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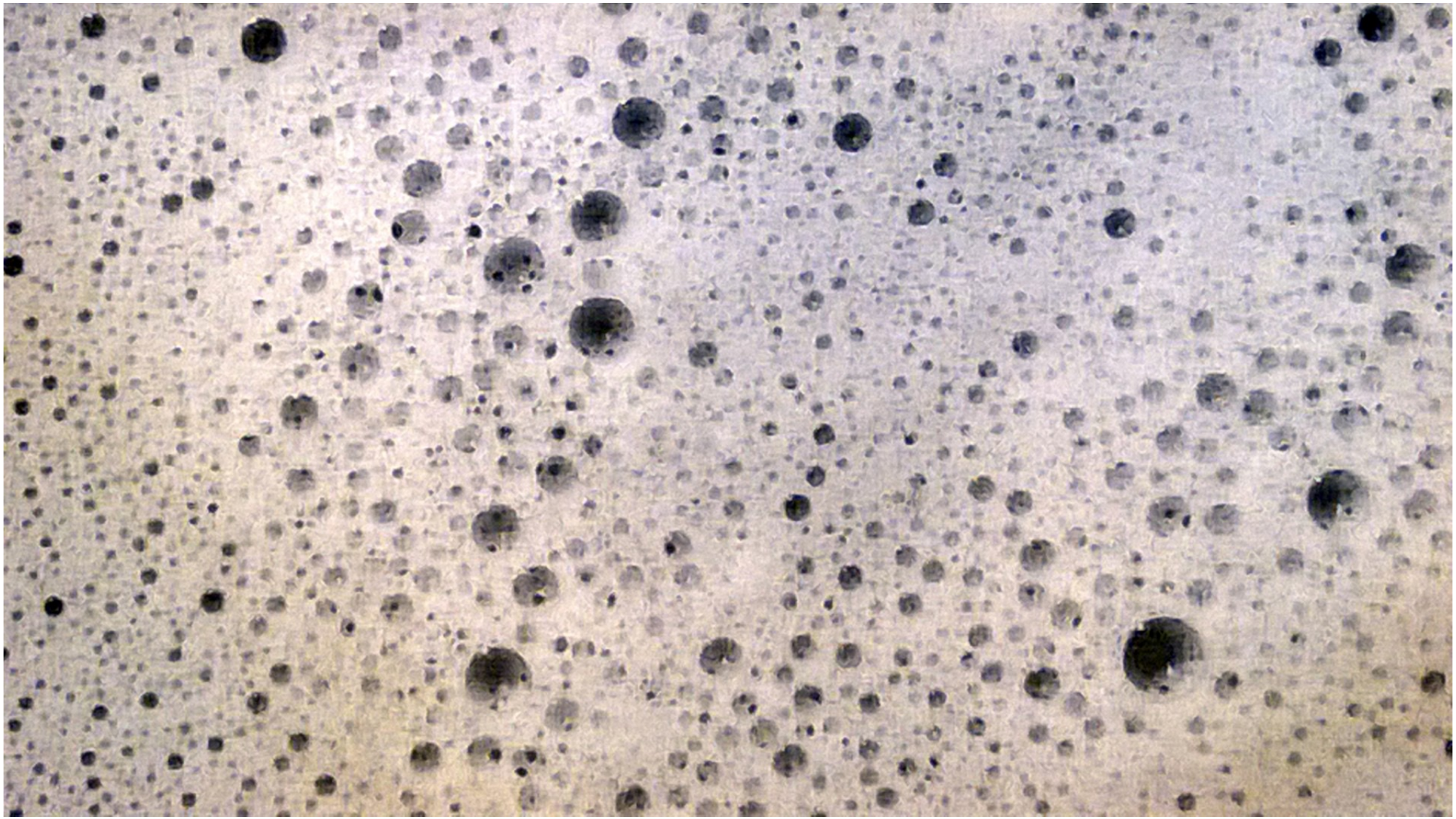
ASSOCIATION OF WATER TECHNOLOGIES

Training Seminars

Defoamers



Foam Control

Agenda

- Foam Creation
- Types of Foam
- Foam Control
- Testing
- Field Applications
- Markets
- Questions

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Foam Control

What Is Foam?

