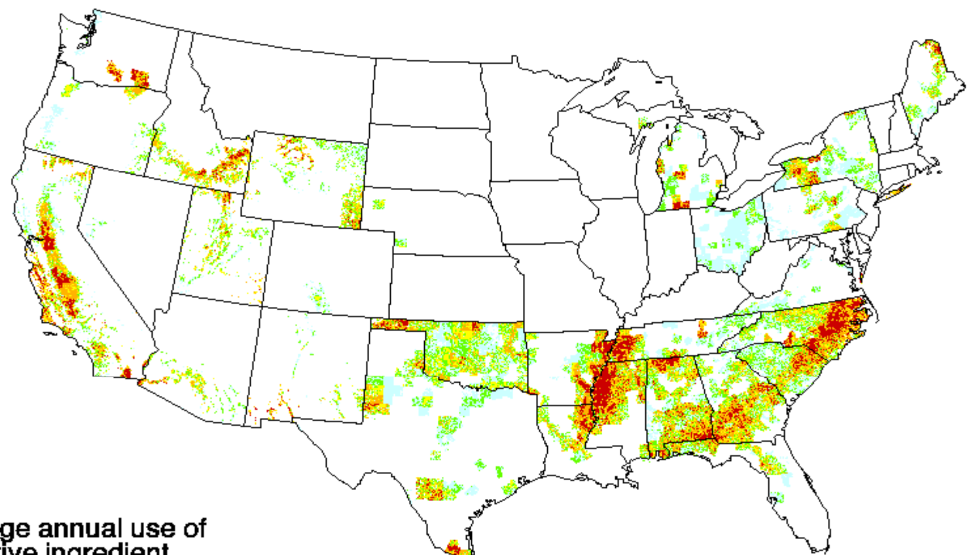
Disulfoton: Background

- Used as organophosphate pesticide/insecticide on cotton, tobacco, sugar beets, asparagus, corn, peanuts, wheat, ornamentals, cereal grains including barley for malting, and potatoes
- Usage:
  - 1.2 million lbs applied annually between 1987-1998 (OPP 2002 IRED)
  - ~1.8 million lbs applied on 24 crops in 34 states in 1992 and 1.2 million lbs on 23 crops in 32 states in 1997 (NCFAP)
- Industrial releases: no TRI data
- No natural sources
- Expected to be not very mobile to moderately mobile in water, based on physical and chemical properties
- Moderately persistent in the environment (biodegrades slowly)

Disulfoton: USGS Usage Map (ca. 2002)

DISULFOTON - insecticide

2002 estimated annual agricultural use



Average annual use of active ingredient (pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.006
- 0.007 to 0.026
- 0.027 to 0.103
- 0.104 to 0.371
- >= 0.372

Crops	Total pounds applied	Percent national use
cotton	175854	51.46
asparagus	33592	9.83
wheat for grain	25812	7.55
potatoes	21855	6.40
green beans	13611	3.98
peanuts	13561	3.97
corn	10726	3.14
tobacco	10308	3.02
barley for grain	7576	2.22
cabbage	7180	2.10

Disulfoton: Health Effects

- 2002 OPP Risk Assessment
- Critical Effect = Plasma, RBC, brain & corneal cholinesterase inhibition
  - Based on 1 year toxicity dog study
  - RfD = 0.00013 mg/kg-day; NOAEL = 0.013 mg/kg-day; UF = 100
- CCL3 HRL: 0.91 µg/L (non-cancer)
- Sensitive populations: None

Disulfoton: Occurrence

- UCMR 1 Screening Survey, 2001-2003 (MRL = 0.5 µg/L):
  - No detections of 2k samples in 295 systems
- California, 1995-2007 (min detect = N/A):
  - No detections reported
- Illinois, 2001 (min detect = N/A):
  - No detections reported
- PDP, 2001-2006 (min detect = N/A):
  - No detections in 4k samples
- USGS data, 1993-2007 (Toccalino et al., 2010) (MRL = 0.01 - 0.02 µg/L)
  - No detections in 647 samples/systems

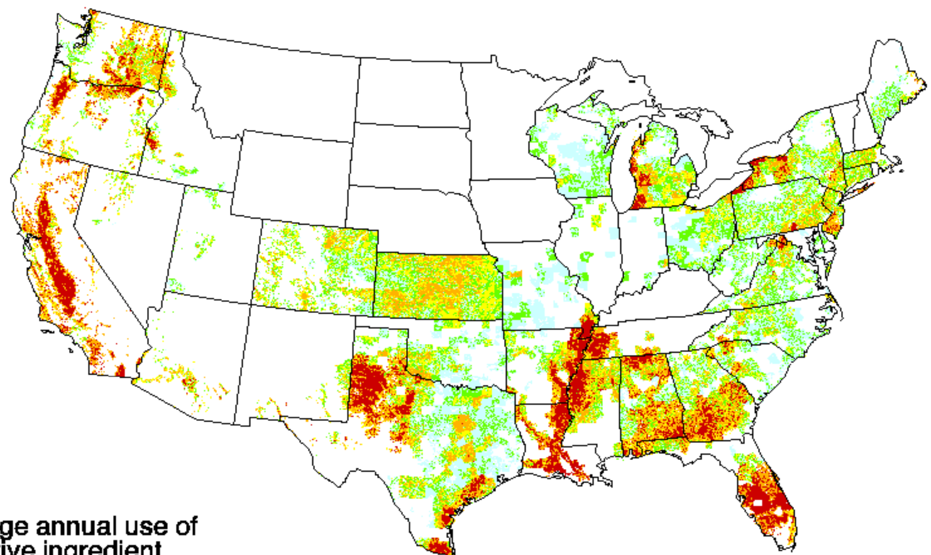
Diuron: Background

- Used as a pesticide/insecticide on 33 crops including citrus, cotton, sugar cane, alfalfa, grapes, asparagus, and pineapple; algaecide in fish production and ponds
- Production/importation: 1 to 10 million lbs in 1998 (CUS)
- Usage: 9 to 10 million lbs applied annually (OPP's 2003 RED)
  - Up from 4.0 million lbs applied on 22 crops in 37 states in 1992 and 4.4 million lbs on 21 crops in 39 states in 1997 (NCFAP)
- Industrial releases to surface water: 5 lbs in 2006 (TRI)
  - Down from 260 lbs in 1999
- Total industrial releases: 91,471 lbs in 2008 (TRI)
- No natural sources
- Expected to be moderately to highly mobile in water, based on physical and chemical properties
- Persistent in the environment (biodegrades sometimes)

