Monitoring the Cleaning, Sterilization and Filling of Kegs

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Outline:

1.) Review of keg processing - high pressure steam racker

2.) Keg monitoring

3) Cleaning – emphasis on Saturated steam

4) Cleaning wooden barrels

4.) Filling

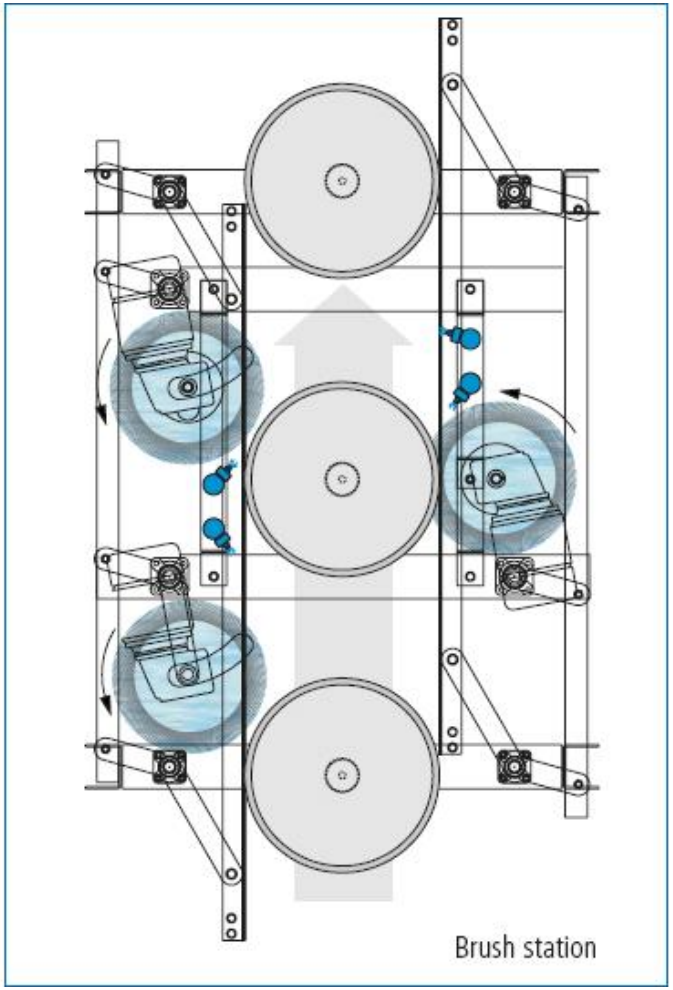
5.) Applications for keg monitoring - Case studies

A keg is a sealed, pressurized, black box / autoclave…

1.) External wash
2.) **Internal washing/disinfection**
3.) **Racking**
4.) Capping & Labeling
5.) Palletizing/Handling

Keg handling

External wash



Modern Rackers come in many shapes and sizes but they all have the same basic functions and **all are black boxes**.


lambrechts
OPGEPAST

How do you know all is ok inside your kegs?

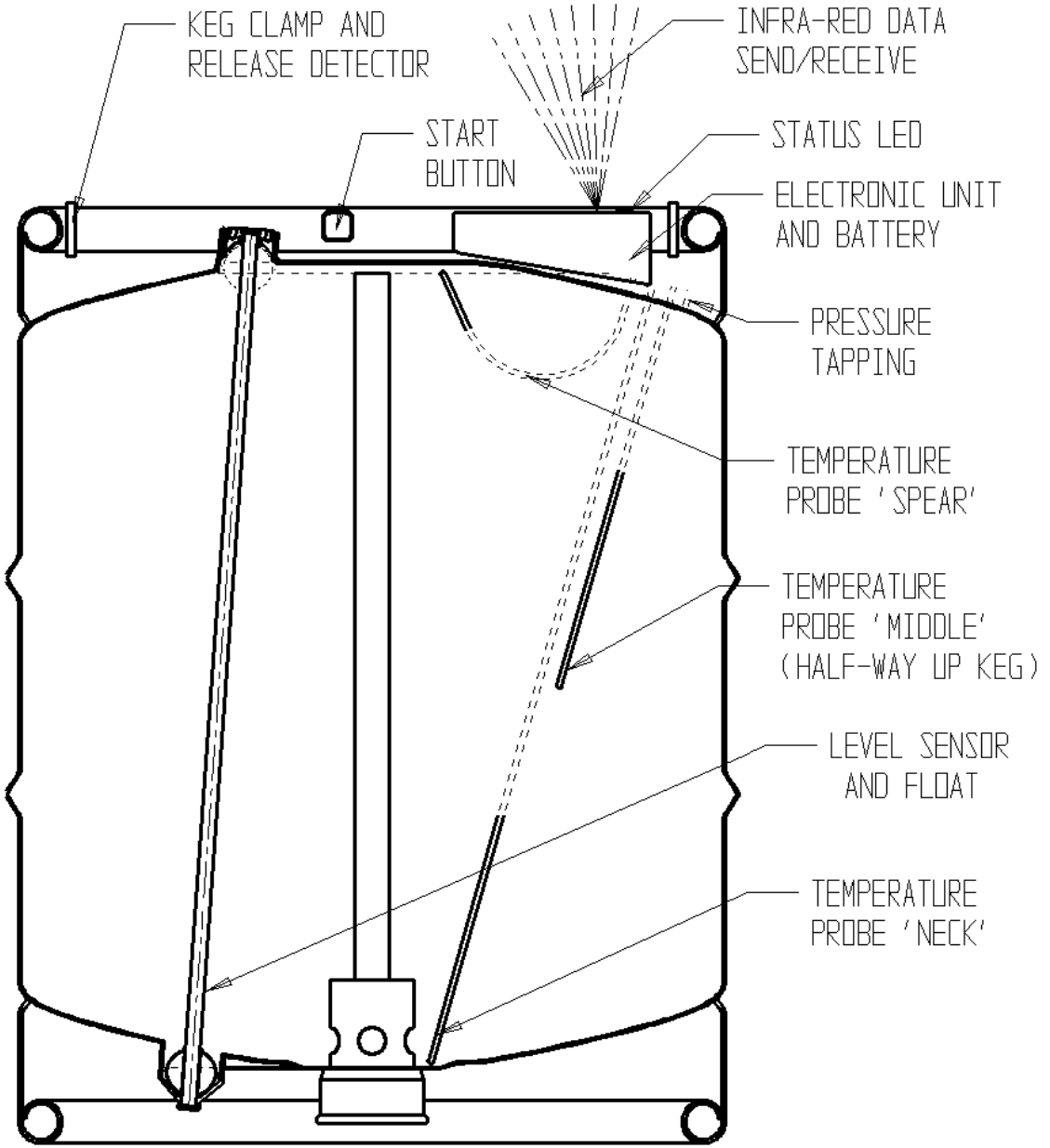
Test kegs

1.) Sight Glass

2.) Rotech keg monitor


KEG
PLU

Black boxes – No more… the *Rotech Keg Monitor*



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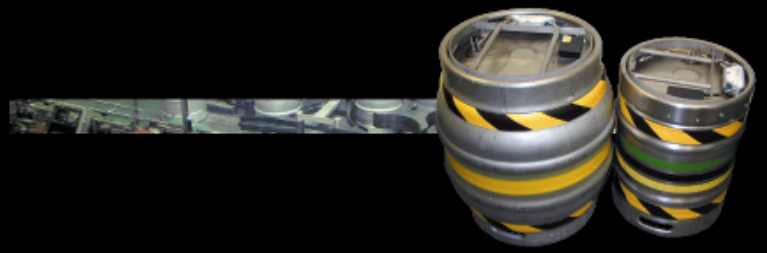
Overview

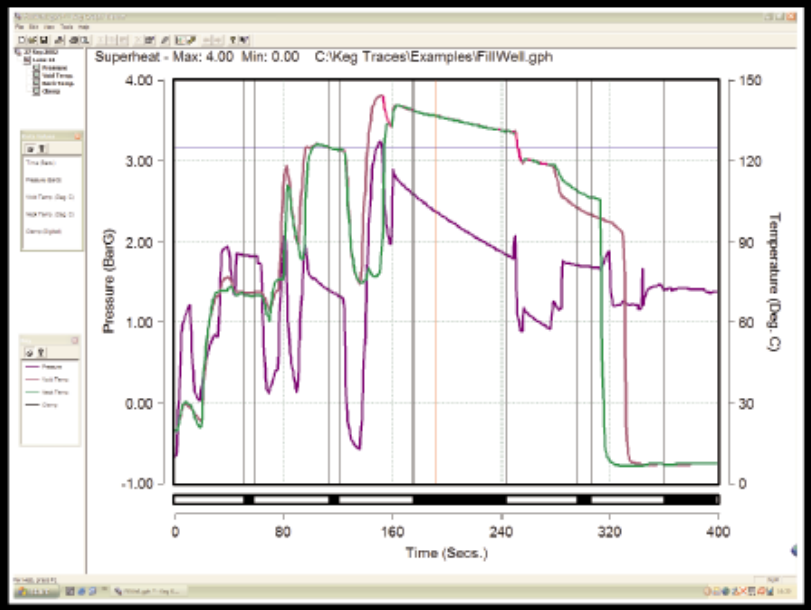


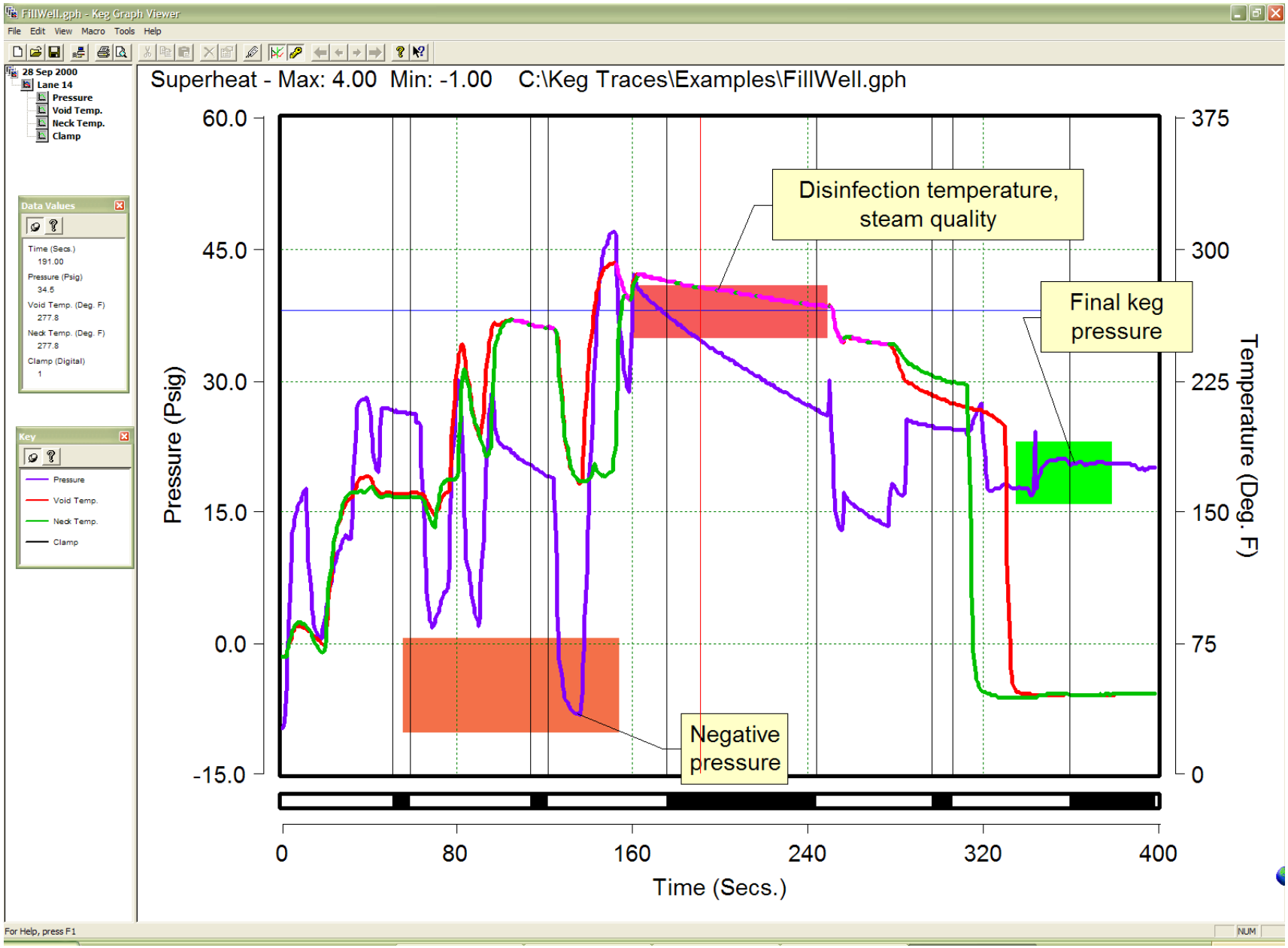
- Accurate information from inside the keg is essential for quality control; and for fast, efficient, and hygienic operation of the filling line
- The Rotech keg provides this by converting your standard keg (any size) to electronic
- This easy-to-use keg collects data; powerful friendly software makes it easy to analyse
- Rotech provides free backup and analysis for 1 year – based on 15 years experience

