INTRODUCTION TO POWER PLANT CHEMISTRY
For NON CHEMICAL ENGINEERS

30 NOVEMBER – 2 DECEMBER 2015, KUALA LUMPUR

TOPICS COVERED

- Steam Turbine and Steam Path Chemistry and Failure Mechanisms
- Boiler / Heat Recovery Steam Generator (HRSG) Chemistry and Failure Mechanisms
- Feedwater Cycle Chemistry Treatments and their Effective Management
- Boiler and HRSG Evaporator Treatments and their Effective Management
- Alternative Cycle Chemistry Treatments and their Management
- Water Treatment Plants
- Cooling Water Chemistry
- Sampling and Analysis Systems
- Inter-relationship of Chemistry Monitoring Parameters
- Inter-relationship of Chemistry Parameters around the Cycle
- Diagnosing and Troubleshooting Cycle Chemistry Issues
- Technical Question and Answer Sessions

Expert Course Faculty Leader
DAVID ADDISON
BSc(Chemistry), MSc(Materials Science)
About This Training Course

This is an introduction cycle chemistry training course for power plant engineers, operators, managers and technicians wishing to expand their knowledge and skills in relation to thermal power plant chemistry for conventional, combined cycle and co-generation plants. Any chemists or chemical engineers recently employed in the thermal power industry will also benefit from this course.

The course will provide ample opportunity for robust technical discussion and expand on concepts in thermal power plant cycle chemistry. As well as cycle chemistry the course also covers water treatment plants, cooling water chemistry and sampling and analysis systems. After registration a plant survey form will be issued to each attendee to allow customization of the course material.

Learning Outcomes

At the completion of this course the attendees should have a significantly increased understanding of cycle chemistry in a thermal power plant and the interrelationships between plant operation, cycle chemistry and potential failure modes due to corrosion and/or deposition throughout the cycle.

Attendees will be better equipped to understand and effectively manage the corrosion and deposition risks in a thermal power plant.

Who Should Attend

The course has been designed for attendees that have 1-5 years’ experience in a thermal power station or co-generation plant (conventional or combined cycle plants) and that have a basic understanding of the form and function of a thermal power station.

The course is suitable for persons without any power plant chemistry or power plant chemical engineering background or are new to the area of cycle chemistry.

After registration pre-course required technical reading will be issued to the attendees.
3 Day Course Outline

Corrosion and Deposition Damage Mechanisms in the Steam / Water Cycle + Cycle Chemistry Programs
- **Boiler / Heat Recovery Steam Generator (HRSG)**
  - Deposition and corrosion
  - Underdeposit corrosion
  - Carryover
- **Steam Turbine and Steam Path**
  - Chemistry of the Phase Transition Zone
  - Volatility of Impurities
  - Corrosion processes
- **Condensate System, Feedwater heaters and Deaerators**
  - Single and two phase flow-accelerated corrosion
  - Copper alloy corrosion
- **Condensers**
  - Condenser tube failures, Air Cooled Condenser failures
- **Feedwater Cycle Chemistry Programs**
  - All Volatile Treatments (Oxidising and Reducing)
  - Oxygenated Treatment
  - Amines (neutralizing and filming)
- **Boiler / Evaporator Cycle Chemistry Programs**
  - Phosphate Treatment
  - Caustic Treatment
  - All Volatile Treatment

Full day training module; covers the details of corrosion / deposition damage mechanisms in the major components of the steam / water cycle and introduces feedwater and boiler water cycle chemistry programs based on International Association for the Properties of Water and Steam (IAPWS) technical guidance documents and other international standards.

Cycle Chemistry Control
- **Chemistry Control Equipment**
  - Chemical dosing systems
  - Sampling systems/wet racks
  - Cycle chemistry instrumentation
- **Introduction to Water Treatment Plants**
  - Pre-treatment
  - Reverse osmosis/electrical deionization plants
  - Ion exchange plants
  - Condensate polishers
- **Layup and Storage**
  - Influence of offline environment
  - Plant storage/mothballing
- **Effective Cycle Chemistry Management**
  - Routine, troubleshooting and strategic chemistry
- **Diagnosing and Troubleshooting Cycle Chemistry Issues**
  - Trends and validation analysis techniques

Full day training module; covers the details of chemical dosing sampling & analysis systems and water treatment plants. Also covered are chemistry aspects of layup and storage and effective cycle chemistry management and troubleshooting.
3 Day Course Outline

Cooling Water/Additional Monitoring/Steam Turbines

- **Cooling Water Chemistry**
  - Cooling tower chemistry
  - Once through cooling – sea water and fresh water
  - Air cooled condensers

- **Corrosion Product Sampling**
  - Effective total iron and total copper sampling and analysis

- **Case Study 1**
  - Cycle chemistry treatments

- **Inter-relationship of Chemistry Parameters around the Cycle**
  - Steam / boiler / HRSG / feedwater / condensate / makeup water relationships

- **Case Study 2**
  - Trouble shooting and data analysis

- **Carryover**
  - Boiler and HRSG carryover

- **Introduction to the Steam Turbine and Steam Path**
  - Chemistry of the phase transition zone
  - Volatility of Impurities
  - Corrosion processes

- **Final Test**
  - Open book test

Full day module; covers cooling water chemistry, corrosion product sampling, carryover, and steam turbine chemistry. Also included are two case study sessions were specific cycle chemistry problems will be outlined and solutions developed for in small groups.

