Fire issues and research

EUROPEAN SPALLATION SOURCE

Fredrik Jörud

Seminar on fire protection for physics research facilities – 2015-10-06--08

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Agenda

- New conditions
- Permit to build & license to operate
- Emergency response planning
- Automatic vs Manual
- Assembly points & Emergency preparedness zone

- Control room
- Active cells
- Fiber optics

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Fire Protection Manager

www.europeanspallationsource.se

Graded approach licensing procedure – radiation safety authorities (SSM)

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ESS-0004722

Fire- & Explosion Safety Program

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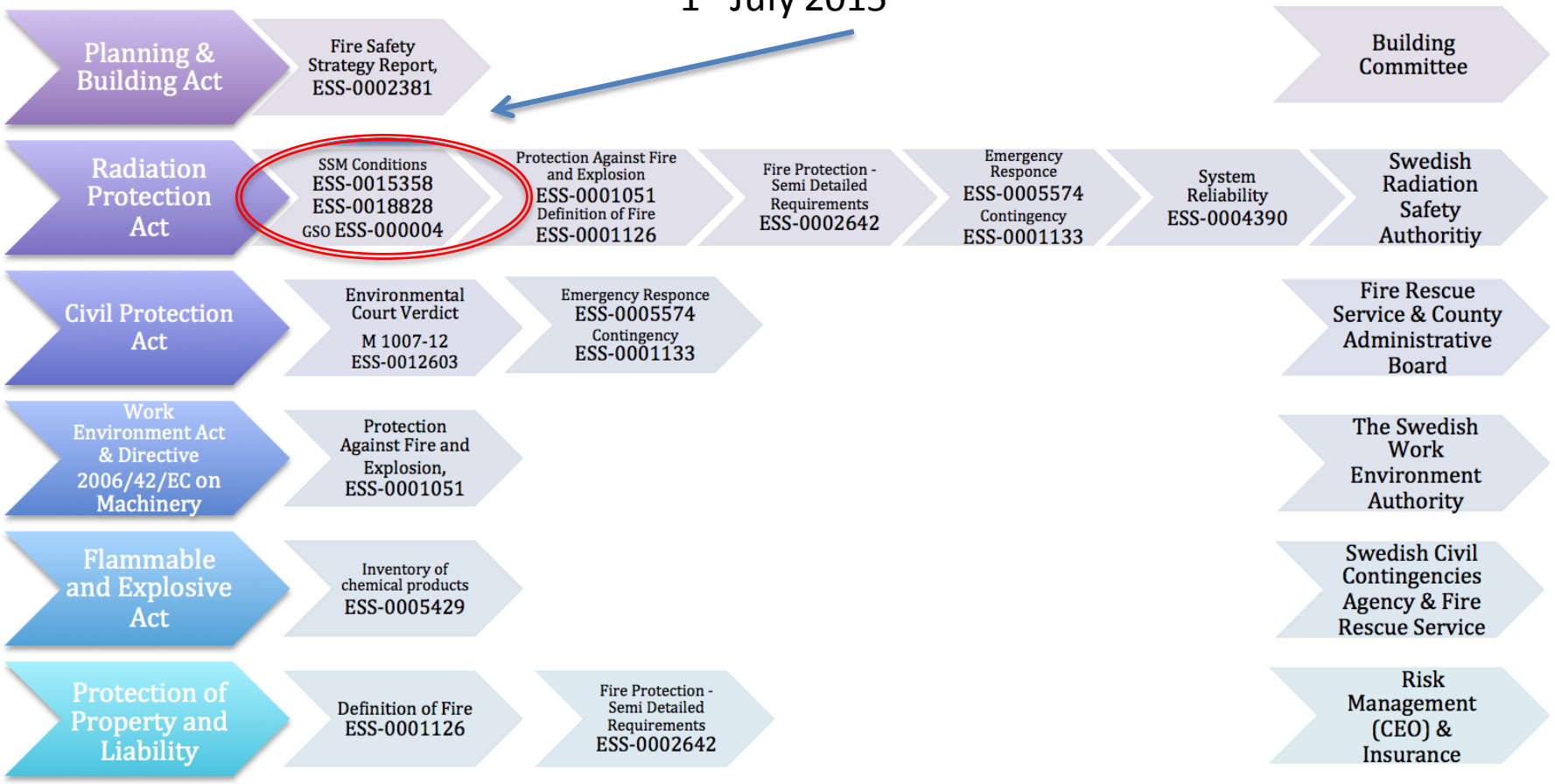
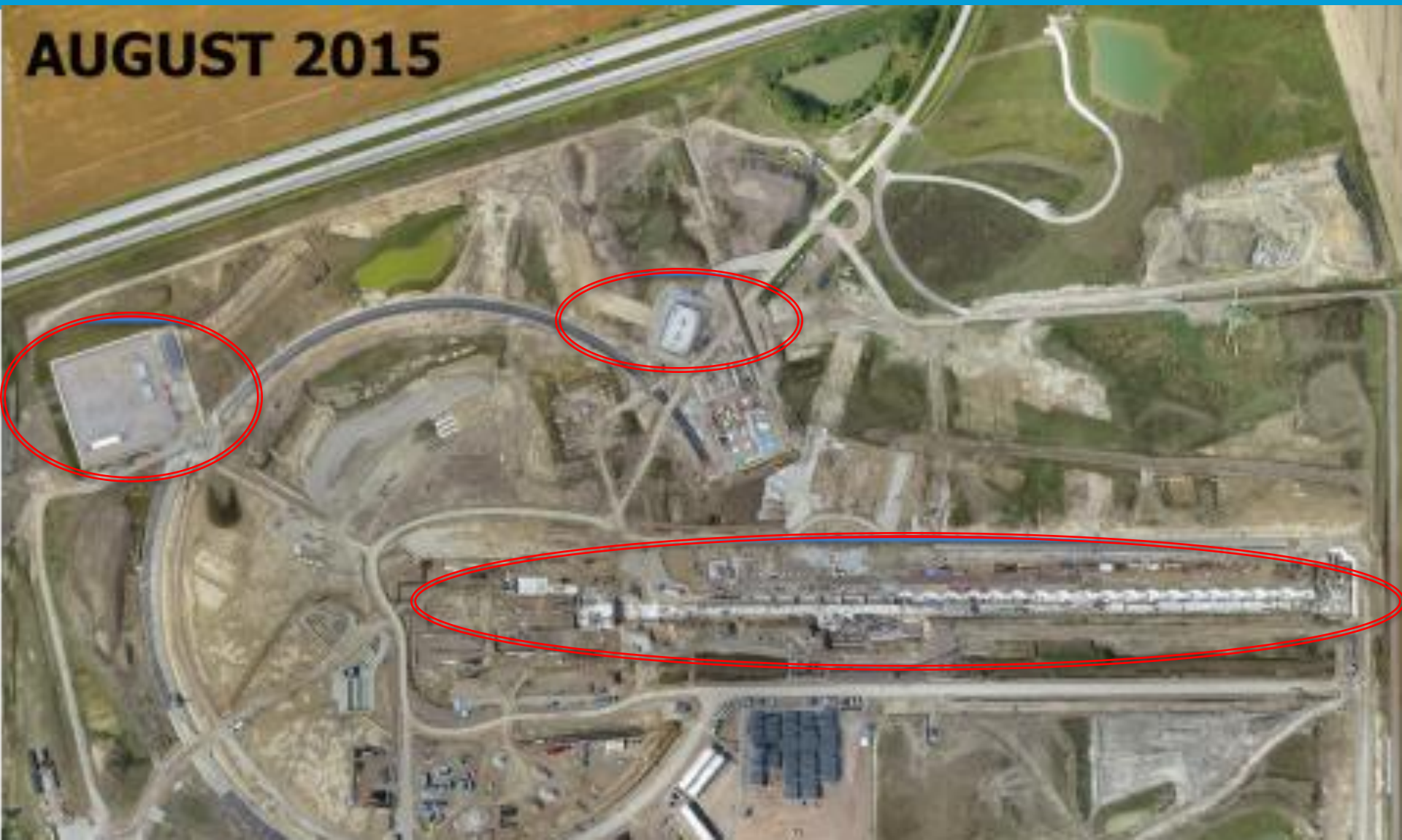
Revised Conditions
1st July 2015