Viewing the results

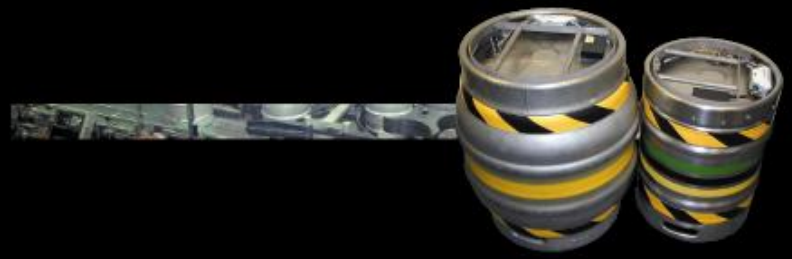
Typical trace from lane filler

- Purple colour shows saturated steam
- Black and white bands show clamp and release on each head
- Every part of every cycle can be examined in ½ - second steps




FillWell.gph - Keg Graph Viewer
File Edit View Macro Tools Help
28 Sep 2000
Lane 14
Pressure
Void Temp.
Neck Temp.
Clamp
Data Values
Time (Secs.)
191.00
Pressure (Psig)
34.5
Void Temp. (Deg. F)
277.8
Neck Temp. (Deg. F)
277.8
Clamp (Digital)
1
Key
Pressure
Void Temp.
Neck Temp.
Clamp
Superheat - Max: 4.00 Min: -1.00 C:\Keg Traces\Examples\FillWell.gph
Disinfection temperature, steam quality
Final keg pressure
Negative pressure
Pressure (Psig)
Temperature (Deg. F)
Time (Secs.)
60.0
45.0
30.0
15.0
0.0
-15.0
375
300
225
150
75
0
0
80
160
240
320
400
For Help, press F1
NUM

Applications



- **Quality control – Hygiene:**
  - Display clearly shows steam quality
  - Software automatically calculates contact time above any set temperature
  - Pinpoint risks – e.g. negative pressures, detergent carry-over, poor gas purging, etc.
- **Quality control – Gas balance in the beer:**
  - Analyse fill cycle for pressure control, frothing

Applications (continued)

- **HACCP/ISO9002 compliance**
  - Rotech Keg records are precise timed and dated statements of quality
- **Engineering Problem solving**
  - Find any engineering problem very rapidly e.g. faulty sensors, sticking valves, wrong times
  - Check the effect of adjustments or repairs in minutes

Applications (continued)

Process improvement

- Improve washing and hygiene by attention to pressures, temperatures, times
- Save energy and utilities (air, steam, gas)
- Improve filling – avoid frothing, avoid keg overfilling
- Increase throughput - cut unnecessary delays

Some Typical Racker Faults/Opportunities

Ref.	Event/opportunity
1	Avoid delays - increase throughput, fill more kegs per hour
2	Poor washing (lack of splashing onto keg walls)
3	No trickle-back (spear tube not being washed)
4	Excessive air consumption (purging)
5	Excessive sterile air consumption
6	Liquid carry-over from head to head
7	Lane-to-lane temperature variations
8	Excessive steam purging/steam consumption
9	Negative pressure due to excessive steaming (risk of infection)
10	Negative pressure improvement
11	Excessive use of utilities (detergent/rinse water)
12	Air in the keg during steam hold (poor disinfection)
13	Low steam temperatures
14	Short steam disinfection cycle
15	Poor steam quality (steam not saturated)

Ref.	Event/opportunity
16	Good & bad steam quality
17	Improvements to GEA-Till steam/gas cycle
18	Steam quality improvement, assure good disinfection
19	Unnecessary steam/vent/re-steam cycles
20	Negative pressure due to external spray (risk of infection)
21	Poor CO2 purging - air/O2 in the beer
22	Poor CO2 purge, condensate in beer
23	Excessive CO2 usage
24	Very poor fill (low pressure)
25	Foaming/frothing during filling
26	Loss of gas balance in the beer
27	Poor, or no slow-fast-slow filling profile
28	Improvements to filling times
29	Over-filling with beer
30	Lane-to-lane final top pressure variations

An emphasis on Saturated Steam.

Definitions.

Sterilization

Any item is considered to be sterile when it is completely free of all living microorganisms and viruses. The definition is categorical and absolute (i.e., an item is either sterile or it is not). A sterilization procedure is one that kills all microorganisms, including high numbers of bacterial endospores. The procedure is defined as a process, after which the probability of a microorganism surviving on an item subjected to treatment is less than one in one million (10-6). This is referred to as the “sterility assurance level.”

Disinfection

Disinfection is generally a less lethal process than sterilization. It eliminates nearly all recognized pathogenic microorganisms but not necessarily all microbial forms (e.g., bacterial spores) on inanimate objects. Disinfection does not ensure an "overkill" and therefore lacks the margin of safety achieved by sterilization procedures. The effectiveness of a disinfection procedure is controlled significantly by a number of factors, each one of which may have a pronounced effect on the end result.

Among these are:

the nature and number of contaminating microorganisms (especially the presence of bacterial spores); the amount of organic matter present (e.g., soil etc).

Disinfection is a procedure that reduces the level of microbial contamination, but there is a broad range of activity that extends from sterility at one extreme to a minimal reduction in the number of microbial contaminants at the other. **By definition, chemical disinfection and in particular, high-level disinfection differs from chemical sterilization by its lack of sporicidal power.** This is an over simplification of the actual situation because a few chemical germicides used as disinfectants do, in fact, kill large numbers of spores even though high concentrations and several hours of exposure may be required. Non-sporicidal disinfectants may differ in their capacity to accomplish disinfection or decontamination.

Low-level Disinfection:

This procedure kills most vegetative bacteria except *M. tuberculosis, some fungi, and inactivates some viruses. The EPA approves chemical germicides used in this procedure in the US as "hospital disinfectants" or* ***"sanitizers."***

Brewing Specific Research

Comparative Sterilization Times

MOIST HEAT
(Saturated steam)

Temp. ºC/ºF	Time
100 / 212	20 hours
110 / 230	2½ hours
115 / 239	50 minutes
120 / 248	15 minutes
125 / 257	6½ minutes
130 / 266	2½ minutes

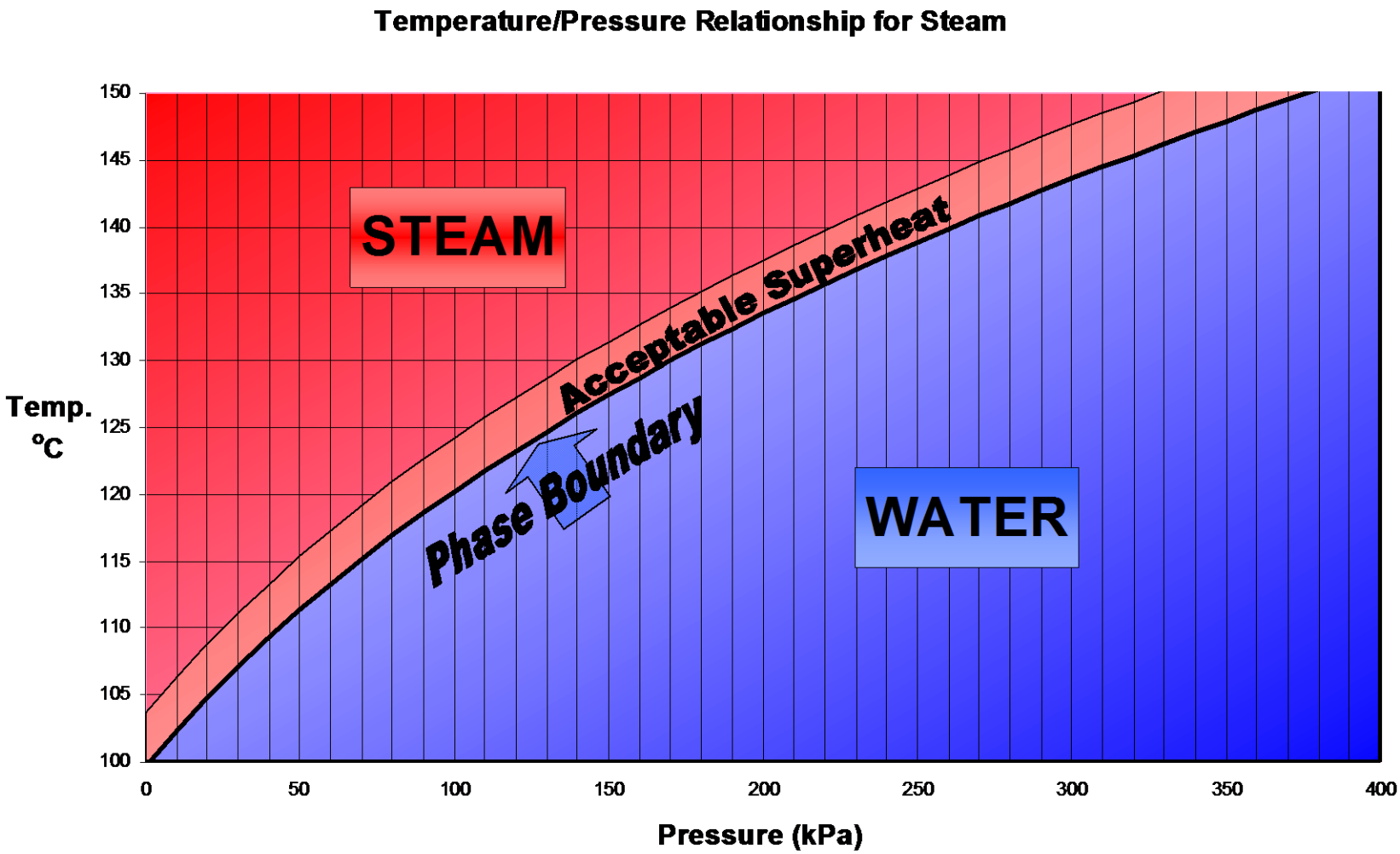
DRY HEAT
(Superheated steam)