- A dispersion of a gas (usually air) in a liquid (usually water) or solid

Foam Control

Foam Control Applications

- **Water Treatment**
  - Cooling Water
  - Wastewater
  - Process Water
  - Municipal
  - Internal Boiler Treatment
- **Specialty Applications**
  - Paper
  - Paints and Coatings
  - Cleaning Industry
  - Textile
  - Agriculture
  - Fiberglass
  - Others

Foam Control

Why Control Foam?

- Foam in the plant discharge can create aesthetic problems for the plant's neighbors
- Unwanted floating clarifier solids
- Discharge fines:
  - Discharge fines can be $25,000 for the first offense and $50,000 for additional discharge violations
- Operational safety problems
  - Slippery floors
  - Unsanitary conditions
- Drifting foam can cause staining on cars, equipment and houses
  - Cleaning, repainting or repairing surfaces fees
- Pump cavitation
- Production problems
  - Poor surface contact in plating or painting

Foam Control

What Causes Foam?

- Pure liquids do not foam
- Liquid and gas sources
- Agitation or turbulence
- Foaming agent
  - Metabolized waste from microbes
  - Surfactant

Foam Control

Surfactants

- **Are relatively low molecular weight molecules having a hydrophilic (water loving) head, and a hydrophobic (water hating) tail. This causes them to orient themselves on the surface of a bubble, producing an elastic film which stabilizes the bubble wall (lamela) against rupture.**

Foam Control

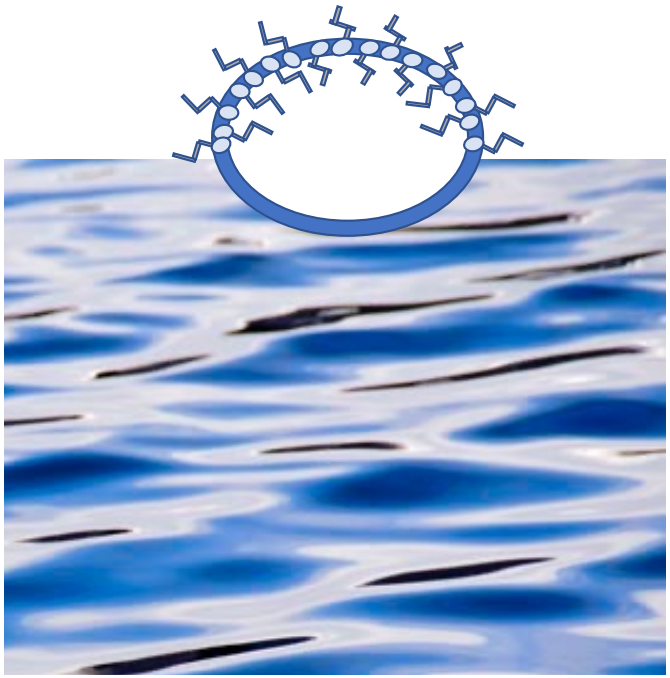
Examples of Surfactants

- All soaps of fatty acids (anionic)
- All sulfonated materials (anionic)
- All nonionics – ethoxylates (nonionic)
- All quats (cationic)
- Phosphated ethoxylates (anionic)

