Waste/Side Stream Testing Guidelines at Pfizer

Jeffrey B. Sperry, Ph.D.

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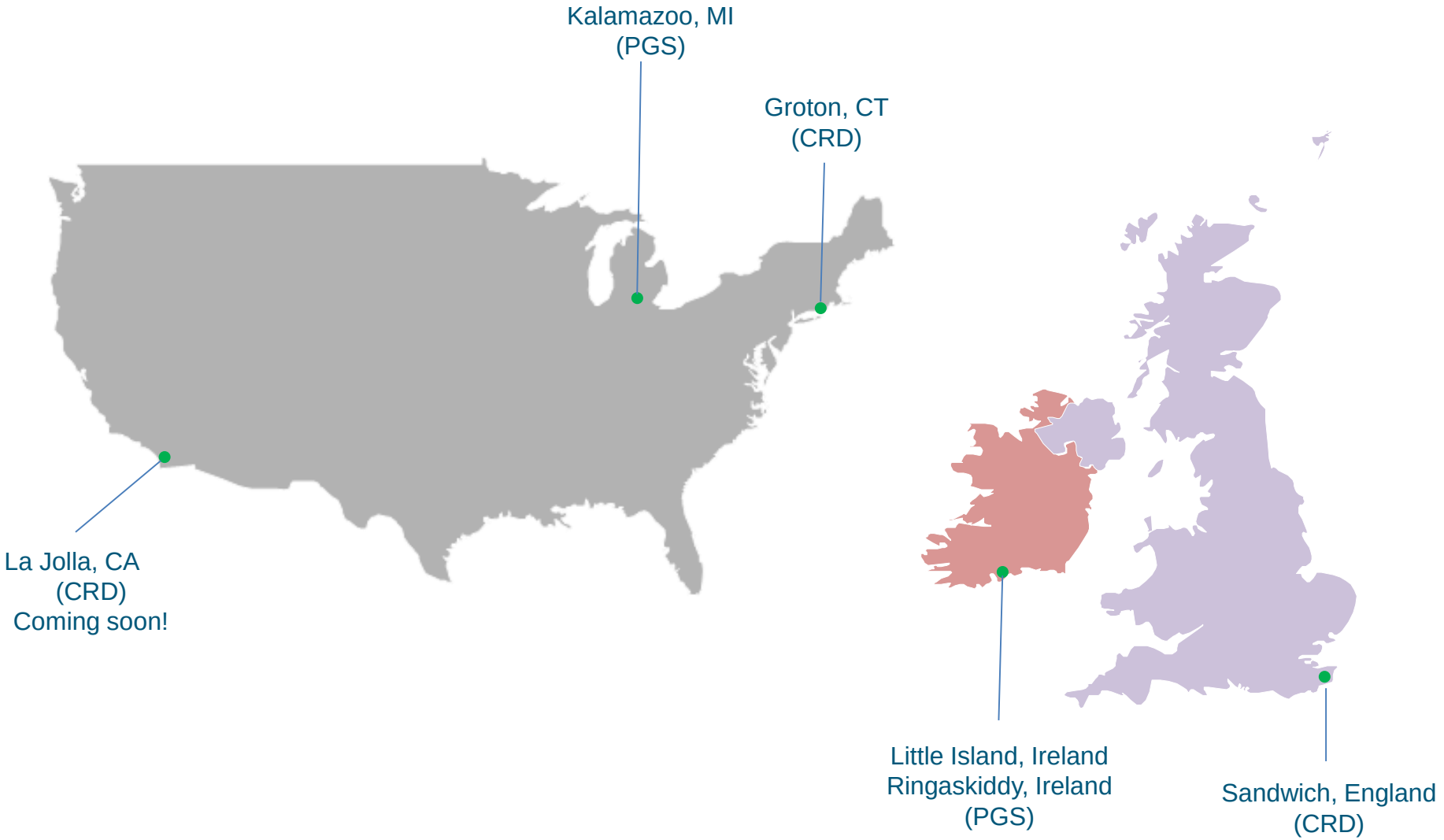
Outline

- Where we manufacture and generate waste
- How different sites handle waste (side) streams
- How we test waste streams
- Questions

Sites Involved in Tech Transfer



Capabilities

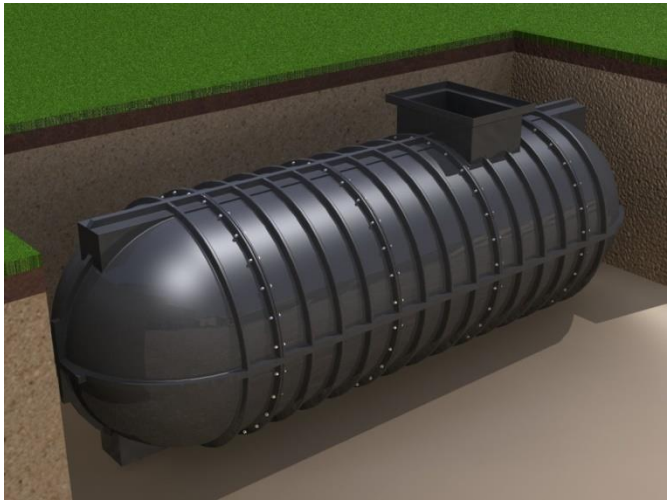
- Groton, CT (Kilo-Lab)
  - 100-200L glass-lined carbon steel reactors
  - 75L Hastelloy reactor
  - 30L Hastelloy hydrogenation vessel
  - 5-20L glass vessels

- Sandwich, UK (Pilot Plant)
  - 250-2500L glass-lined carbon steel reactors
  - 250L Hastelloy (cryo)
  - 250L Hastelloy hydrogenation vessel

Waste Storage Guidelines

- Groton, CT (Kilo-Lab)
  - ***All waste*** from chemical production is drummed and sent out for incineration
  - Waste is drummed in 55 gallon poly-lined carbon steel containers
  - Significant Process Safety testing required to ensure safe storage and transport

- Sandwich, UK (Pilot Plant)
  - ***Almost*** all waste from chemical production is sent to one of two underground storage tanks (Organic and Aqueous)
  - All aqueous waste must be pH 5-9
  - All organic waste must be neutralized (no active species present)
  - Processes must be developed to neutralize waste
  - Waste sent for incineration off site

