Maximizing Kr/Xe Production

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Green Belt Six Sigma Project
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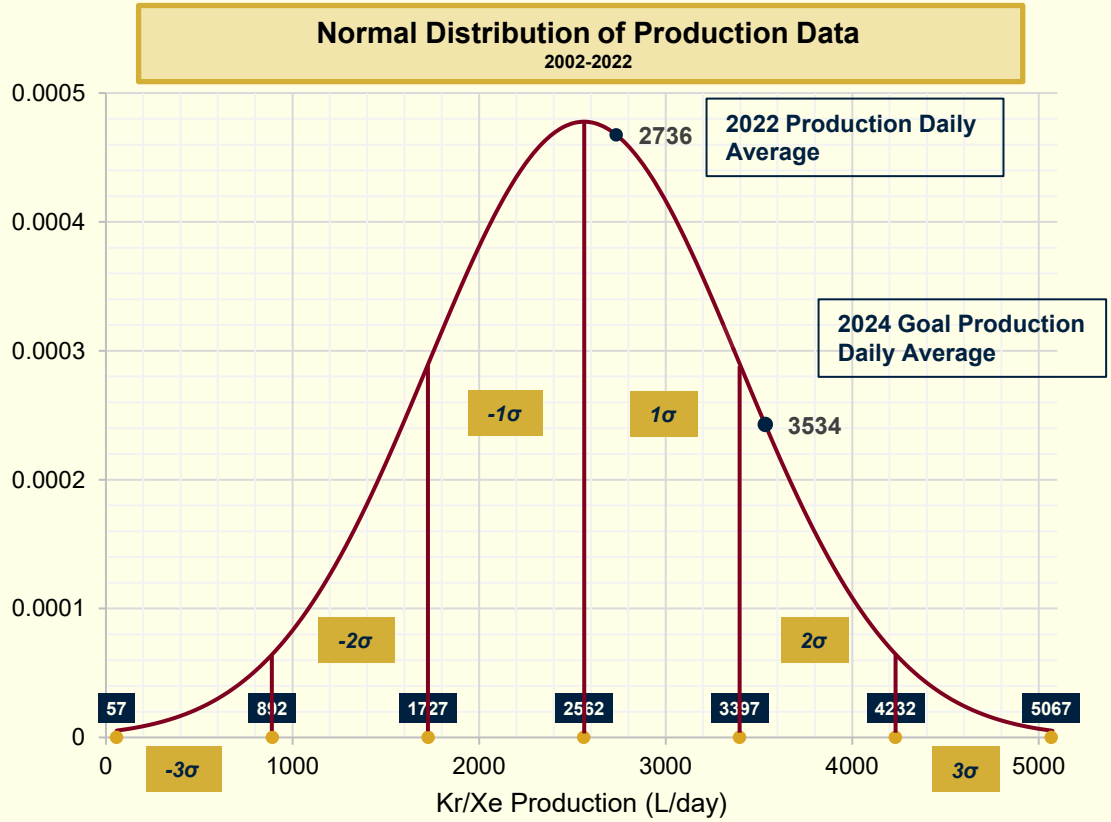
Executive Summary

MESSER Gases for Life

Problem Statement	The design limit for the Kr/Xe process is 1,629,360 L/year and actual 2022 production was 990,065 L/year. • Production was down 22.2% of the time resulting in 387,813 L/year of lost production. • The process underperformed by 20.2% resulting in 310,141 L/year of lost production.
Importance/ Impact	• Kr/Xe is in high demand due to the Russia-Ukraine War. • Reaching the goal production of 1,240,000 L/year would result in an estimated financial benefit of $1,937,500/year using pure pricing or $254,436/year using crude pricing.
My findings	• There is significant potential for improvement in production as shown in Q4 2022. • The top 4 reliability issues identified are critical areas that, if addressed, can greatly improve overall production. • Pure column temperature fluctuations have been identified as a key variable in production.
Next Steps	• Focus efforts on tackling the top 4 reliability issues identified during data analysis. • Conduct a thorough investigation of the factors affecting the stability of the pure column.

