

Increasing Federal Coordination for Oversight of Hydrogen Systems

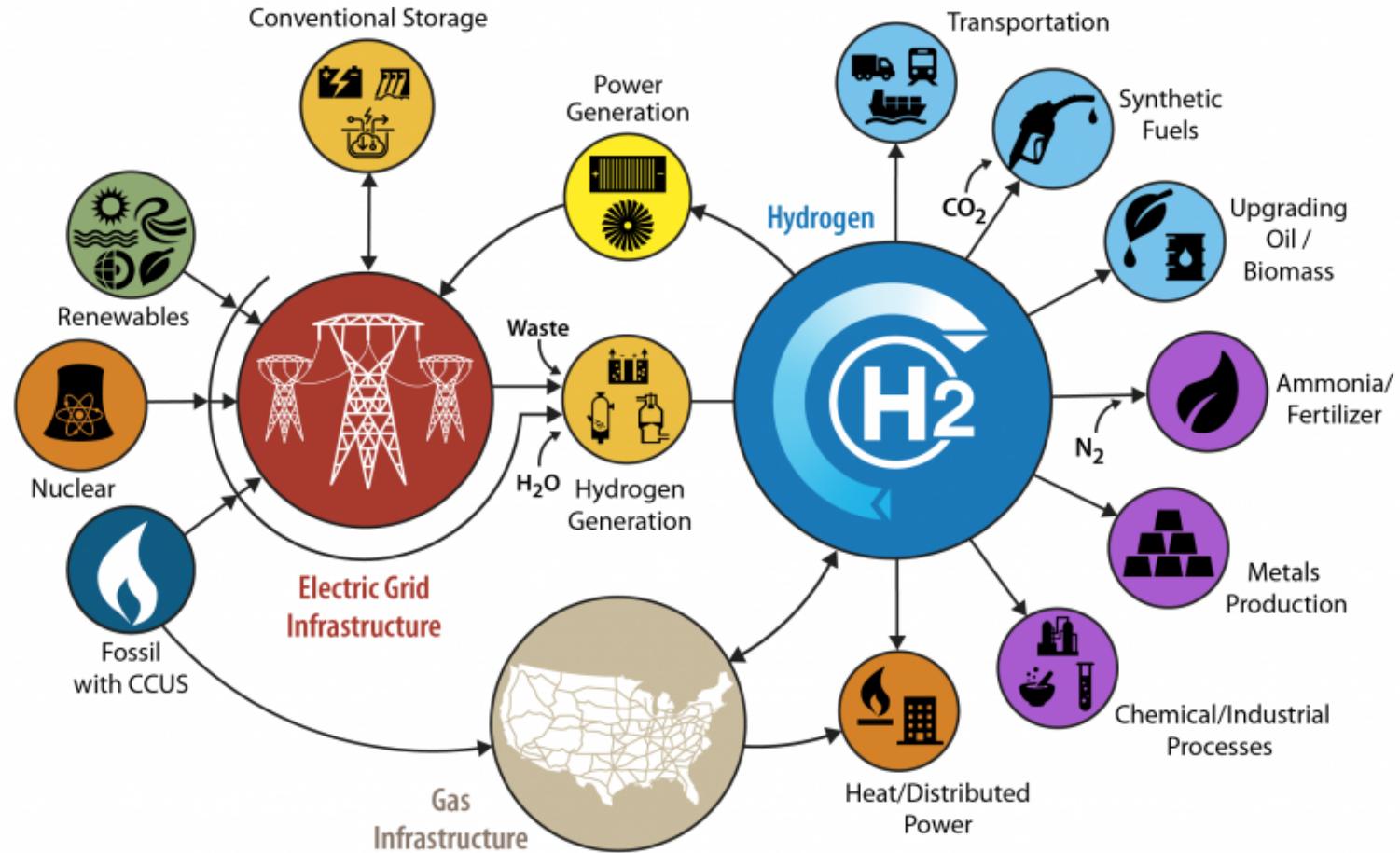
Regulatory Map for H2@Scale

Brian Ehrhart, Austin Baird, Austin Glover,
Chris LaFleur

Interagency Working Group Monthly Meeting

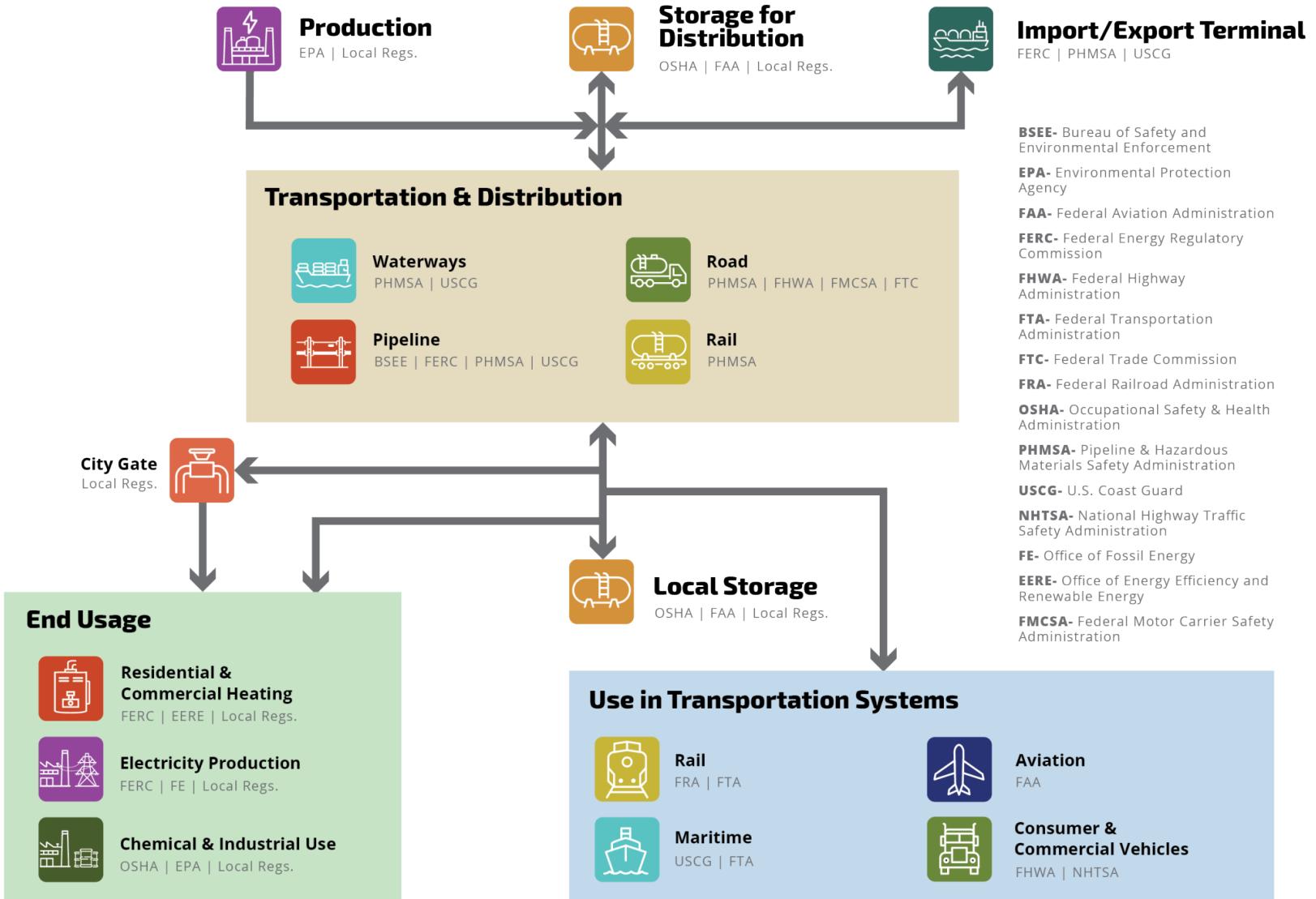
May 18, 2021

H2@Scale - Many New and Expanded Hydrogen Systems: Production, Transport, Storage, and Use





Hydrogen Federal Regulatory Map





Scope of Analysis: Federal Regulation

Review of U.S. federal regulation and oversight

- Not a list of every code and standard that must be followed
- Not a formal interpretation of regulatory language

Goals:

Identify **regulators and agencies** that need to be engaged by stakeholders for future systems

Identify **limits of federal oversight** (i.e., state/local jurisdiction rather than federal)



Hydrogen “Readiness”

Assessment of regulation “readiness” for hydrogen

- **Fully Ready:** Currently have **Hydrogen Specifically Listed**
- **Ready:** Covers flammable/hazardous gases that should **Indirectly Cover Hydrogen**
- **Not Ready:** specific to some other material (such as natural gas)
 - Would need to be modified to include hydrogen; **Hydrogen Not Included**

Scope of Hydrogen Readiness Assessment

- Assessment of the regulations as currently written, not an assessment of the federal agencies themselves
- Identifying if hydrogen is included or not, not an assessment of the “content” (i.e., specific requirements) of the regulations

Note: this “readiness” is based on a current assessment and is subject to regulatory interpretation and changes in the future

Production of Hydrogen

Emissions reporting

- **Environmental Protection Agency (EPA)**
- 40 CFR Part 98 Subpart P – Hydrogen Production
- Subject to source categories and thresholds
- **Hydrogen Specifically Listed**

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Production
EPA | Local Regs.



Storage of Hydrogen



Storage for Distribution

OSHA | FAA | Local Regs.

