JORNADA SOBRE RADON

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Professor University of Cantabria

Radon Group, University of Cantabria

11th INTERNATIONAL WORKSHOP ON THE GEOLOGICAL ASPECTS OF RADON RISK MAPPING
September 18th-20th, June 2012
Prague, Czech Republic

MADRID, 7 DE NOVIIEMBRE DE 2012

LaRUC

Laboratorio de Radiactividad Ambiental

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Radon Group

35 YEARS DEALING WITH NATURAL RADIATION

.- 15000 RADON MEASUREMENTS

.-9000 SOIL SAMPLES ANALYSIS

.- 7000 EXTERNAL GAMMA RADIATION MEASUREMENTS

HEALTH RISKS

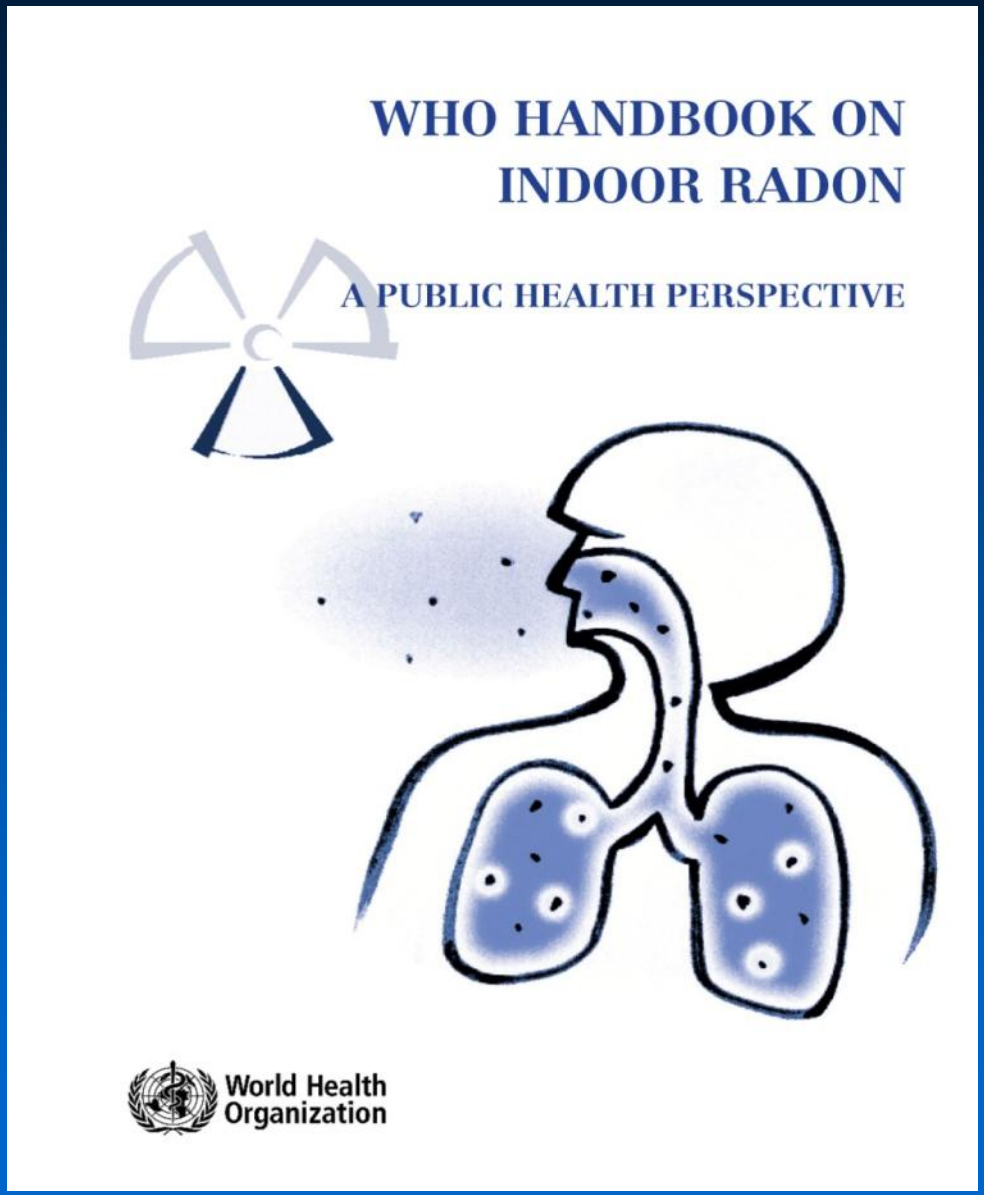
Epidemiological Approach

Dosimetric Approach

Factor 1-3

RADON AND PROGENY WILL BE TREATED IN THE SAME WAY AS OTHER RADIONUCLIDE
ICRP, Publication 115 (2010)

EPIDEMIOLOGICAL



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Effective dose from inhaled radon and its progeny
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ELSEVIER

ICRP
Annals of the ICRP

Effective dose from inhaled radon and its progeny

J.D. Harrison, J.W. Marsh

Health Protection Agency, Centre for Radiation, Chemical and Environmental Hazards, Chilton, Didcot, Oxon OX11 0RQ, UK; e-mail: john.harrison@hpa.org.uk

Abstract–Currently, the International Commission on Radiological Protection (ICRP) uses the dose conversion convention to calculate effective dose per unit exposure to radon and its progeny. In a recent statement, ICRP indicated the intention that, in future, the same approach will be applied to intakes of radon and its progeny as is applied to all other radionuclides, calculating effective dose using reference biokinetic and dosimetric models, and radiation and tissue weighting factors. Effective dose coefficients will be given for reference conditions of exposure. In this paper, preliminary results of dose calculations for Rn-222 prog-

Risk assessment

Dosimetric model

Estimation of dose per unit exposure

from respiratory tract model

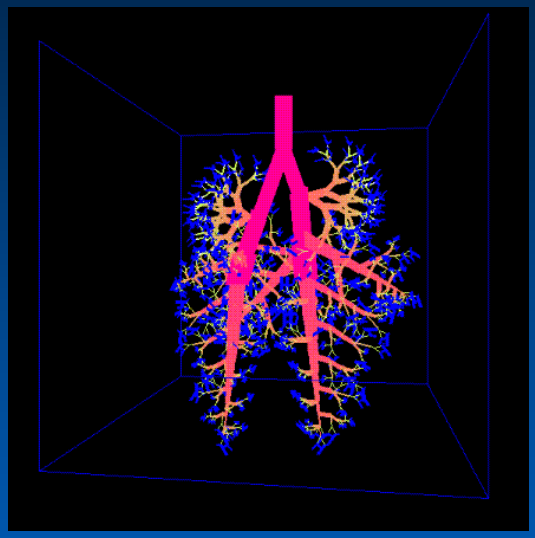
Progeny retention period

Weighting factor for alpha particles

Sensibility of pulmonary tissue

Weighting factors for esch region

Probability density function



Applied to miner's conditions (Birchall 1994) 15 mSv WLM^{-1}

Applied to dwellings (Marsh 2002) 12 mSv WLM^{-1}

Table 2. Average dose conversion factor (DCF) for the inhalation of unattached (DCF_u) and aerosol attached (DCF_{ae}) radon decay products in air of human living places arranged accordingly to aerosol conditions, relative cancer sensitivity distribution of the bronchial (w_{BB}), bronchiolar (w_{bb}) and alveolar (w_{AI}) regions of the thoracic lung, v = inhalation rate, Z = particle concentration of the aerosol.

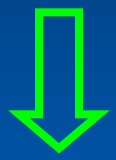
Place	Particle concentration Z (10^3 cm^{-3})	Nose breathing v (m^3 h^{-1})	DCF (mSv WLM^{-1}) ($DCF_u + DCF_{ae}$)	
			$w_{BB} = w_{bb} = w_{AI} = 0.33$	w_{BB}:w_{bb}:w_{AI} = 0.8:0.15:0.05
Outdoor air	20–40	1.2	13.2 (0.6 + 12.6)	9.7 (1.5 + 8.2)
Dwellings	5–40	0.75	8.3 (1.0 + 7.3)	7.3 (2.4 + 4.9)
	40–500	0.75	6.1 (0.1 + 6.0)	4.2 (0.2 + 4.0)
Working places	1–10	1.2	12.0 (3.0 + 9.0)	13.0 (7.0 + 6.0)
	10–50	1.2	8.6 (0.6 + 8.0)	6.7 (1.5 + 5.2)
	50–500	1.2	8.2 (0.2 + 8.0)	5.7 (0.5 + 5.2)
	50–500	1.7	10.3 (0.3 + 10.0)	7.2 (0.7 + 6.5)

Ref: Reinniking-Porstendorfer, 1997.

