

Toxicity Associated with Confined Spaces

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Three Objectives:

- 1) Regulations regarding local toxic substances
- 2) Origin of regulations and extrapolation to maritime industry
- 3) The difference between SCP and CMC in regard to toxics



What are some Common Toxics in Local Confined Spaces?



Common Toxics in Local Confined Spaces

- JP-5
- Diesel
- H₂S
- Carbon Monoxide and Dioxide
- Benzene
- Black Oil
- Gasoline



How are these Toxic Substances Regulated to Ensure Worker Safety?



Regulations and Guidelines:

- OSHA Permissible Exposure Limits (CFR 29 1915 Subpart Z)
- ACGIH Threshold Limit Values, Short Term Exposure Limits, and Ceiling Values



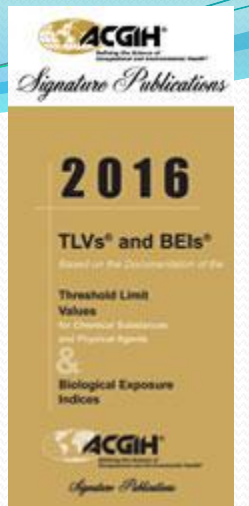
The Regulations with the Force of Law State Themselves, that they are Outdated



- *Two Quotes from OSHA's website:*
- *“OSHA recognizes that many of its permissible exposure limits (PELs) are **outdated** and inadequate for ensuring protection of worker health. Most of OSHA's PELs were issued shortly after adoption of the Occupational Safety and Health (OSH) Act in **1970**, and have not been updated since that time.”*
- *“OSHA's mandatory PELs in the Z-Tables remain in effect. However, **OSHA recommends** that employers consider using the **alternative occupational exposure limits** because the Agency believes that exposures above some of these alternative occupational exposure limits may be hazardous to workers, even when the exposure levels are in compliance with the relevant PELs.”*

American Conference of Governmental Industrial Hygienist

- TLV book is updated **yearly**
- Takes **Published Science** and goes through ACGIH extensive review
- “Guidelines” that **reflect the scientific community’s** opinion in relation to health and safety for all published toxic substances.
- More research is constantly coming in, typically decreasing the existing TLVs to **more stringent** guidelines



How ACGIH TLVs have changed for Benzene

- 1946 American Conference of Governmental Industrial Hygienists (ACGIH) recommends a limit of **100**

ppm for benzene exposure 1947 Recommended value reduced to **50** ppm

- 1948 Further reduced to **35** ppm
- 1957 ACGIH lowers recommended exposure to **25** ppm
- 1977 Based on these results, the US Department of Labor wants to reduce exposure to 1 ppm, but is

challenged in the courts by API

- 1978 Benzene was voluntarily withdrawn from consumer products in the United States
- 1980 US Supreme Court issues the Benzene Decision severely limiting regulatory actions
- 1987 New benzene standard of **1** ppm. This 10-year delay caused more than 200 deaths in the United

States

- 1996 Studies showing benzene-related diseases from **1** ppm level of exposure
- 2016 TLV is set at **0.5** ppm in ACGIH

What is the Origin of these Standards and Guidelines?



Lab Studies, Human Extrapolation, and Epidemiological Data



Lab Constants for Inhalation Toxicity Tests

- The animals should be tested with inhalation equipment designed to sustain “10 air changes per hour” and “uniform conditions” throughout the exposure chamber.
- The total volume of the test animals should not exceed 5 percent of the volume of the test chamber.
- The temperature at which the test is performed should be maintained at 22 ± 2 °C (71.6 °F) and 30 and 70 percent humidity
- Are conditions constant for you in confined spaces?



CDC Study on Jet Fuel

- Target Organs?
- Organs previously exposed/compromised? **Synergism**
 - Liver?
 - Nervous?
 - Immune?
- **Self Evaluation/ Employee consideration**



A few Quotes from the CDC on Jet Fuel

- A study of veterans found **alterations in reaction** time from exposures to 0.00057 ppm JP-8 vapor.
- Although JP-5 has been used for over **60 years** there is **very little data on the toxicity** of kerosene-based jet fuels in humans.
- rats and mice were exposed to aerosolized JP-8. These studies reported an increase in respiratory permeability, increased lung resistance, and terminal **bronchiole lesions**.



A few Quotes from the CDC on Jet Fuel

- Overt signs of **dermal toxicity** have been observed following repeated exposures; effects ranged from erythema and edema to dermatitis to ulceration.
- The **developmental toxicity** of JP-5 and Jet A has **not** been evaluated.



A few Quotes from the CDC on Jet Fuel

- **JP-5** • An MRL of **2 mg/m³** has been derived for intermediate-duration **Inhalation** exposure (15–365 days) to JP-5 vapor.
- **Hepatic Effects:** Several studies in laboratory animals provide evidence that the liver is a sensitive target of jet fuel toxicity.
- **Continuous exposure** to ≥ 150 mg/m³ JP-5 vapor resulted in **hepatocellular fatty changes** and vacuolization in mice.