Diuron: USGS Usage Map (ca. 2002)

DIURON - herbicide

2002 estimated annual agricultural use



Average annual use of active ingredient (pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.006
- 0.007 to 0.03
- 0.031 to 0.133
- 0.134 to 1.026
- >= 1.027

Crops	Total pounds applied	Percent national use
citrus fruit	1233611	35.75
cotton	1001843	29.03
sugarcane	396903	11.50
alfalfa hay	290978	8.43
grapes	127492	3.69
apples	69420	2.01
asparagus	66251	1.92
field and grass seed crop	61094	1.77
pecans	42615	1.23
walnuts	34338	1.00

Diuron: Health Effects

- 2003 OPP Risk Assessment
- Critical Effect = Cancer; Urinary bladder carcinomas
  - Based on carcinogenicity study in rats and mice
  - Cancer Slope Factor = $(0.0191 \text{ mg/kg-day})^{-1}$
- Non-cancer effect = Hemolytic anemia
  - Based on chronic dietary study in rats
  - RfD = 0.003 mg/kg-day; LOAEL = 1.0; UF = 300
- CCL3 HRL: 1.8 µg/L (cancer); 21 µg/L (non-cancer)
- Sensitive populations: None

Diuron: Occurrence

- UCMR 1 Screening Survey, 2001-2003 (MRL = 1 µg/L):
  - Detections > HRL (1.8 µg/L) in 1 of 293 systems (0.34%; 72k pop)
  - Detections > HRL in 1 of 2k samples (0.04%)
- California, 1995-2007 (min detect = 0.1 µg/L):
  - Detections > HRL in 15 of 990 systems (1.52%)
  - Detections > HRL in 26 of 9k samples (0.3%)
- Illinois, 2001 (min detect = N/A):
  - No detections of 1 sample in 1 system
- PDP, 2002-2006 (min detect = 0.0058 µg/L):
  - 112 detections of 2k samples (4.8%); No detections > HRL
- USGS data, 1993-2007 (Toccalino et al., 2010) (MRL = 0.0075-0.0793 µg/L)
  - 31 detections in 587 samples (5.3%); No detections > HRL
- USGS data, 2002-2005 (Hopple et al., 2009 and Kingsbury et al., 2008) (min detect = N/A)
  - Phase 1 detections: 3% of 215 GW samples; 30% of 145 SW samples; No detections > HRL
  - Phase 2 detections: 7% of 61 raw GW & 2% of 59 finished GW samples; 42% of 90 raw and 24% of 89 finished SW samples; No detections > HRL

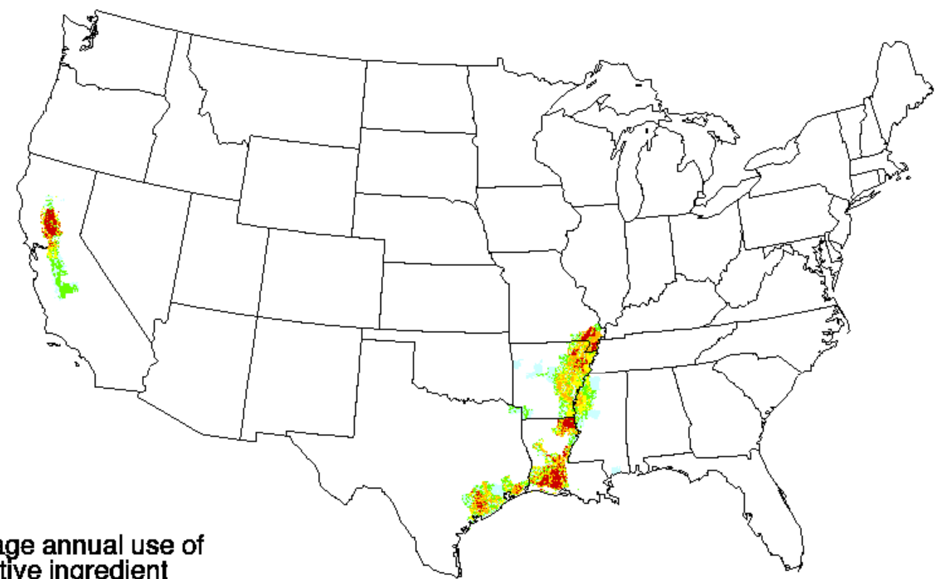
Molinate: Background

- Used as a pesticide and herbicide on rice fields in seven states (AR, LA, TX, CA, MS, MO, TN)
- No use permitted in US after 2009 because of toxicity (69 FR 58079)
- Past Usage: ~ 4.9 million lbs applied in 1992 & ~ 3.7 millions lbs applied in 1997 (NCFAP)
- Industrial releases to surface water: 0 lbs in 2007 (TRI)
  – Down from an average of 100 lbs (1998-2005)
- Total industrial releases: 0 lbs in 2007 (TRI)
- Expected to be moderately mobile in water, based on physical and chemical properties
- Projected half-life in water is 38 days (PBT Profiler)
- No natural sources

Molinate: USGS Usage Map (ca. 2002)

MOLINATE - herbicide

2002 estimated annual agricultural use



Average annual use of active ingredient (pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.604
- 0.605 to 1.864
- 1.866 to 5.736
- 5.738 to 13.39
- >= 13.391

Crops	Total Pounds Applied	Percent National Use
rice	2843649	100.00

Molinate: Health Effects

- 1988 IRIS Risk Assessment
- Critical Effect = Reproductive Toxicity; alteration in sperm morphology; reduced number of viable fetuses/litter
  - Rat reproductive study (gavage)
  - RfD = 0.002 mg/kg-day; NOEL = 0.2 mg/kg-day; UF = 100
- CCL3 HRL:14 µg/L (non-cancer)
- Sensitive populations: Fetuses (developmental neurotoxicity)

Molinate: Occurrence

- UCMR 1 Assessment Monitoring, 2001-2003 (MRL = 0.9 µg/L):
  - 1 detection (5.7 µg/L) of 34k samples in 4k systems; No detections > ½ HRL (7 µg/L)
- California, 1995-2007 (min detect = 2 µg/L):
  - Detections in 3 of 2k systems (0.13%); No detections > ½ HRL
  - Detections in 3 of 30k samples (0.02%); No detections > ½ HRL
- Illinois, 2001-2003 (min detect = N/A):
  - No detections in 341 samples of 85 systems
- Ohio, 2000-2005 (min detect = N/A):
  - No detections in 153 samples of 24 systems
- PDP, 2001-2006 (min detect = N/A):
  - No detections of 2k samples
- USGS data, 1993-2007 (Toccalino et al., 2010) (MRL = 0.0008-0.004 µg/L):
  - Detections in 3 of 635 samples/systems; No detections > ½ HRL

