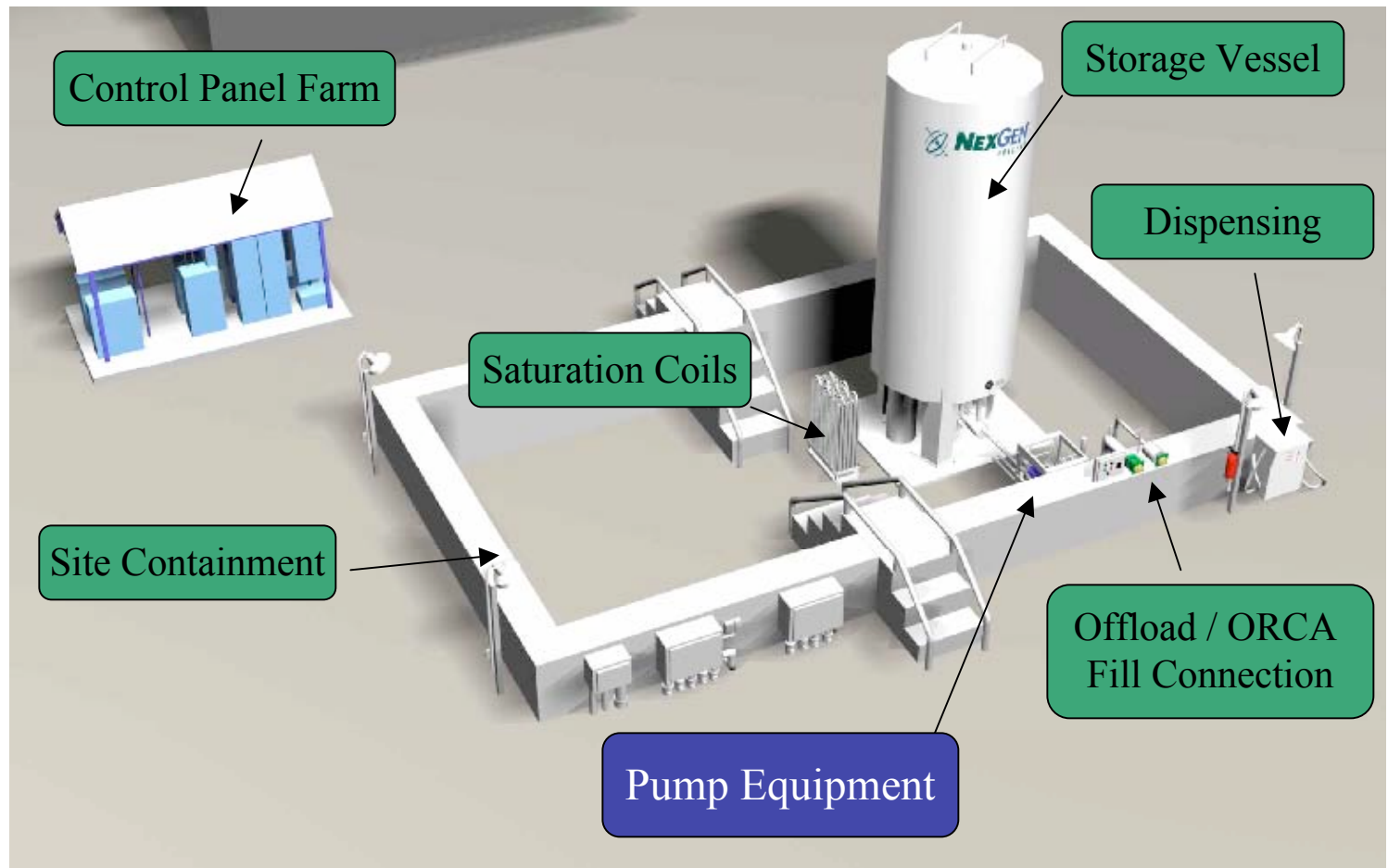




Southern California Alternative Fuel Vehicle Exposition & Natural Gas Infrastructure Workshop

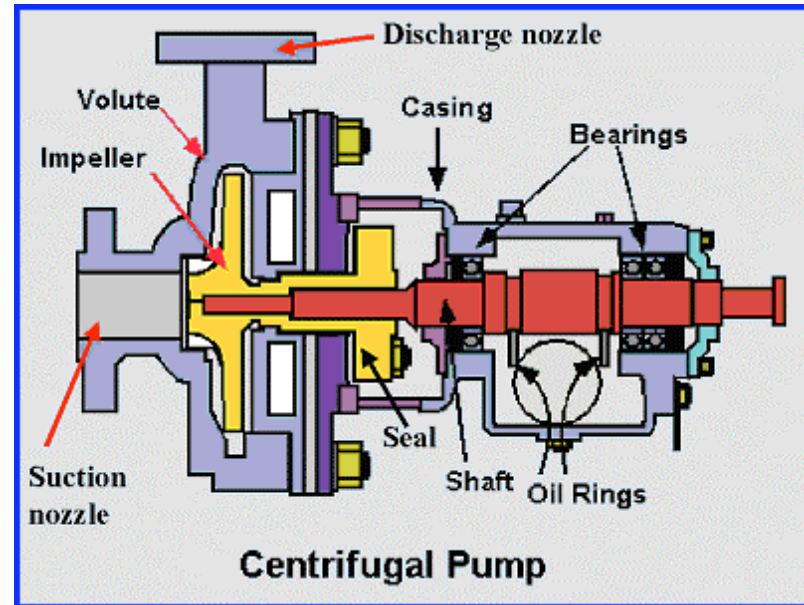
Patrick Hutson
Presenting
LNG Fueling System

