

Meeting Notes



2022 California Energy Code (Title 24, Part 6)

Notes for the Utility-Sponsored Stakeholder Meeting for:

Posted December 4, 2019

Nonresidential Covered Processes Part 2

Meeting Information

Meeting Date: Thursday, November 7, 2019

Meeting Time: 8:30am – 12:30pm PST

Meeting Host: California Statewide Utility Codes and Standards Team

Meeting Agenda

Time	Topic	Presenter
10 minutes prior to call	Live Attendee Poll	
8:30 am	Meeting Guidelines	Alanna Torres (Energy Solutions)
8:35 am	Opening Remarks from the California Energy Commission	Energy Commission Staff
8:40 am	Overview and Welcome	Kelly Cunningham (PG&E)
8:45 am	CASE Presentation I: Pipe Sizing and Leak Testing for Compressed Air Systems	M M Valmiki (Alternative Energy Systems Consulting, AESC)
9:30 am	CASE Presentation II: Steam Trap Monitoring	Kevin Johnson (Alternative Energy Systems Consulting, AESC)
10:45 am	<i>5 Minute Break</i>	
10:50 am	CASE Presentation III: Refrigeration System Opportunities	Trevor Bellon (VaCom Technologies)
12:00 pm	Wrap Up & Closing	Rebecca Aviles (Energy Solutions)

Meeting Attendees

First Name	Last Name	Email	Affiliation
Statewide Utility Codes and Standards Team			
<i>Utility Staff</i>			
Kelly	Cunningham	KACV@pge.com	Pacific Gas & Electric
Mark	Alatorre	M6AC@pge.com	Pacific Gas & Electric
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John	Barbour	JBarbour@semprautilities.com	San Diego Gas & Electric
James	Kemper	James.Kemper@ladwp.com	Los Angeles Department of Power and Water
<i>Codes and Standards Enhancement (CASE) Team Members</i>			
Alanna	Torres	atorres@energy-solution.com	Energy Solutions
Chris	Uraine	curaine@energy-solution.com	Energy Solutions
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Simon	Silverberg	Ssilverberg@energy-solution.com	Energy Solutions
Dough	Scott	Dscott@vacomtech.com	VaCom
Trevor	Bellon	Tbellon@vacomtech.com	VaCom

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Kevin	Johnson	Kjohnson@aesc-inc.com	AESC
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California Energy Commission			
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Danuta	Drozdowicz	Danuta.drozdowicz@energy.ca.gov	California Energy Commission
Stakeholder Attendees			
Jennifer	Fox		2050 Partners
Joe	Fulton		Alta Refrigeration
Philip	Hollander		Baltimore Air Coil
Joe	Sanchez		Bitzer US
Peter	Marotta		Climate Pros
Bill	Jackson		Climate Pros

Tom	Paine		ConSol
David	Booth		David Booth
Armin	Hauer		EBM Papst
Philip	McNamara		Energy 350
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Jamison	Ditthardt		Guntner
Jascha	Heynck		Guntner
Erik	Haffner		Hussman
Kristen	Sahd		Hussman
Ronald	Shebik		Hussman
Jonathan	Tan		J Vidal Associates
Werner	Rauer		Kaeser
Keith	Baker		Kaeser
Brett	Mitchell		Kason
Spencer	Lipp		Lockheed Martin
Ron	Marshall		Marshall Compressed Air Consulting
Bruce	Severance		Mitsubishi
Danielle	Wright		NASRC
Sean	Denniston		New Buildings Institute
Amandeep	Singh		Nexant
Antonio	Inserni		Pan Pacific Supply
Vrushali	Mendon		Resource Refocus

Jan	Hoetzel		SIGA Compressed Air Solutions
Frank	Davis		Sprouts
Peter	Owens		Steam IQ
Charlie	Hon		True MFG
Bill	Scales		William Scales LLC

Meeting Notes

1. Welcome and Meeting Ground Rules

- *Alanna Torres (Energy Solutions, Statewide CASE Team) presented.*

2. 2022 Process Overview

- *Payam Bozorgchami (California Energy Commission) presented.*
- *Kelly Cunningham (PG&E, Statewide Utility Codes & Standards Team) presented.*

3. Meeting Materials

- Presentation available [here](#).
- Submeasure summaries available [here](#).

4. Compressed Air Systems

- *MM Valmiki (AESC, Statewide CASE Team) presented.*
- **Poll 1: How often are compressor room and main branch pipes undersized?**
 - David Booth: Initially they are rarely undersized, but as loads grow over time or plant use changes, issues come in.
 - MM Valmiki (AESC): That is a great point. Designs often do not consider end used piping realities.
- Bill Scales (William Scales LLC): Many pressure drop issues are at the end use application.
- Jonathan Tan (J Vidal Associates): I find the pressure drop mostly at the end use but caused by cheap regulators for the application and no local storage to replenish after they actuate. The drop is intermittent and imperceptible to the compressor. Small localized storage and a needle valve to replenish the small storage based on actuation times fixes the problem.
- David Booth: Regarding the 2psi= 1 percent energy - Note this is only true for compression power at the compressor. This does not hold true for many systems.
- Peter Strait (Energy Commission): Is localized "buffer" storage with needle valve a common practice?
 - MM Valmiki (AESC): I am not sure.
 - Jonathan Tan (J Vidal Associates): In my opinion, yes - after a system has been evaluated by someone, but not in construction.
 - David Booth: This is not the case in my opinion in most installed systems.
 - Peter Strait (Energy Commission): Thank you. We do need to look at measures that would be installed prior to the first occupancy permit, though that may be a strategy or alternative for alterations.

