



# Victoria & Tasmania Section



## MEG Regeneration Technical Meeting 18 June 2009, Port Campbell









- Introductions
- Grounding
- Operator Experience
- Question and Answer Session
- Working Sessions
  - Separating condensate and MEG
  - Occupational health and safety issues with MEG
  - Reducing fouling in MEG regeneration equipment
- Present working session results
- Review opportunities and initiatives
- Close



- Share experiences and knowledge from existing operations
- Review initiatives being taken for new facilities
- Identify common problems
- Stimulate thought and accelerate innovation for MEG regeneration
- Look for ways to reduce OH&S issues with MEG regeneration packages
- Consider common initiatives that be beneficial for the mutual good of the participants



### Safety Moment









### Some Rules









- Generally in accordance with the rules for SPE Forums
- Designed to encourage free interchange of information and ideas
  - Meetings are conducted off the record
  - Written papers are prohibited
  - Extensive note taking is not allowed
  - Information disclosed at the meeting may not be used publicly without the originator's permission
  - Participants are requested to omit reference to meeting proceedings in any subsequent published work or oral presentation
- ▶ A short written summary of major issues and consensus may be prepared and distributed to attendees



- Participants are encouraged to contribute their experience and knowledge, NOT to be spectators or students
- Mobile phones to silent
  - Please take your calls outside



- We need consensus to publish anything from this meeting
- ► The data and experiences are being shared "off the record"
- Our options are:
  - Publish nothing (the default position)
  - Issue a short communique outlining the themes covered (through SPE News)
  - Issue a summary of the workshop to participants only
  - Generate a "best practice" and issue to the participants only
  - Generate a full report suitable for publishing
- ▶ Your thoughts?



### Background

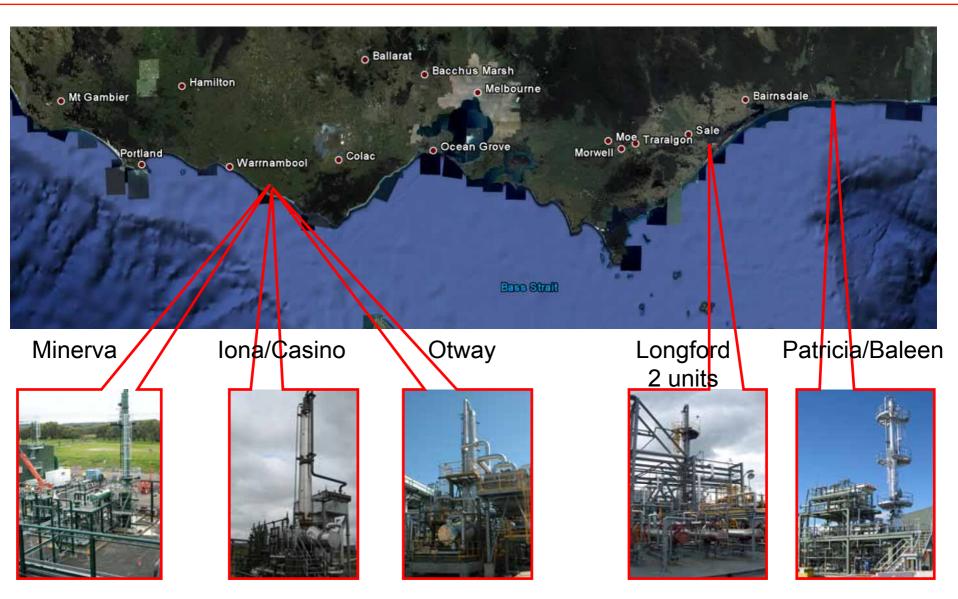






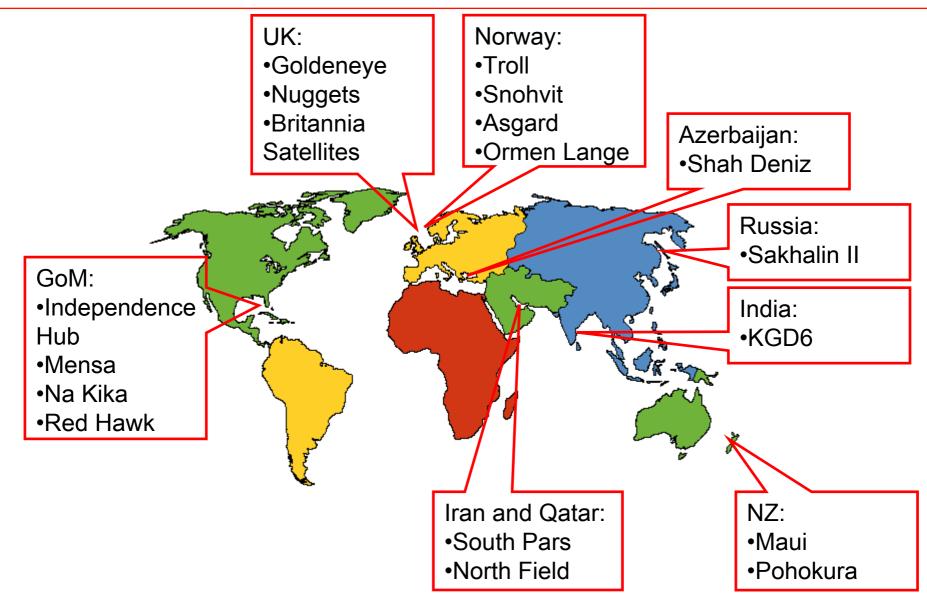


#### **MEG Plants**













- Monoethylene glycol has been chosen as hydrate inhibitor for every wet gas transport pipeline in Bass Strait
- Reasons:
  - Low volatility low losses
  - Good thermodynamic inhibitor
  - Relatively low toxicity
  - Low flammability
  - Simple proven technology required
  - Cheap commodity, readily available





- ► Two characteristic problems in Bass Strait operations
  - Fouling of equipment by iron carbonate deposits
  - Cross contamination of MEG and condensate streams



### Fouling of Equipment









### Fouling of Equipment





### Fouling of Equipment







### Managing Fouled Equipment







### Managing Fouled Equipment





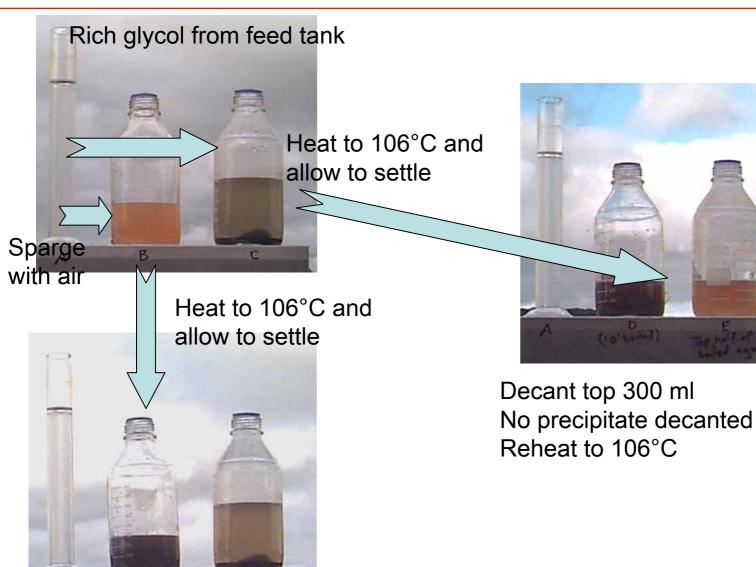
### Managing Fouled Equipment





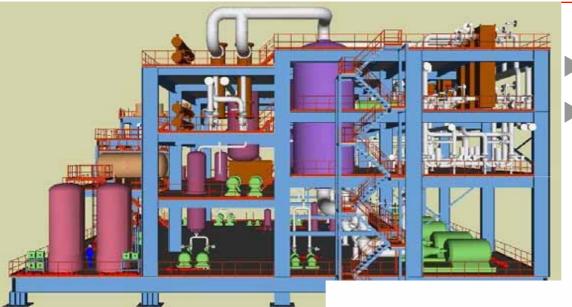








#### Managing Fouling



- MEG Reclaimers
- Large units for world scale projects





### MEG / Condensate Separation









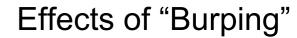
#### Contamination of MEG and Condensate

#### MEG in condensate

- Condensate specification problems
- Fouling of condensate stabilisation equipment
- Contamination of waste water streams

#### Condensate in MEG

- Condensate vapourising in MEG regeneration packages stripping effect
- Lower operating temperatures
- Higher MEG purities
- Contamination of waste water streams from MEG regen
- "Burping" of column due to condensate buildup









### Effects of Burping





#### Condensate / MEG Separation

- Separation of condensate from MEG is affected by:
  - Operating temperature
  - Shear applied to mixture
  - Contaminants added to mixture, including
    - corrosion inhibitor
    - corrosion products
    - scale





