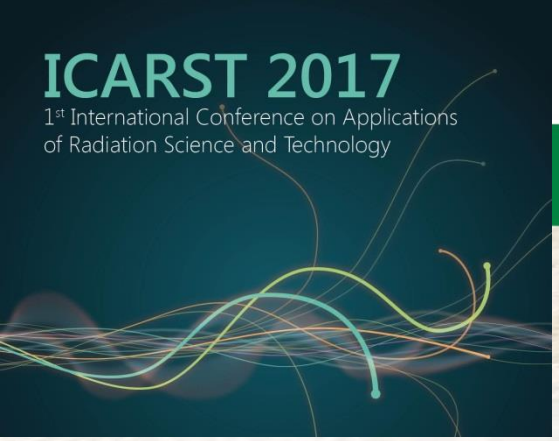


المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

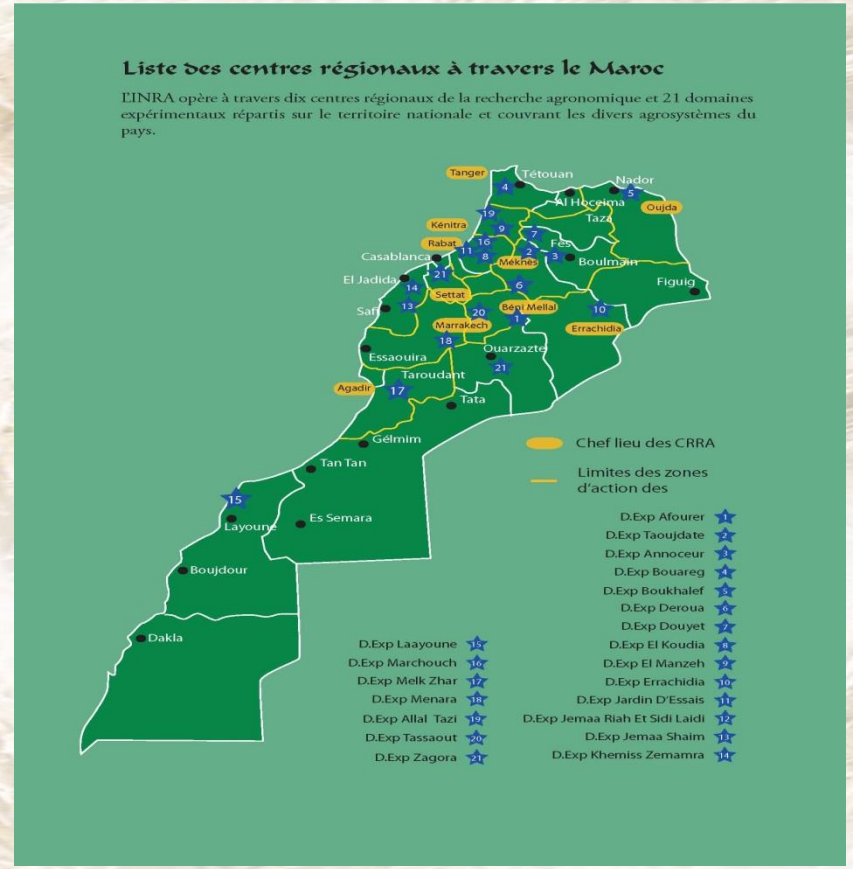
Enhancing Safety and Control features Upgrading Cobalt 60 of Radiation Processing Facility SIBO INRA/Tangier Morocco

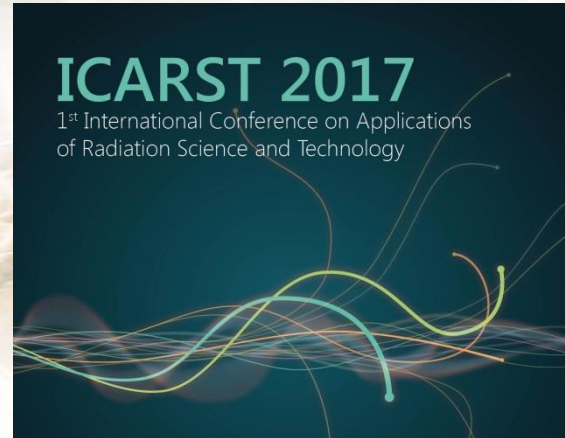
INRA Experiences

Mohammed Mouhib
URTNEQ/CRA-TANGER-
Chercheur INRA
Expert IAEA
momouhib@yahoo.fr

INRA - Morocco

- *INRA Headquarter in Rabat*
- *10 Agricultural Research Centers*
- *24 Research Stations*



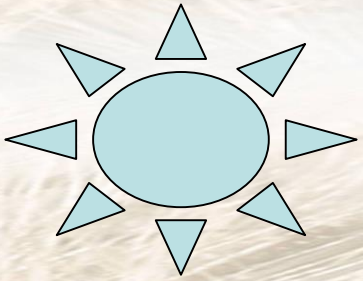


Objectives to insure simultaneously:

Food Safety

Food Security

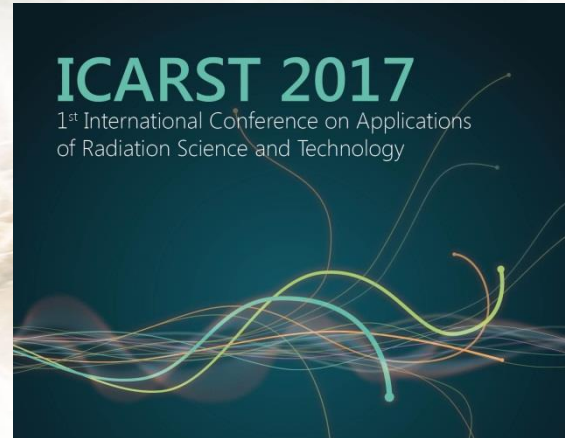
Ensure Food Hygiene



Overcome Quarantine Barriers

Sustainable Agriculture

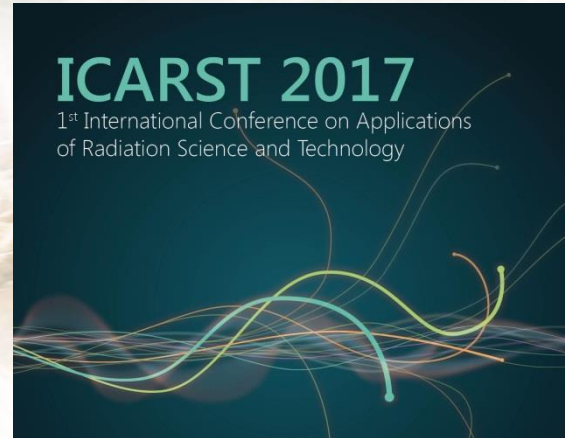
TRADE



المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

- Automatic control System is one of the maiming important parts of all irradiation facility.
- In some cases there is some specific irradiation facility with specific control system. For this kind of irradiator the control system can be developed and upgraded according to return of experiences and in accordance with industrial experiences. These upgrading procedures are also used as experiences by others to increase their systems.

