

SESSION 1: IMPROVING QUALITY of LIFE

PANEL 1.2: Nuclear technologies in industry, material sciences and beyond



Rachad ALAMI
Morocco

Head, Division of Industrial Applications, Centre National de l'Energie, des Sciences et des Techniques Nucléaires (CNESTEN)

Rachad Alami's research focuses on nuclear applications in cultural heritage and industry, including nucleonic control systems, sealed sources, radioactive tracers and non-destructive testing (NDT); he is President of the Morocco Radio-Isotope Association (MORIA) and the Secretary General of COMEND, the Moroccan NDT personnel certification system

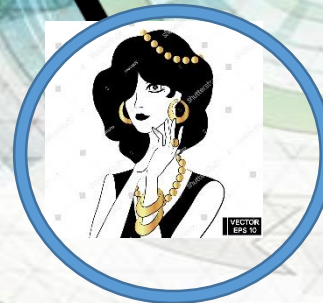
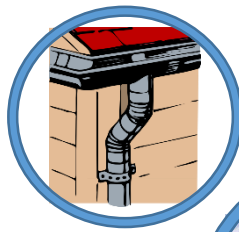


Nuclear Technologies in industry: Nucleonic Control Systems

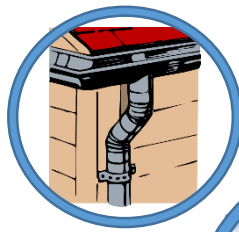
Rachad ALAMI



Industrial applications of nuclear technology is in our daily life...



... But behind the scene !

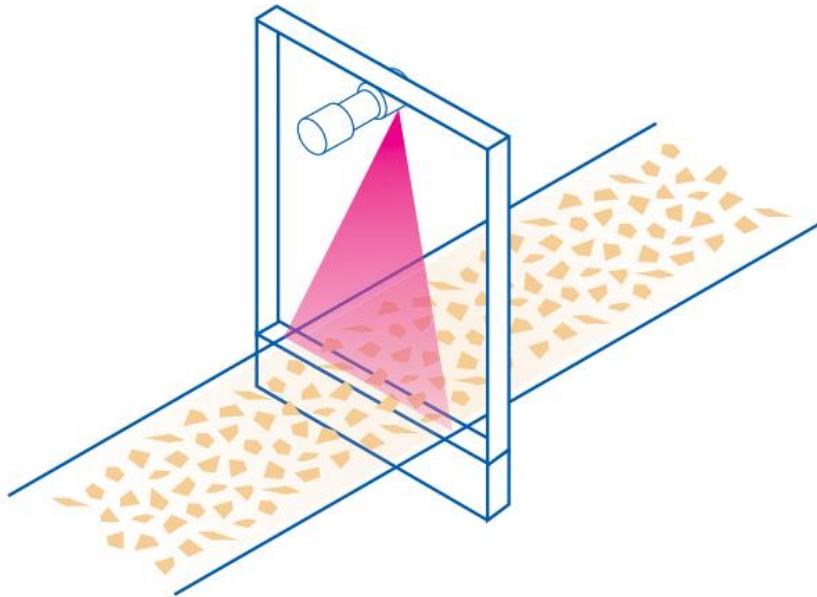


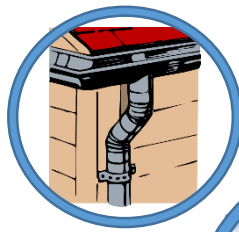
Sugar production



Sugar production

Measurement of the Mass Flow Rate of Sugar Beets / Sugar Cane is essential in order to optimize, control and improve the sugar quality.