Your Expert Course Faculty

**David Addison** (MSc) is the principal Power Plant Chemistry consultant of Thermal Chemistry Limited (New Zealand) where he works with utility organizations worldwide helping to resolve water/steam cycle chemistry, flow-accelerated corrosion, cooling water, water treatment plant and other water/steam related issues for thermal, co-generation and geothermal power plants. These activities are carried out with a clear focus on addressing the root cause of the problems being experienced and ensuring long term resolutions are in place.

Prior to starting up Thermal Chemistry Limited in April 2008, David has worked in the power industry since 1997 and was employed at the largest power station in New Zealand, the Huntly Power Station as a senior project chemist, where he was involved in all aspects of power station chemistry for both conventional (coal and gas) and combined cycle gas turbine units with a heavy involvement with major cycle chemistry changes (AVT[o] to OT), chemical cleaning, and the specification, design review, construction, commissioning and early operation of combined cycle gas turbine units.

David has presented and chaired sessions at numerous international cycle chemistry conferences and user groups meetings worldwide and has had multiple papers and articles published in scientific and industry journals on cycle chemistry in conventional units, cycle chemistry & chemistry commissioning issues in combined cycle gas turbine units, cycle chemistry management for combined cycle units, condensate polishing, and geothermal power plant chemistry.

David has been a contributing author to a book on combined cycle gas turbine plants, a senior author for the latest Electrical Power Research Institute (EPRI) cycle chemistry guidelines for combined cycle power plants, and the lead coordinating author for the soon to be published International Association for the Properties of Water and Steam (IAPWS) Technical Guidance Document (TGD) for corrosion product sampling and analysis in thermal power plants.

David is a member of the Power Cycle Chemistry (PCC) group of the International Association for the Properties of Water and Steam (IAWPS) and is involved in the development of international cycle chemistry guidelines.
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Courses Available

4 Pillars of Transformer Condition
Advanced Project Finance for Power
Advanced Technical Report Writing & Presentation Skills
Advanced Turnaround Shutdown & Outage Management
Ancillary Services in Competitive Electricity
Asset Management for the Power Industry
Best Practice Renewable Energy Capital & Project Management
Biomass Power Generation
CFB Combustion for Boiler Operations
Clean Development Mechanism and Carbon Markets
Coal Contracts
Combined Cycle Power Plants Operation
Combined Heat & Power (CHP) and Co-Generation Plant Operations
Competency Management System for the Power Industry
Design & Operations of Circulating Fluidized Bed Boiler
Developing & Structuring Public-Private Partnership (PPP) for Infrastructure
Effective Tender Process Management for Power & Utilities
Electrical Hazop (eHazop) Studies for the Power Industry
Electricity Demand-Side Management
Electricity Industry Design
Electricity Network Planning
Electricity Retail Contracts
Electricity Theft
Electricity Trading Essentials
Energy Efficiency
EPC Contract Management for Power & Utilities
Essentials of Coal Markets and Trading
Essentials of Power Trading
Excitation Systems
Feed-In Tariffs for PV Systems
Finance for Non-Finance Professionals in Power & Utilities
Financial Modelling for Project Finance in Power & Utilities
Fitness-For-Service AP1 579 & High Energy Piping Life Management
Fundamentals of Geothermal Energy
Fundamentals of Power Generation
Gas & LNG Contract Negotiation
Gas Turbine Generator Selection, Operation & Maintenance
Gas Turbine Hot Gas Paths, Rotors & Failure Analysis
Gas Turbine Major Inspection & Overhaul
GE Gas Turbine Operations Simulation Based HRSG Design, Operations & Understanding, Controlling of HRSG Damage
Mechanisms
HV Substation Design & Construction
IEC for Utilities
Integration of Distributed Generation
Introduction to Carbon Capture & Storage
Introduction to Clean Coal Technology
Introduction to Power Systems
Keeping Electrical Switchgear Safe
Leadership & Team Dynamics for Power & Utilities
LNG Fundamentals
LNG Markets & SPOT Trading
Maintenance Planning & Scheduling
Making IPP & Renewable Energy Projects Contract Frameworks Bankable
Managing Complex Projects for Power and Utilities Professionals
Medium Voltage & High Voltage Switchgear
Metallurgy for Engineers
Mechanical Engineering for Non-Mechanical Engineers
Mini Hydro Project Analysis
MKV Speedtronic Control System
MK VI Speedtronic Control System
Nuclear Energy Project Planning & Economics
Nuclear Power
Offshore Platforms Electrical Systems Design & Illustrations
Operations of Coal Fired Power Plants
Power Generation Commissioning, Operations & Maintenance
Power Generation Operation, Protection & Excitation Control
Power Plant Chemistry for Chemist & Chemical Engineers
Power Purchase Agreements
Process Control Methods
Programmatic CDM
Project Management for Power and Utilities
Relay Protection in Power Systems
Reliability Centered Maintenance Masterclass
Reliability Engineering
Renewable Energy Development & Investment
Renewable Energy Integration
Risk Based Inspection
Risk Management in Power Markets
Root Cause Analysis
Rotating Equipment Maintenance & Reliability Excellence
SCADA & Power Systems
Smart Grid
Solar Energy & Photovoltaic Power
Spare Parts Optimisation
Supercritical and Ultra-Supercritical Coal-Fired Power Plant
Technical Report Writing & Presentation Skills for Power & Utilities Professionals
Ultra Low NOx Gas Turbine Combustion
Uninterruptible Power Supply
Vibration Analysis & Condition Monitoring
Waste to Energy Plant Operations
Water Treatment and Corrosion Control for Steam Generation and Power Production
Writing Effective Standard Operating Procedures (SOP) for Power & Utilities Professionals & Engineers

