

CAYLOR ENGINEERING & ASSOCIATES, PLLC

P. O. BOX 910 • WEST FORK, AR 72774-0910 • JIM_CAYLOR@YAHOO.COM • (817) 739-3210

JIM CAYLOR, PE

SUMMARY

I am an independent consulting mechanical engineer specializing in NH₃ and CO₂ refrigeration systems used in process and cold storage applications. My areas of emphasis are:

- System design and design review (owner's agent).
- Regulatory review (IIAR, IFC/IMC, ASME B31.5, ASHRAE Std 15, OSHA and EPA).
- Forensic analysis and expert consultant/expert witness.
- Operational analysis.

I spent my first 15 years in the refrigeration business as a service and startup technician, including a UA steamfitter apprenticeship, 11 years in the industrial field and the final 8 years self-employed as Caylor Refrigeration. I then returned to college and graduated from Arizona State University in 2000 with a BSME. I worked as a project engineer for two design/build contractors and became a PE before moving to 'Tyson Foods' corporate design group in 2005. I joined Jacobs Engineering's Food and Beverage Group in 2007 as a senior project engineer, finished there in 2013 as Deputy Director over all refrigeration projects and opened my consulting firm in 2014.

Clients include Leprino Foods, Safeway, Dreyer's, Tyson, ConAgra, Unilever, Nestlé, Imperial Irrigation District, Grupo Kuo (Kekén)-MX and US Army Corps of Engineers.

- I designed a dedicated refrigeration system for Leprino Foods that served a process granulated cheese freezer operating at -63°F, a spiral freezer and high temperature loads.
- Tyson work included process freezer design/analysis, par-fry-to-cooked plant conversions, vessel certification negotiations, internal code reviews and specification revisions.
- Principal Nestlé projects included:
 - A design package for a 2,000 TR -45°F recirculator of 14' Ø x 58' OAL, existing equipment demolition and LTRS/LSS branch relocation to new 24" vessel mains.
 - A new NH₃/CO₂ cascade refrigeration system serving a 400 TR variable retention time freezer, 600 TR of other freezers and multiple hygienic process HVAC units.
- The Imperial Irrigation District project was a joint effort with another engineering firm to improve performance of a 4,500 TR gas turbine inlet air cooling plant. The design involved suction protection vessels, S&T chiller liquid control revisions and air-cooled condenser modifications to handle 115°F ambient air design conditions.
- I reviewed the design of a 3,800 TR pork processing plant in Mérida, Yucatán, MX for Kekén (Grupo Kuo), created an overall BFD and MEB and provided recommendations concerning a 725 TR Snap-Chill carcass chiller by Danish Meat Research Institute, a 500 TR carton freezer and multiple evaporative condensers' SRV protection.
- I reviewed the design of high-temperature and low-temperature climatic test chamber refrigeration systems for the US Army Corps of Engineers facility in Natick, MA.

I have been retained in twenty-six expert consultant cases, including six depositions. Twenty of these were resolved to my clients' satisfaction and six are currently preparing for trial. Their issues

include OSHA and EPA citations, OEM and contractor deficiencies, refrigerant releases and personnel fatalities.

EDUCATION

- **BSME, Arizona State University** 1992 – 2000

EXPERIENCE

- **Caylor Engineering & Associates, PLLC** 2014 – present
 - Industrial refrigeration consulting engineer & principal
 - Design and design review
 - Code review
 - Forensic expert witness
 - Operational analysis
- **TranSystems** 2013 – 2014
 - Refrigeration Team Leader
- **Jacobs Engineering Group** 2007 – 2013
 - Deputy Director, Food & Beverage Group
 - Refrigeration Discipline Leader
- **Tyson Foods, Inc.** 2005 – 2007
 - Corporate Sr. Project Engineer
- **Applied Process Cooling Corp (APCCO)** 2001 – 2005
 - Project Engineer
- **Caylor Refrigeration** 1984 – 1992
 - Industrial refrigeration service technician
- **Hussmann Refrigeration** 1979 – 1984
 - Commercial & industrial refrigeration service technician
 - UA LU 342 steamfitter apprenticeship

ASSOCIATIONS

- **ASHRAE** 2000 – present
 - Standard 15, TC 10.1 & TC 10.2 committees
- **ASME** 2019 – present
 - B31.5 Refrigeration Piping committee (chair)
- **IIAR** 1984 – 2020
 - Standards, Code, Government Relations & Piping committees 2005 – 2024
- **IIR** 2020 – present
- **RETA** 1983 – present
 - Vice President of SF Bay chapter (1985)
 - First President & founding member of Phoenix chapter (1991)
 - *Evaporator Leaks & Suction Control Valves*, 2018 conference
 - *ASME B31.5 & Piping Stress Analysis*, 2021 conference
 - *Manual Purging of Noncondensable Gases*, 2022 conference
 - *Liquid Overfeed System Alternatives*, 2024 conference

