SCAN ON TANK DE-11

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ABSTRAK

SKEN PADA TANGKI DE-11. Tangki DE-11 adalah bejana proses yang dilengkapi pengaduk pada kilang polimer dengan proses kontinyu. Problem pada tangki DE-11 diketahui dari indikator yang menunjukkan penurunan arus motor listrik yang mengontrol pengaduk di dalam tangki. Diduga penurunan arus motor disebabkan oleh terlepasnya batang pengaduk dari pengait motor. Untuk membuktikan apakah batang pengaduk masih tetap pada posisinya atau jatuh, penyelidikan dengan menggunakan teknik sken dengan sinar gamma telah dilakukan. Hasil sken dengan menggunakan sumber Co-60, aktivitas 70 mCi membuktikan bahwa batang pengaduk masih tetap berada pada posisinya-tidak jatuh seperti yang diduga. Tambahan lagi dari hasil sken dapat diketahui bahwa level fluida polimer didalam tangki adalah 270 cm dari lantai atau 342,85 dari dasar tangki.

ABSTRACT

SCAN ON TANK DE-11. Tank DE-11 is a processing vessel that is equipped with a mixer at continuously polymer processing plant. Problem on the tank has been identified from an indicator that shows dropped in the electric motor current that control the mixer in the tank. It is suspected that the dropped motor's current has been caused by missing the axle of the mixer from the motor's suction. To prove whether the mixer is still in its position or it felt out, an investigation of using gamma scan technique has been conducted. The scan result of using radiation source, Co-60-activity 70 mCi, shows that the axle of the mixer is still in its position - not felt out as suspected. In addition, from scan results it has been found that the polymeric fluid level in the tank was 270 cm above the floor or 342.85 cm above the bottom of the tank.

INTRODUCTION

Tank DE-11 is processing unit in continuously polymer processing plant at one of petrochemical industry in Tangerang-Banten Province. The tank is basically a processing vessel equipped with a mixer for processing raw polymeric material of textile. Problem in tank DE-11 has been identified when current gauge, which monitoring the motor's current, indicated low current. It was suspected that the dropped current might be caused by missing the axle of the mixer from motor's suction [1].

The purpose of the report is to inform whether the axle of the axle of the mixer is still in its position or it missed. Searching for the axle of the mixer was carried out by applying gamma scan technique.

THEORY OF GAMMA SCAN

The basic principle of gamma scan technique has been published elsewhere [2-4]. The scan graph is produced based on interaction of transmitting gamma rays from gamma source (usually Co-60 or Cs - 137) with a material. When gamma rays strike the material, the rays are partially absorbed by the material and the rest are transmitted. The relationship between intensity of rays before strike the material (Io) and after passing the material can be described exponential equation:

$$I = Io \exp(-\mu x)$$

Where I is the intensity of ray after strike material (cps)
Io is the intensity of ray before strike the material (cps).
μ is the linear attenuation coefficient of the material (cm^{-1}).
x is the thickness of the material (cm).

The equation, is clearly, describe the dependency of the transmitted rays on energy of the radiation and the absorber.

MATERIAL AND METHOD

Material: radiation source Co-60, activity 60 mCi, wincher with steel slink cable for hanging radiation source and scintillation detector, rope for setting up the scan, laptop computer and stationery, and personnel's radiation protection

Method: The procedure of measurement has been carried out as follows: The circumference of the tank is measured. At the outer wall of the tank is signed by letters: C, C+25CM and C-25CM as scan positions. Both radiation source and scintillation detector are put in opposite position at the side of the tank DE-11 at the same level. Starting point was assigned 245 cm above the floor or 342.85 cm from bottom of

the tank. By utilizing wincher, the detector and the source were lifted up for every 5 cm increment step. The movement is stopped when the detector and source reached end point of measurement - just below the *'bordes'*. During the scan, data captured by detector are monitored on laptop computer and then saved after then.

