”Metalworking Fluids”

Impact on Health Safety and the Workplace, A Personal Success Story

New England AIHA

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"The Statements contained in this presentation represent the opinions of the author, and do not reflect the views or positions of any other persons or parties.”

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This Presentation Is About...

- My Personal Experience
- Practical Considerations
  - ✓Everyone Can Understand, Appreciate, and Influence
- What is Possible in MWF Environment
  - ✓Improve Health and Safety
  - ✓Reduce/Eliminate Exposures
  - ✓Operator Acceptance
  - ✓Product Effectiveness
  - ✓Cost and Waste Control
- What You Can Do!!!!

Personal Experience

- Years as a machinist
- Types of machinery
- Fluids used
  - Contamination
  - Filtration equipment
- MWF Management
  - Develop Standard Operating Procedures
  - Set criteria & frequencies
- Six Sigma
  - ✓ MWF cost reduction project
  - ✓ MWF position (40hr)

Personal Health Effects

- New England Medical Center
  - ✓Patch testing (Ames)
    - uncontaminated fluids (virgin)
  - ✓Second testing
    - contaminated fluids (used)
  - ✓Final Diagnosis
    - Dermatitis
      - Sensitized to zinc / sulfur
      - Irritant /allergic metal fines

Personal Aftermath and Consequence

- Living with the condition:
  - ✓Social activities
    - psychological embarrassment
  - ✓Medical removal
    - lower rated classification < $$$$$

Personal Aftermath and Controls

- Education:
  - ✓I needed to know more
  - ✓Action plan and execution
  - ✓Systematic Approach
    - Establish Predictive measurements
    - Established goals and objectives
    - Standard Operating Procedure
    - Pilot plan and presentation
    - Review Agenda

Where Do I Start?

Safety Policy

Water

Concentrate

Concentration

Metals

Lubrication

Mishaps

Hydraulics

Product Stewardship

Training

Seals & Gaskets

OSHA 300 Log

Hazard Communication

Housekeeping

Web sites?

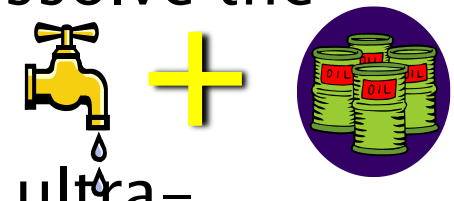
? ? ? ? ?

The most incomprehensible thing about the world is that it is at all comprehensible.
-- Albert Einstein

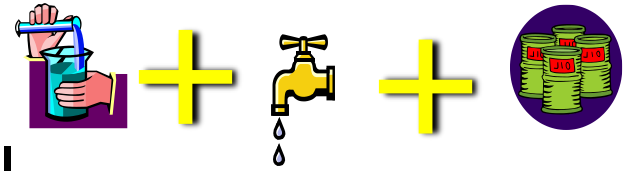
Metal Working Fluids

- **Straight oils**: Composed of mineral, animal, marine, vegetable or synthetic oils. Straight oils are not diluted with water, but other additives may be present.

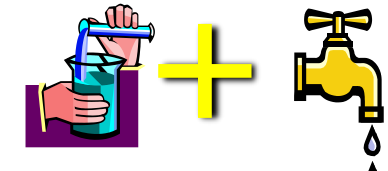
- **Soluble oils**: Containing anywhere from 30-85 percent ultra-refined mineral oils and emulsifiers to dissolve the oil in water.



- **Semisynthetic fluids**: Containing 5-30 percent ultra-refined mineral oils, 30-50 percent water and the remainder additives.