Foam Control

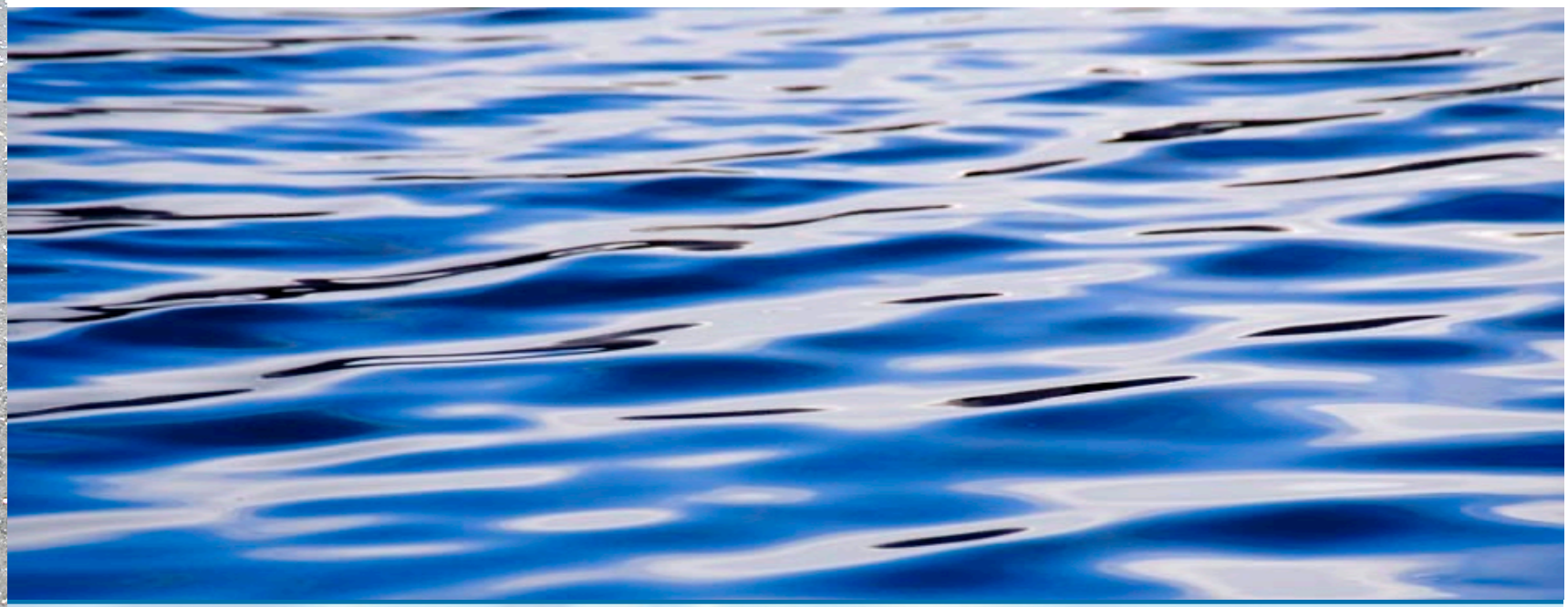
Foam Stabilization

- When a bubble rises it comes in close proximity to the surface of the media
- A liquid lamella forms between the surface of the bubble and the media surface
- The surfactants begin to orient themselves to the lowest thermodynamically stable state



