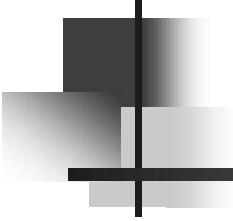


# Wastewater Treatment Plant Safety & Health



**Wisconsin Chapter  
Central States Water Environment Association  
Oshkosh, WI  
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# Purpose of the Presentation

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- Focus on Safety & Health
- Follow OSHA rules/standards
- Relate to WWTP O&M
  - Same applies for WTP
- Provide resources for more information



# Topics

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1. Background
2. OSHA's Role
3. Occupational Safety & Health Act
4. Important terms/concepts
5. OSHA Regulations:
  - 29 CFR 1910: OSHA Standards for General Industry
  - 29 CFR 1926: OSHA Standards for the Construction Industry
6. Wisconsin Rules (not covered):
  - ATCP 93: Flammable, Combustible And Hazardous Liquids (SPS 310)
  - SPS 341: Boilers
  - SPS 382: Plumbing
  - SPS 45: Refrigeration (Ozone Depleting Substances)
  - Workers Compensation
7. OSHA Program List
8. Where to find more information
9. Abbreviations



# OSHA's Role - 1

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- OSHA has responsibility for:
  - Work-place safety
  - Work-place health
- OSHA:
  - Enforcement agency
  - Part of US Dept of Labor
- Employers are not exempt from OSHA regulations, may be exempt from OSHA record-keeping < 10 employees.
- Government, WWTPs may be exempt from OSHA.



# OSHA's Role - 2

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1. Sets safety & health standards – Facilities should:
  - Prepare written programs
  - Provide training
  - Conduct tests, inspections, monitoring & audits
  - Keep records
2. Enforcement through Federal (& State) inspectors
3. Public education & consultation
  - Note:
    - Site should have an OSHA poster, maintain an OSHA 300 log (29 CFR 1904).
    - OSHA does not “approve” anything
    - NIOSH may certify items, e.g., respirators



# Occupational Safety & Health Act

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- Goal: To ensure that “no employee will suffer material impairment of health or functional capacity” from a lifetime of occupational exposure
- General Duty Clause 5(a):
  - (1) “Each employer ... shall furnish ... employment ... free from recognized hazards that are causing or likely to cause death or serious physical harm to his employees”
  - (2) “shall comply with ... safety and health standards...”



# Important Terms/Concepts

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- Hazard: An existing or potential condition that can result in injuries, property damage or other losses
- Risk: The likelihood, high or low, that someone or something will be harmed by a hazard.
- Safety: Control of recognized hazards to achieve an acceptable level of risk
- Safety should be considered during, planning, design, construction, construction, operation, maintenance, etc.



# Chemical Hazards

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1. Acute toxin: short-term
2. Chronic toxin: long term
3. Irritant: causes irritation
4. Sensitizer: changes proteins
5. Tumorogen: produce tumors
6. Mutagen: alter genes, generational impact
7. Teratogen: alter fetuses, non-generational impact
8. Reactive chemical: violent reaction
9. Corrosives: acids/bases
10. Combustibles/flammables: will burn



# Combustibles/Flammables

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- Combustible liquid: 100 – 200 F
- Flammable liquid: < 100 F
- Pyrophoric: spontaneous ignition < 130 F
- Flammable gas: ignitable compressed gas within flammability range, e.g. LPG, CH<sub>4</sub>
- Flammable solid: ignite by friction, water absorption, etc.
- Combustible solid, e.g., paper, plastics, etc.



# Managing Hazards

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- Identify/anticipate hazards
- Assess Hazards/Risk
- Control Hazards
  1. Eliminate hazard
  2. Engineering controls – best control
  3. Administrative controls:
    - Procedures
    - Training
  4. PPE: last line of defense

1

# Job Hazard Analysis - 2

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- Consider doing a JHA for every “routine” task.
  - Keep it simple
- Eventually will have a library of JHAs
  1. List the tasks: step-by-step
  2. List the hazards
  3. List the controls
- Revise JHA if incident involving the job, if you realize step, hazard, or control missing
- Could create simple form



