03/06/2021

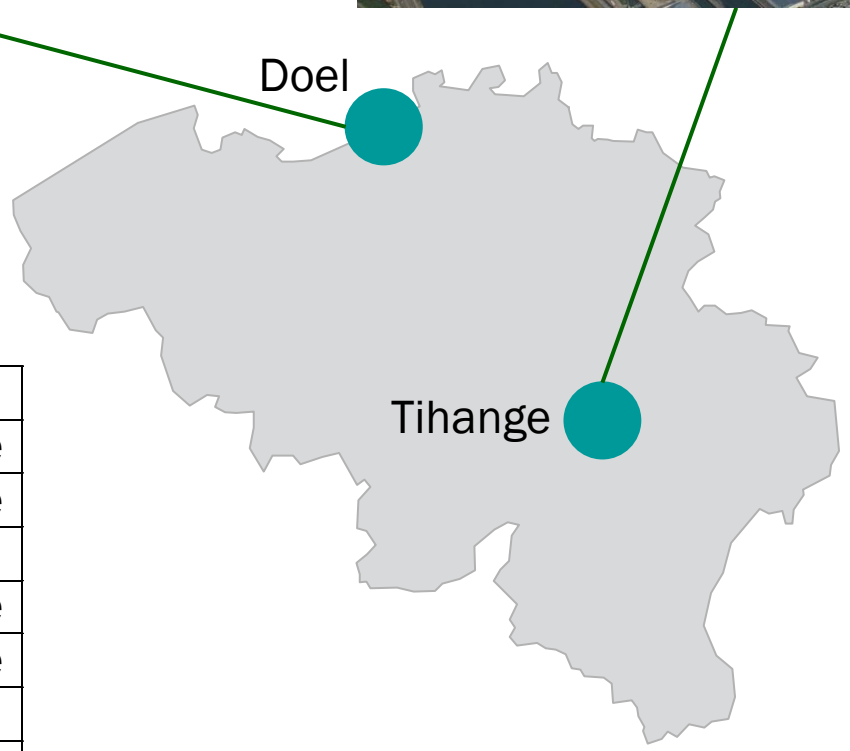
Improvements of the emergency radiation protection arrangements at the Tihange NPP

Benoit LANCE

ENGIE Electrabel

Public
ENGIE Classification

Belgian NPP's

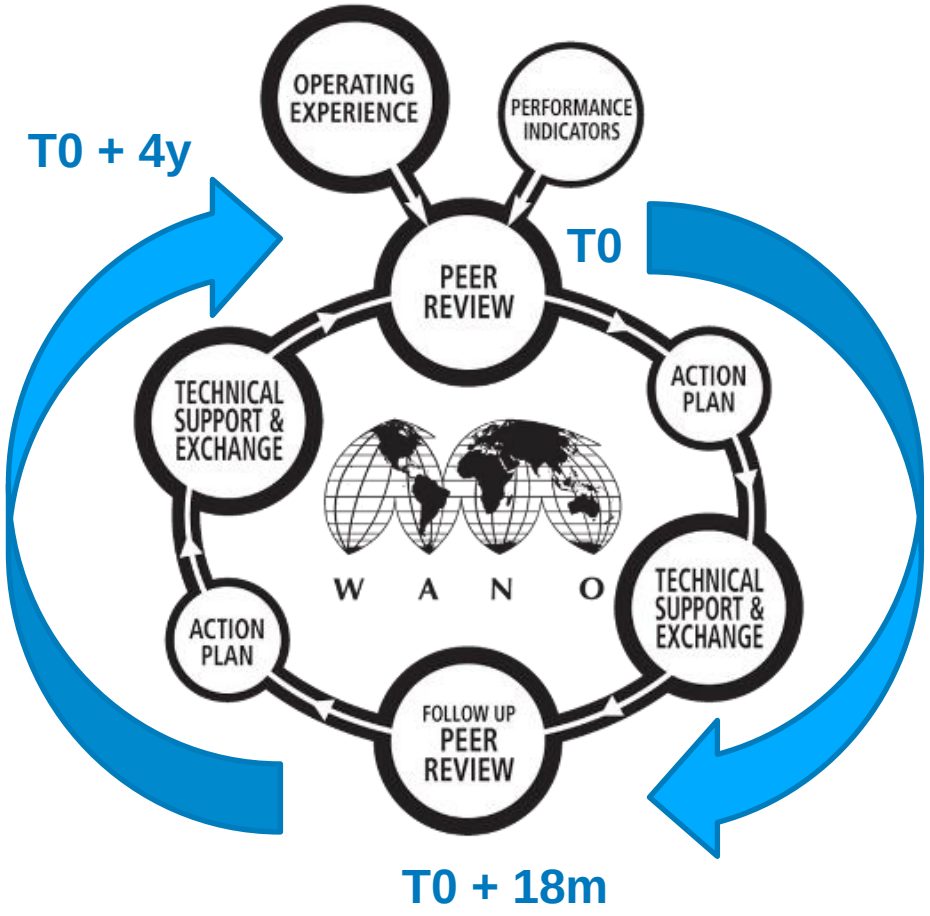


NPP	P (MWe)	Year	Cycle length	Supplier
Doel 1	440	1975	12 m	Westinghouse
Doel 2	440	1975	12 m	Westinghouse
Doel 3	1030	1983	12 m	Framatome
Doel 4	1030	1985	18 m	Westinghouse
Tihange 1	1000	1975	18 m	Westinghouse
Tihange 2	1030	1983	18 m	Framatome
Tihange 3	1030	1985	18 m	Westinghouse

WANO Area For Improvement (February 2018)

“ There are shortfalls in the scope of emergency exercises, emergency facilities and equipment”

