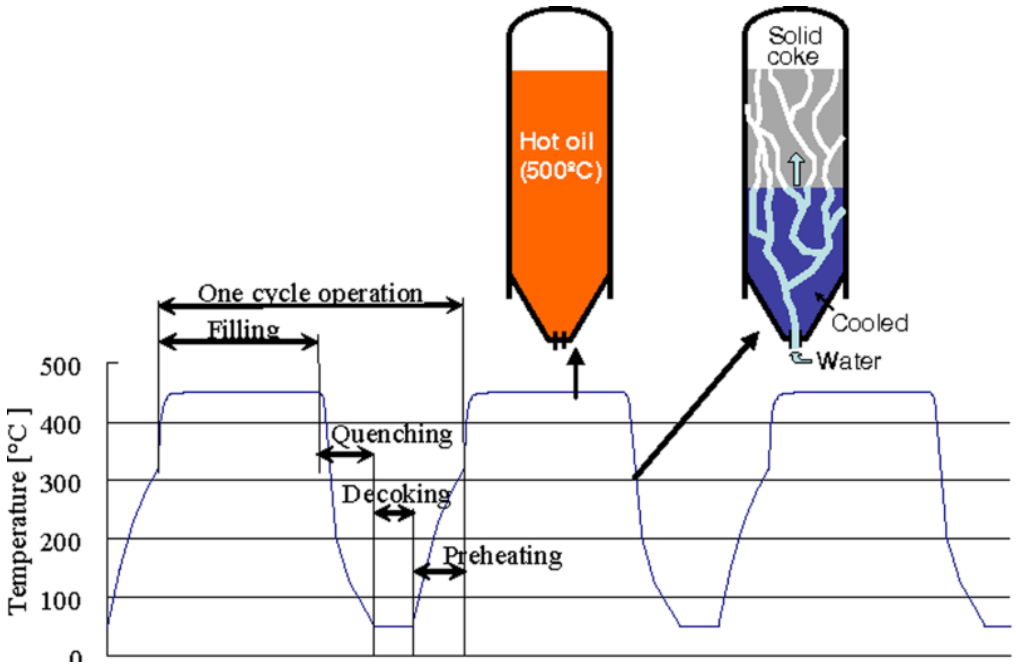
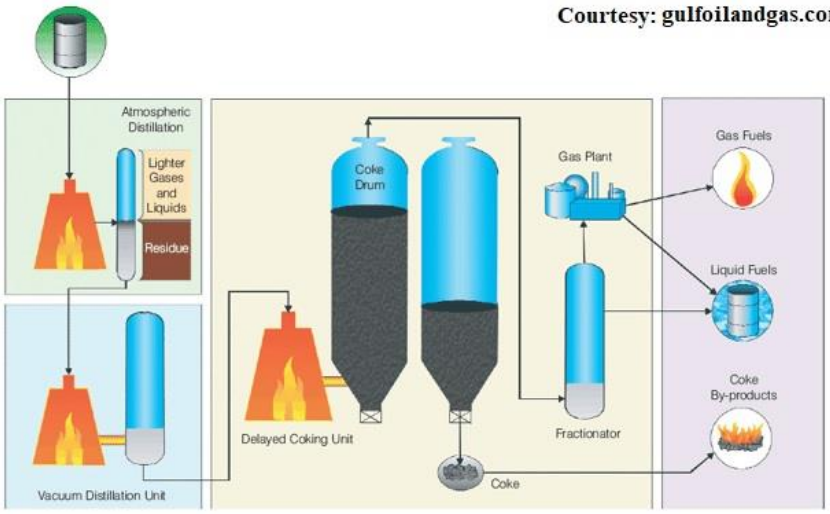
DSL810 - PROJECT -1

Real Time Thermocouple Data Driven Fatigue Life Evaluation of Coke Drum Vessel in Refinery.



