

Abi PRICE-1707799FRIDAY 27th May '22Question 1

- a) The type of corrosion shown in Figure 1 I think is general corrosion. This corrosion can commonly be found on industrial sites such as refineries and storage facilities where old pipelines have been left for long periods of time. General corrosion causes uniform ~~loss of~~ loss of wall thickness, this can be seen on the entire surface. External general corrosion can be identified on exposed structures as it is orange in ~~area~~ colour. This is due to the iron oxide ~~corrosion~~ product deposits which are seen on the surface of uncoated carbon steel. Pipelines on oil refineries / Storage facilities are usually made from carbon steel.

Figure two I think shows corrosion under insulation. This causes general corrosion, localised corrosion and corrosion cracking. General corrosion can be seen by the slight orange colour caused by iron oxide product deposits. Localised corrosion can be extremely damaging to a structure this is due to rapid degradation, also due to the localised nature of the corrosion it can easily pass undetected. Corrosion under insulation is caused by condensation and external water becoming trapped. This can cause a crevice area which retains the water. This often creates an ideal environment for corrosion. This corrosion can be particularly aggressive, this could be because the insulating material may contain

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contaminating material accelerating corrosion. This type of corrosion is hard to find and impossible to inspect without removing insulation. Removing insulation can result in the whole section needing replacing. Corrosion under insulation can be spotted by seeing sunken bits in the insulation or parts of the insulation hanging down lower - typically on pipelines. Damage to lagging could indicate corrosion risk as it offers a ~~path for~~ ~~corrosion~~ path for water to get in.

Figure 3 I think shows crevice corrosion ^{where two} ~~exposed~~ surfaces ~~meet~~ meet. This is typically found under washers, bolts and seals ^{and gaskets}. This corrosion is similar in nature to pitting corrosion as it is found in areas that are subject to the same environment as pitting corrosion. The solution that becomes trapped within the crevice becomes increasingly aggressive, resulting in significant localised attack.

Potentially also cantional corrosion ~~from~~ on elbows

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- B) Issues that need to be considered when evaluating the ageing of electrical control equipment are firstly whether or not the electrical equipment is safety critical. Safety critical equipment should be closely monitored for ageing. Due to the fact that they can be responsible for shutdown systems and alarms. E&I systems can be subject to degradation mechanisms such as corrosion, erosion and fatigue as well as being subject to damage and overheating. Many old electrical systems are running software that is out of date, making them difficult to support and obtaining both physical parts and software updates difficult and expensive. Poor quality of plant maintenance like painting can cause issues with this equipment, sometimes important areas like flammable guards or painting over instruments can happen. With ageing electrical control equipment things can go wrong such as alarms/notifications highlighting & something may of happened when it hasn't. Electrical control systems are there to ensure that process operate within parameters they're required to which may no longer be the case if the equipment is failing and ageing which could have catastrophic consequences. Plans should be put in place to update and change ageing equipment at the end of its lifetime. Procurement should be ready for changes and new equipment by having spares readily available. Management of change meetings should be held and changes documented so new or updated equipment is listed. With correct care and maintenance ~~an~~ electrical control equipment can be kept working for many years.

Question 2

b) An energy audit is a study of feasibility which aims to establish and quantify ~~the~~ the cost of various energy inputs to and flows within a facility or organisation over a certain period of time. This audit will identify viable and cost effective energy measures in the hope to reduce operating costs. The process for an energy audit involves collating data from energy invoices and metres, taking surveys of buildings, plant and equipment. This audit should offer ways to enhance an organisation's operating efficiency, while decreasing maintenance costs. Energy audits can be used to help manage energy usage by highlighting areas within the business where ~~significant~~ energy is being lost and then finding ways to improve this. Common areas excess energy is lost include insufficient plant operation, due to old technology and poor maintenance, old building design and lack of insulation or poor windows/doors. Many organisations do not have a cunnit to save energy and staff do not pay energy bills. These areas would be highlighted using an energy survey. ~~This survey~~ ~~energy~~ ~~survey~~ ~~survey~~ Once survey has been carried out ~~the~~ areas can be identified where companies can save money. Then reasonable steps can be put in place to carry out some of these offers. Some examples of how to save energy could be changing lights to more energy efficient ones, or ones that automatically turn off so no one needs to remember. Changing out an old boiler for a newer more efficient one. Once changes have been made a review should be carried out to see if there have been any reductions in energy bills.

