Tucson Water's
Water Quality Update

Presented By:
Stephen E. Dean
Water Quality & Operations Administrator

Presented to Citizen's Water Advisory Committee
April 7, 2010

Outline

Overview of Water System

Drinking Water Compliance

Water Quality Laboratory

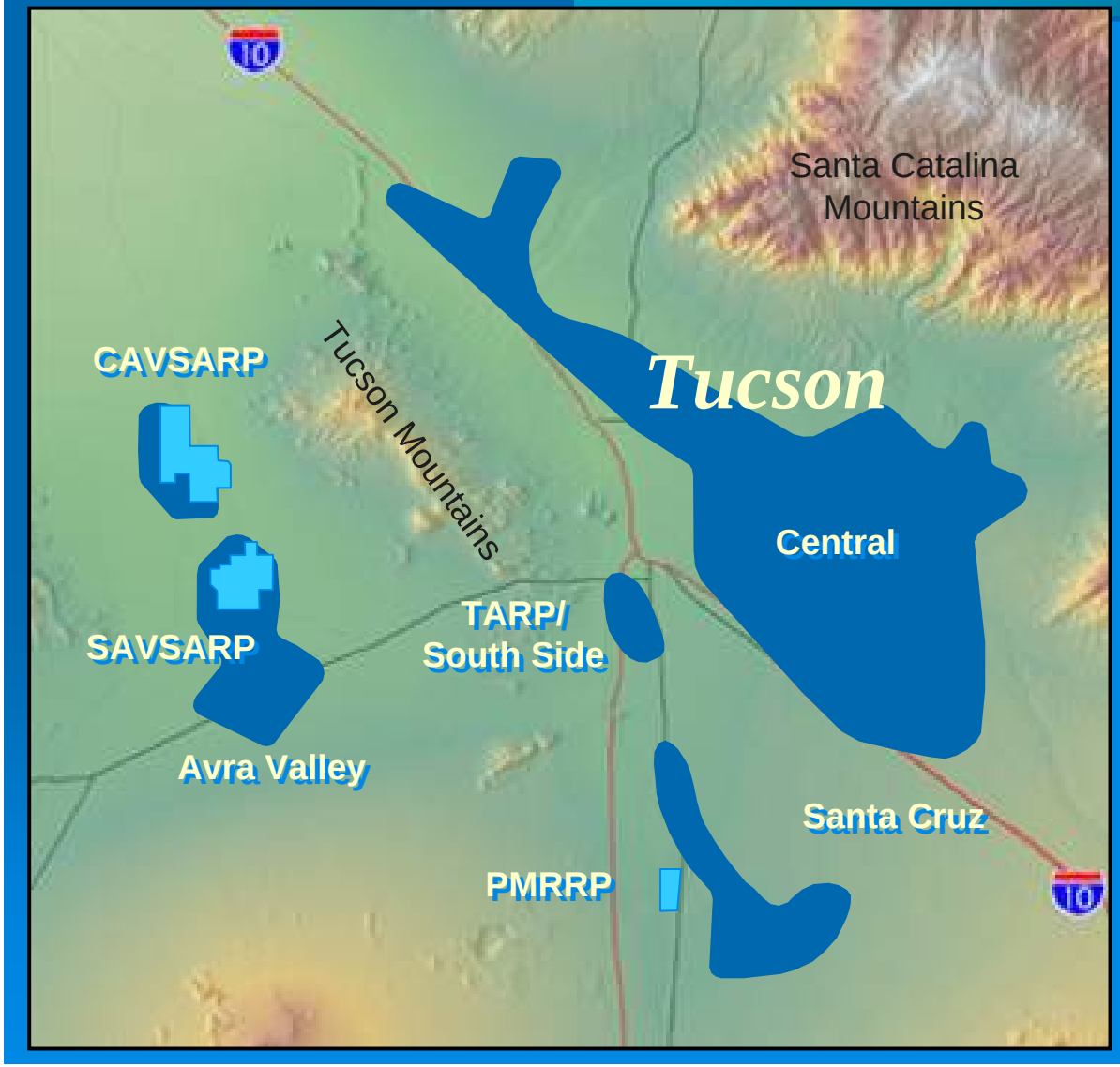
Contaminants of Emerging Concern

Pharmaceuticals

1,4-Dioxane

Arsenic

Overview of Water System



242,600 Services

216 Wells

4,500 Miles of Mains

62 Reservoirs/Tanks

266 Sampling Points

TW's Main System is One of the Largest and Most Complex Groundwater Systems in the Nation

Drinking Water Compliance

Regulatory Hierarchy

U.S. Congress
Enacts legislation

U.S. Environmental Protection Agency (EPA)
Develops regulations

State
Adopts laws and regulations

State (ADEQ)
Issues permits and enforces compliance

Tucson Water and Pima County Regional Wastewater Reclamation Department
Implement regulatory requirements

Regulatory Terms

- CCL Contaminant Candidate List
- MCL Maximum Contaminant Level
- MCLG Maximum Contaminant Level Goal
- Preliminary Remediation Goal
- Health Advisory Level

Drinking Water Compliance (cont.)

PWS	NAME	WELLS
10-158	Valley View Acres	2
10-159	Diamond Bell	2
10-162	Silverbell West	2
10-169	Corona De Tucson	3
10-171	Catalina	2
10-173	Rancho Del Sol Lindo	2
10-179	Thunderhead	2
10-270	Sierrita Foothills	1
10-313	Police-Fire Academy	1
10-325	Sunset Ranch	Marana
10-112	Main System	199

2009 Annual Water Quality Report

City of Tucson Water Quality Management & Operations Division

Detected Contaminants Table

CONTAMINANT	SAMPLE YEAR	MAXIMUM RESULT	RANGE	MCL	MCLG	MAJOR SOURCES OF CONTAMINANT
Disinfection By-Products						
Haloacetic acids (HAA)						
Dichloroacetic Acid	09	1.4 ppb	<1 - 1.4 ppb		None	By-product of chlorination
Dibromoacetic Acid	09	2.1 ppb	<1 - 2.1 ppb		None	By-product of chlorination
Total Haloacetic Acids (5)	09	3.5 ppb	<2 - 3.5 ppb		None	By-product of chlorination
Running Annual Average for HAA5	09	< 2 ppb		60 ppb		
Trihalomethanes (THM)						
Bromodichloromethane	09	2.3 ppb	<0.5 - 2.3 ppb		None	By-product of chlorination
Bromoform	09	5.8 ppb	<0.5 - 5.8 ppb		None	By-product of chlorination
Chloroform	09	1.5 ppb	<0.5 - 1.5 ppb		None	By-product of chlorination
Chlorodibromomethane	09	5.0 ppb	<0.5 - 5.0 ppb		None	By-product of chlorination
Total Trihalomethanes	09	14.5 ppb	<0.5 - 14.5 ppb		None	By-product of chlorination
Running Annual Average for TTHM5	09	6.6 ppb		80 ppb		
Inorganics						
Arsenic	07-09	9.1 ppb	<2.0 - 9.1 ppb	10 ppb	0 ppb	Natural deposits
Barium	07-09	0.13 ppm	<0.02 - 0.13 ppm	2 ppm	2 ppm	Natural deposits; Industrial Uses
Fluoride	09	1.0 ppm	<0.1 - 1.0 ppm	4 ppm	4 ppm	Natural deposits
Nitrate (as N)	09	7.7 ppm	<0.25 - 7.7 ppm	10 ppm	10 ppm	Natural deposits; septic tanks; agriculture; sewage
Sodium	07-09	101 ppm	16 - 101 ppm	None	None	Natural deposits
Volatile Organics						
Total Xylenes	09	0.0015 ppm	0.0015-0.0015 ppm	10 ppm	10 ppm	Solvent used in paint coatings, adhesive, fuel
Synthetic Organics						
Atrazine	07-09	1.3 ppb	<0.05-1.3 ppb	3 ppb	3 ppb	Runoff from herbicides used on row crops
Di (2-ethylhexyl) phthalate	07-09	0.7 ppb	<0.6-0.7 ppb	6 ppb	0 ppb	Discharge from rubber and chemical factories
Simazine	07-09	0.05 ppb	<0.05-0.05 ppb	4 ppb	4 ppb	Herbicide runoff
Radioactive Chemicals						
Alpha Emitters	09	2.2 pCi/L	<1.0 - 2.2 pCi/L	15 pCi/L	0 pCi/L	Natural Deposits
Uranium	09	4.7 ppb	<1.4 - 4.7 ppb	30 ppb	0 ppb	Natural Deposits

