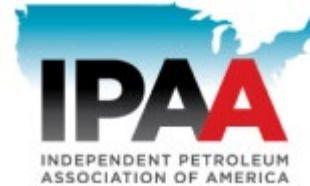


# Operator Survey of Supply Chain Delays for Equipment Needed for EPA Proposed NSPS 0000b Methane Rule



# Operator Survey of Supply Chain Delays for Equipment Needed for EPA Proposed NSPS 0000b Methane Rule

From June through September of 2023, the American Petroleum Institute (API), American Exploration and Production Council (AXPC), Interstate Natural Gas Association of America (INGAA), Independent Petroleum Association of America (IPAA), and GPA Midstream Association (the “Industry Trades”) conducted an operator survey of supply chain delays for components and equipment necessary to comply with the Environmental Protection Agency’s (EPA) proposed rule “Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review.” To comply with antitrust guidelines the survey was blinded, and data was gathered and compiled by a third party consultant, John Beath Environmental.

The EPA’s 0000b New Source Performance Standard (the “methane rule”) is a complex rule that will apply to many thousands of facilities in producing basins across the country. Because of the wide variety of conditions faced by these facilities, the challenges in acquiring equipment due to ongoing COVID-induced supply chain delays, and additional proposed rules which will apply to these sources such as EPA’s revisions to Subpart W of the Greenhouse Gas Reporting Program (GHGRP) that will also require equipment, **operators need a reasonable timeline based on a December 6, 2022 applicability date to come into compliance with the final methane rule.**

# Operator Survey of Supply Chain Delays for Equipment Needed for EPA Proposed NSPS 0000b Methane Rule

Responses to the survey included information from 11 basins; a majority of responses included information from the Permian Basin. The responses suggest that operators have the greatest supply chain concerns with pneumatics, control devices, storage vessels, associated gas, and fugitive emissions components.

**The survey found that current backorder times for components range from 6+ to 24+ months. Implementation of the proposed methane rule is expected to increase current backorder times by an additional 6+ months. A November 15, 2021 applicability date is expected to substantially exacerbate the challenges of equipment acquisition over a December 6, 2022 applicability date.**

**The survey results indicate that reasonable compliance timelines, based on a December 6, 2022 applicability date, would need to allow a minimum of 12 to 26 months for operators to come into compliance with the final methane rule, as appropriate given supply chain backlogs for each affected facility.**

# Current and Anticipated Supply Chain Delays

- Current backorder is generally up to 12 months across affected facilities with additional lead time needed for specialized equipment.
- Finalization of NSPS OOOOb is expected to add a minimum of 6 months of additional backorder time across affected facilities.

Affected Facility	Current Procurement Lead Time ("Backorder") is Delayed	Anticipated Backorder upon NSPS OOOOb Finalization Compared to Existing Lead Time
Pneumatic Controllers and Pumps	<ul style="list-style-type: none"><li>• Up to 12 months across equipment options.</li><li>• Electrical transformers and instrument air skids are experiencing variable delays with 24+ months indicated.</li></ul>	<ul style="list-style-type: none"><li>• Add 6 to 12 months</li></ul>
Control Device Provisions	<ul style="list-style-type: none"><li>• Up to 12 months for both control devices and other equipment (monitoring, etc.)</li></ul>	<ul style="list-style-type: none"><li>• Add 6 to 12 months for control devices and</li><li>• Add 6+ months for other equipment.</li></ul>
Storage Vessels	<ul style="list-style-type: none"><li>• Up to 12 months for steel tanks, vent header control valves</li><li>• Up to 24 months for VRUs and</li><li>• Up to 30 months for PVRVs &amp; thief hatches.</li></ul>	<ul style="list-style-type: none"><li>• Add 6+ months across equipment</li></ul>
Associated Gas	<ul style="list-style-type: none"><li>• Up to 18 months for VRUs, gas compressor skids</li></ul>	<ul style="list-style-type: none"><li>• Add 6 to 12 months</li></ul>
Fugitive Emissions Components	<ul style="list-style-type: none"><li>• Up to 12 months across monitoring options.</li></ul>	<ul style="list-style-type: none"><li>• Add up to 6 months</li></ul>
Other (miscellaneous equipment)	<ul style="list-style-type: none"><li>• Up to 18 months for VFDs</li></ul>	<ul style="list-style-type: none"><li>• Add 6 to 12 months for VFDs</li></ul>

# Recommended OOOOb Compliance Timelines by Affected Facility

Affected Facility / Category	EPA Proposed Compliance Timeline	Anticipated Supply Chain Delay Upon Finalization (Current lead time + additional anticipated lead time)	Industry Trades Recommended Compliance Timeline
Pneumatic Controllers & Pumps	60 days	18 - 36 months	26 months
Control Devices and Closed Vent Systems	60 days	18-24 months	20 months
Associated Gas	60 days	30 months	24 months
Fugitive Emissions Components	60 days	18 months	12 months
Storage Vessels	30 - 60 days	18 - 36 months	26 months

API's February 13 comment letter<sup>1</sup> included anecdotal reports of members' supply chain constraints. This survey quantitatively expands on the supply chain issues raised to demonstrate the need for reasonable compliance timelines.

These recommended compliance timelines account only for supply chain delays and do not contemplate the additional time needed to install equipment. The recommendations reflect the realities of the supply chain, balanced with the urgency of aggressive industry action to achieve compliance with OOOOb and reduce emissions.

While this survey evaluated supply chain delays relative to OOOOb compliance and did not contemplate compliance with OOOOc, given the scope of the proposed rules and available data, similar supply chain constraints are anticipated to continue beyond the OOOOc implementation timeframe.

<sup>1</sup><https://www.regulations.gov/comment/EPA-HQ-OAR-2021-0317-2428>

# Equipment & Services Included by Affected Facility

- ❑ Survey responses included equipment and services for various compliance options for each affected facility (listed below).
- ❑ The survey included estimated equipment counts, supplier market, and supply chain delays.

<u>Pneumatic Controllers &amp; Pumps</u> <ul style="list-style-type: none"><li>• Electrical Transformers</li><li>• Solar Equipment</li><li>• Generator Skids</li><li>• Instrument Air Skids</li><li>• Electrical Valves/Controllers</li><li>• Replacement Pumps</li><li>• Replacement Controllers</li><li>• ECAT System</li><li>• Nitrogen Gas</li></ul>	<u>Control Devices &amp; Closed Vent Systems</u> <ul style="list-style-type: none"><li>• Flares</li><li>• Enclosed Combustion Devices</li><li>• Flow Meters</li><li>• Backpressure Valves</li><li>• Calorimeters</li><li>• Third-party Testing: Performance, Net Heating Value (NHV), Opacity</li><li>• Automatic Pilot Light</li><li>• Thermocouples</li><li>• Piping for Closed Vent System</li></ul>	<u>Storage Vessels</u> <ul style="list-style-type: none"><li>• Steel Tanks</li><li>• Pressure-Vacuum Relief Valves (PVRVs) &amp; Thief Hatches</li><li>• Vent Header Control Valve</li><li>• Vapor Recovery Units (VRUs)*</li></ul>
<u>Associated Gas</u> <ul style="list-style-type: none"><li>• VRUs*</li><li>• Methane Pyrolysis Skids</li><li>• Gas Compressor Skids</li><li>• Gas to Liquids Skids</li><li>• Liquefied Natural Gas Production Skids</li></ul>	<u>Fugitive Emissions Components</u> <ul style="list-style-type: none"><li>• Optical Gas Imaging (OGI) Cameras</li><li>• OGI Camera Technicians</li><li>• Third-party OGI Monitoring</li><li>• Third-party Alternative Screening Technology Monitoring</li><li>• Continuous Monitoring Systems</li><li>• Replacement Piping Components</li><li>• Handheld Methane Detectors</li></ul>	<u>Other (Miscellaneous Equipment)</u> <ul style="list-style-type: none"><li>• Variable Frequency Drives (VFDs)</li><li>• Cabling (Electric/Communications)</li><li>• Engineering Analysis (Associated Gas, Pneumatic Pumps, etc.)</li><li>• Eductor Skid (for compressors)</li></ul>

\*VRUs were considered separately for Storage Vessels and Associated Gas since size and design may differ.

