Radiation Protection in LS2

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CERN | LS2 DAYS
29-30 SEPTEMBER 2015

http://indico.cern.ch/event/436424/

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- radioactive transport
- radioactive material and waste

Conclusion

Radiation Protection Rules

New Swiss Radiation Protection Ordinance will enter into force in January 2017

Major change: clearance limits for radioactive material

Council Directive 2013/59/Euratom of 5th December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionizing radiation

and repealing Directive 89/618/Euratom, 90/641Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom

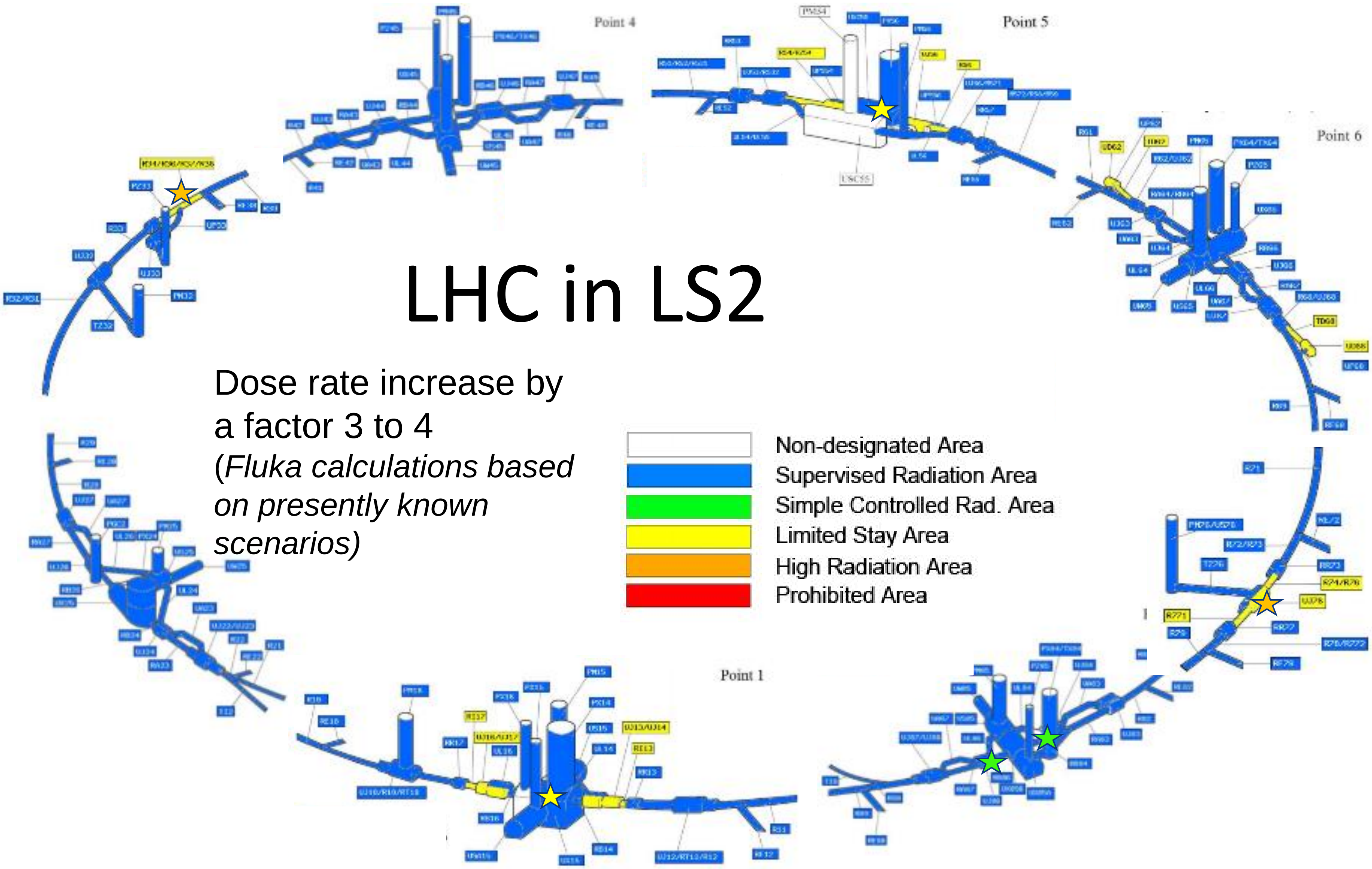
To be implemented by EU member States by 2018