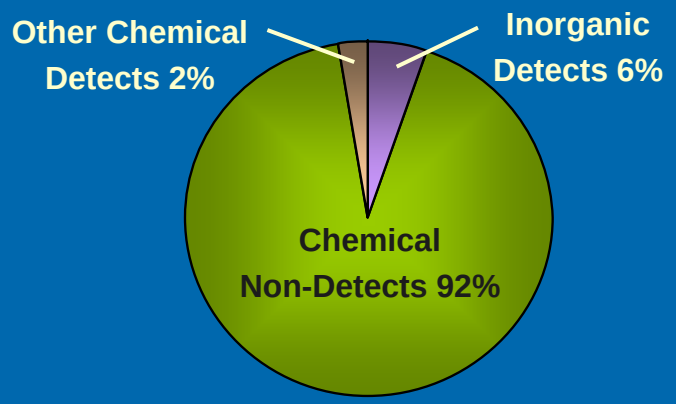
CONTAMINANT	YEAR SAMPLED	NO. OF SAMPLES ABOVE THE ACTION LEVEL	90TH PERCENTILE VALUE	ACTION LEVEL	MCLG	MAJOR SOURCES
Lead	08	one	2.0 ppb	15 ppb	0	Corrosion of household plumbing systems
Copper	08	none	0.12 ppm	1.3 ppm	1.3 ppm	Corrosion of household plumbing systems

CONTAMINANT	YEAR SAMPLED	ANNUAL AVERAGE	MONTHLY AVERAGE RANGE	MRDL	MCLG	SOURCE
Chlorine	09	0.86 ppm	0.79 - 0.93 ppm	4 ppm	4 ppm	Disinfection additive used to control microbes

Potable Water ComplianceTucson Water

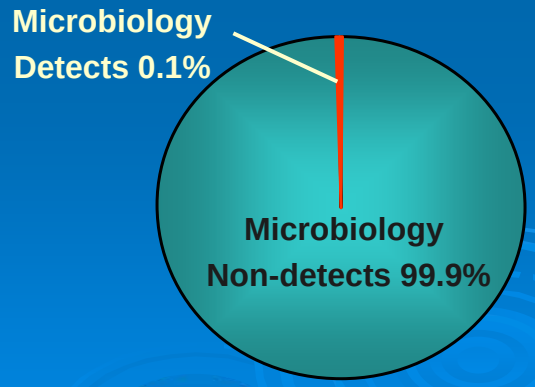
2007 - 2009 Results Drinking Water Compliance Tests

Regulated Chemicals Tested	Samples for Calendar Year 2007 – 2009
Coliforms	9,611
Disinfection By-Products	124
Inorganic Chemicals	2,454
Lead and Copper	326
Maximum Residual Detection Levels	132
Radiochemicals	135
Synthetic Organic Chemicals	10,418
Volatile Organic Chemicals	3,740
Total	**26,926**



Chemical Results

(17,329 Tests)



Microbiology (Coliform) Results

(9,611 Tests)

Regulatory Compliance Monitoring Costs

2009 Cost for Complying with National Primary Drinking Water Standards: $2.83 M

Multi-Barrier Approach

TW utilizes a "Multiple Barrier" approach to potable water protection

Monitoring

Sampling for regulated and unregulated contaminants on a regular basis

Treatment

Maintaining chlorine target levels in the system

Prevention

Management practices, Operational strategies, and participation in on-going research

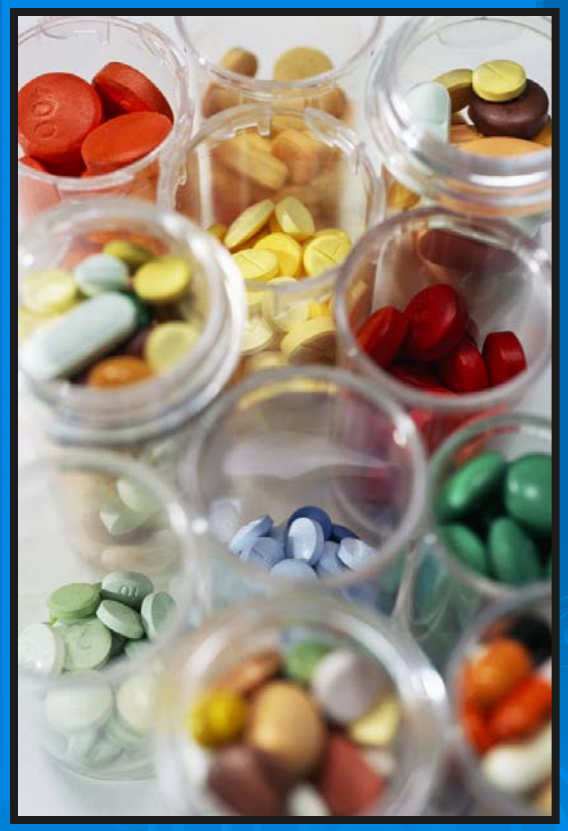
Water Quality Laboratory

The Tucson Water-Water Quality Laboratory is licensed by the **Arizona Department of Health Services (ADHS)**.

Contaminants of Emerging Concern

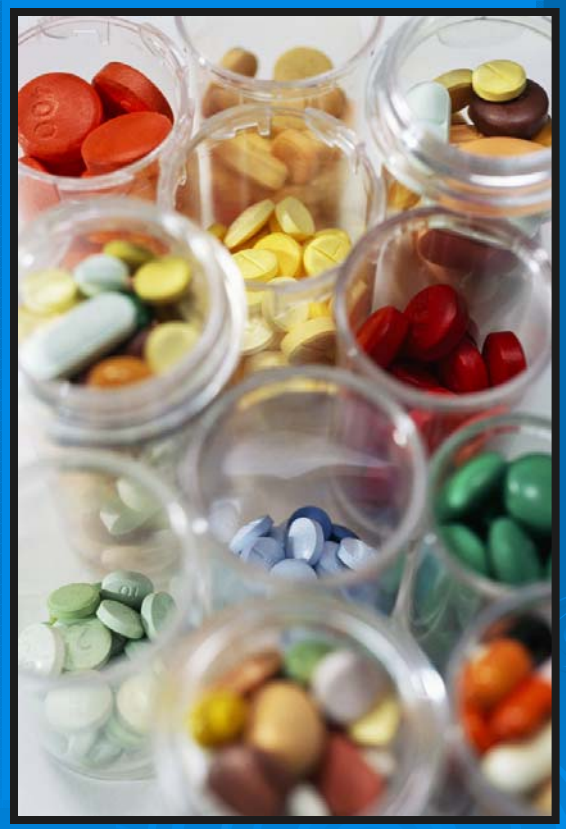
CECs - Natural or manmade compounds that are detected in the environment with a potential effect on organism development and human health.

CECs are often classified as pharmaceutical and personal care products (PPCPs) and endocrine disrupting compounds (EDCs).



Contaminants of Emerging Concern (cont.)

- Antibiotics (Veterinary and Human)
- Human Drugs
  - Prescription
  - Non-prescription
- Industrial and Household Wastewater Products
  - Insecticides
  - Plasticizers, fire retardants, solvents
- Sex and Steroidal Hormones
  - Biogenics
  - Sterols



Contaminants of Emerging Concern (cont.)

Origins and Fate of PPCP's in the Environment

Contaminants of Emerging Concern (cont.)