# Estimated Equipment Counts Needed for NSPS 0000b Compliance

- **Pneumatic Controllers & Pumps**
  - Variety of responses highlight the need for multiple compliance options (i.e., no “one size fits all” solution).
  - 69% of responses indicated that instrument air skids would be needed.
  - Responses continue to indicate that a variety of power generation options will need to be used.
- **Control Devices & Closed Vent Systems**
  - 82% of responses indicated that flow meters would be needed.
  - 27% or more of responses indicated that third-party services (performance testing, NHV testing, or opacity monitoring) were being investigated for use.
- **Storage Vessels**
  - PVRVs & thief hatches were key equipment needed and were not considered in EPA’s cost analysis.
  - 29% of responses indicated that steel tanks would be needed, possibly as replacements for fiberglass tanks to facilitate a closed vent system. Replacement tanks were not considered in EPA’s cost analysis.
- **Associated Gas**
  - While operators support the concept of other types of beneficial use, responses indicated that operators were not planning to implement alternative technology options proposed by EPA (methane pyrolysis, gas to liquids, liquefied natural gas). The costs of alternative use options were not considered in EPA’s cost analysis.
- **Fugitive Emission Components**
  - Responses indicated that most operators were planning to implement their own OGI monitoring program (OGI cameras and technicians). A shortage of OGI technicians was also noted in the responses, and for gas processing operators, availability of qualified OGI camera technicians could be further limited based on the proposed certification and audit requirements in Appendix K. EPA’s cost analysis assumed that operators would use a third-party service.

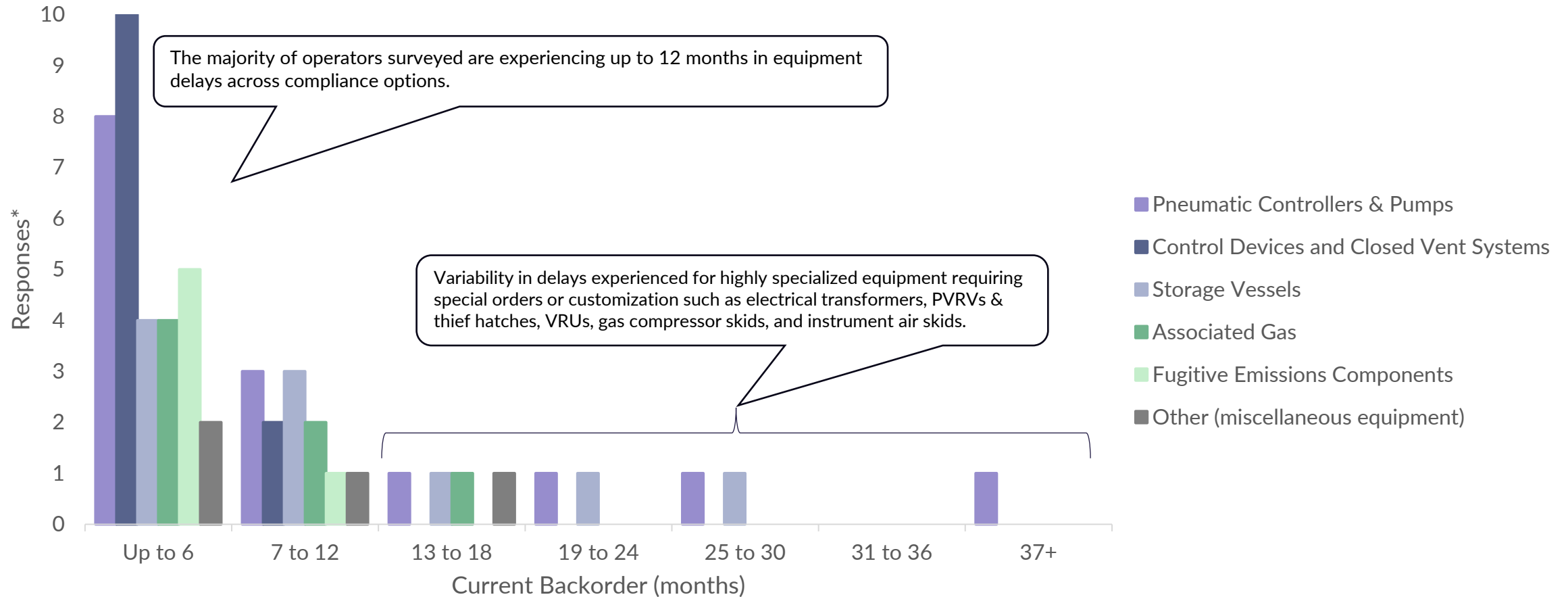
# Survey Results Compared to Previous API Comments

- Since the February 13, 2023 comment deadline, equipment backorder has generally remained the same or worsened.
- A reasonable compliance timeline of 12 to 26 months is needed based on a December 6, 2022 applicability date. Additional time would be needed if EPA maintains the November 15, 2021 applicability date.

Supply Chain Item	Survey Results (August 2023)	Previous API Comments (February 2023)	Summary of Comparison
Control Device Backorder	Up to 6 months: 75% 7 to 12 months: 25%	3 to 4 months	Backorder has increased by up to 8 months.
Flow Meter Backorder	Up to 6 months: 83% 7 to 12 months: 17%	6 to 8 months	Backorder remains approximately 6 to 8 months.
Flow Meter Installation Timeline (Hot Tap)	Up to 2 weeks: 50% 3 to 4 weeks: 33% 12+ weeks: 17%	Up to 4 months	Survey results may not reflect hot tap installations.
Instrument Air Skids Backorder	Up to 6 months: 58% 7 to 12 months: 25% 19+ months: 17%	8 to 12 months	Backorder has increased by up to 7 months.
Solar Panels Backorder	Up to 6 months: 80% 7 to 12 months: 20%	18 to 24 months	Backorder has decreased by 6 to 12 months.

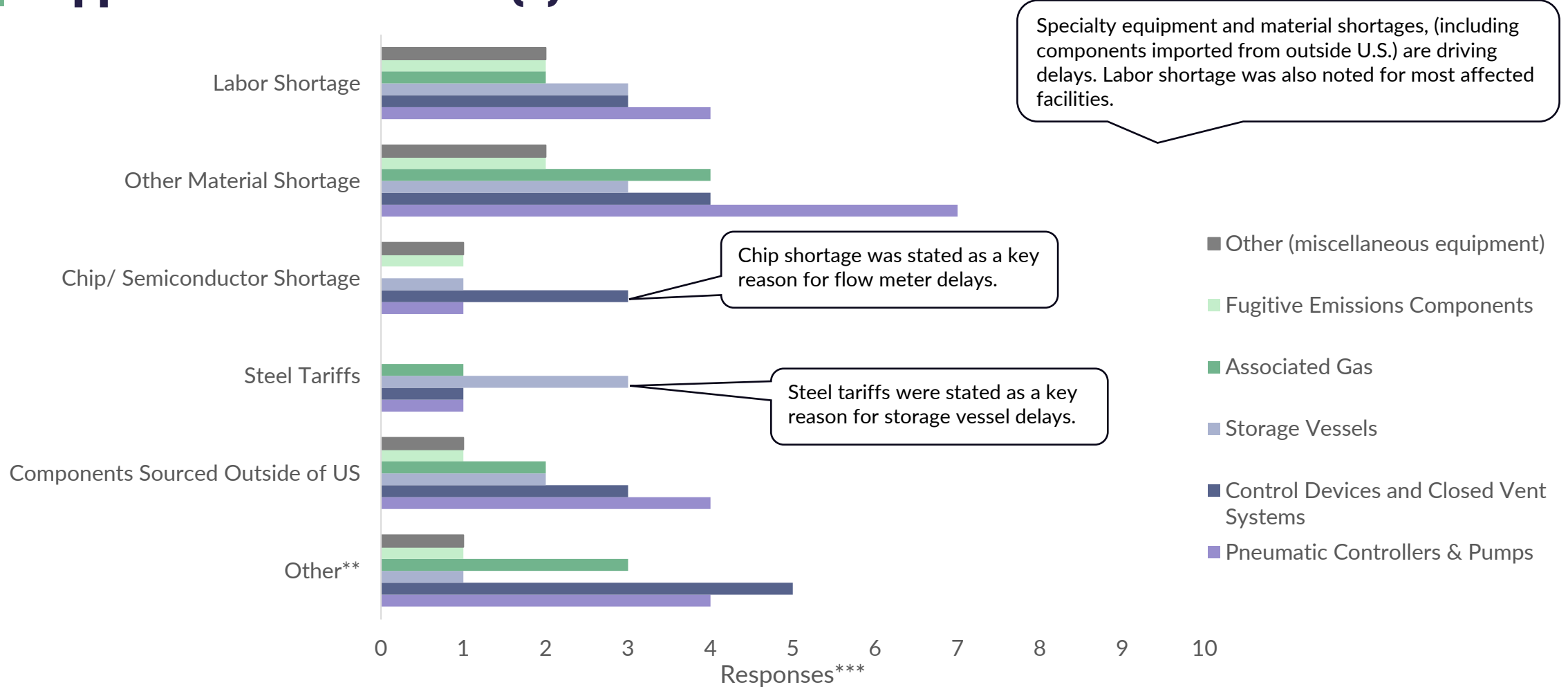


# Current Procurement Lead Time



\*Responses by affected facility based on maximum count for each backorder timeframe.