Major Equipment



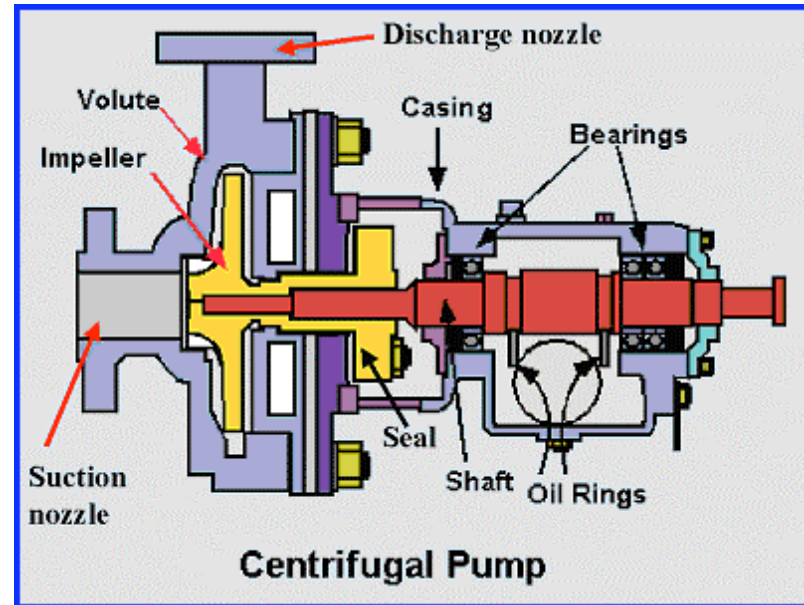
Centrifugal Pumping

- **A centrifugal pump uses an impeller (propeller) to push or fling liquid into a conduit**
- **The force created by the rotation of the impeller causes the liquid to exit the pump at a higher pressure than it entered**
- **The energy and turbulence induced by the impeller increases the energy of the liquid**
- **Boiling liquid may create vapor pockets that cause the discharge pressure and discharge rate to fluctuate rapidly (Cavitation)**



Centrifugal Pumping Cont.

- **Cavitation will unduly wear the pump bearings and impellers causing damage**
- **Cavitation is prevented by**
 - **Cooling pump prior to use**
 - **Maintaining proper NPSH**
 - **Maintaining additional vapor pressure above liquid (Sub-Cool)**



Unsubmerged Ground Pump

☼ Positives

- **Incredible speeds**
- **Lower initial cost**
- **Lower heat introduction (only induces heat while used)**

☼ Negatives

- **Long cool down times**
- **Larger NPSH requirements**
- **Hard to prime at high liquid temperatures**
- **More difficult to automate**



Submerged Pump

☼ Positives

- **Always cold ready to run**
- **Longer lifetime**
- **Lower NPSH requirements**
- **More indifferent to liquid temperature**
- **Consistent pumping easy to automate**

☼ Negatives

- **Higher initial cost**
- **Lower pumping speeds**
- **If always submerged has greater heat introduction**



NexGen Submersible Pump Skid

- **Contains ACD AC-34 Pump**
- **Multifunction Role**
 - **Dispense Product to Vehicles**
 - **Dispense Product to ORCA**
 - **Receive Fuel from Trailer**
- **Shop Assembled to ASME B31.3**



NexGen Pump Combination

• Simple Function Skid

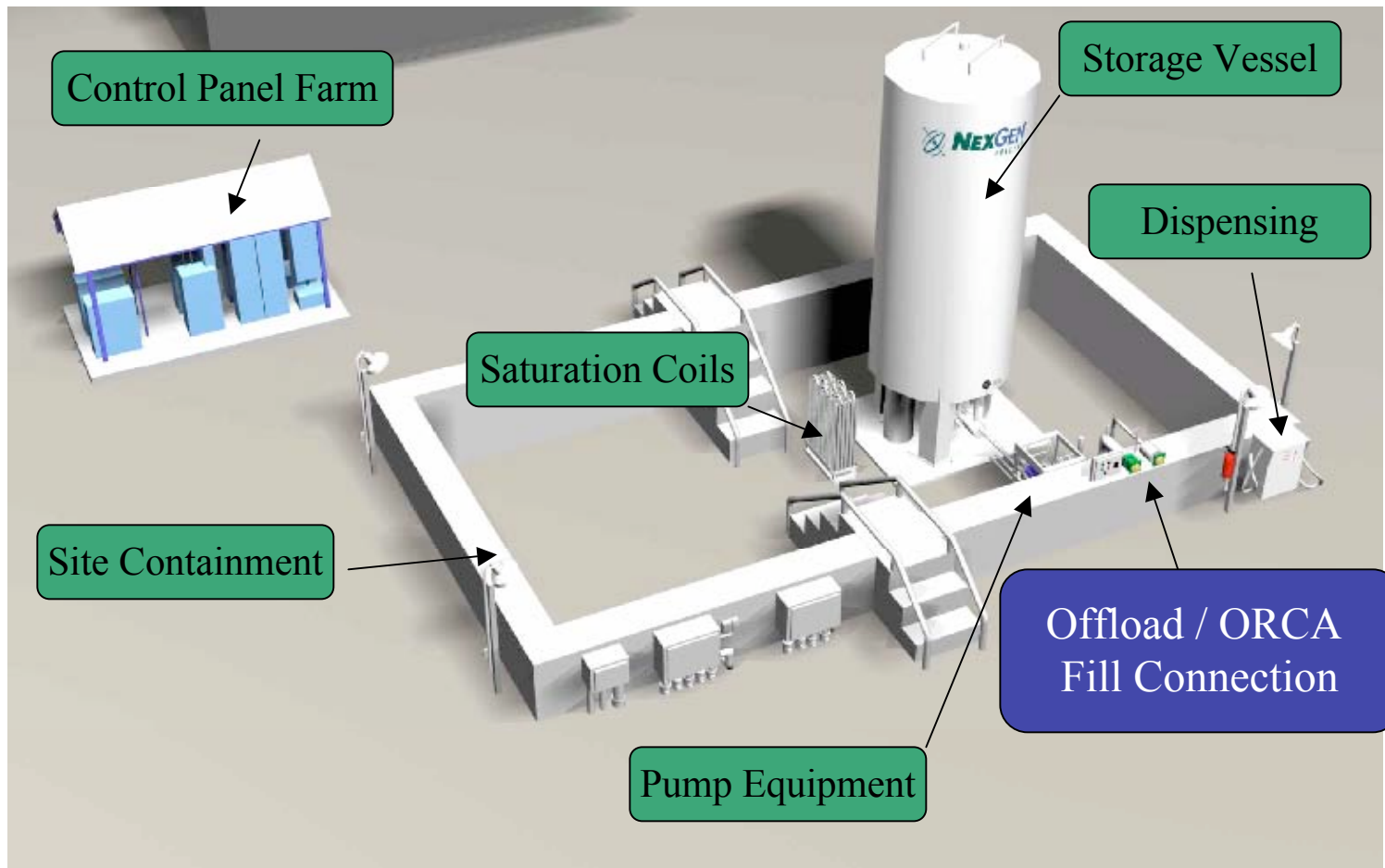
- **Contains ACD TC-34 Pump a smaller less expensive pump**
- **Multiple configurations offering redundancy**
- **Shop Assembled to ASME B31.3**

