HSE
Occupational Health & Safety
and Environmental Protection unit

PulsRad 2022

Environmental monitoring at CERN

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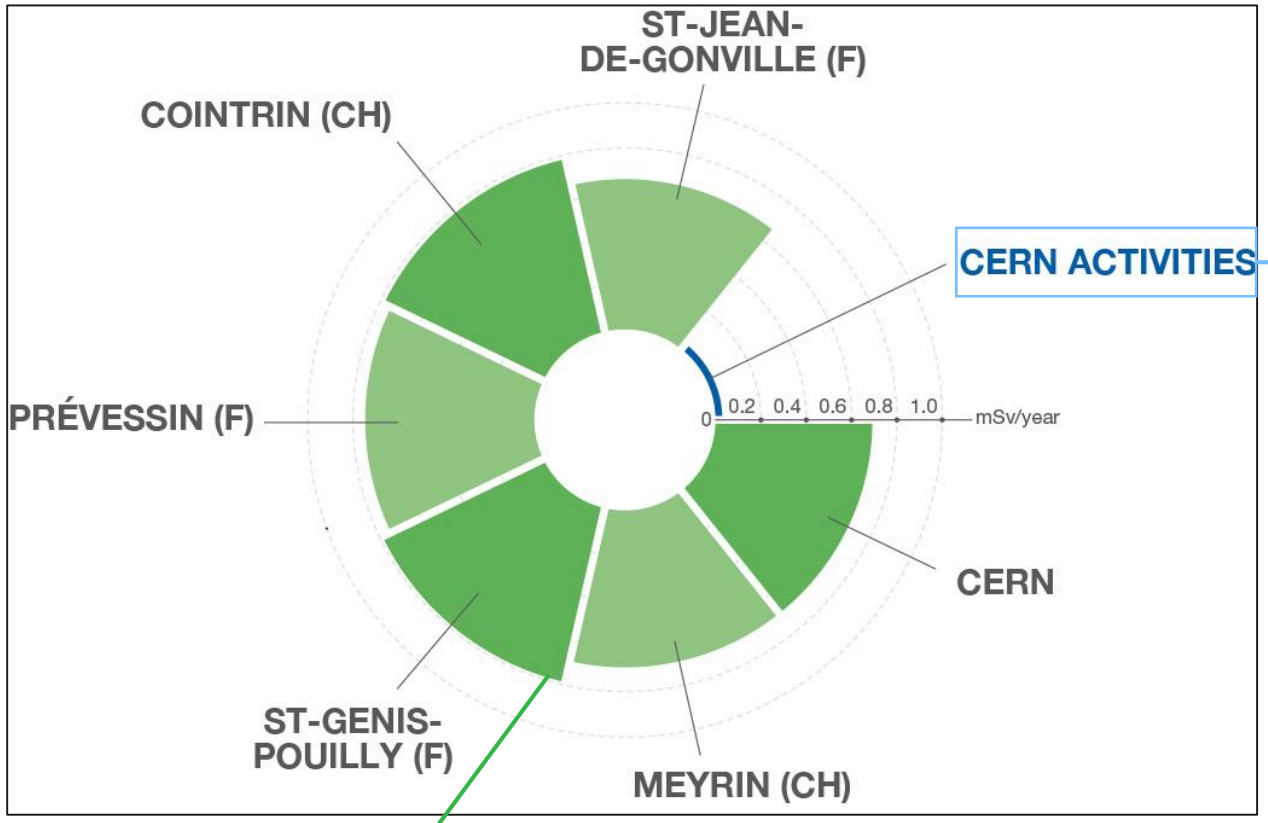
EDMS# 2804166