“Standby emergency facilities are not fully equipped or qualified to compensate for un-tenability of the main facility, transfer between facilities has not been exercised and training not completely implemented”



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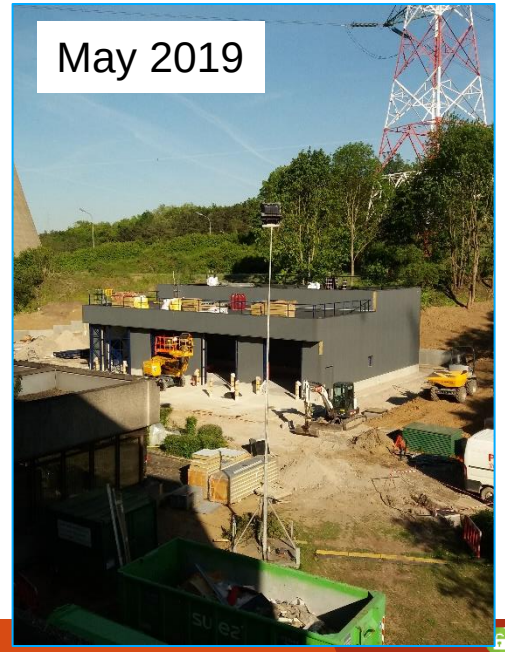
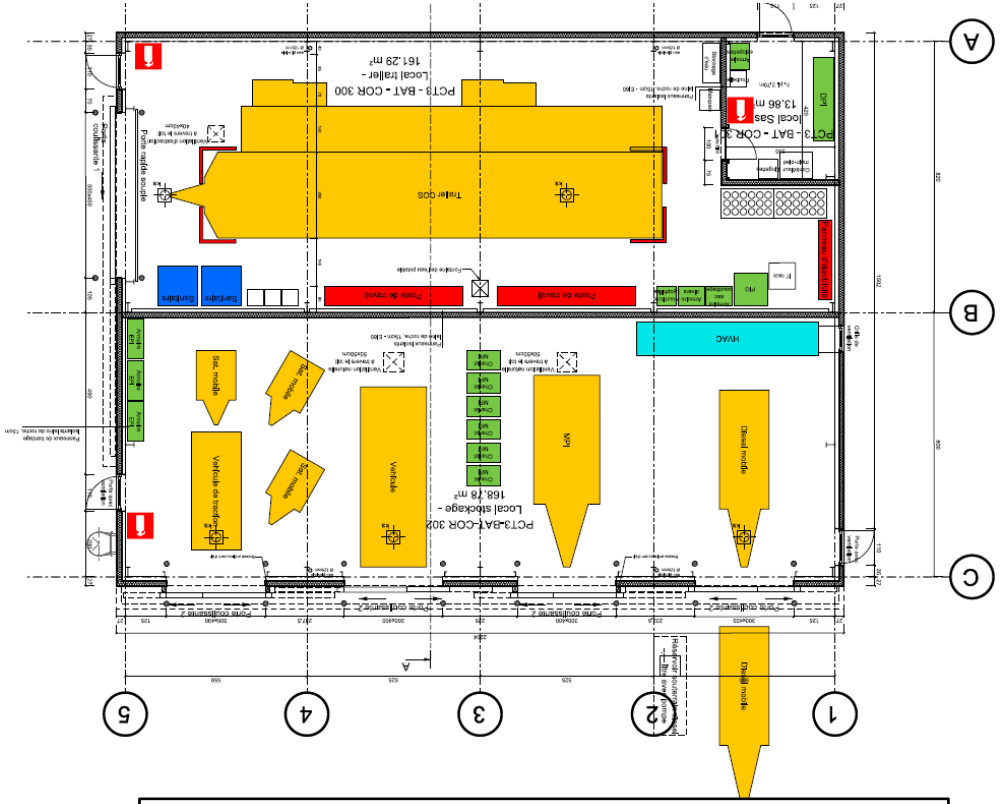
Back-up emergency coordination center (ECC)

Building of the back-up ECC (COR)



Complex exercise

Characteristics of the Back-up ECC (COR)



- Above beyond design flooding level
- Seismic resistance up to 0,25 g PGA
- High Efficiency airborne and iodine filtration
- Supplied by an emergency diesel in case of loss of outside power (SBO)

- COR building activated in case of nuclear accident with planned radioactive releases
- And also in case of security incidents

COR trailer

- Trailer equipped to fulfill all activities assured by the base ECC
- Capacity of ~ 10 persons (on-duty)
- 5 working stations
- Communication networks : (i) fiber, (ii) ADSL, (iii) 3G/4G, (iv) satellite
- Laptops, phones and video-conferences
- Own electrical supply with a fuel tank 450 L to provide 72 h autonomy
- All emergency procedures provided