• CS&P Ground Pump

- **Reliable Offload Pump**
- **Flows up to 190 gpm**

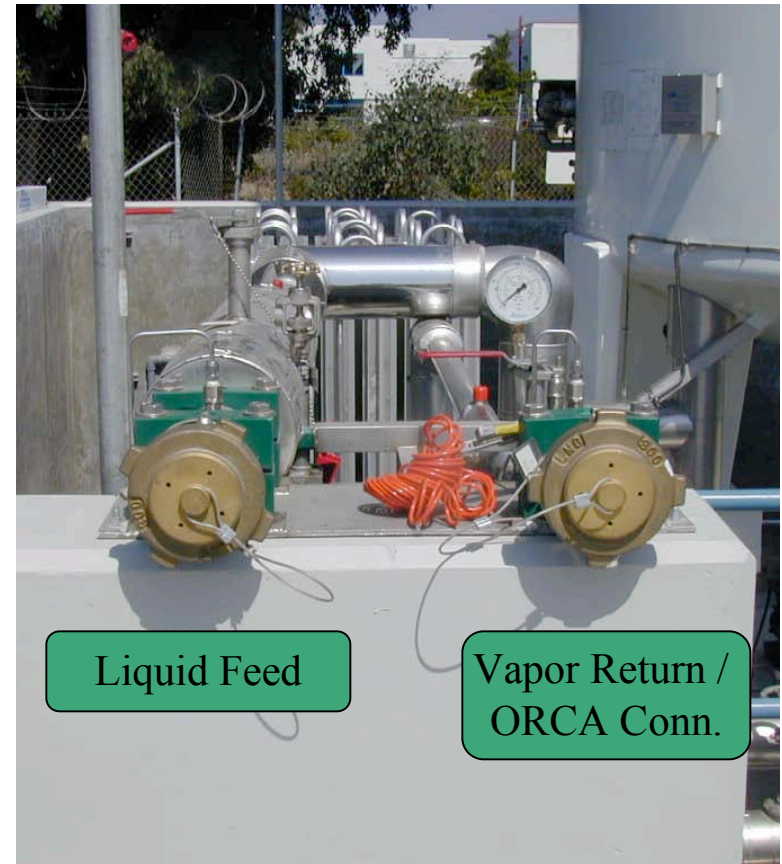


Major Equipment

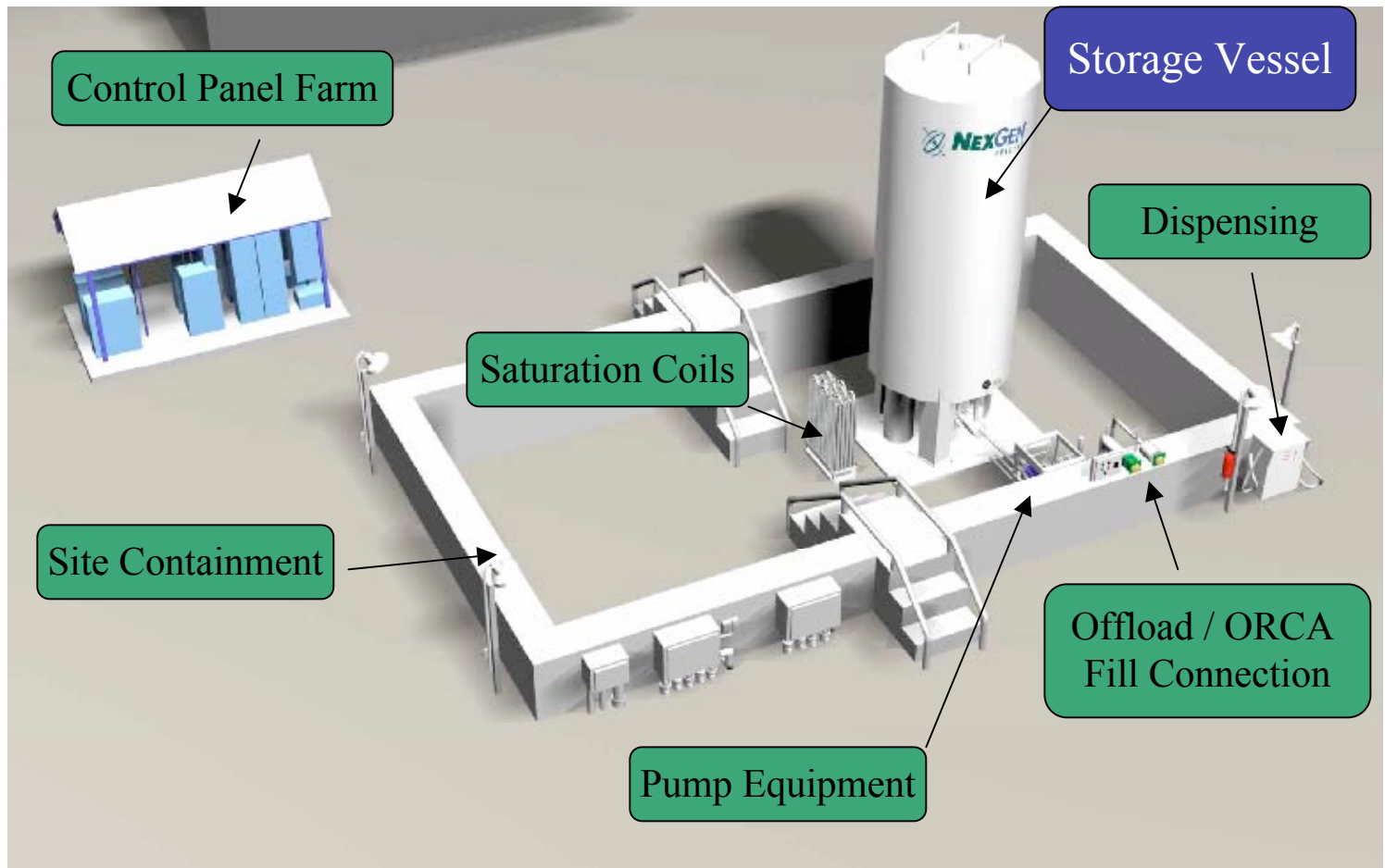


Offload / ORCA Fill Connection

- **Dual connection interface to trailer**
 - **Allows for vapor recovery during offload**