Temp. ºC/ºF	Time
120 / 257	8 hours
140 / 284	2½ hours
160 / 320	1 hour
170 / 338	40 minutes
180 / 356	20 minutes

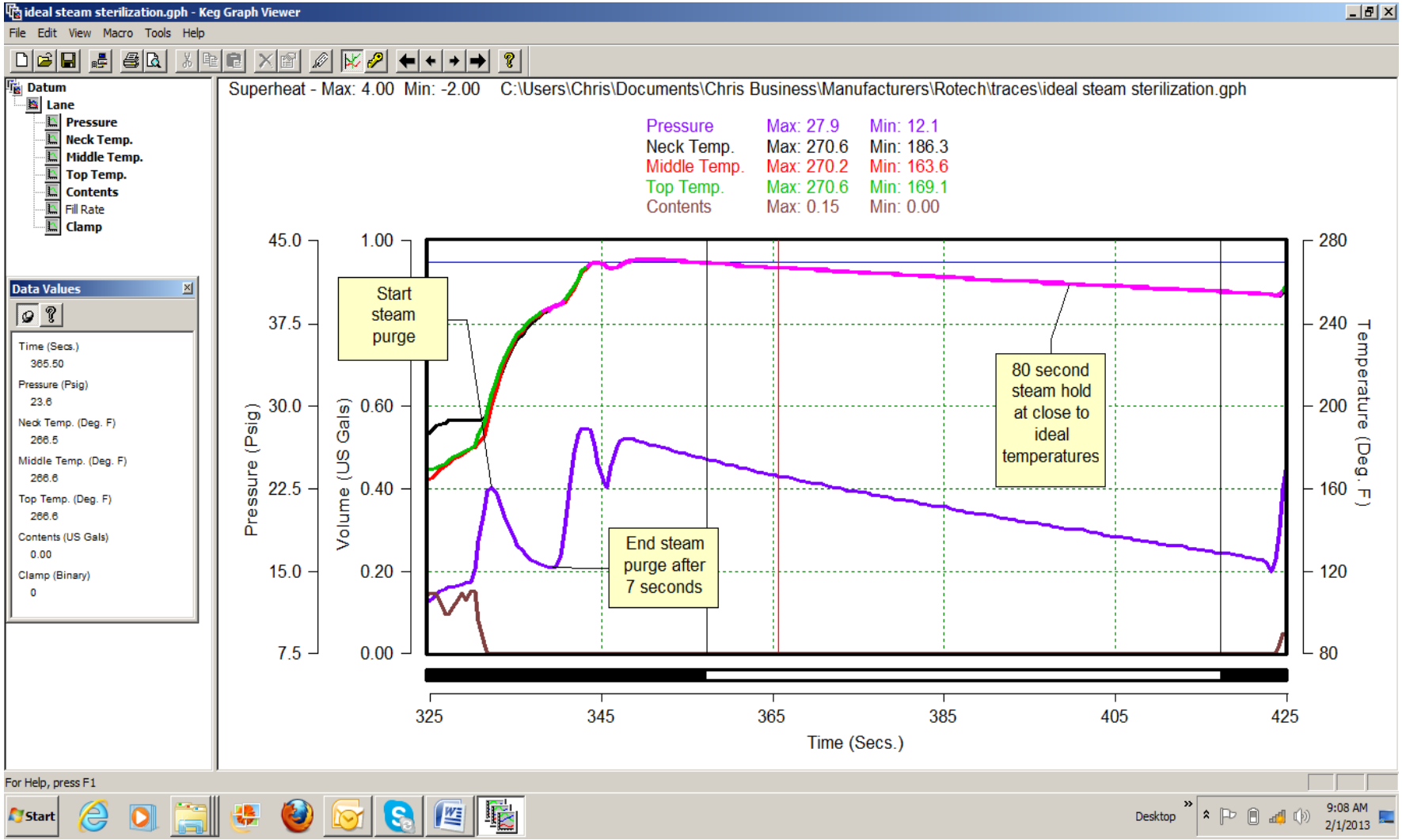
Recommended Procedure for Destroying
All Beer-Spoilage Organisms: Avis & Smith at Burton Brewery UK

135 / 275 1 minute @ approx maximum 40 PSI

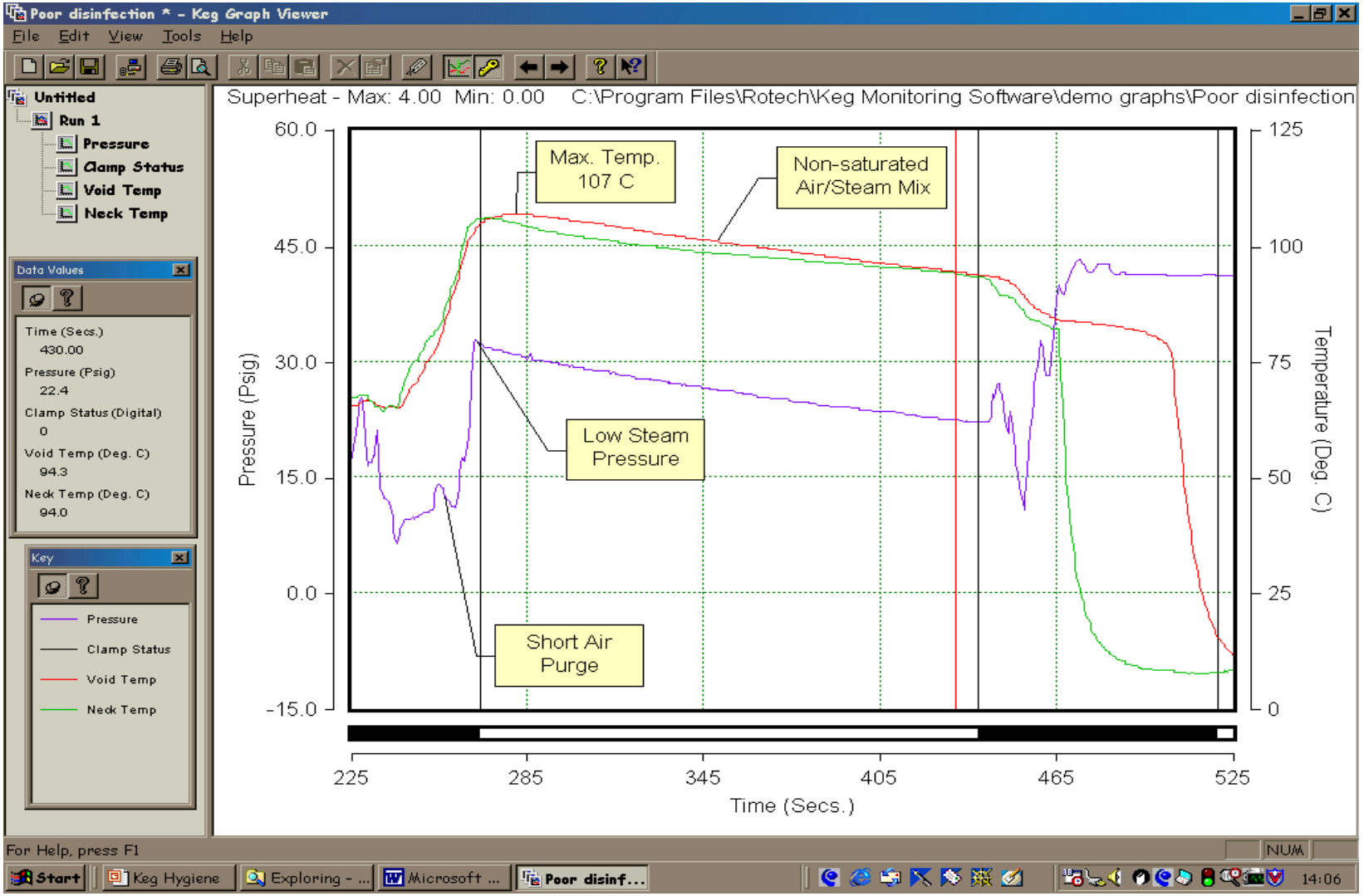
Steam Saturation



Great Disinfection



Disinfection that keeps you awake



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Micro testing – time consuming