# Supplier-Stated Reason(s) for Backorder\*

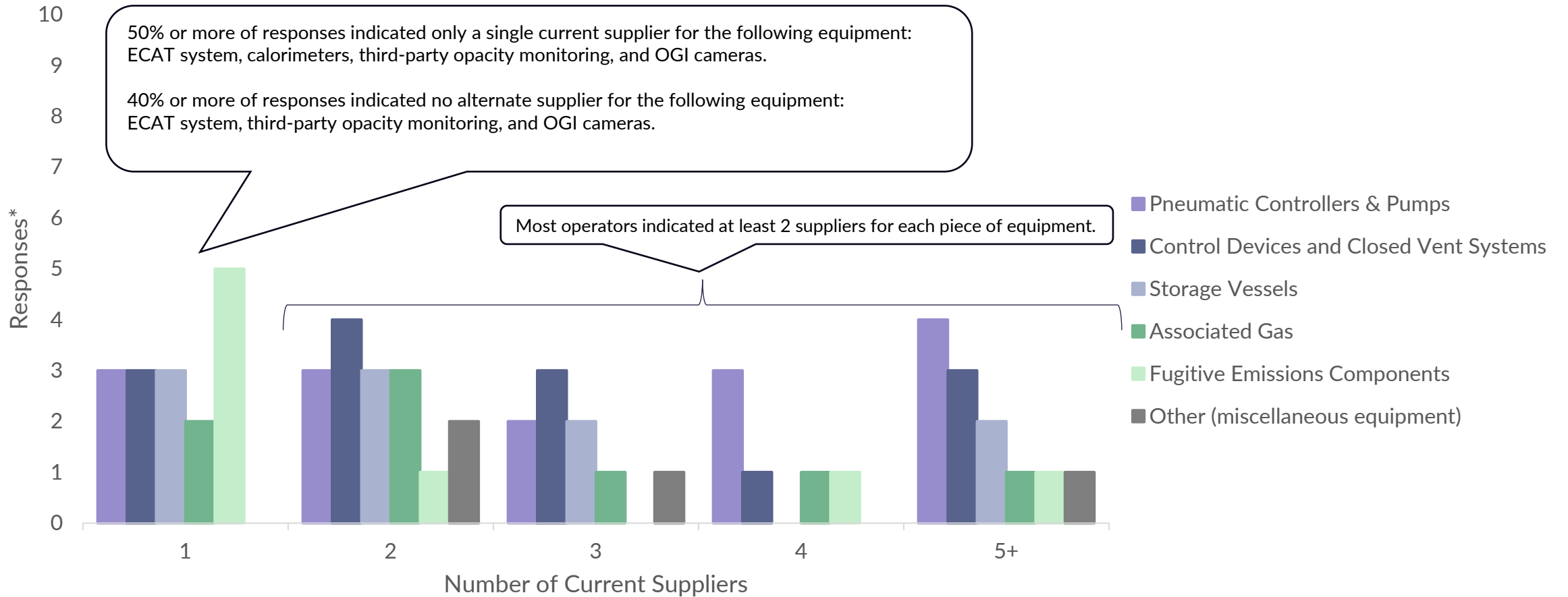


\* Responses could indicate more than one reason for backorder delays

\*\* Other reasons vary by control option but include: "Fabricator backlog"; "Standard lead time"; "Limited inventory as order is customized"; "Engineering design required for proper equipment function".

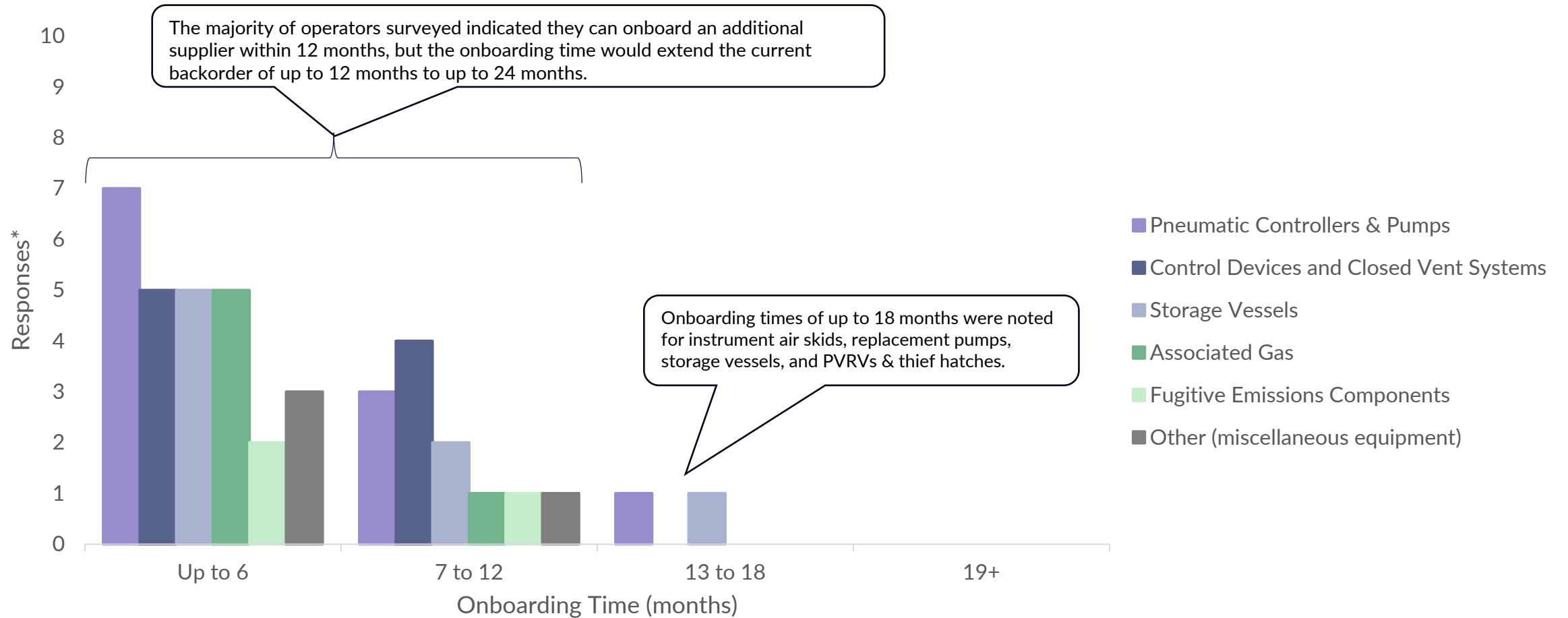
\*\*\* Responses based on maximum count for each reason.

