



Lackland AFB Commissary, TX Sustainment Project Proposed Ammonia/CO2 Refrigeration System Analysis





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Disclaimer:

Defense Commissary Agency (DeCA)

DeCA has no political agenda as it relates to environmental concerns or energy usage.

DeCA is committed to best business practices and is looking for ways to control capital and operating costs in the future and meet the energy and sustainability goals the U.S. Government has established for all public buildings.





Agenda

- Project Summary
- Goals
- Ammonia Plume Study Findings
- Energy Model Results
- Life Cycle Analysis
- Question and Answer

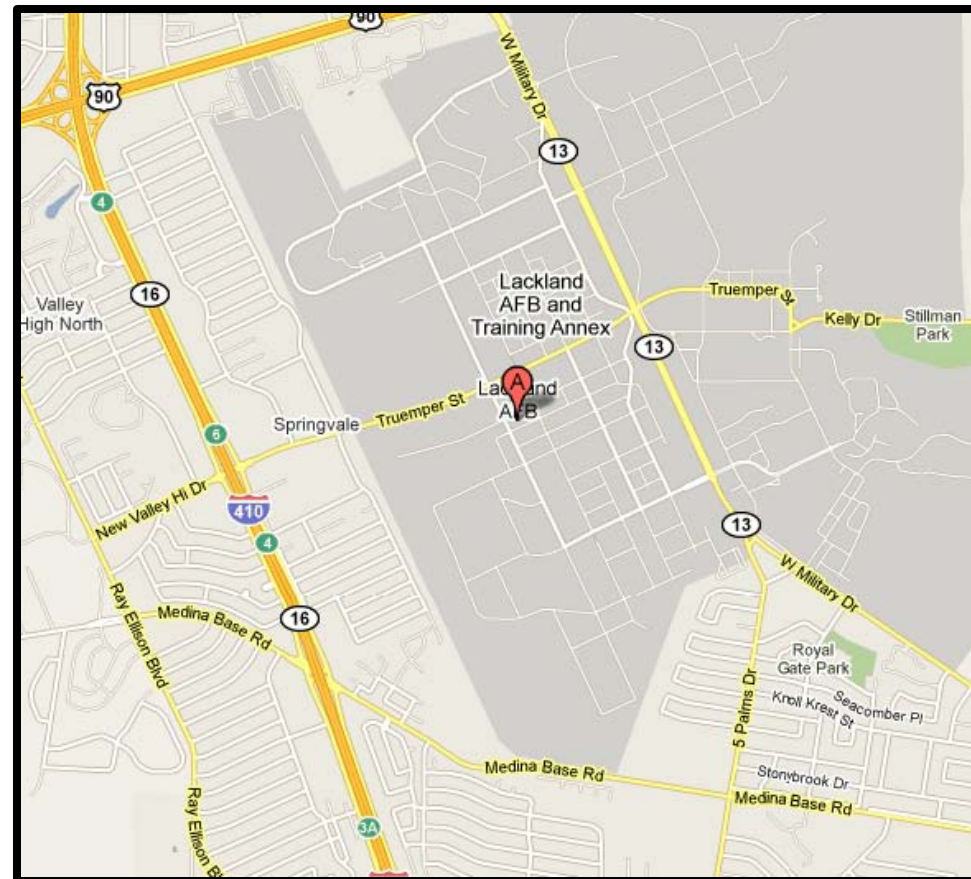
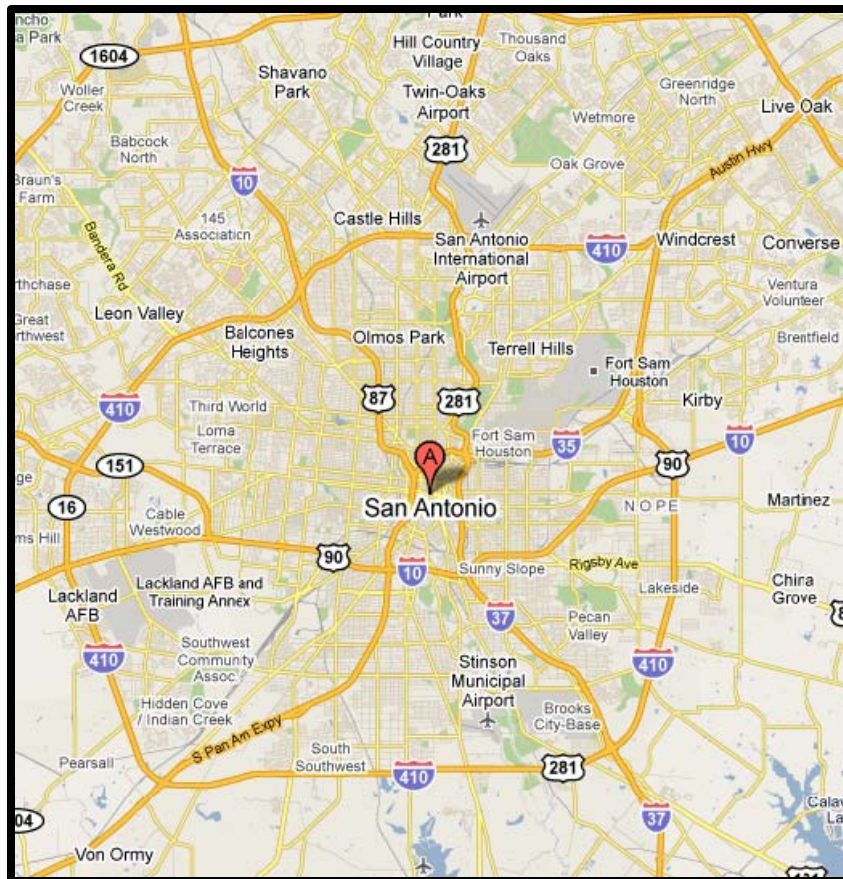