### **Bottle Shake-up Tests**

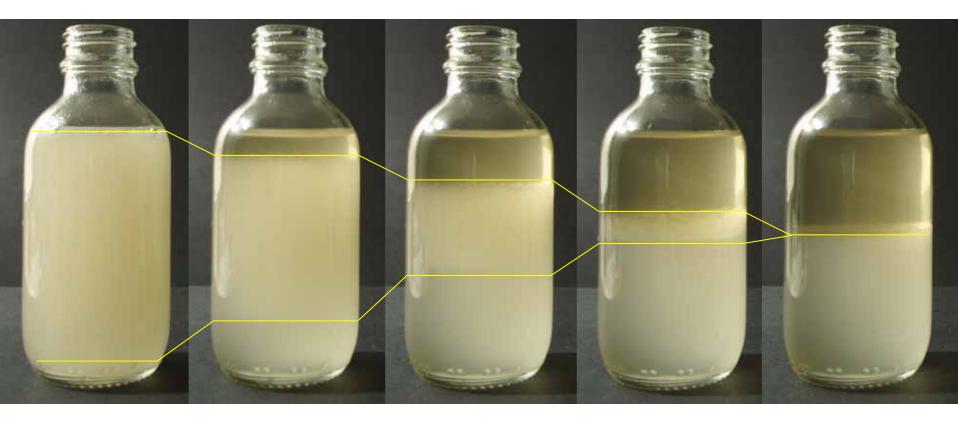












0 Min 0 Sec

1 Min 0 Sec

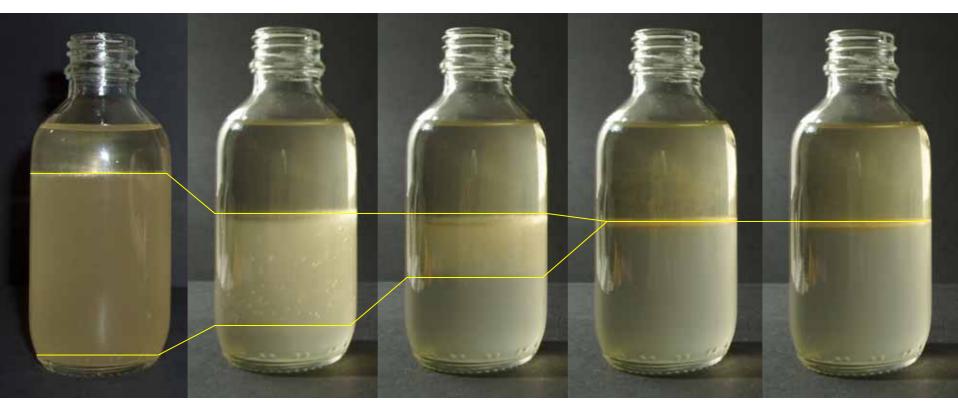
2 Min 0 Sec

3 Min 0 Sec

5 Min 0 Sec







0 Min 0 Sec

0 Min 30 Sec

1 Min 0 Sec

2 Min 0 Sec

3 Min 0 Sec



#### **Temperature Comparison**

24°C

50°C



0 Min 0 Sec

1 Min 0 Sec

2 Min 0 Sec

3 Min 0 Sec

5 Min 0 Sec



### Problems Everywhere













### Briefings





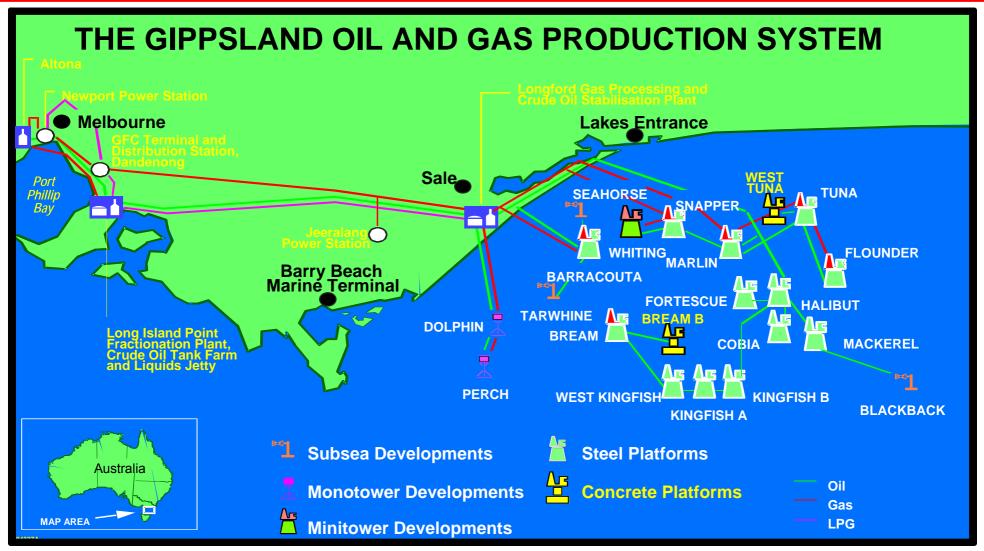


### **ESSO AUSTRALIA PTY LTD**



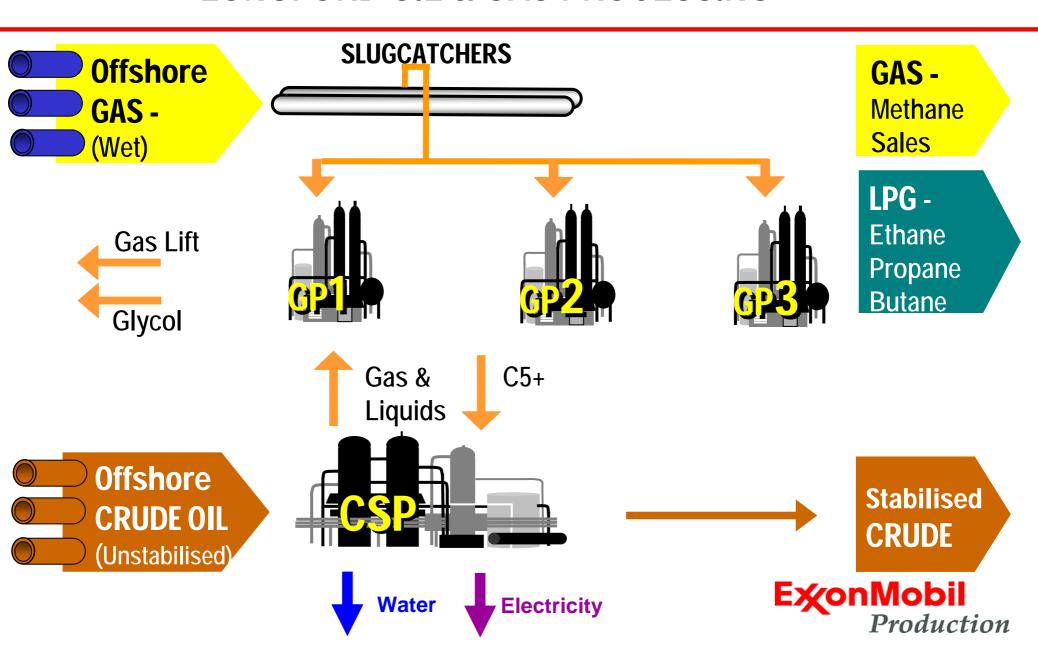


### **SCOPE OF OPERATIONS**





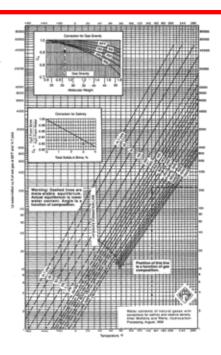
## LONGFORD OIL & GAS PROCESSING



# Gas Hydrate Management

### McKetta Wehe chart (GPSA) predicts hydrates

- Can be approximated with P<sub>w</sub>=e<sup>x</sup> function
- <1030 kPa hydrates do not form, (although if free water is present ice can form)
- >1030 kPa hydrates form at increasing temperatures as pressure increases, up to a maximum of 28°C.
- <0°C the ice vapour pressure sets the equilibrium temperature against which hydrates form.



### Ethylene glycol (MEG) is normally used because:

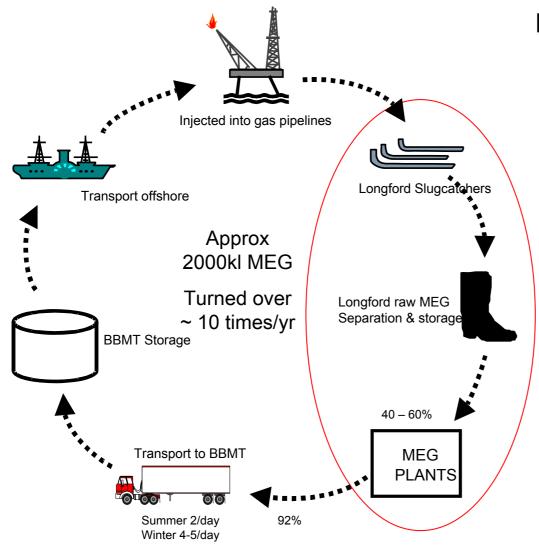
- Lowest molecular weight of the glycols and, therefore, less is required;
- Lower viscosity than the other glycols at the temperatures involved;
- Freezing point of its water solution is appreciably lower than for the other glycols; and
- Less soluble in the condensed hydrocarbons than the other glycols.