DOSE FROM RADON

600 Bq/m3 ---------- 10 mSv/year

T=7000 h F= 0.4
ICRP65



300 Bq/m3, ICRP 115

18 mSv/year
iiiiiiiiii

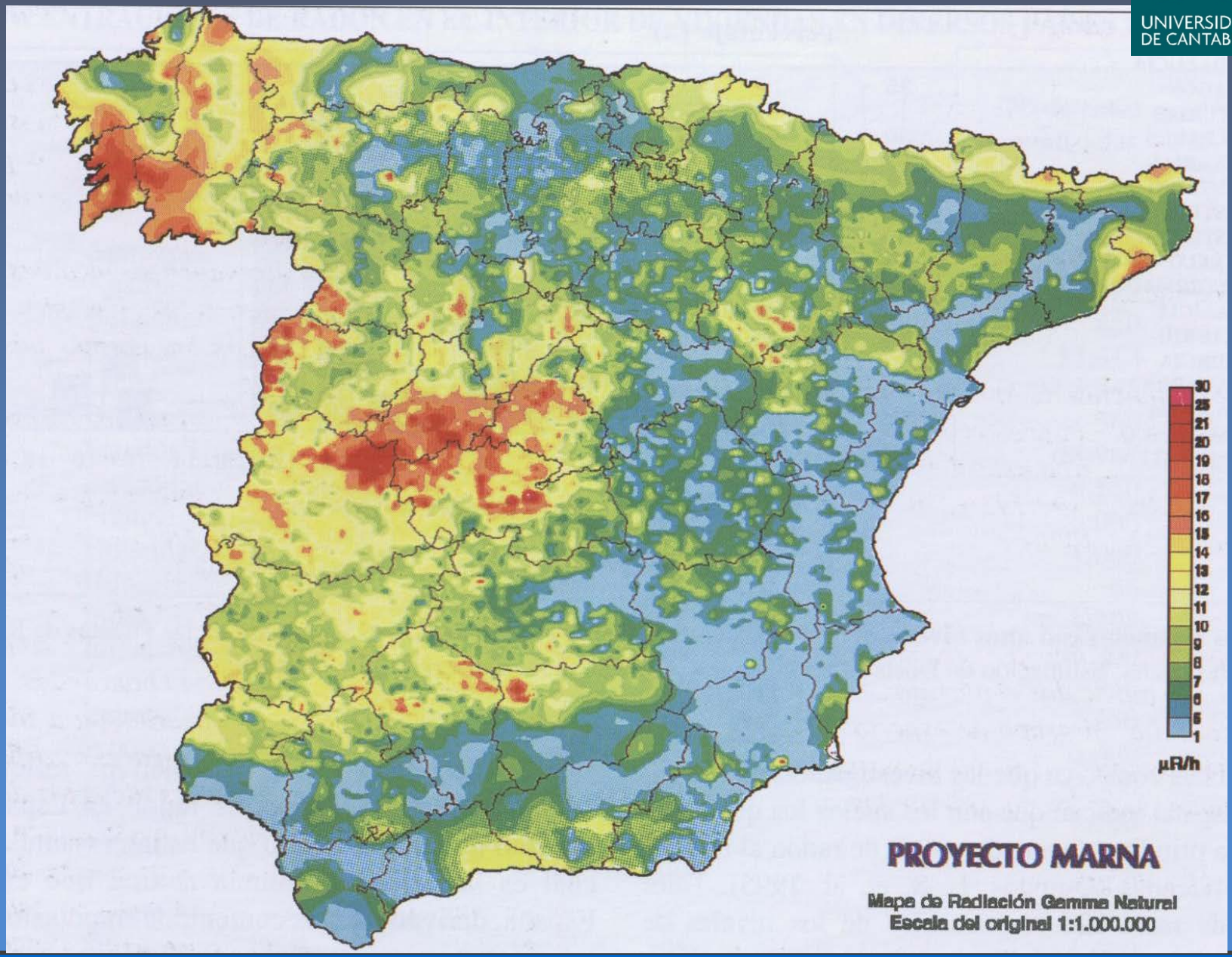
European Council Directive 96/29 EURATOM

Reduction of dose limit: 50mSv/a --> 20 mSv/a
Members of the public --> 1 mSv/a

Monitoring of exposures from natural sources:

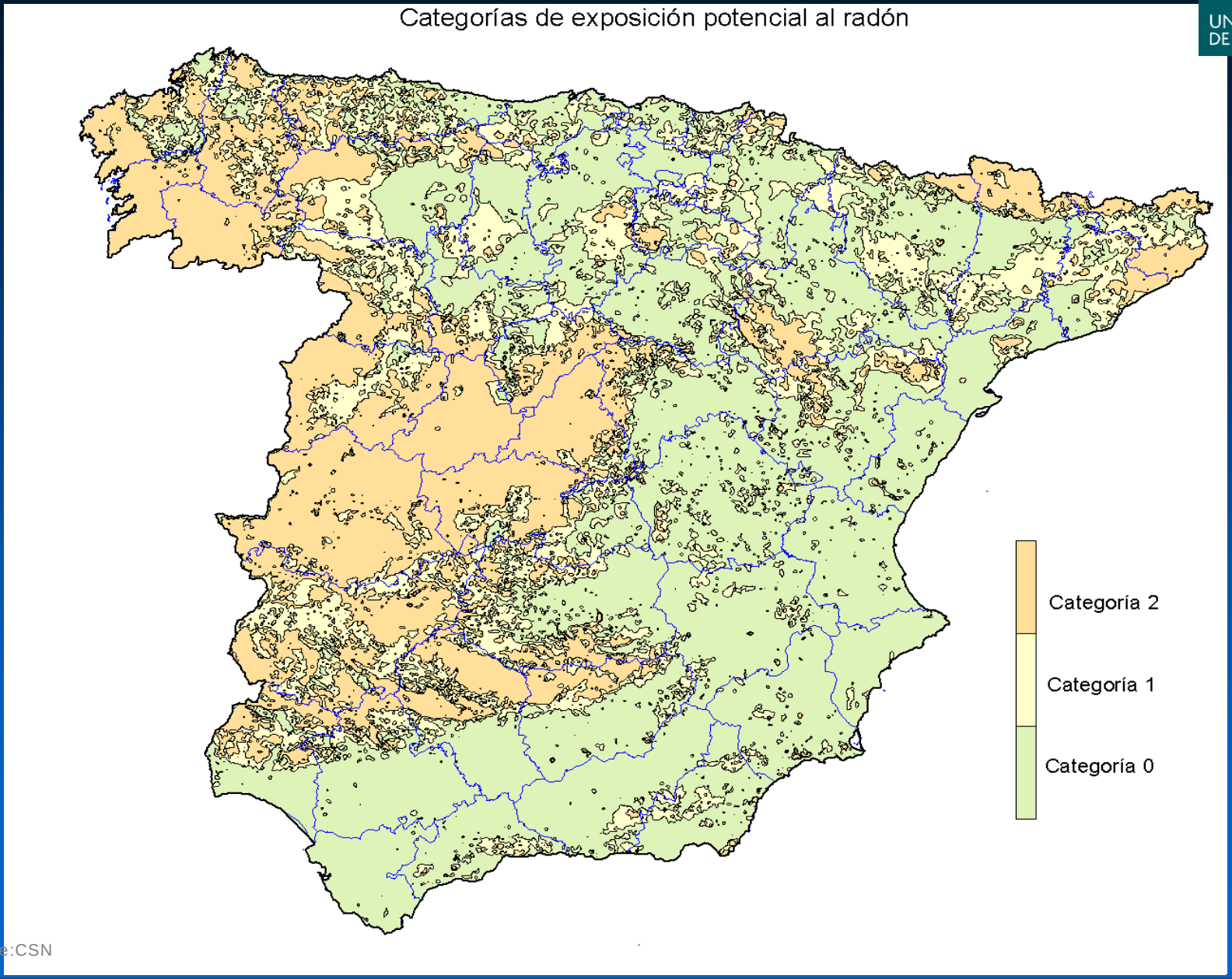
Royal Decree178 , 26 of JULY, 2001
Royal Decree 279, 18 of NOVEMBER, 2010
Royal Decree 22, 26 of JANUARY, 2012

MARNA Project



Data Souce CSN

Radon Potential Exposure



Data Souce:CSN

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RADON 10X10

University Autonoma of Barcelona

University of Santiago de Compostela

University of Cantabria

A first version of a European Geogenic Radon Map (EGRM)

Valeria Gruber[1], Peter Bossew[2],
Tore Tollefsen[1], Marc De Cort[1]

[1] European Commission – DG JRC, Radioactivity Environmental Monitoring (REM), Institute for Transuranium Elements, Ispra, Italy

