

# **Maintenance Washing for Bridge Preservation**

## Addressing Non-Visible Contaminants

Regis Doucette  
Northeast Bridge Preservation Partnership  
Newport, Rhode Island  
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# Flow of Presentation

- Corrosion from ever present Soluble Salts
- What, where, and how are Soluble Salts involved in destruction of structures
- Removal of Soluble Salts per Best Management Practices in many areas
- Mechanism to remove pollutants known as nonvisible contaminants that are soluble salts
- Problem can be removed straight forwardly
- We all benefit!!!

# Some Fluid Ounces of Prevention are Worth Pounds of Cure

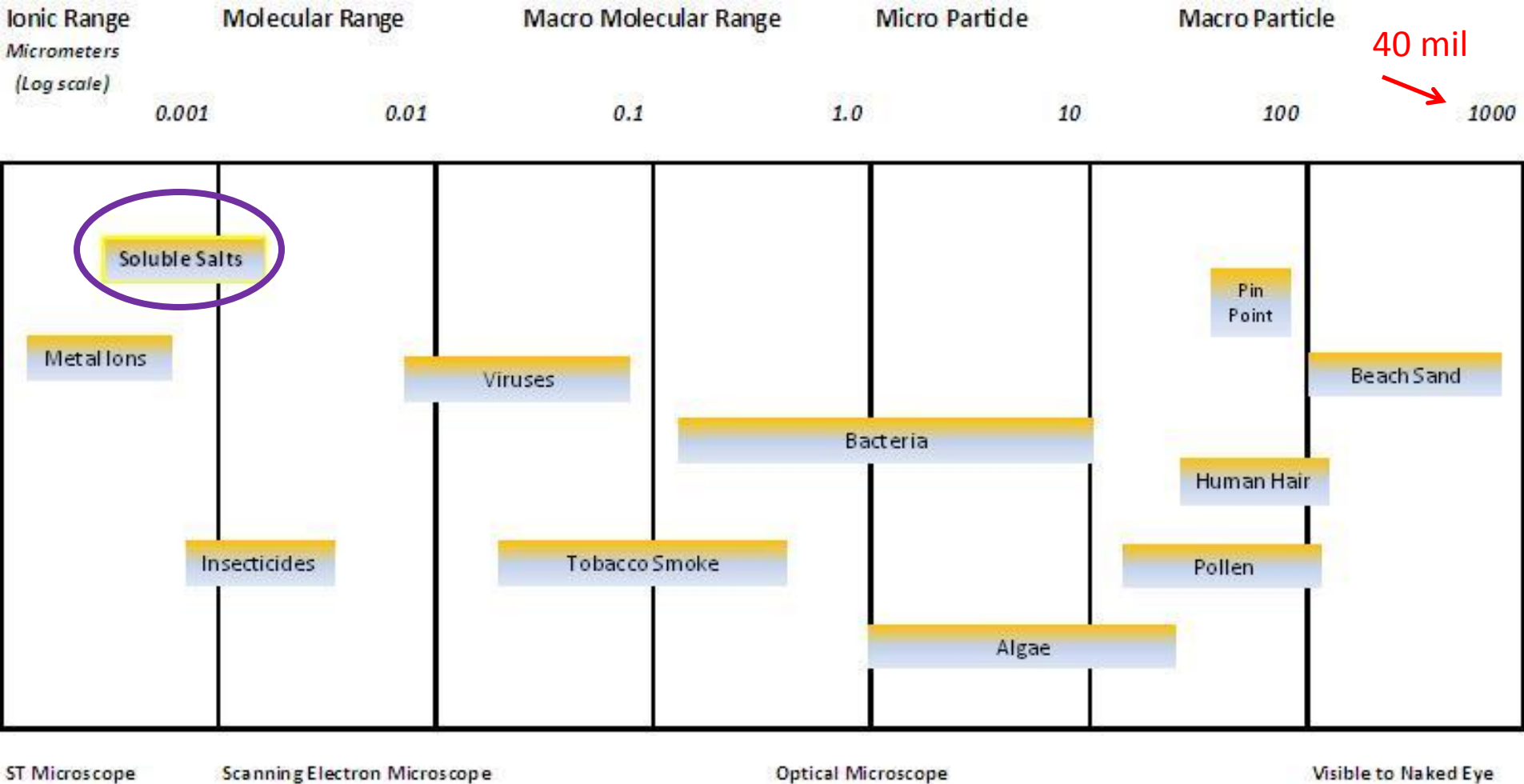
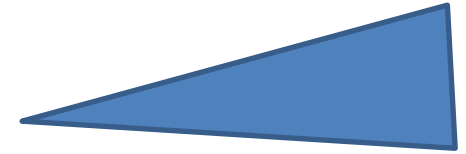


