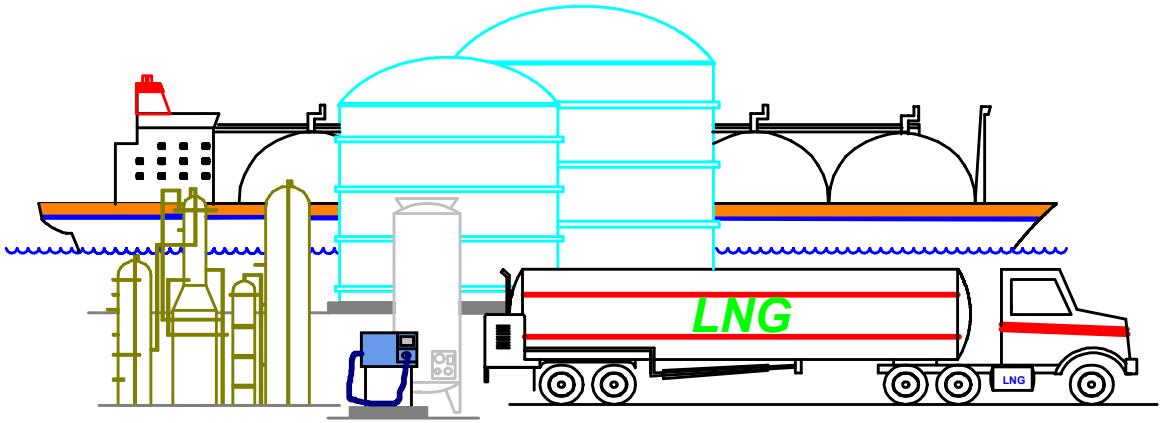
# The Reemergence of U.S. LNG

## Presented by Jeff Beale, CH·IV International




## Presented to OCS Policy Committee Meeting

San Diego  October 31, 2001

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# Agenda

- What is LNG?
- Marine Transport
- Import overview
- Where does it come from?
- Environmental Issues
- Security Issues
- Impact on OCS

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# LNG Basics - What is LNG?

- Not Propane!  Not Methanol!
- It's Cryogenic!!
  - "Freeze a Rose  or tennis ball"
  - Many materials become weaker or brittle
  - SS, AL, brass, and Teflon get stronger

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# The Cryogenic Liquid Family

| Liquid | Boiling Point °F |
|---|---|
| Ethane | -127 |
| Ethylene | -155 |
| LNG | -260 |
| Oxygen | -297 |
| Argon | -303 |
| Nitrogen | -320 |
| Hydrogen | -423 |
| Helium | -453 |

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# LNG Basics - What is LNG?

- **Just natural gas cooled to -260°F**
  - No water, $CO_2$, sulfur compounds, etc.
  - Mostly methane ($CH_4$)
  - Like boiling water 500° colder
  - Vapor/Liquid Volume Ratio = 600:1
    - Water ≈ 1000:1
- **How is LNG Used?**

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# LNG Peakshavers

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# LNG in the U.S.

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# Satellite LNG Peakshaver

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# Propane Replacement

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# LNG Vehicle

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# LNG Vehicle Fueling

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# Supplemental Natural Gas Supply

- Export from Gas-Rich / Industrially-Poor
- Import to Industrially-Rich to Gas-Poor
- Focus of OCS Interest

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# LNG Basics - Properties

- Half the weight of water
- Flammable when vaporized (5% to 15%)
  - Clean burning
  - Basically 1 “C” + 4 “H”
- Colorless
- Odorless
- Tasteless??

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# LNG Basics - Hazards

- LNG Spill - visible white cloud
  - Becomes buoyant @ -160°F
  - Flammable limit edge of cloud
- Flammable
  - Open (unconfined) pool
    - CANNOT EXPLODE
    - "Flameless Explosion"
  - Flame speed ~ 4 fps
  - Above 15%, UFL, insufficient $O_2$
  - Below 5%, LFL, insufficient fuel
  - Cigarette not hot enough to ignite

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# LNG Transport

- Ships
- Barge(s)
- LNG Trailers for vehicular fuel

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# LNG Ships

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# More Ships

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# And more . . .

