# API 510 6.5.2 – Onstream in Lieu of Internal


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# Bio

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- +12 Years Experience in Process Industries
- Variety of roles including Owner's Engineer at some of the largest Oil & Gas and Petro companies in the world
- Licensed Professional Engineer in multiple jurisdictions and Certified API 510 Pressure Vessel Inspector
- Specializes in helping plants manage their aging assets by implementing, optimizing and maintaining robust MI practices

# Introduction to API 510 6.5.2

- What is API 510 paragraph 6.5.2?
  - Onstream Inspection in Lieu of Internal
  - Gives Inspectors and Engineers an alternate method of inspection if assets fit a defined list of requirements
  - Provides an opportunity to implement a more cost-effective inspection while maintaining adequate mechanical integrity practices
  - Allows owner-users to adequately manage their risk using alternative inspection methods
- What it is NOT
  - Is not a loophole to avoid inspecting equipment
  - Does not give owner-users the “green light” to inspect **ALL** equipment via onstream methods

# API 510 Paragraph 6.5.2

**On-stream Inspection in Lieu of Internal Inspections**

**6.5.2.1** - At the discretion of the inspector, an on-stream inspection may be substituted for the internal inspection in the following situations:

a) When size or configuration makes vessel entry for internal inspection physically impossible; OR

b) When vessel entry for internal inspection is physically possible and all the following conditions are met:

   1) The general corrosion rate of a vessel is **known** to be less than 0.125 mm (0.005 in.) per year;

   2) The vessel remaining life is greater than 10 years;

   3) The corrosive character of the contents, including the effect of trace components, has been established by at least 5 years of the same or similar service;

   4) No questionable condition is discovered during the external inspection;

   5) The operating temperature of the steel vessel shell does not exceed the lower temperature limits for the creep rupture range of the vessel material referenced in API 579-1/ASME FFS-1;

   6) The vessel is not subject to environmental cracking or hydrogen damage from the fluid being handled;

   7) The vessel does not have a nonintegrally bonded liner such as strip lining or plate lining

# API 510 Paragraph 6.5.2

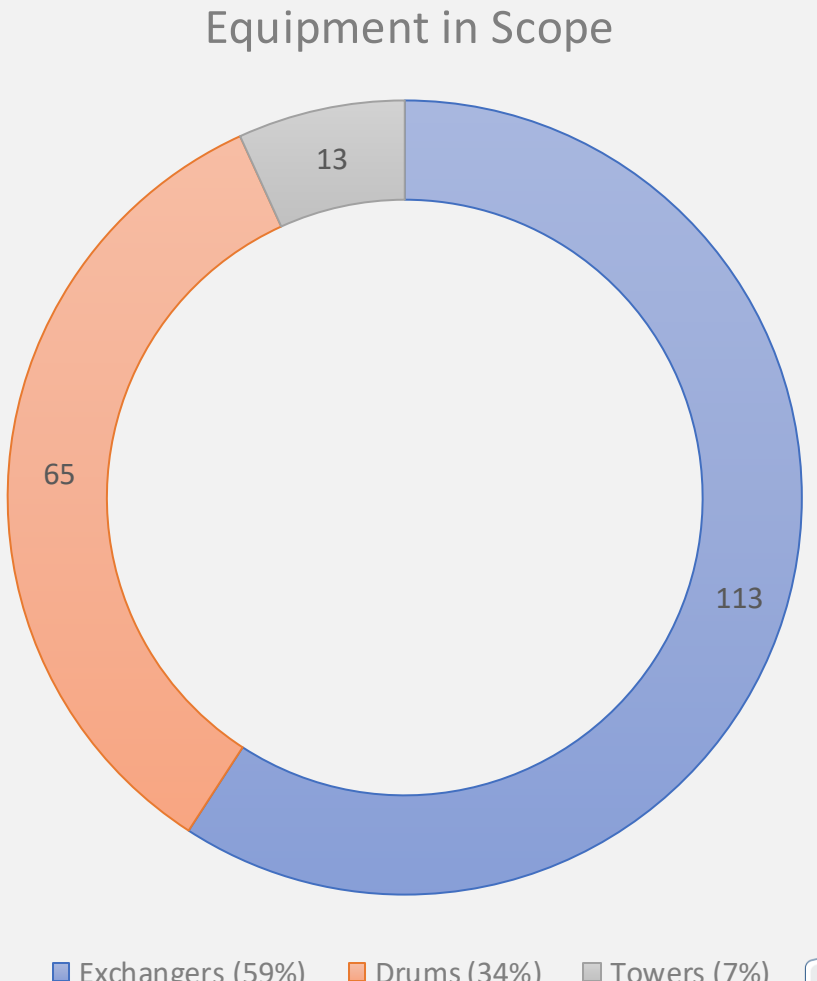
**On-stream Inspection in Lieu of Internal Inspections, cont.**

**6.5.2.2 –** If the requirements of 6.5.2.1 b) are not met, the next inspection shall be an internal inspection. As an alternate to the above limits, an on-stream inspection can be performed if an RBI assessment (per 6.3) determines risk associated with the vessel is acceptable to the owner-operator and the effectiveness of the external NDE technique(s) is adequate for the expected damage mechanism. This assessment should include a review of past process conditions and likely future process conditions.