[2] German Federal Office for Radiation Protection, Berlin, Germany

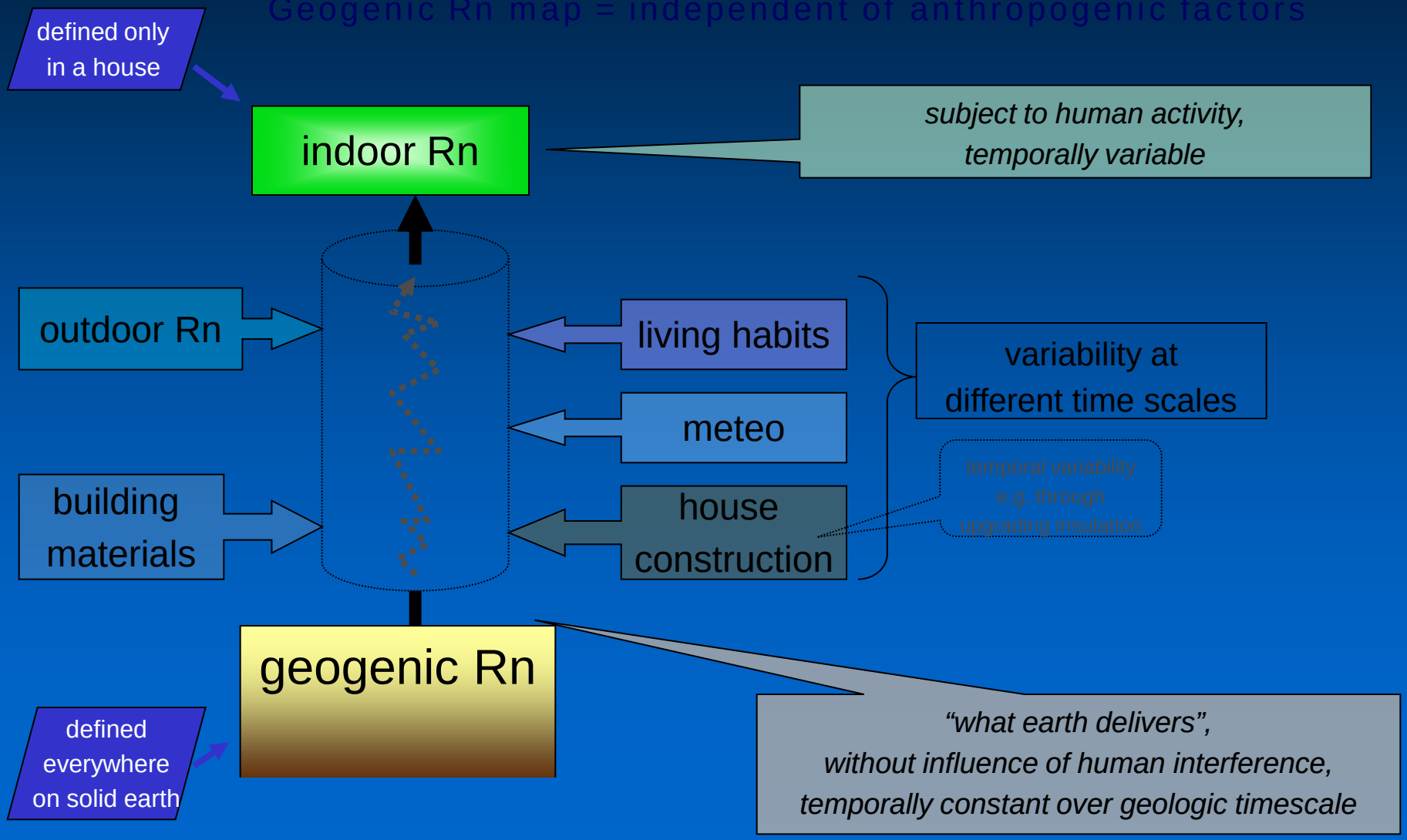
www.remon.jrc.ec.europa.eu
www.jrc.ec.europa.eu

Joint Research Centre

European Geogenic Radon Map (EGRM)

Background

Geogenic Rn map = independent of anthropogenic factors



PLAN NACIONAL DE RADON: EBSS

Mapa de RADON 10x10

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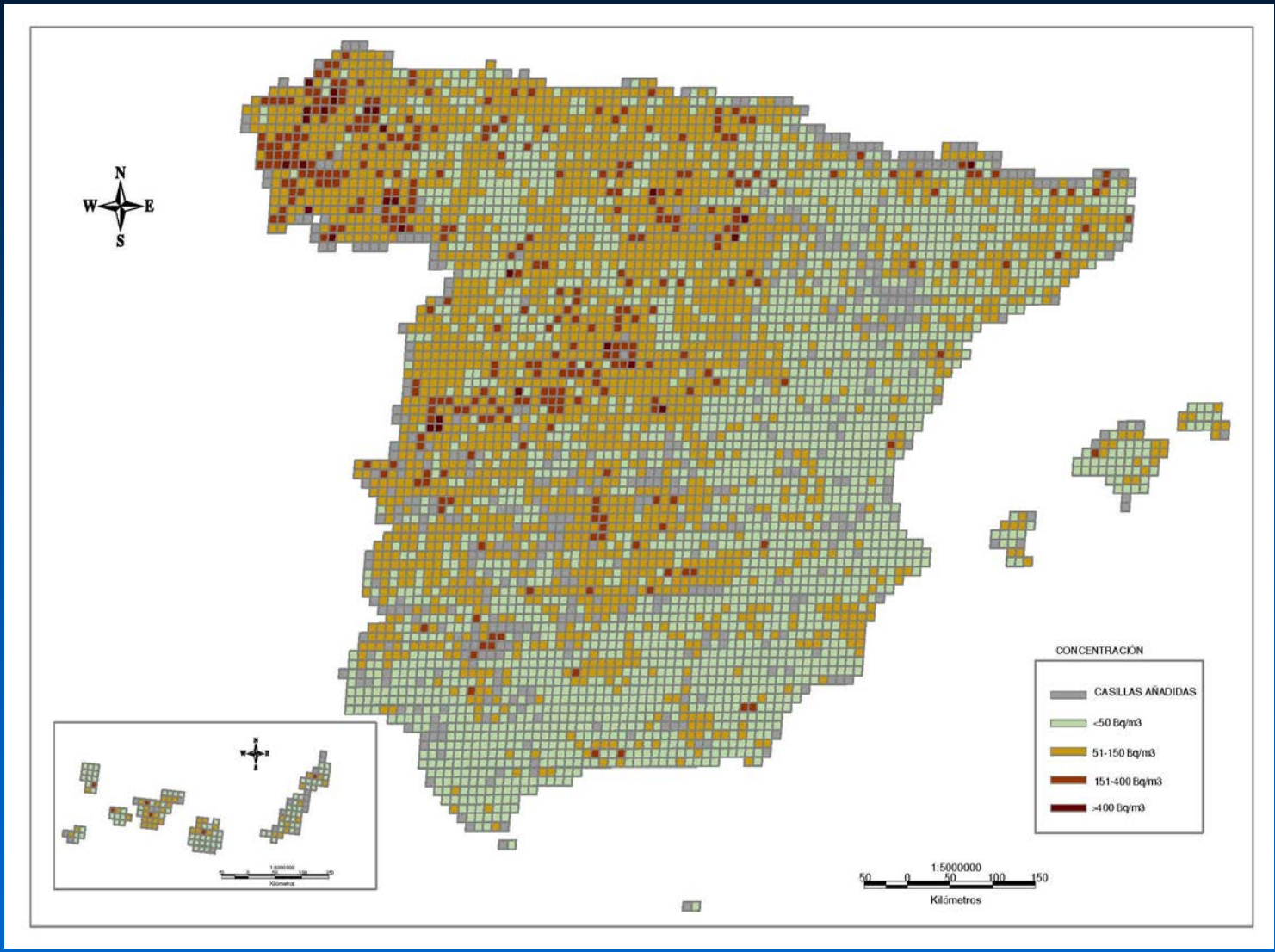
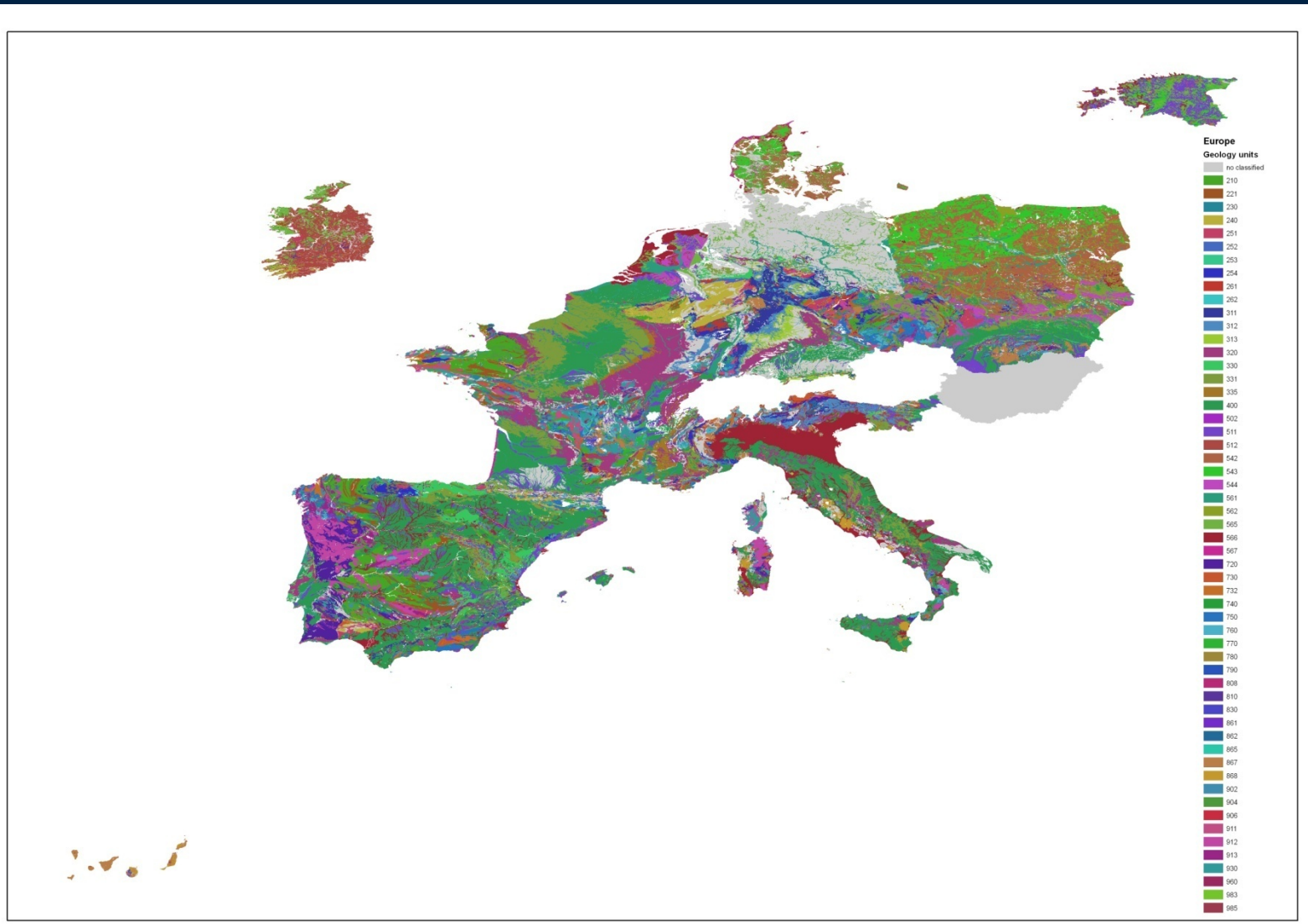