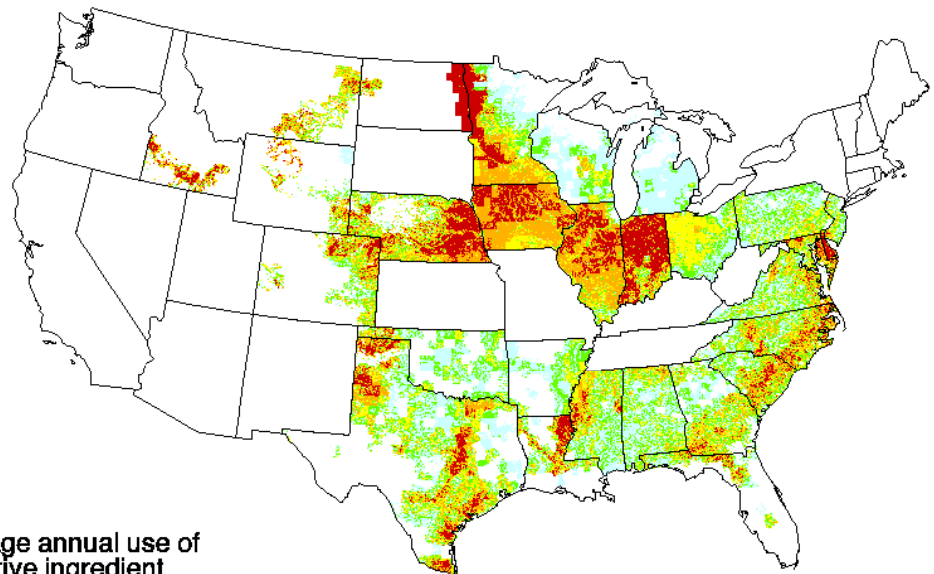
Terbufos & Terbufos Sulfone: Background

- Terbufos is used as a pesticide (e.g., corn & sugar beets)
  - ~7.5 million pounds used per year between 1987-1996 (OPP's 2006 RED)
  - 8.7 million lbs applied in 37 states in 1992 and 6.5 million lbs in 37 states in 1997 (NCFAP)
- No production data available from TRI
- Terbufos sulfone is a degradate of terbufos
- No natural source

Terbufos: USGS Usage Map (ca. 2002)

TERBUFOS - insecticide

2002 estimated annual agricultural use



Average annual use of active ingredient (pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.032
- 0.033 to 0.194
- 0.195 to 0.725
- 0.726 to 2.055
- >= 2.056

Crops	Total Pounds Applied	Percent National Use
corn	2113324	63.44
sugarbeets	1064761	31.96
sorghum	123258	3.70
sweet corn	30019	0.90

Terbufos & Terbufos Sulfone: Health Effects

- 2006 OPP Risk Assessment
- Critical Effect = Plasma cholinesterase inhibition
  - Based on cholinesterase inhibition from a 28-day study in dogs
  - RfD = 0.00005 mg/kg-day; NOAEL = 0.005 mg/kg-day; UF =100
- Studies do not indicate cancer effects
- CCL3 HRL: 0.35 µg/L (non-cancer)
- Sensitive populations: None

Terbufos: Occurrence

- UCMR 1 Screening Survey, 2001-2003 (MRL = 0.5 µg/L):
  - No detects in 2k samples of 295 systems
- California, 2002-2007 (min detect = N/A):
  - No detects in 191 samples of 23 systems
- USGS data, 1993-2007 (Toccalino et al., 2010) (MRL = 0.006-0.013 µg/L):
  - No detections in 898 samples/systems
- USGS data, 2002-2005 (Hopple et al., 2009 and Kingsbury et al., 2008) (min detect = N/A)
  - Phase 1: No detections of 367 samples in 230 systems
  - Phase 2: No detections in 48 raw & 48 finished water samples

Terbufos Sulfone: Occurrence

- UCMR 2 Assessment Monitoring, 2008-2010 (MRL = 0.4 µg/L):
  - Detection > HRL (0.35 µg/L) in 1 of 4,116 systems (0.02%; 45k pop)
  - HRL is less than the MRL
  - Sampling not yet complete (data current as of March 1, 2011)
- Iowa (min detect = N/A):
  - No detects in 13 wells

Questions, Comments or Any Other Information to Share?

- Dimethoate
- Disulfoton
- Diuron
- Molinate
- Terbufos and Terbufos Sulfone

Contaminants Being Considered and Evaluated for Regulatory Determinations 3

Ali Arvanaghi, USEPA

- Acetochlor and its ESA and OA Degradates
- Alachlor ESA and OA Degradates
- Metolachlor and its ESA and OA Degradates

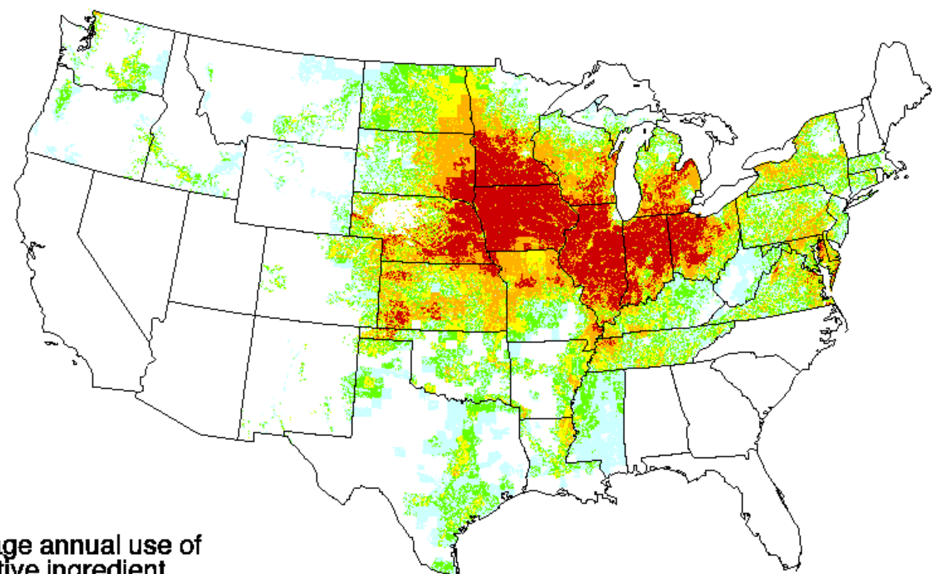
Acetochlor and its ESA and OA Degradates: Background