- David Booth: I am not saying it is not a good practice but that it is not commonly followed.
 - Bill Scales (William Scales LLC): I agree with David's comment above.
- Jonathan Tan (J Vidal Associates): So, based on Mr. Booth's comment, typically, you are overpowering the system to create the potential energy in the existing piping. So, the 2 PSIG (pounds per square inch gauge) to 1 percent becomes the opportunity. You can have >10 PSIG pressure drop across an actuator. Try to think about a 2" pipe going to 1/4" for an application. There is little potential energy in the 1/4" pipe when an actuator goes, but if I am overpressurizing the system, I gain potential energy in the pipe by increasing pressure. Often someone will compress to 120 PSIG, but most applications require 80 or less.
- **Poll 2: How frequently is new compressed air piping tested for leaks (by pressurizing and observing pressure drop or otherwise)?**
 - David Booth: Any good mechanical contractor pressure tests after installing new piping systems.
 - Jonathan Tan (J Vidal Associates): I agree.
 - Ron Marshall (Marshall Compressed Air Consulting): Pressure testing is often required by pressure vessel codes.
- **Poll 3: What percent of leak load occurs in hard-piping (versus hoses, tools and others)? In other words, for every 100 cfm of leaking air, how much occurs in the hard-piping?**
 - Jonathan Tan (J Vidal Associates): Most leaks are fittings and not in the main loop.
- Jon McHugh (McHugh Energy Consultants, *Statewide CASE Team*): For those of you who thought leaks are less than 10 percent in hard piping, could you enter your estimate what fraction this is?
 - Jonathan Tan (J Vidal Associates): I would venture 0-1 percent.
 - Bill Scales (William Scales LLC): I think less than one percent.
 - Ron Marshall (Marshall Compressed Air Consulting): I think less than 1 percent but with twist lock aluminum pipe there can be problems with joints that could push higher.
 - David Booth: To add to Ron's comment, typically in a good system the header and drops are a very small percent of leaks, but one issue in this part of the system can cause a big leak load.
 - Jan Hoetzel (SIGA Compressed Air Solutions): <3 percent.
- Jon McHugh (McHugh Energy Consultants): Jonathan when you say there is a 2 PSIG pressure drop opportunity - are you saying that increasing piping size according to best practice would typically result in a 2 PSIG reduction in compressor pressure setpoint?
 - Jonathan Tan (J Vidal Associates): Type L copper or aluminum systems are pretty tight. Black iron where you have threaded joints more.
 - Jonathan Tan (J Vidal Associates): I am saying if you look at all the loads in a system, most really need less than 80 PSIG to work. If you are pressurizing your system to 120 PSIG, that is 40 PSIG of additional work you are paying for that is not needed or 20 percent of increased energy. You will need some head room of course, but if you can run at 100 PSIG and have small local storage, that is 10 percent. Small storage can be 10 gallons or so.
- David Booth: Be careful, specific power (SP) increasing can just mean you are full loading more compressors which could be because of leaks or changes in demand.
 - Ron Marshall (Marshall Compressed Air Consulting): Canadian Standards Association (CSA) 837 specifies some key performance indicators (KPIs) that address David's concern about specific power. Both SP and kWh need to be tracked together.

- Jonathan Tan (J Vidal Associates): You have to do the math on the application. The frequency it is used and figure out how to spread the load over longer period of time with a needle valve versus just blasting the system at a higher pressure and let everything fly.
- David Booth: That makes it very hard to “codify.”
- David Booth: Completely excluding centrifugals from the code may cause a competitive shift - to save money and buy smaller less efficient centrifugals in some systems just to avoid the code. Particularly because the code that excludes it is geared towards controls.
 - MM Valmiki (AESC): That is something we want to mitigate by making some adjustments.
- Spencer Lipp (Lockheed Martin): The incentive programs have had challenges getting piping changes eligible due to incentive program policies with measure classifications and baselines. It is very difficult to get this measure cost effective without a utility incentive and combined with other measures to get the overall payback in an acceptable range.
 - Kiri Coakley (Energy Solutions, Statewide CASE Team): Spencer, can you describe more of these challenges?
 - Spencer Lipp (Lockheed Martin): Kiri - California programs have effective useful lives for equipment that drive measure classifications. Since the piping is installed at the time of original installation, they typically will exceed the 15 years. This pushes measure classification to a normal replacement which has a standard practice baseline. The investor owned utilities conclude that the compressed air challenge is the standard practice and assert the design would be compliant under the current air demand.
- Jonathan Tan (J Vidal Associates): I think piping changes are a red herring. Most systems are designed well on the front end and having to resize is due to increased load which defeats the purpose of energy efficiency.
- Jon McHugh (McHugh Energy Consultants): CSA C837-16 Compressed Air Efficiency Standard might be a consideration for the type of monitoring calculated metrics that might be required including System Specific Power.
 - David Booth: I agree. CSA837 is a great starting point.
- Jon McHugh (McHugh Energy Consultants): We are interested in your recommendation about the format of data that would be displayed by compressed air system monitoring.
 - Ron Marshall (Marshall Compressed Air Consulting): Two of the best are Airleader and Calms.eu.
 - Ron Marshall (Marshall Compressed Air Consulting): Sparks Dynamics, CALMS.EU, Ecoplant, Enersize
 - Jan Hoetzel (SIGA Compressed Air Solutions): CS-Instruments
 - David Booth: Literally there are dozens of BMS systems that are in place and could be used to include compressed air KPIs.
 - David Booth: BEMS systems
 - Werner Rauer (Kaeser): ELGI. we / Kaeser Compressors can share data with you on monitored systems.
- David Booth: Any common BEMS system can have compressed air KPIs measured and added and alarmed. Often these are already in place and watching the HVAC and other systems in many plants. While they do not directly control the system, they are great for bringing in KPIs in a way that the plant is already familiar with.
- Ron Marshall (Marshall Compressed Air Consulting): 80/20 percent would not be right for systems with 3 compressors or less. Pressure test requirement might be a waste of time and money.

- Jon McHugh (McHugh Energy Consultants): Ron what is your comment about 3 compressors or less?
- Ron Marshall (Marshall Compressed Air Consulting): For piping size, most pressure drops at the end - down drop, hoses, connectors. Size should be for application rather than standard plant wide size. Therefore, 80 percent base is too high in my opinion.
- Jonathan Tan (J Vidal Associates): I agree.
- David Booth: I would be very careful on your wording for sizing of piping based on flows. Often lower flows at the far reaches of the plant during design are lower and this may mislead engineers to downsize headers throughout the plant which down the road may be a serious problem as plants change.
- Peter Strait (Energy Commission): Is right-sizing a separate measure from installation of a monitoring system?
 - MM Valmiki (AESC): Yes, these are considered two separated measures.
- Charles Ehrlich (PG&E): Are there any discussions about updating the Title 24 Alterations trigger mechanisms?
 - MM Valmiki (AESC): Yes. One of our submeasures is to try to revise the existing language. We can alter the trigger mechanisms so that the alterations make sense. If you have insight on what trigger mechanisms we should focus on, let us touch base.
- David Booth: Rarely do industrial plants know before a system is installed and running what the actual real flows will be across the system and in the branches. In general, they have some overall sizing info but rarely at the detail level to do an accurate analysis.
 - Jonathan Tan (J Vidal Associates): I agreed. They are sizing usually, for the maximum potential if all loads hit at the same instantaneous time.

5. Steam Trap Monitoring

- *Kevin Johnson (AESC, Statewide CASE Team) presented.*
- Peter Owens (Steam IQ): I would not necessarily agree a failed closed trap is identified and/or repaired any quicker than a failed open trap.
 - Jon McHugh (McHugh Energy Consultants): Peter – if steam trap is failed fully closed, would not the end use device no longer be heated? For a drip leg steam trap, I understand that it may take a while for that trap to be fixed.
 - Peter Owens (Steam IQ): Sure, for an end use device like a jacketed kettle that no longer reached temp I could agree but there are a lot more distribution traps that would never be discovered. And manifest themselves in other ways like water hammer, broken equipment etc.
- Jon McHugh (McHugh Energy Consultants): Do people agree with the Department of Energy's estimates of failure rates?
- **Poll 4: What operating pressure is most common in process steam systems? Please select the closest pressure.**
 - Peter Owens (Steam IQ): Pressure is going to vary widely depending on process. Even in same plant it is going to vary as it goes through pressure release valves.
- Peter Owens (Steam IQ): If 145MM therms is only 3.3 percent of the 4.4MM therms in California, why ignore the vast installed base if the goal is to save therms and greenhouse gas emissions? Maybe not a mandate but switch to incentive-based model?
 - Jon McHugh (McHugh Energy Consultants): Peter, this proposal covers only code proposal. There are other policy activities that focus on incentives but not the scope of this code change proposal.

