

## **LNG R&D Forum Working Group Focus Areas**

PHMSA is planning a virtual liquefied natural gas (LNG) research and development (R&D) public meeting and forum (“LNG R&D Public Meeting and Forum”) on November 15 and 16, 2022. The purpose of the LNG R&D Public Meeting and Forum is to assist PHMSA in developing an R&D agenda covering the next two years and to address the Department of Transportation’s (DOT) strategic goals.<sup>1</sup> In addition, recently, the transportation of energy and other hazardous materials that PHMSA regulates has increased in complexity and scope. In particular, the United States has experienced a significant increase in LNG exports over the last decade.<sup>2</sup> As a result of the increased demand for LNG exports and to address the safety risks and operational challenges of LNG facilities, PHMSA staff developed the list of topics below as prudent for potential further research.

Attendees participating in the LNG R&D Public Meeting and Forum working groups will examine the various challenges and safety impacts to LNG facilities. The working groups, through presentations and discussions, will conduct LNG safety gap analyses; identify and evaluate ongoing research; prioritize addressing safety gaps; and define potential project objectives, scopes, and goals for the gaps identified during each session. The list below is not all-inclusive but provides a springboard for possible research topics within each working group focus area. PHMSA’s R&D program has funded research in some of the focus areas, such as LNG tank design and construction and hazard modeling.

**LNG Facility Design and Construction** – This working group will evaluate LNG facility design and construction safety-related challenges, risks, concerns, and new technology-based systems or applications for:

- Process and piping design;
- Control systems (base process controls, safety instrumented systems, etc.)
- Process hazard analysis (hazard and operability analysis (HAZOP)/layers of protection analysis (LOPA), etc.);
- Vapor handling (boil off gas (BOG) systems, etc.);
- Structural members (including passive and active fire and cryogenic protection); and
- Construction testing requirements.

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<sup>1</sup> <https://www.transportation.gov/dot-strategic-plan>

<sup>2</sup> According to the U.S. Energy Information Administration (EIA) - <https://www.eia.gov/energyexplained/natural-gas/liquefied-natural-gas.php> (updated as of May 19, 2022), the “U.S. LNG export capacity increased from less than 1 billion cubic feet (Bcf) per day (Bcf/d) in 2015 to 10.78 Bcf/d at the end of 2020. Total peak export capacity in 2021 was about 12.98 Bcf/d. In 2015, total U.S. LNG exports were about 28 Bcf to seven countries. In 2021, U.S. LNG exports reached a record high of about 3,561 Bcf to 45 countries, and LNG exports accounted for 54% of total U.S. natural gas exports.”

**LNG Facility Siting** – This working group will evaluate safety improvements for LNG facility siting:

- Passive and active protection (vapor barriers, berms, ignition controls, etc.); and
- Possible safety gaps in 49 Code of Federal Regulations (CFR) Part 193 and in industry technical standards.

**LNG Facility Fire Protection** – This working group will evaluate safety improvements for fire protection systems at LNG facilities:

- Firewater system design, philosophy, and operability;
- Fire and gas detection technology;
- Emergency shutdown systems; and
- Hazard controls (deluge systems, clean agent systems, fire extinguishers, etc.).

**LNG Operation and Maintenance** – This working group will evaluate safety improvements for the operation and maintenance of LNG facilities:

- Plans and procedures (recommended practices and standards for performance-based regulations, management of change, etc.);
- Safe work practices (lockout/tagout, car seal, confined space, etc.);
- Human factors (understanding the role of human error);
- Incident investigation and reporting requirements (investigation techniques, reporting methodologies, etc.);
- Reporting requirements (incident data collection to inform risk-based decision making);
- Inspection and testing (risk-based inspection of equipment and control systems);
- Maintenance and Repairs (fitness for service assessments, safety of plant personnel during repairs);
- Corrosion protection (internal corrosion, corrosion under insulation, atmospheric corrosion, etc.); and
- Personnel protection (protection for personnel when working near toxic or asphyxiant equipment, requirements for maintenance of toxic equipment, protection for maintenance of flare, contractor safety, etc.).