- What is the purpose of Maintenance Wash (MW)
- Current Methods
- What should be the purpose
- How to improve towards ideal goal

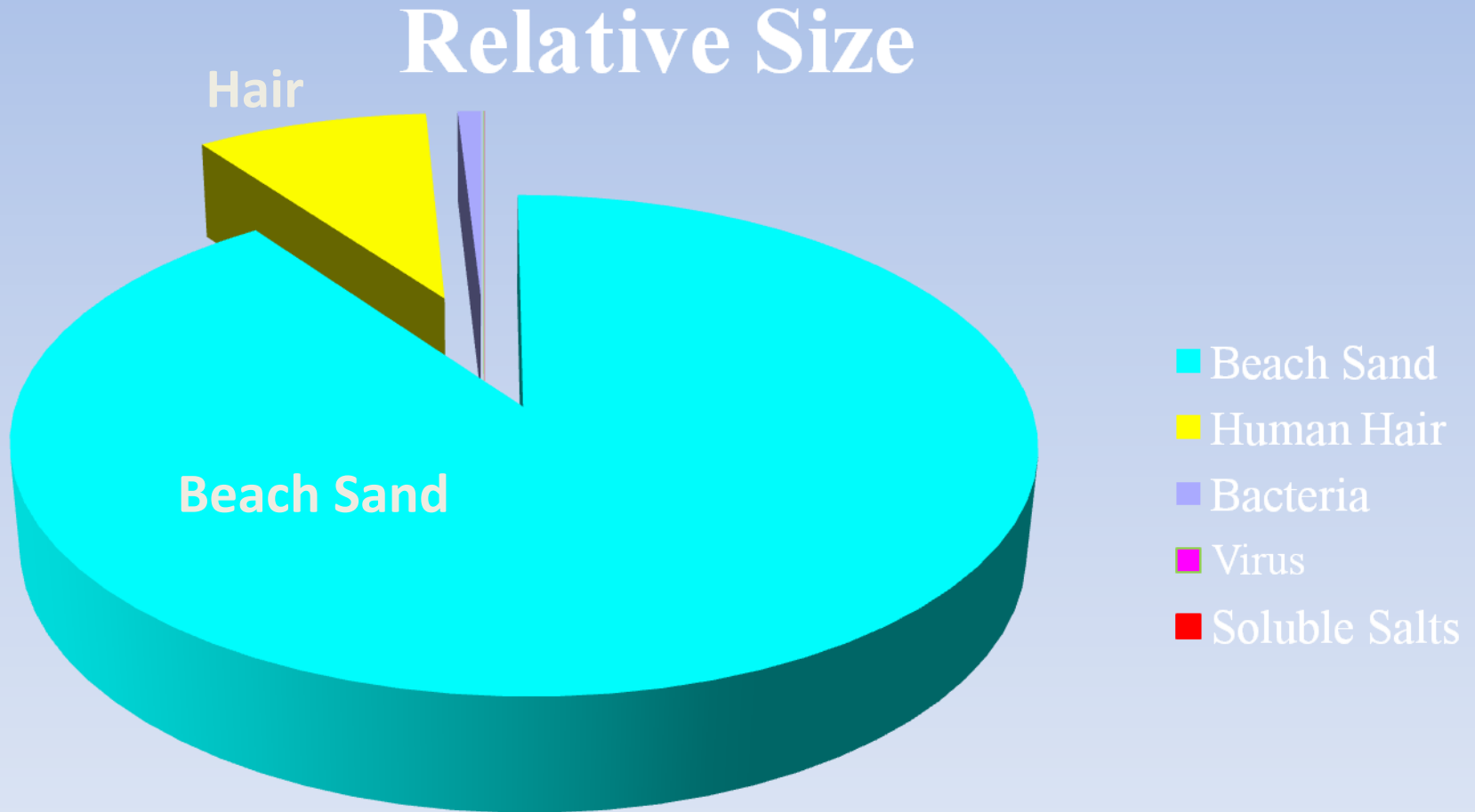
# Current Trend to Be Smarter Out of Necessity

