August 23, 2019

U.S. Department of Energy
1000 Independence Ave. SW, Mailstop OE-20
Washington, DC 20585
Attn: Office of Electricity, Guidance for Enhancing Oil and Natural Gas Resilience.

SUBJECT: Office of Electricity Delivery (OE), U.S. Department of Energy (DOE), Notice of Request for Information, Codes, Standards, Specifications, and Other Guidance for Enhancing the Resilience of Oil and Natural Gas Infrastructure Systems Against Severe Weather Events, Document Number 2019-14548.

The American Petroleum Institute, American Gas Association, American Fuel & Petrochemical Manufacturers, the Interstate Natural Gas Association of America, and the American Public Gas Association (collectively, "Commenters[1]") offer the following comments on the Department of Energy's Request for Information (RFI), "Codes, Standards, Specifications, and Other Guidance for Enhancing the Resilience of Oil and Natural Gas Infrastructure Systems Against Severe Weather Events." The Commenters represent respective members involved in all aspects of the oil and natural gas industry, including producers, refiners, suppliers, distributors, pipeline operators and marine transporters, as well as service and supply companies that support all segments of the industry. Commenter members are deeply committed to safe, secure, resilient, and environmentally responsible operations which reduce potential risk to the public, as well as employees, contractors, and operations.

Safety is the core value of the industry and we continue to work with stakeholders, including DOE, to ensure we are operating in a manner that protects our workers and communities, promotes safe practices, and improves our ability to deliver critical products around the nation to meet consumer demand.

Resilience in the Natural Gas and Oil Industries

Commenters are concerned that the vision of resilience laid out in DOE's RFI implies that resilience is a standalone concept, separate from other processes and programs. The natural gas and oil industries do not approach resilience this way. Instead, we view resilience as a product of many interconnected efforts to operate safely and efficiently, throughout any circumstances, to the best of an operator's ability. For decades, the natural gas and oil industries have built a vast and reliable infrastructure that has withstood many disasters. Simultaneously, our industries built a culture where every employee feels a responsibility for the safety of his or her co-workers, their customers and communities. Our companies and our energy production and delivery systems have been tested in recent years by extreme weather, and we have succeeded.

[1] API, AGA, and INGAA are also submitting comments through the Natural Gas Council

The competitive nature of natural gas and oil markets drives innovation in the industry, which is focused on constant improvement and continuously adds to the resilience of the system. The industry is operating twenty-four hours per day, 365 days per year, producing more than 4 billion barrels[2] (bb/d) of U.S. crude oil and almost 33 Mcf[3] of natural gas in 2018. The operational efficiency and technological innovation that has made the U.S. the world's leading producer of natural gas and oil has also developed a robust infrastructure domestically that provides system resilience through a diversity of supply, modes and routes of transportation, and storage and delivery options.

In general, operational capabilities minimize the possibility that any disruption has more than a localized impact. For example, the following list demonstrates how resilience is designed into the operations and built into the course of normal business practices for natural gas pipelines:

- An extensive network of interconnected pipelines offers multiple pathways to reroute deliveries;
- Parallel pipelines increase pipeline capacity and make it possible to shut off one while keeping others in service;
- Geographically dispersed production and storage ensure supply flexibility;
- A physical property of natural gas known as compressibility allows for additional volume of gas molecules to be packed into the pipeline.
    - This excess volume of compressed gas, known as "line pack," provides a flexible buffer of stored energy to be naturally available in the pipeline system.
    - The purpose of this buffer is to ensure the capability of the pipeline operations to accommodate changing conditions throughout the day.
    - Though line pack neither creates incremental capacity (the pipe size itself does not change) nor is it a substitute for appropriate transportation contracts, it often can be used to help minimize the impact of short-term supply disruption;
- The combination of physical characteristics of natural gas and the interconnected pipeline system allows operators to control and redirect the flow around pipeline outages (analogous to driving a 'detour').

Commenters take issue with the statement, "Although these industries and agencies have been working for several years to develop a culture of resilience, at present there is no settled body of expert knowledge about requirements and practices for enhancing the resilience of these systems." The statement ignores the decades of experience and expertise that exist throughout the industry and the performance of the industry in the face of events such as Hurricanes Harvey and Irma, which directly impacted both operations and the corporate headquarters of many large oil and natural gas companies. Despite record flooding, natural gas service was never disrupted

[2] https://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_m.htm
[3] https://www.eia.gov/dnav/ng/hist/n9050us2A.htm

to customers who could receive it and supplies of liquid products were maintained to allow Florida residents to both evacuate and return as Irma passed through the state.

Resilience through Regulation

Throughout the oil and natural gas value chains, the industries utilize a broad portfolio of tools to protect facilities from physical and cybersecurity threats. Recognizing industry's commitment to security and the resilience and redundancy built into pipeline systems, the federal government has opted to partner with the pipeline industry on cyber and physical security instead of requiring mandatory and prescriptive regulations. This partnership is notably reflected by our industries' commitment to updating and implementing the TSA Pipeline Security Guidelines (Guidelines), which provide a risk-based approach to protecting pipeline infrastructure from cyber and physical security threats. The Guidelines cover an expansive range of operations, regions, and commodities, including natural gas and hazardous liquid transmission pipeline systems, natural gas distribution pipeline systems, and liquefied natural gas (LNG) facilities. Additionally, resilience in the various segments of the oil and natural gas value chains is fostered by operation and/or location specific security standards, including but not limited to Department of Homeland Security (DHS) Chemical Facility Anti-Terrorism Standard's (CFATS) 6 CFR Part 27-impacting oil and natural gas storage, refining, processing and storage; the United States Coast Guard's 33 CFR Part 105 -– Maritime Transportation Security Act (MTSA) for coastal facilities; and State Public Utility Commissions for intra-state operations, such as natural gas utilities.

