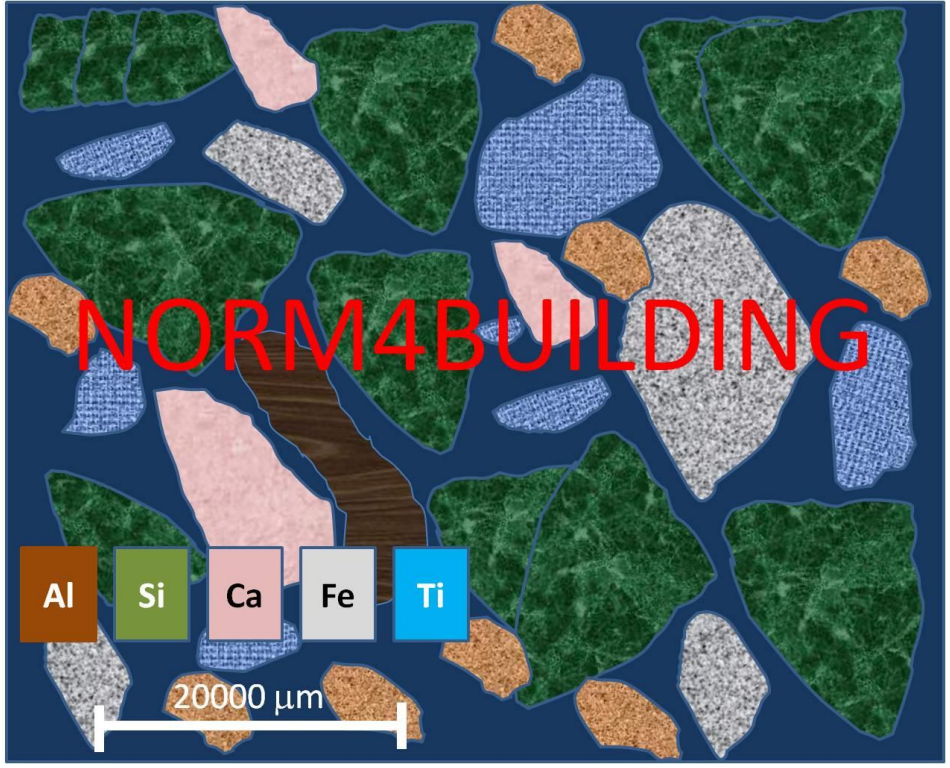


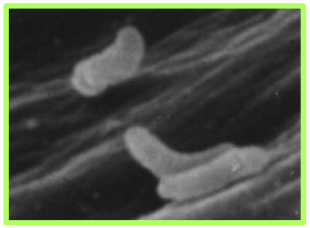
"COST Network Tu1301 NORM4Building" (2014-2017)