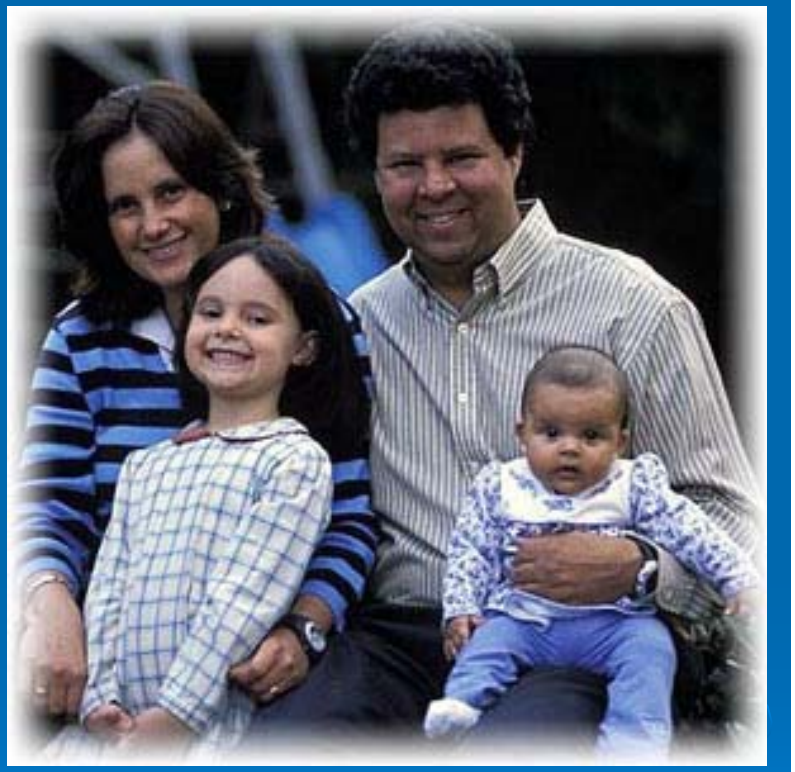
- Scientists first found pharmaceuticals in wastewater during the1970s.
- Since the mid-1990's, EPA's Office of Water used the term "emerging contaminants" to loosely describe chemicals and other substances that have no regulatory standard.

- 1999 -2000 The USGS published the discovery of emerging contaminants in U.S. waterways.
- Primarily due to improved analytical detection levels, microconstituents in the environment have been routinely detected.

Contaminants of Emerging Concern (cont.)

What Are the Health Risks?

- The risks to aquatic organisms and to humans are unknown regarding CECs, largely because the concentrations vary in water.
- There are currently no known human health effects from such low-level exposures in drinking water.



Contaminants of Emerging Concern (cont.)

Dr. Shane Snyder

Statement before the Senate Subcommittee (04/15/08)
"Contrary to recent reports that characterize pharmaceuticals in water as an entirely new issue, pharmaceuticals were first reported in US waters by the EPA in 1975. The fact that more water pharmaceuticals are detected today are due to increasingly sensitive analytical technology."

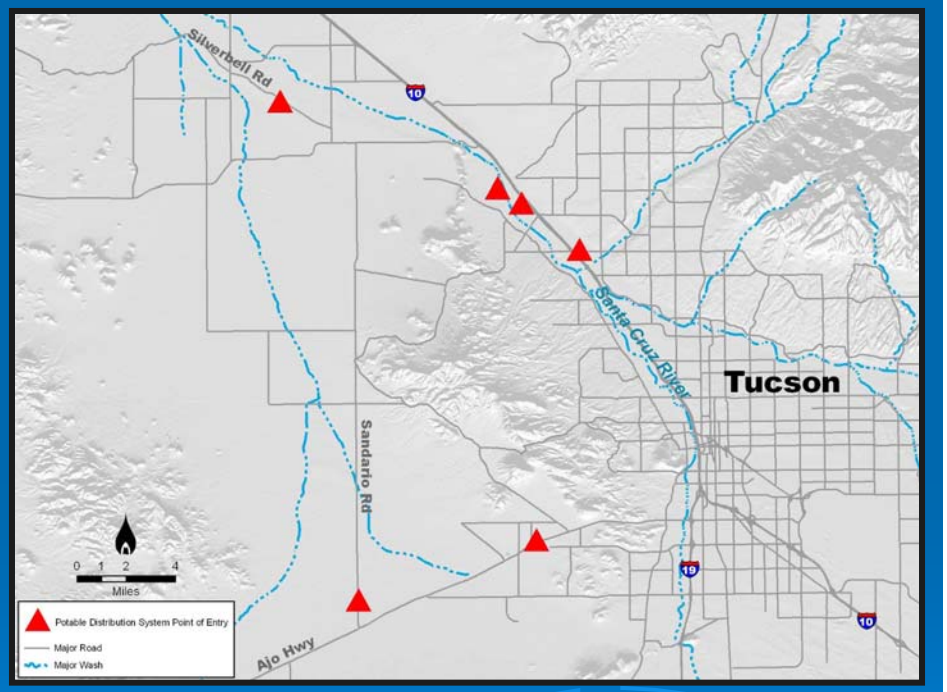
The Snyder et. al. AwwaRF report is the most extensive report to date on treatment technologies that were successful, partially successful or unsuccessful in removing CECs in the studied surface and reuse waters.

THE UNIVERSITY OF ARIZONA

Recently recruited to work at the Arizona Laboratory for Emerging Contaminants (ALEC) – University of Arizona

Tucson Water's Sentry Program

TW initiated a Microconstituent Sampling program ("Sentry Program") in 2008



Purpose:

- *To identify the possibility of microconstituents in our potable water supply*

Sampling Locations:

- *Wells that may be influenced by effluent.*

Microconstituent Detections - 2009

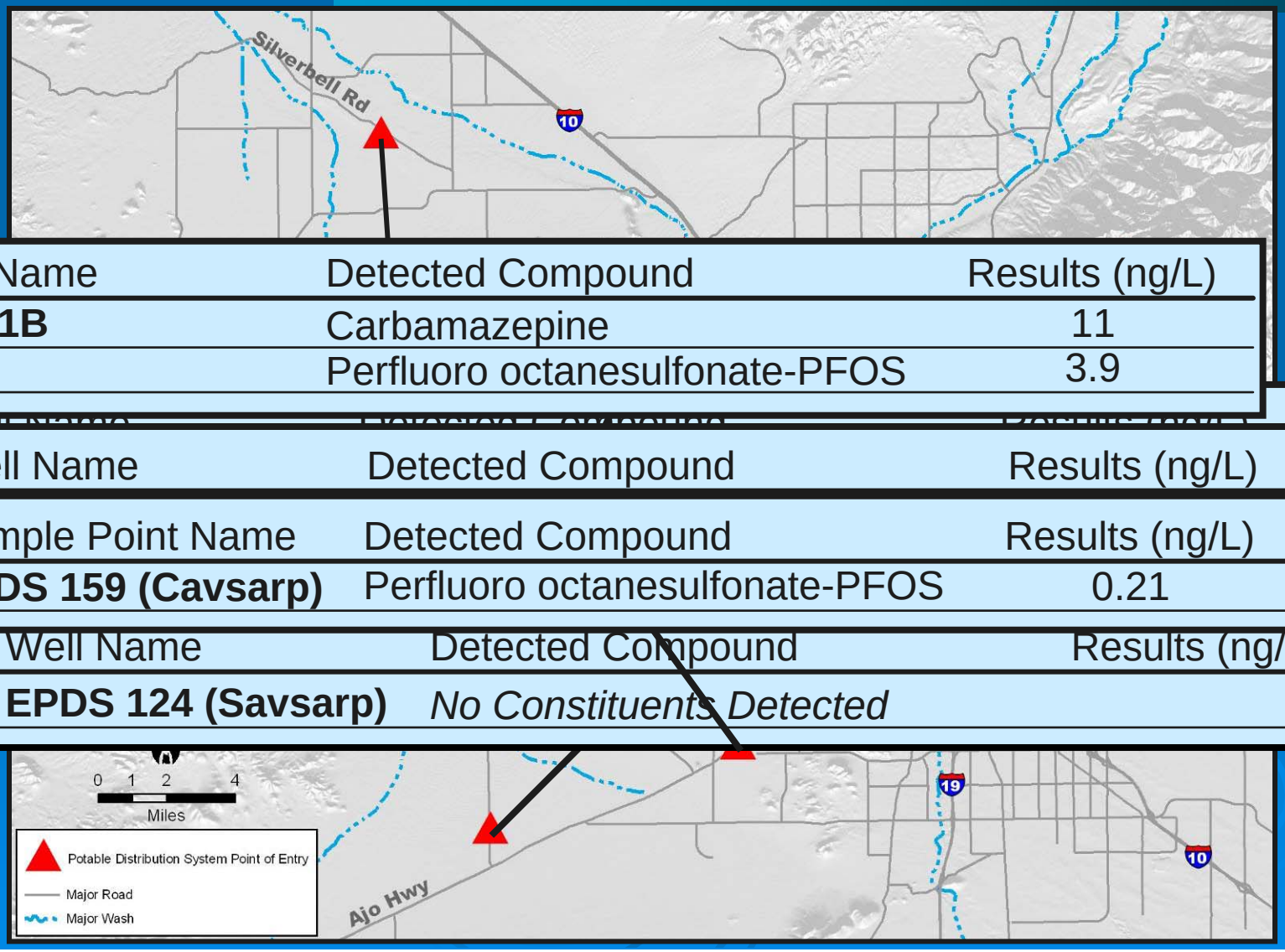
Carbamazepine is an anticonvulsant and mood stabilizing drug used primarily in treatment of epilepsy and bipolar disorder.