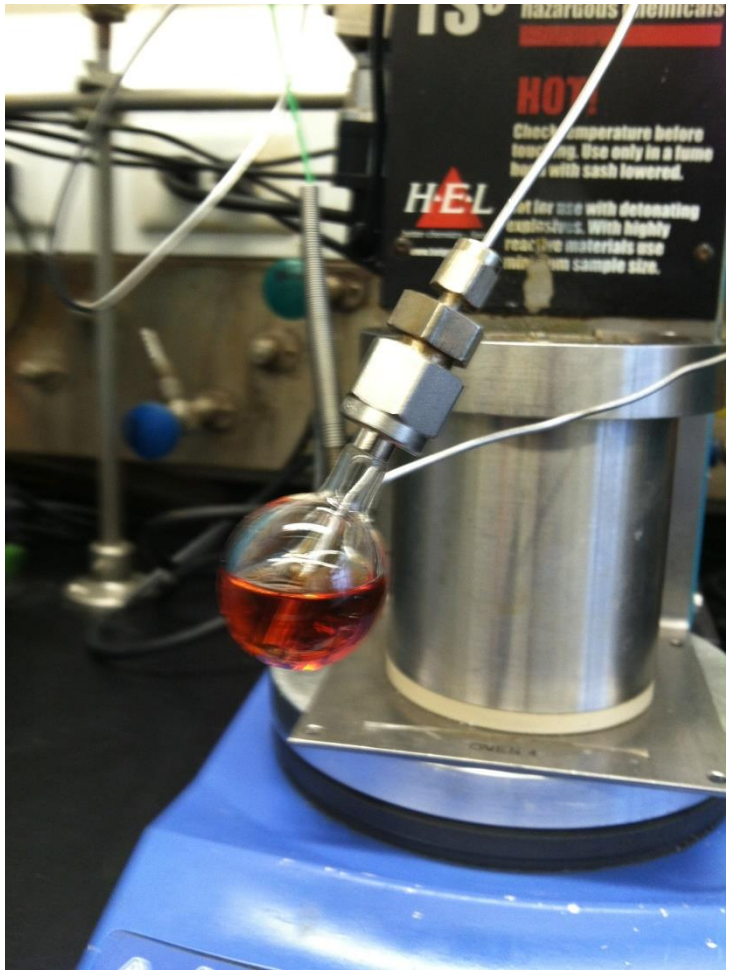


HOW DO WE TEST WASTE (SIDE) STREAMS?

Thermal Screening Unit (TSu)

TSu Design:

- 8 mL high pressure test cells
- Sufficient volume for truly representative samples, and the study of liquids, solids and reaction mixtures
- Temperature from ambient to 400 °C
- SS, Hastelloy, glass, titanium, carbon steel



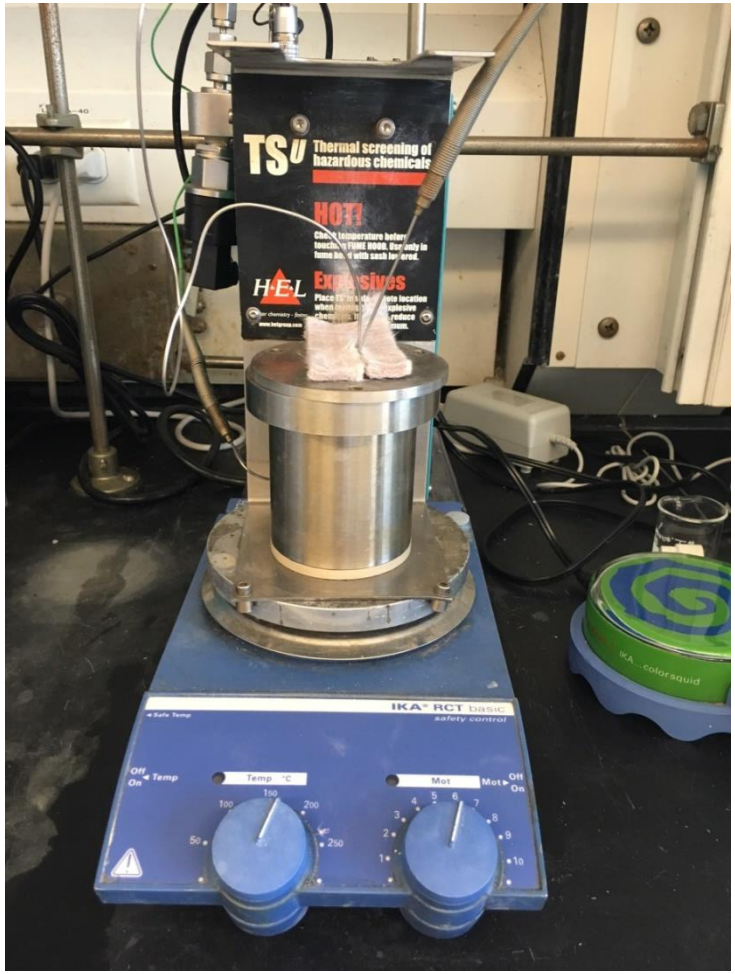
Thermal Screening Unit (TSu)

Applications

- Thermal stability of feeds, intermediates and products
- Test liquids and solids
- Evaluate long term exposure at elevated temperatures (isothermal test)
- Evaluate safe operating and storage temperatures, as well as the consequences of a runaway reaction

Key Data

- Onset temperature of exotherm
- Rate of temperature rise
- Rate of pressure rise
- Maximum temperature and pressure
- Time from exotherm initiation to maximum rate
- Margin of Safety for TSu thermal onset is 75 °C



Waste (Side) Stream Testing

- Waste (side) streams generated in Groton KL are tested when any of the following criteria are met:
  - Process uses or generates gas
  - Process uses a reducing agent
  - Process uses an oxidizing agent
  - Process uses materials with HEFGs
  - Process uses carbonate or bicarbonate

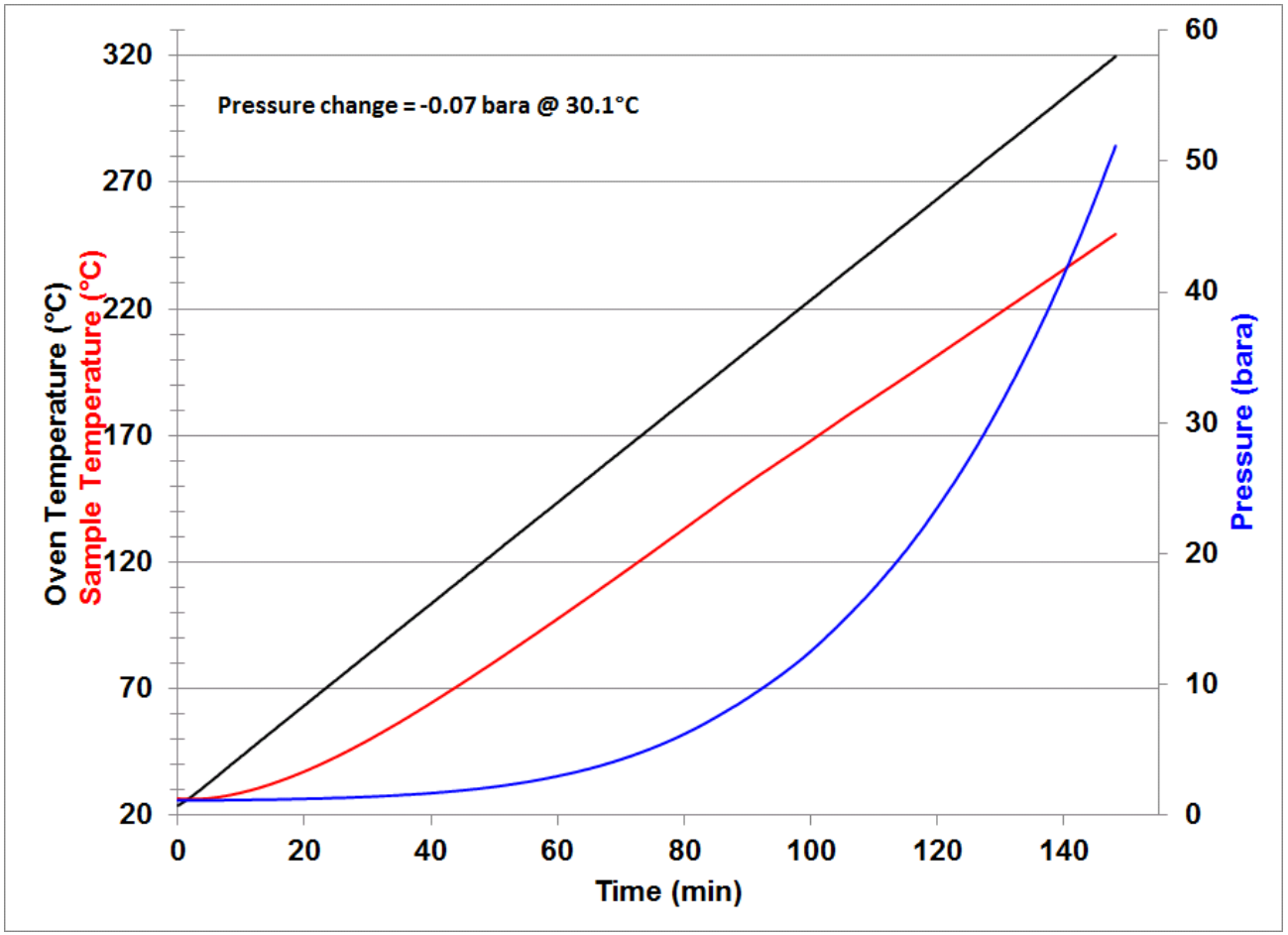
- All waste streams generated in Sandwich Pilot Plant that are destined for drums are tested

