ISOE

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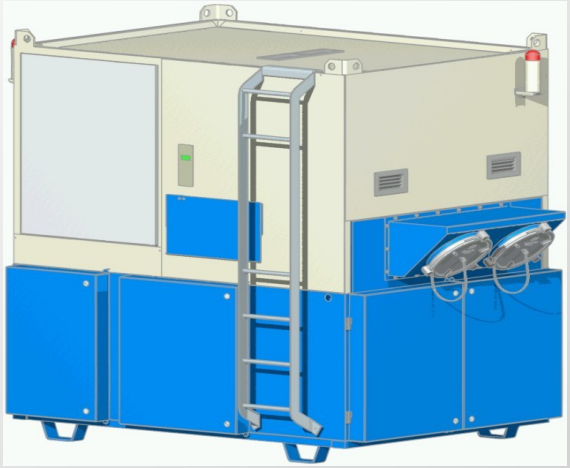
the Portable Ventilation Units Supervision demarch :

A strong in-depth defense during outages …



Maurer J-Eric / Piegay Eric

eDF Tricastin – DELTA NEU

Work site controle :
Dynamic confinement

→Contamination events and Operating Experiences

→Analysis :

« From theory… and some samples of bad practises »

→Upgrading confinement equipments :

« Parades …application of in-depth defense principles»

→Strategy for production sites

« Organisation, Alarm Strategy and Supervision »

→ Results of a gradual deployment approach in the eDF fleet

→ Events and Operting Experiences

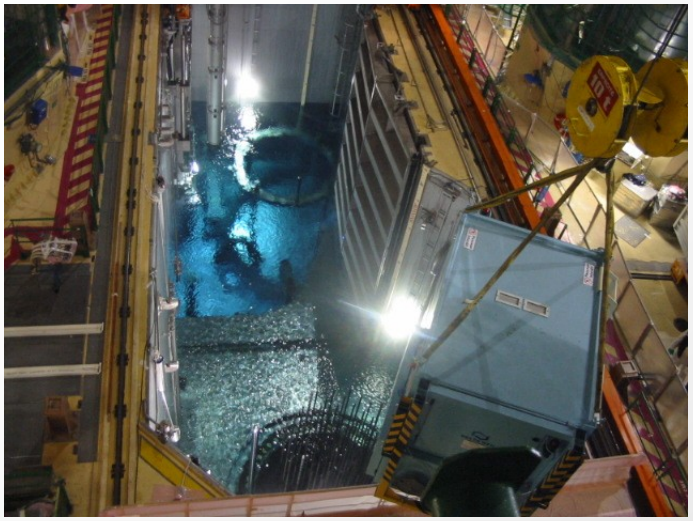
Dozen of identified events took place in **France** and abroad

- 80% of hazardous operations occur during outages
- 20 % during production, maintenance, decontamination, dismantling operation, wastes handling.

The awareness :
« When an aerosol or iodine monitor alarms…
It's too late…. Event has already occured !... »

Consequences:
healthy, planning, costs,
radiological cleaness, medias….

→ Then, How to anticipate any event? …



Reminder : Contexte - Organisation

eDF/PWR

1. Reactor Vessel is fully unloaded
2. Water level is moved down

   (Nozzle lower level)
3. A dummy head is located above vessel

Indicators of Dynamic Confinement Quality :

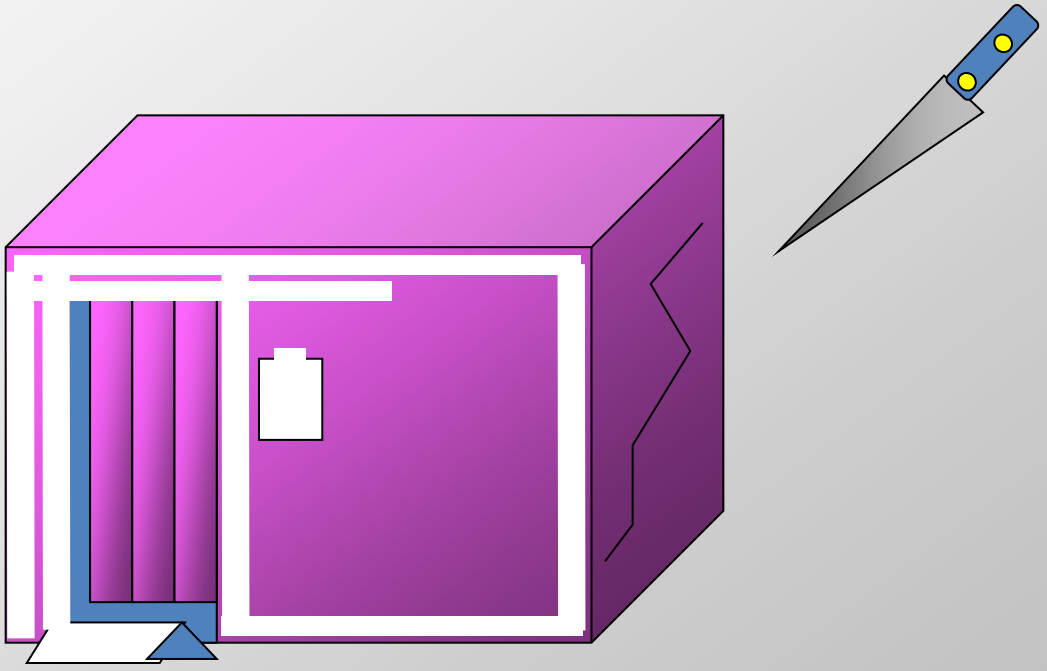
are analysed on the field according 3 standards :

1. **Ventilated anti contamination tenting**
2. **Local dynamic confinement**
3. **Internal dynamic depressurisation**

Parades : from theory…

…to bad practises

- **Static confinement**

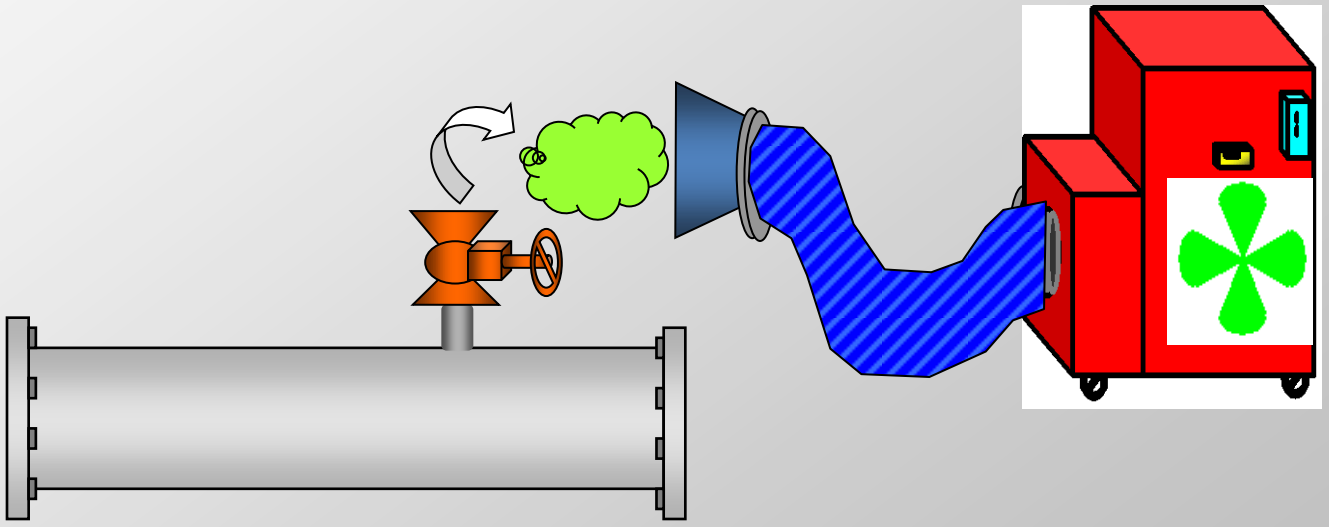


- Inapropriate cutting
- Removed scotch,
- Area step missing….
- Access, dress or dress out rules not respected …

- **Local dynamic confinement**
  (suction close to source term)

theory

- Suction hood must be installed with precision

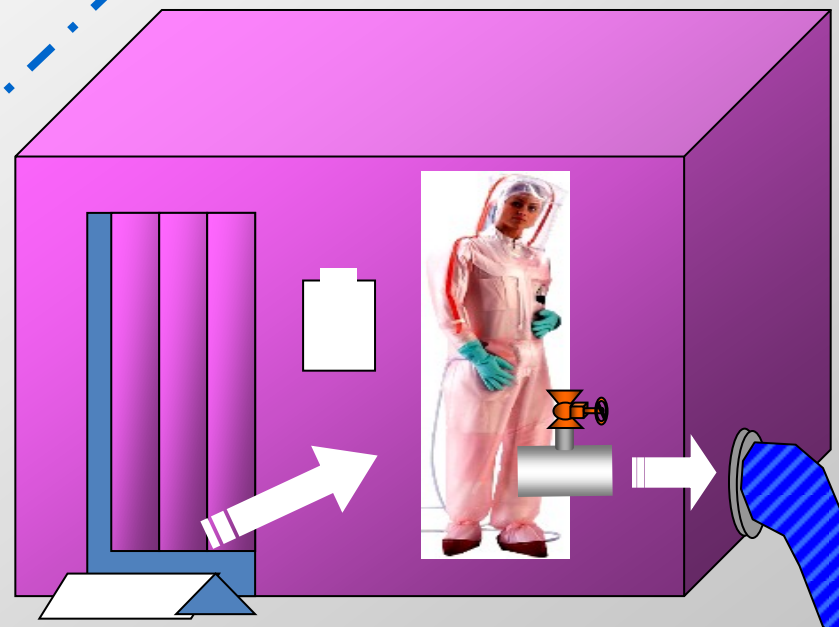


Example : with a ø300mm hose and 3000 m³/h Cyclair
→ over 80cm, vacuum becomes inefficient…..
Air velocity decreases below 0.5 m/s….