Foam Control

No Surfactants



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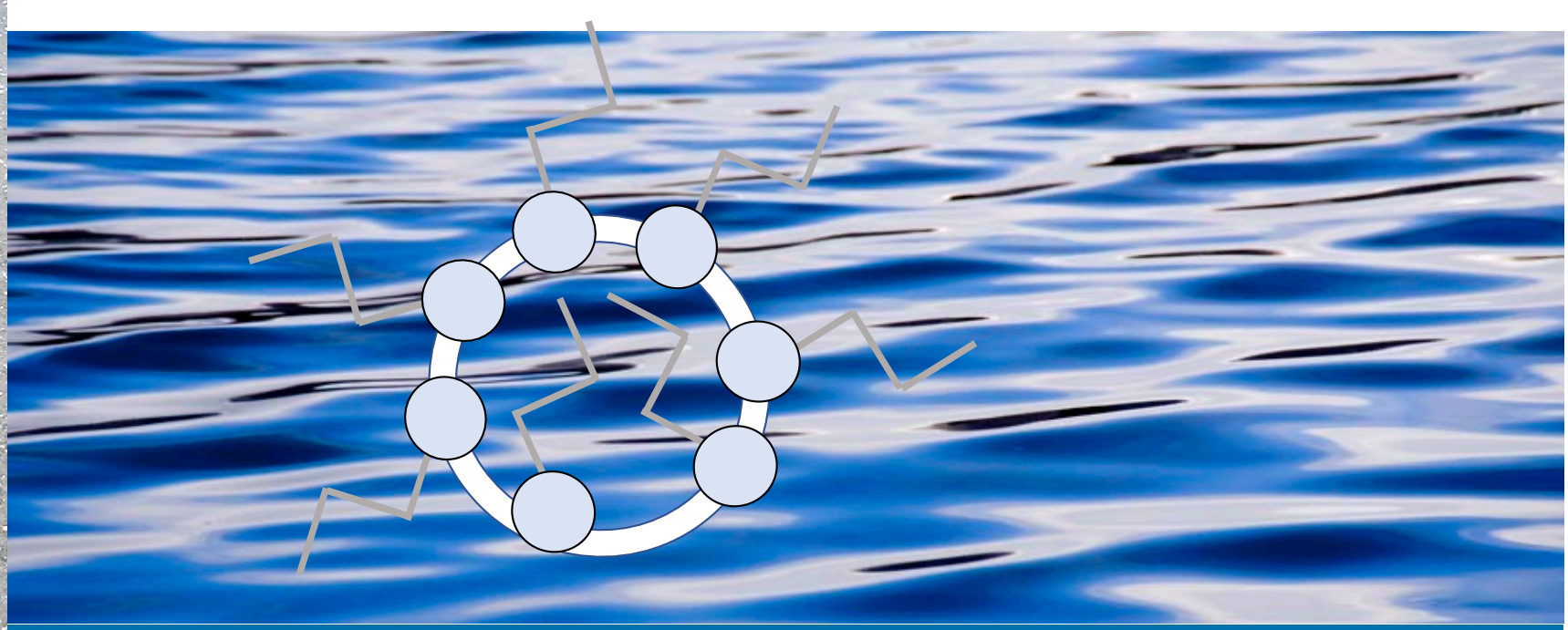
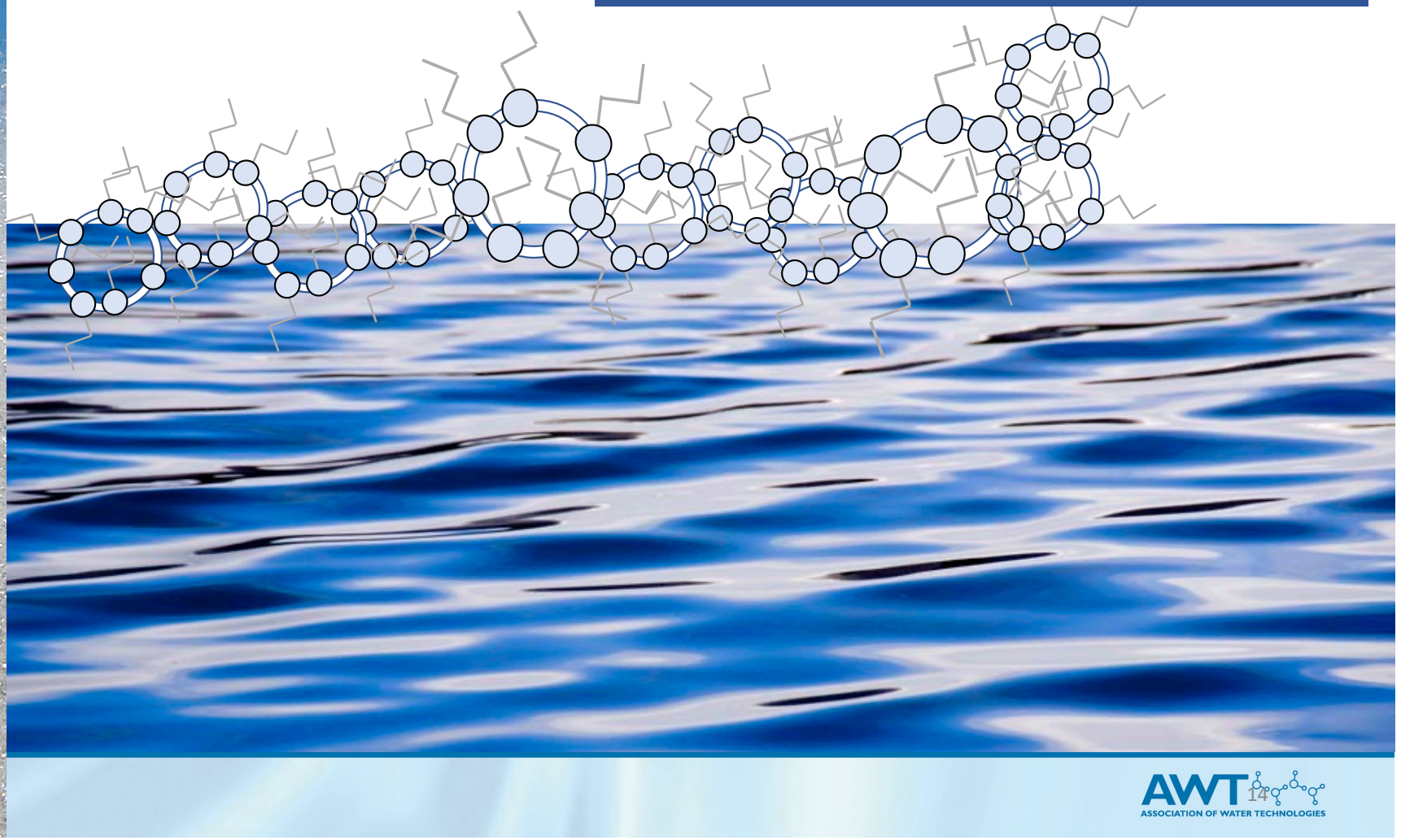
Foam Control