Impact of CERN activities



Cosmic & telluric

Public living or working in the vicinity of CERN

Effective dose < 0.02 mSv/y

Content

Rad. environmental aspects of CERN facilities

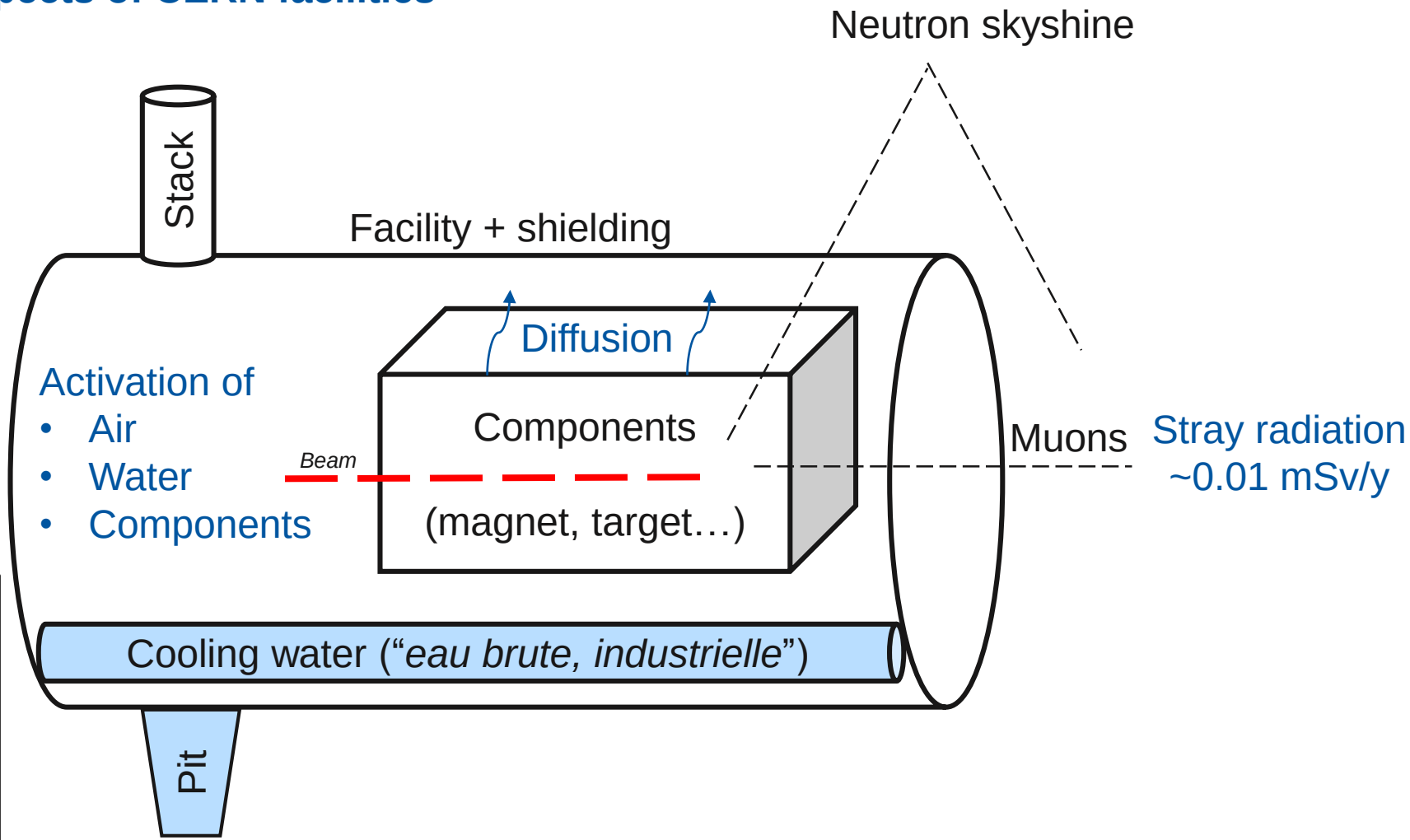
Monitoring program

Evaluation of dose by stray radiation

https://hse.cern/environment-report-2017-2018

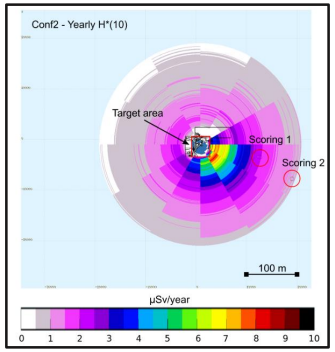
Radiological environmental aspects of CERN facilities

Releases of radionuclides
(mainly short-lived)