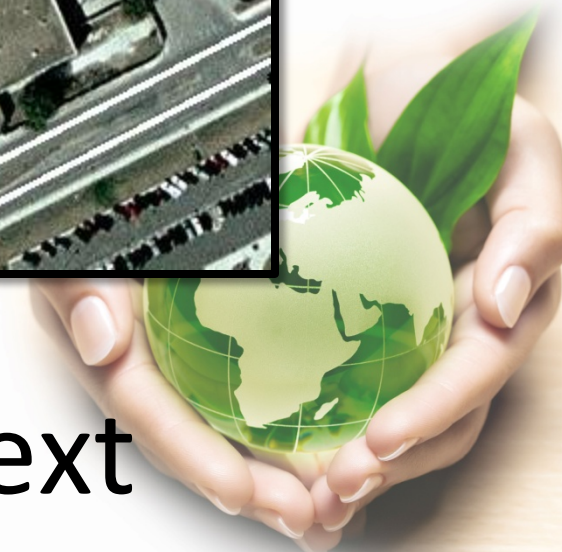
Project Summary

- Existing 117,000 Sq/Ft Commissary in San Antonio, TX
- Sustainment Project
- Project Design Partners
 - DeCA
 - EPA
 - NREL (DOE/Commercial Building Partnership)
 - Design Consultants





Project Context





Goals of Project

- Low Global Warming Potential (GWP) System or 100% Natural Refrigerant
- More Energy Efficient than Industry Standard Systems
- Eliminate Safety concerns
- Serviceable Equipment
- Reasonable Costs