# Mono Ethylene Glycol

## Issues

- Recovered as a bottoms product in recovery plants
- Difficult to remove non volatile contaminants
- Carbonate deposition
- Iron Sulphide fouling of recovery plant reboiler
- Recovery is sensitive to condensate contamination of recovery plant feed

# Esso's MEG Hydrate Inhibitor Loop



#### **Longford Facilities**

- Slugcatchers
- Boot system
- Raw MEG storage
- GP-2 & GP-3 MEG Plants
- Limited MEG product storage

Gas Management System (GMS) manages:

- Pipeline configuration
- Ramp rates
- Platform delivery
- MEG rates



# **GP-2 MEG Plant Schematic**

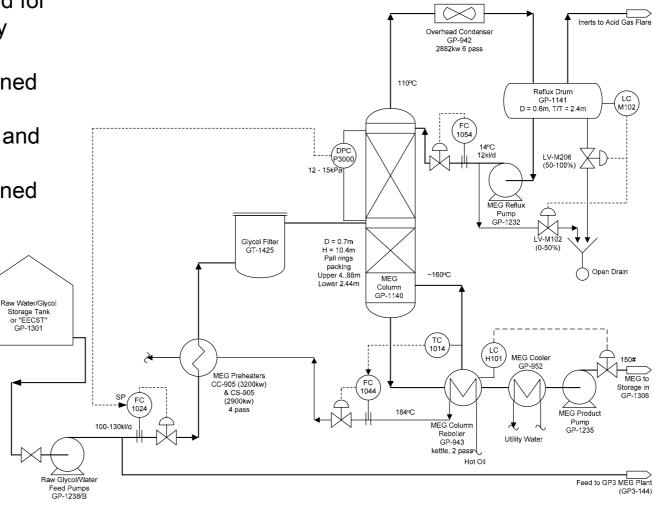
- Originally designed for Methanol recovery
- Feed exchanger mechanically cleaned 1-2 weekly
- Packing removed and reboiler bundle mechanically cleaned annually

From Glycol/Water

Surge Tank (AX-1116)

GP-1301

MEG residue in overhead water



# **GP-3 MEG Plant Schematic**

4438

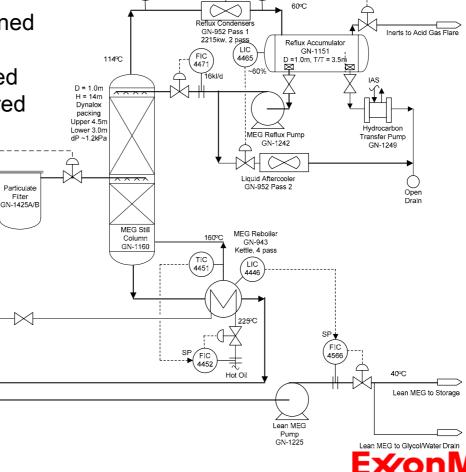
- Custom designed commissioned 2004
- Provision for chemical cleaning of feed exchangers
- Feed exchangers mechanically cleaned 2 - 4 weekly
- Reboiler bundle mechanically cleaned annually, packing removed as required

MEG/Water from Raw Glycol/Water

Feed Pumps 90 -100kl/d

Primary

Preheaters GN-940A-D



4460

Hot Oil

Return

Preheaters

GN-915A/B

4 pass

Particulate Filter

# Carbonate and Sulphide Deposition

- MEG recovery plant operation is not as well researched and documented as eg TEG dehydration
- Carbonate and bicarbonate build-up is a common problem
  - Is formed from CO<sub>2</sub> and water in the pipeline, ie

$$CO_2 + OH^{-pH \sim 7.0} + CO_3 \stackrel{pH \sim 8.5}{\longleftrightarrow} CO_3^{2-} + H_2O \rightarrow Insoluble carbonate (Fe/Ca/Mg)$$

- Overseas anecdotal information suggests that carbonate can be inhibited using an amine based inhibitor.
  - Esso is not advocating or recommending this. The potential for emulsion formation and foaming in the MEG still must be assessed when considering chemical addition.
- MEG degradation temperature (325°F/163°C) is based on reboiler heat flux of 12,000 BTU/ft<sup>2</sup> which equates to a film temperature of 215°C. Degradation temperature can be increased if a lower heat flux is used.
- Other common problem is Iron Sulphide build-up in the reboiler there is no known solution for this.

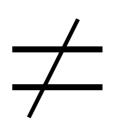


# Condensate in MEG Plant Feed

## **GP-3 MEG Plant**

#### **Design Feed Conditions**

- 40 60wt% MEG
- 0.1wt% hydrocarbons
- ~20,000mg/L particulates



#### **Winter Actual Feed Conditions**

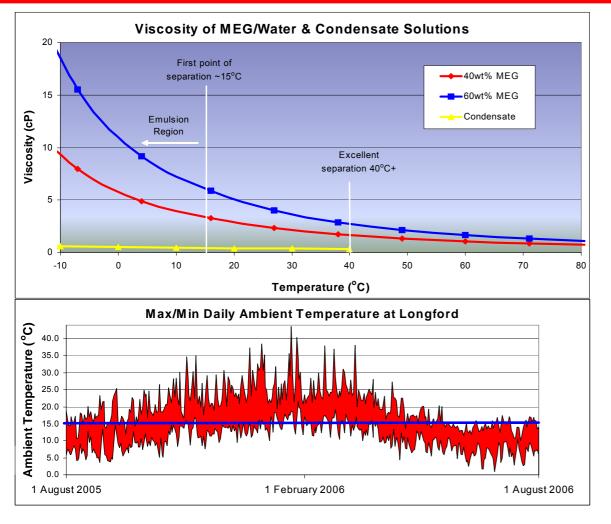
- 40 60wt% MEG
- 10wt% hydrocarbons
- ~20,000mg/L particulates



Presence of **MEG/Condensate** emulsion under winter conditions

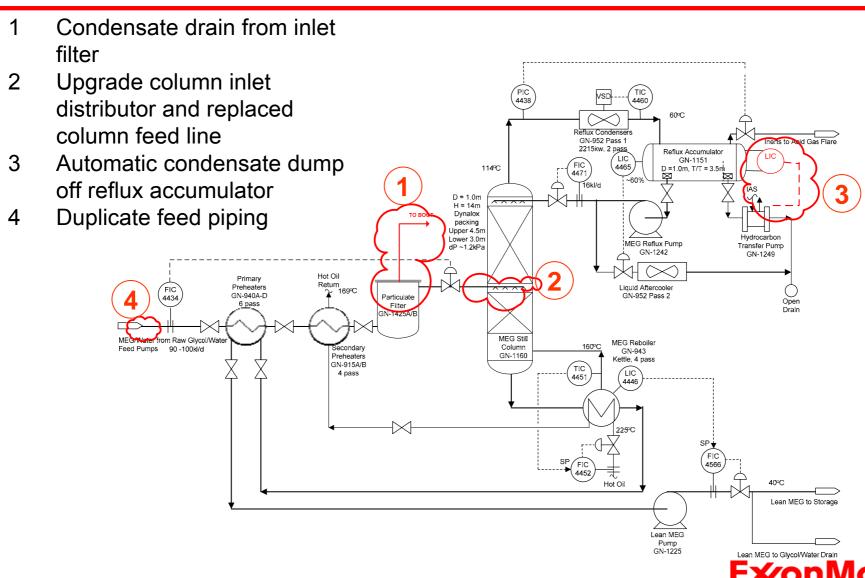


# Condensate Separation from MEG Plant Feed



- <15°C poor separation due to high viscosity and potential emulsion formation
- Emulsion formation favoured by:
   < 15°C &
   higher MEG
   concentrations</li>
- >40°C preferred reduced viscosity and heat breaks emulsions

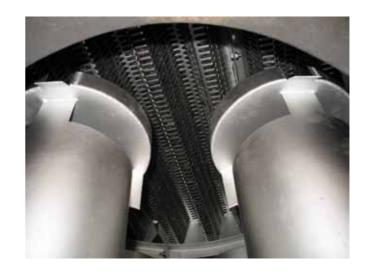
# **GP-3 MEG Plant Upgrades**



Production

# GP-3 Upgraded Inlet Distributor









# Summary

- Carbonate accumulation is linked to CO<sub>2</sub> in raw gas. Difficult to prevent, mechanical removal is the preferred control
- Sulphide accumulation in reboiler no known prevention or online control. Managed via annual mechanical clean during pre-winter shutdown.
- Condensate ingress should be allowed for in design. Online control via effective removal upstream of MEG plant.



# **MEG Regeneration Technical Meeting**

18th June 2009, Port Campbell

## **Iona MEG Loop**





## Raw Gas & MEG key components

#### Casino Gas:

- $\triangleright$  CO<sub>2</sub> = 0.9 mol%
- $\rightarrow$  H<sub>2</sub>S < 0.2 ppm
- $\rightarrow$  H<sub>2</sub>O = 4500 kg/10<sup>6</sup> std m<sup>3</sup>
- $\triangleright$  Condensate = 5,000 L/10<sup>6</sup> std m<sup>3</sup>
- Gas Rate = 96 TJPD

#### **Rich MEG:**

- $ightharpoonup Fe^{2+} = 25ppm$
- Corrosion Inhibitor = 300ppm
- $\rightarrow$  H<sub>2</sub>O = 55% w/w
- > Condensate = 4% v/v
- $\rightarrow$  MEG Rate = 1.3 m<sup>3</sup>/h



## **Issues with Iona MEG Loop**

#### **Rich MEG Degasser Issues:**



Rich MEG degasser feed



Rich MEG degasser outlet



## **Issues with Iona MEG Loop**

#### **MEG Regenerator Issues:**







Still Column Packing

Distribution Cylinder

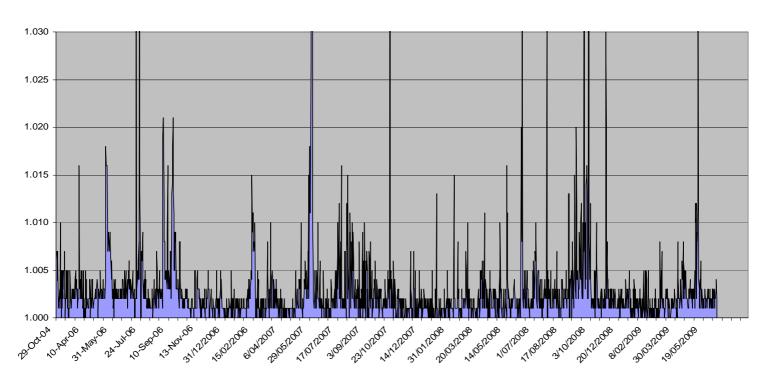
**Suction Strainers** 



## Issues with Iona MEG Loop

#### **MEG** regenerator issues:

#### **Prod Water SG over Time**





## **Potential Solutions to Fouling**

#### The following have been investigated

- Ion Exchange Resins
- Oxidation and microfiltration
- > pH Stabilisation
- Citric Acid Flushing



