Misinterpreting Codes and Standards - What are the consequences?

William Cantor, PE
InfoBatt 2010

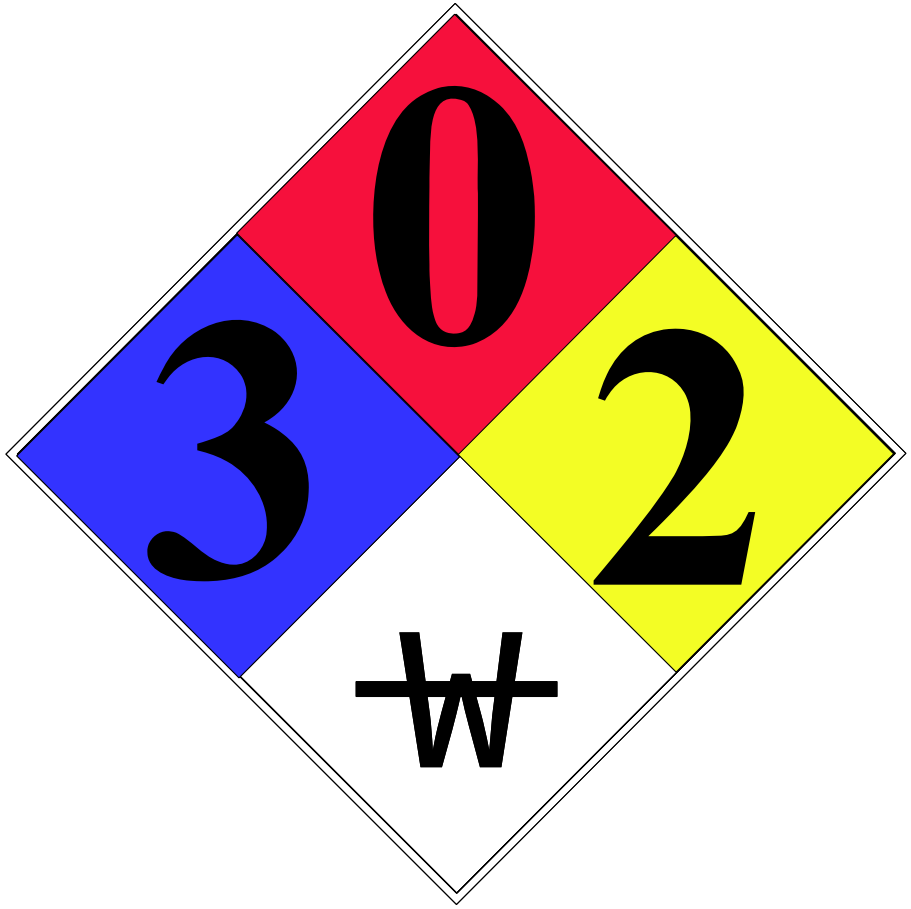
Agenda

- NFPA reactivity
- Sprinklers in battery rooms
- Containment
- Ventilation

NFPA Reactivity

- ISSUE:
  - Overstating the water reactivity of electrolyte
- Code:
  - NFPA 704
- Implications:
  - Recommends not to use water on a fire
  - Life safety issue

NFPA Fire Diamond



Reactivity of sulfuric acid

- Very reactive at 85% and above concentrations
  - 1.770 specific gravity and higher
  - Water reactivity 2 per NFPA 704 guidelines
  - Requires ₩ symbol on fire diamond
- Battery electrolyte is very low reactivity
  - 1.300 gravity is <40% concentration
  - 1.210 gravity is <30% concentration
  - Water reactivity 0 or 1 per NFPA 704
  - Does NOT require ₩ symbol

Battery MSDS

- Inconsistent and subject to interpretation
- Many battery MSDS state a reactivity of 2
  - …and may include a note that concentrated sulfuric acid is water reactive
- Reactivity of 2 requires ₩ symbol

₩ symbol

- The ₩ symbol is totally unnecessary since water on the batteries is NOT a safety issue.
  - …which leads to the next issue
- Common sense should override a strict interpretation of the MSDS and NFPA 704

Fire suppression in battery rooms

- ISSUE:
  - Overspending for fire suppression in battery rooms
- Code:
  - various
- Implications:
  - Cost
  - Reliability

Sprinklers in battery rooms

- Product selection, installation and housekeeping are critical in fire prevention
- High oxygen index, self-extinguishing battery cells and cables will prevent fire sustainability
- Must be in conjunction with strict procedures to keep flammable materials out of the room (e.g. cardboard boxes)
- With “nothing to burn”, fire suppression is unnecessary (but maybe required by code)

Sprinklers in battery rooms

- Sprinklers, if required, are effective, safe and reliable for battery rooms
  - Commonly and safely used in electrical rooms
  - Will not typically harm batteries, even when operational
- Sprinkler heads have a failure rate of about 1 in 16 million or a probability of 6.25×10^{-8}
- sprinkler discharging inadvertently for all reasons is 1 in 2.5 million (probability of 4.0×10^{-7})
- Roof leak probably more likely

Battery acid containment systems

- ISSUE:
  - Overspending for battery containment systems
- Code:
  - various
- Implications:
  - Cost

Battery acid containment systems

- Reality check
  - Very very rare event that a cell would break open installed on the rack
  - The vast majority of acid spills caused by cells being dropped during installation/de-installation
    - Rack containment provides no protection for this type of event

Battery acid containment systems

- Common sense solutions
  - Follow guidance IEEE Std. 1578
    - IEEE Recommended Practice for Stationary Battery Electrolyte Spill Containment and Management
  - Consider whole room containment with neutralization kit

Battery ventilation systems/hydrogen detection systems

- ISSUE:
  - Under/over designing for battery ventilation
- Code:
  - various
- Implications:
  - Safety/Cost

Battery Ventilation

- ALL batteries generate hydrogen
  - Hydrogen can cause an explosion if ventilation is completely ignored
- Hydrogen generation is not a major issue
  - Very few incidents
  - Hydrogen generation is typically very low
- IEEE 1635 will provide much better guidance than is currently available
- Standard code requirement is excessive
  - 1 CFM per square foot

Battery Ventilation (continued)

- Hydrogen Sensors are NOT recommended
  - IEEE 1635
  - Difficult to field calibrate
    - Many instruments do no have field calibration procedures
  - Limited life span
  - Nearly all units installed in battery rooms do not get calibrated and many are not in ideal locations
  - Can be FALSE sense of security
- Recommend alarm ventilation

Summary

- Codes are intended to maximize safety
  - Incorrect interpretation can reduce safety and maximize cost
- Never use the ₩ symbol because of battery electrolyte
- Sprinklers are a reliable choice in a battery room
  - Suppression may not be necessary
- Do not go overboard with battery containment
- Design for realistic hydrogen generation
  - Do not rely on hydrogen detectors