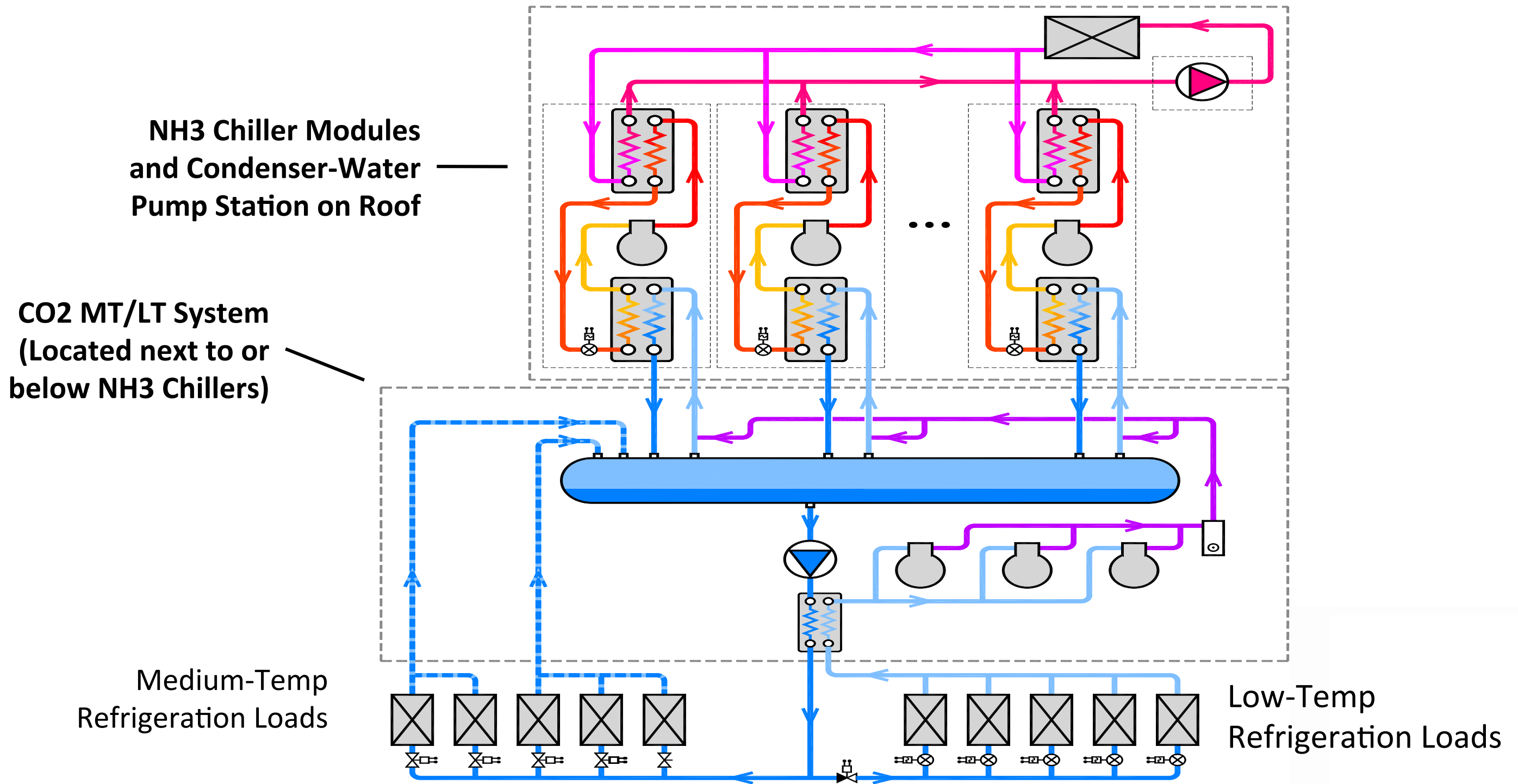
Current Readily Available Systems

- Low Global Warming Potential (GWP) System
- Less Energy Efficient than Industry Standard Systems