Ventilated anti-contamination tenting :

theory

Tent shall not be totaly airproof… air stream has to be managed and controlled…



For a good efficiency, the air must successively passes from :

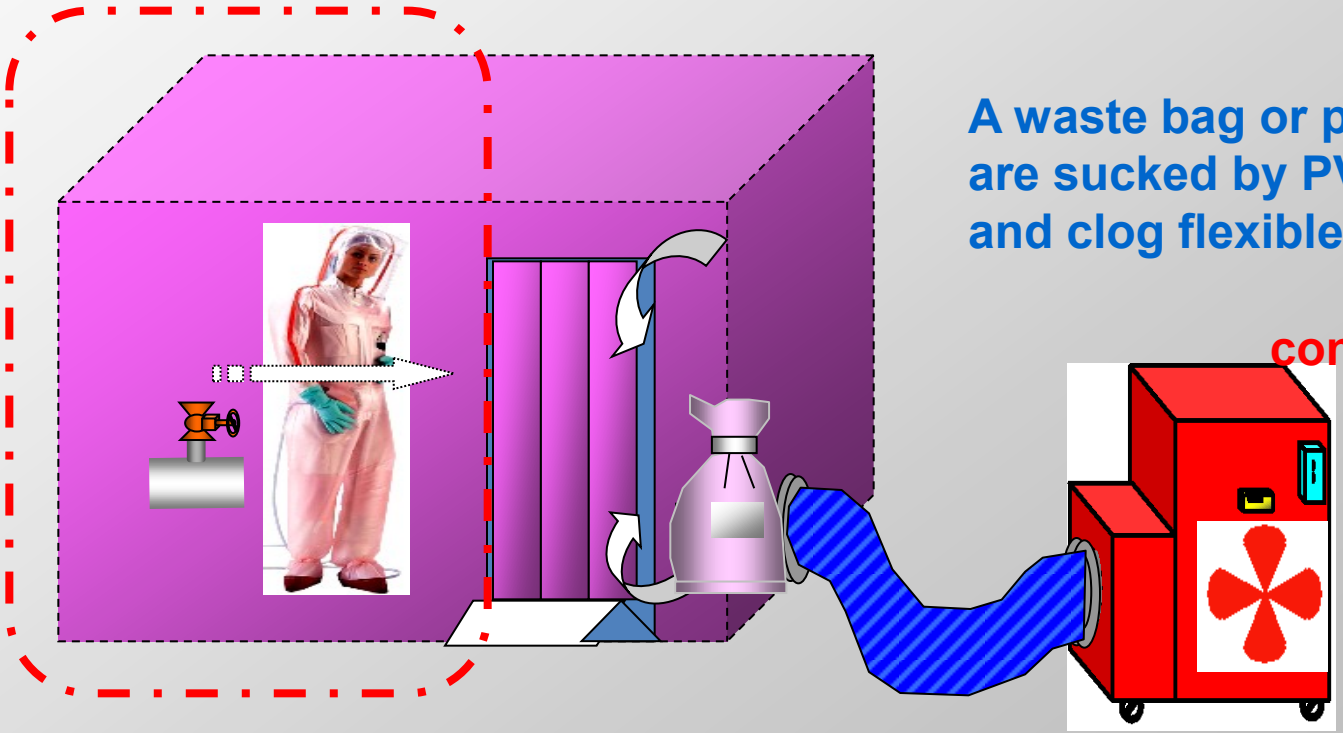
1. The bottom side
2. The worker
3. The Valve or other contaminated device
4. Finally, is vacuumed from opposite side

➔ Coverall remains clean…

Ventilated anticontamination tenting : *Bad practise*

Volume isn't well covered

Air comes from the door and doesn't pass through contaminated valve….



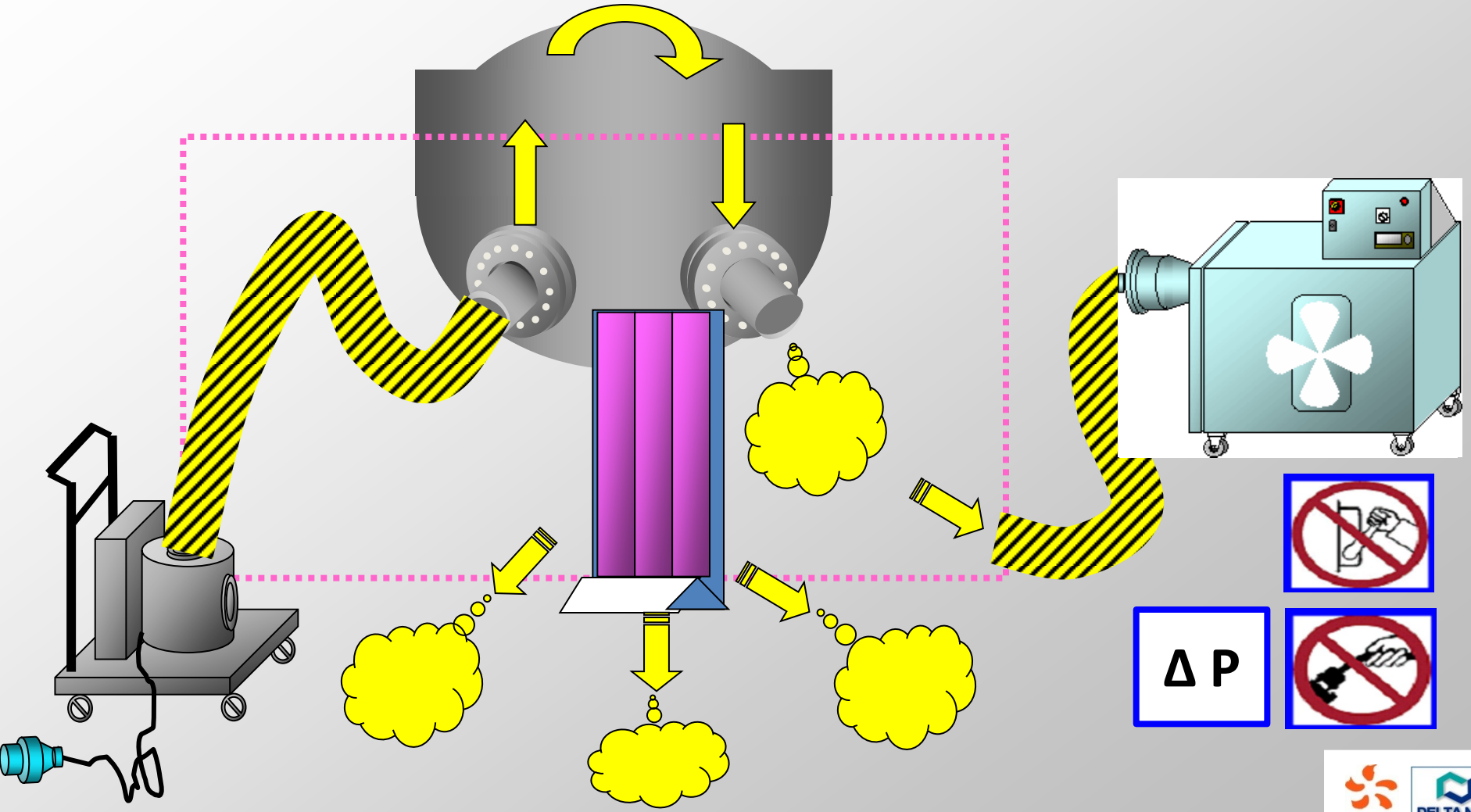
A waste bag or plastic slats are sucked by PVU and clog flexible hoses !….

Failing confinement !

