PHMSA Pipeline Safety Research and Development Forum

Current challenges – from a hazard analysis point of view

Filippo Gavelli, Ph.D., PE

November 16-17, 2016

GEXCON

Current hazard analysis challenges

- Regulatory environment
- Physics of releases
- Hazard analysis methodology

GEXCON

Regulatory Environment

- Prescriptive regulations:
  - No harm to public outside boundaries from credible worst-case event (WCE)

- Challenges:
  - What is the WCE?
    - Someone always seems to disagree…
    - Potential conflict, siting vs. other studies
  - How does US WCE correlate with other countries' or risk-based regulations?
    - Vapor barriers, anywhere but here?

GEXCON

Physics of releases

- Flashing and jetting:
  - Complex physics (2-phase flow, variable system conditions) currently approximated using very conservative assumptions
  - Uncertainties in source term propagate all the way through the analysis

Hazard analysis methodology

- Flammable vapor dispersion:
  - MEP to determine model acceptance
    - 2D (PHAST, DEGADIS) and 3D (FLACS) approved and used
    - No flashing and jetting in database
  - Reasonably consistent methodology
    - User dependency could still be reduced…

Hazard analysis methodology (2)

- Thermal radiation:
  - No MEP to determine model acceptance
    - Primitive model (LNGFIRE3) required for pool fires
    - No model required for jet fires
      - 2D (PHAST) and sometimes 3D (FLACS) used
  - Reasonably consistent methodology
    - User dependency would increase with use of more detailed/complex models

Hazard analysis methodology (3)

- Vapor cloud explosions:
  - No MEP to determine model acceptance
    - 2D (BST, TNO) and 3D (FLACS) models used
  - Inconsistent methodology
    - 2D and 3D models have widely different degrees of sophistication
    - User inputs too vague in some cases, with no guidelines
    - No minimum expectations defined
    - Too many parameters and approaches available

Hazard analysis methodology (4)

- Other hazards:
  - Toxic dispersion
    - Similar to flammable dispersion
    - Lack of clarity on combined effects
  - BLEVE
    - Rudimentary modeling tools
    - Lack of clarity on WCE and endpoints
      - Projectiles?

Conclusions

- From an international hazard analysis company's point of view, the major current issues are:
  - US regulations do not align well with much of the rest of the world
  - Some of the physics are not currently modeled accurately (the problem is magnified by the prescriptive regulatory environment)
  - Prescriptive regulations need to have clear requirements across the board but that is missing for several hazards

GEXCON