# Routes of Entry for Contaminants

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1. Inhalation:
  - Controls to reduce exposure:
    1. Engineering: Ventilation (General/Local), LO/TO, etc.
    2. Administrative controls: procedures, training, etc.
    3. PPE
  - OSHA, NIOSH, ACGIH set exposure levels, may be different
2. Skin contact, eyes
3. Ingestion
  - Food
  - Controls: Wash hands before eating
  - Keep food out of workplace
4. Injection
  - Sharps



# 29 CFR 1910: Occupational Safety & Health Standards - General Industry

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- Subparts:
  - A: General
  - D: Walking-Working Services
  - E: Means of Egress
  - F: Powered Platforms, Manlifts, Vehicle Mounted Equipment
  - G: Occupational Health & Environmental Control



# 29 CFR 1910: Occupational Safety & Health Standards - General Industry

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- Subparts:
  - H: Hazardous Materials
  - I: Personal Protective Equipment (PPE)
  - J: General Environmental Control
  - K: Medical and First Aid
  - L: Fire Protection
  - M: Compressed Gas & Compressed Air Equipment
  - N: Materials Handling and Storage

# 29 CFR 1910: Occupational Safety & Health Standards (General Industry)

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- Subparts:
  - O: Machinery and Machine Guarding
  - P: Hand & Portable Powered Tools & Other Hand-Held Equipment
  - Q: Welding, Cutting and Brazing
  - S: Electrical
  - Subpart T: Commercial Diving Operations
  - Z: Toxic and Hazardous Substances





# Subpart A: General

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- 1910.6: Incorporation By Reference - OSHA adopts many technical standards from:
  1. ACGIH: American Council of Governmental Industrial Hygienists
  2. ANSI: American National Standards Institute
  3. ASTM: American Society for Testing & Materials
  4. CGA: Compressed Gas Association
  5. NFPA: National Fire Protection Association
  6. NIOSH: National Institute for Occupational Safety & Health
  7. SAE: Society of Automotive Engineers
  8. UL: Underwriters Laboratories

# Subpart D: Walking - Working Surfaces

1. Need to protect against falls into pits, vats, manholes, tanks
2. Need to post floor load limits
3. Need to guard floor, wall openings (> 4'), holes – Should have ~42" railings, ~4" toe boards
4. Stairs must carry loads, be non-slip, have railings, have standard tread height/depth, carry 1,000#
5. Portable wood, metal, etc. ladders have standards – non-conductive, don't paint, non-skid
6. Fixed ladders have standards, cages > 20', 42" over roof line, etc.
7. Platforms, scaffolds have ladder, railings, toe boards, 10' from power
8. Mobile ladders must have wheel locks, rail, toeboards
9. Use fall protection – anchors, lanyards, full body harnesses, rated for 5,000 lbs.





# Subpart E: Means of Egress

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- Egress is the way to an exit, the way out (1910.37)
  - Buildings must have adequate exits
  - Exits must be unobstructed, illuminated
  - Exits must meet minimum width – 28”, not be blocked by snow
  - Non-exits must be marked, must not be locked
- Workplace must have emergency, fire protection and evacuation plan (1910.38)
  - Must be written, exits marked on map – post plan & map
  - Training required, must be documented
  - Must have alarms
  - Should have a marked assembly area
  - Should hold fire drills – go outside, tornado drills – go to safe area, e.g., basement
- Fire Prevention Plan (1910.39)
- NFPA 101: Life Safety Code – 1910.35



# Ventilation

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1. Could have general or local exhaust ventilation
2. Contaminants kept out of breathing zone
3. Certain tanks must be ventilated.
4. Dust must be collected for certain operations.
5. Labs should have ventilation, lab-hoods.
6. 100 FPM at booth/hood face for operator
7. Must use approved, NIOSH certified respirator
8. Ventilation to remove Cyanide, Chlorine, acids, gases, etc.
9. Check OSHA PELs, ACGIH-TLVs, NIOSH – IDLH
10. Subpart G: Occupational Health & Environmental Control

# Hearing Conservation/ Occupational Noise Exposure

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- Occupational Noise Exposure:
  - > 85 dBA – need hearing conservation program
  - > 90 dBA – need administrative, engineering controls; if they don't work use PPE
  - Annual noise surveys, notify employees > 85 dBA
  - Need written program, training, equipment, hearing tests – keep documentation
- Must protect from/against Ionizing/Non-ionizing Radiation - e.g., signs in microwave area
- Subpart G: Occupational Health & Environmental Control - 29 CFR 1910.95