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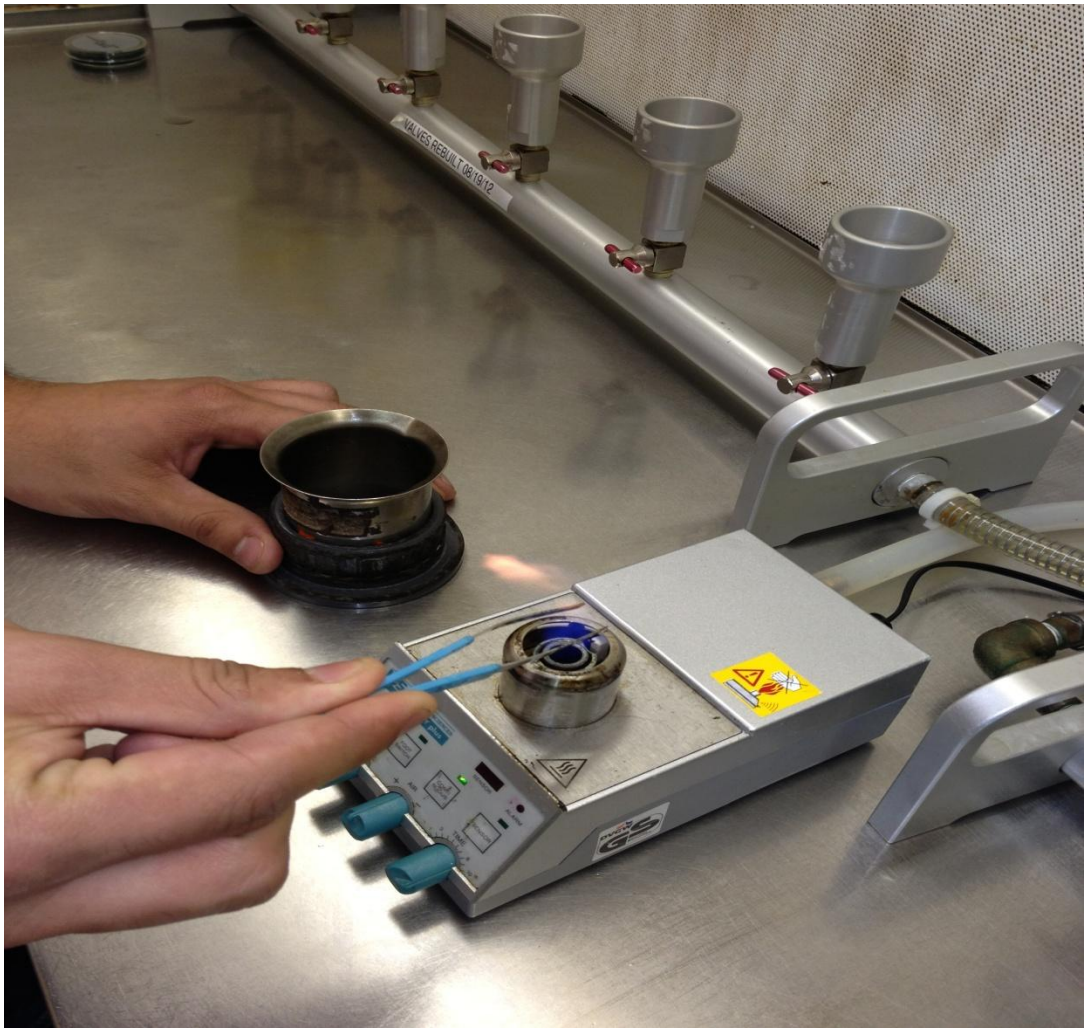
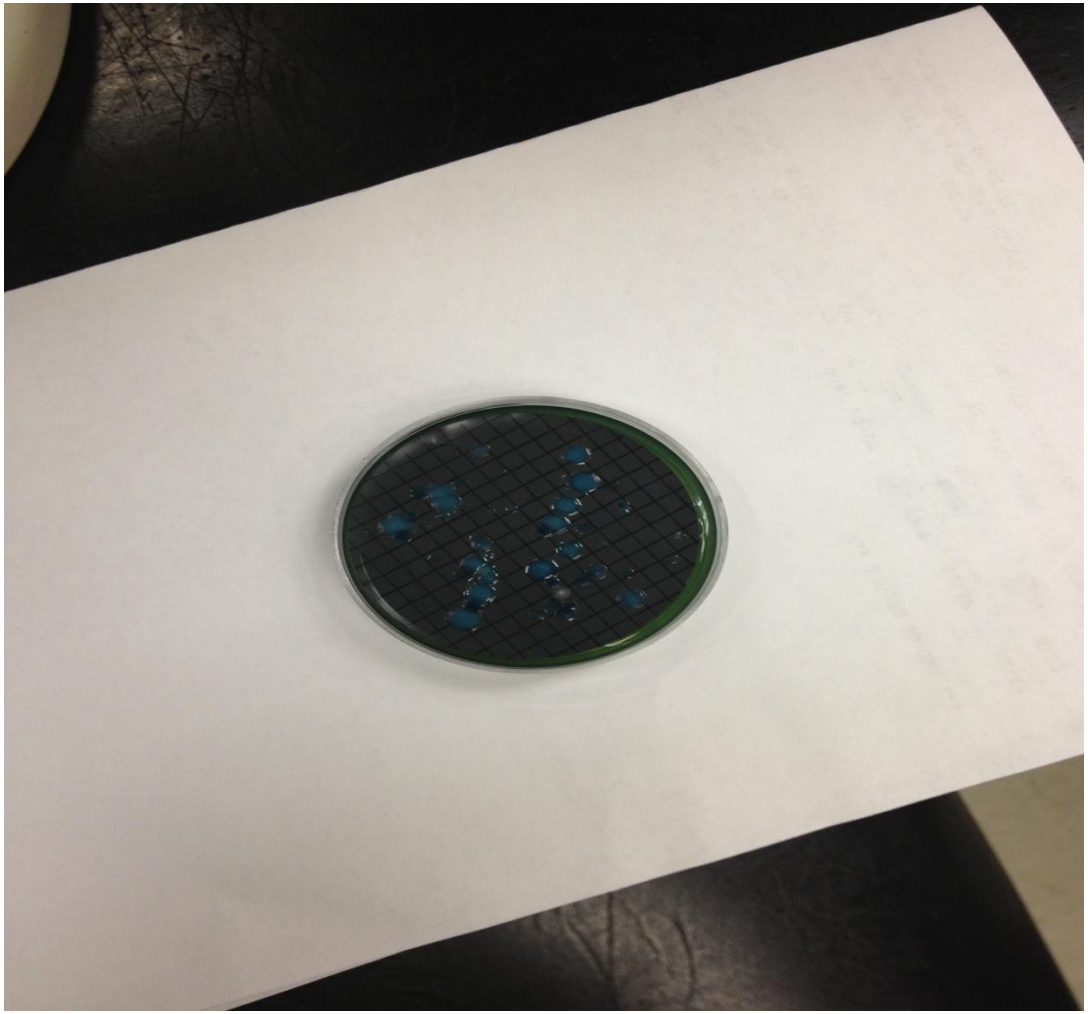
Micro testing – time consuming



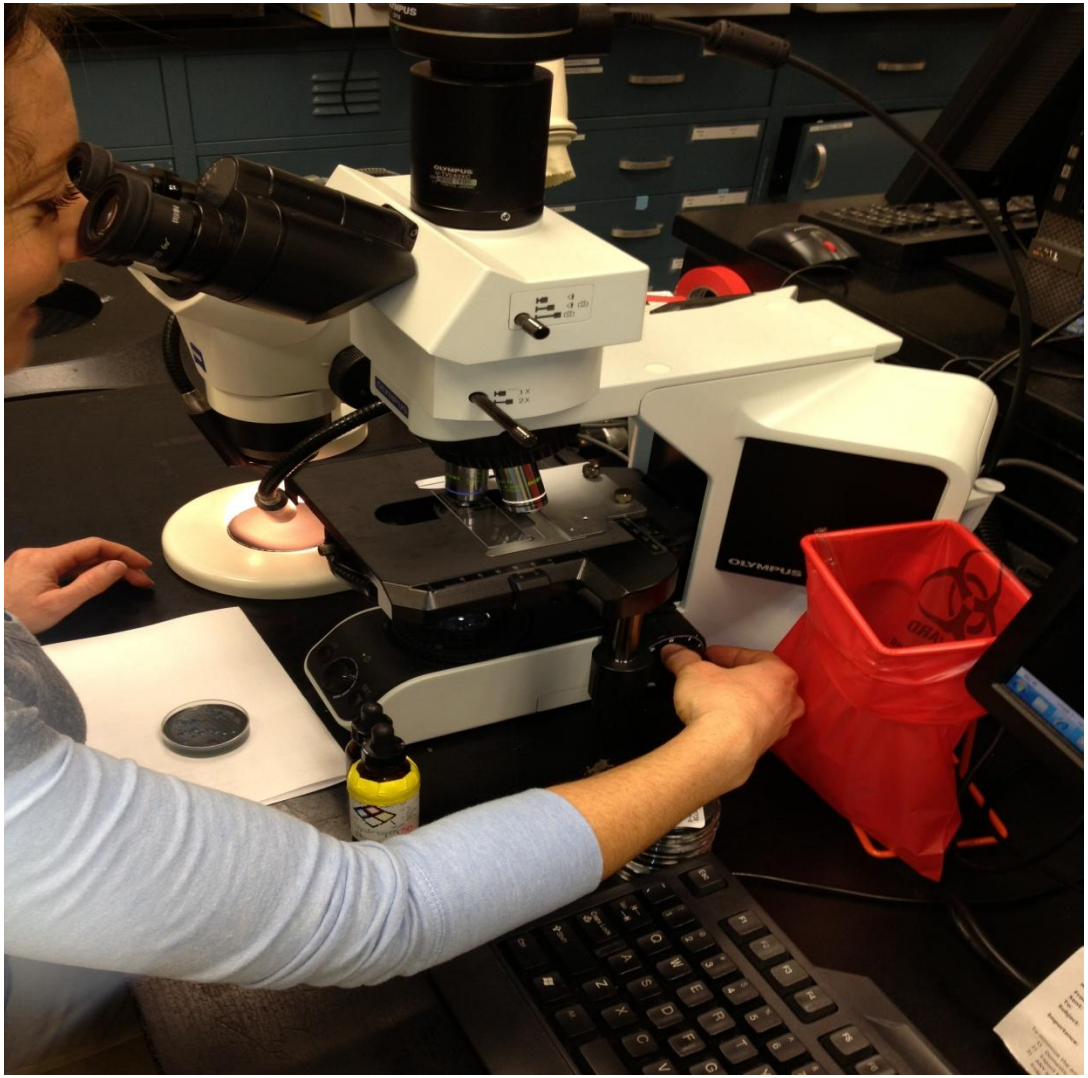
Micro testing – time consuming

Micro testing – time consuming

Micro testing – time consuming



Micro testing – time consuming



Wooden Barrels:

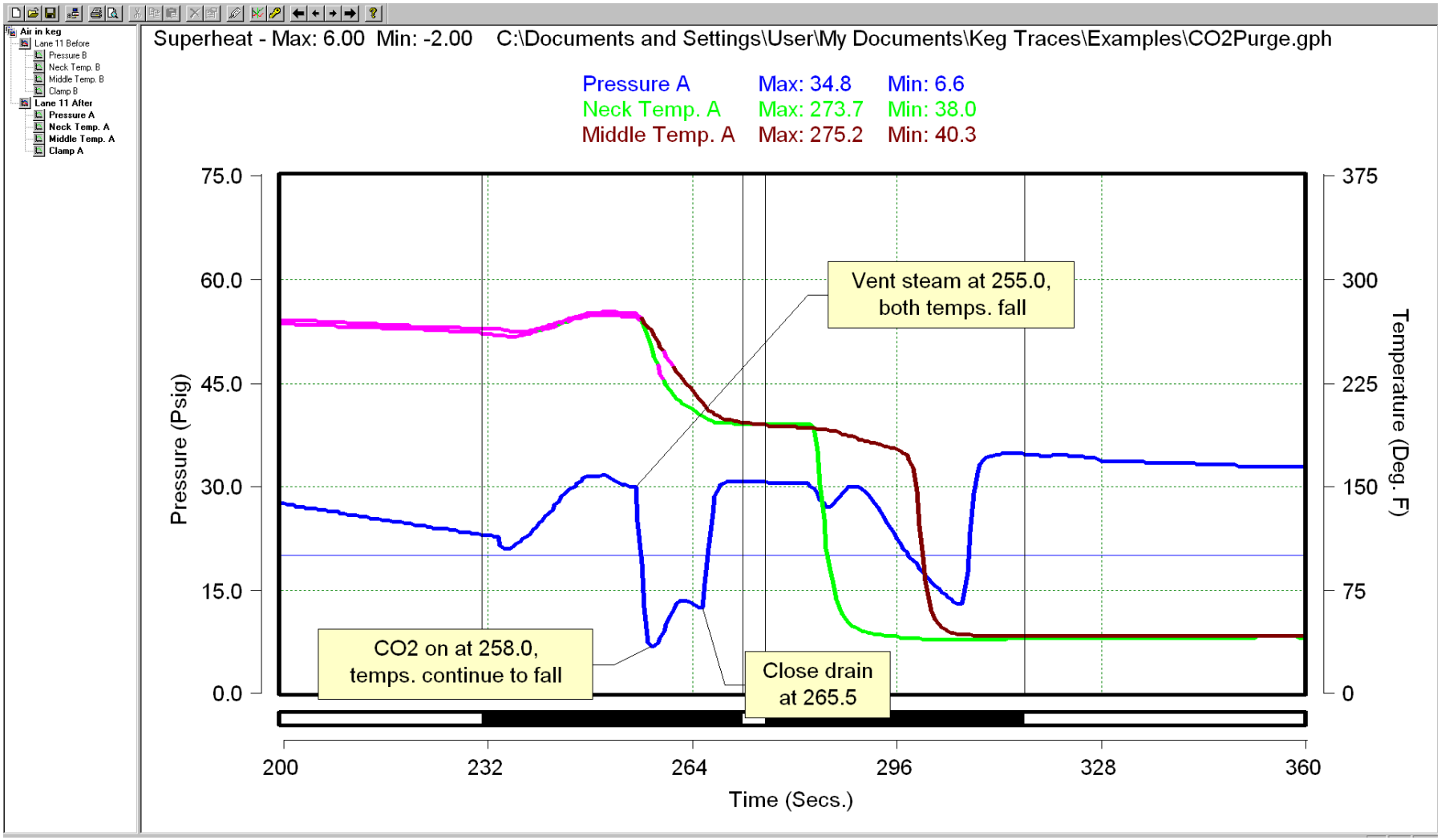
“The only way to sanitize a wooden barrel is with gasoline and a match”