No major impact for CERN

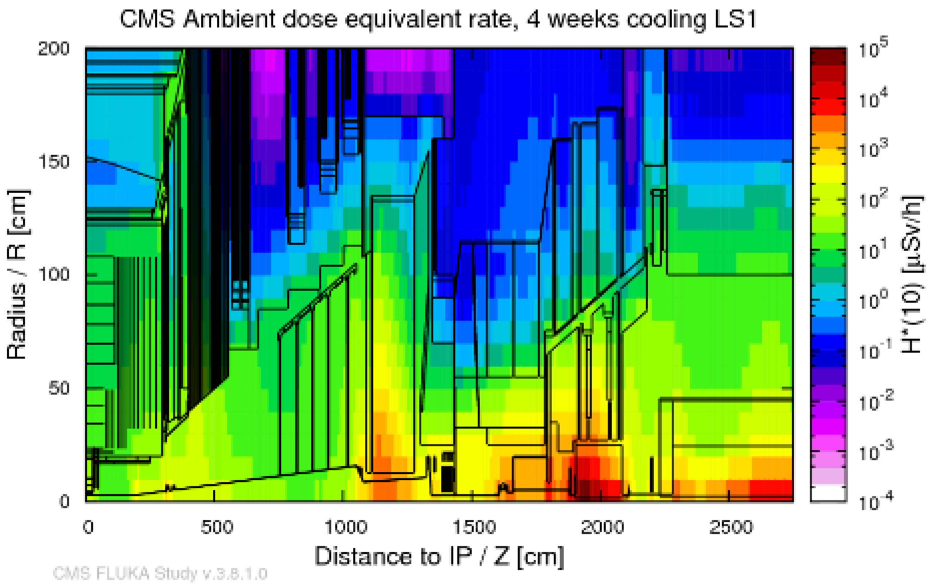
LHC in LS2

Dose rate increase by a factor 3 to 4

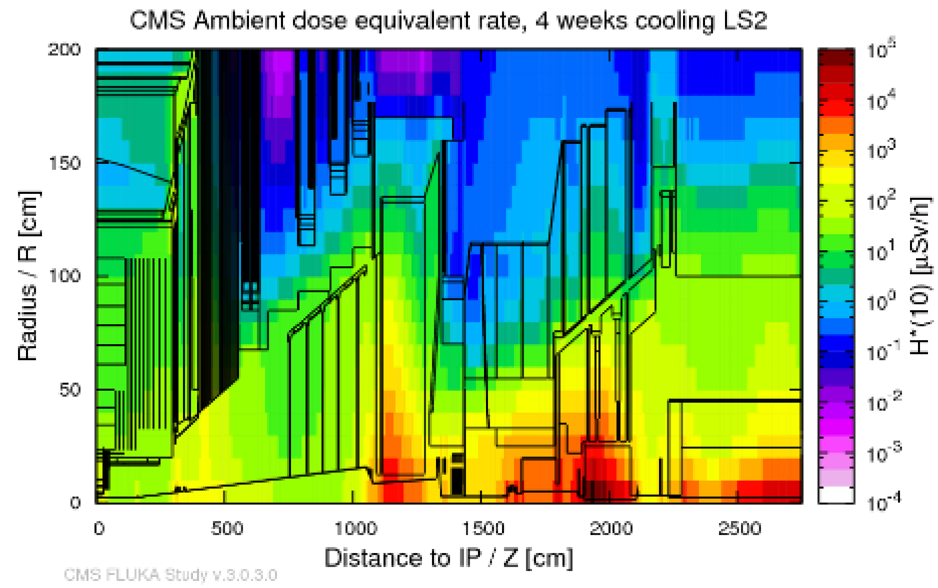
(*Fluka calculations based on presently known scenarios)*



CMS in LS1

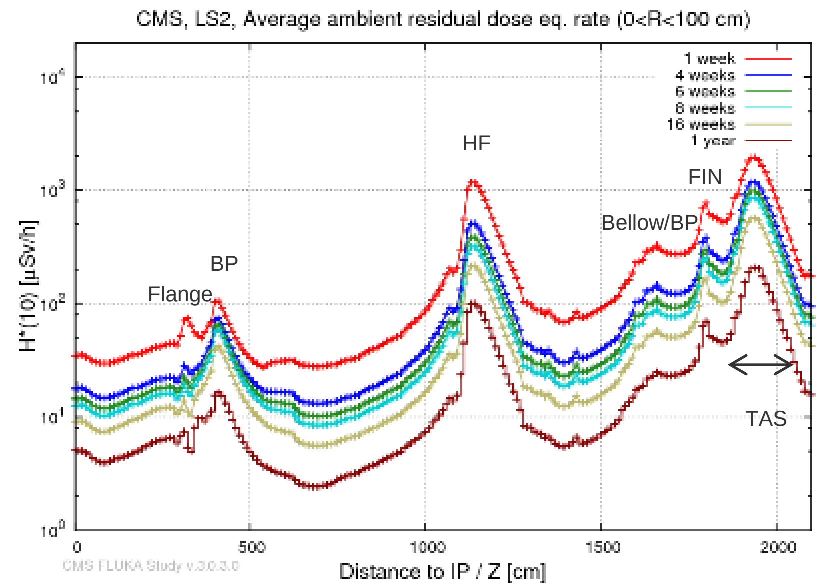


CMS in LS2



ATLAS/CMS in LS2:

