SCAN ON CAUSTIC /WATER WASH TOWER DA 202

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ABSTRAK

SKEN PADA CAUSTIC/WATER WASH TOWER DA 202. Teknik gamma sken telah diaplikasikan untuk menyelidiki kondisi material di dalam caustic/water wash tower DA 202 berdiameter 4, 2 meter. Pekerjaan sken dilakukan sepanjang 10 meter dari tray 13 (ketinggian 26950 mm) sampai tray 4 (ketinggian 35050 mm) diatas permukaan tanah. Hasil sken dengan sumber Co-60, aktivitas 70 mCi dan detektor sintilasi menunjukkan bahwa semua tray tetap berada pada tempatnya masing-masing. Tray 4 sampai tray 10 dan tray 13 tidak menunjukkan adanya penyimpangan perilaku. Banjir ringan (*light flooding*) teridentifikasi pada tray 11. Tray 12 lebih parah. Selain mengalami banjir berat (*heavy flooding*) diduga terdapat material asing, yang kemungkinan berupa padatan, pada tray 12 tersebut. Banjir pada tray 11 dan tray 12 diduga disebabkan adanya sumbatan (blocking) pada tray-tray tersebut.

ABSTRACT

SCAN ON CAUSTIC/WATER WASH TOWER DA 202. Gamma scan technique has been applied to investigate the material condition in caustic/ water wash tower DA 202 having 4.2 meters in diameter. The scan work has been carried out for 10 meter which cover from tray 13 (at elevation 26950 mm) to tray 4 (at elevation 35050 mm) above ground level. Scan results using Co-60 source, activity 70 mCi and scintillation detector shows that all trays were in their position. Tray 4 to tray 10 and tray 13 did not show abnormal behaviors. Light flooding was identified on tray 11. Tray 12 was more severe. In addition to experiencing heavy flood, it was suspected a foreign material, which probably was solid in character, was on tray 12. Flooding on tray 11 and tray 12 was suspected caused by blocking on those trays.

INTRODUCTION

Gamma scan is most competitive method to inspect 'material condition' in technically complex industrial process plants. The success of the application of this technique is attributed to its unique ability to provide information which is cannot be obtained by other techniques. One of the prominent advantages of the gamma scan technique is that the technique is carried out when plant is just in operation. If the technique is applied for various conditions of operations the plant can be scheduled for optimal operation [1].

It is purpose of the paper to give result of scan investigation of material condition in the caustic/ water wash tower DA 2002 which has functioned for neutralize poisonous gas in etylene line of petrochemical industry [2]. The scan was carried out from level 26250 mm to 35950 mm above ground level which cover tray 13 to tray 4. The data of measurement are presented come with its summary.

THEORY

The basic principle of gamma scan technique, presented in figure 1, is based upon the interaction of transmitting gamma rays with a material in which it is passed. When gamma rays are passed through the material part of the rays are absorbed and the rest are transmitted.

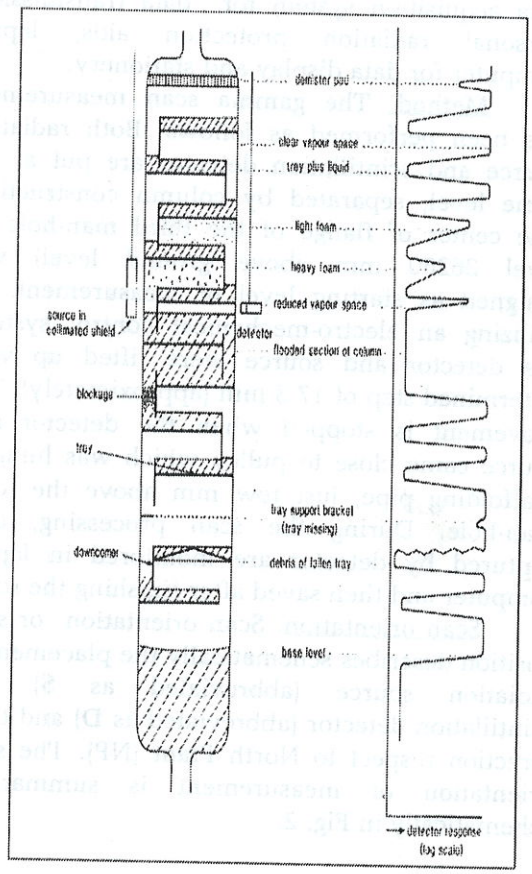

Figure 1. Principle of gamma scan (adopted from reference. no. 3)

