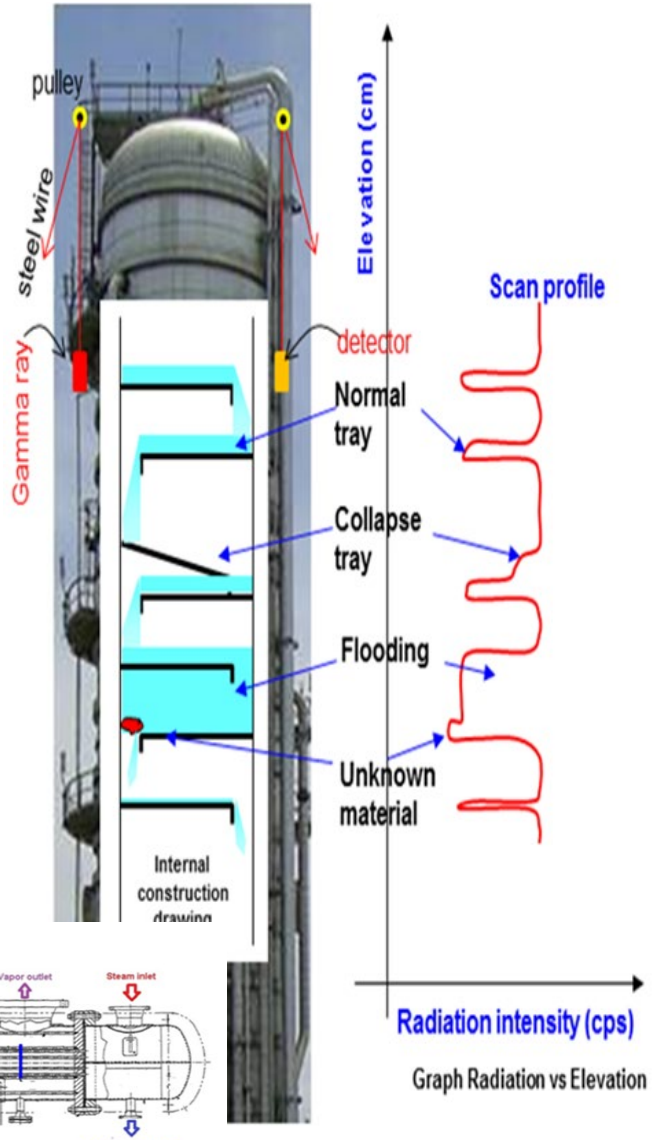
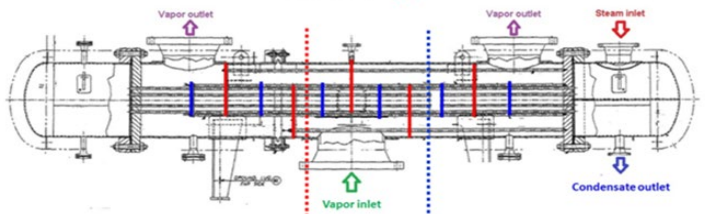


Graph Radiation vs Elevation

BE-106 A



PT. GAMMA TEKNOLOGI INOVASI

Moves to Innovate

TEKNIK GAMMA
COLUMN SCANNING DALAM INDUSTRI PROSES

PENDAHULUAN

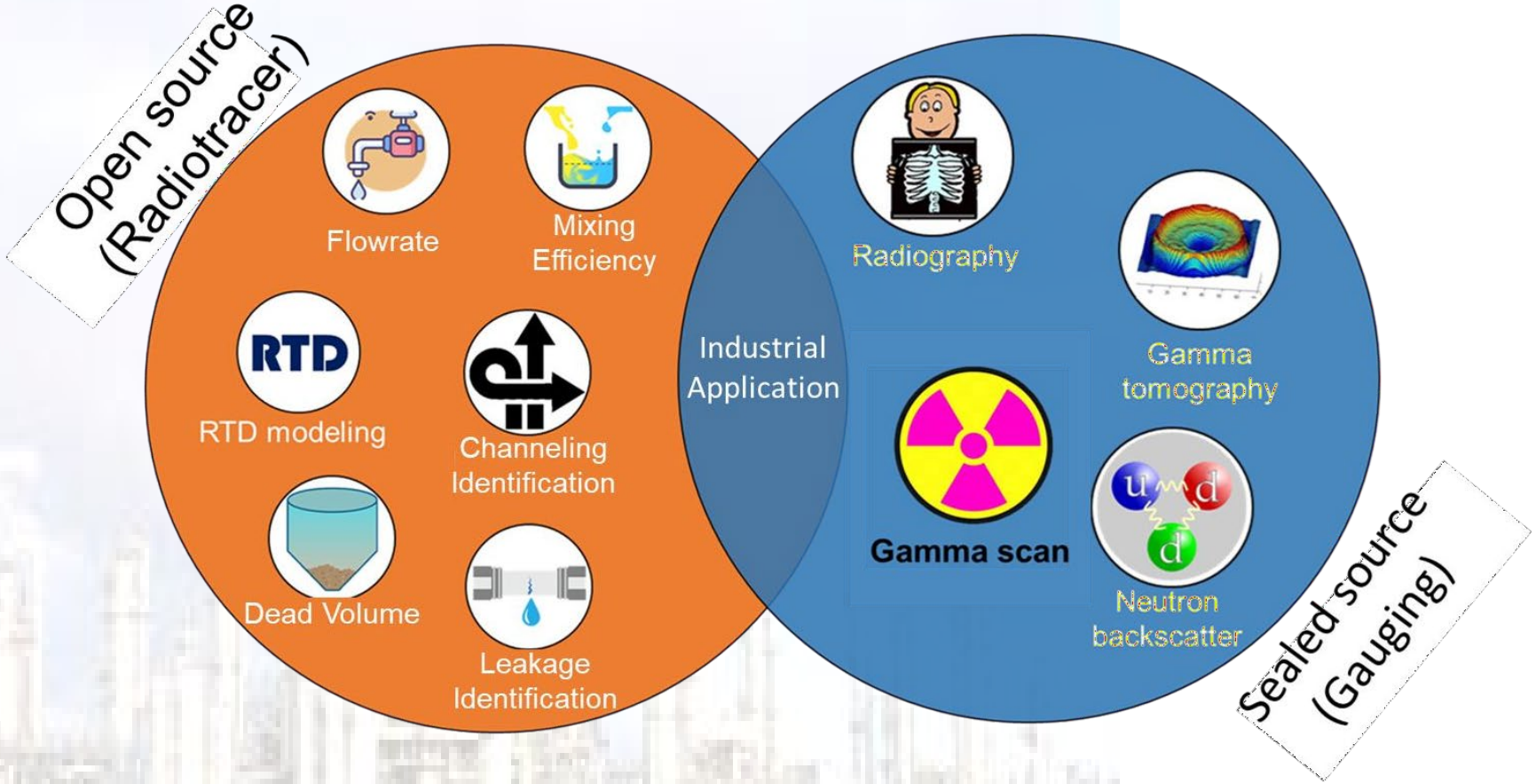
Teknik Gamma Scan merupakan aplikasi teknologi nuklir untuk mendiagnosa malfungsi pada fasilitas produksi di indutri proses. Unit proses yang dapat diinvestigasi misalnya ***tray column, packed column, heat exchanger***. Internal struktur pada tray column dapat diidentifikasi posisi tray performa *bubble cap* atau *chimney, level liquid, flooding, blockage, collapse tray*. Hasil diagnosa dapat diferifikasi dengan data di-control room terkait delta pressure dan temperature operasi. Pada unit packed column distribusi pall ring atau katalis dapat diinvestigasi dengan melakukan beberapa kali scanning. Kemungkinan terjadinya penggumpalan pada packed bad atau packing support yang runtuh dapat diinvestigasi dan didiskripsikan dalam gambar tiga dimensi.

Performa *heat exchanger* bisa mengalami abnormal apabila ada kehadiran benda asing yang mengakibatkan parameter temperatur dan pressure yang tidak sesuai referensi. **Eksistensi benda asing dapat diinvestigasi dengan menggunakan teknik ini.**

Teknik gamma scanning memanfaatkan fenomena radiasi gamma yang dapat menembus metal yang mana merupakan konstruksi utama industri proses. Seperti teknik radiography yang telah dikenal luas untuk uji kualitas welding menggunakan citra film atau digital image, teknik gamma scanning digunakan untuk diagnose unit proses menggunakan kurva-kurva scanning.

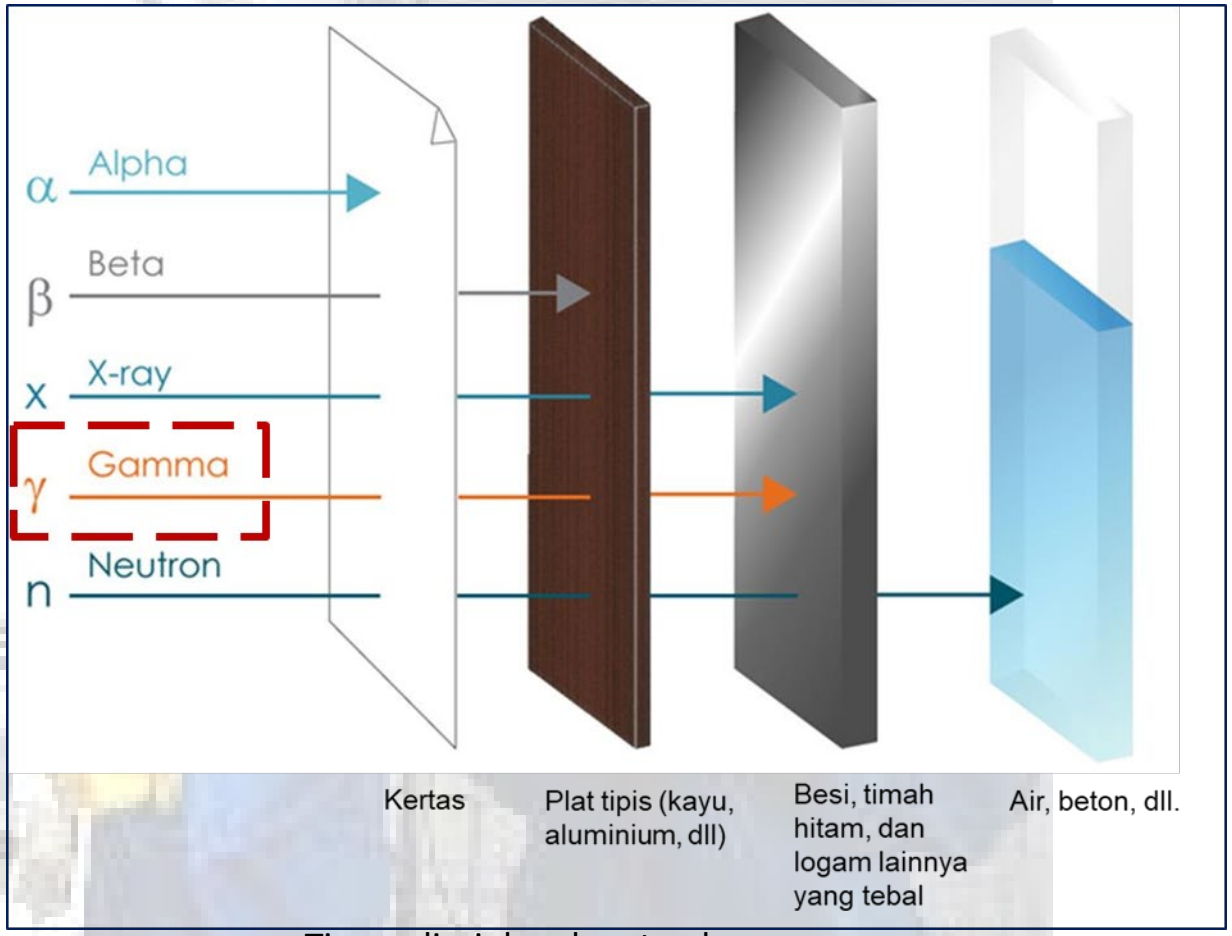
Teknik gamma scanning biasanya menggunakan sumber gamma sekitar 100-200 mCi Cobalt-60 (Co-60) yang berarti cukup hanya 1% dari kekuatan yang digunakan teknik Radiography. **Pada saat dilakukan investigasi publik masih dapat beraktivitas pada radius 10-20 meter.**