The objective of this presentation is to share a local experience in upgrading security, safety systems and special upgrading of cobalt 60 for the irradiator.
This presentation is the summary of three others specific papers are in progress to be published in international scientific journal. And concern



المعهد الوطني للبحث الزراعي
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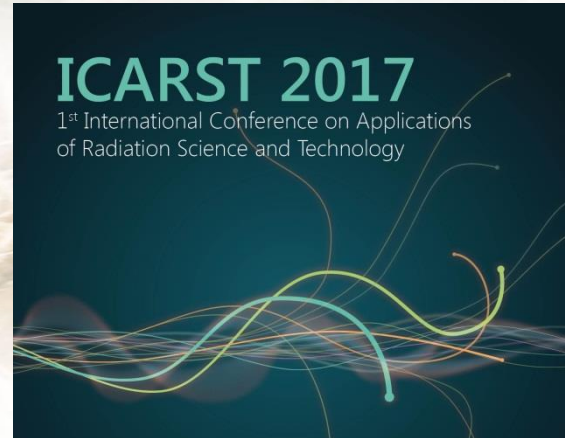
1- Upgrading of cobalt 60 in SIBO irradiator In Tangier this operation has been made in collaboration with IAEA and has been a success story of the year 2014 during the general conference of IAEA

2- safety and technical Upgrading of system of SIBO irradiator made in collaboration with IAEA

3- Installation and up grading of security system in accordance with Global Threat Reduction Program to reduce the threat of a Radiological Dispersion Device (RDD) in collaboration with The United States Department of Energy's National Nuclear Security Administration (NNSA).



Irradiation facility history

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

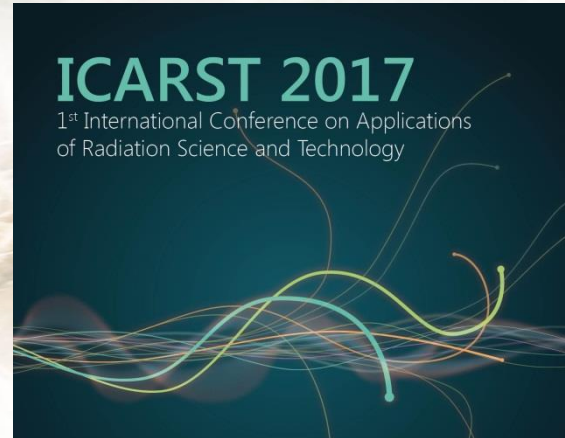
Construction 1994-1995

operational Dec. 1995

Upgrading Cobalt 60 2014

Upgrading Monitoring system 2015-2016

Upgrading Security system 2014-2015

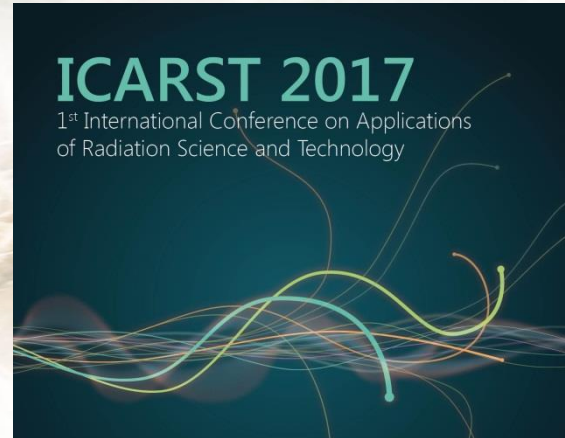


Irradiation facility history

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

Construction
1994-1995

Preparation of all safety document



Irradiation facility history

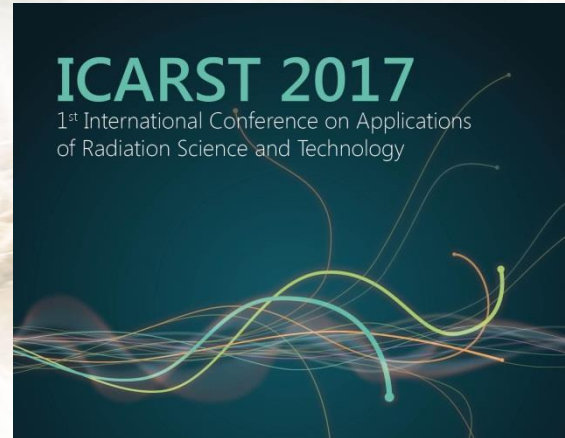
المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

operational
Dec. 1995

transport

Container in source cell

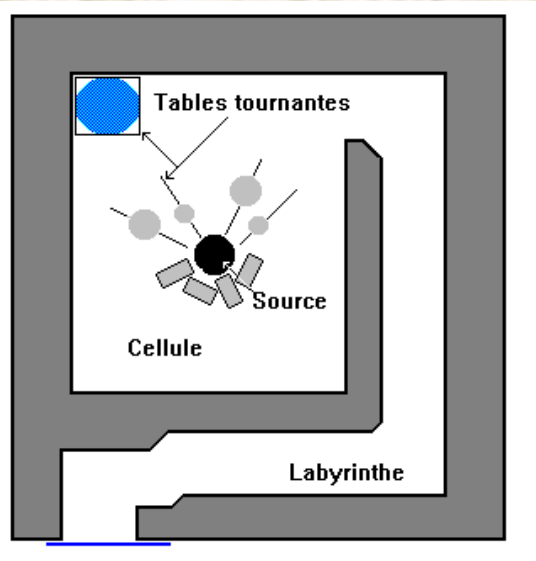
All Security and radioprotection services

