

Minutes of Meeting

Venue Port Campbell Surf Life Saving Club

Date 18 June 2009

Minutes by Stephen Henzell

Position	Name	Company	Specialisation
Meeting Chairman	Stephen Henzell	WorleyParsons	Overview
Speaker	John Gibbeson	Esso Australia	Longford
	Alex Perisa	TRUenergy	Iona
	Steve Fogarty	BHPBilliton	Minerva
	Mark McKenna	Woodside	Otway
	Mark Johnstone	AGR	Patricia/Baleen
	Nathan Smith	WorleyParsons	Patricia/Baleen
	Craig Dugan	Process Group	MEG Plant Supply
	John Kenez	Aker Process Solutions	MEG Reclaimers
Other Attendees	Tony Griebenow	AGR	
	Peter Kenny	AGR	
	John Kenez	Aker Solutions	
	Alfi Zakhari	BHP Billiton	
	Pat O'Connor	BHP Billiton	
	Kate Frueh	Esso Australia	
	Ryan Walsh	Esso Australia	
	Allan Kewming	Esso Australia	
	John Gooding	Esso Australia	
	John Westover	John Westover PL	
	Richard Walls	Mustang	
	Karen Grieve	Mustang	
	Anthony Booth	Nexus Energy	
	Peter Chernishoff	Nexus Energy	
	Tim Jessen	Origin	
	Sue Kennedy	Origin	
	Phil Tuckett	Process Group	
	Michael Cavill	Process Group	
	Andrew Glucina	Santos	
	Peter Salmon	Transpacific	
	Alex Perisa	TRUenergy	
	Lella Lambardi-Weston	TRUenergy	
	Hans Mulia	TRUenergy	
	Steve Sexton-Jones	TRUenergy	
	Warrick Hyde	United Group	
	Owen Mulder	Woodside	
	Gordon Wright	Woodside	
	Rawand Kader	Woodside	
	Richard Chorley	Woodside	
	Matthew Henderson	WorleyParsons	
	Thomas Steffen	WorleyParsons	
	Flavio Xantidis	WorleyParsons	

Items

1. Purpose of Meeting

Mono-ethylene glycol (MEG) is used by many operators in Bass Strait and onshore Victorian gas fields to control hydrate formation in raw gas transmission pipelines. There are now 6 MEG regeneration units in operation in Victoria with one due to start imminently. Some operations have nearly 40 years of operating experience to draw on.

MEG is an attractive hydrate inhibitor because it can be readily recovered from the raw gas stream and regenerated for re-use in the operation. Losses are normally only a small percentage of the circulated flowrate. However, all the operators experience a range of common problems with their MEG regeneration plants. Each operation can suffer from a number of the following problems:

- Poor separation of MEG from condensate, leading to operating problems in the condensate processing facilities and the MEG regeneration facilities
- Precipitation of dissolved elements during regeneration of the MEG which can lead to fouling of equipment and poor operating performance
- Occupational health and safety issues associated with managing fouled equipment in systems not appropriately designed for routine maintenance/cleaning intervention.

While all the operators have learned to live with the problems, there are opportunities to significantly improve performance and avoid the problems that are being experienced.

The purpose of the meeting is to share the experiences from the many plants, looking for common experiences and solutions that have been effective.

2. Briefings

The meeting commenced with a series of briefings to provide the relevant information and experience from each of the operators and other parties who are involved. The briefings included:

1. Steve Henzell from WorleyParsons provided the outline of the meeting workshop and a briefing on the common problems besetting all of the operating plants.
2. John Gibbeson from Esso Australia provided the experiences from two MEG regeneration units at Longford and commented on the variation seen between the two plants. The oldest plant is almost 40 years old.
3. Alex Perisa from TRUenergy talked about the problems at the Iona Gas Plant and the initiatives considered for addressing the problems. He outlined plans to use caustic dosing to manage pH in the Casino pipeline to reduce corrosion and dissolved iron in the plant.
4. Steve Fogarty from BHP Billiton talked about the Minerva gas plant and the major problems experienced in the plant until the emulsions of condensate and MEG could be effectively treated. Excessive corrosion inhibitor injection was identified as one of the causes.
5. Mark McKenna from Woodside talked about the Otway gas plant. This plant is the newest unit to be commissioned and initial problems are now being overcome. Emulsions of condensate and MEG were a key contributor to problems – a demulsifier has been effective in breaking the emulsions. In-place cleaning has been shown to be effective at removing iron carbonate deposits.
6. Mark Johnstone from AGR and Nathan Smith from WorleyParsons talked about the design initiatives being taken at the Patricia/Baleen gas plant MEG unit and upstream separation systems. The lessons learned from previous plants have resulted in numerous design features being deliberately added to the facilities.
7. Craig Dugan from Process Group talked about their involvement in the construction of many of the MEG units in operation. He also talked about initiatives that could be taken to reduce the cross contamination of MEG and condensate streams. He proposed in-place cleaning as an effective method of removing carbonate deposits.
8. John Kenez from Aker Process Solutions presented Aker's MEG reclaimer experience, which aims to precipitate salts in a controlled fashion.

3. Working Sessions

The meeting divided into three working sessions to investigate the following themes:

1. Separating Condensate and MEG; initiatives to reduce contamination of product streams
2. Reducing Fouling of MEG Regeneration Equipment; controlling the fouling of equipment or preventing the fouling

- occurring
3. The Problems of Solids in MEG Regeneration; occupational health and safety problems experienced and initiatives to reduce the problems

Each of the working sessions were asked to consider the following questions:

- 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?

4. Separating Condensate and MEG

The focus of this session was on the separation of condensate from MEG.

