Wins International Workshop
Security of Radioactives Sources
Mexico City, Mexico

Wednesday 23 October 2019

- **Nuc-Track Solution** for tracking and safeguard of radioactive sources

- **Other innovative technologies** for improving Security of Radioactive sources

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French Nuclear Program

France is one of the world’s most nuclear powered country

75% of its electricity derives from nuclear energy

With 58 nuclear reactors in 19 power plants having a total capacity of 63.2 Gwe,

France is the 2nd largest producer of nuclear energy in the world

- Long experience in the use of Radioactive sources on French soil
- Organization through French regulation bodies (MTES, ASN, IRSN,…)
- Permanent improvements and innovations
The Project Partners

- **nuc21**: Specialist of Nuclear and CBRN topics operating in France and Internationally

In partnership with large groups:
- Research and Development
- Consulting

- **assystem**: Delivering Engineering Services for Complex Projects with high levels of constraints

- **nuc21**: Creative nuclear solutions

12,000 employees worldwide

1st Independent Nuclear Engineering Company in the World

50 Years of Experience in Nuclear

Industry

Infra

Nuclear

Power generation

Life Sciences

Oil&Gas

Physical Security

Cyber Security

Functional Security

OUR GLOBAL SECURITY APPROACH

In partnership with large groups:
- Research and Development
- Consulting

Nuclear Industry

Defense

Security

Industry

Infra

Nuclear

Power generation

Life Sciences

Oil&Gas

ABC

Point-Core

L2i

Schlumberger

Systel
Aid & Support

Collaborative Project

The Nuc-Track project is approved by two French competitiveness clusters:

- Nuclear Industry Cluster
- Paris Region Systems & ICT Cluster

The Nuc-Track project is supported by the French government:
The **nuc-track** Security Project

- Real time surveillance of radioactive sources during all phases of the cycle: **Storage, Transport and Use**
- Protection against various threats (theft, human error, malicious act) following a risk reduction pattern.

The **Nuc-Track project** provides:
- a solution for protecting radioactive sources, especially in transport situations, when such sources are most vulnerable.
- an accurate **traceability** of all the sources’ movements and whereabouts.
- an efficient **answer to a national security concern**. This sensitive issue will lead to the implementation of new domestic laws aimed at tightening the sources security.
Radioactive sources
Radioactive Sources examples for different applications

- **Gammagraphy, Radiography**
  - Ir192 (74 days half life)
  - Co60 (5.2 years half life)
  - Se75 (120 days half life)

- Up to **4.4 TBq** for the most common source

- **Oil Well logging**
  - Cs137 (30 years half life)
  - Am/Be (432 years half life)
  - Cf252 (2.6 years half life)

- Up to **63 GBq** for the most common source
Radioactive Sources examples for different applications

- **Medical**:
  - Teletherapy: Co60 Cs137
  - Curietherapy: Ir192 Cs137
  - Blood Irradiator: Cs137 Co60

Activities up to 220 TBq
Global security: an holistic approach

The system security level is defined by the weakest link of the chain

Threats / Vulnerabilities

- Human factors & equipment reliability:
  - Physical attacks
  - Cyber attacks
  - Insider threat
  - Human error
  - Equipment failure

Solutions

- Protection means:
  - Physical security
  - Tracking / Detection
    - Cyber security
    - Procedures
  - Redundancy of equipment
  - Virtualization

Risk analysis
Strategy: a Combination of Technologies & Procedures

- **Deterrence**
  - Discretion
  - Strict procedure for packaging and preparing missions
  - Security means (video, access control, intrusion detection) during the different phases

- **Protection**
  - Facility physical protection
  - Vehicle protection
  - Tracking & permanent electronic surveillance of packages
  - Tampering devices

- **Prompt Detection Identification**
  - Round-the-clock surveillance
  - Alarm processing following escalation procedures taking into account criticality level

- **Interception**
  - Mechanical locking
  - Anti-ignition system

- **Blocking actions**
Nuc-Track Solution
Principle of the solution

Security of the Vault
- Access control
- Biometrics
- Video analytics

Security of Transport
- Real time follow-up
- Tracking of packages
- Blocking devices
- Audio communication
- Intrusion detection
- Panic button

Security in Use
- 2 persons rule
- Detection
- Video

End-user application

GPS positioning & satellite transmission

Surveillance Center
- 24/24 – 7/7

Surveillance application

Secured Communications

Nuc-Track embedd
ed tracker

Radiation sensor

GSM transmission

Alarm

Mission data:
- Customer Departure
- Arrival

End-user application

Video surveillance application

End-user application

End-user application

STOR

TRANSP
The components

A modular solution consisting of embedded components and software

**Nuc-Track embedded Tracker**

Autonomous ruggedized Black-box fixed to the radioactive source packaging and embedded with several components (positioning GPS, GSM or satellite transmission, innovative sensor control and gamma radiation, and a Battery).