# Process Safety Management

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- Prevent catastrophic releases of highly hazardous chemicals
  - > 130 specific toxic, reactive, flammable liquids & gases
  - Gasoline, LPG, propane excluded if used as fuel, for heat
  - Chlorine threshold is 1,500 pounds (Appendix A)
- CAA 304 > OSHA, 14 Elements of PSM (CAA-RMP 40 CFR 68)
  1. Employee participation
  2. Process Safety Information
  3. Process Hazard Analysis
  4. Operating Procedures
  5. Training
  6. Contractors
  7. Pre-Start-up Safety Review
  8. Mechanical Integrity
  9. Hot Work Permit
  10. Management of Change
  11. Incident Investigation
  12. Emergency Planning and Response
  13. Compliance Audits – 3 years
  14. Trade Secrets
- Need written program
- 29 CFR 1910.119, Subpart H: Hazardous Materials





# Hazardous Waste Operations and Emergency Response

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- HAZWOPER
- Covers clean-up/emergency response of Hazardous Substances at RCRA/NPL/TSD sites
- Focus on HAZMAT team, Safety & Health program, site characterization, site control, medical surveillance, engineering controls, monitoring, material handling, decontamination
- Various levels of response, training (8, 24, 40 hr.)
- Need written program, training, equipment, spill prevention & response, safety & health program, annual refresher
- Subpart H: Hazardous Materials
- 29 CFR 1910.120

# Subpart I: Personal Protective Equipment (PPE)

1. Survey workplace for hazards requiring PPE – PPE Hazard Assessment – 1910.132
2. Eye & face protection – impact/spill resistant – 1910.133
3. Respiratory protection – 1910.134
4. Head protection – don't paint, wear backwards, no stickers – 1910.135
5. Foot protection – steel-toed/soled, substantial shoes – 1910.136
6. Ear protection > 85 dBA - 1910.95
7. Electrical PPE – 1910.137
8. Electrical protective devices – NFPA 70E
9. Hand protection – check permeability, chemical use – 1910.138
10. PPE: clean, good order, fit, available, stored properly, provided for free
11. Need written program, training, equipment





## Subpart J: General Environmental Control

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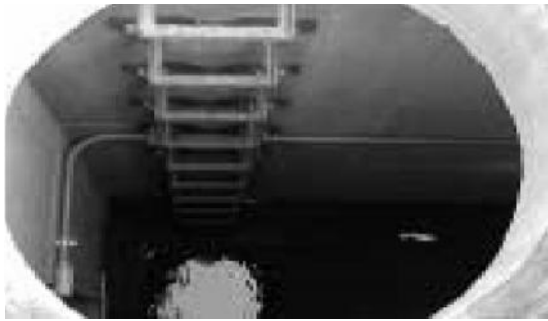
- Sanitation 1910.141
  - Need to provide proper sanitation, toilets, water, trash, etc.
- Safety color code - marking hazards – 1910.145
  - Mark pipes: contents, direction of flow
  - Green-start, red-stop
  - Safety cans – red
  - Danger: red, black and white
  - Caution: yellow, black letters
  - Instruction: white, green or black letters
- Specs for Safety Signs/Tags – 1910.145

# Confined Space Entry

1. Survey Confined Spaces - identify and assess hazards
2. Classify Confined Spaces
3. Mark confined spaces
4. Develop entry plan
5. Use confined space entry permit - document
6. Test atmosphere before & during entry - record
7. Have a rescue/recovery/retrieval plan
8. Need written program, training, equipment
9. Avoid confined space entry if possible
10. Subpart J: General Environmental Control
11. 20 CFR 1910.146



# Examples of Confined Spaces



Manhole



Storage tank



Sump



Sewer/Drain

# Control of Hazardous Energy (LO/TO)

1. LO/TO: Lock-out/Tag-out
2. Identify Hazardous Energy sources
3. Make locks available, 1 key
4. Make tags available – could have name/photo on it
5. Conduct annual inspection
6. Need to be able to control/isolate all forms of energy = zero energy state, verify isolation
7. Need written program, training, equipment
8. Subpart J: General Environmental Control
9. 29 CFR 1910.147



# Subpart K: Medical and First Aid

- Eyewash facilities, safety showers
  - Immediately available
  - Test, inspect, maintain, record
- Medical help nearby
  - Emergency room., clinic within 5 minutes
- First aid supplies present
- Have trained first aid responders on-site
- Know what symptoms to look for – see MSDSs
- Plan for injuries, be prepared for burns, chlorine gas/liquid, cyanide poisoning, etc.





