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Enhancing Safety and Control Features of Radiation Processing Facility SIBO INRA/Tangier Morocco

Mouhib Mohammed1.; Chentouf Mouad1. ;Guessous Amina2 ; Pierre Bureau3
1 INRA/CRRA Tangier Morocco,2 Faculté des sciences IBN TOFAIL Kenitra Morocco, 3 APPI Tours France;
momouhib@yahoo.fr

المعهد الوطني للبحث الزراعي
Institut National de la Recherche Agronomique

Introduction

It is estimated that more than 400 gamma ray irradiators are currently in operation all around the world. advantages in comparison with other known methods, gamma radiation processing is being more intensely applied for sterilization of health care products including pharmaceuticals, irradiation of food and agricultural products, and material modification processes, such as polymerization, polymer cross-linking and gemstone coloring. , in the case of safety critical systems, such as irradiation facility, the requirements concerning the high degree of safety and reliability are of paramount importance. 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 (FME)) 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. “Failure modes” means the ways, or modes, in which something might fail. Failures are any errors or defects, especially ones that affect the customer, and can be potential or actual. “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 purpose of the FMEA is to take actions to eliminate or reduce failures, starting with the highest-priority ones. Failure modes and effects analysis also documents current knowledge and actions about the risks of failures, for use in continuous improvement. FMEA is used during design to prevent failures. Later it’s used for control, before and during ongoing operation of the process. Ideally,

This paper will first present the facility organization, operation and safety elements of panoramic irradiator with dry store ; Then will be presented the specific operation of cobalt 60 replenishment; the upgrading of technical and safety system finally the implementation and upgrading of the security system.

The system is implemented by the use of the latest advances in computer and information technology.

The facility is a panoramic irradiator with dry store of cobalt 60 in a container used also as transport container in the first loading. It is the first one in Morocco and was installed in 1995[1.2]; in order to introduce this technology in Morocco the characteristic of this facility are :

Irradiation Cell: 6,1 m length; 5,8 m width; 2,6 m heigth

Three exposition systems have been installed around the source:

4 big turn tables for high doses;4 small turn tables adjustable in two dimensions for medium doses;1 turn table for low doses

Type of the storage flask: SV-68 B(U) type, Year of manufacture: 1994

Dimensions of the flask: Ø 770 mm x 1160 mm ;Material: Stainless steel case poured with lead ; Weight: 4940 kg

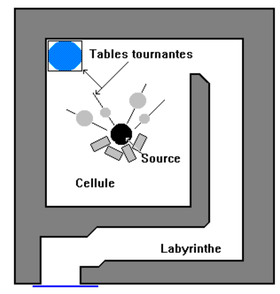
Source holder: Round holder with 20 pencil positions, at present 2 positions contain source pencils.

Cavity of the flask for sources: Ø 131.5 mm x 615 mm

Safety condition: tree independent interlock system, 2 fixed gamma detectors and one personnel detector. The unit is controlled by a PLC system

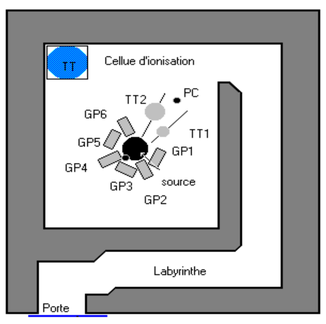
Operation panel of the control system

Radiation Monitoring System



Original turn table system

Modified turn table system



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[1.3]..

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

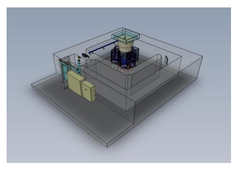
This operation has been done on 2000 in order to prepare the facility to the upgrading of cobalt 60 to 60 kci.