 - **Allows optional connection to ORCA**
- **Mates with dedicated ground pump or submerged pump skid**



Major Equipment

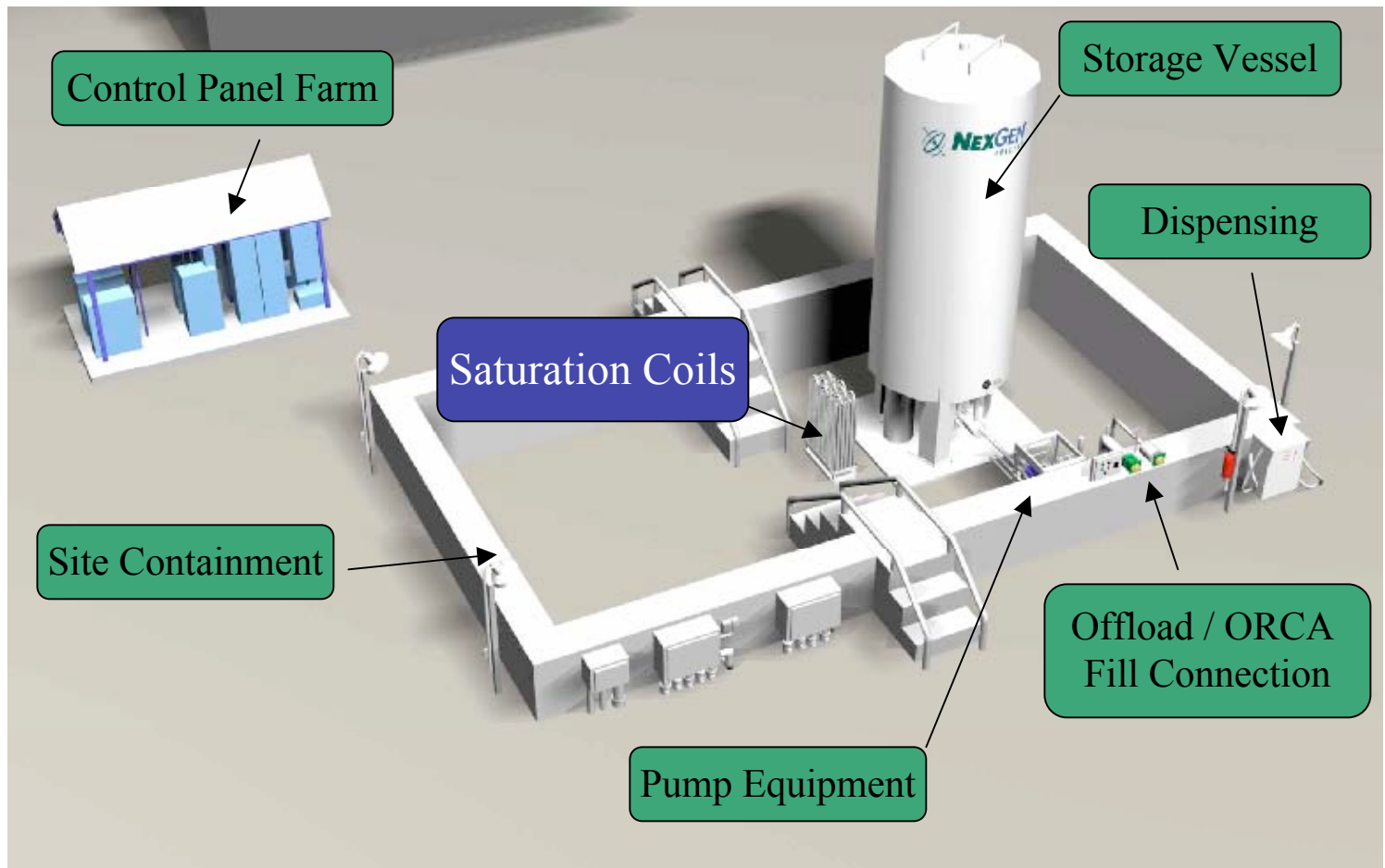


Storage

- **Enough reserve fuel for Dispensing to fleet**
- **Thermally balanced with incoming fuel**
- **Optimal size is 15000 Gallons gross capacity**