Dr. MJ Lewis, 1982 UCD brewing lecture

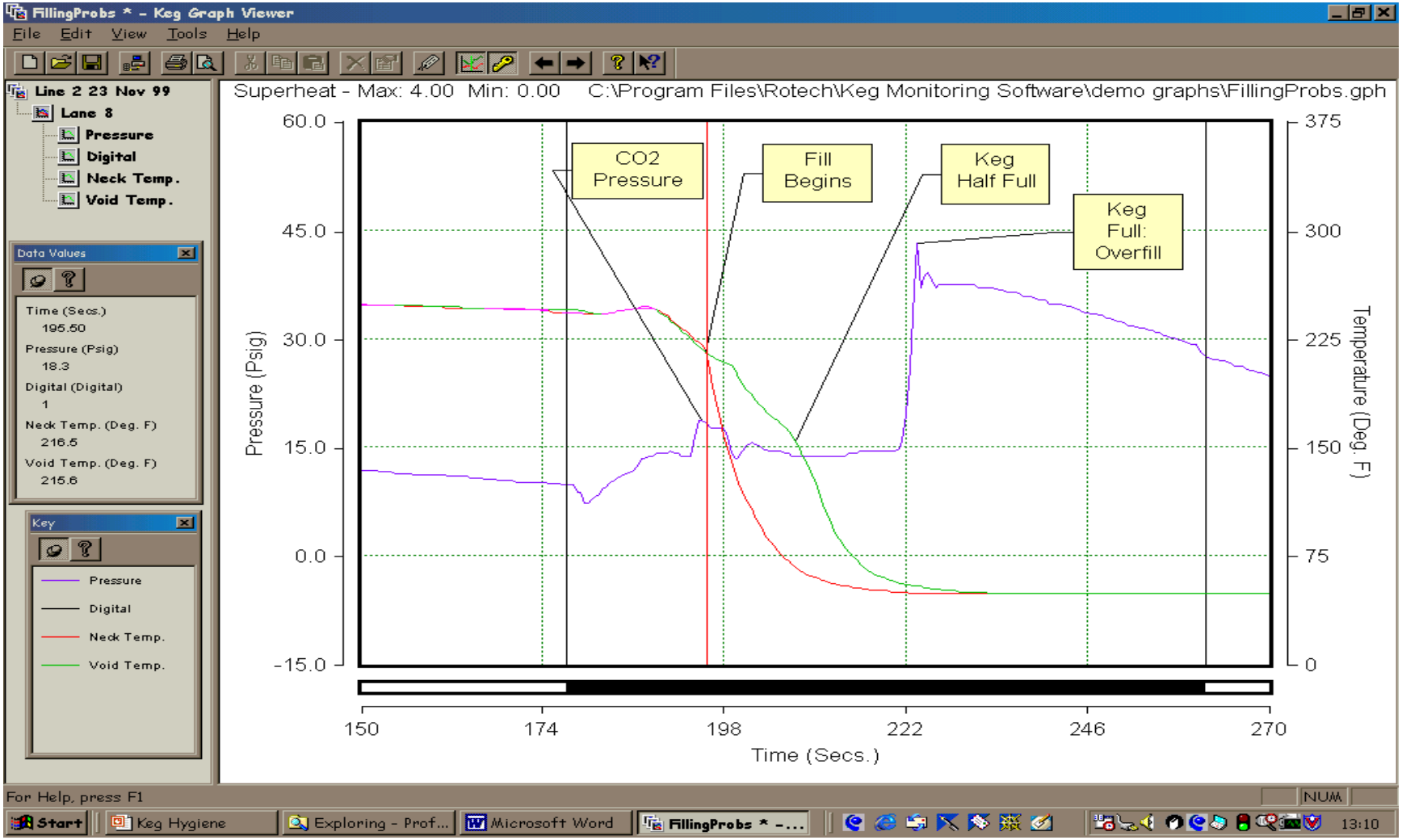
Why Barrels Harbor Microbes

Rough surfaces are easy to attach to and are protective. Porous nature gives additional shelter and nutrient source (wood, sugars, product).

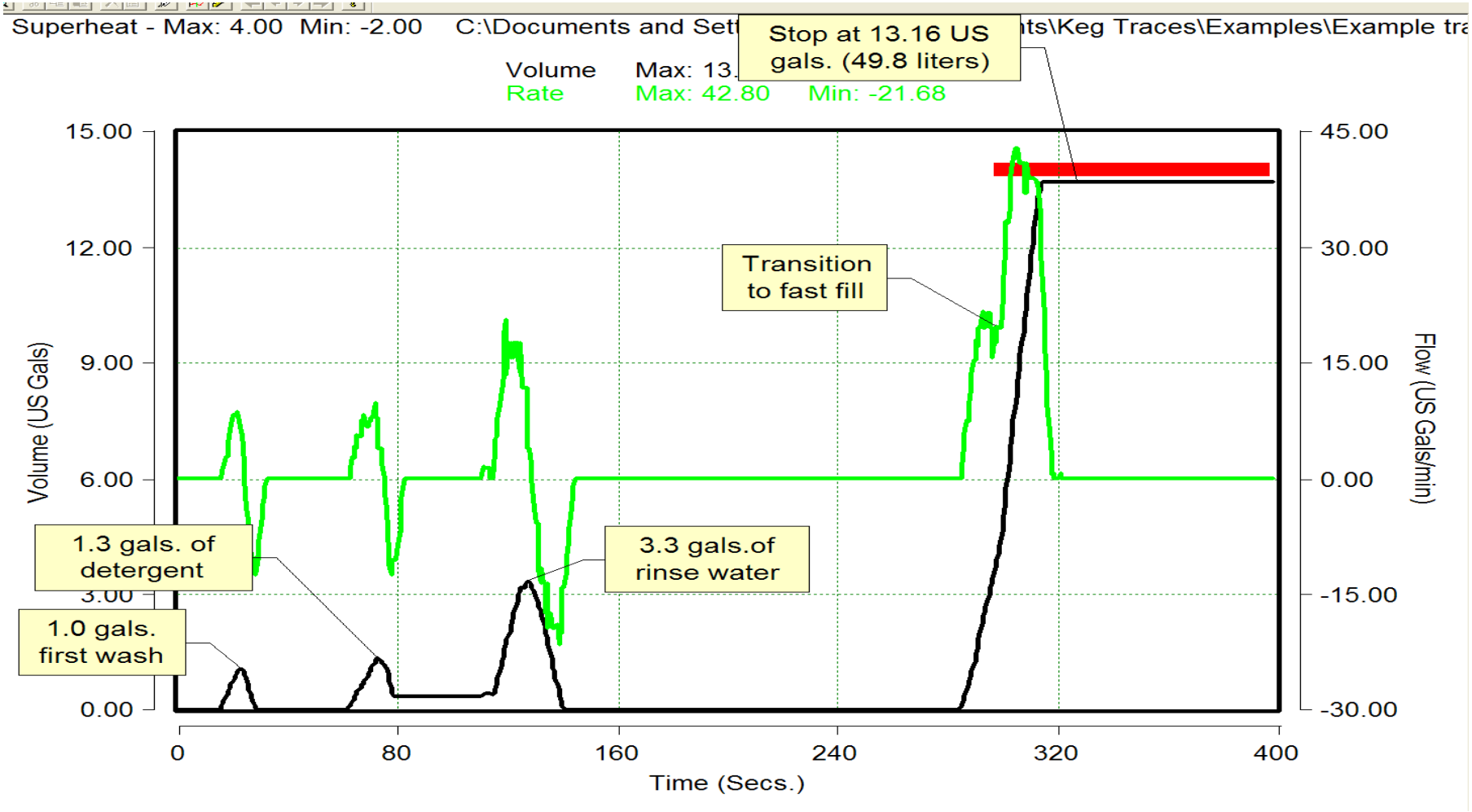
Good Fill


Air in keg
Lane 11 Before
Pressure B
Neck Temp. B
Middle Temp. B
Clamp B
Lane 11 After
Pressure A
Neck Temp. A
Middle Temp. A
Clamp A
Superheat - Max: 6.00 Min: -2.00 C:\Documents and Settings\User\My Documents\Keg Traces\Examples\CO2Purge.gph
Pressure A Max: 34.8 Min: 6.6
Neck Temp. A Max: 273.7 Min: 38.0
Middle Temp. A Max: 275.2 Min: 40.3
Vent steam at 255.0, both temps. fall
CO2 on at 258.0, temps. continue to fall
Close drain at 265.5
Pressure (Psig)
75.0
60.0
45.0
30.0
15.0
0.0
Temperature (Deg. F)
375
300
225
150
75
0
200
232
264
296
328
360
Time (Secs.)