Stray radiation and emission monitoring

Focus



Agreed with

Models / Methods

Effective dose

Numbers, illustration of scope, reporting

130 monitoring stations / 500 channels

80 TLD dosimeters

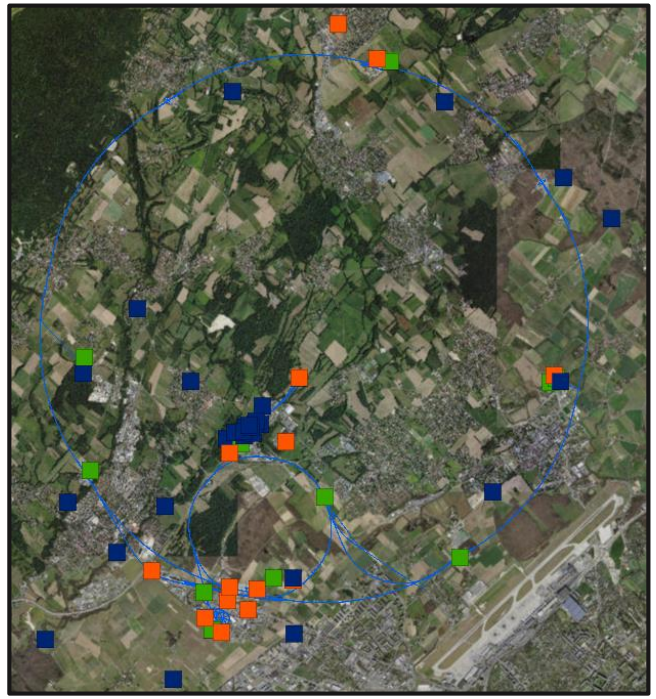
4000 samples & laboratory analysis

Quarterly reports
OFSP & ASN

Annual report
(Ed. OFSP)

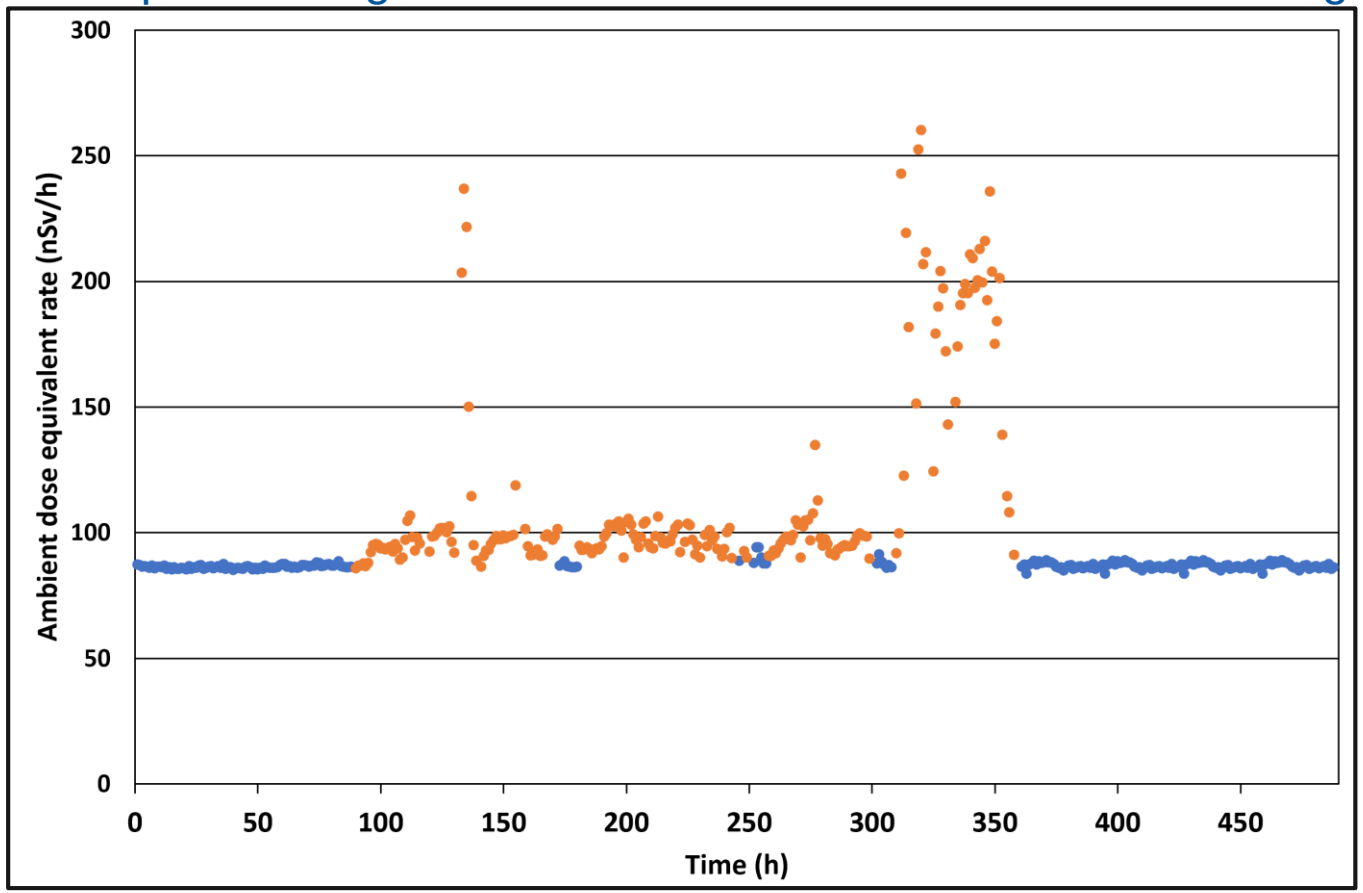
Stray radiation and emission monitoring (Meyrin cluster)

