

Nuclear Technology as applied to industry: The Moroccan experience

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How does Morocco use radiation in industrial applications?

- Moroccan industry & radiation technology: 3 decades,
- Nuclear techniques ; to detect problems and improve production quality
- Two creeds:

**Inspect without altering:
NDT**

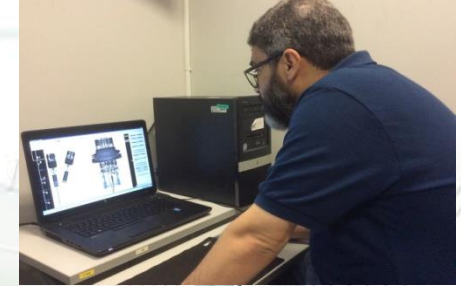
**Diagnose without interfering:
Scan & Tracer Techniques:**

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NDT

- NDT used to inspect industrial equipment and conduct quality assurance tests.
- NDT : > 98% of the technical inspections worldwide
- NDT using ionizing radiation (radiographic testing: RT): to test the quality of materials with **No damage & No radioactive residue**.
- RT :
 - largest NDT technique on the market
 - reference method for other complementary techniques.
 - based on gamma sources or X-ray generators.

**Digital RT on
Temperature probes**
(service provided to
Zodiac Aerospace)



UT on chemical unit
(service provided to Samir
Oil Company)



**RT & PT on Marine
propeller**
(service provided to
JANNOT Group)



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Scan Techniques

Conventional methods: not precise, not sensitive enough

Gamma scanning:

- internal inspection of any process or equipment without interrupting production.
- better idea of what is happening inside the unit and find the source of the problem.
- helps restore petrochemical refinery operations within hours



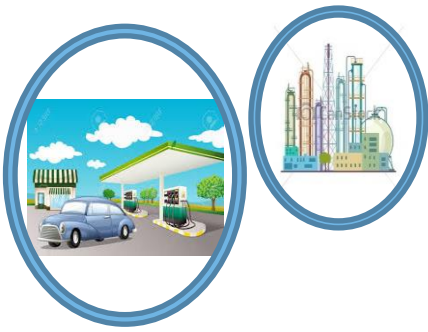
**Gamma Column
Scanning**

(service provided to Samir
Oil Company)

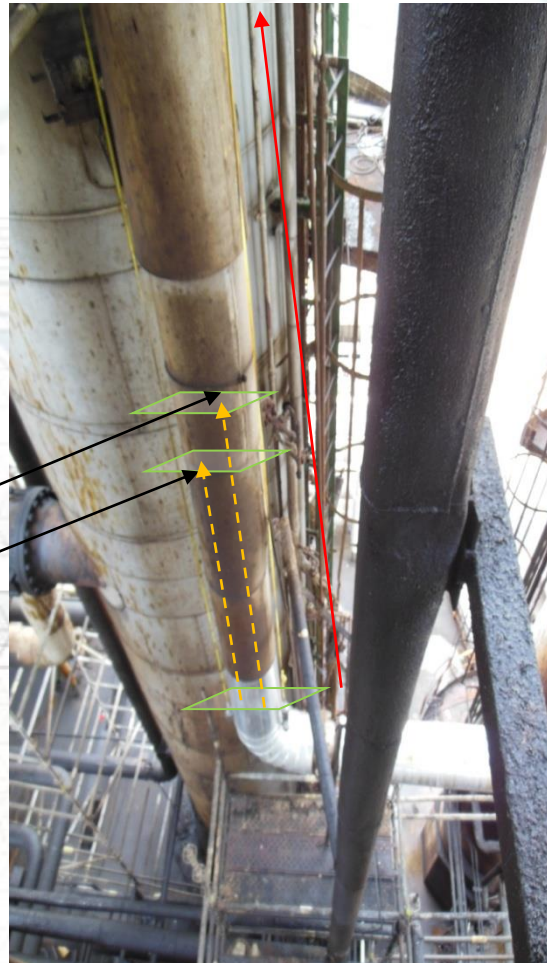
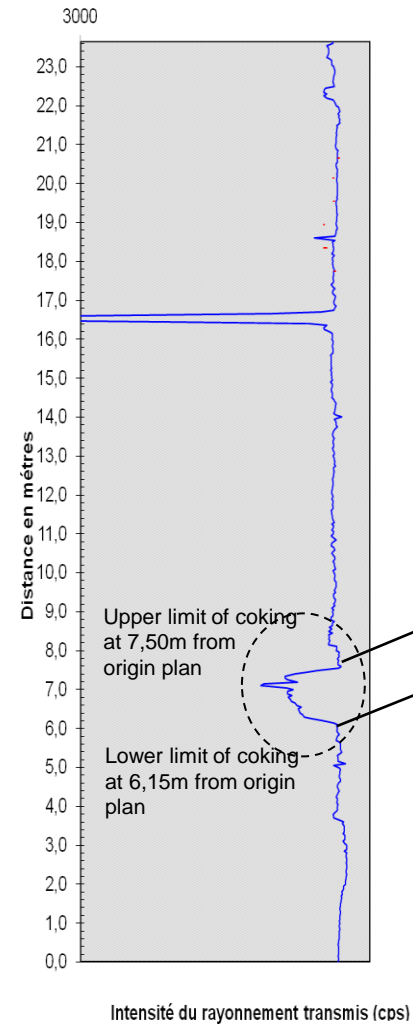
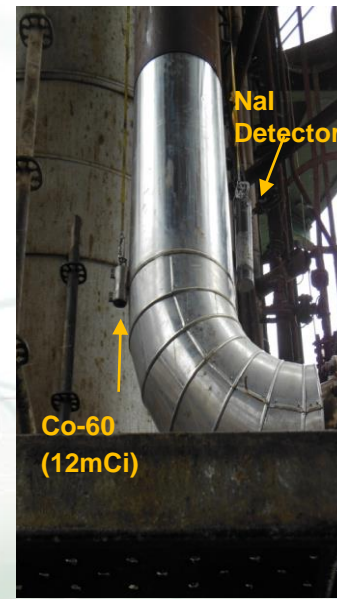