Baseline vs. Target & Insights



Insights

- Average production data for 2022 is **slightly higher than the mean** for 2002-2022.
- Production in 2022 had a **z-score of 0.208** corresponding to roughly the 58th percentile, meaning average 2022 production was **higher than 58% of historical production**.
- Based on the distribution of historical production, there is **significant room for improvement**.

Top Causes of Downtime (Reliability)

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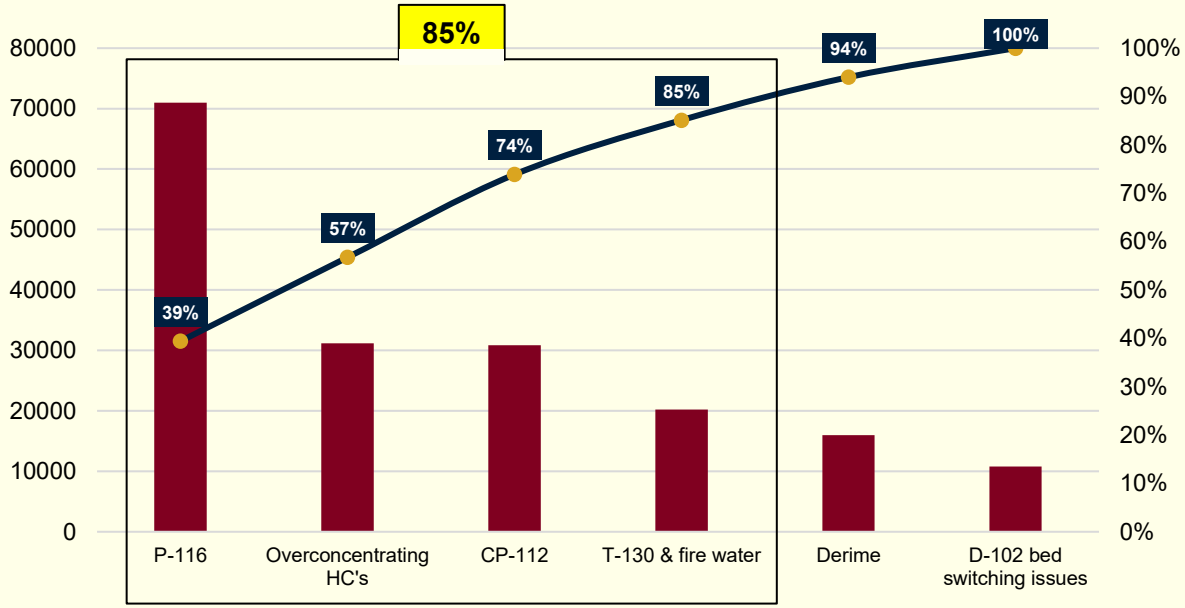
Top causes of lost Kr/Xe production
Jan-Dec 2022



Insights

- 85% of lost production is due to the top 4 issues.
- Focused on the **Top 4 issues** for the most impact.
- Brainstormed and worked with team to find solutions.

Root Cause Analysis & Insights (Performance)