Fluoxetine is the primary ingredient found in common anti-depressants like Prozac.

Sulfamethoxazole is an antibiotic commonly used to treat urinary tract infections.

Perfluoro octanesulfonate-PFOS is a common ingredient found in 3M Scotchguard brand products. It has been found globally in the environment.

2009 Microconstituents Sampling Results



Well Name	Detected Compound	Results (ng/L)
W-001B	Carbamazepine	11
	Perfluoro octanesulfonate-PFOS	3.9

Well Name	Detected Compound	Results (ng/L)

Sample Point Name	Detected Compound	Results (ng/L)
EPDS 159 (Cavsarp)	Perfluoro octanesulfonate-PFOS	0.21

Well Name	Detected Compound	Results (ng/L)
EPDS 124 (Savsarp)	*No Constituents Detected*	

What is the size of a Microconstituent?

- Part per million (mg/L)
  - *one second of time in approximately 11½ days.*
- Part per billion (µg/L)
  - *one second of time in approximately 31.7 years*
- Part per trillion (ng/L)
  - *one second of time in approximately 31,700 years.*

What Are We Doing About It?

Tucson Water is currently the sponsoring agency or supporting the following related projects and programs:

- Voluntary Sentry Research Testing Program for Microconstituents (CECs)
- UA ALEC project: CECs analytical laboratory analysis method development; characterization of source contributions of CECs.
- Proposed USGS project: CECs source occurrence and removal mechanisms by conventional reclaim water treatment and/or natural attenuation through recharge.
- Pima County Wastewater Management: Pharmaceutical Take Back Program for destruction and control of prescription drugs and medications.

TUCSON WATER

USGS science for a changing world

THE UNIVERSITY OF ARIZONA.

PAG

WATER RESEARCH FOUNDATION
ADVANCING THE SCIENCE OF WATER

Regional Wastewater Reclamation Department

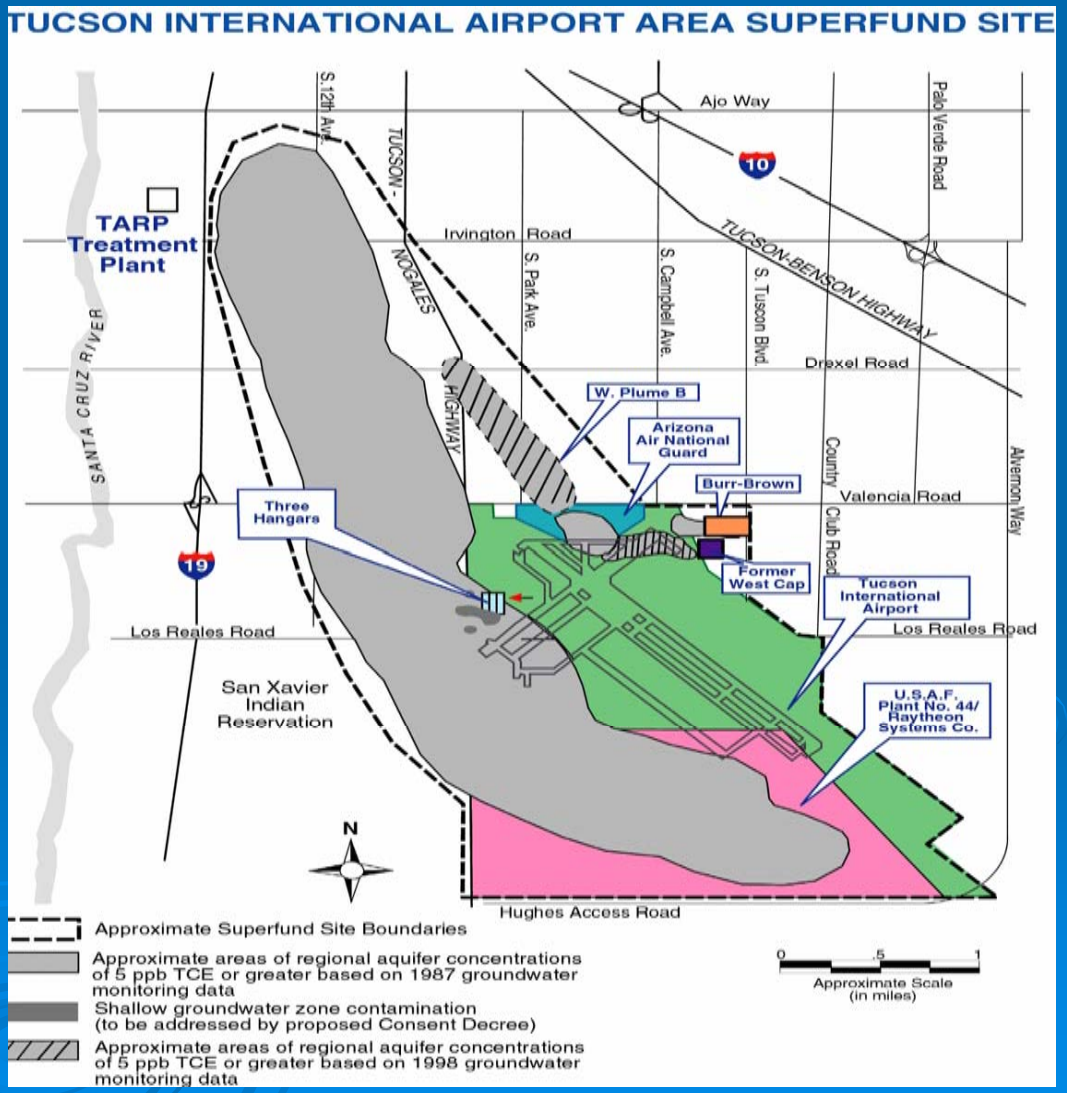
Contaminant of Emerging Concern: 1,4-dioxane

Tucson Airport Remediation Project (TARP)

Region 9: Superfund

Since 1995, TARP is an example of TW's involvement in, and response to TCE in groundwater. The Remedy is for TCE only.

1,4-dioxane was detected in 2002, is currently on the CCL, and has a Health Advisory.