- **Synthetic fluids**: Containing no mineral oil

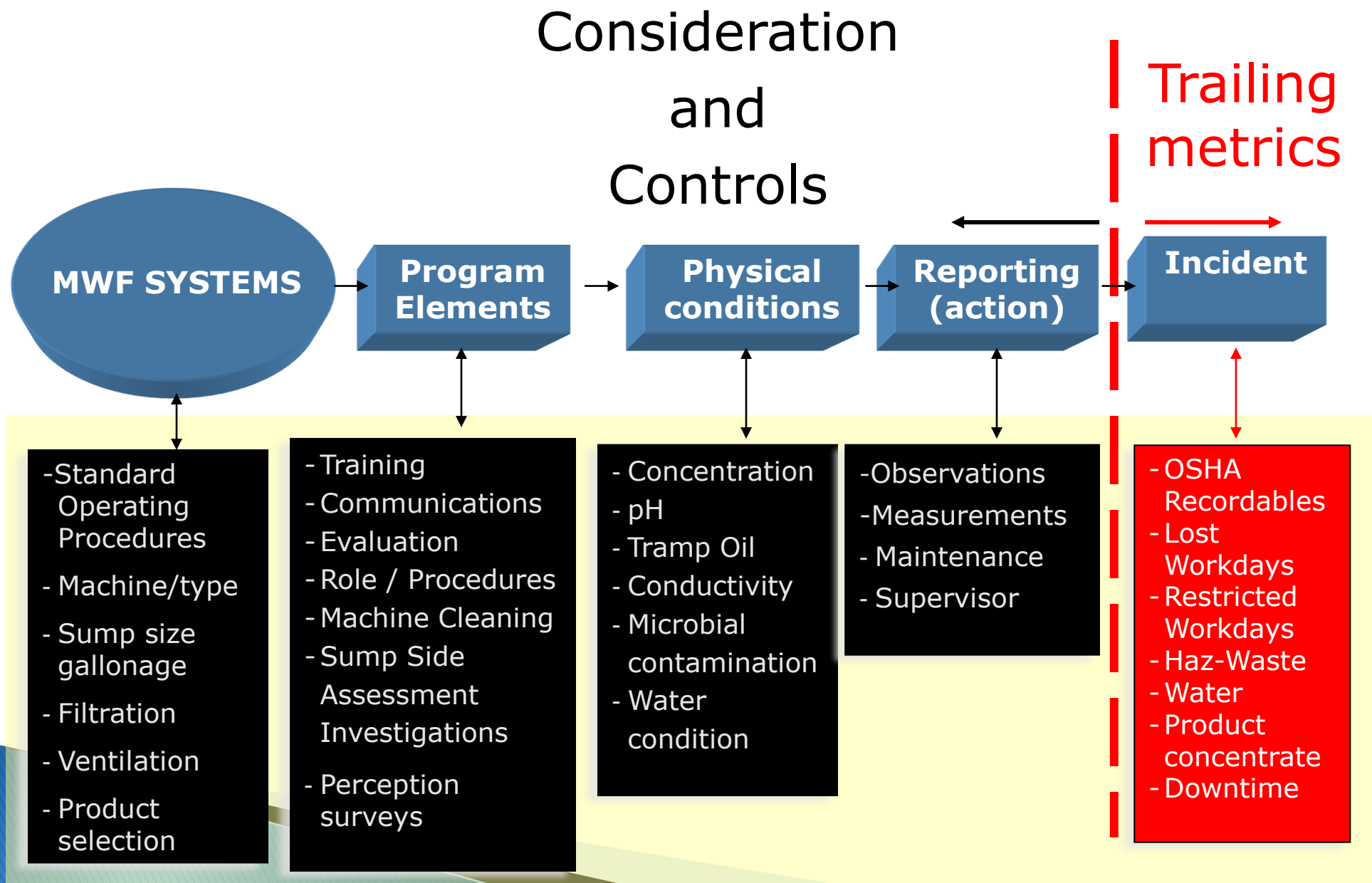


An Introduction to MWF's

- MWF's are ubiquitous but necessary.
  - ✓ (1) Valued at US $11.23 billion in 2019 and is anticipated to reach US$15.31 billon by 2025
- MWF's account for up to 15% of a shop production cost
  - ✓ Purchase $5 – $16 / gal
  - ✓ Maintenance: $0.20 – $1.20/gal
  - ✓ Disposal: $1.25 – $3.00/gal

(1) https://www.fortunebusinessinsights.com/industry-reports/methodology/metalworking-fluids-market-101391

Systematic Management



Why "Be" Concerned ?