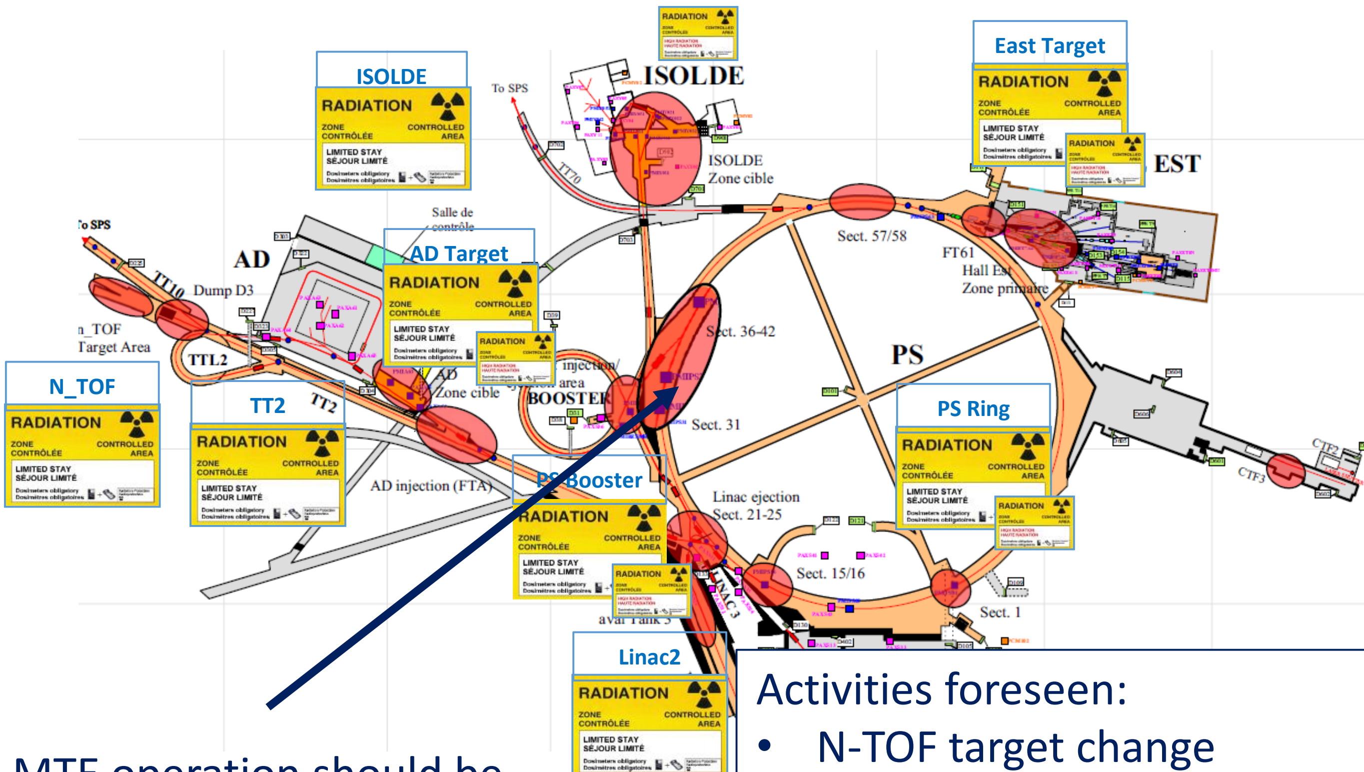
- Increase of dose rate by a factor of 2 – 3
- Exchange of some steel components by aluminum in LS1 (in ATLAS) -> (local) decrease of dose rates
- *Supervised Radiation Area* for major part of cavern
- *Limited Stay Area* around Forward Shielding and Inner Detector



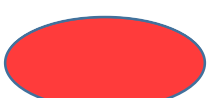
LHCb/ALICE: *Supervised Radiation Area*

Radiological Situation in PS complex in LS2

No major changes when compared to LS1



MTE operation should be beneficial and decrease radiation levels

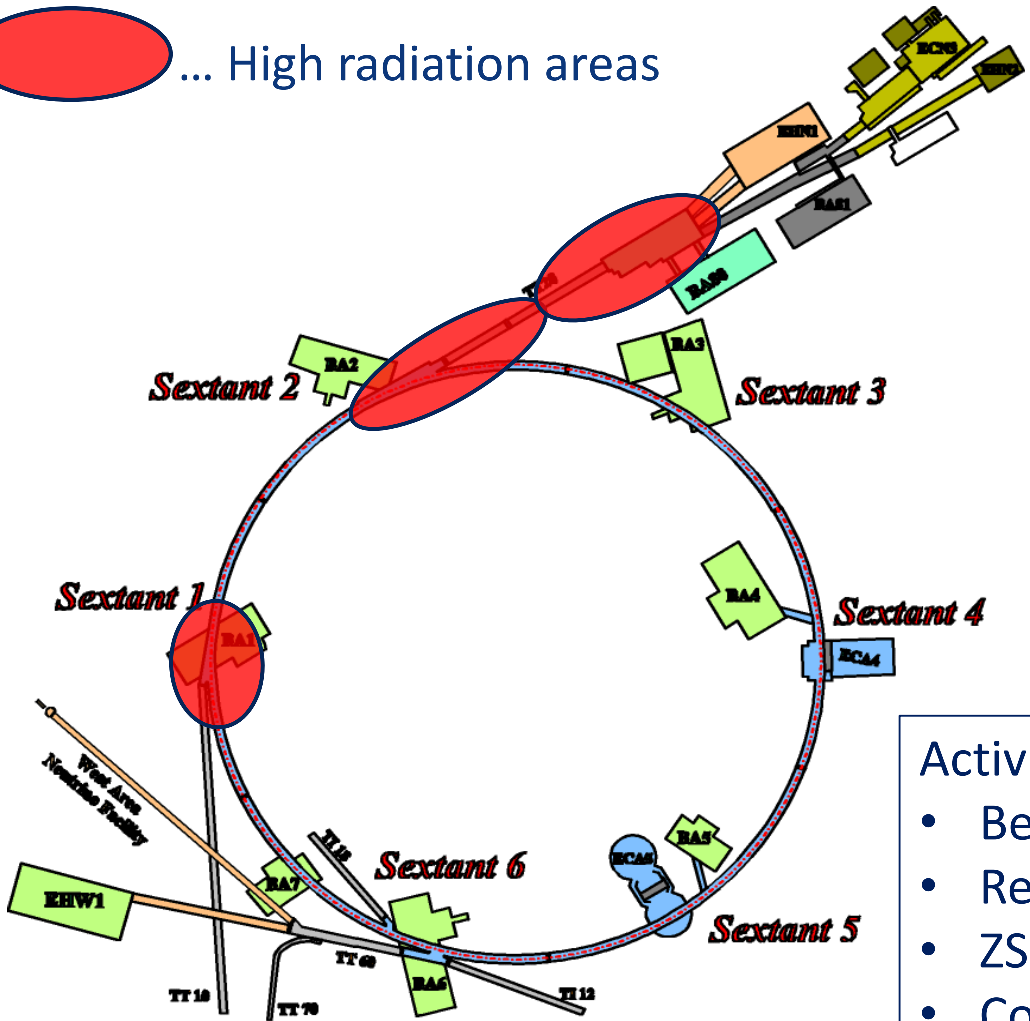

... High radiation areas

Activities foreseen:

- N-TOF target change
- East Area target up-grade and consolidation
- AD target area up-grade and consolidation
- PSB modifications in injection area
- LINAC4 connection

Radiological Situation in SPS complex in LS2

… High radiation areas



Radiation levels compared to LS1

- BA2 - TT20 - TDC2/TCC2:
  Dose rate levels might increase by a **factor of 3** (in case high intensity to North Area remains)
- BA1: no major changes expected
- BA3 and 5: new losses seen in 2015 which might lead to increased dose rate levels compared to LS1 (at the moments no details foreseeable)

Activities foreseen:

- Beam dump installation in BA5
- Removal of beam dumps in BA1
- ZS improvements
- Coating activities (test campaign)
- De-cabling campaigns

Preparation of LS2 Activities

Close involvement in the activity preparation
(like RP in Decabling Campaign Working Group, SMACC, AD stripline repair):

RP constraints known from the beginning

RP performs early risk assessment and contributes to problem solving

RP requirements integrated into technical specification

RP and equipment team - direct communication

Good and permanent communication at all levels is key:

RP participates in all coordination meetings

+ regular meetings between RP, RSSOs and RPEs?

+ RP to go into the equipment groups and sections?

+ ...

ALARA (1)

CERN's (individual) dose objective of 3 mSv/year during LS1 was discussed with the Complex Manager and decided by the Director General!

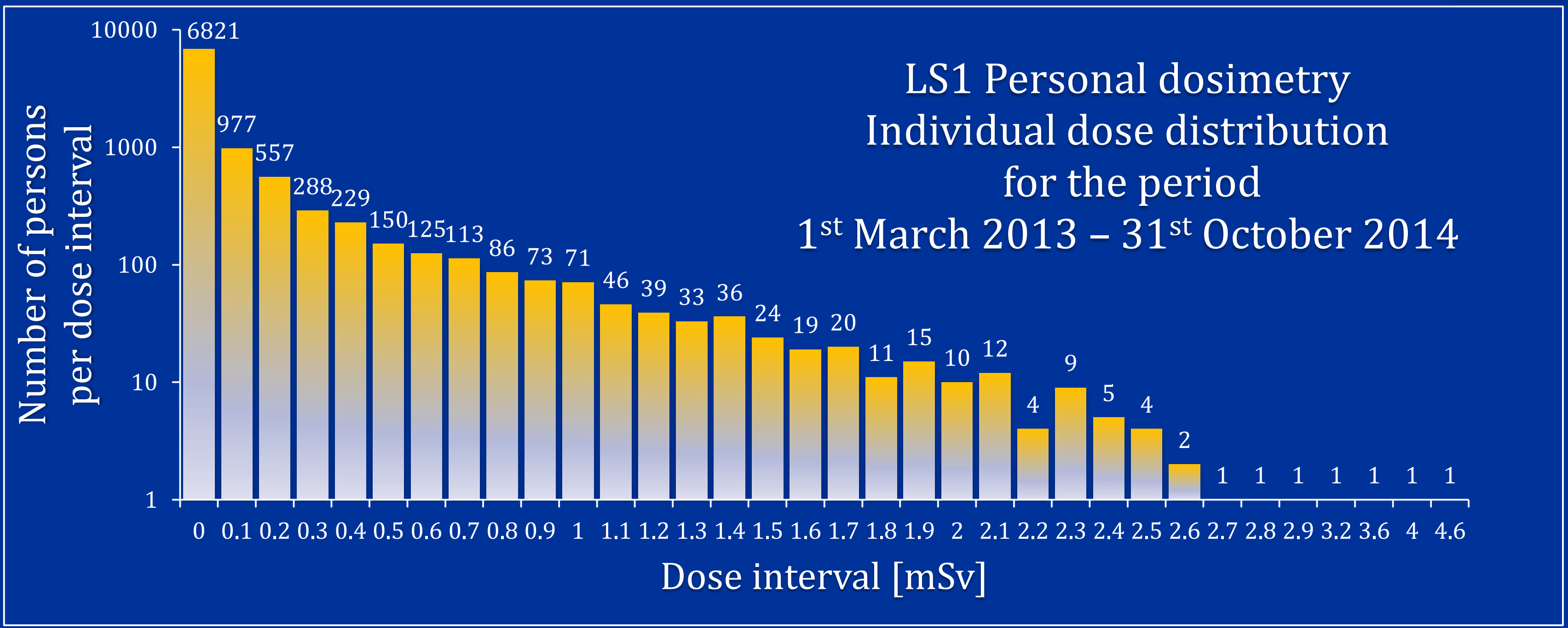
- Dose objectives are not dose limits!
- Dose objectives are good practice in radiation protection!
- Dose objectives contribute to the protection of workers!

Cat B workers intervene in CERN's Limited Stay and High Radiation Areas – justified as CERN takes dose objective seriously!

Safety@CERN in 2014

Dosimetry in LS1

- **CERN's objective** to keep the dose to its radiation workers below 3 mSv/year was largely met*!



*(*only two workers slightly exceeded the 3 mSv/year)*

- ALARA became an essential and natural part of CERN culture!

DG's New Year's Speech 2015

ALARA (2)

Job and dose planning to be done during Runs or early in LS

-> conservative dose estimate based on educated assumptions (dose rate, time)

-> real dose taken during interventions is in many cases lower than estimated dose

-> might cause surprise

ALARA rules will not change for LS2

However:

Optimizing the work is the key issue for pro-active radiation protection (and safety!)