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# LNG Barge

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# LNG Trucking

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# LNG Import Overview

- Unload ships
- Store LNG
- Pump to pressure and vaporize

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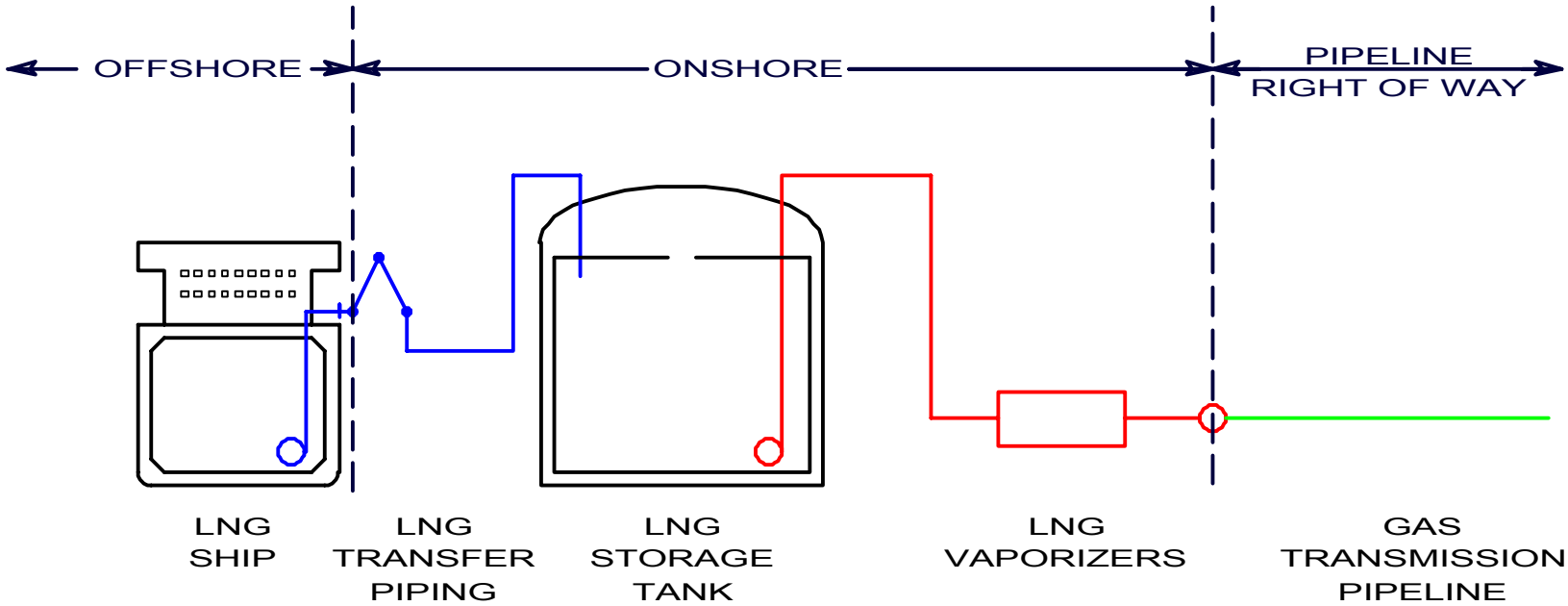


