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AGENCE FÉDÉRALE DE
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sck cen
Belgian Nuclear Research Centre

Mesures aéroportées dans la gestion post-accidentelle : l'expérience belge

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Competent authorities for nuclear and radiological EP&R

Centre de crise National

Missions :

- To increase the resilience of our society
- To organise emergency planning and crisis management at the national level
- To ensure active vigilance
- To process passenger data (BelPIU)

AFCN
AGENCE FÉDÉRALE DE CONTRÔLE NUCLÉAIRE

Mission :

- To protect the health of the population, workers and the environment against the danger of ionizing radiation.

- monitors radioactivity throughout the territory in both normal and emergency situations
- provides technical assistance in drawing up emergency plans decided by the Minister of the Interior.
- organizes an intervention cell for emergencies.

Stakeholders in EP&R

National level

Centre de crise National

AFCN – AGENCE FÉDÉRALE DE CONTRÔLE NUCLÉAIRE

BEL V

Defense

Civil Protection

Federal Public Service Public Health

Federal Agency for the Safety of the Food Chain (FASFC)

SCK CEN

IRE

RMI

Provincial level : Governors

Local level : operators of the Class I nuclear sites

GOAL :

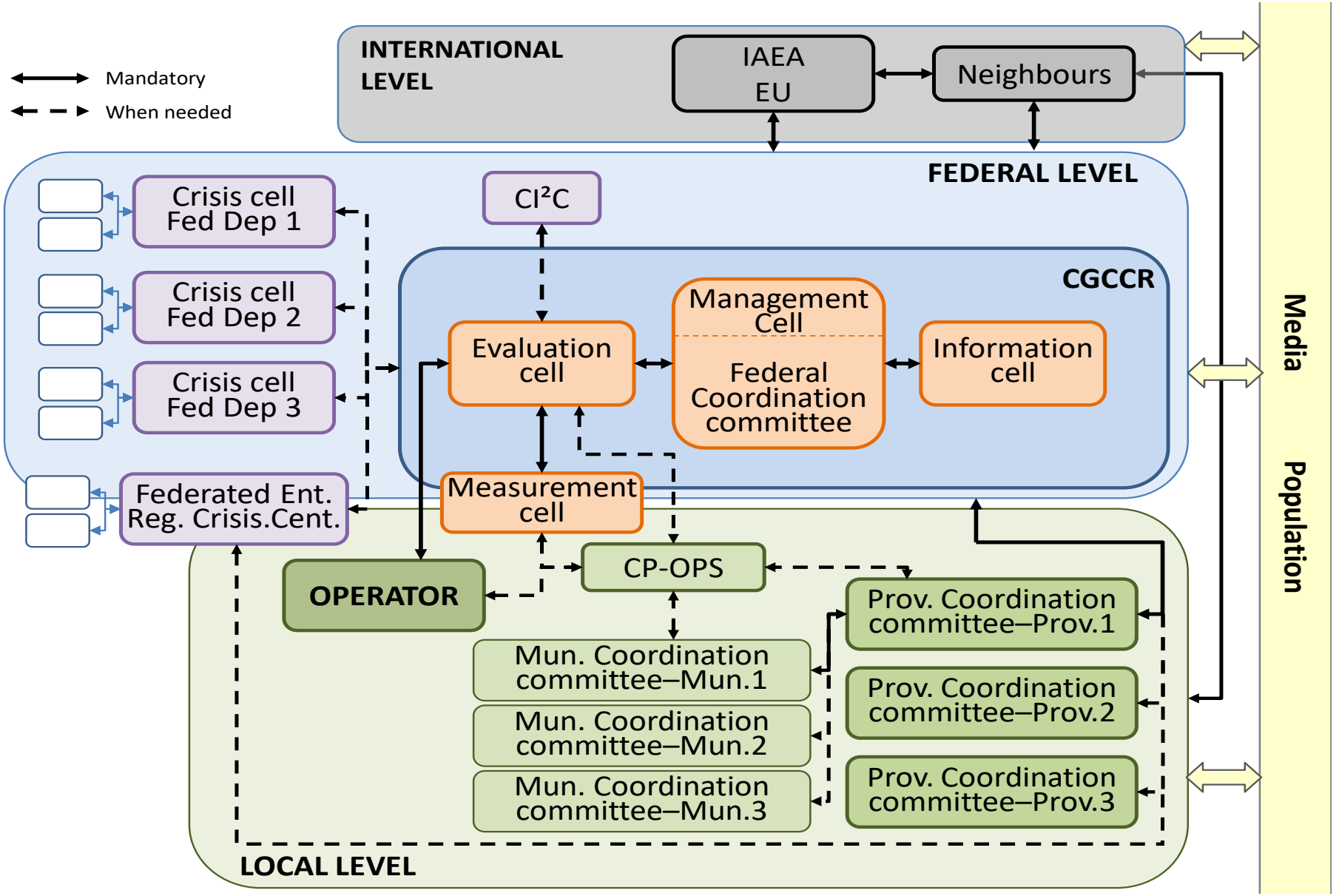
Coordination of actions in order to :
protect population, environment & socio-economic life
in case of a nuclear or radiological emergency situation