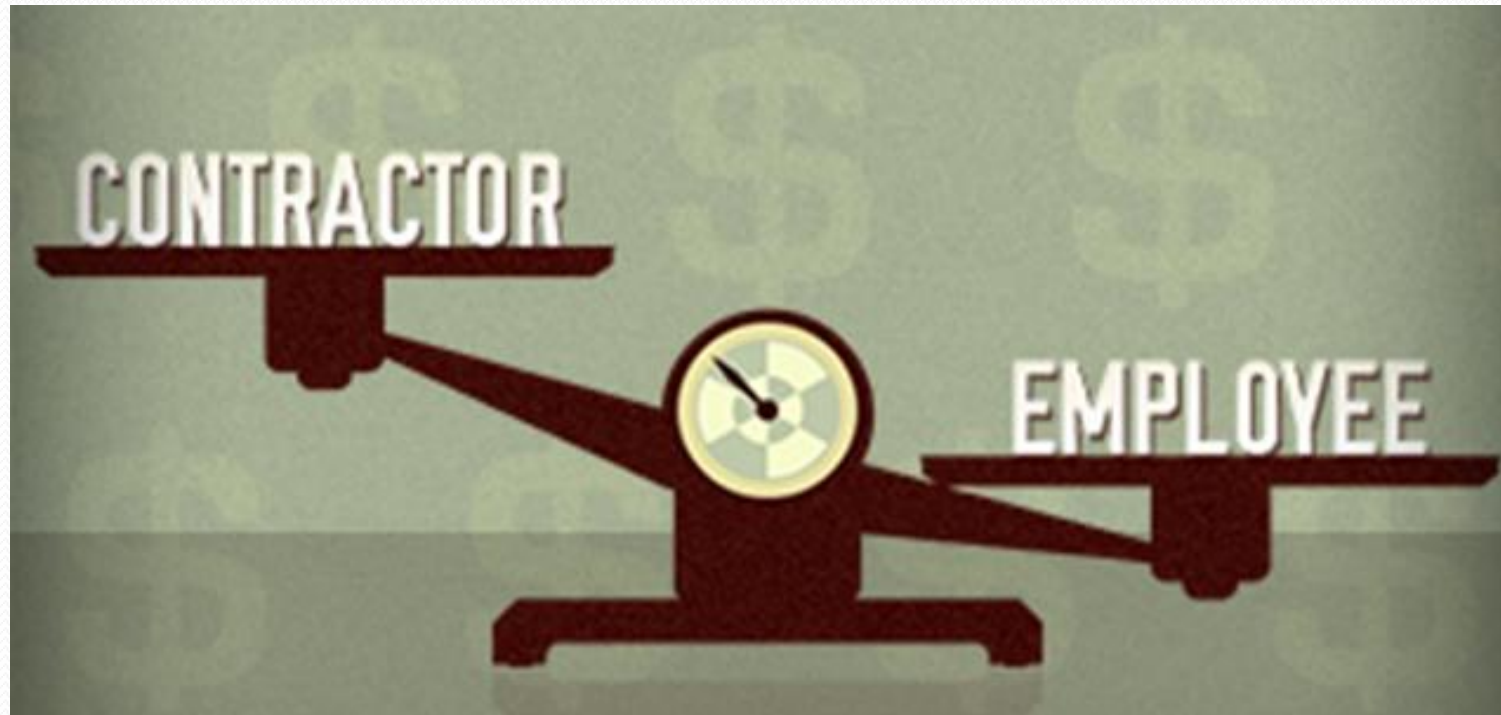
Confined Spaces and Toxicity

- A rat in a box is not a man in a confined space
- Synergy: **alcohol and pain killers**
- **Increased respiratory rate** while working in confined spaces
- Glass boxes are controlled environments, conditions change in confined spaces
- Insufficient data for carcinogenicity, unlike asbestos that has documented health effects from over a century ago



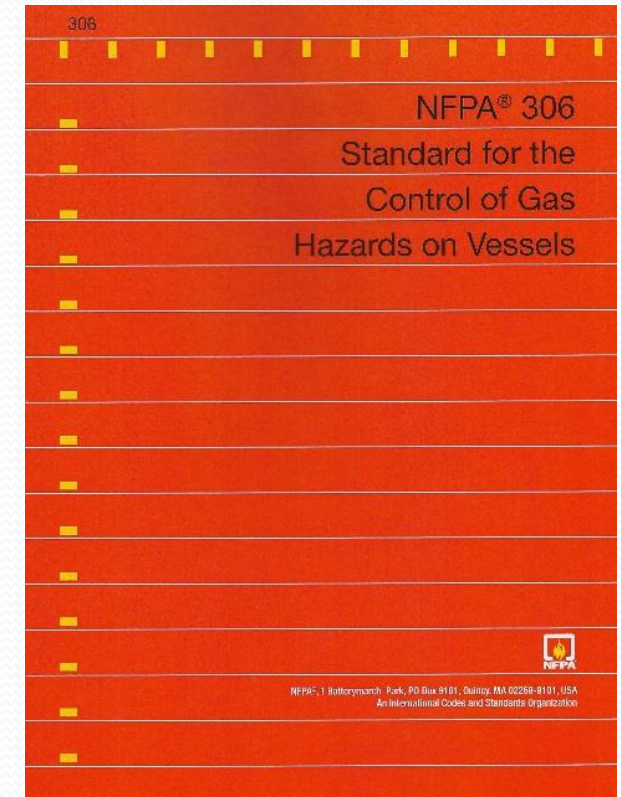
Who Protects Maritime Workers from Exposure?

- SCP and CMC
- What are the differences between the two?



Who is Your Authority?

- Shipyard competent persons are designated and under OSHA authority.
- Certified Marine Chemists are certified by the National Fire Protection Agency and under the authority of NFPA 306.
 - 306 (Standard for the Control of Gas Hazards of Vessels)



Three Take-Aways:

- 1) Regulations regarding local toxic substances
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**I WILL FIND
YOU**

**AND I WILL THANK
YOU**