Wouter Schroeyers, UHasselt

NORM ENVIRONET Project, Vienna, 16-20/10/2017

Centre of Environmental Sciences: Research Themes

1. Effect of environmental stressors on organisms




2. Sustainable and Clean Technologies





3. Biodiversity, Ecosystem Services and Climate Change



Outline – NORM4Building

1. **Introduction**

2. Databases
    1. General NORM4Building database

    2. BY-BM Database

3. Publications

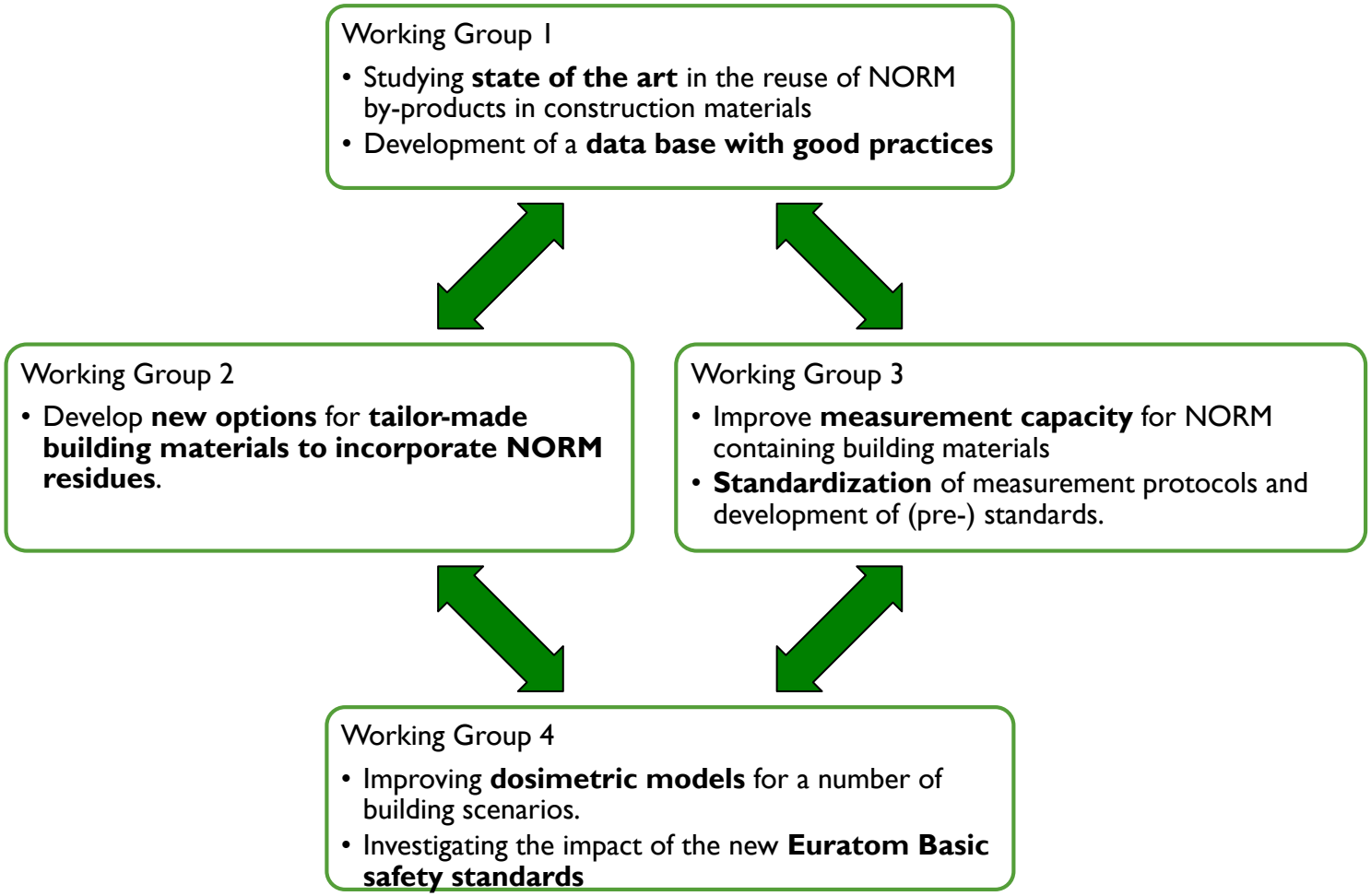
4. Conclusions - Outlook

The NORM4Building Network

- Exchange of multidisciplinary knowledge and experiences (radiological, technical, economical, legislative, ecological, …)

Stimulate the **reuse of by-products in new tailor-made sustainable building materials**	While **assuring (radiation) protection of the population / environment**

Objectives NORM4Building



The NORM4Building Network

- Meetings – Training schools – STSMs - …






Outline – NORM4Building

1. Introduction

2. **Databases**
    1. **General NORM4Building database**
    2. BY-BM Database

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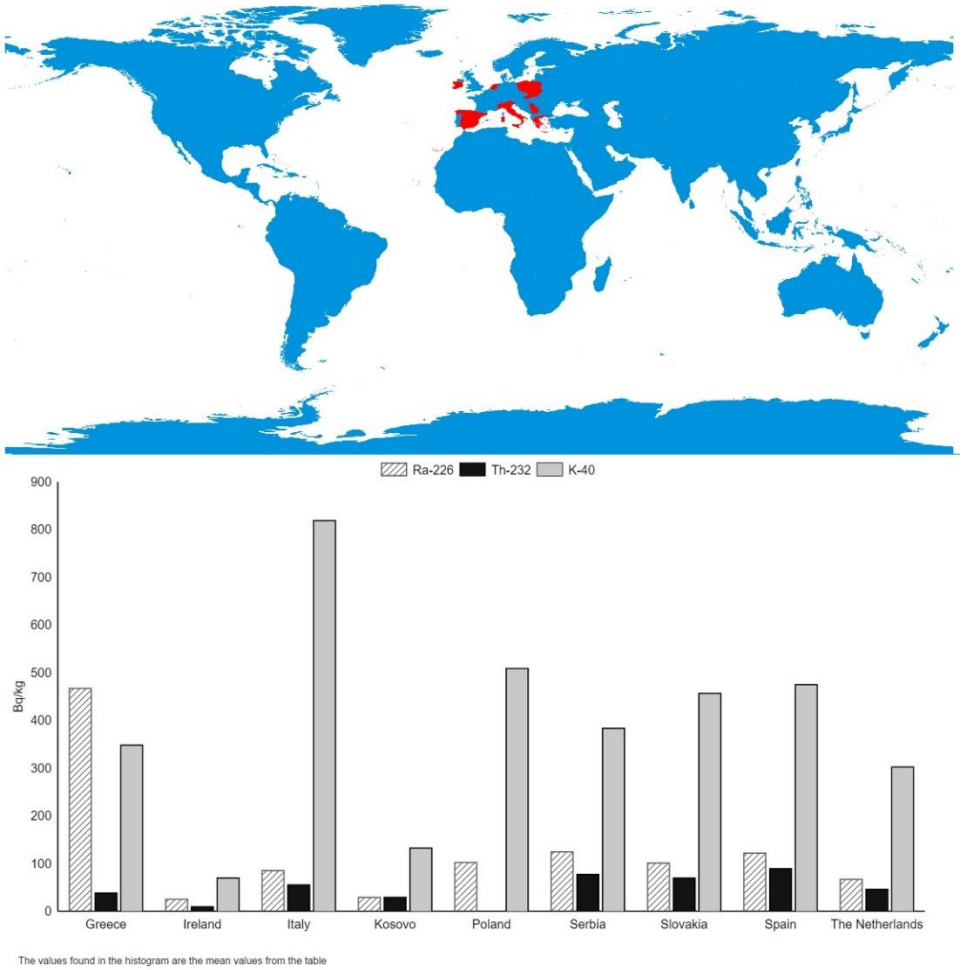
General NORM4Building database



