

Major Project Questions

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Question 1

What are the size of the particles passing through the filter paper? What are the sizes of the holes in the filter paper currently being used? Discuss.

The filter media used at the First Stage Grinding process is a Polyester Needle Felt media, that has been developed for use in fine contamination applications where high dirt loading is expected. The media has a mean pore size of 57µm to 200µm, which would typically allow any particulate smaller than 57µm through to the clean side of the filtration system. However, 'depth filtration', which is the term used to describe how the build-up of particulate cake on the filter media can provide further fine particle filtration, may reduce the particulate equilibrium level within the metalworking fluid (MWF) to lower than 57µm.

Particulate cleanliness of the MWF is often given at an equilibrium level, as there is no absolute filtration in the metalworking fluid industry and a residual level of metal particulate will always be expected. The purpose of separation and filtration is to minimise the metallic contamination equilibrium. An equilibrium of metal contaminate develops because a filtration device will not remove 100% of the metal removed during the process. Each filter system and process will require a different equilibrium level, the level is related to the fluid used, the maintenance of the fluid, the filter, and a host of other outside influences. To determine the equilibrium level which is reasonable and necessary, tests can be run on existing filtration systems and then correlated. These tests will provide a direction toward the particulate levels which should be maintained

Question 2

What are the actual and potential health and safety costs to TIMET due to this issue?

The First Stage Grinding process uses a water-soluble MWF, which can contain alkanolamines, boron, emulsifiers, surfactants, corrosion inhibitors, detergents, odorants, anti-foaming and anti-mist agents, abrasives, and biocides that limit microorganism growth. Through in-use deterioration the MWF can become further contaminated by tramp oils, soluble metals, metal fines, and microorganisms (bacteria, yeast and fungi). All can have detrimental effects to the health of personnel if not managed correctly. The two main health concerns from MWF exposure are skin disease (dermatitis) and lung disease (occupational asthma and occupational hypersensitivity pneumonitis); which can be caused either through regular skin contact with MWF, or through inhalation of MWF mist.

The Control of Substances Hazardous to Health Regulations 2002 (COSHH) require employers to carry out a suitable and sufficient risk assessment for those exposed to MWF. The risk assessment should identify the measures required to ensure that exposure is either prevented or adequately controlled (i.e., kept to a minimum). TIMET are vulnerable to liability if any harm should come to an employee by not adhering to this guidance. The current filtration system is prone to MWF leaks and overspill events. Which are exposing personnel to these harmful chemicals through system and equipment failures, and the clean-up operations undertaken afterwards. The events also present risks of slips and trips from the leaked MWF.

Question 3

What will be the environmental impact to the business if this project doesn't go ahead?

Customers and shareholders are increasingly demanding that organisations are careful to minimise the impact of their behaviour on the environment; ISO 14001 is the international standard for businesses and outlines guidance for the development of an environmental management system (EMS). ISO 14001 lists examples of environmental aspects that must be effectively managed as:

- Use of resources such as energy or water
- Use of recycled materials
- Emissions
- Disposal of waste, including waste water
- Any potential pollution, including risks of leaks, spills etc

Therefore, the main environmental concern from not completing the filtration project is the continued inefficient use of the MWF. When MWF is properly maintained, its effective life can be indefinite and disposal costs can be eliminated. Other advantages include reducing the amount of MWF concentrate to be purchased, achieving longer cutting tool life, improving part quality and minimising machine downtime.

The MWF used at the First Stage Grinding process is generating excessive waste from system losses and also presenting potential pollution risks. The MWF leaks are increasing the use of absorbent pads, PPE and used mop heads that are being added to the waste stream. Used MWFs cause a high level of environmental contamination due to the presence of a complex mixture of several chemicals, which increases the demand on their final treatment or disposal. All metalworking fluids should be disposed of in accordance with national and local legislative demands and a licensed waste disposal contractor should be used. Disposal is usually carried out by a combination of several physical and chemical methods, augmented by biological methods, e.g. aerobic/anaerobic fluidized bed reactors/bioreactors with the use of a variety of fillings, media (sand, charcoal, peat etc.), or membranes.

Question 4

If you were to undertake a project like this again using the DMAIC approach what would you do differently and why?

A more applicable approach to the project, if the outcome had been known and the purchasing of new equipment had been realised at project launch, would have been DMADV. DMADV is a Six Sigma framework that focuses primarily on the development of a new service, product or process as opposed to improving a previously existing one. The approach; Define, Measure, Analyse, Design and Verify can offer advantages over the DMAIC approach when a redesign of an existing product or process is needed, rather than constantly correcting the existing one.

The activities in DMADV Define are the same as DMAIC, but in Measure and Analyse, there is a slight difference in what you measure and what and how you analyse. The Design and Verify provide tools to facilitate the introduction and development of a new process or product design to meet Six Sigma levels of Performance. Hence, DMADV is alternatively also called as DFSS (Design for Six Sigma). The tools available within the different phases are more applicable to new product or process design:

Design Phase - develop design to meet customer needs

- Possible Design Tools:
 - QFD Matrix
 - FMEA Failure Mode Effects Analysis
 - TRIZ
 - Pugh
 - Taguchi Robust Design
 - DFX – Design for X

Verify

- Possible Validate/Verify Tools:
 - Validate with a pilot run
 - transition to operations team
 - close the DFSS team
 - Use flowcharts and checklists
 - Create a plan for full implementation and metrics to keep it measured.

Question 5

If this projected was implemented what control measures would need to be put into place?

A process control plan would have been completed and included in the handover documentation to production. The plan would outline the necessary procedures that need to be adhered to, to prevent the process from returning to the 'old ways'. It would contain the before and after data on the key project metrics, operational and training documents, and updated process maps. The new baseline assessment calculation of the key project metric would have been routinely audited to ensure all gains from the project are sustained. However, any change to this metric would naturally be identified during the weekly engineering meeting. This meeting regularly updates the Engineering Manager on the engineering KPIs on equipment, which would include this downtime metric.

A Failure Mode Effect Analysis (FMEA) would have been undertaken in order to develop an efficient maintenance strategy for the new equipment. FMEA is a process of identifying and reviewing potential failure modes within a system and their corresponding causes and effects. The FMEA is generated within a worksheet and failures are prioritised based on consequence, frequency of occurrence and how detectable the failure is. By fully identifying and understanding the failures from adherence to the FMEA process, control measures or actions can be taken to mitigate these problems. The FMEA documentation and process should be stored and periodically reviewed as a continuous improvement initiative.