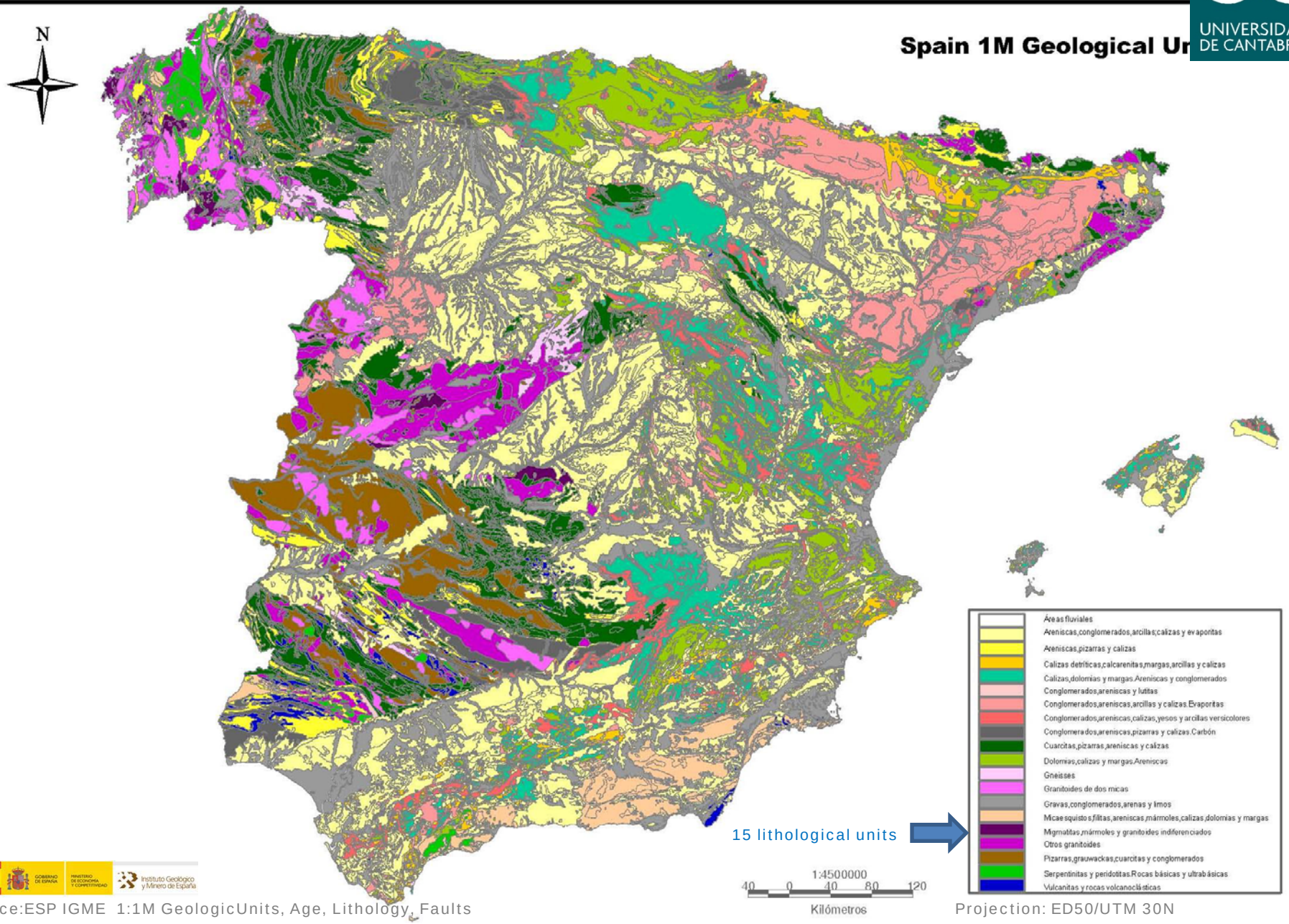
15.000 indoor radon data

First Trial EGRM

Geo-types



Spain 1M Geological Units

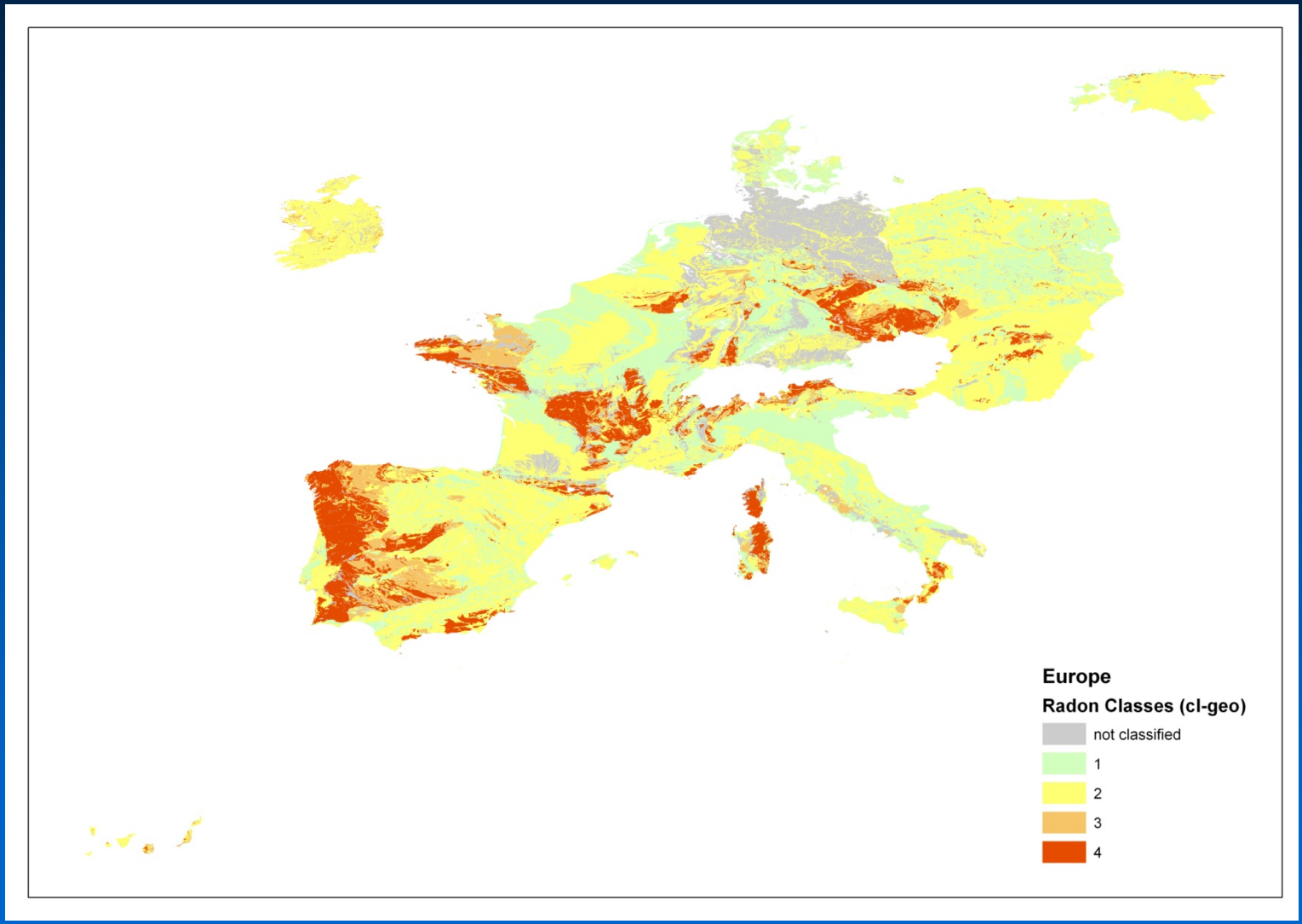


Source:ESP IGME 1:1M GeologicUnits, Age, Lithology, Faults

Projection: ED50/UTM 30N

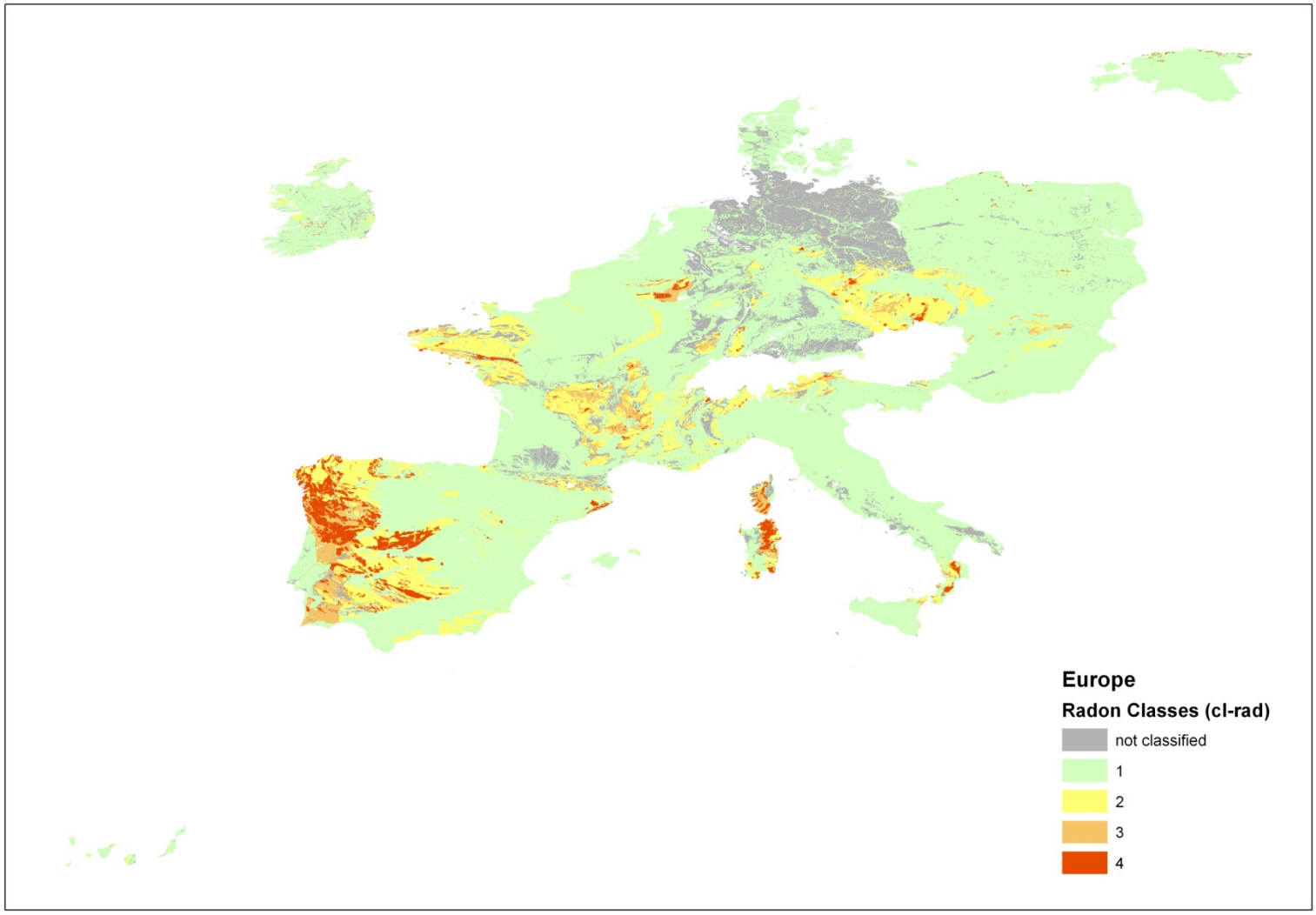
First Trial EGRM

Radon Classes "geological"

