



Radiation Protection

Stefan Roesler for HSE/RP



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LS2 Days – 7th & 8th November 2016
<https://indico.cern.ch/event/564604/>

Outline

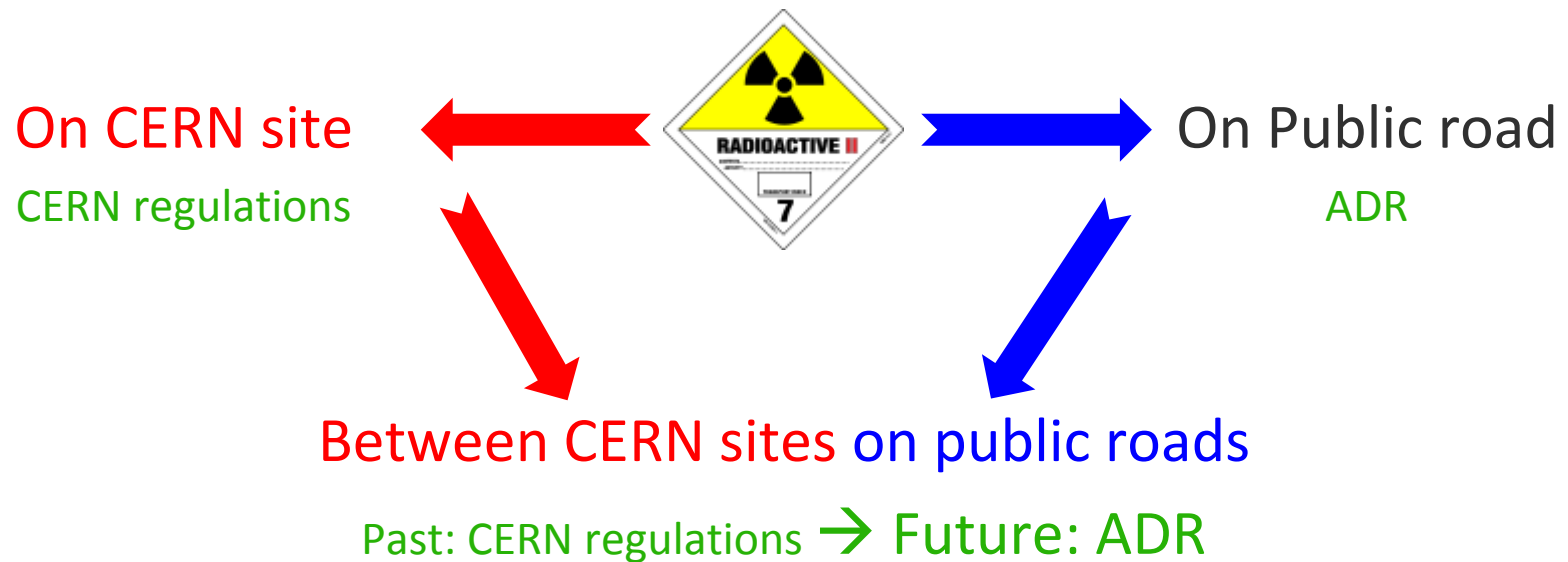
1. New: inter-site radioactive transport procedure
2. New: centralized vacuum cleaner management
3. New: procedure for obtaining access to Radiation Areas for MPA at CERN
4. Reminder/Update: CERN acceptance criteria for radioactive waste
5. Reminder: radiological classification and dose rate estimates for the LHC



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Inter-site radioactive transport - *Legislation*



ADR = Accord européen relatif au transport international des marchandises Dangereuses par Route

Inter-site radioactive transport - *Legislation*

Compliance with ADR means

- Transport classification based on specific and total activity per radionuclide, dose rate, form of content, etc.
- Adequate packaging
- Labelling and transport documents

Goal: ***efficient procedure***, adequate to CERN needs

- Grouping into 8 families of components (see next slide)
- Four families group special items for which specific characterization is needed for transport
- Generic study for the remaining four families (mainly shielding, accelerator and detector components) in order to allow the transport classification only by external dose rate measurement and control of non contamination



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Inter-site radioactive transport - *Categorization*

Nr	Family
1	Sealed sources
2	Alpha emitters & contaminated material
3	Liquids, Gases
4	Ion exchangers
5	Shielding blocks
6	Major accelerator components
7	Special accelerator components
8	Bulk material

- 30% of all inter-site radioactive transports
 - Specific characterization (source certificate, gamma spectrometry, smear test, liquid scintillation counting, etc.)
 - Possibility to easily identify the correct transport class
-
- 70% of all inter-site radioactive transports
 - Transport classification **only** by external dose rate measurement and control of non contamination
 - Need of study to relate measured dose rates to nuclide inventory



Inter-site radioactive transport – *Study*

Comprehensive study

- Most common materials (iron, steel, copper, concrete, aluminium, lead, tungsten)
- Different densities (two per material) and elemental compositions (in case of steel and concrete)
- Different volumes (about 4 cm³ – 4 m³)
- 896 irradiation scenarios (1.4 GeV - 7 TeV, irradiation time 1 day - 20 years, cooling time 1 day - 20 years, 7 different particle spectra)