Intensity of transmitted rays before and after passing through the material is given by

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

Where I and Io are the intensity of the transmitted rays after and before passing the material (cps)

- μ is the linear attenuation coefficient of material (cm^{-1}).
- x is the thickness of the material (cm).

From the above equation, it is clear that the transmitted intensity of radiation after passing through the material is depend upon the energy of gamma rays and the nature of absorbing material.

As mentioned elsewhere [1,3-4] that every material has ability to absorb gamma rays, therefore scan curve obtained from scan examination represent the material's profile to which the gamma ray is passed.

MATERIAL AND METHOD

Material and equipment. .Radiation source, Co-60, energy 2.5 MeV, activity 70 mCi; electro-mechanical control system equipped with stainless-slink cable for controlling movement of detector and source; scintillation detector and data acquisition system for data transmission; personal radiation protection aids, laptop computer for data display and stationery.

Method. The gamma scan measurement has been performed as follows: Both radiation source and scintillation detector are put at the same level, separated by column construction. The center of flange of the third man-hole (at level 26250 mm above ground level) was assigned as starting level of measurement. By utilizing an electro-mechanical control system, the detector and source were lifted up with determined step of 17.3 mm (approximately). The movement is stopped when the detector and source came close to pulley which was hung at scaffolding pipe, just few mm above the forth man-hole. During the scan processing, data captured by detector are monitored in laptop computer and then saved after finishing the scan.

Scan orientation. Scan orientation or scan position describes schematically the placement of radiation source (abbreviated as S) and scintillation detector (abbreviated as D) and their direction respect to North Plant (NP). The scan orientation of measurement is summarized schematically in Fig. 2.

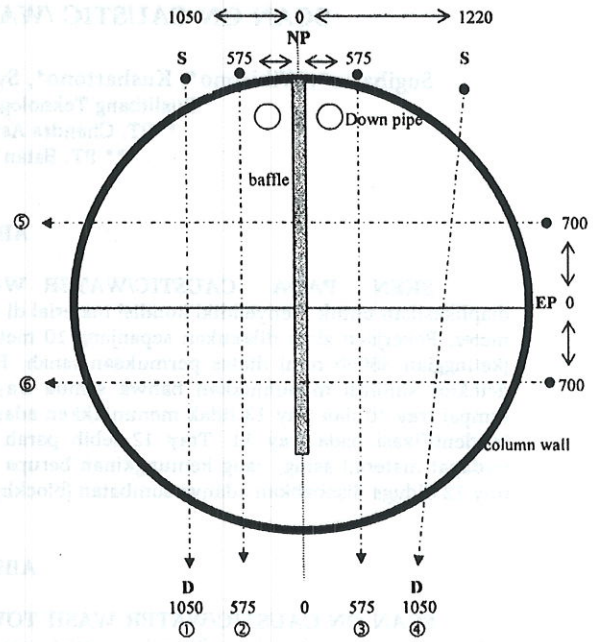

Figure 2. Schematic scan orientation. Please note that (S ◆⟶ D) is direction of measurement. For example : ◆⟶ ③ is scan of position 3

RESULTS AND DISCUSSION

Material conditions in tower DA 202 are analyzed based on scan data. For normal trayed column, in which the trays are positioned at the same spaced distance, the scan data shows a curve of regular pattern in which hill and valley patterns consecutively appear at that curve. The hill curve shows a more gamma rays are transmitted, however, the valley shows less transmitted rays. For trouble trayed column, however, the scan data shows curve with irregular patterns. Due to scattering interferences, 'material condition' in the column could not be determined precisely, however, one can estimate 'material condition' in the scanned column with tolerable errors.