TEHNIK INVESTIGASI



RADIASI

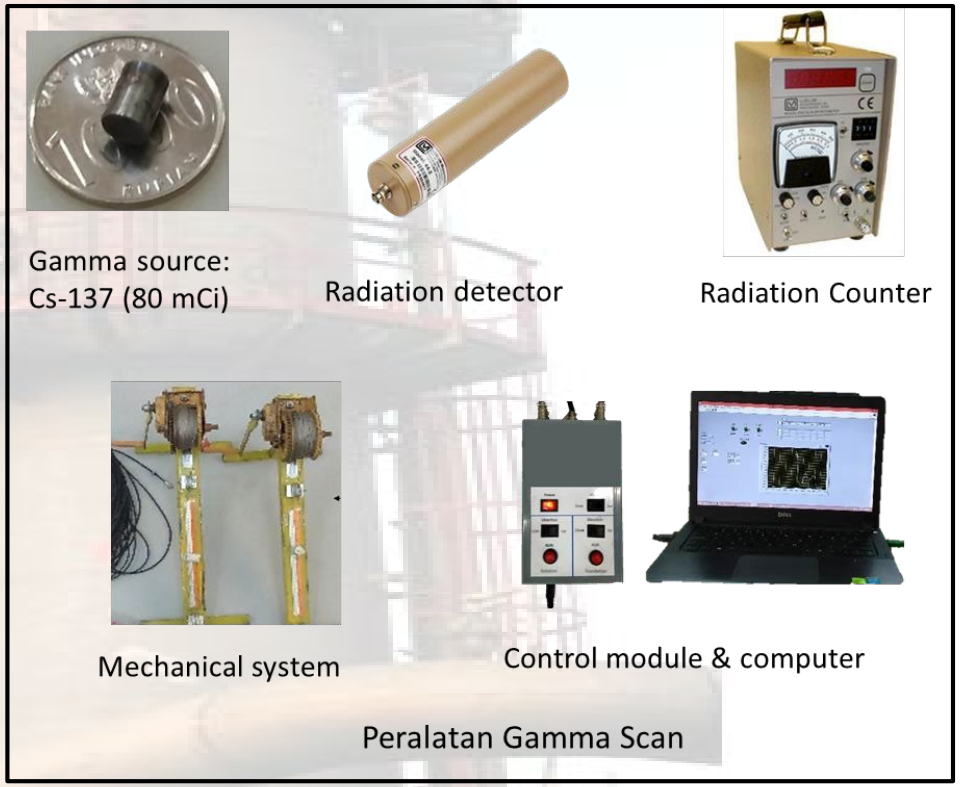
Energy Emmission/ Propagation through material or Media

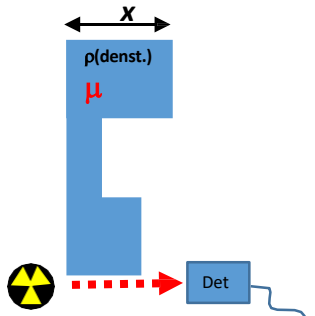


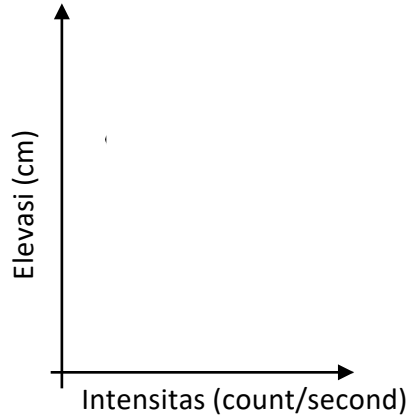
Tipe radiasi dan daya tembusnya

TEHNIK GAMMA SCAN

Radiation will absorbed when passing through the object

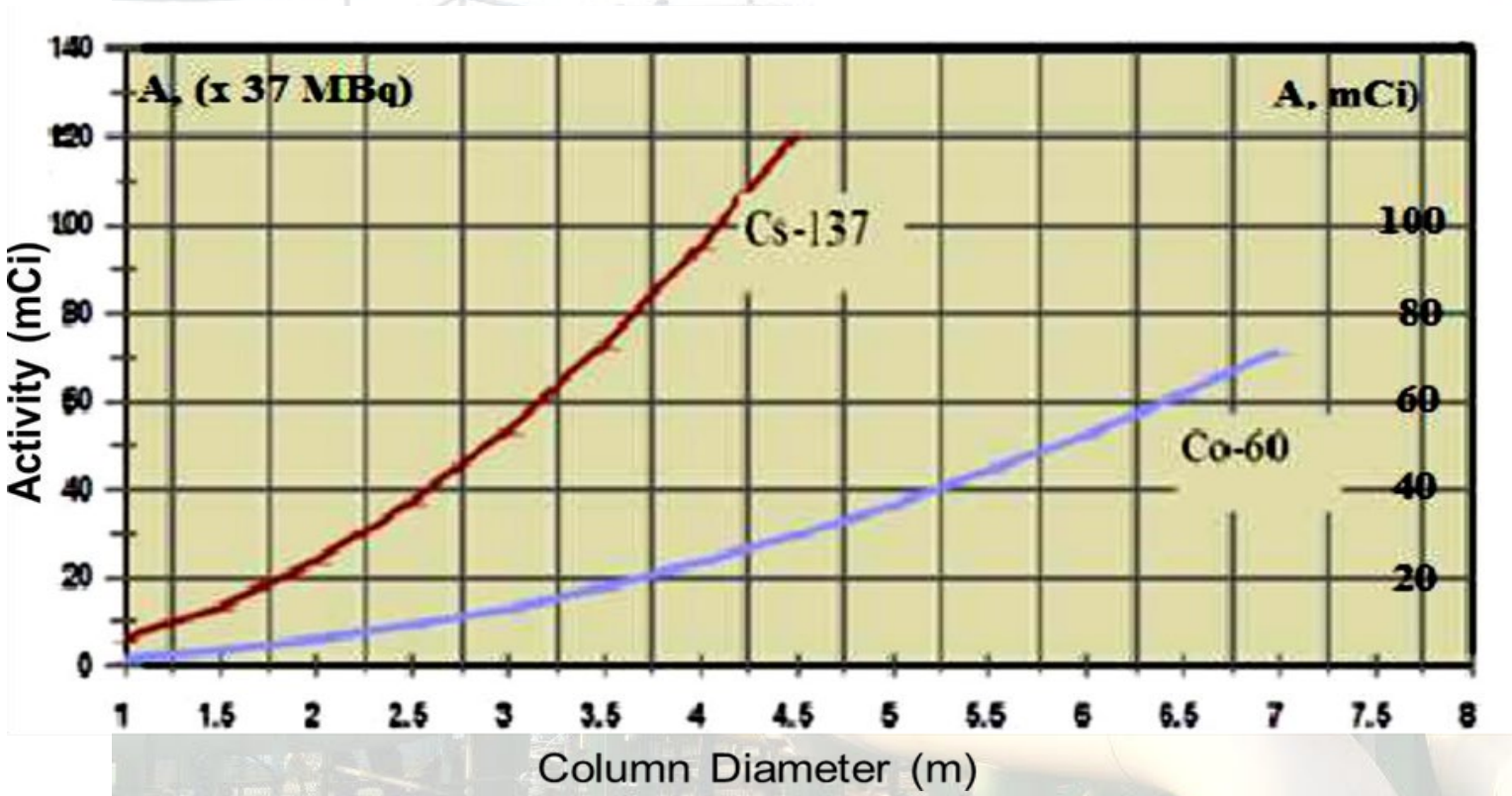






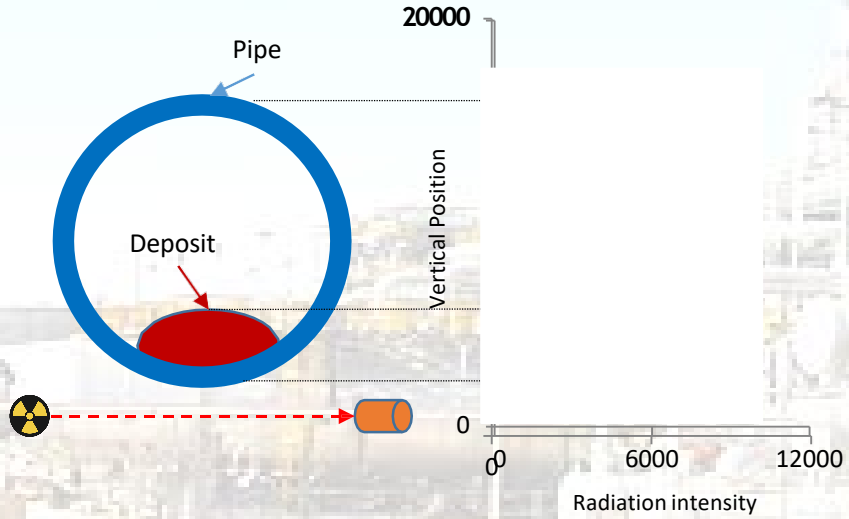
$$I = I_o e^{-\rho \mu x}$$

Radiation Activity for Gamma Scanning Technique (Co-60 and Cs-137)

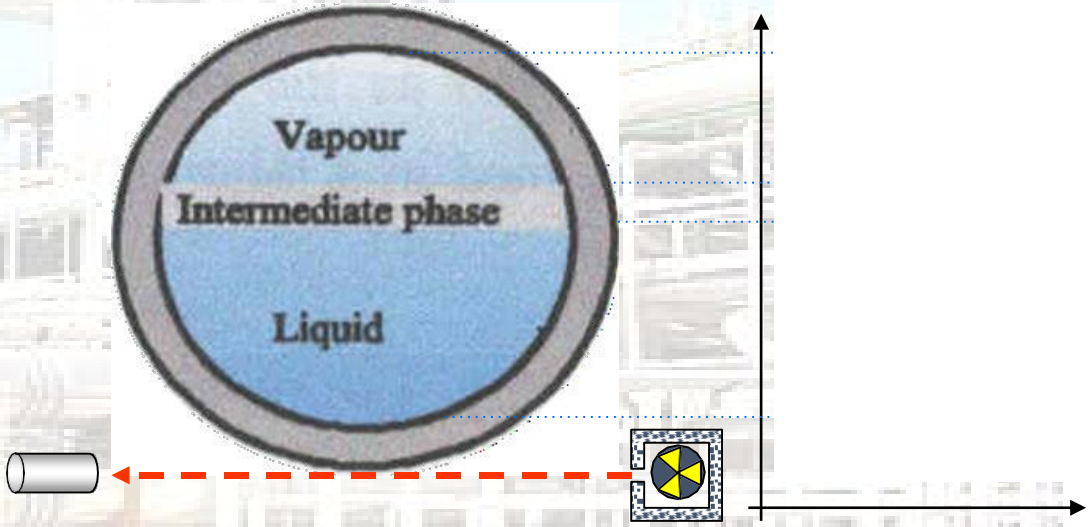


GAMMA PIPE SCAN

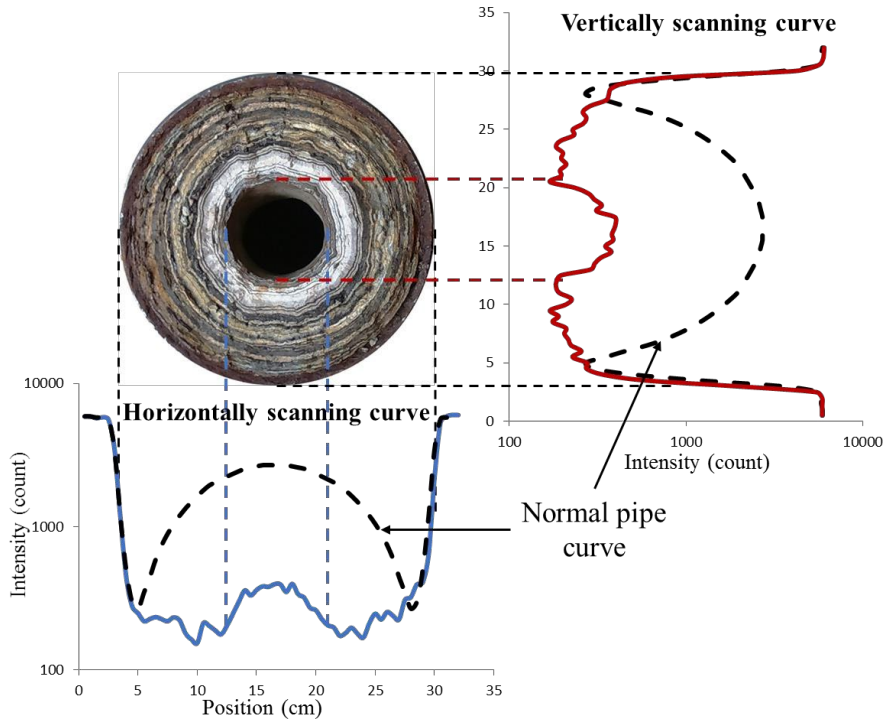
Deposit investigation **inside pipeline**