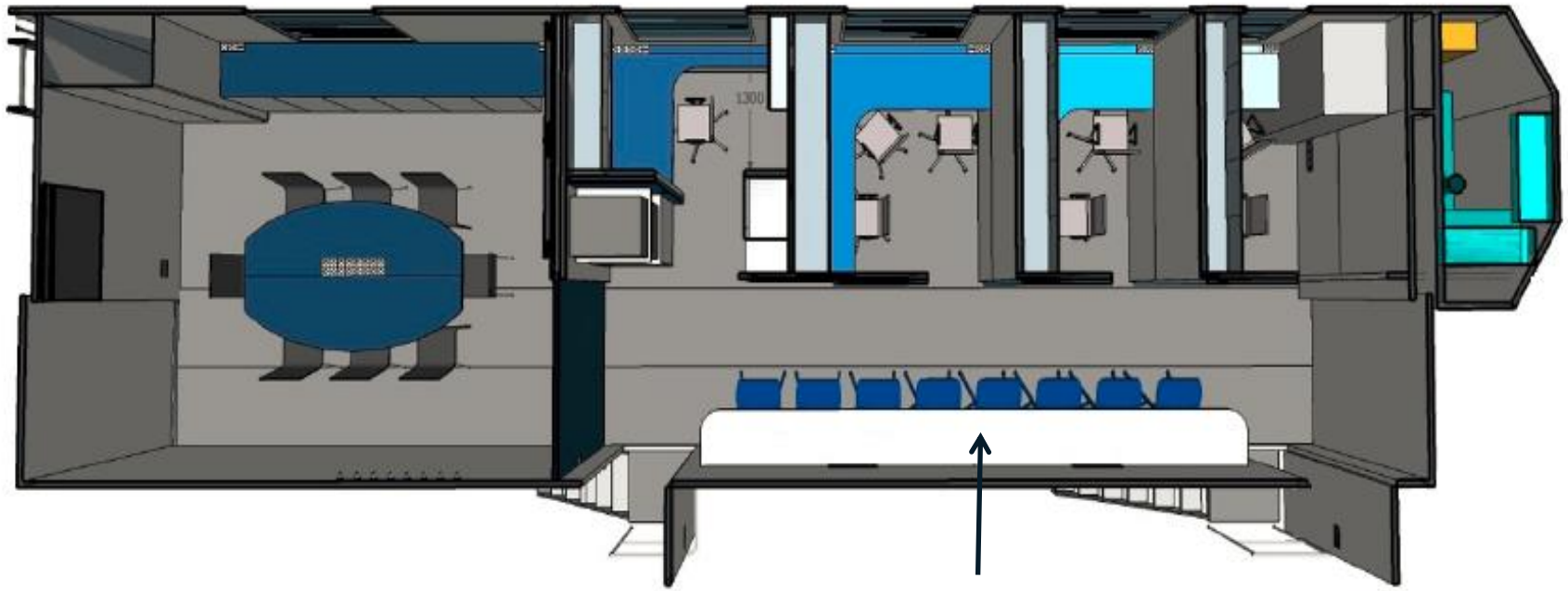
Working stations in the COR trailer

Emergency Director, technical adjunct and knowledge officer

HR & COM

RP

Logistics, safety & security



8 extra workplaces

2

Enhanced RP realism during exercises

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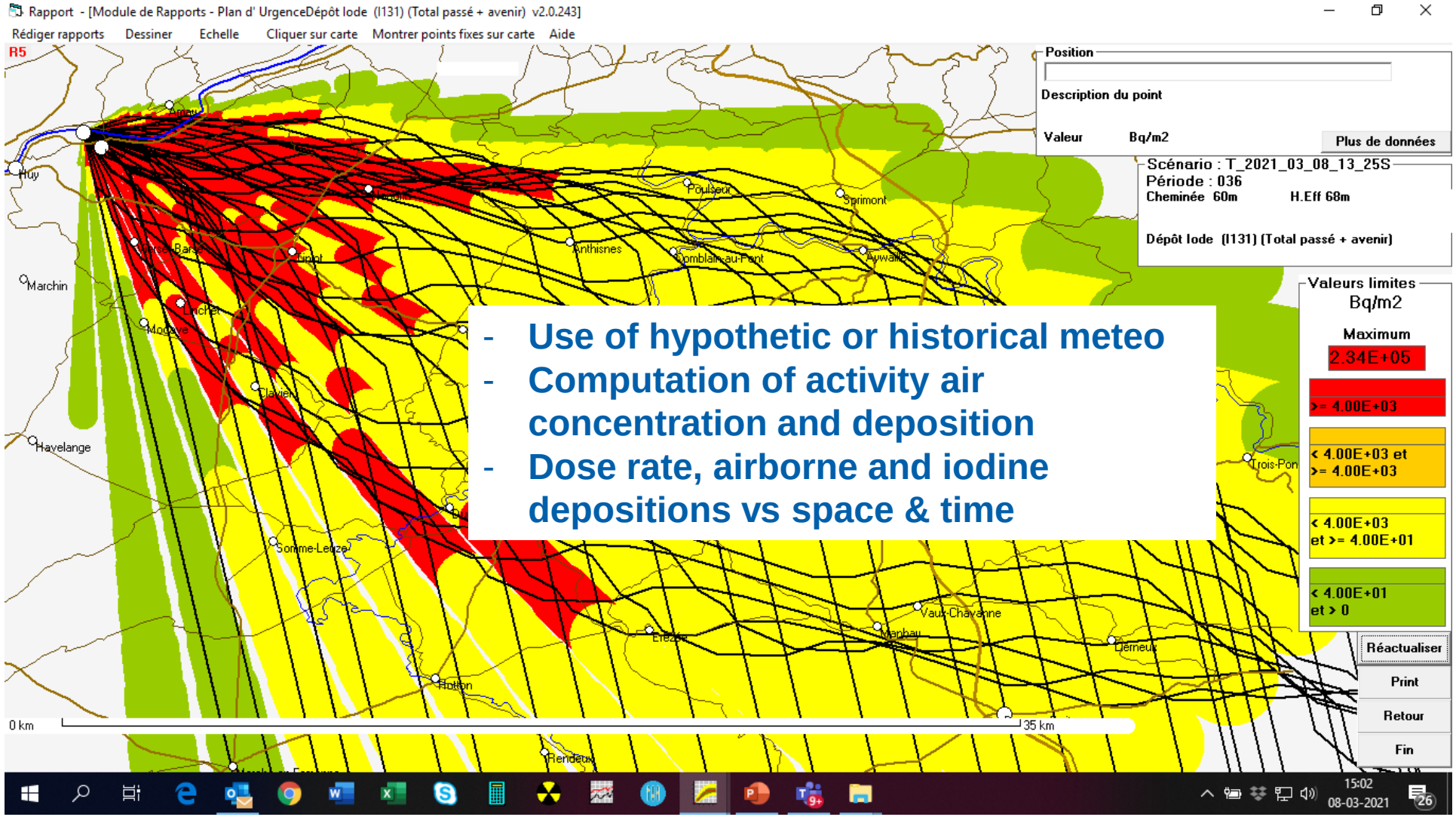
Enhanced RP realism during exercises