Major Equipment



Conditioning System

- ❁ **Increases the liquid temperature (Saturation) of the LNG**
- ❁ **Necessary for most engine manufacturers**
- ❁ **Temperature identified by corresponding saturation pressure**



Ambient Air Vaporizer

☼ Positives

- **No power requirements**
- **No moving parts**
- **Near Zero Maintenance**
- **Lower initial cost**
- **Lower long term cost**

☼ Negatives

- **Only efficient for short duration usage**
- **Lower heat transfer rates**



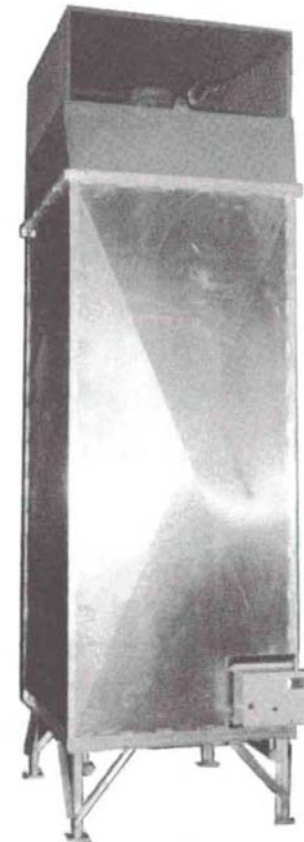
Fan Assisted Vaporizer

☼ Positives

- **High heat transfer rates**
- **Efficient for long duration usage**

☼ Negatives

- **Requires power**
- **Utilizes a motor**
- **Higher initial cost**
- **Higher operational cost**



Sources of Heat

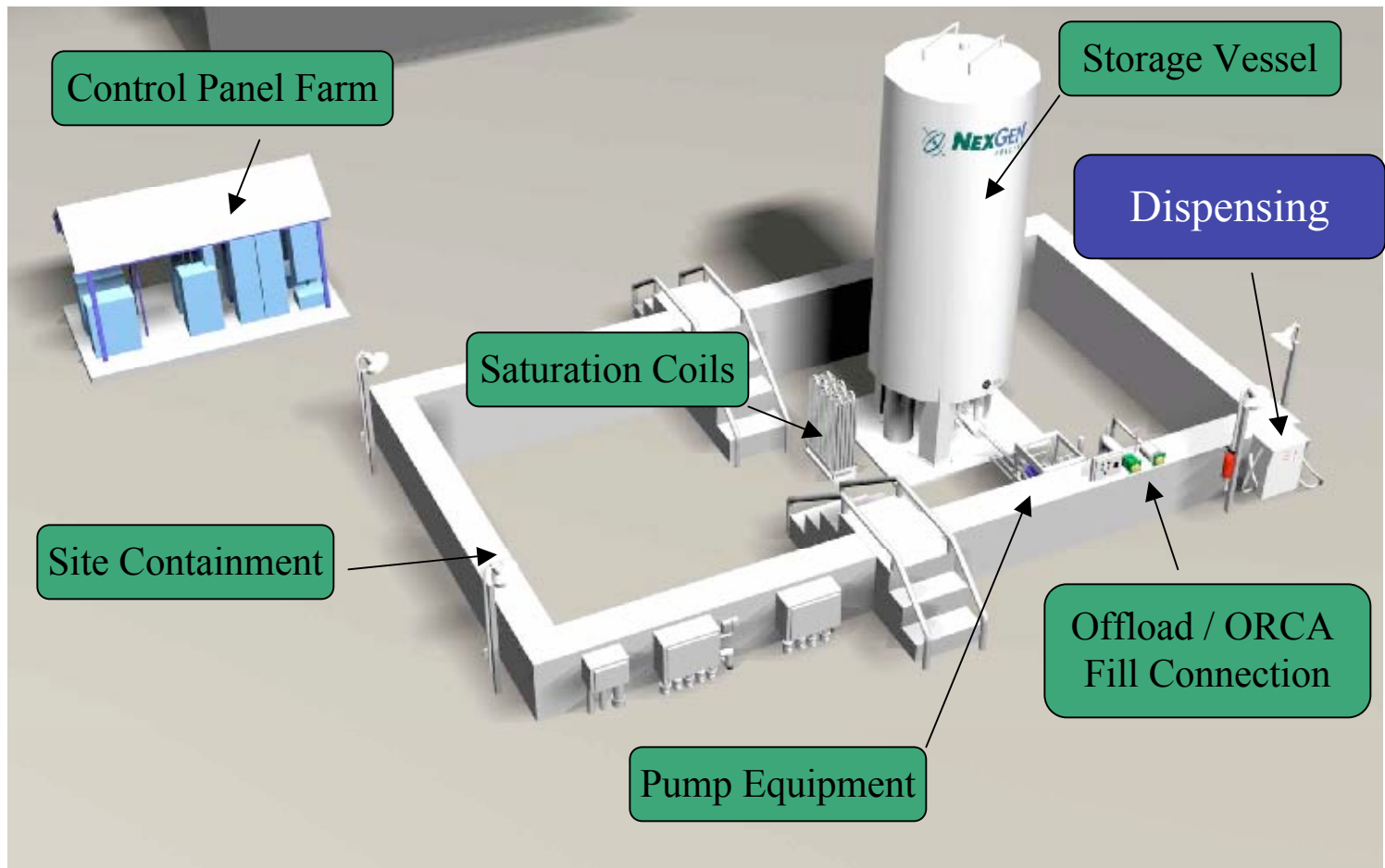
- **Typical saturation pressure requirements are between 80 and 120 psi**
- **Typical fuel deliveries are between 20 and 30 psi**
- **Storage vessel maintains a “heel” of liquid and warm mass of metal when delivery arrives**
- **Dispensing pump adds heat to liquid increasing saturation by up to 30 psi**