While industry's primary goal is to avoid all incidents and to build integrity, process safety, operational programs, and culture to prevent any of these events from occurring, sometimes incidents do occur. Historically, industry has learned through the sharing of lessons learned from incidents, as well as from regulations following significant incidents. The Oil Pollution Act of 1990 (OPA '90) brought sweeping changes to the oil industry with the aim of preventing oil spills and mitigating the impacts if one were to occur. OPA '90 requires operators of liquid pipelines, vessels carrying oil, refineries, and offshore platforms to develop and submit oil spill response plans that outline how they will manage a spill, the resources they can bring to bear, and the process for recovery. Exercise requirements are a significant example of how companies have built response, recovery and resilience into their operations.

Exercises and drills are also required on a predetermined basis and oil companies must use the U.S. Coast Guard's National Preparedness for Response Exercise Program guidelines, which require the use the Incident Command System (ICS). ICS is a federal framework for incident response that, when used, ensures companies have the roles and responsibilities for incident response predetermined, and structured in a manner which can easily integrate with the regulatory agency, if an incident occurs. In addition to this, many preparedness initiatives were created in the 2010s, with source control being a primary concern. Often, companies will include regulatory agencies and local emergency responders in their exercises to test learnings from the past few decades to ensure they are familiar with response plans and their roles within the response. All these activities ensure that a facility or operation has the tools and plans in place to respond and recover if an incident occurs, therefore building resilience into operations. Further , operators often utilize business continuity plans to ensure their supply chain remains robust in the event of a spill or natural disaster. As many companies are producing and moving both oil and natural gas, this culture of preparedness is not specific to oil alone.

Pipelines:

Pipeline safety regulations and consensus standards provide a "defense in depth" approach, ensuring the safety of the public while also enabling pipeline infrastructure to deliver reliably and resiliently. Pipeline safety standards have historically been developed by the American Society of Mechanical Engineers (ASME), the American Petroleum Institute (API) and the National Association of Corrosion Engineers (NACE). The U.S. Department of Transportation (USDOT), Pipelines and Hazardous Materials Safety Administration (PHMSA), Office of Pipeline Safety (OPS) is responsible for promulgating pipeline safety. PHMSA's regulations incorporate the vast majority of the consensus technical standards used by pipeline operators to ensure safe, reliable, and resilient operations. Therefore, PHMSA's regulatory code represents a comprehensive body of expert knowledge about requirements and practices for ensuring resilient pipeline infrastructure.

Tables 1 and 2 below summarize the current PHMSA regulations that promote pipeline safety, reliability, and resilience.

Table 1

Gas Pipeline Regulations (49 C.F.R. Part 192)
Subpart A – General
Subpart B – Materials
Subpart C – Pipe Design
Subpart D – Design of Pipeline Components *Includes requirements for the installation of overpressure protection devices*
Subpart E – Welding
Subpart F – Joining of Materials
Subpart G – Construction Requirements
Subpart H – Customer Meters, Service Regulators and Service Lines
Subpart I – Corrosion Control
Subpart J – Pressure Testing
Subpart K – Uprating
Subpart L – Operations *Includes requirements for damage prevention, public awareness, emergency preparedness and response, and control room management*
Subpart M – Maintenance *Includes requirements for patrolling, leak surveys, and pipeline repairs*
Subpart N – Qualification of Personnel
Subpart O – Gas Transmission Integrity Management *Includes requirements for risk assessments, pipeline inspection, and evaluation of pipeline condition*
Subpart P - Distribution Integrity Management

Table 2

Hazardous Liquid Pipeline Regulations (49 C.F.R. Part 195)
Subpart A – General
Subpart B – Reporting
Subpart C – Pipe Design *Includes requirements for design and selection of pipeline materials and components*
Subpart D – Construction
Subpart E – Pressure Testing
Subpart F – Operations and Maintenance *Includes requirements for damage prevention, public awareness, emergency preparedness and response, control room management, and integrity management*
Subpart G – Qualification of Personnel
Subpart H – Corrosion Control

Figure 1 summarizes how the pipeline safety practices provided by PHMSA regulations and consensus standards address threats to pipeline safety, reliability, and resilience through a combination of both preventative and mitigative measures.