Waste (Side) Stream Testing – TSu Methods

- Ramp TSu from 30 °C to 200 °C using either glass or Hastelloy test cell after considering MOC
- If the residual pressure at the end of the test is $\leq$ +0.2 bar then okay to drum
  - Recommendation made: “**acceptable to store and ship under ambient conditions in sealed containers for up to one year**”.
  - If positive residual pressure observed at the end of the test, then stream **"fails ramp test“** and must undergo isothermal test
- Isothermal TSU at 60 °C for 24 hours is needed using a glass or Hastelloy test cell after considering MOC
- If the residual pressure at the end of the test is $\leq$ +0.2 bar then okay to drum
  - Recommendation made: “**acceptable to store and ship under ambient conditions in sealed containers for up to one year**”
  - If positive residual pressure observed recommendation will be made: "**not suitable for ambient drum storage as tested**"

Waste (Side) Stream Testing

- Example: A side steam that passes the ramp test



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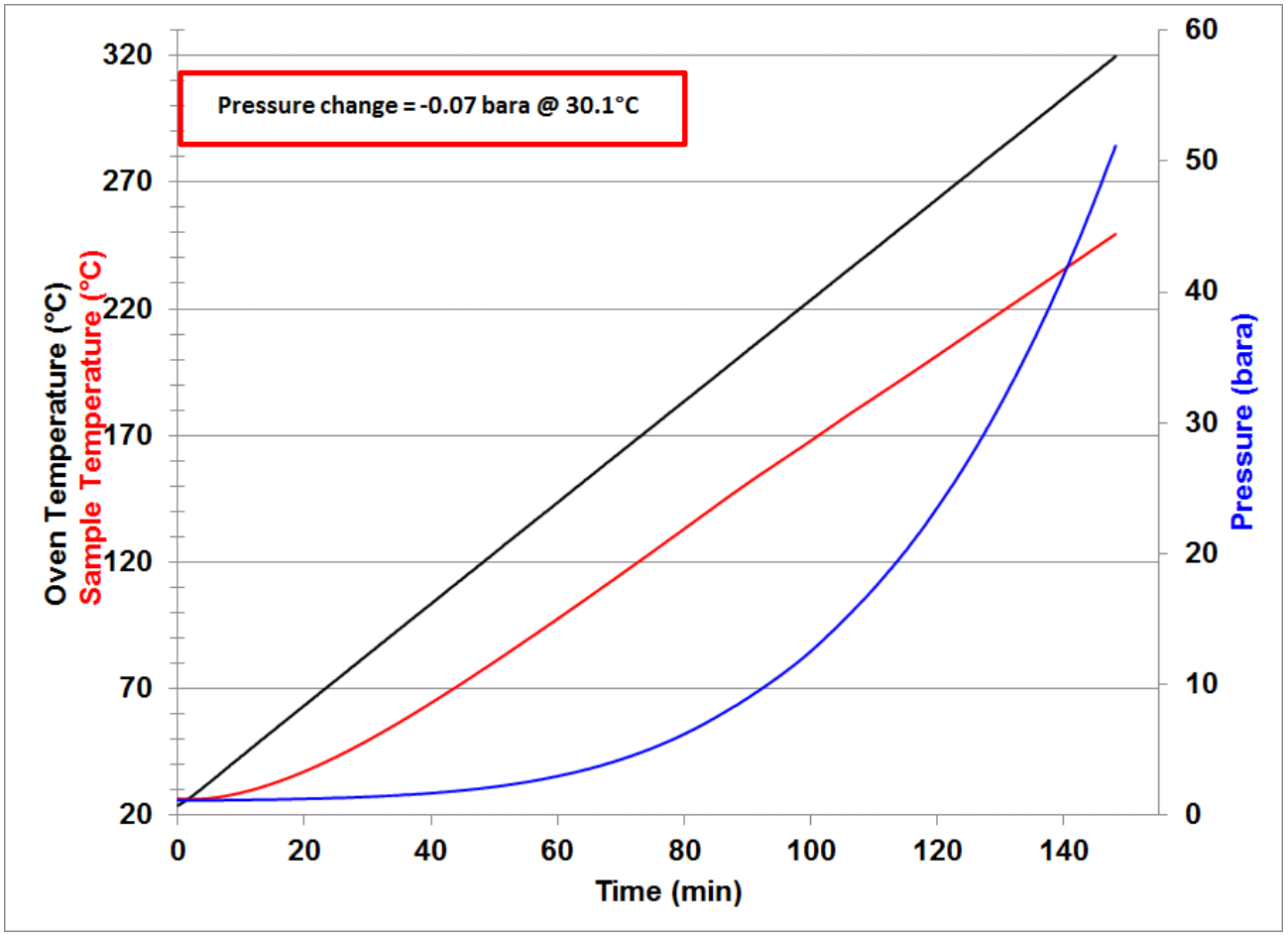