- Use of the radiation protection vehicles with a revised strategy
- Increased consideration of personnel during simulated reactor accident
- Increased simulation of radioactive consequences during reactor accident
- Setting of arrangement against radioactive contamination in emergency crisis centers
- Shuttles (next chapter)
- …

Enhanced use of RP clothes during exercises

Calculations of radiological consequences on beforehand



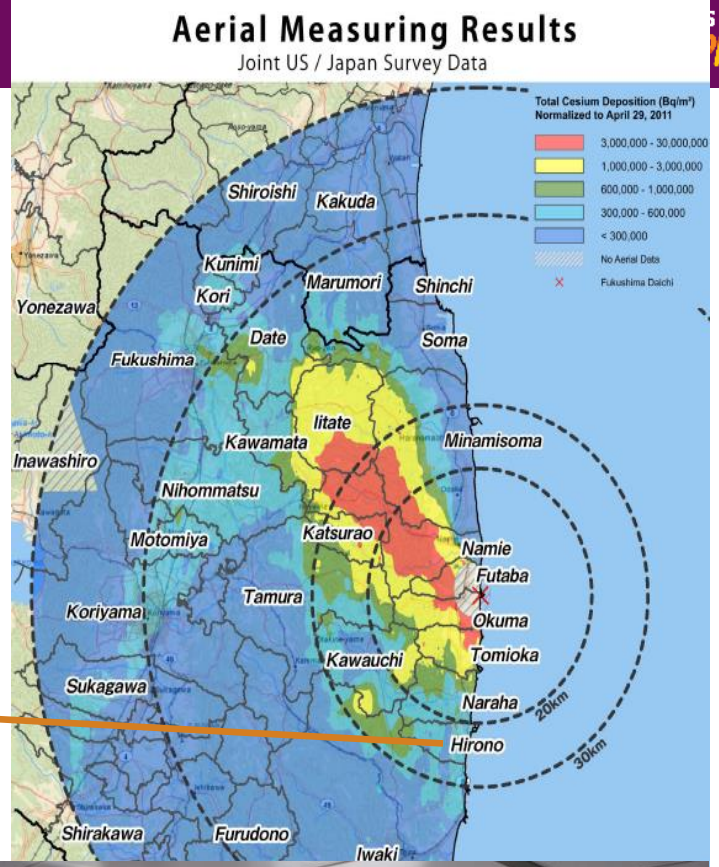
- Use of hypothetic or historical meteo
- Computation of activity air concentration and deposition
- Dose rate, airborne and iodine depositions vs space & time

