Warwick Chemicals
Mostyn, Holywell, Flintshire

Modification to AED Recycle Plant

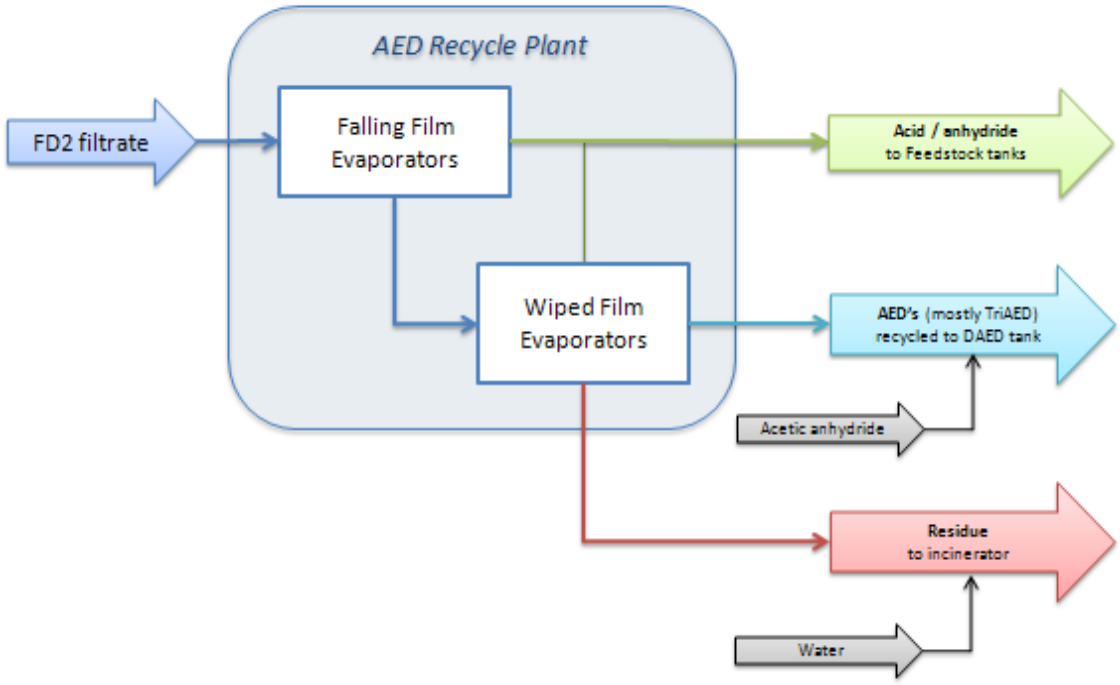
Application for permit variation
Section 1.5 (Minor Operational Change)

Introduction

Problems identified during the commissioning phase of the final stage of the Olympian project have led to a redesign of some sections of the final material dilution and transfer process. This has introduced a requirement to install a mixing tank and associated vent system.
This change has prompted the need for an application variation under section 1.5 (Minor Operational Changes) of the Companies EP Permit BU2357 (as varied).

Background

The final stage of the Olympian project installation takes mother liquor slurry directly from the filter dryer plant and will pass it through a series of falling film evaporators. This will strip off the acetic acid/acetic anhydride mixture, which is then sent to Distillation Unit 4 for recovery, the residual molten AED material is then fed back into a wiped film evaporator with the AED's being distilled and blended with the DAED stream that is fed into Plant 5. The residues from the wiped film evaporator will then be sent to the incinerator for burning and heat recovery.
This revised operation will provide a single stream of DAED that will then be converted to TAED in Plant 5.



The commissioning of Phase two of the Olympian Project has been extended as a result of a number of operational difficulties. The final water dilution of the Acetyl - ethylenediamine residues and pumping of this diluted material to the incinerator feed tank has been problematic due to the inability to produce a consistent stream of in-specification diluted material and the variable viscosity of this material causing pump performance issues.

As a result of these problems the back-end of the plant has been redesigned to mirror an existing dilution and pumping operation that delivers consistent production up-time. At the same time an additional pipeline will be installed from the AED plant to Plant 6 to allow concentrated material from the falling film evaporators to be processed in Plant 6 should there be any maintenance requirements with the back-end process on the AED plant. This pipeline transfer facility will allow a degree of flexibility for the commissioning of the AED plant. Once the AED plant is operational the pipeline will be mothballed. The concentrated material will be worked up into TAED in Plant 6 following the current manufacturing process.

Discussion

The plant has been redesigned so that the residue material from the base of the thin-film evaporators will drop through a three way valve into a 6.3m^3 stainless steel agitated vessel (AR/T8105) fitted with an external cooling coil. The residues will be mixed with water in this vessel. Calculations have shown that the resultant temperature of the residue/water mixture will be around 150^oC. The vessel will be cooled down to the required operational limit of 100^oC. The temperature monitoring equipment has an operational range of 0^oC to 250^oC. Connection points for an additional external heat exchanger have been installed into the tank recirculation line should there be the need to cool the diluted material to a lower operating temperature.