Hydrogen Storage and Delivery Requirements

- U.S. Department of Labor **Occupational Safety and Health Administration (OSHA)**
- 29 CFR Part 1910 Subpart H – Hazardous Materials
- Applicability depends on maximum quantity and state of H₂ (gas or liquid)
- **Hydrogen Specifically Included**

Aircraft and Spacecraft Launch Sites

- U.S. Department of Transportation (DOT) **Federal Aviation Administration (FAA)**
- 14 CFR Part 420
- Separation distances for hazardous storage
- **Hydrogen Specifically Included**

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Local Storage

OSHA | FAA | Local Regs.



Transportation by Pipelines

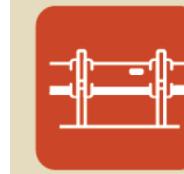
Minimum safety requirements for pipeline facilities and the transportation of gas

Onshore, interstate

- DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)
- PHMSA Office of Pipeline Safety (OPS) for inspections and enforcement after construction
- **Hydrogen Indirectly Included**

Onshore, intrastate and Offshore, state waters

- Regulated either by state agency or OPS per agreement
- Agreements maintained by PHMSA
- **Hydrogen Indirectly Included**
 - May vary by state



Pipeline

BSEE | FERC | PHMSA | USCG

Offshore, outer continental shelf

- U.S. Department of Interior **Bureau of Safety and Environmental Enforcement (BSEE)**
 - Office of Offshore Regulatory Programs (OORP)
 - **Hydrogen Not Included:** Oil/nat. gas specific
- U.S. Department of Homeland Security **United States Coast Guard (USCG)**
 - Related to transfers to/from vessel and facility
 - **Hydrogen Indirectly Included**

Sales and Distribution

- **Federal Energy Regulatory Commission (FERC)**
- **Hydrogen Not Included:** Natural gas specific



Transportation by Road

Hydrogen as cargo

Hazardous Materials Regulations (HMR) - 49 CFR
Subchapter C

- DOT **Pipeline and Hazardous Materials Safety Administration (PHMSA)**
- 49 CFR 172 lists hazardous materials
- 49 CFR 173 lists requirements for cryogenic and compressed gases
- 49 CFR 177 lists loading and unloading practices
- 49 CFR 178 includes details for shipping containers, including cylinders and tanks
- 49 CFR 180 includes details for other packaging and containers
- **Hydrogen Specifically Listed**



Road

PHMSA | FHWA | FMCSA | FTC

Highway Safety Improvement Program

- DOT **Federal Highway Administration (FHWA)**
- Highway safety, including bridges, tunnels, etc.
- **Not Directly Related to Hydrogen**; not specific to hazardous materials transport

DOT **Federal Motor Carrier Safety Administration (FMCSA)**

- Motor carrier routing
- General motor carrier safety regulations
- Driving and parking rules for hazmat transport
- **Hydrogen Specifically Listed** as a hazardous material in HMR (DOT PHMSA)

Certification and Posting of Fuel Ratings

- **Federal Trade Commission (FTC)**
- **Hydrogen Not Included**; even for alternative automotive fuel



Transportation by Rail



Rail
PHMSA

Hydrogen as cargo

Hazardous Materials Regulations (HMR)

- **DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)**
- 49 CFR 172 lists hazardous materials
- 49 CFR 173 lists requirements for cryogenic and compressed gases
- 40 CFR Part 174 for rail transportation
 - Approval by permit from DOT **Federal Railroad Administration (FRA)**
- 49 CFR 178 includes details for shipping containers, including cylinders and tanks
- 49 CFR 179 and 180 cover construction and qualification for DOT-113 tank cars
- **Hydrogen Specifically Listed**

State Rail Plans

- **DOT Federal Railroad Administration (FRA)**
- Railroad network policy, planning, and development for each state



Transportation by Waterways



Waterways
PHMSA | USCG

Hazardous Materials Regulations (HMR) - 49 CFR Subchapter C

- **DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)**
- 49 CFR 176 gives requirements for transport by vessel
- **Hydrogen Specifically Listed**

Transfer Operations and Vessel Specifications

- **DHS United States Coast Guard (USCG)**
- Transfers on navigable waters or for 250 barrel capacity vessels
 - Capacity may need to be clarified for hydrogen
- Transfers to/from facility and vessel
- Transport of liquefied or compressed flammable gases, Incompatibility of hazardous materials and rules for transport
- Non-self-propelled ships carrying bulk cargo, self-propelled ships carrying bulk cargo, self-propelled vessel containing bulk liquefied gases as cargo
- **Hydrogen Indirectly Included**



Import and Export Terminals



Import/Export Terminal

FERC | PHMSA | USCG

Pipeline to Maritime Transport

Regulation/Oversight of Near- and Off-shore Natural Gas Import/Export

- **Federal Energy Regulatory Commission (FERC)**
- 18 CFR Part 153
- DHS **United States Coast Guard (USCG)** responsible for enforcement after construction
- **Hydrogen Not Included**: Natural gas specific

Hazardous Material Transport between Vessels and Facilities

- DHS **United States Coast Guard (USCG)**
- 33 CFR Part 154
- **Hydrogen Indirectly Included**