REGISTRATION

- AL, AR, AZ, CA, CO, GA, IA, ID, IL, MS, NC, NY, OK, PR, TN, TX, UT, WA & WI
- NCEES Record (MLE)

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JIM CAYLOR, PE

EDUCATION & TRAINING

Salinas Valley Ammonia Safety Day	2020
IRC Research & Technology Forum, Madison, WI	2006, 2011, 2018, 2019, 2021, 2024
York Industrial Refrigeration School, York, PA	2003
BSE in Mechanical Engineering, Arizona State University, Tempe, AZ	1992 – 2000
IIAR/RETA Industrial Refrigeration School for Users, San Jose, CA	1986
IIAR Industrial Refrigeration Workshop, Urbana, IL	1984
Steamfitter apprenticeship, UA Local #342, Concord, CA	1978 – 1982
Welding and machine tool courses, Diablo Valley College, Pleasant Hill, CA	1974 – 1976
Liberal arts courses, University of California, Riverside and Santa Cruz	1969 – 1971
National Merit Letter of Commendation, Riverside Polytechnic High School, CA	1968

EXPERIENCE

Caylor Engineering & Associates, PLLC, 2014 – present

Principal

- Consulting mechanical engineer specializing in industrial refrigeration
 - Lineage Logistics – Expert consultant for fire damage, Finley, WA, 2025
 - Cacique Foods – Expert consultant for construction defect, Amarillo, TX, 2025
 - NW Selecta – Expert consultant for system design, San Juan, PR, 2024
 - Tyson Foods – Design consultant for chiller piping, Carthage, TX, 2024
 - Perry's Ice Cream – Design consultant for freezing process, Akron, NY, 2024
 - US Army CE – Design consultant for climatic chamber, Natick, MA, 2024
 - 32 Cold Storage – Expert consultant for product loss, Commerce, CA, 2024
 - Rich Products – SRV & EPCS design, Crest Hill, IL, 2024
 - Tyson Foods – SRV discharge piping review, Rogers, AR, 2024
 - Peco Foods – NH₃ release calculation, Pocahontas, AR, 2024
 - Numeat Foods – Expert consultant for process HVAC, San Juan, PR, 2023
 - American Seafood – Expert consultant for NH₃ release, Seattle, WA, 2023
 - 99¢ Stores – Expert consultant for NH₃ release, Houston, TX, 2023
 - Kelvion, Inc. – Design analysis for HX pumps, Afton, TX, 2023
 - Algood Foods – Design review of SSHE addition, Louisville, KY, 2023
 - Riviana Foods – Design review of IQF freezer, Memphis, TN, 2023
 - Olean Grocery – Expert consultant for NH₃ release, Olean, NY, 2022
 - Don Miguel Foods – Expert consultant for plant renovation contract review, Farmers Branch, TX, 2022 (D)
 - Bama Foods – Design consultant for spiral freezer performance, Tulsa, OK, 2022