Immission monitoring



Evaluation of doses from stray radiation in the environment of CERN [1] (1/5)

Example: readings of ionisation chamber downstream of a target area



Background DR during beam stop
Gross DR during beam operation

Decision threshold : Stdev(BG)

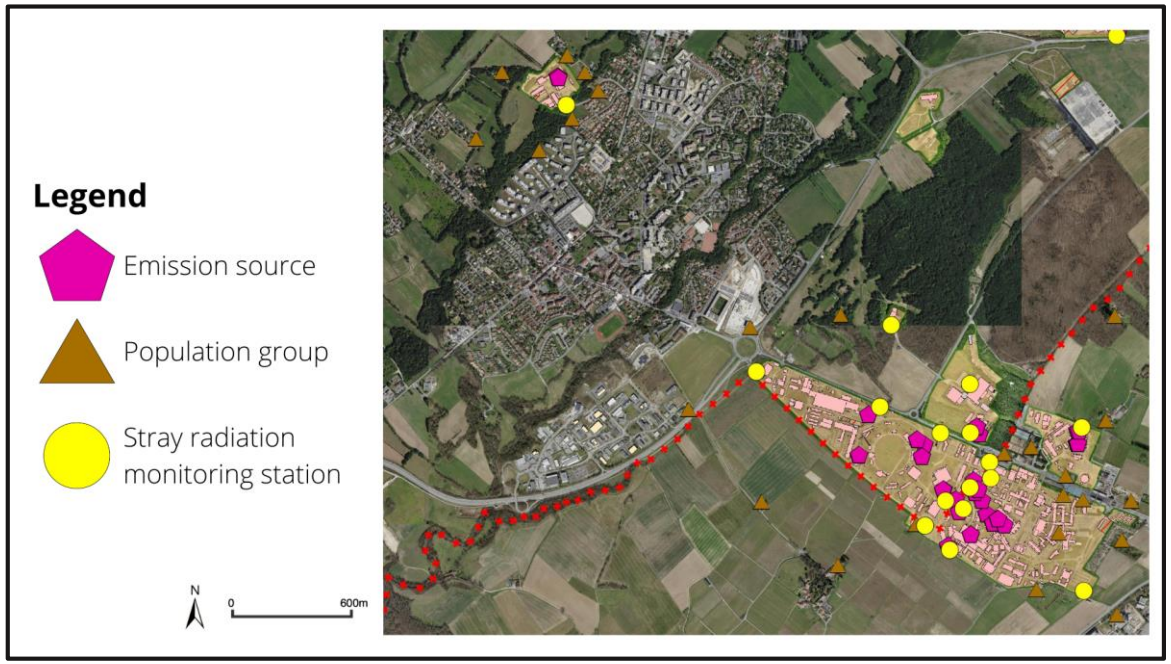
Uncertainties : calibration, field factor