Royal Decree of March 1st 2018 laying down the nuclear and radiological emergency plan for Belgian territory

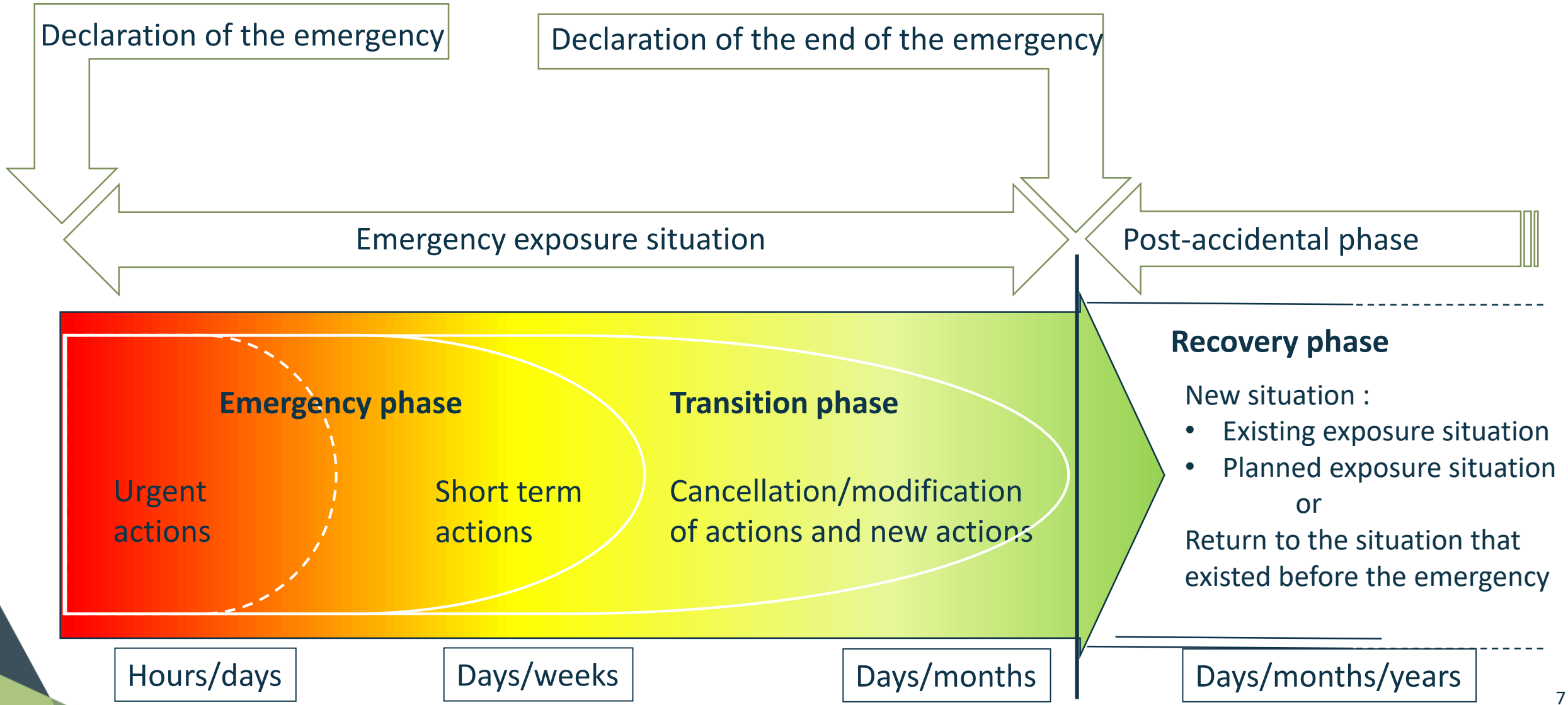
Transposing partially

- 2013/59/Euratom BSS
- 2014/87/Euratom Nuclear Safety

Nuclear and Radiological Emergency Plan



Nuclear and Radiological Emergency Plan



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Aerial Measurements