- Over 1.2 million workers exposed
- 185,000 workplaces (Burt 1997)
- 2,779 machine shops (NE area)

Not included

- ✓Universities
- ✓Vocational Schools

Potential Risks

Ignorance

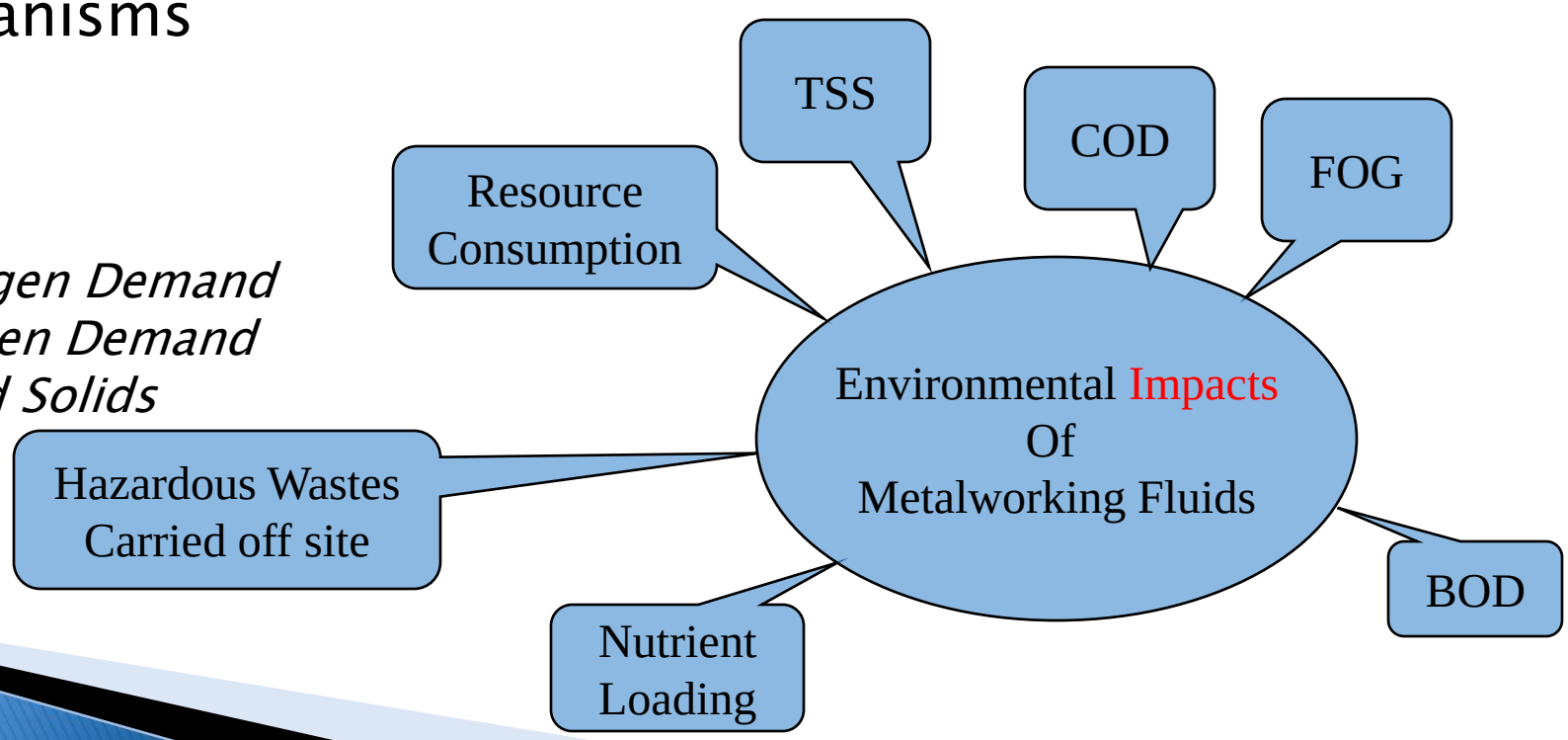
Can be Deadly

King Cholera dispenses contagion: the London Cholera Epidemic of 1866 George John Pinwell

Concerns about MWF

- Serious Environmental Burden
- Hazardous to Human Health (if not managed)
  - ✓Additives (TSCA Regulated chemicals)
  - ✓Microorganisms
  - ✓Biocides

FOG *Fat Oil Grease*
BOD *Biological Oxygen Demand*
COD *Chemical Oxygen Demand*
TSS *Total Suspended Solids*



Can Metalworking Fluids cause health problems?

- In today's work environment, Metalworking Fluids are generally used without incident, however, they can cause problems if ***improperly*** used, mishandled or poorly maintained.