BASIC
LNG IMPORT FACILITY
PUERTA RICO

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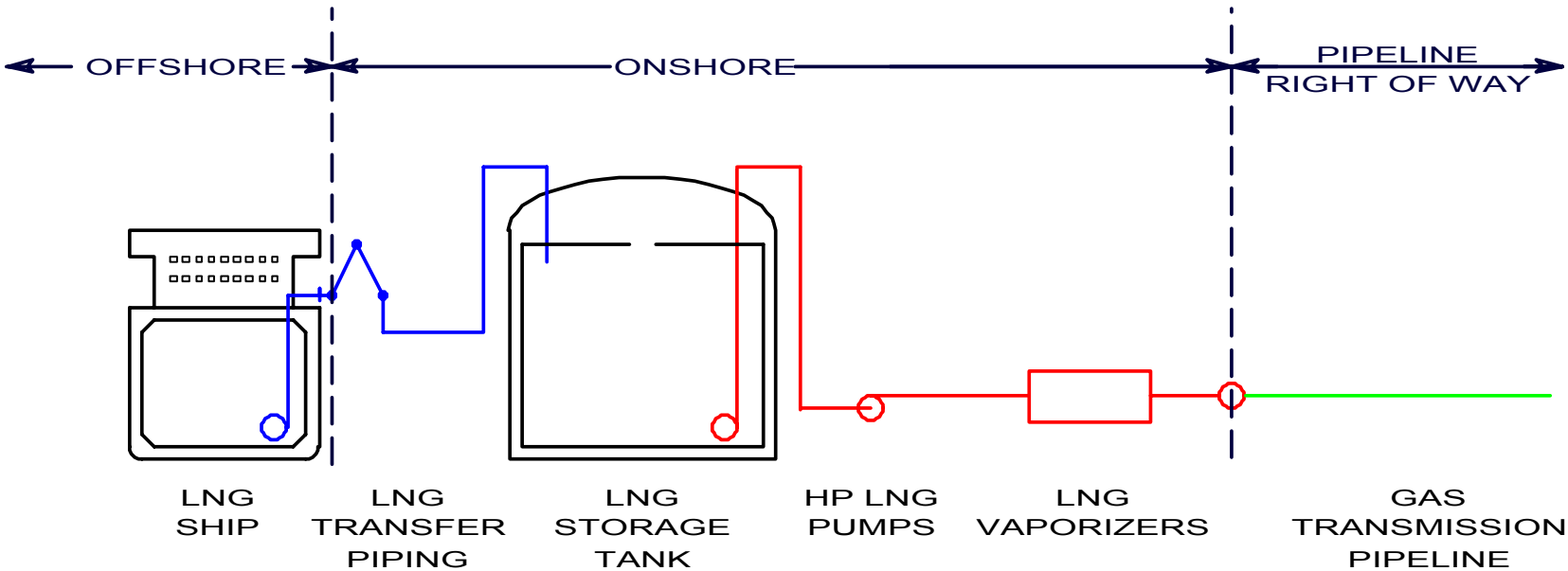


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LNG IMPORT FACILITY
EVERETT - LAKE CHARLES
ELBA ISLAND - PUMPS OUTSIDE

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# LNG Import Terminal ~ Lake Charles

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# LNG Import Terminal ~ Elba Island

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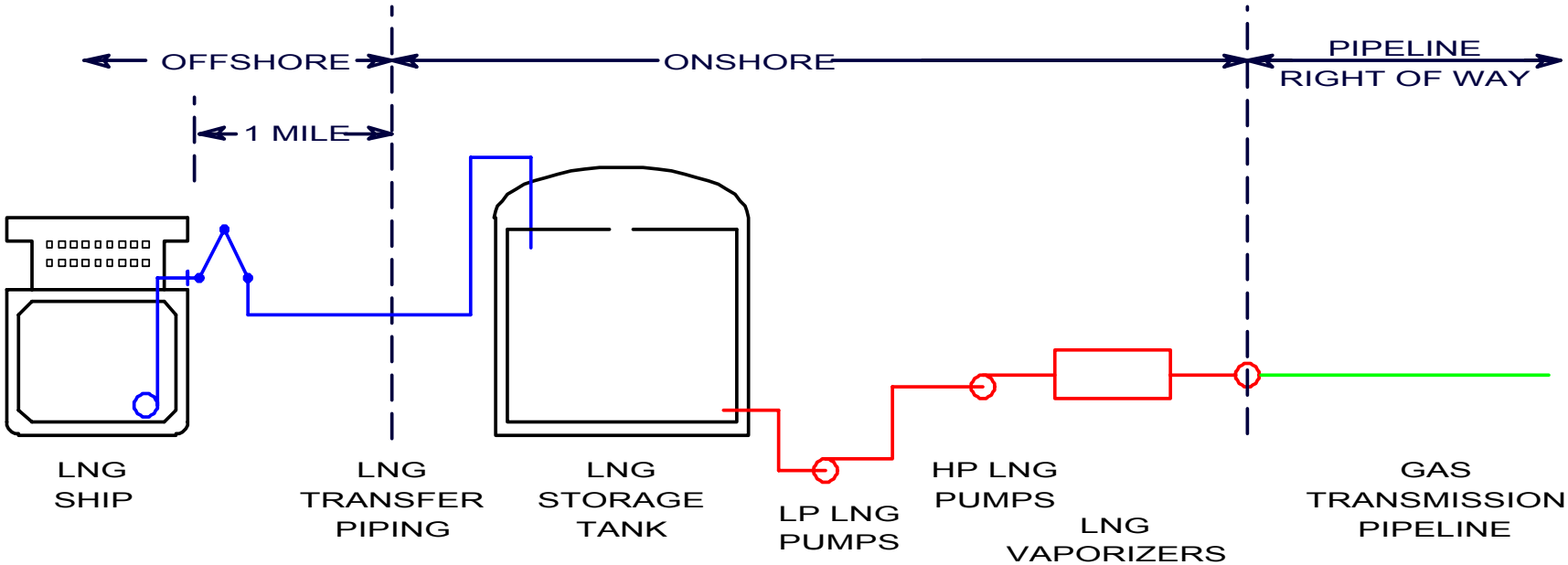