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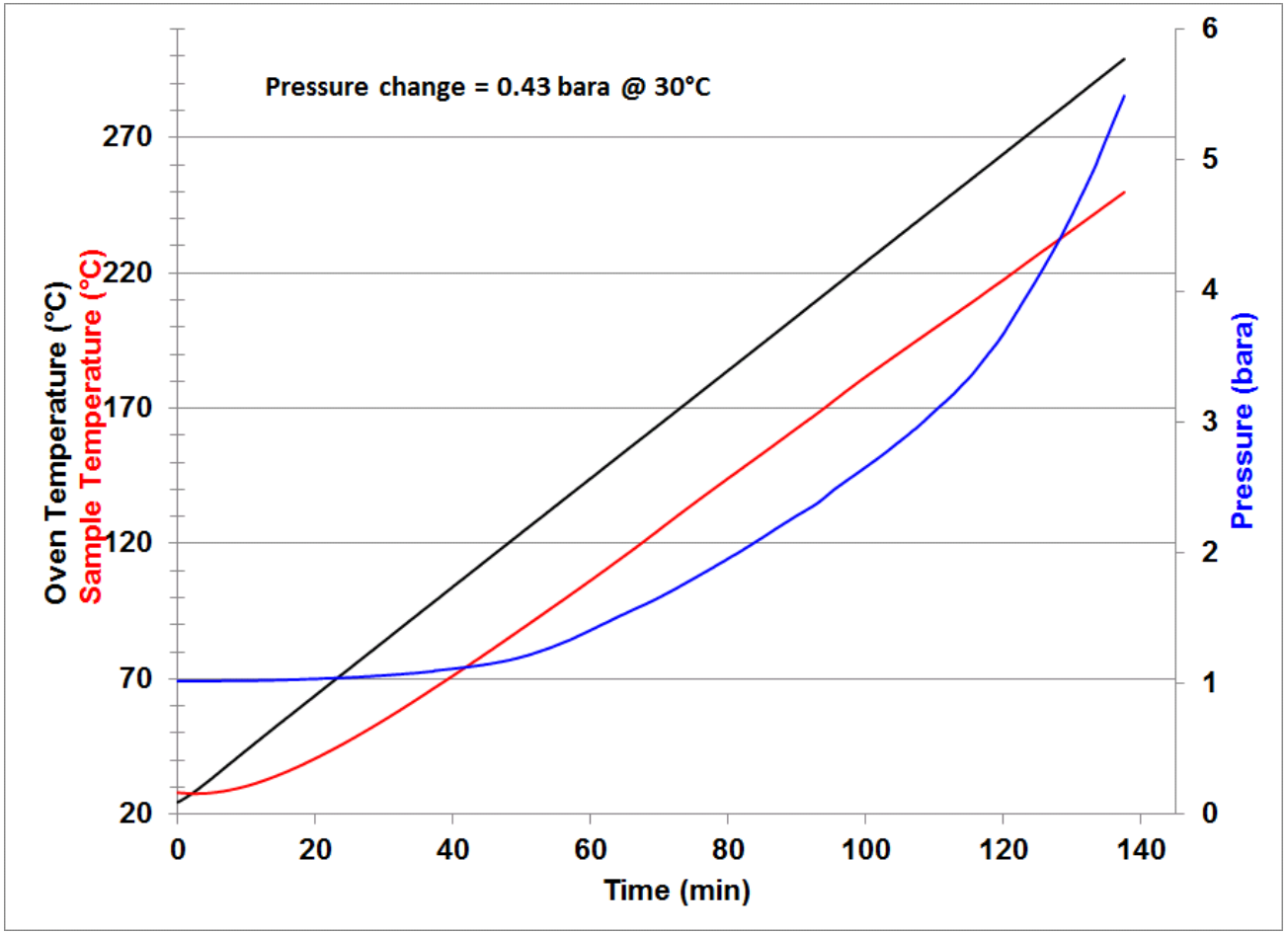

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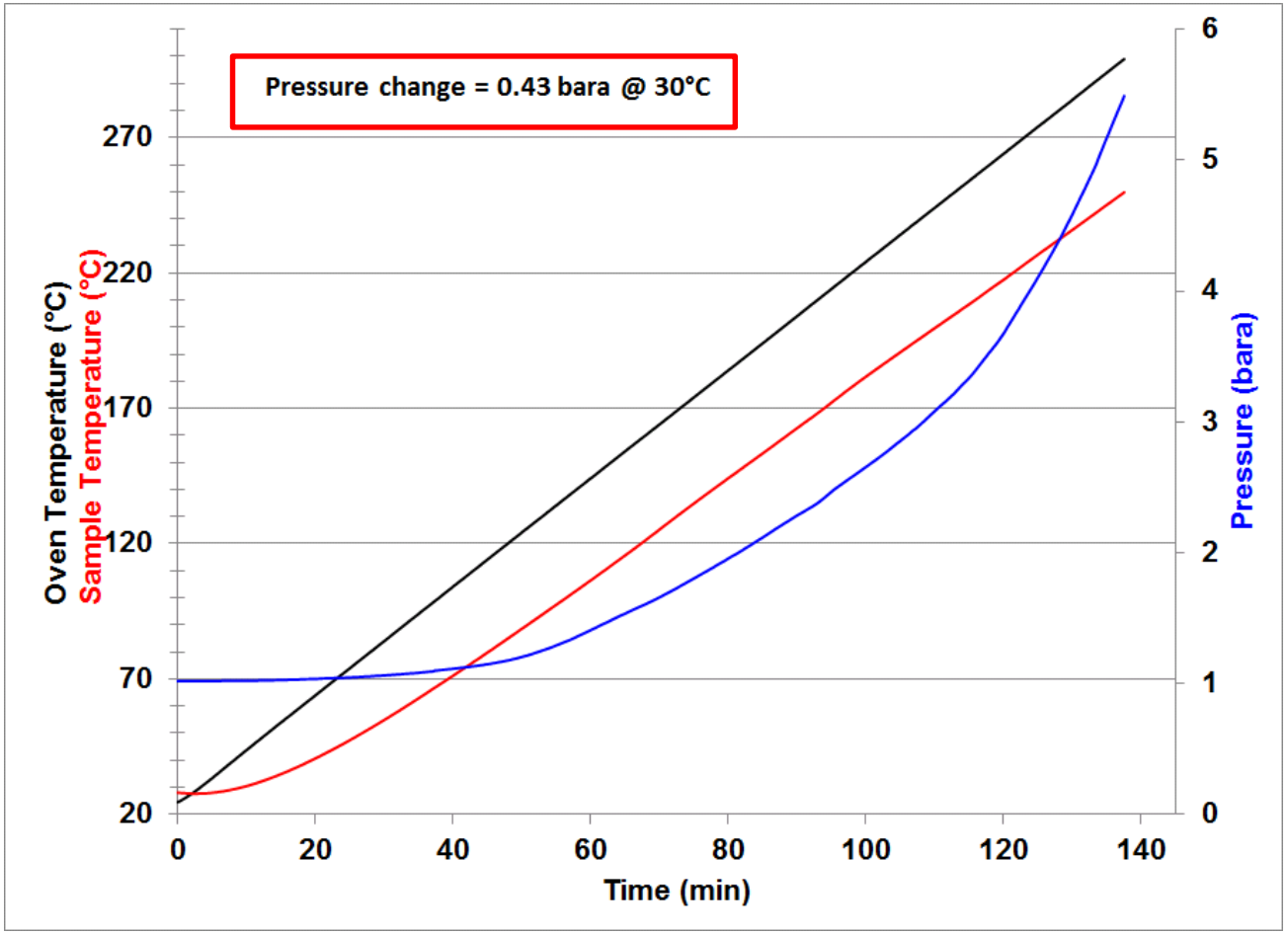