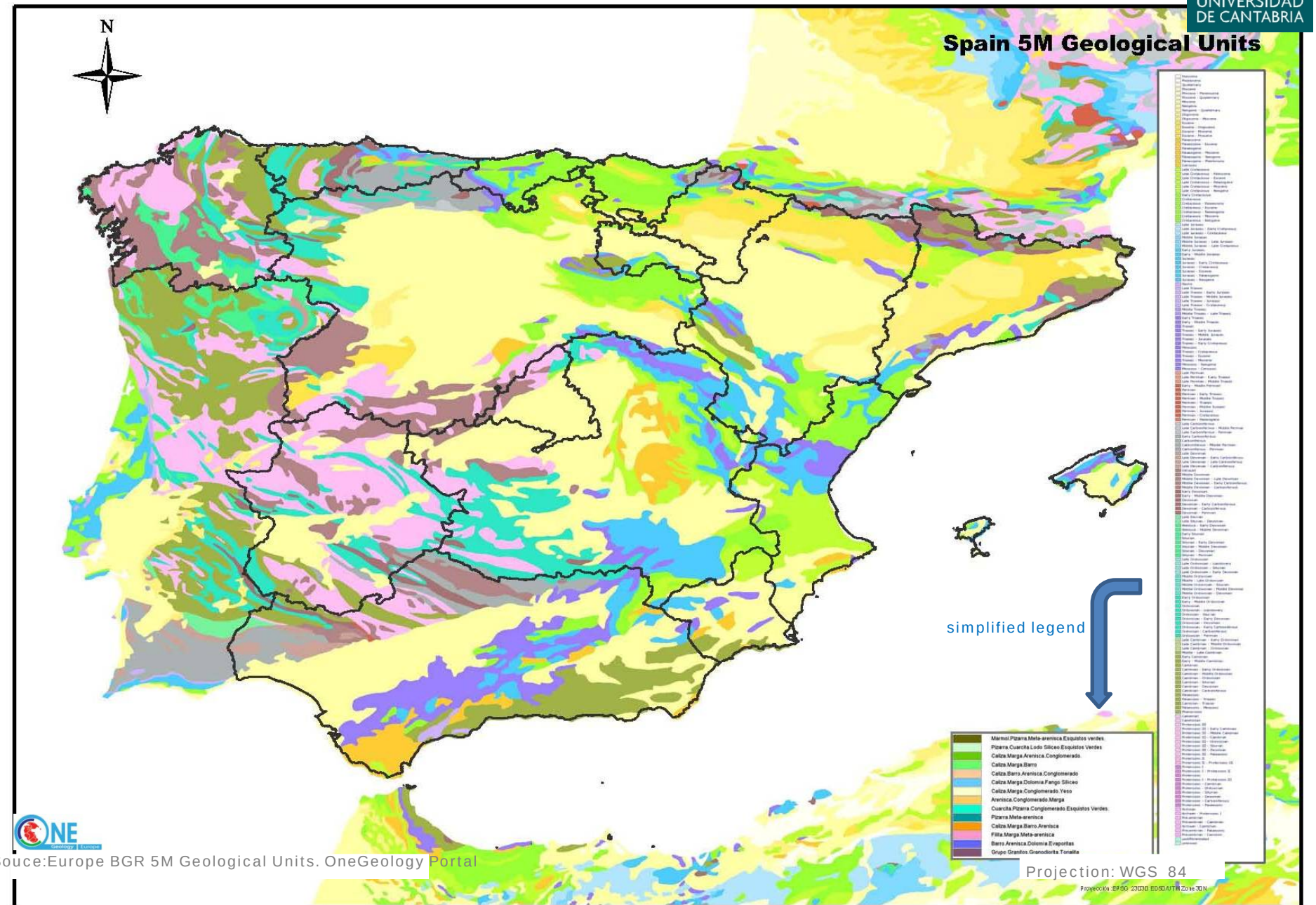


First Trial EGRM

Radon Classes "radiological"



Spain 5M Geological Units



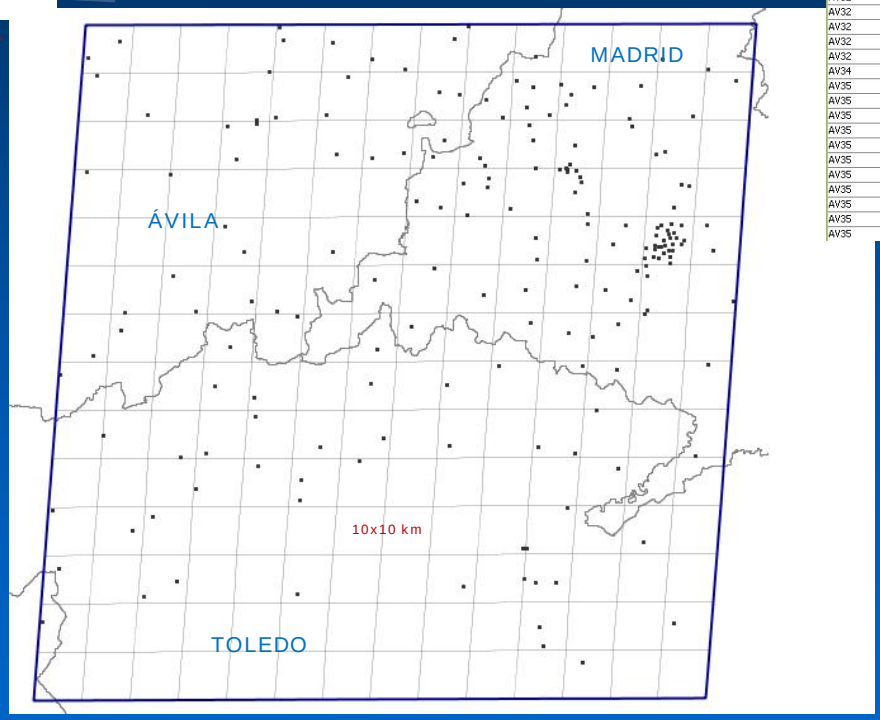
Souce:Europe BGR 5M Geological Units. OneGeology Portal

Projection: WGS 84

study area 140x140 km.2

Database

CASILLA	ID	LOCALIDAD	X	Y	COD	MedidaCOD
AV13	72.0	Herreros de Suso	327987.99396	4518874.99...	T99112	128.0
AV13	74.0	S.Garcia de Ingelmos	321482.99275	4515268.99...	T65290	19.0
AV16	101.0	Mingorria	359324.9978	4512526.99...	T65410	68.0
AV17	102.0	Vega de S³M³	361491.99795	4521849.99...	W32016	83.0
AV17	105.0	S³Domingo de las Pos	362108.998	4519153.99...	W32448	182.0
AV18	110.0	Maello	372661.99866	4518655.99...	P79114	75.0
AV18	110.0	Maello	372661.99866	4518655.99...	W32327	171.0
AV21	119.0	Mirueña Infanzones	323400.99316	4511654.99...	T65562	312.0
AV22	137.0	Narrillos del Reboll	333876.995	4503384.99...	T65426	81.0
AV24	149.0	Avila(n)	356787.99762	4502502.99...	T75957	124.0
AV24	149.0	Avila(n)	356787.99762	4502502.99...	T99087	26.0
AV25	468.0	Avila(e)	360543.41125	4502893.91...	P79376	318.0
AV26	160.0	S³M³del Cubillo	375811.99882	4511312.99...	T64886	14.0
AV26	162.0	Urraca Miguel	371277.9986	4503538.99...	T21577	181.0
AV32	193.0	La Colilla	350679.99708	4501072.99...	P68506	200.0
