Refinery And Chemical Industry Emissions Symposium

Symposium Presentation Summaries

Developed by UC Davis Air Quality Research Center Conference Staff

Symposium Overview

Refineries and chemical industry facilities store and use large quantities of chemicals. Some of these chemicals pose health risks since they may be toxic, become toxic due to reactions in the atmosphere, or pose a fire or explosion hazard. In response to recent episodic releases and fires from such facilities, the state of California has requested that the Air Quality Research Center at UC Davis convene a conference on this subject to exchange information on the state of science and policy related to these risks and appropriate responses. The conference will cover:

1. Modeling episodic and ongoing emissions from these facilities
2. Measuring these emissions
3. Using these models and measurements for appropriate emergency response

Symposium Sessions

1. Opening Case Studies
2. Plenary
3. Episodic Measurements
4. Long Term Measurements
5. Emissions Estimation
6. Routine Modeling
7. Episodic Modeling
8. Policy & Community Involvement
9. Needs & Gaps Assessment

Opening Case Studies

Importance of Safety Culture

Manny Ehrlich, Chemical Safety Board

Examining the importance of a safety culture, Manny Ehrlich discusses the dangers unsafe practices. Typical, repetitive, issues were seen throughout the analysis as a result of poor safety culture. Ehrlich points to a "normalization of deviance," where employees take risks and shortcuts, leading to dangerous situations.

Connecting Ozone Exceedances in Houston TX to Variability in Industrial Emissions: Implications

Will Vizuete, University of North Carolina, Chapel Hill

Will Vizuete analyzes the Houston area regarding ozone exceedance events. With the highest concentration of oil and gas refineries in the US, there are major attainment issues. Vizuete found that rotational wind pattern in the late afternoon that affected local concentrations, characterizing each event using both spatial and temporal characteristics. Lastly, Vizuete discusses the importance of model resolution for tracking these events, identifying the plume requires data on the event, location, and meteorology.

IoT sensing as a tool for determining the resilience of buildings for forest fire generated PM2.5

Jovan Pantelic, University of California, Berkeley

Jovan Pantelic discusses a case study performed in Berkeley, CA involving building protection from forest fire pollution. This study, involving two buildings, analyzes the concentration variances between differing ventilation methods. Pantelic found that mechanically ventilated buildings protected occupants better than naturally ventilated buildings. In addition to this analysis, Pantelic found that occupant perception aligned with the data, though it is not necessarily an adequate identifier of air quality danger.

Plenary

Managing Public Expectations in Times of Crisis, Case Study of the Torrance Refinery Explosions and AB 1646 Implementation into the South Bay Region of Los Angeles County

Soraya Sutherlin, Emergency Management Safety Partners

Discussing the impacts of AB 1646 on the South Bay, this presentation analyzes the Torrance Refinery Explosion and critical takeaways from this event. Sutherlin analyzes the methods used to notify the public during and after this event, pointing to areas of improvement in the future.

Episodic Measurements

Managing and Reducing Uncertainties in ORS Based Flux Measurements

Marianne Ericsson, Fluxsense Inc

This presentation analyzes two technologies used for FLUX measurements, DIAL and SOF, discussing uncertainties and reliability. Uncertainties arise from measurements such as wind or ambient sources, publishing an uncertainty of 20-30%. These measurements allow for the facility to understand their emissions and take initiative.

Development of an Unmanned Aerial Vehicle (UAV) for Episodic Air Pollution Measurements

Aravind Sreejith, University of California, Davis

Aravind Sreejith discusses the development of data driven methodologies to design and build plume models through the collection of 3D time series data using UAVs. This method can be used for things such as plume detection or source estimation. Sreejith discusses the sensor package used and the preliminary implementation of this design.

Inverse Modeling of Episodic Measurements for Conventional and Real Time Applications

Jay Olaguer, Michigan Department of Environment

This presentation discusses three examples of inverse modeling applications. The first example explains how dispersion modeling was implemented to track Ethylene Oxide emissions from a sterilization facility. The second example discusses the use of dispersion modeling regarding refinery emissions of reactive formaldehyde. Lastly, the third example discusses the application to underground pipeline leaks of benzene.

Jack Rabbit II Source Description for Atmospheric Dispersion Modeling

Tom Spicer, University of Arkansas

This presentation analyzes the Jack Rabbit II experiments involving liquid chlorine releases, used to quantify the behavior of catastrophic releases. Quantifying characteristics of these releases such as mass release rate and rainout estimations can help quantify these releases. These source characteristics can be then inputted into atmospheric dispersion models.

