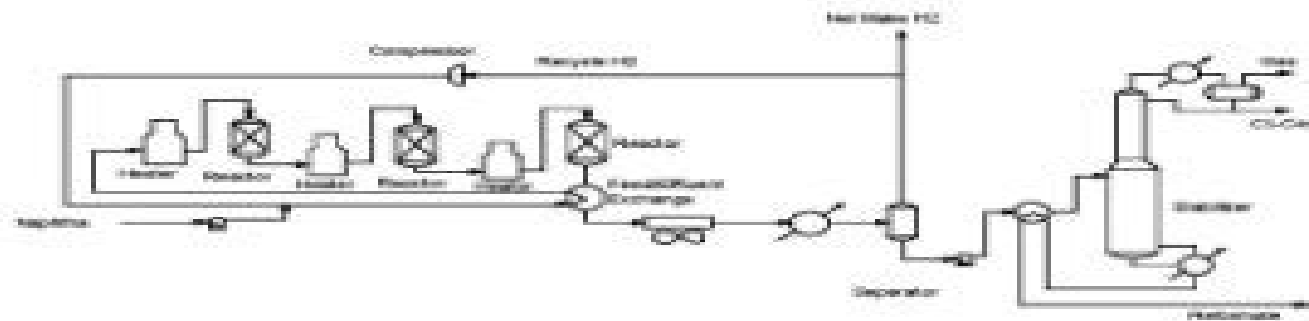


REFINERY PROCESS MODELING

Sample Problem Three:

Modeling a Naphtha Desulfurizer/Reformer Unit



Gerald L. Kaes

*Consulting Chemical Engineer
Chemical Process Simulation
Calbert, Georgia*

Refinery Process Modeling Sample Problem One

Modeling A Crudevacuum System With Preheat Train

**Gerald L. Kaes, Kaes Enterprises,
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Although chemical and physical phenomena underlying fouling deposition are extremely complex and several details remain unknown the understanding of the fouling process has progressed significantly in the past 40 years. However, this knowledge has so far not been exploited to effectively improve heat exchanger and heat exchanger network design and operation. As a result, old methodologies that neglect the local effects and dynamics of fouling in favour of lumped steady state heuristic models, e.g. using TEMA fouling factors, are still used. In this thesis, a novel mathematical model for pre heat trains undergoing crude oil fouling was developed, validated with plant data and used to propose mitigation strategies. The model is dynamic, distributed and considers simultaneously several scales of investigation. Key phenomena are captured at the tube level as a function of local conditions. These include the dependence of fouling rate on temperature and velocity, the variation of physical properties, the structural changes of the deposits over time, ageing and the dynamics of surface roughness. The single tube model was then extended to describe a unit scale heat exchanger geometry. This has been validated against plant data from four units in two refineries operated by major oil companies. The predicted outlet temperatures over extended periods, i.e. 4-16 months, are accurate within 1% for the tube side and 2% for the shell side. Model simulations were then used to assist the retrofit of one particular unit for which it was possible to save ca. 22% of the energy losses, not including pumping power produced by fouling, over ca. a year of operation. Finally, the interconnection of single heat exchangers in a network allowed the simulation of the fouling behaviour of two existing pre heat trains. To systematically assess the impact of fouling on refinery economics, a set of key performance indicators (KPIs) was proposed. Network level simulations were used in conjunction with the KPIs to unveil complex interactions and propose network retrofit arrangements that improve energy recovery over time whilst reducing fouling. It is concluded that the model can be used with confidence to predict fouling and assist monitoring, design and retrofit of refinery heat exchangers and heat exchanger networks. The results shown indicate that the approach proposed can lead to substantial benefits. *Crude Oil Fouling* Francesco Coletti, Geoffrey

Hewitt, 2014-11-21. Nearly every gallon or litre of fuel which is used in transport vehicles, cars, trucks, trains, aeroplanes, etc. is derived from oil which is extracted in the crude state from oil wells and which is then processed in an oil refinery to yield the required transport fuel, gasoline, diesel, kerosene, etc. The first task in the refinery is to separate these useful fuels from the crude oil by the process of distillation, in which the components of the oil are separated on the basis of their volatility. Of course, the components of crude oil which are of volatility too low to allow them to be used as fuels are also separated in the distillation process and can be either directly used, for example as lubricating or fuel oils, or can be chemically converted to more volatile materials. Refinery Process Modeling Gerald L. Kaes, 2008

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Table of Contents Refinery Process Modeling Sample Problem One Modeling A Crudevaccum System With Preheat Train

1. Understanding the eBook Refinery Process Modeling Sample Problem One Modeling A Crudevaccum System With Preheat Train
 - The Rise of Digital Reading Refinery Process Modeling Sample Problem One Modeling A Crudevaccum System With Preheat Train
 - Advantages of eBooks Over Traditional Books
2. Identifying Refinery Process Modeling Sample Problem One Modeling A Crudevaccum System With Preheat Train
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Refinery Process Modeling Sample Problem One Modeling A Crudevaccum System With Preheat Train
 - User-Friendly Interface
4. Exploring eBook Recommendations from Refinery Process Modeling Sample Problem One Modeling A Crudevaccum System With Preheat Train
 - Personalized Recommendations

- Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train User Reviews and Ratings
 - Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train and Bestseller Lists
5. Accessing Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train Free and Paid eBooks
- Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train Public Domain eBooks
 - Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train eBook Subscription Services
 - Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train Budget-Friendly Options
6. Navigating Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train eBook Formats
- ePub, PDF, MOBI, and More
 - Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train Compatibility with Devices
 - Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train Enhanced eBook Features
7. Enhancing Your Reading Experience
- Adjustable Fonts and Text Sizes of Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
 - Highlighting and Note-Taking Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
 - Interactive Elements Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
8. Staying Engaged with Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
- Joining Online Reading Communities
 - Participating in Virtual Book Clubs

- Following Authors and Publishers Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
- 9. Balancing eBooks and Physical Books Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
 - Setting Reading Goals Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
 - Fact-Checking eBook Content of Refinery Process Modeling Sample Problem One Modeling A Crudevacuum System With Preheat Train
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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