With Surfactants



Foam Control

Foam



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Foam Control

Surfactant Foam

- Foam generated by the introduction of surface active agents into water. This foam is stable, WHITE in color and irregular in shape.

Foam Control

Biological Foam

- Foam created by the activity of the microorganisms as they metabolize and breakdown the organics. This foam is extremely stable and dry in appearance. This type of foam is comprised of very small circular bubbles and is typically TAN to BROWN in color. Biological foam is similar to shaving cream in appearance.

Types of Foam

- **Entrained air**
  - Internal foam – not on surface
- **Microfoam**
  - Colloidal Foam (1 micron – 1 nanometer)
  - Macroscopic Foam (>1micron)
- **Impinged air**
  - Microfoam attached to dispersed solids – fibers or fines in a slurry
- **Dry Foam**
  - Less water more organics

Foam Control

Defoamer or Antifoam

- Defoamer – A substance used to reduce or eliminate the amount of foam
- Antifoam – A substance used to prevent the formation of foam
- Chemistry – The chemistry and mechanism of defoamers and antifoamers are usually the same or very similar. The methods of application may be different

Defoamer or Antifoam

These terms are often interchangeable!

We've even interchanged them in this presentation

Foam Control

Municipal Plant Discharge

Defoamer……
Fed only when residents complain!!

Antifoam……
Fed 24/7 during first weeks of Trout Season

Same product used as a Defoamer or Antifoam

Defoamer or Antifoam

Foam Control

What is Needed?

Knock-Down

And/Or

Persistency

Foam Control

The ability for a Defoamer to reduce, remove, or "kill" an existing foam

Key parameters

- Speed
  - How quickly
- Thoroughness
  - How much
  - All or Some

What is Needed?