➔ Coverall is totally contaminated… and tent as well…

Ventilated anticontamination tenting : *Bad practise*

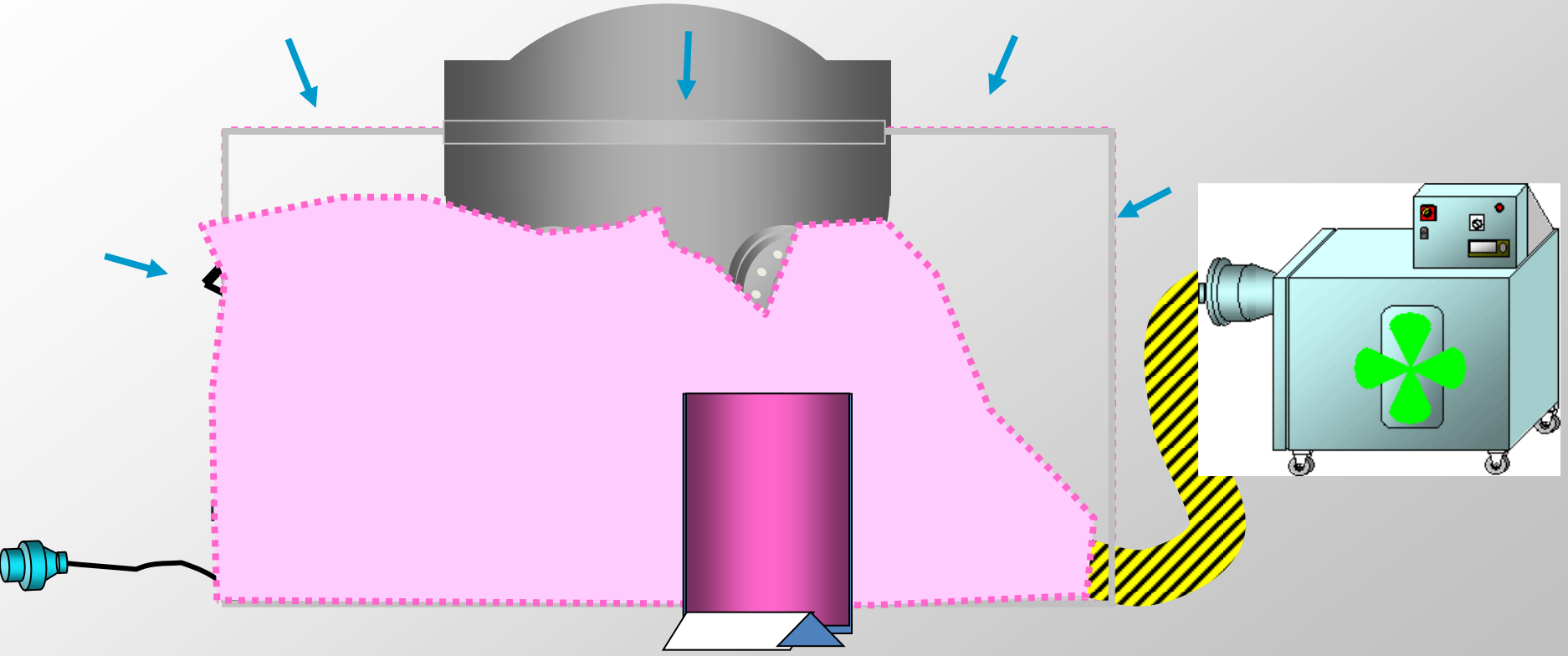
- Tent is just like a dusty bag…. In positive pressure!….



- OF: Water box of Steam Generator (with or without heater)

Ventilated anticontamination tenting : *Bad practise*

- You said airproof !.....

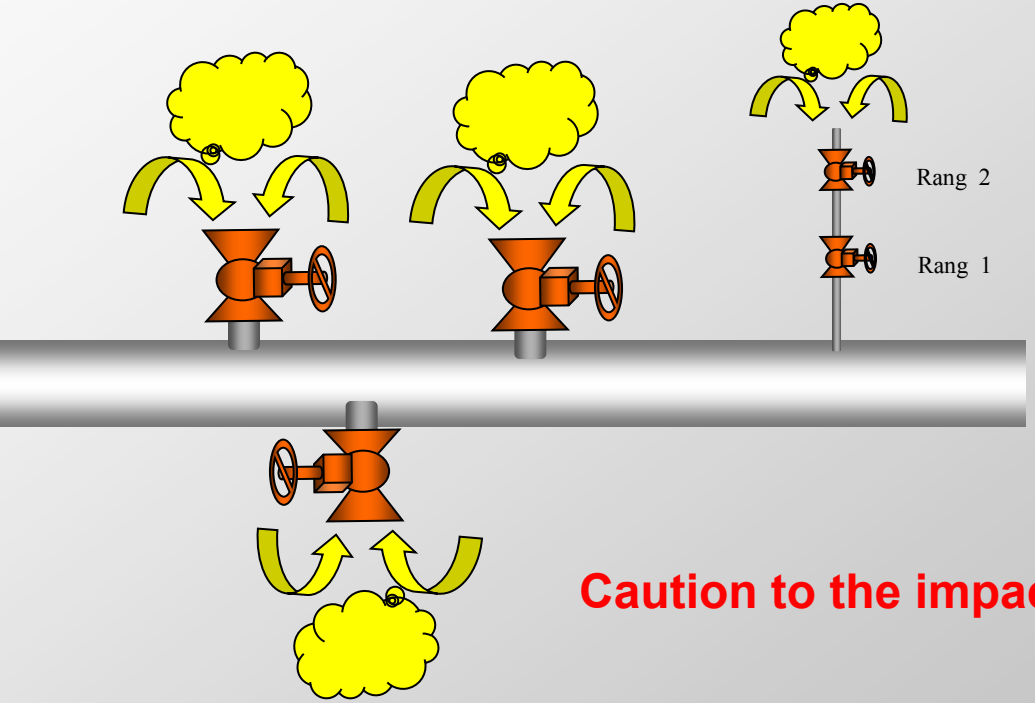


A tent too air proof **➔ Tent can collapse**

- **OE**: Water box of Steam Generator (with or without heater)

• Internal dynamic depressurisation :

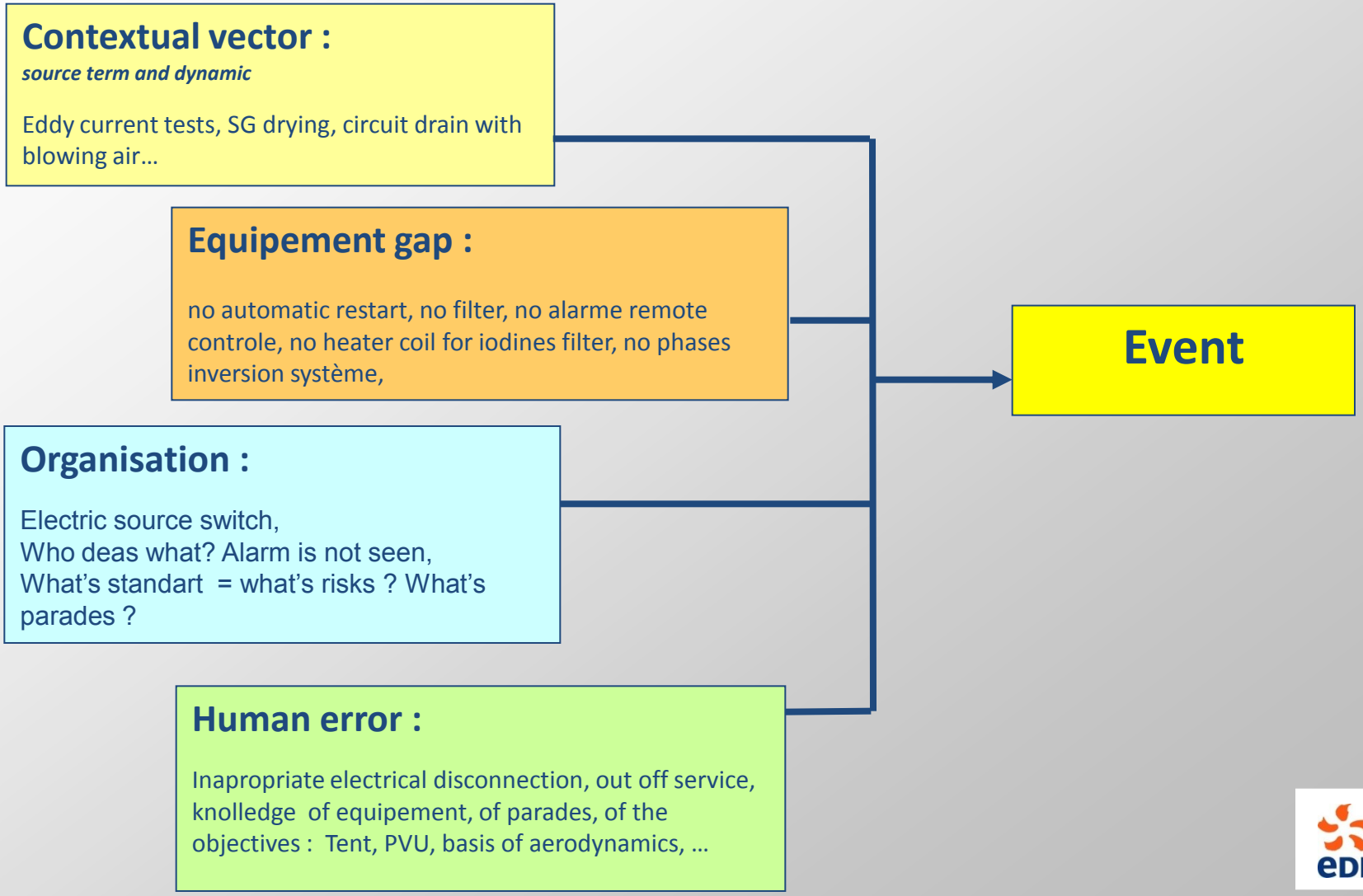
MED CP permits to centralize the confinement devices
➔Decreases quantity of PVU



Caution to the impact of common mode !…

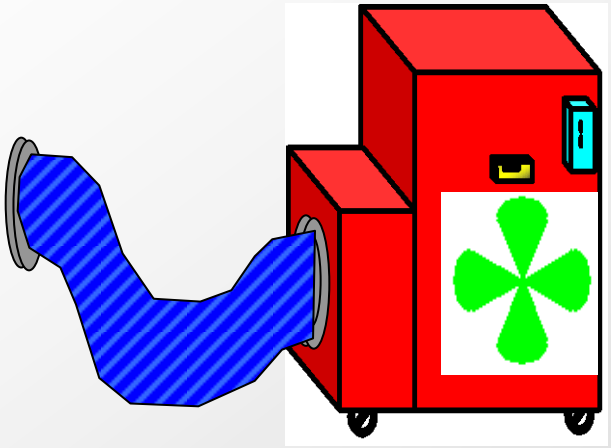
Analysis outcome

What are the causes of the events ?