www.norm4building.org

Database team:
Tibor Kovacs
Gergo Bator
Zoltan Sas

Verification team:
Cristina Nuccetelli
Rosabianca Trevisi
Federica Leonardi

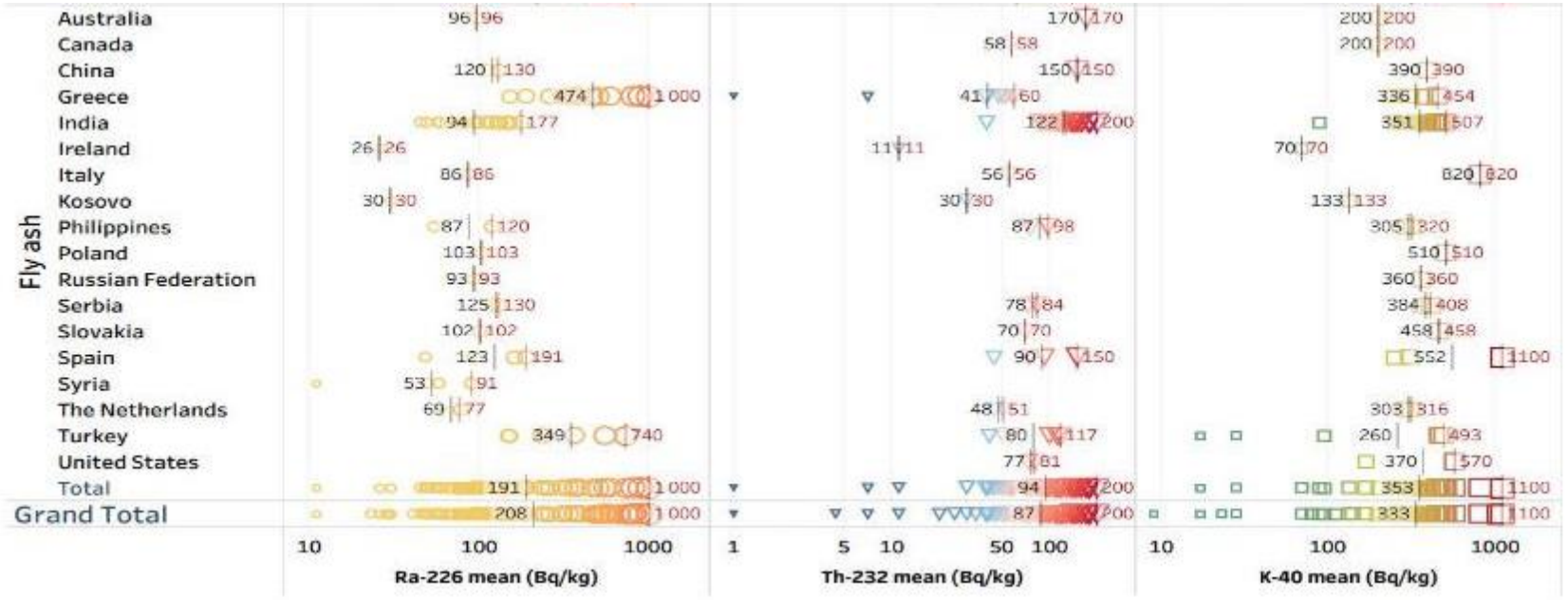
- W. Schroeyers et al. Construction and building materials, 2017, paper in publication

Building the NORM4Building database:

- **By-products & reuse options**

- **Semi-automatic approach for data collection**
  - >68.000 publications processed (from Science Direct, Web of Science, etc…)
  - Manual validation of entries (so far 460 entries validated: 7705 samples)

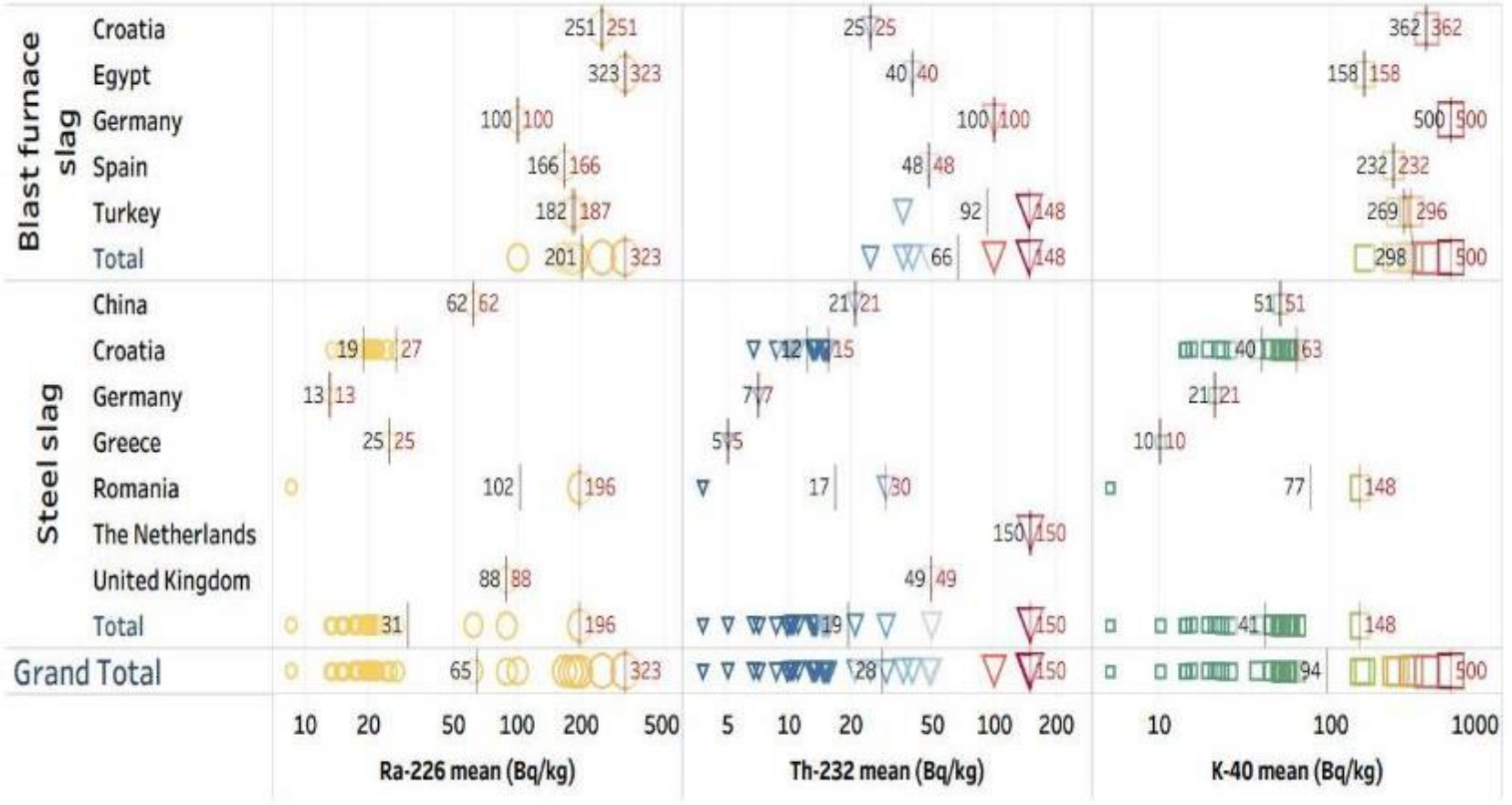
Fly ash from coal, peat and heavy oil fired power plants



NORM4Building database (www.norm4building.org)

- W. Schroeyers et al. Construction and building materials, 2017, paper in publication