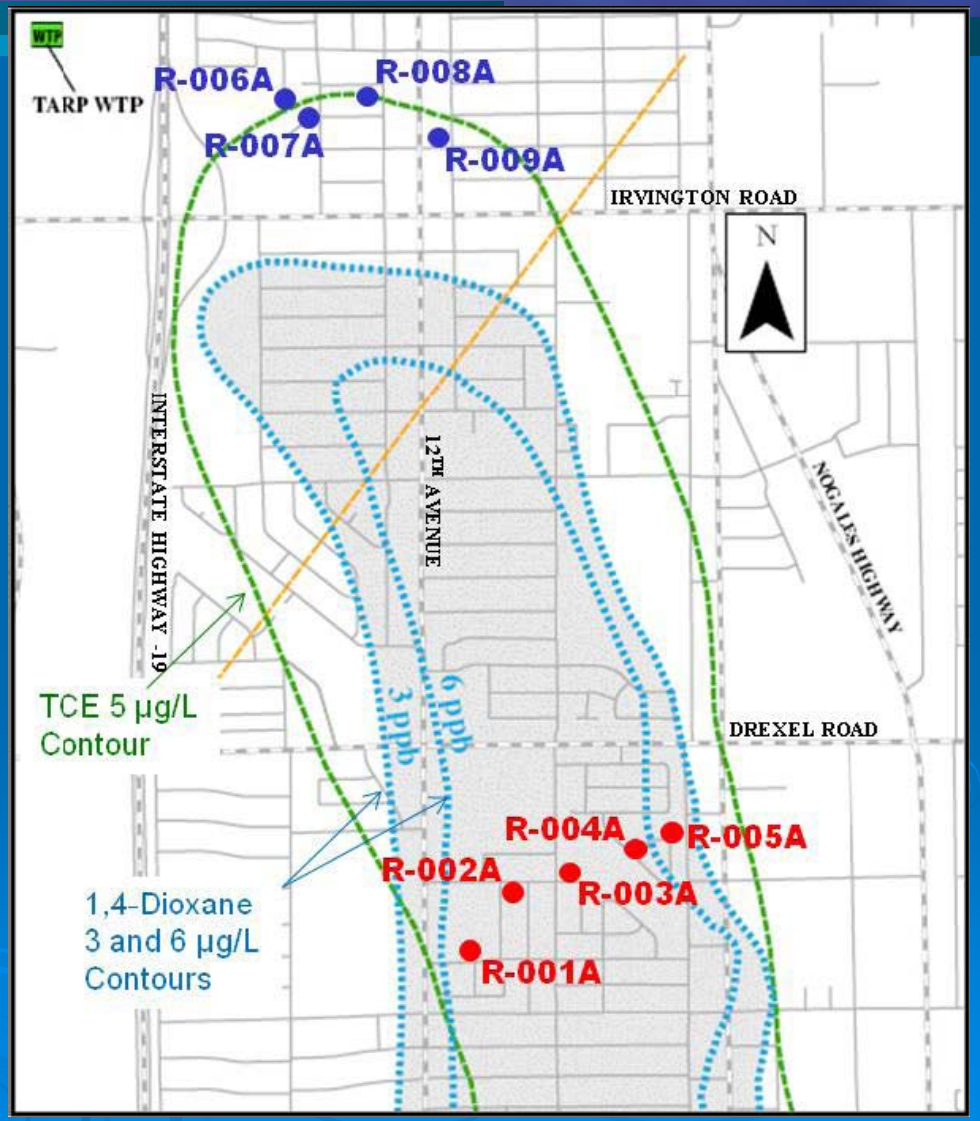


1,4-dioxane (cont.)

What is 1,4-dioxane?

1,4-dioxane is a solvent commonly found in cosmetics, toiletries, paints varnishes, and even foodstuffs as a byproduct of packaging or manufacturing. It is also used as a stabilizer in cleaning and degreasing agents.

Because millions of pounds of 1,4-dioxane are used every year in manufacturing, the compound has been frequently detected in the environment.



1,4-dioxane (cont.)

What are the Potential Health Effects?

According to the EPA's fact sheet on this substance:

- At the Preliminary Remediation Goal level of 6.1 ppb, people who drink 2 liters of water every day for 30 years will have no more than a one-in-one million increased chance of developing cancer.
- At the Health Advisory level of 3.0 ppb, people would have to drink 2 liters daily over a 70 year lifetime to achieve the same one-in-one million risk exposure.

PUBLIC OUTREACH: UCAB

The Unified Citizens' Advisory Board was established to monitor the TCE remediation program.

It is composed of residents living in the area of the TCE plume, regulatory agencies, and the remaining "potentially responsible parties."

UCAB was notified in May 2002 of 1,4-Dioxane findings in the TARP Plume.

Get the facts on the environmental cleanup

Get up-to-date information on the environmental cleanup program at the Tucson International Airport Area (TIAA) Superfund site.

The Unified Community Advisory Board helps to raise community awareness of the ongoing environmental cleanup program at the TIAA Superfund site and to ensure that community concerns are part of the environmental cleanup decision-making process. Beginning this meeting, a **poster session** will be available before each meeting so that those attending can get answers from the experts about topics to be presented at the meeting.

UCAB

Next UCAB Meeting

What: Quarterly meeting of the Unified Community Advisory Board (UCAB) for the TIAA Superfund site.

When: Wednesday, April 21, 2010
5:30 p.m. Poster Session
6 – 8 p.m. RAB Meeting

Where: El Pueblo Activity Center
101 W. Irvington Rd.
Tucson, Ariz. 85714
(Intersection of W. Irvington and S. 6th Ave.)

Agenda:
- EPA Update
  - West Cap
  - Vapor Intrusion
  - Texas Instruments
- AFP 44 Update
  - HiPOx Treatment Update & July HiPOx Tour
  - Status of Focused Remedial Investigation and Shallow Groundwater Zone Remedial Process Optimization
  - Regional Groundwater Feasibility Studies
- Airport Property, Tucson Water TARP Facility & 1,4-dioxane, Library Repository, and High School TCE Curriculum Updates
- UCAB Co-Chair Election

For details, call:
Martin Zeleznik, Government Cochair, 866-372-9378
Ignacio Gomez, Community Cochair, 520-883-2730

What Are We Doing About It

Tucson Water has been working closely with the Environmental Protection Agency (EPA), the Arizona Department of Environmental Quality (ADEQ), and more recently with the U.S. Air Force, regarding1,4-Dioxane issues.

Existing Treatment

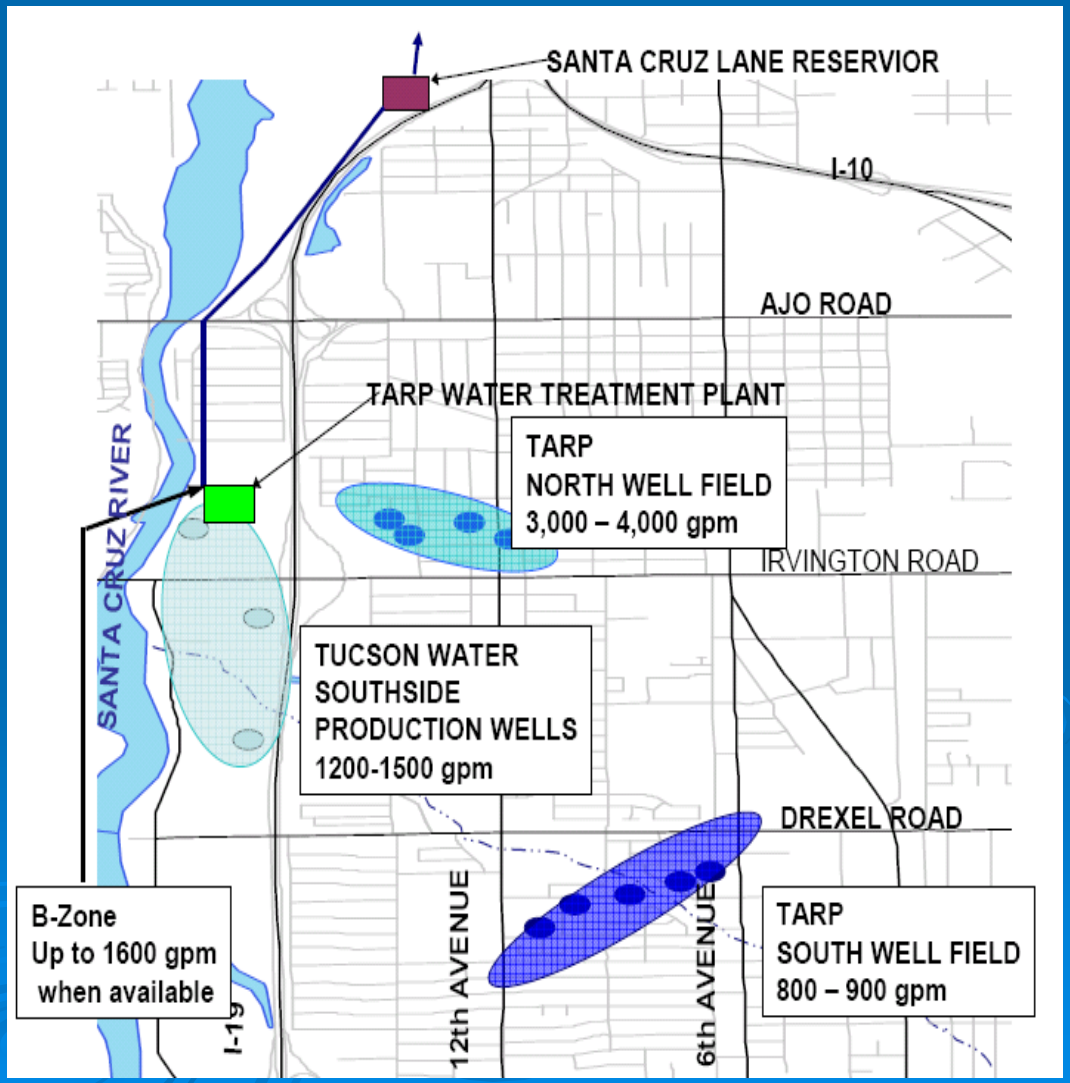
The air stripping process used to remediate groundwater at TARP and at AFP-44 does not remove 1,4-dioxane due to its high solubility in water.

