

DOE Enabled Code Development – NFPA 55

Hydrogen and Fuel Cell Technical Advisory Committee

Washington DC

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Martin Gresho - Background

- Code Developer
 - Chair of NFPA 2 – Hydrogen Technologies
 - Member of NFPA 55 – Compressed Gas
 - Member of NFPA 400 – Hazardous Materials
 - Participant in International Code Council development hearings – IBC, IFC model codes
- Fire Marshal at Sandia CA (15 years) – Code Enforcer
- Licensed Fire Protection Engineer

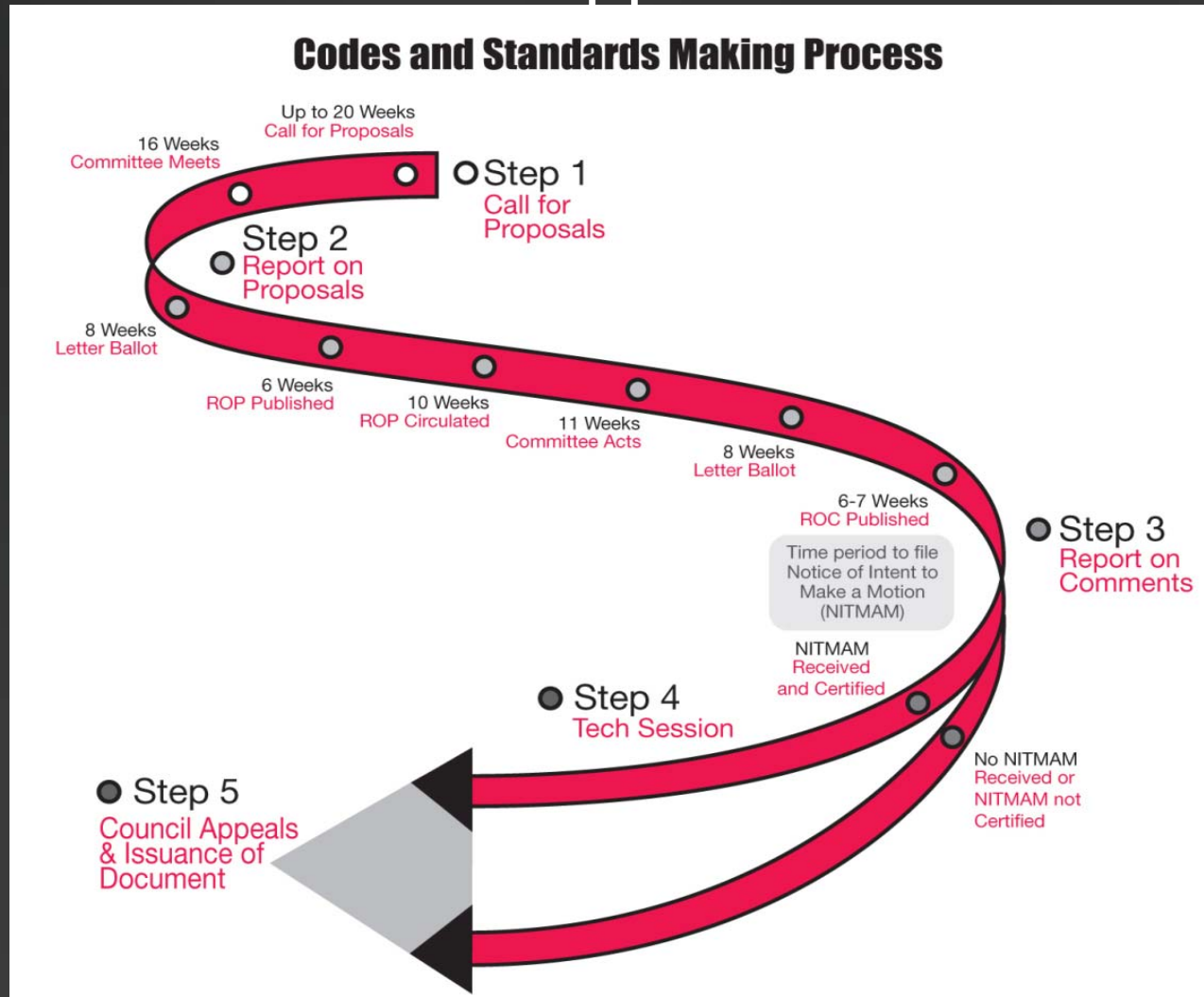
DOE Enabled Code Development

3 Topics

- Research Informed Code Development
 - Synopsis of Traditional Methods
 - Research based.
- NFPA 55 Separation Distances
 - DOE R&D Lab assisted
 - Success Story
- NFPA 2 – Hydrogen Technologies
 - Status in Code Cycle
 - Predicted Publication Date

NFPA C&S Development Process

● ANSI Approved



Building & Fire Code Development

Basic Methods

- Built Environment Codes are Prescriptive (BEST)
 - Example: Locate bulk GH2 storage 50 ft. from sidewalks
 - Easy to enforce
 - Easy to comply
 - Hard to codify
- Alternative Approach – Goal Oriented Analysis
 - Example: Perform analysis to determine the acceptable separation distance.
 - Need mutual agreement to proceed (Code Official)
 - Agree on: Acceptance criteria, scenarios.
 - Perform analysis
 - Review analysis (3rd party consultant)
 - Accept results and ID new
 - Easy to codify – hard and expensive to use

Code Development

Why Continued Support is Needed

- Experience Based Development
 - Relies on experience of members
 - Precedence
 - Relatively easy and fast
- Work well but ONLY when there is experience (loss history)