Paper industry

9

12

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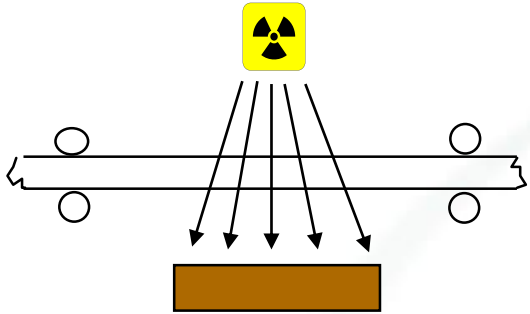


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Principle: absorption of (β, γ) radiation by material



Application



Sheet products

(paper, textiles, rubber, plastics, laminating/rolling of material sheet)

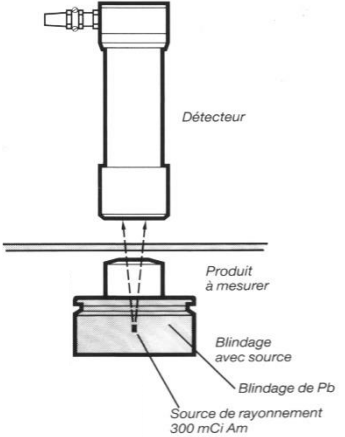
NCS



Weight / unit area (basis weights)

Automation, servocontrol

0.1% (e) < Contrast < 1% (e)
(lowest signal)



Weight per unit area (Grammage) gauge = measuring the weight per unit area of sheet material

E.g.: paper with 80 g/m²: A4 sheet



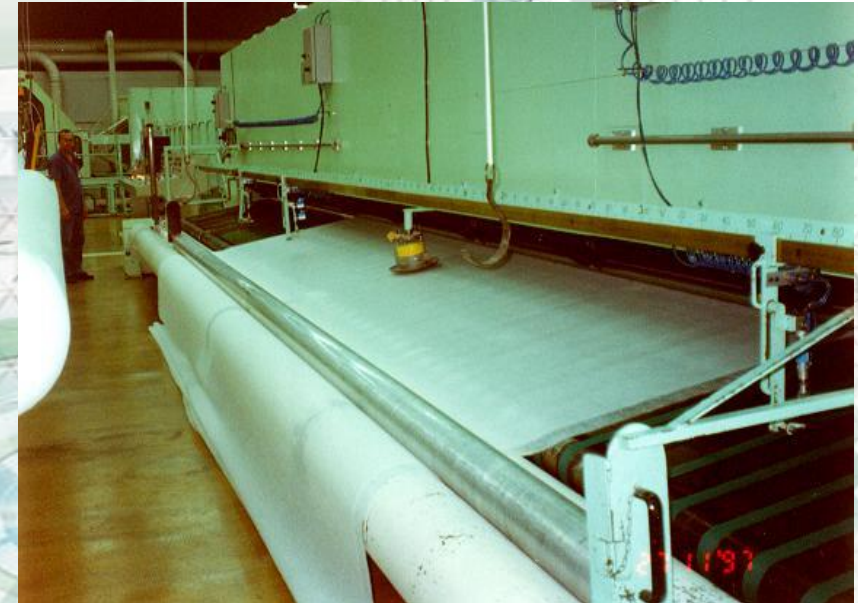
E.g.: paper with 80 g/m²: A4 sheet



Film Thickness



Paper Thickness



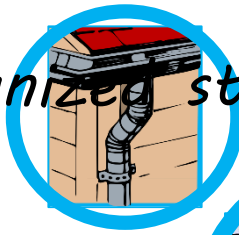
Paper with 80 g/m²
A4 size

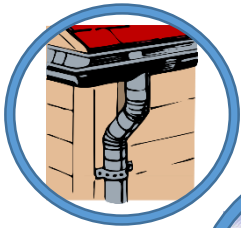
A4 sheet:
 $S = 21,0437 \times 29,7001$
 $= 625 \text{ cm}^2$

A4 sheet:
 $m = 5 \text{ g}$

Weight per unit area (Grammage) =
 $5 / (625 \times 10^{-4}) = 80 \text{ g/m}^2$

Galvanized steel





Galvanized steel



Gauge implemented on Maghreb Steel Galvanizing Line (Morocco)