	Time-Dependent Threats *The threat level may grow over time if unchecked*			***Resident Threats*** *The threat is inherent but does not grow over time unless acted upon by pressure or external load*			***Time Independent Threats*** *The threat exists outside of the continuum of time*		
	External Corrosion	**Internal Corrosion**	**Stress Corrosion Cracking**	**Manufacturing Related**	**Construction/ Fabrication Related**	**Equipment Related**	**Excavation Damage**	**Incorrect Operations**	**Weather & Outside Forces**
Primary CAUSES	**Coating Degradation and Inadequate Cathodic Protection**	**Crude Constituents**	**Coating Degradation, Pipe Surface Condition, Environment, Stress & Fluctuations, Discharge Temperature**	**Long-Seam Defects, Pipe Defects**	**Girth Welds, Coupled Pipe, Wrinkle Bends, Branch Connections**	**Gaskets, Relief Valves/ Regulators**	**1st, 2nd and 3rd Party Caused Damage**	**Human Error, Inadequate Training, Failure to Follow Procedures**	**Weather-Related Events, Ground Movement**
Primary PREVENTION	Cathodic Protection	Quality Monitoring	Cathodic Protection	Pipe Specification	Construction Practices	Preventative Maintenance	Excavation Observation and Patrolling	Operating Procedures	Continuous or Event-Based Surveillance
PRACTICES	Annual & Close Interval Surveys	Site-Specific Plans	Field Inspections	Inspection During Manufacturing	Inspection During Construction	Inspection During Maintenance	Use of One Call System	Training & Development	
MITIGATION PRACTICES	In-line Inspection	Operational Pigging	Pressure Testing	Mill Pressure Testing	Pressure Testing	Patrolling	Locating & Marking	Operator Qualification	Emergency Preparedness
INCLUDING ASSESSMENT TECHNOLOGY	Direct Assessment	In-Line Inspection	Direct Assessment	Pressure Testing	Patrolling	Monitoring Pressure & External Loads	Excavation Monitoring	Audits	Slope Monitoring & Stabilization
	Pressure Testing	Direct Assessment	Coating Surveys (DCVG and ACVG)	Monitoring Pressure & External Loads	Monitoring Pressure & External Loads		Public Awareness & Engagement		
	Coating Surveys (DCVG and ACVG)	Pressure Test	In-line Inspection	In-line Inspection	In-line Inspection				

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Figure 1 – Prevention, Assessment and Mitigation Practices for Gas Transmission Pipeline Systems

Refineries:

There is a plethora of Federal and state environmental and safety laws and regulations that contribute to the resiliency of a refining site such as the Resource Conservation and Recovery Act, the Clean Water Act, OPA '90, the Occupational Safety and Health Administration, etc. This panoply of laws and regulations require resilient-like controls such as secondary containment, spill response plans, waste minimization and recovery. Some examples of regulations in the refining industry that are geared towards safety and personnel security are listed below.

General Industry
https://www.osha.gov/laws-regs/regulations/standardnumber/1910

- 1910 Subpart D - Walking-Working Surfaces
- 1910 Subpart E - Exit Routes and Emergency Planning
- 1910.95 - Occupational noise exposure.
- 1910.119 - Process safety management of highly hazardous chemicals.
- 1910.133 - Eye and face protection.
- 1910.134 - Respiratory Protection.
- 1910.137 - Electrical Protective Equipment.
- 1910.138 - Hand Protection.
- 1910.140 - Personal fall protection systems.
- 1910.146 - Permit-required confined spaces
- 1910.178 - Powered industrial trucks.
- 1910.179 - Overhead and gantry cranes.
- 1910.254 - Arc welding and cutting.
- 1910.1001 - Asbestos.
- 1910.1025 - Lead.
- 1910.1026 - Chromium (VI)
- 1910.1028 - Benzene.
- 1910.1053 - Respirable crystalline silica.
- 1910.1200 - Hazard Communication.

The following regulations are specific to construction activities:
https://www.osha.gov/laws-regs/regulations/standardnumber/1926

- 1926.20 - General safety and health provisions.
- 1926.21 - Safety training and education.
- 1926.22 - Recording and reporting of injuries.
- 1926.23 - First aid and medical attention.
- 1926.24 - Fire protection and prevention.
- 1926.25 - Housekeeping.
- 1926.28 - Personal protective equipment.

Resilience through Industry Standards

API:

API was formed in 1919 as a standards-setting organization and is the global leader in convening subject matter experts across segments to establish, maintain, and distribute consensus standards for the oil and gas industries. In its first 100 years, API has developed more than 700 standards to enhance operational safety, environmental protection and sustainability across the industry, especially through these standards being adopted globally. API standards are developed under API's American National Standards Institute accredited process, ensuring that the API standards are recognized not only for their technical rigor but also their third-party accreditation which facilitates acceptance by state, federal, and increasingly international regulators.

Below is a sampling of API consensus standards that contribute to safe and secure operations across the oil and natural gas value chains and which create resilience in the system.

General:

- ANSI/API Standard 780, Security Risk Assessment Methodology for the Petroleum and Petrochemical Industries
- API RP 781, Facility Security Plan Methodology for the Oil and Natural Gas Industries

Upstream:

- RP T-2, 2nd Ed., 2001, Qualification Programs for Offshore Production Personnel Who Work with Safety Devices
- RP T-6, 1st Ed., 2002, Recommended Practice for Training and Qualification of Personnel in Well Control Equipment and Techniques for Wireline Operations on Offshore Locations
- RP T-7, 2nd Ed., 1995, Training of Personnel in Rescue of Person in Water
- RP 2D, 7th Ed., 2014, Operation and Maintenance of Offshore Cranes
- RP 5L1, 7th Ed., 2009, Recommended Practice for Railroad Transportation of Line Pipe
- RP 5LW, 3rd Ed., 2009, Recommended Practice for Transportation of Line Pipe on Barges and Marine Vessels
- RP 7HU1, 1st Ed., 2009, Safe Use of 2-Inch Hammer Unions for Oilfield Applications
- RP 7L, 1st Ed., 1995, Inspection, Maintenance, Repair, and Remanufacture of Drilling Equipment
- RP 8B, 8th Ed., 2014, Inspection, Maintenance, Repair, and Remanufacture of Hoisting Equipment
- RP 9B, 13th Ed., 2011, Application, Care, and Use of Wire Rope for Oil Field Service
- RP 11ER, 3rd Ed., 2009, Recommended Practice for Guarding of Pumping Units
- RP 14B, 5th Ed., 2005, Design, Installation, Repair and Operation of Subsurface Safety Valve Systems
- RP 14G, 4th Ed., 2007, Recommended Practice for Fire Prevention and Control on OpenType Offshore Production Platforms

