ATMOsphere America — the Business Case natural refrigerants
June 12-13 2012 | Washington DC

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

Presenter:

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Introductions

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

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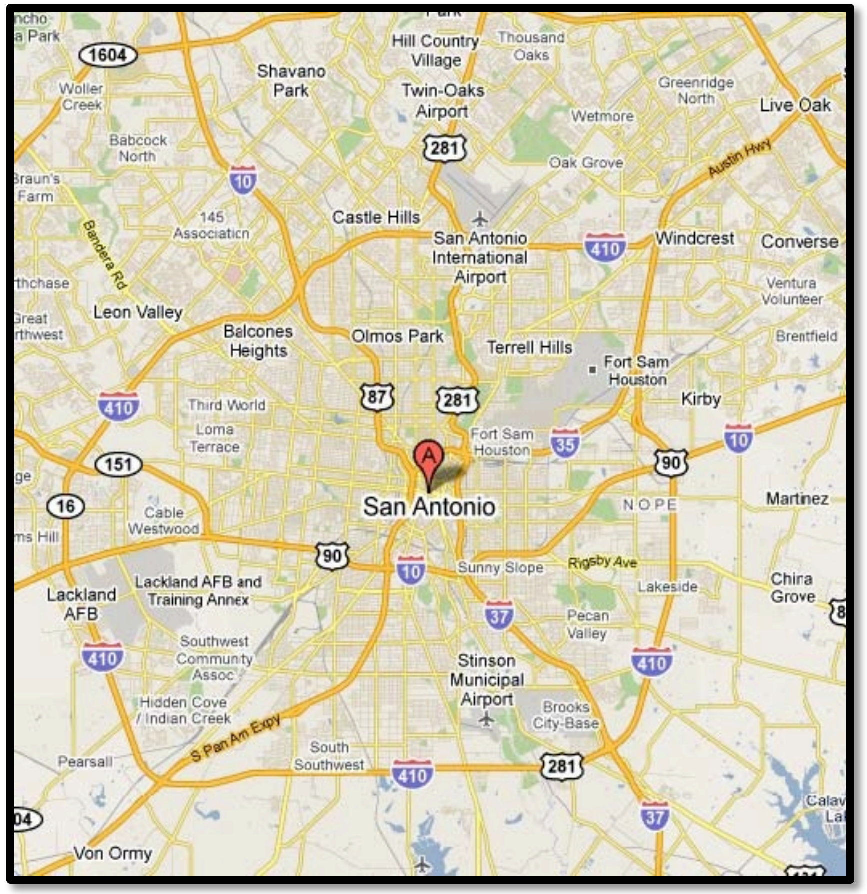
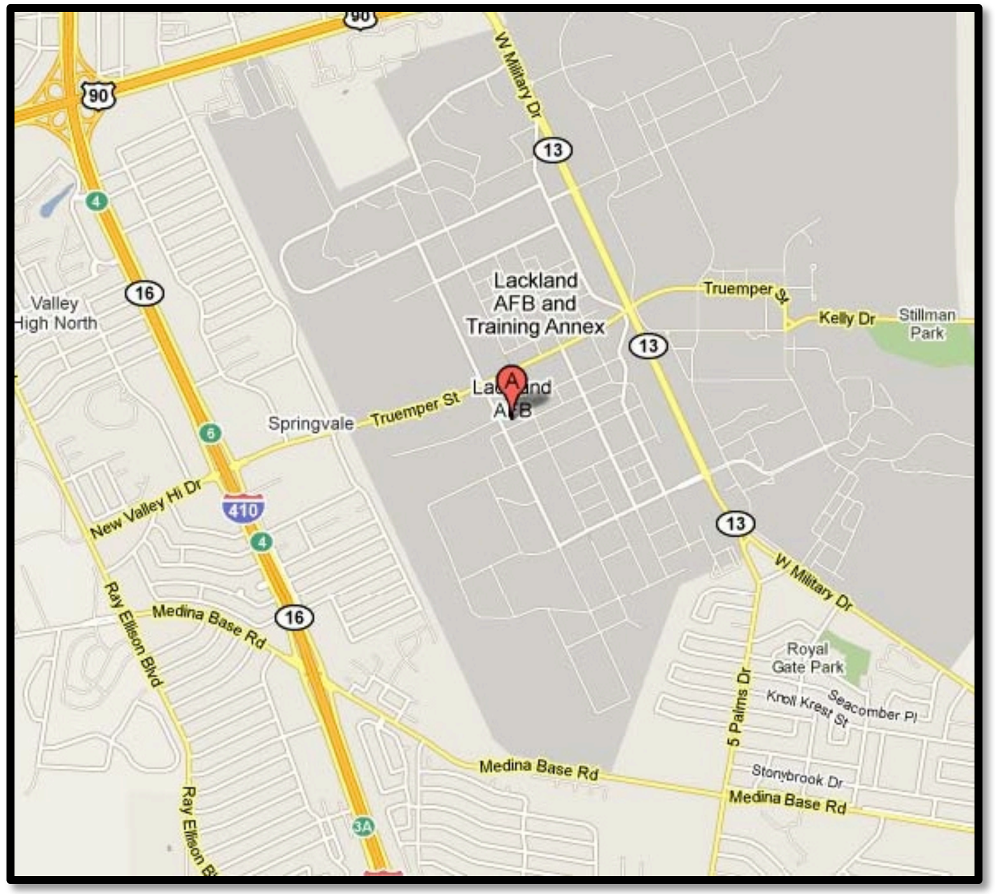