3

Rear base and shuttles

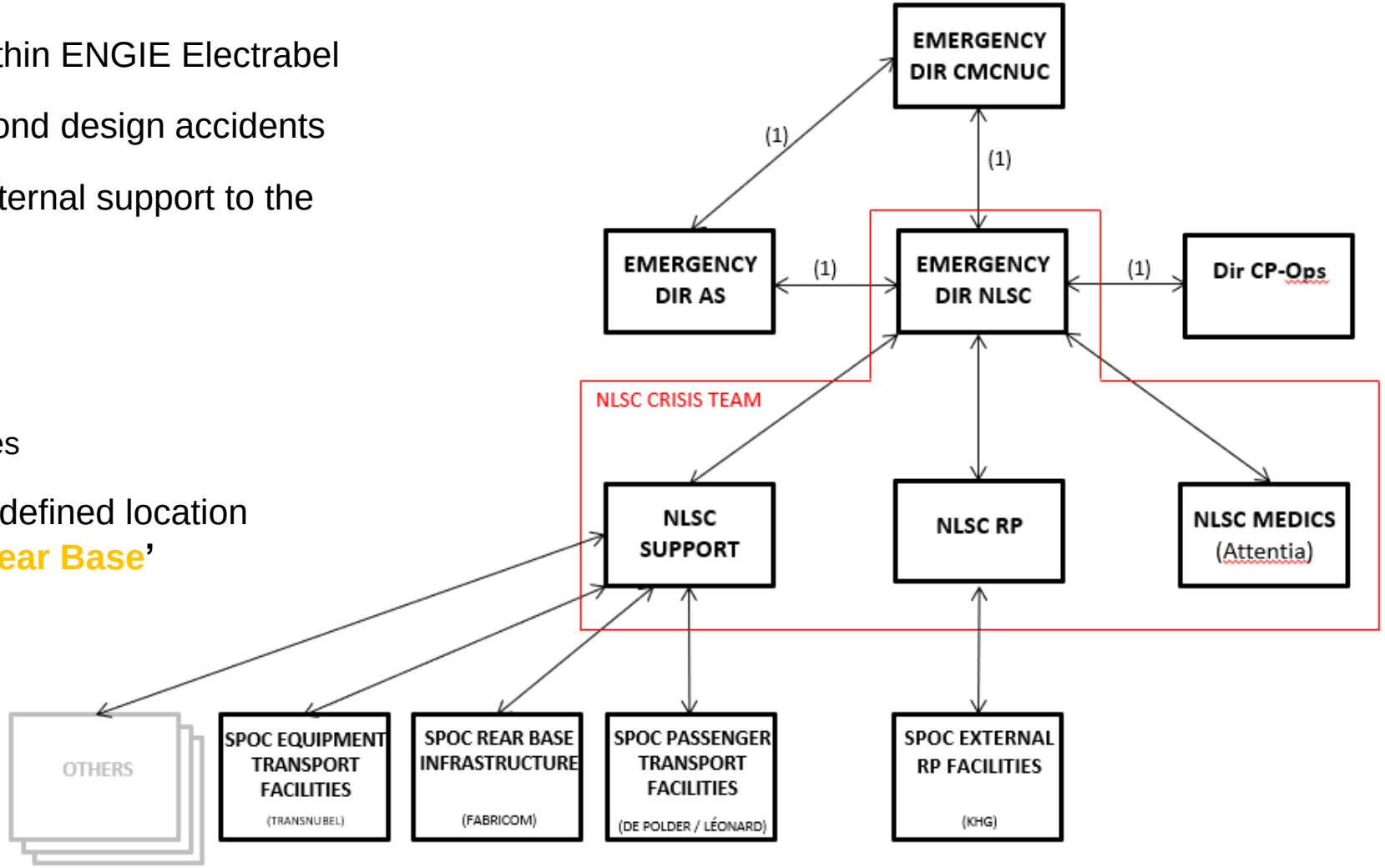
Rear base concept

- Based upon the J-village located ~20 km from Fukushima Daiichi
- Now included in the Belgian regulation



NLSC : NUCLEAR LOGISTICS SUPPORT CELL

- **Mobile organization** within ENGIE Electrabel
- Activated in case of beyond design accidents
- **Objective** : providing external support to the affected site with:
  - Logistical support
  - Radiation Protection
  - Public emergency services
- NLSC will act from a predefined location in Belgium, called the '**Rear Base**'



(1): Briefings (minimum at planned intervals)

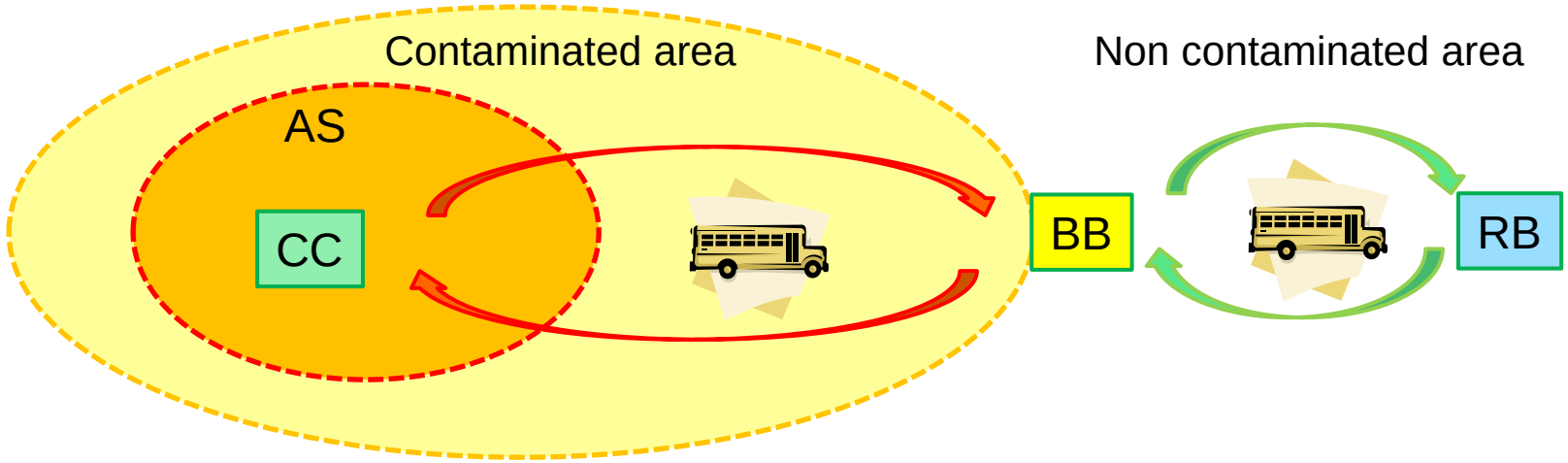
NUCLEAR LOGISTICS SUPPORT CELL: rear base locations

Possibly present @ a Rear Base

- NLSC
- CP-Ops
- Army
- Civil Protection
- Fire Department
- Police
- Red Cross
- …….

The shuttle procedure

- How to organize the shuttle of emergency workers from the Rear Base (RB) to the Affected Site (AS), up to the Crisis Centers (CC), going through a possible Border Base (BB)
- And coming back…
- → Shuttles (contaminated shuttle / non contaminated shuttle)



4

Complex exercise

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Expectations from the complex exercise

- Involvement of all crisis partners (exception of Safety Authorities) (Tihange NPP, Corporate, NLSC, KHG, Tractebel, Doel NPP)
- Setting up and use of a rear base for the purpose of shuttles
- Multi-units initiator
- Radiological consequences (site contamination) making the base ECC untenable
- Long duration exercise (> 1 day)
- Use of ultimate arrangements (post FK equipments)