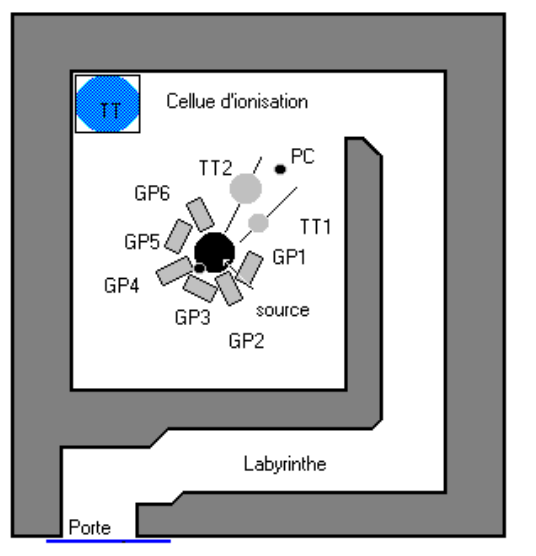


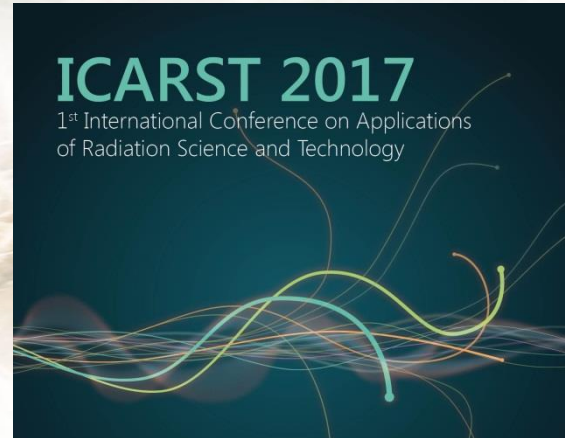
المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

The first upgrading done was: added 2 big turn table and two calibrated point in order to have the possibility to irradiate more product in big tables and have a calibrated point used for dosimetry calibration system.

We have also realized 12 cages (75 x 50 x 153 cm) to place on the six big tables for semi industrial purposes.







Irradiation facility history

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

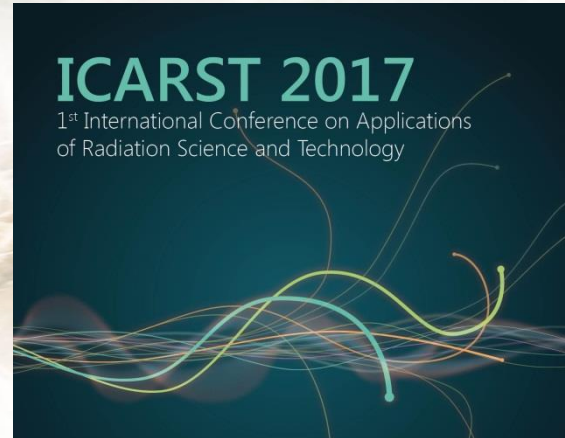
Since 2000 we started a procedure of upgrading CO60

But we have been faced to big difficulty of transport

Specially after 11 September

After 2004 our container has no transport certificat

Solution ?



Upgrading Cobalt 60 activity

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

Upgrading Cobalt 60 2014

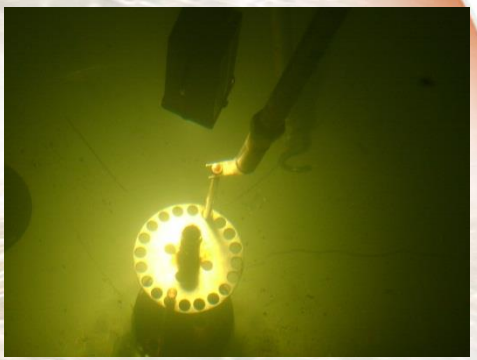
Bring Sources in manufacturer container

And

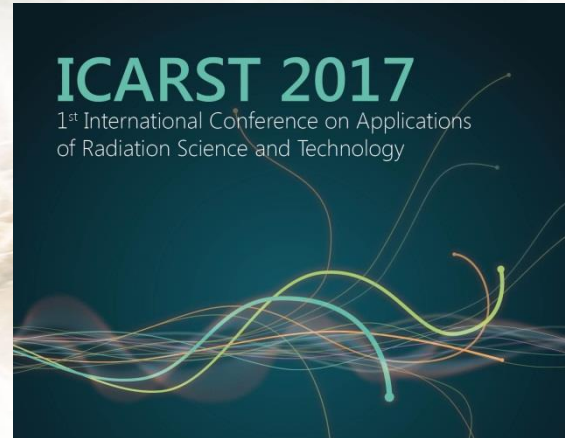
Make transfer of sources of CO60 to our container

Cleaning the pool inside

Temporary pool filled with water



Preparation of a temporary pool for transfer of sources of CO60



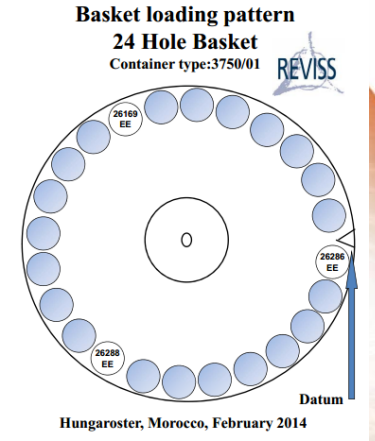
• Upgrading Cobalt 60

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

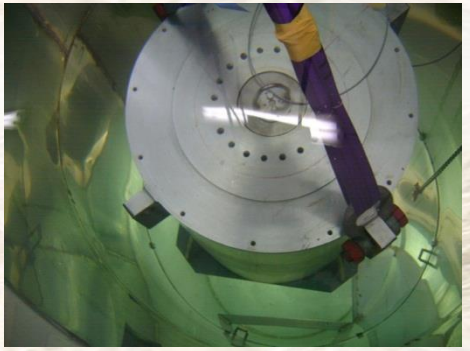
B(U) type transport package at the airport

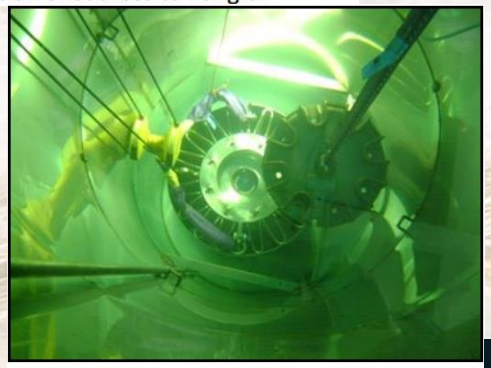
Transportation of sources to Tangier

Transport of new source in manufacturer containers

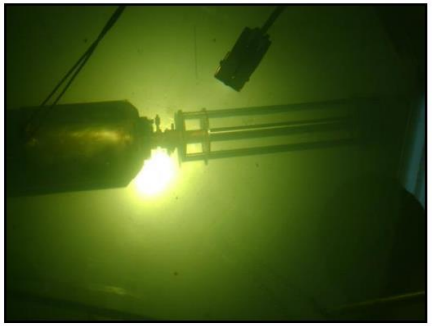


Transfer of new source from manufacturer containers to our conainer

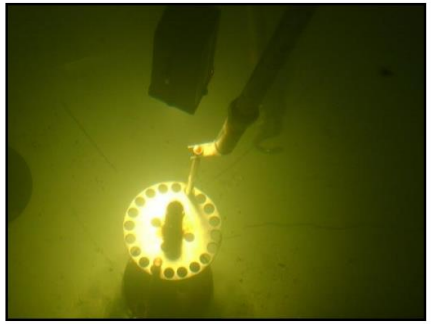




Unloading sources from the REVISS container



Manipulation of the source basket (holder)