**Surveillance Center application**

- A 24 hours a day monitoring service to follow-up the transport mission,
- A global supervisory system to manage alarms and the linked instructions,
- An intuitive man-machine interface based on a GIS solution,
- In addition, possibility to manage storage & use phases with physical security as video, access control or intrusion detection,
- Option of a SIEM for cyber security purposes

**End-user application**

- Data base management for radioactive sources
- Mission planning
Example of gammagraphy packaging used in France

The device which contains the source is identified by a unique serial number printed on a Q/R code label. This device is inserted in a transportation box. This packaging is equipped with the Nuc-track tracker embedding a unique identifier.
General Architecture

DATA CENTER - Opérateur de service
Gestion parc et mission SW2

Communication SW1

Surveillance SW3

GS M

Poste Opérateur de surveillance

Balise véhicule (BV)
Connexion infos véhicule
Alarmes portes
Signalisations sonore et lumineuse

Terminal navigation

Balise véhicule (BV)
Connexion infos véhicule
Alarmes portes
Signalisations sonore et lumineuse

Terminal

GPS

Transpot multi-colis

Terminal colisage

Poste Utilisateur

Balise colis (BC)
Capteur Gamma
Surveillance Procedures

- Entering mission data
- Transfering mission data in terminal
- Preparing package:
  - Coupling source/tracker
  - Checking source presence
- Loading Vehicle

STORAGE

- Checking package presence
- Alarm management
- Permanent & real time surveillance

TRANSPORT

- 2 persons rule control

USE
End-user Interface

The end-user application software includes two main functionalities:

- **Data base management** of the radioactive sources
  - Inventory of sources
  - Real time status of equipment
  - Regulatory requirements
  - Reporting

- **Mission planning**
  - Mission configuration
  - Downloading mission data to terminal
  - Transmission to Surveillance center
  - Reporting
Surveillance Center MMI

- GIS & Alarm management system:
  - Operator log & procedure management
  - Traceability
  - Reporting

- Audio communication

- Video surveillance

- SIEM (Security Information and Event Management)
Deployment
• Nuc-Track solution could be deployed on a large scale:

• First step in France:
  • starting next year

• Second Step: In Europe and in many other countries
  • After the deployment in France
The **Nuc-Track solution** is a security tool providing response to crucial security issues through a global approach:

- Continuous security during all operational phases,
- Monitoring of the source’s packaging,
- Insider threat mitigation insured,
- Cyber security embedded,
- Scalable solution to accommodate small or large fleets of sources,
- Easy traceability and reporting of all source movements,
- Complies with code of conduct and guidelines to improve radioactive sources security.
Other technologies improving the security of radioactive sources
• NuVISION solution
disruptive innovation
providing:

A real time imaging
together with:

- Location of the source
- Gamma doserate
- Identification of the source
NuVision

**Detected isotopes**

- **AM-241**
  - DR [μSv/h]: 4.7
  - Conf. [%]: 920.2

- **BA-133**
  - DR [μSv/h]: 2.6
  - Conf. [%]: 146.4

**Energy window**

Energy [keV]

- 0 to 683 keV
- 683 to 1366 keV

**Count rate of en. window [imp./s]**

- 3673.8

**Measurement details**

- Acquisition time [s]: 231.3
- Dead time [%]: 4.5
- Total counts: 811694
- Total count rate [imp./s]: 5159.0
- Total dose rate [μSv/h]: 8.7
- Spectrum residual [%]: 30.9

**Battery (97%)**
A combination of this new tool together with specific procedures:

Will bring quite a revolution for:

Improving Security of radioactive sources during:

- **Storage phase** (fix installed version)
- **In Use phase** (mobile version (3kg))
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