- Used as a herbicide (chloroacetanilide) on field corn and popcorn. First registered in 1994 (OPP's 2006 TRED)
- Usage: ~30 to 36 million lbs per year in 1997, 1999, and 2001 (EPA's Pesticide Industry Sales and Usage Report)
- No natural sources
- Expected to be moderately to highly mobile in soils (HSDB)
- Projected half-life in water is 60 days (PBT Profiler)

Acetochlor: USGS Usage Map (ca. 2002)

ACETOCHLOR - herbicide

2002 estimated annual agricultural use



Average annual use of
active ingredient
(pounds per square mile of agricultural
land in county)

- no estimated use
- 0.001 to 0.154
- 0.155 to 0.915
- 0.916 to 4.688
- 4.689 to 21.221
- >= 21.222

Crops	Total Pounds Applied	Percent National Use
corn	36140838	100.00

Acetochlor and Degradates: Health Effects

- IRIS 1993 Risk Assessment
- Acetochlor Critical Effect = Histopathology in the testes, kidney, and liver; increased alanine aminotransferase
  - 1-year dog feeding study
  - IRIS RfD = 0.02 mg/kg-day; NOAEL = 2 mg/kg-day; UF = 100
- Acetochlor ESA & OA Critical Effect = Decreased body weight
  - Degradates unlikely to be carcinogenic and are less toxic
  - 90-day feeding study in rats
  - Supplemental NOEL = 23 mg/kg-day
- Acetochlor CCL3 HRL: 140 µg/L (non-cancer)
- Acetochlor ESA/OA CCL3 HRL: 161 µg/L (non-cancer); Parent is surrogate
- Sensitive populations: None

Acetochlor: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 2 µg/L):
  - No detections in 11k samples of 1,196 systems
  - Sampling not yet complete (data current as of March 1, 2011)
- UCMR 1 Assessment Monitoring, 2001-2003 (MRL = 2 µg/L):
  - No detections in 34k samples of 4k systems
- California, 2001-2007 (min detect = N/A):
  - No detections in 3k samples at 279 systems
- Illinois, 1999-2005 (min detect = 1.6 µg/L):
  - No detections > ½ HRL (70 µg/L) in 3k samples of 897 systems
- Ohio, 2000-2005 (min detect = N/A):
  - No detections in 180 samples at 26 systems

Acetochlor: Occurrence

- PDP, 2006 (min detect = 0.0153 µg/L):
  - No detections > ½ HRL (70 µg/L) in 727 samples
- USGS (Toccalino et al., 2010) (MRL = 0.002-0.003 µg/L):
  - Detections in 2 of 800 samples/systems
- USGS, 2002-2005 (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting limit = 0.006 µg/L)
  - Phase 1: Detections in 0.5% of 221 GW samples and 12% of 146 SW samples from 230 SW and GW systems; No detections > ½ HRL
  - Phase 2: Detections in 16% of 90 raw SW samples and 11% of 87 finished SW samples; No detections > ½ HRL
  - Phase 2: No detections of 51 raw and 51 finished GW samples

Acetochlor ESA: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 1 μg/L):
  - Detections in 2 of 1,196 systems; no detections > HRL (161 μg/L)
  - Sampling not yet complete (data current as of March 1, 2011)
- PDP, 2006 (min detect = 0.0027 μg/L):
  - No Detections > ½ HRL (80.5 μg/L) in 737 samples
- USGS, 2002-2005 (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.02 μg/L):
  - Phase 1: Detections in 1% of 73 GW samples and 41% of 39 SW samples from 230 SW and GW systems; No detections > ½ HRL
  - Phase 2: Detections in 25% of 49 raw SW samples and 27% of 48 finished SW samples; No detections > ½ HRL
  - Phase 2: Detections in 19% of 32 raw GW samples and 19% of 32 finished GW samples; No detections > ½ HRL

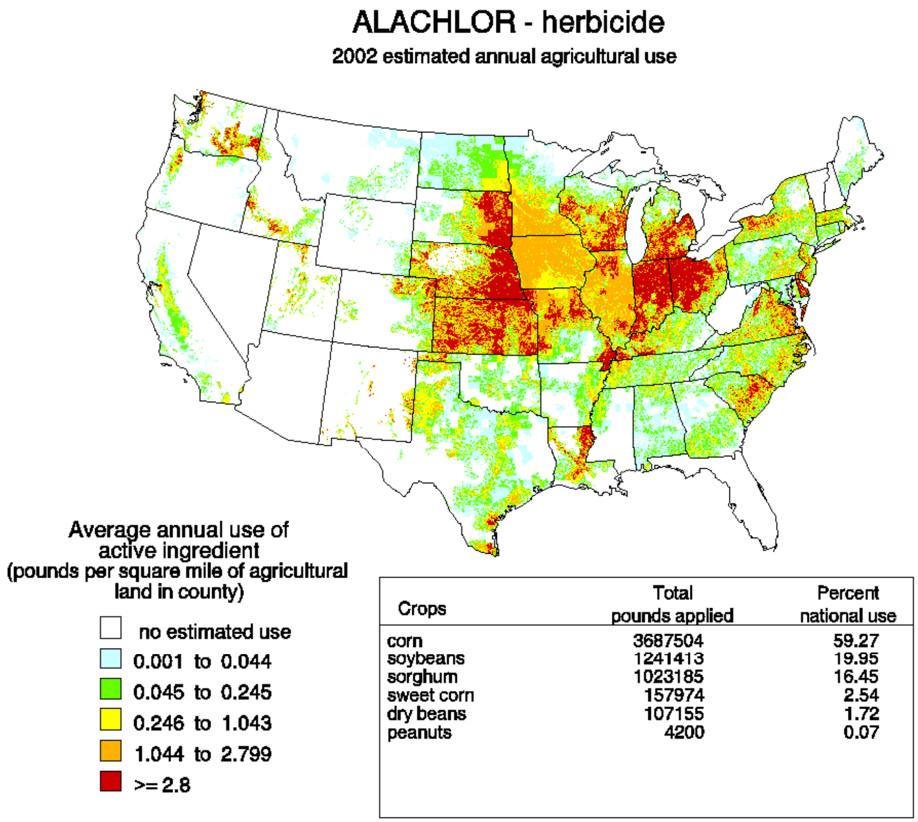
Acetochlor OA: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 2 µg/L):
  - No detections in 11k samples of 1,196 systems
  - Sampling not yet complete (data current as of March 1, 2011)
- PDP, 2006 (min detect = 0.0011 µg/L):
  - No detections > ½ HRL (80.5 µg/L) in 737 samples
- USGS (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.02 µg/L)
  - Phase 1: Detections in 1% of 73 GW samples and 39% of 39 SW samples from 230 SW and GW systems; No detections > ½ HRL
  - Phase 2: Detections in 32% of 49 raw SW samples and 25% of 48 finished SW samples; No detections > ½ HRL
  - Phase 2: Detections in 9% of 32 raw GW samples and 19% of 32 finished GW samples; No detections > ½ HRL