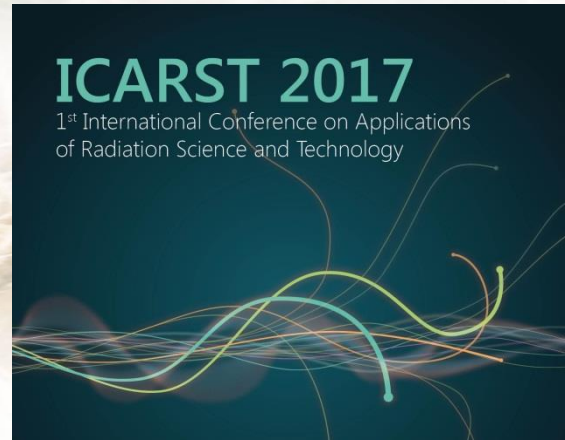
Removal of sources from the open basket

Safety and technical Upgrading of system of SIBO

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

Based on the initial design of the facility principles and on the return of experience for more than 20 years and in the study of the performance of the equipment used in the facility we have used the Failure Mode and Effects Analysis (FMEA), also called failure modes, effects and criticality analysis (FMECA). Failure modes and effects analysis (FMEA) is a step-by-step approach for identifying all possible failures in a design, a manufacturing or assembly process, or a product or service.

- **"Effects analysis" refers to studying the consequences of those failures. Failures are prioritized according to how serious their consequences are, how frequently they occur and how easily they can be detected.**
- **The system is implemented by the use of the latest advances in computer and information technology.**



Panoramic Batch Irradiator Class III

Irradiation Cell:

- ✓6,1 m length
- ✓5,8 m width
- ✓2,6 m heigth

Three exposition systems have been installed around the source:

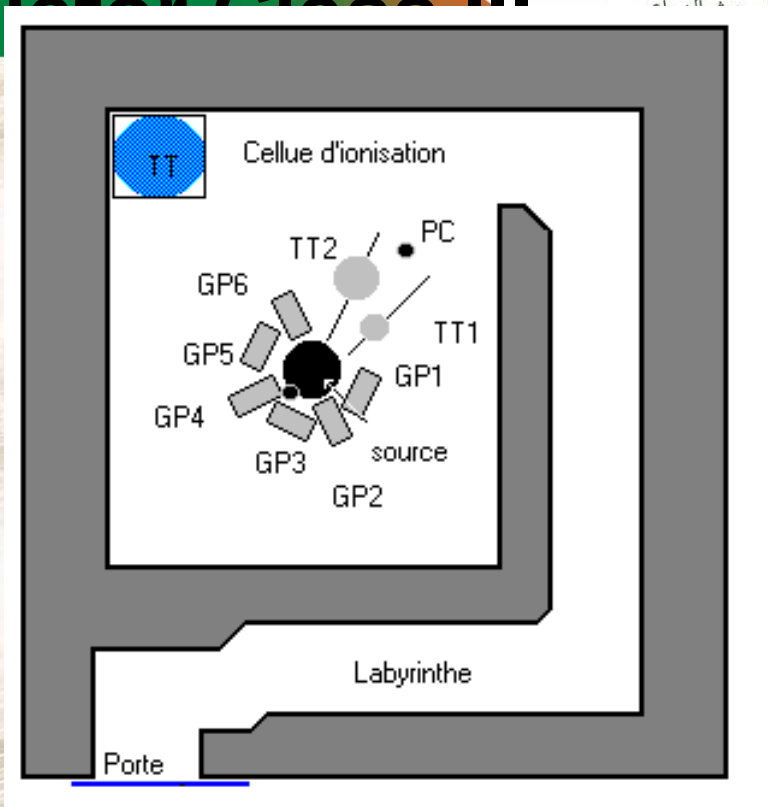
- ✓6 big turn tables for high doses
- ✓2 small turn tables adjustable in two dimensions for meduim doses
- ✓1 turn table for low doses

Safety condition: tree independent interlock system, 2 fixed gamma detectors and one personnel detector.

The unit is controlled by a PLC system.

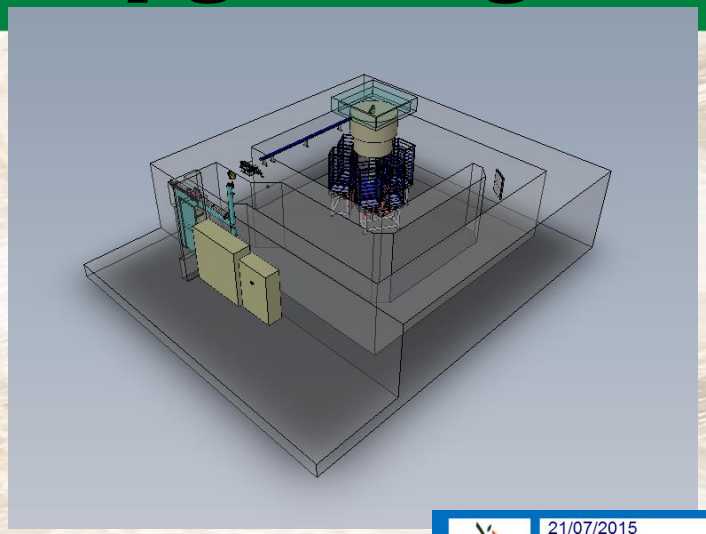
We have also realized 12 batches (75 x 50 x 153 cm) to replace the six big tables for semi industrial purposes.

Labyrinth with a shielding thickness of 1.63 M

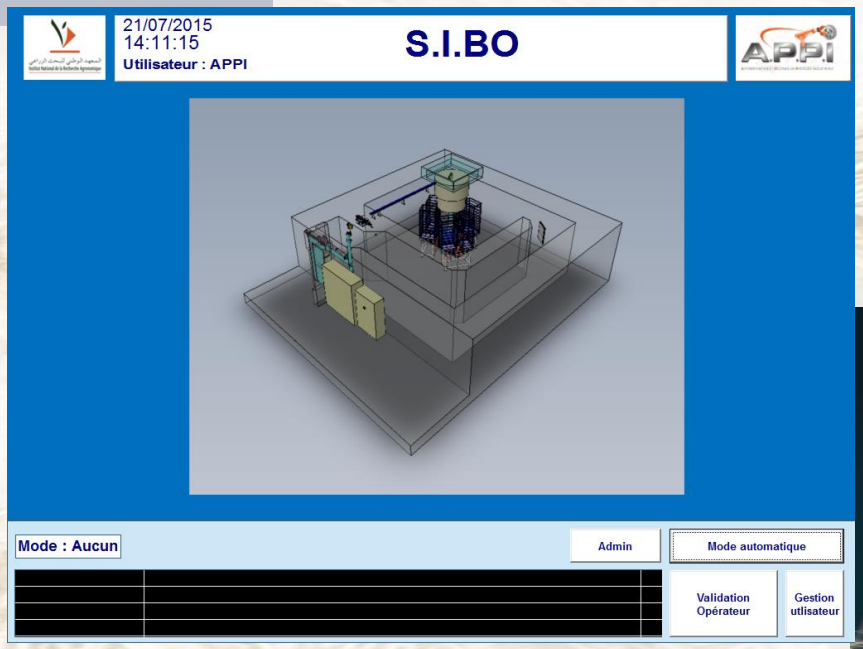


• Upgrading monitoring system

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique



Laser detector emails
Camera detector inside



ICARST 2017
1st International Conference on Applications of Radiation Science and Technology