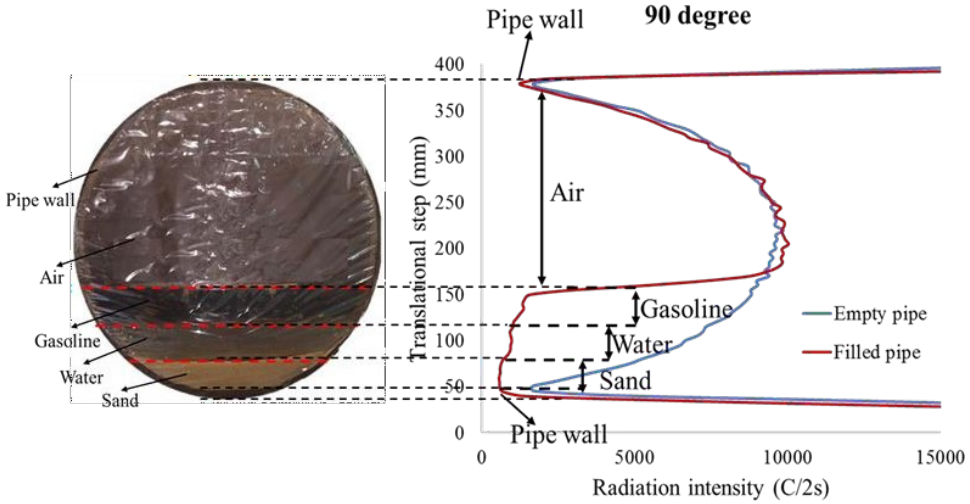
Fluids **interfaces** investigation **inside pipeline**



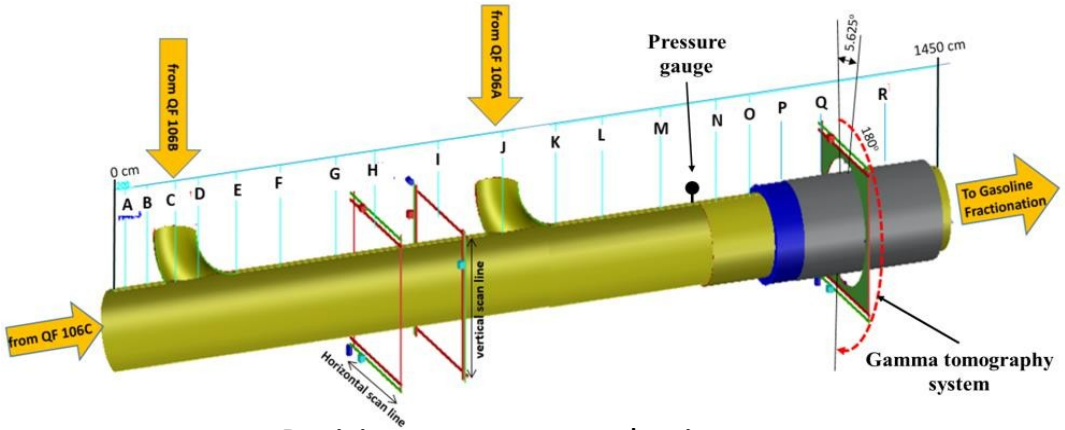
GAMMA PIPE SCAN DATA



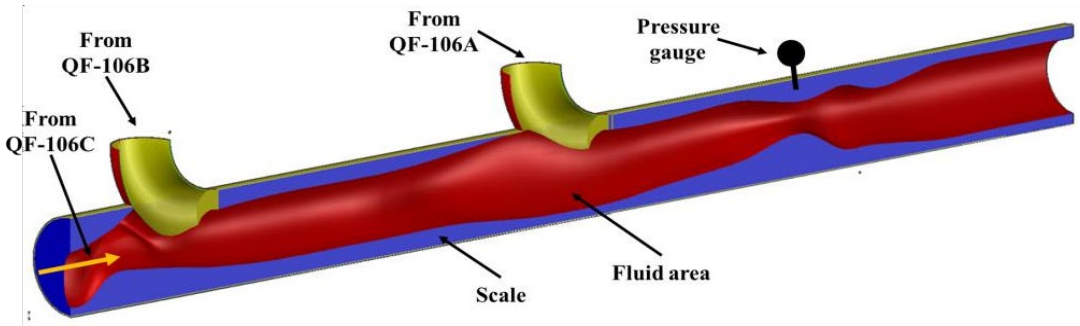
Deposit/scale inside the pipe



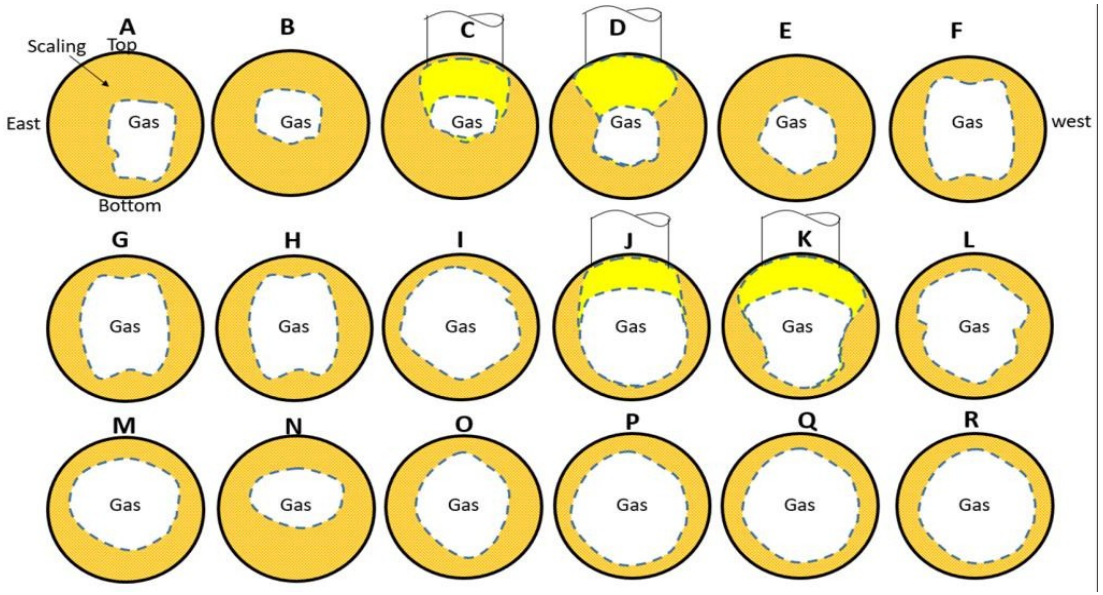
Fluids interfaces inside the pipe



Posisi gamma scan pada pipa



Pipe scale prediction inside the pipeline (3D)



Gamma pipe scanning results

GAMMA COLUMN SCAN

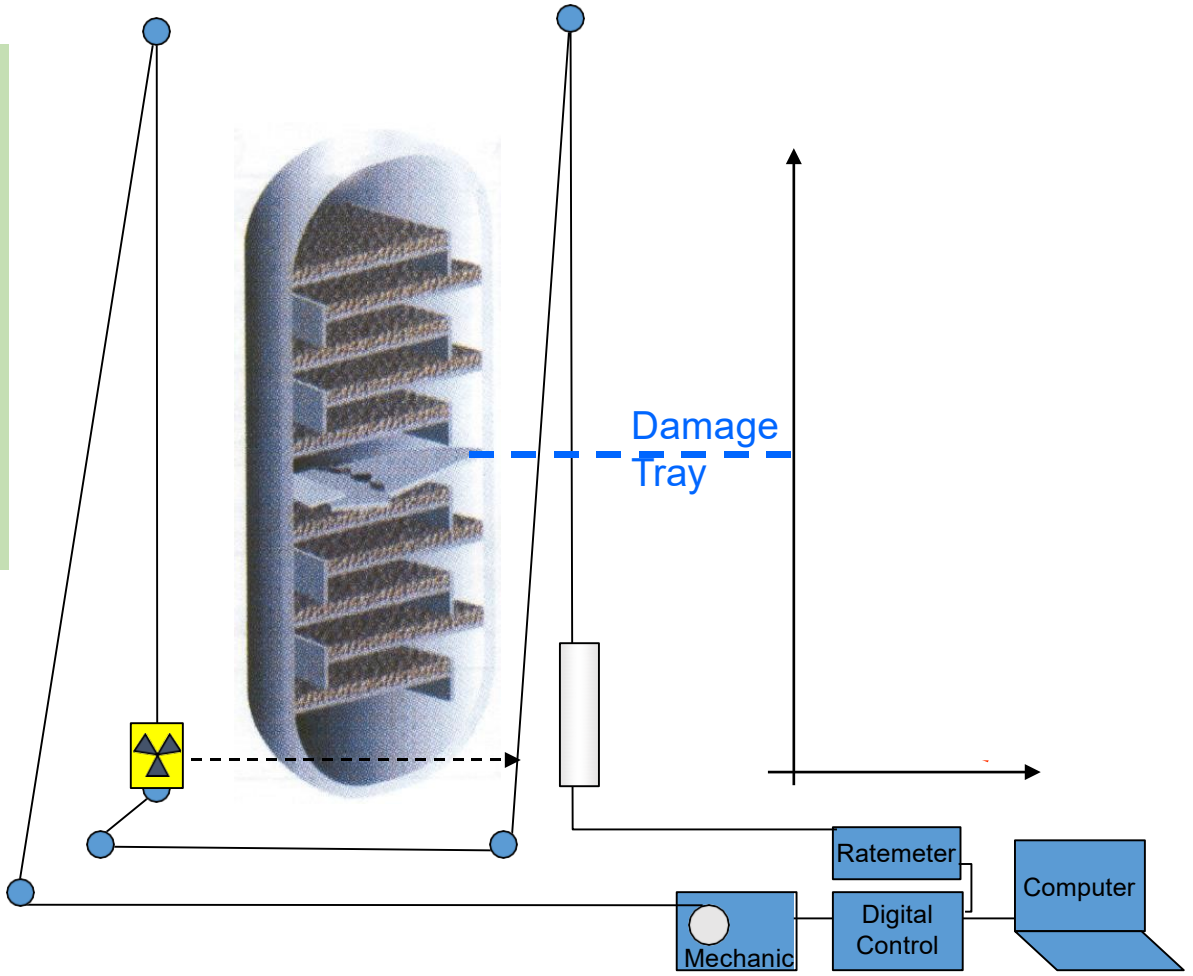
Process columns

Process **Column Malfunctions :**

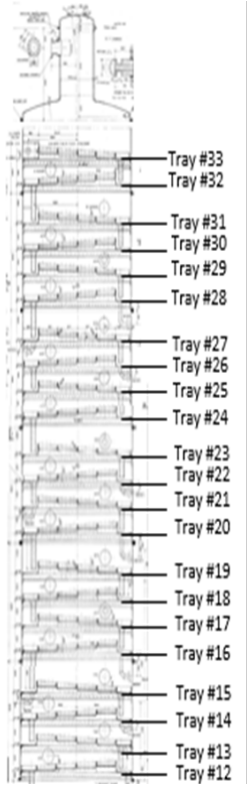
Column Problems	Malfunction Descriptions
Mechanical	• Displaced/damaged trays, demister, and packing • Corrosion resulting in partial tray damage • Missing, collapsed or buckled trays or man-ways • Out-of-place liquid or vapor distributors • Level control problems on chimney trays or base liquid level
Flow Rate	• Flooding • Weeping or dumping trays • Dry or flooded trays due to loading condition • Unequal liquid level on trays
Process	• Foaming on trays or in reboiler • Bad distribution of vapor and liquid in packing • Liquid hold-up due to plugging and fouling • Superheated or subcooled feed or reflux