What We Know

- MWF formulations are;
  - ✓Complex mixtures of:
    - Emulsifiers
    - Corrosion inhibitors
    - Extreme pressures agents
    - Coupling agents
    - Biocides/ Antimicrobial pesticides
      - formaldehyde condensates (Triazine)
    - Antifoaming agents

Known Potential Health Effect: ENT = eye, nose, and throat

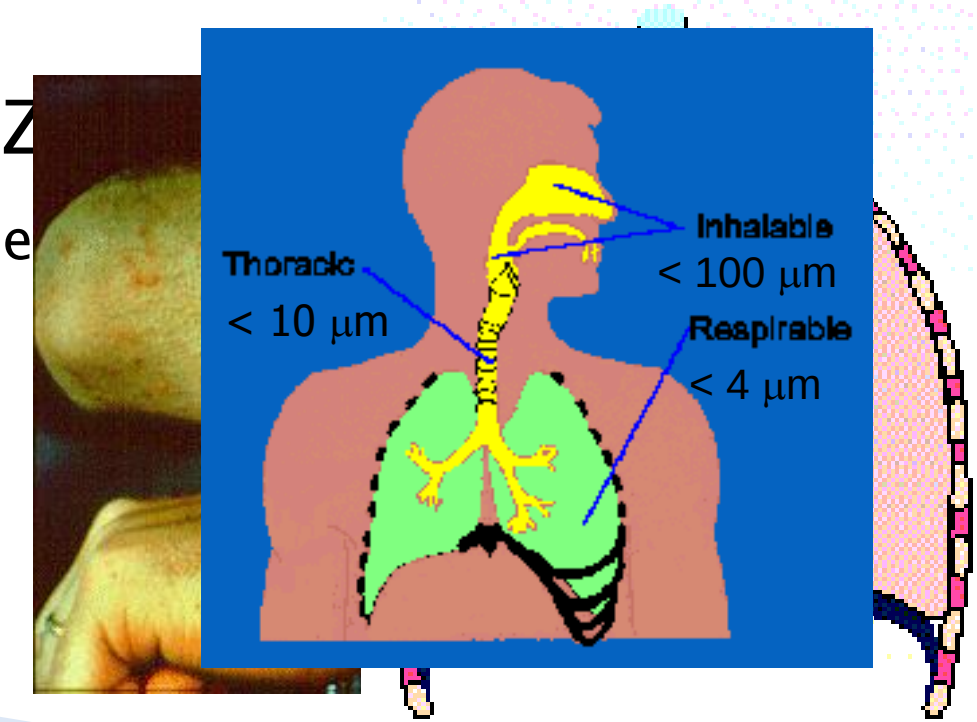
CNS (central nervous system) depression = headache, dizziness, drowsiness, nausea

What We Know...cont.

- "Improperly Managed" MWF's
  - ✓Health & Safety Problems
    - Dermatitis: irritant , allergic, sensitizers, fines
    - Eye, Nose, Throat Irritation
    - Respiratory Complaints / Diseases
    - Cancer (potential)
- Elimination of Exposure = Z
  - A single source can affect a varie
  - Safer alternatives
  - Engineering controls

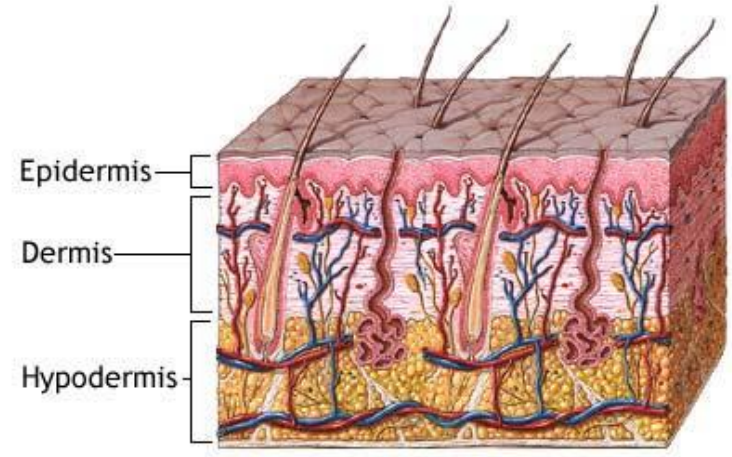
    (not practical in all cases)

Avoid food, tobacco and cosmetics in the work area



What We Know…cont.