Possible Systems that meet Goals

- Sub Critical/Transcritical CO₂ Systems
- Ammonia/CO₂ Cascade System

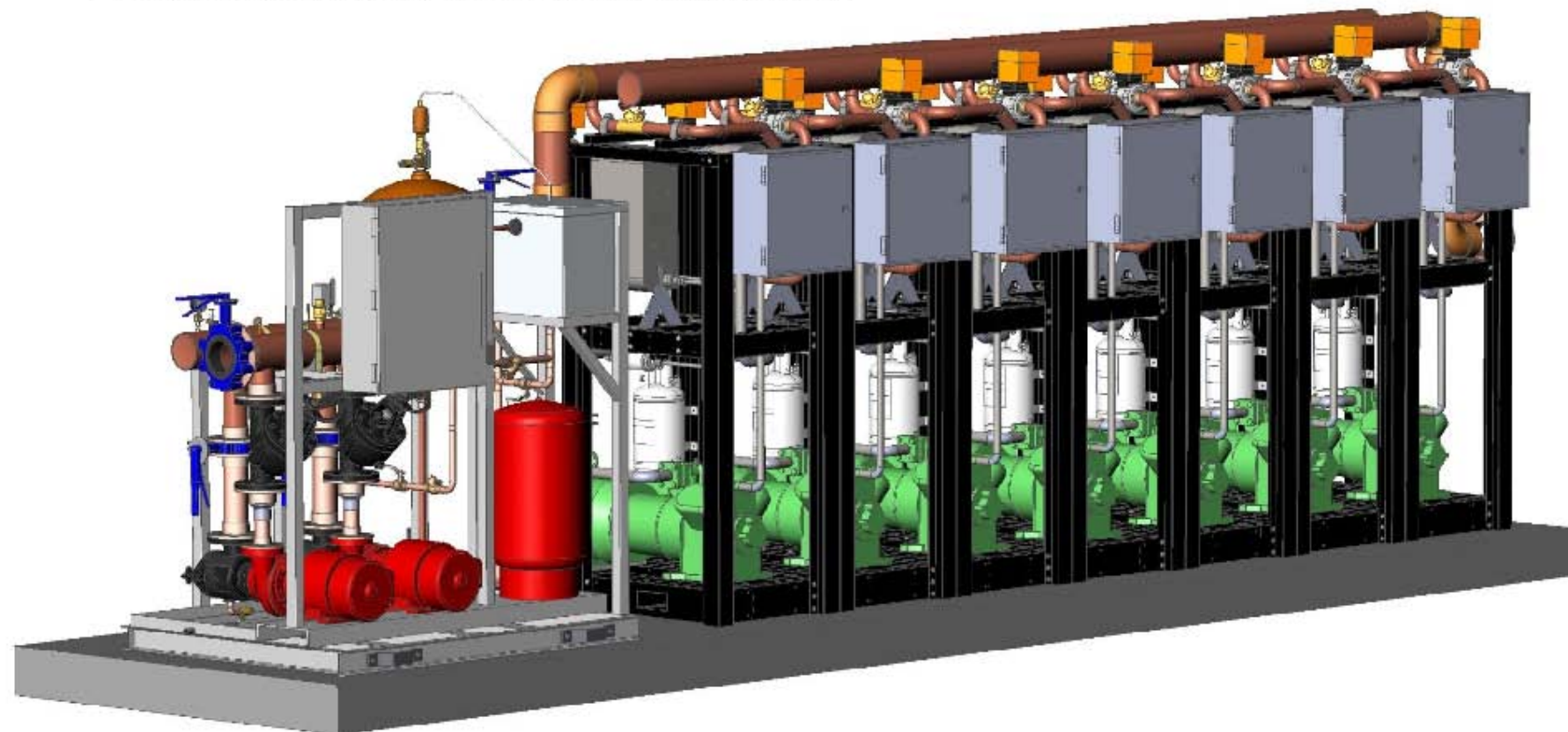






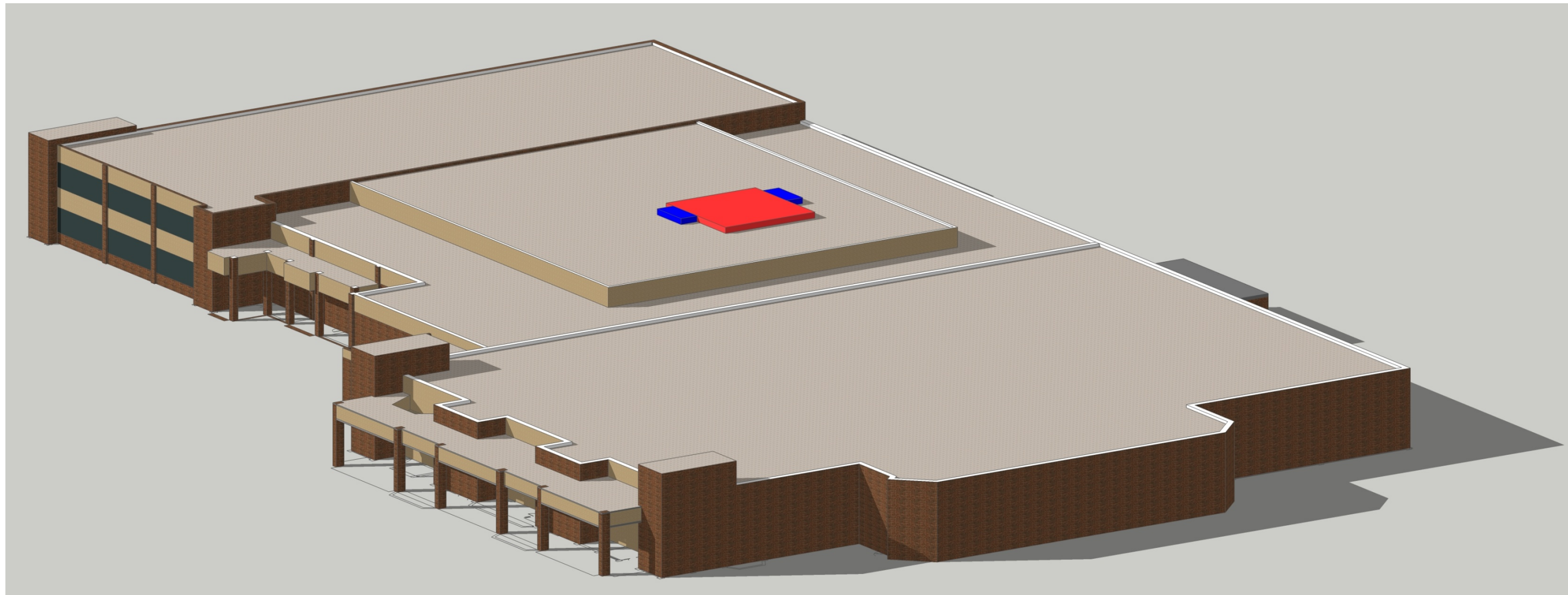
Implemented System Example

- Modular design with integrated condenser-water pump-station and manifolding
- Total capacity of 1,260 kBtu/Hr for MT and LT operation
- Paneled enclosure for outdoor installation



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Building Model



Why Consider Ammonia/CO2 System

- State and National Codes and EPA or Legislative Regulations
 - Energy Code Requirements
 - Penalties for Leaks of HFC's
 - Possible Taxes on HFC's (R-404a)
 - Possible HFC Refrigerant Charge Limits
 - Prevent need for future Refrigerant Conversion





Why Consider Ammonia/CO2 System

- Environmental Concerns
 - Industry Standard Traditional Refrigeration Systems
 - On average grocery stores leak 1000 lbs of refrigerant a year
 - 25% leak rate
 - Advanced Refrigeration Systems
 - Minimal to no leaks of Synthetic Refrigerants





Why Consider Ammonia/CO2 System

- Energy Consumption
 - Expect 8% Energy Savings on this project
 - Other countries with more experience claiming 25% or higher Energy Savings





Ammonia Plume Study

What did the Study Seek to do?

- Determine if ammonia was safe for this installation?
- Can the proposed system impact the surrounding area?
- Is there risk for the surrounding population?
- Determine most likely and worst case impacts.





Ammonia Plume Study

So What Does All This Mean?

- The results of this study suggest that in the vast majority of failure scenarios, there would be very little potential for public health risks associated with the proposed facility.
- The results of the dense gas modeling suggest that there is some small potential for public impacts during catastrophic worst case scenarios. However, in the case of small leaks or non-catastrophic events, the system poses little health based threats, with most impacts being limited to short lived unpleasant odors.