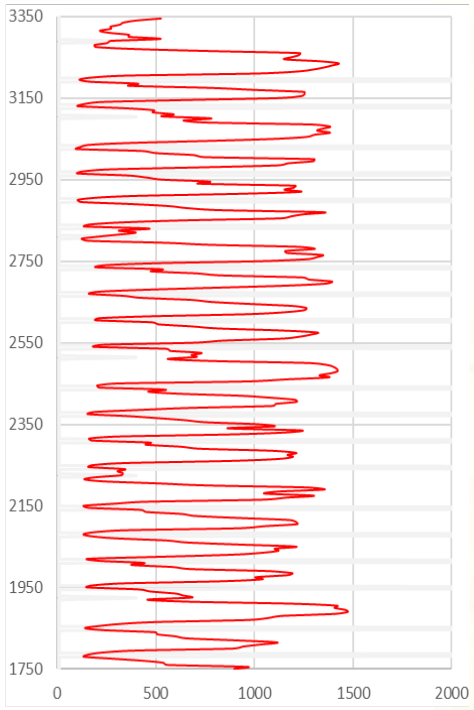
Investigation time:

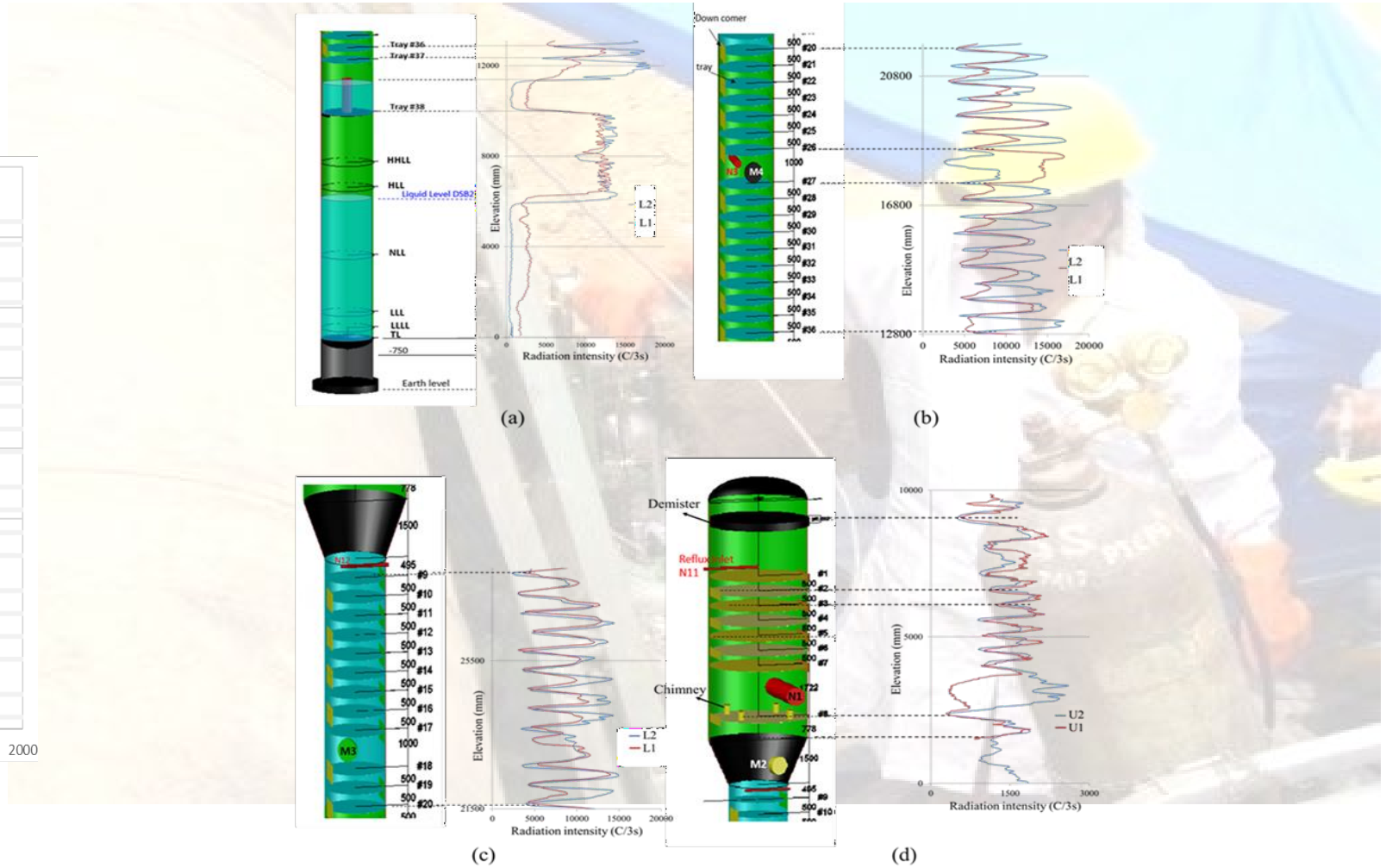
- Pre-commissioning **(blank data)**
- After commissioning **(reference data)**
- Periodic measurement, every 6/12 months **(performance checkup)**
- Trouble **(determine trouble area)**



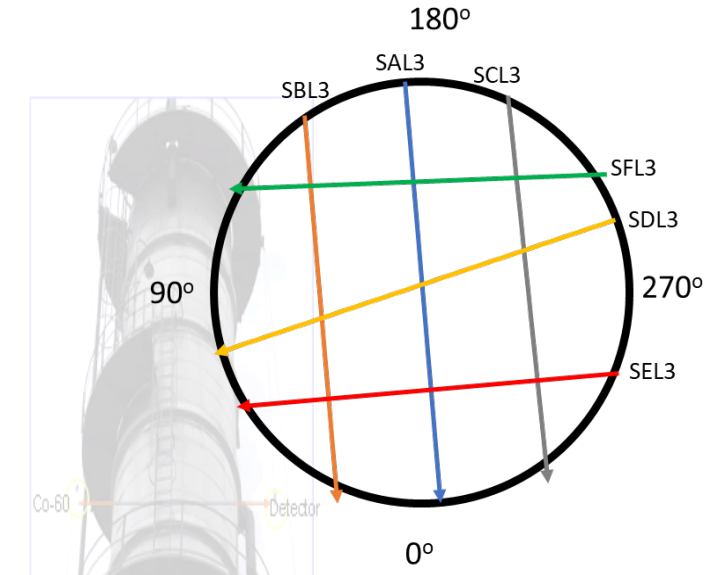
GAMMA COLUMN SCAN DATA ON TRAYED COLUM



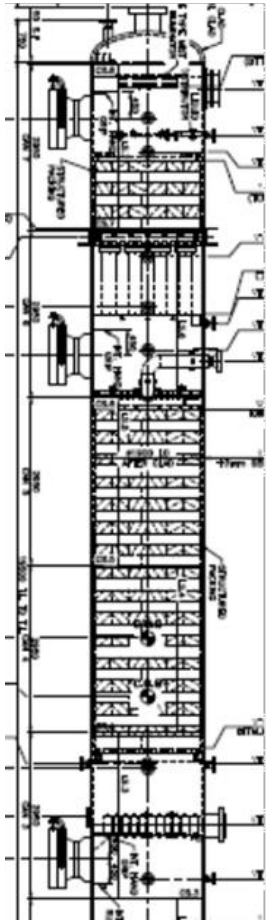




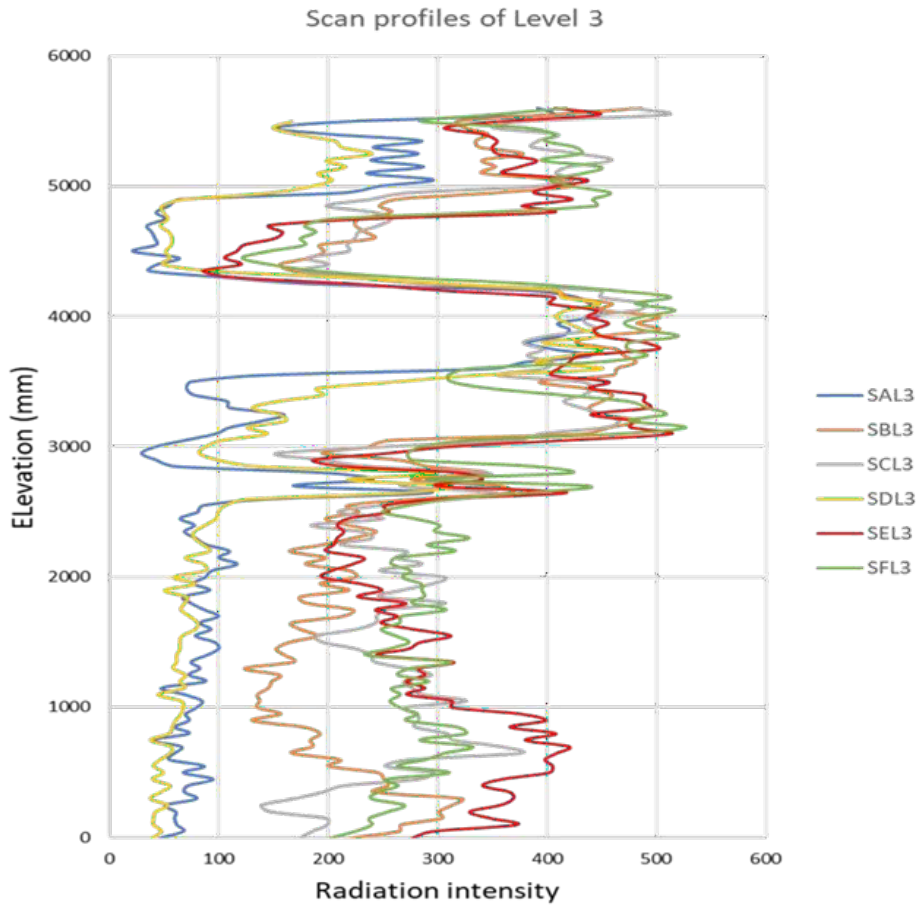
Scan data, (a) lower segment TL-tray #36, (b) lower segment tray #36-#20, (c) lower segment tray #20-#9, and (d) upper segment tray #8-demister.



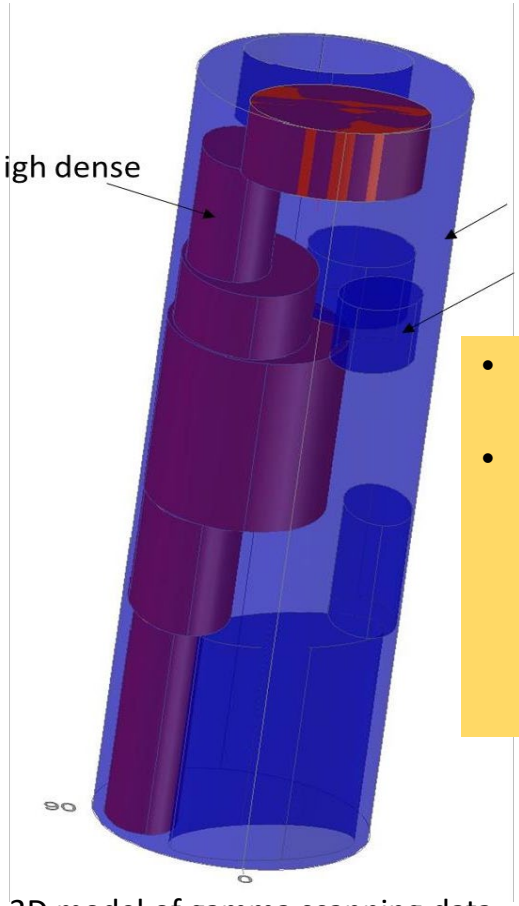
Scan orientations



90



EXAMPLE OF GAMMA COLUMN SCAN



3D model of gamma scanning data interpretation on packed column

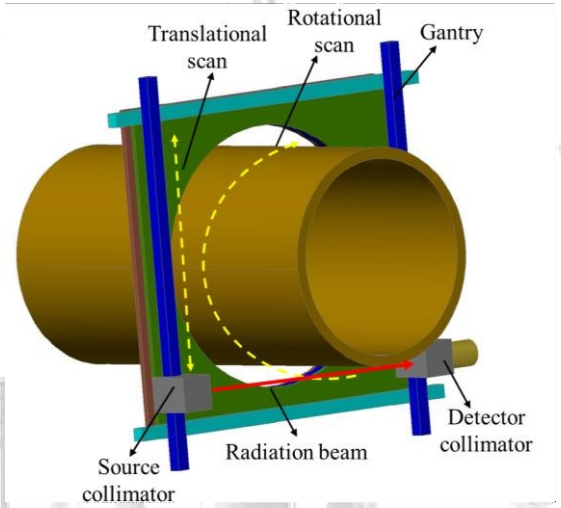
- Cavities area were observed
- Denser area were observed, suspected caused by blockage that obstruct the fluids flow.