Furfural unit at SAMIR Oil
Refinery - Morocco





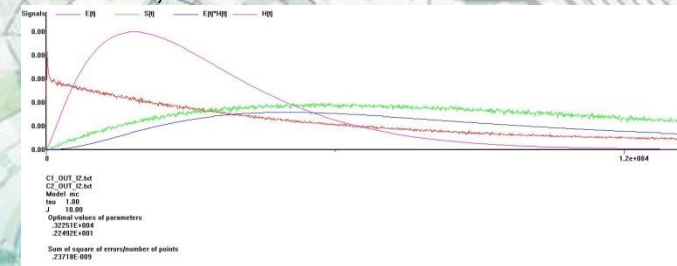
Coking phenomenon detection in gaseous phase pipe using sealed source (Gamma scanning technique)



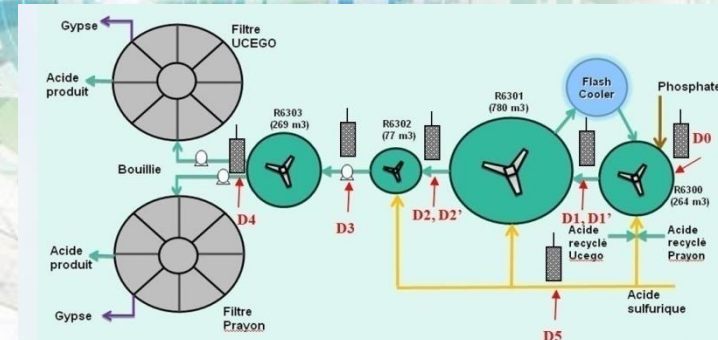
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Tracer Techniques

- Radiotracers: effective means to diagnose troubleshooting and malfunctioning in production lines (mixers, digesters, crystallizers or heat exchangers).
 - Residence times distribution of the material within the vessel
- ↓
- Many types of diagnosis can be made: dead volumes, leaks or short circuits, etc
- ↓
- Process engineers to take the necessary measures to restore normal operating conditions to their units.



**Radiotracer study on
Phosphoric Acid Unit**
(service provided to OCP
Group)



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Safety & Security first !

While performing nuclear techniques
(gamma radioactive sources)



- International radiation protection regulation
- Nuclear security & safety standards

strictly adhered to



**During all phases and at any times
(24/7)**

- Transportation
- Use (sealed sources)
- Radioactive tracers : team not leaving until unit radiological level returns to initial baseline

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What are the benefits for industry and for the country at large?

Minimum benefit ratio:
32/1

Every euro spent on { NDT,
Radiotracers
& other radiation applications,

Return of at least 32 euros.

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How does CNESTEN support its industry operators?

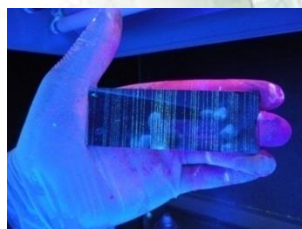
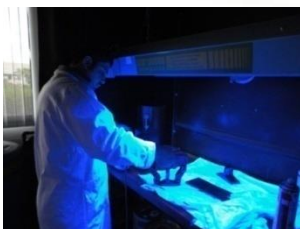
CNESTEN operates at three levels:

- As a training and certification centre
 - CNESTEN : the only examination centre recognized by the Moroccan NDT Confederation (COMEND).
 - 100 Moroccan and foreign NDT operators / year
 - Compliance with international norms and standards (ISO 9712)

Over the past 20 years, this training has contributed to the creation of several dozen private companies acting as NDT offices in Morocco and abroad.



- As a laboratory of excellence recognized both nationally and internationally.
- Service provider regularly called upon (in cases beyond the competence of private operators).



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How CNESTEN is supporting countries in the region to benefit from this technology?

- Moroccan experts to support countries around Africa and beyond
 - Morocco's collaboration in the region :
 - IAEA technical cooperation programs with various countries
 - IAEA-supported AFRA (African Regional Co-operative Agreement) for "Research, Development & Training Related to Nuclear Science and Technology"
 - AFRA program : direct cooperation between Morocco and countries such as: Angola, Cameroon, R.D. Congo, Egypt, Ethiopia, Ghana, Kenya, Senegal, Sudan, Tunisia, Tanzania and Zimbabwe.
- ↓
- A number of these countries have been able to implement nuclear and nuclear-related techniques in their own local industries.



Expert mission to Cameroon
(To implement Gamma column scanning technique)

The IAEA works with countries like Morocco to promote the peaceful use of radiation technologies in industry with the aim of having an immediate impact on the countries' economies

THANK YOU !



Name, Title,