- Fleischmann Vinegar – Design consultant for OEM Dynalene chiller skid SRV & condenser piping, Chicago, IL, 2022
- Darling Ingredients – Design review of plate freezer performance, Springdale, AR, 2022
- Sage V Foods – Expert consultant on industrial fatality, Little Rock, AR, 2022
- Belfonte IC – Expert consultant on NH₃ release, Kansas City, MO, 2022
- Planterra Foods – Spiral freezer piping stress analysis, Denver, CO, 2022
- Grupo Kuo – Design review of 3,800 TR Kekén pork process facility rebuilt after 2020 fire, Mérida, Yucatán, MX, 2022
- Bama Foods – Design consultant for TSOC piping system revision, Tulsa, OK, 2022
- Summit Livestock – Expert consultant on commercial freezer design, Albany, IN, 2022
- Palermo Pizza – Expert consultant on pizza crust spiral freezer, Milwaukee, WI, 2021 (D)
- I-44 Cold Storage – Expert consultant for cold storage NH₃ system operational recovery after storm damage, Springfield, MO, 2021
- Arctic Sablefish – Expert consultant on commercial fishing vessel NH₃ release, Dutch Harbor, AK, 2021 (D)
- Evapco – Design consultant for OEM low-charge packaged split refrigeration system, MD, 2021
- CA Shellfish – Expert consultant on commercial freezer product storage, Sacramento, CA, 2021
- ITT – Design consultant for OEM 0.5 MW liquid cooled battery charging cable, Valencia, CA, 2021
- Ajinomoto Foods – Expert consultant for product damage from NH₃ release, Tulsa, OK, 2020
- Global Cooling – Expert consultant for OEM in Stirling cycle -80°C lab freezer manufacturing process, Athens, OH, 2020 (D)
- Primus Builders – Expert consultant for contractor in ammonia fatality, Statesville, NC, 2020
- Grupo Kuo – Design review of 3,800 TR Kekén pork process facility, Mérida, Yucatán, MX, 2019
- Huntsville Airport – Expert consultant for contractor on cooler condensation issues, Huntsville, AL, 2019 (D)
- Ticonderoga GC – Expert consultant on refrigerant fire, Ticonderoga, NY, 2019
- Superior Catfish – New NH₃ refrigeration system design for plant conversion from cryogenic process, Macon, MS, 2018
- Doerle Foods – Consultant for facility MI review, Broussard, LA, 2018
- Ruiz Foods – Expert consultant on freezer coil ruptures, north TX, 2017
- Peco Foods – Expert consultant for EPA excessive NH₃ usage citations at multiple AL and MS processing plants, 2017
- CBRE – Consulting engineer for packaged and field constructed ammonia systems in multiple Mondelez plants, 2016
- Confidential – Expert code consultant to Arent Fox LLP, 2016-2019
- OK Foods – 10,000 LBH fully cooked spiral freezer and consolidation of existing machinery rooms, Oklahoma City, OK, 2016
- Cargill – Beef process line engineering, Fort Morgan, CO, 2016

- Pilgrim's Pride – PSM task review, Mt. Pleasant, TX, 2015
- Global Foods – Expert consultant in arbitration for Baker Refrigeration, Russellville, AR, 2015 (D)
- IID – Engineering partnership to resolve reliability issues on 4,500 TR R-22 GTIAC project, Niland, CA, 2015
- CODA – Assessed 300,000 ft² refrigerated warehouse for real estate consulting firm, Riverside, CA, 2014
- (D) – deposed

Tyson Foods

- Sedalia, MO – -60°F spiral freezer operations review, 2017
- San Diego, CA – NH₃-CO₂ system MEB & SRV-MRV design review, 2017
- Rogers, AR – LTRL liquid transfer issue, CNQ, 2017
- Springdale, AR – Berry St plant-wide SRV-ADT design, 2017
- New Holland, PA – RTE area process HVAC unit, 2017
- Waldron, AR – Ammonia inventory, 2016
- Tarboro, NC – Ammonia inventory and MEB, 2016
- Sanford, NC – HPR SOP, 2016
- Haltom City, TX – Ammonia inventory and MEB, 2016
- San Diego, CA – Owner's expert in cascade HX failure analysis, 2015
- Dallas, TX – Modified HT recirculator suction piping, 2015
- NRH, TX – Plant operations review and MRV, 2015
- Springdale, AR – NH₃ pipe wall loss resolution, 2015
- Carthage, MS – SRV & MRV redesign, 2015
- Vicksburg, MS – Ammonia inventory, 2014

Rich Products

- Hilliard, OH – Bakery ventilation study, 2017
- Brunswick, GA – Bakery ventilation study, 2017
- Crest Hill, IL – Evaluated spiral freezer refrigeration system, 2014
- Brunswick, GA – Designed (3) process fryer ventilation systems, 2014

TranSystems Corporation, Fort Worth, TX, 2013 – 2014

Refrigeration Team Leader, MEP Division, MS 40

- Discipline SME
 - Unilever – Refrigeration system modifications for dual-circuit scraped surface heat exchangers (SSHE), Chicago, IL, 2013

Jacobs Engineering, Fort Worth, TX, 2007 – 2013

Deputy Director & Refrigeration Discipline Leader, Food & Beverage Group

- Supervise F&BG refrigeration personnel for a global A&E firm
- Presented review of IIAR 2-2008 piping requirements for IRC, Madison, WI, 2011

Nestlé USA

- Springville, UT – Led -35°F and -45°F LTRL redistribution design, 2012
- Laurel, MD – Led south machinery room redesign, 2012
- Danville, VA – Led heated glycol heat exchanger design, 2012
- Modesto, CA – Led sterilizer cooling water, MRV and SRV replacement design teams, 2012
- Cleveland, OH – NH₃/CO₂ machinery room design, 2012
- Haverhill, MA – Led chilled glycol process HVAC utility design, 2011
- Gaffney, SC – Led 14' Ø x 58' OAL -45°F NH₃ recirculator design, 2011