Results

- Lowest external dose rate at 10 cm over all considered scenarios and parameters corresponding to a certain ADR classification limit (very conservative but very flexible for later use in practise)
- Most restrictive and frequent radionuclide inventory for transported materials
- Conversion coefficients from external dose rate to total activity



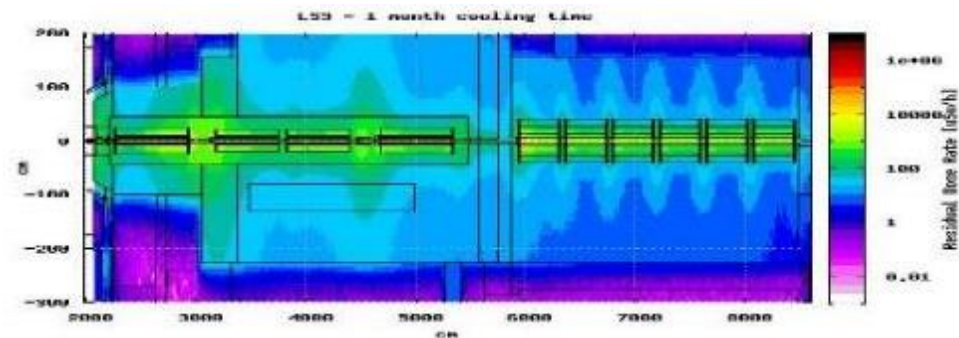
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Inter-site radioactive transport – *Study*

Conclusions from study and agreed with ASN and OFSP

- ADR classification based on external dose rate measurements possible for most situations
- Difficulties (i.e., relevant dose rates for ADR classification below detection threshold) only for small objects (pragmatic solution, see next slide)
- Transport declaration: most restrictive radionuclide inventories available, total activities can be scaled with external dose rates
- Demonstration that the homogeneity of activation of items activated at CERN accelerators are in agreement with ADR for a transport classification



Inter-site radioactive transport - *Packaging*

small items



big items



bulk items



Inter-site radioactive transport - *Packaging*

1. Bulk material (27%):

- Transport in IP-2 container (already done now)
- If classified as Type A use of existing dedicated Type A truck



2. Small items (20%):

- Packaging according to transport classification (no packaging, IP-2, Type A)
- If transport classification by dose rate measurement not possible use of Type A package (conservative)
- Self-transport possible (as in past), but in special (small) container, HSE/RP will identify and certify (as Type A) most cost efficient packaging

3. Big items (23%):

- If possible packaging according to transport classification (no packaging, IP-2, Type A)
- If packaging needed but not possible (about 15 transports per year): RP will request one or two special arrangement(s) to be submitted to ASN/OFSP



Inter-site radioactive transport - *Conclusion*

- Procedure has been developed that allows efficient (=time saving), ADR-conform inter-site radioactive transport
- Transport classification by external dose rate measurement, envelope radionuclide inventories based on study
- ADR-conform transport container already in use (thanks to EN/HE)
- Container for self-transport: HSE/RP is investigating cost-efficient solutions and will take care of certification
- Impact of new radioactive transport procedure to user should be minimal
- Approach agreed with host state authorities, formal approval by Tripartite meeting Nov 24, 2016
- Gradual implementation starting after EYETS



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Vacuum cleaner management

- Creation of centralized service for the management of vacuum cleaner for Radiation Areas by HSE/RP
- Includes purchase, storage, delivery and reception, periodical checks and maintenance as well as repair
- Free of charge, except for loss or damage
- Start and test of new service with EYETS 2016/17
- Location: building 574
- Initial stock (pool) should include all vacuum cleaner presently in use (about 200), request to hand them over to HSE/RP
- Announcement sent to vacuum cleaner owners on 15 October 2016
- Vacuum cleaner will automatically be included into pool unless HSE/RP has received objection
- Start of service: 01/12/2016,
- Test and statistics: EYETS 2016/17



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Vacuum cleaner management

REQUEST

- **At least 24H in advance**
- Web form : <http://cern.ch/rp-vacuum-cleaners>

PROVISION

- Provision in Buffer Zone (or B.574 or delivery in the Radiation Area)
- Automatic email confirmation

USE

- **Before use declare use in TREC**
- **The user is responsible of the vacuum cleaner**

RETURN

- Return in Buffer Zone mandatory
- Declare the end of use (emptying request) in TREC

For any question, please call the RP vacuum cleaner service (Meyrin, B.574): 70037



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Vacuum cleaner management

Model *

- 118H
- IVT1000
- GDS
- Vacuum cleaner for water
- Other

118H: 26kg, capacity 12L, worksites, all works
IVT1000: 8kg, capacity 7L, laboratory, all works
GDS: 5kg, capacity 5L, supervised radiation areas only.

Infos: https://cern.ch/rp-ps/SitePages/vc_infos.aspx
User guide: <https://edms.cern.ch/document/1556473>

Reason *

Work description *

Broomstick needed *

Nozzle needed

Wished Date *

Duration (days) *

Zone *

Location *

Responsible *

Main user

Transport *

Budget code *

Free of charge, the budget code will only be used in case of damage.