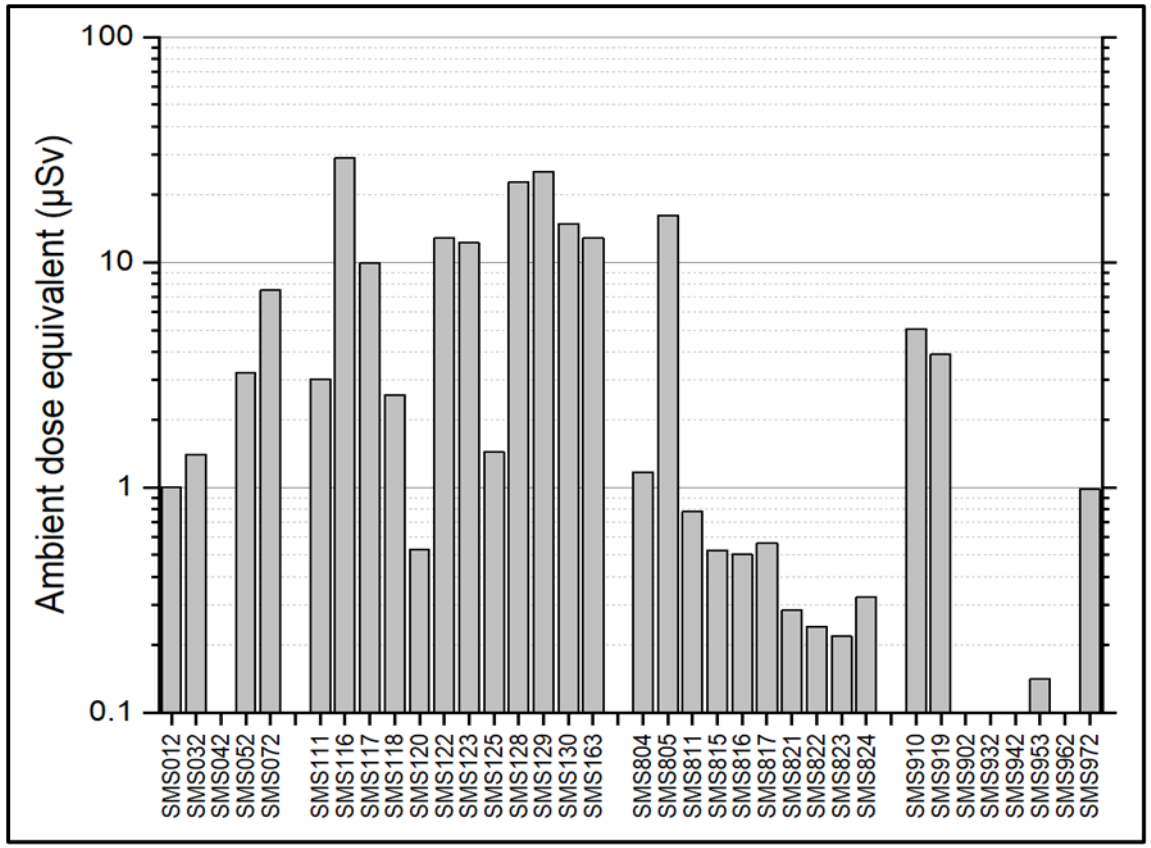
Detection limit (1 year): ~10 µSv
Neutron + *Gamma*

[1] P. Vojtyla (Ed.), R. Froeschl, F. Malacrida, F. Pozzi, Ch. Theis, (2022), EDMS# EDMS 2386315 Rev. 3.2

Evaluation of dose by stray radiation (2/5)

Correction for local releases of short-lived radioactive gases (i.e. ^{11}C, ^{41}Ar…)