Kellogg's

- Memphis, TN – Led plant-wide air balance pilot project and full scale design project, 2011
- Rome, GA – Assisted in plant-wide process area HVAC ventilation design, 2010

ConAgra

- Batesville, AR – Led Takeoff Cooler HVAC design, 2011
- Batesville, AR – Led design of North Machinery Room SRV discharge piping and ventilation, 2010
- Marshall, MO – Assisted ConAgra process engineer in process design of 6,000 LBH sauce kitchen, 2008

Miller-Coors

- Fort Worth, TX – Led Kathabar design project, 2010

Tyson Foods, Springdale, AR, 2005 – 2007

Sr. Project Engineer

- Design engineer in Tyson Engineering Services, Poultry Refrigeration Design
 - Code review – Led review of Tyson refrigeration code compliance, 2007
 - Dardanelle, AR – Design and installation for (2) Aerofreeze 6,600 LBH sequential defrost spiral freezers, 2006
 - Gadsden, AL – Design for replacement of (8) blast cell and (4) spiral freezer piping mains, 2006
 - Monett, MO – Design for 340 TR process area air conditioning unit, 2006
 - Carthage, MS – Redesigned booster compressor discharge piping and Skaginn process freezer LTRS piping, 2006
 - Pine Bluff, AR – Design for engine room upgrade to (7) 10,000 LBH spiral freezers, 2006
 - Pine Bluff, AR – Design and installation for (1) Aerofreeze 10,000 LBH sequential defrost spiral freezer, 2006
 - Vicksburg, MS – Design for Frigoscandia 8,000 LBH spiral freezer, 2006

Applied Process Cooling Corporation, Modesto, CA, 2001 – 2005

Project Manager/Project Engineer

- Project manager/project engineer for design/build industrial refrigeration contractor
 - Dreyer's – 700 TR NH₃ ice cream storage, Manteca, CA, 2005
 - Bayer – 240 TR R-407C process glycol chillers, Berkeley, CA, 2004
 - ConAgra – Safety and compliance upgrade, Modesto, CA, 2004
 - E & J Gallo – Operations/energy engineering survey for 4,500 TR NH₃ winery, Modesto, CA, 2003
 - Hershey – 200 TR NH₃ process glycol chiller, Oakdale, CA, 2003
 - Ratto Bros – 1,600 TR NH₃ produce facility, Modesto, CA 2003
 - Lepirino Foods – 700 TR two-stage NH₃ system for cheese plant, Ravenna, NE, 2002
 - Safeway – Repiping and restarting of existing NH₃ engine rooms, Denver, CO, 2002
 - Safeway – NH₃ King Air units on mixed load and produce area docks, Denver, CO, 2002

Industrial Refrigeration & Boiler Company, Phoenix, AZ, 2001

Project Manager

- Supervised shop and field crews in piping prefabrication and installation

- Performed material takeoffs and labor estimates from engineering drawings
- Devised Excel spreadsheet to calculate pipe pressure drop
 - Northwind – Piping contractor for 4,000 TR R-22 district cooling plant, Phoenix, AZ, 2001

Arizona State University, Tempe, AZ, 1992 – 2000
BSME

Instructor, GateWay Community College, Phoenix, AZ, 1991

- Designed and taught semester-length industrial refrigeration course to 30 students for Phoenix RETA chapter at GateWay Community College, Phoenix, AZ, 1991

Caylor Refrigeration: CA, 1984 – 1989; AZ, 1989 – 1992

Owner and operator

- Licenses: AZ #087918-006 (L-49); NV #0033215 (C-21a)
- Performed industrial refrigeration service and startup for end users and an OEM, including screw and reciprocating compressor teardowns
 - Smith's Foods – Started 2,000 TR NH₃ ice cream plant, Layton, UT, 1990
 - Mike Yurosek – Started 800 TR NH₃ hydrocooler, Lamont, CA, 1989
 - CSULB – Started 350 TR R-22 TES plant, Long Beach, CA, 1988
 - Chef America – Started 1,500 TR NH₃ food processing plant, Chatsworth, CA, 1987 - 1988
 - M&M – Startup of OEM screw compressor packages, 1987 - 1991
 - Fleming Foods – R-22/R-502 distribution centers in Milpitas/Fremont, CA, 1984 - 1986
 - Rich Pik'd Rite – R-22 fruit processor with seasonal 500 TR R-22 blast freezer and cold storage, Escalon, CA, 1984 - 1986
 - Seven-Up – 500 TR NH₃ bottling plant, San Jose, CA, 1984 - 1986

