National Perspective on Advancing LNG Safety

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What Will be Covered

1. Who We Are & Who We Represent
2. Drivers Behind Regulatory Change
3. Why Performance Based Regulations
4. Development of Regulatory Framework
5. Technical Challenges
6. Role of Consensus Standards

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Who We Are

API represents all segments of America's natural gas and oil industry, which supports more than 11 million U.S. jobs and is backed by a growing grassroots movement of millions of Americans. Our nearly 600 members produce, process and distribute the majority of the nation's energy, and participate in API Energy Excellence®, which is accelerating environmental and safety progress by fostering new technologies and transparent reporting. API was formed in 1919 as a standards-setting organization and has developed more than 800 standards to enhance operational and environmental safety, efficiency and sustainability.

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Who we represent

In Operation

- Cheniere
- Sempra
- Venture Global

Proposed Projects

- NextDecade
- Tellurian

Global Footprint

- COP
- XOM
- Shell
- BP

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Drivers Behind Regulatory Change

- 40-Year-old regulation
- More prescriptive versus performance based
- Focus on smaller peak shaving facilities
- Not fit for purpose for large scale export operations
- Other proven approaches, e.g. PSM, RAGAGEP
- Advances in technology and engineering practices
- Keeping up with emerging technical challenges
- PIPES Act 2020 Section 110

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Why Performance Based Regulations

- Support LNG facilities of varying sizes and operations and shifts from a prescriptive approach that can impact the prioritization of critical resources to risk-informed scalable & flexible integrity management approach

- Risk-based/process safety management approach provides fit for purpose alternatives, for example
  - Equipment inspection,
  - Corrosion control,
  - Qualification and training

- It will be beneficial to the regulator and the industry to leverage past experience including OSHA's PSM program

- The risk-based application of recognized and generally acceptable good engineering practice (RAGAGEP) benefits both the regulator and the industry

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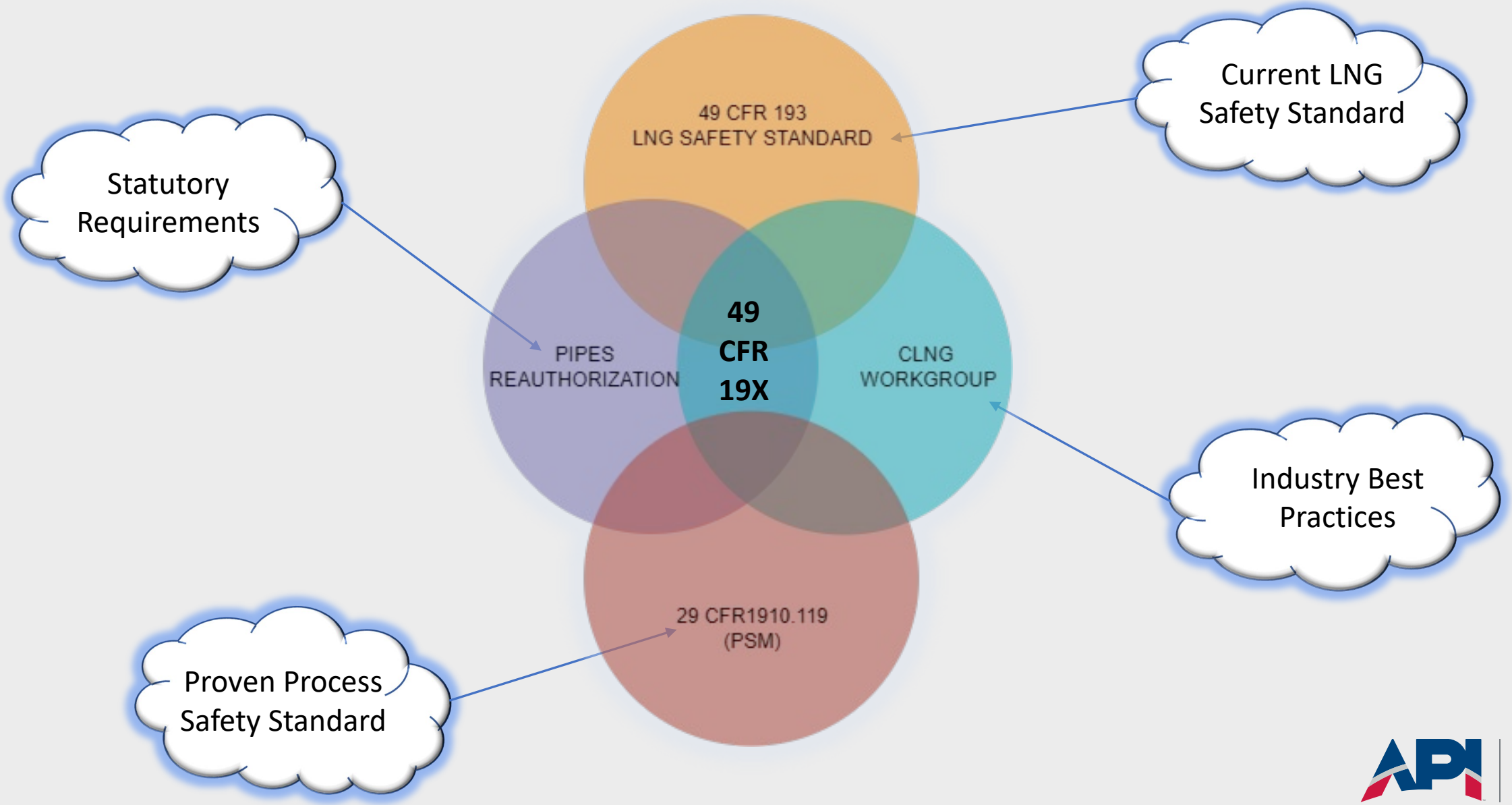
Development of LNG Regulatory Framework