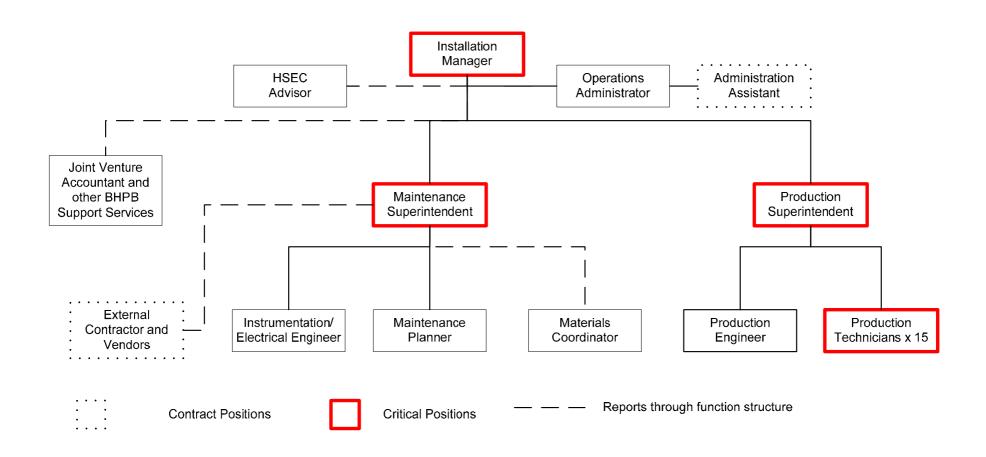
Minerva Gas Plant SPE MEG Forum Port Campbell June 2009





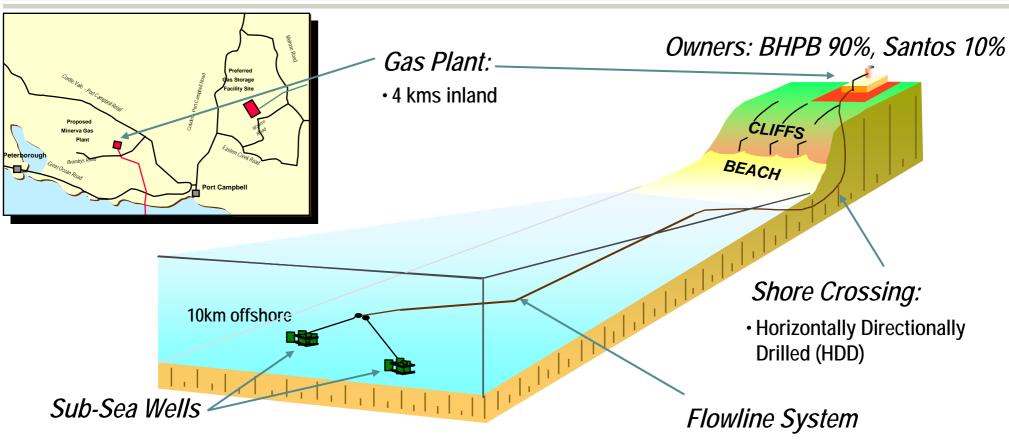


# **Minerva Organisational Chart**



# Minerva Sub-Sea Wells – Overview of Development





First Sales Gas 26th January 2005

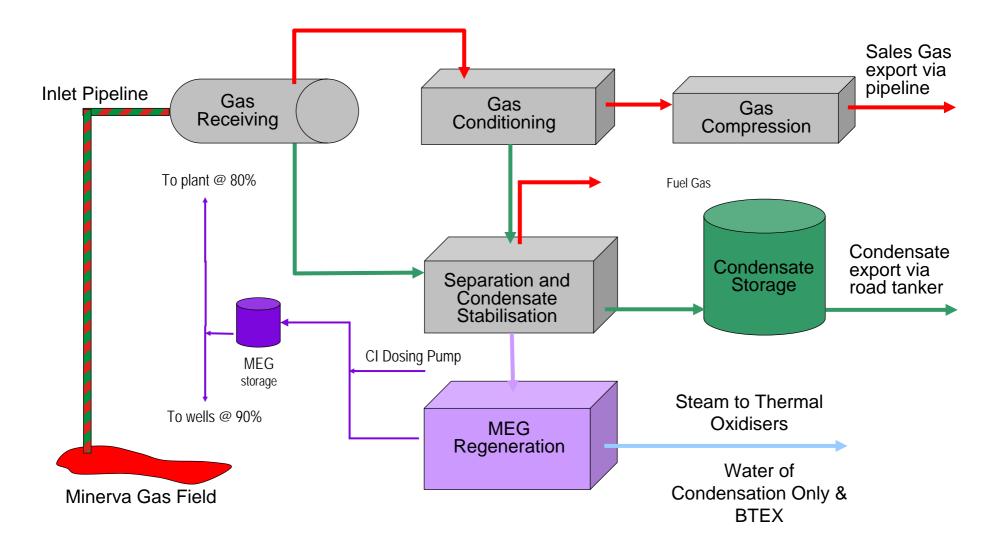
## **Minerva Gas Plant Aerial View**





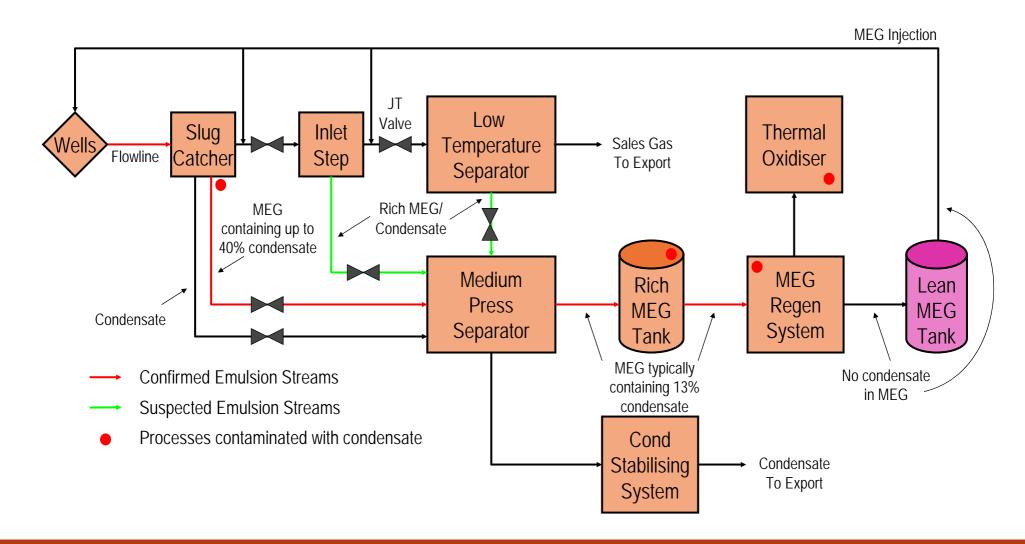


# **Simplified Process Flow Diagram**



# Emulsion – Flow Path (with Condensate intrusion)





# **Emulsion – MEG Samples**



## Samples all showing milky emulsion of condensate in MEG

From Slug Catcher from sample bomb after depressurising, i.e. un-sheared From Rich MEG Tank

From Medium
Pressure

/ Separator

From Slug
Catcher after
shearing
through
sample point
valve



# **Emulsion – Causes & Actions & Contingency**



#### **Causes**

- The emulsion is stabilised by the thermal degradation products of the old corrosion inhibitor.
- Vendor recommended top-up rates for closed loop circuit order of magnitude greater than required for maintaining required concentration. Actual top-up at 0.01% versus 5-10%.
- Overdosing causes emulsion, particularly over 2500ppm in Lean Meg

#### Action to date

- Old Corrosion Inhibitor Nalco EC1440A stopped December 06
- New Corrosion Inhibitor Nalco EC1503A started January 07
- Commenced to observe process stability due to reduced emulsions December 07

#### **Contingency Plan**

- Emulsion breaking skid Tie-ins were installed to allow for future installation
- Sourced centrifuge separator for online separation if required.

#### The challenges and difficulties addressed included:

- Careful management for the introduction of a new corrosion inhibitor to the chemical stream which could have had a disastrous effect by enhancing emulsion properties;
- Closely monitor concentrations including reduction in size of CI dosing pumps.