Comments

Request form:

<http://cern.ch/rp-vacuum-cleaners>

Declare
Move at CERN
Stock/destock at CERN
Dispatch outside CERN
Vacuum cleaner
Request RP measurement
Update location
My requests
Logout

TREC Traceability of Radioactive Equipment at CERN

Actions Rechercher

S'il vous plaît choisir l'action qui va se passer après la mesure

*Action future

- Aspirateur: declaration d'utilisation
- Aspirateur: fin d'utilisation
- Aspirateur: demande vidange
- Vacuum cleaner: déplacement

Annuler Suivant

Follow-up:

<http://trec.cern.ch>


Access to Radiation Areas for MPA

Present requirements

- A valid contract with CERN
- and**
- successful completion of the required RP training (e-learning for Supervised Radiation Areas or classroom for Controlled Radiation Areas)
- and**
- Institute Certificate **or** Radiation Passport **or** Medical Certificate certifying fitness to work in Radiation Areas



Access to Radiation Areas for MPA

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EDMS 1428686 v3

CERTIFICATE
for associated members of the CERN personnel
occupationally exposed to ionising radiation at CERN

CERN ID (if available)

Name, First name(s) (as in passport)

Date of birth (day/month/year)

Name and address of home institution

Name and email address of the person responsible in matters of radiation protection at the home institution

I, the undersigned, authorized representative in matters of radiation protection of the home institution identified above, hereby certify that the above mentioned associated member of the CERN personnel is employed by or enrolled at our institute and fulfils our requirements to be occupationally exposed to ionising radiation. I, further certify that the home institution complies with all obligations it may have towards him/her in this respect, it being understood that the effective dose he/she may receive at CERN is less than 6 mSv in 12 consecutive months.

If applicable, please indicate a different effective dose constraint and the corresponding period:

I have taken note that CERN is responsible for the operational aspects of radiation protection on its site and that it will provide the specific radiation protection training concerning its installations and procedures applicable at CERN. CERN will perform personal dosimetry for its own purposes¹.

Expiry date of this certificate²:

Date: Signature:

Institute stamp Name of signatory (in block capitals):

Function of signatory:

¹ On request, CERN can provide dosimetry reports.
² The expiry of this certificate will result in the withdrawal of the access authorisations of the associated member of the personnel to CERN radiation areas.

CERN, Dosimetry Service, CH-1211 Geneva 23, Switzerland, Phone: +41 (0)22 76 72155, dosimetry.service@cern.ch

 European Organization for Nuclear Research
European Laboratory for Particle Physics
CH - 1211 GENEVE 23

Reserved for CERN Medical and Radioprotection Services

ID CERN: _____

NOM: _____

PRENOM(S): _____

DATE DE NAISSANCE: _____

DATE D'EXAMEN: _____

DATE FIN DE VALIDITE: _____

MEDICAL CERTIFICATE USER

As a result of the medical examination performed on:

CERN ID (if already attributed) _____

Name (as in passport) _____

First name(s) _____

Date of birth (day/month/year, in figures) _____

Name of institute _____

I hereby declare that he/she:

MAY BE ADMITTED to radiation areas with work which can comprise a professional exposure to the ionizing radiation.
(N.B.: except explicit restriction, the period of validity of aptitude is 24 months as from the date of examination or 12 months if CERN decides to classify the person to category A)

MAY BE ADMITTED BUT WITH RESTRICTION: (please precise) _____

SHOULD NOT BE ADMITTED to radiation areas

Date of examination (day/month/year, in figures) _____ Signature and stamp of Medical Practitioner _____

NOTE TO THE MEDICAL PRACTITIONER

1) This examination is essential to ensure that there is no medical contraindication which would prevent this person from being exposed to ionizing radiation during the exercise of his/her profession.

2) The examination should include a clinical and hematological examination (red and white cells, platelets, differential count).

3) The medical certificate must be given by the person or his/her representative to Dosimetry Service (55-R-004) of the CERN for the delivery of the dosimeter.

P.S: These examinations are not paid by CERN



Access to Radiation Areas for MPA

New policy (following EU directive and Swiss legislation)

- Medical surveillance of Category B Radiation Workers (effective dose for 12 consecutive months less than 6 mSv) no longer required by CERN for any category of personnel
- For MPA the decision to submit Category B workers to medical surveillance will be left to the employer or home institution (i.e., CERN does not require any medical certificate)
- CERN will continue to request the surveillance of Category A Radiation Workers (effective dose for 12 consecutive months >6mSv)



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Access to Radiation Areas for MPA

Future requirements (after EYETS)

- A valid contract with CERN

and

- successful completion of the required RP training (e-learning for Supervised Radiation Areas or classroom for Controlled Radiation Areas)

and

- Institute Certificate **or** Radiation Passport (**for EU, EEA, CH**)
- Information to employer or home institute that CERN assumes the classification as Radiation Worker by default and asks for comments (**for all other countries**)