Upgrading safety and monitoring system

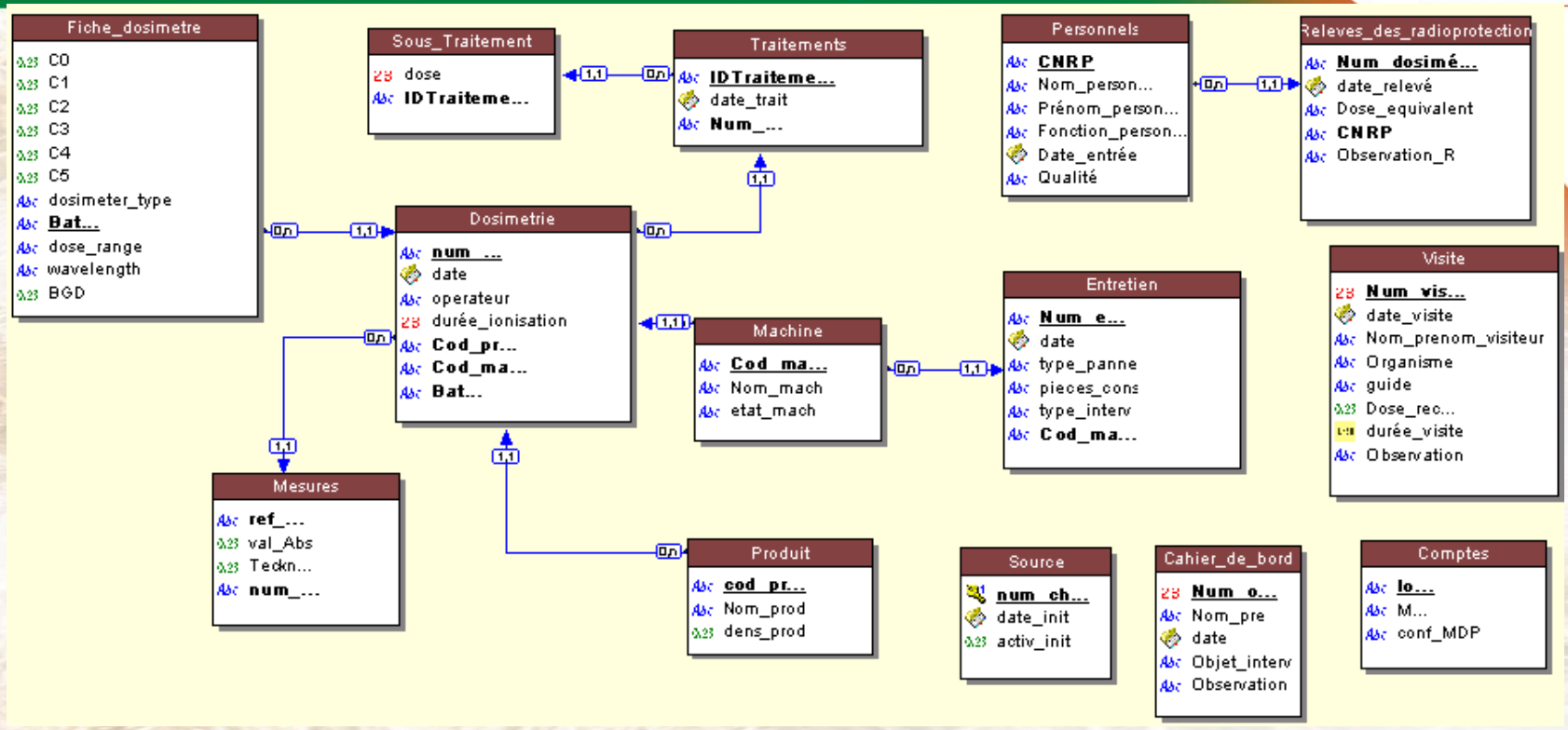
المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

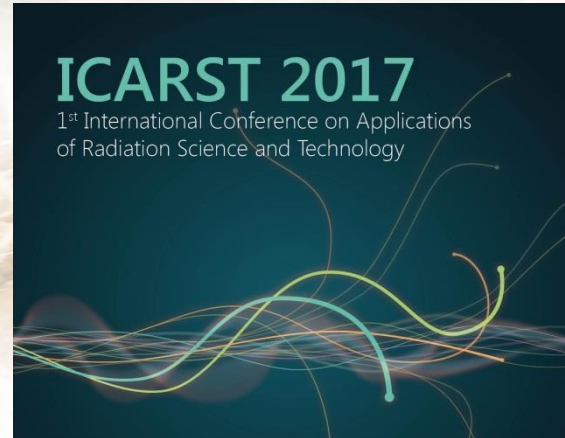
Biometric access Turn tables

ICARST 2017
1st International Conference on Applications of Radiation Science and Technology

