Failures of piping systems in the oil, gas and petrochemical industries can lead to damage of assets, personal injury and loss of life. Piping failure can be caused by excessive vibration, in the form of high levels of acoustic energy (AIV), or by flow turbulence (FIV) created by shear forces within the piping system.

A desire for increased flow rates, the use of ‘thin’ wall piping, the growing demand to reduce mass, the requirement for fast activating valves and use of longer piping has led to a rise in the number of potential piping failures. Although the phenomenon of induced vibration has been understood since the 1950s (in the aerospace industry), it is only more recently that process and piping engineers have had to consider these impacts in the preliminary and detailed design phases of their projects.

As a leading provider of AIV and FIV assessment for the oil and gas industry WKC offer bespoke training in the assessment and evaluation of AIV and FIV training.
Course Overview

- Acoustically-induced vibration - including description of relevant AIV methodologies and codes (EI, CONCAWE, Exxon, Eisinger)
- Flow-induced vibration - using EI Guidelines
- Application of the assessment methodologies and mitigation measures used during the design phase of a project to minimize the risk of induced vibration

Course Objectives

The course objectives are to:

- Enable participants to be able to undertake an AIV an FIV assessment following good industry practice.
- Allow participants to gain an understanding of the prediction, screening and assessment procedures.
- Provide participants with an oversight of design measures that can be implemented in order to minimise the risk of induced vibration.
- Provide worked examples of the application of the assessment methodologies during the design phase of a project.

Specially Designed For

The course is aimed at professionals who have involvement in the design of oil and gas assets, who want to gain a comprehensive understanding of how AIV and FIV assessments are carried out and gain some practical experience in undertaking such studies.

The course is primarily aimed at Project Managers, Process Engineers, and Mechanical Engineers.

Program Schedule

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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</thead>
<tbody>
<tr>
<td>08:00 – 09:00</td>
<td>Registration (Day1)</td>
</tr>
<tr>
<td>09:00 – 11:00</td>
<td>Session I</td>
</tr>
<tr>
<td>11:00 – 11:15</td>
<td>Refreshment &amp; Networking Session I</td>
</tr>
<tr>
<td>11:15 – 13:00</td>
<td>Session II</td>
</tr>
<tr>
<td>13:00 – 14:00</td>
<td>Lunch</td>
</tr>
<tr>
<td>14:00 – 15:30</td>
<td>Session III</td>
</tr>
<tr>
<td>15:30 – 15:45</td>
<td>Refreshment &amp; Networking Session II</td>
</tr>
<tr>
<td>15:45 – 17:00</td>
<td>Session IV</td>
</tr>
<tr>
<td>17:00</td>
<td>End of Day</td>
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</tbody>
</table>

Supported by

[Logos of various companies and organizations supporting the event]
Course Agenda

DAY 1

Introduction
This will provide a brief summary of the course, and definitions and brief explanations of AIV, FIV. With further explanation into what the risks are and the research that has been carried out to date.

AIV Assessment and Mitigation
Covering the principles and theory of AIV, and outline the relevant screening guidance documents such as CONCAWE 85/52, Eisinger, Exxon and the EI Guidelines. The session will then go on to explain how to conduct a screening and detailed assessment followed by an overview of the possible design solutions that could be incorporated into the design to minimize the risk from AIV.

DAY 2

AIV ‘Real Word’ Case Study Examples
Based on the principles learnt on day 1 and following the EI Guidelines Methodology, participants will undertake a step by step assessment of a real world case study example. The Likelihood of Failure (LOF) will be calculated at each discontinuity downstream of a pressure reducing device to the flare header and where required recommendations discussed on how the risk of fatigue/failure could be minimised

FIV Assessment and Mitigation
An overview of the principles and theory of Flow-induced Vibration in gaseous and liquid systems. Followed by a breakdown of the assessment process as detailed within the EI Guidelines and an examination of the possible design changes that could be incorporated into the design in order to alleviate the potential risk from FIV.

DAY 3

FIV Case Study Examples
Using the EI Guidelines worked examples will be followed to provide process and piping engineers with the basic understanding of how to carry out an FIV study during the design stages of a project and to provide a recap of the assessment procedures

Small Bore Connection (SBC) Assessment
SBCs are branch lines with a diameter of equal to or less than 2 inches. This will focus on the SBC assessment for different branch types and configurations in order to provide a modified assessment of the risk from FIV along these lines. The practical application of control measures for SBCs shall also be discussed.
Richard Palmer, based in WKC’s Abu Dhabi office, has over 12 years’ experience of working in the oil and gas and petrochemical industries, specialising in acoustic and vibration assessments. He is an acoustic specialist by background and has the responsibility of overseeing and providing noise services in the form of environmental and occupational noise assessments, acoustically and flow induced vibration studies, permit applications, modelling, and training for major international oil & gas developments, particularly in the Middle East, Caspian Region, East Asia and South Africa.