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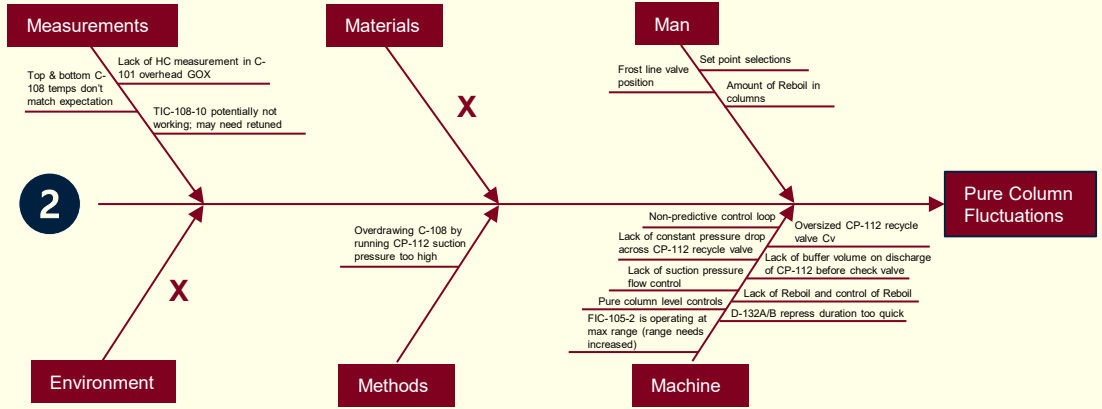
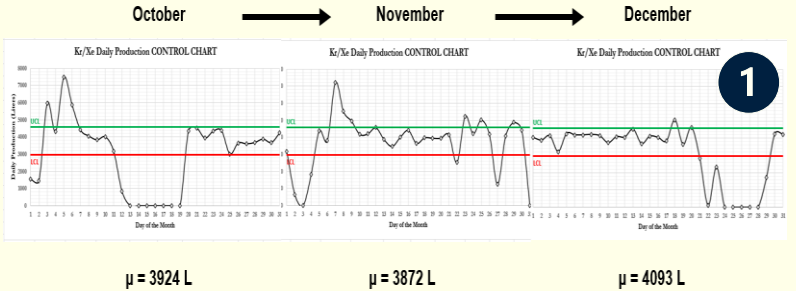
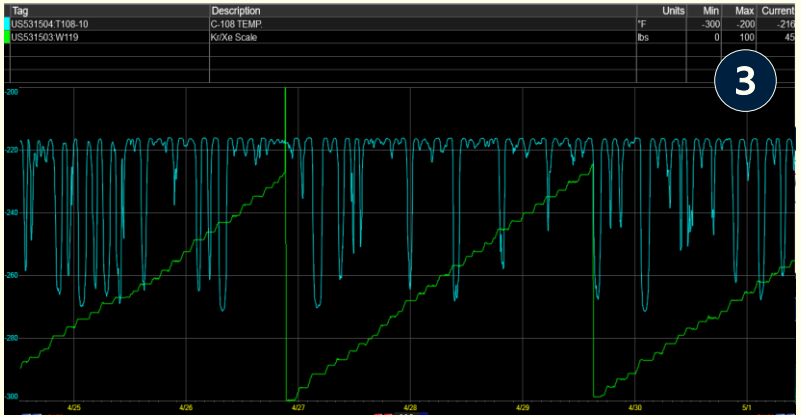
Root Cause Analysis – Pure Column Fluctuations

1. Q4 2022 Control Charts show current Kr/Xe process performance capability can meet the goal production.
2. Must investigate other factors such as suction pressure flow control and D-132A/B repress duration.
3. The **Pure Column Temperature** has shown to be one of the main causes of variation. Per Trend: if Temperature > -220˚F, Kr/Xe is produced.



Data Control Charts





Next Steps

Next steps in the process:

1. Improve System Reliability
    - *P-116*: Investigate frequent issues with P-116 and implement necessary changes.
    - *Overconcentrating HC's*: Look into process modifications to avoid this issues.
    - *CP-112*: Similar to P-116, examine the root cause of CP-112 issues and rectify them.
    - *T-130 & Fire Water*: Understand and mitigate the risks associated with T-130 and fire water.
2. Investigate Pure Column Stability Factors
    - Conduct an in-depth investigation on factors such as suction pressure flow control, D-132A/B flow consumption during repress, and how these factors impact the stability of the pure column.
3. Risk Management
    - Develop a risk register to track potential risks and devise strategies to mitigate them.
4. Review Project Economics
    - Monitor the actual costs against the allotted projected budget.