# **Emulsion Issue – Plant Impacts**



#### **MEG Tanks**

- Build up of Condensate layer in Rich Meg Tanks requires frequent skimming of condensate.
- Lean Meg tank also requires occasional manual skimming

#### **MEG Regeneration System:**

- Had troublesome column operation with flooding / surging and quality issues. Flooding resulted in damage to column packing that required replacement.
- Have fitted fixed skimmers to tower and kettle to facilitate continuous condensate removal.
- Reduced Hot Oil temperature from 220C to 200C
- Operating Medium Pressure Separator at 55C to drive separation
- Operation of Tower at steady nameplate and recycle excess lean MEG back to Column

#### **Thermal Oxidisers**

- Had condensate in the overhead stream resulting in over-firing, unstable operation, and tripping;
- This resulted in unstable combustion, due to the sudden fuel load
- Ran standby TOx fulltime due to unstable operation now back to single operation so saving of Fuel Gas

# **Emulsion Issue – Plant Impacts (Cont)**



#### **Condensate Stabilization**

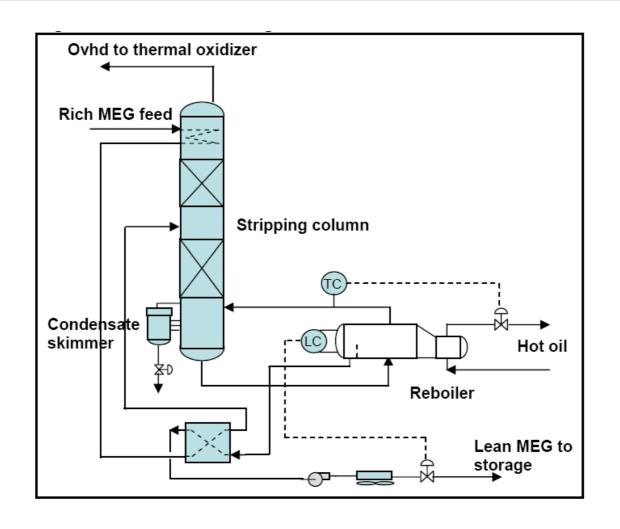
- Water draw off tray has control valve fitted to allow for continuos removal of MEG.
- Upgraded Low point drain on Condensate tanks to allow for draining of tank. Had upto 10% Meg in buffer / batch tanks

#### **Waste and Availability**

- Reduced throughput and uptime of Regen required disposal of un-regenerated MEG and addition of new fresh MEG into the circuit.
- Previously upto 100 m3/year, now only requiring top-up quantities.
- Also resulted in Annual shutdowns to clean process equipment no longer required
- Corrosion inhibitor degradation products and precipitated Iron further propagates emulsion. Addition of 50µm filters to plant MEG loop (Slug Catcher and DPCU) has significantly reduced circulating particulate matter

# The Minerva MEG Regeneration - GA





## **Emulsion Issue**

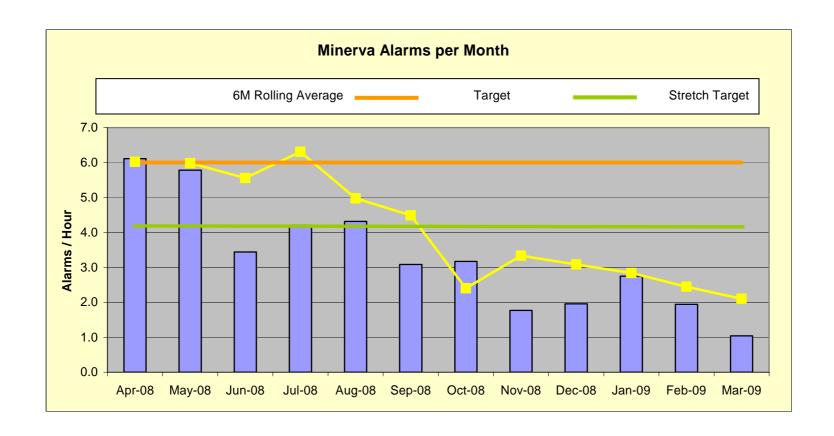


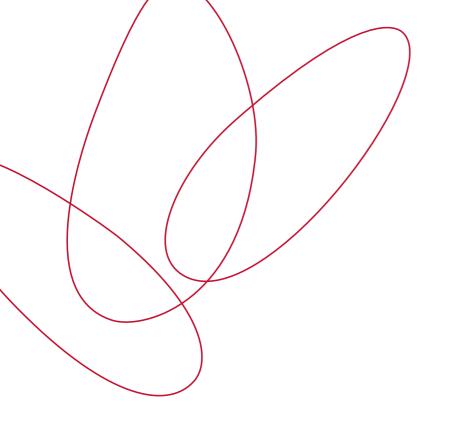
The Effect of Temperature on EC1440A in a carbon dioxide environment form brown sticky scum that is similar to Oleic Acid normally found to be plugging the MEG regenerator reboiler bundle



# Alarm Reduction with declining Emulsion







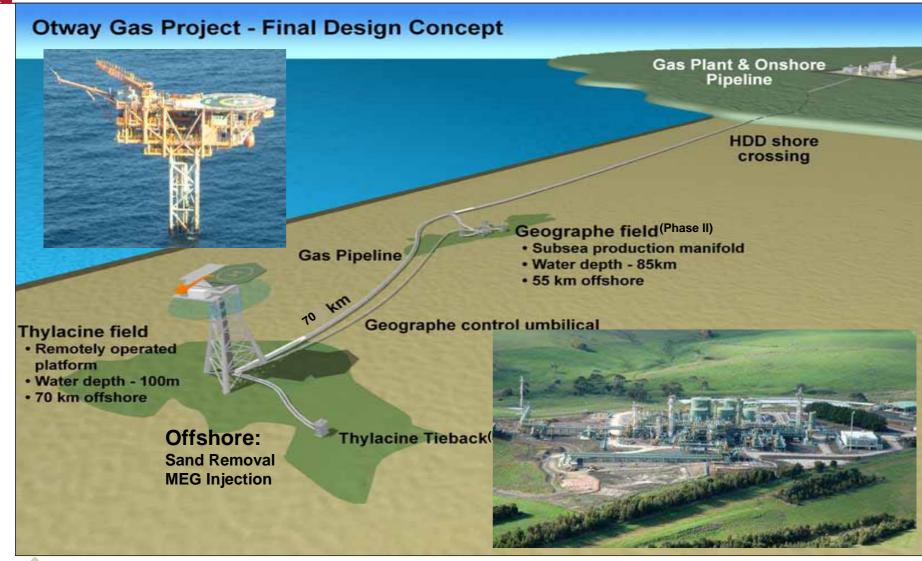
# Woodside Otway MEG Experience

Mark McKenna Senior Process Engineer, Otway

18/6/09

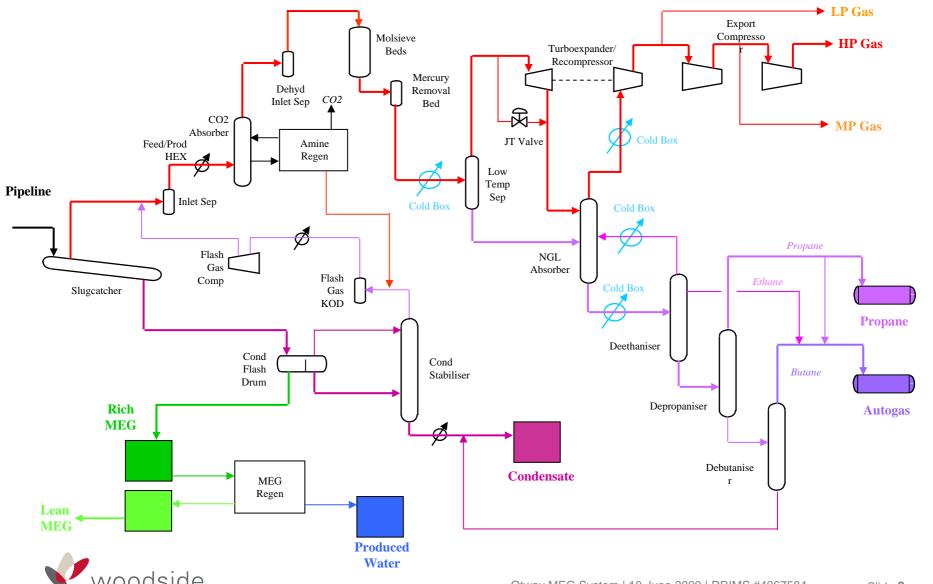


# **Otway Process**

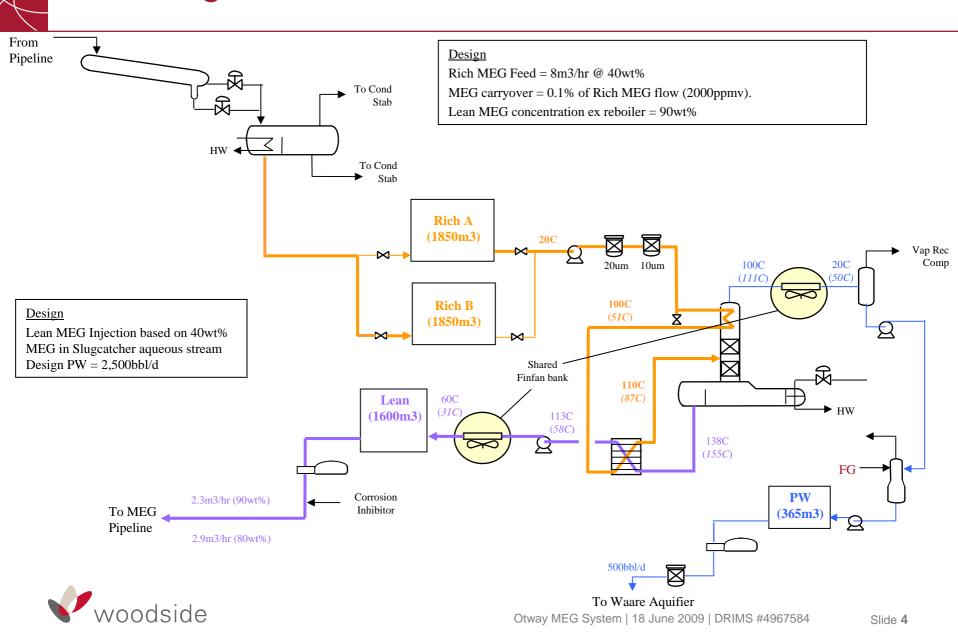




## **Onshore Plant**



# **MEG** Regeneration Unit



### Historical Problems (1 of 4)

#### Iron Carbonate (FeCO3) Fouling

- Still Condenser, Cross Exchanger, Packing, Reboiler



- weekly citric acid/water cleaning

#### **Emulsions**

- 60bar pressure drop across Slugcatcher LCV's
- severe emulsion (shaving cream) in Condy Flash Drum.
- flashing CO2 (dissolved) and hydrocarbons (dissolved and emulsified).
- emulsion stabilised by MEG at low temperatures (<60C)
- MEG carryover to Condensate Stabilisation (60ppmv in condensate)
- hydrocarbon carryunder through Rich MEG tanks, MEG Regeneration Unit to PW Tank
- hydrocarbon concentrations up to 120,000ppmv
- interface control is a balance between carryover and carryunder!
- thought emulsion was due to over-injection of corrosion inhibitor