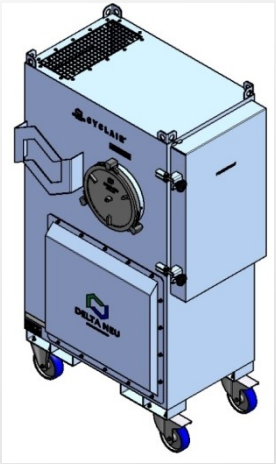


A Portable Ventilation Unit …. What's this ?

For some people, it's only:



A vacuum cleaner with on/off button

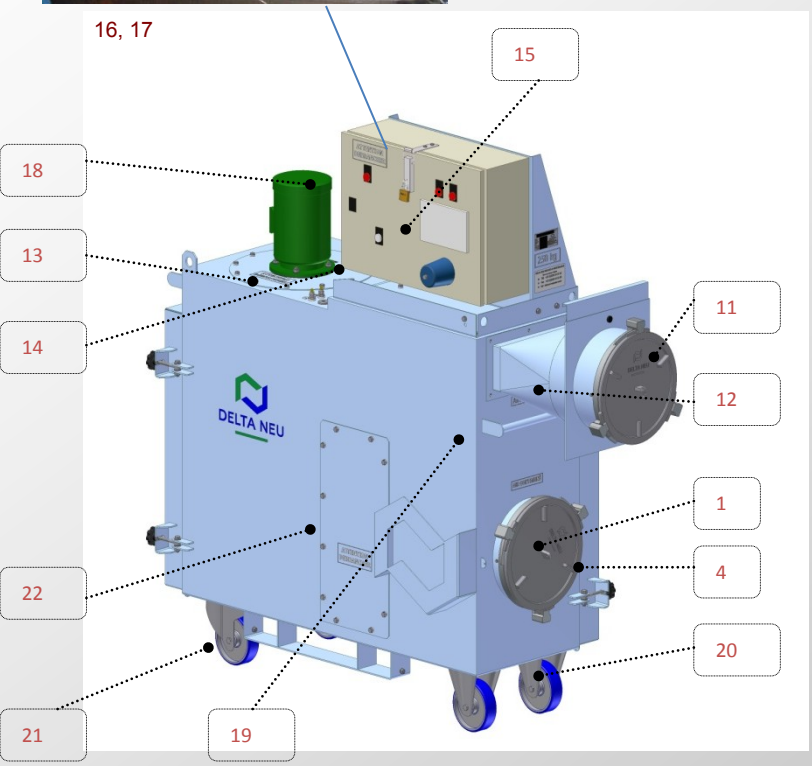


For us, it becames an Overall Concept :

1 default ➔ 4 alarm levels for 4 different actors
(example : Eddy Curent)

Opportunity to upgrade totally the concept of the PVUs:

- Each componant has been studied.
  All parameters can be read remotely



1 – **Dirty air** inlet + ZAG alu connector
2 – Absolute filter
(airtigth flanges, qualified welds)
3 – **Switch contact for HEPA filter**
(anti-starting)
4 – HEPA filter casing door
(FME closing organs)
5 – Iodines filter
6 – **Switch contact for iodine filters**
(anti-starting)
7 – Activated charcoal filter door
(FME closing organs)
8 – Access trap for centrifugal fan
(IP 55 certified)
9 – **UNILINE®** centrifugal fan
10 – Motor
11 – Clean air outlet (cleaness rubber, upper side release)
12 – Air flow balance / damper or converter
13 – Analogical pressure gauge
14 – **Electrical panel**
- Automatic restart
- Phase inverter
- Stop temporised
- Maintenance hourmeter
- Auxiliary remote plug
- Compliance test button

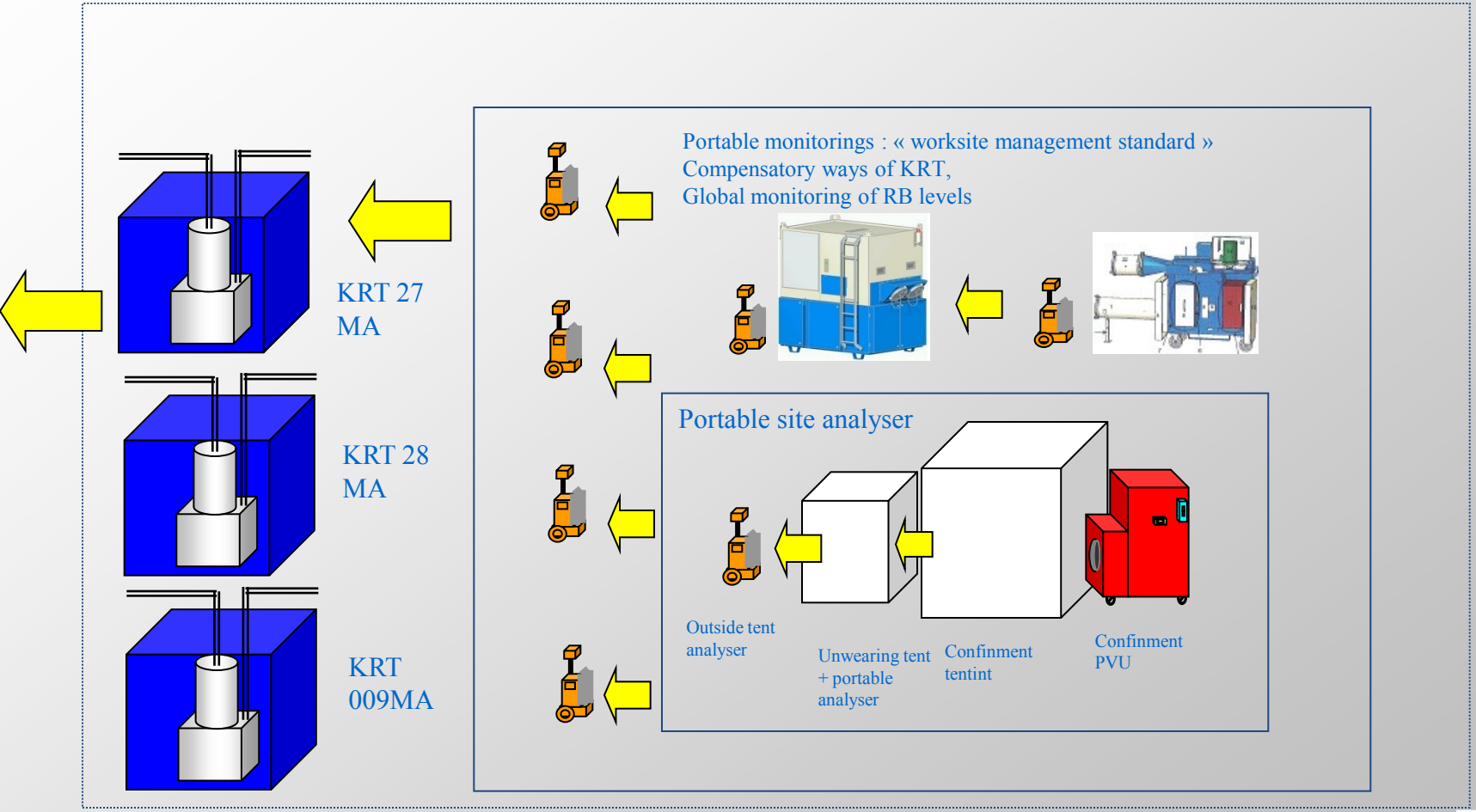
15 – **Display**
- Digital ΔP (threshold set up)
- Dose rate (option)

16 – **Communication interface:**
- Remore alarm socket,
- Shleter consol,
- RPSS socket (RS 485)
- Association socket / RP monitor

17 – **Siren**
18 – Lockable circuit breaker
19 – Traction bar
20 – **Rotating wheels with brakes**
no tracks(OEEI)
21 – Fixed wheels
22 – **Heater coil**
(Ensure relative humidity % / PI + temperature probe)
23 – **Certified handling rings**
24 – **Lower center of gravity < 1/3 H**
25 – **Acoustic level < 80 dB**
26 – **Dimensions HLP => RB lift**

Organisation upgrade :

the continuous monitoring of « nested » *concentric* volumes constitute several in-depth defense lines



