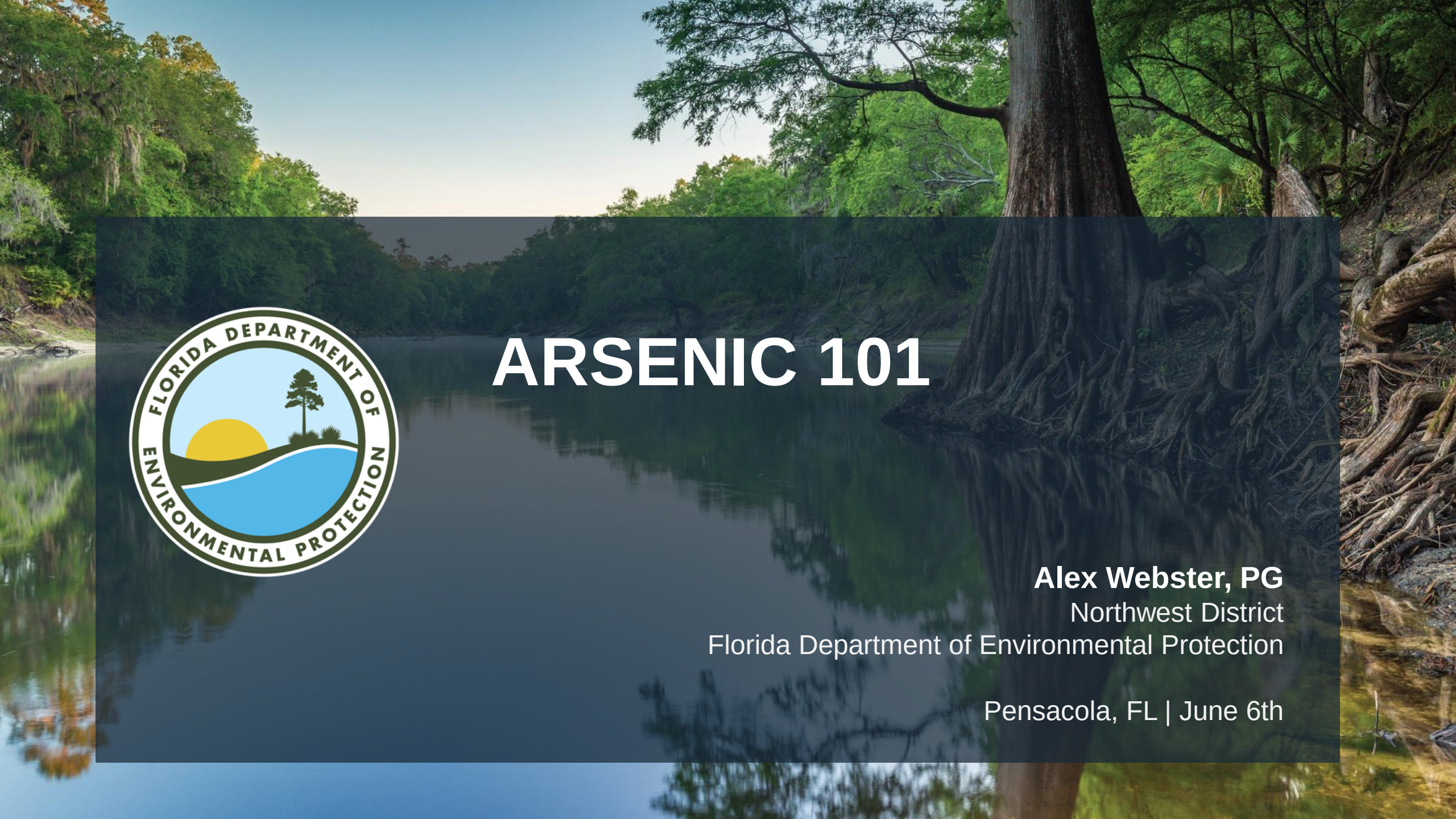

ARSENIC 101

Alex Webster, PG
Northwest District
Florida Department of Environmental Protection

Pensacola, FL | June 6th

WHAT IS ARSENIC?

ARSENIC 101

WHAT IS ARSENIC?

What is Arsenic?