Waste (Side) Stream Testing –Antoine Plot

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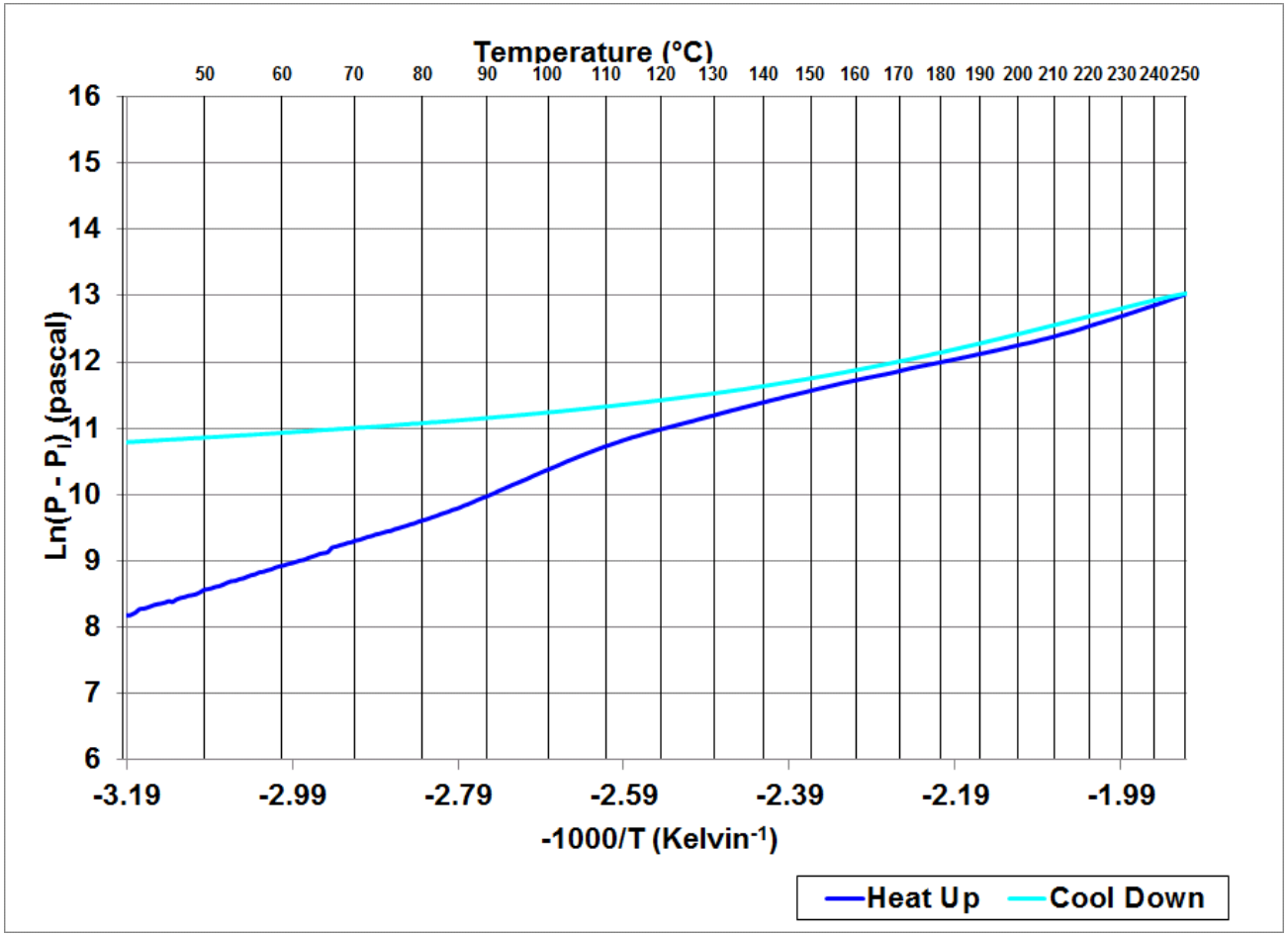
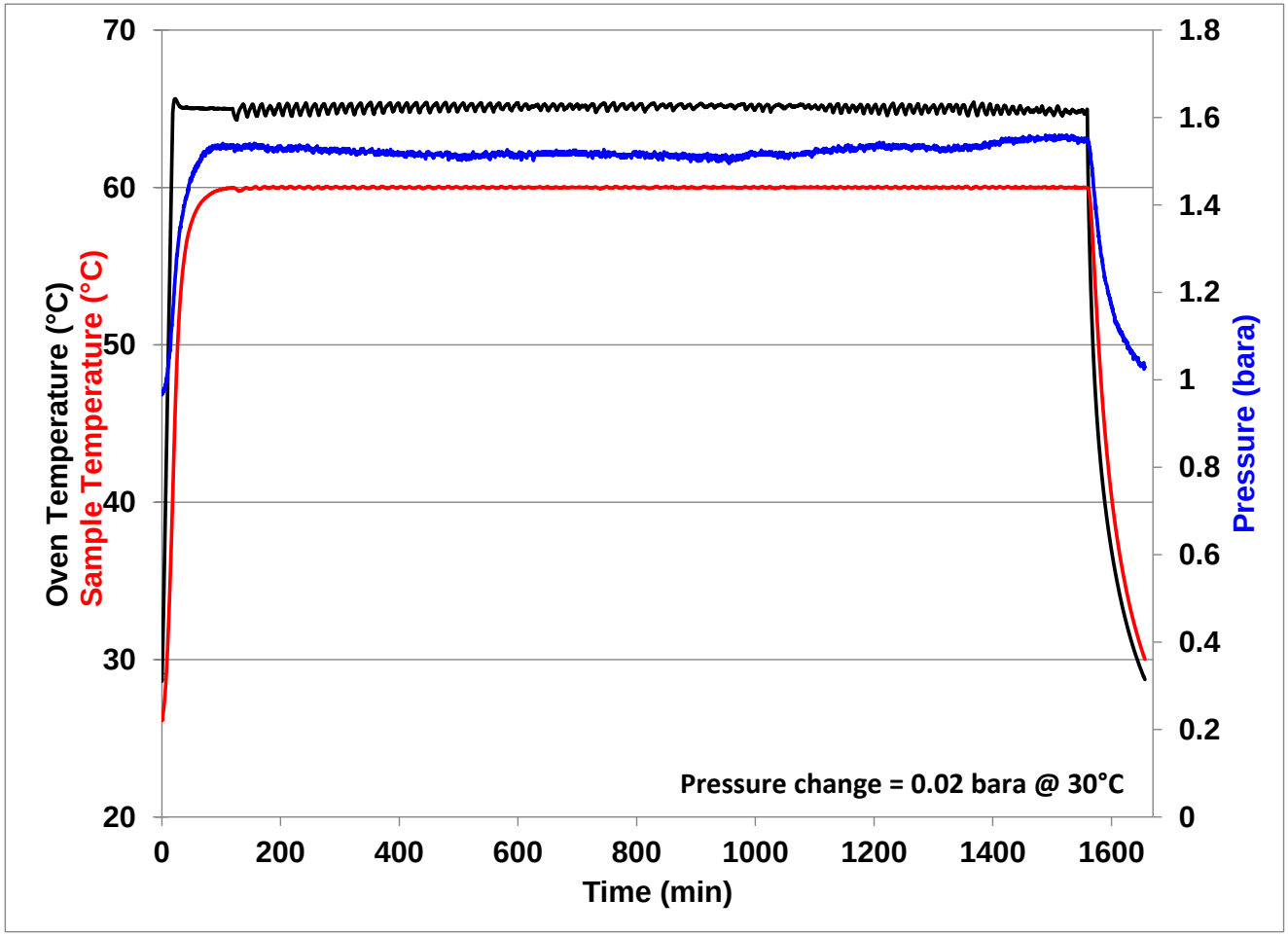