Solutions answer to in-depth defense principles

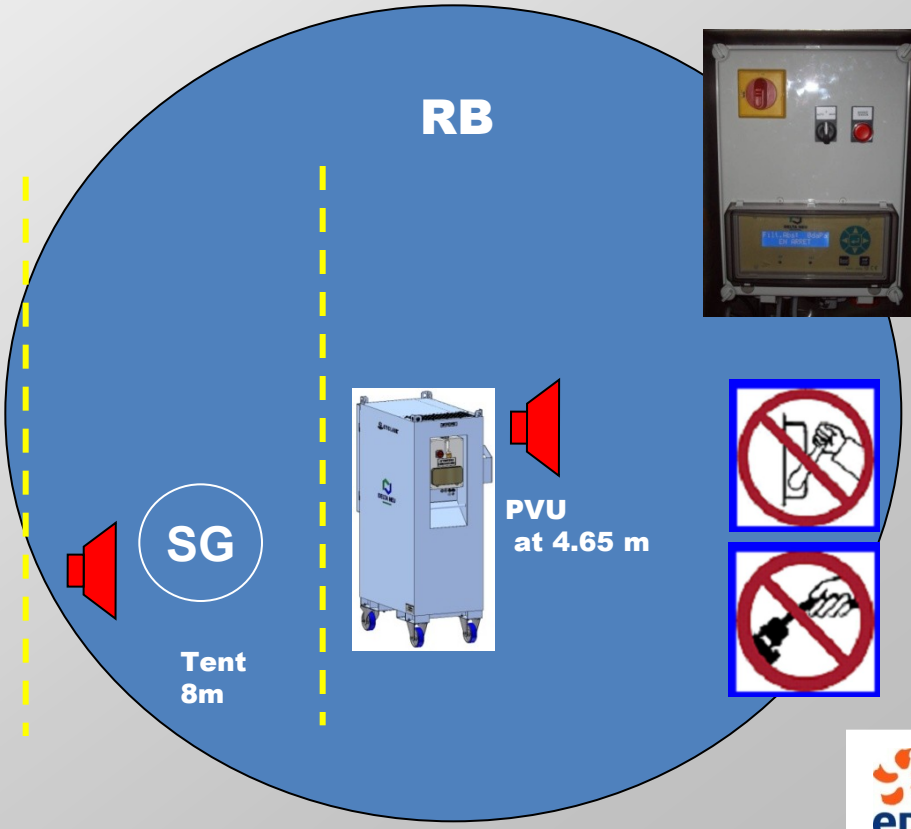
- Example :

  1 default➔ 4 alarm defauts for 4 different actors

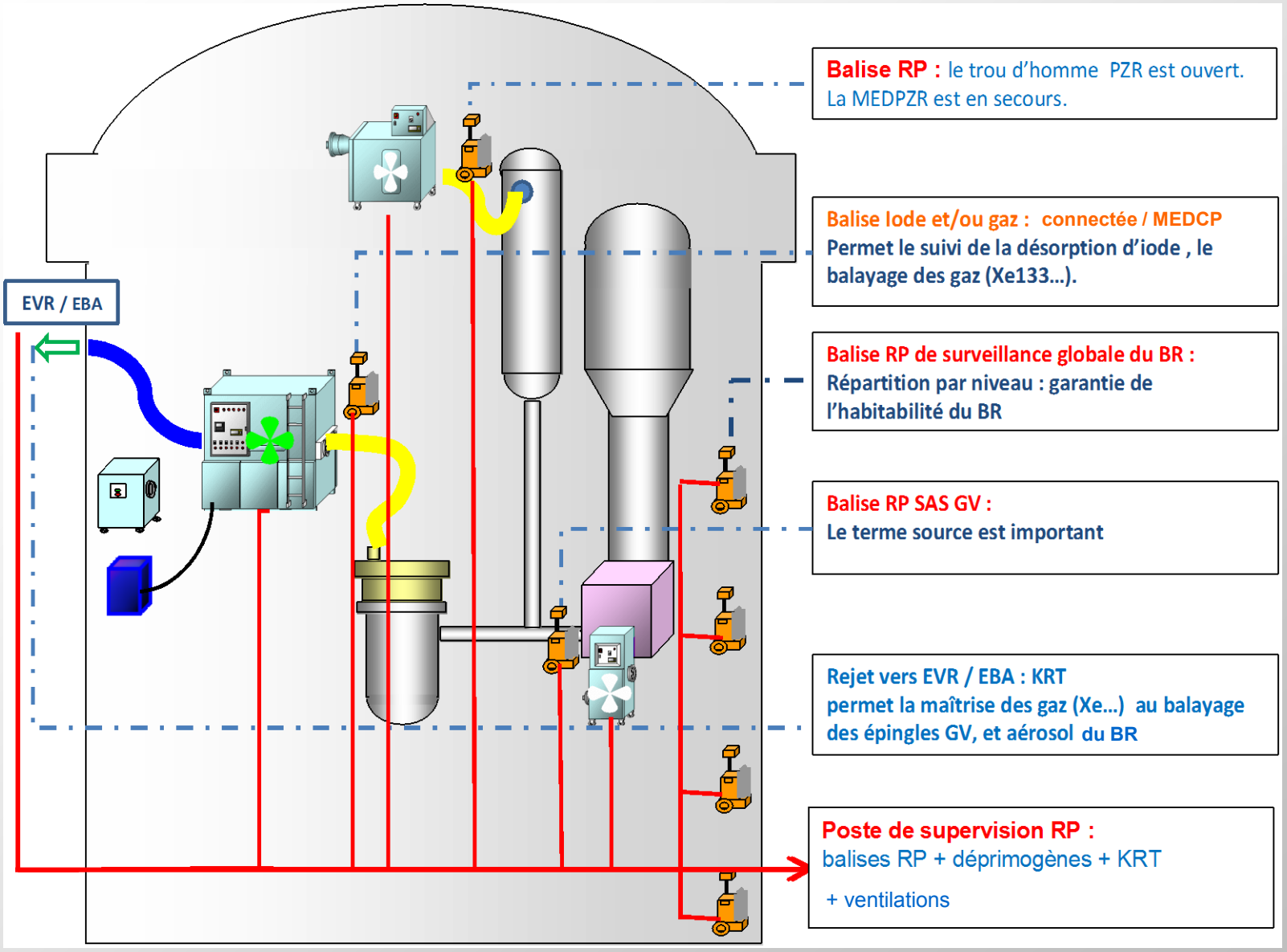
PSRP
supervision station
RPD / COPAT

Shelter board

Outside RB



Organisation sample : SG secure + worksites in NLL



Balise RP : le trou d'homme PZR est ouvert.
La MEDPZR est en secours.

Balise Iode et/ou gaz : connectée / MEDCP
Permet le suivi de la désorption d'iode , le balayage des gaz (Xe133…).

Balise RP de surveillance globale du BR :
Répartition par niveau : garantie de l'habitabilité du BR

Balise RP SAS GV :
Le terme source est important

Rejet vers EVR / EBA : KRT
permet la maîtrise des gaz (Xe…) au balayage des épingles GV, et aérosol du BR

Poste de supervision RP :
balises RP + déprimogènes + KRT
+ ventilations

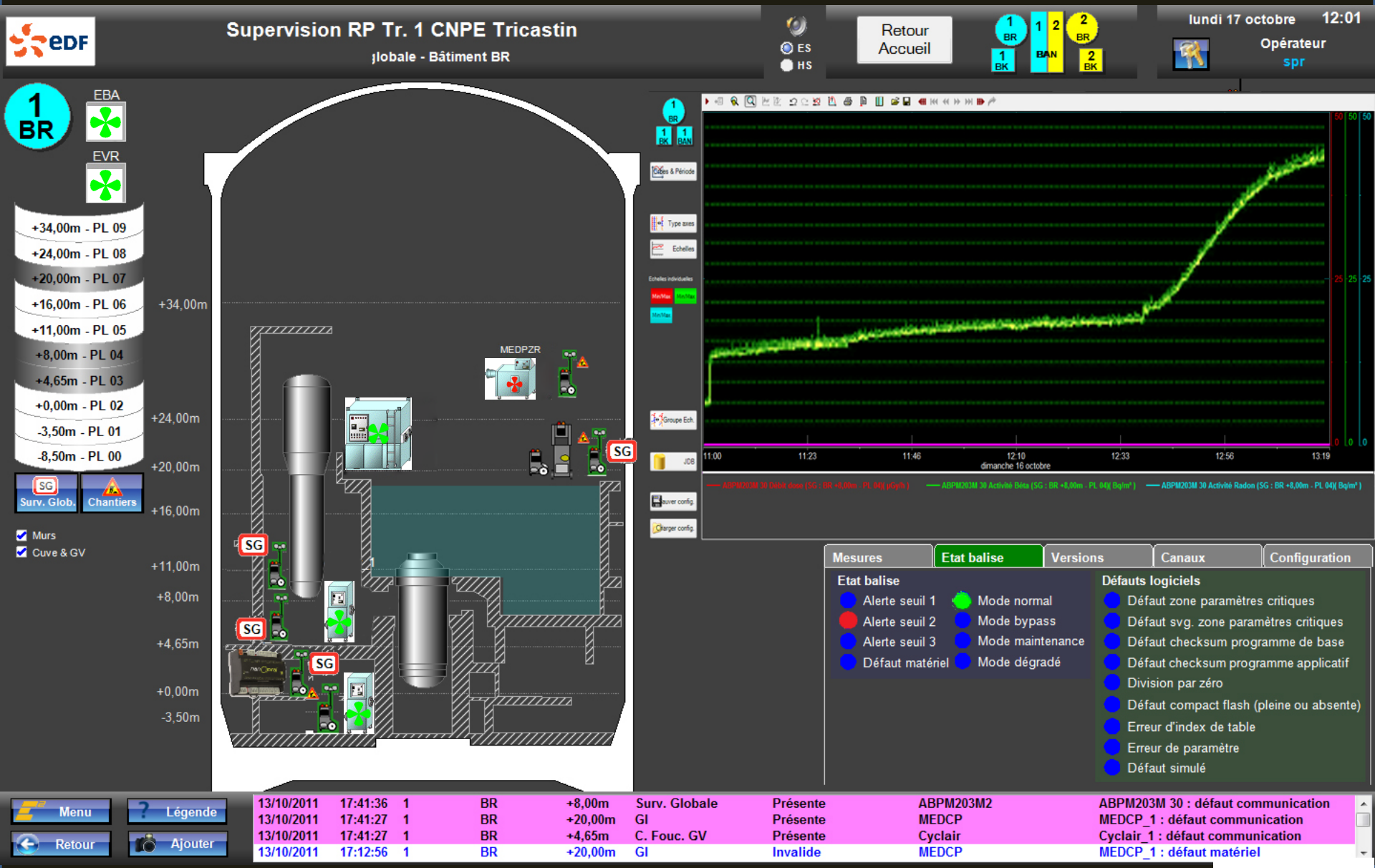
These principles allow :

- **To anticipate** : Forecast hazardous situations
- **To alert** :
  - Install the good alarm at the good place…
  - Round checking : parameters control
- **To act** :
  - Exploitation,
  - Automatism when possible,
  - Manually, if necessary to analyse and correct with an expert,
  - To define who does what, and how ?
- **Impact measurement** :
  - On site Iodines and aerosols analysers…
  - Registrer and follow up of centralized datas
  - Adapted checking
- **To validate conformity status** : define a standard
  - Periodics tests on equipements : remote and in situ control.