- Element (Metalloid).
- Atomic # 33.
- Atomic Mass 74.92.
- 1 natural isotope 75As.

Photo Source: CC BY-SA

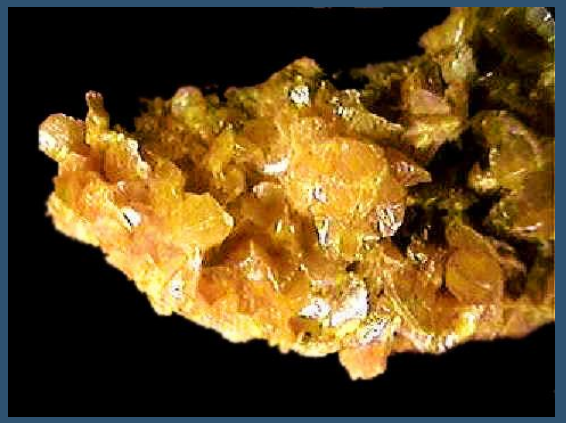

Photo Source: CC BY-SA

WHAT IS ARSENIC?

What is Arsenic?

- Metallic or non-metallic appearance.
- Five Electrons in the outer shell.
- Nine oxidation states from -3 to +5.
- Readily combines with other metals and Sulfur.

ARSENIC
MOST COMMON FORMS

Arsenic's Most Common Forms:

- +3 Arsenites (reducing conditions).
- +5 Arsenates (oxidizing conditions and most Organoarsenic compounds).
- 0 Metallic Arsenic.
- -3 Arsenide.

ARSENIC
USES

Arsenic is often used in:

- Insecticides/Pesticides/Herbicides.
- Wood Preservatives (CCA).
- Pigments (Orpiment/Realgar).
- Alloys (Lead, Gallium).
- Taxidermy.
- Pottery Glazes.

ARSENIC
OXIDATION

Specific oxidation state allows Arsenic to:

Ionically substitute for other elements with the same ion charge.

ARSENIC
OXIDATION

Specific oxidation state allows Arsenic to:

Be adsorbed through interaction with exposed surfaces.

ARSENIC
OXIDATION

Specific oxidation state allows Arsenic to:

Be intercalated within lattice structures (lattice swelling) in several mineral species, especially clays.

ARSENIC

NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

Physical and chemical weathering of igneous and metamorphic rock in the southern Appalachians (For example, Georgia and Alabama).

ARSENIC

NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

These crystalline rocks have:

- Arsenical Iron (FeAs2 and Fe4As3).
- Arsenical Pyrites (FeSAs and CuFeSAs).

Photo Source: CC BY-SA

ARSENIC

RESULTING OXIDE MINERALS

- Goethite up to 4 mg/Kg.
- Lepidocrocite up to 3.5 mg/Kg.
- Gibbsite < 0.6 mg/Kg.

NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

Arsenic can incorporate into:

- Calcium Carbonate (shells/tests from marine organisms and precipitation of carbonate rock from seawater).
- $CaCO_3$ → $CaAsO_3$.

NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

Naturally occurring inorganic arsenic in Florida can be found in:

- Formainifera/ Coccoliths.
- Mollusks.
- Gastropods.

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NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

Naturally occurring inorganic arsenic in Florida can be found in plants. Arsenic incorporated into plants via uptake from soils (Phytoremediation).

NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

Photo Source: CC BY-SA

Photo Source: CC BY-SA

NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

Arsenic left as a residual in clay minerals.