# Supplier Market



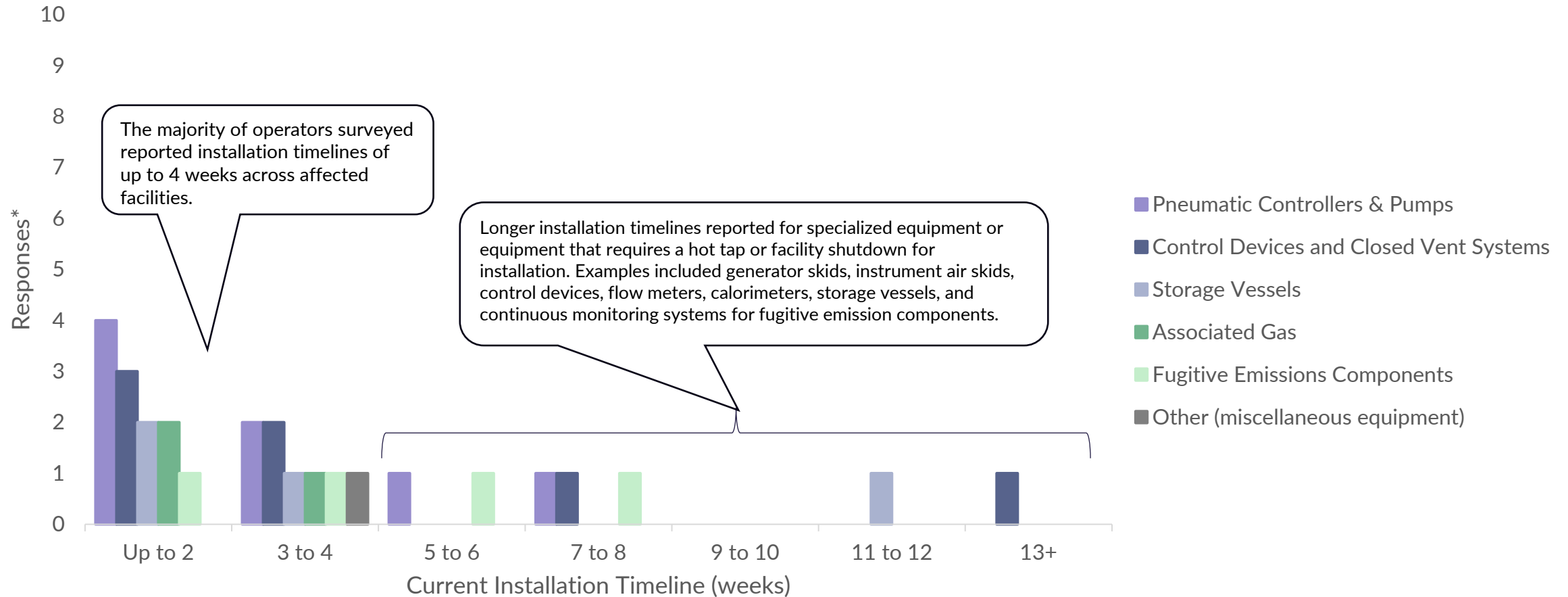
\*Responses by affected facility based on maximum count for each number of current suppliers.

# Onboarding Time for an Additional Supplier



\*Responses by affected facility based on maximum count for each onboarding timeframe.

# Current Installation Timelines



\*Responses by affected facility based on maximum count for each installation timeline.

# Reason(s) for Installation Timelines



\* Responses could indicate more than one reason for backorder delays

\*\* Other reasons vary by control option but include: "Engineering evaluation needed"; "Normal construction timeline"; "Weather, road conditions".

\*\*\* Responses based on maximum count for each reason.

# Assessment of Supply Chain Delays for Equipment and Services Essential for Compliance with EPA's Proposed NSPS OOOOb Methane Rule Based on Operator Feedback

## Purpose:

The purpose of this assessment was to understand the current and anticipated supply chain delays that companies may face resulting from the proposed NSPS OOOOb standards. Analysis of operator responses was blinded such that no particular company was referenced in the results.

## Survey Responses:

Operator responses included information related to equipment and services for various compliance options by affected facility under proposed NSPS OOOOb.

Responses provided information on estimated equipment counts, context for the supplier market, and supply chain delays.

Survey was conducted from June through August 2023 with members of the following trade organizations:

American Petroleum Institute (API),  
American Exploration and Production Council (AXPC),  
Interstate Natural Gas Association of America (INGAA),  
Independent Petroleum Association of America (IPAA), and  
GPA Midstream Association.

## Disclaimers:

Operators provided information on equipment and services of most interest to them based on readily available data, so the response rate varied for each affected facility. The most feedback, at 15 total responses, was specific to pneumatic controllers and pumps.

The total response rate for a given affected facility is greater than the response rate for any individual equipment or service required for compliance.

These results depict the struggles operators are facing in obtaining equipment or services. Results are not meant to be interpreted as a statistical analysis or representation, but rather a snapshot of the existing supply chain.

Any non-blank information was counted as a response.

Information was collected into tables for review and analysis.

## Conducted by:

**John Beath Environmental, LLC**

Denise Grubert

[denise.grubert@beath.us](mailto:denise.grubert@beath.us)

Robert Ontko

[robert.ontko@beath.us](mailto:robert.ontko@beath.us)



## General Information

### Segment Information:

Segment	Number of Respondents
Production	12
Gathering & Boosting	7
Processing	2
Transmission	1
<b>Total</b>	<b>15</b>

### Basin Information:

AAPG Geologic Province	Province No.	Number of Respondents
Permian Basin	430	10
Anadarko Basin	360	5
Gulf Coast Basin	220	3
Williston Basin	395	3
Appalachian Basin (Eastern Overthrust Area)	160-A	1
Arkla Basin	230	1
Arkoma Basin	345	1
Fort Worth Syncline	420	1
Powder River Basin	515	1
South OK Folded Belt	350	1
Uinta Basin	575	1

### By Affected Facility:

Affected Facility	Number of Respondents
Pneumatic Controllers & Pumps	15
Control Devices and Closed Vent Systems	14
Storage Vessels	11
Associated Gas Flaring	10
Fugitive Emissions Components	10
Other	8



## Estimated Equipment Count:

Affected Facility	Equipment Description	Estimated Number Required for NSPS 0000b			
		Number of Respondents	Number of Respondents with Non-Zero Count	Number of Respondents with Zero Count	% of Responses Need This Equipment
Pneumatic Controllers & Pumps	Electrical Transformers	6	4	2	31%
Pneumatic Controllers & Pumps	Solar Equipment	5	3	2	23%
Pneumatic Controllers & Pumps	Generator Skids	5	3	2	23%
Pneumatic Controllers & Pumps	Instrument Air Skids	10	9	1	69%
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	8	6	2	46%
Pneumatic Controllers & Pumps	Pump Replacement	8	8	0	62%
Pneumatic Controllers & Pumps	Replacement Controllers	9	9	0	69%
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	2	1	1	8%
Pneumatic Controllers & Pumps	Nitrogen Gas	2	0	2	0%
<b>Pneumatic Controllers &amp; Pumps</b>	<b>Total (for any Equipment)</b>	<b>13</b>			
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	8	7	1	64%
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	8	5	3	45%
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	6	5	1	45%
Control Devices and Closed Vent Systems	Flow Meters	9	9	0	82%
Control Devices and Closed Vent Systems	Backpressure Valves	6	5	1	45%
Control Devices and Closed Vent Systems	Calorimeters	4	3	1	27%
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	4	3	1	27%
Control Devices and Closed Vent Systems	Automatic Pilot Light	3	2	1	18%
Control Devices and Closed Vent Systems	Thermocouple	4	4	0	36%
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	4	3	1	27%
Control Devices and Closed Vent Systems	Piping for Closed Vent System	4	4	0	36%
<b>Control Devices and Closed Vent Systems</b>	<b>Total (for any Equipment)</b>	<b>11</b>			
Storage Vessels	Steel Tanks	4	2	2	29%
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch	6	4	2	57%
Storage Vessels	Vent Header Control Valve	3	1	2	14%
Storage Vessels	Vapor Recovery Units	5	5	0	71%
<b>Storage Vessels</b>	<b>Total (for any Equipment)</b>	<b>7</b>			
Associated Gas Flaring	Vapor Recovery Units-Flaring	7	4	3	57%
Associated Gas Flaring	Methane Pyrolysis Skid	2	0	2	0%
Associated Gas Flaring	Gas Compressor Skid	4	2	2	29%
Associated Gas Flaring	Gas to Liquids Skid	2	0	2	0%
Associated Gas Flaring	Liquified Natural Gas Production Skid	2	0	2	0%
<b>Associated Gas Flaring</b>	<b>Total (for any Equipment)</b>	<b>7</b>			
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras	6	5	1	71%
Fugitive Emissions Components	OGI Camera Technicians	5	4	1	57%
Fugitive Emissions Components	OGI Monitoring (3rd Party)	3	2	1	29%
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)	2	0	2	0%
Fugitive Emissions Components	Continuous Monitoring System	4	2	2	29%
Fugitive Emissions Components	Replacement Piping Components	1	0	1	0%
Fugitive Emissions Components	Handheld Methane Detector	1	1	0	14%
<b>Fugitive Emissions Components</b>	<b>Total (for any Equipment)</b>	<b>7</b>			
Other	Variable Frequency Drive (VFD)	3	3	0	43%
Other	Cabling (Electric/Communications)	1	1	0	14%
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	2	1	1	14%
Other	Eductor Skid (For compressors)	1	1	0	14%
<b>Other</b>	<b>Total (for any Equipment)</b>	<b>6</b>			