3-Safety and technical Upgrading of system of SIBO irradiator

After solving the problem of replenishment of cobalt 60 the upgrading of technical and safety system of the facility become necessary so we started the work during 2015 and this work concern

1 – Changing the big tables with a new system of motorization
2 – Changing the door of the irradiator
3 - Changing the emergency bottom by emergency cable
4 – Changing the source loading equipment
5 – Adding laser detector
6 – Add a camera in side with mirror reflexing
7 – Changing the round bottom
8 – Changing monitoring system and plc. System with new connection by email
9 – Add a database for the system and integrating all aspect of managing the irradiator .
10 – Changing the fixed gamma detectors
11 – Changing the Fire alarm
12- Install a power bank for the facility of 10 Kva

In general all equipment has been updated according to Failure modes and effects analysis (FMEA)



General view of irradiator

Roud trip botton to ensur no one is inside befor any irradiation operation

Biometric control before opening irradiator’s door

View of source loading

Opening and closing access door of the irradiation cell

Laser scanner and emergency cable

New access door with emergency

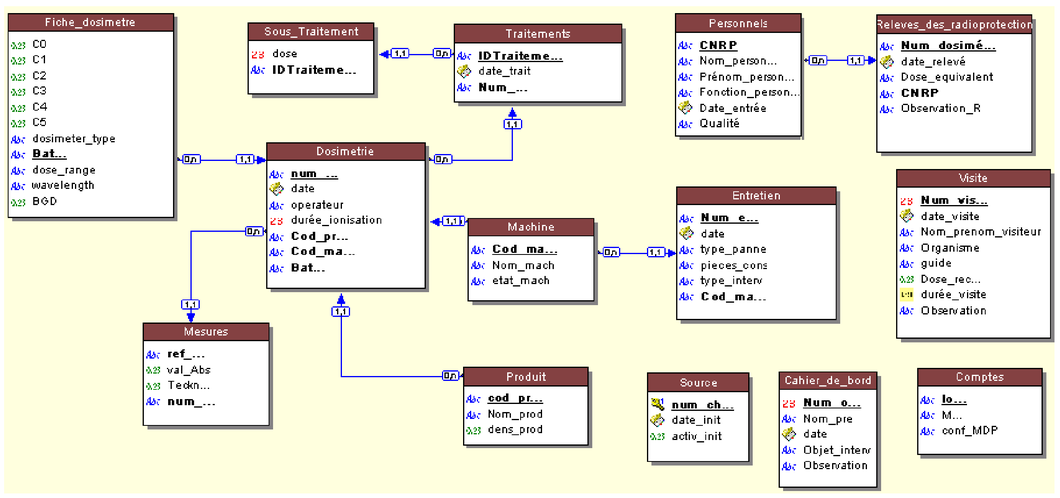
New tables with cages for product

The multi choice of the system of turn table used during an irradiation of one or more product and automatic file will be generated for each turn table system separatel

Inox mirror to have a view of irradiation room

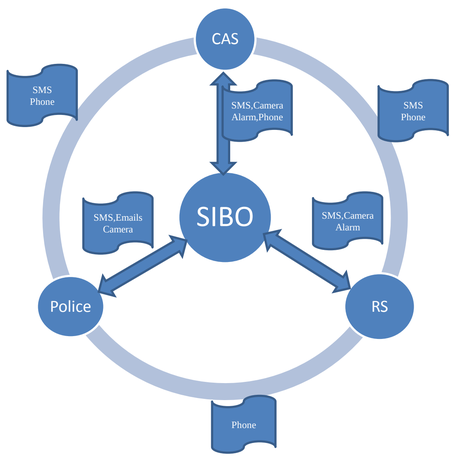
Upgrading operation for electrical and plc New PLC system

Irradiation of some product in new facility



General information on the generation of data base on new system

With this system we have better tractability of irradiation processing and better safety system to have a better functioning in safe way. The system controls, monitors and records the entire irradiation process, from reception of products at the facility to the production of post irradiation documentation. The system is implemented by the use of latest advances in computer and information technology



Communication between Police, Cas and Responsible of safety in the facility

Conclusion

During The last two year many works has been done on the facility concerning the upgrading of cobalt 60, upgrading of safety and technical control of the facility, upgrading of security of the facility. This work has been done following the latest regulation and Norms using the latest technology and using 20 year work experience in the field.

This combined system upgraded in security and safety and processing purpose offer a new largest system with the best of each one and can give a specific global solution to similar facility witch need to upgrade the control system.