Building permit ?

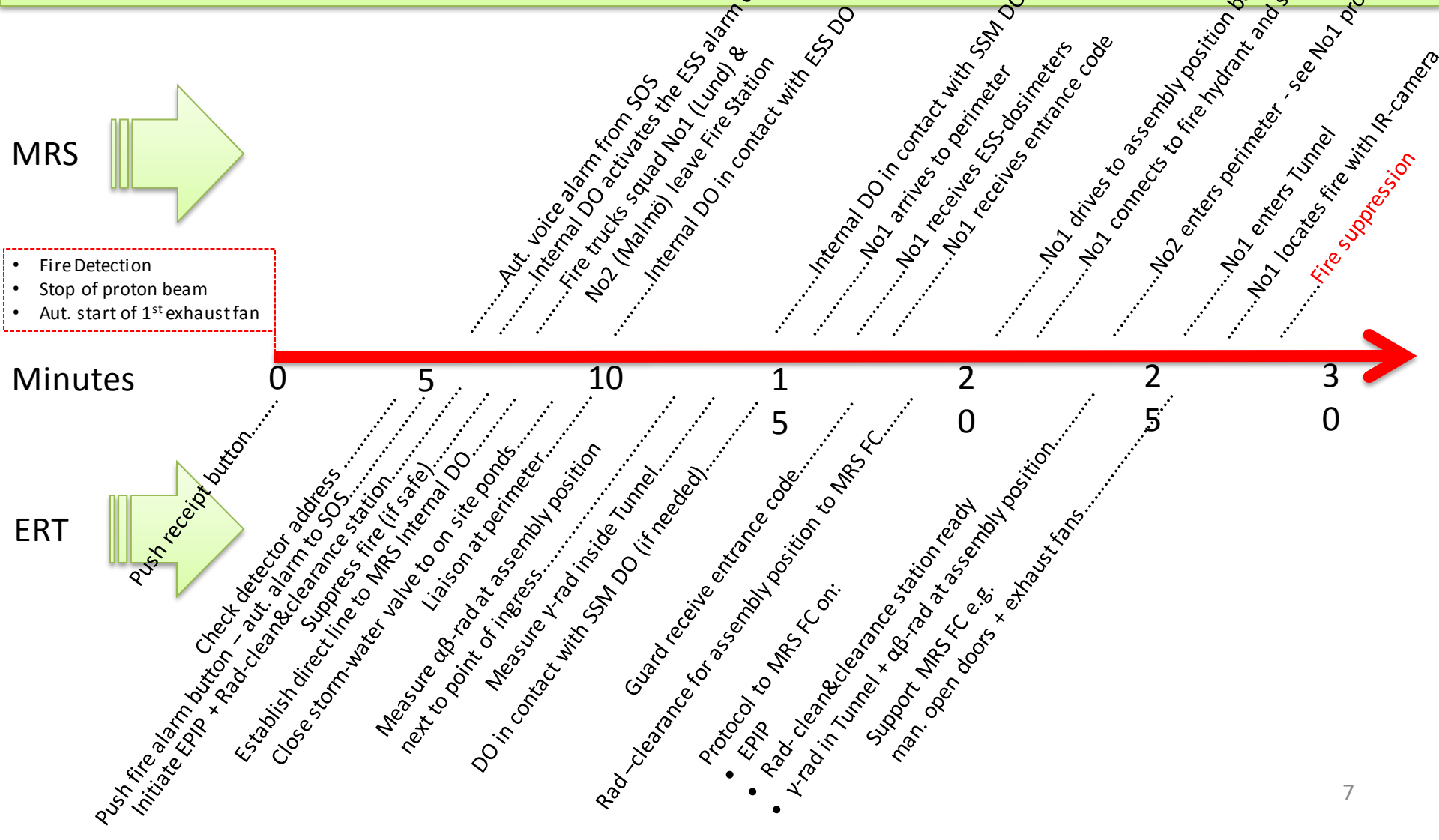


Emergency Response Planning

Emergency response planning – 8 design scenarios!

Abbreviation

EPIP	Emergency Power Insulation and Grounding Plan
ERT	ESS Emergency Response Team
MRS	Municipal Rescue Service (Räddningstjänsten Syd)
DO	Officer on Duty
FC	On site Fire Commander



Fire Alarm- - ERT Actions in progress……

- Rescue people in immediate danger*
- Manage evacuation**
- Push reciept- or SOS alarm button
- Identify location of accident
- Confirm type of accident to MRS DO***
- Estimate remaining number of people in the building
- Execute EPIP
- Initiate suppression and/or open smoke ventilators**
- Provide access to hydrants
- Confirm automatic fire suppression system operating (pump&valve) and shut down at order from DO or FC
- Secure MRS passage through perimeter
- Give ESS dosimeters to MRS crew