**6.5.2.3 –** When an on-stream inspection is conducted, **the type and extent of NDE shall be specified in the inspection plan**. This could include ultrasonic thickness measurements, radiography, or other appropriate means of NDE to measure metal thicknesses and/or assess the integrity of the pressure boundary (e.g., vessel wall and welds). **When an on-stream inspection is conducted, the inspector shall have sufficient access to all parts of the vessel (heads, shell, and nozzles) so an accurate assessment of the vessel condition can be made.**

# Case Study – TA List Review

- 191 Pieces of Equipment
- Review/Update each Equipment Strategy
  - Populate missing history entries
  - Calculate CR where applicable
- Screen 2023 TA list for onstream inspection opportunities
  - Use API 510 6.5.2 rules to determine eligibility
  - API 510 9.3.5 allows owner user to determine consequence and adjust interval accordingly
- Reviewed and updated Critical Path inspection plans identified by the site.



# Case Study – TA List Review

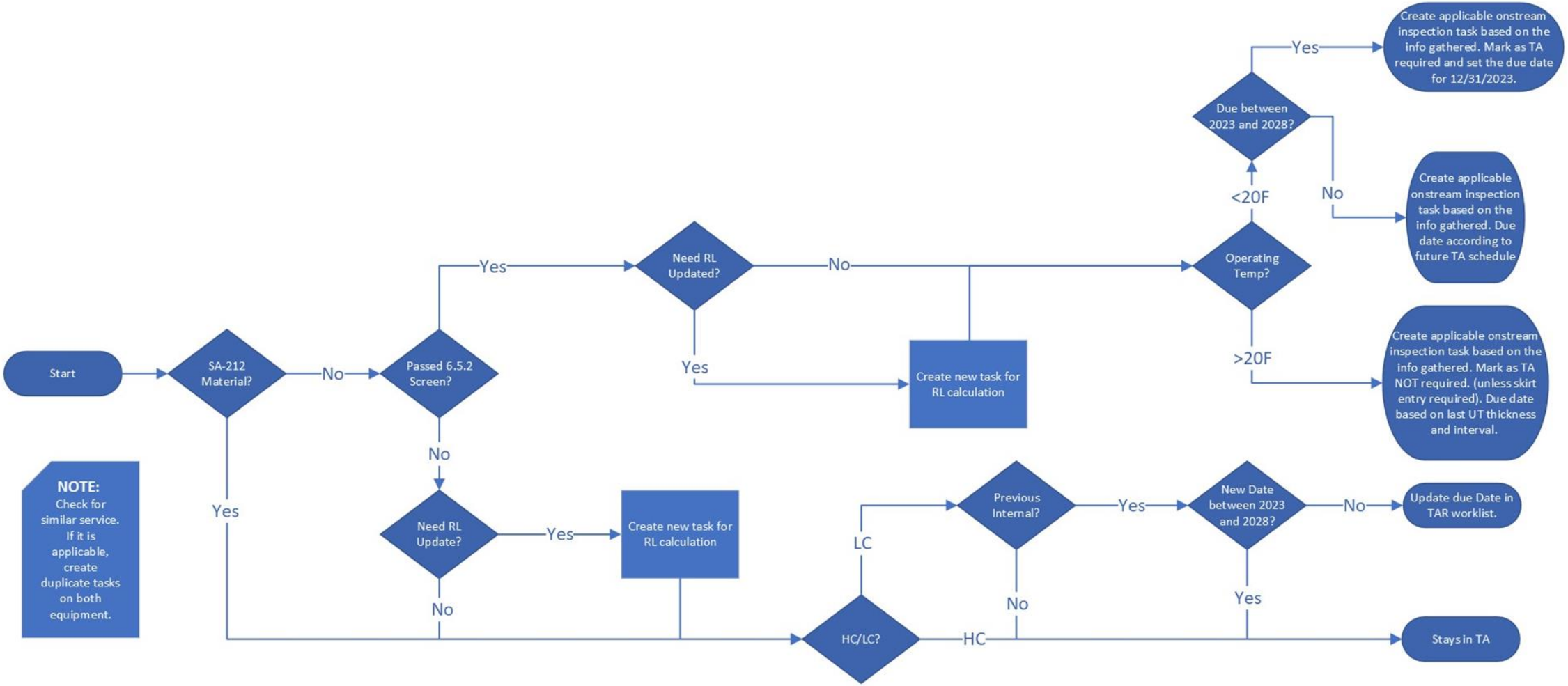
**Basis was API 510 paragraph 6.5.2**

- Some assumptions were made to clarify direction of the project
  - API does not define what size or configuration is “physically impossible” to enter
    - In this case the site defined this term as anything <4’ diameter and/or <18” manways.
  - Per site representative, assume no process changes within the last 5 years
  - Expanded no questionable conditions clause to include any past external **AND/OR** internal inspections plus the following DM:
    - Any history of localized corrosion
    - Any history of cracking
  - Expanded environmental cracking/hydrogen damage clause to include **ANY** expected cracking damage mechanism.

# Case Study – TA List Review

- Additional Factors to Consider
  - This site has a significant amount of cold service equipment. Even if the asset passed the 6.5.2 screening, it may not be possible to inspect onstream due to ice build up.
  - This site does not allow entry into vessel skirts while the equipment is operating, making it impossible to complete the bottom head NDE data necessary for onstream inspection.
- To address the factors above, if an asset passed the 6.5.2 screening but required a TA to inspect, a disclaimer was placed on the inspection tasks/recommendations generated as part of the project.
- Additionally, complex towers or columns were also excluded from onstream inspections even if they passed all other parameters