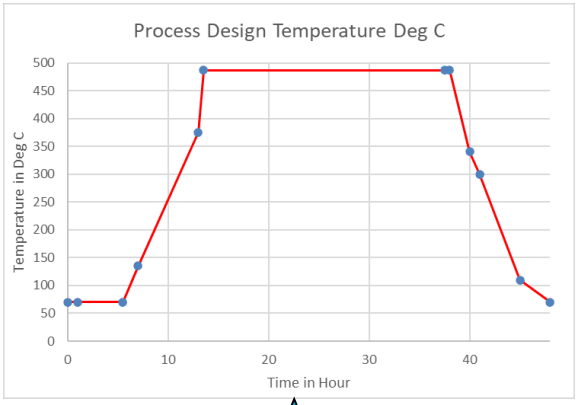


Problem Statement:

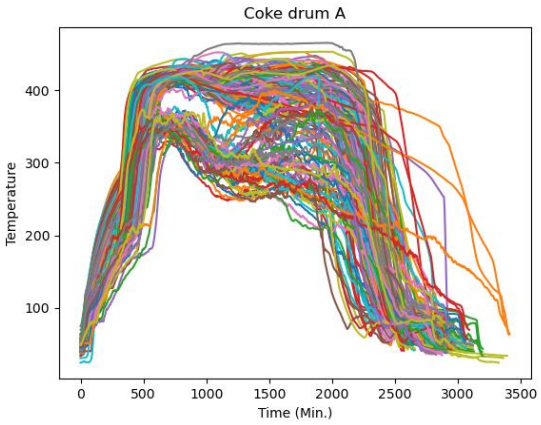
Due to the uncertainties in operation procedure like, rise in supply-demand, poor quality batch of Crude , Inefficient performance of ancillary equipment's in process line, the output process Temperature Cycle varies significantly from Ideal desired temperature Cycle pattern as shown above. As a result the Coke Drum starts to deteriorate earlier than the expected time.

In case of unplanned shutting down of coke drum operation in refinery incurs major loss of upto 30-40% of efficiency of Unit, which is never accepted.

Short-term Problem Statement:



To be Operated Like This



Being Operated Like This

Results in Early Failure.

COKEDRUM LIFE ENHANCING METHOD – An Approach:

Thermal cyclic loading is the causes fatigue failure of Cokedrum.

Thermocouples are attached to Cokedrums.

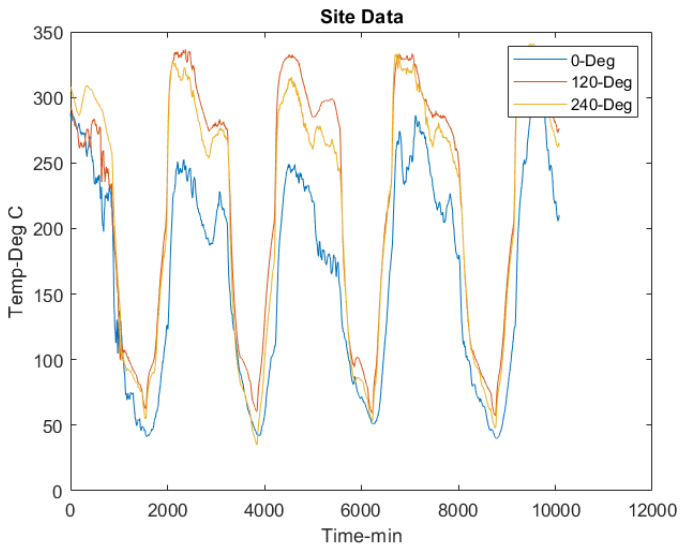
The historian of data from these thermocouples are retrieved. Statistically impact of irregular skin temperature pattern will be studied and effective stresses accumulated will calculated. From which, if the operating procedure follows the similar pattern, the remaining life of the cokedrum will be evaluated as per Standard Code of Construction guided procedures.

```
global abspath datapath scriptpath datasetspath;
%path of the folder
abspath='D:\dataProj\Proj';

%path for the raw data from Jhudata
datapath=strcat(abspath,'\sitedata\');

%path where the scripts are kept
scriptpath=strcat(abspath,'\scripts\');

%path where the results are kept
datasetspath=strcat(abspath,'\datasets\');

addpath(scriptpath);
addpath(datapath);
addpath(datasetspath);
```

