Identification of the Internal Condition of Crude Oil Distillation Unit Using Gamma Column Scanning Technique

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Radioisotope techniques for industrial application in Myanmar

- IAEA/TC program since 2012
  - Building National Capability to use Radiotracer and Sealed Source Techniques in Industry
- Established Radioisotope Techniques Laboratory
  - Building National Capacity in Radiotracer and Non Destructive Evaluation Techniques in Industry
Radiotracer and Sealed Source Techniques

- Residence Time Distribution (RTD) analysis
- Flow rate measurement
- Leak testing and mixing efficiency
- Gamma column scanning (GCS)
- Gamma process tomography (CT)
- Neutron back scattering
Awareness Seminars of Radiotracer and Sealed Source Techniques to Industries

No.1 Refinery (Thanlyin)  
No.4 Urea Fertilizer Plant
Science and Engineering Exhibitions
Gamma Column Scanning (GCS)

- GCS technique; introduced and applied to end-user for the benefit of Sealed Techniques and their ability of problems solving in industries.
Aims and Objectives

❖ To apply the applications of radiotracer and sealed techniques in petroleum and petrochemical industries in Myanmar

❖ To identify the internal structures in the crude oil distillation unit C at the No.(1) Refinery (Thanlyin) by using gamma scanning technique
No. (1) Refinery (Thanlyin), Crude Oil Distillation Unit C

- One of three Refineries under the Myanma Petrochemical Enterprise, Ministry of Energy, situated on the bank of Bago river and 14 km far from Yangon.
- Only Refinery - capable of using both crude oil and condensate as feedstock.
- Unit C: Tray-type distillation column
  - Number of trays – 52 trays
    - Tray # 1 to # 41 – single pass trays
    - Tray # 42 to # 52 – double pass trays
  - Diameter – 2 m
  - Height – 43.55 m
- Constructed by Mitsubishi Heavy Industries, Japan
- Commissioned – August, 1980
- Production capacity – 6000 BSPD *Barrels Per Stream Day*
- It has been shutdown since 2013 due to some processing problem.
Experimental Procedures

Scan Orientation

- Refer to the mechanical drawing of the tower;
- Select a reference point at 0°
- Select three scan lines within the left and right down corner areas of distillation column
- Place $^{60}$Co source at 44°, 59° and 107°
- Place detector at 224°, 291° and 224°
Equipments for Gamma Column Scanning

- 50 mCi $^{60}$Co Gamma Source
- Source container
- NaI(TI) Scintillation detector
- ColScanCK1 + NibraS software
- Manipulation system
- Detector Cable
Equipments Installation

- **Starting point** – the elevation of 7350 mm noted as 0 mm (zero position)
- **End point** – tray # 52 at elevation of 43550 mm
- **Scan step** – 50 mm,
- **Counting time** – 2 s
Equipments Installation at the top of the column

Measuring gamma column scanning from the ground
Radiological Safety

- Briefing about the radiation safety requirement to industrial people
- Handling the source as follow ALARA principle
- Design of radiation source holder not to exceed dose permissible limits as ICRP
- Using personal protection equipments, area survey meter, radiation protection equipments, radiation sign and radiation barricade
- After scanning work, radiation level on source container is monitored to ensure that the source is at safe place in the transport container.
Data Interpretation

By referring to the mechanical drawing, investigated scan data can interpret the condition of inside of the column.
RESULT AND DISCUSSION

From the first and second scan profile,

- Trays located at their position – #42 to #52
- Abnormal scan profile – Tray #44, #45, #46, #49, #52

(due to internal constructions of distillation unit – vapor in, side reflux draw off and reflux in are were existing at these positions)
RESULT AND DISCUSSION

From the third scan profile,

- Trays #1 to #8
  (could not be identified completely because trays are very small and scan line pass through down comer area)

- Trays located at their position—
  #9 to #41

- Abnormal scan profile—
  tray #11, #18, #20, #21 and #31
  (due to internal constructions of distillation unit - Manhole, MY Go Draw off and LT GO Draw off were existing at these positions)
Gamma Column Scanning Profiles Compared with Mechanical Drawings
CONCLUSION

- Gamma column scanning technique was utilized to identify the mechanical in trayed column of Crude Oil Distillation Unit C at the No. (1) Refinery (Thanlyin), Yangon, Myanmar.

- It was challenged to scan because the space between insulator and ladder is very narrow, in some places detector and source were passed the ladder with considering of radiation safety aspect.

- Local team had capability and confident to conduct column scanning experiment in industrial scale. Local team could identified # 9 to # 52 trays located at their position.

- Future suggestion – To keep a systematic and complete record of column operating conditions, on-line investigation should be implemented during operation.