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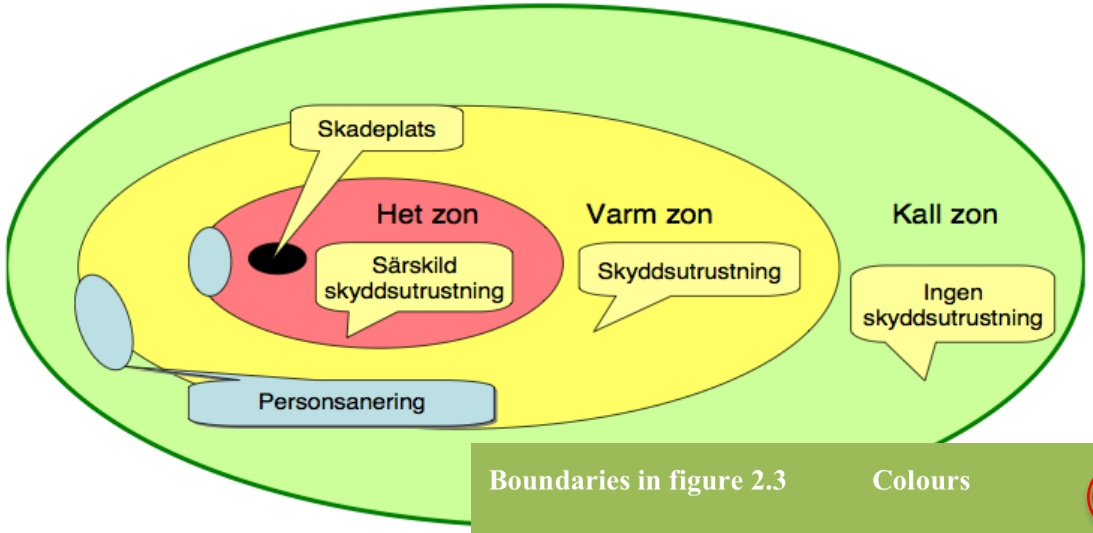
Municipal Rescue Service (MRS) - limitations

ESS-0039566 Nordic Flagbook Feb 2014



Boundaries in figure 2.3	Colours	Acceptable threshold (µSv/h)	Initial position at ESS before protocol on radiation
Cold Zone/ Warm Zone	Green/Yellow	10	MPOA (Gate in perimeter A, B or C)
Warm Zone/ Hot Zone	Yellow/Red	100	POA (Appointed entrance to buildings)
Decontamination	Blue	10	Waste Building with a permanent decontamination track (alternative track is main transport entrance area to Target Building

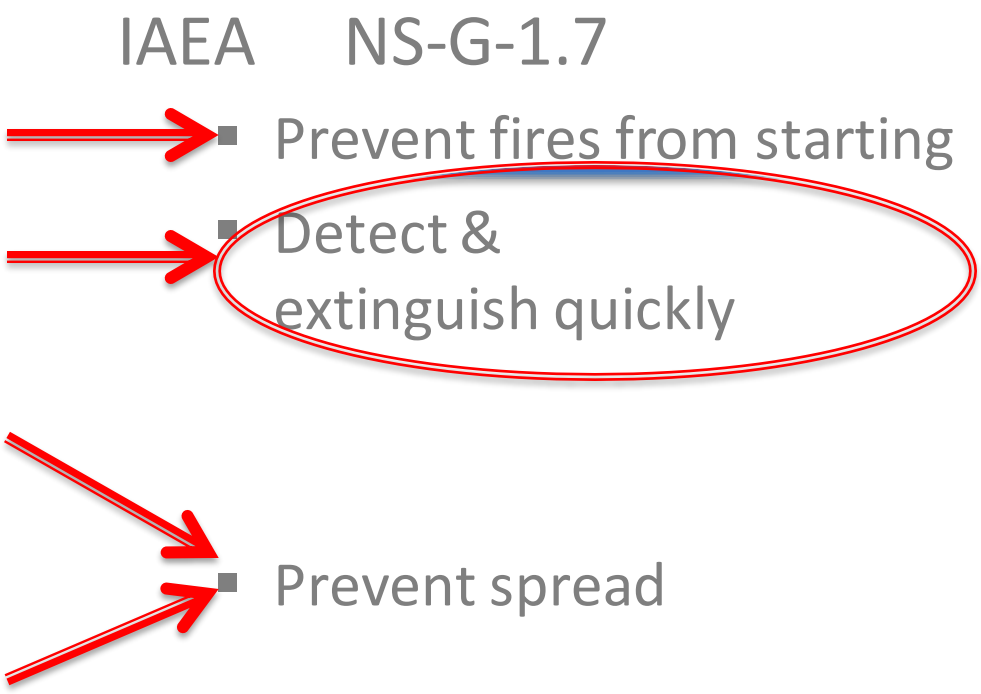
Automatic vs Manual

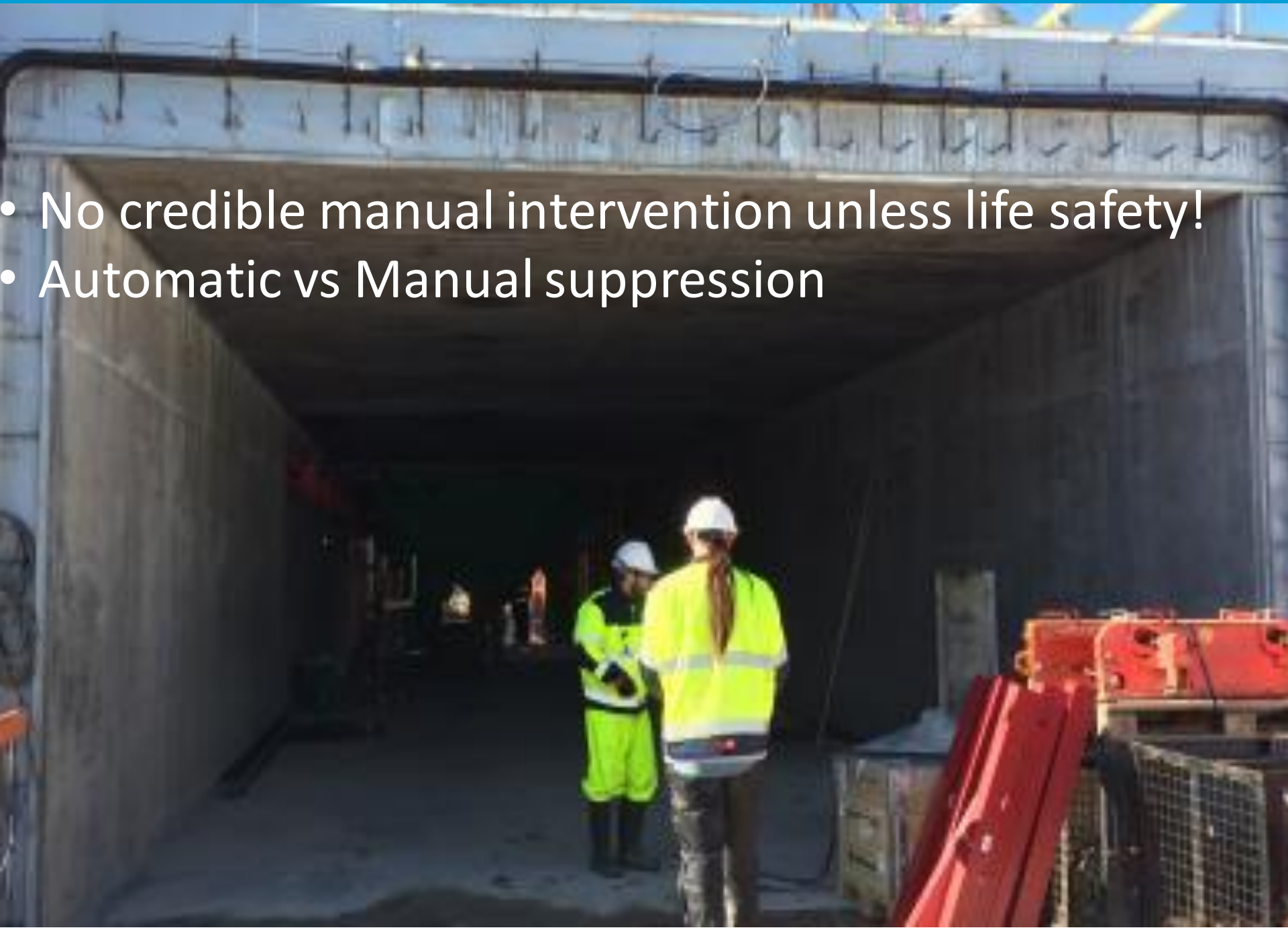
Defence in depth (DID)