# Case Study – TA List Review

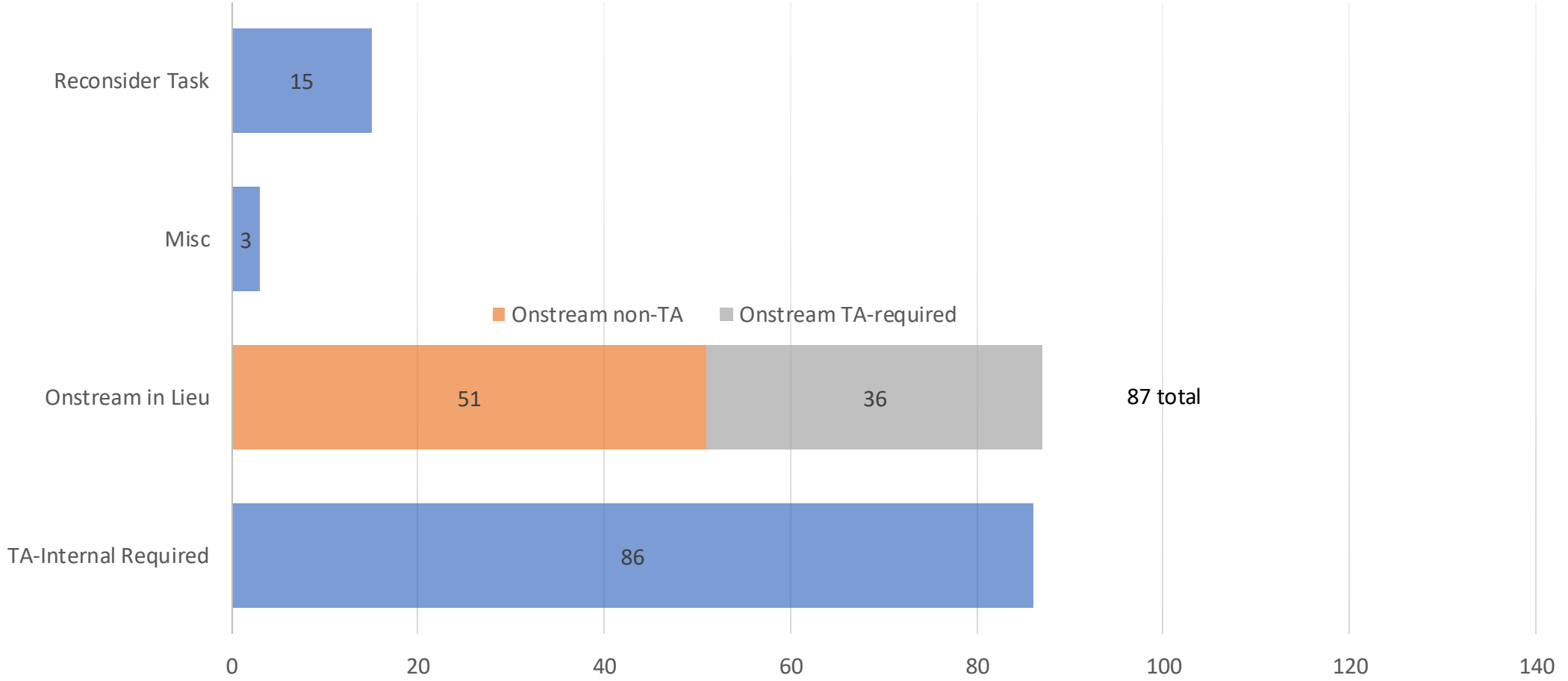


# Case Study – TA List Review

- Created a standardized data tracker to be used by all evaluators
  - Multiple engineers were working this project due to short time frame
  - Creating a standard worksheet with preset decision logic built in minimizes errors

| 6.5.2 Screening | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a) asset too small for entry? | b1) Max LTCR (mpy) | b2) Rem Life (yrs) | 1/2 Life | 3/4 Life | b3) process same for the last 5 years? | b4) Questionable condition with external inspection? | b5) Creep limit concerns? (assume no) | b6) Is vessel subject to environmental cracking or hydrogen damage? | b7) Does vessel have | 6.5.2 Online in lieu | Operating Temp? | 6.5.2 Screening Complete |
| no | 1 | 7 | 3.9 | 5.8 | yes | yes | no | no | no | NO | <20F | 7/25/2022 |
| no | 5 | 0 | | | yes | yes | no | yes | no | NO | >20F | 7/22/2022 |
| no | 1 | 59 | 29.5 | 44.3 | yes | yes | no | no | no | NO | >20F | 7/25/2022 |
| no | 1 | 28 | 14.4 | 21.6 | yes | yes | no | no | no | NO | <20F | 7/25/2022 |
| no | 1 | 125 | 67.0 | 100.4 | yes | no | no | no | no | YES | >20F | 7/25/2022 |
| yes | NA | | | | yes | no | no | no | no | YES | >20F | 7/25/2022 |
| yes | 1 | 63 | 33.6 | 50.4 | yes | no | no | no | no | YES | | 7/25/2022 |
| yes | NA | | | | yes | no | no | no | no | YES | >20F | 7/25/2022 |