- The ammonia in the system is continuously monitored for leaks. Should a leak of sufficient size be detected, you will be notified of the event.





Energy Model

- Energy Monitoring
 - Over 1 year of existing energy monitoring prior to project
 - Continuous energy monitoring after project
- Energy Consumption
 - Expect 8% Energy Savings on compressor system over baseline
 - Direct Expansion Ammonia system is not most efficient option
 - Other countries with more experience claiming 25%+ Energy Savings





DeCA Lackland - Comparison of Refrigeration System Energy Use				
System	Subsystem	Baseline System	Proposed Systems	
		4-Rack R-404A System		Cascade NH3 Over CO2 System
Rack Systems	LT Compressors	170,671		
	MT Compressors	225,719		
	Primary Compressors			277,369
	Secondary Compressors			81,105
	Secondary Pumps			6,531
SubT Rack Systems		396,390		365,005
Energy Use Compared To Existing System				7.9% Less





DeCA Lackland - Comparison of Refrigeration System Energy Use

System	Subsystem	Baseline System	Proposed Systems	
		4-Rack R-404A System		Cascade NH3 Over CO2 System
LT End Uses	Fans, Lights, ASW, Defrost	323,084		323,084
MT End Uses	Fans, Lights, ASW, Defrost	186,525		186,525
Rack Systems	LT Compressors	170,671		
	MT Compressors	225,719		
	Primary Compressors			277,369
	Secondary Compressors			81,105
	Secondary Pumps			6,531
Condensers	Condenser Fans	193,541		194,855
SubT End-Uses		509,609		509,609
SubT Rack Systems		396,390		365,005
SubT Condensing Systems		193,541		194,855
Total System Loads		1,099,540		1,069,469
Energy Use Compared To Existing System				2.7% Less





	R-404A Industry Std	Ammonia/CO2	
Life of equipment (yrs)	20	20	
Discount Rate for non energy related factors	0.06	0.06	
UPV Factor for Annual Energy Costs	14.81	14.81	
Total First Cost		28%	
Annual Energy cost as Uniform Present Value		-3%	
Annual Refrigerant cost as Uniform Present Value		-93%	
Annual Maintenance cost as Uniform Present Value		-39%	
Total 20 Year Life Cycle Cost as Uniform Present Value		8%	\$ 340,175.99





Question Answer

Thank you!