Waste (Side) Stream Testing

- Example: A side steam that passes the isothermal test



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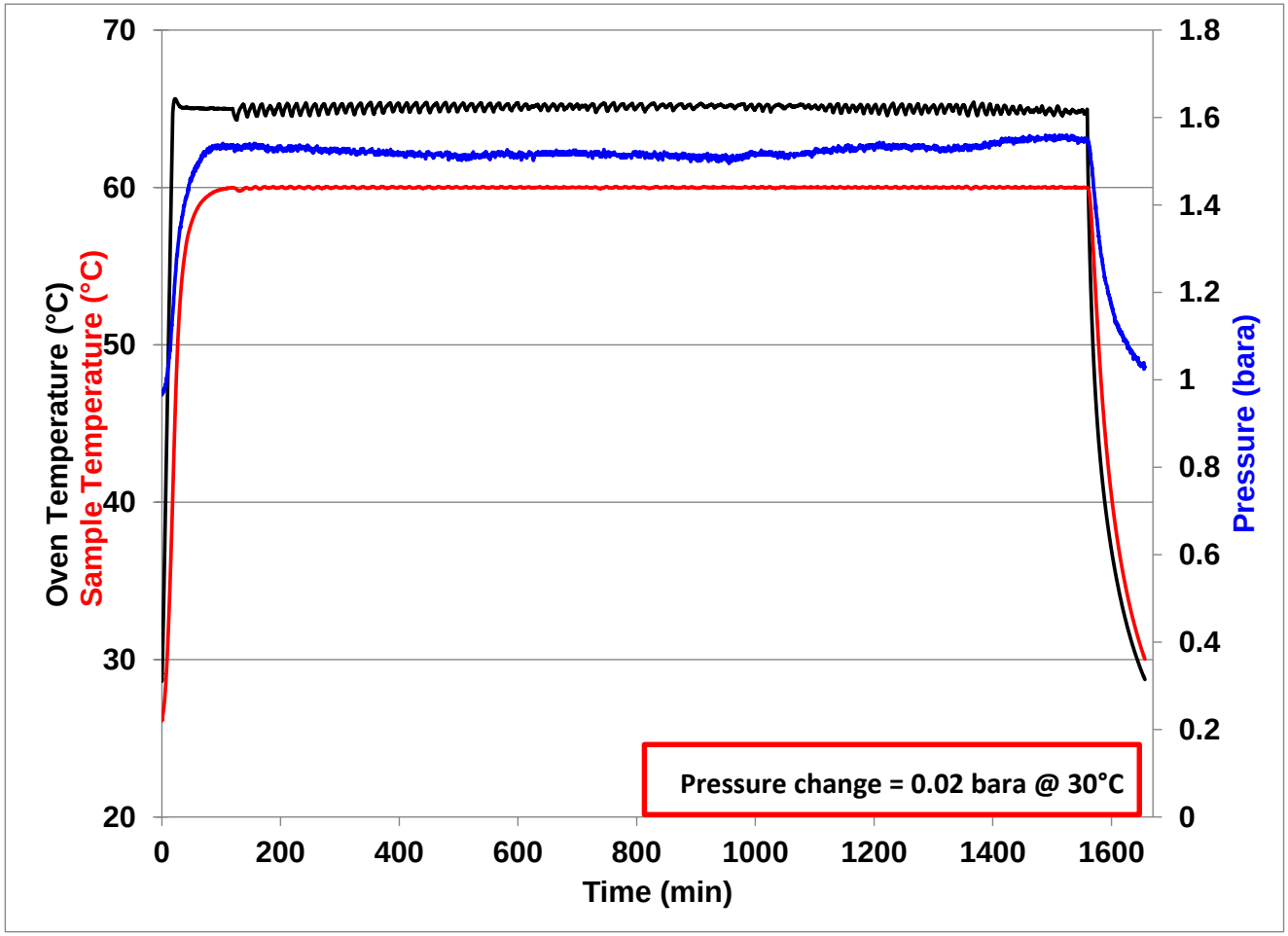

Thermal Screening Unit (TSu)

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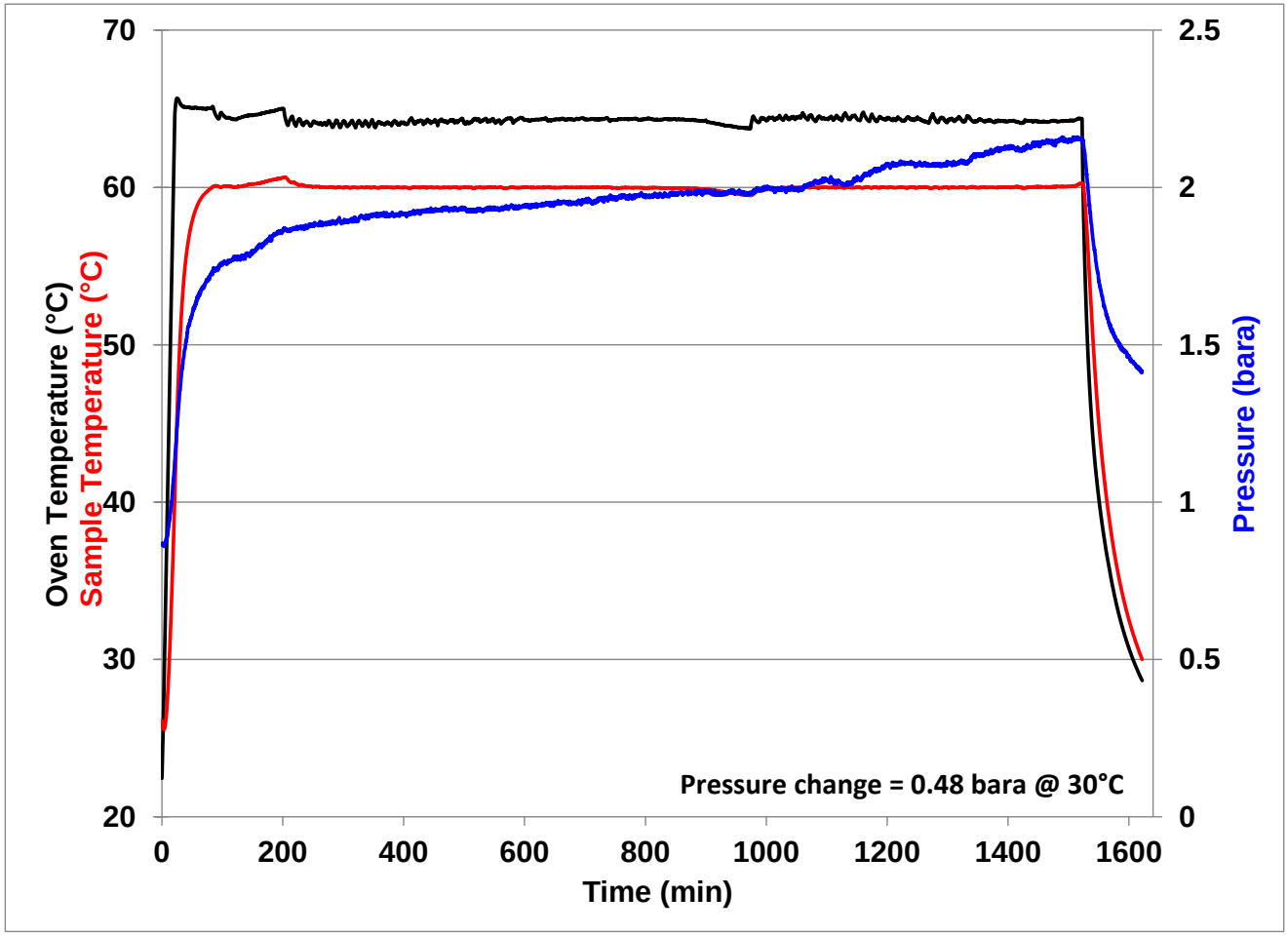