Other pipeline and maritime transport regulations can also apply

- DOT **Pipeline and Hazardous Materials Safety Administration (PHMSA)**



End Use: Electricity Production

Cogeneration and Small Power Production Facilities for the Grid

- **Federal Energy Regulatory Commission (FERC)**
- 18 CFR Part 292
- 18 CFR Chapter I for interstate electric transmission, interconnections, licensing, etc.
- **Hydrogen Specifically Included**; fuel cells included in definition

Alternative Fuel Power Plants

- **DOE Office of Fossil Energy (FE)**
- 10 CFR Parts 503 and 504
- May prohibit new and existing powerplants from using petroleum or natural gas without the ability to use coal or another alternate fuel
- **Hydrogen Indirectly Included**; hydrogen not specifically mentioned, but potentially included as fuel obtained from alternative sources

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Electricity Production

FERC | FE | Local Regs.



End Use: Residential, Commercial, and Industrial Heating

Commercial Heaters, Hot Water Boilers, and Similar Heating Appliances

- DOE **Office of Energy Efficiency and Renewable Energy (EERE)**
- 10 CFR Part 431 regulates energy efficiency program
- **Hydrogen Not Included**; definition of "gas" specific to natural gas and propane

Sales and Distribution of Natural Gas

- **Federal Energy Regulatory Commission (FERC)**
- 18 CFR Part 284
- **Hydrogen Not Included**: natural gas specific

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



**Residential &
Commercial Heating**
FERC | EERE | Local Regs.



Chemical and Industrial Use

Hydrogen Storage and Delivery Requirements

- U.S. Department of Labor **Occupational Safety and Health Administration (OSHA)**
- 29 CFR Part 1910 Subpart H – Hazardous Materials
- Applicability depends on maximum quantity and state of H₂ (gas or liquid)
- **Hydrogen Specifically Listed**

Emissions Reporting

- **Environmental Protection Agency (EPA)**
- 40 CFR Part 98 Subpart P – Hydrogen Production
- 40 CFR Part 98 Subpart G – Ammonia Manufacturing
- Subject to source categories and thresholds
- **Hydrogen Specifically Listed**

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Chemical & Industrial Use
OSHA | EPA | Local Regs.



Blending into Natural Gas

City Gate
Local Regs.



Analogous regulations would apply (e.g., pipelines on previous slides)

- Safety, construction, operation, inspection
- Onshore/offshore, interstate/intrastate
- Sale, import/export

Alternative Fuel Power Plants

- **DOE Office of Fossil Energy (FE)**
- 10 CFR Parts 503 and 504
- May prohibit new and existing powerplants from using petroleum or natural gas without the ability to use coal or another alternate fuel
 - *Blends included as alternate fuel*
- **Hydrogen Indirectly Included**; hydrogen not specifically mentioned, but potentially included as fuel obtained from alternative sources



End Use: Auxiliary Power Systems

Local/Off-Grid Electricity Generation

- Examples: mobile generators for lighting, refrigerated transport

On-Road Safety

- DOT **Federal Highway Administration (FHWA)**

- **Hydrogen Indirectly Included**; not specific to fuel used

Rail Safety

- DOT **Federal Railroad Administration (FRA)**

- **Hydrogen Not Included**; exhaust gases specific to combustion and battery venting, not fuel cells or hydrogen storage

Maritime Safety

- DHS **United States Coast Guard (USCG)**

- **Hydrogen Not Included**; specific to boiler, diesel gas turbine, or steam turbine, no alternatives

Aviation Safety

- DOT **Federal Aviation Administration (FAA)**

- **Hydrogen Indirectly Included**; not specific to fuel used



Use in Road Vehicles

Federal Motor Vehicle Safety Standards (FMVSS)

- DOT **National Highway Traffic Safety Administration (NHTSA)**
- Currently 65 FMVSSs
- Manufacture, sale, or import motor vehicles prohibited unless conforms to FMVSS
- **Hydrogen Indirectly Included**; titles specific to natural gas, but also used for hydrogen

Highway Safety Improvement Program

- DOT **Federal Highway Administration (FHWA)**
- Highway safety, including bridges, tunnels, etc.
- **Not Directly Related to Hydrogen**; not specific to hazardous materials transport





Use in Rail

Safety Design and Crashworthiness Requirements

- DOT **Federal Railroad Administration (FRA)**
- Locomotive and passenger locomotive design and crashworthiness
- **Hydrogen Indirectly Included**; includes requirements for alternative designs

Safety and Security for Local Transit Systems

- Including light rail, trollies, subways
- DOT **Federal Transit Administration (FTA)**
- Safety and security plans, Safety oversight
- 49 USC 5329(e) National Public Transportation Safety Plan
 - For public transport that receives federal funding (not just rail)
- **Hydrogen Indirectly Included**; not fuel specific

State Rail Plans

- DOT **Federal Railroad Administration (FRA)**
- Railroad network policy, planning, and development for each state