Medical certificate no longer used for dosimeter attribution at CERN

For further information and future updates see <http://cern.ch/rp-dosimetry>



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Access to Radiation Areas for MPA

Reminder: Short-term visitor (VCT: Visiteur Court Terme)

(users of experiments, stay at CERN is less than two months integrated over a calendar)

- A valid contract with CERN
- and**
- Successful completion of the e-learning for Supervised Radiation Areas

Work is limited to Supervised Radiation Areas and the personal dose is limited to 1 mSv/year



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Radioactive waste - *Acceptance criteria*

The management of radioactive waste starts at the source. A close collaboration between departments, experiments and RP is required to increase efficiency and effectiveness

Internal acceptance criteria are fundamental for the correct management of radioactive waste in order to:


- **Minimize hazards**
contamination, toxicity, avoid dissemination of waste
- **Optimize resources**
Temporary storage space, minimization of resources and costs for the Organization
- **Facilitate disposal**
Minimize the non conformities
Ensure compliancy with the acceptance criteria for waste to be disposed of towards Switzerland and France



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Radioactive waste - Acceptance criteria

CERN CH-1211 Geneva 23 Switzerland 	EDMS NO. 1364231	REV. 1.8	VALIDITY RELEASED
	REFERENCE -		
Date : 06-11-2015			
CERN'S INTERNAL ACCEPTANCE CRITERIA FOR RADIOACTIVE WASTE			
<p>ABSTRACT: This document details CERN's internal acceptance criteria for the radioactive waste produced by the Departments to be treated by the Radiation Protection Group (DGS-RP). The purpose of the internal acceptance criteria is to minimize the risks of radiation and contamination for the operators as well as the dissemination of waste, to optimize the resources committed (storage space, manpower) and to facilitate the assembly of the packages for disposal.</p> <p>In the event that the waste owner foresees that he will not meet the acceptance criteria, he can contact the "Radioactive Waste" Section of the DGS-RP Group (rp-rw-operational@cern.ch) to study a conditioning procedure that will take into account the technical possibilities and the type of non-compliance foreseen.</p>			
DOCUMENT PREPARED BY: L.BRUNO [DGS-RP] M.GUICHARD [DGS-RP] L.ULRICI [DGS-RP]	DOCUMENT CHECKED BY: S.ROESLER [DGS-RP] M.MAGISTRIS [DGS-RP] Y.ALGOET [DGS-RP] Hz.VINCKE [DGS-RP] T.SCHMITTLER [DGS-RP] R.MICHAUD [DGS-RP] N.CONAN [DGS-RP] G.DUMONT [DGS-RP] C.TROMEL [DGS-RP] A.ERRAHHAOUI [DGS-RP]	DOCUMENT APPROVED BY: D. FORKEL-WIRTH [DGS-RP]	
DOCUMENT SENT FOR INFORMATION TO:			
This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use .			

The following materials shall be identified, sorted and delivered in separate containers:

- Combustible material
- Material with risks other than radioactivity and combustibility
- Electronic devices and electronic cards
- Cables
- Ventilation filters
- Fluorescent tubes and light bulbs

Only the containers listed in Annex I are accepted

- SCEM codes are given for each type of container
- Containers shall be procured by the project

All radioactive waste must be identified in TREC and labelled










Radioactive waste - Acceptance criteria

New version as from end of November 2016

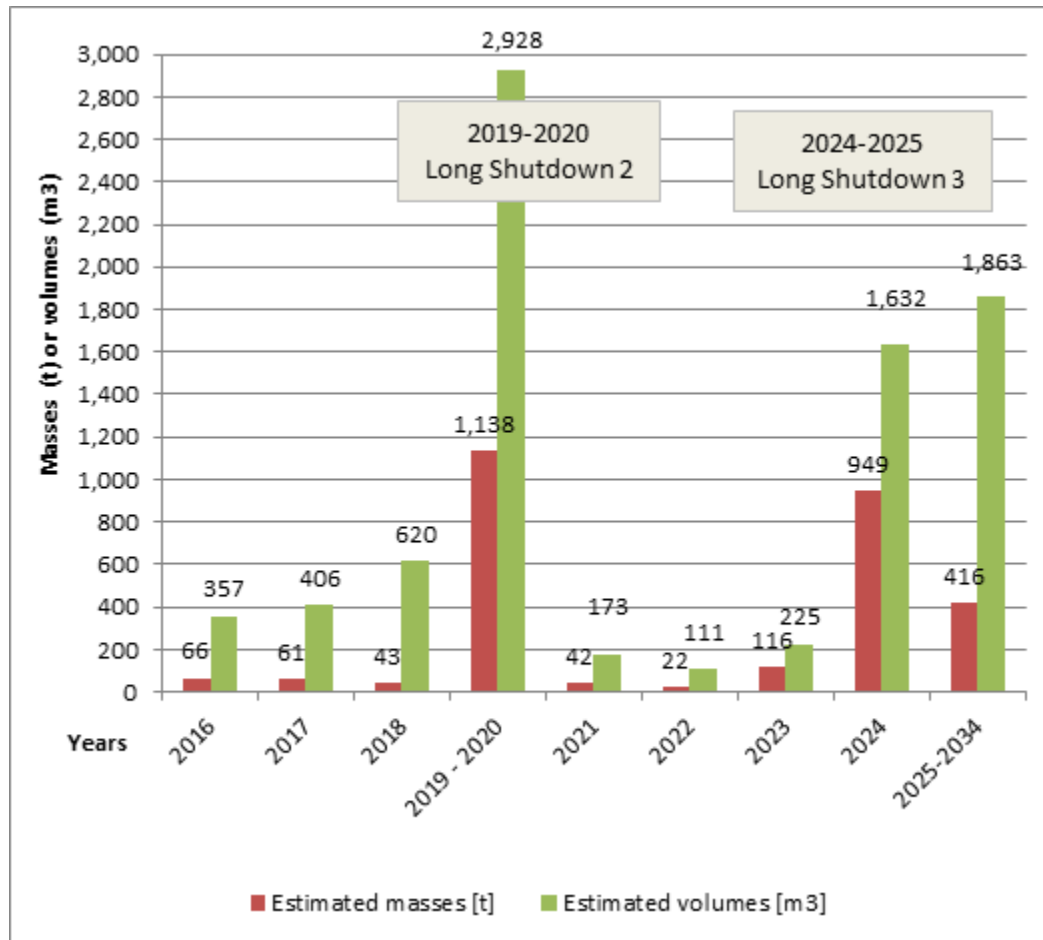
Changes in the internal acceptance criteria