RESULTS AND DISCUSSION

Tank DE-11 is a processing vessel with diameter (including insulation) 442 cm and height 642 cm. It is equipped with 9.95 cm thick of mixer axle -which rotates at speed 88 rotation/ minutes. Scan on tank DE-11 has been carried out on the 22nd February 2005 for three scan positions: at the center (signed as C) to scan the axle, 25 cm left center (signed as C-25CM) and 25 cm right the center (signed as C + 25 CM).

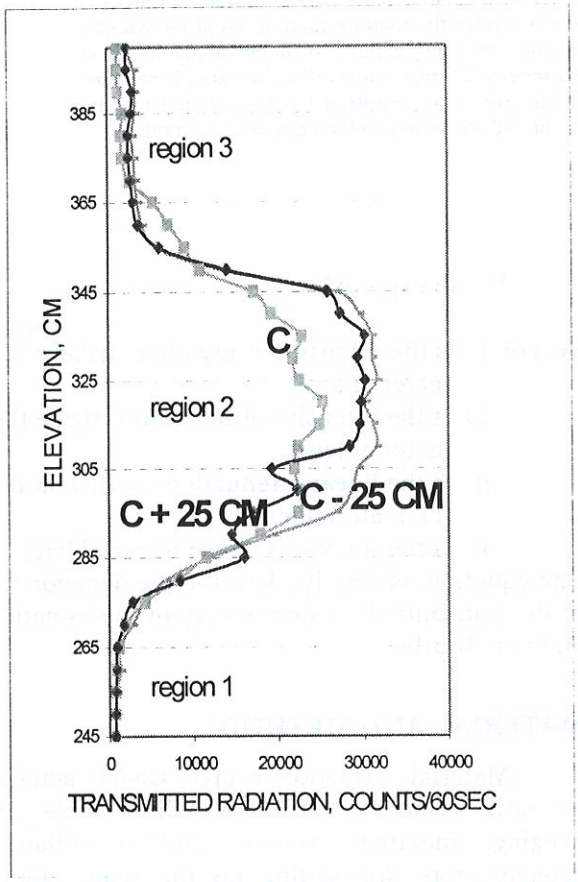

Fig. 1. Scan on tank DE-11 for determination of position of the axle of the mixer

The scan data is presented in figure 1. As a thumb of the rule that fluid level is determined by curve deflection of the scan data and the axle position is determined on how the scan data can be differentiate each others. If the area of measurement is divided into three regions: region 1 from level 245 cm to 270 cm , region 2 from 270 cm to 365 cm, and region 3 from 365 cm and above, one can analyze the data for each region. Please note that all level is measured from the floor level. In order to avoid error in data interpretation consultation to the vessel drawing and plant personnel is a compulsory.

Region 1. (level 245 – 270 cm).

All scan data in region 1 are almost in a line or data are superimposed each others. According to the vessel drawing, in the region 1, radiation rays are passing through the following materials: vessel wall (including insulation), polymeric fluid, and the axle of the mixer. In deep searching in region 1 shows that the all scan data (**C-25 CM**, **C** , and **C+25 CM**) cannot be distinguished. This is because the ability of the absorber (axle and polymeric fluid) is almost the same. As a consequence, determination of the axle of the mixer in the region 1 is impossible.

Region 2. (Level 270 cm – 365 cm).

Scan data in region 2 is clear. Two data (blue curve, **C + 25 CM**, and green curve, **C-25 CM**) are closed each other, while the other data (red curve, **C**) is separated from them. According to the vessel drawing, in region 2 there are the following materials: the vessel wall (including insulation), the axle of the mixer and the vapor of the fluid. The red curve (C) is produced due to interaction of gamma rays with vessel wall (including insulation) and the axle of the mixer and the vapor of the fluid. This fact, red curve in figure 1, shows that the axle of the mixer is still in position - not felt as suspected. The two other curves (**C+25 CM**) and (**C- 5 CM**) are produced because of interaction of the following materials: the wall of the vessel (including insulation) and the vapor of the fluid - not interact with the axle of the mixer. This is why these curves shows higher intensity compared with the red curve (C).