ESS- 0015358 SSM licensing conditions

SSM Ch4

1. **prevent** deviations from normal operations
2. **detect** deviations
3. **minimise the impact**
4. ensure that radioactive **emissions** to the environment are **as low as reasonable**
5. **mitigate** the radiological **consequences**





- No credible manual intervention unless life safety!
- Automatic vs Manual suppression

Automatic vs Manual ⇔ small vs big fire ⇔ limited vs vast damage

Evacuation alarm

Evacuation alarm - Mapping

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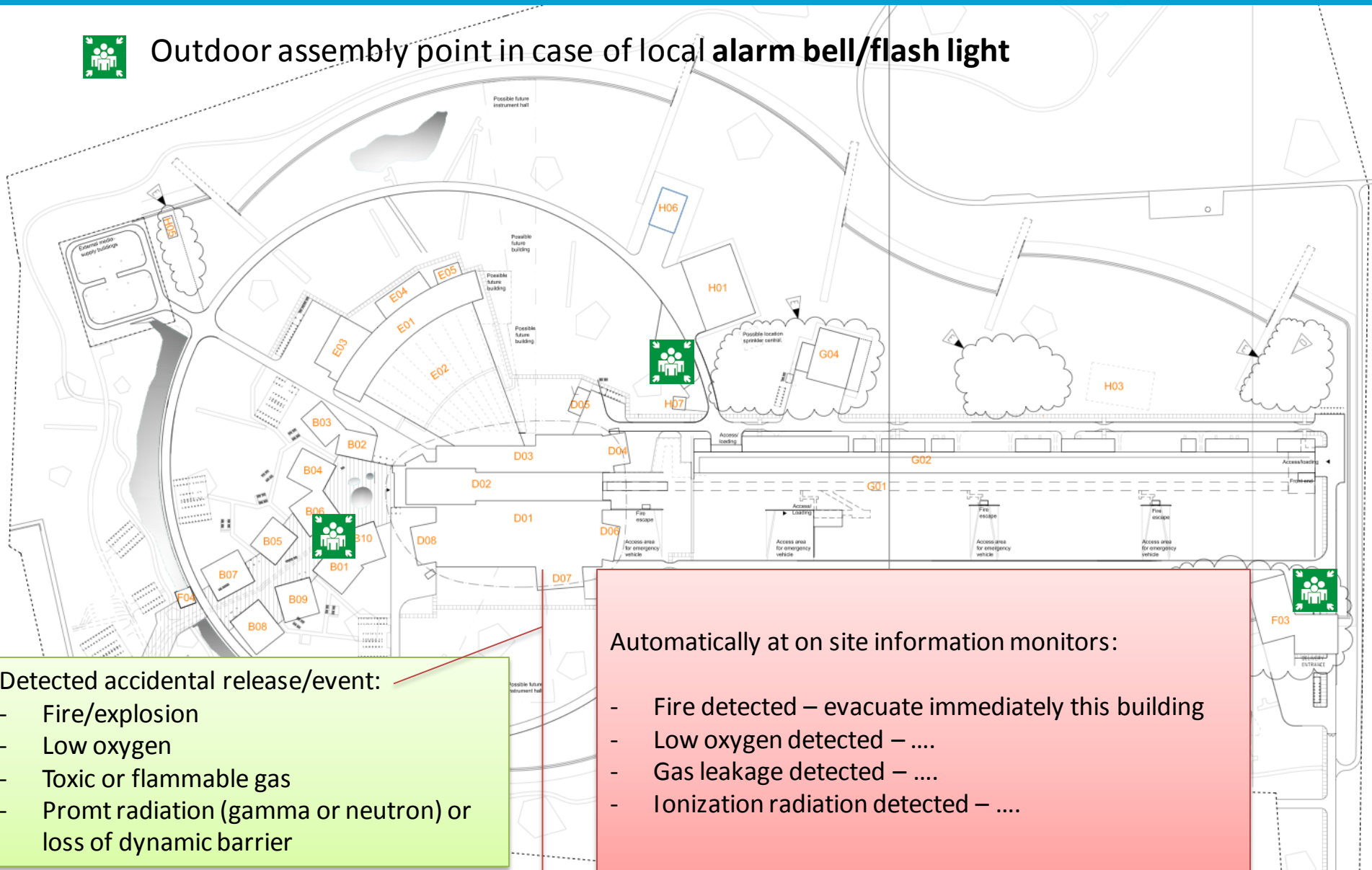
Off Site Evacuation Alarm	On Site Evacuation Alarm	Legislation	Derived Requirement	Reference	Estimated Effected Risk Area on Site	Notification	Corresponding assembly point	Position of suitable assembly point Outdoor	Position of suitable assembly point Indoor	Reciept on achieved evacuation	Worst Case Assembly Point	Worst Case Alarm	Type
	Fire	Work Environmental + Planning & Building Act	The sound level should not be less than 65 dB(A) in places occupied more than temporarily. The sound level should also be at least 10 dB(A) above the normal surrounding background level and should not be less than 115 dB(A) at a distance of one metre from the alarm device. In rooms where high ambient noise is expected, this should generate two different kinds' of signals such as with sound and light. The evacuation signal should continue until the alarm has been reset. All alarm devices should be equipped with a sign that indicates the significance of the signal and an instruction of suitable action. An example of text may be "evacuation alarm – leave the building immediately when the alarm sounds/flashes". The sign should be designed with white text on a red background and be legible from standing level below or beside the alarm device. The evacuation alarms should be able to emit an evacuation signal for at least 30 minutes after an interruption of power of 24 hours.Acoustic or optical alarm devices shall be verified using SS-EN 54-3 or 54-23.	ESS-0002381 Fire Strategy Report Ch 9.6.2	Building	Aduio and visible	Away from position where rescue service vehicles need access. Position marked with a sign and corresponding information on escape route drawings.	x		Evacuation leader	Local outdoor assembly point	Local Fire Alarm	LOCAL
	Oxygen Deficiency Hazard	Work Environmental Act			Room or Building	Audio and visible	Away from position where rescue service vehicles need access. Position marked with a sign and corresponding information on escape route drawings.	x		Evacuation leader	Local outdoor assembly point	Local ODH Alarm	LOCAL
	Toxic gas or flammables	Work Environmental Act			Room or Building			x	x	Card reader	Site indoor assembly point	Site VMA	SITE
	Ammonia release	Work Environmental + Civil Protection Act			Building and Site	Audio and visible + written message			x	Card reader	Site indoor assembly point	Site VMA	SITE
	Loss of Dynamic Barrier	SSM Conditions	**Area alarm:** An event or disturbance has occurred which threatens the safety of the facility. Radionuclide releases which warrant protective measures for the surrounding environment are occurring or could occur **Information:** An event or disturbance has occurred with injury or damage, or risk of injury or damage, to personnel and facility. The event does not threaten the safety of the facility **An alarm signal** shall be given to reach all areas at the site. Equipment shall enable to reach recievers with a message at the assembly point	ESS-0015358 & ESS-0018828 Anx 1, Chap 3 C2 , C6	Building or Site	Audio and visible + written message		x	x	Card reader	Site indoor assembly point	Site VMA	SITE
	Radiological alarm - gamma or neutron	SSM Conditions	**Area alarm:** An event or disturbance has occurred which threatens the safety of the facility. Radionuclide releases which warrant protective measures for the surrounding environment are occurring or could occur **Information:** An event or disturbance has occurred with injury or damage, or risk of injury or damage, to personnel and facility. The event does not threaten the safety of the facility **An alarm signal** shall be given to reach all areas at the site. Equipment shall enable to reach recievers with a message at the assembly point	ESS-0015358 & ESS-0018828 Anx 1, Chap 3 C2 , C6	Room or Site	Audio and visible	Away from position where rescue service vehicles need access. Position marked with a sign and corresponding information on escape route drawings.	x	x	Evacuation leader	Local outdoor assembly point	Local Rad Alarm	LOCAL
	Radiological alarm - stack monitor or area monitor alpha or beta or tritium	SSM Conditions	**Area alarm:** An event or disturbance has occurred which threatens the safety of the facility. Radionuclide releases which warrant protective measures for the surrounding environment are occurring or could occur **Information:** An event or disturbance has occurred with injury or damage, or risk of injury or damage, to personnel and facility. The event does not threaten the safety of the facility **An alarm signal** shall be given to reach all areas at the site. Equipment shall enable to reach recievers with a message at the assembly point	ESS-0015358 & ESS-0018828 Anx 1, Chap 3 C2 , C6	Site	Audio + written message			x	Card reader	Site indoor assembly point	Site VMA	SITE
x		Civil Protection Act	Signalen VM och meddelande i radio och TV utgör tillsammans "Viktigt meddelande till allmänheten" (VMA). Signalen underrättar människor om att en olycka har inträffat vid en an läggning, eller att överhängande fara för olycka råder. Signalen uppmanar allmänheten att söka skydd inomhus och lyssna på radio. Signalen åtföljs av ett meddelande i radio och TV. Förhandsinformation som ska kunna förmedlas till kringboende. RSyd kommer framöver i högre utsträckning låta verksamhetsutövare kunna aktivera VMA – tutor. Verksamhetsutövaren underrättar normalt SOS Alarm som i sin tur larmar kommunens organisation för räddningstjänst, polismyndigheten och länsstyrelsen samt andra aktörer vid behov.....Från och med den 1 september 2014 kommer VMA-information även att kunna spridas via fast och mobil telefoni i områden som den som begär VMA bestämmer. Då tas ett system för automatisk uppringning med talmeddelanden i bruk som ett komplement till övriga varningskanaler.	ESS-00156952 and kap. 4 § lagen (2003:778)1 om skydd mot olyckor och förordningen (2003:789)2 om skydd mot olyckor. MSBFS 2014:2	On Site and off site	VMA - Outdoor audio siren: 7s-14s-7s-14s-7s-14s.... Hazardous situation off 30-40s firm signal + Message on official TV and radio channel and text message in mobile phones		x				ON&OFF SITE