Alachlor Degradates: Background

- Alachlor (currently regulated in drinking water) is used as a herbicide on corn, soybeans, sorghum, peanuts, and beans. Produced under names like Lasso and Alanex (OPP's 1998 RED)
- Usage: 6 - 9 million lbs in 2001 (EPA's Pesticide Industry Usage and Sales Report)
  - Down from 55 - 60 million lbs 1987
- Industrial releases to surface water: 9 lbs in 2008 (TRI)
  - Down from high of 390 lbs in 1999
  - Total releases: 368 lbs in 2008
- No natural sources
- Alachlor ESA is very mobile in soils and, in water, is estimated to be 10 times more soluble than alachlor

Alachlor: USGS Usage Map (ca. 2002)



Crops	Total pounds applied	Percent national use
corn	3687504	59.27
soybeans	1241413	19.95
sorghum	1023185	16.45
sweet corn	157974	2.54
dry beans	107155	1.72
peanuts	4200	0.07

Note: Although alachlor is regulated, use map provides a sense of where degradates likely to occur.

Alachlor Degradates: Health Effects

- 1998 OPP Risk Assessment
- Alachlor ESA Critical Effect = Decreased body weight
  - Based on 91 day drinking water rat study in males
  - Supplemental NOEL = 157 mg/kg-day
- Alachlor OA Critical Effect = Cancer (Parent is surrogate)
  - Based on carcinogenicity rodent study
  - Cancer slope factor = $(0.08 \text{ mg/kg-day})^{-1}$
- Alachlor ESA CCL3 HRL: 1,100 µg/L (non-cancer)
- Alachlor OA CCL3 HRL: 0.4 µg/L (cancer); Parent is surrogate
- Sensitive populations: None
- Alachlor, the parent compound, is already regulated with an MCL of 2 µg/L

Alachlor ESA: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 1 µg/L):
  - Detections in 3 of 1,196 systems; no detections > HRL (1,100 µg/L)
  - Sampling not yet complete (data current as of March 1, 2011)
- PDP, 2006 (min detect = 0.0028 µg/L):
  - No detections > ½ HRL (550 µg/L) in 737 samples
- USGS (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.02 µg/L):
  - Phase 1: Detections in 35% of 58 GW samples and 59% of 39 SW samples from 230 SW and GW systems; No detections > ½ HRL
  - Phase 2: Detections in 61% of 49 raw SW samples and 59% of 48 finished SW samples; No detections > ½ HRL
  - Phase 2: Detections in 77% of 17 raw GW samples and 77% of 17 finished GW samples; No detections > ½ HRL

Alachlor OA: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 2 µg/L):
  - No detections in 11k samples of 1k systems
  - MRL exceeds HRL (0.4 µg/L)
  - Sampling not yet complete (data current as of March 1, 2011)
- PDP, 2006 (min detect = 0.001 µg/L):
  - No detections > ½ HRL (0.2 µg/L) in 737 samples
- USGS, 2002-2005 (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.02 µg/L):
  - Phase 1: Detections in 6% of 73 GW samples and 41% of 39 SW samples from 230 SW and GW systems; Max concentration (1.23 µg/L) > HRL
  - Phase 2: Detections in 50% of 49 raw SW samples and 50% of 48 finished SW samples; Max concentration (0.26 µg/L) > ½ HRL
  - Phase 2: Detections in 25% of 32 raw GW samples and 28% of 32 finished GW samples; Max concentration (0.84 µg/L) > HRL

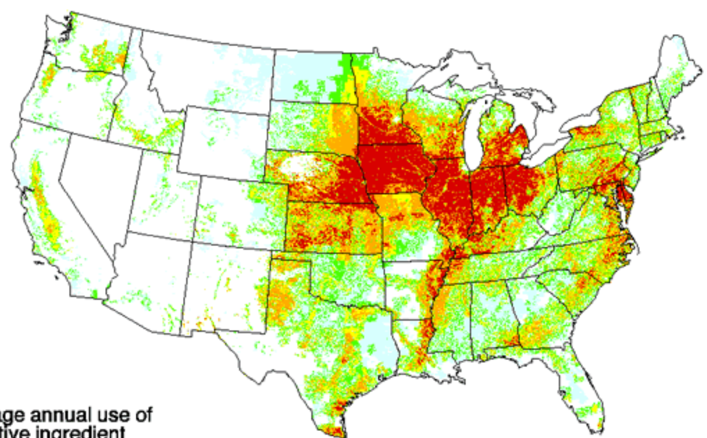
Metolachlor and its ESA and OA Degradates: Background

- Used as a herbicide on a variety of crops and landscaping for weed control
- Manufactured as racemic mixture (metolachlor) and as single enantiomer (S-metolachlor)
- Usage of racemic mixture (EPA Pesticide Industry Sales and Usage Report)
  - 15 - 22 million lbs in 2001, down from 63 - 69 million lbs in 1997
- Usage of S-metolachlor (EPA Pesticide Industry Sales and Usage Report)
  - 20 - 24 million lbs in 2001, up from 16 - 19 million lbs in 1999
- No natural sources
- Metolachlor moderately to very mobile in soil (RED)
- Metolachlor projected half-life in water is 60 days (PBT Profiler)