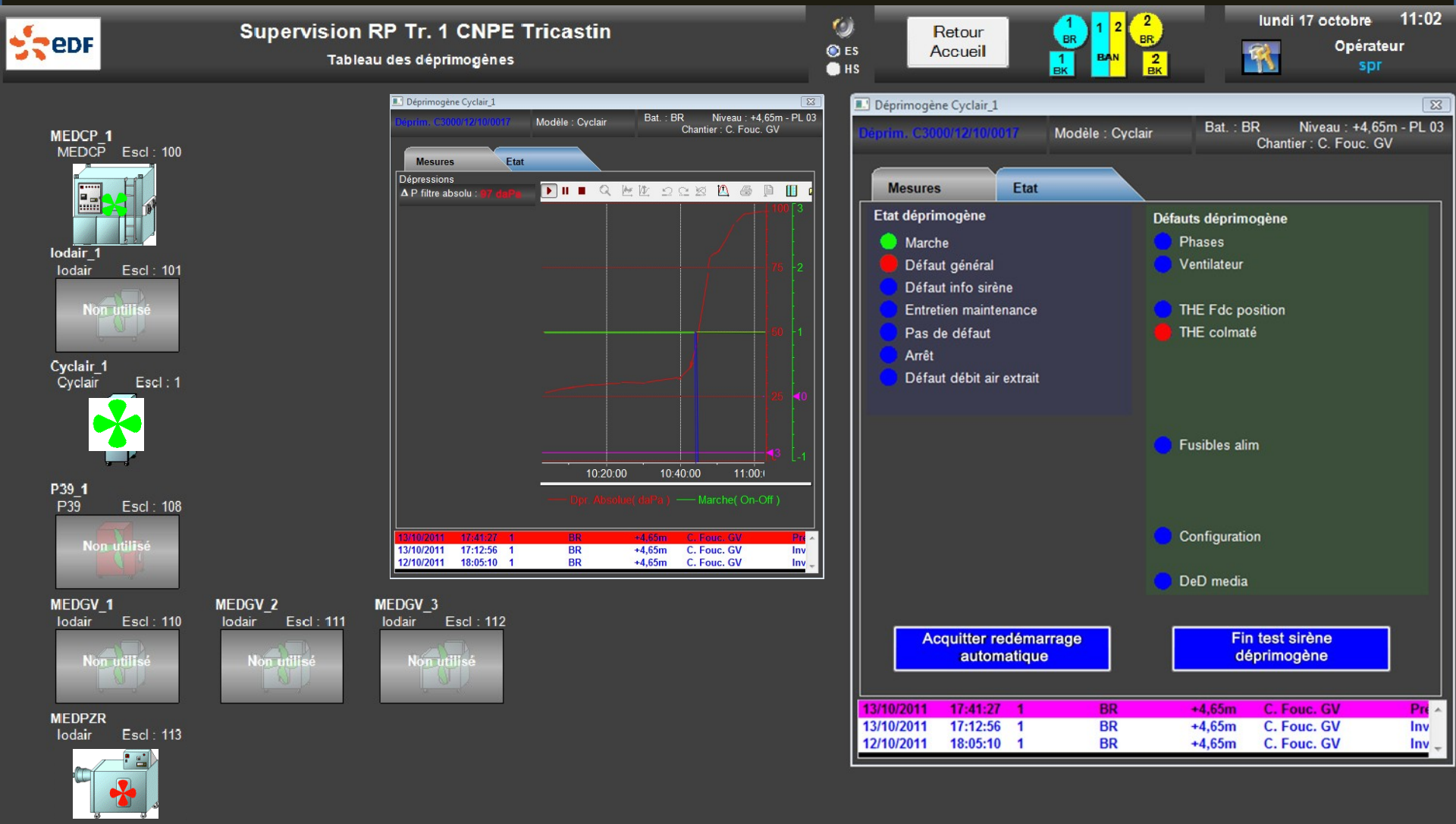
These are reinforced by the Supervision

PSRP : (RPSS)
Radio Protection Supervision Station

- **Ensure RB habitability**

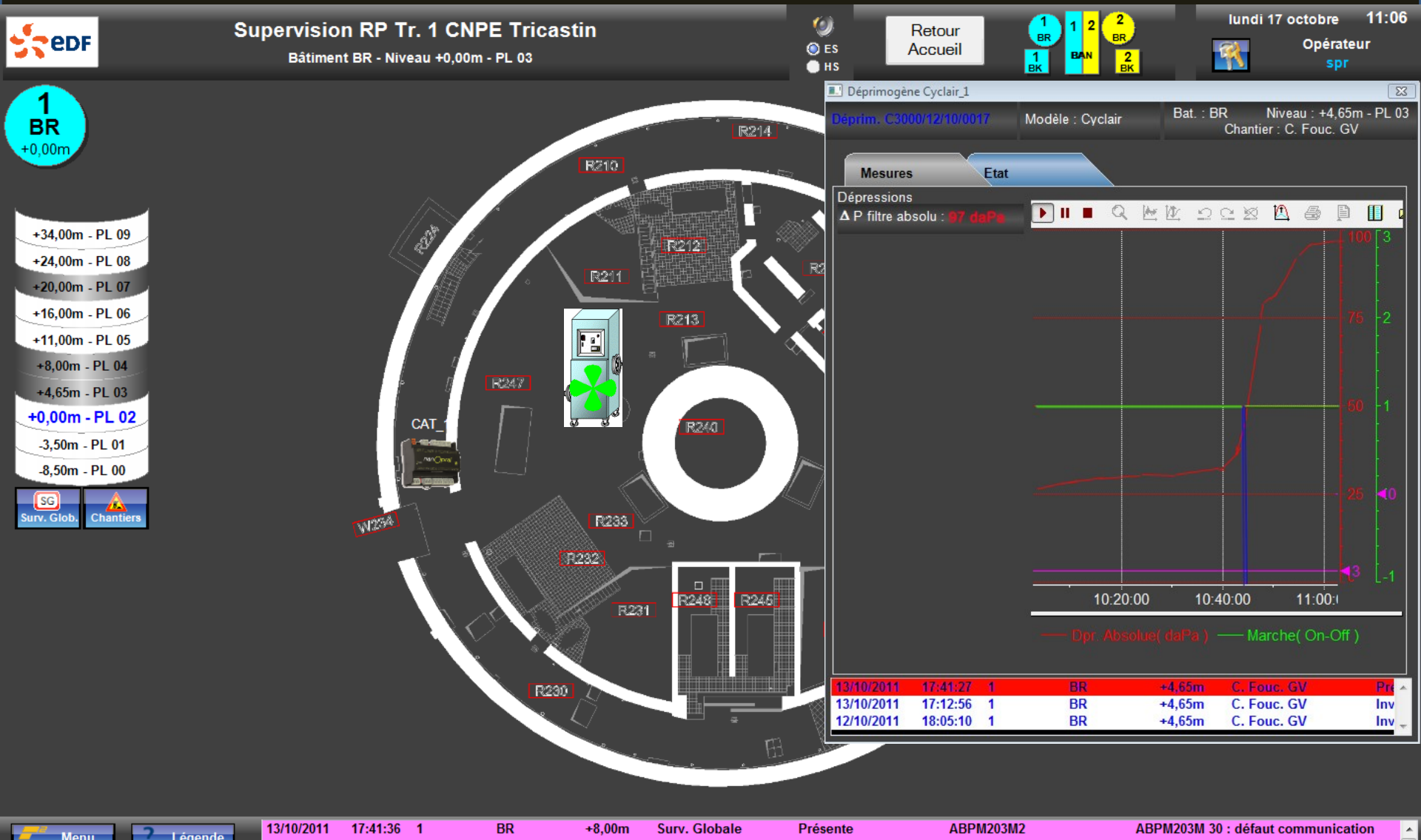


View : Overall control, RP monitors + PVU



View : PVU fleet + focus on equipements status

+ curves and datas in real time (next option : Filter Dose rate …)



View : Level 0 RB – implementation of devices + focus (CAT 1 : nanopral)

Synthesis

- **Roll out and Experimentation of concept in Tricastin NPP :**
  3 decennial outages, 3 simple refueling outages, 2 partial outages
  (with 2 difficult contexts : Iodines and Alpha).

Outcomes :

Zero evacuation with healthy impact

Serenity : PVU alarms are transmitted as near as possible from operators directly concerned with contamination source term

Zero confinement loss further to any electrical switch or brief electrical breakdown : equipements restart automatically.