Fill with Problems



Continuous Volume Measurement



Example of accelerated fill

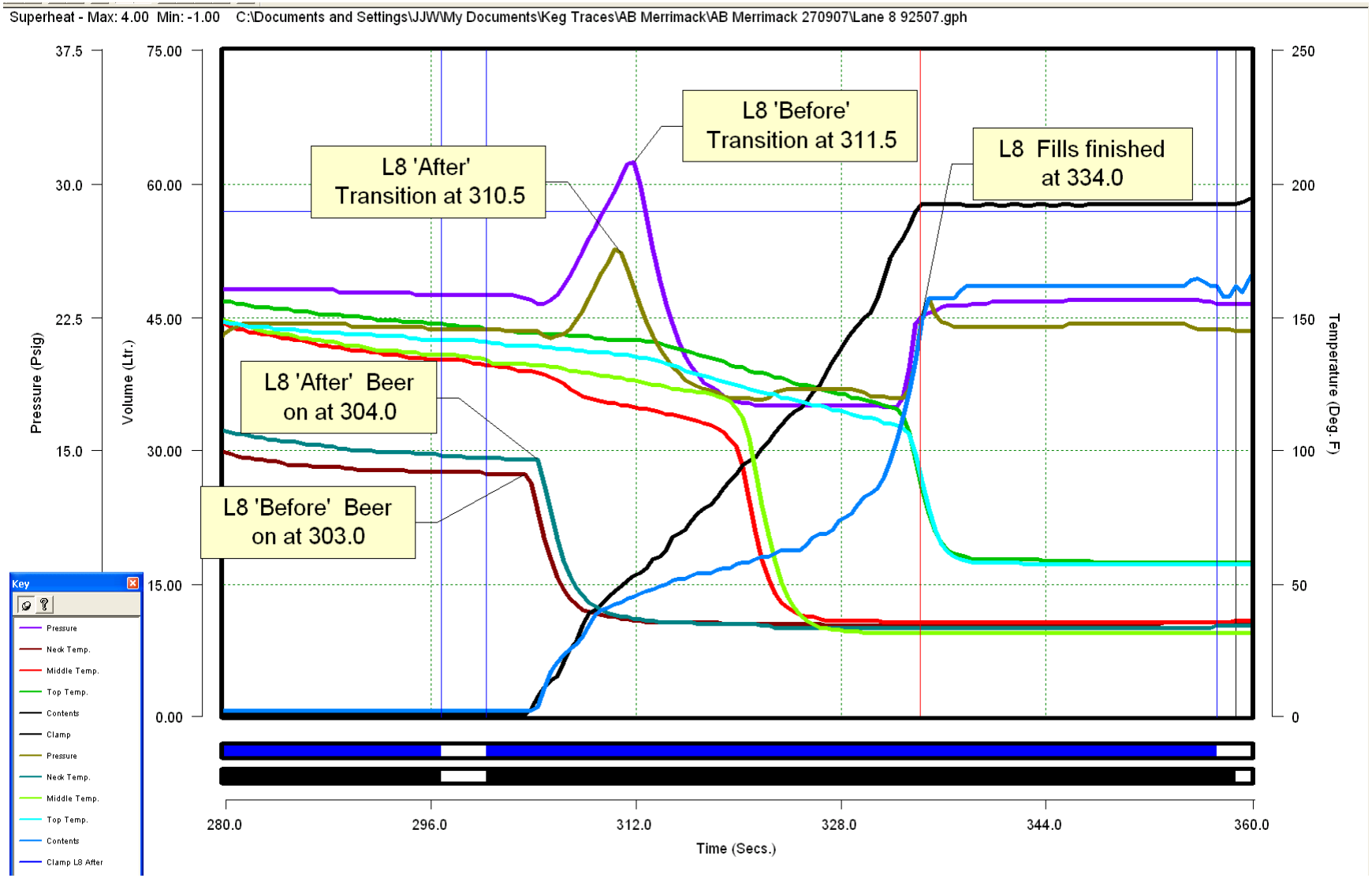


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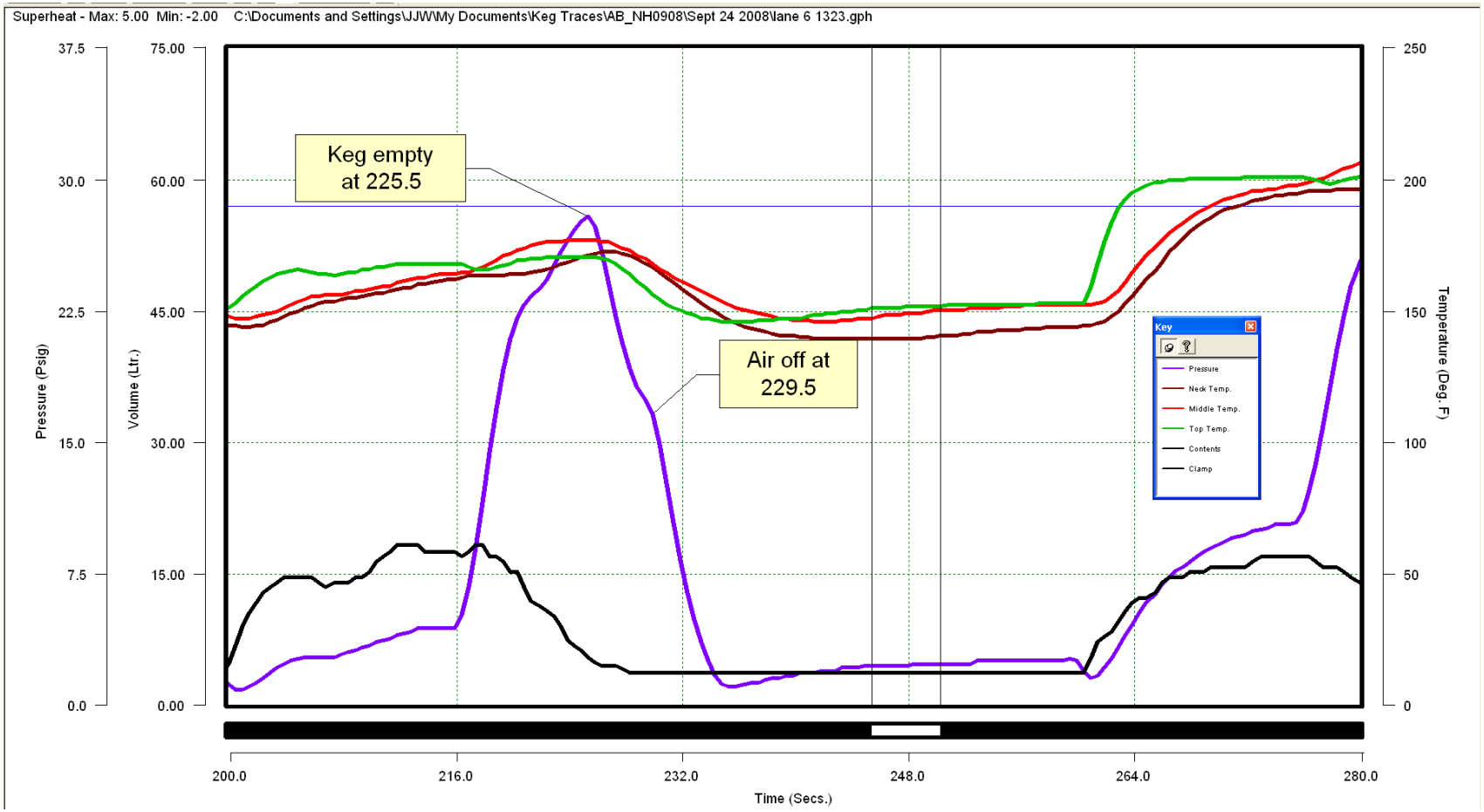
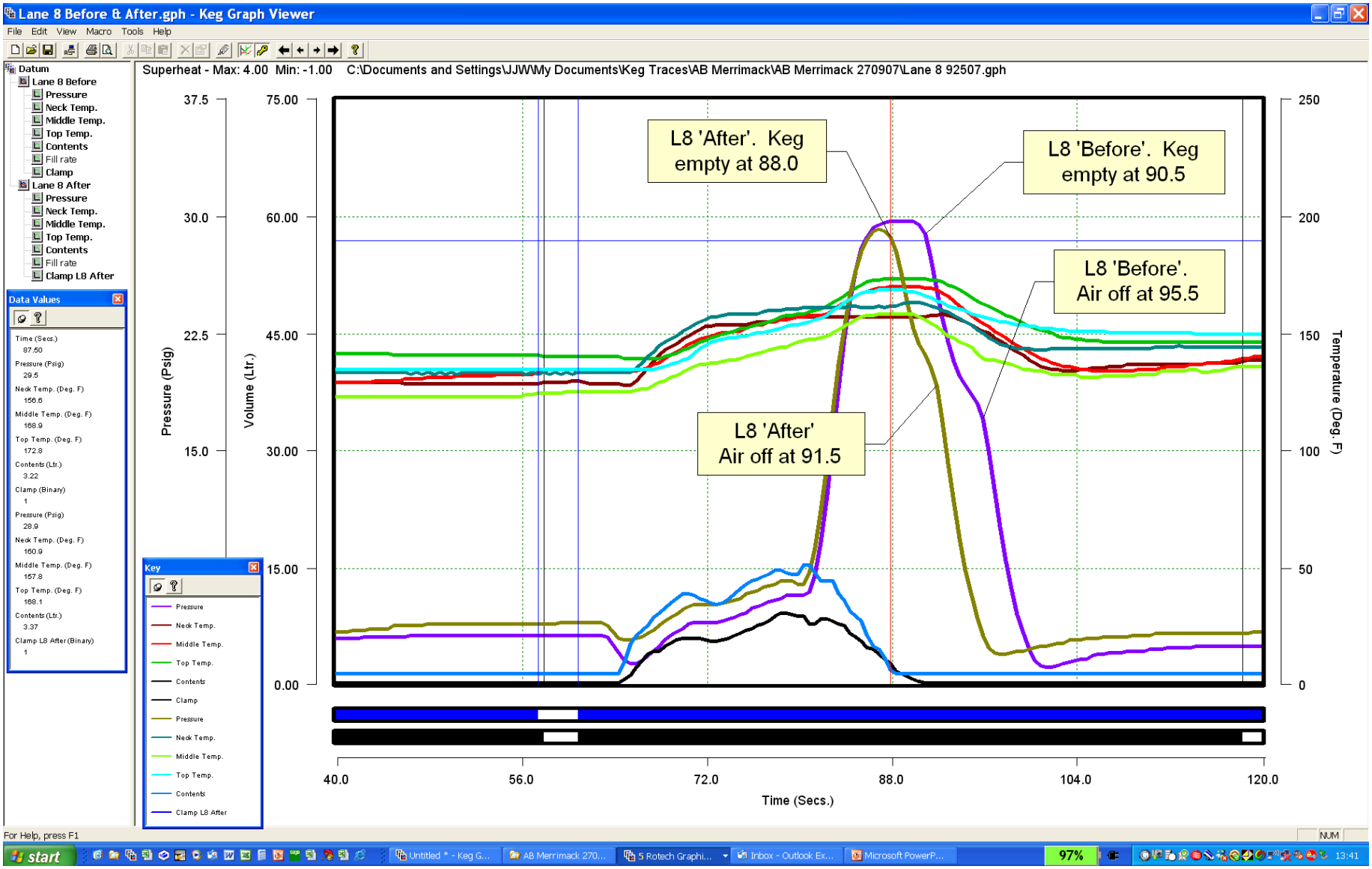
Illustration of possible Sterile Air over- purging (Head 2)




Lane 8 Before & After.gph - Keg Graph Viewer
File Edit View Macro Tools Help
Datum
Lane 8 Before
Pressure
Neck Temp.
Middle Temp.
Top Temp.
Contents
Fill rate
Clamp
Lane 8 After
Pressure
Neck Temp.
Middle Temp.
Top Temp.
Contents
Fill rate
Clamp L8 After
Data Values
Time (Secs.) 87.50
Pressure (Psig) 29.5
Neck Temp. (Deg. F) 166.6
Middle Temp. (Deg. F) 168.9
Top Temp. (Deg. F) 172.8
Contents (Ltr.) 3.22
Clamp (Binary) 1
Pressure (Psig) 28.9
Neck Temp. (Deg. F) 160.9
Middle Temp. (Deg. F) 157.8
Top Temp. (Deg. F) 168.1
Contents (Ltr.) 3.37
Clamp L8 After (Binary) 1
Superheat - Max: 4.00 Min: -1.00 C:\Documents and Settings\JJW\My Documents\Keg Traces\AB Merrimack\AB Merrimack 270907\Lane 8 92507.gph
L8 'After'. Keg empty at 88.0
L8 'Before'. Keg empty at 90.5
L8 'Before'. Air off at 95.5
L8 'After' Air off at 91.5
Pressure (Psig)
Volume (Ltr.)
Temperature (Deg. F)
Time (Secs.)
Key
Pressure
Neck Temp.
Middle Temp.
Top Temp.
Contents
Clamp
Pressure
Neck Temp.
Middle Temp.
Top Temp.
Contents
Clamp L8 After
For Help, press F1
start
97%

Quick Comparison of Multiple Lanes

Applications for the *Rotech Keg Monitor*:

1.) Monitoring of racker;
2.) Finding faults;
3.) Commissioning of rackers
4.) Audits.