- Aerial Gamma Spectrometry using Helicopters
- Unmanned Aerial Vehicles (UAVs) for Radiological Monitoring in (Post-)Accident Situations

Aerial Gamma Spectroscopy Capabilities and Experience

Rationale:

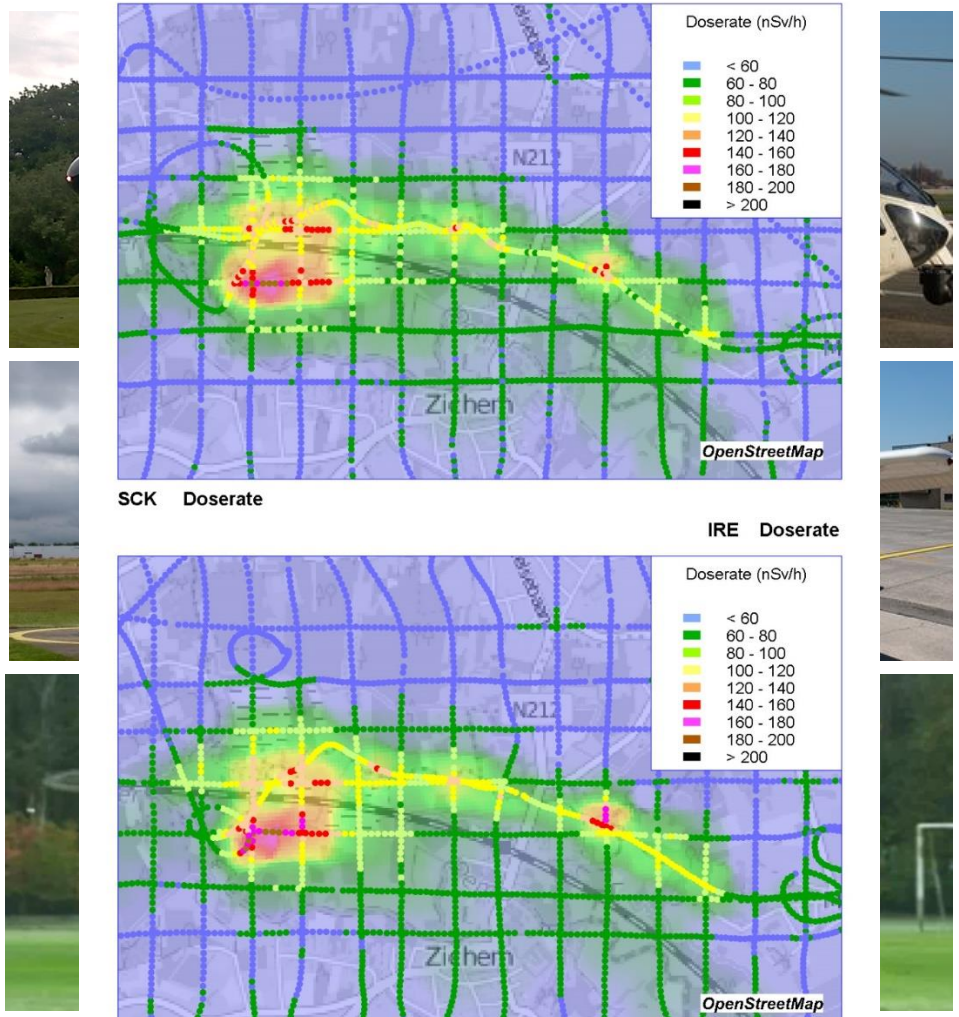
- Complement early warning network (TELERAD) information and monitoring teams
- Fast survey of (potentially) affected areas in post-release phase