The separation issues were identified to include:

- ▶ Operations engaged too late in the design process
- ▶ Insufficient temperature and residence time for adequate separation
- ▶ Start-up and shutdown issues affecting separation
- ▶ Excessive shear
- ▶ Chemicals and their concentrations
- ▶ Trade off between capex and life cycle costs
- ▶ Emulsion suspenders in the glycol stream including solids, corrosion products, well clean-up fluids
- ▶ Condensate quality including presence of surfactants
- ▶ Inability to predict or model separation performance thermodynamically
- ▶ Lack of lessons learned from previous operations
- ▶ Inadequate project specifications (treating the MEG system as a simple, clean distillation process) – MEG is often treated as a utility rather than a key process unit
- ▶ Lack of data on the effect of temperatures and shear on emulsions
- ▶ Difficulty in testing at pipeline conditions
- ▶ Condensate contamination of MEG regeneration feed streams is typically underestimated
- ▶ Lack of understanding and confidence in predicting the chemistry of the inlet stream

Good practice in the area was assessed to be:

- ▶ Emulsions can be created by suspended solids, chemicals, upstream process (shear) and needs to be carefully considered in the design. Emulsion formation prediction would benefit from increased study and laboratory testing.
- ▶ Hysys is not effective in predicting the condensate content in MEG and additional allowance needs to be made in the design of MEG regeneration equipment.
- ▶ Condensate should be expected to accumulate at various points in the process. Side draws and decants should be provided to allow the condensate to be recovered.
- ▶ Treatment of emulsions relies on a combination of heat, chemicals (demulsifiers) and residence time. Condensate can be separated at multiple points in the process and not just in the primary three phase separator.
- ▶ Additional treatment to recover condensate from the MEG prior to entering the MEG regen package should be considered. This could include the application of deoiler hydrocyclones, which are commonly deployed in similar applications in other industries.
- ▶ A Cooperative Research Centre was suggested for addressing the problems facing the industry. More testing and R&D could bring significant benefits to the problems.

5. Reducing Fouling of MEG Regeneration Equipment

The focus of this session was the fouling that has been experienced in all MEG units in operation in Victoria.

The fouling issues were identified to include:

- ▶ Carbonate precipitates
- ▶ Iron sulphate on reboiler tubes (sub-micron particle sizes)

- ▶ Degradation products from the MEG and corrosion inhibitor

Two strategies were identified to manage fouling; either control the fouling and its location or prevent fouling occurring.

Control Fouling:

- ▶ Pre-heat and filter upstream of column – identify self cleaning filter
- ▶ Provide a filter / pump loop on the reboiler
- ▶ Provide spare filters and heat exchanger bundles so that cleaning can be undertaken with minimal downtime
- ▶ Use plate heat exchangers (with pumped reboiler circuits) because they are easier to clean
- ▶ Acid clean on column (better than pulling column apart)
- ▶ Acid clean on heat exchangers

Prevention:

- ▶ Increase the purge of MEG from the system (to remove built-up solids from the system – similar to boiler feed water blowdown)
- ▶ Prevent oxygen contamination (leading to degraded products)
- ▶ Proper selection of corrosion inhibitor
- ▶ Avoid overdosing of corrosion inhibitor
- ▶ Minimise MEG reboiler temperature (less than 200°C on heating medium side) and keep MEG purity less than 90%
- ▶ Filters on onshore lean MEG injection points
- ▶ pH management of the raw gas pipeline

6. The Problems of Solids in MEG Regeneration

The focus of this session was the occupational health and safety issues that are created because of the operational problems experienced in the MEG units and upstream processes.

Many OH&S issues were identified with the existing MEG units and in particular with the mechanical cleaning currently used to remove iron carbonate deposits:

- ▶ BTEX is often present in the MEG regeneration systems. OH&S rules are tightening on BTEX emissions.
- ▶ Manual handling is a major issue with mechanical cleaning of the columns, heat exchangers and filters
- ▶ Working at height is necessary for mechanical cleaning of the columns
- ▶ Mechanical cleaning versus in-situ cleaning
 - Mechanical cleaning is effective but maintenance intensive
 - Chemical cleaning is still developing. The chemical solvents need to weigh cleaning effectiveness against toxicity and hazard
- ▶ Third party services
 - Cleaning is normally done by third party services
 - Disposal of waste streams

Good practice in the area was assessed to be:

- ▶ Prevention is better than cure and it is better to avoid or manage the fouling rather than to clean up afterwards
- ▶ Provision for in-situ cleaning in the design. This takes many forms – proper access for supply and return lines, design to ensure that the solvent can access all the fouling locations, working at height issues, etc
- ▶ Provide proper access to:
 - Filters
 - Top of column
 - Flanges on column
- ▶ Maintenance provision
 - Separate reboiler from still
 - Provision for bundle pulling
 - Filter head davit
 - Laydown areas
- ▶ Indication of fouling
 - Differential pressure across fouling points
- ▶ Hydrocarbon skimming
 - Reboiler
 - Bottom of column

- Reflux drum
- Rich MEG tank
- Lean MEG tank
- ▶ Provision for BTEX contamination
 - At all manual handling locations
 - Filter change outs

7. Way Forward

The meeting agreed the following actions:

- Presentation should be distributed to attendees (action Steve Henzell)
- The Aker presentation needs to be confirmed as being available for distribution (action John Kenez)
- The findings from the sessions should be documented (by these minutes, action Steve Henzell)
- Follow-up meetings should be explored:
 - A follow-up meeting on MEG once the Patricia Baleen facilities are operating and once Iona's pH stabilisation (or whatever is selected) is trialled
 - Other meeting suggestions included waste stream treatment and disposal, flare systems, mercury and H₂S.