- Lacking scientific research to PREDICT results new code is likely to be either:
 - Prescriptive – conservative OR
 - Alternative Analysis based

Research Informed Code Development Time Scale

- Traditional Experienced Based Method
 - Codification start date - ~ **6 months** prior to Proposal deadline
- Research Informed Method
 - Codification starts after research results published and peer reviewed.
 - Codification start date - ~ **2 years** prior to Proposal deadline

Research Informed Code Development

- Research results should be **targeted** to a specific **code or standard**
- Codification effort should be **timed** to a specific **cycle**
- TC needs assistance. Research needs to be **supported** throughout the code development process.

Separation Distances - Background

NFPA 55 lists separation distances between bulk GH2 storage and various exposures since 1950

- ~2003 Concern voiced about the basis for the distances
- ~2003 – 2007 Sandia developed mathematical models of GH2 releases
- Model validated with physical testing - critical
- Results presented to NFPA 55

Joint Task Group Empowered by TC

- Full Technical Committees (~30 members each) met and Established Task Groups [NFPA 2 11/06; NFPA 55 01/07]
- 13 TC members from NFPA 55 and/or 2 + 2 SNL R&D
- Task group deliberations
 - 4 in-person multiple day meetings
 - 12 + telecons
- Sandia researchers provided support for task group
 - Iterations on mathematical model
 - Development of SAND report on risk informed method – part of documented basis.
- Sandia researchers did not provide code text.
- Task group product = proposal to NFPA 55