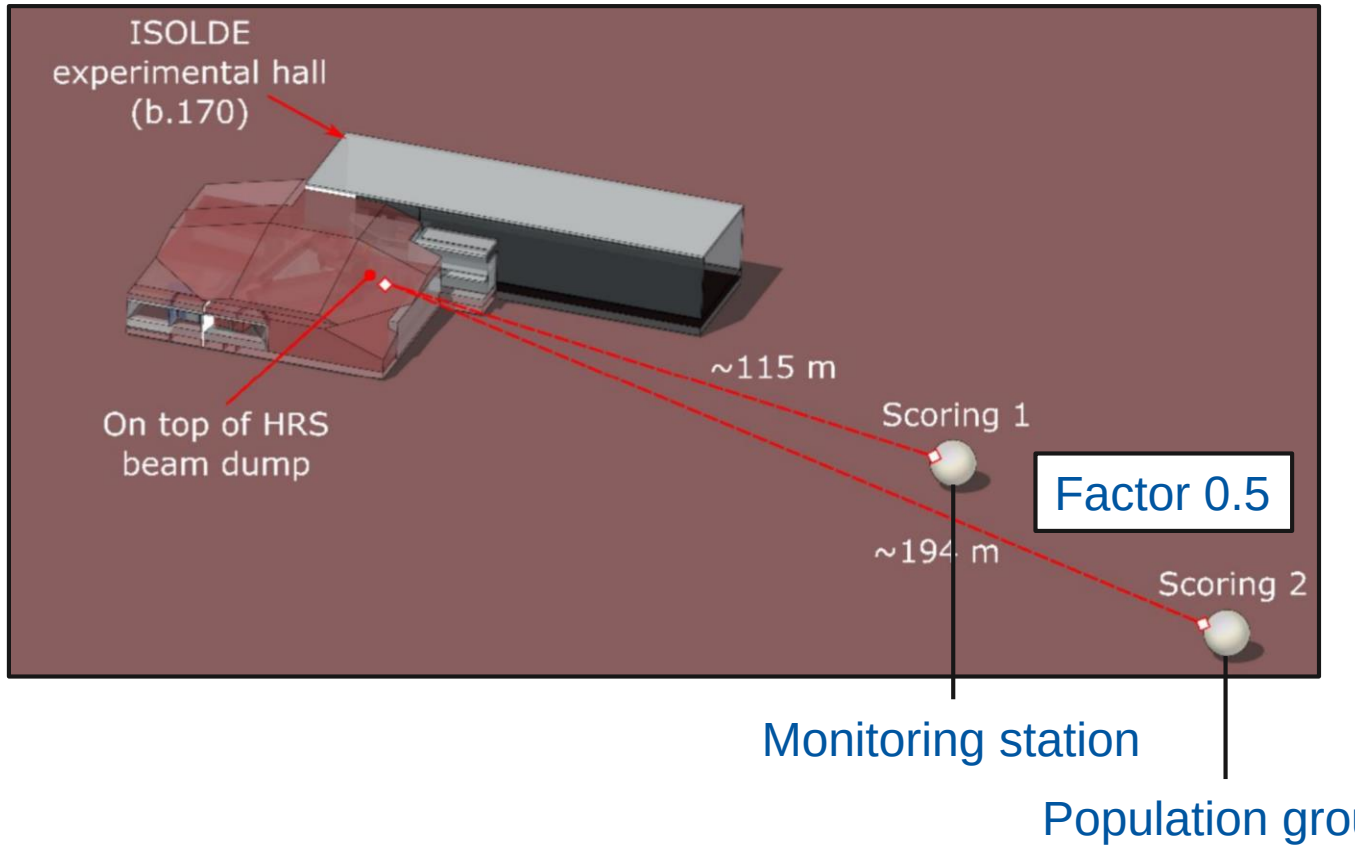
P. Vojtyla, Models for assessing the dosimetric impact of releases of radioactive substances from CERN facilities to the environment – Air (2022), EDMS# 2010420 V 3.1

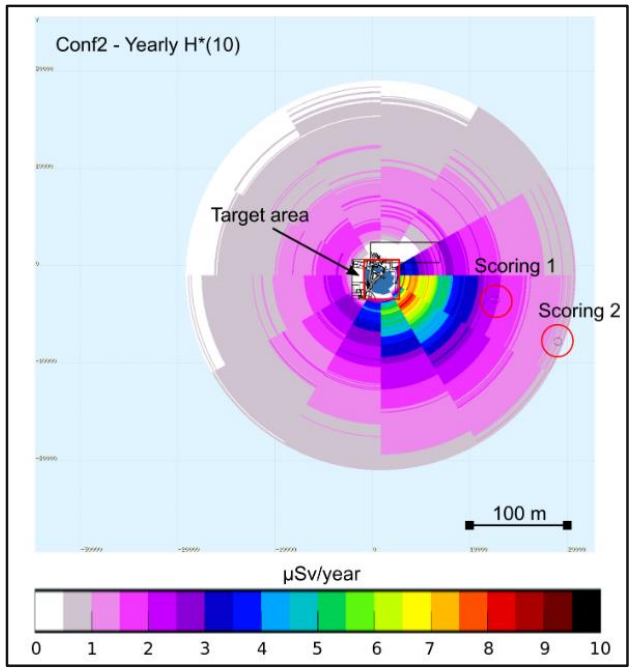
F. Malacrida, Process for the evaluation of the dosimetric impact by atmospheric releases (2022), EDMS# 2781087 V 1.0