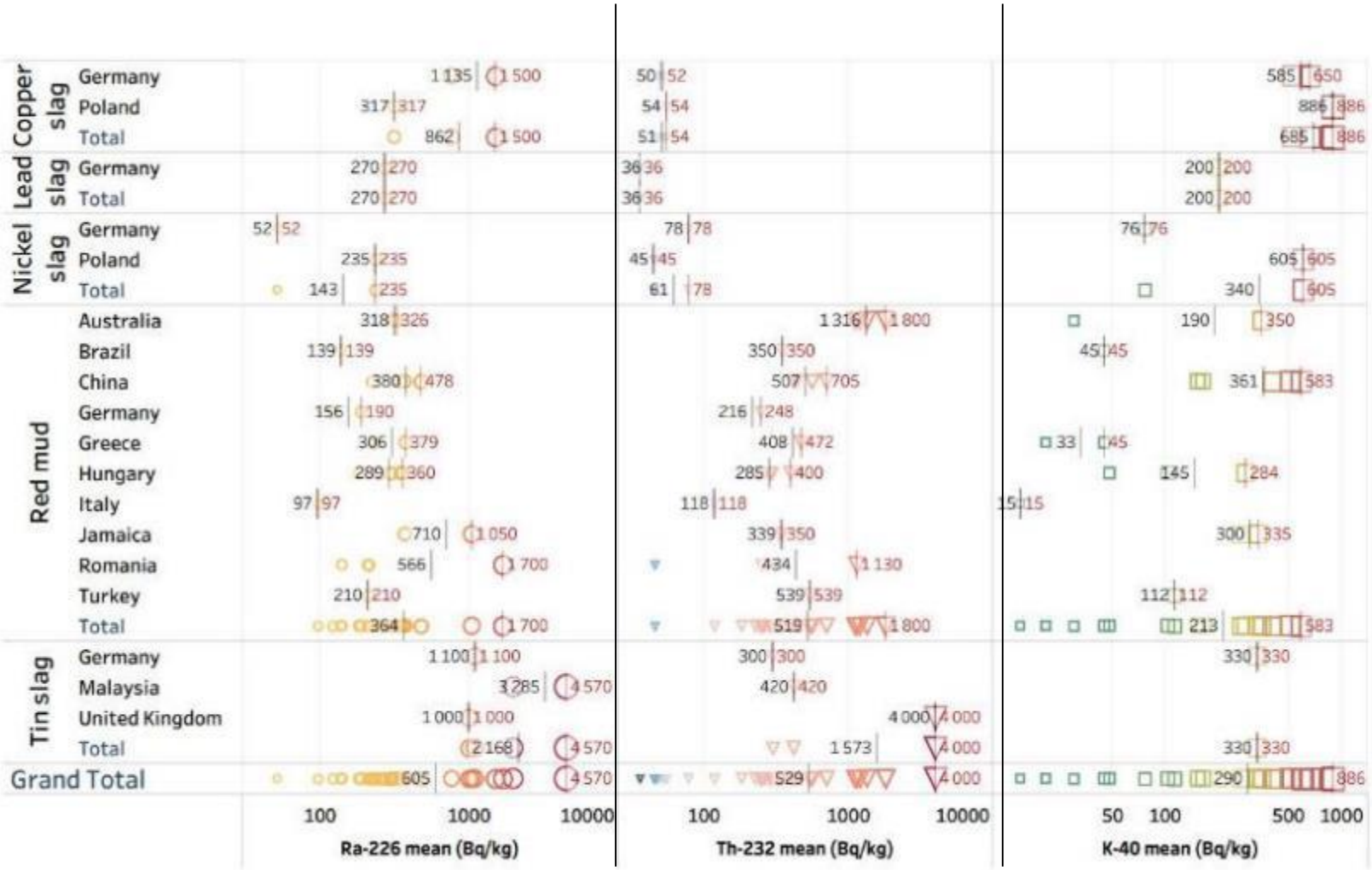
By-products from ferrous industry



NORM4Building database (www.norm4building.org)

- W. Schroeyers et al. Construction and building materials, 2017, paper in publication

By-products from non-ferrous industry



NORM4Building database (www.norm4building.org)

- W. Schroeyers et al. Construction and building materials, 2017, paper in publication

Discussion: evaluating datamining approach

- Strength:
  - **Hundreds of publications** can be **processed monthly**
  - Finds data **accurately**
  - Allows **continuous (automated) search** for new data: useful for keeping inventory up to date
  - Can run again on collected data using **different key-words**

- Limitations
  - Reliability of the data is strongly dependent of the **reliability of the published results:**
  - Validation is a **labour intensive step**
  - Data from **graphical images** (eg.: histograms) is currently not collected
  - Licence for datamining software is **expensive**
  - **Industrially relevant?**
    - **There is a need** to filter out publications according to date, insert **more data from national surveys**

W. Schroeyers et al. Construction and building materials, 2017, paper in publication

I-index calculations

$$I - index = \frac{Ac_{226Ra}}{300\ B\ q/k\ g} + \frac{Ac_{232Th}}{200\ B\ q/k\ g} + \frac{Ac_{40K}}{3000\ B\ q/k\ g}$$

Euratom-BSS, 2013

- First screening to verify if I-index < 1 to assess which materials need further investigation
- **Only used for building materials** (or for their constituents if the constituents are also building materials)
- Values used in calculations:
  - Cement: I-index 0,38 (*)
  - Soil/aggregates: I-index 0,45 (*)