Measuring Heads

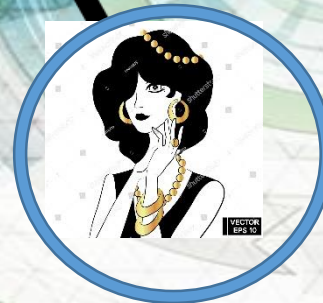
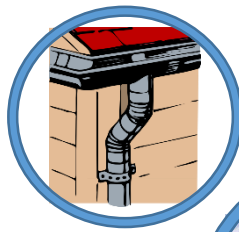


Detectors : Crystal Ca F_2



Sources : ^{241}Am
11.1 GBq (300 mCi)

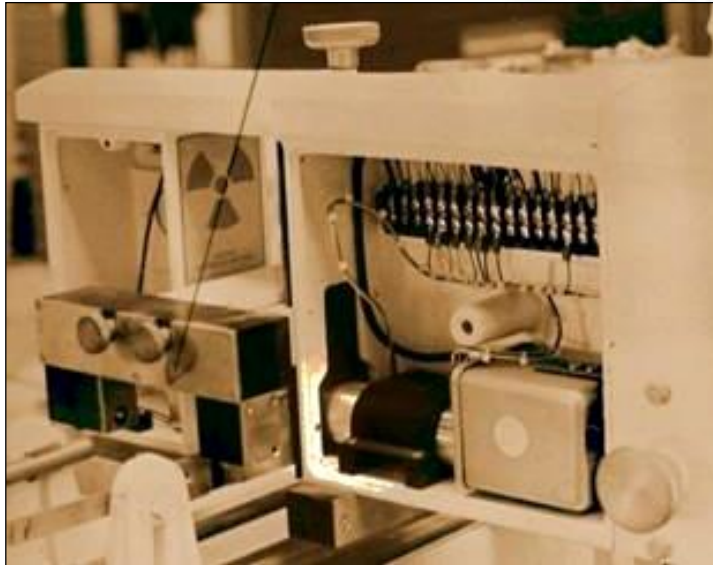
Food industry





For small containers e.g. drink cans, low energy gamma radiation may be used (^{241}Am) or electrically generated X-rays.

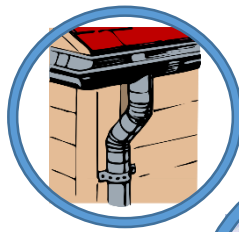
Beverage Level



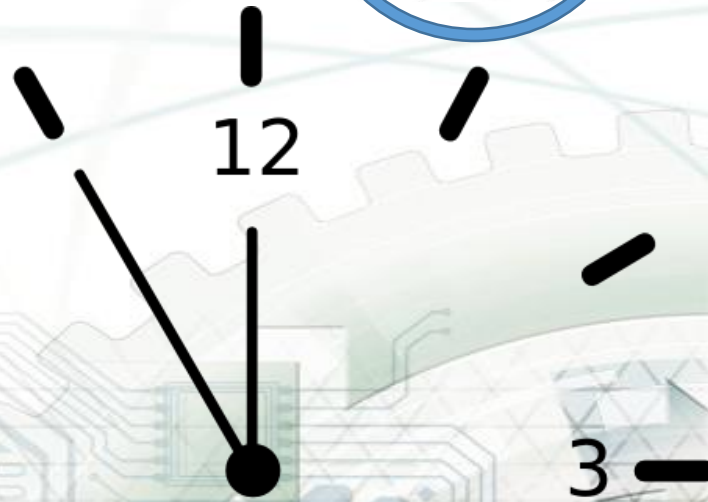
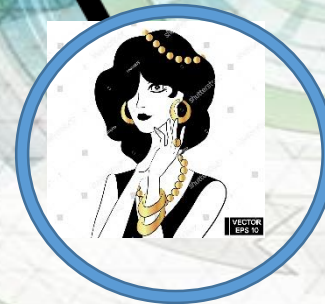
241Am level gauge