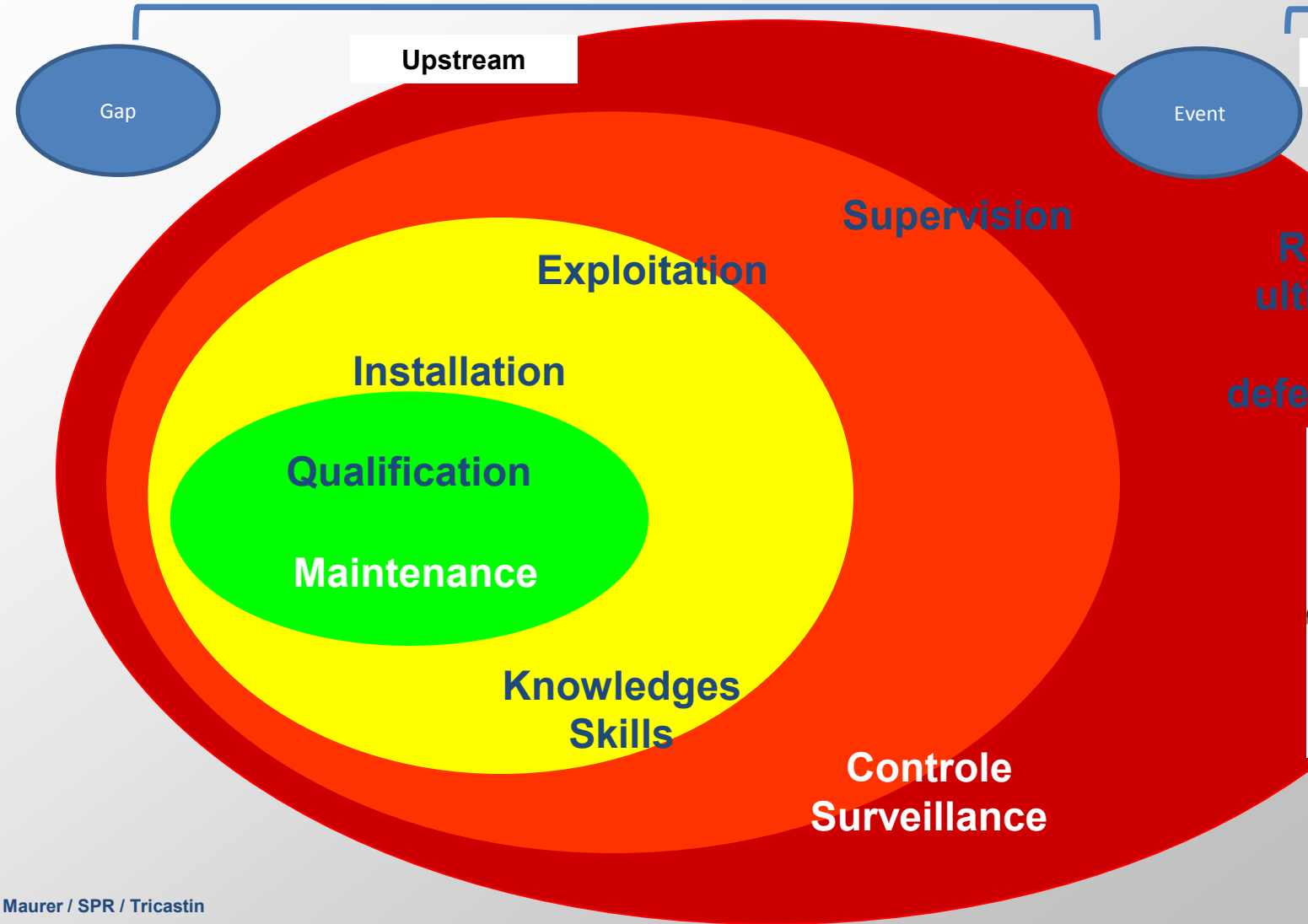
Zero unavailable hour during NLL and respect of operating schedule

Gain : Optimisation of CPC confinement by using MEDCP has permit to save 50 % of PVU's installation.

Wastes : decrease wastes quantity (Tent, Mururoa holdings...) and optimisation of wastes management (no HEPA filter >2 mSv/h).

Conclusion :

Confinement devices became strong in-depth defense lines.
They are complementary and essential tools for Radio Protection



RP analyzer = ultimate sensors for defense line failure

Remember :

« When an aerosol or iodine monitor alarms ……

…….it's already too late …….. »

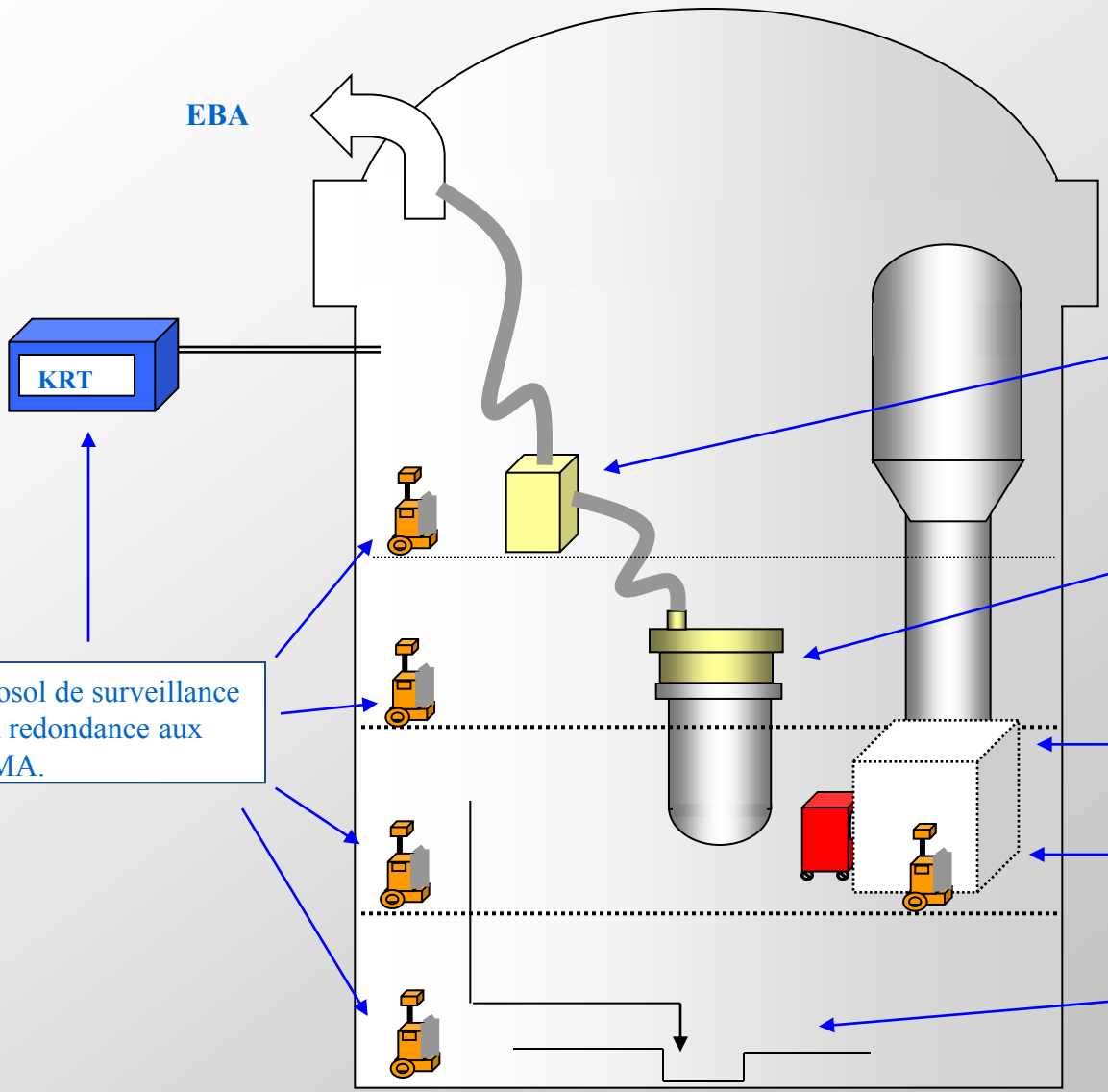
Let's work upstream !….

Thank you for attention.

Thank you to our partenairs in the adventure

Documents en annexe

REX évènement Tricastin 2008 -2009



Le groupe Aerofrance met en dépression le circuit primaire.

Le faux couvercle est en place sur la cuve.