- Some Metals, and Metal Alloy contaminants are Hazardous
- Chemicals
  - ✓ Primary irritants
    - Chemical reaction on the skin
  - ✓ Sensitizers
    - Repeat exposures/allergic reactions
- Physical
  - ✓ Mechanical
    - Friction, abrasions, lacerations and contusions
- Microbial Biological Contamination
  - ✓ Health effects and Fluid degradation



Consequences of poor maintenance

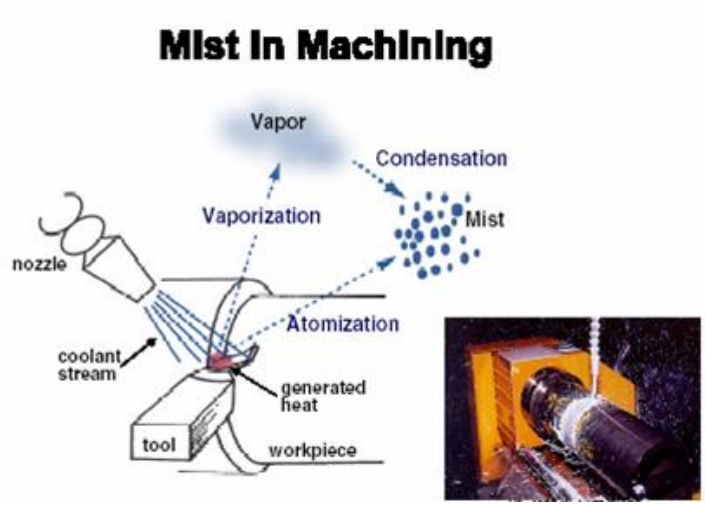
- Fungus
- Residue
- Rust
- Foam

What Is Practical…

- …And Immediately Possible
  - **Communication**
    - Employee / Employer
    - Establish personal shop survey
    - Sump Side Assessment
  - Training
  - Minimize Exposure
  - Minimize Risk
  - Shop Evaluation
    - machine inventory, ventilation, lubricant usage, waste pump-outs

Minimizing Risk...

- Choose “Low Impact” MWF’s
- Proper fluids Filtration
  - ✓keep It workii
- ✓ Proper Ventilati
  - ✓application
- Train People
  - ✓Good Persona
  - ✓Symptoms
  - ✓Who To Call With/Concerns
  - ✓Good Housekeeping
    - Minimize Contamination



- ✓Keep MWF In Good Condition!
- ✓Appropriate Concentration
- ✓Correct pH
  - ow Biological Growth
  - owest Reasonable Biocide evels (sump side)
  - linimize Oil Contamination
    - Fix Leaks
    - Skim Tramp Oil

= Stable Emulsion

Catch Problems Early Relying On Operators

Minimizing Exposures…

- Machine Enclosures
- Ventilation
- Mist Collectors
- Automated Operations
  - ✓ Operator is Removed
  - ✓ Exposure likely Reduced
- Low Pressures
  - ✓ Machining Operations
  - ✓ Sluiceways flushing
  - ✓ Blow-offs parts
- "Low Mist" Coolants
- Design Changes
  - ✓ Machines/control parameters
  - ✓ Be involved "Early"
- Training, Training, Training
  - ✓ Teach How NOT To Be Exposed
  - ✓ Teach How to observe problems
  - ✓ Use Toolbox

Sump Side Tools

- Activity Log
- I/I sump-side assessment doc.
- Concentration
- pH
- Water Hardness
- Biological Dip Slides
- % Tramp Oil/Free oil

Refractometer

Appendix C. Forms

Metalworking Fluids
Sump side assessment

Date: __/____/_____ **QRT/ID#**_____
Bldg.:_____
W/S: _____

Machine Type:_____
Ventilation:_____
Fluid Type:_____
System type: (standalone/central) _____
Wash down hose:_____

Machine Condition:
Residue on vertical surfaces:_____
Residue on horizontal surfaces: _____
Residue on tooling fixtures: _____

Sump side fluid sample test:
Conc. _
pH _____
Hard. _____
Tramp oil _____

Laboratory sample taken: NO___ YES___ Sample #____ **Date:** _____ **Time:** _____

Personal: (optional)
Name:_____
First time affected: NO_____ YES_____
State reason for reporting:
_____
_____
_____