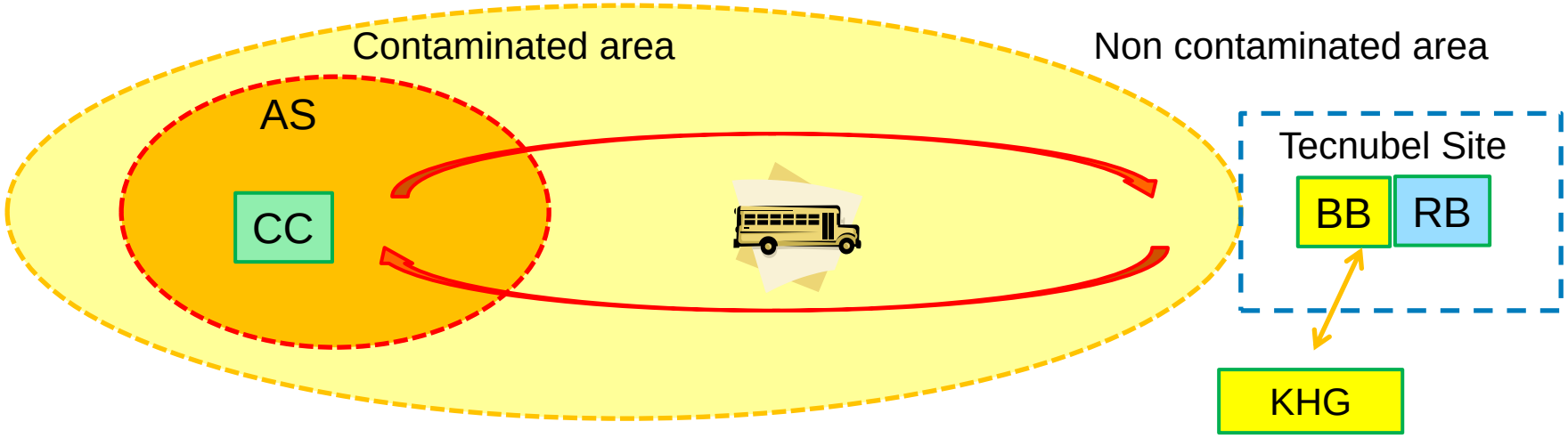
Building the complex exercise scenario

- Date : 21-22 november 2019
- Duration : 2 days
  - 4 teams x half-day exercise (during open hours)
  - Shift turnovers each day
- ~ 160 participants (incl. contractors)

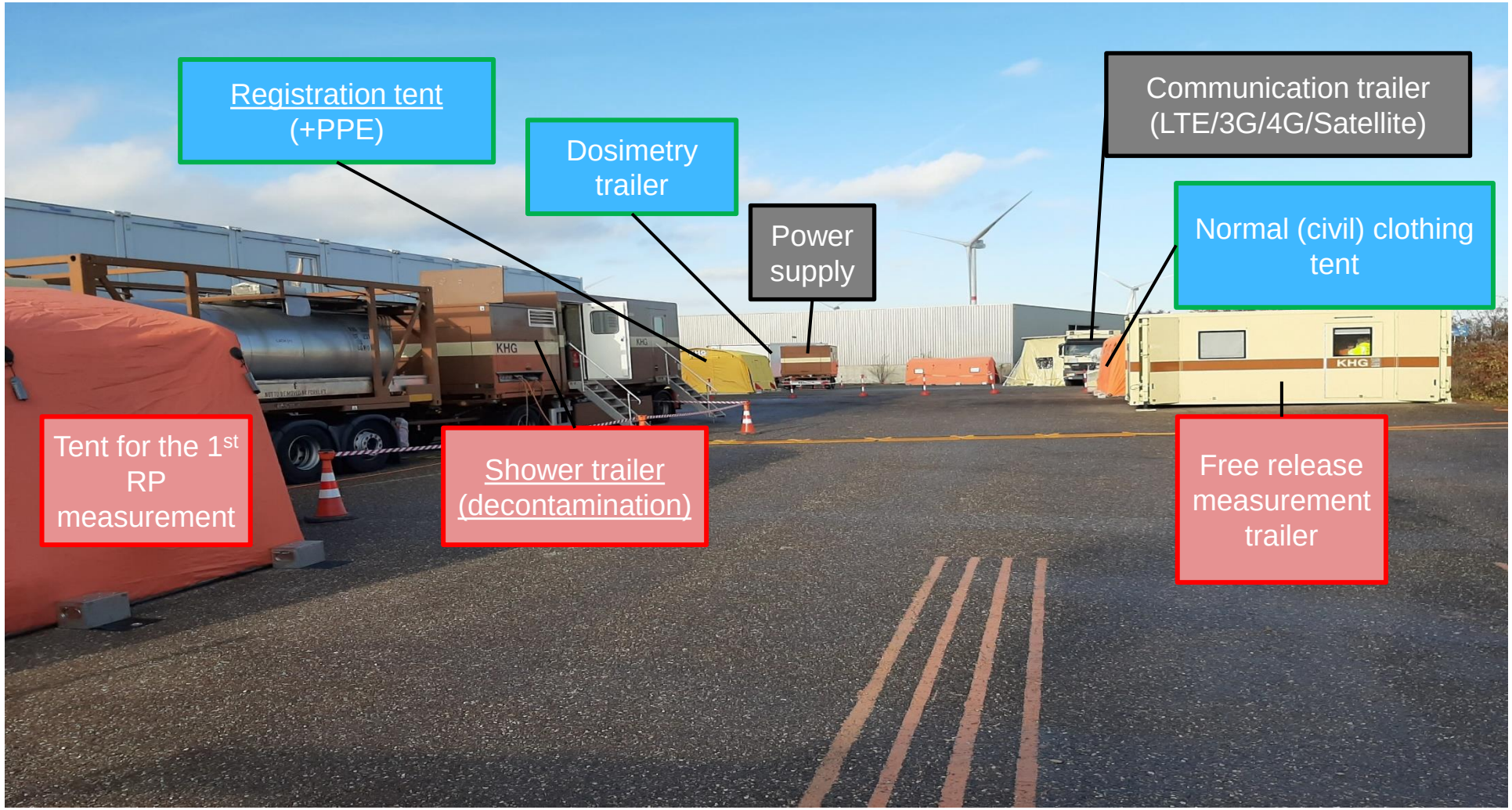
Teams	Period	Summary of scenario
1	Day 1 AM	Exercise focus = Complete Station Black Out
2	Day 1 PM	Exercise focus = Severe Accident Management Guidelines
3	Day 2 AM	Exercise focus = Habitability of the main control rooms / shuttle
4	Day 2 AM → PM	Exercise focus = Preparing the Containment Filtered Vent System (SAMG) / shuttle