- Kevin Johnson (AESC): I would agree with that approach and think that an incentive would be a good process. The tricky part about mandating it goes back to the acceptance requirement and how to identify what a reasonable code trigger event might be and also the compliance component and how to actually enforce something like that. At this point, it is still being evaluated and maybe the numbers we presented today are conservative in terms of energy savings potential. Please provide feedback on what are additions and alterations triggers.
- Charles Ehrlich (PG&E): How about "manual check" as baseline for "fail-closed" steam traps because failures will be addressed quickly. Whereas the baseline for "fail-open" steam traps' baseline would be some type of real-time monitoring.
 - Jon McHugh (McHugh Energy Consultants): Charles the proposal is for real time monitoring. The baseline is some levels of periodic checking of steam traps. Periodic checking is typically walking around with test equipment.
 - Charles Ehrlich (PG&E): Sorry--in my mind new codes = baseline. So yes, current standard practice is yet to be determined.
 - MM Valmiki (AESC): Charles, have you encountered steam trap monitoring coming through any incentive programs or other channels?
 - Charles Ehrlich (PG&E): In my limited experience, none. But lots of incentives for steam trap replacements which have been flagged over the years by the California Public Utilities Commission (CPUC) codes and standards evaluators.
- Charles Ehrlich (PG&E): Rewriting my note above: How about new code requiring "manual check" for "fail-closed" steam traps because failures will be addressed quickly. Whereas the new code for "fail-open" steam traps' baseline would be some type of real-time monitoring.
 - Peter Strait (Energy Commission): Building Code cannot make operational requirements. Our authority ends when the occupancy permit is issued.
 - Jon McHugh (McHugh Energy Consultants): Charles if you can send to the team links or data you are aware of CPUC evaluations of steam trap programs etc. we would appreciate it.
- Peter Owens (Steam IQ): In my experience, steam trap monitoring does drive a major shift in maintenance activities for facilities. But it needs to be coupled with a repair plan and buying from facilities.
 - MM Valmiki (AESC): That is good to hear. Similar to the compressed air monitoring in that sense.
 - Peter Strait (Energy Commission): Also similar to damper monitoring for economizers, conceptually.
- **Poll 5: What is the frequency that a steam trap fails in an open position versus closed?**
- **Poll 6: In the absence of an associated strainer, what is the average expected time between steam trap failures?**
- Jon McHugh (McHugh Energy Consultants): Are there any applications where a strainer is not recommended in front of the steam trap?
 - Peter Owens (Steam IQ): I think you will find the majority of industrial (50 PSIG+) traps already have strainers and blow downs. But they are typically ignored since it requires manual action.
 - Peter Owens (Steam IQ): Bucket traps do not really need strainers typically. They are very resistant to dirt and debris by their bottom feeding nature. It does not hurt though.
- Peter Strait (Energy Commission): Is sensing strainer condition an option? That is, if strainers are usually present but are often ignored, is there a way to make their condition visible?

- Peter Owens (Steam IQ): I do not think strainer sensing is realistic vs just having a periodic plan to walk around and blow them all down.
 - Jon McHugh (McHugh Energy Consultants): I agree blowing them down regularly is needed.
- Jon McHugh (McHugh Energy Consultants): I have seen integral strainers for disk traps but for other types such as bucket traps it seems like these do not have an integral strainer. Any reason not to protect these other traps with strainer?
- Jon McHugh (McHugh Energy Consultants): If the strainer is clogged and there is no flow through the steam trap then the monitoring system can detect the strainer being clogged.
- **Poll 7: What is the average expected time between steam trap failures for steam traps equipped with a strainer (integral or external)?**
- Peter Owens (Steam IQ): Detecting failed closed traps should trigger the manual inspection and a strainer blow down should be second nature.
- **Poll 8: How often do you conduct a steam leak assessment?**
- Jon McHugh (McHugh Energy Consultants): Would liability issues (live steam, etc.) prevent leaving a steam trap blow-off valve open to heat a process while a steam trap is clogged?
 - Peter Owens (Steam IQ): Happens all the time. I would say more common as a bypass valve vs blow down, but both achieve same result. One is just messier than the other.
- **Poll: How soon following identification of a failed open steam trap is a repair/replacement conducted?**
- Jon McHugh (McHugh Energy Consultants): How frequently are by-pass valves provided?
 - Peter Owens (Steam IQ): Depends a lot on the customer. Routine in industrial process, less common in commercial.
- Jon McHugh (McHugh Energy Consultants): When the bypass is opened or opening, how long before trap is fixed? Would it get fixed more quickly if spilling condensate on the floor?
 - Peter Owens (Steam IQ): The bypass valve would still dump the steam into condensate return so there would be nothing observable.
- Peter Owens (Steam IQ): I would triage on HOURS, PSIG, APPLICATION, ORIFICE SIZE. Pipe size is very imprecise at best. Big cost factor is installation. Wired vs wireless etc.

6. Refrigeration System Opportunities

- Trevor Bellon (VaCom Technologies, Statewide CASE Team) presented
- Jonathan Tan (J Vidal Associates): Should mandate doors on all remote cases with exception of Wet Produce for new construction.
 - Trevor Bellon (VaCom Technologies): This is not something we are looking at right now in the code cycle.
 - Peter Marotta (Climate Pros): If you do that, you end up needing more air conditioning.
 - Jonathan Tan (J Vidal Associates): Yes, Pete, but energy efficiency rating (EER) is better cooling your store than using your cases. and, would make CO2 better fit and eliminate the argument of trans-critical versus direct expansion (DX) by lowering BTU load by 80 percent. Reduce defrost, extend life of cases. This refers to new construction not retrofits or existing.
- Peter Marotta (Climate Pros): I would add more to barriers. Power variations in California as a major issue and storing CO2 charges on site and local AHJ barriers to that.
- Jonathan Tan (J Vidal Associates): Again, the savings is based on existing open cases to open cases. making all cases with doors reduces the load. Then CO2 w/ doors get compared to DX

without. Additional load to HVAC is better served too with higher EER of HVAC versus refrigeration. Almost 2x.