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LNG IMPORT FACILITY
COVE POINT

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# LNG Import Terminal ~ Cove Point Dock

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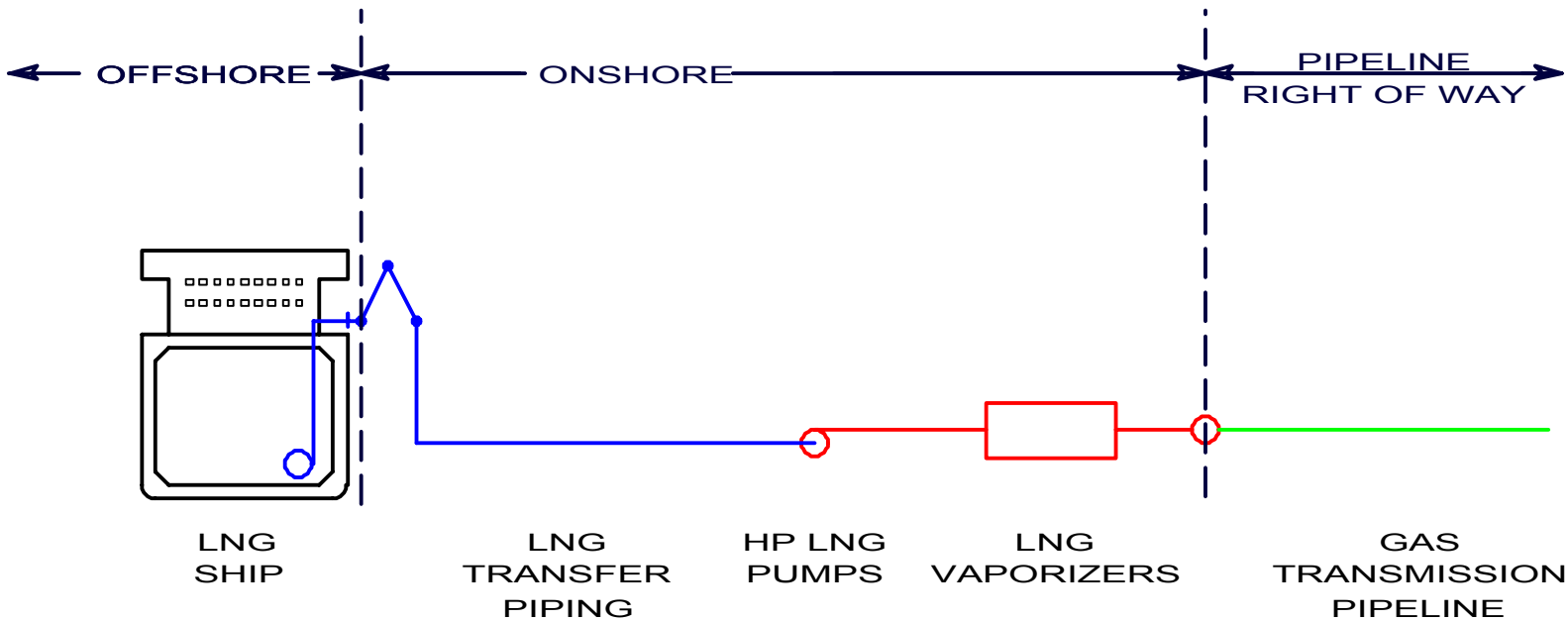