On site local outdoor assembly points

Outdoor assembly point in case of local **alarm bell/flash light**



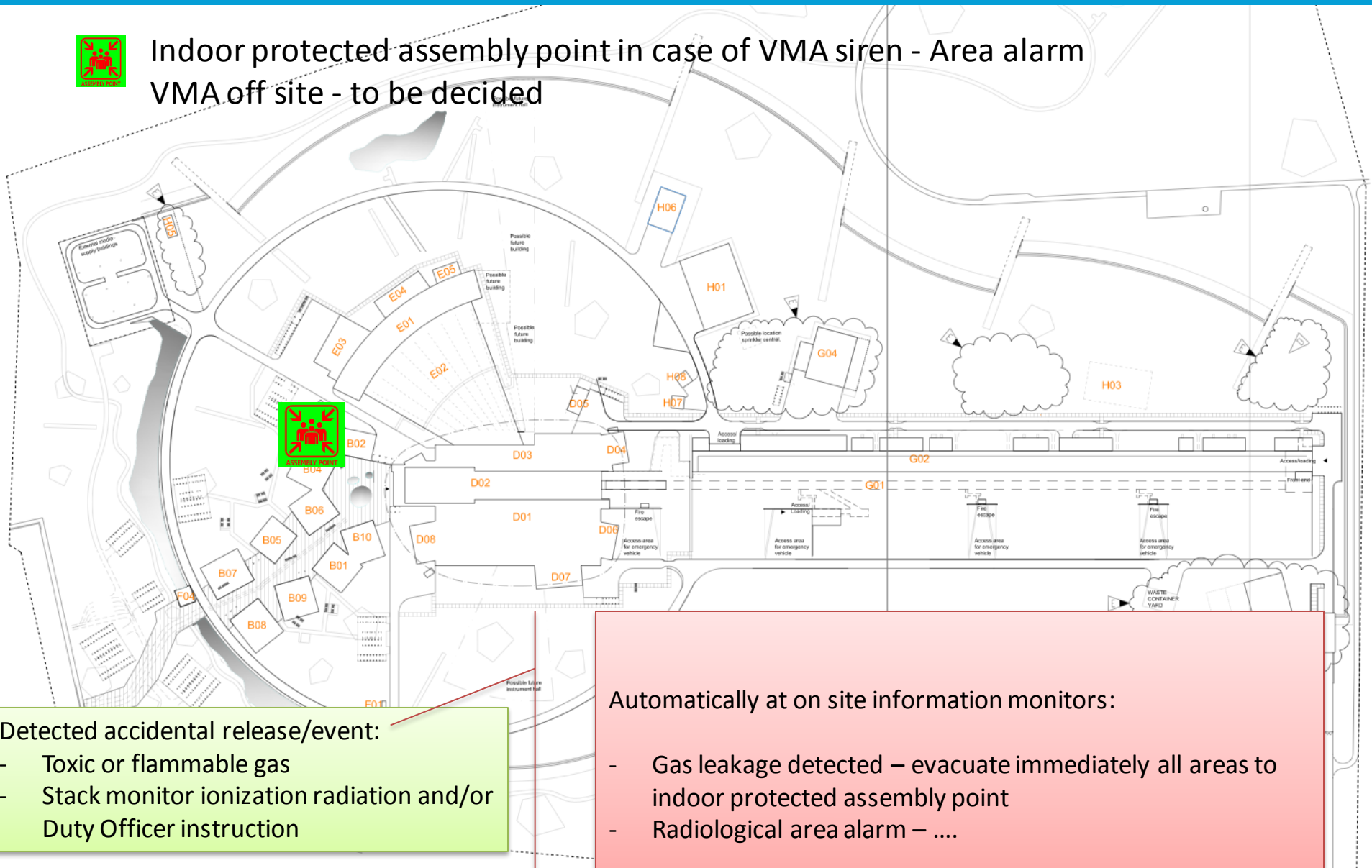
Detected accidental release/event:
- Fire/explosion
- Low oxygen
- Toxic or flammable gas
- Promt radiation (gamma or neutron) or loss of dynamic barrier

Automatically at on site information monitors:

- Fire detected – evacuate immediately this building
- Low oxygen detected – ….
- Gas leakage detected – ….
- Ionization radiation detected – ….