### Supply Chain Delays:

Affected Facility	Equipment Description	Anticipated Backorder upon NSPS OOOOb Finalization									Number of Responses
		0 to 6 months	7 to 12 months	13 to 18 months	19 to 24 months	25 to 30 months	31 to 36 months	More than 36 months	Other		
Pneumatic Controllers & Pumps	Electrical Transformers	0	0	1	1	0	0	1	0		3
Pneumatic Controllers & Pumps	Solar Equipment	3	0	0	0	0	0	0	0		3
Pneumatic Controllers & Pumps	Generator Skids	0	1	1	1	0	0	0	0		3
Pneumatic Controllers & Pumps	Instrument Air Skids	2	1	2	0	0	0	2	1	0 to 12 month	8
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	3	1	2	0	0	0	1	0		7
Pneumatic Controllers & Pumps	Pump Replacement	4	1	1	0	0	0	1	0		7
Pneumatic Controllers & Pumps	Replacement Controllers	2	1	2	0	0	0	0	1	0 to 12 month	6
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	0	1	0	0	0	0	0	0		1
Pneumatic Controllers & Pumps	Nitrogen Gas	2	0	0	0	0	0	0	0		2
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	2	1	2	1	0	0	0	0		6
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	2	1	1	1	0	0	0	0		5
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	2	0	0	0	0	0	0	0		2
Control Devices and Closed Vent Systems	Flow Meters	4	1	2	0	0	0	0	0		7
Control Devices and Closed Vent Systems	Backpressure Valves	2	0	2	0	0	0	0	0		4
Control Devices and Closed Vent Systems	Calorimeters	1	1	1	0	0	0	0	0		3
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	0	0	0	0	0	0	0	0		0
Control Devices and Closed Vent Systems	Automatic Pilot Light	0	0	0	0	0	0	0	0		0
Control Devices and Closed Vent Systems	Thermocouple	1	0	1	0	0	0	0	0		2
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	1	0	0	0	0	0	0	0		1
Control Devices and Closed Vent Systems	Piping for Closed Vent System	0	0	1	0	0	0	0	0		1



## Supply Chain Delays:

Affected Facility	Equipment Description	Supplier-Stated Reason(s) for Backorder						
		Steel Tariffs	Chip/Semiconductor Shortage	Other Material Shortage	Other Material Shortage Description 1	Other Material Shortage Description 2	Labor Shortage	Components Sourced Outside of US
Pneumatic Controllers & Pumps	Electrical Transformers	0	0	3	No details provided.		2	3
Pneumatic Controllers & Pumps	Solar Equipment	0	0	1	No details provided.		0	1
Pneumatic Controllers & Pumps	Generator Skids	0	1	2	No details provided.		1	2
Pneumatic Controllers & Pumps	Instrument Air Skids	1	1	7	PLC Componets	Dryer shortage	4	4
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	0	1	3	No details provided.		1	2
Pneumatic Controllers & Pumps	Pump Replacement	0	0	2	No details provided.		1	1
Pneumatic Controllers & Pumps	Replacement Controllers	0	0	2	No details provided.		1	1
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	0	0	1	No details provided.		1	1
Pneumatic Controllers & Pumps	Nitrogen Gas	0	0	0	N/A		1	0
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	1	0	4	No details provided.		3	3
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	0	0	3	No details provided.		2	2
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	0	0	1	Possible delays on data logging controls		2	0
Control Devices and Closed Vent Systems	Flow Meters	0	3	4	No details provided.		2	3
Control Devices and Closed Vent Systems	Backpressure Valves	0	0	2	No details provided.		1	2
Control Devices and Closed Vent Systems	Calorimeters	0	1	2	No details provided.		1	1
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	0	0	0	N/A		1	0
Control Devices and Closed Vent Systems	Automatic Pilot Light	0	0	0	N/A		0	0
Control Devices and Closed Vent Systems	Thermocouple	0	0	1	No details provided.		1	1
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	0	0	0	N/A		1	0
Control Devices and Closed Vent Systems	Piping for Closed Vent System	0	0	0	N/A		0	0

## Supply Chain Delays:

Affected Facility	Equipment Description	Supplier-Stated Reason(s) for Backorder						
		Steel Tariffs	Chip/Semiconductor Shortage	Other Material Shortage	Other Material Shortage Description 1	Other Material Shortage Description 2	Labor Shortage	Components Sourced Outside of US
Storage Vessels	Steel Tanks	3	1	2	No details provided.		3	1
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch	0	0	2	No details provided.		2	1
Storage Vessels	Vent Header Control Valve	0	0	1	No details provided.		1	0
Storage Vessels	Vapor Recovery Units	1	0	3	No details provided.		2	2
Associated Gas Flaring	Vapor Recovery Units-Flaring	1	0	4	No details provided.		2	2
Associated Gas Flaring	Methane Pyrolysis Skid	0	0	0	N/A		0	0
Associated Gas Flaring	Gas Compressor Skid	1	0	2	No details provided.		1	1
Associated Gas Flaring	Gas to Liquids Skid	0	0	0	N/A		0	0
Associated Gas Flaring	Liquified Natural Gas Production Skid	0	0	0	N/A		0	0
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras	0	1	2	No details provided.		1	1
Fugitive Emissions Components	OGI Camera Technicians	0	0	0	N/A		2	0
Fugitive Emissions Components	OGI Monitoring (3rd Party)	0	0	0	N/A		0	0
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)	0	0	0	N/A		0	0
Fugitive Emissions Components	Continuous Monitoring System	0	1	1	No details provided.		1	1
Fugitive Emissions Components	Replacement Piping Components	0	0	0	N/A		0	0
Fugitive Emissions Components	Handheld Methane Detector	0	0	0	N/A		0	0
Other	Variable Frequency Drive (VFD)	0	1	2	No details provided.		2	1
Other	Cabling (Electric/Communications)	0	0	1	No details provided.		1	1
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	0	0	0	N/A		0	0
Other	Eductor Skid (For compressors)	0	0	1	No details provided.		0	0

## Supply Chain Delays:

Affected Facility	Equipment Description	Supplier-Stated Reason(s) for Backorder						
		Other	Other Description 1	Other Description 2	Other Description 3	Other Description 4	Other Description 5	Number of Responses
Pneumatic Controllers & Pumps	Electrical Transformers	1	Fabricator Backlog					5
Pneumatic Controllers & Pumps	Solar Equipment	1	Normal time to acquire materials and fabricate equipment					3
Pneumatic Controllers & Pumps	Generator Skids	1	These units are not typically just kept in inventory since there would be a high likelihood of degradation when just sitting in a warehouse. These would be made to order and therefore have longer lead times					2
Pneumatic Controllers & Pumps	Instrument Air Skids	4	Standard Lead Time	Compressor manufacturers backlogged	Quincy compressor & air dryer shortage	Cascade Bottles		10
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	2	Normal time to acquire materials and fabricate equipment	Typically long(er) lead item. Can get items stocked on the shelf pretty quickly but as they begin selling out, it will take longer to get newly manufactured valves				4
Pneumatic Controllers & Pumps	Pump Replacement	1	Standard Lead Time					3
Pneumatic Controllers & Pumps	Replacement Controllers	0	N/A					2
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	0	N/A					1
Pneumatic Controllers & Pumps	Nitrogen Gas	0	N/A					1
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	4	Fabrication Lead-Time	Blowers	Engineering design timeline to ensure proper combustion	Knockout Vessels		7
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	3	Normal time to acquire materials and fabricate equipment	These types of quantities of units are not available off the shelf and would need to be made to order	Knockout Vessels			5
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	2	Limited crew availability	Normal time to acquire materials and fabricate equipment				3
Control Devices and Closed Vent Systems	Flow Meters	5	Common Historical lead time for meters	Fabrication Lead-Time	Normal time to acquire materials and fabricate equipment	Currently only one vendor/type of meter that can meet the +/- 2% accuracy requirements at the low-variable flow rates needed for proper flare design while also ensuring we do not add additional pressure drop into the line or add a restriction (orifice meter)	Meter Runs	7
Control Devices and Closed Vent Systems	Backpressure Valves	0	N/A					2
Control Devices and Closed Vent Systems	Calorimeters	0	N/A					2
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	1	Very limited crew availability					1
Control Devices and Closed Vent Systems	Automatic Pilot Light	0	N/A					0
Control Devices and Closed Vent Systems	Thermocouple	0	N/A					1
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	0	N/A					1
Control Devices and Closed Vent Systems	Piping for Closed Vent System	0	N/A					0