Capabilities:

- Two identical systems available since around 2008 (Mirion)
- Different airborne vectors (private companies, Federal Police & Defense, mainly helicopters)
- Large number of test flights in last years, mainly historic contaminations (NORM)

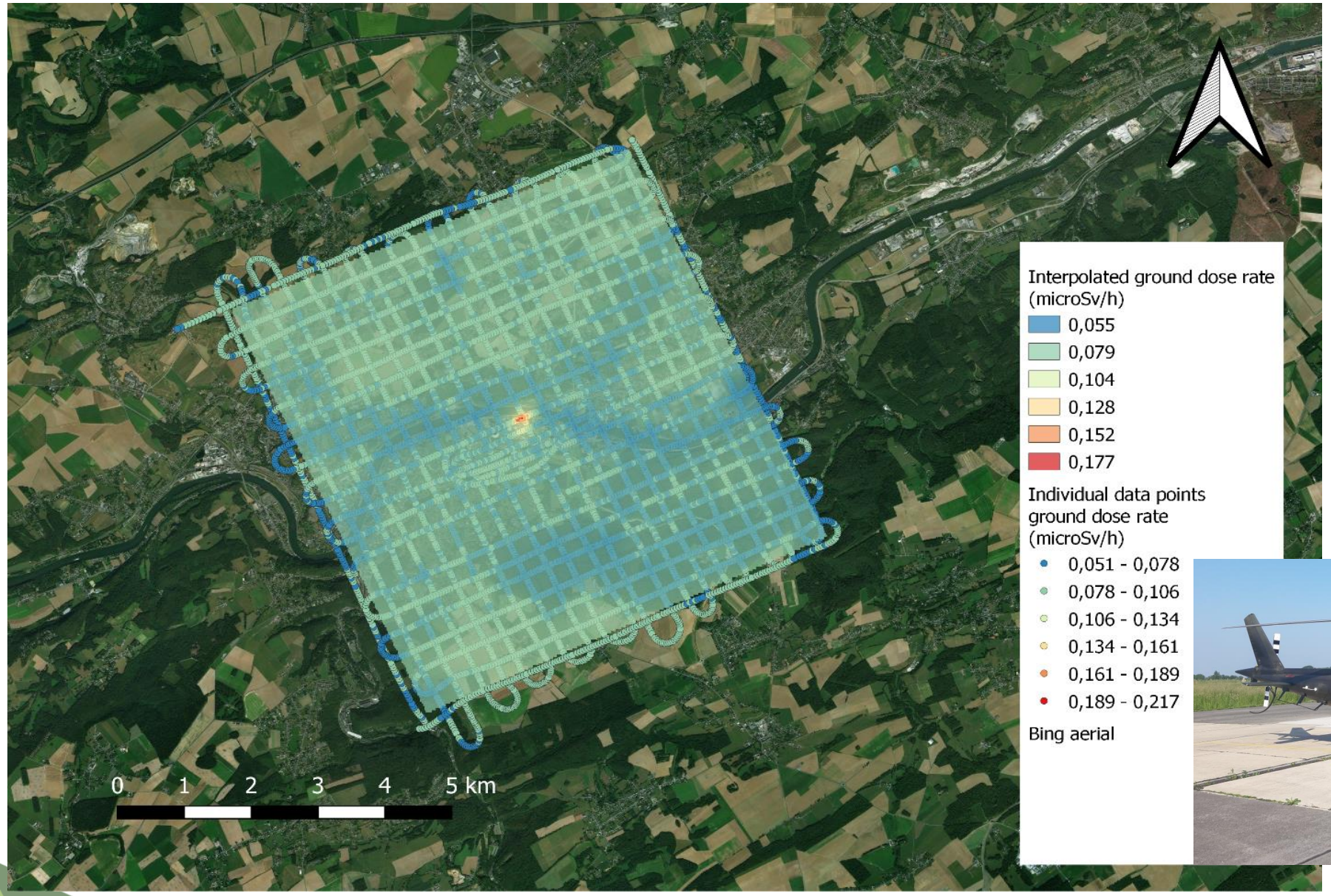
Recently (2019-2021):