- Jonathan Tan (J Vidal Associates): If you make meat a requirement to put behind doors, you gain two things. 1, saturated suction temperatures (SST) can be raised several degrees. 2, reduced food waste as the meat will stay longer. meat typically is the lowest MT SST.
- Peter Marotta (Climate Pros): What about open single deck cases?
 - Jonathan Tan (J Vidal Associates): I would disallow for New Con or exempt it, but that may become your worst SST.
- Peter Marotta (Climate Pros): Single deck cases are very efficient.
- Jonathan Tan (J Vidal Associates): The island cases will drive lower SST too. But if everything else is behind glass
- Jamison Ditthardt (Guntner): One consideration for trans critical vs subcritical is that subcritical heat rejection generally requires more surface/airflow than trans critical
 - Philip Hollander (Baltimore Air Coil): Agree w/ Jamison, unless design selection is done at/near the critical point.
- Philip Hollander (Baltimore Air Coil): CO2 systems typically lower head pressure down to 50 saturated condensing temperature (SCT)
- Peter Strait (Energy Commission): Note that we may not be able to prohibit installation of appliances for which a federal appliance efficiency standard exists due to preemption. (Not 100 percent sure it applies here but is worth noting that it may apply.
- Jamison Ditthardt (Guntner): I think around 1100 pounds per square inch (PSI) is more typical than 1200.
 - Philip Hollander (Baltimore Air Coil): I agree again w/ Jamison.
- Jon McHugh (McHugh Energy Consultants): Peter could you describe the AHJ barriers to storing CO2 on site?
- Peter Marotta (Climate Pros): I prefer that heat reclaim is a major advantage on CO2. I would like not to limit that; it is best way to keep stores dry.
- Jonathan Tan (J Vidal Associates): CO2 is inexpensive, so the distributors are less inclined to stock as they would prefer to store more expensive gas. Pete is referring to storing your own make-up gas as it can be problematic currently to source.
 - Peter Marotta (Climate Pros): Jonathan, yes, I have seen CO2 stores storing a full charge on site.
- Peter Marotta (Climate Pros): This is a major add for controls, including cases controllers and related wiring.
- Philip Hollander (Baltimore Air Coil): To clarify, 1100 PSI (or lower) is often used with adiabatic on design days. 1200-1400 PSI is used with air-cooled, since it is associated with the SCT of 95-110F+.
 - Jamison Ditthardt (Guntner): I agree with Philip.
- Peter Marotta (Climate Pros): Storing charge on site is very expensive considering bottle rentals.
- Adam Spitz (Energy Solutions, *Statewide CASE Team*): What is the incremental cost for CO2 storage on-site?
 - Peter Marotta (Climate Pros): You should check with rsd.net or Airgas, but they typically own the bottles and you have to pay rent on them.
 - Danielle Wright (NASRC): Adam, it will depend on the retailer. Some have agreements with local distributors or contractors.
 - Jonathan Tan (J Vidal Associates): Plus, the logistics and process to manage the stock.

- Jonathan Tan (J Vidal Associates): That is today, as we do not have (no pun intended) critical mass of installations.
- Jon McHugh (McHugh Energy Consultants): The original comment indicated an AHJ (code official) barrier to CO2 storage, it is only a cost barrier or are there any applications where storage is not allowed?
 - Jonathan Tan (J Vidal Associates): I am not aware of it being not allowed, there are requirements for racking and safety chaining like all compressed gases.
 - Jamison Ditthardt (Guntner): What indications do you have that that indicate it would not be proper to apply current standards to packaged systems?
 - Peter Marotta (Climate Pros): Jon -- your internal safety department may have to sign off also.
 - Jonathan Tan (J Vidal Associates): Absolutely, insurance requirements, etc.
 - Jonathan Tan (J Vidal Associates): Are you aware of any code prohibiting though?
- Joe Fulton (Alta Refrigeration): Trevor I agree that is the trend.
- Philip Hollander (Baltimore Air Coil): Variable speed control on these modular packages is available (at least on some of them).
- Adam Spitz (Energy Solutions): Is the safety concern high pressure?
 - Jonathan Tan (J Vidal Associates): @ Adam, for storing? If so, any pressure vessel is required to be secured.
- Peter Marotta (Climate Pros): I visited a retailer in Westchester, NY, he has 4 CO2 stores, his findings was more energy efficient than his older DX stores (one to one systems).
 - Kelly Cunningham (PG&E): @Peter Marotta: Can we follow up with you later to learn more about the retail install?
 - Peter Marotta (Climate Pros): Sure - My brother has done many CO2 system in urban areas (NYC) some AHJ's and building owners in high rises have required enhanced leak detection and purge fans for CO2 there.
- Jamison Ditthardt (Guntner): Are speed control EC fans being considered alongside VFD fans?
 - Trevon Bellon: we would not specify the technology. It is more about enabling variable speed fans.
- Philip Hollander (Baltimore Air Coil): Regarding Submeasure A: Are there plans to recommend or mandate specific technologies based on climate (parallel, adiabatic, ejectors, etc.)? If so, how will that be done? What metrics will be used?
 - Trevor Bellon (VaCom Technologies): We will be looking at potential differences based on climate for mandating specific measures. We will use that go to model that uses weather data, to figure out the cost-effectiveness given the specific climate.
- Joe Fulton (Alta Refrigeration): How will the rating be specified? There are multiple ways evaps are rated in the industrial sector.
 - Trevor Bellon (VaCom Technologies): We would look at the returning air temperature.
- Jonathan Tan (J Vidal Associates): Would it make more sense to provide a required EER for the system? Everything is relative to the system such as climate, load, equipment selection, etc.
- Armin Hauer (EBM Papst): You mean electric input power to the evaporator, right? - Or mechanical input power at the impeller shaft?
 - Trevor Bellon (VaCom Technologies): We do mean electric input power.
- Erik Haffner (Hussman): Will the rating conditions have to be certified? If so how?
 - Trevor Bellon (VaCom Technologies): We are looking at requiring some sort of certification rating. Not necessarily requiring a particular type. If a manufacturer