- Update of the container list
- Check list included in TREC
- Content of the 1 m³ containers limited to 1200 kg
- Specific requirements on: liquid waste, radioactive labels for burnable waste
- Annex with specific criteria (cables)
- Available in English and French

N° EDMS 1724006 REV. 0.1 VALIDITE : DRAFT	
 RADIOACTIVE CABLES	
Packaging	1.35 m ³ ANDRA container or 2.77 m ³ ANDRA container  or  SCEM : 55.50.75.400.5
Maximal gross mass	= 5 t
 Packaging inside the containers	<ul style="list-style-type: none">✓ Cables connectors must be removed and packaged separately.✓ Cables must be packaged separately per family, i.e. power cables in copper, power cables in aluminium, signal cables in copper, coaxial cables in copper and coaxial cables in aluminium/copper. If this is not possible, please contact HSE-RP-RW.✓ Cables must be cut at the length or width size of the container.  
 Restrictions	<ul style="list-style-type: none">• The packages must only consist of 100 % cables (no connectors).• Cables presenting significant levels of contamination (see with HSE-RP-AS) must be packaged separately.• If the dose rate of the package > 100 µSv/h, please contact HSE-RP-RW.
For any situation where the above conditions cannot be fulfilled, please contact HSE-RP-RW, rp-rw-operational@cern.ch .	
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Radioactive waste – *Estimate until LS3*