Richard has managed and undertaken numerous acoustically induced and flow induced vibration studies for major oil and gas projects within the Middle East region - He is familiar with the major international guidelines, including; the Energy Institute, CONCAWE, Exxon, Shell, Eisinger, and Carucci and Mueller.

As a member of the Energy Institute he has access to the most recent research into the phenomenon of induced vibration fatigue and has open dialogue with a number of its senior members, specifically in the ongoing research projects into AIV and FIV.

**Project Experience**

- Ruwais Refinery Expansion Project Package 2 - Acoustically Induced Vibration Study, TAKREER, Abu Dhabi, UAE
- Lube Base Oil Project Acoustically Induced Vibration Study, TAKREER, Abu Dhabi, UAE
- Yanbu Export Refinery Project (3 & 4) – Acoustically and Flow Induced Vibration Study, Saudi Aramco, Kingdom of Saudi Arabia
- Jubail Export Refinery – Acoustically Induced Vibration Study, SATORP, Kingdom of Saudi Arabia.
- Kuwait Oil Company Pipelines Project – Acoustically and Flow Induced Vibration Study.

**Fields of Competence**

- Acoustic Engineering
- Environmental and Occupational Noise Measurement
- Acoustic Induced Vibration Studies
- Transportation and Industrial Noise Modelling
- Environmental Impact Assessment
- Environmental Policy and Compliance

**Partial Client List**

- Exxon
- Shell
- Fluor
- Kuwait Oil Company
- Worley Parsons
- Saudi Aramco
- Technip
- Arensco
- TAKREER
- Bureau Veritas
- CIC Energy
- SK (E & C)
- Daelim
- Tecnicas Reunidas
- Gulf Marine Service
- CONCAWE
- UAE (GS & C)
- Eisinger
- Carucci
- Mueller
- HYUNDAI
COURSE DETAILS
Title: Acoustic and Flow Induced Vibration
Date: 23rd - 25th November 2015
Location: Kuala Lumpur, Malaysia

INVESTMENT PACKAGES
Please checklist the package that you are attending!

<table>
<thead>
<tr>
<th>Investment Packages</th>
<th>Deadline</th>
<th>Course Fee</th>
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</thead>
<tbody>
<tr>
<td>Standard Price</td>
<td>20th Nov 2015</td>
<td>SGD 2,995</td>
</tr>
<tr>
<td>Early Bird Offer</td>
<td>23rd Oct 2015</td>
<td>SGD 2,795</td>
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| Group Discount (3 or more)  | 20th Nov 2015  | 10% discounts for group of 3 registering from the same organization at the same time

* Group discount is based on standard price
* To enjoy the promotion & discount offer, payment must be made before deadline
* For 5 or more delegates, please inquire for more attractive package
* Prices include lunches, refreshments and materials. Promotion & discount cannot be combined with other promotional offers.
* Important: Please note that registration without payment will incur a SGD 200 administration fee.

DELEGATES DETAIL

1st Delegate Name: ___________________________  Mr  Mrs  Ms  Dr  Others  
Direct Line Number: ___________________________  Email: ___________________________
Job Title: ___________________________  Department: ___________________________
Head of Department: ___________________________

2nd Delegate Name: ___________________________  Mr  Mrs  Ms  Dr  Others  
Direct Line Number: ___________________________  Email: ___________________________
Job Title: ___________________________  Department: ___________________________
Head of Department: ___________________________

3rd Delegate Name: ___________________________  Mr  Mrs  Ms  Dr  Others  
Direct Line Number: ___________________________  Email: ___________________________
Job Title: ___________________________  Department: ___________________________
Head of Department: ___________________________

INVOICE DETAILS
Attention Invoice to:   ______________________________________________________________________________
Direct Line Number: ___________________________  Fax:  _____________________________________________
Address: _______________________________________________________  Postcode: _________________________
Company:____________________________________________  Industry :  __________________________________
Country: ________________________  Email: __________________________________________________________

PAYMENT METHODS
By Credit Card :
Name printed on card: ____________________________________________________________________
Card Number: ___________________________  Security Code: ___________________________
Expiry Date: ___________________________

By Direct Transfer : Please quote invoice number(s) on remittance advice
PETROSINC GLOBAL PTE LTD: Bank details:
Account Name: PETROSINC GLOBAL PTE LTD
Bank Name: DBS Bank Ltd
Bank Code: 7171  Bank Swift Code : DBSSSGSGXXX  Branch code : 288
Account No :  - SGD : 288-901898-0  - USD : 0288-002682-01-6

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CONFIRMATION
I agree to PETROSINC’s terms & conditions, payment terms and cancellation policy.

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- For Credit Card payment, there is an additional 4% credit card processing fee.

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CONTACT:
Name : Cay Aagen
Email : registration@petrosync.com
Phone : +65 6415 4500
Fax : +65 6826 4322

Note: If you have not received an acknowledgement before the training, please call us to confirm your booking.

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Bank Code: 7171  Bank Swift Code : DBSSSGSGXXX  Branch code : 288
Account No :  - SGD : 288-901898-0  - USD : 0288-002682-01-6

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