- RP 14J, 2nd Ed., 2001, Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities
- Spec 16C, 2nd Ed., 2015, Choke and Kill Systems
- Spec 16D, 3rd Ed. 2018, Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment
- RP 17N, 2nd Ed., 2017, Recommended Practice for Subsea Production System Reliability and Technical Risk Management
- RP 17O, 2nd Ed., 2014, Recommended Practice for High Integrity Pressure Protection Systems (HIPPS)
- RP 49, 2nd Ed., 2001, Recommended Practice for Drilling and Well Service Operations Involving Hydrogen Sulfide
- Std 53, 5th Ed., 2018, Well Control Equipment Systems for Drilling Wells
- RP 54, 4th Ed., 2019, Recommended Practice for Occupational Safety for Oil and Gas Well Drilling and Servicing Operations
- RP 55, 2nd Ed., 1995, Conducting Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide
- RP 59, 2nd Ed., 2006, Recommended Practice for Well Control Operations
- Std 64, 3rd Ed., 2017, Diverter Systems Equipment and Operations
- RP 65-1, 2nd Ed., 2018, Cementing Shallow Water Flow Zones in Deep Water Wells
- RP 65-2, 2nd Ed., 2010, Isolating Potential Flow Zones During Well Construction
- RP 67, 2nd Ed., 2007, Recommended Practice for Oilfield Explosives Safety
- RP 68, 1st Ed. 1998, Well Servicing and Workover Operations Involving Hydrogen Sulfide
- RP 70, 1st Ed., 2003, Security for Offshore oil and Natural Gas Operations
- RP 70I, 1st Ed., 2004, Security for Worldwide Offshore Oil and Natural Gas Operations
- RP 74, 1st Ed., 2001, Recommended Practice for Occupational Safety for Onshore Oil and Gas Production Operation
- RP 75, Recommended Practice for Development of a Safety and Environmental Management Program for Offshore Operations and Facilities
- RP 76, 2nd Ed., 2007, Contractor Safety Management for Oil and Gas Drilling and Production Operations
- RP 77, 1st Ed., 2018, Risk-based Approach for Managing Hydrocarbon Vapor Exposure during Tank Gauging, Sampling, and Maintenance of Onshore Production Facilities
- RP 96, 1st Ed., 2013, Deepwater Well Design and Construction
- RP 98, 1st Ed., 2013, Personal Protective Equipment Selection for Oil Spill Responders
- RP 99, 1st Ed., 2014, Flash Fire Risk Assessment

Midstream:

- API Standard 650 on Welded Steel Tanks for Oil Storage
- RP 1115, 2nd Ed., Nov 2018, Design and Operation of Solution-mined Salt Caverns Used for Liquid Hydrocarbon Storage

- RP 1130, 1st Ed., Sept 2007, Computational Pipeline Monitoring for Liquids
- RP 1133, 2nd Ed., Dec 2017, Managing Hydrotechnical Hazards for Pipelines Located Onshore or Within Coastal Areas
- RP 1160, 3rd Ed., Feb 2019, Managing System Integrity for Hazardous Liquid Pipelines
- RP 1161, 4th Ed., Feb 2019, Pipeline Operator Qualification (OQ)
- RP 1162, 2nd Ed., Dec 2010, Public Awareness Programs for Pipeline Operators
- Std 1164, 2nd Ed., June 2009, Pipeline SCADA Security
- RP 1165, 1st Ed., Jan 2007, Pipeline SCADA Displays
- TR 1166, 2nd Ed., Oct 2015, Excavation Monitoring and Observation for Damage Prevention
- RP 1167, 2nd Ed., June 2016, Pipeline SCADA Alarm Management
- RP 1168, 2nd Ed., Feb 2015, Pipeline Control Room Management
- RP 1169, 1st Ed., July 2013, Basic Inspection Requirements—New Pipeline Construction
- RP 1170, 1st Ed., July 2015, Design and Operation of Solution-Mined Salt Caverns Used for Natural Gas Storage
- RP 1171, 1st Ed., Sept 2015, Functional Integrity of Natural Gas Storage in Depleted Hydrocarbon Reservoirs and Aquifer Reservoirs
- RP 1173, 1st Ed., July 2015, Pipeline Safety Management Systems
- RP 1174, 1st Ed., Dec 2015, Onshore Hazardous Liquid Pipeline Emergency Preparedness and Response
- RP 1175, 1st Ed., Dec 2015, Pipeline Leak Detection—Program Management
- RP 1177, 1st Ed., Nov 2017, Steel Pipeline Construction Quality Management Systems
- Bull 1178, 1st Ed., Integrity Data Management and Integration
- RP 2200, 5th Ed., Sept 2015, Repairing Hazardous Liquid Pipelines
- RP 3000, 1st Ed., Sept 2014, Classifying and Loading of Crude Oil into Rail Tank Cars

Downstream:

- API Recommended Practice 751, 4th Ed., May 2013, Safe Operation of Hydrofluoric Acid Alkylation Units
- API Recommended Practice 752, 3rd Ed., Dec 2009, Management of Hazards Associated with Location of Process Plant Permanent Buildings
- API Recommended Practice 753, 1st Ed., June 2007, Reaffirmed Jan 2012, Management of Hazards Associated with Location of Process Plant Portable Buildings
- ANSI/API Recommended Practice 754, 2nd Ed., April 2016, Process Safety Performance Indicators for The Refining and Petrochemical Industries, Second Edition
- ANSI/API Recommended Practice 755, 2nd Ed., May 2019, Fatigue Risk Management Systems for Personnel in The Refining and Petrochemical Industries
- API Recommended Practice 756, 1st Ed., Sept 2014, Management of Hazards Associated with Location of Process Plant Tents

In addition, as part of the industry’s ongoing commitment to continuous process safety improvements, API, in collaboration with industry partners, developed a Process Safety Site Assessment Program (PSSAP). This program primarily involves the assessment of a site’s process safety systems by independent, credible, third party teams of industry-qualified process safety expert assessors. In order to meet the requirements of the program, companies must conform to the following standards:

- Std 510 - Pressure Vessel Inspection Code: In-service Inspection, Rating, Repair, and Alteration
- Std 520 - Sizing, Selection, and Installation of Pressure-relieving Devices, Part I—Sizing & Selection
- Std 520 - Sizing, Selection, and Installation of Pressure-relieving Devices, Part II—Installation
- Std 521 – Pressure-relieving and Depressuring Systems
- Std 530 - Calculation of Heater-tube Thickness in Petroleum Refineries
- RP 538 – Industrial Fired Boilers for General Refinery and Petrochemical Service
- Std 560 – Fired Heaters for General Refinery Service
- RP 570 - Piping Inspection Code: In-service Inspection, Rating, Repair, and Alteration of Piping Systems
- RP 571 - Damage Mechanisms Affecting Fixed Equipment in the Refining Industry
- RP 572 – Inspection Practices for Pressure Vessels
- RP 573 – Inspection of Fired Boilers and Heaters
- RP 574 – Inspection Practices for Piping System Components
- RP 575 - Inspection Practices for Atmospheric and Low-Pressure Storage Tanks
- RP 576 - Inspection of Pressure Relieving Devices
- RP 577 – Welding Inspection and Metallurgy
- API 579-1/ASME FFS-1 - Fitness-For-Service
- RP 580 – Risk-based Inspection
- RP 581 – Risk-based Inspection Technology
- RP 582 - Welding Guidelines for the Chemical, Oil, and Gas Industries
- RP 584 – Integrity Operating Windows
- RP 585 - Pressure Equipment Integrity Incident Investigation
- Std 620 - Design and Construction of Large, Welded, Low-Pressure Storage Tanks
- Std 650 – Welded Tanks for Oil Storage
- RP 651 - Cathodic Protection of Aboveground Petroleum Storage Tanks
- RP 652 - Linings of Aboveground Petroleum Storage Tank Bottoms
- RP 653 - Tank Inspection, Repair, Alteration, and Reconstruction
- Std 660 - Shell-and-Tube Heat Exchangers
- Std 661 - Petroleum, Petrochemical, and Natural Gas Industries—Air-Cooled Heat Exchangers for General Refinery Service
- Std 663 - Hairpin-type Heat Exchangers
- Std 664 – Spiral Plat Heat Exchangers

- Publ. 932B - Design, Materials, Fabrication, Operation, and Inspection Guidelines for Corrosion Control in Hydroprocessing Reactor Effluent Air Cooler (REAC) Systems
- RP 934-A - Materials and Fabrication of 2 ¼Cr-1Mo, 2 ¼Cr-1Mo-¼V, 3Cr-1Mo, and 3Cr-1Mo-¼V Steel Heavy Wall Pressure Vessels for High-Temperature, High-Pressure Hydrogen Service
- RP 934-C - Materials and Fabrication of 1 ¼CR-½Mo Steel Heavy Wall Pressure Vessels for High Pressure Hydrogen Service Operating at or Below 825 °F (441 °C)
- RP 934-E - Recommended Practice for Materials and Fabrication of 1¼Cr-½ Mo Steel Pressure Vessels for Service Above 825 °F (440 °C)
- RP 934-G - Design, Fabrication, Operational Effects, Inspection, Assessment, and Repair of Coke Drums and Peripheral Components in Delayed Coking Units
- RP 939-C - Guidelines for Avoiding Sulfidation (Sulfidic) Corrosion Failures in Oil Refineries
- RP 939-E - Identification, Repair, and Mitigation of Cracking of Steel Equipment in Fuel Ethanol Service
- RP 941 - Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants
- RP 945 – Avoiding Environmental Cracking in Amine Units
- RP 970 – Corrosion Control Documents

Manual of Petroleum Measurement Standards (MPMS):

- Chapter 5.5, 2nd Ed., Aug 2005, Fidelity and Security of Flow Measurement Pulsed-Data Transmission Systems
- Chapter 21.1, 2nd Ed., Feb 2013, Flow Measurement Using Electronic Metering Systems—Electronic Gas Measurement
- Chapter 21.2, 1st Ed., June 1998, Flow Measurement Using Electronic Metering Systems—Electronic Liquid Volume Measurement Using Positive Displacement and Turbine Meters
- Chapter 17.2, 2nd Ed., May 1999, Marine Measurement—Measurement of Cargoes on Board Tank Vessels
- Chapter 17.10, 1st Ed., April 2014, Measurement of Cargoes on Board Marine Gas Carriers Part 1—Liquefied Natural Gas

ASME:

The American Society of Mechanical Engineers (ASME) is the professional society that initially led the development of the pipeline safety consensus standards. ASME published the first standard for pressure piping in 1935. Today, the ASME standard for natural gas transmission pipelines is ASME B31.8, and the ASME standard for liquid pipelines is ASME B31.4.