X-ray (100 kV) level gauge



*Navigation
Security in ports*



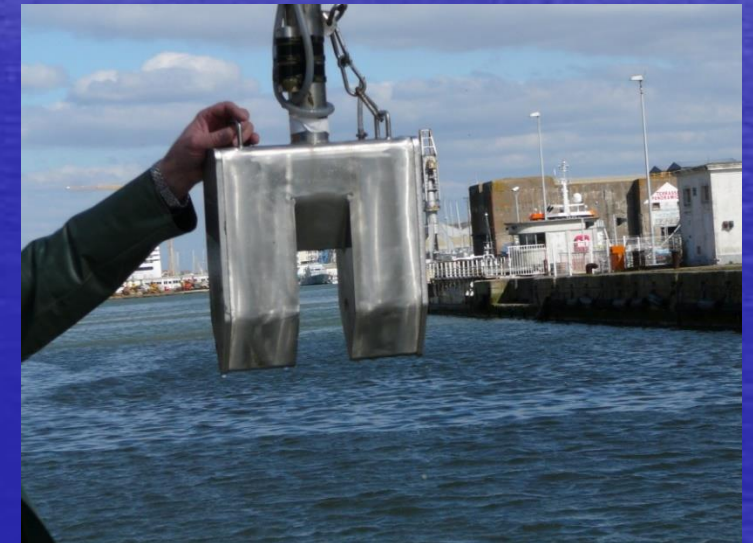
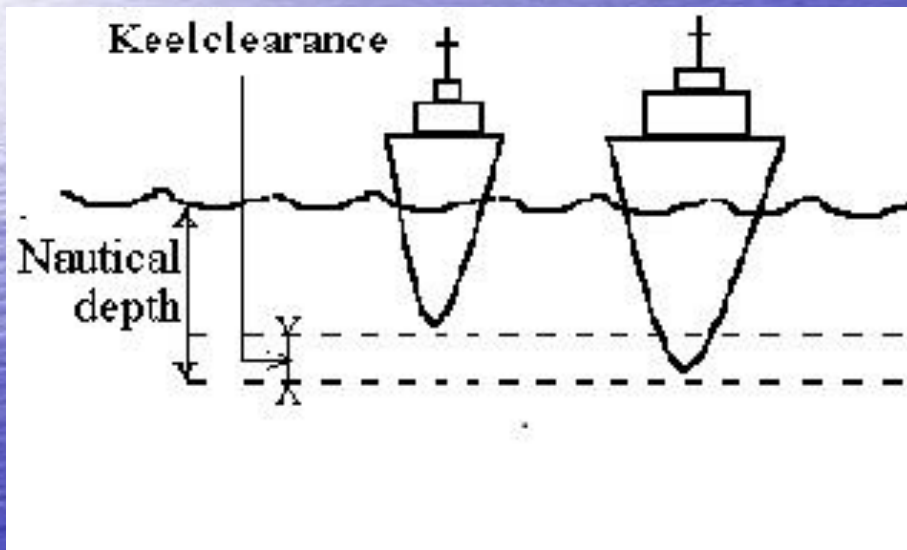


Nuclear Techniques as applied to Sediment Management and Control

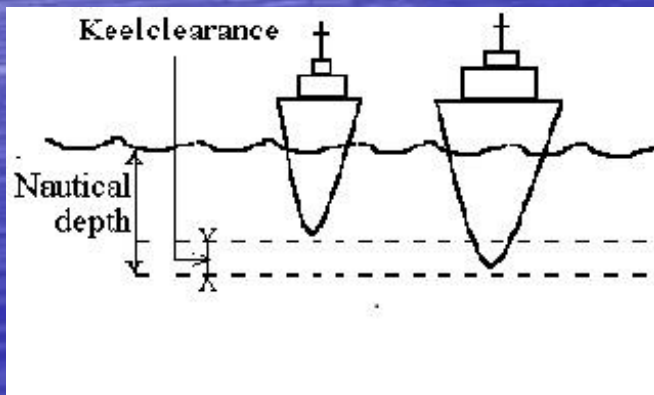
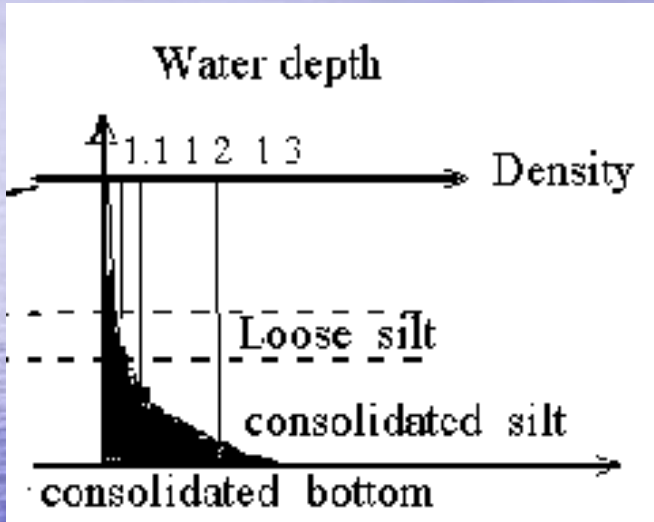
Nucleonic Control Systems (NCS): Navigability depth limit