# Subpart L: Fire Protection

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1. Fire brigades require training, equipment: NFPA 600
2. Portable fire extinguishers: NFPA 10, 1910.157
  - A/B/C/D/K – distances, types
  - Need to inspect, maintain, test – keep records
3. Automatic sprinkler systems: NFPA 13, 1910.159
4. Fire pumps: NFPA 20
5. Detection is the key for a fire
  - Employee/fire alarm systems: NFPA 72, 1910.165
  - If see fire, sound alarm, call for help, head for exit
  - System Testing, Maintenance: NFPA 25
6. Fire Doors, Windows: NFPA 80
7. Fire Walls: NFPA 221



# Subpart M: Compressed Gas & Compressed Air Equipment

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- Compressors and Air receivers (1910.169)
- Need oil, water drain valves – to process sewer, not storm
- Need safety valves
- < 30 PSI pressure regulators on air guns
- Keep air guns in holsters
- Protect against noise
- Buy/use quiet, energy efficient compressors



## Subpart N: Materials Handling and Storage

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- Maintain aisle width for forklifts, people
- Don't store materials in aisle – fire/safety hazards
- Powered industrial trucks:
  - Operators trained, Operators licensed
  - Secure trailers, trucks before loading
  - Inspect forklift
  - Drive backwards if can't see over load, sound horn
- Overhead and gantry cranes:
  - Inspection procedure
  - Inspect wire ropes, chains, slings,
  - Capacities marked
- 29 CFR 1910.176 - 184

# Subpart O: Machinery and Machine Guarding

- General requirements – guard moving equipment
- Woodworking
- Abrasive wheels
  - Should have a clearly marked on/off switch
  - Top guard for wheel should not exceed ¼ inch from wheel
  - Work rest/bottom guard should not exceed 1/8 inch from wheel
  - Operator should wear proper eyewear and heavy gloves when grinding
  - Should have a protective Lexan/Plexi glass cover over wheel
- Power presses, Forging machines, Mechanical power-transmission
- Fans > 7' don't need guards
- Machinery should be anchored





## Subpart P: Hand & Portable Powered Tools & Other Hand-Held Equipment

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- General requirements
  - Compressed air at nozzle < 30 PSI
- Guards on saws, grinders, sanders
  - Anti-kick back, manual re-start (not auto)
- Grounding
  - Consider requiring GFCIs
- Pneumatic tools
- Fasteners

# Subpart Q: Welding, Cutting and Brazing (Hot Work)

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- Oxygen - fuel gas welding cutting
- Arc welding and cutting
- Resistance welding
- Concerns for
  - Toxic metals: Cd, Ni, Zn, Pb, etc. - Ventilation
  - Proper PPE, eyewear
  - Hot work - could cause fires
  - Need Hot work permit program
  - NFPA 51B: Cutting & Welding



# Subpart S: Electrical

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1. Machinery disconnects must be marked
2. Mark electrical equipment with voltage, current, amperage
3. 36" Clear area in front of electrical panel/box (locked)
4. Insulate/ground tools/appliances
5. Cover circuit breakers, boxes, etc.
6. Proper polarity at outlet/plugs
7. Proper grounding at outlet/plugs
8. Do not work on energized equipment
9. GFCI in wet areas, temporary wiring,
10. All circuits - 2 wire with ground
11. Need protection from shocks, electrical arcs, etc.
12. Need training
13. NFPA 70: National Electrical Code

# Subpart Z: Toxic and Hazardous Substances

- Air Contaminants
- Asbestos, Arsenic, Cadmium, Chromium, Lead, etc.
  - 29 CFR 1910.1027: Cadmium
  - 29 CFR 1910.1026: Chromium (VI)
- HCN, H<sub>2</sub>SO<sub>4</sub>, CaO<sub>3</sub>, NaOH, H<sub>2</sub>S, Cl<sub>2</sub>, etc.
  - Read SDS/MSDS
  - HCN toxic gas at WWTP, IDLH: 50 PPM, OSHA PEL: 20 PPM
  - H<sub>2</sub>S toxic gas at WWTP, IDLH: 100 PPM, OSHA PEL: 10 PPM
- Medical records – restrict access to records
- Blood-borne pathogens – Need program
  - Medical waste, sharps require special disposal
  - 29 CFR 1910.1030
- Markings – DOT, NFPA 704, HMIS
- Laboratories:
  - Chemical Hygiene Plan, training, inventory, first aid
  - 29 CFR 1910.1450
- Ensure these areas are addressed via training, etc.