Metolachlor (ca. 1997) & S-Metolachlor (ca. 2002): USGS Usage Maps

METOLACHLOR - herbicide

1997 estimated annual agricultural use



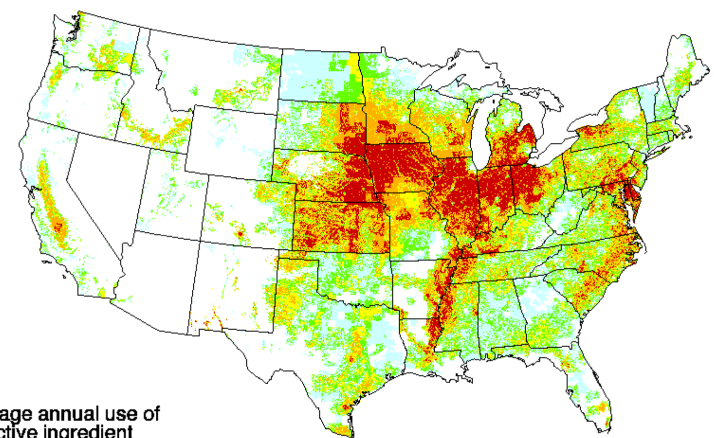
Average annual use of active ingredient (pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.246
- 0.247 to 1.799
- 1.8 to 8.219
- 8.22 to 28.876
- >= 28.877

Crops	Total pounds applied	Percent national use
corn	50, 106, 770	74. 74
soybeans	9, 426, 549	14. 06
sorghum	4, 545, 517	6. 78
peanuts	920, 726	1. 37
sweet corn	524, 334	0. 78
cotton	496, 278	0. 74
dry beans	381, 197	0. 57
potatoes	278, 187	0. 41
green beans	184, 489	0. 28
dry peas	42, 455	0. 06

S-METOLACHLOR - herbicide

2002 estimated annual agricultural use



Average annual use of active ingredient (pounds per square mile of agricultural land in county)

- no estimated use
- 0.001 to 0.132
- 0.133 to 0.909
- 0.91 to 4.112
- 4.113 to 12.815
- >= 12.816

Crops	Total pounds applied	Percent national use
corn	17822074	72.50
soybeans	2468149	10.04
sorghum	2357665	9.59
cotton	439816	1.79
peanuts	310432	1.26
sweet corn	301541	1.23
dry beans	291885	1.19
potatoes	268445	1.09
green beans	135994	0.55
tomatoes	101192	0.41

Metolachlor and Degradates: Health Effects

- 1995 OPP Risk Assessment
- Metolachlor Critical Effect = Decreased body weight gain
  - Based on 1-year feeding study in dogs
  - RfD = 0.1 mg/kg-day; NOEL = 9.7 mg/kg-day; UF = 100
- Class C (Possible human carcinogen) based on 1998 study (IRIS)
- Metolachlor ESA & OA
  - No biologically significant effects
  - Supplemental NOEL ≥ 1,000 mg/kg-day
- Metolachlor CCL3 HRL: 700 µg/L (non-cancer)
- Metolachlor ESA/OA CCL 3 HRL: ≥ 7,000 µg/L (non-cancer); Parent is surrogate
- Sensitive populations: None

Metolachlor: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 1 µg/L):
  - Detections in 3 of 1,196 systems; no detections > HRL (700 µg/L)
  - Sampling not yet complete (data current as of March 1, 2011)
- UCM Round 2 cross-section, 1993-1997 (min detect = 0.01 µg/L):
  - Detections in 116 of 13k systems (0.9%); no detections > HRL
  - Detections in 211 of 34k samples (0.6%); no detections > HRL
- California, 1995-2007 (min detect = 0.1 µg/L):
  - No detections > ½ HRL (350 µg/L) in 24k samples at 2k systems
- Illinois, 1999-2005 (min detect = 0.3 µg/L):
  - No detections in 3k samples at 875 systems
- North Carolina, 1998-2005 (min detect = 0.5 µg/L):
  - No detections > ½ HRL in 14k samples of 2,477 systems
- Ohio, 1999-2005 (min detect = 0.1 µg/L):
  - No detections > ½ HRL in 2k samples of 821 systems

Metolachlor: Occurrence

- Region 9 Tribes, 1998-2005 (min detect = N/A):
  - No detections in 734 samples at 225 systems
- South Dakota, 1993-2007 (min detect = N/A):
  - No detections in 2k samples at 255 systems
- Texas, 1998-2007 (min detect = 0.1 µg/L):
  - No detections > ½ HRL (350 µg/L) in 12k samples at 2,252 systems
- Florida, 2004-2007 (min detect = N/A):
  - No detections in 28 samples at 6 systems
- Wisconsin, 1984-1999 and 2000-2008 (min detect = 0.1 µg/L):
  - No detections > ½ HRL in 3k samples at 1,175 systems
- Wisconsin, 2000-2009 (min detect = 0.1 µg/L):
  - No detections > ½ HRL in 2k samples at 915 systems

Metolachlor: Occurrence

- PDP, 2006 (min detect = 0.0025 µg/L):
  - No Detections > ½ HRL (350 µg/L) in 727 samples
- USGS (Toccalino et al., 2010) (MRL = 0.002-0.006 µg/L)
  - No detections > HRL in 870 samples/systems
- USGS (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.006 µg/L)
  - Phase 1: Detections in 11% of 221 GW samples and 51% of 146 SW samples from 230 SW and GW systems; No detections > ½ HRL
  - Phase 2: Detections in 59% of 90 raw SW samples and 54% of 87 finished SW samples; No detections > ½ HRL
  - Phase 2: Detections in 13% of 64 raw GW samples and 11% of 65 finished GW samples; No detections > ½ HRL

Metolachlor ESA: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 1 µg/L):
  - Detections in 19 of 1,196 systems; no detections > HRL (7,000 µg/L)
  - Sampling not yet complete (data current as of March 1, 2011)
- PDP, 2008 (min detect = 0.0006 µg/L):
  - No detections > ½ HRL (3,500) in 737 samples
- USGS (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.02 µg/L)
  - Phase 1: Detections in 29% of 73 GW samples and 69% of 39 SW samples from 230 SW and GW systems; No detections > ½ HRL
  - Phase 2: Detections in 68% of 49 raw SW samples and 59% of 48 finished SW samples; No detections > ½ HRL
  - Phase 2: Detections in 47% of 32 raw GW samples and 41% of 32 finished GW samples; No detections > ½ HRL

Metolachlor OA: Occurrence

- UCMR 2 Screening Survey, 2008-2010 (MRL = 2 µg/L):
  - Detections in 1 of 1,196 systems; no detections > HRL (7,000 µg/L)
  - Sampling not yet complete (data current as of March 1, 2011)
- PDP, 2006 (min detect = 0.0053 µg/L):
  - No detections > ½ HRL (3,500) in 737 samples
- USGS (Hopple et al., 2009 and Kingsbury et al., 2008) (reporting level = 0.02 µg/L)
  - Phase 1: Detections in 15% of 73 GW samples and 67% of 39 SW samples from 230 SW and GW systems; No detections > ½ HRL
  - Phase 2: Detections in 77% of 49 raw SW samples and 59% of 48 finished SW samples; No detections > ½ HRL
  - Phase 2: Detections in 38% of 32 raw GW samples and 34% of 32 finished GW samples; No detections > ½ HRL

Questions, Comments or Any Other Information to Share?