- GOOD NEWS is that related areas of Bridge Preservation have addressed “non-visible” contaminants for surface preparation prior to protective coating projects.
- Acceptance of most detrimental non-visible contaminants, soluble salts, which have become Best Management Practices to extend life of protective coatings (NACE, SSPC, AREMA, NAVFAC, US-ACE, private industry, DOT’s)
- Logically, similar mindset to extend life of structures and their critical elements
- Thus, we can also move away from visual inspection criteria for MW

# Soluble Salt Relative Size Chart



# Perspective -- Sizing



# Most Common Non-Visible Contaminants Include Soluble Salts

## • HOW ARE THEY QUANTIFIED IF SO TINY?

- Pinky fingerprint approximates **1 square centimeter**
- M&M candy sliced into ***one million pieces***
  - single slice = 1 microgram



- Salt packet from McDonalds for fries
  - dissolved in water
  - then spread over 1,000 sq ft would **deposit**

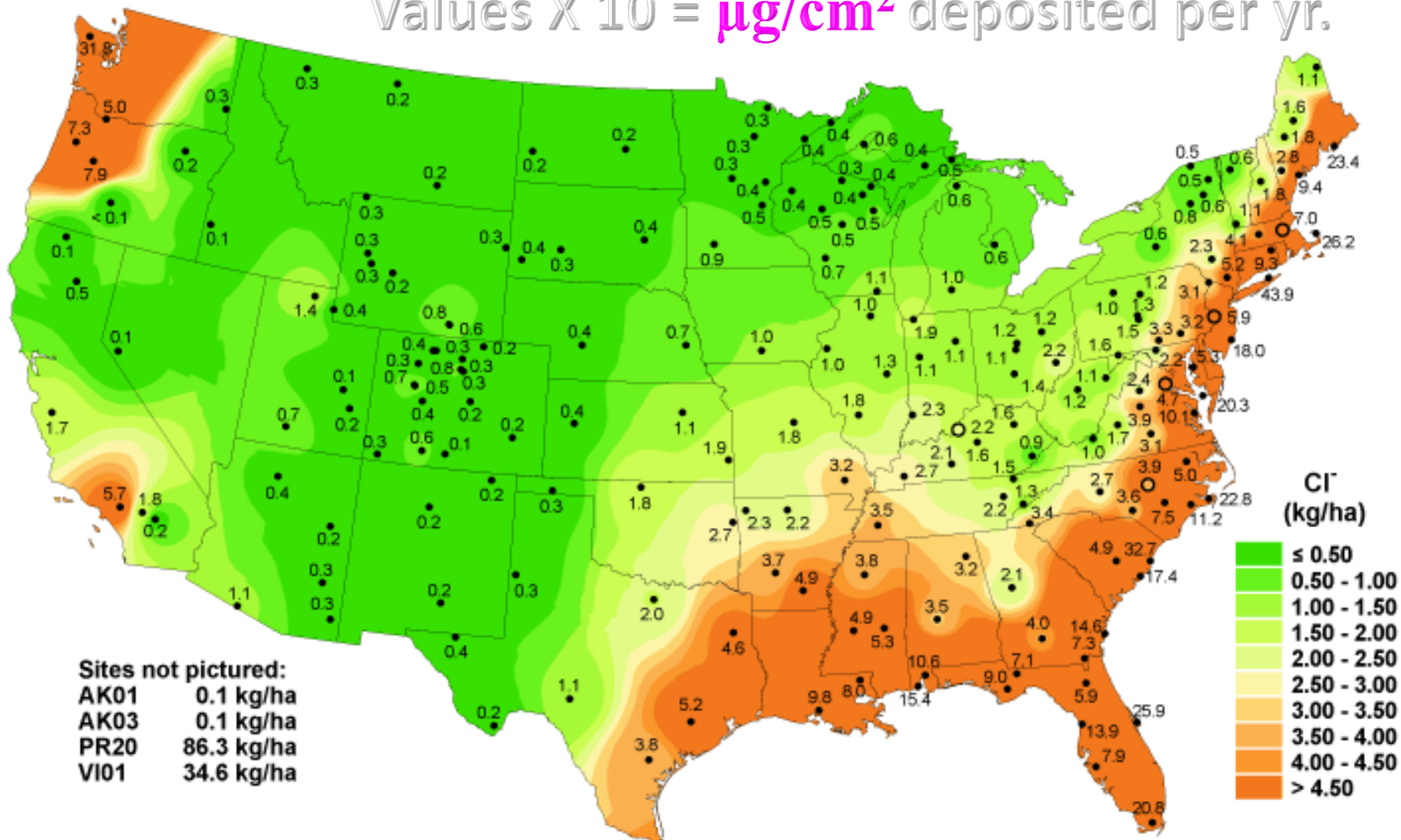
**1 microgram per square centimeter**

**$\mu\text{g}/\text{cm}^2$**

- Test kits exist to assess cleanliness of ion specific contamination

# Chloride ion wet deposition, 2008

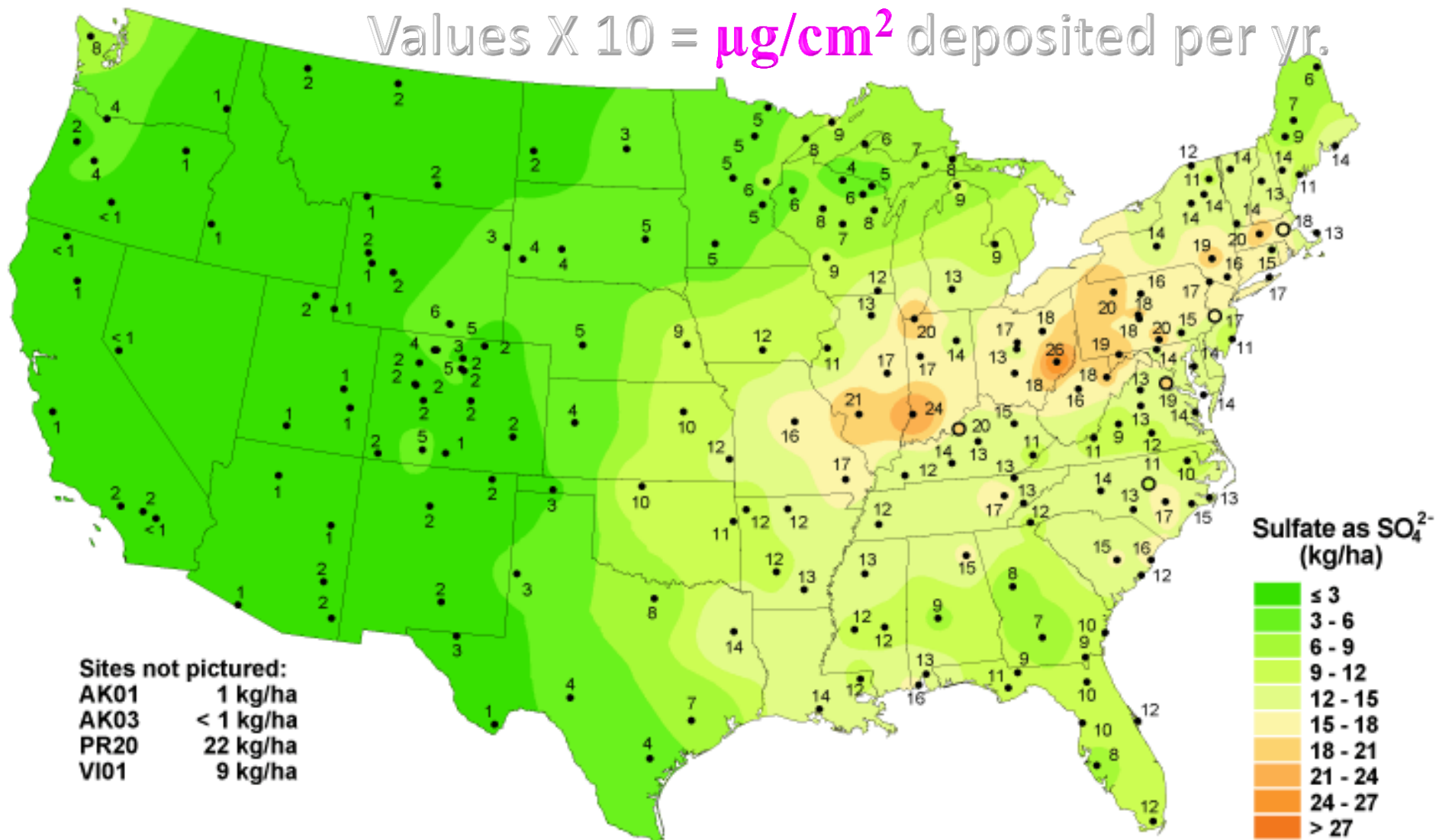
Values X 10 =  $\mu\text{g}/\text{cm}^2$  deposited per yr.