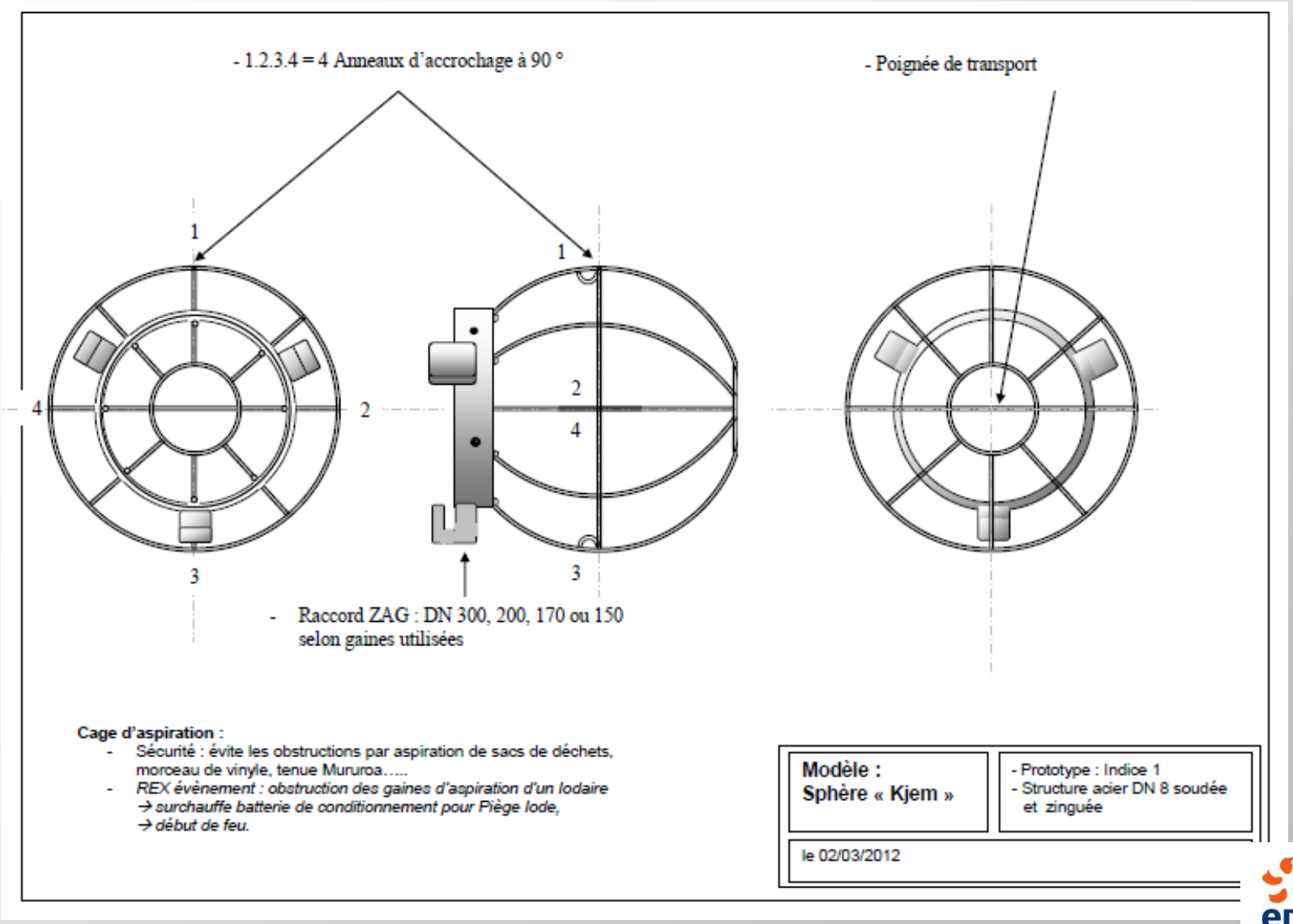
Les opérations de séchage des GV sont en cours sur les autres GV.

Test aux courants de Foucault sur un GV.

Vidange poussée à l'air d'un circuit.

Les balises aérosol de surveillance globale sont en redondance aux KRT 27 et 28 MA.

Sphère cage : anti obstruction des gaines d'aspiration



Objectifs de la MEDCP :

Mettre en dépression le circuit primaire en GI lors des arrêts de tranche par assurer un confinement dynamique pour chaque ouverture d'organe ou portion de circuit

…. Cet objectif n'est pas limité aux VP…

Garantie de l'efficacité des confinements dynamiques : dispositif « intelligent » régulation / critères ASN

Garantie des critères FME: aspiration adaptée (exp : evt baudruche PZR….)

Gain en temps chemin critique : séchage des GV

Maîtrise des caractéristiques de l'air extrait : instrumentation pour mesure directe [Iode 131]

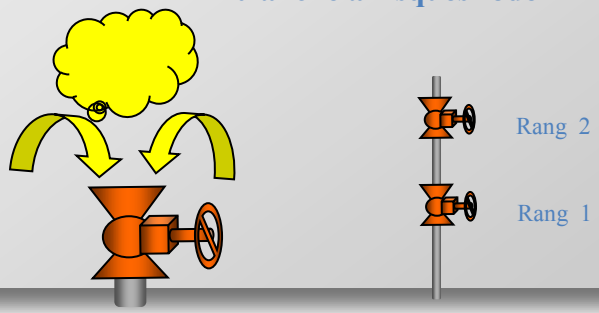
Gain en logistique de chantier : réduction des SAS

Réduction de la multiplicité des moyens onéreux : filtres Iodes tranche à risques Iode

Ouverture organe ou circuit

Maintenance, test, lignage

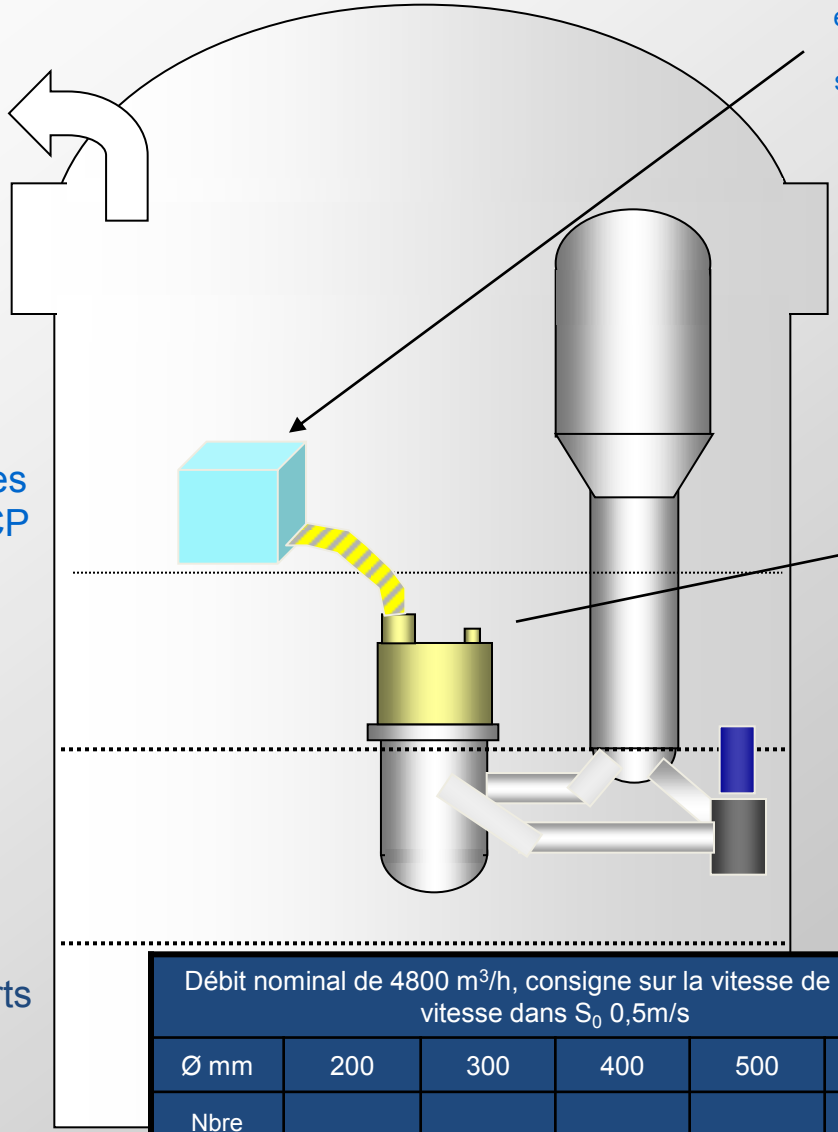
…



Circuit primaire

Le principe et couverture de la MEDCP

- **Dépression adaptée du CPP :** régulée en fonction des ouvertures des circuits et organes : Cette régulation est organisée en prenant en compte deux anémomètres positionnés sur le faux couvercle. Ils servent de « fuites calibrées » pour piloter la MEDCP. Ces anémomètres peuvent aussi être déplacés et positionnés sur un organe du CPP spécifique.



- **Aujourd'hui :**
  REX exploitation

1. Seules les branches chaudes sont couvertes par la MEDCP dans la configuration connexion au FOC.
2. Les branches en U sont couvertes si hors d'eau et trous d'homme GV fermés
3. EIS en cuve : même couverture de dépression.
4. Les trois GV ouverts (BAE froides) peuvent être couverts : 3 x 1600 m3/h
   - balayage gaz (Xe133…),
   - désorption Iode 131.
   - séchage des GV

Total des sections ouvertes possibles en mode régulé

= 2.7 m2

Débit nominal de 4800 m^3/h, consigne sur la vitesse de 6,8m/s, vitesse dans S_0 0,5m/s					
Ø mm	200	300	400	500	600
Nbre max de bouches	65	29	16	10	7

MEDCP : Principe de sécurisation

- **Redondance :** Tous les composants importants sont doublés *(ventillo, sondes de régulation, sondes de température et d'hygrométrie, gaines, …),*
- **Secours :** en cas de défaillance ultime : le mode manuel et le mode forcé existe,
- **Diversification :** La MEDPZR ou le groupe de secours MEDCP peuvent prendre le relais *(mode automatique ou manuel)*
- **Basculement de source :** Kit de redémarrage automatique.
- **Confinement dynamique :** Tous les éléments filtrant travaillent en dépression et non en surpression.
- **Ligne de défense :** Les filtres à Iodes sont en aval des filtres absolu / risque de déchirement du filtre THE.
- **Alarme :** in situ et déportée sur PSRP.

Comment garantir cette stratégie ?