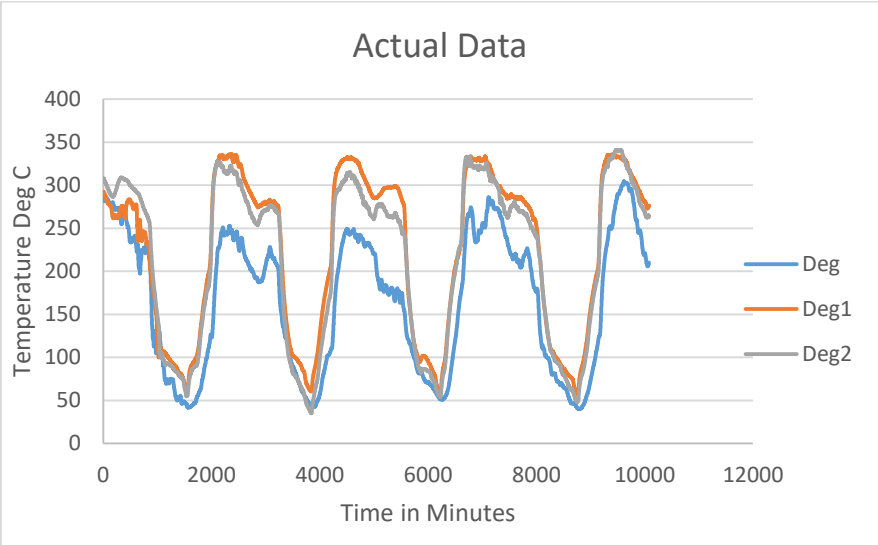
Plotting Data

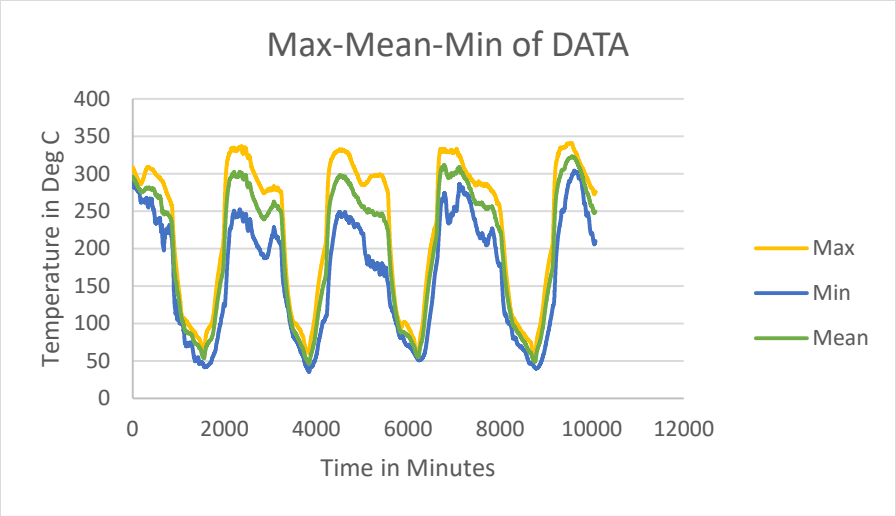
```
plot(R1.Time_mins,R1.Deg);xlabel('Time-min');ylabel('Temp-Deg C');title('Site Data');
hold on;
plot(R1.Time_mins,R1.Deg1);xlabel('Time-min');ylabel('Temp-Deg C');title('Site Data');
plot(R1.Time_mins,R1.Deg2);xlabel('Time-min');ylabel('Temp-Deg C');title('Site Data');
```

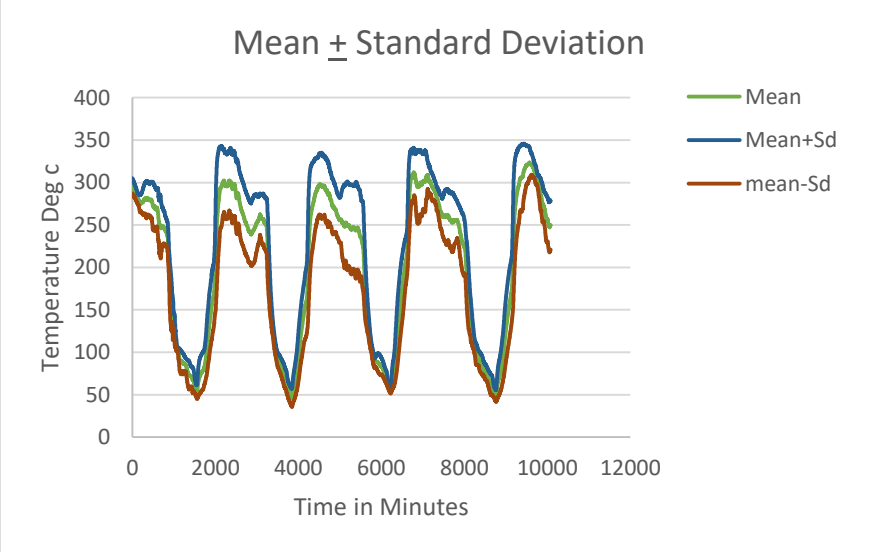
```
hold off;legend('show');legend('0-Deg','120-Deg','240-Deg')
```



The minute-wise data are easily extracted and plotted and visually compared using Matlab. Further the Data obtained has to be filtered and studied. Deg, Deg1 & Deg 2 are Thermocouple Probes.