Hussmann Refrigeration, San Jose, CA, 1979 – 1984

Industrial mechanic

- Performed service and startup on market and industrial refrigeration systems
 - Fleming Foods – R-22/R-502 distribution centers in Milpitas/Fremont, CA, 1982 - 1984
 - Mrs. Smith's – NH₃ food processor with 500 TR blast freezer, San Jose, CA, 1982 - 1984
 - Rich Pik'd Rite – R-22 fruit processor with seasonal 500 TR R-22 blast freezer and cold storage, Escalon, CA, 1982 - 1984
 - Seven-Up – 500 TR NH₃ bottling plant, San Jose, CA, 1982 - 1984
 - Select-Sysco – Started new 200 TR NH₃ plant for existing cold storage, Hayward, CA, 1981
 - TD system – Two-stage R-22 market system with intercooling, liquid subcooling and HG defrost; end users included Lucky Stores, Raley's Markets and Safeway; 1979 - 1982
- Advanced to industrial work and foreman's pay scale (110% of journeyman) in 1982
- Advanced from 50% to 100% of journeyman pay scale after 1 year (1980)

UA Steamfitters' Local Union #342, Concord, CA, 1978 – 1982
Steamfitter apprenticeship

Contra Costa Welding Supply, Concord, CA, 1976 – 1979

Inside sales and machine repair

- Ran sales counter and maintained all cylinder inventory records
- Repaired electric and gas welding equipment
- Performed annual cylinder inventories at Shell Oil, Shell Chemical, Dow Chemical, Exxon and various PG&E power plants

Diablo Valley College, Pleasant Hill, CA, 1974 – 1976

Welding and machine tool courses

Kenney Refrigeration Service, Riverside, CA, 1972 – 1974

Serviceman

- Serviced residential and commercial A/C and refrigeration systems
- Installed commercial refrigeration equipment at military bases across the USA

ASSOCIATIONS

ASHRAE

2000 – present

- SSPC15 Safety Standard for Refrigeration Systems 2008 – 2019
- CIS Code Interaction Subcommittee 2008 – 2012
- TC 10.1 Custom Engineered Refrigeration Systems, Piping, Controls & Acc 2021 – present
 - Chair 2021 – 2023
 - *Refrigeration Handbook* chapter 1 revisions 2022 – present
 - *Refrigeration Handbook* chapter 2 & 3 revisions 2022
- TC 10.2 Refrigeration Applications 2021 – present
- TC 10.1 Custom Engineered Refrigeration Systems 2008 – 2021
 - *Refrigeration Handbook* chapter 2 revisions 2014
- TC 10.3 Refrigerant Piping, Controls and Accessories 2015 – 2021
 - Chair 2019 – 2021
 - *Refrigeration Handbook* chapter 2 & 3 revisions 2018
- TC 10.5 Refrigerated Distribution & Storage Facilities 2014 – 2021
- SPC 64 ...Laboratory Testing...Evaporative Refrigerant Condensers 2009 – 2010

ASME

2019 – present

- B31.5 Refrigeration Piping Committee 2019 – present
 - Chair 2020 – present

IIAR

1984 – 2020

- Standards Review Committee 2005 – 2013; 2018 – 2020
- Standards Review Code Subcommittee 2017 – 2018
- Code Committee 2009 – 2019
- Government Relations Committee 2015 – 2024
- Piping Committee 2023 – 2024

IIR

2020 – present

RETA

1983 – present

- National Conference – *Evaporator Leaks & Suction Control Valves* 2018
- *ASME B31.5 & Piping Stress Analysis* 2021
- *Manual Purging of Noncondensable Gases* 2022

	– <i>Liquid Overfeed System Alternatives</i>	2024
• San Joaquin chapter	– RETA Book I & II instructor	2004 – 2005
• Consortia trainer	– Bakersfield, CA	2002
• Phoenix chapter	– First President and founding member	1991
• SF Bay Area chapter	– Vice-President	1985
	– RETA Region II conference, Sunnyvale, CA	1985

REGISTRATION

	<u>PE</u>	<u>COA</u>	<u>Year</u>
• AL	PE53337	---	2023
• AR	16107	2772	2014
• AZ	67219	21302	2018
• CA	M33246	N/A	2005
• CO	50969	---	2016
• GA	PE039079	PEF006577	2014
• IA	24268	---	2017
• ID	P-22768	---	2023
• IL	062066107	---	2014
• MS	26121	26219	2014
• NC	50532	---	2020
• NY	109023-01	---	2023
• OK	28721	7577	2016
• PR	28954	---	2024
• TN	117602	---	2014
• TX	116556	17189	2014
• UT	13638354-2202	---	2023
• WA	23032217	---	2023
• WI	100386-6	---	2023
• NCEES Record (MLE)	57647	---	2014