- All Belgian nuclear sites have been surveyed as part of a Federal Emergency Exercise



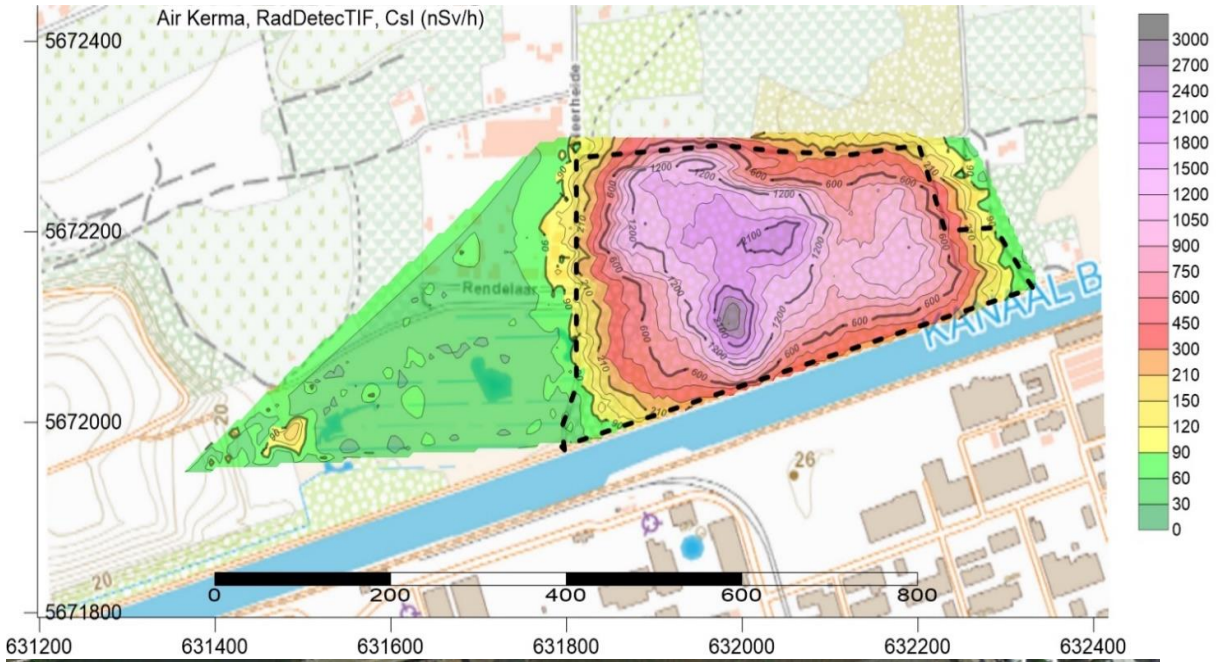
Nuclear area Mol-Dessel (SCK CEN – BP)

Tihange NPP (8 June 2021)