Rail
FRA | FTA



Use in Maritime

Vessel Design, Construction, and Fire Protection

- DHS **United States Coast Guard (USCG)**
- **Hydrogen Indirectly Included**; requirements can depend on fuel properties

Safety and Security for Local Transit Systems

- DOT **Federal Transit Administration (FTA)**
- 49 USC 5329(e) National Public Transportation Safety Plan for public transport that receives federal funding (not just rail)
- **Hydrogen Indirectly Included**; not fuel specific

DOT Maritime Administration (MARAD) supports U.S. maritime transportation system and stakeholders likely to continue to collaborate closely with USCG



Maritime
USCG | FTA



Use in Aviation

Aircraft Requirements and Airworthiness Standards

- DOT **Federal Aviation Administration (FAA)**
- 14 CFR Part 23 – normal category airplanes
- 14 CFR Part 25 – transport category airplanes
- 14 CFR Part 27 – normal category rotorcraft
- 14 CFR Part 29 – transport category rotorcraft
- 14 CFR Part 33 – aircraft engines
- **Hydrogen Indirectly Included**; requirements for flammable gases





Summary of “Hydrogen Readiness” in Federal Regulations

Production

- Regulations currently exist for emissions reporting

Transport

- Regulations exist for transport by tanker trucks, rail, and waterways
- Regulations exist for pipelines, but some are natural gas specific

Storage

- Regulations currently exist for safety
 - **Requirements themselves may be outdated?**

Use

- Regulations exist for use in trucks, rail, waterways, and aviation
- Regulations exist for on-board electric power, though **some are natural gas or battery specific**
- **Many heating regulations are specific to natural gas or propane**
- Regulations exist for grid electricity generation



Different Types of Gaps

- Language specific to natural gas (or propane, etc.)
 - There may be specific reasons for this (e.g., pipeline spills leading to contamination)
- Language specific to material-specific properties
 - For example, volume-based requirements
- Not always clear if hydrogen is included as alternate fuel
 - Might be included for grid electricity production?
 - Not included as automotive fuel ratings
- Regulation and sale
 - Especially for interstate/pipeline transport
- Outdated requirements
 - Storage is a part of every system