ASME B31.4 and B31.8 embody requirements for managing the life cycle of a pipeline system, including requirements for material specification, design, welding, construction, testing, operations, and maintenance. One of the unique aspects of the ASME pipeline standards is that they require every system to be pressure tested prior to being placed into service. Pipelines are one of the few engineered structures that undergo a pre-service test. The ASME pipeline standards also specify conservative design factors to ensure the system is resilient from inception.

Many aspects of the ASME pipeline standards were codified into a set of Minimum Federal Safety Standards for Transportation of Natural and Other Gas by Pipelines (49 C.F.R. Part 192) beginning in 1970. These regulations stipulated requirements for materials and design, welding, construction, overpressure protection, operations and maintenance. Federal regulations for hazardous liquid pipeline safety were first promulgated in 1981 and incorporated many of the elements from the gas pipeline regulations and ASME standards.

NACE:

NACE develops consensus standards for preventing and mitigating pipeline corrosion. For example, NACE developed a recommended practice for the control of external corrosion in buried and submerged piping in 1969. The recommended practice has been revised over the past thirty years and is today embodied in NACE SP0169. A similar standard was developed for internal corrosion, SP0106. Federal regulations for pipeline corrosion control were first promulgated in 1971.

Shared Leading Practices

The oil and natural gas industries have been operating in the U.S. for over a century. Throughout that time, the industry has successfully responded to operational challenges throughout the supply chain. Industry has built formalized repositories of knowledge and learnings from past events. Through exercises and real-world events, operators, response contractors, and regulators have continued to develop and share expertise regarding emergency response and business continuity. Thus, there is significant capacity within the industry focused on business continuity, which is a term that encompasses the concept of resilience. We would point the DOE OE to the study the Secretary of Energy commissioned by the National Petroleum Council (NPC) in 2014 to study oil and natural gas industry resilience, *Enhancing Emergency Preparedness for Natural Disasters*, as well as the 2016 addendum. The NPC emergency preparedness study provides advice on how the oil and natural gas industry and government at all levels can better prepare for and respond to defined emergencies. The report states:

> "Under normal conditions, the U.S. oil and natural gas supply chains—from production of crude oil and natural gas, through transportation and processing, to distribution to retail facilities and end users—are robust and highly resilient. This resiliency can be witnessed almost daily as companies involved in the production and distribution of fuels routinely make adjustments to their systems to compensate for both planned and unplanned temporary variations, including disruptions. These routine adjustments maintain a steady supply of fuel to consumers. A key source of this resiliency and robustness comes from diversity of supply sources and diversity of distribution channels, including the following:

- 2.1 million miles of natural gas utility distribution and service pipelines providing service in all 50 states
- 306,000 miles of wide-diameter, high-pressure interstate and intrastate natural gas pipelines
- 192,000 miles of crude oil and petroleum products (gasoline, diesel, jet fuel, natural gas liquids, etc.) pipelines 142 refineries nationwide 1,305 petroleum products terminals
- 8,000 independent marketers of gasoline, propane, diesel, and home heating oil."

While some of these figures have changed in the last few years (largely increasing), the report is full of information as informative and relevant today as it was in 2014. Through many engagement sessions and the review of historical after-action plans, the report's conclusions and recommendations are largely focused on improvements to the government's ability to communicate and respond to an event, both within the government and with the private sector.

The following is an exemplary list of planning and implementation guidance developed by industry or Federal government entities which support planning, preparedness, security and resilience. Operators may consult the current editions of these and other references on a frequent basis in developing and reviewing their company's security programs.

- Federal Emergency Management Agency's Continuity Guidance Circular
- International Standards Organization's 22301- Business Continuity Management Systems
- International Standards Organization's 22316- Security and Resilience
- National Fire Protection Association's 1600- Standard for Emergency Management and Business Continuity
- American Chemistry Council, *Guidance for Addressing Cyber Security in the Chemical Industry*
- American Gas Association (AGA) Report Number 12, *Cryptographic Protection of SCADA Communications, Part 1: Background, Policies and Test Plan*
- American National Standards Institute (ANSI)/International Society of Automation (ISA)99.00.01 – 2007, *Security for Industrial Automation and Control Systems: Terminology, Concepts, and Models*
- ANSI/ISA – 99.02.01 – 2009, *Security for Industrial Automation and Control Systems: Establishing an Industrial Automation and Control System Security Program*
- American Petroleum Institute (API) Standard 1164 *Pipeline SCADA Security (under revision)*
- U.S. Department of Commerce, National Institute of Standards and Technology (NIST), *Framework for Improving Critical Infrastructure Cybersecurity*
- U.S. Department of Commerce, NIST, Special Publication 800-82, *Guide to Industrial Control Systems (ICS) Security*
- U.S. Department of Homeland Security, Office of Infrastructure Protection, *Risk-Based Performance Standards Guidance: Chemical Facility Anti-Terrorism Standards,* May 2009
- U.S Department of Energy, Office of Electricity Delivery and Energy Reliability*, Energy Sector Cybersecurity Framework Implementation Guidance,* January 2015

- U.S Department of Homeland Security, *Transportation Systems Sector Cybersecurity Framework Implementation Guidance*, June 2015

The Deepwater Horizon accident is an example of how the industry utilizes lessons learned to improve industry performance, forming the Center for Offshore Safety (COS) as an industry sponsored group focused exclusively on offshore safety on the U.S. Outer Continental Shelf. The Center serves the US offshore oil & natural gas industry with the purpose of adopting standards of excellence to ensure continuous improvement in safety and offshore operational integrity.