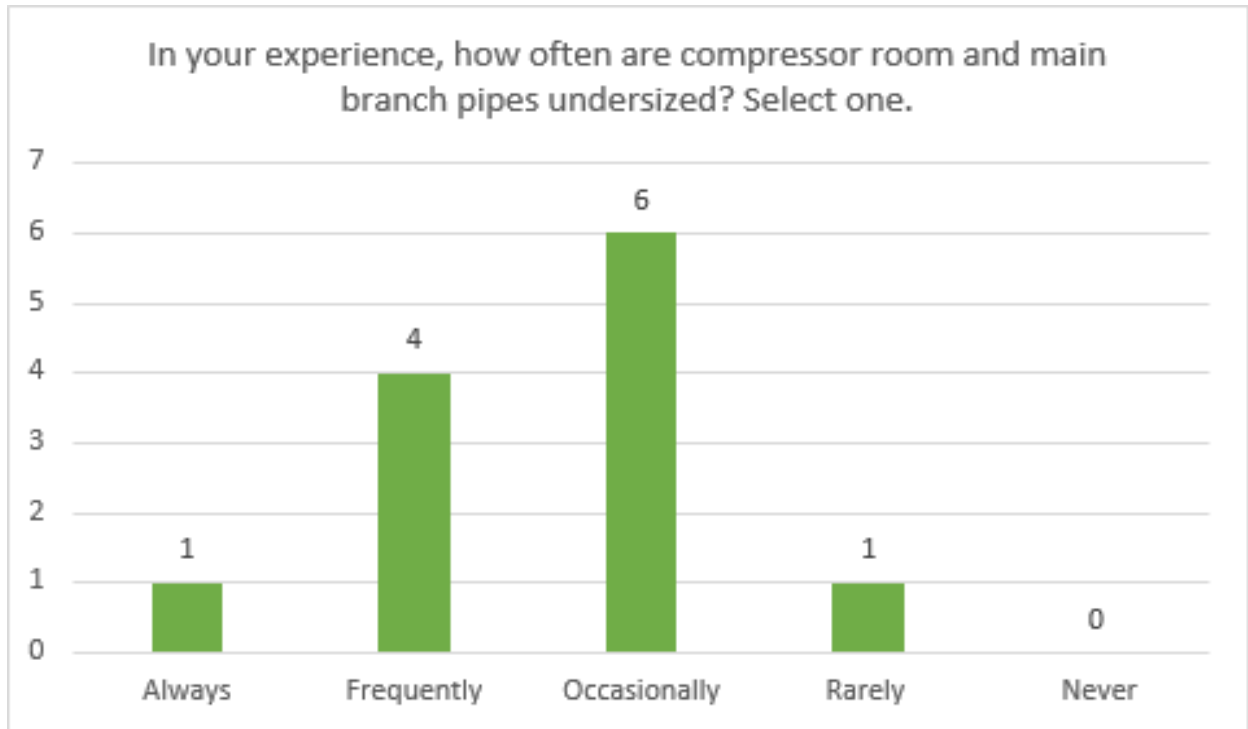
decides to opt out of a certified, there may be a d-rated value for the performance requirement.

- Jonathan Tan (J Vidal Associates): Where does the estimated new con of 1.3m ft² of refrigerated warehouse 2023 figure come from?
 - Trevor Bellon (VaCom Technologies): Forecast was provided by Energy Solutions.
- Peter Marotta (Climate Pros): These are definitely a good idea.
- Jonathan Tan (J Vidal Associates): Air curtains, I would say no. They are not that effective in my opinion. Plus, you are adding connected power to operate. A closed door or even strip curtains are more effective.
- Peter Marotta (Climate Pros): I would suggest an audible and flashing alarm on all walk-in doors, as store associates tend to chain or prop doors open, defeating the self-closure mechanisms. Associates, unfortunately, will tie back or cut strip curtains, and they do wear out quickly. High temp sensors with audible alarms may be better long-term solution.
 - Jonathan Tan (J Vidal Associates): I agree.
- Adam Spitz (Energy Solutions): The strip curtains could disrupt the door gasket as well, correct?
- Peter Marotta (Climate Pros): Please consider requirements to add strip curtains to exterior on grade receiving doors. These doors left open for hours have a significant impact on store energy use.
- Peter Marotta (Climate Pros): California should require entrance vestibules as in Washington. Note Washington State added a requirement for a dedicated outside air supply, but I would caution adding that requirement as it should be an either or (most efficient measure) Washington code is ambiguous and adds cost.
- Jonathan Tan (J Vidal Associates): You may want to check Nick Wirth, Wirth Research in the United Kingdom. He is a computational fluid dynamics expert out of Formula One. He has shown vestibules from an energy efficiency perspective are not that effective. Proper make-up air requirements are more important.
- Peter Marotta (Climate Pros): Have you compared efficiency of R-290 micro distributed units versus stationary CO₂? I would not mandate doors. You should leave it up to retailers to decide.
 - Jonathan Tan (J Vidal Associates): Are you considering doors on cases?
 - Trevor Bellon (VaCom Technologies): We have not. We are not recommending one technology type over another.
- Erik Haffner (Hussman): Since there are federal standards would the evaporation minimum efficiency only apply to rooms > 3000 square feet?
 - Trevor Bellon (VaCom Technologies): That is correct. Only applies to spaces greater than 3000 square feet.
- Peter Marotta (Climate Pros): If you go micro, you lose the reclaim.
 - Jonathan Tan (J Vidal Associates): The problem with micro is, we are too far out for charge increase.
- Jonathan Tan (J Vidal Associates): My soap box is, we are 100 years since Clarence Birdseye and Piggly Wiggly. It seems insane to me that we still have merchandisers without doors.
- Peter Marotta (Climate Pros): I suggest you add incentives for dehumidification systems. This way RTUs run less.
- Peter Marotta (Climate Pros): I am not a fan of all doors.
 - Jonathan Tan (J Vidal Associates): I understand that, but if we are talking Title 24, energy efficiency, and greenhouse gas reductions, we are not going to get there by still having open cases.
 - Peter Marotta (Climate Pros): There is a higher maintenance costs of doors.