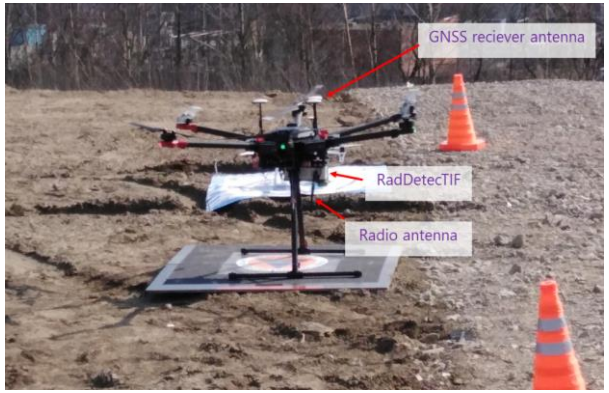
UAVs CELMES drill March 2021

- Test different drone detector combinations in CELMES context (FANC-AFCN, Civil Protection, SCK CEN)
- Map historically contaminated site (D1 –Olen, radium 226 contamination) –very heterogenic contamination
- Compare with ground-based data



DJI-M600
3”x3” Plastic Scintillator

DJI-F550
GM tube

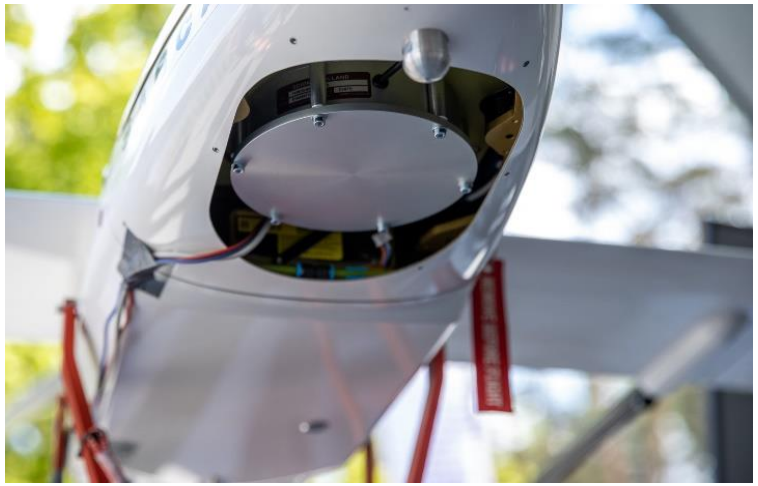


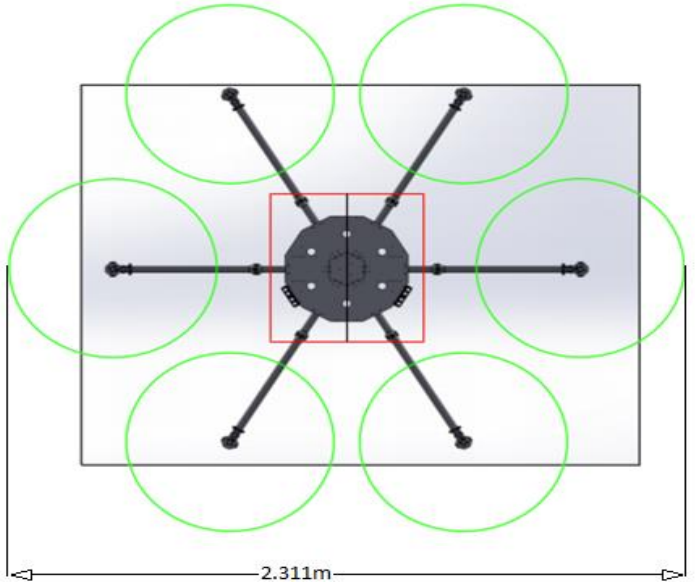
DJI-M600
1”x1”x2” CsI scintillator

Olyslaegers et al. (2021), SCK CEN-BLG-2933

Belgian Unmanned aerial systems for Decommissioning, Detection and AWAreness of radioactive risK (BUDDAWAK)

- Collaborative project between SABCA (expert in aviation technologies) & SCK CEN - Funded via Energy Transition Fund, Belgian Ministry of Economy
- Demonstration of fully optimized fixed-wing and multi-copter unmanned aerial systems for radiological surveillance/emergency situations and for decommissioning/remediation
    - Fixed-wing, long endurance for surveillance during threat-phase, release-phase and post-release phase of an accident
    - Multi-copter system for detailed radiological mapping in dismantling and remediation (e.g.; in post accident phase)