# Sulfate ion wet deposition, 2008

Values X 10 =  $\mu\text{g}/\text{cm}^2$  deposited per yr.



# Sulfuric Acid Reigns Supreme

[http://www.turi.org/library/turi\\_publications/massachusetts\\_chemical\\_fact\\_sheets](http://www.turi.org/library/turi_publications/massachusetts_chemical_fact_sheets)

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such as automotive aerosol parts cleaners and degreasers. PCE is reported to be the chemical most widely found in groundwater contamination at Superfund sites. [Read more...](#)

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## Sulfuric Acid and Fuming Sulfuric Acid

Sulfuric acid is a corrosive toxic chemical that causes direct effects ranging from irritation to burns on the skin, eyes, and respiratory tract. Massachusetts businesses consumed almost 45 million pounds of sulfuric acid, **the world's most widely used chemical**, in the production of chemicals, electricity, food products, paper products, electronics, textiles, leather goods, and electroplated parts. Fuming sulfuric acid is used to transport high concentrations of acid. [Download PDF file \(47.99 kB\)](#)

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1 2 [Next >>](#)

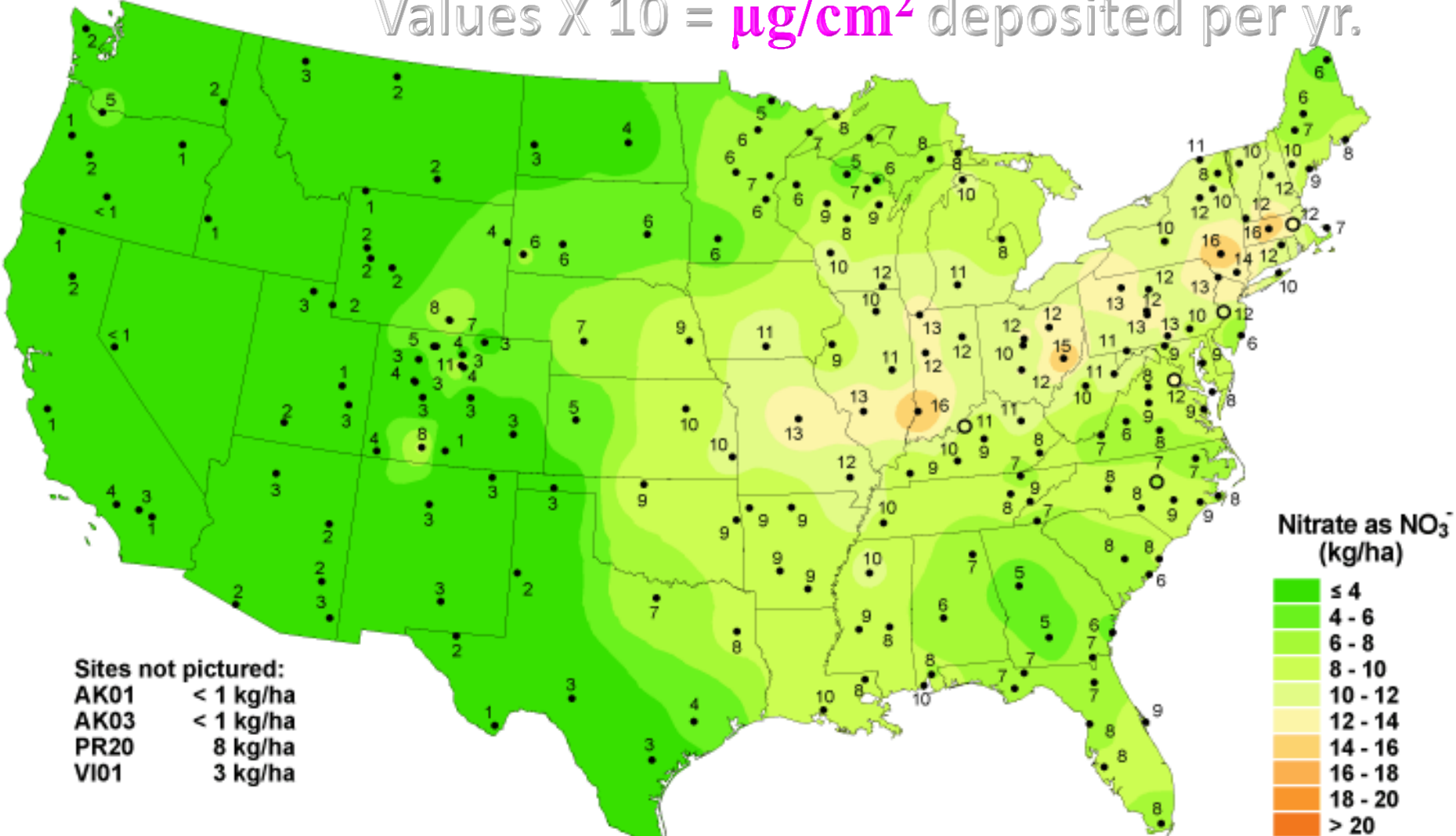
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# Nitrate ion wet deposition, 2008