## Supply Chain Delays:

Affected Facility	Equipment Description	Supplier-Stated Reason(s) for Backorder						
		Other	Other Description 1	Other Description 2	Other Description 3	Other Description 4	Other Description 5	Number of Responses
Storage Vessels	Steel Tanks	1	Labor shortage on field fabricated tanks					4
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch	1	2-3 months back order					3
Storage Vessels	Vent Header Control Valve	0	N/A					1
Storage Vessels	Vapor Recovery Units	1	Low capital investment					3
Associated Gas Flaring	Vapor Recovery Units-Flaring	3	Manufactured skid	Fabrication Lead-Time	Low capital investment			6
Associated Gas Flaring	Methane Pyrolysis Skid	0	N/A					0
Associated Gas Flaring	Gas Compressor Skid	2	Low capital investment	Ariel compressor shop backlog (single provider)				2
Associated Gas Flaring	Gas to Liquids Skid	0	N/A					0
Associated Gas Flaring	Liquified Natural Gas Production Skid	0	N/A					0
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras	1	Current lead time is negligible but the pure quantity that will be needed to sustain increased OGI requirements					3
Fugitive Emissions Components	OGI Camera Technicians	1	Overall getting qualified personell for technical work is hard to do in the current market					2
Fugitive Emissions Components	OGI Monitoring (3rd Party)	0	N/A					0
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)	0	N/A					0
Fugitive Emissions Components	Continuous Monitoring System	0	N/A					1
Fugitive Emissions Components	Replacement Piping Components	0	N/A					0
Fugitive Emissions Components	Handheld Methane Detector	0	N/A					0
Other	Variable Frequency Drive (VFD)	0	N/A					2
Other	Cabling (Electric/Communications)	0	N/A					1
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	0	N/A					0
Other	Eductor Skid (For compressors)	1	New, specific design					1

Supplier Market:

Affected Facility	Equipment Description	Number of Current Suppliers							Does an Alternate Supplier Exist?			
		1	2	3	4	5+	% with 1 Supplier	Number of Responses	Yes	No	% with No Alternate Supplier	Number of Responses
Pneumatic Controllers & Pumps	Electrical Transformers	0	0	1	1	3	0%	5	5	0	0%	5
Pneumatic Controllers & Pumps	Solar Equipment	2	1	1	0	1	40%	5	5	0	0%	5
Pneumatic Controllers & Pumps	Generator Skids	1	1	1	0	1	25%	4	4	0	0%	4
Pneumatic Controllers & Pumps	Instrument Air Skids	1	3	2	3	1	10%	10	10	0	0%	10
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	3	1	1	0	3	38%	8	8	0	0%	8
Pneumatic Controllers & Pumps	Pump Replacement	0	3	1	1	2	0%	7	8	0	0%	8
Pneumatic Controllers & Pumps	Replacement Controllers	1	1	2	0	4	13%	8	7	0	0%	7
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	1	0	0	0	0	100%	1	0	1	100%	1
Pneumatic Controllers & Pumps	Nitrogen Gas	1	1	0	0	1	33%	3	3	0	0%	3
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	3	3	3	0	1	30%	10	8	1	11%	9
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	2	1	2	0	1	33%	6	6	0	0%	6
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	1	1	0	0	0	33%	3	2	1	33%	3
Control Devices and Closed Vent Systems	Flow Meters	3	4	1	0	3	27%	11	8	1	11%	9
Control Devices and Closed Vent Systems	Backpressure Valves	0	3	1	1	2	0%	7	5	1	17%	6
Control Devices and Closed Vent Systems	Calorimeters	2	1	0	0	0	50%	4	2	0	0%	2
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	0	1	0	0	0	0%	1	0	0	0%	0
Control Devices and Closed Vent Systems	Automatic Pilot Light	0	1	1	0	0	0%	2	2	0	0%	2
Control Devices and Closed Vent Systems	Thermocouple	0	3	0	0	2	0%	5	5	0	0%	5
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	1	1	0	0	0	50%	2	1	1	50%	2
Control Devices and Closed Vent Systems	Piping for Closed Vent System	0	0	0	1	3	0%	4	3	0	0%	3

Supplier Market:

Affected Facility	Equipment Description	Number of Current Suppliers							Does an Alternate Supplier Exist?			
		1	2	3	4	5+	% with 1 Supplier	Number of Responses	Yes	No	% with No Alternate Supplier	Number of Responses
Storage Vessels	Steel Tanks	1	1	2	0	2	17%	6	6	0	0%	6
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch	3	2	0	0	2	43%	7	6	1	14%	7
Storage Vessels	Vent Header Control Valve	0	3	0	0	1	0%	4	3	1	25%	4
Storage Vessels	Vapor Recovery Units	3	3	1	0	1	38%	8	7	0	0%	7
Associated Gas Flaring	Vapor Recovery Units-Flaring	2	3	0	0	1	33%	6	6	0	0%	6
Associated Gas Flaring	Methane Pyrolysis Skid	1	0	0	0	0	100%	1	1	0	0%	1
Associated Gas Flaring	Gas Compressor Skid	1	0	1	1	1	25%	4	3	1	25%	4
Associated Gas Flaring	Gas to Liquids Skid	0	0	0	0	0	0%	0	0	0	0%	0
Associated Gas Flaring	Liquified Natural Gas Production Skid	0	0	0	0	0	0%	0	0	0	0%	0
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras	5	0	0	0	0	100%	5	3	2	40%	5
Fugitive Emissions Components	OGI Camera Technicians	0	0	0	0	0	0%	0	0	0	0%	0
Fugitive Emissions Components	OGI Monitoring (3rd Party)	0	0	0	0	0	0%	0	0	0	0%	0
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)	0	0	0	0	0	0%	0	0	0	0%	0
Fugitive Emissions Components	Continuous Monitoring System	1	1	0	1	0	33%	3	2	0	0%	2
Fugitive Emissions Components	Replacement Piping Components	0	0	0	0	1	0%	1	1	0	0%	1
Fugitive Emissions Components	Handheld Methane Detector	0	0	0	0	0	0%	0	0	0	0%	0
Other	Variable Frequency Drive (VFD)	0	2	1	0	1	0%	4	3	1	25%	4
Other	Cabling (Electric/Communications)	0	1	0	0	0	0%	1	1	0	0%	1
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	0	0	0	0	0	0%	0	0	0	0%	0
Other	Eductor Skid (For compressors)	0	0	0	0	0	0%	0	0	0	0%	0

Supplier Market:

Affected Facility	Equipment Description	Time Required to Onboard an Additional Supplier							
		0 to 6 months	7 to 12 months	13 to 18 months	19 to 24 months	25 to 30 months	31 to 36 months	More than 36 months	Number of Responses
Pneumatic Controllers & Pumps	Electrical Transformers	4	1	0	0	0	0	0	5
Pneumatic Controllers & Pumps	Solar Equipment	4	0	0	0	0	0	0	4
Pneumatic Controllers & Pumps	Generator Skids	3	1	0	0	0	0	0	4
Pneumatic Controllers & Pumps	Instrument Air Skids	6	3	1	0	0	0	0	10
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	7	1	0	0	0	0	0	8
Pneumatic Controllers & Pumps	Pump Replacement	6	1	1	0	0	0	0	8
Pneumatic Controllers & Pumps	Replacement Controllers	5	2	0	0	0	0	0	7
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	0	0	0	0	0	0	0	0
Pneumatic Controllers & Pumps	Nitrogen Gas	3	0	0	0	0	0	0	3
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	5	4	0	0	0	0	0	9
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	3	3	0	0	0	0	0	6
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	1	2	0	0	0	0	0	3
Control Devices and Closed Vent Systems	Flow Meters	5	4	0	0	0	0	0	9
Control Devices and Closed Vent Systems	Backpressure Valves	3	3	0	0	0	0	0	6
Control Devices and Closed Vent Systems	Calorimeters	1	1	0	0	0	0	0	2
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	0	0	0	0	0	0	0	0
Control Devices and Closed Vent Systems	Automatic Pilot Light	1	1	0	0	0	0	0	2
Control Devices and Closed Vent Systems	Thermocouple	3	2	0	0	0	0	0	5
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	1	1	0	0	0	0	0	2
Control Devices and Closed Vent Systems	Piping for Closed Vent System	2	1	0	0	0	0	0	3