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49 CFR 19X - LIQUEFIED NATURAL GAS FACILITIES: LARGE SCALE FACILITIES FEDERAL SAFETY

- Proposed Code Development
- Pipes requirements:
  - Review the minimum operating and maintenance standards required under section 60103(d) of title 49, United States Code.
  - Update the standards applicable to large-scale liquefied natural gas facilities (other than peak shaving facilities) to provide for a risk-based regulatory approach for such facilities.
- Development proposes referencing 49 CFR 193 in “19X” for areas not included in PIPES requirements.

Contents

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Technical Challenges -- Drivers

- Market drive to increase worldwide supply of LNG for environmental and commercial needs
- Wave of new large scale liquefaction facilities in US
- Departure from ‘traditional’ peaking facilities in size & scale requires high reliability and tightly scheduled maintenance
- Development of Safety Management Systems and their influence on regulations
- Continued development of technology and reliability influenced maintenance management

Technical Challenges – Alignment

- Existing regulations need to be updated based on drivers
- Overlapping oversight by both PHMSA and FERC
- Stakeholder alignment on application of Regulations, Consensus Standards, OEM Practices, Industry Best Practices, and RAGAGEP
- Fortunately, guides are available from industries that are ahead of us – Chemical Industry (OSHA PSM) & Aviation Industry
- Careful guided progress will allow all stakeholders to focus on what moves the needle for LNG safety

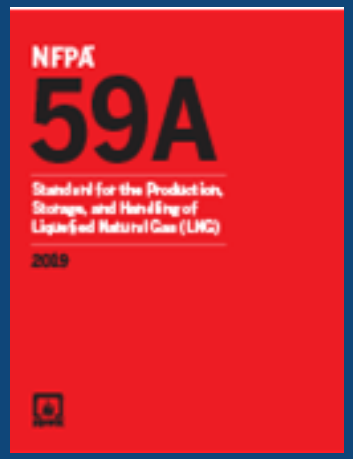
Technical Challenges – Inspection & Maintenance

- Large scale LNG production requires very high percentages of up time; maintenance outages are tightly scheduled and may not occur seasonally
- Reliability Maintenance Systems provide guidance for optimized maintenance strategies from preventative/calendar based, through predictive based, and into real time condition based monitoring
- Calendar based inspection requirements are often difficult to align with scheduled outages and may or may not provide marginal benefits to safety – remember that the reliability curve is double ended
- Several areas to look at include Control Systems, Relief Valves, Turbines & Motors

Technical Challenges – People & Processes

- Staffing levels at large scale liquefaction facilities is much larger than at traditional peaking facilities and some work is also performed by contractors
- The scale of coordination necessitates good coordination across all personnel to ensure work is done safely
- Processes for Employee & Contractor Participation, Process Hazard Analysis, Control of Work, and Management of Change must be fit for purpose
- Operating and Maintenance Plans and Qualification of personnel must also be fit for particular facilities – understanding differences across facilities may present challenges for regulatory stakeholders

Role of Consensus Standards



- Built around industry leading practices
- Responsive to emerging industry challenges
- Provide for fit for purpose combination of prescriptive and risk based approaches
- Standards complement rulemaking through IBR or going beyond regulatory requirements
- NFPA 59A *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)* (2019 edition) foundational
- Other important API standards
- National Center of Excellence for Liquefied Natural Gas Safety

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API Standard 620

Design and Construction of Large, Welded, Low-Pressure Storage Tanks

- Outlines the design and construction of large field-assembled, welded, low pressure carbon steel above ground storage tanks (including flat-bottom tanks) that have a single vertical axis of revolution, that contain petroleum intermediates (gases or vapors) and finished products, as well as other liquid products commonly handled and stored by the various branches of the petroleum and natural gas industry

- Standard is applicable to tanks that (a) hold or store liquids with gases or vapors above their surface or (b) hold or store gases or vapors alone

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API Standard 625

Tank Systems for Refrigerated Liquified Gas Storage

Covers low pressure, aboveground, vertical, and cylindrical tank systems storing liquefied gases requiring refrigeration

- Provides general requirements on responsibilities, selection of storage concept, performance criteria, quality assurance, insulation, and commissioning of tank systems.
    - storage capacity of >800 cubic meters

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API Standard 521

Pressure-Relieving and Depressuring Systems

- Used primarily in oil refineries
- Also applicable to petrochemical facilities, gas plants, LNG facilities, and oil and gas production facilities
- Standard is designed to aid in the selection of the system that is most appropriate for the risks and circumstances involved in installations. This standard specifies requirements and gives guidelines for the following:
    - examining the principal causes of overpressure;
    - determining individual relieving rates;
    - selecting and designing disposal systems, including such component parts as piping, vessels, flares, and vent stacks.