Question 2

- a) Energy monitoring and Targeting programme's aim to detect avoidable energy waste, quantify no savings achieved, identify fruitful lines of investigation of energy surveys and to be able to provide feedback for staff awareness.

Three components must be in place ~~where~~ in order for the implementation of an energy ~~and~~ monitoring and targeting programme. These include consumption Data, Driving factor data and methods for calculating expected consumption. Consumption data can come from metres, Delivery and stock-level figures and proxy metres. For consumption data repeatability of measurements is more important than accuracy. This is because you will gather a more reliable/true set of Data. Also meter readings should be read in house to ensure that they are accurate. ~~Breakdown~~

Driving factors are based on hours of darkness, production figures, Degree day statistics and mileage. This data critically must be synchronised with the assessment intervals and where production data is used, they should be gross volumes.

Monitoring and targeting is a management technique where all plant and building utilities are managed as controllable resources. It also requires the facility to be divided into energy cost centres. Utilities in each centre are closely monitored. Energy usage is compared with production volume or suitable measures.

Splitting of facility has its advantages as it allows sites to be split down into manageable areas. This also allowing facilities to determine which areas are using more energy and need to implement more changes. Once energy consumption information

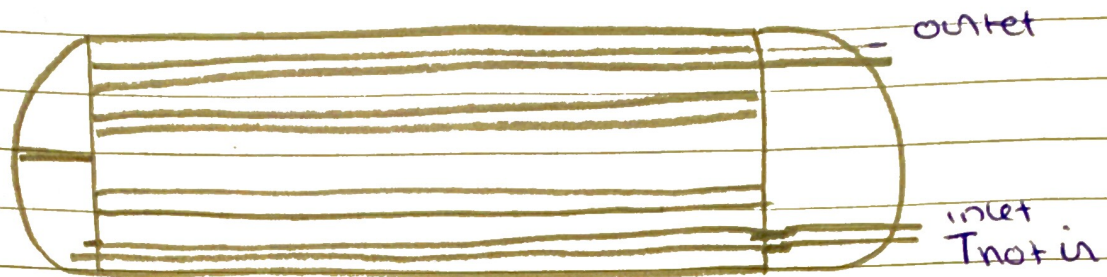
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is available targets can be set, trends can be identified with action then being taken. Advantages to this process include knowledge to whether your current energy is better or worse than before. If your energy usage follows any trends. How much your energy usage/costs could change ~~and~~ your business. It also allows specific areas of wasted energy to be highlighted. However, disadvantages could include a cost implication with long payback to implement changes.

The components up ^{allow for} ~~offer~~ a good overall assessment to be obtained provided the data needed is collected accurately.

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D) Water (cond) 15's 60°C
is



$$OIL = 165^{\circ}\text{C} - 135^{\circ}\text{C}$$

ii) $\dot{Q} = \dot{m} c_p \Delta T$

$$\dot{Q}_H = \dot{m}_H \cdot c_{pH} \cdot (T_{Hin} - T_{Hout})$$

$$= (0.05)(2350)(165 - 135)$$

$$\dot{Q}_H = 66975 \text{ W}$$

$$66.97 \text{ kW}$$

$c_{pOIL} 2350$

water 4180

iii) $\dot{Q} = \dot{m} c_p \Delta T$ - cond stream

$$\dot{m}_c = \frac{\dot{Q}_c}{c_{pc} (T_{ccondin} - T_{ccondout})}$$

∴

$$\frac{66975}{4180 (15 - 60)} = -0.356$$