AV32	196.0	Avila(s)	356680.99762	4501580.99...	T21669	199.0
AV32	200.0	Aldea Rey Niño	352321.99725	4494271.99...	T65266	73.0
AV32	196.0	Avila(s)	356680.99762	4501580.99...	T21721	156.0
AV32	196.0	Avila(s)	356680.99762	4501580.99...	T21454	434.0
AV32	196.0	Avila(s)	356680.99762	4501580.99...	V83650	48.0
AV34	203.0	La Cañada	373348.99872	4495304.99...	T20343	920.0
AV35	204.0	Navalperal de Pinare	380652.99905	4494499.99...	T99134	24.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99048	123.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99055	108.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99220	230.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T98980	362.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99126	91.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99120	45.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99143	74.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	P79362	198.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99072	276.0
AV35	206.0	Navas del Marques	387269.99929	4495542.99...	T99241	24.0



140 KM

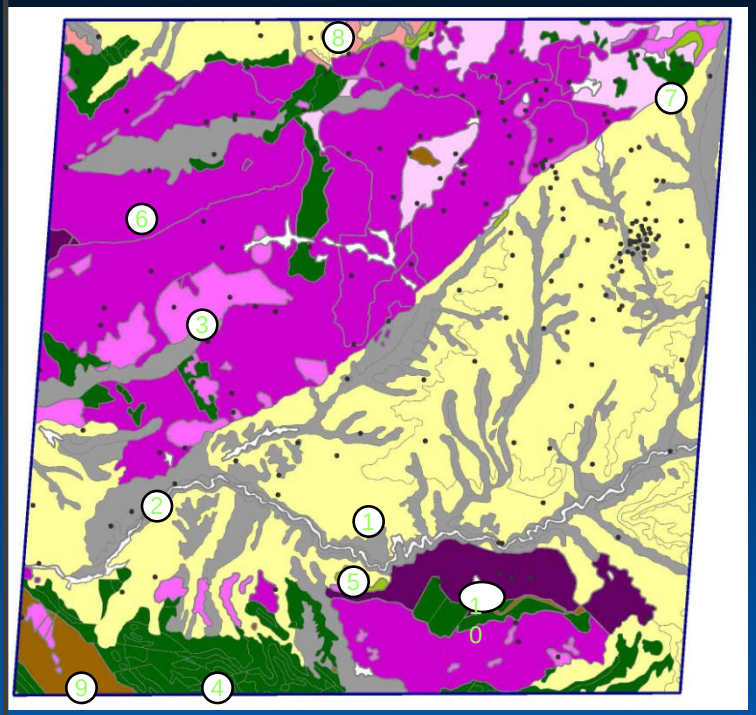
140 KM

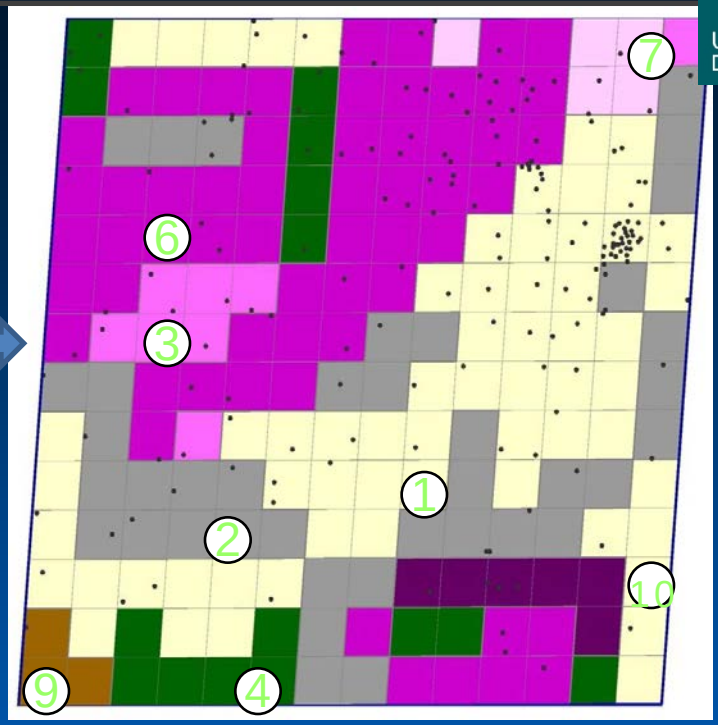
Study area:

- 224 grids 10x10 km2

- 485 data

Spain 1M Geological Units. Study Area.