The data of the scans are presented in Figure 3 to 8. Figure 3 is the data of May 24, 2004, while figures 4 to 6 and figures 7 and 8 are the data scan of May 25 and 26, 2004 respectively. The detailed results of scan are summarized as presented in each figure.

Scan data on caustic/ water wash tower DA 202 show that trays 4 to 10 and tray 13 were in position. They were functioned normally and carried approximately the same amount of liquid. Trays 11 to 12 were in position but they were in trouble. Light flooding on tray 11 and heavy flooding on tray 12 were identified. In addition, suspecting foreign material, which probably solid in character, was identified on tray 12. The conditions of trays are summarized in table 1

Table 1. **Tray condition based on scan data**

Tray	Tray condition	Observed from scan orientation
4	Normal	①②③④⑤⑥
5	Normal	①②③④⑤⑥
6	Normal	①②③④⑤⑥
7	Normal	①②③④⑤⑥
8	Normal	①②③④⑤⑥
9	Normal	①②③④⑤⑥
10	Normal	①②③④⑤⑥
11	Light flooding	③④⑤⑥
12	Heavy flooding and foreign material	③④⑤⑥
13	Normal	①②③④⑤⑥

CONCLUSION

All trays were in their position; however some of them were in trouble. The severe condition was occurred on tray 11 on which light flooding was observed. Tray 12 has experienced heavy flooding and suspecting foreign materials, which probably is solid in character, was also identified.

Recommendation:

Denser grid scan on tray 12 is needed to estimate the dimension of the foreign material

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ACKNOWLEDGEMENT.

All authors from P3TIR-BATAN wish to express our appreciation to PT. Batan Teknologi (Persero) that has mandated us to do scan work at PT. Chandra Asri (Persero). Our appreciation and respect are dedicated to Adi Indrajaya and his colleagues at PT Chandra Asri (Persero) for beautiful team-work and valuable discussion.