Global System Management

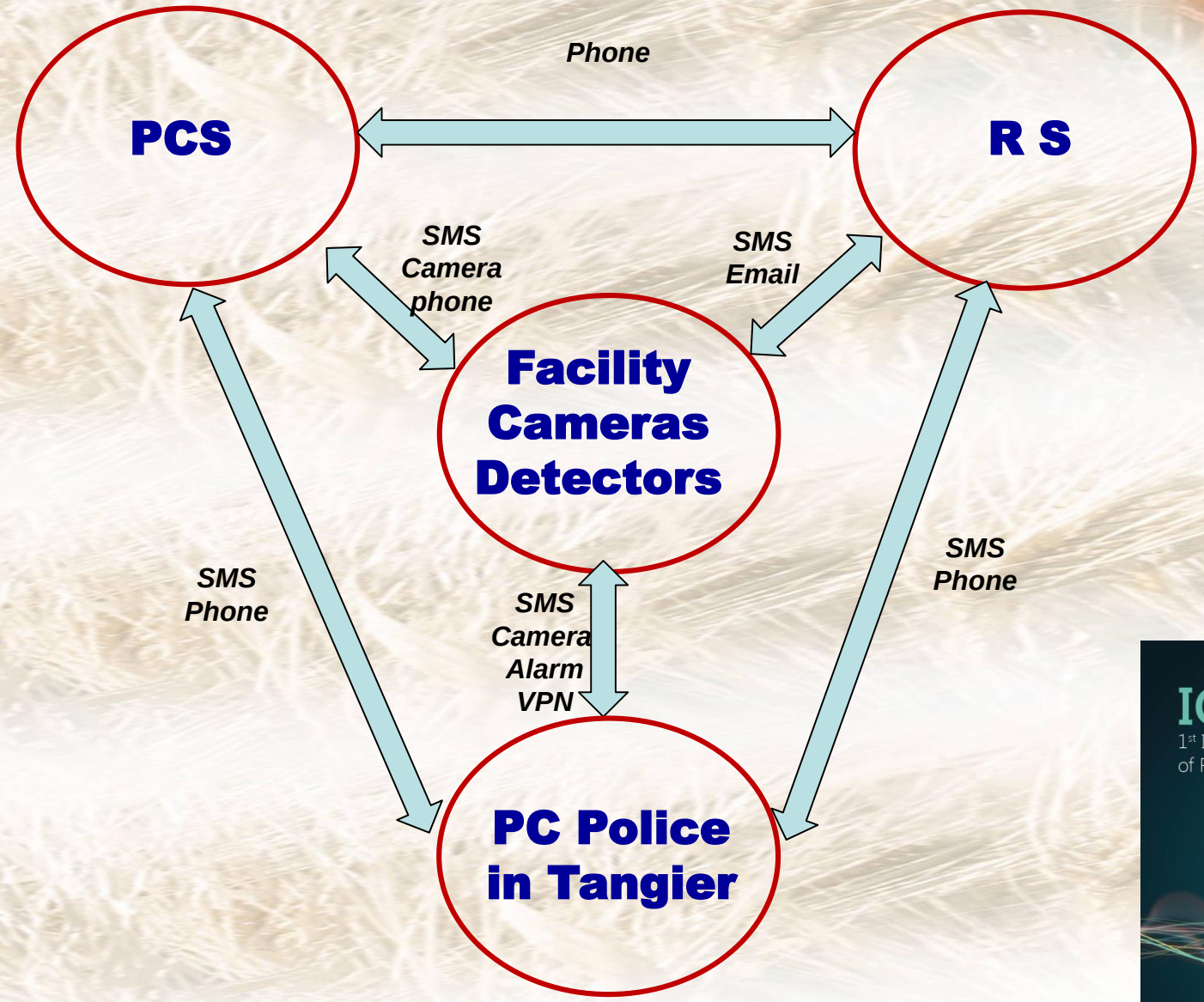
المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

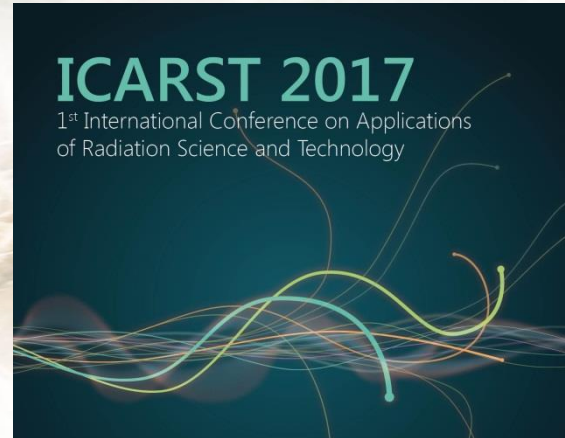




Global System Communication

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique



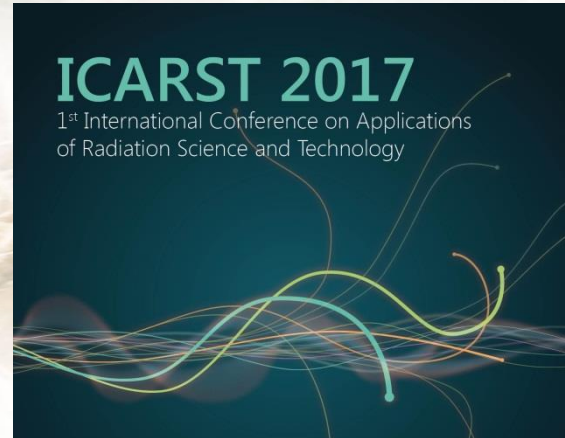


Installation and up grading of security system

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

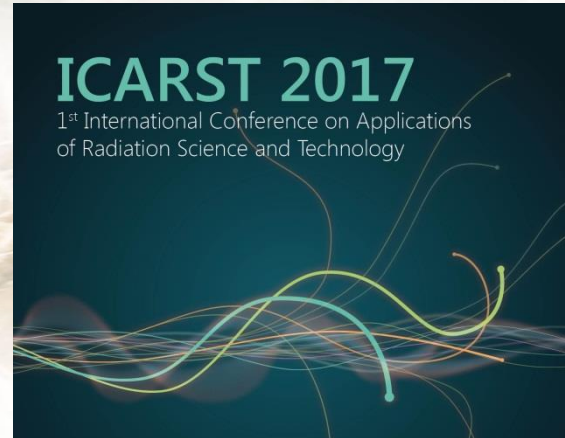
Radioactive sources are widely used in many industrial, agricultural research and medical facilities and are commonly available in nuclear facilities. Control and accountability of these sources are conducted mainly from a safety and health perspective, not from the security perspective that is common practice in the control and accountability of special nuclear material. There is a growing concern that terrorist groups can gain access to radioactive sources and may plan attacks on nations worldwide. Identifying, consolidating, and securing radioactive sources are in the best interests.

The security requirements contained are based on the performance objectives from IAEA Nuclear Security Series No. 11 Security of Radioactive Sources for Security Level A, and the practices and policies of the NNSA Global Threat Reduction Initiative (GTRI).