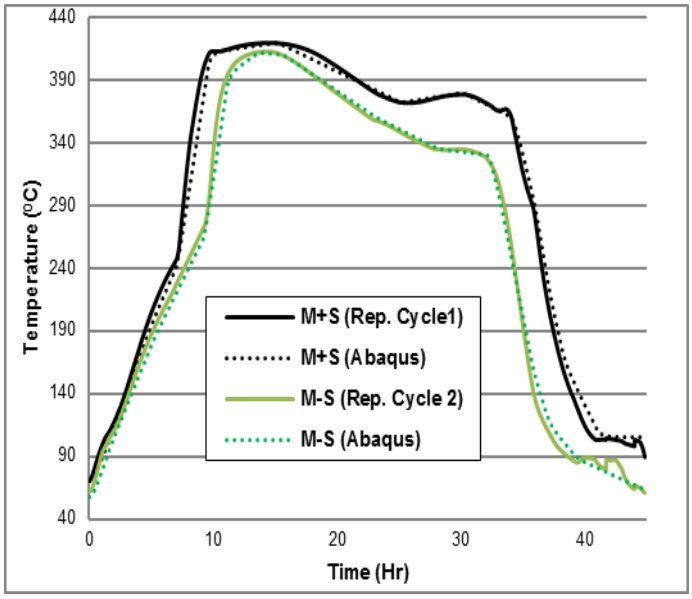




Kirkpatric et al.(2003) Guidelines

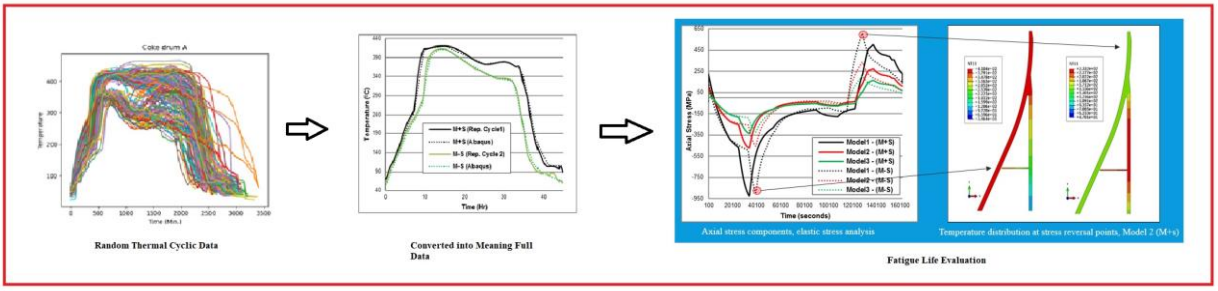
-An avg thermal profile incorporating all possible conditions
-Good baseline curve including critical thermal fluctuations
-Using most severe heating and cooling rates can be conservative and should be considered if thermal cycle varies
-If severe distinct transients exists, more than one base line curve may be required

For the representative cycle, the fatigue Evaluation is performed as per ASME Section VIII Division 2 and life of the Coke drum will be estimated.