What Are We Doing About It (cont.)?

Blending

Continue to utilize existing blending strategies by way of existing available water sources to manage and mitigate 1,4-dioxane levels at or below 3 ppb going into the drinking water system.

$500,000 yr



Potential Treatment Cost

Advanced Oxidation Plant, for removal of 1,4-dioxane levels down to 1.00 ppb going into the drinking water system.

CIP $6.6M
O&M
$830,000 yr

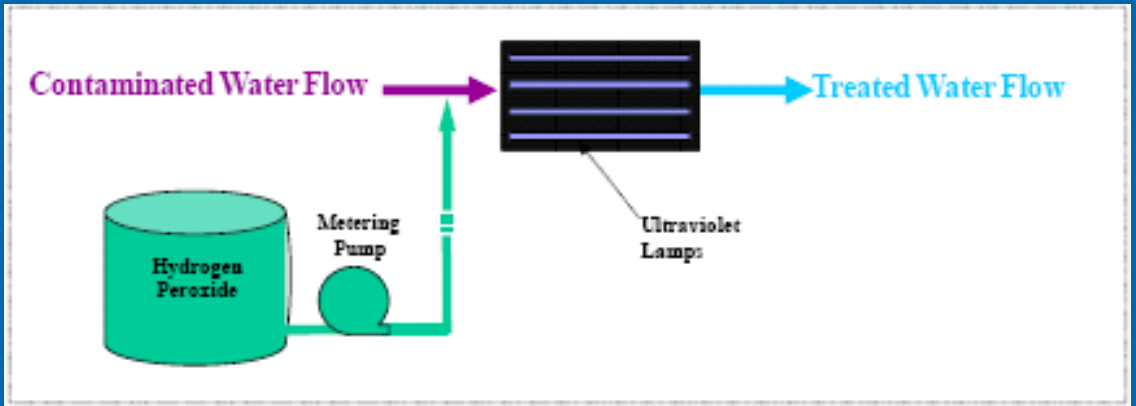


Figure 3-2: Conceptual UV-Peroxide Process Schematic

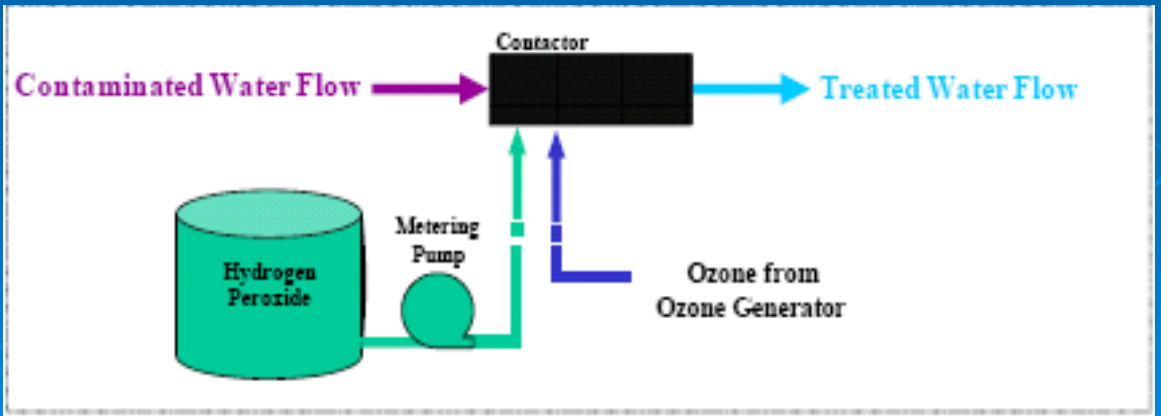
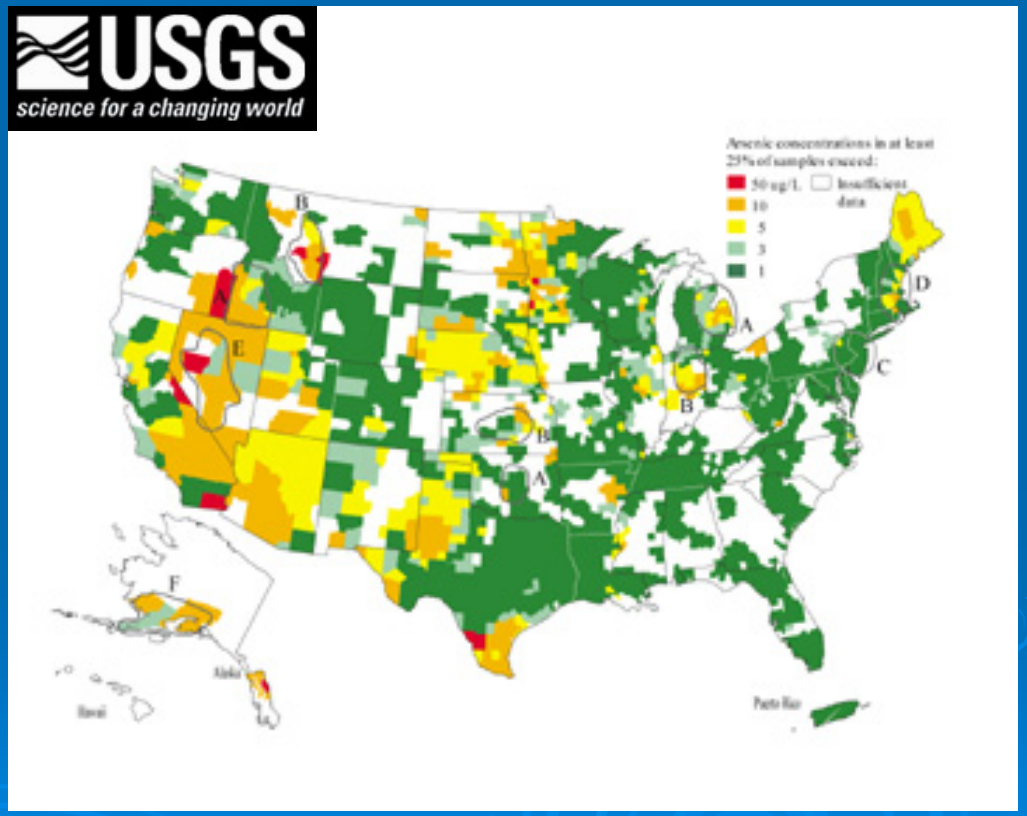