Values X 10 =  $\mu\text{g}/\text{cm}^2$  deposited per yr.





# Nutrient Pollution

## *Additional Resources Available*



**EPA** United States Environmental Protection Agency

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1 2

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**ACT**

# Other Sources of Soluble Salts Directly Upon Bridges

- Nitrates from vegetation, animal waste, decomposing animals upon bridge surfaces
- Water runoff (chlorides, sulfates, and nitrates)
- Vehicle emission (sulfates)
- Industrial processes



# Quick Recap



Nitrates

Sulfates

Chlorides

# Removal of Soluble Salts

- Salts adhere and have a strong mechanical bond to the surfaces requiring stronger force to break those bonds
- Weak acid breaks bonds via chelation process
- Biodegradable feature
- True cleaning only available with true cleaning

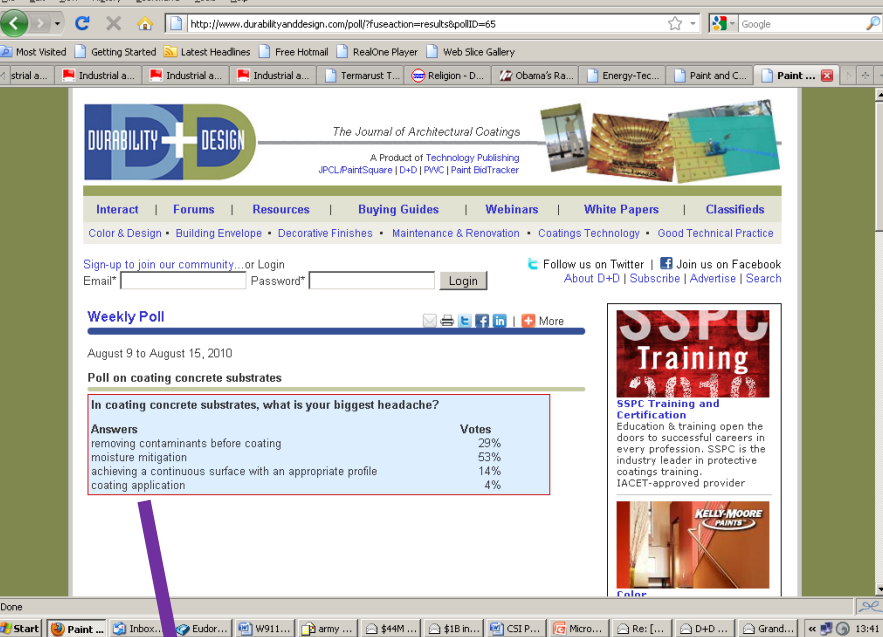


# What to do?

- Life can be added to the decks by corrective washing regularly, especially in the spring and prior to seasonal rains to prevent migration of deicing salts **down through the concrete.**
- Rebar and concrete structure compromise
- Structure critical joints and crevices also can be cleansed

# Why Want Properly Cleaned Deck?

- Reduce entrapment of salts that would provoke corrosion in rebar
- Facilitates subsequent coating projects
- Demonstrated enhancement to concrete patch efforts at site of needed repairs
- The same formulation or mix, applied twice, does surface preparation for patches that will endure as it removes surface chlorides that will interfere with bonding.