- Acetochlor and its ESA and OA Degradates
- Alachlor ESA and OA Degradates
- Metolachlor and its ESA and OA Degradates

Next Steps

- Publish preliminary regulatory determinations for public comment by mid-2012.
- After considering comments, publish final regulatory determinations by August 2013.

Appendices

Appendix A: Unregulated CCL 3 Contaminants
106 Chemicals and 12 Microbes

1,1,1,2-Tetrachloroethane
1,1-Dichloroethane
1,2,3-Trichloropropane
1,3-Butadiene
1,3-Dinitrobenzene
1,4-Dioxane
17 alpha-Estradiol
1-Butanol
2-Methoxyethanol
2-Propen-1-ol
3-Hydroxycarbofuran (degradate)
4,4'-Methylenedianiline
Acephate
Acetaldehyde
Acetamide
Acetochlor
Acetochlor ethanesulfonic acid (ESA)
Acetochlor oxanilic acid (OA)
Acrolein
Alachlor ethanesulfonic acid (ESA)
Alachlor oxanilic acid (OA)
alpha-Hexachlorocyclohexane (former)
Aniline
Bensulide
Benzyl chloride
Butylated hydroxyanisole
Captan
Chlorate (also D-DBP)
Chloromethane (Methyl chloride)
Clethodim
Cobalt
Cumene hydroperoxide
Cyanotoxins (3)
Dicrotophos
Dimethipin
Dimethoate
Disulfoton
Diuron
Equilenin
Equilin
Erythromycin
Estradiol (17-beta)
Estriol
Estrone
Ethinyl Estradiol (17-alpha)
Ethoprop
Ethylene glycol
Ethylene oxide
Ethylene thiourea
Fenamiphos
Formaldehyde (formerly)
Germanium
Halon 1011 (Bromochloromethane)
HCFC-22
Hexane
Hydrazine
Mestranol
Methamidophos
Methyl bromide (Bromomethane)
Methyl tert-butyl ether
Metolachlor
Metolachlor ethanesulfonic acid (ESA)
Metolachlor oxanilic acid (OA)
Molinate
Molybdenum
Nitrobenzene
Nitroglycerin
N-Methyl-2-pyrrolidone
N-Nitrosodiethylamine (NDEA)
N-nitrosodimethylamine (NDMA)
N-Nitroso-di-n-propylamine (NDPA)
N-Nitrosodiphenylamine
N-nitrosopyrrolidine (NPYR)
Norethindrone (19-Norethisterone)
n-Propylbenzene
o-Toluidine
Oxirane, methyl-
Oxydemeton-methyl
Oxyfluorfen
Perchlorate
Perfluorooctane sulfonic acid (PFOS)
Perfluorooctanoic acid (PFOA)
Permethrin
Profenofos
Quinoline
RDX
sec-Butylbenzene
Strontium
Tebuconazole
Tebufenozide
Tellurium
Terbufos
Terbufos sulfone
Thiodicarb
Thiophanate-methyl
Toluene diisocyanate
Tribufos
Triethylamine
Triphenyltin hydroxide (TPTH)
Urethane
Vanadium
Vinclozolin
Ziram

Adenovirus
Caliciviruses
Campylobacter jejuni
Enterovirus
Escherichia coli (0157)
Helicobacter pylori
Hepatitis A virus
Legionella pneumophila
Mycobacterium avium
Naegleria fowleri
Salmonella enterica
Shigella sonnei

Appendix B: Contaminants on the Second Unregulated Contaminant Monitoring Regulation (UCMR 2)