NexGen Conditioning System

- **NexGen uses an ambient air vaporizer for saturation**
- **The cumulative amount of energy added during offload and dispensing vastly reduces the amount of energy required of the vaporizer**
- **The added thermal throughput of a fan assisted vaporizer is rarely required**



Major Equipment

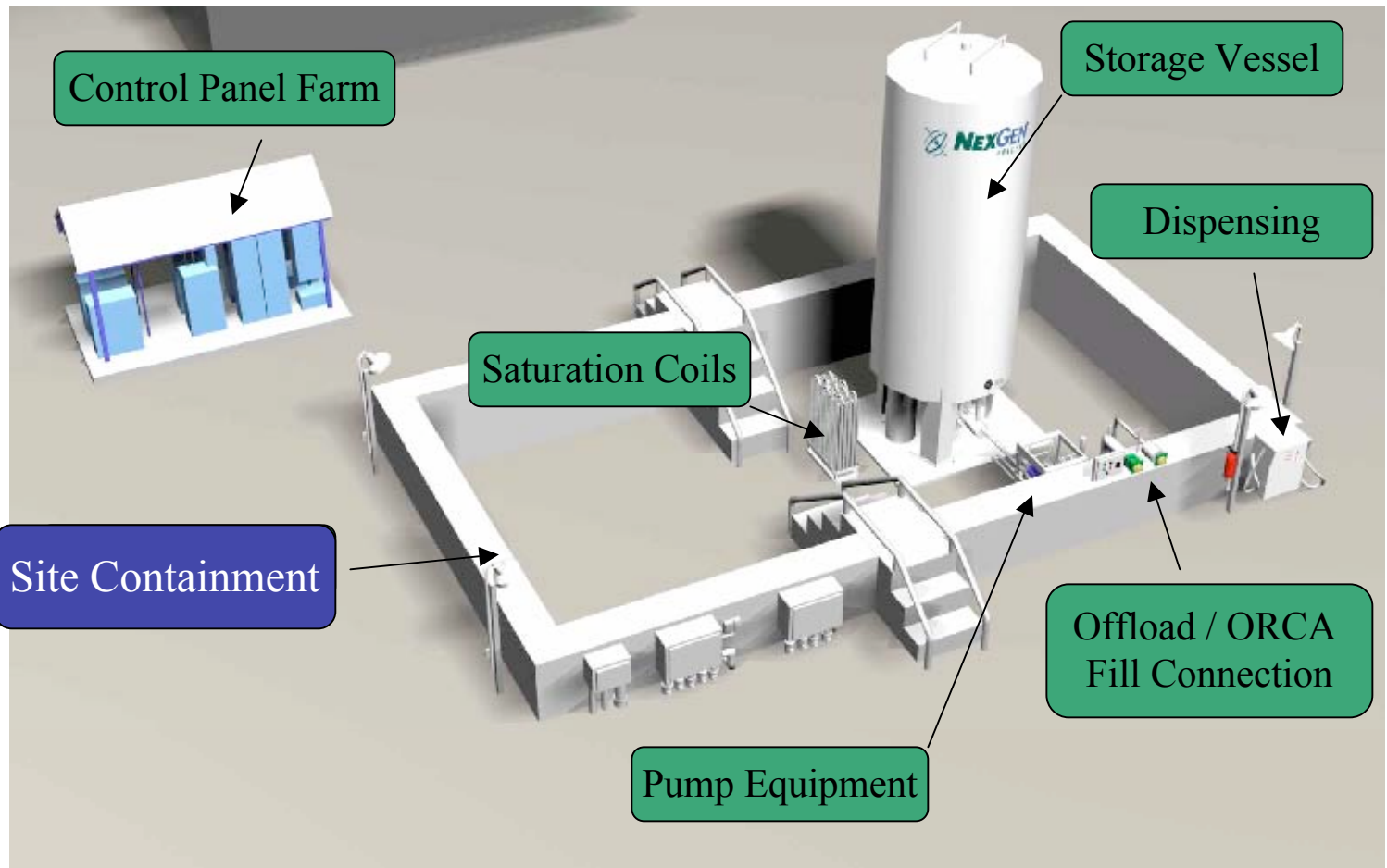


Dispenser/Metering

- **Weights and Measures Approved**
- **Creates familiar interface for dispensing**
- **Houses meter in phase separator**
- **Allows for remote locating of fueling lane**