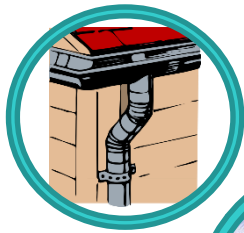
NCS for determination of volumetric density of bottom fine sediments

SEDIRACKER X30

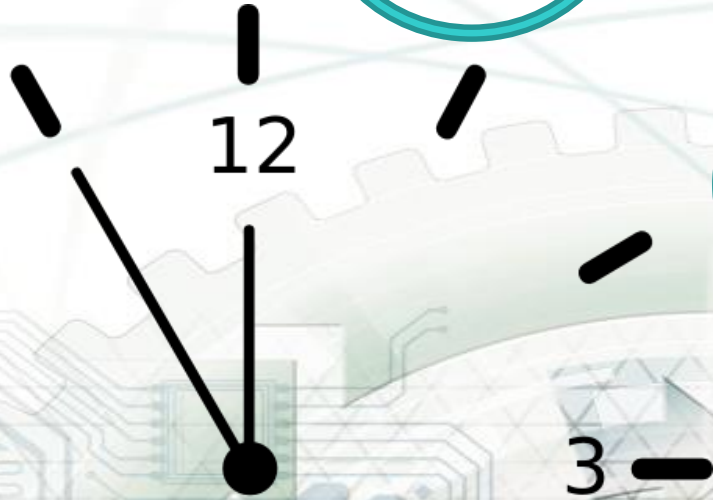


X ray generator 30 KV





Vehicle fuel production



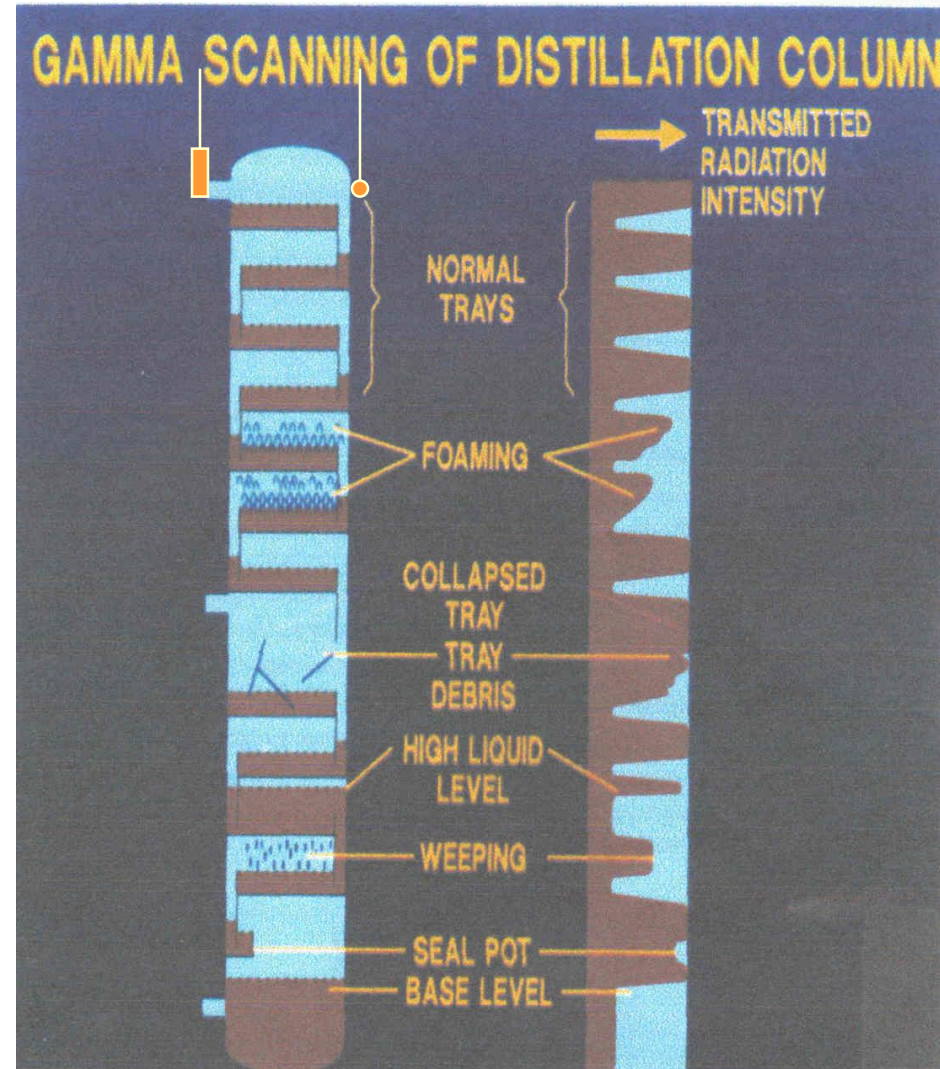


Coking phenomenon detection in gaseous phase pipe using sealed source (Gamma scanning technique)

- Gamma Scanning technique was applied to investigate Furfural unit which have experienced a serious problem of pressure drop at the thermally insulated gaseous line connecting the output at column head to other production units.