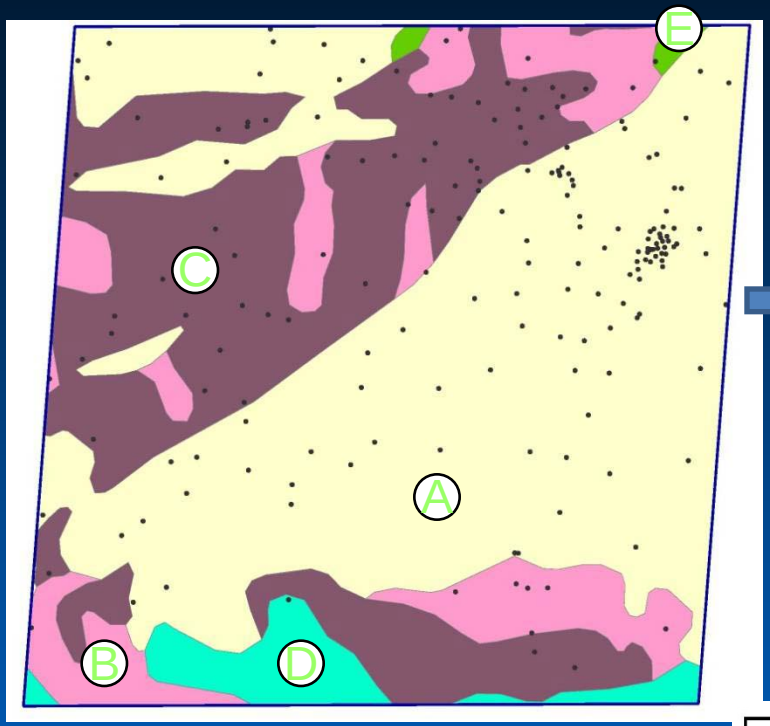


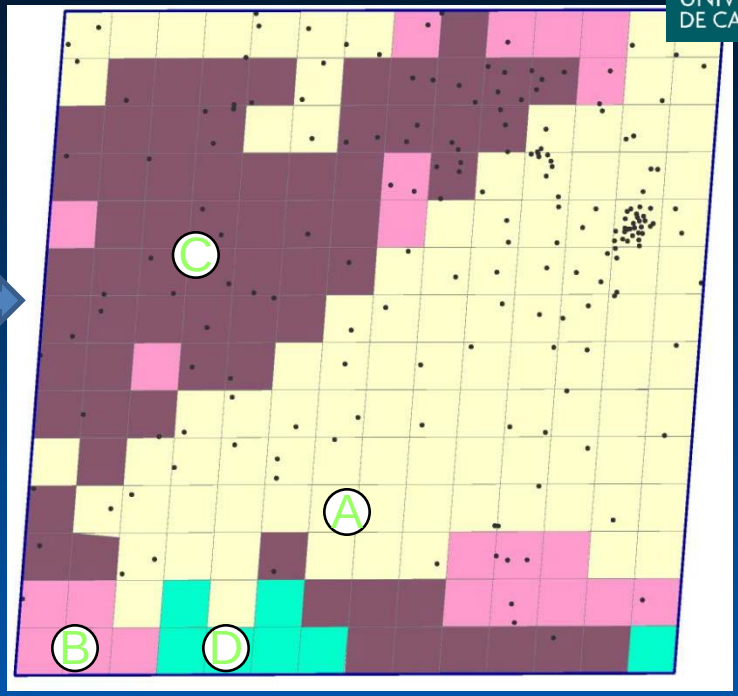
Geological Units:

1. Sandstones, conglomerates, clays, limestones and evaporites
2. Gravels, conglomerates, sands and silts
3. Two-mica granites
4. Quartzites, slates, sandstones and limestones
5. Dolomite, limestone and marl. Sandstones
6. Other granitoids
7. Gneisses
8. Conglomerates, sandstones, clays and limestones. evaporites
9. Slates, grauwackas, quartzites and conglomerates
10. Migmatites, marbles and undifferentiated granitoids

	1 M GEOLOGICAL UNITS	Median	A.M	s.d	G.M	s.d	Max.	Min.	Nº Samples
	Sandstones, conglomerates, clays, limestones and evaporites	76,00	**82,46**	37,89	**72,61**	1,8	170	5	217
	Sandstones, shales and limestones								
	Limestones, dolomites and marls. Sandstones and conglomerates								
	Conglomerates, sandstones, clays and limestones. evaporites								
	Conglomerates, sandstone, limestone, gypsum and clay versicolor.								
	Conglomerates, sandstones, shales and limestones. Coal.								
	Quartzites, slates, sandstones and limestones	74,00	**135,60**	141,19	**98,01**	2,1	472	57	10
	Dolomites, limestones and marls. sandstones								
	Gneisses.	367,50	**357,50**	317,32	**207,65**	3,5	647	58	6
	Two-mica granites	194,00	**165,00**	58,15	**153,44**	1,5	274	45	21
	Gravels, conglomerates, sands and silts	61,00	**77,52**	46,09	**67,36**	1,7	185	14	50
	Migmatites, marbles and undifferentiated granitoids	44,00	**43,00**	2,24	**42,95**	1,1	44	39	5
	Other granitoids	138,00	**148,29**	85,42	**125,52**	1,8	475	5	175
	Slates, grauwackas, quartzites and conglomerates	12,00	**12,00**	-	**12,00**	-	12	12	1
	Serpentinites and peridotites. Basic and ultrabasic rocks.								
	Volcanics and volcaniclastic rocks								

Spain 5M Geological Units. Study Area.





Geological Units:

A. Marl, conglomerate, limestone, gypsum

B. Gneiss, mylonite

C. granite group, granodiorite, tonalite

D. Quartzite, shale/slate, greenschist, conglomerate

E. Limestone, sandstone, marl, mud

5 M GEOLOGICAL UNITS	Median	A.M	s.d	G.M	s.d	Max.	Min.	Nº Samples
Meta-sandstone. Marble. Slate. greenschist								
Sandstone. Marl. Limestone. conglomerates								
Limestone. Marl mud								
Sandstone. Mud. Limestone. conglomerates								
Limestone. Dolomite. Marble. Silicon Fango								
Marga. Conglomerate. Limestone. Gypsum	64,00	**87,01**	89,39	**64,03**	2,2	920	4	275
Sandstone. Conglomerate. Marl								
Quartzite. Slate. Greenschist. conglomerates								
Slate. Meta-sandstone								
Sandstone. Mud. Marl. limestone								
Phyllite. Meta-sandstone. Marl	83,00	**185,63**	227,38	**100,90**	3,1	939	12	32
Mud. Sandstone. Dolomite. evaporites								
Granites Group. Granodotorita. tonalite	104,50	**140,28**	129,85	**94,42**	2,5	737	5	178

Comparison data. Study Area.