Major Equipment



Site Containment

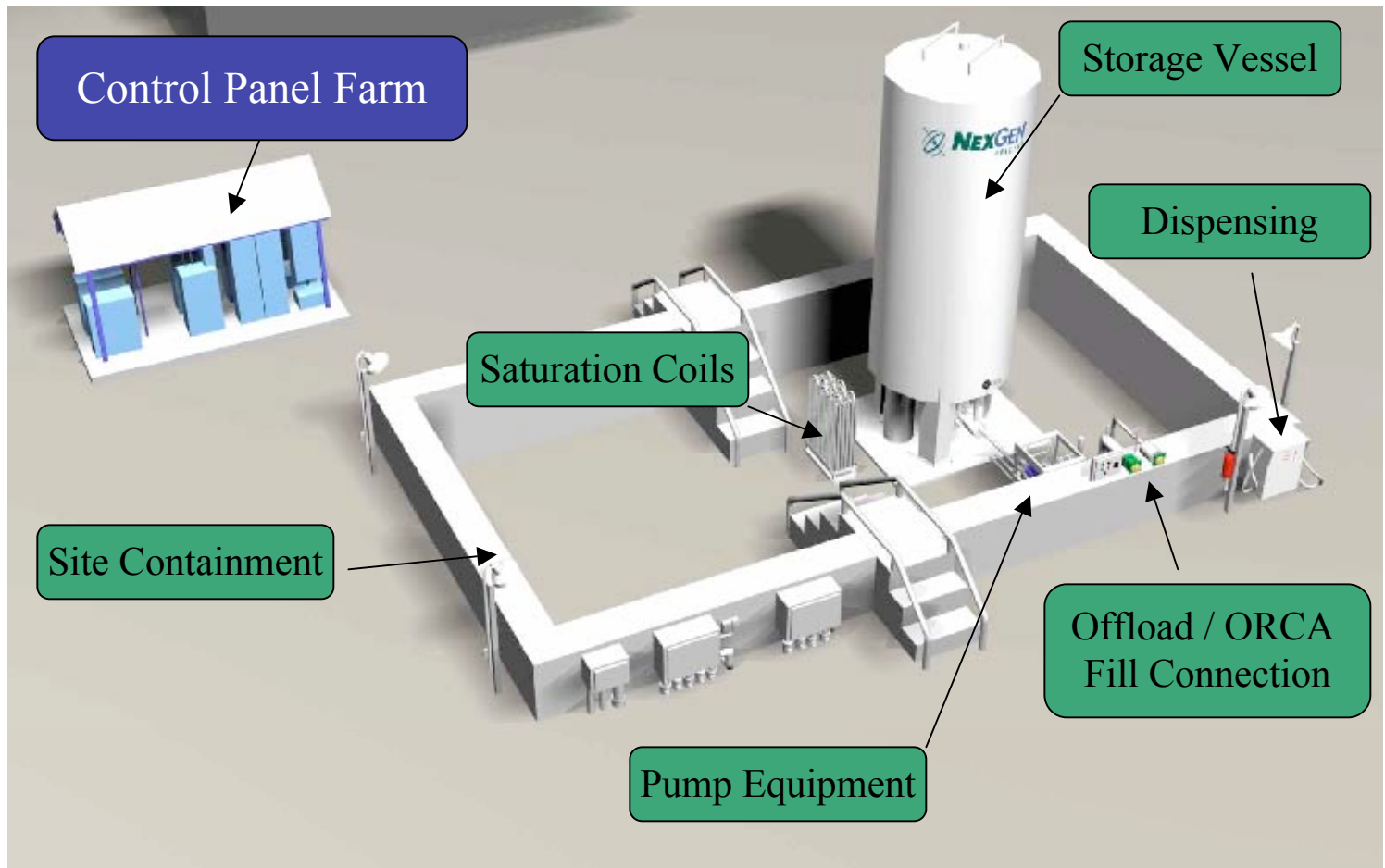
- **Provides Foundation for Equipment**
- **Provides Secondary Containment per NFPA 59A Chapter 10**
- **Includes utilities and safety system provisions**



Site Containment Issues:

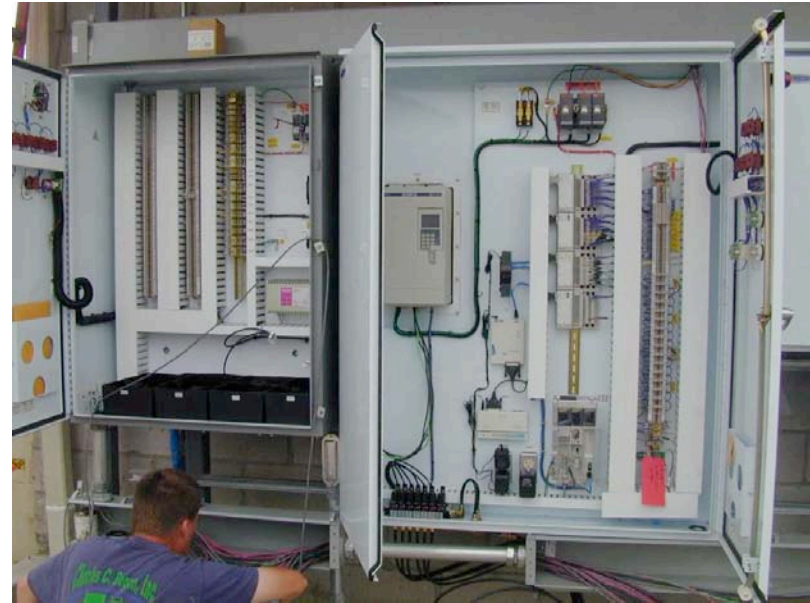
	NFPA 57 “LNG Vehicle Systems”	NFPA 59A Chpt. 10 “Alternate rules for LNG Facilities”
Storage Area Containment	100% of Volume	100% of Volume
Transfer Area Containment	10 minute Spill Containment	Not referenced in chapter 10
Site Design	NFPA 57/59A compliant Foundation in Pit which allows transfer are to drain into it, or foundation at grade with sufficient trenching or drain fields	NFPA 59A Chpt. 10 Compliant Foundation at grade with containment wall