Observation (worldwide including CERN): quality of the work improves

Ideal: ALARA committees during RUN - preparation during LS stressful for all parties involved

RP Training

RP training scheme will not change in LS2:

- e-learning for Supervised Radiation Areas
- face to face training for Controlled Radiation Areas

RP courses are continuously up-dated - no need for special LS2 RP courses

But:

Refresher scheme to be developed in 2016!

Number of workers arriving and influx distribution over LS2?

Insourcing of RP training for contractors?

Languages other than French and English?

Pool of CERN accredited translators?

Being studied

Dosimetry

LS1: 9000 persons/y monitored

Dosimeter	Type	Assigned (2015)	Dosimetry service (2015)	Price/item
DIS	personal	6500	**500**	350 CHF
DMC	operational	1100	**200**	700 CHF

- **Number of workers arriving, influx distribution over LS2?**
- Increase pool use for operational dosimeters?
- Operational dosimeter to be connected to access and checked if switched on!
- Distribution system for operational dosimeters at the access points?
- Safe return points for both types of dosimeters spread over CERN?
- *Impact number to be selected at the access points via touch screen*

RP Operational Aspects in LS2 Activities (1)

- An RP member in the activity team!

- Activity planning:
  - balanced distribution of activities over time to avoid rush later!
  - allocate sufficient time for testing and contingency at the end of LS2!
  - finishing the LS2 jobs should have priority over cold-check out!

- Infrastructure:
  - radioactive workshop Bat 109 (Meyrin) sufficient for LS2?
  - new, mechanical radioactive workshop in Prevessin to reduce number of intersite transports (BE-BI: 600 transports during LS1!) ?
  - some buffer zones are too small and more are needed (SPS/BA80)!
  - Lack of storage for radioactive material and for waste!

RP Operational Aspects in LS2 Activities (2)

RP to provide a list with SCEM code for RP related PPE and specific items like containers

- PPE:
  - PPE costs to be included in the activity or budget!
  - Recommended: dedicated work clothes (e.g. cotton) in radiation areas
  - Obligatory: special clothes (e.g. tyvek, gloves, overshoes) in areas with risk of contamination!
  - PPE supply for big worksites by a central GS-IS service?

- Containers:
  - Costs to be included into activity or project budget!
  - CADRA (EDMS 1364231) lists the types of container

RP Operational Aspects in LS2 Activities (3)

- Vacuum Cleaners (VC):

Proposal: central management of VCs for radiati

Test in YETS and EYETS?

Dedicated RP service

Regular RP checks for contamination, dose rate, filtration efficiency, integrity & performance

- Follow-up and traceabilit location, maintenan verifications, et
- Transport
  - E rt for
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Optim ability and

o

ol allows efficient use of VCs

- Regular checks and close follow-up: less damages, less maintenance, improved reliability
- Reduced transport delay
- Reduced maintenance delay

Estimated costs: 130 - 190 kCHF/y

Radiological Control of Material

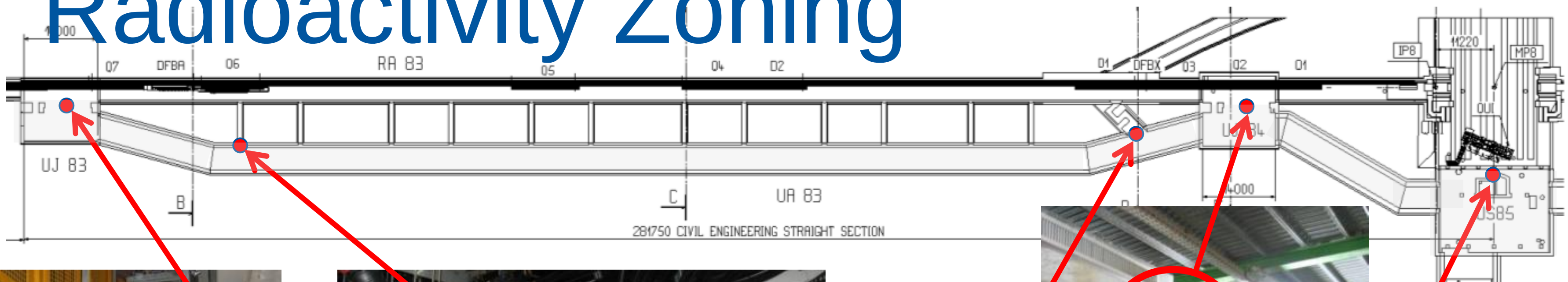
Future clearance limits will not allow the classification of potentially radioactive material as non-radioactive based on dose rate or count rate measurements only

Isotope	LS1	LS2
22Na	3 Bq/g	0.1 Bq/g
54Mn	10 Bq/g	0.1 Bq/g
60Co	1 Bq/g	0.1 Bq/g

Way out:

- "Radioactivity Zoning" for all facilities - like LHC (tunnel versus galleries)
- Development of new characterization technique combining
    - dose rate measurements
    - γ-spectroscopy
    - MC simulation

Radioactivity Zoning



UJ83A

UA83A

UJ84A

Samples in the area

Subdividing areas according to level of radioactivity for handling, intersite transport and waste