This system has been installed in different phases the first one was with only two camera in 2002
The objective of this task is to implement security enhancements at the site. The enhanced security systems will be incorporated into the existing site access control system, intrusion detection system, and CCTV system.
The main work done concern the Irradiator Building and Central Alarm Station (CAS) with installation of specified equipment in police station control station and concern :

- **Installation of a hardened (steel) door of substantial construction to replace the entrance door to the control room.**
- **Installation of an electro-magnetic locking mechanism on the irradiator room door and the door to the control room**



• Upgrading Security system

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

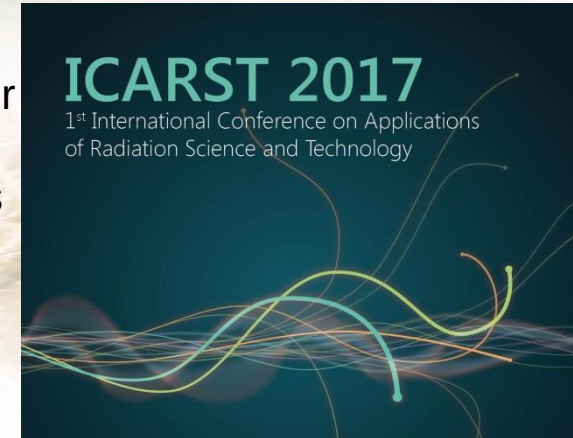
- Installation of a dual credential biometric access control device on the door to the irradiator and the door to the control room.
- Installation of security window film on the windows in the control room. There shall also be security grating on the interior windows to prevent access.
- Installation of a color CCTV system appropriate for the environmental conditions providing video surveillance of the area of the irradiator, outside the entrance door to the irradiator room, and the control room. Cameras shall be focused on the exterior an interior
- Installation of Balanced Magnetic Switches (BMS) tamper

Installation of dual technology (passive infrared and microwave) motion sensors.

- Installation of fixed duress buttons and providing mobile duress buttons for the staff.
- Installation of a TID (IR Barrier or BMS switch) on the irradiator cap to detect any unauthorized tampering with the irradiator.

.

- Installation of a strobe light and local siren that will annunciate in the vicinity of the room at a level exceeding 100 decibels (dB)
- Installation of a prox card access control system on the front door to the building. Which utilize an electro-magnetic locking system with an emergency release on the inside of the door. The access control system (dual credential requiring prox card and pin access).

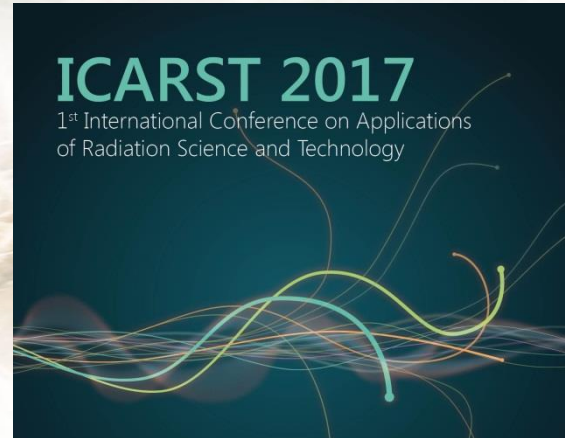


• Upgrading Security system

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

- Installation of an exterior intrusion detection system on the fence surrounding the perimeter of the irradiator building. Allow for the detection of an intruder as well as assessment during daytime and night time conditions.
- Replace the pedestrian gate with a turnstile system. The turnstile shall have an automated prox card access control system. This shall utilize a dual credential authorization requiring prox and pin number to grant access. The turnstile allows only one person to enter at a time.
- Automate the vehicle gate by installing an automatic closure device on the gate. This only is opened from the CAS.

- Installation of static vehicle bollards on the inside of the gate to prevent a vehicle from ramming the gate to gain access to the irradiator building.
- Installation of color CCTV camera appropriate for the environmental conditions (sealed camera or in environmental housing) providing video surveillance
- Replace the door to the CAS with a hardened steel door. utilize an electro-magnetic lock with an emergency release on the inside of the door and a proximity access control device with keypad to assure two levels of authentication



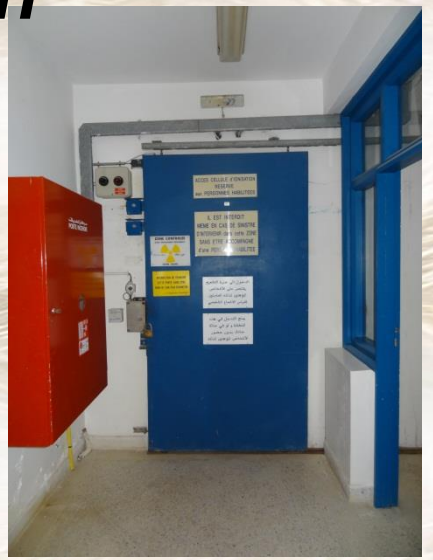
• Upgrading Security system

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

- Construction of fences around the irradiator building, this fences replacing the previous one topped with razor wire.
- Installation of a remote monitoring station at the local police.. This accepts all video and sensor alarms from the site.
- An alarm management system This system also sent encrypted video and alarm information to the Tangier police dispatch center.

