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# The #H2IQ Hour

## Today's Topic:

Overview of Federal Regulations for Hydrogen Technologies in the U.S.

This presentation is part of the monthly H2IQ hour to highlight research and development activities funded by U.S. Department of Energy's Hydrogen and Fuel Cell Technologies Office (HFTO) within the Office of Energy Efficiency and Renewable Energy (EERE).



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# Overview of Federal Regulations for Hydrogen Technologies in the U.S.

Regulatory Map for H2@Scale

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HFTO Webinar

April 29, 2021

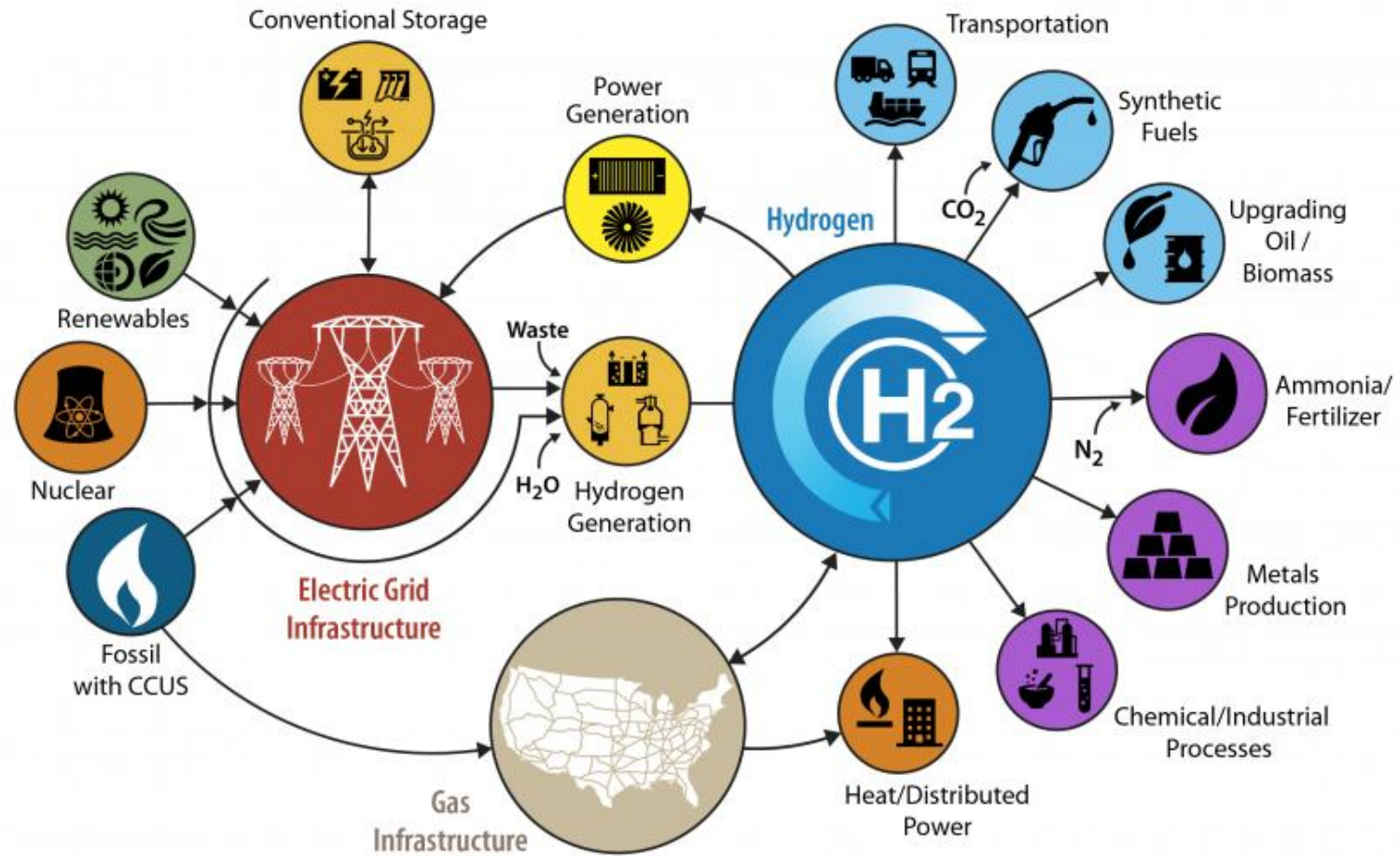
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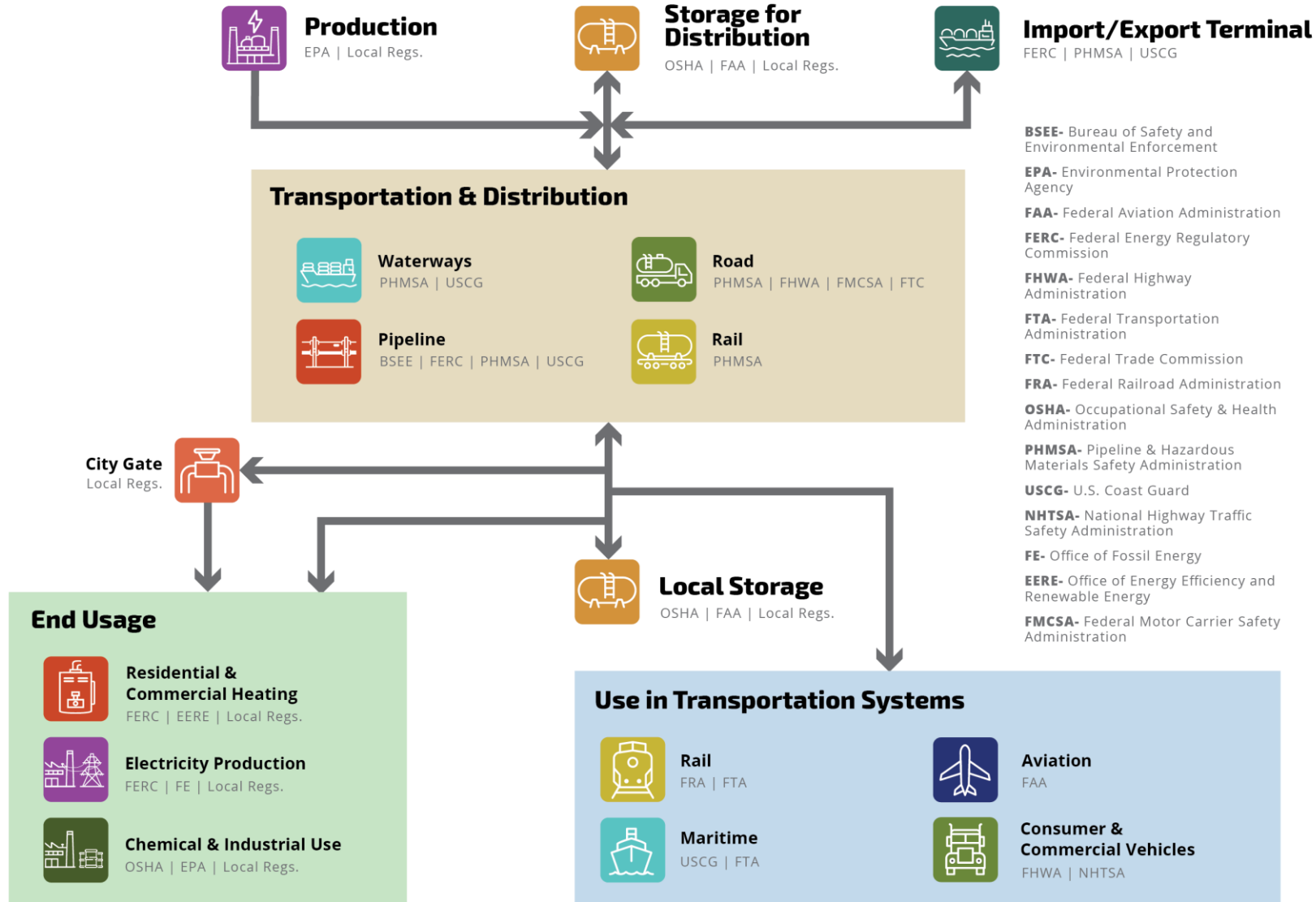