The data is confirmed, Bed packed condition after the column is dismantled, there are denser and cavity area on the bed packed due to operation.

TEHNIK GAMMA TOMOGRAPHY

Investigate :

- Deposit inside pipe, HE, Vessel, etc.
- Internal structure of HE, column, etc.

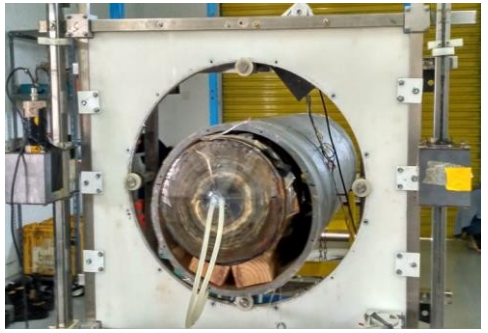


Gamma tomography system

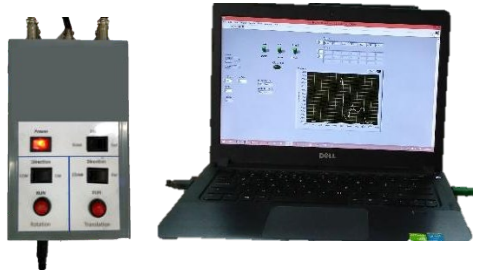
Gamma source:
Cs-137 (80 mCi)

Radiation detector

Radiation Counter



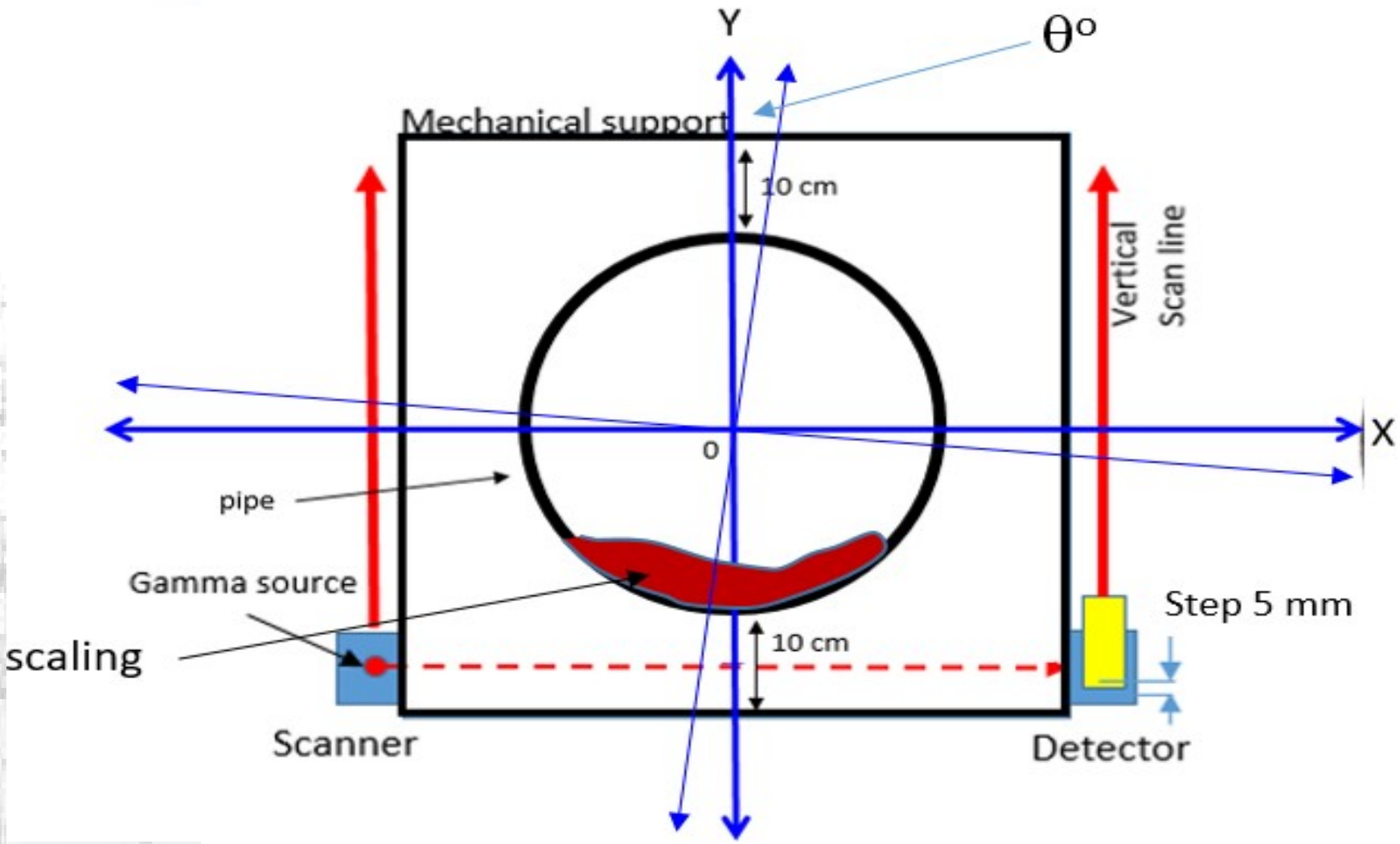
Mechanical system



Control module & computer

Gamma tomography equipment

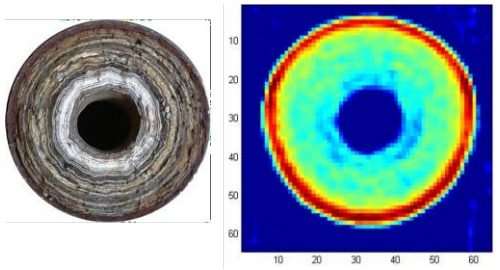
PRINSIP KERJA TEHNIK GAMMA TOMOGRAPHY

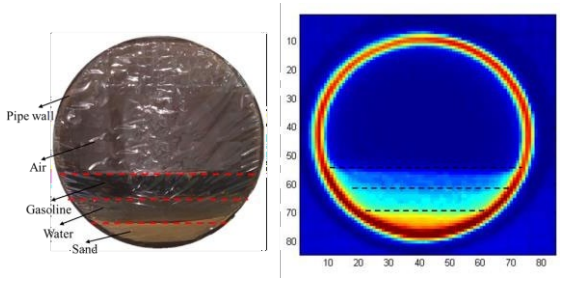


- **Scan gamma tomography**

DATA GAMMA TOMOGRAPHY (1)

Lab. Scale Gamma Tomography Data





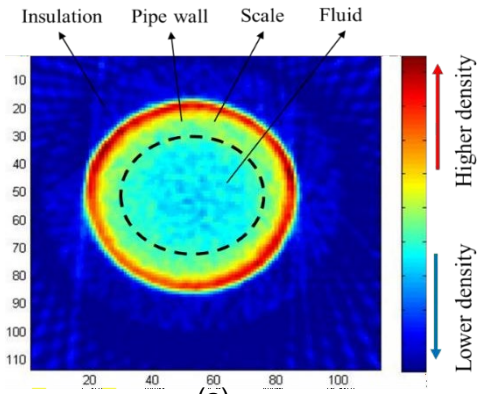
Field Work Gamma Tomography Data

(a)

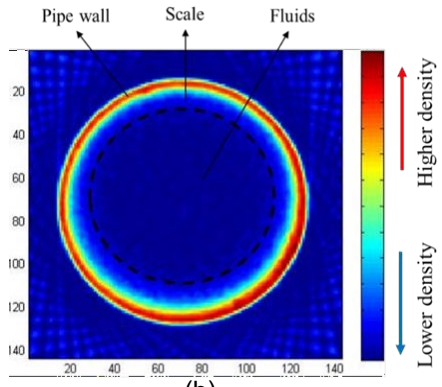
(b)

(c)

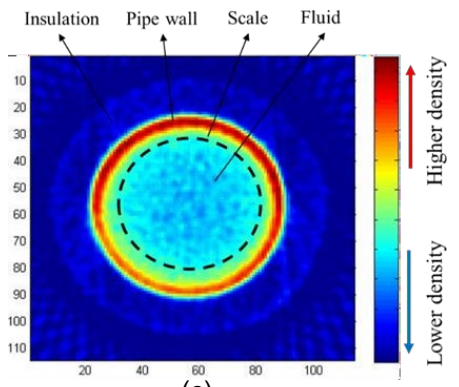
Location (a, b, and c)



(a)

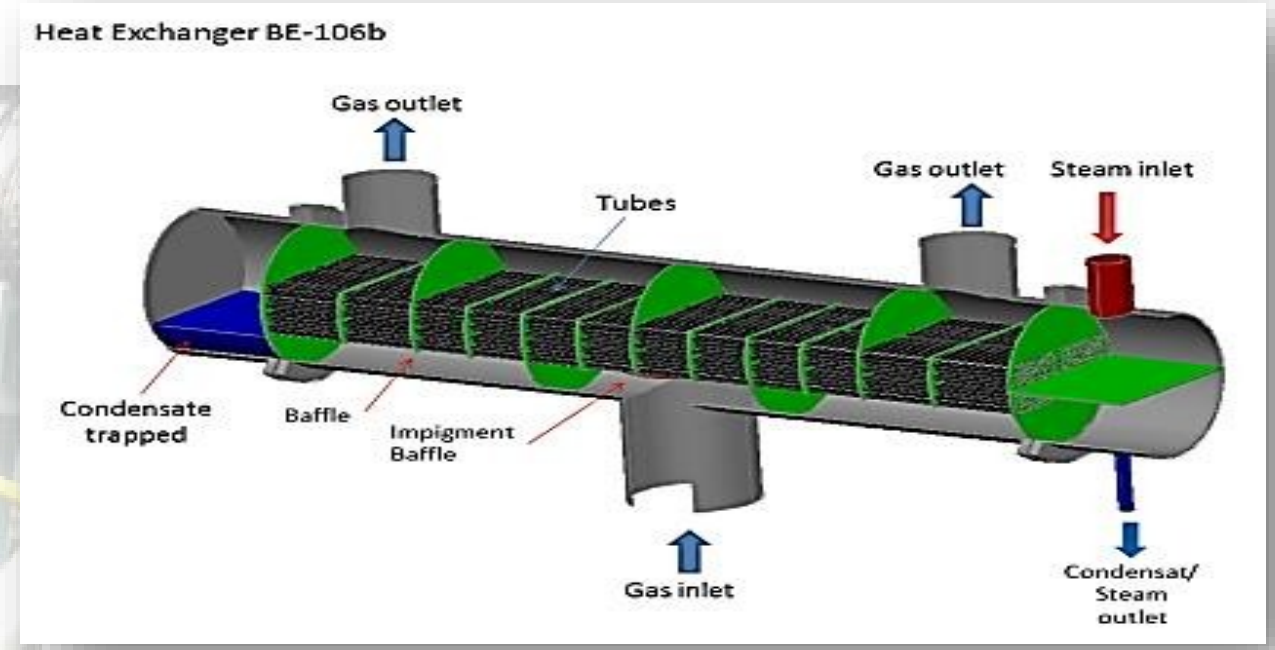


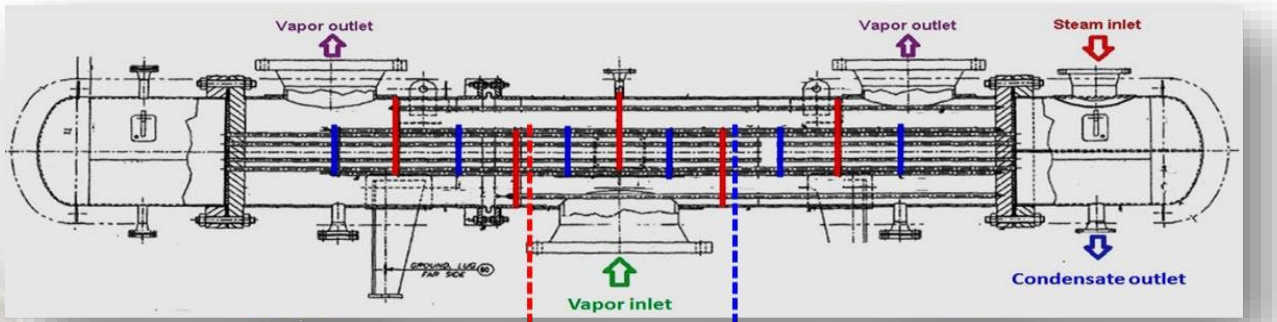
(b)