The Center is responsible for:

- Developing good practice documents for the offshore industry in the areas of Safety and Environmental Management Systems (SEMS)
- Assuring that third party certification program auditors meet the program's goals and objectives
- Compiling and analyzing key industry safety performance metrics
- Coordinating Center sponsored functions designed to facilitate the sharing and learning process
- Identifying and promoting opportunities for the industry to continuously improve
- Developing outreach programs to facilitate communicating with government and external stakeholders

Security Builds Resilience

Millions of miles of pipelines traverses the United States, mostly underground; thousands of compressor stations, pumping stations, and other aboveground facilities; and a highly reliable storage network of underground geological reservoirs and aboveground tank facilities. Given the expansiveness and diversity of these operations, physical security is strategically a risk-based approach that takes all systems and system components into consideration, while homing in on protection of the most critical for public safety and to minimize opportunities for unauthorized disruption. The TSA Pipeline Security Guidelines is the leading reference used for pipeline physical security. Operators also use the DHS Infrastructure Survey Tool, which stresses resilience. Fences, routine patrols, and continuous monitoring, as appropriate, help protect above-ground facilities such as compressors, well sites, processing plants, refineries, and meter stations. Unmanned aerial systems (UAS), also called "drones", video-monitoring, intrusion cameras, motion-detectors, and biometrics are all examples of technologies deployed to address physical threats. The oil and natural gas industries routinely hold threat briefings and workshops to discuss and improve security and have developed industry guidelines and identified practices to protect facilities and data. Oil and natural gas trade associations and operators regularly run simulated response/recovery exercises to help prepare for natural or man-made disasters. The industries also work closely with government agencies to share threat information through the Downstream Natural Gas Information Sharing & Analysis Centers (DNG ISAC), the Oil and Natural Gas ISAC (ONG ISAC), the Electricity ISAC, the Fusion Centers, FBI, local law enforcement and emergency responders, and the Sector Coordinating Councils.

Refinery Resilience:

The refining industry plays a key role in maintaining and distributing the oil and gas supply within the United States and the world and many refining sites are categorized as critical infrastructure by various government agencies-DOE, DHS, and the USCG. Ensuring that facilities are secure and prepared to deter threats is a top priority for U.S. refiners. Refining facilities in the U.S. are required to follow federal security regulations and to ensure the safety of their employees, operations and surrounding communities. As technology has advanced, our industries are continually evolving to protect our critical infrastructure from cyber-attacks.

The refining industry, a subset of the oil industry, believes in a collaborative and proactive approach to all security and cybersecurity issues. Refiners and their trade associations work closely with federal agencies to examine and advise on security-related practices and policies, standards and guidelines, and regulatory and legislative trends.

Given the critical nature of these sites to America's energy security, physical security is highly important and just like pipelines, employs a risk-based approach taking into consideration security protections and vulnerabilities, locations and site/company resiliency. Refineries are subject to two major security regulatory regimes—CFATS and MTSA. These programs are risk-based and performance-based regulations that by their nature require a partnership approach with the DHS and the USCG. CFATS is the nation's first regulatory program focused specifically on security at high-risk chemical facilities. The Cybersecurity and Infrastructure Security Agency (CISA) manages the CFATS program by working with facilities to ensure they have security measures in place to reduce the risks associated with certain hazardous chemicals and prevent them from being exploited in a terrorist attack. Sites must adhere to 18 CFATS risk-based performance standards. These performance standards stress resilience via security features such as fences, routine patrols, and training, cybersecurity, background checks, etc. In addition, refining sites are now beginning to use unmanned aerial systems, also called "drones", video-monitoring, intrusion cameras, motion-detectors, and biometrics -- all examples of technologies deployed to address physical threats. The refining sector routinely holds threat briefings and conferences to discuss and improve security and have developed industry guidelines and identified practices to protect facilities and data.

MTSA was enacted to address port waterway security. It requires vessels and port facilities to conduct vulnerability assessments and develop security plans that may include passenger, vehicle and baggage screening procedures; security patrols; establishing restricted areas; personnel identification procedures; access control measures; and/or installation of surveillance equipment. The Act creates a consistent security program for all the nation's ports to better identify and deter threats.

Developed using risk-based methodology, the MTSA security regulations focus on those sectors of maritime industry that have a higher risk of involvement in a transportation security incident, including various tank vessels, barges, large passenger vessels, cargo vessels, towing vessels, offshore oil and gas platforms, and port facility sites such as refineries that may handle certain kinds of dangerous cargo or service the vessels listed above.