www.poweredgeasia.com
Frequently Asked Questions (FAQs)

1. Does PowerEdge have other programmes than those listed? We have more than 200 programmes that we are capable of running. All we need is for you to contact us and request for the preferred programme and we will able to develop it.

2. Where is PowerEdge based? PowerEDGE is headquartered in Singapore but we run our training programmes in different venues around Asia.

3. What does PowerEdge do? We are a Power & Utilities Training Specialist.

4. Can this course be done in our city? It absolutely can. Get in touch with us to request for a training programme to be carried out in your city.

5. Can you reduce the price of our preferred course? While our price has been reduced before it is even launched, we are always happy to help you with further discounts.

6. Can you change the dates of the course? If you have a special requested date, let us know and we will arrange another session for you.

7. Who are the companies that will be participating? This varies from a diversity of Power Operators, Regulators, Financiers, to Vendors in the Power & Utilities industry.

8. Where is the venue for the course? We usually engage a 4 to 5 star hotel meeting room to ensure the comfort of our participants.

9. How many delegates should we expect for each course? This varies from 15 to 20 participants. Class sizes are kept small to allow trainers to focus better on each participant.

10. What are the different payment modes? We accept Visa/MasterCard, cheques, bank transfers and cash on site.

11. Is accommodation included when I sign up for a course? Accommodation is not included in the course fee but we are always happy to advise on available accommodations.

12. Can I get a cheaper accommodation through PowerEdge? We will be pleased to help you negotiate a better rate with hotels.

13. Is lunch provided during the course? We provide lunch and 2 tea breaks every day during our training programmes.

14. Are the training materials included once I have signed up for a course? Yes, training and course materials are included in the course fee.

15. Will there be a certificate for the course? Yes, there will be a certificate of participation upon completion of a course.

16. Who are PowerEdge trainers? They are expert consultants and practitioners with many years of experience in the subject matter that they deliver on.

17. Are PowerEdge trainers competent? We have received numerous favourable feedbacks on our trainers from past participants.

18. Can PowerEdge assist with Visa travel applications? We can assist in advising you on the relevant procedure(s) and embassies/consulates that provide Visa for travel purposes.

19. Can we purchase training materials without attending a course? Unfortunately this option is not available as training materials are specially developed for courses.

20. Can course content be tweaked to cater to our needs? Of course! Just let us know your request and we will get the trainer to assist in carrying it out.
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REGISTRATION FORM

<table>
<thead>
<tr>
<th></th>
<th>NORMAL PRICE</th>
<th>Early Bird SAVE SGD 200 Ends 30 Sept 2015</th>
<th>GROUP OF 3 or More</th>
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<tr>
<td>3 Day Programme</td>
<td>SGD 3,800 Per Participant</td>
<td>SGD 3,600 Per Participant</td>
<td>SGD 3,300 Per Participant</td>
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ATTENDEE DETAILS

Name ........................................................................................................... Job title ...........................................................................................................
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COMPANY DETAILS

Organisation name ........................................................................................................Industry...........................................................................................................
Address .............................................................................................................Country...........................................................................................................
Postcode..............................................................................................Country...........................................................................................................
Tel .............................................................. Fax..............................................................

Payment Terms

By Cheque/ Bank Draft: Make Payable to Asia Edge Pte. Ltd.
By Direct Transfer: Please quote AE1 with the remittance advise
Account Name: Asia Edge Pte. Ltd.
Bank Number: 508 Account Number: 762903 Swift Code: OCBCSGSG
All bank charges to be borne by payer. Please ensure that Asia Edge Pte Ltd receive the full invoiced amount.

Contact us today at info@poweredgeasia.com
Can’t make it for the Course? We’ll make the course come to you!!
Simply let us know your preferred time and dates and we will meet you at your schedule and venue.
With a host of highly trained experts, we will be happy to customize your programme with your needs 100% fulfilled.

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