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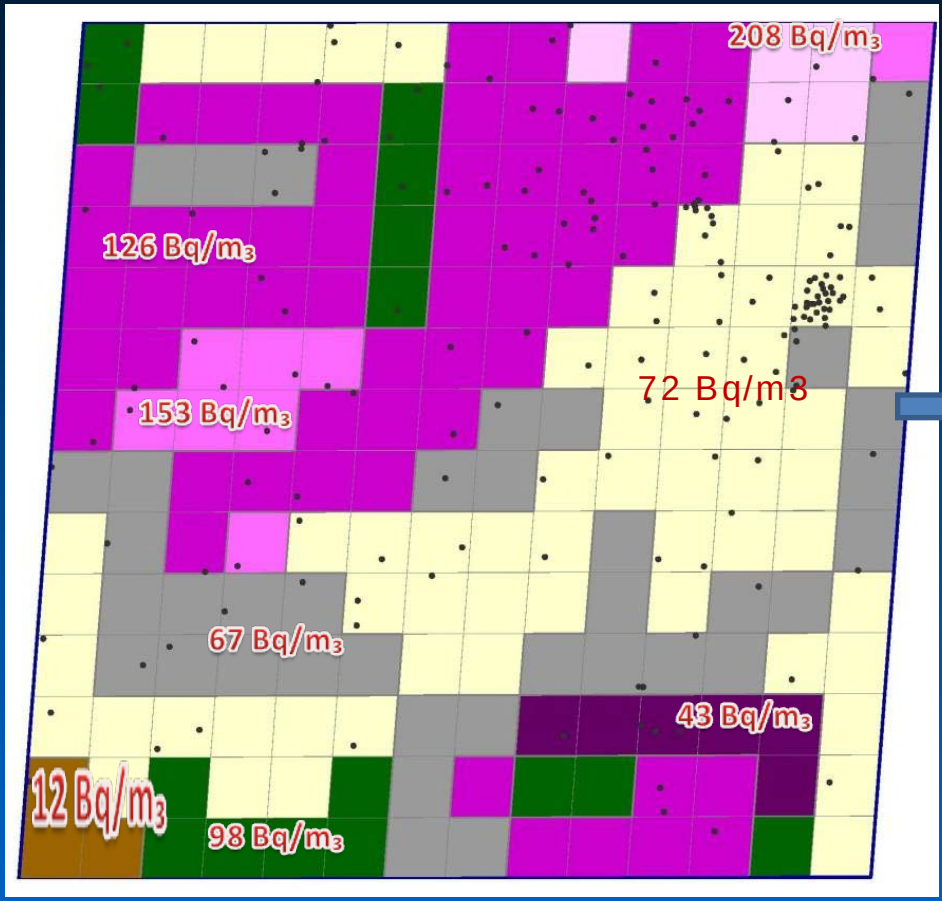
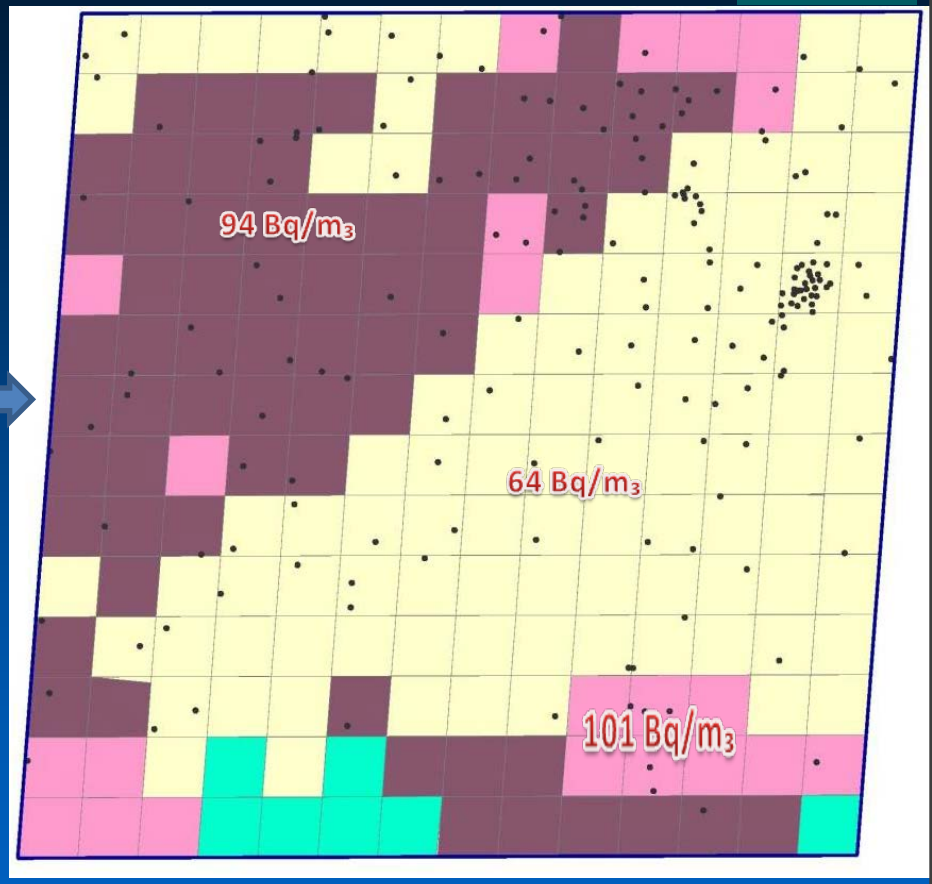
1M Geological Units. Study Area.



	1 M GEOLOGICAL UNITS	id	G.M
	Sandstones, conglomerates, clays, limestones and evaporites	1	72,61
	Quartzites, slates, sandstones and limestones	4	98,01
	Gneisses.	7	207,65
	Two-mica granites	3	153,44
	Gravels, conglomerates, sands and silts	2	67,36
	Migmatites, marbles and undifferentiated granitoids	10	42,95
	Other granitoids	6	125,52
	Slates, grauwackas, quartzites and conglomerates	9	12,00

5M Geological Units. Study Area.



	5 M GEOLOGICAL UNITS	id	G.M
	Marga. Conglomerate. Limestone. Gypsum	A	64,03
	Phyllite. Meta-sandstone. Marl	B	100,90
	Granites Group. Granodotorita. tonalite	D	94,42

LABORATORY OF NATURAL RADIOACTIVITY (LRN)

LRRN Main building

... one step further about quality

International Intercomparison exercise
under field conditions

42 LABORATORIES

17 COUNTRIES

LABORATORIO DE RADIACTIVIDAD NATURAL *(LRN)*

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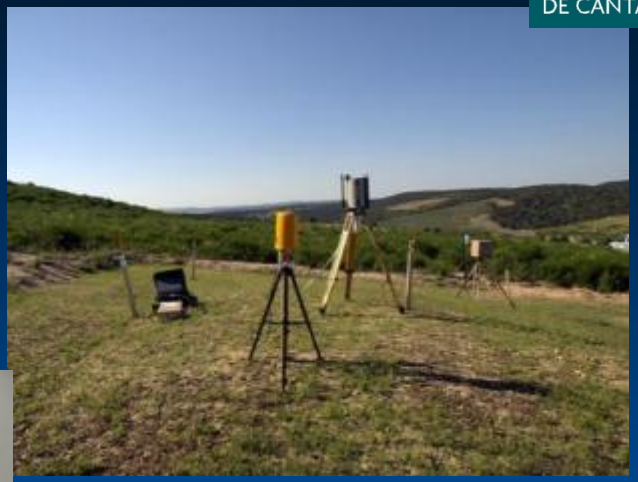
Uranium mine
Saelices el Chico
Salamanca, Spain

Rn
in soil



External gamma
exposure

Rn in air (indoors, outdoors)

Rn in water

Radon exhalation
(soil, building materials)

EUROPEAN ASSOCIATION OF RADON SCIENTISTS AND TECHNOLOGISTS (EARST)

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EARST

European Association of Radon Scientists and Technologists

This site is aim for informing all members of EARST and interchanging opinions and debate.

Enter

Forum

Access to the Forum of EARST where you will be able to discuss and give new ideas on everything related to radon.

EARST Forum

We welcome you

We have set a forum in order to discuss and talk all matters about Radon. Please contact us if you have any comments on the web or any ideas for improving it.

Partners

Universidad de Cantabria cooperates with Earst

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www.earst.eu

some goals...

.- To promote public awareness of radon measurement, radon mitigation and new construction radon reduction techniques.

.- To ensure quality standards are developed and adopted in radon measurement, radon mitigation and in construction of new radon reduction techniques.

.- To provide a community for education, sharing of ideas, resources and research.

.- To provide an effective partnership between radon professionals in the field and other interested public and private organizations.

.- To organize the annual Radon conference combining scientific presentations and technical exhibitions from companies working on radon gas.

+ YOUR PROPOSALS HERE!!

FUTURE GOALS

COMPLETE THE NATIONAL INDOOR RADON MAPPING IN DWELLINGS

PARTICIPATE IN THE EUROPEAN GEOGENIC RADON MAP WITH THE ANALYSIS OF THE SPANISH DATA AVAILABLE

ENSURANCE THE QUALITY OF MEASUREMENTS BY PARTICIPATION/ORGANIZATION OF INTERCOMPARISON EXERCISES UNDER FIELD CONDITIONS AND CALIBRATION CHAMBERS

MEASURING OCCUPATIONAL RADON EXPOSURE AT A NATIONWIDE SCALE ACCORDING TO THE SPANISH LAW
Titulo VII *BOE 178 DE 26 DE JULIO DE 2001-2012*

SPANISH SOIL RADON GAS MAPPING WILL BE START IN 2013

NEW BASIC SAFETY STANDARDS

ANNEX XVI

Indicative list of items to be covered in the national action plan to manage long term risks from radon exposures

www.elradon.com

LaRUC
Laboratorio de Radiactividad Ambiental

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