Supplier Market:

Affected Facility	Equipment Description	Time Required to Onboard an Additional Supplier							
		0 to 6 months	7 to 12 months	13 to 18 months	19 to 24 months	25 to 30 months	31 to 36 months	More than 36 months	Number of Responses
Storage Vessels	Steel Tanks	5	0	1	0	0	0	0	6
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch	5	1	1	0	0	0	0	7
Storage Vessels	Vent Header Control Valve	3	1	0	0	0	0	0	4
Storage Vessels	Vapor Recovery Units	5	2	0	0	0	0	0	7
Associated Gas Flaring	Vapor Recovery Units-Flaring	5	1	0	0	0	0	0	6
Associated Gas Flaring	Methane Pyrolysis Skid	1	0	0	0	0	0	0	1
Associated Gas Flaring	Gas Compressor Skid	4	0	0	0	0	0	0	4
Associated Gas Flaring	Gas to Liquids Skid	0	0	0	0	0	0	0	0
Associated Gas Flaring	Liquified Natural Gas Production Skid	0	0	0	0	0	0	0	0
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras	2	1	0	0	0	0	0	3
Fugitive Emissions Components	OGI Camera Technicians	0	0	0	0	0	0	0	0
Fugitive Emissions Components	OGI Monitoring (3rd Party)	0	0	0	0	0	0	0	0
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)	0	0	0	0	0	0	0	0
Fugitive Emissions Components	Continuous Monitoring System	1	1	0	0	0	0	0	2
Fugitive Emissions Components	Replacement Piping Components	1	0	0	0	0	0	0	1
Fugitive Emissions Components	Handheld Methane Detector	0	0	0	0	0	0	0	0
Other	Variable Frequency Drive (VFD)	3	1	0	0	0	0	0	4
Other	Cabling (Electric/Communications)	1	0	0	0	0	0	0	1
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	0	0	0	0	0	0	0	0
Other	Eductor Skid (For compressors)	0	0	0	0	0	0	0	0

Installation Delays:

Affected Facility	Equipment Description	Current Installation Timeline							
		0 to 2 weeks	3 to 4 weeks	5 to 6 weeks	7 to 8 weeks	9 to 10 weeks	11 to 12 weeks	More than 12 weeks	Number of Responses
Pneumatic Controllers & Pumps	Electrical Transformers	1	1	0	0	0	0	0	2
Pneumatic Controllers & Pumps	Solar Equipment	2	0	0	0	0	0	0	2
Pneumatic Controllers & Pumps	Generator Skids	1	0	0	1	0	0	0	2
Pneumatic Controllers & Pumps	Instrument Air Skids	4	2	1	0	0	0	0	7
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	2	2	0	0	0	0	0	4
Pneumatic Controllers & Pumps	Pump Replacement	1	2	1	0	0	0	0	4
Pneumatic Controllers & Pumps	Replacement Controllers	4	1	0	0	0	0	0	5
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	1	0	0	0	0	0	0	1
Pneumatic Controllers & Pumps	Nitrogen Gas	0	0	0	0	0	0	0	0
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	2	1	0	1	0	0	0	4
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	2	2	0	1	0	0	0	5
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	1	1	0	0	0	0	0	2
Control Devices and Closed Vent Systems	Flow Meters	3	2	0	0	0	0	1	6
Control Devices and Closed Vent Systems	Backpressure Valves	2	0	0	0	0	0	0	2
Control Devices and Closed Vent Systems	Calorimeters	1	0	0	1	0	0	0	2
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	0	0	0	0	0	0	0	0
Control Devices and Closed Vent Systems	Automatic Pilot Light	0	0	0	0	0	0	0	0
Control Devices and Closed Vent Systems	Thermocouple	1	0	0	0	0	0	0	1
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	1	0	0	0	0	0	0	1
Control Devices and Closed Vent Systems	Piping for Closed Vent System	0	1	0	0	0	0	0	1

Installation Delays:

Affected Facility	Equipment Description	Current Installation Timeline							
		0 to 2 weeks	3 to 4 weeks	5 to 6 weeks	7 to 8 weeks	9 to 10 weeks	11 to 12 weeks	More than 12 weeks	Number of Responses
Storage Vessels	Steel Tanks	1	0	0	0	0	1	0	2
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch	2	0	0	0	0	0	0	2
Storage Vessels	Vent Header Control Valve	0	1	0	0	0	0	0	1
Storage Vessels	Vapor Recovery Units	1	1	0	0	0	0	0	2
Associated Gas Flaring	Vapor Recovery Units-Flaring	2	1	0	0	0	0	0	3
Associated Gas Flaring	Methane Pyrolysis Skid	0	0	0	0	0	0	0	0
Associated Gas Flaring	Gas Compressor Skid	0	1	0	0	0	0	0	1
Associated Gas Flaring	Gas to Liquids Skid	0	0	0	0	0	0	0	0
Associated Gas Flaring	Liquified Natural Gas Production Skid	0	0	0	0	0	0	0	0
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras	1	1	0	0	0	0	0	2
Fugitive Emissions Components	OGI Camera Technicians	0	0	1	0	0	0	0	1
Fugitive Emissions Components	OGI Monitoring (3rd Party)	0	0	0	0	0	0	0	0
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)	0	0	0	0	0	0	0	0
Fugitive Emissions Components	Continuous Monitoring System	0	1	0	1	0	0	0	2
Fugitive Emissions Components	Replacement Piping Components	0	0	0	0	0	0	0	0
Fugitive Emissions Components	Handheld Methane Detector	0	0	0	0	0	0	0	0
Other	Variable Frequency Drive (VFD)	0	1	0	0	0	0	0	1
Other	Cabling (Electric/Communications)	0	1	0	0	0	0	0	1
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	0	0	0	0	0	0	0	0
Other	Eductor Skid (For compressors)	0	0	0	0	0	0	0	0

Installation Delays:

Affected Facility	Equipment Description	Reason(s) for Installation Timeline						
		Labor Shortage	Specialized Labor Required	Safety Concerns	Other	Other Description 1	Other Description 2	Number of Responses
Pneumatic Controllers & Pumps	Electrical Transformers	1	2	1	0	N/A		2
Pneumatic Controllers & Pumps	Solar Equipment	1	0	0	0	N/A		1
Pneumatic Controllers & Pumps	Generator Skids	1	1	0	1	ROW for fuel gas sourcing as needed could be a limiting factor; Engineering evaluation would be a long lead item as well		1
Pneumatic Controllers & Pumps	Instrument Air Skids	2	2	1	0	N/A		3
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	1	1	0	0	N/A		1
Pneumatic Controllers & Pumps	Pump Replacement	2	2	1	1	Engineering evaluation would slow down retrofit timeline to due constraints on internal resources		3
Pneumatic Controllers & Pumps	Replacement Controllers	1	1	1	0	N/A		1
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)	0	0	0	0	N/A		0
Pneumatic Controllers & Pumps	Nitrogen Gas	0	0	0	0	N/A		0
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	2	2	0	1	Requires engineering evaluation on closed vent system design and would be a limiting factor		3
Control Devices and Closed Vent Systems	Enclosed Combustion Devices	2	2	0	2	Normal construction timeline	Requires engineering evaluation on closed vent system design and would be a limiting factor	4
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	2	1	2	2	Weather, Road Conditions, H2s	Normal construction timeline	3
Control Devices and Closed Vent Systems	Flow Meters	3	2	1	1	Normal construction timeline		4
Control Devices and Closed Vent Systems	Backpressure Valves	0	0	1	1	Some safety concerns with man lifts required on site and getting on top of tanks with H2S present		1
Control Devices and Closed Vent Systems	Calorimeters	1	1	0	0	N/A		1
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	0	0	0	0	N/A		0
Control Devices and Closed Vent Systems	Automatic Pilot Light	0	0	0	0	N/A		0
Control Devices and Closed Vent Systems	Thermocouple	0	1	0	0	N/A		1
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	2	1	2	1	Weather, Road Conditions, H2s		2
Control Devices and Closed Vent Systems	Piping for Closed Vent System	0	1	0	1	Welders		1