# Chemical Hygiene Plan

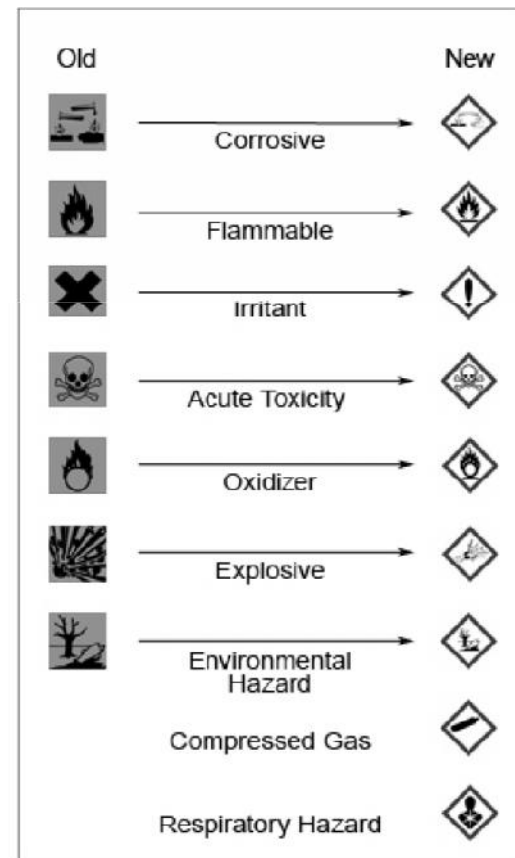
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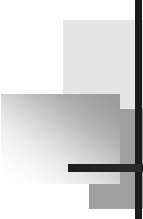
- CHP to reduce exposure to hazardous chemicals in laboratories.
- It has general and specific requirements.
- Exposure should be controlled.
- Employees must be notified of exposure.
- *Need a written Chemical Hygiene Plan (e)*
- *Need Lab Safety Training (f)*
- *29 CFR 1910.1450: Occupational Exposure to Hazardous Chemical in Laboratories*



# Hazard Communication

- Employee Right-To-Know
- Global Harmonization – HazComm 2012
  - GHS: pictograms, training, deadlines
- Containers labeled re contents, hazards
- SDS/MSDSs – available, know how to read
- You can refuse to work if no MSDS
- Know hazards, risks, incompatibles, etc.
- Know how to read signs, labels, etc.
- Know what to do in an emergency
- Subpart Z: Toxic Hazardous Substances
- 29 CFR 1910.1200
- Keep DOT labels: 29 CFR 1910.1201
- Need written program, training
- Reference Books:
  - NIOSH Pocket Guide to Chem. *Hazards*
  - ACGIH TLV Book