# H2@Scale - Many New and Expanded Hydrogen Systems: Production, Transport, Storage, and Use





# 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



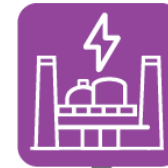
# Production of Hydrogen

## 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

## 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 H<sub>2</sub> (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



## Storage for Distribution

OSHA | FAA | Local Regs.



## 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***



## **Pipeline**

BSEE | FERC | PHMSA | USCG



# 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

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



**Rail**

PHMSA



# 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**



**Waterways**

PHMSA | USCG



# 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**



**Waterways**

PHMSA | USCG





## 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



### Electricity Production

FERC | FE | Local Regs.

#### 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



# 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 H<sub>2</sub> (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



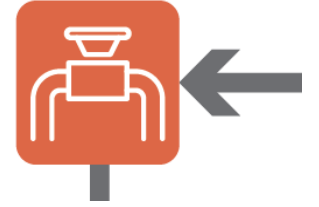
### Chemical & Industrial Use

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<sub>2</sub> as cargo)

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



## Use in Rail



**Rail**

FRA | FTA

### 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, trolleys, 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





## 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



## Use in Aviation



**Aviation**

FAA

### 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

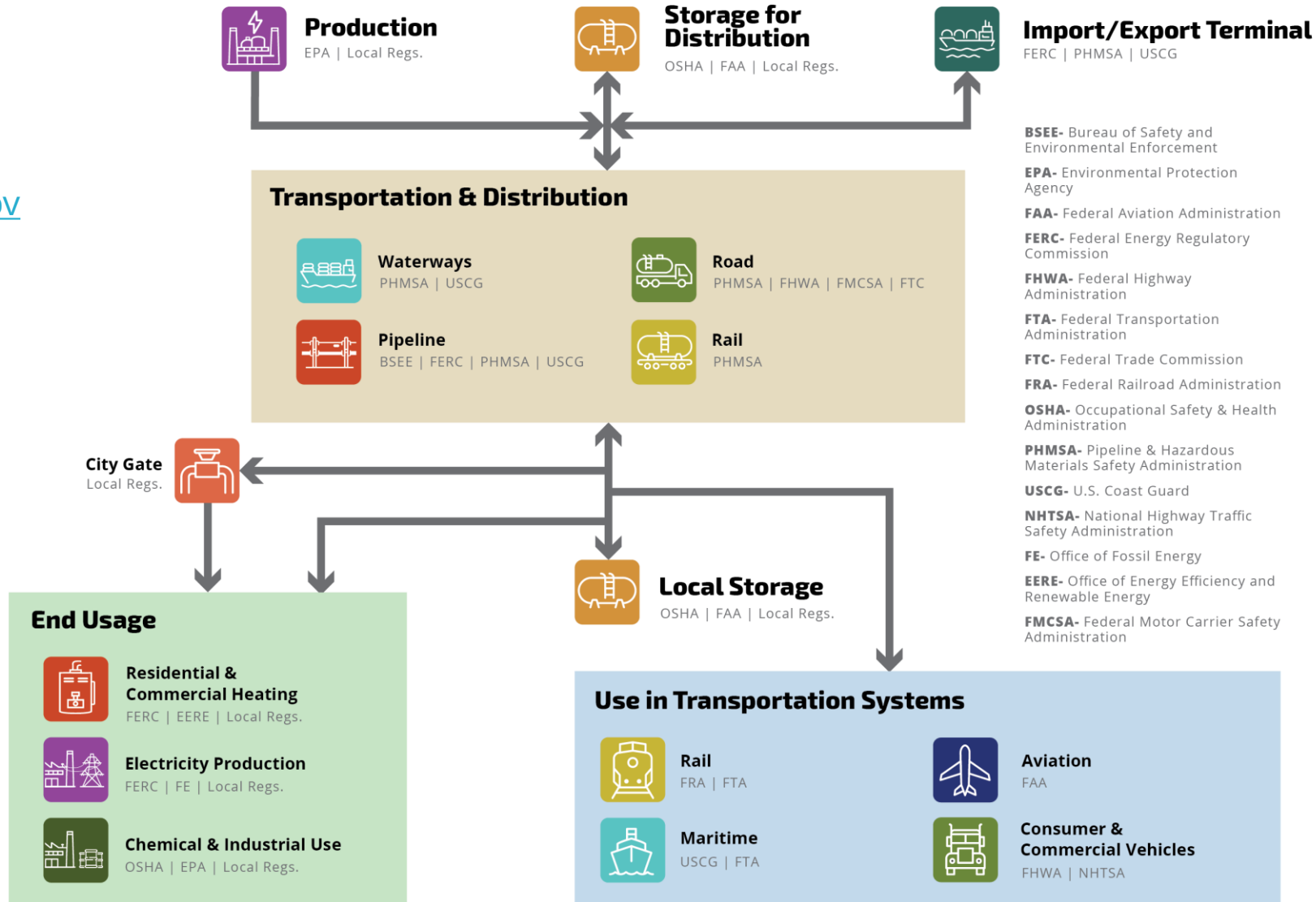
## **Use**

- 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



# 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](https://energy.sandia.gov/wp-content/uploads/2021/03/H2-Regulatory-Map-Report_SAND2021-2955.pdf)



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Q&A ×

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