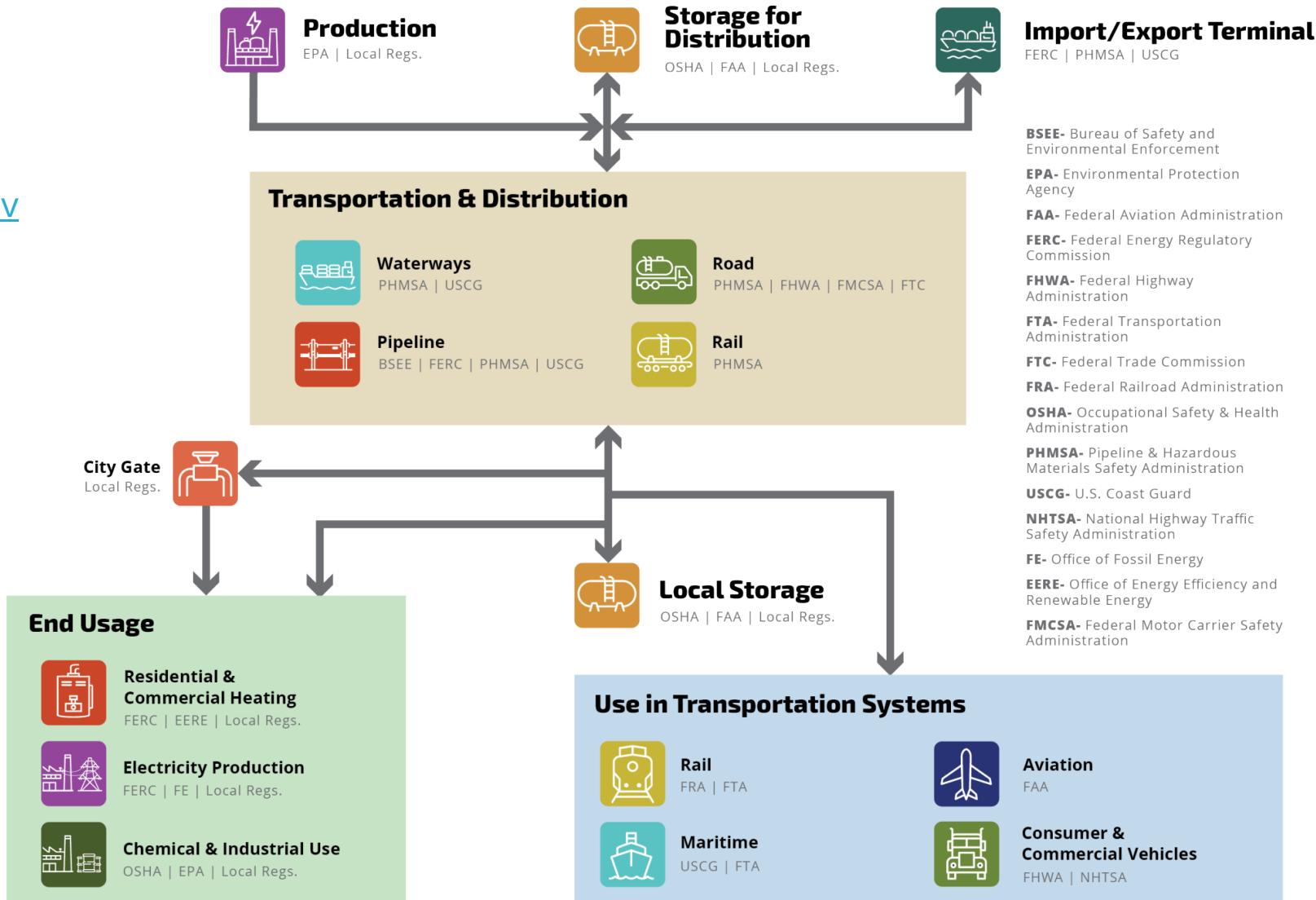


Hydrogen Federal Regulatory Map

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Final Report Available:

<https://energy.sandia.gov/wp-content/uploads/2021/03/H2-Regulatory-Map-Report SAND2021-2955.pdf>



Thank you!
Questions?

Backup Slides

Production of Hydrogen

Emissions reporting

- **Environmental Protection Agency (EPA)**
- 40 CFR Part 98 Subpart P – Hydrogen Production
- Subject to source categories and thresholds
- **Hydrogen Specifically Listed**

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Production
EPA | Local Regs.



Storage of Hydrogen



Storage for Distribution

OSHA | FAA | Local Regs.

Hydrogen Storage and Delivery Requirements

- U.S. Department of Labor **Occupational Safety and Health Administration (OSHA)**
- 29 CFR Part 1910 Subpart H – Hazardous Materials
- Applicability depends on maximum quantity and state of H₂ (gas or liquid)
- **Hydrogen Specifically Included**

Aircraft and Spacecraft Launch Sites

- U.S. Department of Transportation (DOT) **Federal Aviation Administration (FAA)**
- 14 CFR Part 420
- Separation distances for hazardous storage
- **Hydrogen Specifically Included**

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Local Storage

OSHA | FAA | Local Regs.



Transportation by Pipelines

Minimum safety requirements for pipeline facilities and the transportation of gas

Onshore, interstate

- **DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)**
- 49 CFR Part 192, minimum safety standards
- PHMSA Office of Pipeline Safety (OPS) for inspections and enforcement after construction
- **Hydrogen Indirectly Included**

Onshore, intrastate

- Regulated either by state agency or OPS per agreement
- Agreements maintained by PHMSA
- **Hydrogen Indirectly Included**
 - May vary by state



*Pipeline oversight depends on location:
onshore/offshore, interstate/intrastate*



Transportation by Pipelines - Continued

Offshore, state waters

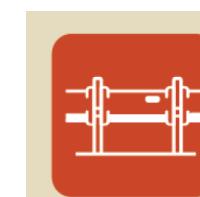
- Similar to onshore intrastate (PHMSA OPS or state agency)

Offshore, outer continental shelf

- U.S. Department of Interior **Bureau of Safety and Environmental Enforcement (BSEE)**
 - Office of Offshore Regulatory Programs (OORP)
 - 43 USC Part 29
 - **Hydrogen Not Included:** Oil and natural gas specific
- U.S. Department of Homeland Security **United States Coast Guard (USCG)**
 - 33 CFR Part 154, related to transfers to/from vessel and facility
 - **Hydrogen Indirectly Included**

Sales and Distribution

- **Federal Energy Regulatory Commission (FERC)**
- 18 CFR Part 284
- **Hydrogen Not Included:** Natural gas specific



Pipeline

BSEE | FERC | PHMSA | USCG



Transportation by Road

Hydrogen as cargo

Hazardous Materials Regulations (HMR) - 49 CFR Subchapter C

- **DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)**
- 49 CFR 172 lists hazardous materials
- 49 CFR 173 lists requirements for cryogenic and compressed gases
- 49 CFR 177 lists loading and unloading practices
- 49 CFR 178 includes details for shipping containers, including cylinders and tanks
- 49 CFR 180 includes details for other packaging and containers
- **Hydrogen Specifically Listed**



Road

PHMSA | FHWA | FMCSA | FTC



Transportation by Road - Continued

Highway Safety Improvement Program

- DOT **Federal Highway Administration (FHWA)**
- 23 CFR Part 924
- Highway safety, including bridges, tunnels, etc.
- **Not Directly Related to Hydrogen**; not specific to hazardous materials transport

DOT **Federal Motor Carrier Safety Administration (FMCSA)**

- 49 CFR Part 356 regulates motor carrier routing
- 49 CFR Part 389 gives general motor carrier safety regulations
- 49 CFR Part 397 gives driving and parking rules for transportation of hazardous materials
- **Hydrogen Specifically Listed** as a hazardous material in HMR (DOT PHMSA)