Status January 2016

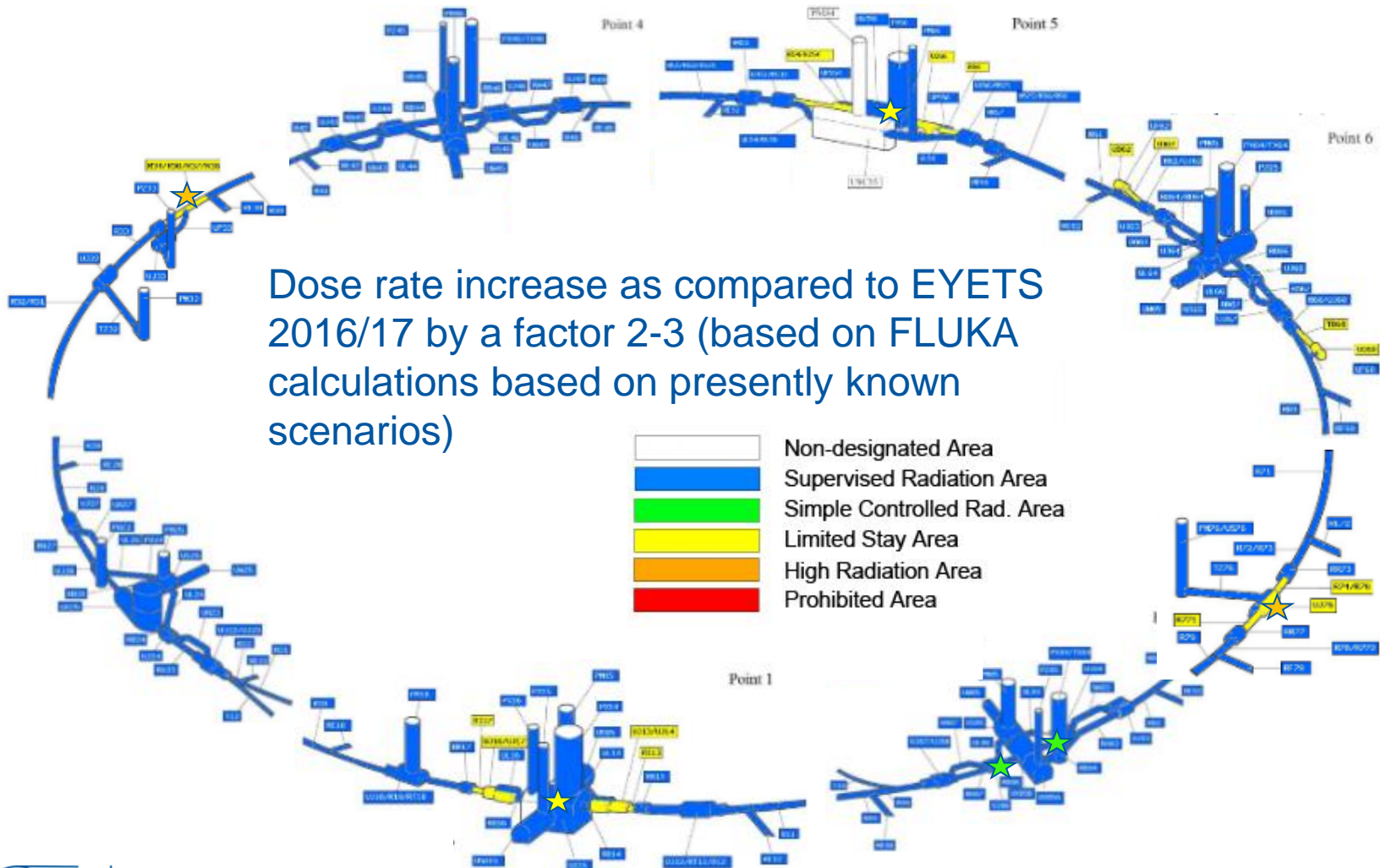


Update of the estimate of future waste is needed for the correct planning of storage space and the waste elimination planning.