Intrusion

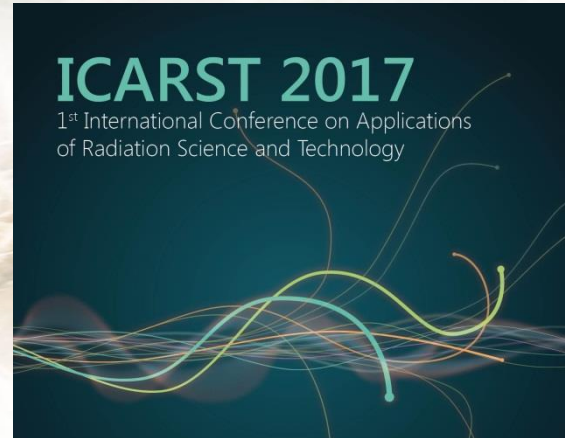
Access control



Radiation Detectors

CCTV

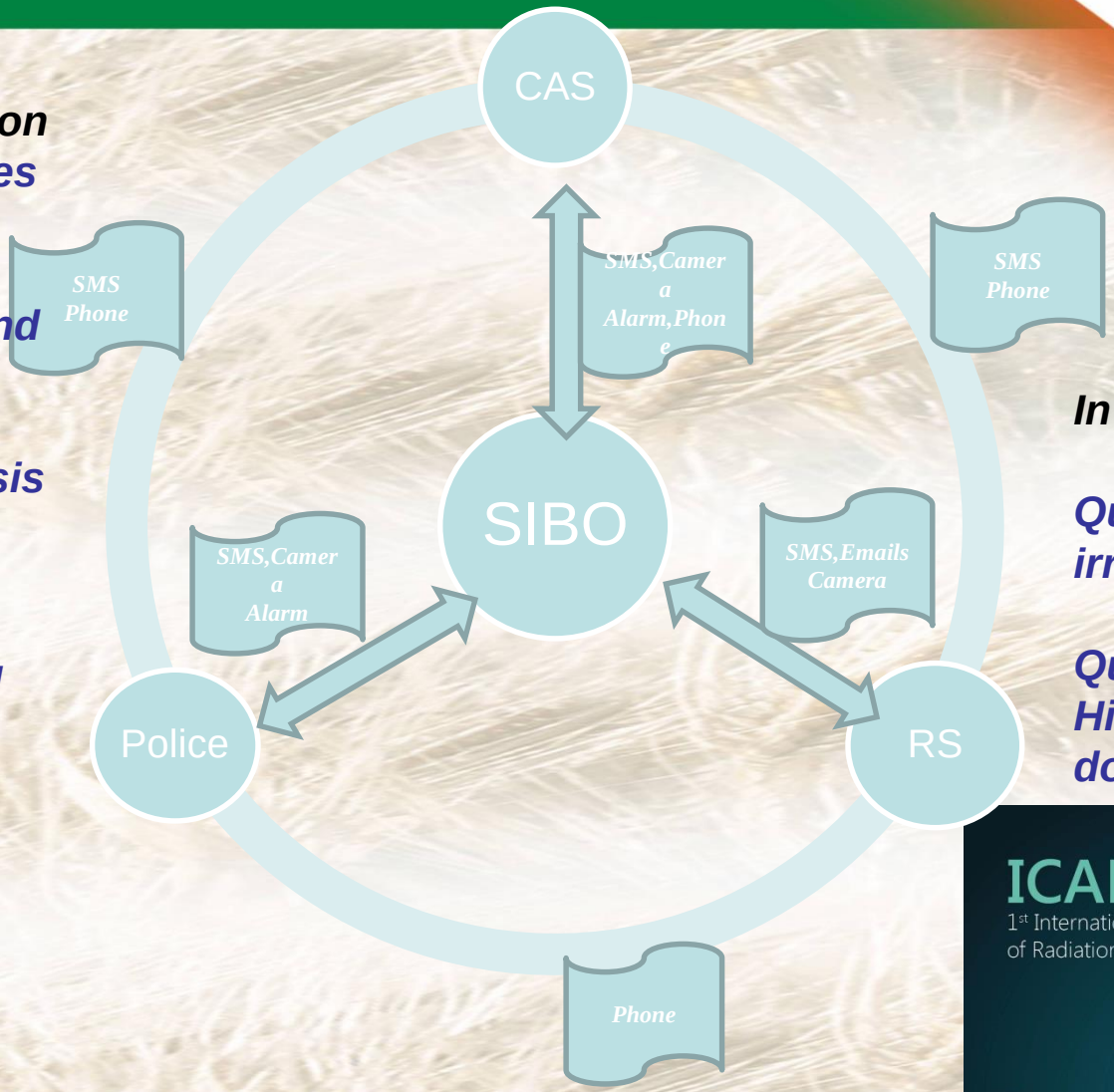
The control of this system is in direct collaboration With the National police department of Tangier



المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

INRA contribution

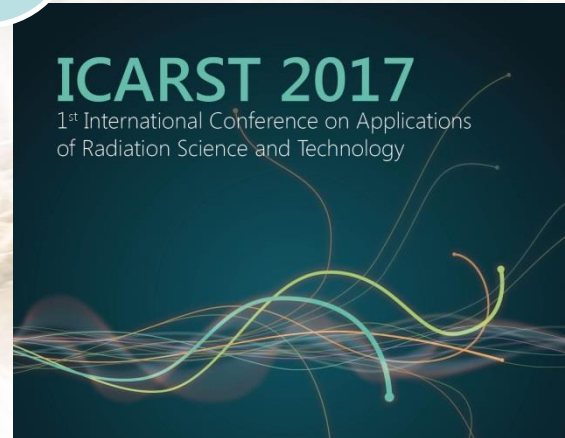
- ***Some courses With IAEA, CNSTEN University and other***
- ***Training , master , thesis***
- ***Expert and consultating mission***
- ***Seminar and workshop***



In progress

Qualification of the irradiation facility

Qualification of High dose dosimetery Lab



UNITÉ DE RECHERCHE SUR LES TECHNIQUES NUCLÉAIRE , L'ENVIRONNEMENT ET LA QUALITÉ

Principaux domaines d'application des techniques nucléaires dans la recherche agronomique

Domaine de la conservation des aliments par ionisation

- Inhibition de la germination des pommes de terre, oignon et ails;
- Amélioration de la qualité hygiénique de la viande de volaille, des produits déshydratés et des plantes aromatiques et médicinales
- **Traitement de quarantaine des agrumes**
- Prolongation de la durée de conservation des fraises
- Désinsectisation des dattes et du blé

Domaine de l'induction de mutation

Obtention par induction de mutation de:
Trois mutants de lentille à rendement élevé et tolérants au fusarium;
Un mutant de coton à cycle court;
Des mutants nains de blé.

Autres Produits étudiés à la station SIBO

• Papier :
5 kGy permet une réduction notable de la Charge microbienne du papier buvard.

• Articles médicaux:
25 kGy est suffisante pour la stérilisation des fils de suture et de compte goutte .

• Fraises:
Les doses de 1,5 kGy et 2 kg Gy combinées au froid (7°C) prolongent la durée de stockage de 12 jours.

Pomme de terre et oignons:
90 Gy sont suffisants pour inhiber la germination des pommes de terre et des oignons, prolongation de durée de stockage de plus de 10 mois à 10°C pour la pomme de terre et plus de 8 mois à température ambiante pour les oignons.

• Dattes:
650 Gy permettent la l'éradication des insectes ravageurs des dattes (boufgouss et jihle) sans altération de leurs qualités.

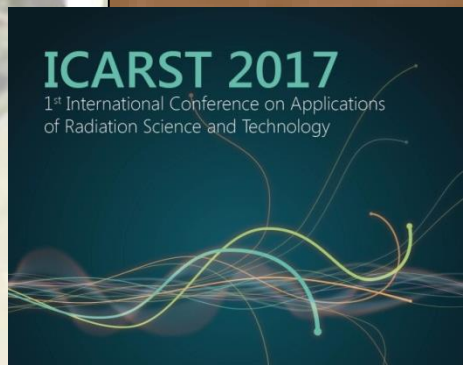
• Tomate en poudre :
5 kGy sont suffisants pour améliorer la qualité microbiologique sans altérer sa qualité technologique. Les essais de démonstration à l'échelle industrielle ont été réalisés.

• Agrumes :
250 Gy permettent l'éradication de la mouche méditerranéen

• Légumineuses alimentaires(lentilles et fèves) :
250 Gy sont suffisantes pour contrôler l'infestation de ces produits au cours du stockage.

• Blé:
500 Gy élimine les insectes ravageurs et améliore légèrement sa qualité technologique.

• Volaille :
Une étude sur la volaille de la région du Nord (Tanger et Tétouan) a montré une qualité hygiénique médiocre. Une dose de 3 KGy améliore cette qualité .



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THANK YOU FOR YOUR ATTENTION!

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