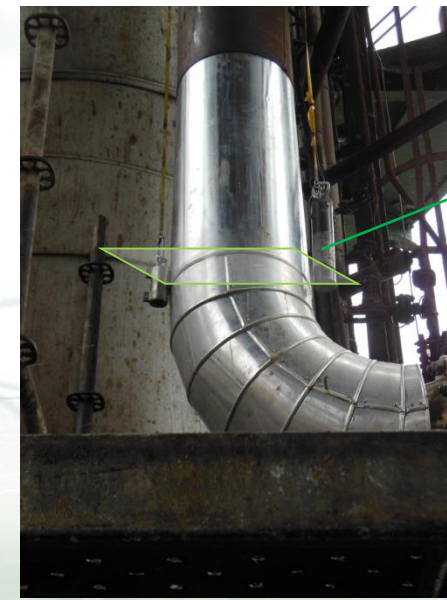


The unit was operating at only 10% of its nominal capacity



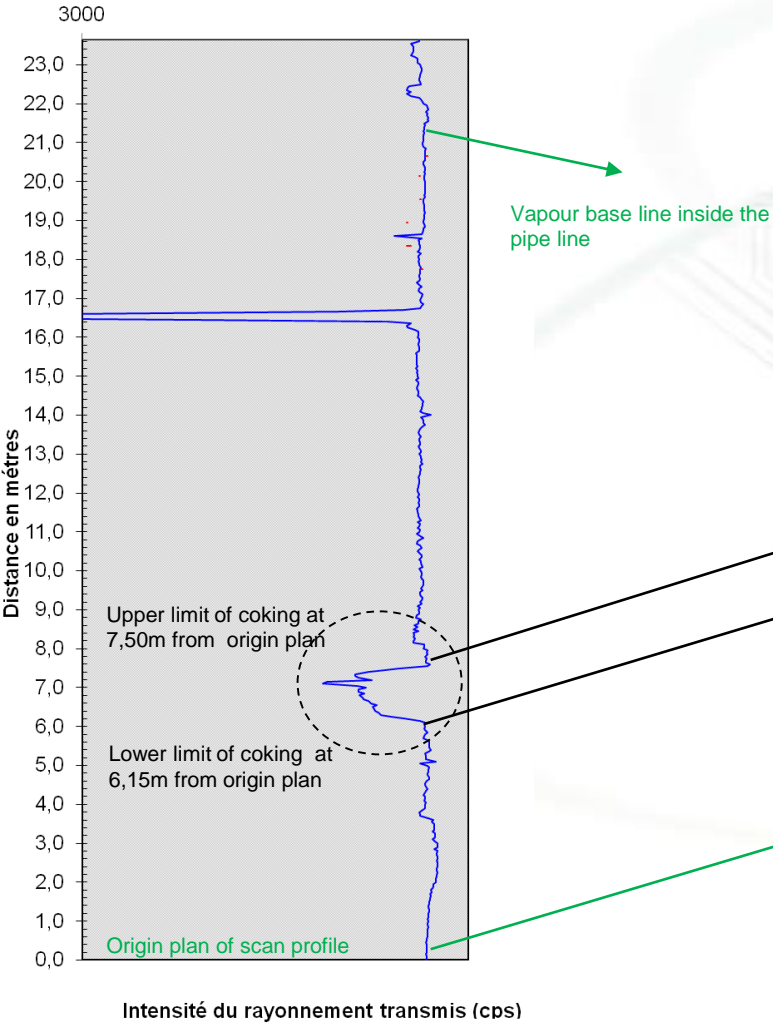


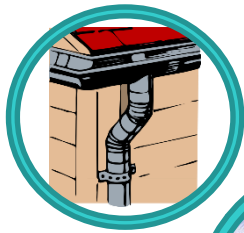
Coking phenomenon detection in gaseous phase pipe using sealed source (Gamma scanning technique)



Plan origin of the scan profile

- 12 mCi ^{60}Co source used.
- Scan measurements were made with a pitch of 5cm along the line.