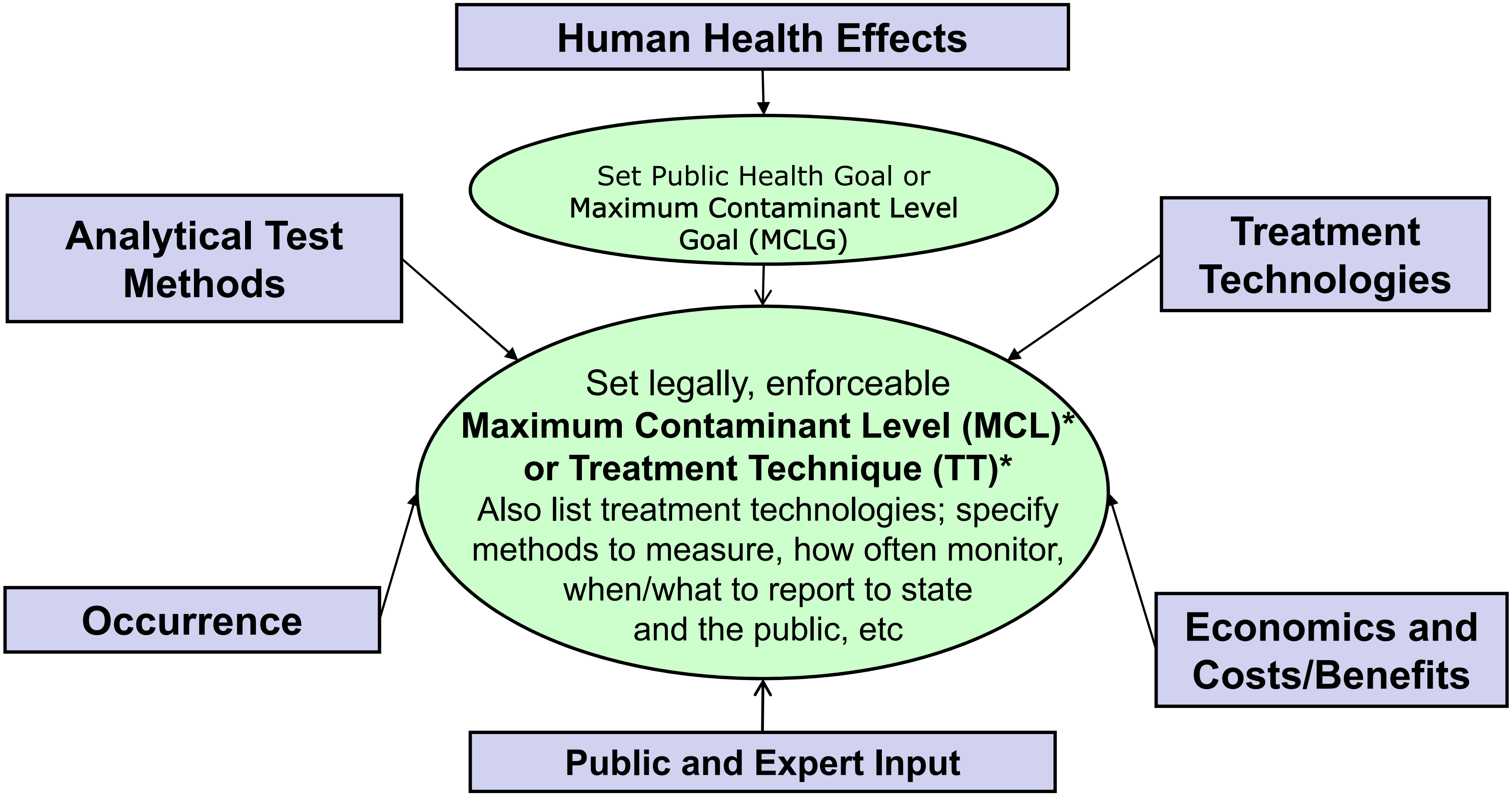
10 Assessment Monitoring

- 3 Explosive
  - hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
  - 2,4,6-trinitrotoluene (TNT)
  - 1,3-dinitrobenzene
- 7 Insecticides and Flame Retardants
  - Dimethoate
  - Terbufos sulfone
  - **5 Brominated Flame Retardants**

15 Screening Survey

- 9 Acetanilide pesticides/degradation products
  - **Acetochlor**
  - **Acetochlor ESA**
  - **Acetochlor OA**
  - **Alachlor**
  - **Alachlor ESA**
  - **Alachlor OA**
  - **Metolachlor**
  - **Metolachlor ESA**
  - **Metolachlor OA**
- 6 Nitrosamines
  - **N-nitroso-diethylamine (NDEA)**
  - **N-nitroso-dimethylamine (NDMA)**
  - **N-nitroso-di-n-butylamine (NDBA)**
  - **N-nitroso-di-n-propylamine (NDEA)**
  - **N-nitroso-methylethylamine (NMEA)**
  - **N-nitroso-pyrrolidine (NPYR)**

Appendix C: What Factors Do We Consider and How Do We Develop Standards?



* **Maximum Contaminant Level (MCL)** - the highest level or amount of a contaminant that EPA allows in drinking water.
***Treatment Technique (TT)** – a prescribed process intended to reduce the level of a contaminant in drinking water.

Appendix D: Nitrosamines Occurrence in Ambient Water (STORET)

Nitrosamine Compounds in CCL3	#Samples in Dataset	#Samples with Detection	#Sample Sites in Dataset	#Sites with Detection
NDMA*	599	0	261	0
NDEA**	3	0	3	0
NPYR**	5	0	5	0
NDPA*	1,508	22 (1.5%)	602	20 (3.3%)
NDPhA*	1,268	31 (2.4%)	470	31 (6.1%)

* From both GW & SW
** From SW

Appendix E:

NDMA UCMR2 Inventory Information and Occurrence by Water Type and Monitoring Location (Based on UCMR2 Data of March 1, 2011 Version)

Nitrosamines: UCMR 2 Inventory Information (as of March 1, 2011)

(NDMA as an example)	Systems ≥ 100 k	Systems between 100 k & 10 k	Systems < 10 k	Overall
Number of Samples	10,733 (60%)	3,950 (22%)	3,233 (18%)	17,916 (100%)
Number of Systems in Dataset	398	318	480	1,196
Number of Systems in UCMR2 Screening Survey Design	398 (All)	320	480	1,198

Nitrosamines: Occurrence (cont.)

Summary Statistics among NDMA Detections in Surface Water Systems: Disinfectant Types (UCMR 2)

	with Chlorine	**with Chloramines**
Number of Detections	171	728
Detection Rate	4%	39%
Mean (ng/L)	8.4	9.3
Median (ng/L)	3.4	4.1
Maximum (ng/L)	84.6	470
%Measurements* ≥ 10 ng/L	0.8%	7.9%

* Among all of measurements

Nitrosamines: Occurrence (cont.)

Summary Statistics among NDMA Detections in Surface Water Systems with Chlorine: Monitoring Locations

	At EP	At MR
Number of Detections	87	84
Detection Rate	4.0%	4.7%
Mean (ng/L)	7.8	9.0
Median (ng/L)	3.2	3.6
Maximum (ng/L)	61.7	84.6
%Measurements* ≥ 10 ng/L	0.5%	0.8%

* Among all of measurements

Nitrosamines: Occurrence (cont.)

Summary Statistics among NDMA Detections in Surface Water Systems with Chloramines: Monitoring Locations

	At EP	At MR
Number of Detections	326	402
Detection Rate	28.6%	53.7%
Mean (ng/L)	9.8	8.6
Median (ng/L)	4.1	4.0
Maximum (ng/L)	470	110
%Measurements* ≥ 10 ng/L	5.8%	11.1%

* Among all of measurements

Nitrosamines: Occurrence (cont.)

Summary Statistics among NDMA Detections with Chlorine: Water Types

	GW	SW
Number of Detections	85	171
Detection Rate	1.4%	4.3%
Mean (ng/L)	4.7	8.4
Median (ng/L)	3.1	3.4
Maximum (ng/L)	55.0	84.6
%Measurements* ≥ 10 ng/L	0.08%	0.8%

* Among all of measurements

Nitrosamines: Occurrence (cont.)

Summary Statistics among NDMA Detections with Chloramines: Water Types

	GW	SW
Number of Detections	60	728
Detection Rate	11.7%	38.6%
Mean (ng/L)	3.7	9.1
Median (ng/L)	2.8	4.1
Maximum (ng/L)	10	470
%Measurements* ≥ 10 ng/L	0.2%	7.9%

* Among all of measurements

Appendix F: Timeline