Separation Distances

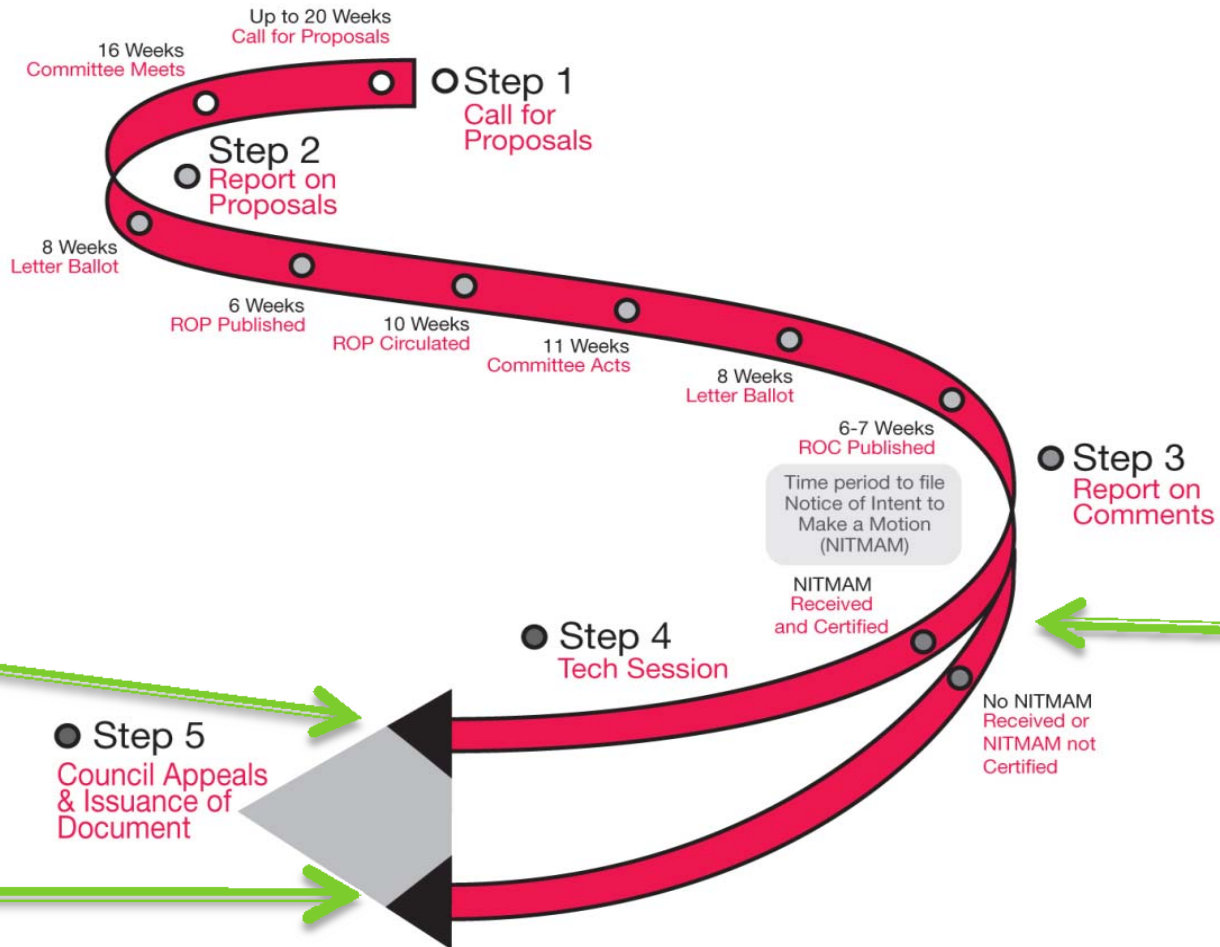
- Result – code proposal with defensible basis **accepted** by NFPA 55 TC and published in 2010 edition – now available
- DOE Support summary
 - Initial research
 - Physical Testing
 - Mathematical model
 - Risk Expertise
 - Technical Support through public review
 - DOE DID NOT WRITE THE CODE
- This change was widely supported but would NOT have been possible w/o DOE support!! ENABLING
- Thank You DOE!!

NFPA 2 – Hydrogen Technologies Status

- New code with all hydrogen requirements
- Consolidates requirements from multiple NFPA codes and standards
- Upon issuance will simplify construction permits and regulation of hydrogen in *built environment*
- DOE provided seed funding
- 3 pre ROP meetings, ROP, ROC - all complete *4 year process*

NFPA 2 Status

Codes and Standards Making Process



Conclusion

- NFPA 55 was a success story – supported by many – enabled by DOE
- The process to codify research results can serve as a model
 - Scientific results
 - Expert judgment
 - Codification plan
- Code development **can** be strengthened by research
 - Research is one project
 - Codification is another – special skill
- Code development process is regimented and not fast
- Combining research results with codes = better public safety