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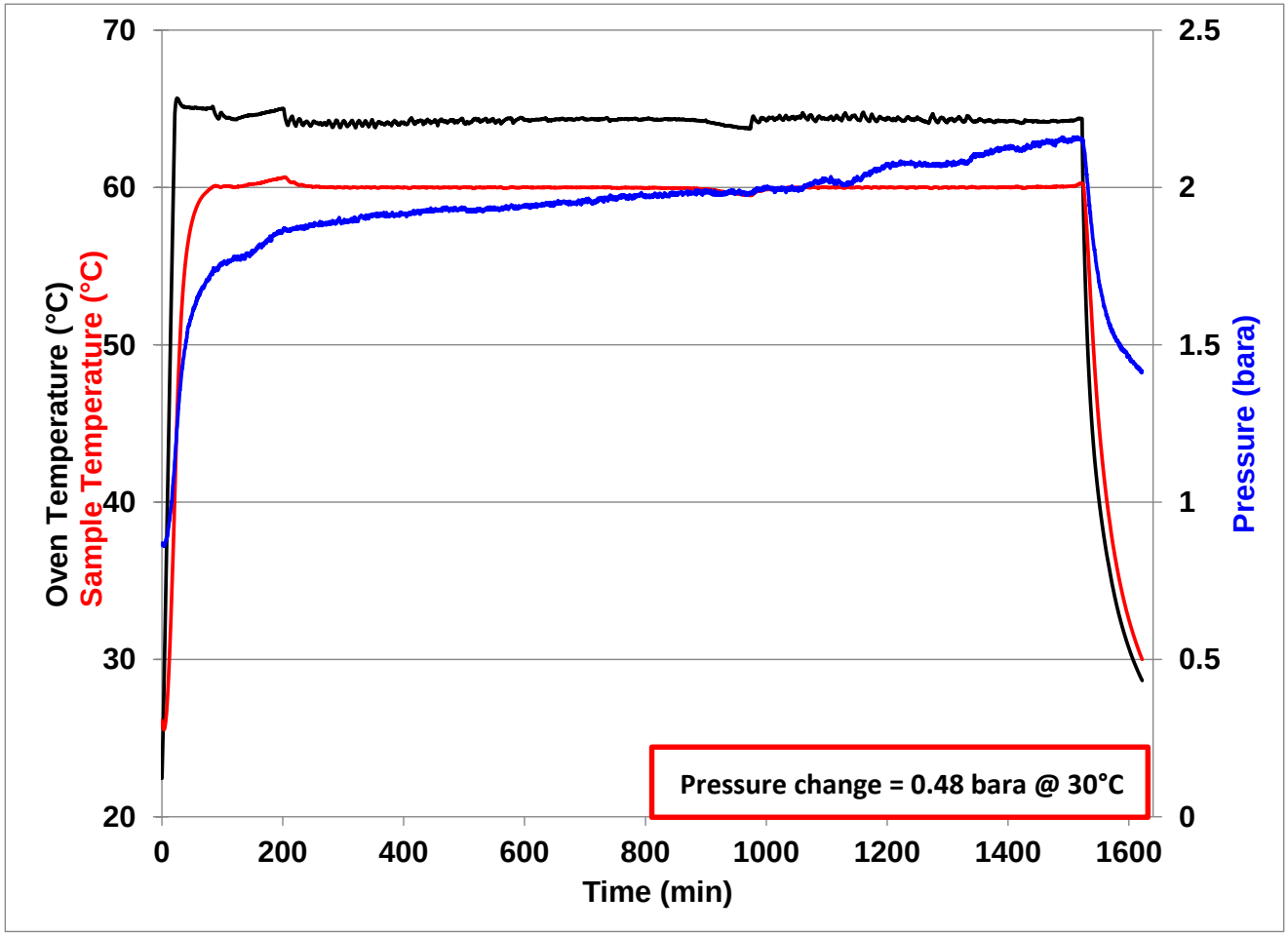
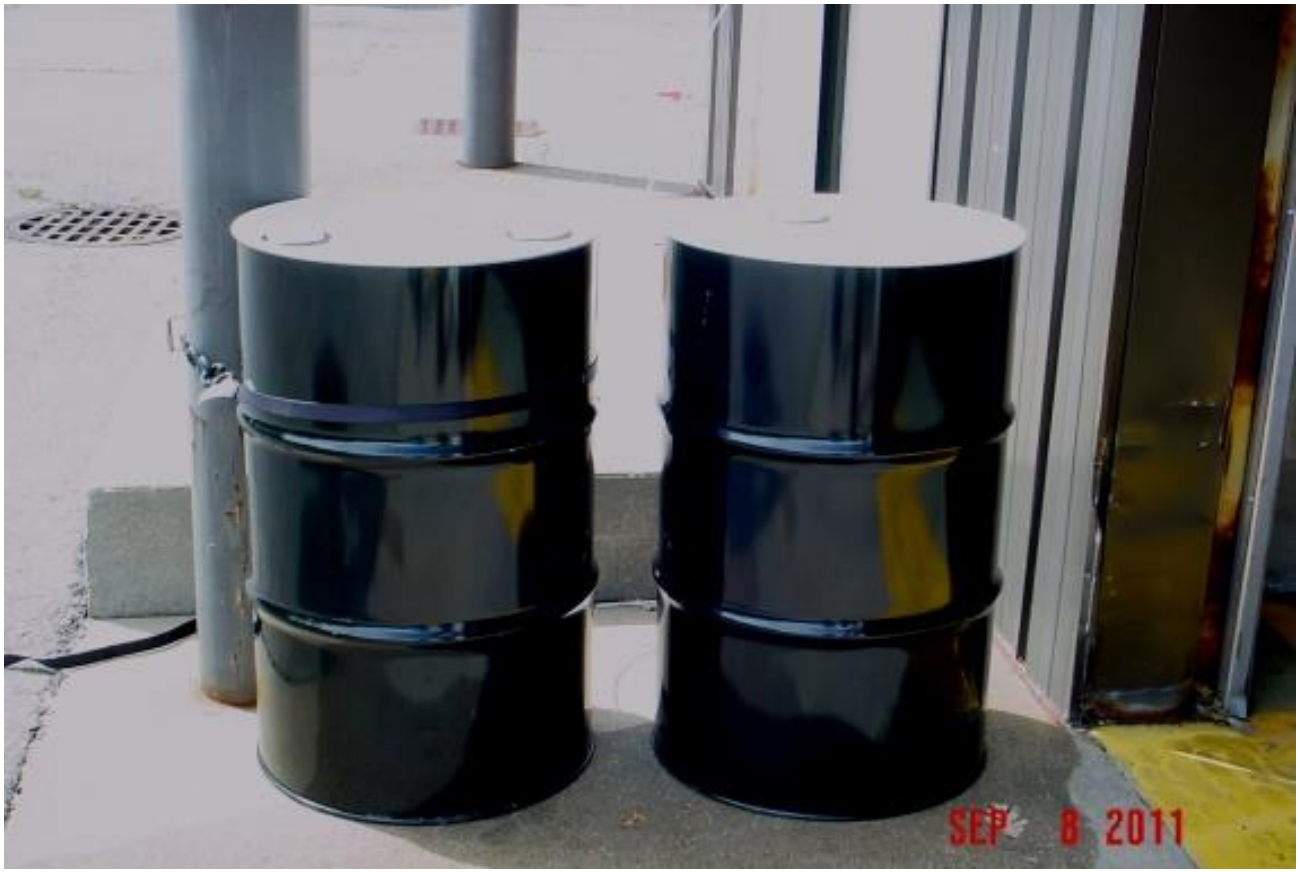