Responders:
_____ _____
_____ _____
_____ _____

Action Follow Up:
_____

The Tool Box

Personal Hygiene

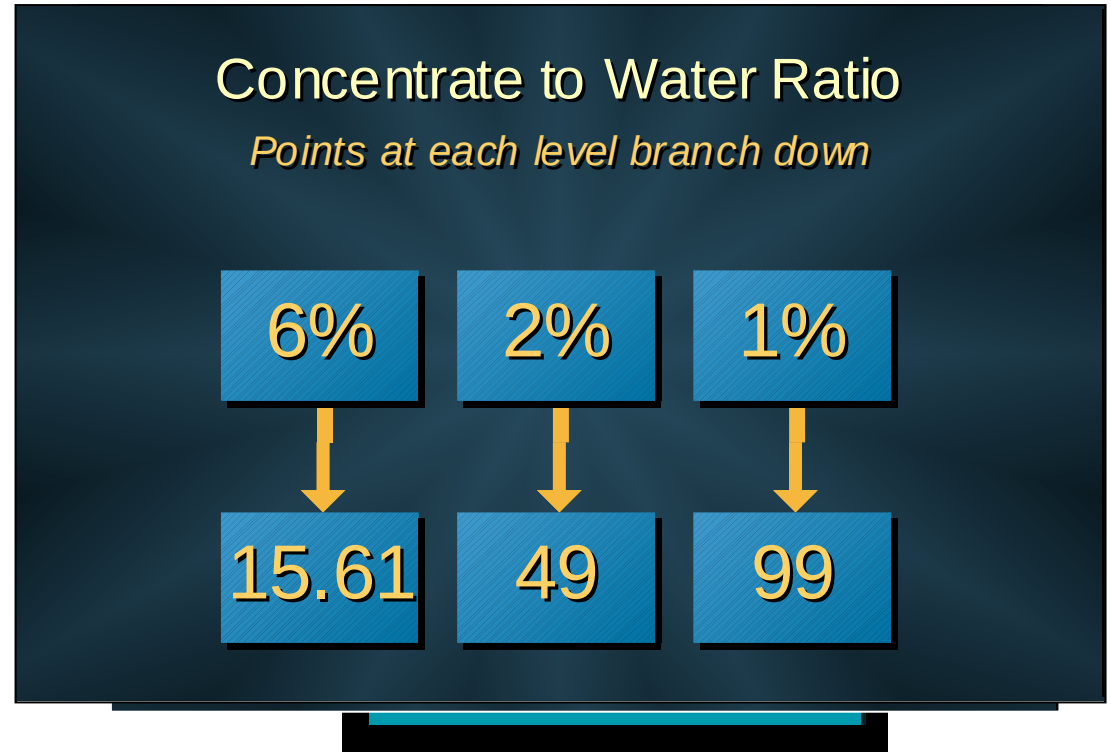
- ✓ Keep the MWF off the skin and avoid breathing MRF mist whenever possible.
- ✓ Change MRF-soaked clothing immediately. DON'T allow it to dry while you're wearing it.
- ✓ Change work gloves at least daily, more often if they become wet.
- ✓ Don’t use dirty shop towels to wipe hands.
- ✓ Wash with the mildest soap- rinse with plain water if appropriate
- ✓ Report any skin or respiratory irritation to your supervisor or the appropriate medical personnel immediately.

The Tool Box

- **MWF Hygiene**
  - ✓ Keep MWF as free from contamination (oils, soaps, debris, etc.) a
  - ✓ Practice good housekeeping – keep area clean and don't allow coolant to puddle or stagnate.
  - ✓ FIX OIL LEAKS! (And keep oil skimmed from top of coolant as much as possible.) The importance of this CANNOT be overstated.
  - ✓ Maintain the MWF at the correct concentration %.
  - ✓ Keep MWF filtration and chip removal systems working properly.
  - ✓ Use the lowest practical MWF flow rates and pressures for the machining and chip removal operations.
  - ✓ If you suspect a problem with the MWF, tell the person in charge of chemical management for the system immediately.

What Is Possible...

- Prevent loss time
  - ✓Illness/injury
  - ✓Machine down time
- Medical Avoidance cost
  - ✓workers comp.
- Product quality
- Fluid optimization
- Water conservation
- Hazardous waste (dissolved metals / contaminants)



The Three MOST IMPORTANT Things…

- **Training**
  - ✓ Teach people how to work safely with MWF's
    - Awareness
    - Assessment
    - Observations
    - Technical

Available Guidance

- NIOSH Criteria Document – www.cdc.gov/niosh
- OSHA Guidance Document
- British HSE Metal Working Fluid Good Practice Manual
- Independent Lubricant Manufactures Association – www.ilma.org
- STLE Society of Tribologist and Lubrication Engineers
- Product Supplier / Formulator

Questions?

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