Please send updates to rp-rw-operational@cern.ch or contact HSE-RP-RW



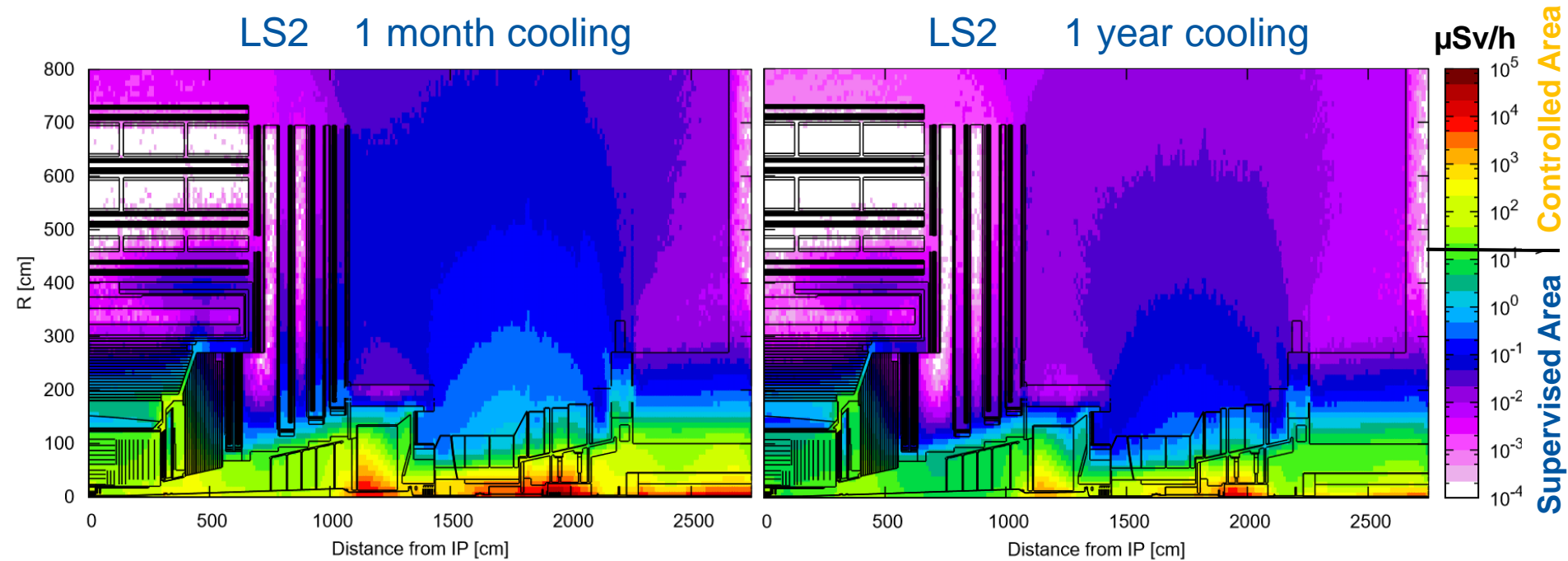
Radiological classification - LHC



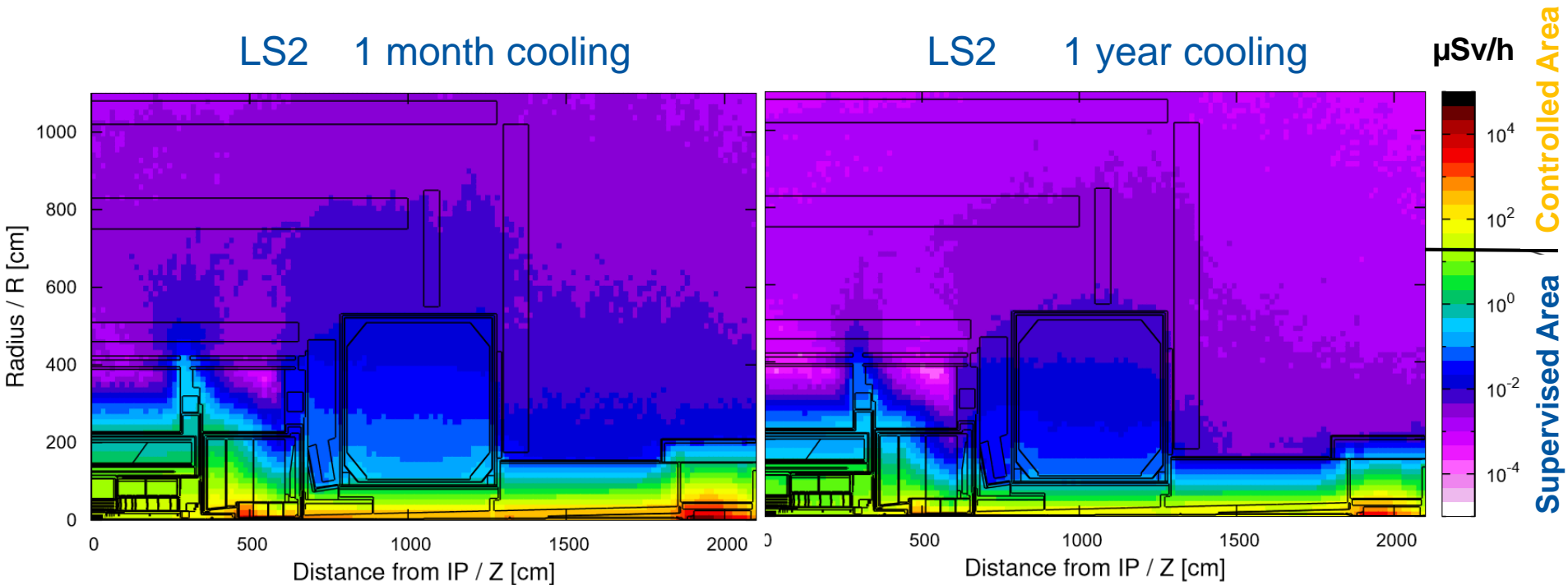
Radiological classification - CMS

LS2 1 month cooling

LS2 1 year cooling



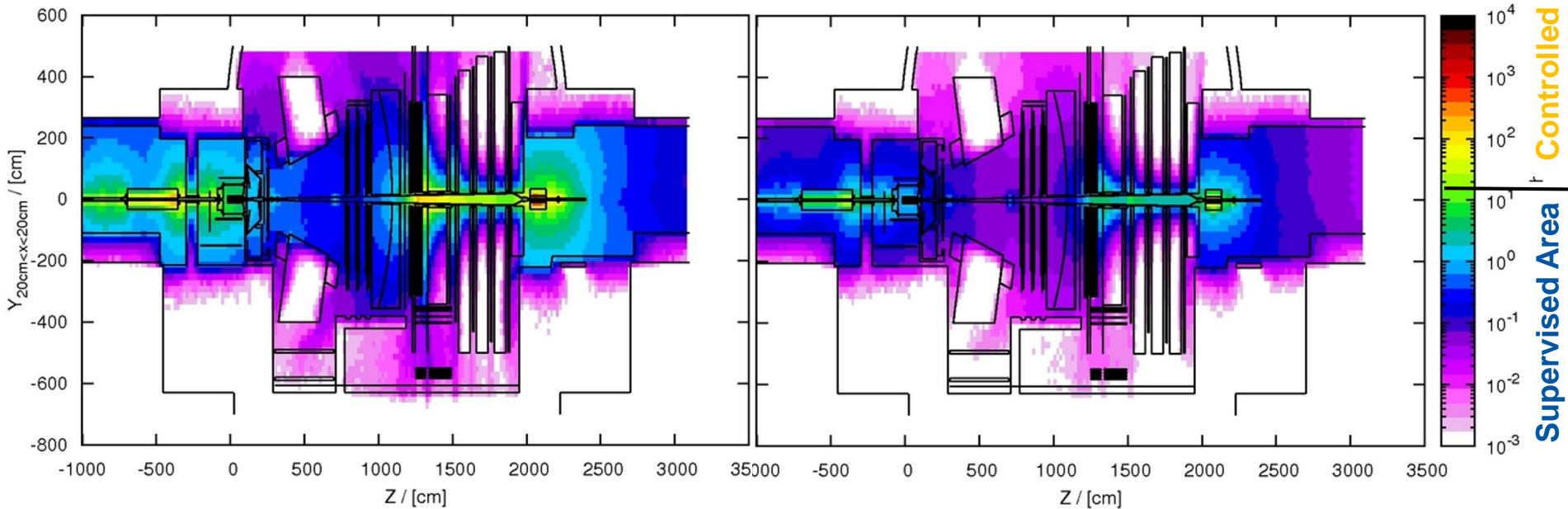
Radiological classification - *ATLAS*



Radiological classification - *LHCb*

LS2 1 month cooling

LS2 1 year cooling



Conclusions

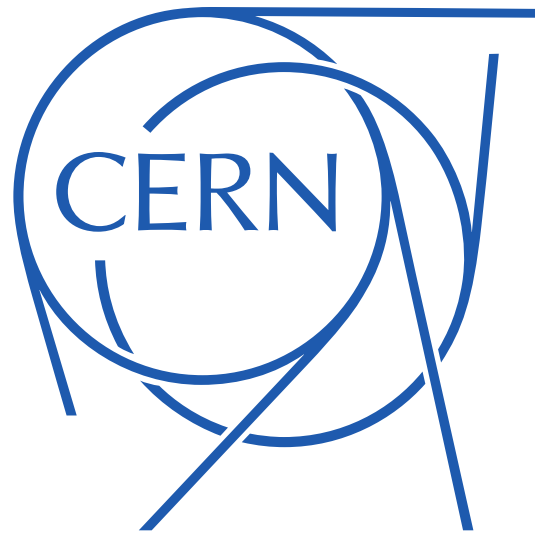
1. **New: inter-site radioactive transport procedure**
 - Method developed that allows efficient inter-site transport according to ADR, agreed by host state authorities
 - Procedures now being elaborated and implemented (after EYETS)
2. **New: centralized vacuum cleaner management**
 - Centralized service will start Dec 1, 2016 pooling all vacuum cleaner available at CERN
 - Free of charge for users
 - EYETS used as first test
3. **New: procedure for obtaining access to Radiation Areas for MPA at CERN**
 - After EYETS no medical surveillance of category B Radiation Workers
 - Medical certificates no longer required nor accepted for dosimeter attribution
4. **Update: CERN acceptance criteria for radioactive waste**
 - Update of acceptance criteria procedure by end Nov 2016
 - Update of radioactive waste estimates until LS3 during 2017
5. **Reminder: radiological classification and dose rate estimates LHC**
 - Dose rate increase as compared to EYETS 2016/17 by a factor 2-3
 - Estimates available for work planning and optimization