CTA JBR

Project Context

Goals of Project

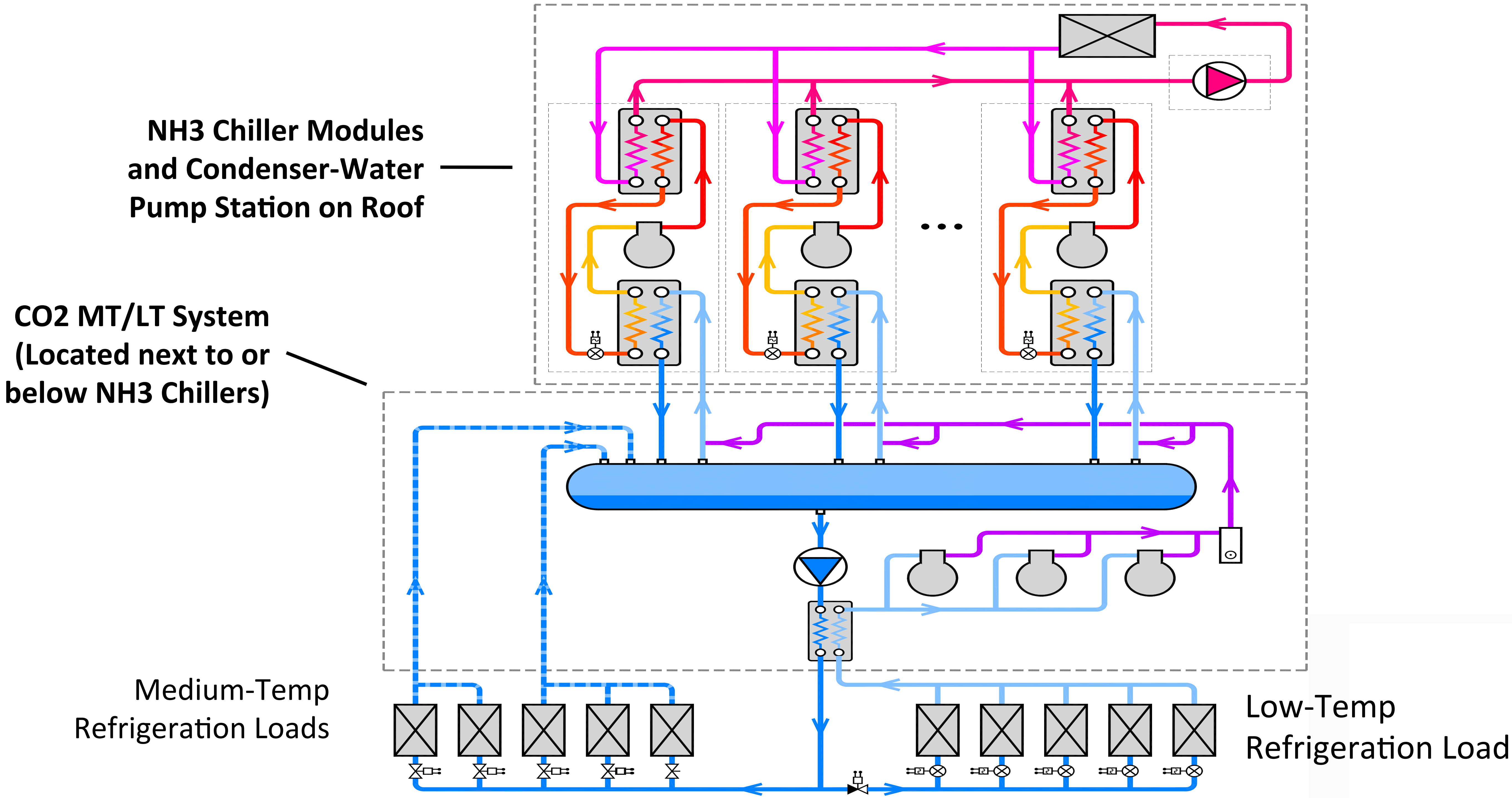
- Low Global Warming Potential (GWP) System or 100% Natural Refrigerant
- More Energy Efficient then Industry Standard Systems
- Eliminate Safety concerns
- Serviceable Equipment
- Reasonable Costs