The management of the dilution will be carried out by computer control using the parameters of the monitoring equipment fitted to the mixing vessel. The residues will be added to a quantity of water that is already present in the mixing vessel – this will remove the potential for steam being generated and flashed off. Once this residue addition has started then the quantity of water needed to produce the final diluted specification will begin to be added to the vessel (this will be based on the quantity of residue being added to the vessel, measured by flow-meter). The diluted material will be circulated round the mixing vessel, with the cooling coils maintaining the target temperature of around the 100^oC mark, until the high level point is reached and then the discharge valve on the circulation line will open and allow the diluted material to be pumped to the incinerator feed tank, T083. When the low level point is reached the discharge valve will close and the mixing tank is back on re-circulation.

This vessel will then operate on level control with the diluted material being circulated round the tank and then pumped away to the incinerator feed tank (T083) between the upper and lower set point limits, the proposed operational set point will be 50% of the vessel volume, with an upper limit set at 80% of the vessel volume to trip shut the residue feed valve.
The receiving tank, T083, is an agitated tank with an operational temperature of 80^oC to 85^oC fitted with a shell and tube heat exchanger on the vent line, the tank is run at atmospheric pressure. It is envisaged that there will be no change to the current operation of this tank and the on-going residue incineration operation.

The dilution/mixing tank (AR/T8105) will be operated at atmospheric pressure and is fitted with a ‘free-flowing’ 150mm stainless steel vent line that exits 5 meters above the upper floor level of the top of the plant (exit point at a height of 28 meters). This will allow any condensate in the line to flow back to the vessel. There is no scrubber fitted to this vessel or its vent line. However, the water dilution feed has been routed into the system via the vessel vent pipe and will provide a counter current spray down the vent pipe to minimise any acidic emission.

Emission rates from the vent line have been calculated to be about 0.7m^3/h with allowances for poor control during the start-up period where the emission rate may rise to 1 m^3/h.

To ensure that the operation of the vessel is being carried out correctly and that the additional vent on the plant does not become a designated release point emission monitoring will be carried out on a weekly basis for the first two months of its operation. The sample point will be located in the top section of the vent line.

This change to the back-end of the process will ensure that the dilution of the residues will be carried out accurately and will therefore not generate any waste material. The current process, because of its poor performance, resulted in pump and line blockages which required steaming out drumming off and off-site disposal. The computer control coupled with formal documented procedures will ensure that the operation of the mixing tank, residue dilution and diluted mixture pump away will dovetail into the operation of the rest of the AED Recycle plant to maximise the production of material for the manufacture of TAED and minimise the production of waste and emissions. In the short term any maintenance operations that need to be carried out during the commissioning period can be accommodated by switching the material from the falling film evaporators through the pipeline into Plant 6 where the conversion to TAED can be carried out.

Conclusions

Management techniques: manufacturing operations will continue to be run under ISO 9001, ISO 14001 management systems and complying with other relevant regulatory requirements, COMAH, EPR, etc.

Aqueous waste: there will be no change to the quantity of aqueous waste generated by the AED Recycle plant as a result of this engineering change.

Abatement systems: the new vessel has been designed to operate without any abatement. The 150mm vent stack from the vessel will terminate at a height of 28m. Monitoring to demonstrate that gas scrubbing is not required will be carried out for the first two months of operation. There will be a review of the emission monitoring results to determine if any changes to the operation or plant are needed.

Waste production: there will be a slight reduction to the quantity of solid waste generated by the current AED Recycle plant as a result of this engineering change. The modifications will remove the need for pump and pipe clean-outs which currently generates residue that requires disposal off-site.

Energy consumption: there is an additional agitator on the plant with the additional vessel and this will deliver a slight increase in the amount of electricity required when the AED plant utilities requirements were first calculated. However, the energy required to recover and clean the current plant set-up will cease.

Raw material storage: there will be a slight increase in the inventory on the plant as a result of introducing an additional vessel. The overall inventory will increase by some 3m^3 of diluted residues.

Accident prevention: as the change to the existing plant has been modelled on an existing proven operation it is expected that the modified plant will reduce the potential for accidents that have arisen when cleaning out and operating the current plant set-up.

Noise: the equipment is new and has been designed for low noise output. This area will be added on to the site register for noise monitoring.

Emissions of polluting substances: the equipment is new and built to a high specification. Calculations have shown that the emissions from the vent on the new tank will be in the order of 0.7m^3 per hour and should rise to no greater than 1.0m^3per hour. Any emissions will be acidic in nature (acetic acid) the current emission limit from any vent on site being 50mg/m^3.

For Warwick Chemicals

Mr P. J. Bryant
HSE Manager

24th March 2015

Appendix 1