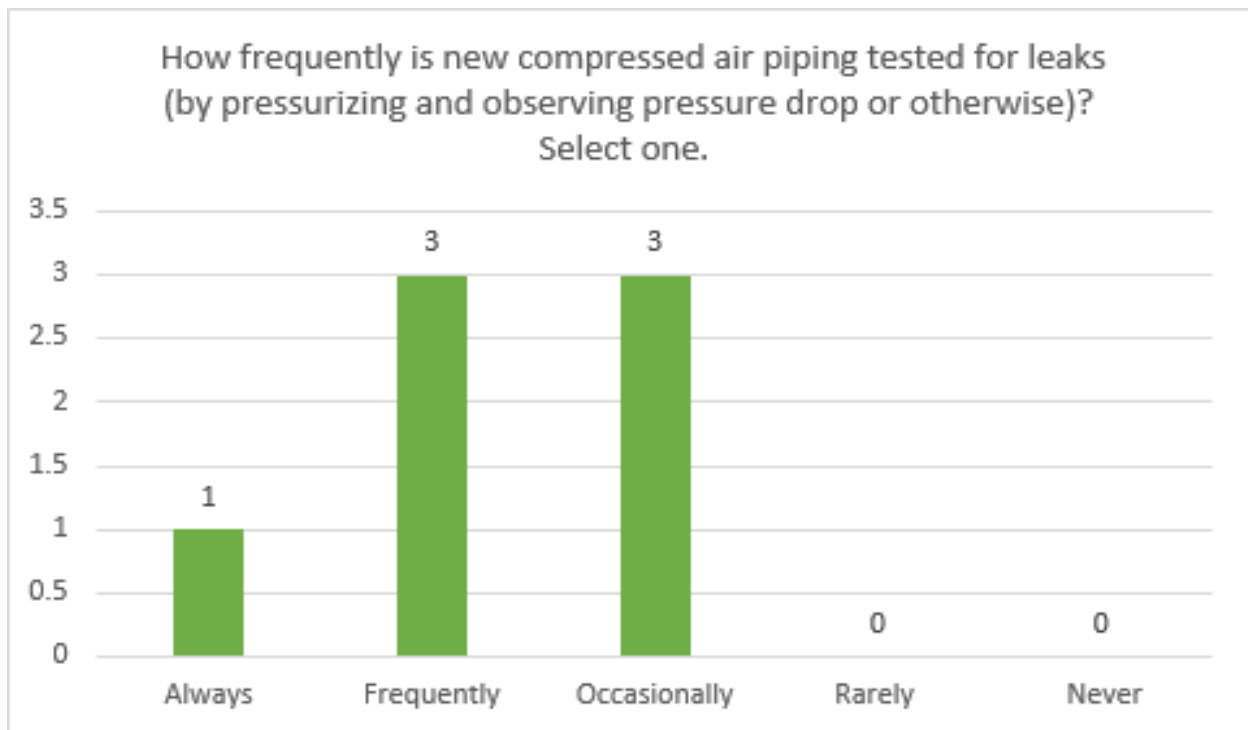
- Jonathan Tan (J Vidal Associates): We said the same thing when we switched from coffins to doors.
- Peter Marotta (Climate Pros): With Micro distributed, all doors are pretty much mandatory.
- Jonathan Tan (J Vidal Associates): The power load and the charge were reduced after it became a closed unit rather an open one. There was an 80 percent Btu load reduction.
- Peter Marotta (Climate Pros): Many customers still use coffins in new stores.
- Jonathan Tan (J Vidal Associates): We are talking new construction.
- Jonathan Tan (J Vidal Associates): Does that really make sense?
- Peter Marotta (Climate Pros): The customer demand is what drives design changes.
- Jonathan Tan (J Vidal Associates): Agreed, but we did not lose sales from coffins to doors.
- Peter Marotta (Climate Pros): I have seen evidence to the contrary.
- Joshua Heinrichs (AESC): If doors are mandatory, then everyone is impacted by the perceived sales issue, not just early adopters.
- Jon McHugh (McHugh Energy Consultants): Unfortunately, doors on display cases are preempted by the federal government. For walk-ins, doors are mandated.