"NO STORAGE"
LNG IMPORT FACILITY
HACKBERRY, LOUISIANA

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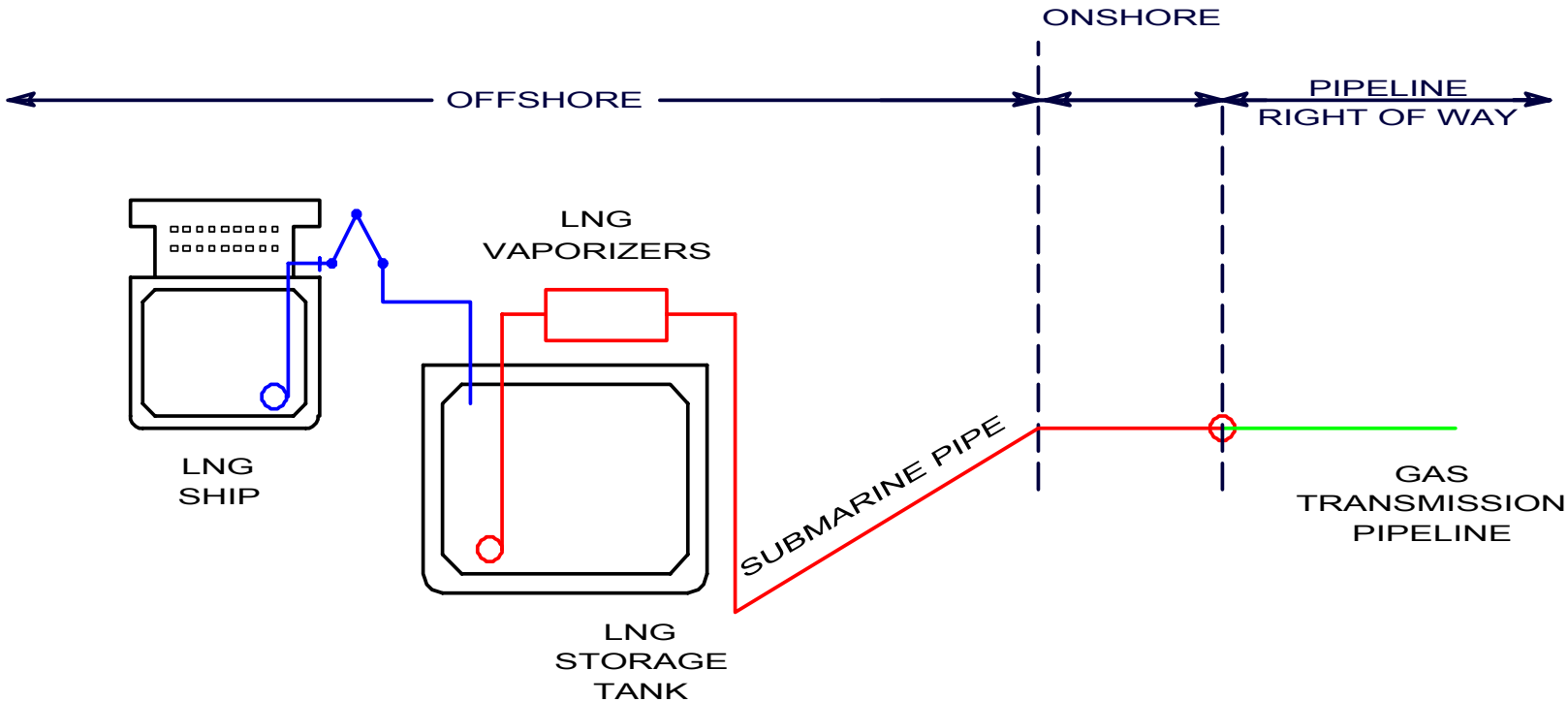