Figure 3-12: Conceptual Ozone-Peroxide AOP Process Schematic

Emerging Issue: Arsenic

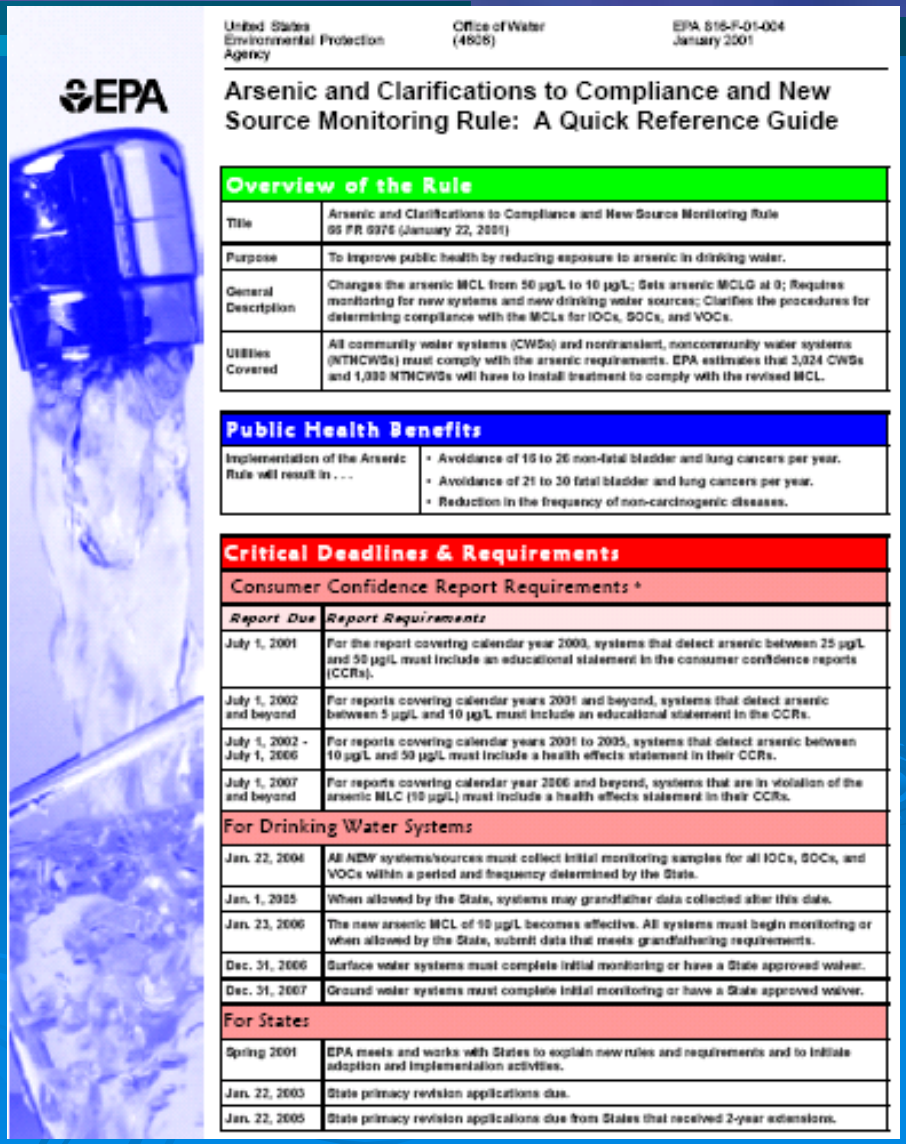
Arsenic occurs naturally in the geology and the groundwater of the Southwestern United States, including the Tucson Region.



Arsenic (cont.)

The Arsenic Rule

- In October 2002, EPA announced decision to lower Arsenic standard from 50 ppb down to 10 ppb.
- Effective date of rule was January 23, 2006.



United States Environmental Protection Agency | Office of Water (4606) | EPA 816-F-01-004 January 2001

EPA

Arsenic and Clarifications to Compliance and New Source Monitoring Rule: A Quick Reference Guide

Overview of the Rule

Title	Arsenic and Clarifications to Compliance and New Source Monitoring Rule 66 FR 6976 (January 22, 2001)
Purpose	To improve public health by reducing exposure to arsenic in drinking water.
General Description	Changes the arsenic MCL from 50 µg/L to 10 µg/L; Sets arsenic MCLG at 0; Requires monitoring for new systems and new drinking water sources; Clarifies the procedures for determining compliance with the MCLs for IOCs, SOCs, and VOCs.
Utilities Covered	All community water systems (CWSs) and nontransient, noncommunity water systems (NTNCWSs) must comply with the arsenic requirements. EPA estimates that 3,024 CWSs and 1,000 NTNCWSs will have to install treatment to comply with the revised MCL.

Public Health Benefits

Implementation of the Arsenic Rule will result in . . .	• Avoidance of 18 to 26 non-fatal bladder and lung cancers per year. • Avoidance of 21 to 30 fatal bladder and lung cancers per year. • Reduction in the frequency of non-carcinogenic diseases.

Critical Deadlines & Requirements

Consumer Confidence Report Requirements *

Report Due	Report Requirements
July 1, 2001	For the report covering calendar year 2000, systems that detect arsenic between 25 µg/L and 50 µg/L must include an educational statement in the consumer confidence reports (CCRs).
July 1, 2002 and beyond	For reports covering calendar years 2001 and beyond, systems that detect arsenic between 5 µg/L and 10 µg/L must include an educational statement in the CCRs.
July 1, 2002 - July 1, 2006	For reports covering calendar years 2001 to 2005, systems that detect arsenic between 10 µg/L and 50 µg/L must include a health effects statement in their CCRs.
July 1, 2007 and beyond	For reports covering calendar year 2006 and beyond, systems that are in violation of the arsenic MLC (10 µg/L) must include a health effects statement in their CCRs.

For Drinking Water Systems

Jan. 22, 2004	All NEW systems/sources must collect initial monitoring samples for all IOCs, SOCs, and VOCs within a period and frequency determined by the State.
Jan. 1, 2005	When allowed by the State, systems may grandfather data collected after this date.
Jan. 23, 2006	The new arsenic MCL of 10 µg/L becomes effective. All systems must begin monitoring or when allowed by the State, submit data that meets grandfathering requirements.
Dec. 31, 2006	Surface water systems must complete initial monitoring or have a State approved waiver.
Dec. 31, 2007	Ground water systems must complete initial monitoring or have a State approved waiver.

For States

Spring 2001	EPA meets and works with States to explain new rules and requirements and to initiate adoption and implementation activities.
Jan. 22, 2003	State primacy revision applications due.
Jan. 22, 2005	State primacy revision applications due from States that received 2-year extensions.

Arsenic (cont.)

Maximum Contaminant Level
in parts per billion (ppb)
MCL = 10 ppb

Maximum Contaminant Level Goal MCLG = 0 ppb

Health Effects
Skin damage or problems with circulatory systems, and may have increased risk of getting cancer

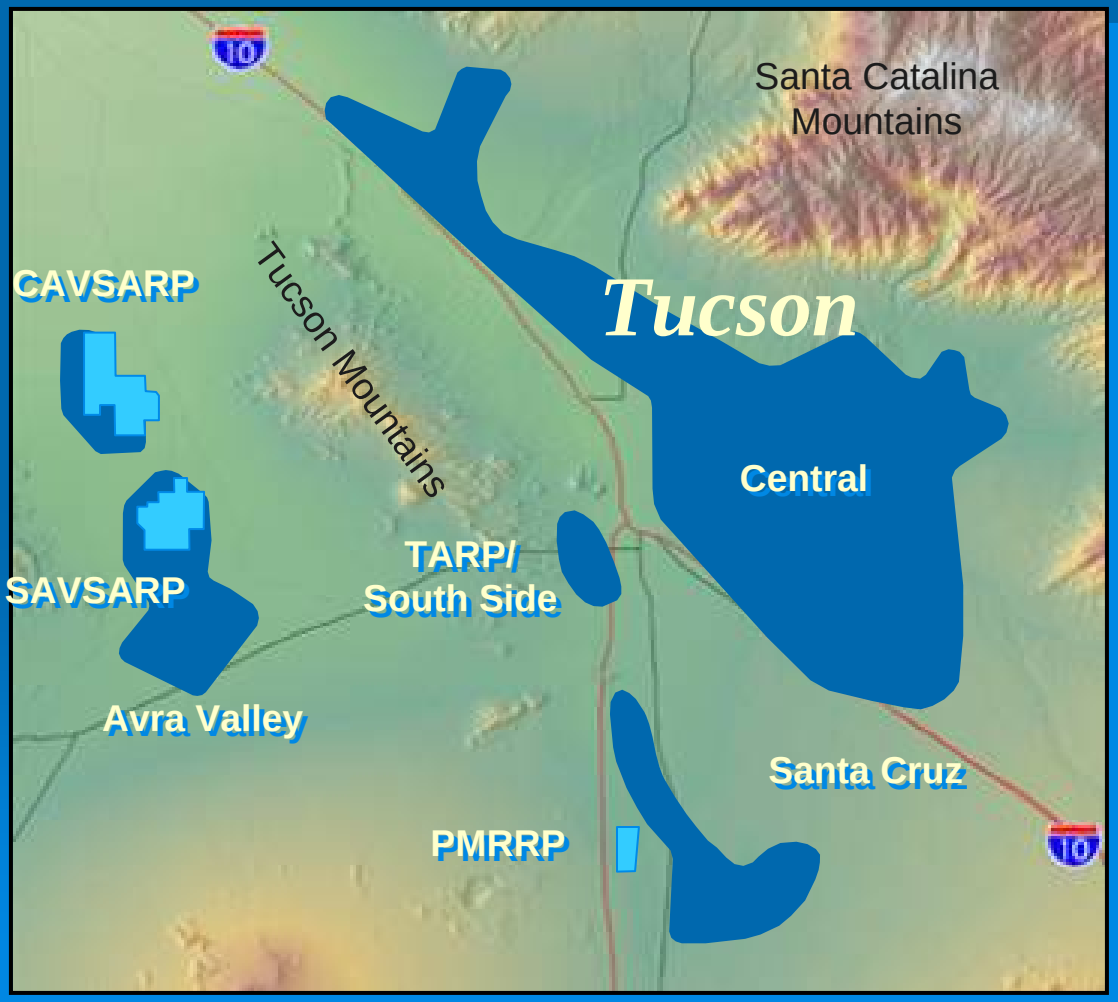
Sources of contamination
Erosion of natural deposits; runoff from orchards, runoff from glass & electronic production wastes