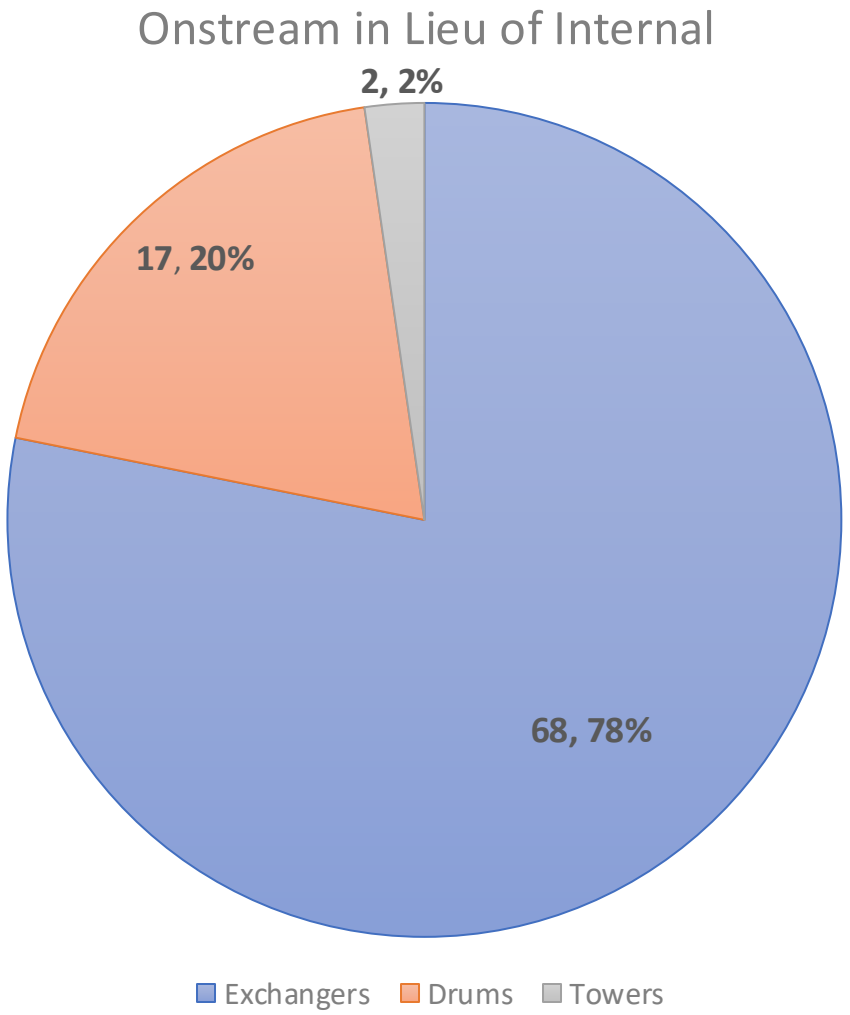
# Case Study – Results



# Case Study – Results

**Breakdown of assets recommended for onstream in lieu of internal by asset type:**

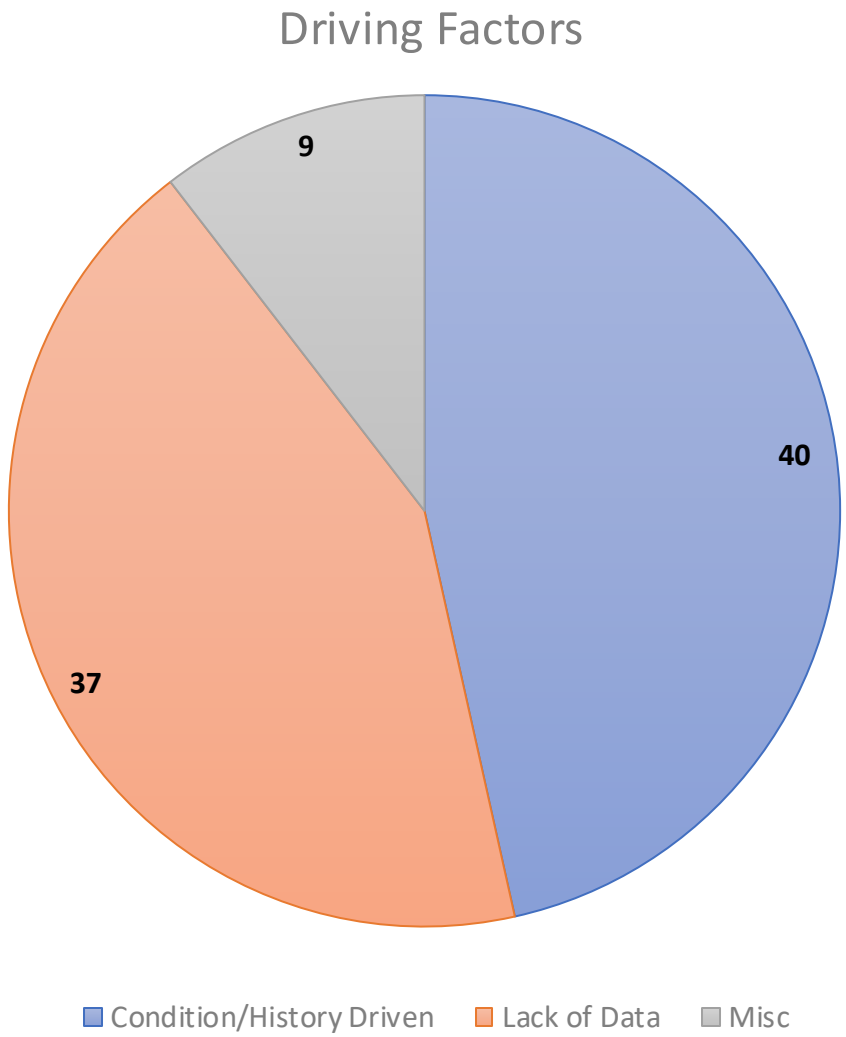
- Exchangers – 78%
  - Mostly due to physically impossible to enter
- Drums - 20%
- Towers / Distillation Columns – 2%



# Case Study – Results

**Internal Inspections Remaining**

- 21% of the equipment failed screening due to insufficient data
- 26% of the equipment failed onstream in lieu of internal screening due to known conditions or historical issues/repairs.



# API 510 Paragraph 6.5.2 Tips

- Not an option if there is no data or no confidence in operational history
- Be willing to pivot when extra requirements arise such as cold service etc.
- Pre-determine and **DOCUMENT** the assumptions that will be made and build that into the decision logic
- Look for opportunities to utilize similar service to apply CR and DM history
- Be keenly aware of the access types allowed by the site and understand the inspection methods available
- Make sure that EVERY damage mechanism is being addressed/mitigated with the onstream inspection plan
- Consider applying onstream in lieu of internal on alternating intervals with full internal

# QUESTIONS?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