On site indoor protected assembly point

Indoor protected assembly point in case of VMA siren - Area alarm
VMA off site - to be decided



Detected accidental release/event:
- Toxic or flammable gas
- Stack monitor ionization radiation and/or Duty Officer instruction

Automatically at on site information monitors:

- Gas leakage detected – evacuate immediately all areas to indoor protected assembly point
- Radiological area alarm – ….

SSM requirement:
Emergency preparedness zone > 500m

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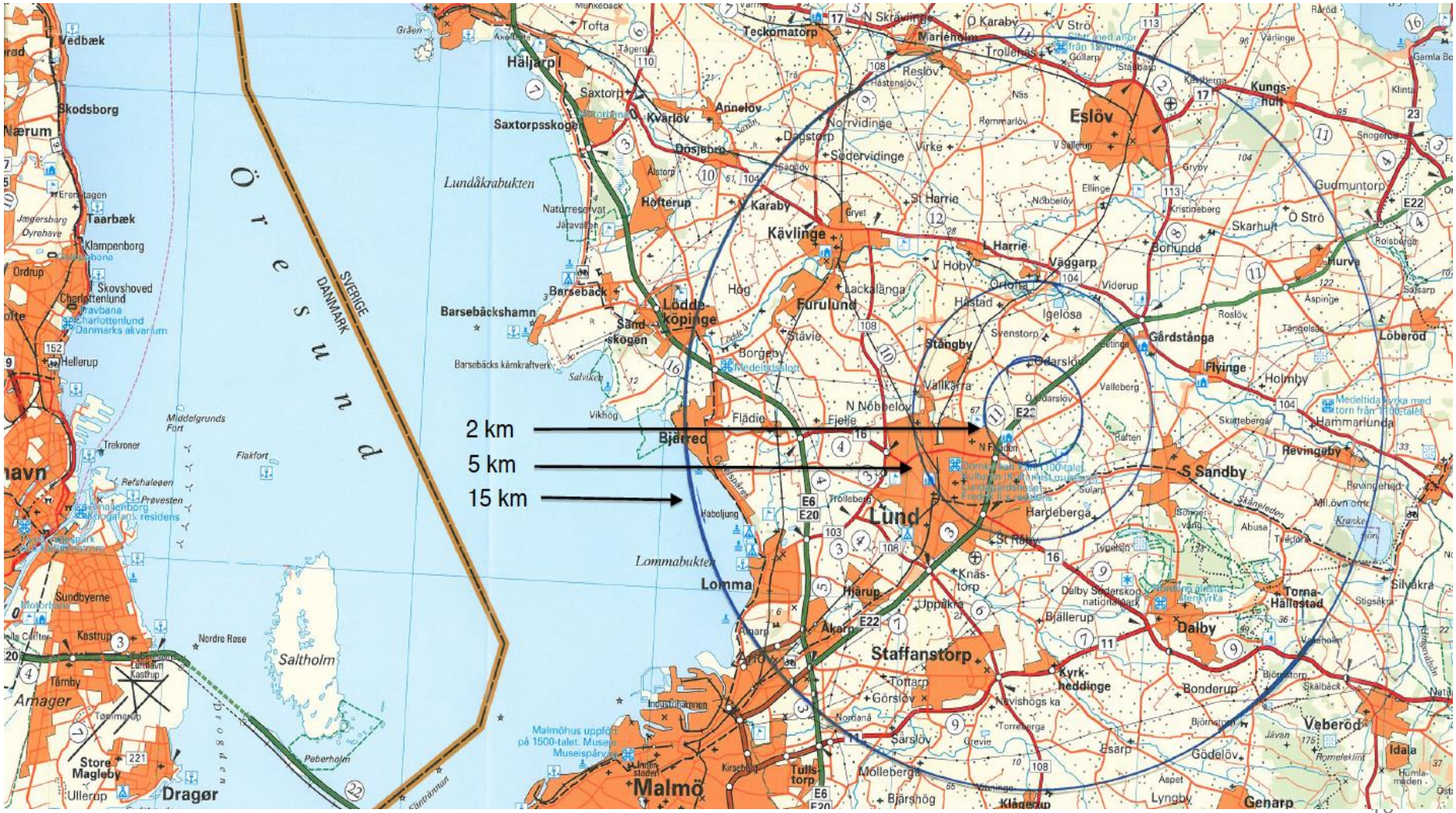
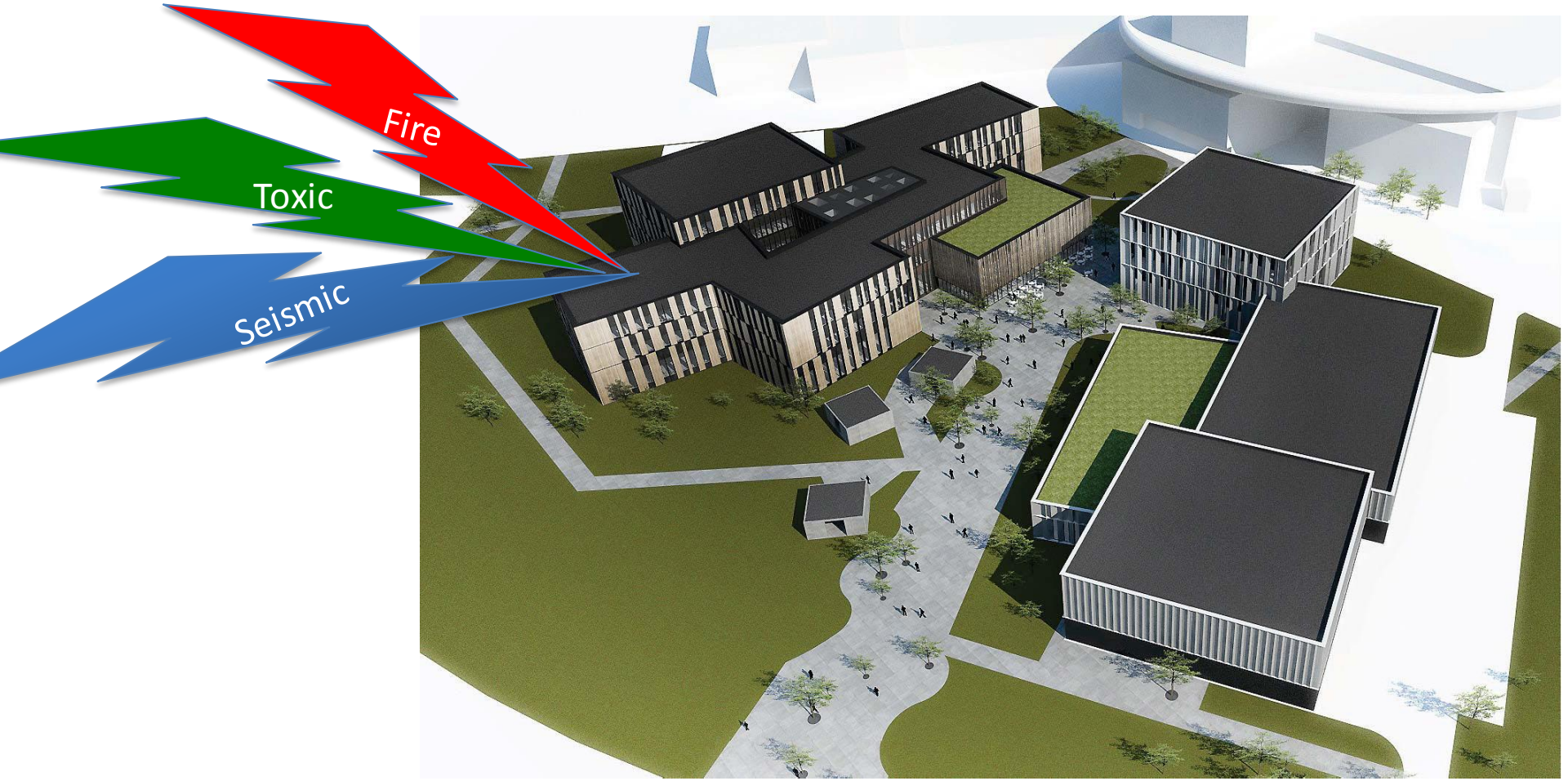