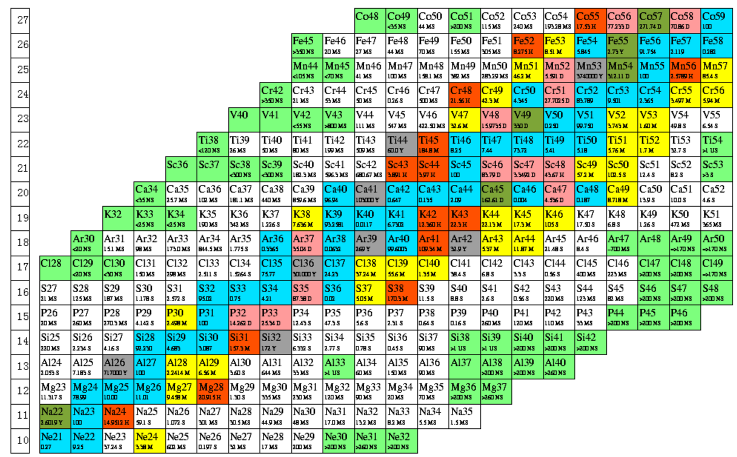
UA83B

US85A

Intersite Transport

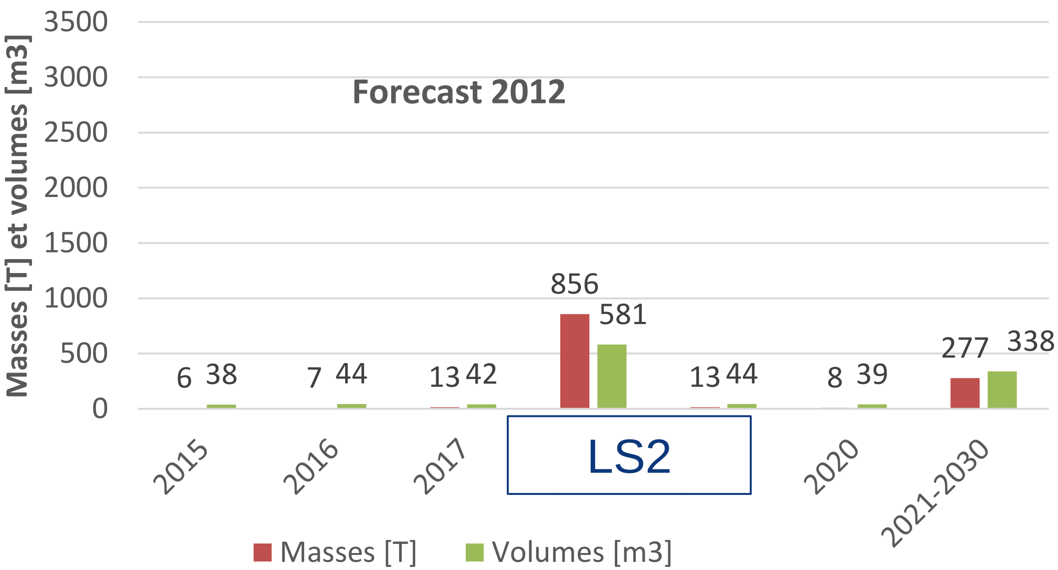
ADR Transport containers
already in use
Thanks to EN!

Arrangements with regard to ADR rules still to be discussed within the Tripartite process (for an efficient CERN operation)



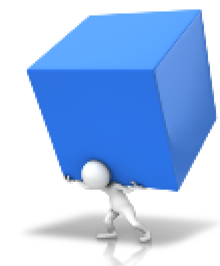
Nuclide inventory defining intersite transport class to be determined before transport
-> RP aims for an efficient scheme by identifying radiological envelop cases

Radioactive Waste in LS2 - Forecast



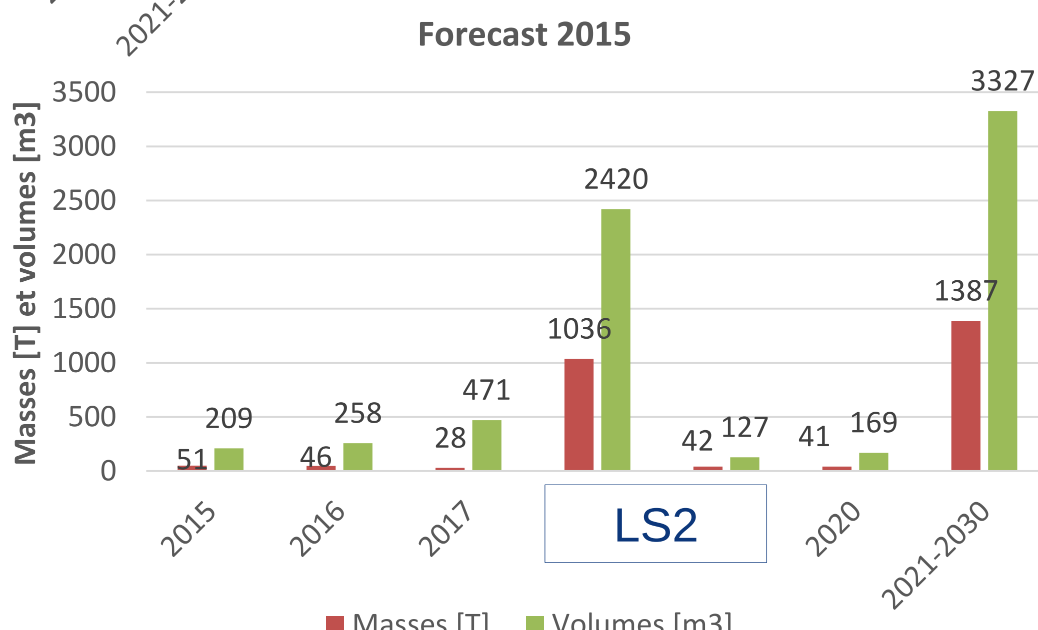
6500 m³ waste stored in ISR, up to 3000 m³ to be freed by LS2!

A challenge!



Regular up-dates required!