MTSA also required the establishment of committees in all the nation's ports to coordinate the activities of all port stakeholders, including other federal, local and state agencies, industry and the boating public. These groups, called Area Maritime Security Committees, are tasked with collaborating on plans to secure their ports so that the resources of an area can be best used to deter, prevent and respond to terror threats. Refinery trade associations and operators regularly run simulated response/recovery exercises to help prepare for natural or man-made disasters. The refining sector also work closely with government agencies to share threat information through ONG ISAC, the Fusion Centers, FBI, local law enforcement and emergency responders, and the Sector Coordinating Councils.

Additionally, refining companies and sites all have hurricane preparedness plans and business continuity plans to consider how to maintain business continuity in case of other natural disasters, an infectious disease outbreak, or even a crippling work shortage. American Fuel and Petrochemical Manufacturers (AFPM) member companies work throughout the year with federal, state and local first responders to develop detailed hurricane preparedness and response plans and to practice those plans using drills and exercises to ensure employees and facilities are ready for unexpected events. These companies also work closely with state and federal government agencies, including DHS, DOE, DOT PHMSA, the USCG, and state energy offices to share information and coordinate efforts.

Refineries invest heavily in preventative measures and regularly update process hazard analyses and other risk assessments to apply learnings from previous weather events to their facilities. The nation’s refiners and petrochemical manufacturers have developed robust preparedness measures that can be taken in the event of a hurricane or extreme weather event. Refiners are proactive in planning for these types of events. Refiners have taken measures like building and elevating new refinery control rooms, electrical equipment, pumps and compressors to avoid flooding, as well as added redundant power supplies and generators. They have developed, executed and continuously refine comprehensive preparedness plans and have also increased on-site containment facilities and developed additional operating procedures for startup and shutdown events.

Preventative closures of refineries are a central tenet of the refining industry’s storm preparedness protocols in advance of a storm like Hurricane Harvey. Shutdowns can take several days and are done carefully to ensure the safety of workers and surrounding communities. After shutdowns, these facilities are typically staffed with a “ride-out crew” to stay onsite to monitor safety and any potential damage resulting from the storm. These preventative measures are effective. Harvey disrupted fuel markets by impacting 24 refineries that normally churn out a quarter of U.S. fuels. This prompted market participants to turn to inventories and send fuel over longer distances to keep feeding markets. But 20 refineries resumed fuel manufacturing, in full or in part, in the two weeks following the storm. At that point, facilities still offline represented just 4 percent of U.S. refining capacity. This is a testament to refiners' commitment to producing and supplying fuels the are critically important to the American economy. The relatively quick resumption in output was significant given that restarting plants is much more complicated than flipping on a light switch. Like shutdowns, restarts must be done slowly and deliberately, to protect the health and safety of employees, as well as communities and the environment. Restarts after storms include securing safe access to the site, checking the integrity of equipment, storage tanks, process units and instrumentation. They also include inspecting facilities for storm damage, making necessary repairs and verifying there are sufficient feedstocks, such as oil and natural gas, available for processing from ports and pipelines. Inbound supplies must be able to arrive at the refinery, and outbound products must have a clear route to market; so transportation infrastructure is also examined before opening. As soon as all facilities are determined to be safe, crews move to energize electrical systems and cautiously ramp up activity in process units to begin turning raw materials to into products such as diesel, gasoline and jet fuel.

When a refinery is restarted, operators proceed slowly and carefully because piping systems may have unprocessed hydrocarbons inside of them left over from the shutdown. Operators also work to identify anomalies or changes in the system as units are brought back online. Making sure each unit is operating normally keeps the overall system safe. Sometimes refineries must flare during shutdowns or restarts. A flare is first and foremost a safety device, essentially a safety relief valve, which a refinery uses to safely burn excess material, or hydrocarbons, which cannot be recovered or recycled. The excess hydrocarbons are safely burned in the flare, a more environmentally sound method than releasing the hydrocarbons directly into the atmosphere. Flaring is regulated by both the EPA and state environmental agencies and is minimized as much as possible. In sum, preventative closures, as well as restarts and flaring, are part of methodical procedures designed to ensure the safety of workers, communities and the environment. The resumption in activity we have seen at Gulf Coast refineries speaks to the resilience of the industry and its commitment to fueling America's economy.

AFPM and their members also provide websites with links to a suite of government materials and information, including an emergency supply checklist, contact information for emergency management agencies across the country, and flood safety information for the public to access at any time, such as:

- https://www.afpm.org/industries/performance/preparing-disruption
- https://www.afpm.org/system/files/attachments/AFPM-White-Paper-Hurricane-Security-Operations.pdf

Conclusion

In summary, safety is the core value of our industries. We continue to work with government and private stakeholders to promote the safe, secure, resilient, and environmentally responsible operations of our systems in a manner that reduces potential risk to the public, as well as employees, contractors, and operations.

Given safety being a core value, we view resilience as a product of many interconnected efforts to operate safely and efficiently, throughout any circumstances, to the best of an operator's ability. *Resilience* is not a standalone concept. The natural gas and oil industries design and build resilience into our processes and programs. Extreme weather events continue to test our systems and demonstrate our resilience; operational capabilities minimize the possibility that a disruption has more than a localized impact. Regardless, these same events drive our system improvements. We recognize the significant role we play in our nation's energy system and strive daily to improve our ability to deliver the critical products to meet consumer demand.

Should you have questions regarding the material listed or would like to meet with our organizations, please contact Suzanne Lemieux at lemieuxs@api.org or 202-682-8453.

Regards,

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