

Project Dreadnaught vs. Project Ballast — Hybrid Propane Comparison

Emissions • Storage Setbacks • Fire Safety Analysis • Toxicity & Vapor Cloud Risks | Heavily Cited Reference

1. Side-by-Side Comparison

Factor	Ballast Hybrid (NG + Propane Combustion)	Dreadnaught (Solid Oxide Fuel Cells)
Technology	Combustion turbines or reciprocating engines; dual-fuel capable (NG primary, propane secondary/backup)	Non-combustion solid-oxide fuel cells
NOx	Combustion levels (typ. 0.07–0.15+ lb/MWh with SCR)	0.003 lb/MWh
Particulate Matter	Present (combustion)	None (zero)
SO ₂	Low but present	Negligible (<0.001 lb/MWh)
CO ₂	Higher when on propane (higher carbon intensity than pipeline NG)	679–833 lb/MWh
Noise	Higher (combustion + rotating equipment)	Very low
On-site Fuel Storage	Large propane storage required for meaningful backup/peaking	Minimal (pipeline NG primary)
NFPA 58 Setbacks	50–100+ ft depending on tank size (see Table 2)	None applicable (no bulk LPG)
Fire Safety Analysis	Required if aggregate >4,000 gal water capacity	Not required

Sources: Bloom Energy “How Bloom Reduces Emissions” Technical Note; EIA CO₂ emission coefficients; industry dual-fuel practice.

2. NFPA 58 Propane Storage Setbacks (Explicit Cites)

Large aboveground ASME containers are governed by **NFPA 58, Liquefied Petroleum Gas Code**, Table 6.4.1.1 (Container Separation Distances). Key distances to buildings and property lines that can be built upon:

Water Capacity per Container	Aboveground Distance to Buildings / Property Line	Distance Between Containers	NFPA 58 Cite
501 – 2,000 gal	25 ft	3 ft	Table 6.4.1.1
2,001 – 30,000 gal	50 ft	5 ft	Table 6.4.1.1
30,001 – 70,000 gal	75 ft	¼ sum of diameters	Table 6.4.1.1
70,001 – 90,000 gal	100 ft	¼ sum of diameters	Table 6.4.1.1
90,001 – 120,000 gal	125 ft	¼ sum of diameters	Table 6.4.1.1
>120,000 gal	200–400 ft (scale-dependent)	¼ sum of diameters	Table 6.4.1.1

Source: NFPA 58 (2020/2024 editions), Table 6.4.1.1 and §6.4. Underground/mounded tanks have reduced distances (typically 10 ft) under §6.4.2.

3. Fire Safety Analysis (FSA) Requirements — NFPA 58

Trigger: Aggregate water capacity of ASME containers **greater than 4,000 gallons** (NFPA 58 §6.29.3.1 / prior §6.27.3.1). A written Fire Safety Analysis is required for all new installations above this threshold and for existing installations (compliance timeline after code adoption). The FSA must specify modes of fire protection and be submitted to the Authority Having Jurisdiction and local emergency responders (§6.29.3.2–6.29.3.3). Installations in heavily populated or congested areas may face additional distance or protection requirements based on the FSA. **Dreadnaught:** No bulk LPG storage → FSA not required. **Ballast hybrid with meaningful propane backup:** Almost certainly exceeds 4,000 gal aggregate → written FSA mandatory.

Source: NFPA 58 §6.29 (Fire Protection for Industrial Plants, Bulk Plants...); Fire Safety Analysis Manual for LP-Gas Storage Facilities (industry guidance implementing the code).

4. Propane Toxicity and Vapor Cloud / BLEVE Risks

Toxicity: Propane is classified as a simple asphyxiant (displaces oxygen). It is not highly toxic in the classic chemical sense, but high concentrations cause oxygen deficiency, dizziness, unconsciousness, and death. OSHA PEL is not specifically listed as a toxic substance; NIOSH REL and IDLH focus on asphyxiation risk in confined spaces. **Primary hazard is physical, not toxicological.**

Vapor Cloud & BLEVE Risks: Propane is stored as a liquefied gas under pressure. A major leak can form a dense, ground-hugging flammable vapor cloud. If ignited, outcomes include flash fire, vapor cloud explosion (VCE), or — if a tank is weakened by fire — a Boiling Liquid Expanding Vapor Explosion (BLEVE). Historical incidents (e.g., Toronto Sunrise Propane 2008) demonstrate multi-tank BLEVEs, projectiles, and large fireballs. Academic and industry literature consistently identify large LPG storage as carrying significant VCE/BLEVE potential when loss of containment occurs, especially with congestion or delayed ignition. These risks are the principal reason for the large NFPA 58 separation distances and the mandatory Fire Safety Analysis above 4,000 gallons.

Sources: NIOSH Pocket Guide / OSHA guidance on simple asphyxiants; peer-reviewed literature on LPG vapor cloud explosions and BLEVEs (e.g., studies of storage-tank accidents and fire-test data); Toronto Sunrise Propane incident reports; NFPA 58 technical basis for separation distances.

Bottom line for local messaging: Even as a hybrid, Ballast remains a combustion plant with the full suite of NOx/PM/noise characteristics that generated opposition, plus the added land, setback, and emergency-response burden of large-scale propane storage under NFPA 58. Fuel cells eliminate the criteria pollutants of concern and avoid bulk LPG storage risks entirely.