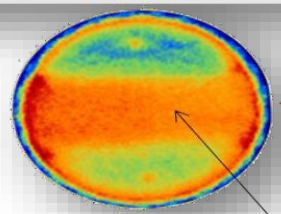


(c)

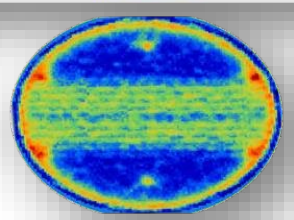
Image reconstruction of gamma tomography on pipeline

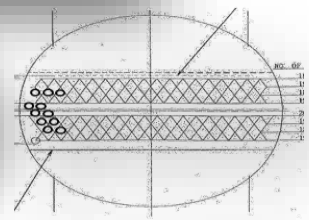






Unknown material





Tube configuration

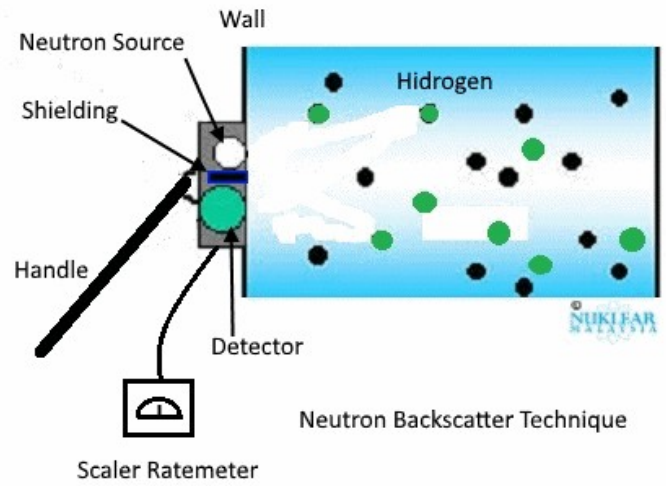
TEHNIK NEUTRON BACKSCATTER

Also known as “Hydrogen Detector”

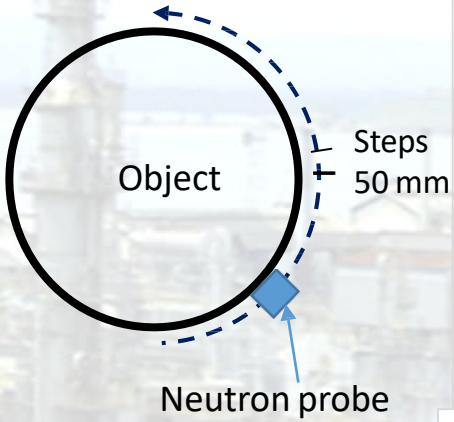
Measure the concentration of hydrogen in the material (including liquid in the vessel)

Investigate:

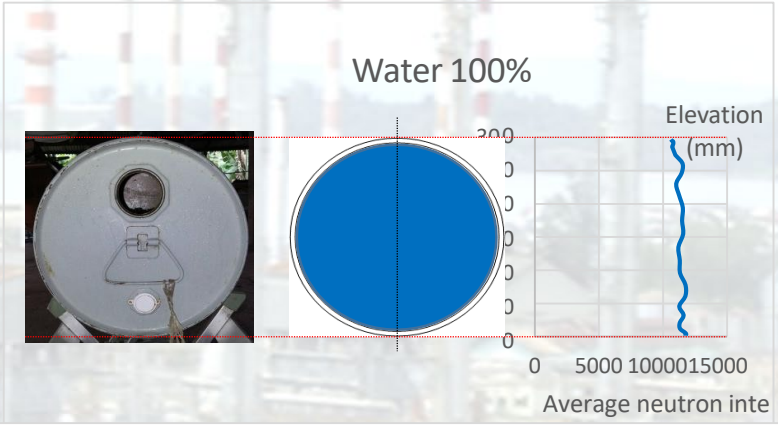
- Storage tank sludge and inventory level
- Deposit inside pipe
- Calibration of existing level gauge
- Determine the location of wet insulation and CUI

