**Centaur Process – Control Philosophy**

* Flammable process. No reaction takes place, blending and mixing of liquids and powders. Distillation under vacuum to remove moisture from the process. 2 agitators in the vessel, one anchor agitator and 1 high speed. Reaction is temperature sensitive at 95˚C and reaction could become exothermic if moisture ingress occurs.
* Vessel may already be charged with some products to enable it to stay clean.
* Several liquids added and mixed, no heat added:

1. Xylene (Solvent)
2. Flame retardant plasticiser
3. Wetting agent
4. UV Stabiliser
5. Defoamer
6. Tin based Catalyst

* Several powders added via the screw feeder over 2 hours, high speed agitator used:

1. Aluminium Trihydrate powder
2. Titanium Dioxide (White pigment)
3. Iron Oxide (Black pigment)
4. Diurom Powder Biocide
5. Dolomite Powder (Filler)
6. Barytes

* Heat applied to the vessel until at 95˚C (using steam from boilers).
* Vacuum applied to the vessel and the xylene will boil at 26” Hg. This will remove moisture from the process.
* Vacuum pump isolated and vacuum held for 20 minutes. Vacuum tolerance ±2” Hg – if drops below then vacuum reapplied.
* Xylene is removed (along with moisture) via a condenser to a catch pot.
* Nitrogen gas is used to bring the vessel back to atmospheric pressure.
* Catch pot is emptied and weighed. Any distillate removed is replaced with fresh xylene (estimated to be <150kg xylene).
* Repeat the vacuum distillation process for a 2nd time.
* Repeat the vacuum distillation process for a 3rd time. Catch pot is emptied on 1st and 3rd distillations. Any Xylene is replaced with fresh.
* Liquid is added:

1. TDI based Moisture Scavenger

Xylene used to flush the line through

* Temperature maintained at 95˚C. Left for 60 minutes to allow the moisture scavenger to work.
* Mix is sampled for moisture control – titration (<90ppm of moisture).
* Process is repeated if result is greater than 90ppm.
* Apply cooling to the vessel by central coil to 50˚C using chilled water from the chillers.
* The following liquids and powders are added to the vessel:

1. TDI prepolymer – low monomer
2. TDI prepolymer – low monomer
3. IPDI prepolymer – low monomer
4. Fumed silica powder
5. Moisture Scavenger powder

Xylene – Liquid

* Observations made. High speed mixer back on and temperature of 40-45˚C maintained.
* The following liquid is added:

1. Defoamer

* Both mixers on. Vacuum pump is on as high as possible – mix will foam up and allowed to reach the lid of the vessel.
* Vacuum pump is isolated, and vacuum held for 5 minutes.
* Return vessel to 15” Hg – using nitrogen gas
* Reapply vacuum and repeat until level of foaming has reduced – based on a visual assessment of foam levels – this is a measure of how effective the degassing process has been.
* This is generally achieved in a maximum of 8 x 5minute sessions.
* Bring back to atmospheric pressure (0”Hg) using nitrogen.
* Check catch pots for Xylene.
* Cool to 30˚C using chilled water.
* The following liquid is added:

1. Moisture Trigger Agent
2. Xylene (to flush the line)

* 83-84% solids should be present at this stage. Mix with high-speed mixer for 15 minutes.
  + QC Sampling
  + Viscosity
  + SG
  + Hegman grind test
  + Underwater test
  + Calculation of 15L Weight using the SG.
* Xylene can be added to thin the mixture if above tolerance.
* Pack down into tins. Nitrogen purged to help preserve the product.
* The vessel and catch pot is cleaned. Liquid pumped via spray head and liquid stirred.
* Liquid decanted off – will be rich in product.
* Xylene used to pump around pack down lines and pack down head to clean them.
* Vessel is charged with the first 6 liquids ready to start the process again.