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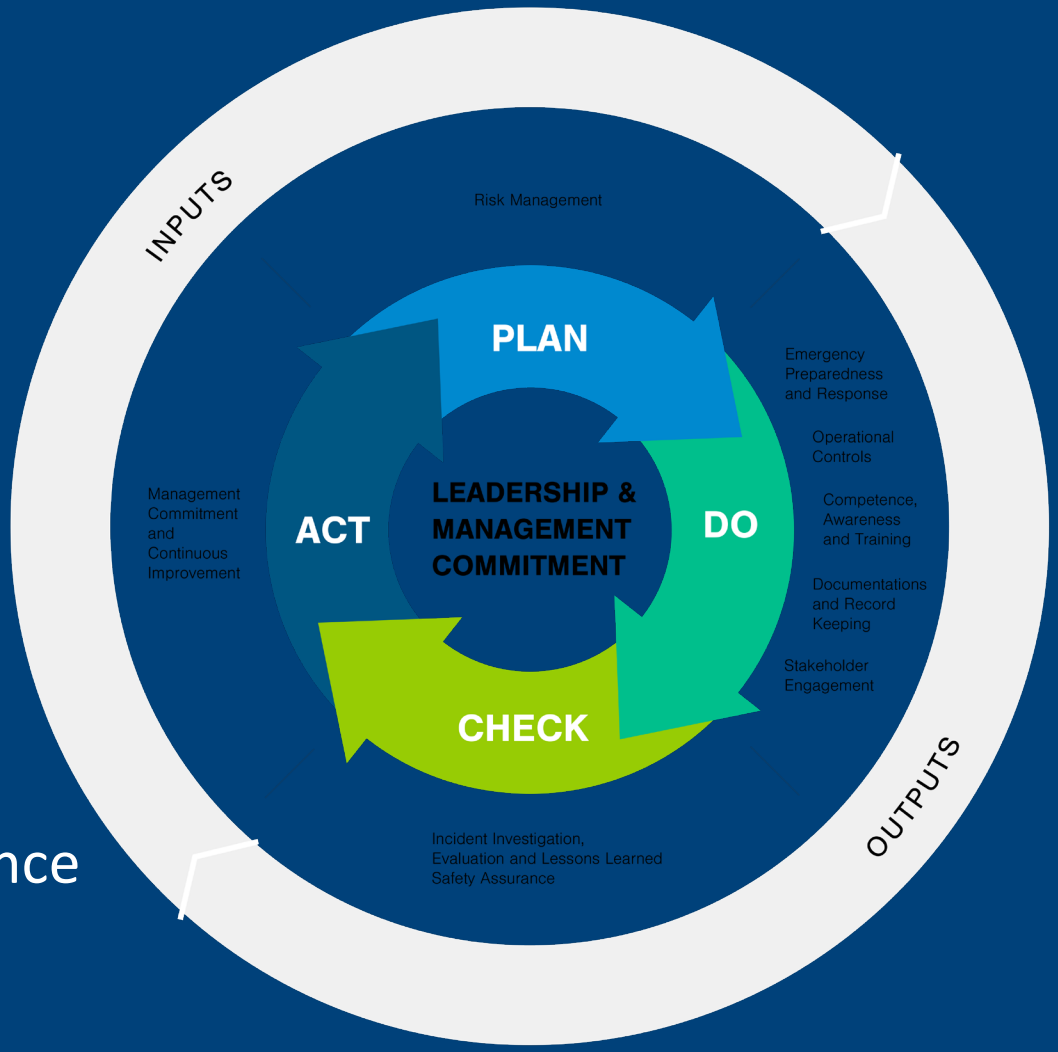
API RP 1173

Pipeline Safety Management Systems (SMS)

- Effectively manage risks faced by the organization
- Communicate with stakeholders
- Ensure the effective operation of key processes
- Drive continual improvement of performance



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LNG Center of Excellence

- The LNG Center of Excellence can be leveraged to assist with challenges as LNG export moves forward
- The Center can provide a nexus for stakeholders including regulators, industry, standards organizations, academia
- The Center can assist with application and development of Standards & Best Practices to enhance Safety
- The Center can leverage existing expertise across related industries to expedite Safety System Development
- The Center can provide training and education opportunities across stakeholder groups

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Thank You

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