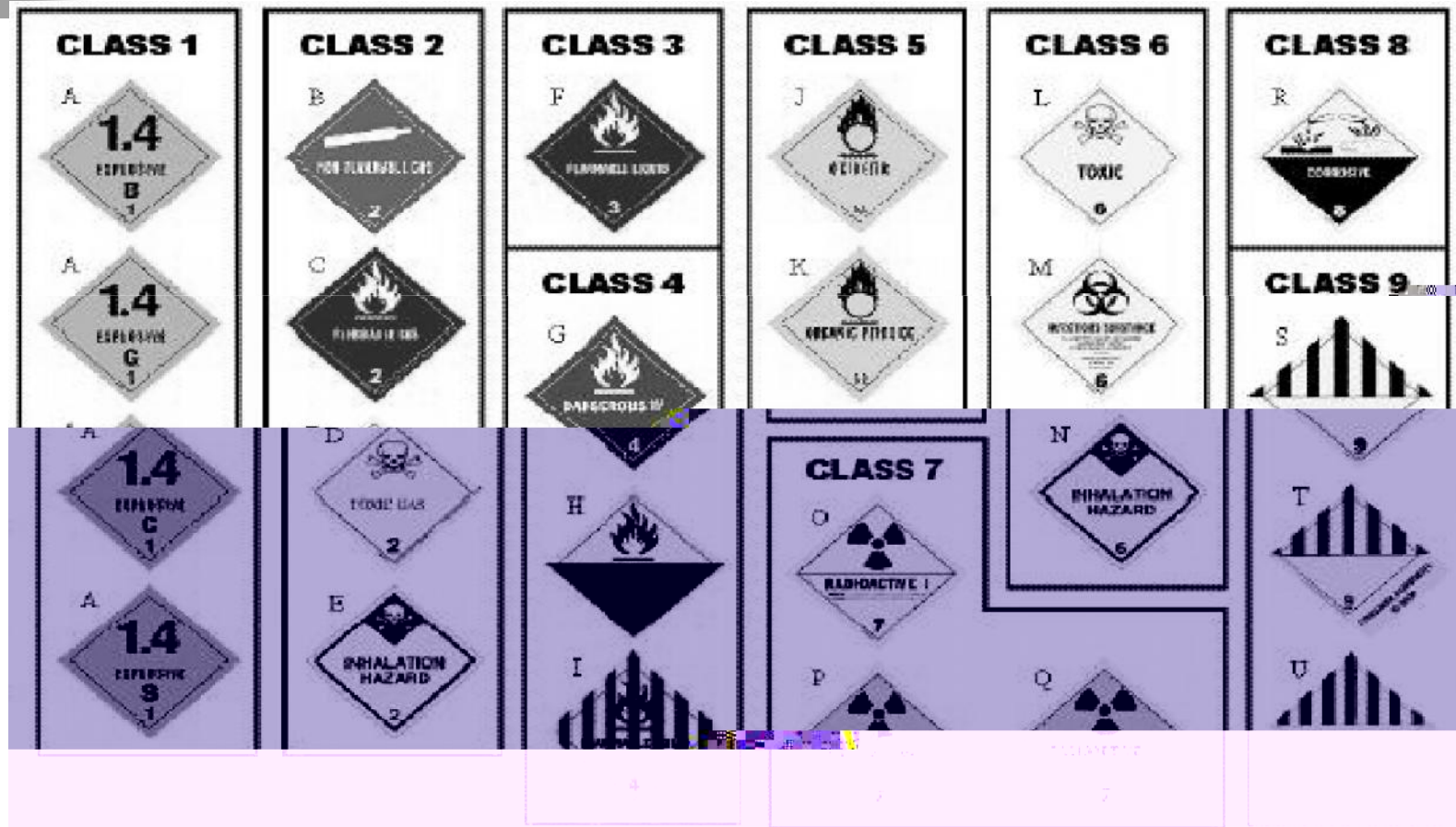


## DOT: 49 CFR 172.101: Hazardous Materials

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- Class 1 - Explosives (6 divisions)
- Class 2 - Compressed Gases (3 divisions)
- Class 3 - Flammable & Combustible Liquids
- Class 4 - Flammable Solids (3 divisions)
- Class 5 - Oxidizing Materials (2 divisions)
- Class 6 - Poisons (2 divisions)
- Class 7 - Radioactive Materials
- Class 8 - Corrosive Materials
- Class 9 - Miscellaneous Materials
- ORM-D - Other Regulated Material (consumer commodities)

# DOT Labels



# Emergency Response Guidebook (Orange)

- 4 digit DOT ID # - 3 digit ERG Guide # - Name
- Sections:
  - Yellow: DOT ID #/ERG Guide #/Name of Material
  - Blue: Name of Material/ERG Guide #/DOT ID #
  - Orange: ERG Guide – 2 Page by 3 digit ERG Guide #
    - Potential Hazards: Fire, Health
    - Public Safety: Clothing, Evacuation
    - Emergency Response: Fire, Spill/Leak, First Aid
  - Green:
    - Table 1: Initial Isolation/Protective Action Distances
    - Table 2: Water Reactive Materials Producing Toxic Gases
    - Table 3: Initial Isolation/Protective Action Distances – TIH Gases
  - White: Placards, General, BLEVE, IEDs, Glossary, etc.