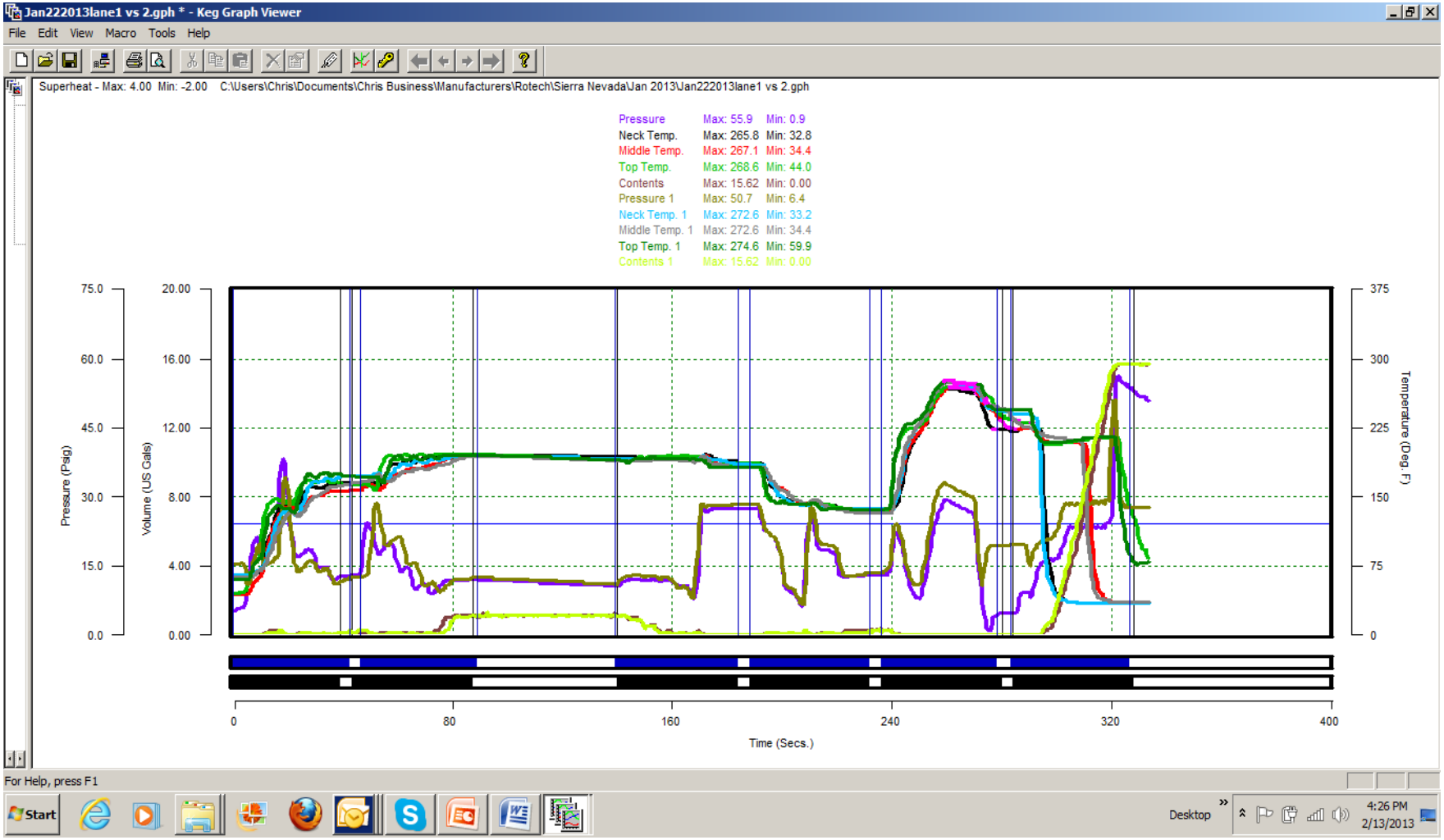
Case Studies:

1.) Sierra Nevada

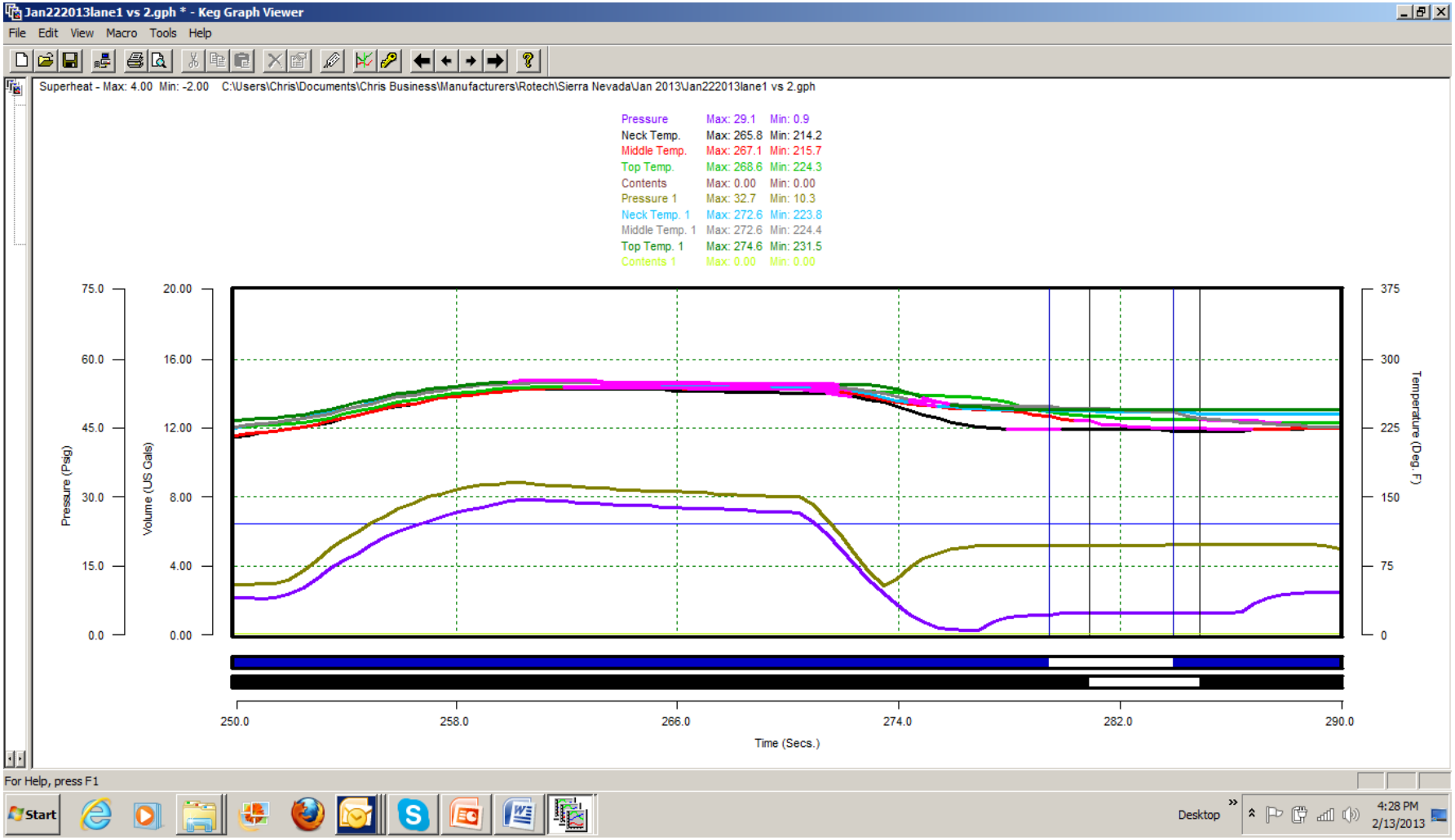
Consulting:

Finding an anomaly.

Engineering checks - Illustration of anomalies



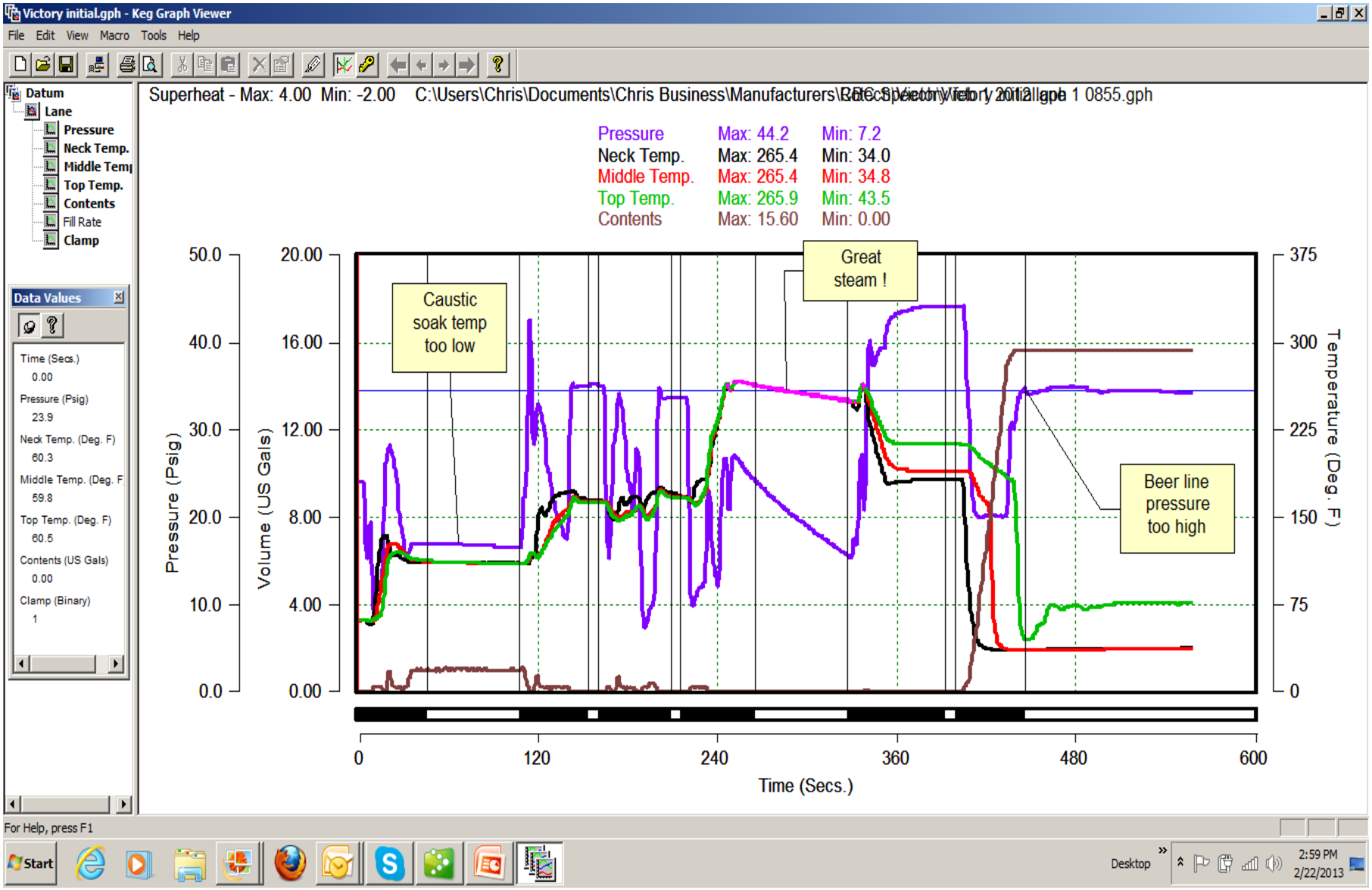
Engineering checks - Illustration of anomalies



Case Studies:

2.) Victory Brewing

Commissioning a new keg line.