Region 3. (Level 365 cm and above)

The patterns of the scan data in region 3 shows a different feature compared to the scan data in region 1 and region 2. The red curve (C) is closer to the vertical axis while the other two curves are (**C+25 CM**) and **C-25 CM**) a little bit far from the vertical axis. According to the drawing of the vessel, the gamma rays in region 3 were passing through the following material: the wall of the vessel (including insulation), the 'lifting lug' of the vessel, empty space and the axle of the mixer. The red curve (C) was produced as a result of interaction of gamma rays with the wall of the vessel (including insulation), the lifting lug of the vessel, the empty space and the axle of the mixer. The blue curve (**C+25 CM**) and the green curve (**C-25 CM**) were

produced from interaction of gamma rays with the wall of the vessel (including insulation), the lifting lug of the vessel and the empty space. Due to interaction of gamma rays with the axle of the mixer, therefore the curve of the scan data (red curve, C) shows closer to the vertical axis.

An Intensive discussion has been made among the scan team, polymer supervisor and factory personnel at the polymer division in order to determine the fluid level and the axle position. From scan data presented in figure 1, it was proved that the axle (presented by red curve, C curve) is still in its position (not felt) and the fluid was at level ± 270 cm above floor. Above fluid level was empty space contained fluid vapor.

CONCLUSION.

The gamma scan has been successfully applied to prove the position of the axle and it has been able to determine the fluid level. Scan data in figure 1 shows that the axle of the mixer is still in its position and the level of the fluid was ± 270 cm from the floor.

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Appendix 1.

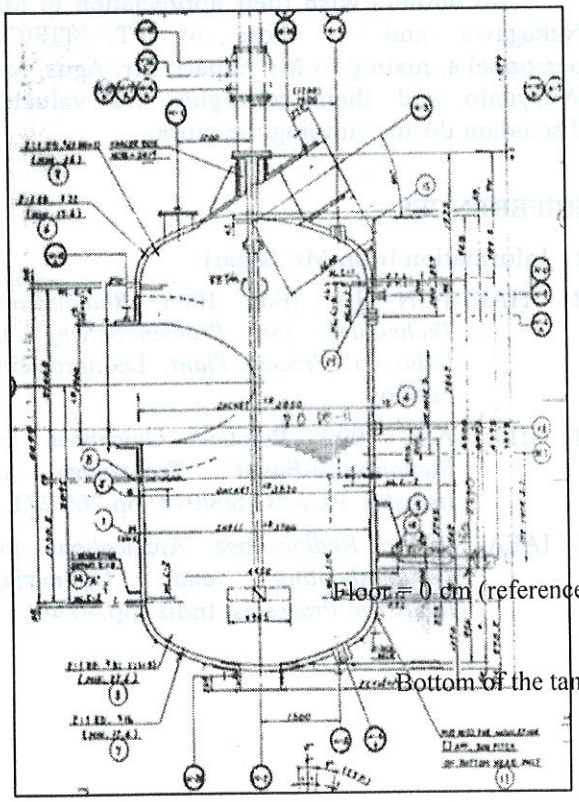

Figure 2. Drawing of tank DE-11

Appendix 2

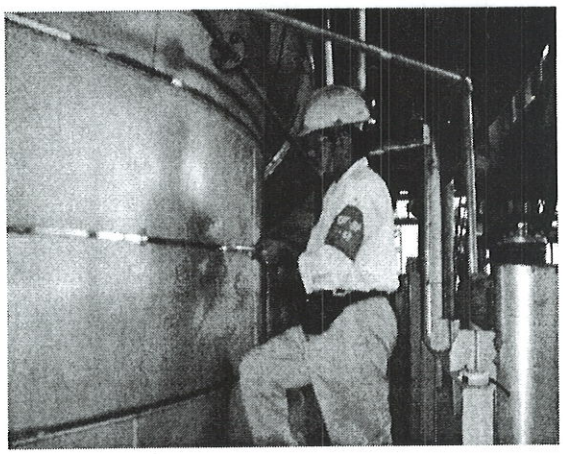

Fig. 3. Setting up for scanning

Appendix 2 (cont')

Fig. 4. Scan in progress

Appendix 2 (cont')

Fig. 5. Look ! the axle is there