Simplified shuttle procedure

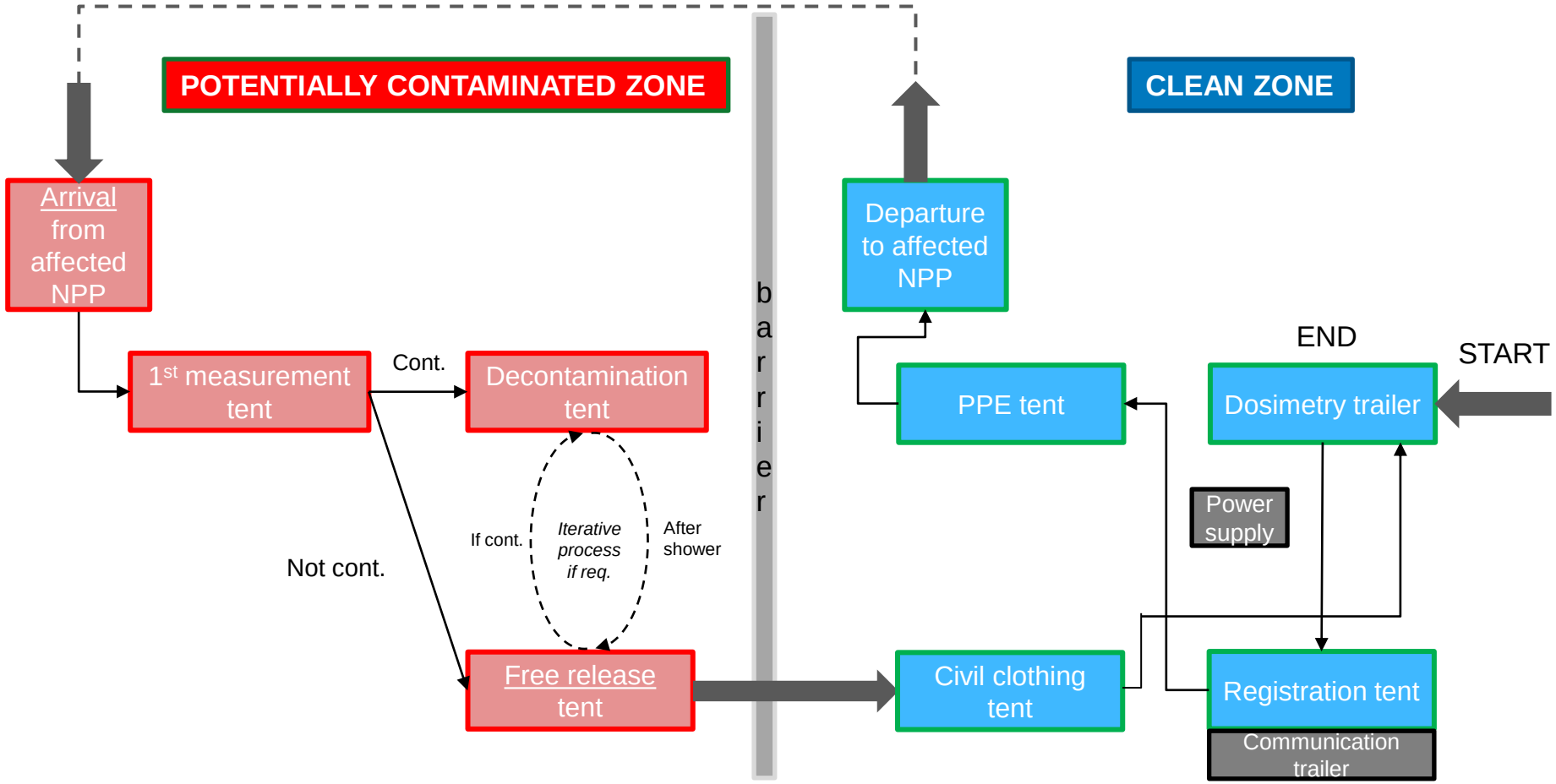
- Use of the TECNUBEL site located ~ 8 km from Tihange NPP