BTEX Observations by UV Absorption Spectroscopy: From Research to Monitoring

Jochen Stutz, University of California, Los Angeles

Jochen Stutz discusses the applications of UV absorption spectroscopy in BTEX observations. Stutz discusses the reliability of various methods and instruments and how this method can be implemented.

Long Term Measurements

Developing a Community Air Monitoring Network to Assess the Impacts of Refinery Emissions

Olga Pikelnaya, South Coast Air Quality Monitoring District

This presentation discusses combating the issue of underestimated emissions and the implementation of the South Coast AQMD rule 1180. Olga Pikelnaya suggests installing air monitoring systems relative to the size of the refinery and taking the goals of these measurements into account when choosing instruments. Pikelnaya suggests displaying air quality to the public and distributing educational material to better understand this data.

Use of Open Path UV-DOAS as an Alternative Method to Meet Fence-line Monitoring Provisions for Federal Benzene Monitoring Rule: A Case Study

Mark Wicking-Baird, Argos Scientific Africa Inc.

This presentation analyzes a case study involving running open path UV-DOAS within a refinery environment. Mark Wicking-Baird discusses various methods and models pertaining to this method to fence-line monitoring.

Lessons Learned During BAAQMD Required Refinery Fence Line Monitoring Program Development - Available Technology & Data Quality System Update

Jerry Bovee, Bay Area Air Quality Management District

This presentation discusses the history leading to Reg. 12, Rule 15 and the Air Monitoring Guidelines for Petroleum Refineries. Jerry Bovee presents the fence-line monitoring program requirements and the various factors that must be considered when monitoring.

Emissions Estimation

Estimating air pollutant emissions from co-processing raw bio-oil in petroleum refineries

Arpit Bhatt, National Renewable Energy Laboratory

Arpit Bhatt discusses two types of permits New Source Review program and the Title V permitting program. With these two programs, Bhatt suggests that bio-oil could be an attractive option. This presentation includes an analysis of co-processing including limitations and potential.

Establishing Refinery Emission Inventories - ORS Measurements or Permit Based Calculations

Marianne Ericcson, Fluxsense Inc.

This presentation focuses on the transition from calculated emissions to measured emissions. There are various measurement technologies available and with the inaccuracy of calculated emissions, Marianne Ericcson suggest the US transition away from calculated emissions. Ericcson explains the main components required for measuring emissions in her presentation and advantages of measuring emissions.

Artificial Intelligence Models for the Predictive Analysis of Flaring Performance

Helen Lou, Lamar University

Helen Lou introduces her research on flaring and her development of a combustion mechanism as well as a CFD simulation of flares in this presentation. Lou also discusses her dynamic simulation for flare minimization and predictive flare control.

Routine Modeling

Regional Shelter Analysis: Assessing the Protection US Buildings Provide Against Outdoor Particulate Hazards

Michael Dillon, Lawrence Livermore National Laboratory

In this presentation, Michael Dillon discusses the under appreciated protection that buildings provide from outdoor pollutants. Dillon discusses his research into regional shelter analysis, incorporating shelter quality into existing assessment methods.

Using Dispersion Modeling and Monitoring as a Basis of Estimating Emissions from Refineries

Shari Libicki, Ramboll

Shari Libicki discusses analysis of fence-line data involving the Chevron refinery in Richmond, CA. Ramboll is working to make fence-line data available through an app available to the public using Ramboll Shair.

Forecasting Wildlife Smoke PM2.5 Using the AIRPACT5 Air-Quality Forecasting System: Recent Experience, Emerging Approaches and a Near-term Application

Joseph Vaughan, Washington State University, Laboratory for Atmospheric Research

This presentation by Joseph Vaughan describes AIRPACT5, a fire emission forecasting program available through Washington State University. AIRPACT5 consists of many components and Vaughan discusses how plume rise is detected and other intricacies within the program.

VOC Source Signatures and Source Apportionment Studies from Automated Gas Chromatography Data in Houston, TX

Bradley Flowers, AECOM

In this presentation Bradley Flowers discusses the recent trends in ozone, NOx, and VOCs, VOC apportionment studies, and VOC source signatures. With a large, rich, data set, Flowers uses Houston in his analysis.