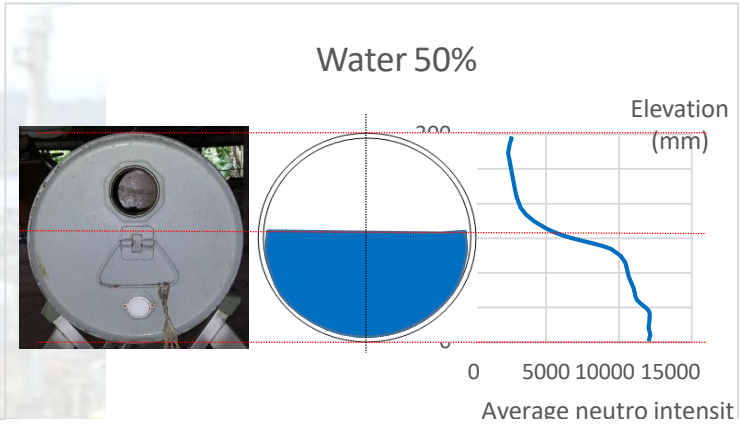


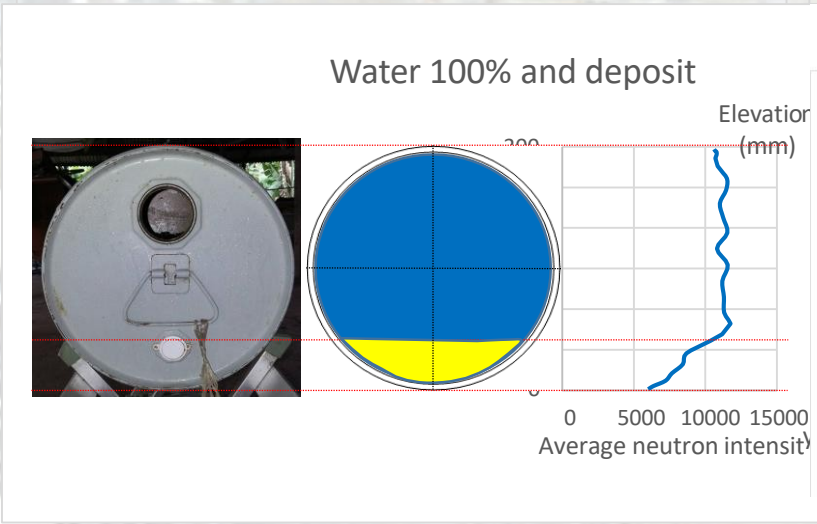
NEUTRON BACKSCATTER DI PIPA

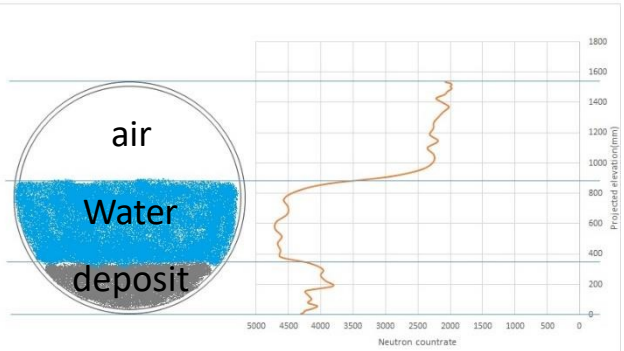


Provide inside pipe/vessel condition based on gamma the hydrogen concentration

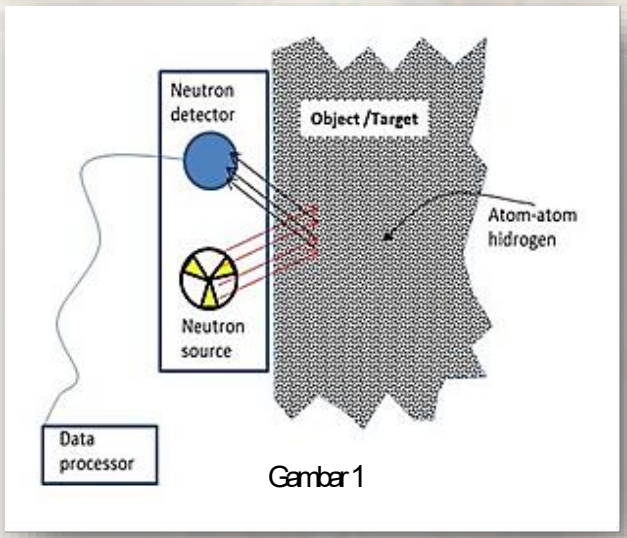




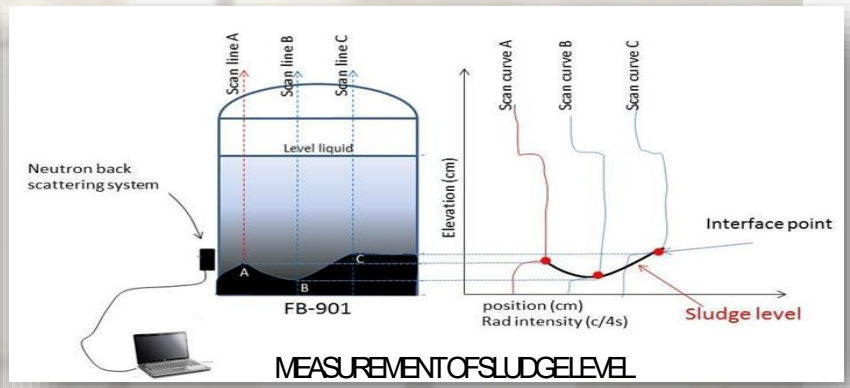




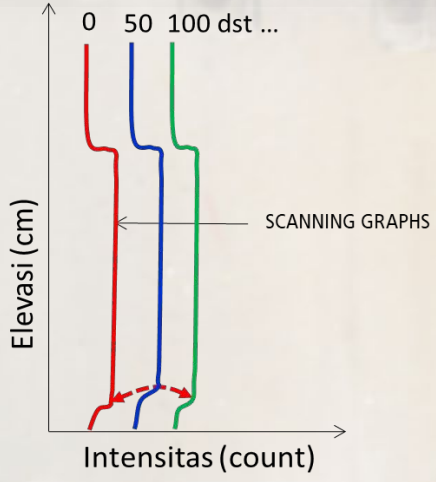
NEUTRON BACKSCATTER DI STORAGE TANK

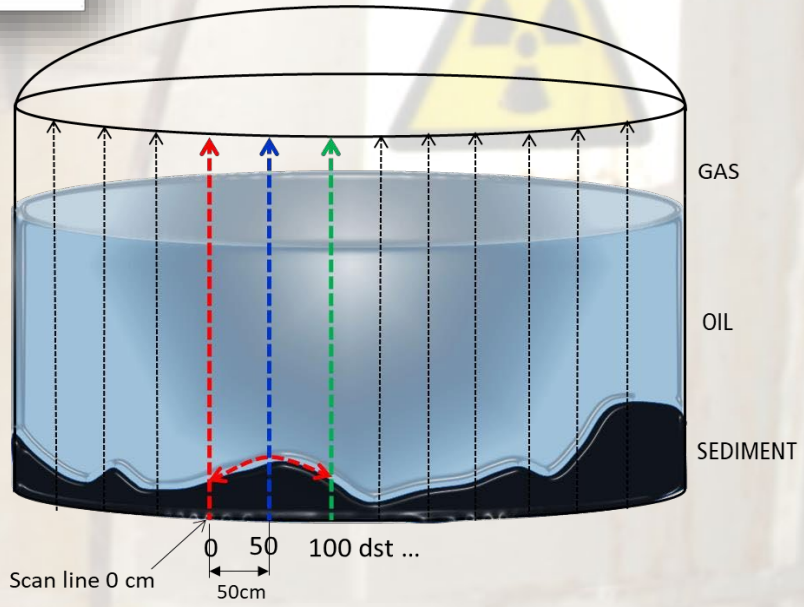


Gambar 1

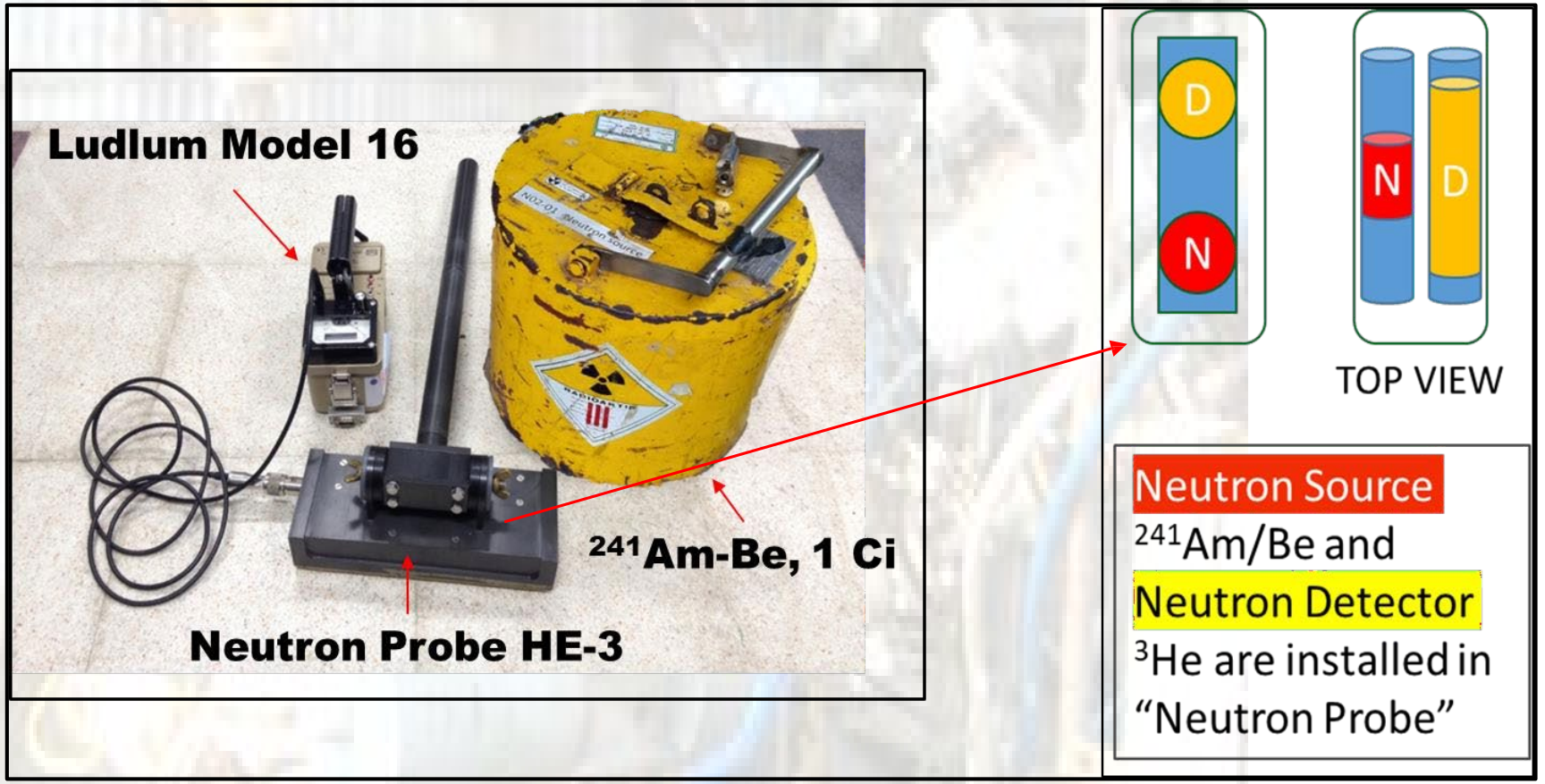


MEASUREMENT OF SLUDGE LEVEL





PERLENGKAPAN NEUTRON BACKSCATTER



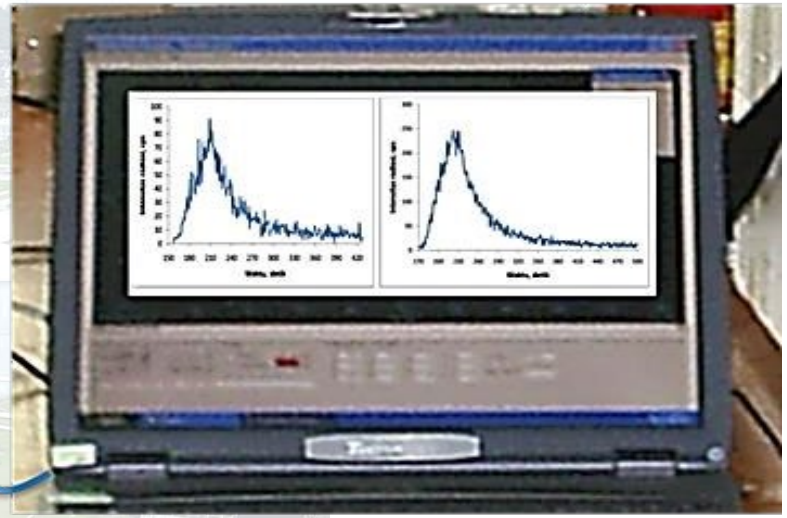
TEHNIK RADIOTRACER

- Pengukuran debit air,
- Investigasi kebocoran pipa bawah tanah,
- Efisiensi pencampuran,
- Pemodelan distribusi waktu tinggal (Residence Time Distribution Modeling),
- Identifikasi penyaluran (Channeling Identification),
- Pengukuran volume (Dead Volume Measurement),

LAPTOP COMPUTER

12 CHANNEL DATA-LOGGER

INJECTOR



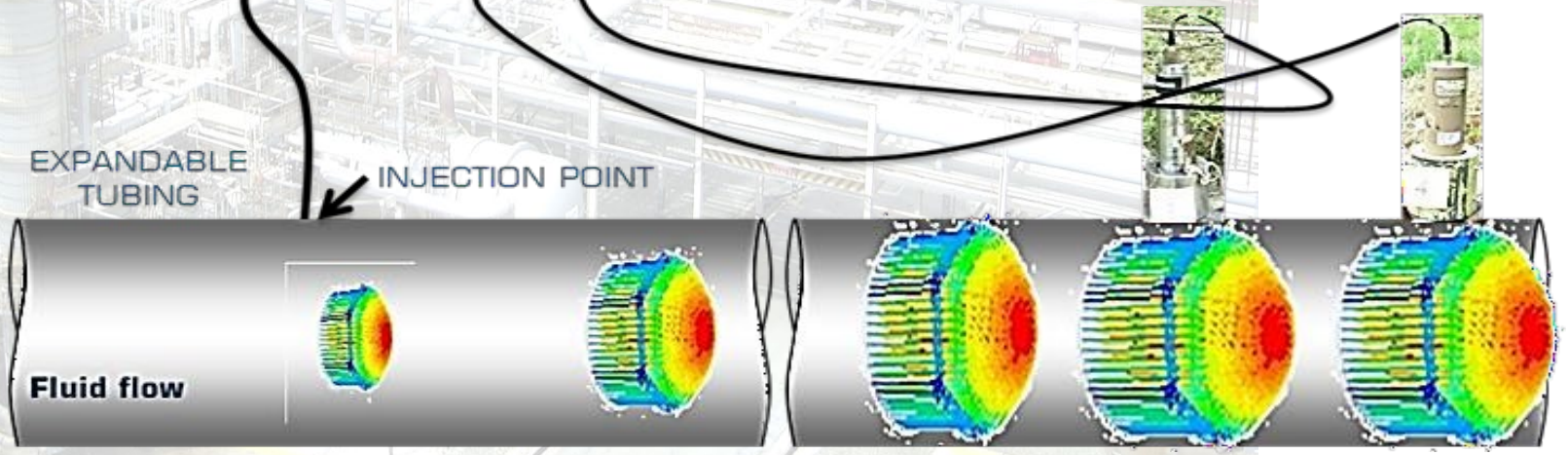
DETECTOR CABLE

RS-232 DATA CABLE

RADIATION DETECTOR

EXPANDABLE TUBING

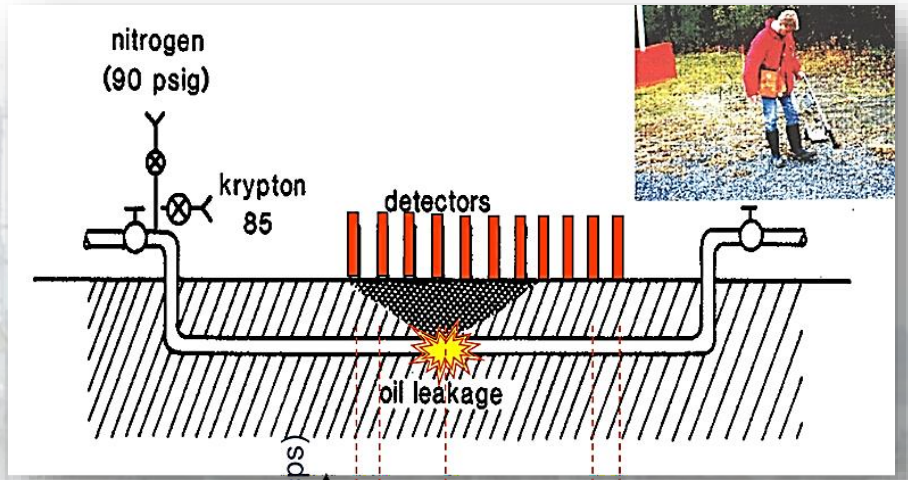
INJECTION POINT

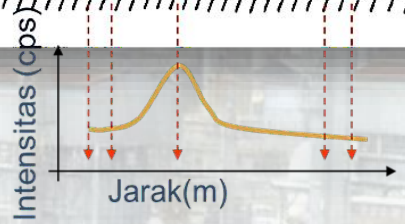


Detection of underground pipeline leakage

Procedure:

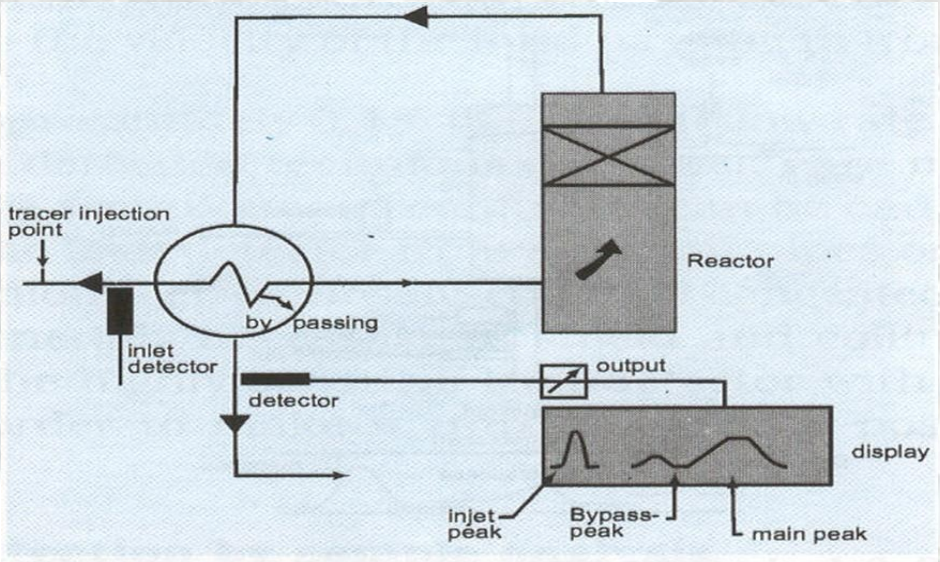
- Injection of radioisotope to pipeline.
- Radiation worker counts radiation intensity above ground.