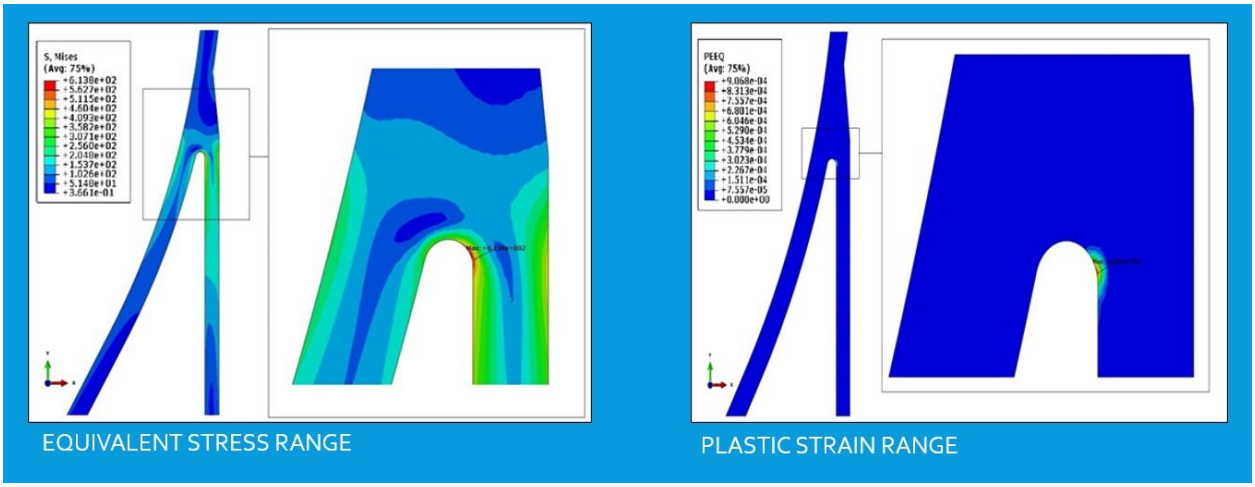


Further, after obtaining larger amount of Data, the analysis will be performed and more accurate remaining life of Cokedrum shall be calculated.

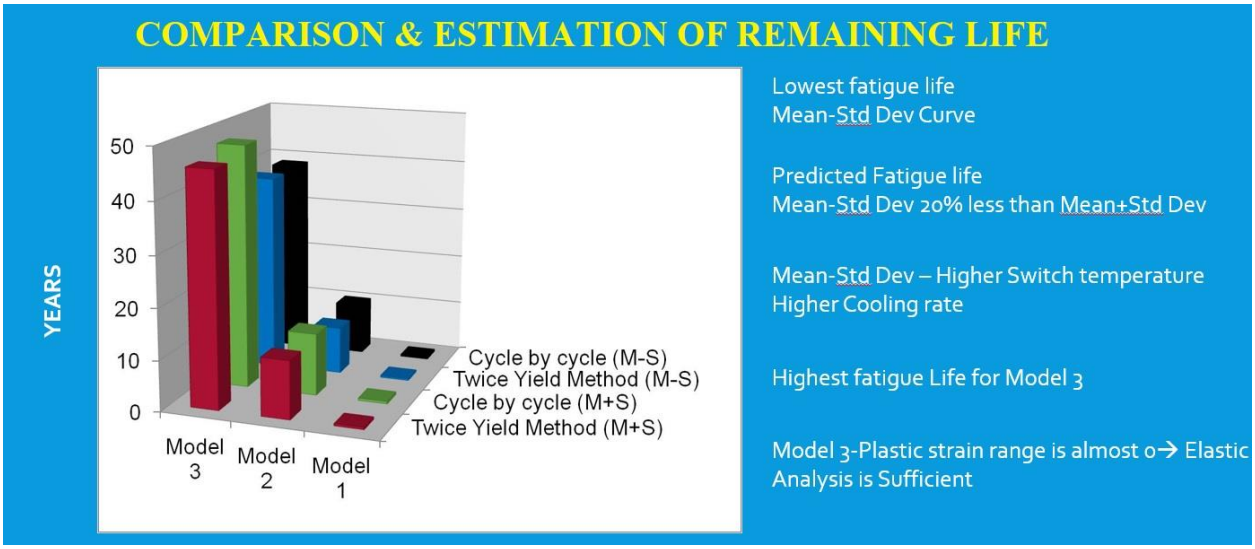
From the Processed data, the FE model is evaluated for Fatigue life calculations.



Stresses are Evaluated at Critical Point of Failure.



Then CokeDrum Fatigue Life Adequacy Shall Be Evaluated.



More Data; More accurate will be the results.

PROJECT PROPOSED TIMELINE

Timeline

1st spiral - End of november

2nd spiral - 15 Dec

3rd Spiral - 1st week of Jan

1st Nov	1st Nov - 30 Nov	1st Dec - 15 Dec	15 Dec - 7 Jan	7 Jan - After
Project Proposal Submission	**1st Spiral** we will take 1 week of data and evaluate the life	**2nd Spiral** 100 days data + visual representation + comparison with actual data	**3rd Spiral** Digital prototype + improvement is visual representation + accuracy	**4th Spiral** Expand the data set