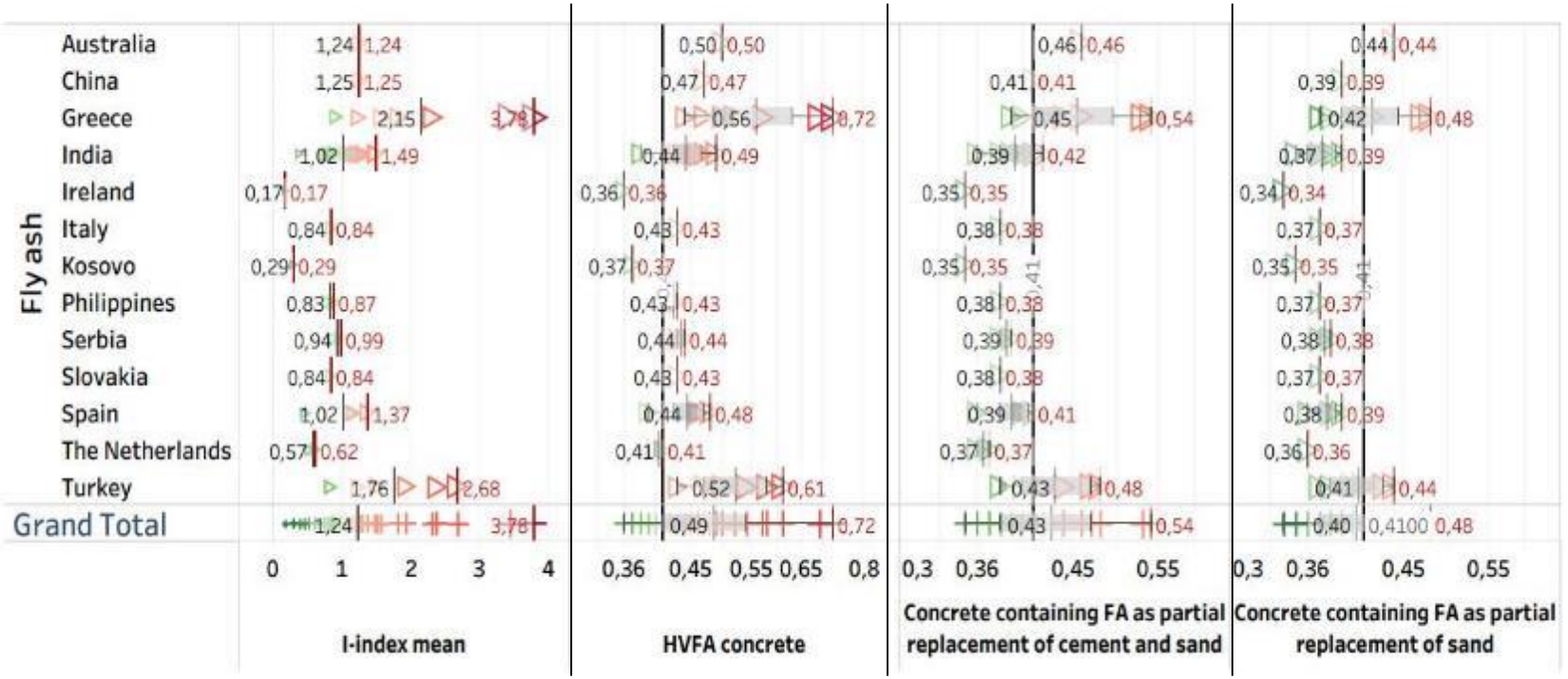
*R. Trevisi et al. J. Environ. Radioact. 105 (2012) 11–20.

Scenarios for evaluation use of by-products

Scenario ID	Construction Material	Composition (kg/m^3)			
		Cement	By-product	Aggregates	Water
1	Reference concrete	400		1850	150
2	High volume fly ash (HVFA) concrete	160	220 (fly ash (FA))	1700	140
3	Concrete with FA as partial replacement of cement and sand'	320	130 (FA)	1750	150
4	Concrete with FA as partial replacement of sand	360	90 (FA)	1800	150
5	Concrete with slag as partial replacement of cement and aggregates'	80	720 (slag)	1850	150
6	Concrete with slag as partial replacement of cement	80	320 (slag)	1850	150
7	Concrete with slag as partial replacement of aggregates'	400	400 (slag)	1450	150
8	Alkali activated concrete containing red mud as partial replacement of cement and aggregates		1800 (red mud)	450	150