Installation Delays:

Affected Facility	Equipment Description	Reason(s) for Installation Timeline						
		Labor Shortage	Specialized Labor Required	Safety Concerns	Other	Other Description 1	Other Description 2	Number of Responses
Storage Vessels	Steel Tanks	1	0	0	1	Field fab tanks only		2
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch	1	0	0	0			1
Storage Vessels	Vent Header Control Valve	1	0	0	0			1
Storage Vessels	Vapor Recovery Units	1	1	0	0			2
Associated Gas Flaring	Vapor Recovery Units-Flaring	1	1	0	0			2
Associated Gas Flaring	Methane Pyrolysis Skid	0	0	0	0			0
Associated Gas Flaring	Gas Compressor Skid	1	0	0	0			1
Associated Gas Flaring	Gas to Liquids Skid	0	0	0	0			0
Associated Gas Flaring	Liquified Natural Gas Production Skid	0	0	0	0			0
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras	1	2	1	0			2
Fugitive Emissions Components	OGI Camera Technicians	0	0	0	0			0
Fugitive Emissions Components	OGI Monitoring (3rd Party)	0	0	0	0			0
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)	0	0	0	0			0
Fugitive Emissions Components	Continuous Monitoring System	1	0	1	0			1
Fugitive Emissions Components	Replacement Piping Components	0	0	0	0			0
Fugitive Emissions Components	Handheld Methane Detector	0	0	0	0			0
Other	Variable Frequency Drive (VFD)	0	1	0	0			1
Other	Cabling (Electric/Communications)	0	1	0	0			1
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	0	0	0	0			0
Other	Eductor Skid (For compressors)	0	0	0	0			0

## Additional Notes:

Responses are directly copied from operator input. No edits have been made to content or spelling.

Affected Facility	Equipment Description	Additional Notes		
		Response 1	Response 2	Response 3
Pneumatic Controllers & Pumps	Electrical Transformers	Demand for transformers is high and shops are backlogged with work.	Had to move to electric compression due to natural gas compression lack of availability but now faced with long lead issues and high costs on electrical transformers	
Pneumatic Controllers & Pumps	Solar Equipment			
Pneumatic Controllers & Pumps	Generator Skids	Currently we only lease/rent this item	Pricing is very generalized, as this would need to be sourced/sized by site.	
Pneumatic Controllers & Pumps	Instrument Air Skids	Going to be using new design for OOOOb, no historic reference	Although we can find other "one-off" brands it's important to keep standardized equipment in the field to ensure we have all critical spares needed to do maintenance and keep the units running properly.	
Pneumatic Controllers & Pumps	Electrical Valves/Controllers	Although we can find other "one-off" brands it's important to keep standardized equipment in the field to ensure we have all critical spares needed to do maintenance and keep the units running properly.		
Pneumatic Controllers & Pumps	Pump Replacement			
Pneumatic Controllers & Pumps	Replacement Controllers	Converting existing valves to non-vent	No concerns with the replacement controllers that can just be rekit to be non-emitting. Most of these devices are already in the progress of being changed out and most kits are in company inventory.	
Pneumatic Controllers & Pumps	ECAT (zero emitter/gas recovery system)			
Pneumatic Controllers & Pumps	Nitrogen Gas			
Control Devices and Closed Vent Systems	Flares [High-Pressure (HP), Low-Pressure (LP), Dual]	Need to evaluate all current flares to ensure we are meeting combustion requirements and review any additional automation and monitoring needed. Major concern would be installation of PLC and communication on sites where that currently does not exist.		
Control Devices and Closed Vent Systems	Enclosed Combustion Devices			
Control Devices and Closed Vent Systems	Control Efficiency Testing (3rd Party)	Still working on quotes to complete this work and to better understand what type of staffing is needed to complete this in the required timeline		
Control Devices and Closed Vent Systems	Flow Meters	4-month lead time currently. No historical reference of the specific meter required	Although we absolutely support and would like to move forward with installing flare/ECD meters across the board, we will most likely need additional time to complete this work as a lot of legacy sites acquired from other companies are not currently equipped with meters.	Although we absolutely support and would like to move forward with installing flare/ECD meters across the board, we will most likely need additional time to complete this work as a lot of legacy sites acquired from other companies are not currently equipped with meters.
Control Devices and Closed Vent Systems	Backpressure Valves			

## Additional Notes:

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Affected Facility	Equipment Description	Additional Notes		
		Response 1	Response 2	Response 3
Control Devices and Closed Vent Systems	Calorimeters	Personell to calibrate and maintain these units after installation is a major concern. We have high BTU content gas and monitoring for lower NHV is not a concern for our sites. We would lean towards the one time test to show that we are well above minimum NHV. We havent put alot of effort into quoting these units for this reason.		
Control Devices and Closed Vent Systems	Net Heating Value (NHV) Testing (3rd Party)	11 days per line and 45 additional days for analysis	Haven't found a 3rd party offering this service	We've been actively searching for an economic option to meet these requirements and multiple vendors have declined to bid. We have considered purchasing our own analyzers but the lead time is too long to meet the current proposed timeline.
Control Devices and Closed Vent Systems	Automatic Pilot Light			
Control Devices and Closed Vent Systems	Thermocouple			
Control Devices and Closed Vent Systems	Monthly Opacity Testing (3rd Party)	Still working on quotes to complete this work and to better understand what type of staffing is needed to complete this in the required timeline		
Control Devices and Closed Vent Systems	Piping for Closed Vent System			
Storage Vessels	Steel Tanks			
Storage Vessels	Pressure Vacuum Relief Valve (PVRV) & Thief Hatch			
Storage Vessels	Vent Header Control Valve			
Storage Vessels	Vapor Recovery Units	We are not considering this as an acceptable option currently due to the on/off operation of the sites that need controls. Reliability of the VRU skids would be a major issue and we wouldn't be able to guarantee that we could actually capture the gas as designed.	See above	
Associated Gas Flaring	Vapor Recovery Units-Flaring	Right at 6 months lead time, but very likely to increase. Historic pricing not applicable to current size/design requirement	125hp unit	
Associated Gas Flaring	Methane Pyrolysis Skid			
Associated Gas Flaring	Gas Compressor Skid	Natural gas driven gas-lift compressors tough to find currently, only one vendor manufactures compressors (Ariel) and they only have capacity to build so many compressors at a time.		
Associated Gas Flaring	Gas to Liquids Skid			
Associated Gas Flaring	Liquified Natural Gas Production Skid			

**Additional Notes:**

*Responses are directly copied from operator input. No edits have been made to content or spelling.*

Affected Facility	Equipment Description	Additional Notes		
		Response 1	Response 2	Response 3
Fugitive Emissions Components	Optical Gas Imaging (OGI) Cameras			
Fugitive Emissions Components	OGI Camera Technicians	In general qualified technical labor is hard to find, train and keep employed in the current economic enviroment.		
Fugitive Emissions Components	OGI Monitoring (3rd Party)			
Fugitive Emissions Components	Alternative Screening Technology Monitoring (3rd Party)			
Fugitive Emissions Components	Continuous Monitoring System	Personell to monitor, repair, report and respond to the alarms is the major concern with installing these widescale.		
Fugitive Emissions Components	Replacement Piping Components			
Fugitive Emissions Components	Handheld Methane Detector			
Other	Variable Frequency Drive (VFD)			
Other	Cabling (Electric/Communications)			
Other	Engineering Analysis (Associated Gas, Pneumatic Pumps)	Engineering analysis will need to be completed on every OOOOb applicable facility. Management of change process for all upgrades will take time with limited internal resources to complete. We'd also propose to expand surveillance on all OOOOb applicable sites which may be tied into some of the costs listed above. Expecting to have a team of 3-4 engineers dedicated solely to OOOOb/c facility compliance and upgrades.		
Other	Eductor Skid (For compressors)			