### Historical Problems (2 of 4)

#### **Emulsions cont'd**

- reluctance to use demulsifier (long-chain polymer)
- trialled antifoam chemical at Slugcatcher with limited success

#### **MEG Carryover from Still Column**

- column 'puking', MEG carryover up to 250,000ppmv (PW inj spec = 10,000ppmv)
- small PW tank, cannot dilute, requirement to truck away PW for disposal
- MEG unit requiring constant supervision to prevent 'puking'
- puke when column temp exceeds 102C or when reboiler pressure reaches 30kPag
- puke if feed exceeds 5.8m3/hr or reboiler exceeds 128C
- 128C limit resulted in Lean MEG concentration of 70wt%
- max gas rate of 205TJ/d at 70wt% equivalent to 7.6m3/hr Rich MEG (not enough!)
- suspect that column is undersized and designed without foaming factor
- foaming factor approx 0.75 (= 6 v 8m3/h)



### Historical Problems (3 of 4)

#### **Overdosing of Corrosion Inhibitor**

- badly designed injection system (pump flow calibration setup)
- -1000ppmv versus 500ppmv target

#### Reboiler Level Control

- reboiler full of Rich instead of Lean MEG causing increased vapour traffic up column

#### **Lean MEG Rundown Temperature**

- 113C v design of 58C, due to fouling of Cross HEX and hot Rich MEG

#### **Produced Water Rundown Temperature**

- combined Air Cooler Fin Fans for Lean MEG and PW
- overcooling of PW (20C v 65C design), BTEX to PW instead of to vapour recovery



### Historical Problems (4 of 4)

#### Screen Failure





- original packing 1" Dynalok random metal rings, insufficient replacement packing
- current Lower packing = larger 1.5" Nutter rings
- current Upper packing = mix of original 1" Dynalok and 1.5" Nutter

#### **Condensate Flash Drum Temperature**

temp control difficult in drum and Stabiliser causing trips, operation at 45C v 60C

#### **Piping Low Points**

- low points in overheads piping backpressuring Column, requiring manual draining



### Solutions (1 of 2)

#### **Demulsifier Injection at Slugcatcher**

- 200ppmv of EC6023A has reduced shaving cream to milky water
- reduced MEG carryover (10ppmv in condensate product)
- reduced hydrocarbon carryunder from 100,000ppmv to <100ppmv

#### **MEG Regeneration Unit Modification (1)**

- external water spray on Cross HEX to assist cooling of Lean and Rich MEG
- bypass of Rich MEG Cross HEX to reduce column feed temperature

#### **MEG Regeneration Unit Modification (2)**

- -external spray replaced with service water flow thru HEX Rich channel
- the coil bypass is partially opened to cool the column feed to 80C



- increased column reflux and reduced MEG carryover
- cooler Lean MEG needs less finfan duty, this results in less effect on overheads finfan
- can now feed up to 6.2m3/h without puking



### Solutions (2 of 2)

#### MEG Regeneration Unit Modification (2) cont'd

- PW MEG below 5,000ppmv and OIW below 50ppmv
- very careful unit startup, slow flow and temperature ramp

#### **Demulsifier Injection at PW Tank**

- injection of EC6023A to treat emulsion, then skim off hydrocarbon
- may be able to turn EC6023A off due to reduced carryover of hydrocarbon

#### **PW Coalescing Skid**

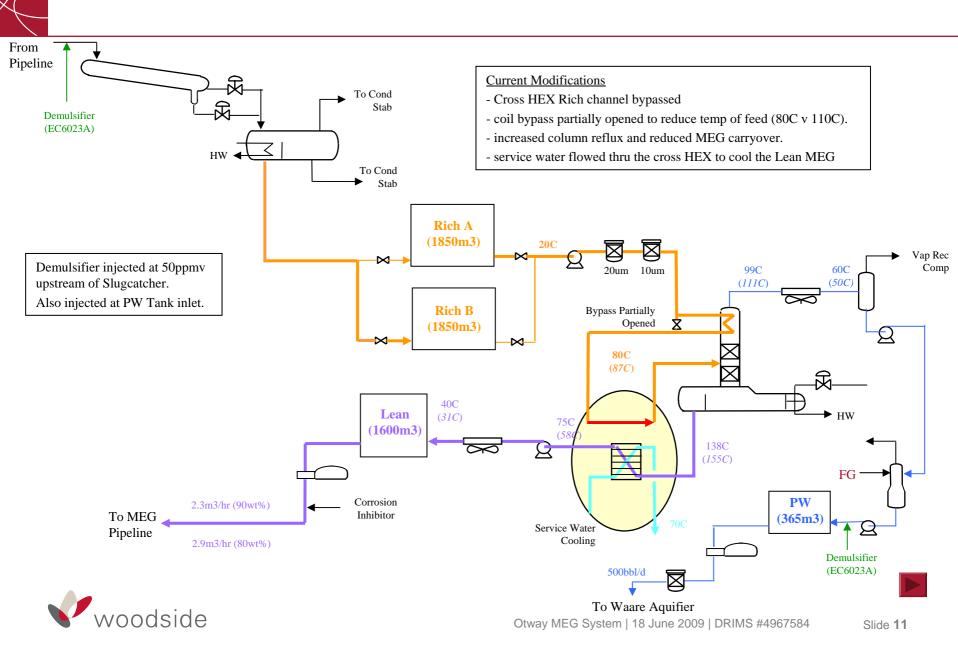
-Purchased CETCO coalescing skid to guarantee PW OIW spec of 150ppmv

#### **MEG Regeneration Unit Modification (Future)**

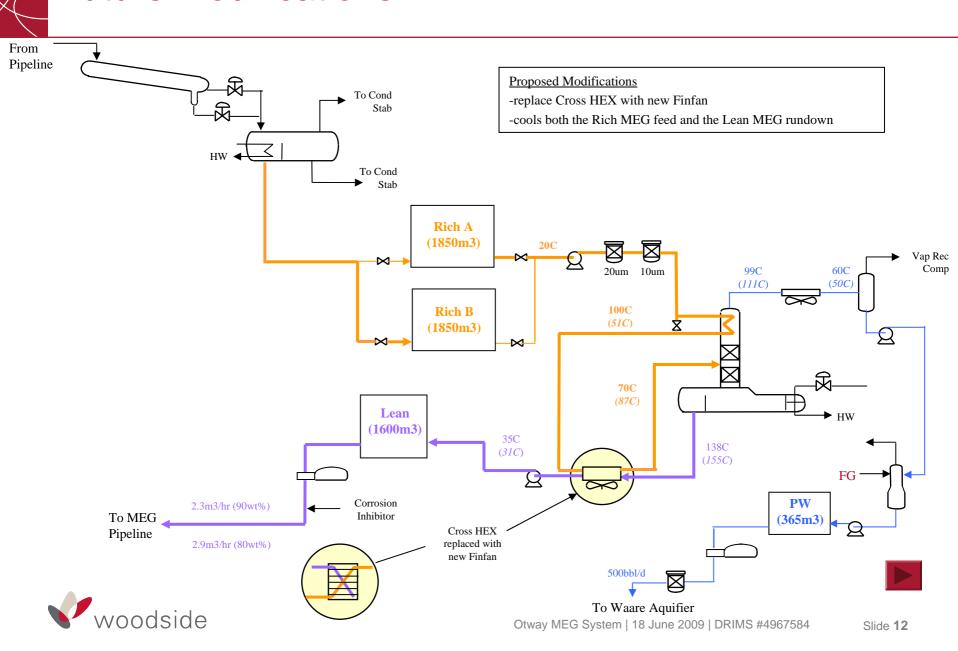
- replace HEX and service water cooling with a new finfan to cool both Rich MEG feed and Lean Meg rundown



### **Current Modifications**



### **Future Modifications**



### **Packing Photos**











### **Other Photos**







Santos

## Patricia Baleen MEG System



The Patricia Baleen MEG system is a Process Group package that underwent several design modifications researched by Santos and Worley Parsons, these modifications where implemented to enable enhanced efficiency of operation, reduced maintenance costs, reduced maintenance downtime whilst reducing risks and hazards associated with maintaining MEG systems.

The modifications include the following,

- Lean MEG pre filter,
- •MEG Sump tank,
- Larger physical size, including longer intermediate deck,
- Cooler access,





- Docking Stations for tower sections,
- Distributers and bed limiter redesign
- •GPO outlets and plugs for lighting instead of hard wiring
- Tower redesign for ease of dismantling.