Poll Responses

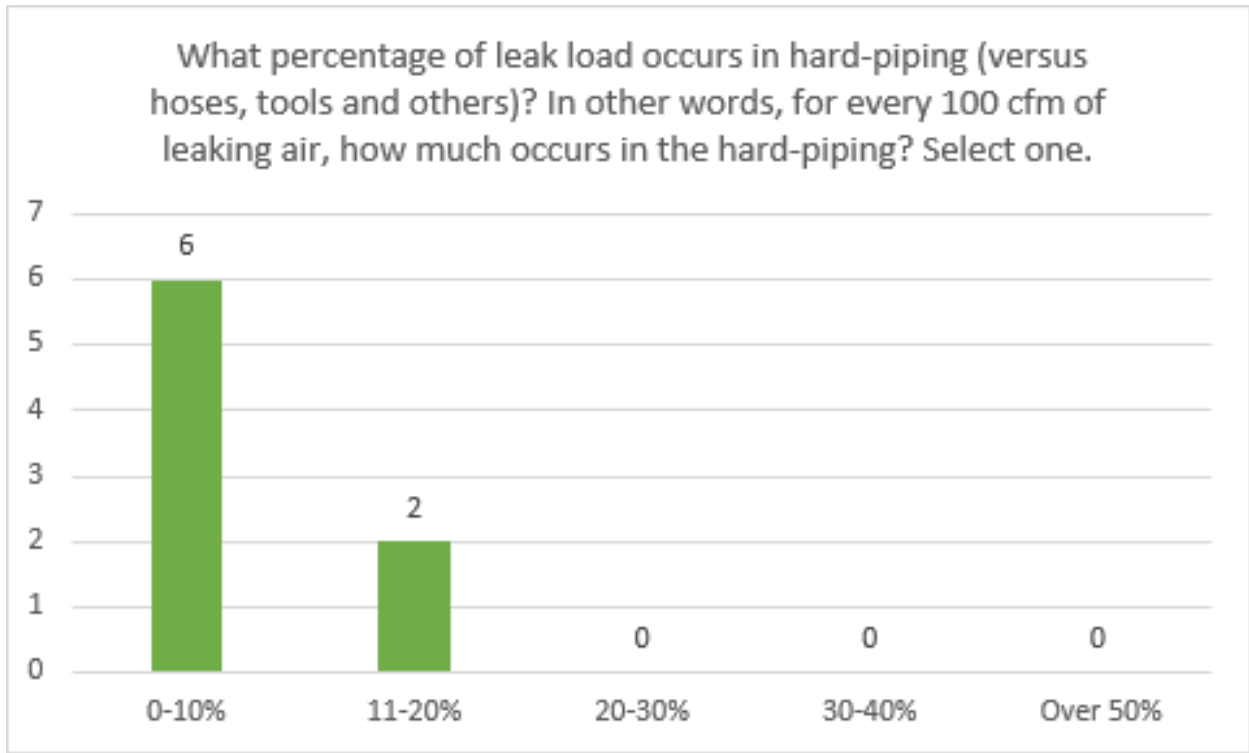
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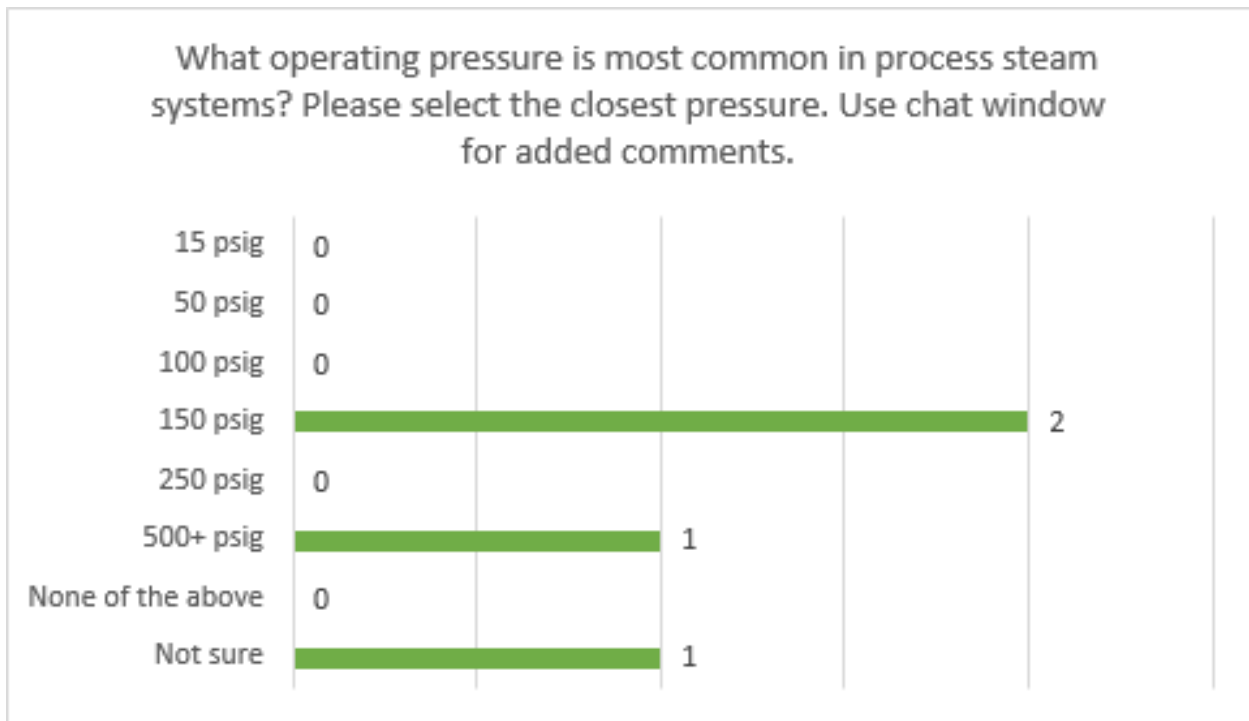
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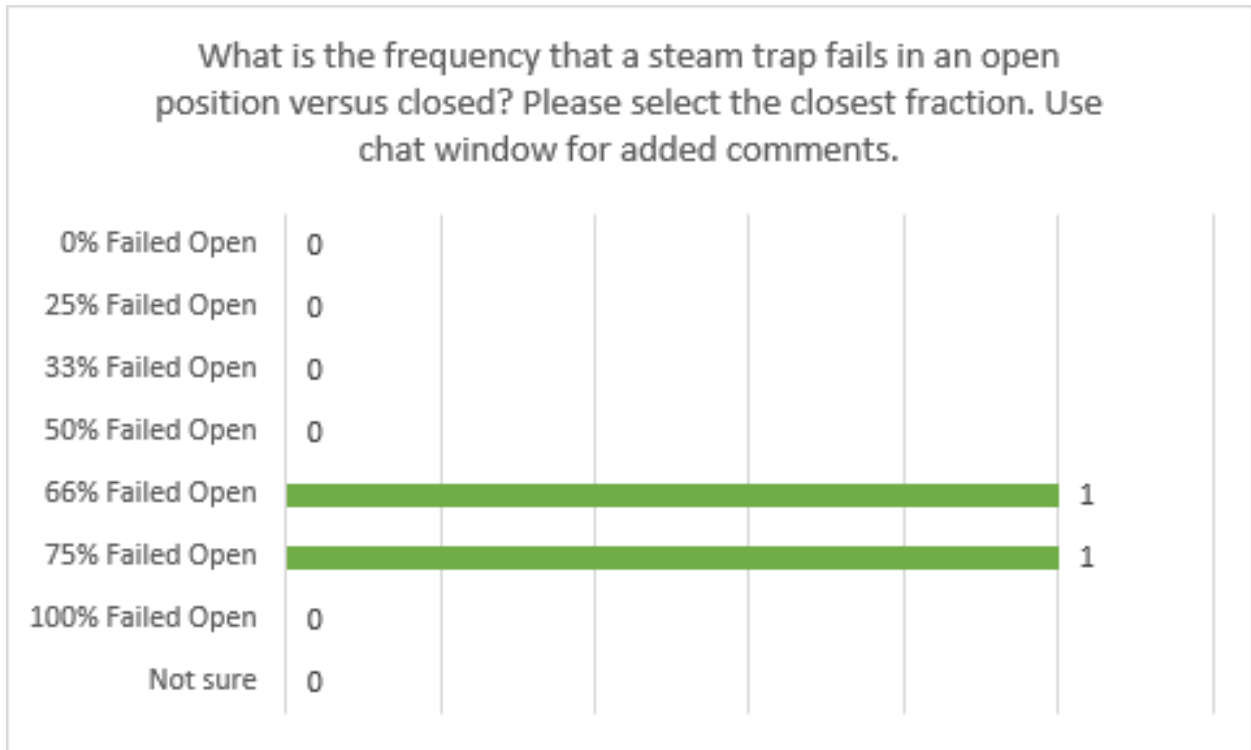