- W. Schroeyers et al. Construction and building materials, 2017, in press

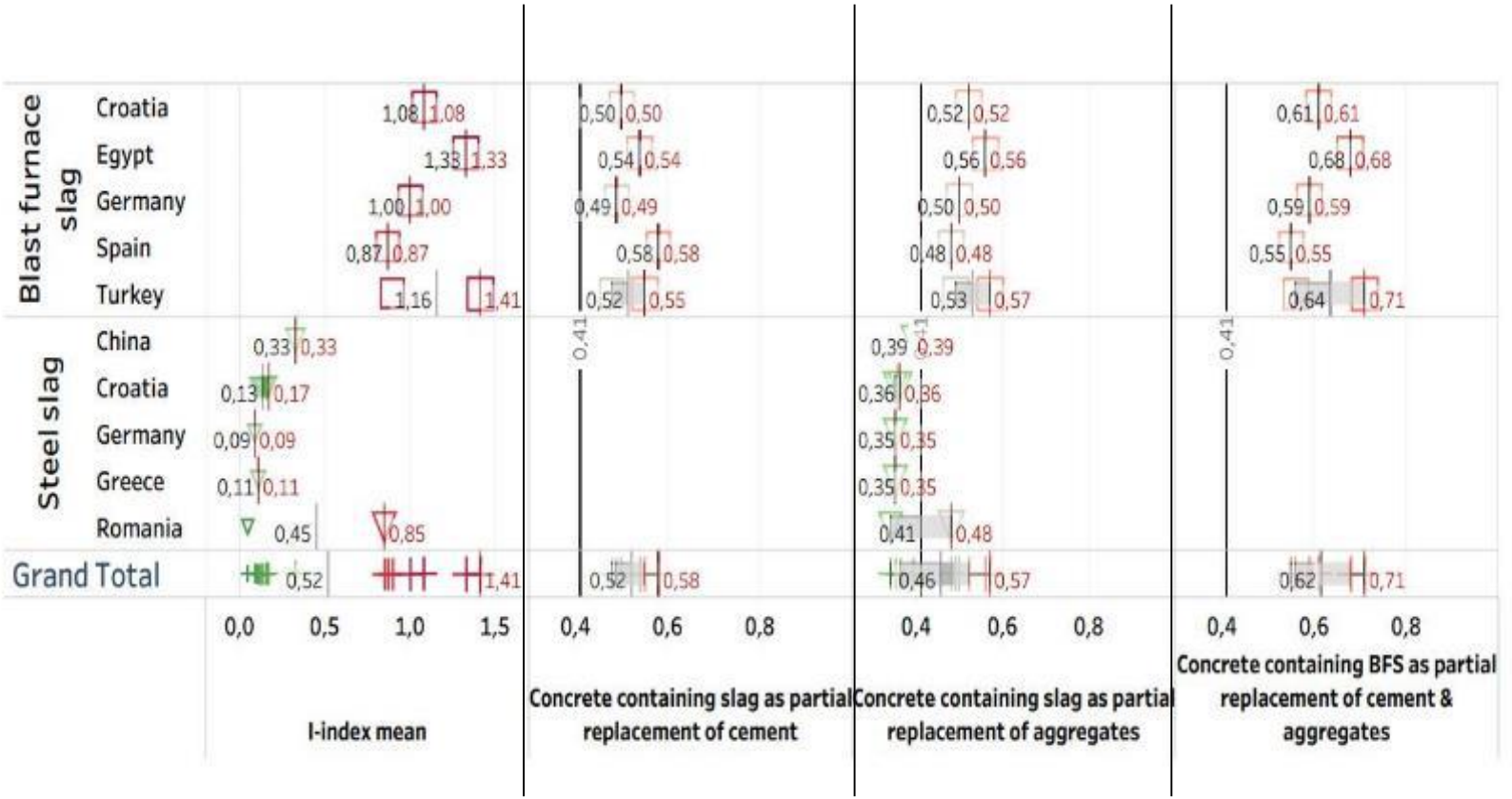
I-index concretes containing fly ash



NORM4Building database (www.norm4building.org)

- W. Schroeyers et al. Construction and building materials, 2017, paper in publication

I-index concretes containing blast furnace slag



NORM4Building database (www.norm4building.org)

- W. Schroeyers et al. Construction and building materials, 2017, paper in publication

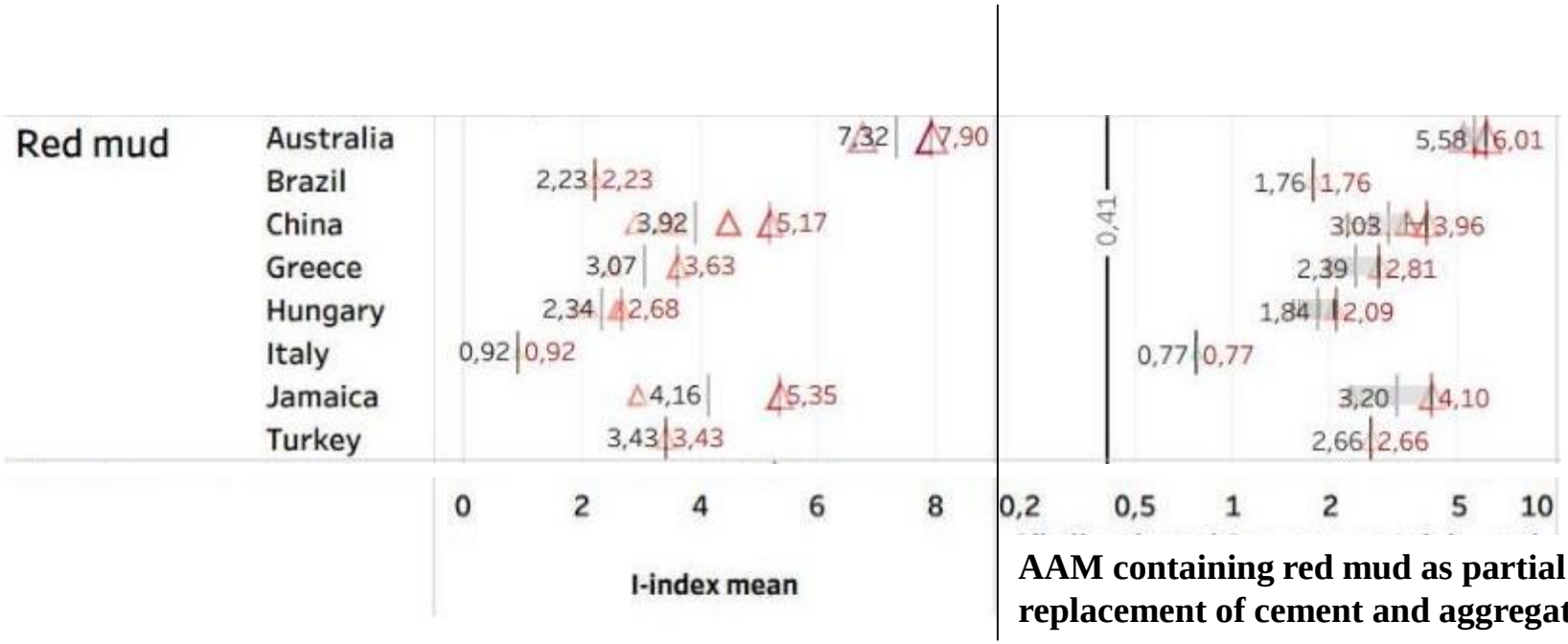
I-index concrete containing non-ferrous slag as replacement aggregates

Concrete containing slag as partial replacement of aggregates

NORM4Building database (www.norm4building.org)

- W. Schroeyers et al. Construction and building materials, 2017, paper in publication

I-index Alkali Activated Material (AAM) containing red mud



AAM containing red mud as partial replacement of cement and aggregates

NORM4Building database (www.norm4building.org)

- W. Schroeyers et al. Construction and building materials, 2017, in press

Outline – NORM4Building

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H2020-MSCA-IF-2015

By-BM

MARIE CURIE ACTIONS

Natural radioactivity database

MSCA project:
Zoltan Sas

By-BM Database

Record info

- Total records: 1526 (1095 Building materials; 436 By-products)
  - 48 countries

Distribution analysis

- Mean value of Ra-226, Th-232 and K-40 content were **2.52, 2.35 and 0.39** times higher in case of the By-products