Arsenic (cont.)

- EPA's Office of Research and Development is in the process of updating the agency's Arsenic Toxicological Review.
- This document is now in external peer review with EPA's Science Advisory Board.
- A new lower MCL of 0.21 ppb is now being considered by EPA.

Arsenic (cont.)

What are the potential implications for Tucson Water if the MCL is lowered?



Central
- Wells = 119
- Capacity = 88.7 MGD

South Side
- Wells = 3
- Capacity = 1.6 MGD

TARP
- Wells = 9
- Capacity = 6.6 MGD

Santa Cruz
- Wells = 15
- Capacity = 12.1 MGD

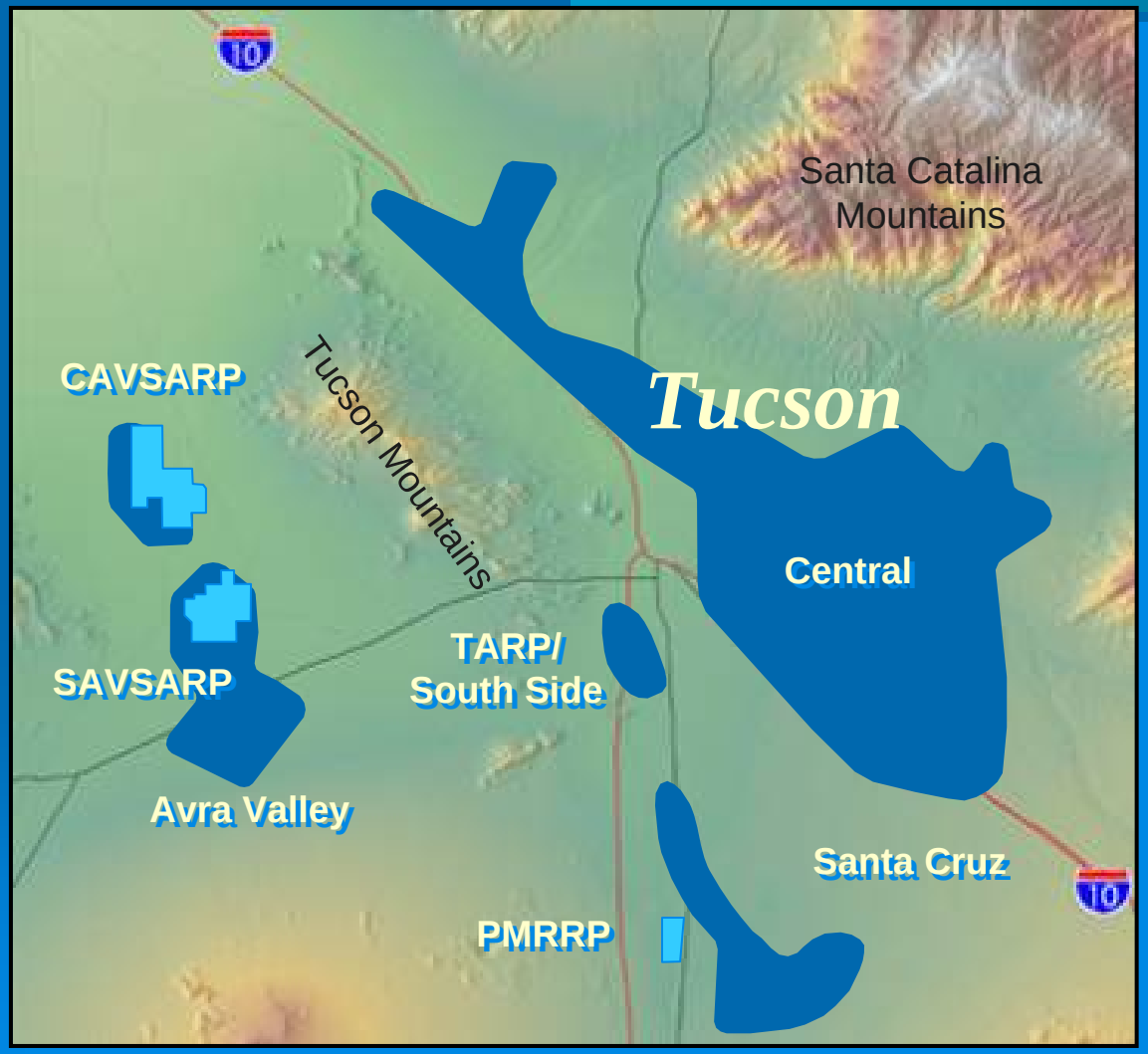
Avra Valley
- Wells = 23
- Capacity = 28.7 MGD

CAVSARP
- Wells = 33
- Capacity = 70.2 MGD

Total
- **Wells = 216 wells**
- **Capacity = 212 MGD**

Arsenic (cont.)

What are the potential implications for Tucson Water if the MCL is lowered?



111 MGD or ??% of Total Tucson Water Supply is Currently Greater than 0.21 ppb in Arsenic

Santa Cruz

- Wells = 15
- Capacity = 12.1 MGD
- **Arsenic = 8 ppb**

CAVSARP

- Wells = 33
- Capacity = 70.2 MGD
- **Arsenic = 4.2 ppb**

Avra Valley

Wells = 23

Capacity = 28.7 MGD

Total

- **Wells = 216 wells**
- **Capacity = 212 MGD**

Arsenic (cont.)

What are the potential implications for Tucson Water if the MCL is lowered?

Costs to treat for Arsenic are substantial

EPA Recommended Treatment Technologies

Treatment Technology	Typical Removal Efficiency for Arsenic (V)
Adsorption with iron-based media	98%
Adsorption with hybrid iron-based media	98%
Adsorption with activated alumina	95%
Ion exchange	95%
Coagulation/oxidation/filtration with iron-based coagulant	50-95%
Reverse Osmosis	95%

Both activated alumina and granular ferric hydroxide appear to be the best treatment options for Tucson Water.

Preliminary cost estimates for the city indicate each 1 MGD will cost $1 million in capital costs and $250,000 in annual operation and maintenance costs.

What Are We Doing About It?

- AWWA's Government Affairs Office has organized a group of interested utilities (including Tucson Water) to discuss this new assessment and the implications for drinking water utilities.

American Water Works Association
The Authoritative Resource on Safe Water

TUCSON WATER

Questions?

Presented By:
Stephen E. Dean
Water Quality & Operations Administrator

Presented to Citizen's Water Advisory Committee
April 7, 2010