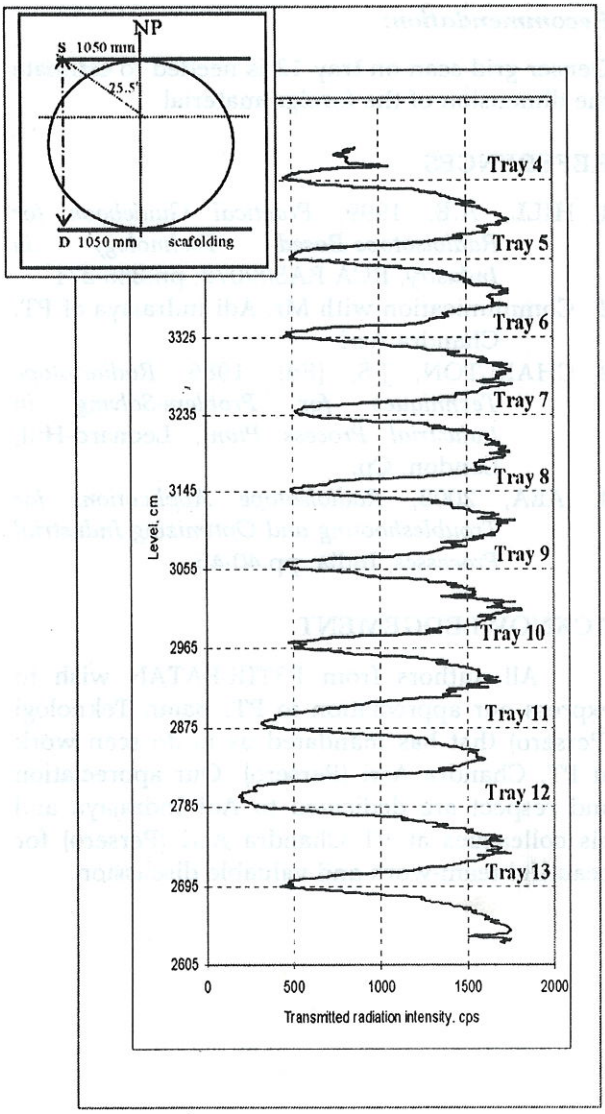

Figure 3. Profile of Caustic/ Water Wash Tower DA-202 obtained from scan orientation 1. The scan was carried out on May 24, 2004 at 17:00 p.m. The source and the detector were positioned at 1050 mm (25.5°) and 1050 (154.5°) western North Plant (NP) respectively. Trays 4 to 10 and tray 13 were in position and carried approximately the same amount of liquid. These trays were functioned properly. Light flooding on tray 11 and a heavy flooding on tray 12 were observed as indicated by their lower and wider scan curve. The flooding was probably due to blocking on these trays.

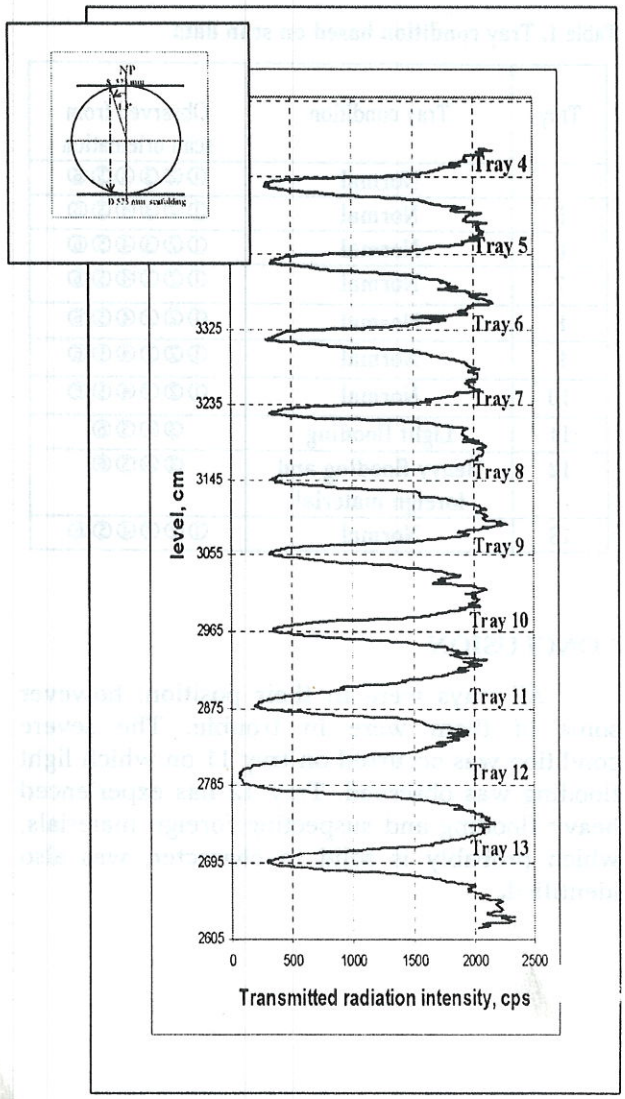

Figure 4. Profile of Caustic/ Water Wash Tower DA-202 obtained from scan orientation 2. The scan was carried out on May 25, 2004 at 12:19 p.m. The source and the detector were positioned 575 mm (1.5°) and 575 mm (178.5°) western North Plant (NP) respectively. Trays 4 to 13 were in position and carried approximately the same amount of liquid. These trays were functioned properly. Light flooding on tray 11 and a heavy flooding on tray 12 were observed as indicated by their lower and wider scan curve. The flooding was probably due to blocking on these trays.