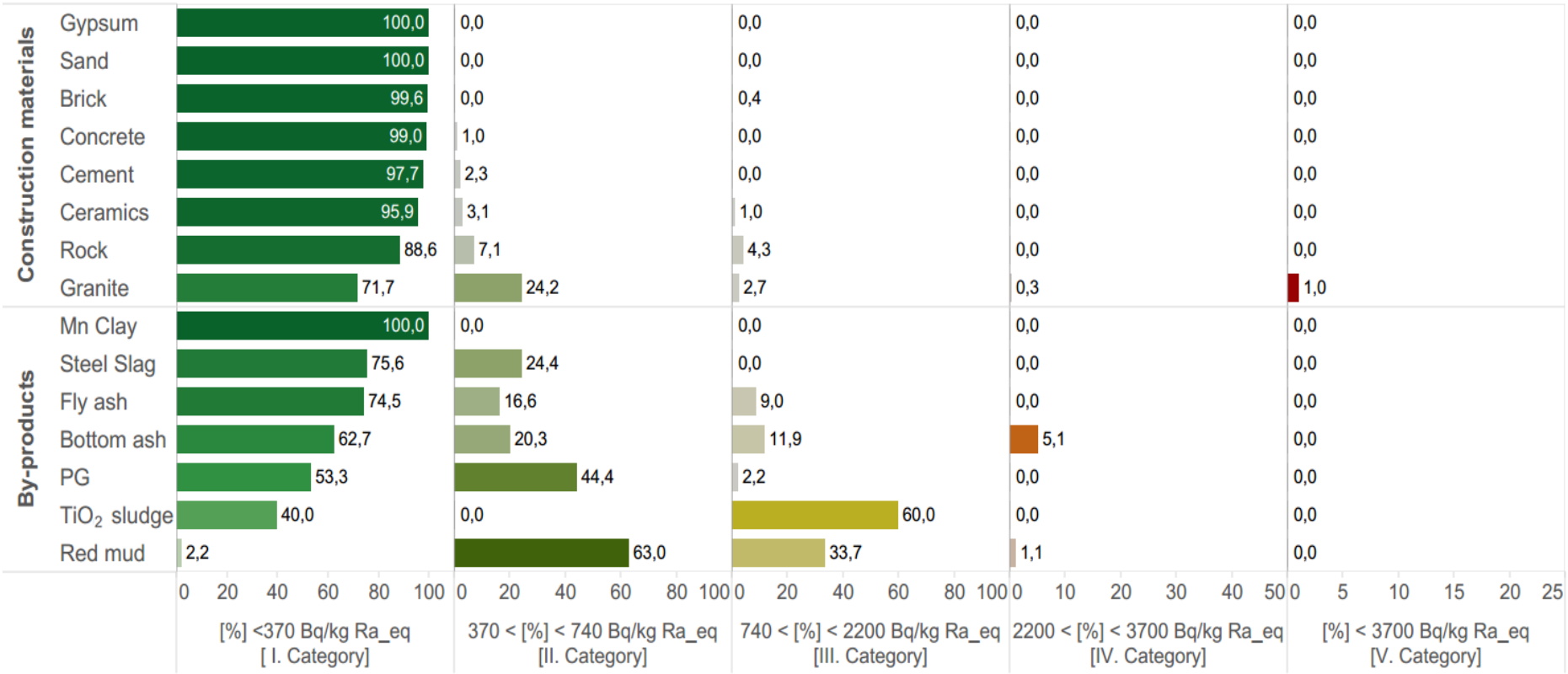
Visualisation

- Demo version is ready

By-BM Database

H2020-MSCA-IF-2015 By-BM

Ra eq conentration of datamined materials



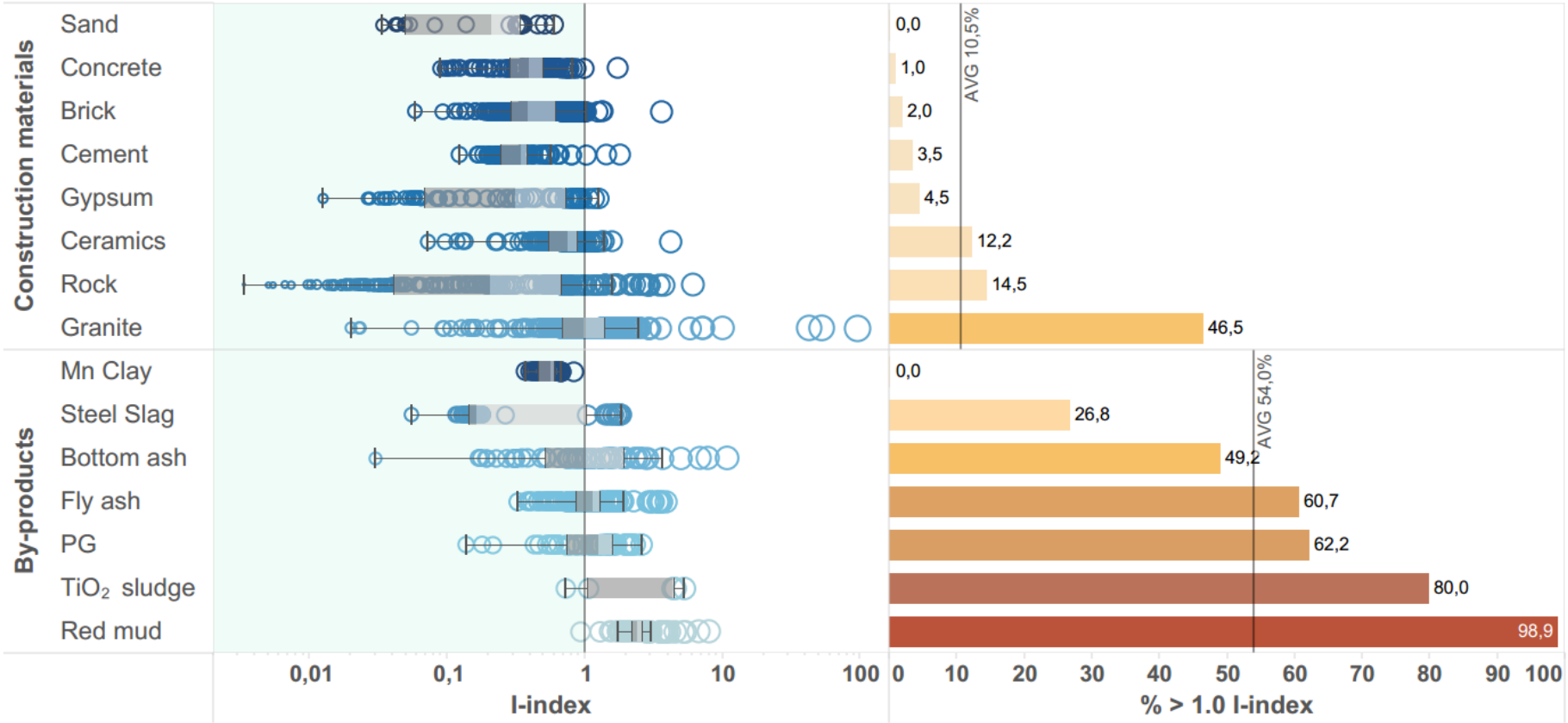
www.bybmproject.com/

Queen's University Belfast · UHASSELT · MARIE CURIE ACTIONS · H2020-MSCA-IF-2015 By-BM · NORM4BUILDING · cost