## Weekly Poll

August 9 to August 15, 2010

### Poll on coating concrete substrates

**In coating concrete substrates, what is your biggest headache?**

#### Answers

removing contaminants before coating	29%
moisture mitigation	53%
achieving a continuous surface with an appropriate profile	14%
coating application	4%

#### Votes

29%
53%
14%
4%

# Rehabbed Concrete on Coolidge Dam: Nine Years and Still Holding

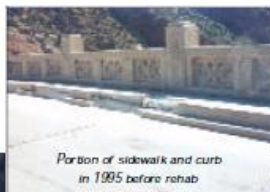
By Lori R. Huttman, JPCL-PCE

After their rehabilitation in 1995, the concrete curbs and pylons on the roadway atop the Coolidge Dam are in excellent condition, despite the original soluble salt contamination on concrete and rebar, says Jim Johnson of Chlor\*Rid International (Chandler, AZ), who helped remediate the salt problem in 1995.

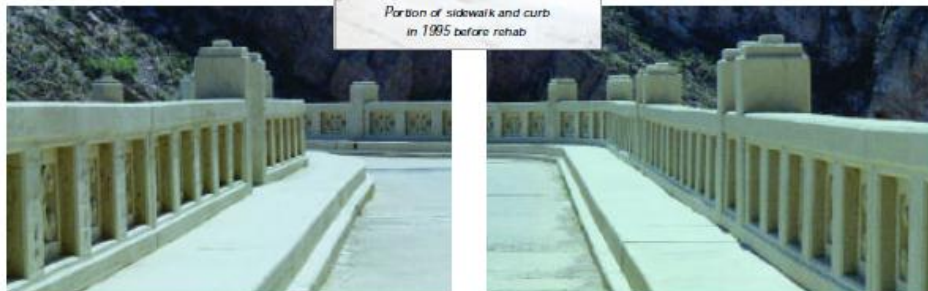
At that time, the concrete curbs and pylons of the roadway over the Coolidge Dam were severely cracked and spalling. As part of a larger project, which included work on the dam's spill-

way walls and sidewalls as well as the roof of the powerhouse, these areas were rehabilitated and brought back to their original appearance through pressure washing with a solution of liquid soluble salt remover, removal of damaged concrete, crack repair, concrete replacement, and the application of a protective coating, says Johnson.

At the time of the rehabilitation, high levels of chlorides in the concrete were



Portion of sidewalk and curb in 1995 before rehab



Curb and walkway on both sides of road 9 years after rehab



This sidewalk area has had puddled standing water since being repaired and recoated but the coating remains intact  
Photos courtesy of Chlor\*Rid



Top: Pylon before rehabilitation in 1995. Center and bottom: Pylon in September 2004. There is minor rust staining from the fixture above. Completely intact as completed in 1995 with some small rust stain bleeding from above.







# Looking Ahead – Key Priorities

- Working with more states to develop and implement **soluble salt removal** from structure critical components.
- Chlorides, Sulfates, and Nitrates are harmful **“pollution”** upon structures and their key connections.
- Continued commitment to science offers economic payback for all stakeholders including owners, taxpayers, departments with tight budgets
- Assistance with development of states’ numeric threshold standards (C, S, N---3, 10, 5 respectively for ionic assessments)

# Looking Ahead

- A number of ongoing and new collaborative initiatives are underway nationwide in related venues such as sheet piling, vehicles owned by DOT's/Thruway Authorities
- Buy in already for surface preparation for Best Management Practices for bridges
- Several studies are lowering acceptable limits on their structures
- Broader and more effective outreach to stakeholders so wider recognition of proper cleaning beyond visual standards, just like our hand washing is enhanced with soapy water versus just clean water .



# Maintenance Washing Additive to Enhance Desired Cleanliness

- ✓ Proven
- ✓ Efficient
- ✓ Cost effective
- ✓ Improves adhesion
- ✓ Remove surface oils
- ✓ Safe
- ✓ Easy to use
- ✓ Environmentally friendly
- ✓ Facilitates subsequent treatments
- ✓ Enhances enduring repairs