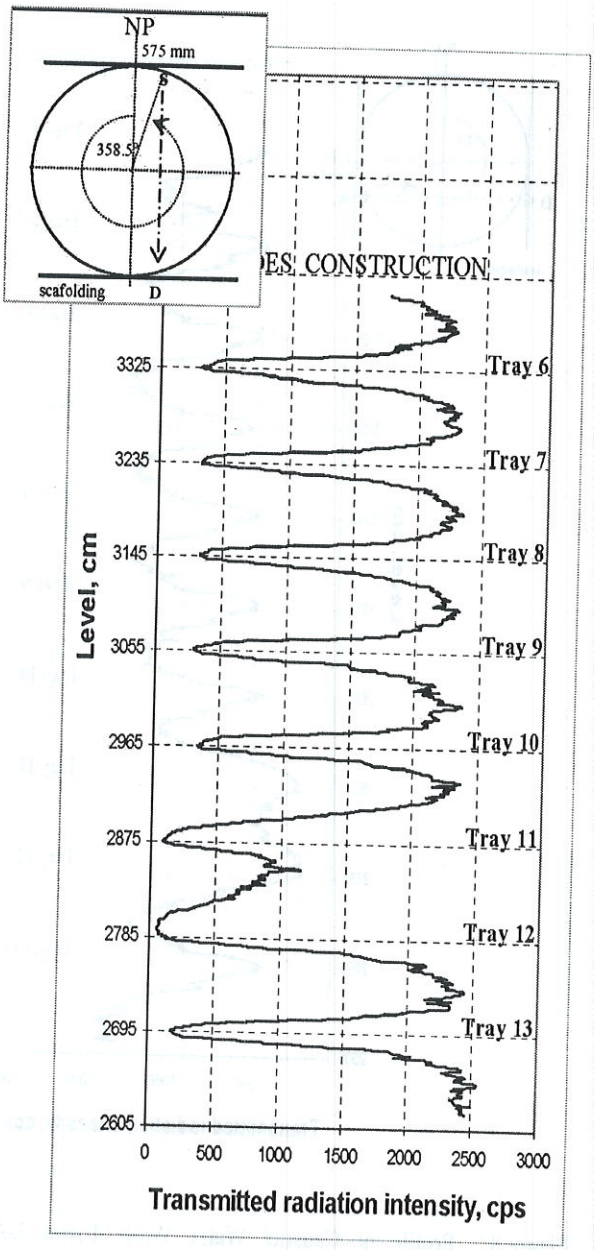

Figure 5. Profile of Caustic/ Water Wash Tower DA-202 obtained from scan orientation 3. The scan was carried out on May 25, 2004 at 17:29 p.m. The source and the detector were positioned 575 mm (358.5°) and 575 mm (181.5°) eastern North Plant (NP) respectively. Trays 6 to 13 were in position and carry approximately the same amount of liquid. Low radiation intensity between tray 11 and 12 was observed indicating a foreign material which probably is solid in character. Light flooding on tray 11 and a heavy flooding on tray 12 were observed as indicated by their lower and wider scan curve. The flooding was probably due to blocking on these trays.