Recent issues & research

- Main Control Room
- Active Cells
- Fiber Optics

Control room in office area



Active Cells – Disassemble and intermediate storage

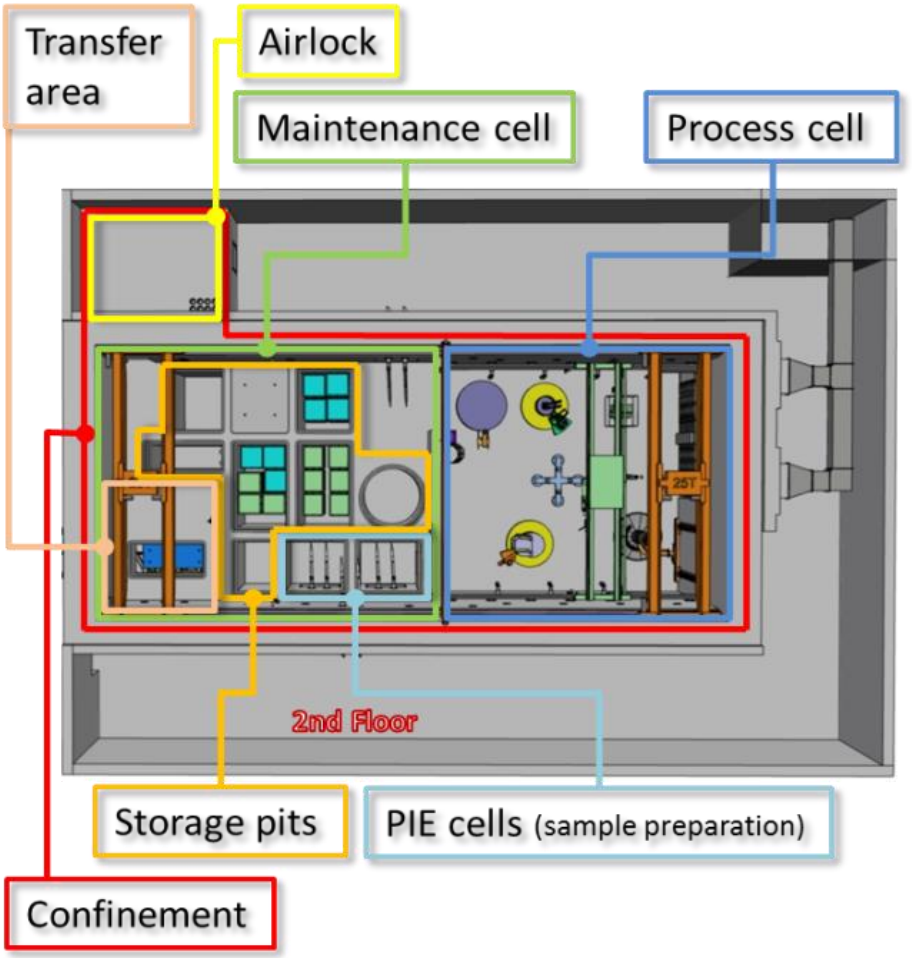
Nitrogen=>

Hypoxic air (ISO 17873:2004) =>

Water mist => ?