Evaluation of dose by stray radiation (3/5)

Correction for distance (neutrons)

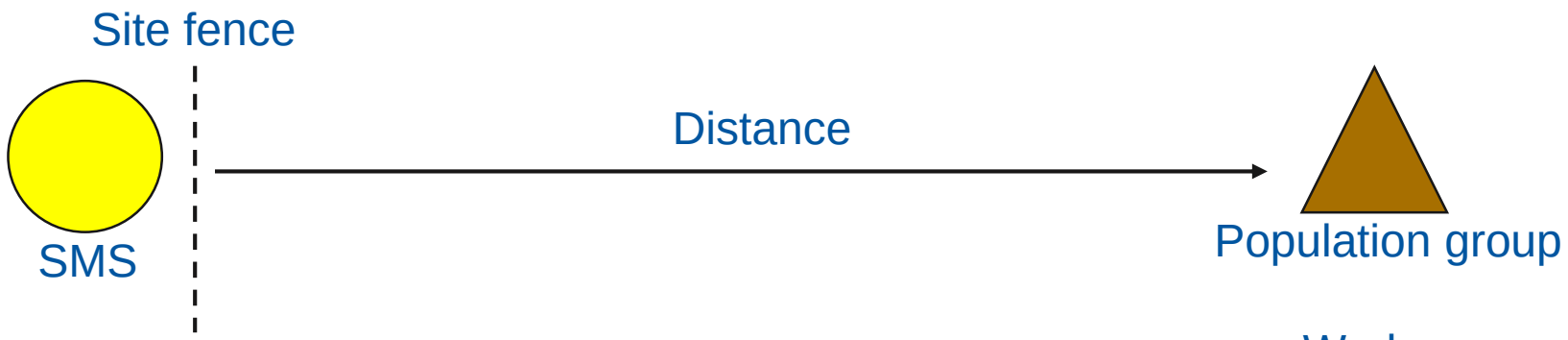
Example





Alajos MAKOVEC, Fabio POZZI, *Simulation of the neutron spectrum outside ISOLDE at the location of the PMSN163 and calculation of detector in-field calibration factors* (2020), EDMS# 2390377

Evaluation of doses from stray radiation (4/5)



Workers
Occupancy: 0.23

Gamma (µSv)

Net *H*10*	10 ± 3
*H*10 f*rom atm. releases	8
*H*10* by stray radiation	-

EXAMPLE

Neutron (µSv)

Net *H*10*	20 ± 4
Correction for distance	0.5

<u>Effective</u> dose by stray radiation: 20 x 0.5 x 0.23 = 2 µSv

Discussion (5/5)

IAEA: "*100 µSv is negligible*"

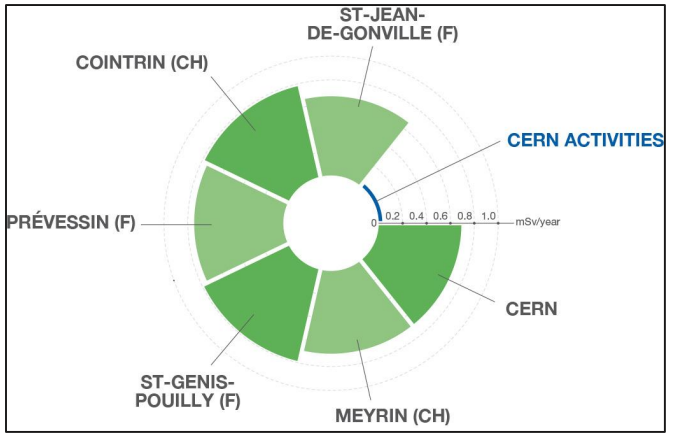
CERN objective : "*negligible/10*" = 10 µSv

What would be required to reach 10 µSv? What is 10 µSv?

Atmospheric releases of short-lived gases: 100 TBq, ~100'000 x detection limit of gas monitor

However…

Stray radiation: in the order of natural background fluctuations



Key requirement: signal stability

www.cern.ch