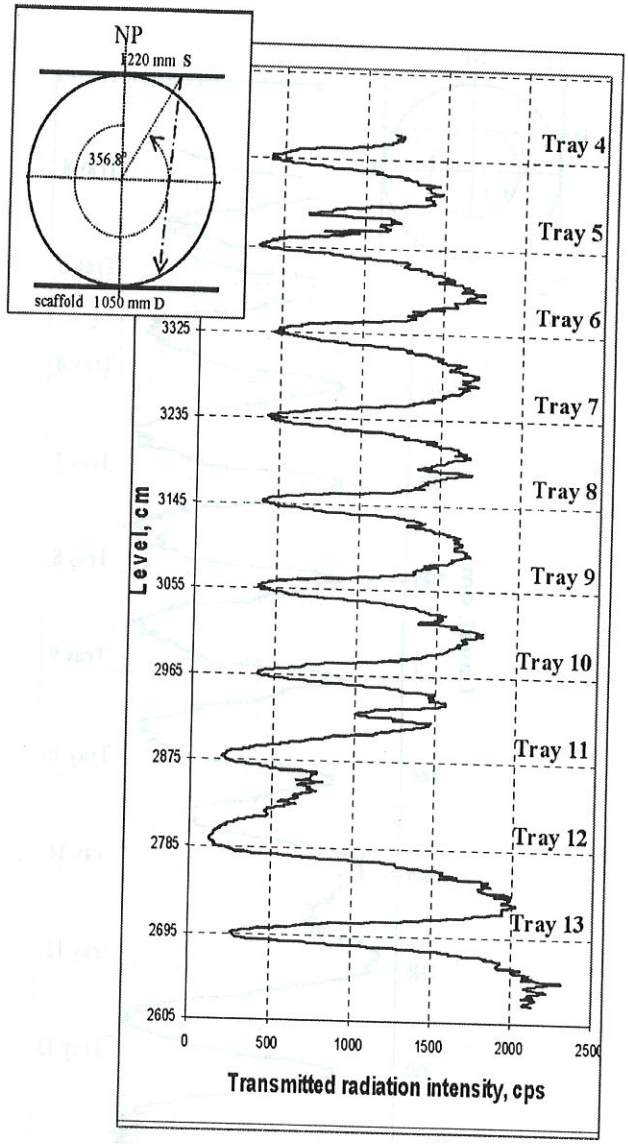

Figure 6. Profile of Caustic/ Water Wash Tower DA-202 obtained from scan orientation 4. The scan was carried out on May 25, 2004 at 16:05 p.m. The source and the detector were positioned 1220 mm (356.8°) and 1050 mm (182.7°) eastern North Plant (NP) respectively. Trays 4 to 13 were in position and carry approximately the same amount of liquid. A low intensity between tray 11 and 12 was observed indicating a foreign material which probably is solid in character. Light flooding on tray 11 and heavy flooding on tray 12 were observed as indicated by their lower and wider scan curve. The flooding was probably due to blocking on these trays.