Certification and Posting of Fuel Ratings

- **Federal Trade Commission (FTC)**, 16 CFR Part 306
- Related to hydrogen as a fuel, but also transfer of fuel between entities
- **Hydrogen Not Included**; even for alternative automotive fuel



Road

PHMSA | FHWA | FMCSA | FTC



Transportation by Rail



Rail
PHMSA

Hydrogen as cargo

Hazardous Materials Regulations (HMR)

- **DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)**
- 49 CFR 172 lists hazardous materials
- 49 CFR 173 lists requirements for cryogenic and compressed gases
- 40 CFR Part 174 for rail transportation
 - Approval by permit from DOT **Federal Railroad Administration (FRA)**
- 49 CFR 178 includes details for shipping containers, including cylinders and tanks
- 49 CFR 179 and 180 cover construction and qualification for DOT-113 tank cars
- **Hydrogen Specifically Listed**

State Rail Plans

- **DOT Federal Railroad Administration (FRA)**
- Railroad network policy, planning, and development for each state



Transportation by Waterways

Hazardous Materials Regulations (HMR) - 49 CFR Subchapter C

- **DOT Pipeline and Hazardous Materials Safety Administration (PHMSA)**
- 49 CFR 172 lists hazardous materials
- 49 CFR 173 lists requirements for cryogenic and compressed gases
- 49 CFR 176 gives requirements for transport by vessel
 - Specific to maritime
- 49 CFR 178 includes details for shipping containers, including cylinders and tanks
- 49 CFR 180 includes details for other packaging and containers
- **Hydrogen Specifically Listed**



Transportation by Waterways - Continued

Transfer Operations and Vessel Specifications

- DHS **United States Coast Guard (USCG)**
- 33 CFR Part 156 regulates transfers on navigable waters or for 250 barrel capacity vessels
 - Capacity may need to be clarified for hydrogen
- 33 CFR Part 154 regulates transfers to/from facility and vessel
- 46 CFR Part 38 regulates transport of liquefied or compressed flammable gases
- 46 CFR Part 150 describes incompatibility of hazardous materials and rules for transport
- 46 CFR Part 151 regulates non-self-propelled ships carrying bulk cargo
- 46 CFR Part 153 regulates self-propelled ships carrying bulk cargo
- 46 CFR Part 154 regulates self-propelled vessel containing bulk liquefied gases as cargo
- **Hydrogen Indirectly Included**





Import and Export Terminals



Import/Export Terminal

FERC | PHMSA | USCG

Pipeline to Maritime Transport

Regulation/Oversight of Near- and Off-shore Natural Gas Import/Export

- **Federal Energy Regulatory Commission (FERC)**
- 18 CFR Part 153
- DHS **United States Coast Guard (USCG)** responsible for enforcement after construction
- **Hydrogen Not Included**: Natural gas specific

Hazardous Material Transport between Vessels and Facilities

- DHS **United States Coast Guard (USCG)**
- 33 CFR Part 154
- **Hydrogen Indirectly Included**

Other pipeline and maritime transport regulations can also apply

- DOT **Pipeline and Hazardous Materials Safety Administration (PHMSA)**



End Use: Electricity Production

Cogeneration and Small Power Production Facilities for the Grid

- **Federal Energy Regulatory Commission (FERC)**
- 18 CFR Part 292
- 18 CFR Chapter I for interstate electric transmission, interconnections, licensing, etc.
- **Hydrogen Specifically Included**; fuel cells included in definition

Alternative Fuel Power Plants

- **DOE Office of Fossil Energy (FE)**
- 10 CFR Parts 503 and 504
- May prohibit new and existing powerplants from using petroleum or natural gas without the ability to use coal or another alternate fuel
- **Hydrogen Indirectly Included**; hydrogen not specifically mentioned, but potentially included as fuel obtained from alternative sources

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Electricity Production

FERC | FE | Local Regs.



End Use: Residential, Commercial, and Industrial Heating

Commercial Heaters, Hot Water Boilers, and Similar Heating Appliances

- DOE **Office of Energy Efficiency and Renewable Energy (EERE)**
- 10 CFR Part 431 regulates energy efficiency program
- **Hydrogen Not Included**; definition of "gas" specific to natural gas and propane

Sales and Distribution of Natural Gas

- **Federal Energy Regulatory Commission (FERC)**
- 18 CFR Part 284
- **Hydrogen Not Included**: natural gas specific

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



**Residential &
Commercial Heating**
FERC | EERE | Local Regs.



Chemical and Industrial Use

Hydrogen Storage and Delivery Requirements

- U.S. Department of Labor **Occupational Safety and Health Administration (OSHA)**
- 29 CFR Part 1910 Subpart H – Hazardous Materials
- Applicability depends on maximum quantity and state of H₂ (gas or liquid)
- **Hydrogen Specifically Listed**

Emissions Reporting

- **Environmental Protection Agency (EPA)**
- 40 CFR Part 98 Subpart P – Hydrogen Production
- 40 CFR Part 98 Subpart G – Ammonia Manufacturing
- Subject to source categories and thresholds
- **Hydrogen Specifically Listed**

Local regulations also apply

- NFPA, ASME, CGA, etc. as adopted/required



Chemical & Industrial Use
OSHA | EPA | Local Regs.