OFFSHORE (FLOATING)
LNG IMPORT FACILITY
GULF OF MEXICO

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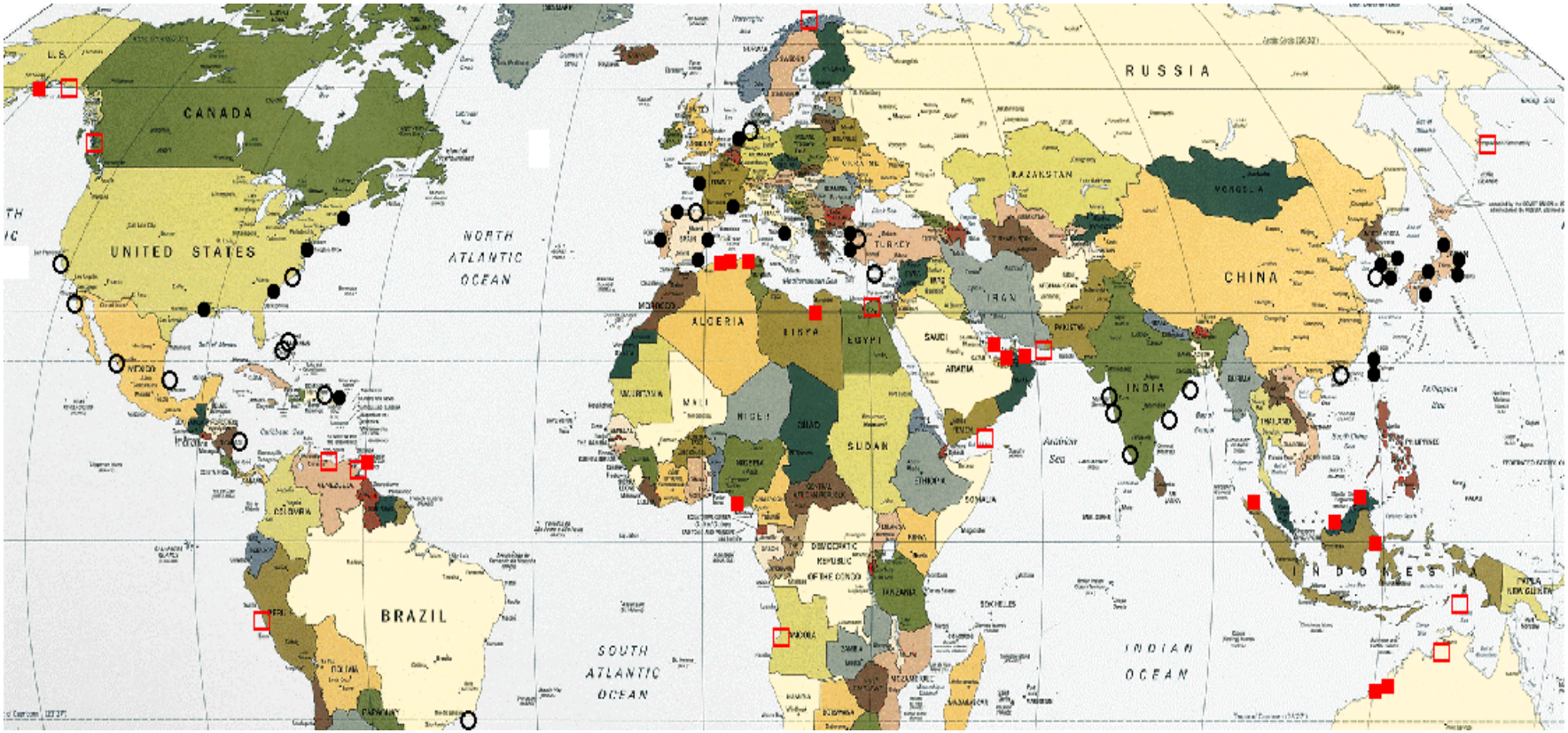
# Worldwide LNG Facilities




- ● - Existing LNG Import Terminals
- ○ - Planned Import Terminals
- ■ - Existing LNG Export Terminals
- □ - Planned Export Terminals

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# Public Perception

- The "BOMB"
  - 5 reasons
    - "Time Bomb"
    - "The Night Manhattan Burned"
    - "Frozen Fire"
    - "Deadly Frost"
    - "Balls"
- The Reality
  - Cleveland - 1944
  - 1945 to Present

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# Environmental Issues - LNG Spills

- LNG Ships
  - Double hull
  - Multi-compartment
- LNG Tank
  - Second containment
  - Full containment
- Exclusion Zones
- No “Blast Zone”
- No Residue - Vaporizes - Dissipates

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# Environmental Issues

- Not a ground water contaminent
- No benzenes, PCBs, aromatics, sulphurs, etc.
- Cleanest burning of carbon-based fuels
  - Excellent diesel replacement
  - Cleaner than pipeline natural gas
- It is a form of energy
  - Must be respected
  - Follow design, construction and operating codes

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# Impact on OCS

- Gulf of Mexico
- California
- North Carolina?
- Florida?
- Where else?

- You tell me

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# Security Issues

- All changed on 9/11
  - Have to think about everything differently
- Are LNG facilities and LNG ships targets?
- On one hand . . . “Time Bomb”!
- On the other . . .
  - Gasoline, propane, ammonia, chlorine, 19 others
- We must be vigilant on all fronts

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# Thank you

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# Contact Information


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# *Questions?*

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