Major Equipment

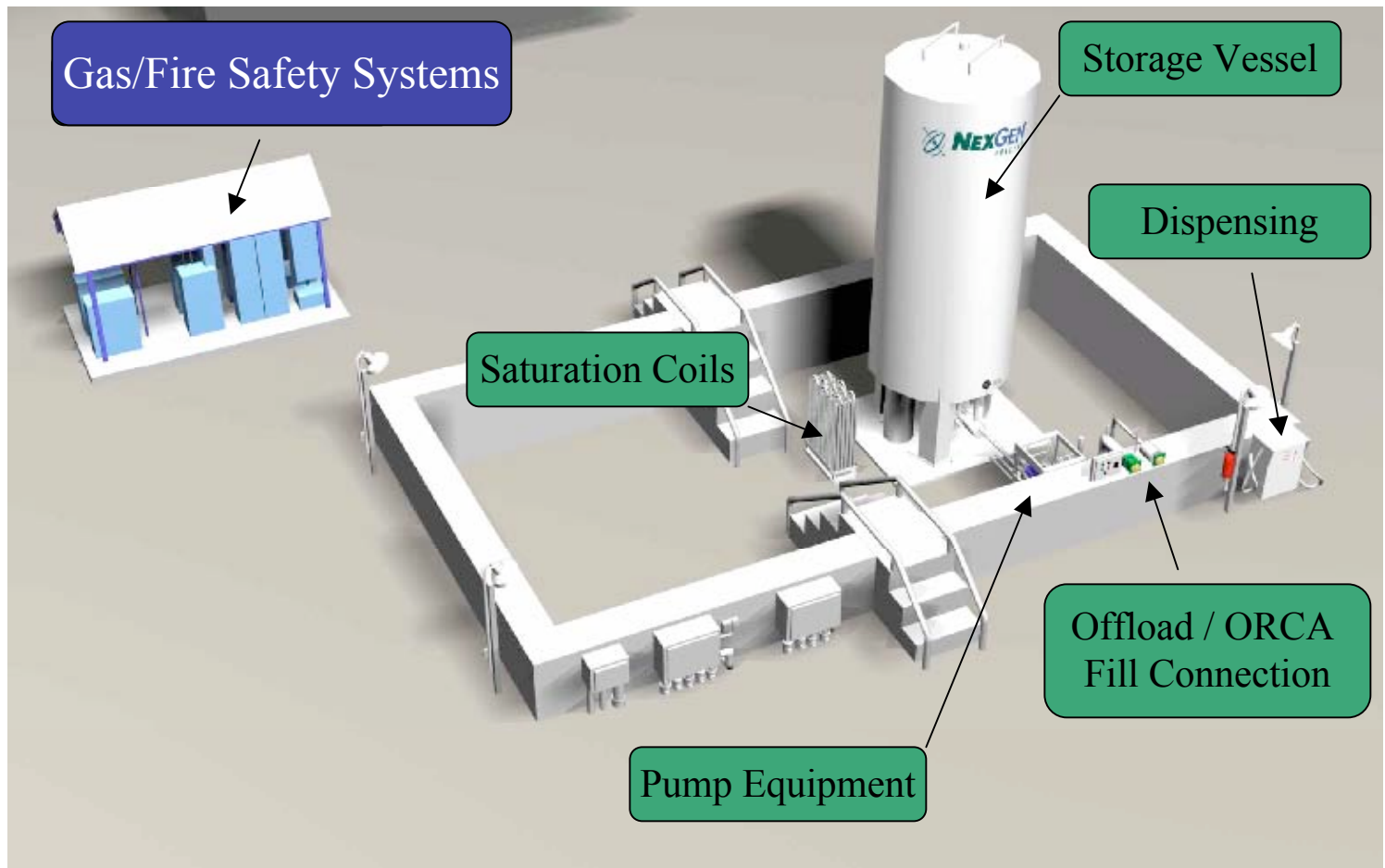


Control Panel Farm

- **Multiple control panels provides redundancy**
- **Equipment housed in rain tight enclosures**
- **Shop assembled and tested by a UL shop before arriving on site**



Major Equipment



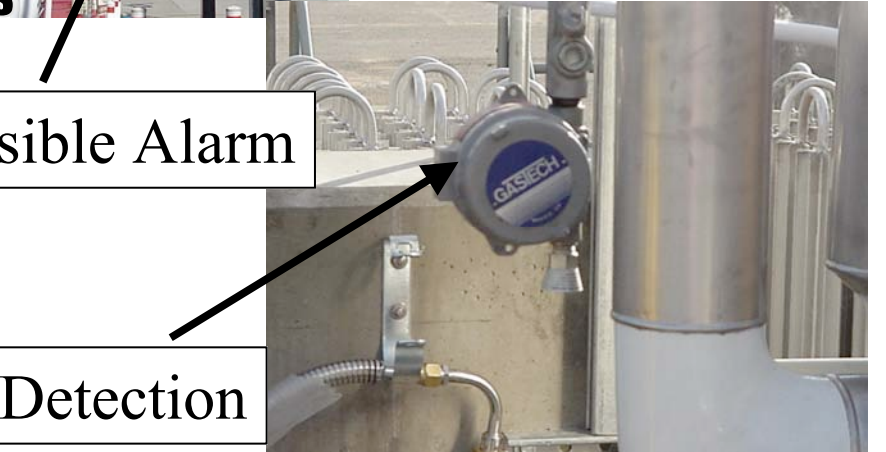
Gas/Fire Safety System

- **Satisfies NFPA 59A Chapter 10 requirements**
- **NFPA 72 Design for UPS requirements**
- **Provides for automatic shutdown**
- **Interface to automatic dialers is possible**

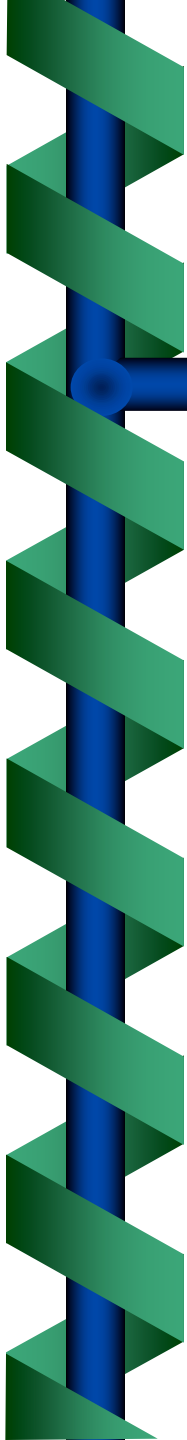
Flame Detection



Audible/Visible Alarm



Flammable Gas Detection





Thank You

800-506-9511

www.nexgenfueling.com