Information on influx of waste over time (scale of months) would be very helpful



Radioactive Waste in LS2

Waste management starts at the source (in the facility!) – a close collaboration*) between departments, experiments and RP is required to increase efficiency and effectiveness

(*) like for ISOLDE targets, project "*Clearing of Radioactive Material Storage" [EDMS 1493919]*

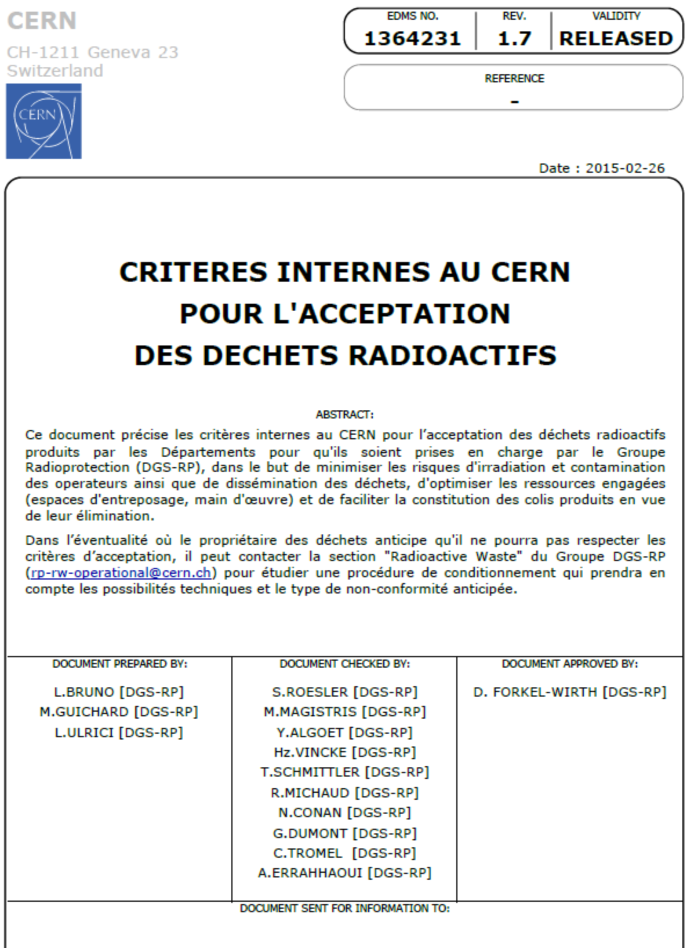
Proposal: Sorting and (pre-)characterization should be done at the source to optimize the elimination process**)

(**) project "*Clearing of Radioactive Material Storage" is used as test case for the new approach*

Implement well organized storage facilities for radioactive material and waste and link data bases (TREC, BAAN, ISRAM***)

(***) TREC will replace ISRAM at the end of 2015

Acceptance Criteria for Waste



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EDMS NO.	REV.	VALIDITY
1364231	1.7	RELEASED

REFERENCE
-

Date : 2015-02-26

CRITERES INTERNES AU CERN
POUR L'ACCEPTATION
DES DECHETS RADIOACTIFS

ABSTRACT:

Ce document précise les critères internes au CERN pour l'acceptation des déchets radioactifs produits par les Départements pour qu'ils soient prises en charge par le Groupe Radioprotection (DGS-RP), dans le but de minimiser les risques d'irradiation et contamination des operateurs ainsi que de dissémination des déchets, d'optimiser les ressources engagées (espaces d'entreposage, main d'œuvre) et de faciliter la constitution des colis produits en vue de leur élimination.

Dans l'éventualité où le propriétaire des déchets anticipe qu'il ne pourra pas respecter les critères d'acceptation, il peut contacter la section "Radioactive Waste" du Groupe DGS-RP (rp-rw-operational@cern.ch) pour étudier une procédure de conditionnement qui prendra en compte les possibilités techniques et le type de non-conformité anticipée.

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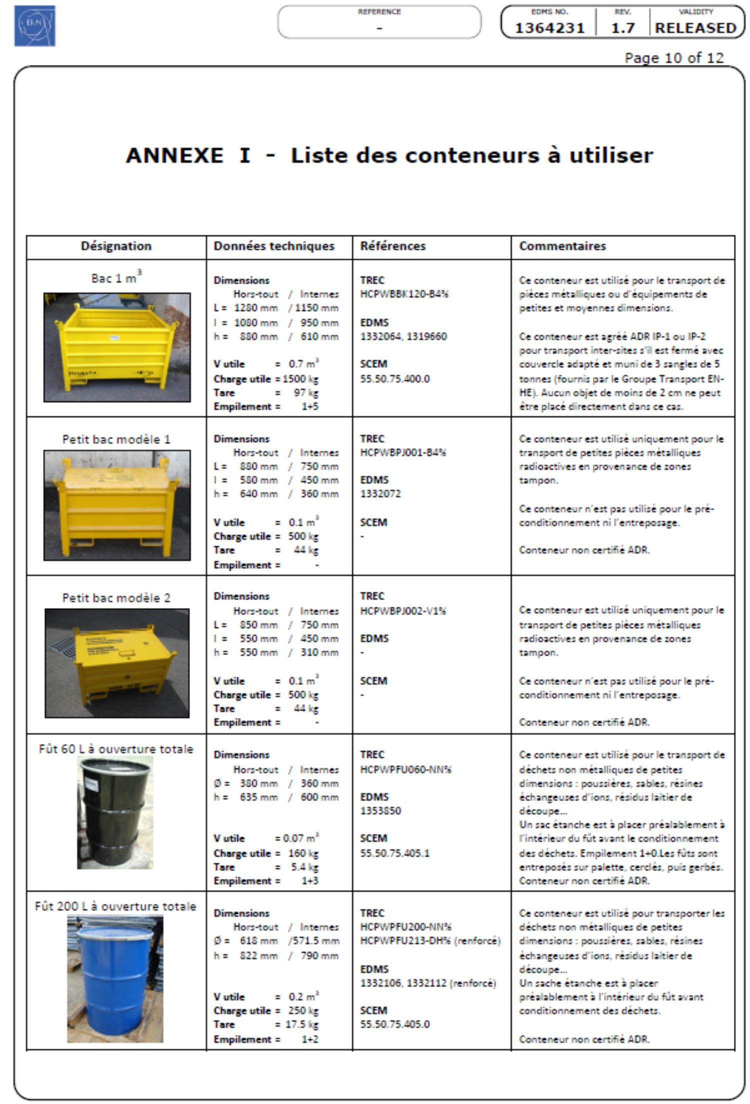
DOCUMENT SENT FOR INFORMATION TO:

First step towards treatment at the source



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ANNEXE I - Liste des conteneurs à utiliser

Désignation	Données techniques	Références	Commentaires
Bac 1 m³	**Dimensions** Hors-tout / Internes L = 1280 mm / 1150 mm l = 1080 mm / 950 mm h = 880 mm / 610 mm **V utile** = 0.7 m³ **Charge utile** = 1500 kg **Tare** = 97 kg **Empilement** = 1+5	**TREC** HCPWBBK120-B4% **EDMS** 1332064, 1319660 **SCEM** 55.50.75.400.0	Ce conteneur est utilisé pour le transport de pièces métalliques ou d'équipements de petites et moyennes dimensions. Ce conteneur est agréé ADR IP-1 ou IP-2 pour transport inter-sites s'il est fermé avec couvercle adapté et muni de 3 sangles de 5 tonnes (fournis par le Groupe Transport EN-HE). Aucun objet de moins de 2 cm ne peut être placé directement dans ce cas.
Petit bac modèle 1	**Dimensions** Hors-tout / Internes L = 880 mm / 750 mm l = 580 mm / 450 mm h = 640 mm / 360 mm **V utile** = 0.1 m³ **Charge utile** = 500 kg **Tare** = 44 kg **Empilement** = -	**TREC** HCPWBPJ001-B4% **EDMS** 1332072 **SCEM** -	Ce conteneur est utilisé uniquement pour le transport de petites pièces métalliques radioactives en provenance de zones tampon. Ce conteneur n'est pas utilisé pour le pré-conditionnement ni l'entreposage. Conteneur non certifié ADR.
Petit bac modèle 2	**Dimensions** Hors-tout / Internes L = 850 mm / 750 mm l = 550 mm / 450 mm h = 550 mm / 310 mm **V utile** = 0.1 m³ **Charge utile** = 500 kg **Tare** = 44 kg **Empilement** = -	**TREC** HCPWBPJ002-V1% **EDMS** - **SCEM** -	Ce conteneur est utilisé uniquement pour le transport de petites pièces métalliques radioactives en provenance de zones tampon. Ce conteneur n'est pas utilisé pour le pré-conditionnement ni l'entreposage. Conteneur non certifié ADR.
Fût 60 L à ouverture totale	**Dimensions** Hors-tout / Internes Ø = 380 mm / 360 mm h = 635 mm / 600 mm **V utile** = 0.07 m³ **Charge utile** = 160 kg **Tare** = 5.4 kg **Empilement** = 1+3	**TREC** HCPWPFU060-NN% **EDMS** 1353850 **SCEM** 55.50.75.405.1	Ce conteneur est utilisé pour le transport de déchets non métalliques de petites dimensions : poussières, sables, résines échangeuses d'ions, résidus laitier de découpe… Un sac étanche est à placer préalablement à l'intérieur du fût avant le conditionnement des déchets. Empilement 1+0.Les fûts sont entreposés sur palette, cerclés, puis gerbés. Conteneur non certifié ADR.
Fût 200 L à ouverture totale	**Dimensions** Hors-tout / Internes Ø = 618 mm /571.5 mm h = 822 mm / 790 mm **V utile** = 0.2 m³ **Charge utile** = 250 kg **Tare** = 17.5 kg **Empilement** = 1+2	**TREC** HCPWPFU200-NN% HCPWPFU213-DH% (renforcé) **EDMS** 1332106, 1332112 (renforcé) **SCEM** 55.50.75.405.0	Ce conteneur est utilisé pour transporter les déchets non métalliques de petites dimensions : poussières, sables, résines échangeuses d'ions, résidus laitier de découpe… Un sache étanche est à placer préalablement à l'intérieur du fût avant conditionnement des déchets. Conteneur non certifié ADR.



Let’s move forward together for exemplary management of radioactive material and waste - like we did for ALARA!


Conclusions (1)

- EU Directive 2013/59/Euratom and the Tripartite will have an influence on LS2 – but we have some time left to prepare
- Radiation levels in LS2:
  - LHC LSS will increase by a factor of 3 – 4,
  - LHC experiments will be compatible with Supervised Radiation Areas,
  - increase of radiation levels in SPS
- ALARA:
  - CERN's approach to ALARA will not change,
  - CERN's (individual) dose objective is useful – it is an objective within the context of continuous improvement and not a legal limit,
  - The optimization process is key
- Communication needs improvement

Conclusions (2)

- RP needs to be close to the activities and be integrated into the activity teams
- RP needs information about the number of workers arriving and the influx distribution over LS2 *(e.g. for RP training and dosimetry)*
- The forecast for radioactive material and waste production needs to be up-dated regularly to allow the timely provision of storage space
- Waste management starts at the source
  (first exercise: "Clearing of Material Storage")

PS: DGS-RP as equipment group – replacement of North Area ARCON by RAMSES

CERN

LS2 DAYS

29-30 SEPTEMBER 2015