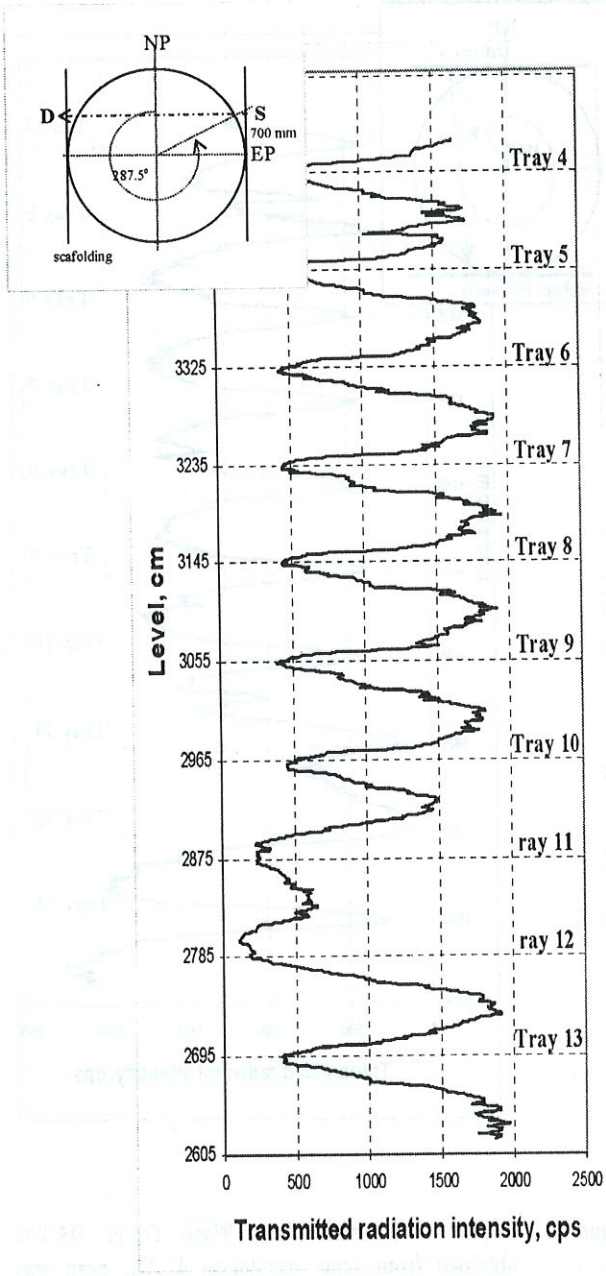

Figure 7. Profile of Caustic/ Water Wash Tower DA-202 obtained from scan orientation 5. The scan was carried out on May 26, 2004 at 9:17 a.m. The source and the detector were positioned 700 mm (287.5°) and 700 mm (72.5°) northern East Plant (EP) respectively. Trays 4 to 13 were in position and carry approximately the same amount of liquid. Low intensity between tray 11 and 12 was observed indicating a foreign material which probably is solid in character. Light flooding on tray 11 and heavy flooding on tray 12 were observed as indicated by their lower and wider scan curve. The flooding was probably due to blocking on these trays.

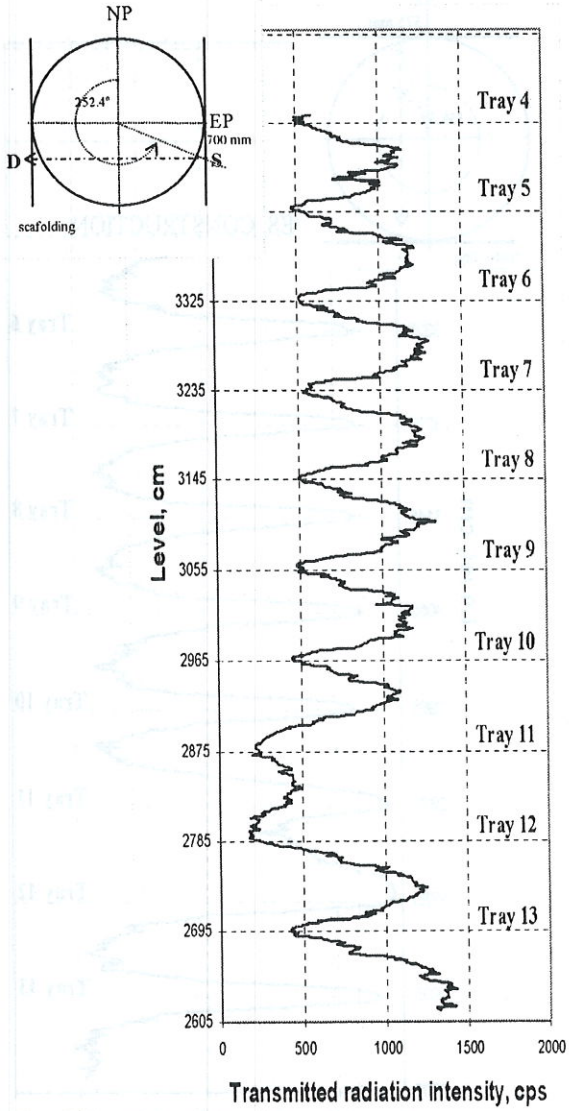

Figure 8. Profile of Caustic/ Water Wash Tower DA-202 obtained from scan orientation 6. The scan was carried out on May 26, 2004 at 11:55 a.m. The source and the detector were positioned 700 mm (252.4°) and 700 mm (107.6°) southern East Plant (EP) respectively. Trays 4 to 13 were in position and carry approximately the same amount of liquid. Low intensity between tray 11 and 12 was observed indicating a foreign material which probably is solid in character. Light flooding on tray 11 and heavy flooding on tray 12 were observed as indicated by their lower and wider scan curve. The flooding was probably due to blocking on these trays.