Current Readily Available Systems

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

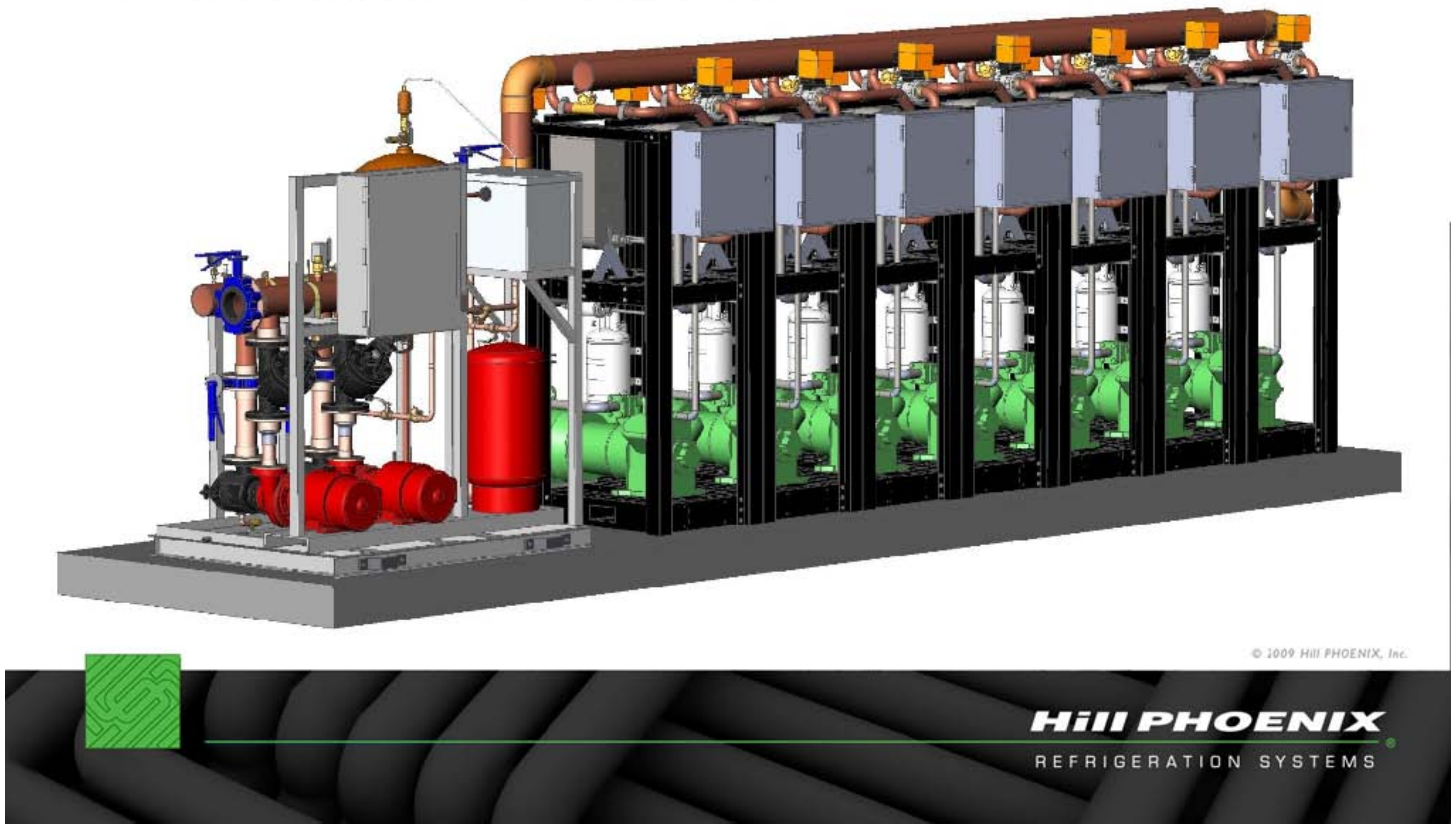
Possible Systems that meet Goals

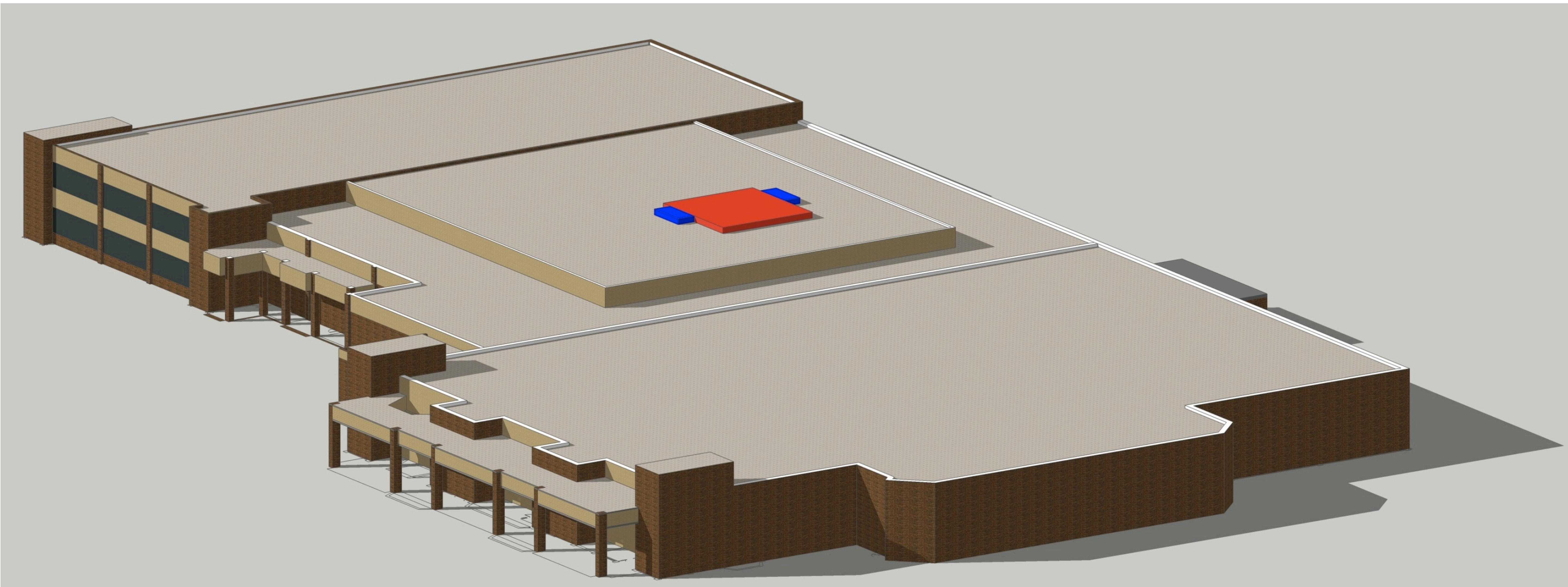
- Sub Critical/Transcritical CO_2 Systems
- Ammonia/CO_2 Cascade System


NH3 Chiller Modules and Condenser-Water Pump Station on Roof
CO2 MT/LT System (Located next to or below NH3 Chillers)
Medium-Temp Refrigeration Loads
Low-Temp Refrigeration Loads

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





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: 4-Rack R-404A System	Proposed Systems	Proposed Systems: 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: 4-Rack R-404A System	Proposed Systems	Proposed Systems: 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!