Rear Base overview



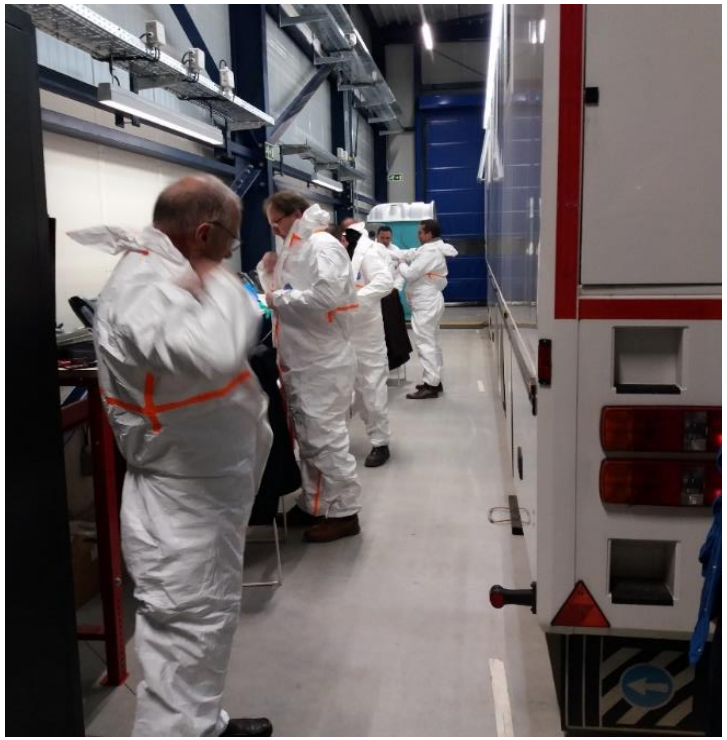
Personnel path @ rear base: overview



Potentially contaminated zone - 1st measurement

Lessons learnt from the complex exercise (1)

- **Positive points:**
  - Usefulness of a scenario with enhanced RP realism (→ operational constraints)
  - Questioning attitude, solution-oriented emergency teams
  - 1st test of the new facility COR & trailer



Lessons learnt from the complex exercise (2)

- **Areas for improvement**
  - Shift turnover procedure
  - Work station for radiation protection on-duty personnel
  - Use of emergency communication means
  - PPE inventory check programme
  - Organisation of the COR sas
  - Use of HP tools during emergency

5

Conclusions

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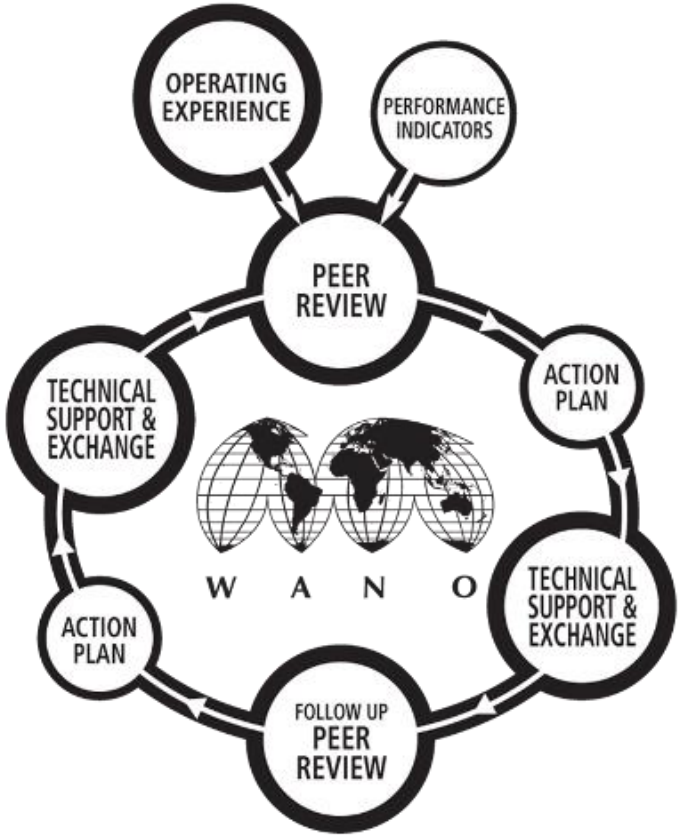
WANO Follow-up review (October 2020)

“ There are shortfalls in the scope of emergency exercises, emergency facilities and equipment.

Level A = satisfactory :

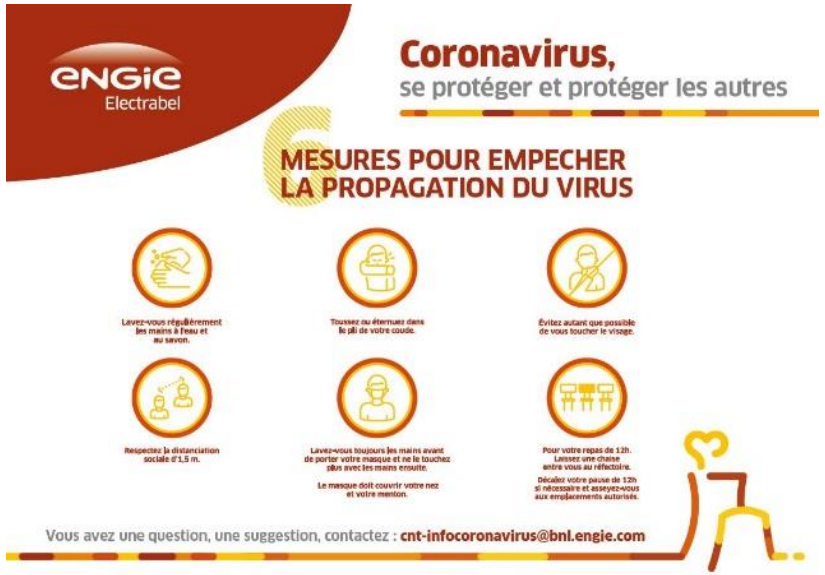
“Evidence shows that actions taken have resolved the AFI and satisfactory performance has been achieved”



Next step : preparing WANO Peer Review 2022

- Pursue with RP realism during exercises
- Appropriate coverage of initiators and thema's in exercises
- Improvements of the COR facility (back-up ECC)
- Improvement in the use of emergency communication means
- Strict follow-up of the emergency equipment maintenance and inventory program
- …

- Exercises during pandemic
  - Video-conferences exercices (focus = use of procedures)
  - Use of alternative & larger rooms
  - Wearing of FFP2 masks
  - Testing



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