#### MEG Sump Tank

Provisions have been made for a MEG sump tank to drain the Rich MEG filters into vessels into during routine maintenance, the PSV's have also been plumbed to this tank to capture any liquids in the event of a PSV lifting.

#### MEG Column Distributor including Bed Limiter

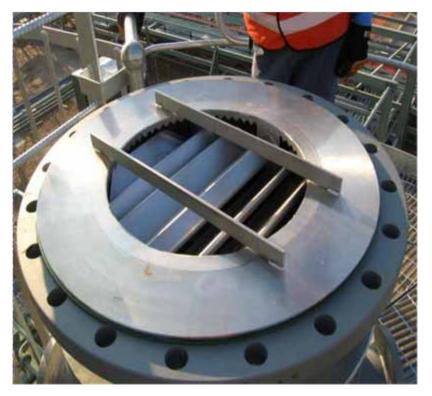
The Distributor and Flash box where redesigned to incorporate bed limiters, the design took into account ease of removal and installation, this resulted in the final design which sees the unit held in place between the tower flanges. Packing bed supports where designed as a three piece unit to enable ease of removal through man ways if required.





#### MEG Column Distributor including Bed Limiter









#### Lean MEG Pre Filters

Lean Meg Pre filters where designed and installed to capture any contaminates before they entered the Heat exchanges reducing the risk of fouling







#### MEG Tower Docking Stations

Designed to support the two sections of the column during packing removal and cleaning process, provisions have also been made to allow for gaskets to be inserted between the spool and tower to enable the tower section to be filled with chemical for cleaning purposes.







#### Coolers located for ease of maintenance

Additional grating provided under cooler to enable ease of access for routine maintenance reducing the need for EWP access.







#### Extended Intermediate Deck

The intermediate deck has been extended and strengthened to enable the tube bundle to be removed without the need for EWP and crane access, the site is currently looking into suitable tube bundle removal tools for this task.







#### Wireless Transmitters

Wireless transmitters have been used on the MEG column to remove the need for disconnect/ re-connect during dismantling of the column







#### MEG Column

The MEG Column has been designed to enable the column to be dismantled leaving the platforms and ladders attached for access to enable high pressure cleaning and Bed limiter removal.

The use of GPO style electrical fittings on lighting will enable ease of removal for Column dismantling





## MEG Regeneration Operational Problems

SPE Meeting – 18/06/2009



### Hydrocarbon contaminants can:

- cause the MEG Regenerator to operate erratically;
- cause irregular vapour and liquid loads across the packed beds often resulting in column "burping";
- promote Glycol carryover into downstream systems;
- generate excessive back pressures on the MEG Regenerator;
- swing lean Glycol concentration;





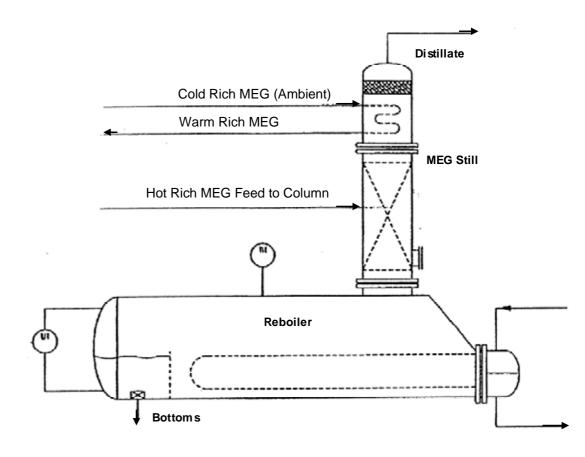






#### **Internal Reflux:**

- no opportunity to capture any vapourised Benzene
- entire distillate stream must be sent to thermal oxidiser/flare
- condensation can occur resulting in increased pressure drop to flare

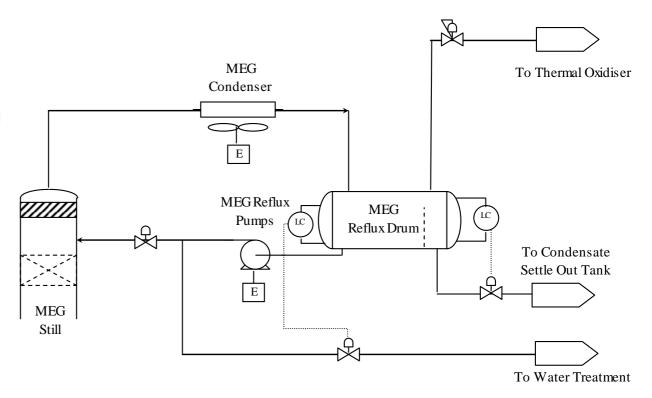






### **External Reflux:**

- liquid/liquid separation in MEG reflux drum
- saturated
   Benzene will
   remain in water
   system





### Internal & External Reflux Examples

resources & energy

### Internal Reflux

Minerva







### **External Reflux**

Longford





Patricia Baleen

**Eco**Nomics



### Contaminant Management at PB

resources & energy



Exchangers

'Sundeck' Present to allow for Reboiler Bundle Change Out

**Eco**Nomics



### Contaminant Management at PB

#### MEG Still features:

- MEG Still inlet includes a Flash Box type liquid distributor
- Hydrocarbon skimmer at MEG Still well
- wireless transmitters
- break flanges for easy dismantle & cleaning

MEG Regeneration System at Patricia Baleen





### Contaminant Management at PB

#### Reboiler features:

- Reboiler fitted with underflow/overflow baffle
- Lean MEG pumps capable of pumping 150% rate to handle possible Reboiler level upsets
- Hydrocarbon skimmer installed
- larger tube pitch for easier cleaning
- easy access for bundle removal & cleaning

#### MEG Reboiler at Patricia Baleen











- resources & energ
- ► Three phase separator to operate between 60 70°C
- At least 20 minutes residence time



Patricia Baleen Condensate Stabiliser

Bulk Liquids Heat Exchanger (MEG/Condensate Pre-Heater)

Medium Pressure Separator











**Eco**Nomics

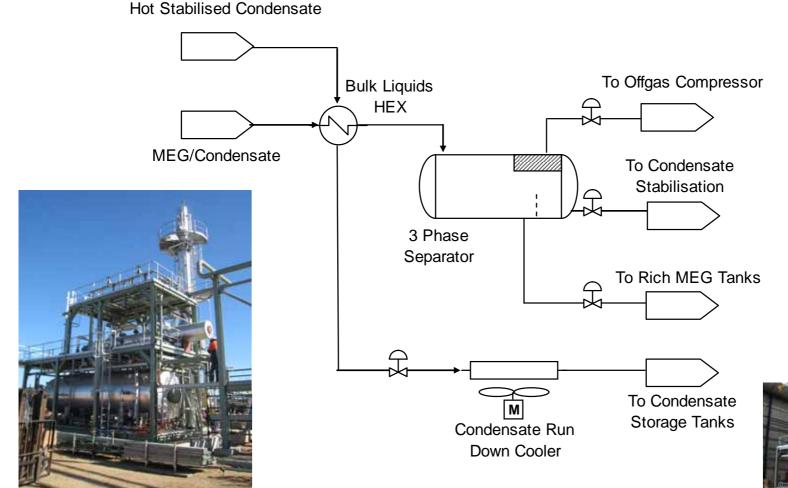






### MEG/Condensate Feed Pre-Heating

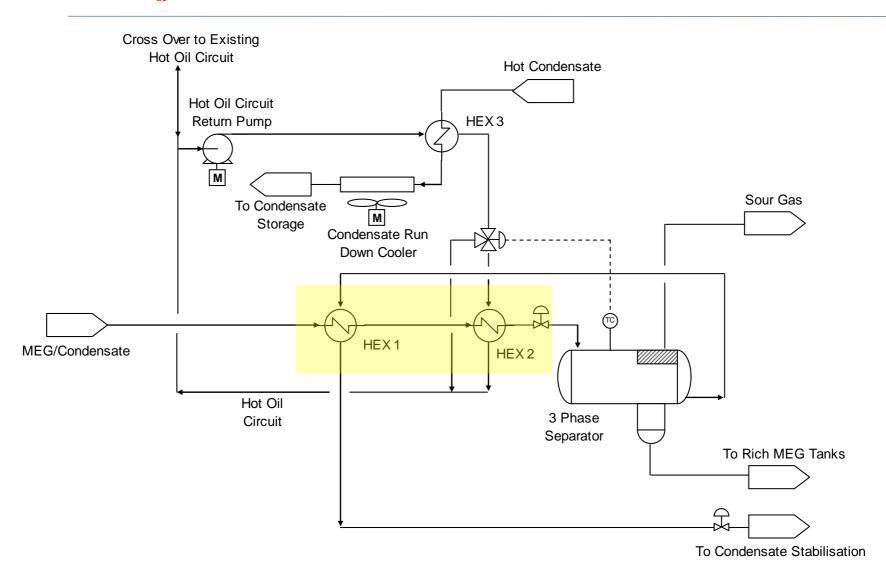
#### Patricia Baleen Medium Pressure Separator Process Sketch





### Alternative Pre-Heat System

resources & energy







MEG Regeneration Technical Meeting 18 June, 2009, Port Campbell



### **MEG Reclaim**

#### The Issue:

- Few MEG Regeneration enquiries define levels of dissolved lons, Salts, Dissolved Solids, etc.
- No Operators specify additional equipment to deal with the contaminants (ie: no interest in spending more money on process plant),
- PG do not see enquiries for Rich MEG storage / Hydrocarbon Separation.
- Typically the Hydrocarbon content of Rich MEG in MEG Regeneration enquiries is underestimated.