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Thank you for your attention !



Additional information



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Inter-site radioactive transport – Study

Small blocks and solid components



< 100 nSv/h

< 32x32x32 cm ³	Iron	Steel	Concrete	Copper	Lead	Tungsten
Dose rate @ 10 cm	uSv/h	uSv/h	uSv/h	uSv/h	uSv/h	uSv/h
A. conc. exempt material	1.37E-03	5.74E-03	3.07E-03	8.95E-03	4.55E-04	3.76E-04
A. exempt consignment	1.35E-04	2.50E-03	8.96E-04	2.36E-02	4.00E-05	3.27E-04
Excepted Mat. Package	5.26E+00	5.85E+01	3.01E+01	4.43E+01	1.43E-01	7.48E-02
LSA-I	4.11E-02	1.72E-01	9.20E-02	2.69E-01	1.36E-02	1.13E-02
LSA-II	6.93E+02	7.34E+03	5.49E+02	7.47E+03	4.42E+01	2.76E+01
LSA-III	1.39E+04	1.47E+05	1.10E+04	1.49E+05	8.84E+02	5.53E+02
A2	5.26E+03	5.85E+04	3.01E+04	4.43E+04	1.43E+02	7.48E+01



Inter-site radioactive transport – Study

Large blocks and solid components



< 100 nSv/h

> 32x32x32 cm ³	Iron	Steel	Concrete	Copper	Lead	Tungsten
Dose rate @ 10 cm	uSv/h	uSv/h	uSv/h	uSv/h	uSv/h	uSv/h
A. conc. exempt material	2.68E-01	1.13E+00	1.31E+00	1.63E+00	5.47E-02	4.57E-02
A. exempt consignment	2.04E-06	3.57E-05	1.83E-05	3.61E-04	5.72E-07	4.29E-06
Excepted Mat. Package	7.90E-02	8.36E-01	6.25E-01	6.76E-01	2.08E-03	9.82E-04
LSA-I	8.03E+00	3.39E+01	3.92E+01	4.90E+01	1.64E+00	1.37E+00
LSA-II	1.36E+05	1.51E+06	2.32E+05	1.30E+06	5.32E+03	2.78E+03
LSA-III	2.71E+06	3.02E+07	4.64E+06	2.59E+07	1.06E+05	5.56E+04
A2	7.90E+01	8.36E+02	6.25E+02	6.76E+02	2.08E+00	9.82E-01