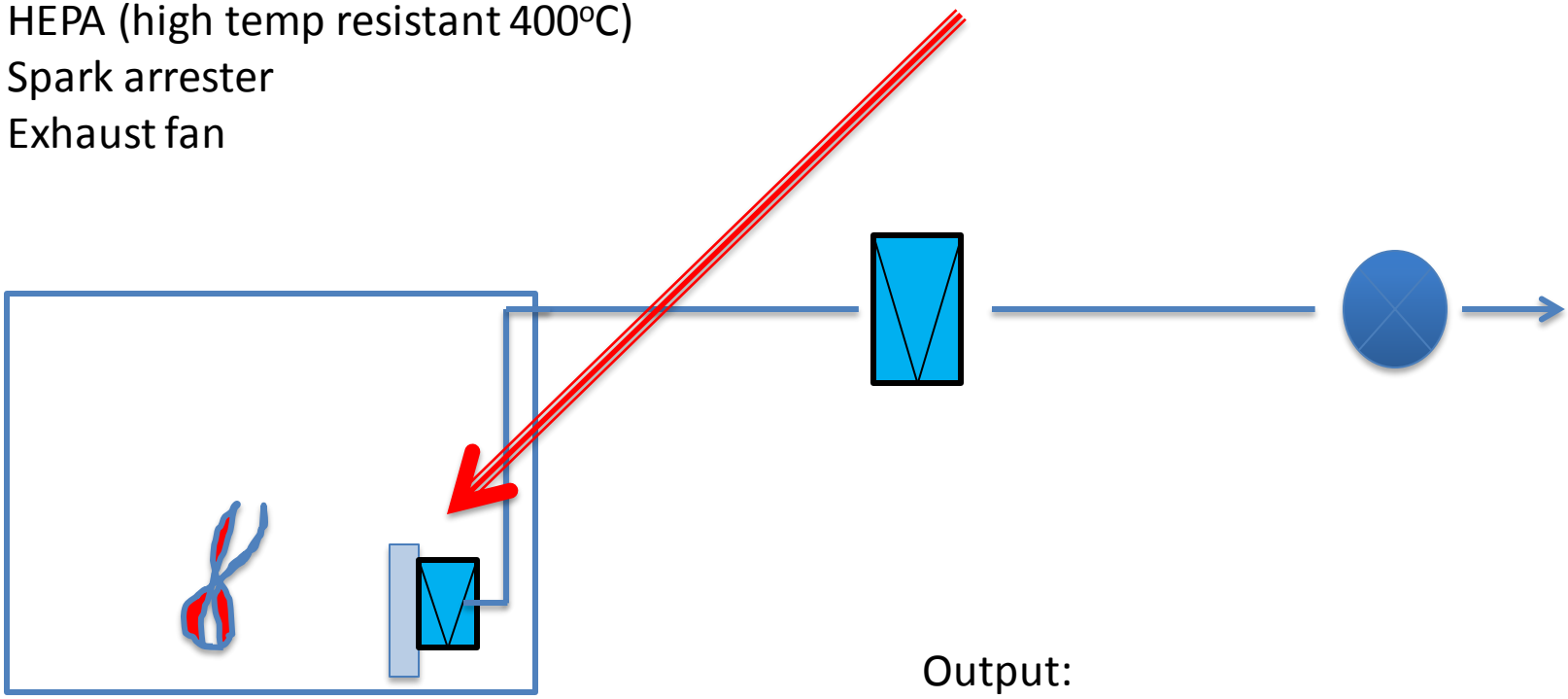
Others have:

- Belgium Experience: Nitrogen
- SNS: Water Mist
- Cadarache: Nitrogen/Argon or manual MG20-Powder



Lack of tests - Spark arrester properties & filter clogging

1. Leak tight container
2. HEPA (high temp resistant 400ºC)
3. Spark arrester
4. Exhaust fan



Variables:

- Fire Properties
- Spark intensity from cutting tool
- Position spark arrester

Output:

- Ignition of filter(s) Y/N
- Delta pressure filter(s)
- Delta pressure containment
- Temp at the filter
- Temp in the container

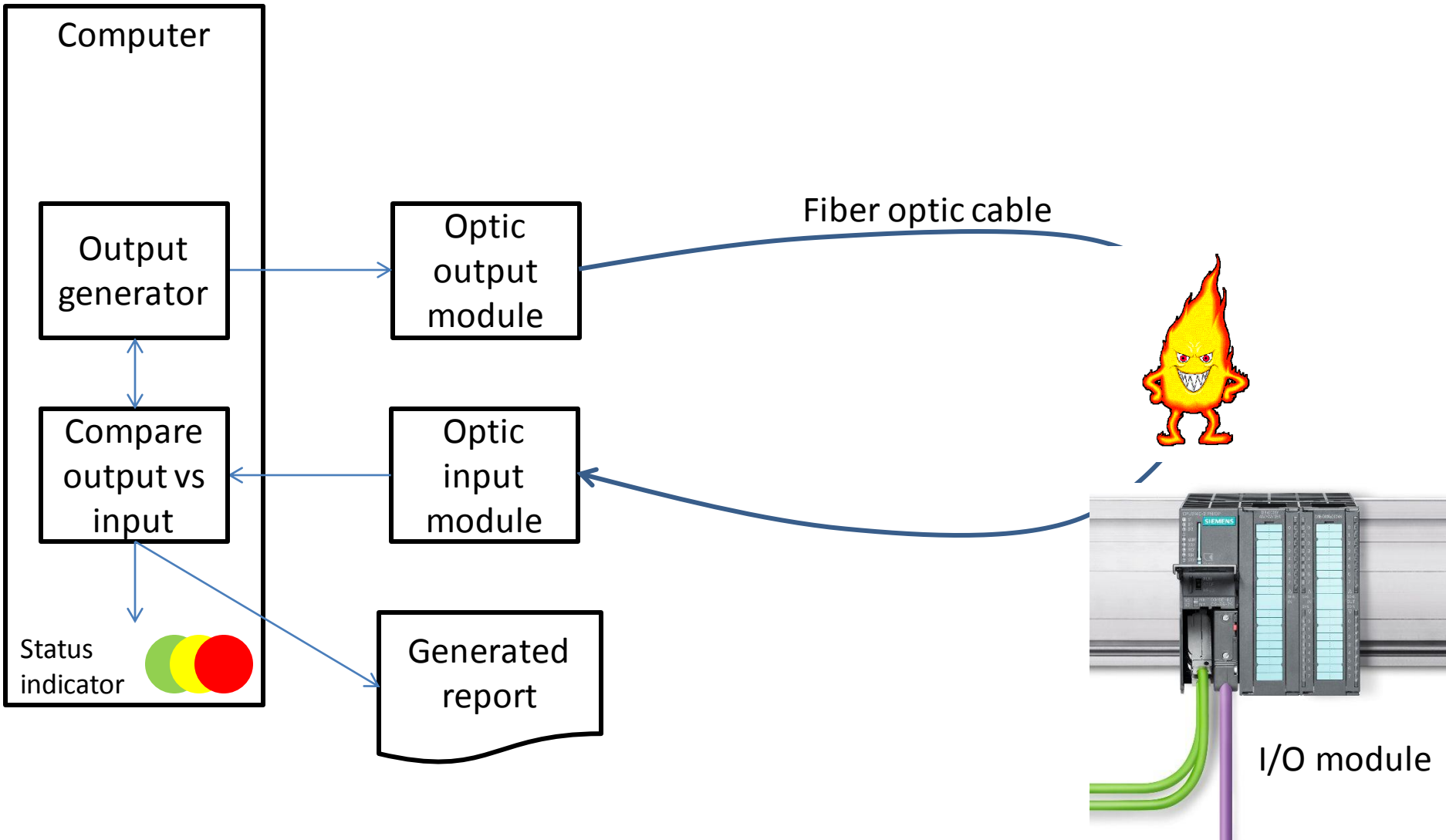
ESS-0029972
SS-EN 60709

Fiber optic communications should be applied wherever practical.

- No attenuation before break !
- Will fire induced failures appear before break ?

Back - up slides

Fiber optics – fire induced failures



Double interlock – empty pipe – open nozzles
Issues - ceiling height & tungsten temperature

Green – Detector pipe sampling (smoke)

Red – Closed heads empty pipe detector (heat)

Blue – Open heads empty pipe with spray nozzles

Stubs
Combustible shielding => sand/concrete

60 min fixed seal

Cable channel none combustible (steel plate) max 0,25x0,5 (SBF 110:7)

If this area needs detection or suppression will be decided based on independent inspection at site acceptance test of SBF 110:7 & SS-EN 12845:2004

Gallery

Tunnel

Position of Control room & Assembly points