Victory initial.gph - Keg Graph Viewer
File Edit View Macro Tools Help
Datum
Lane
Pressure
Neck Temp.
Middle Temp
Top Temp.
Contents
Fill Rate
Clamp
Data Values
Time (Secs.)
0.00
Pressure (Psig)
23.9
Neck Temp. (Deg. F)
60.3
Middle Temp. (Deg. F
59.8
Top Temp. (Deg. F)
60.5
Contents (US Gals)
0.00
Clamp (Binary)
1
Superheat - Max: 4.00 Min: -2.00
Pressure Max: 44.2 Min: 7.2
Neck Temp. Max: 265.4 Min: 34.0
Middle Temp. Max: 265.4 Min: 34.8
Top Temp. Max: 265.9 Min: 43.5
Contents Max: 15.60 Min: 0.00
Caustic soak temp too low
Great steam !
Beer line pressure too high
Pressure (Psig)
Volume (US Gals)
Temperature (Deg. F)
Time (Secs.)
0
120
240
360
480
600
For Help, press F1
Start
Desktop
2:59 PM
2/22/2013

Case Studies:

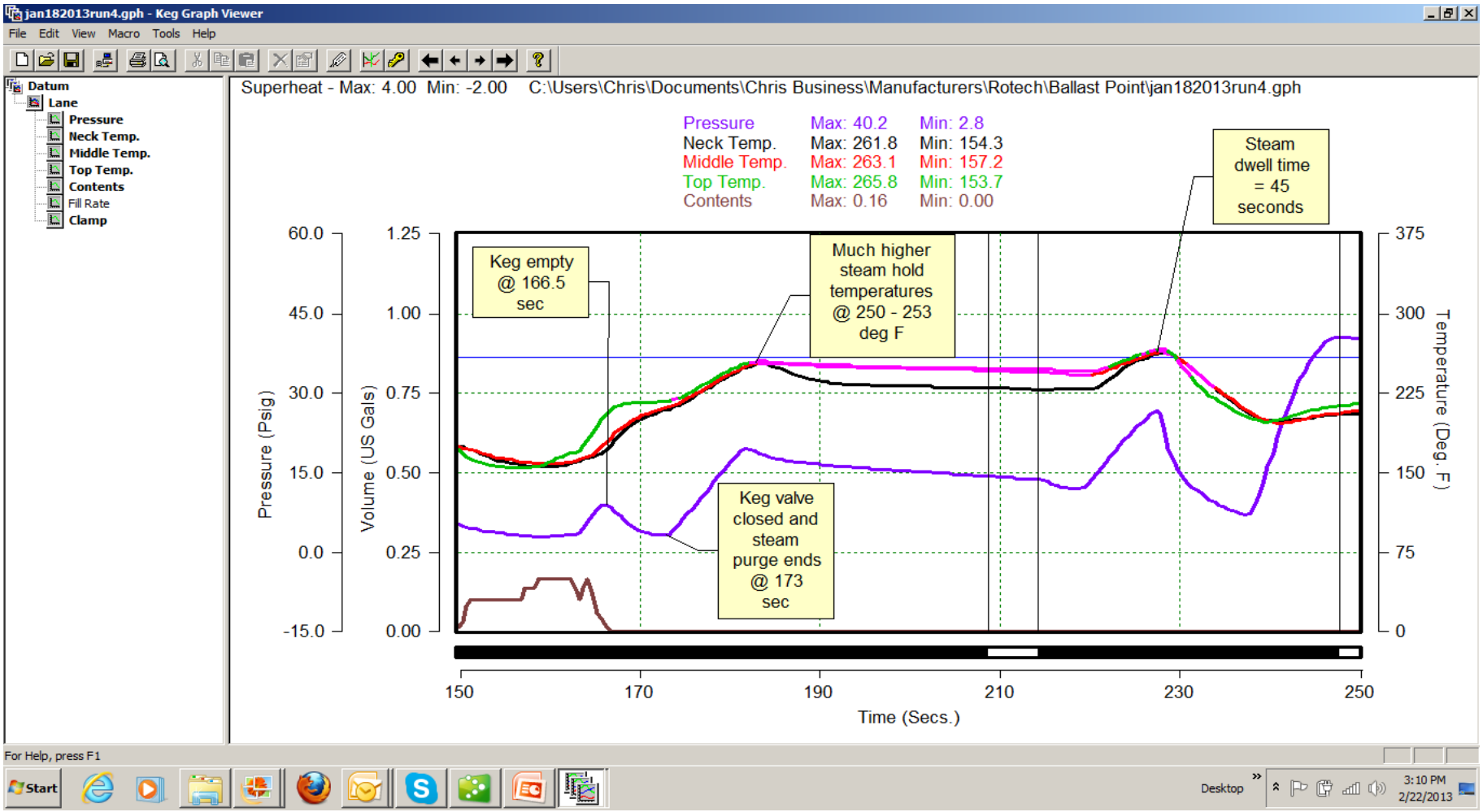
3.) Ballast Point

Commissioning a new keg line.

Before:


jan1120133croppedandlabels.gph - Keg Graph Viewer
File Edit View Macro Tools Help
Datum
Lane
Pressure
Neck Temp.
Middle Temp.
Top Temp.
Contents
Fill Rate
Clamp
Data Values
Time (Secs.)
209.00
Pressure (Psig)
1.2
Neck Temp. (Deg. F)
208.6
Middle Temp. (Deg. F
209.3
Top Temp. (Deg. F)
211.5
Contents (US Gals)
0.00
Clamp (Binary)
0
Superheat - Max: 4.00 Min: -2.00 C:\Users\Chris\Documents\Chris Business\Manufacturers\Rotech\Ballast Point\jan1120133croppedandlabels.gph
Pressure Max: 39.7 Min: 0.6
Neck Temp. Max: 268.6 Min: 150.7
Middle Temp. Max: 268.3 Min: 150.1
Top Temp. Max: 269.8 Min: 146.1
Contents Max: 0.24 Min: 0.00
Purge pressure at 8.2 PSI
Temp at 210 deg F
Pressure at 0.6 PSI
Pressure (Psig)
Volume (US Gals)
Temperature (Deg. F)
Time (Secs.)
For Help, press F1
Start
Desktop
3:13 PM
2/22/2013

After:

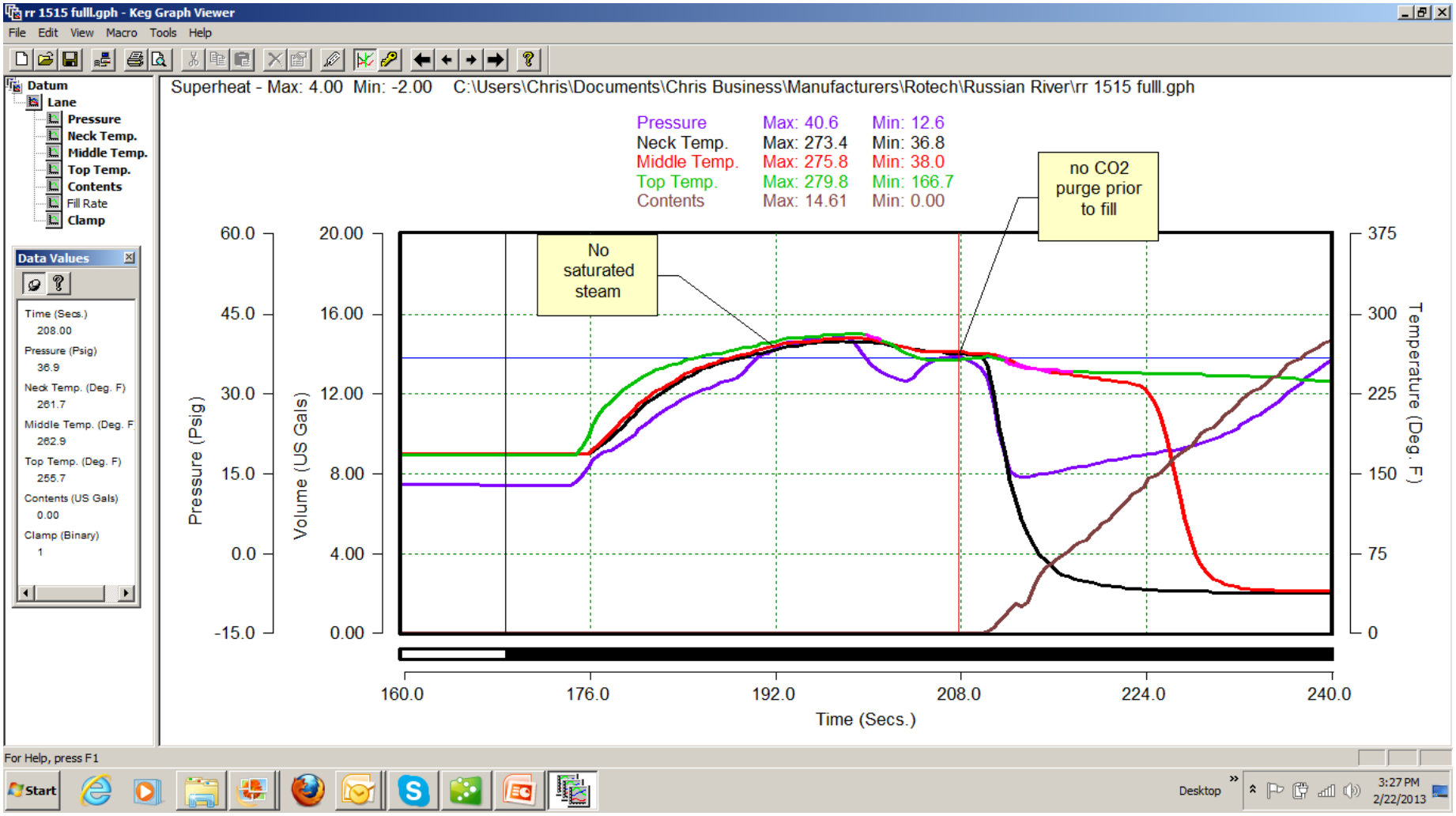

jan182013run4.gph - Keg Graph Viewer
File Edit View Macro Tools Help
Datum
Lane
Pressure
Neck Temp.
Middle Temp.
Top Temp.
Contents
Fill Rate
Clamp
Superheat - Max: 4.00 Min: -2.00 C:\Users\Chris\Documents\Chris Business\Manufacturers\Rotech\Ballast Point\jan182013run4.gph
Pressure Max: 40.2 Min: 2.8
Neck Temp. Max: 261.8 Min: 154.3
Middle Temp. Max: 263.1 Min: 157.2
Top Temp. Max: 265.8 Min: 153.7
Contents Max: 0.16 Min: 0.00
Steam dwell time = 45 seconds
Keg empty @ 166.5 sec
Much higher steam hold temperatures @ 250 - 253 deg F
Keg valve closed and steam purge ends @ 173 sec
Pressure (Psig)
Volume (US Gals)
Temperature (Deg. F)
Time (Secs.)
For Help, press F1
Start
Desktop
3:10 PM
2/22/2013

Case Studies:

4.) Russian River

Commissioning a new keg line.

Before:


rr 1515 fulll.gph - Keg Graph Viewer
File Edit View Macro Tools Help
Datum
Lane
Pressure
Neck Temp.
Middle Temp.
Top Temp.
Contents
Fill Rate
Clamp
Data Values
Time (Secs.)
208.00
Pressure (Psig)
36.9
Neck Temp. (Deg. F)
261.7
Middle Temp. (Deg. F
262.9
Top Temp. (Deg. F)
255.7
Contents (US Gals)
0.00
Clamp (Binary)
1
Superheat - Max: 4.00 Min: -2.00 C:\Users\Chris\Documents\Chris Business\Manufacturers\Rotech\Russian River\rr 1515 fulll.gph
Pressure Max: 40.6 Min: 12.6
Neck Temp. Max: 273.4 Min: 36.8
Middle Temp. Max: 275.8 Min: 38.0
Top Temp. Max: 279.8 Min: 166.7
Contents Max: 14.61 Min: 0.00
no CO2 purge prior to fill
No saturated steam
Pressure (Psig)
60.0
45.0
30.0
15.0
0.0
-15.0
Volume (US Gals)
20.00
16.00
12.00
8.00
4.00
0.00
Temperature (Deg. F)
375
300
225
150
75
0
160.0
176.0
192.0
208.0
224.0
240.0
Time (Secs.)
For Help, press F1
Start
Desktop
3:27 PM
2/22/2013

Acknowledgements

- Justin Walshe, Rotech (Swindon) Ltd.
- Filip Beyens, Lambrechts
- Henning Schlabach, Schaefer Kegs
- Brewers Association
- Sierra Nevada, Victory, Ballast Point, Russian River, Karl Ockert, Steven Pauwels and Kathleen Lawson

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Thank you !

Egyptian Proverb -
Do not cease to drink beer, to eat, to intoxicate thyself, to make love, and to celebrate the good days.