Episodic Modeling

Overview of HSE's Approach to Dispersion Modeling of Major Accident Hazards in Great Britain

Simon Grant, Health and Safety Executtive

Simon Gant discusses UK's regulatory context and HSE's role within this environment, explaining dispersion modeling tools and applications. Explaining DRIFT and recent research, Gant point to knowledge gaps and challenges HSE faces.

Jack Rabbit II Inter-model Comparison Exercise

Joe Chang, RAND

In Joe Chang's presentation he describes the Jack Rabbit II experiments and inter-model comparison protocols and participants. Chang discusses Arc Max C observations and comparison of cloud width and height.

Experimental Program to Model Chlorine Reactivity with Environmental Materials in Atmospheric Dispersion Models

Tom Spicer, University of Arkansas

In this presentation, Tom Spicer discusses atmospheric modeling by dry deposition while examining past and present experimental data. Spicer points out that previous assessments have not analyzed the environmental deposition of chlorine as his project does.

Employing Machine Learning Techniques to Determine Emission Sources at Industrial Facilities Use of Open Path Air Monitoring Systems

Don Gamiles, Argos Scientific, Inc.

> Don Gamiles discusses the goals of fence-line monitoring in his presentation while providing an overview of machine learning and its applications. Gamiles describes a case study conducted at a refinery with sensors surrounding the fence-line.

Recent Improvements to Industrial Chemical Safety, Preparedness, and Response Modeling

Michael Dillon, Lawrence Livermore National Laboratory

> In Michael Dillon's presentation, he analyzes the difference between "at-risk" populations versus "affected" populations while introducing the Goldfish study and Response Risk Assessment. Determining the difference between these two populations can assist in planning while considering other factors.

Policy and Community Involvement Panels

Community Right to Know Panel Discussion

Moderator: Greg Nudd, Bay Area Air Quality Management District

Panelists: Andres Soto, CBE, Helen Mearns, DHS S&T Chemical Security Analysis Center

> Opening the discussion, Andres Soto discusses his position with Community for a Better Environment and their triad model aimed at advocating for the community. Emphasizing Richmond's current environmental state, Soto discusses CBE's experience with BAAQMD. Helen Mearns explains her position and why her department exists, discussing the wide range of responsibilities it has. Following the opening statements, the panel takes questions from the audience.

Policies to Address Refinery and Industrial Emissions Panel

Moderator: Alan Lloyd, University of Texas, Austin

Panelists: Suma Peesapati, CalEPA, Andres Soto, CBE, Tiffany Roberts, WSPA

> Tiffany Roberts introduces the overall future of energy, including what that may look like and the current consumption of fossil fuels. Roberts concludes with her experience in the field. Suma Peesapati discusses her experiences with the policy aspect of air quality management and environmental management in general. Peesapati includes the state of federal level government and the various goals of current policy implementation. Andres Soto includes the current areas of focus within environmental management and its recent evolution in his opening statement. Soto continues to explain the political atmosphere surrounding air quality management. The panel takes questions from the audience regarding the current state of policy and the pros and cons to cap-and-trade.

Case Study by Community for Better Environment

Moderator: Greg Bazley, US EPA Region 9

Panelist: Greg Karras, CBE

This panel discussion was led by Greg Karras from Community for Better Environment. With a commitment to work for a just transition to renewable energy, Karras discusses how to transition and the concept of cap-and-trade.

Case Studies Panel

Moderator: Greg Bazley, US EPA Region 9

Panelists: Elena Craft, EDF, Tony Miller, Entanglement Technologies

Elena Craft and Tony Miller discuss emergency response and effective communication. The panelists explain policy objectives, requirements, and data generation. Craft and Miller analyze a large scale fire event in Houston, TX and a power interuption in Benicia, CA.

Needs and Gaps Assessment Panel

Moderator: Greg Vlasek, California Air Resources Board

Panelists: Will Vizuete, University of North Carolina, Chapel Hill, Olga Pikelnaya, South Coast Air Quality Management District, Greg Yarwood, Ramboll, Joe Chang, RAND, Greg Bazley, US EPA Region 9, Alan Lloyd, University of Texas, Austin

The members of this panel give perspectives on the presented info from the entire conference with thoughts on current practices and the future of these topics. Each speaker gave their thoughts on the overall conference and specific ideas presented throughout the week, highlighting presentations and topics that really stood out to them.