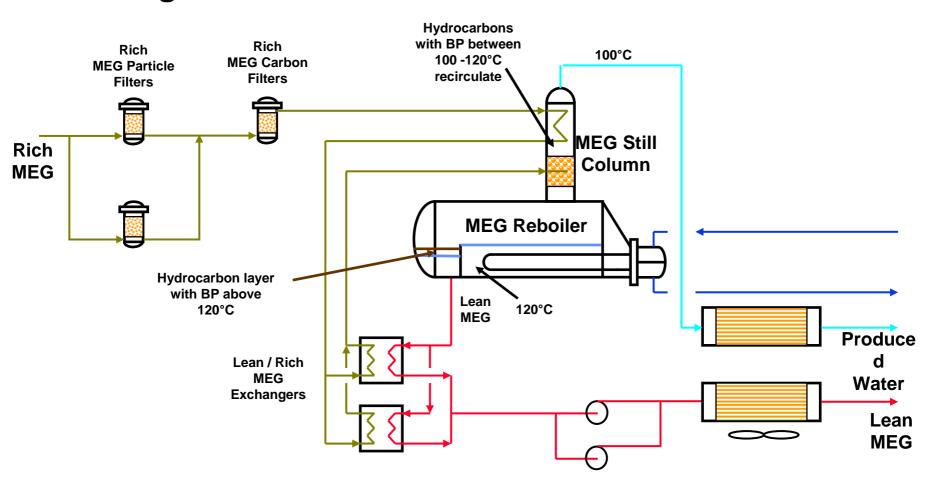
### **Design Issues**

### **Hydrocarbons:**

- Stable Hydrocarbon (HC) Emulsions enter MEG Regen Units,
- HC goes direct to Reboiler/Still Column.
- HC in Boiling Point Range 100-120oC will be held up in Still Column resulting in an periodic burp/belch.
- HC in Boiling Point Range >120oC will end up downstream of Reboiler Weir.

# **General Overview**

### **MEG** Regeneration





# **Design Issues**

#### **Dissolved Salts & Solids, etc:**

- Limited Specifications of type and nature of contaminant.
- Limited field data as to the nature of solids build-up.
- Difficulty and high cost of MEG Reclamation.
- No Operators interested in paying for high cost MEG Reclamation



# **Potential Solutions**

# **Hydrocarbons:**

- Improve HC separation in Rich MEG Storage Tanks,
- Add additional HC Separation to MEG Regen Units.

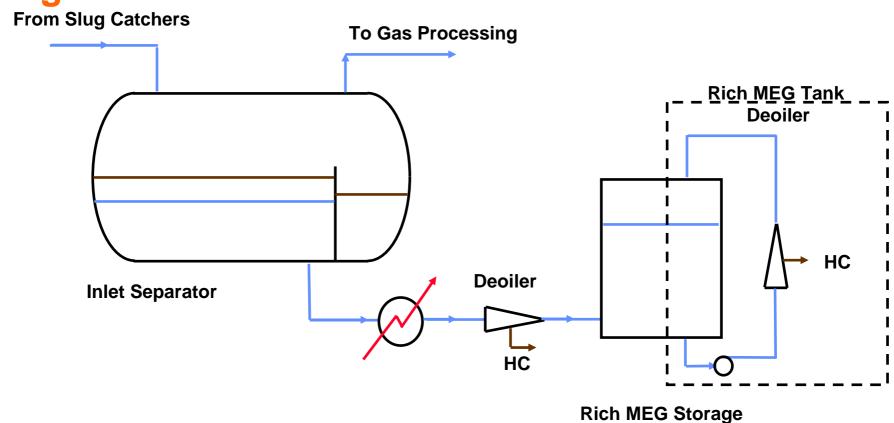


## **Potential Processes**

# **Hydrocarbon Liquids:**

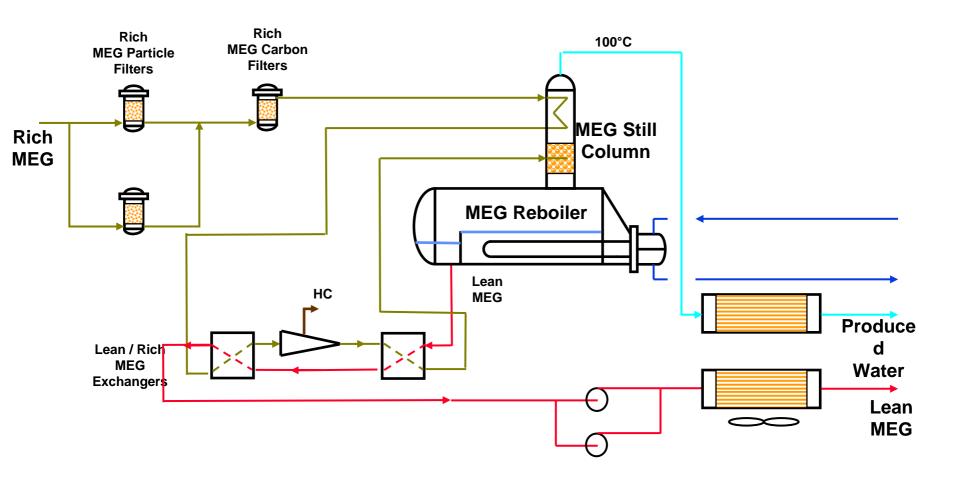
- 1. Use Hydrocyclones to separate HC from MEG by:
  - Recirculating from Rich MEG Tank, or
  - Prior to entering Rich MEG Tank, or
  - As part of MEG Regen system.
- Add heat to Rich MEG to assist Coalescence of HC.
- 3. Add HC skimming capability to Reboiler

# HC Removal Prior to MEG Regeneration



# **MEG** Regeneration

With HC Removal





## **Potential Solutions**

#### Solids:

MEG Reclamation: Expensive

ION Exchange: Unreliable

- Develop CIP (Clean In Place) equipment to allow planned on-line cleaning of equipment prone to fouling.
- Control/Minimise corrosion and creation of Iron Sulphide/ Carbonates, etc by injection of corrosion inhibitors or pH adjustment / stabilisation.



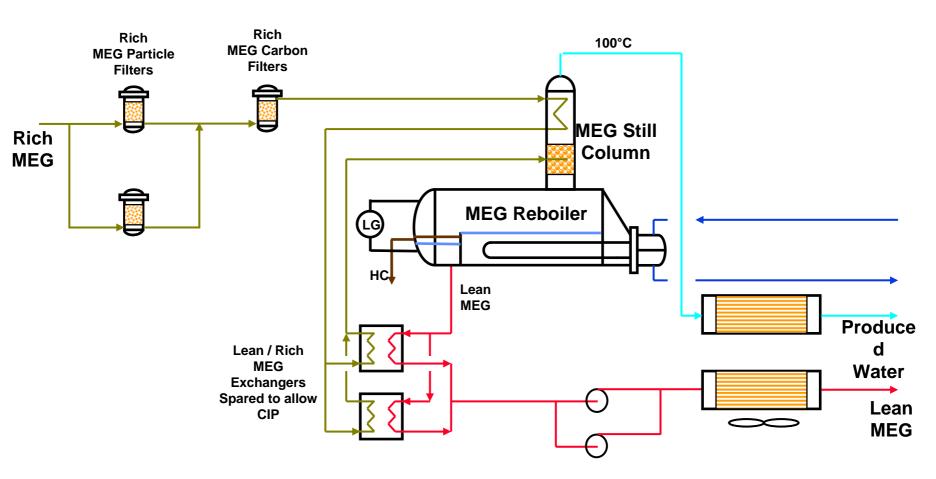
# **Potential Processes**

#### Solids:

- 1. PG have investigated CIP solutions with samples from Iona observed good results with 5% Oxyalic Acid Solution.
- 2. Therefore allow isolation, draining and then CIP of individual equipment.
- 3. May need spare exchangers and Reboiler / Still if continuous operation is required. However, this may be avoided with sufficient Lean MEG storage
- 4. Any solution MUST incorporate pH control in flowlines

# **CIP**

# **MEG Regeneration**





# Working Sessions









- Three parallel sessions
- Separating condensate and MEG; initiatives to reduce contamination of product streams Leader:
- 2. The problems of solids in MEG regeneration; OH&S problems experienced and initiatives to reduce the problems Leader:
- 3. Reducing fouling of MEG regeneration equipment; controlling the fouling of equipment or preventing the fouling occurring Leader:





#### Questions to consider

- What are the issues affecting the subject?
- Are there common themes?
- Can we identify solutions to these issues? What works and what doesn't
- Are the solutions novel or proven and what are the risks?
- Are there areas where industry should/could do better?
- Is the issue the responsibility of individual companies or should there be joint initiatives?
- Can we identify "best practice" in this area?
- Summarise the findings and present to the entire group



# Closing of Meeting









- We need consensus to publish anything from this meeting
- ▶ The data and experiences are being shared "off the record"
- Our options are:
  - Publish nothing (the default position)
  - Issue a short communique outlining the themes covered (through SPE News)
  - Issue a summary of the workshop to participants only
  - Generate a "best practice" and issue to the participants only
  - Generate a full report suitable for publishing
- ➤ Your thoughts?



- Thank you for your attendance and input
- ▶ Thank you to the sponsors
  - TRUenergy
  - WorleyParsons
- If you are driving back tonight remember to take a rest break