Blending into Natural Gas

City Gate
Local Regs.



Analogous regulations would apply (e.g., pipelines on previous slides)

- Safety, construction, operation, inspection
- Onshore/offshore, interstate/intrastate
- Sale, import/export

Alternative Fuel Power Plants

- **DOE Office of Fossil Energy (FE)**
- 10 CFR Parts 503 and 504
- May prohibit new and existing powerplants from using petroleum or natural gas without the ability to use coal or another alternate fuel
 - *Blends included as alternate fuel*
- **Hydrogen Indirectly Included**; hydrogen not specifically mentioned, but potentially included as fuel obtained from alternative sources



End Use: Auxiliary Power Systems

Local/Off-Grid Electricity Generation

- Examples: mobile generators for lighting, refrigerated transport

On-Road Safety

- DOT **Federal Highway Administration (FHWA)**
- 23 CFR Part 390
- **Hydrogen Indirectly Included**; not specific to fuel used

Rail Safety

- DOT **Federal Railroad Administration (FRA)**
- 49 CFR Part 229
- **Hydrogen Not Included**; exhaust gases specific to combustion and battery venting, not fuel cells or hydrogen storage

Maritime Safety

- DHS **United States Coast Guard (USCG)**
- 46 CFR Part 111
- **Hydrogen Not Included**; specific to boiler, diesel gas turbine, or steam turbine, no alternatives

Aviation Safety

- DOT **Federal Aviation Administration (FAA)**
- 14 CFR 23, 25, 27, and 29
- **Hydrogen Indirectly Included**; not specific to fuel used



Use in Road Vehicles



Consumer &
Commercial Vehicles
FHWA | NHTSA

Federal Motor Vehicle Safety Standards (FMVSS)

- DOT **National Highway Traffic Safety Administration (NHTSA)**
- 49 CFR 571 – currently 65 FMVSS
- Manufacture, sale, or import motor vehicles prohibited unless conforms to FMVSS
- 200 series of 49 CFR 571 covers vehicle crashworthiness
- 300 series of 49 CFR 571 covers fuel system integrity
- **Hydrogen Indirectly Included**; titles specific to natural gas, but also used for hydrogen

Highway Safety Improvement Program

- DOT **Federal Highway Administration (FHWA)**
- 23 CFR Part 924
- Highway safety, including bridges, tunnels, etc.
- **Not Directly Related to Hydrogen**; not specific to hazardous materials transport

Note: current hydrogen vehicle fuel systems are not built to meet DOT PHMSA HMR (H_2 as cargo)

- DOT Special Permit required if transporting vehicle with hydrogen remaining in the system



Use in Rail

Safety Design and Crashworthiness Requirements

- DOT **Federal Railroad Administration (FRA)**
- 49 CFR Part 229 – locomotive design and crashworthiness
- 49 CFR Part 238 – passenger locomotive design requirements
- **Hydrogen Indirectly Included**; includes requirements for alternative designs

Safety and Security for Local Transit Systems

- Including light rail, trollies, subways
- DOT **Federal Transit Administration (FTA)**
- 49 CFR Part 659 safety and security plans
- 49 CFR Part 674 safety oversight
- 49 USC 5329(e) National Public Transportation Safety Plan
 - For public transport that receives federal funding (not just rail)
- **Hydrogen Indirectly Included**; not fuel specific

State Rail Plans

- DOT **Federal Railroad Administration (FRA)**
- Railroad network policy, planning, and development for each state



Rail

FRA | FTA



Use in Maritime

Vessel Design, Construction, and Fire Protection

- DHS **United States Coast Guard (USCG)**
- 46 CFR Parts 24-196
- **Hydrogen Indirectly Included**; requirements can depend on fuel properties

Safety and Security for Local Transit Systems

- DOT **Federal Transit Administration (FTA)**
- 49 USC 5329(e) National Public Transportation Safety Plan for public transport that receives federal funding (not just rail)
- **Hydrogen Indirectly Included**; not fuel specific

DOT Maritime Administration (MARAD) supports U.S. maritime transportation system and stakeholders likely to continue to collaborate closely with USCG



Maritime
USCG | FTA



Use in Aviation

Aircraft Requirements and Airworthiness Standards

- DOT **Federal Aviation Administration (FAA)**
- 14 CFR Part 23 – normal category airplanes
- 14 CFR Part 25 – transport category airplanes
- 14 CFR Part 27 – normal category rotorcraft
- 14 CFR Part 29 – transport category rotorcraft
- 14 CFR Part 33 – aircraft engines
- **Hydrogen Indirectly Included**; requirements for flammable gases