Thermal Screening Unit (TSu)

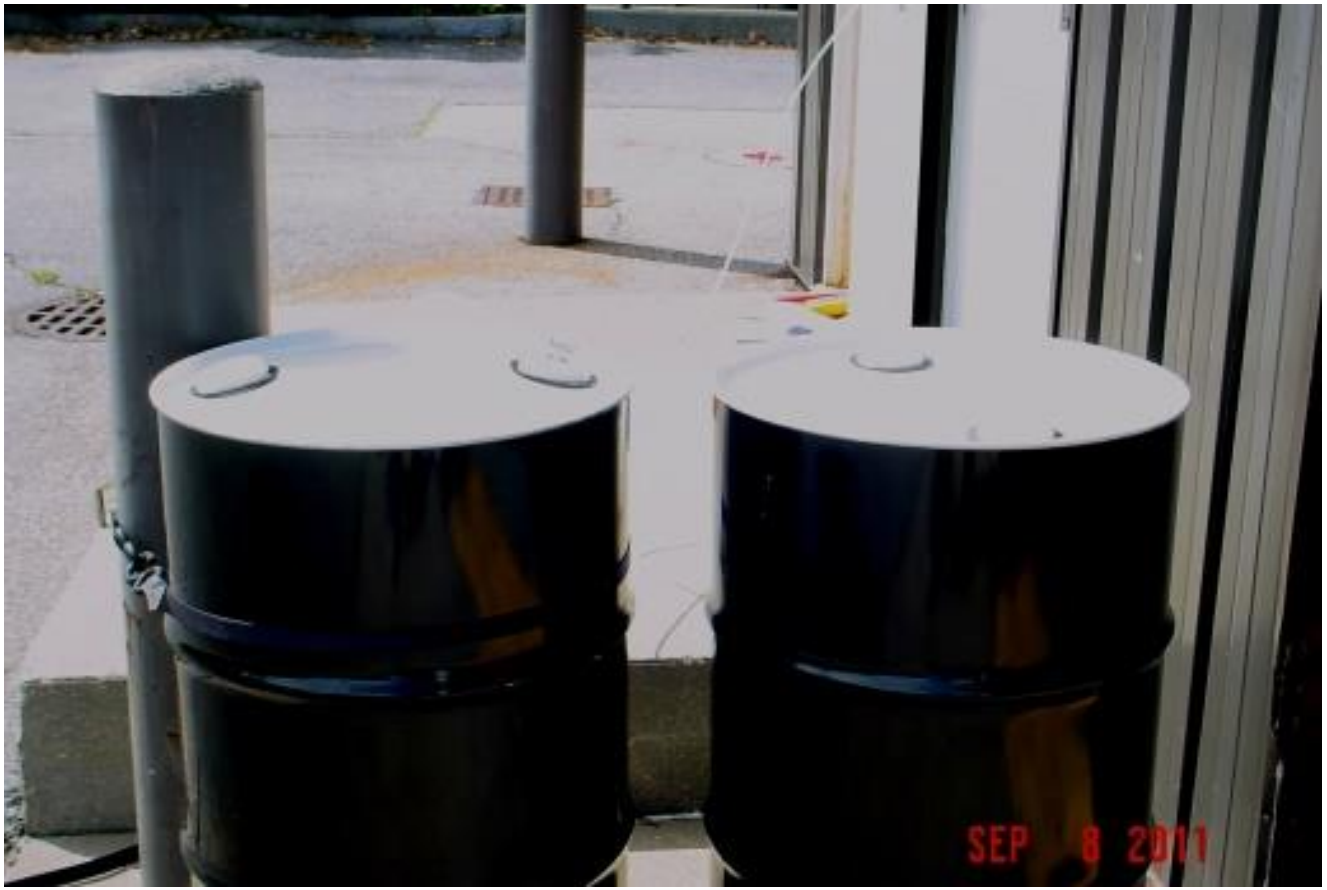
- Bulging drums



+0 bar

Thermal Screening Unit (TSu)

- Bulging drums



+1 bar

Thermal Screening Unit (TSu)

- Bulging drums

+2 bar

Thermal Screening Unit (TSu)

- Bulging drums

+3 bar

Thermal Screening Unit (TSu)

- Bulging drums

+4 bar

Thermal Screening Unit (TSu)

- Bulging drums

+5 bar

Conclusions

- Groton, CT Kilo lab uses 5 criteria for testing drummed waste/side streams:
  - Process uses or generates gas
  - Process uses a reducing agent
  - Process uses an oxidizing agent
  - Process uses materials with HEFGs
  - Process uses carbonate or bicarbonate
- Sandwich Pilot Plant sends almost all waste to one of two storage tanks
  - All waste to be sent out is tested. All side streams held in sealed drums is tested
- TSu used to study pressure generation
  - Test 1: Ramp test from 30 °C to 200 °C, if it fails then
  - Test 2: Isothermal test at 60 °C for 24 hours
  - If pressure change at ambient temperature is $\geq$0.2 bar then contents are not safe to store as tested

QUESTIONS?