UAV

Fixed-wing drone

Fixed-wing platform Penguin-C

- Long autonomy (>12h);
- Flexibility to deploy (locations – conditions);
- Typical speed 19-22 m/s, height ≥ 120 m up to 5000 m (above radioactive plume);
- Range antenna: 100 km;

Optimized detection system

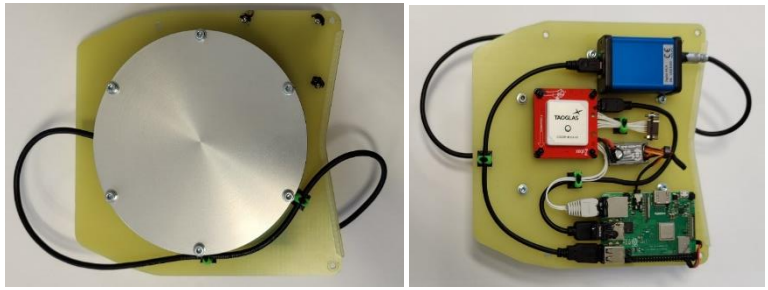
- Optimization of detection efficiency for available payload (with max. endurance 2 kg);
- ϕ11 cm x 3 cm CsI spectrometer system

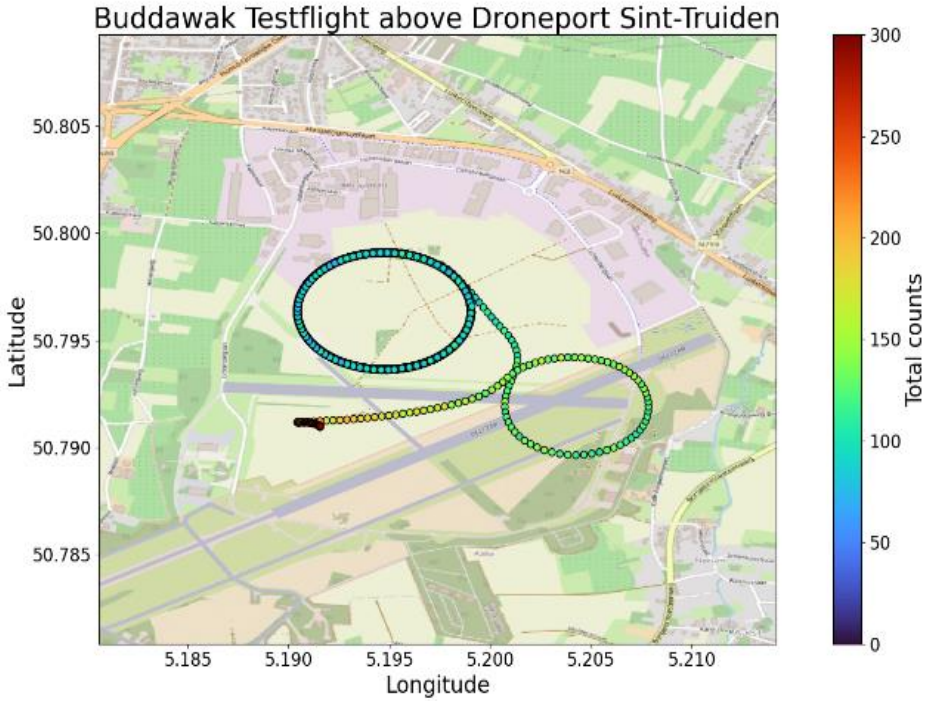
Integration

- Fully integrated to protect for environmental conditions
- Real-time data transmission to ground (and local data storage as back-up)

Test Flights

- 2 flights performed @ DronePort, background (quantification of K-40)
- Scheduled: flight over nuclear site trying to map both increased radiation levels from site as well as routine releases to atmosphere