# Excavations/Trenches - 29 CFR 1926 P

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- Hazards include cave-ins, trench collapses, and being struck by falling objects
- Check for buried utilities before digging
- Use protective system such as trench box and/or shoring
- Keeps dirt back 3 feet from edge
- Provide ladder, stairway, ramp every 30 feet, since mud can come up from bottom of trench; must always have a safe exit
- Assign a trained person to inspect trenches and excavations to ensure they meet safety requirements



# OSHA's Top 10 List of Violations

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1. Fall Protection: 29 CFR 1926.501
  2. Hazard Communication: 29 CFR 1910.1200
  3. Scaffolding: 29 CFR 1926.451
  4. Respiratory Protection: 29 CFR 1910.134
  5. Electrical Wiring: 29 CFR 1910.305
  6. Powered Industrial Trucks: 29 CFR 1910.178
  7. Ladders: 29 CFR 1926.1053
  8. Lockout/Tagout: 29 CFR 1910.147
  9. Electrical System design: 29 CFR 1910.303
  10. Machine Guarding: 29 CFR 1910.212
- 2013, May vary from year to year



# Start-Up

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- Ensure construction complete
- Equipment installed & tested – use checklist
- Test equipment and start-up systems
- Conduct training
- Ensure procedures in-place
- Start-up process should include:
  - Pre-occupancy checklist
  - PSSER: Pre Start-up Safety & Environmental Review
  - New equipment checklist



# Incidents

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- First, respond to the emergency – know what to do
  - There should be a procedure or training on incident response
- Report incident:
  - Internally
  - Emergency personnel
  - Worry about external reporting later
- Then, investigate the incident:
  - What happened?
  - How did it happen?
  - Why did it happen?
  - What can be done to prevent recurrence?
- Were the errors based on:
  - Failure to follow rules
  - Lack of knowledge
  - Not having the right skills
- Identify the cause of the incident and the lessons learned
- Verify the effectiveness of the action taken
- Track data on incidents, injuries, etc.





# Your Role

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1. Follow site rules
2. Follow procedures, training
3. Do not bypass safety equipment
4. Know utility locations – call digger’s hotline
5. Identify/report/eliminate/control hazards
6. Control/reduce risks
7. Stop work if see unsafe acts/behaviors/conditions
8. Do JSAs
9. Hold pre-job safety meetings
10. Know emergency procedures
11. Document work done
12. Be safe for your family



# Where to Find More Information

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1. Safety, Health, and Security in Wastewater Systems, MOP 1 (WEF Manual of Practice)
2. [www.osha.gov](http://www.osha.gov)
3. [www.nsc.org](http://www.nsc.org)
4. [www.nfpa.org](http://www.nfpa.org)
5. [www.wef.org](http://www.wef.org)
6. [www.epa.gov](http://www.epa.gov)
7. [www.dnr.wi.gov](http://www.dnr.wi.gov)



# Abbreviations

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1. ACGIH: American Council of Governmental Industrial Hygienists
2. ANSI: American National Standards Institute
3. ASTM: American Society for Testing & Materials
4. CAA: Clean Air Act
5. CGA: Compressed Gas Association
6. DOT: Department of Transportation
7. GFCI: Ground Fault Circuit Interrupter
8. IDLH: Immediately Dangerous to Life & Health
9. LPG: Liquefied Petroleum Gas
10. OSHA: Occupational Safety & Health Act
11. OSHA: Occupational Safety & Health Administration
12. NFPA: National Fire Protection Association
13. NIOSH: National Institute for Occupational Safety & Health
14. MSDS: Material Safety Data Sheet
15. PPE: Personal Protection Equipment
16. SAE: Society of Automotive Engineers
17. UL: Underwriters Laboratories



# Top 10 Unsafe Things to Do - 1

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1. Take a nap in a confined space – no one will catch you napping.
2. Walk the plank without fall protection equipment.
3. Smoke while handling flammable liquids.
4. Don't wear safety glasses, you'll be safer after you lose your first eye.
5. You won't be able to hear with ear plugs.



## Top 10 Unsafe Things to Do - 2

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6. You don't need to lock anything out, I can't tell if it'll work if you turn the power off.
7. You don't need that stupid guard, it makes things less safe.
8. Don't waste your time reading that stupid MSDS – they make that stuff up anyway.
9. Hold my beer and watch this, what's the worst thing that can happen?
10. You're not really hurt, don't be a wuss.



# Contact Information

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