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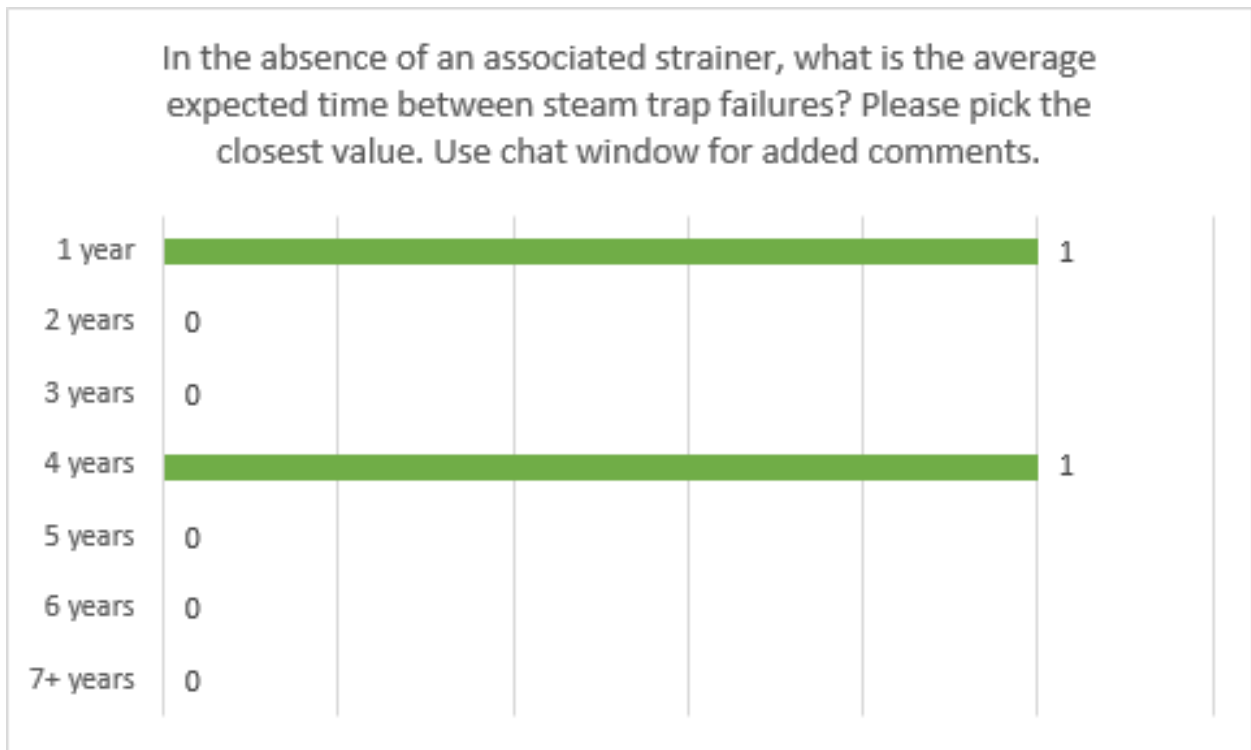
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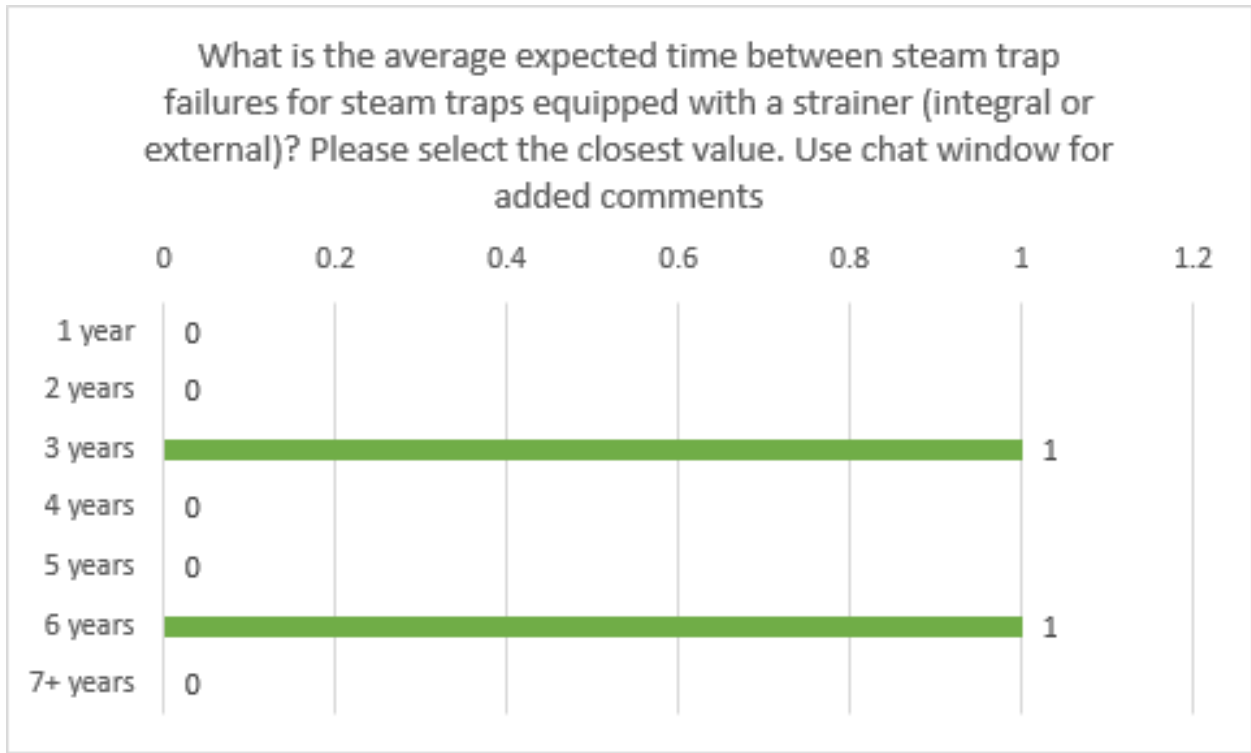
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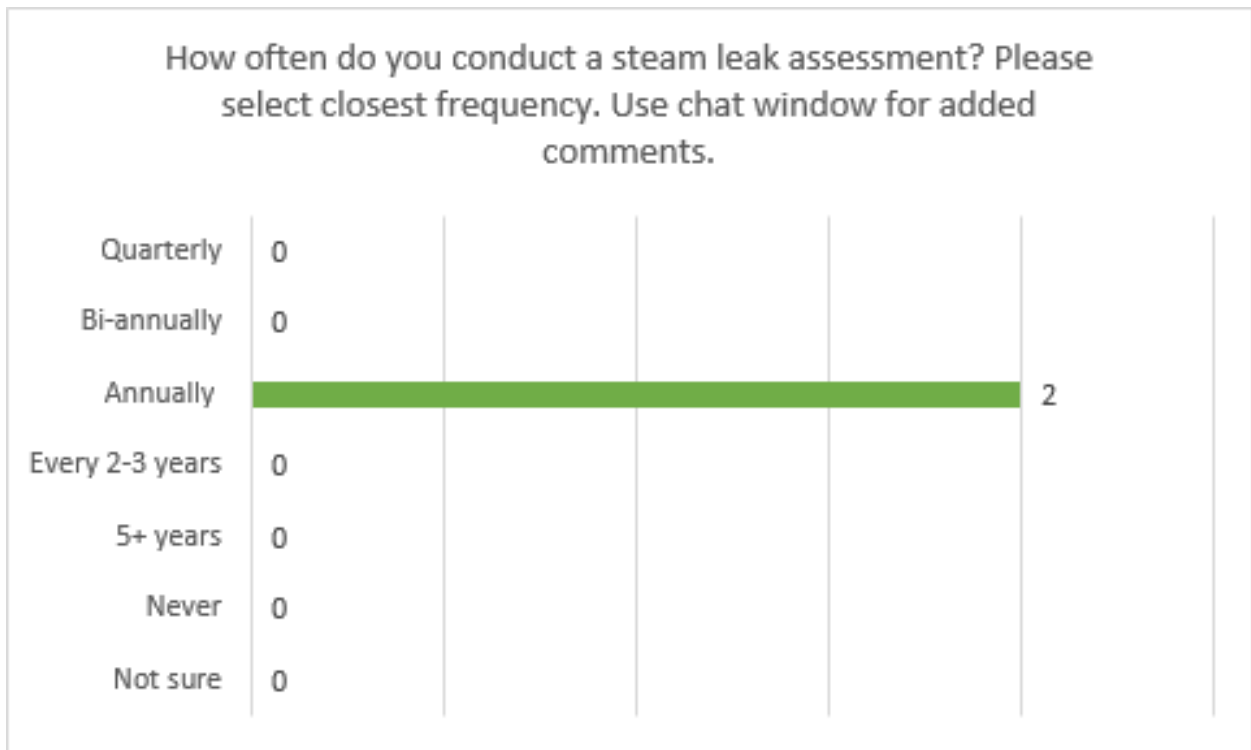
Poll 6 -



Poll 7 -



Poll 8 -



Poll 9 -