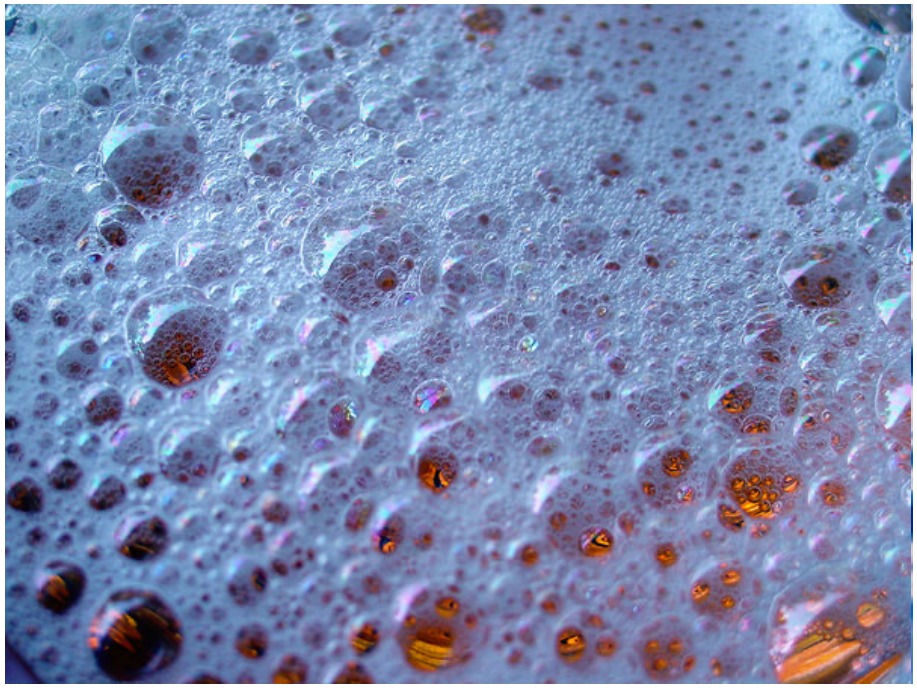
Knock-Down

Foam Control

The ability for an Antifoam to keep foam from reoccurring

What is Needed?

Persistency



Key parameters

- Time
  - How long before reoccurring
- Thoroughness
  - How much
  - All or Some
  - Maintained to what level

Types of Defoamers

- **Silicone Based**
- **Oil Based**
- **Synthetics**
  - Oil Free
  - Ester Based
- **Water Based**
  - Water Extended

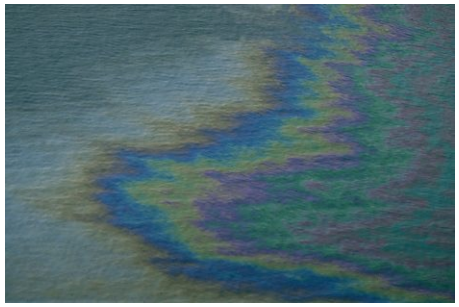
Component Restrictions

Silicones

- Problems with metal finishing

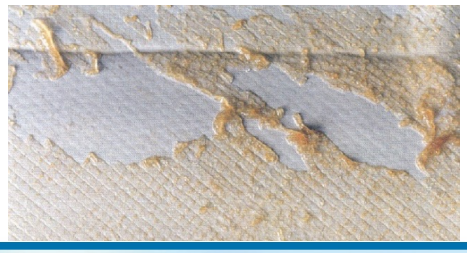
Mineral Oils

- Oil sheen on water ways



Reverse Osmosis

- Particles blind membranes



Factors Affecting Foam

- **System Parameters**
  - System obstacles
  - Agitation
  - Cascade amount and location
  - Retention time

Foam Control

Foam Control Tests

Shake Test

- Field test
- Quick and easy
- Basic idea of product
- Test both for Defoamer or Antifoam abilities

Clear Bottles

Syringes

Foam Control

Air Stone Test

- Field test
- More control than shake test
- Easy to refine treatment
- Effective for testing Defoamers or Antifoams

Foam Control Tests

Aquarium Air Pump

Stopwatch

Aquarium Air Stones

Tubing

Graduated Cylinder

Foam Control

Foam Cell

- Typically a lab test
- Foam development can be controlled
- Most testing control
- Easiest to refine treatment
- Effective for testing Defoamer or Antifoam

Foam Control Tests

Stopwatch

Recirc Pump