Photo Source: CC BY-SA

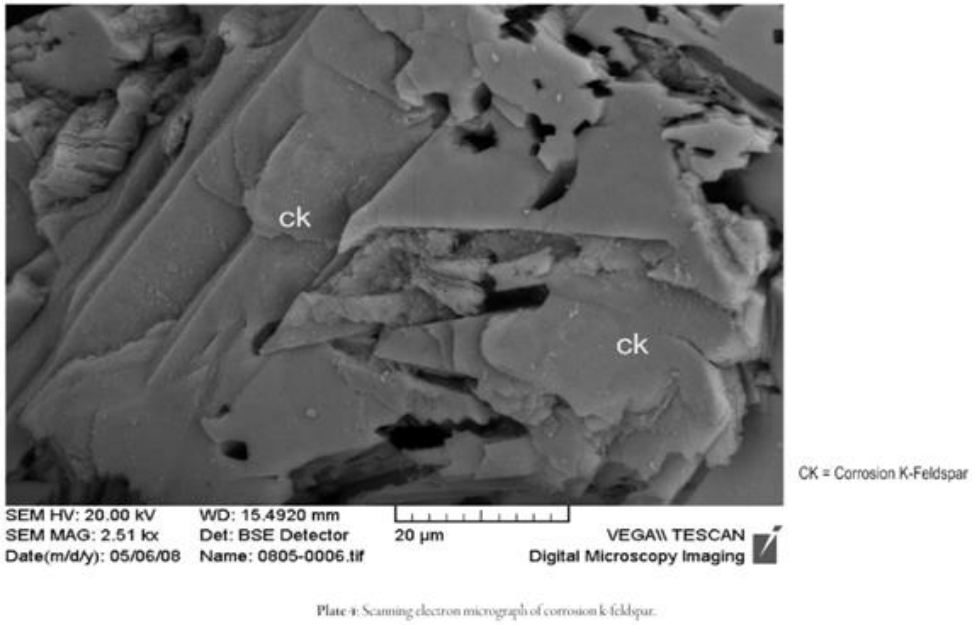

Plate 9: Scanning electron micrograph of corrosion k-feldspar.

Photo Source: CC BY-SA

NATURALLY OCCURRING INORGANIC ARSENIC IN FLORIDA

ARSENOBETAINE AND ARSENOCHOLINE

Naturally occurring inorganic arsenic in Florida can be found in:

- Fish.
- Shrimp.
- Crab tissue.
- Shrimp and crab shells.
- Mushrooms.

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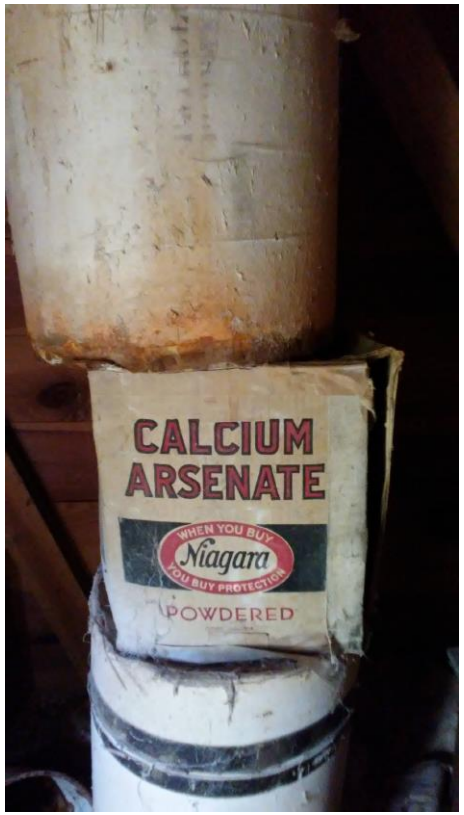
INORGANIC ARSENIC

WHERE DO WE COMMONLY SEE IT?

Inorganic Arsenic is found in:

- Wood Preservatives (CCA).
- Herbicides (MSMA/DSMA).
- Used Oil.



EXPOSURE

WHY IS THIS IMPORTANT?

Florida’s Soil Cleanup Target Level for Residential is 2.1 mg/kg and for Commercial Direct Exposure is12 mg/kg.

CHRONIC EXPOSURE

WHY IS THIS IMPORTANT?

Chronic dermal exposure can lead to:

- Skin Lesions.
- Skin Cancer.

PRIMARY DRINKING WATER STANDARDS

WHY IS THIS IMPORTANT?

Primary Drinking Water Standards is 10 µg/L

Chronic ingestion exposure can lead to:

- Heart Disease/Stroke.
- Diabetes.
- Cancer:
  - Lung, Liver, Kidney.
  - Skin Cancer.

GUIDANCE

WHY IS THIS IMPORTANT?

For more information, please visit: https://FloridaDEP.gov/waste/district-business-support/documents/guidance-comparing-background-and-site-chemical

THANK YOU

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