Multicopter drone

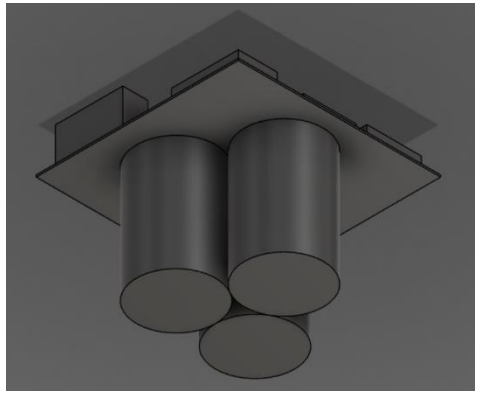
Innovative Multicopter drone:

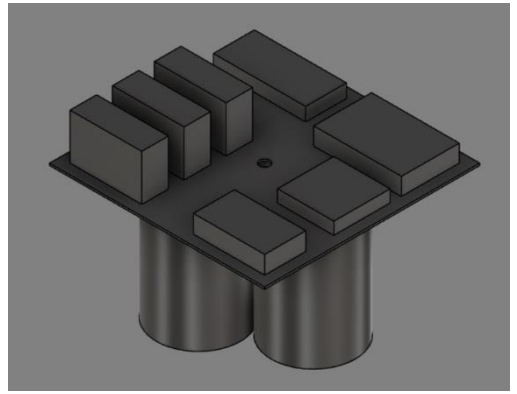
- Hexacopter with tilted and removable arms
- Endurance of 45 minutes with 5 kg payload
- Basic collision avoidance LiDAR / altimeter integration
- Implementation of an Ethernet bus system and LTE module for communication with the payload
- Extra: Hydrogen ready, 75 minutes endurance with 3kg payload

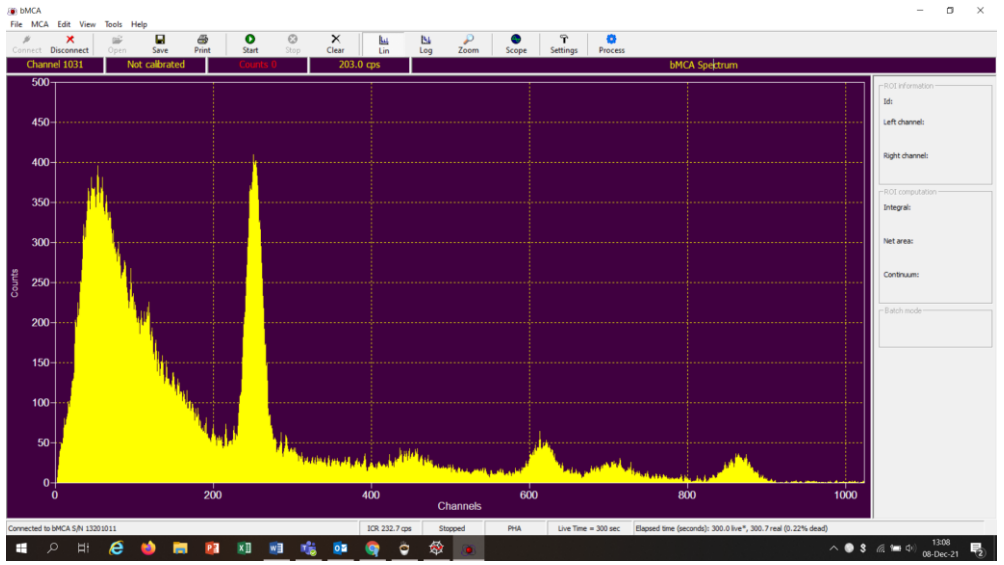
Innovative detector system development:

- Consists of 3 CsI detectors (3x 7 cm x 7 cm)
- Combining signals → very high efficiency
- Individual detector readout: direction sensitivity → increase in spatial resolution

System is under testing







From measurement technique to (post-)accident monitoring strategy

- When performing flights and in which areas (e.g.; residual releases, …);
- Comparison with ground-based measurements;
- (Automated) optimization;
- Reproducibility of aerial surveys;
- Interpretation (above plume flights, deposition mapping in urban environments, ….);
- Image fusion (radiological – visual);
- Evolution in UAV technology.
- ….

Although technology well developed still some challenges ahead

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Thank you

Questions?