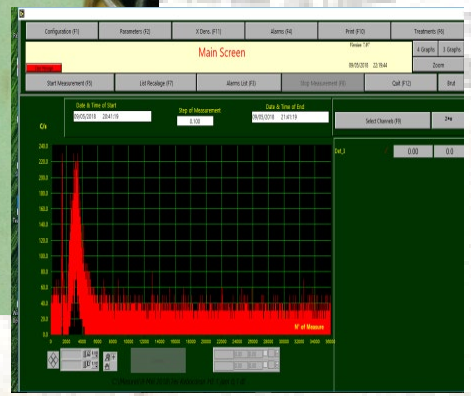
Heat Exchanger leakage identification

- Injection of radioisotope to high pressure inlet.
- If there is leakage, radioisotope will go through the lower pressure channel inside tube or shell.



Technical Data

Preparation and dummy test



Result

Table 1. C206 Heat exchanger design condition [as built drawing].

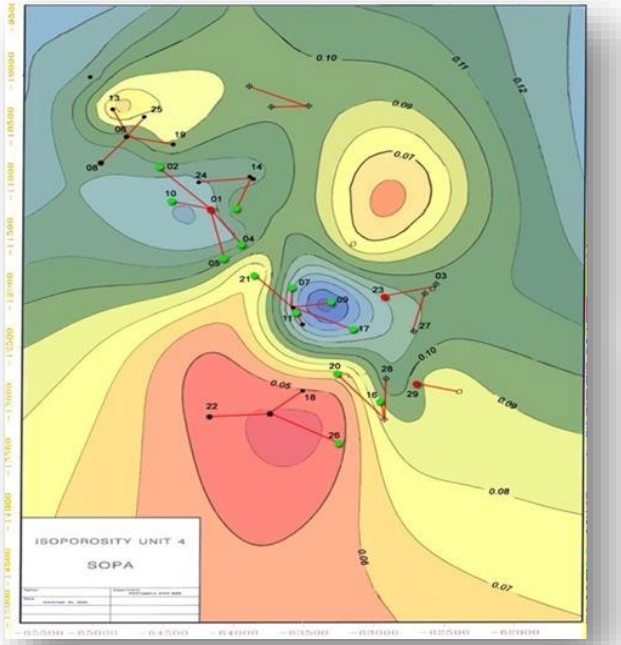
C 206 HEAT EXCHANGER DESIGN CONDITON		
Code	ASME Section VIII Division 1, 2015 Ed. 'NO-STAMP'	
Standard	TEMA CLASS C Type AEL	
Regulation	DEPNAKERTRANS RI	
Service	Non Lethal Contents	
Quantity	1 Unit	
Installing Position	Horizontal	
Test Position	Horizontal	
Area	**Shell Side**	**Tube Side**
Healing Surface	1147,5 m^2	1117.7 m^2
No. of Passes	1	1
Fluid	Cooling Water	Crude EDC/Water/Inerts
Internal Design Pressure	7/FV. kg/cm^2G	6/0,21 kg/cm^2G
Operating Pressure	4 kg/cm^2G	3.05 kg/cm^2G
Hydrostalk Test	9.1 kg/cm^2G	7.86 kg/cm^2G
Operating Temperature	110 °C	235/105 °C
Operating Temperature (In/Out)	33/40 °C	34.5/40 °C
Volume	8.04 m^3	10.27 m^3
Corrosion Allowance	1.5 mm	0 mm
Production Test Plate	N/A	N/A
NDE Radiographic Exam	Spot	Spot
Dye Penetrant Exam	Yes	Yes
Joint Efficiency	0.55	0.55
PWHT	No	No
Insulation (Customer's Scope)	No	25 (PP)
Empty Weight	21780 kg	
Hydro Test Weight	45570 kg	

Conclusion

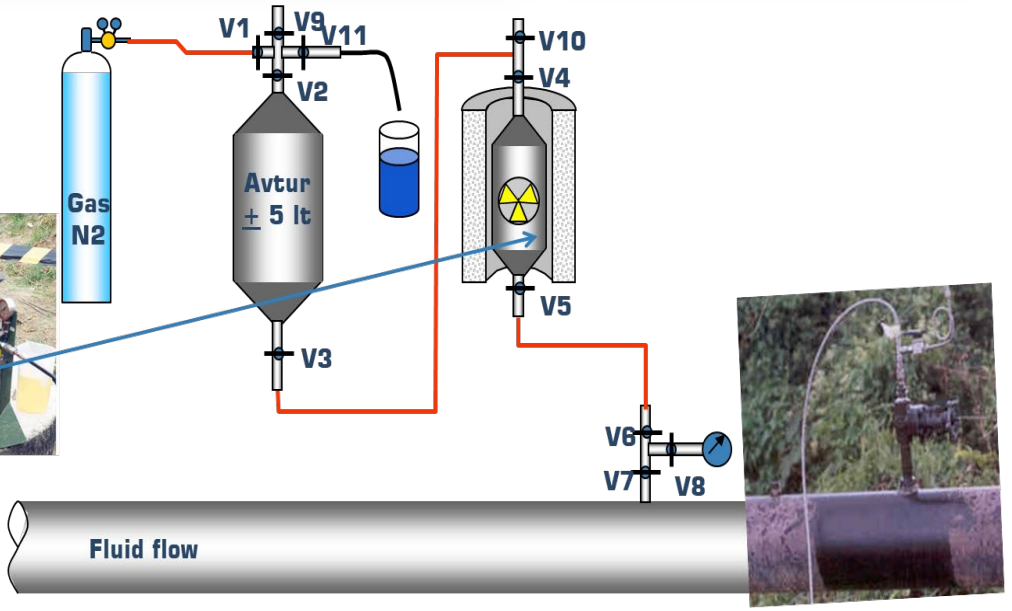
HE leakage is about 6,28 %

Well inter connection

Connection between wells on the oil field have been investigated by readiotracer technique using Tritium and Co-60 isotope.

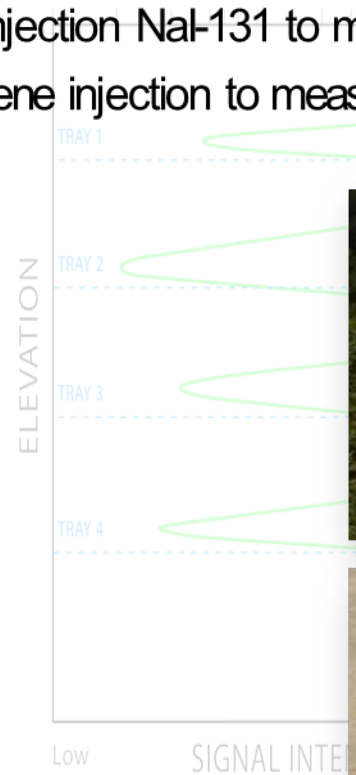


Radiotracer Injection



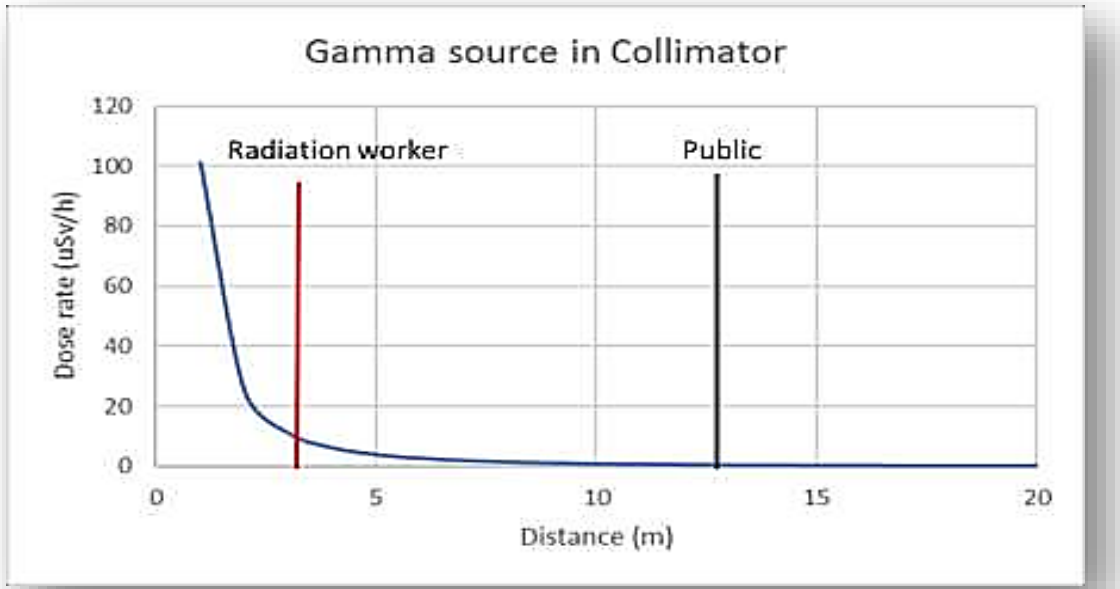
Multiphase measurement: Crude oil, water, and gas

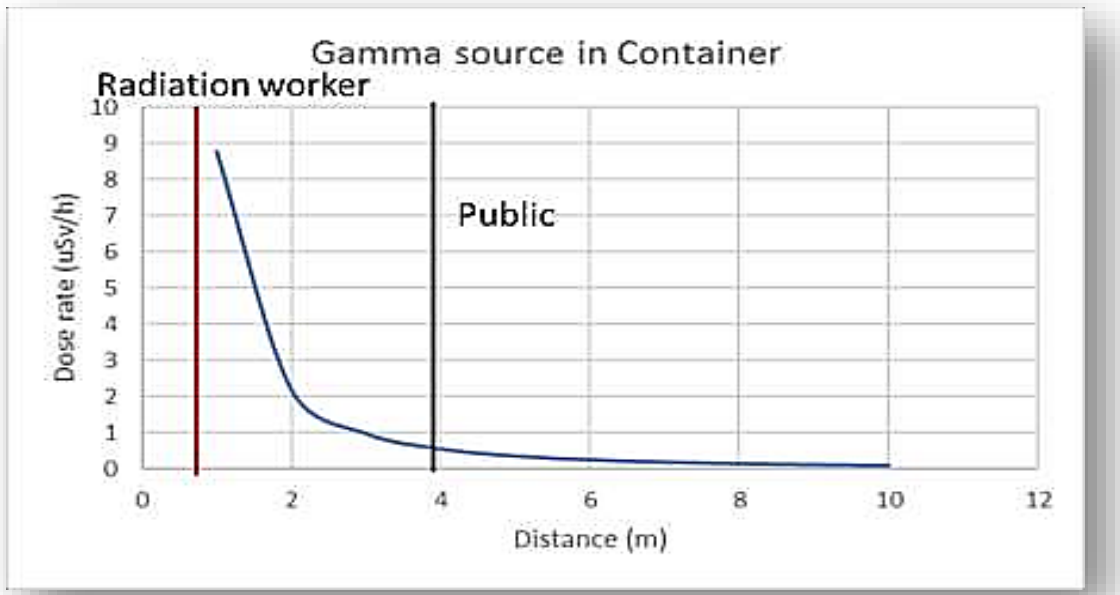
- Isotope injection NaI-131 to measure water flowrate.
- Iodobenzene injection to measure crude oil flowrate.



ASPEK KESELAMATAN

Nuclear technique application in industry is always supervised by Radiation Protection Officer (Petugas Proteksi Radiasi/PPR) who has lisenced from regulatory (BAPETEN)


Gamma source in Collimator
Radiation worker
Public
Dose rate (uSv/h)
120
100
80
60
40
20
0
0
5
10
15
20
Distance (m)


Gamma source in Container
Radiation worker
Public
Dose rate (uSv/h)
10
9
8
7
6
5
4
3
2
1
0
0
2
4
6
8
10
12
Distance (m)

BENEFIT DAN REKOMENDASI

- Meningkatkan produksi (enhancing production level),
- Melokalisasi area kerja saat melakukan pemeliharaan agar menghemat tenaga dan waktu (localize work area when conduct maintenance to safe power and time),
- Pengujian tidak merusak (NDT-Non Destructive Testing),
- Pengukuran dilakukan saat on-stream, tidak mengganggu produksi (theme asurement is conducted while on stream, not interfere the production),
- Menyediakan material yang sesuai dengan kebutuhan (efektif),
- Mempercepat waktu kembali operasi

- Dilakukan scanning menjelang TA (lokalisir pekerjaan),
- Dilakukan scanning pada saat baru beroperasi (referensi),
- Dilakukan scanning pada saat kapasitas maksimum (perform column),
- Dilakukan scanning secara periodik (ideal 1x setahun)

DOKUMENTASI PEKERJAAN