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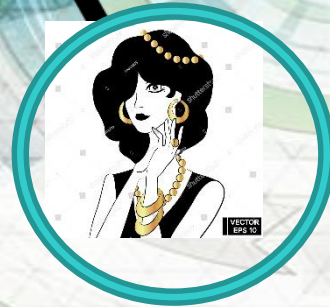
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Gold mining

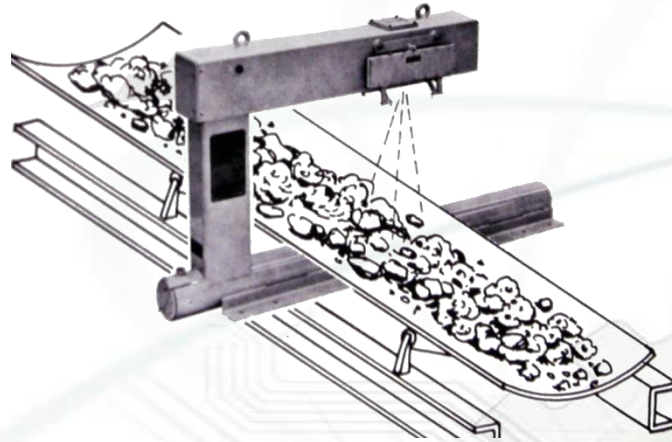


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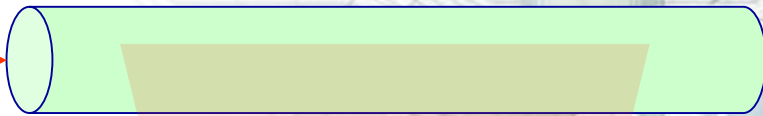
Mining Industry



Belt weighing gauge



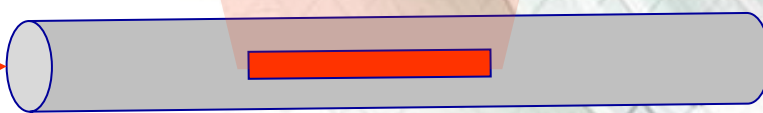
Detector



Product on conveyor belt



Source (may be extended)



Mineral Weight