By-BM Database

H2020-MSCA-IF-2015 By-BM

I-index of datamined materials



www.bybmproject.com/

Queen's University Belfast · UHASSELT · MARIE CURIE ACTIONS · H2020-MSCA-IF-2015 By-BM · NORM4BUILDING · cost

Outline – NORM4Building

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3. **Publications**

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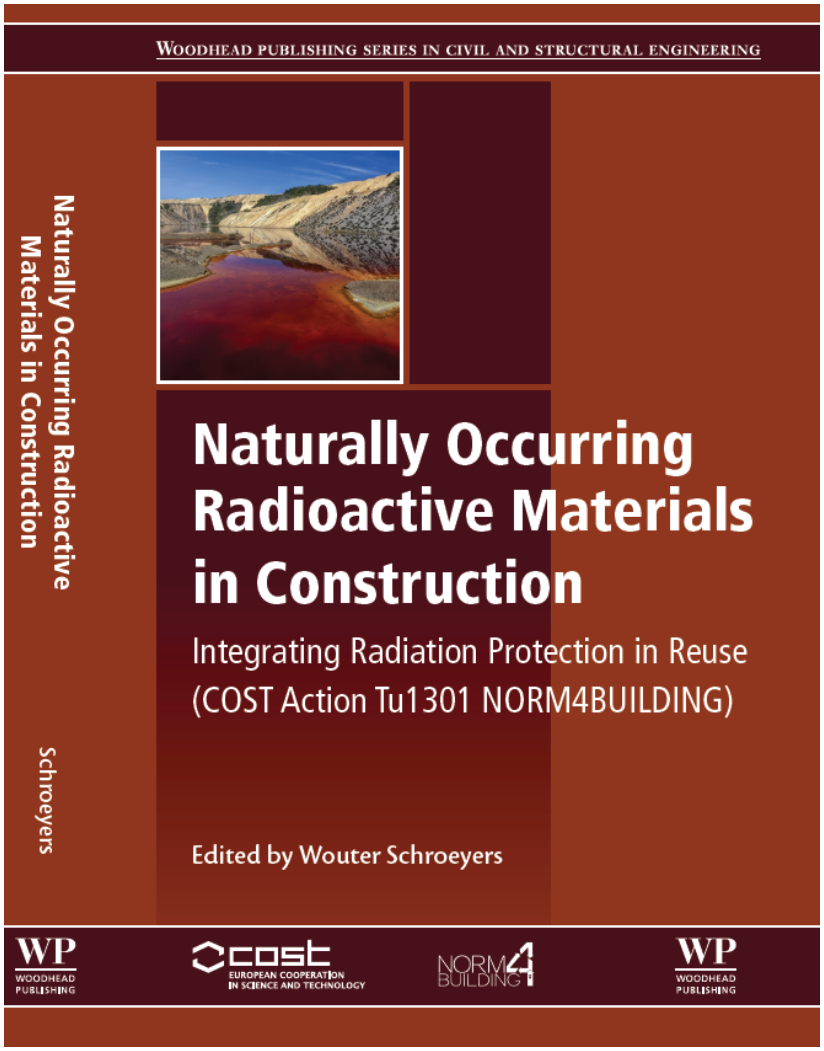
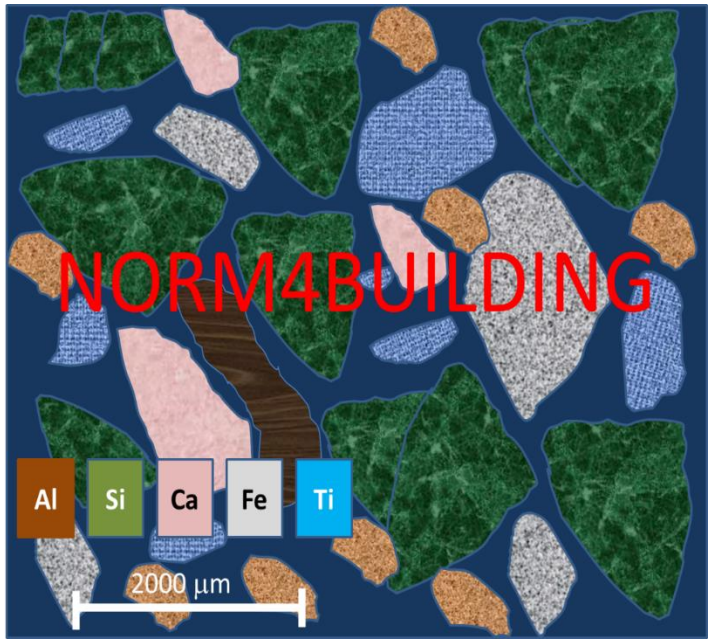
NORM4Building, the book



1. Objectives
2. Introduction
3. Basic aspects of natural radioactivity
4. Legislative aspects
5. Measurement of NORM
6. From raw materials to NORM by-products
7. From NORM by-products to building materials
8. Leaching assessment
9. Nontechnical aspects
10. General conclusion and the way forward

NORM4Building "special issues"



- Previous special issue:
  - **Journal of Environmental Radioactivity**
  - 'Natural radioactivity in construction'
  - Volume 168, March 2017
- Upcoming special issue
  - **Journal: Construction and building materials**
  - Expected publication March 2018

Outline – NORM4Building

1. Introduction

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3. Publications

4. **Conclusions - Outlook**

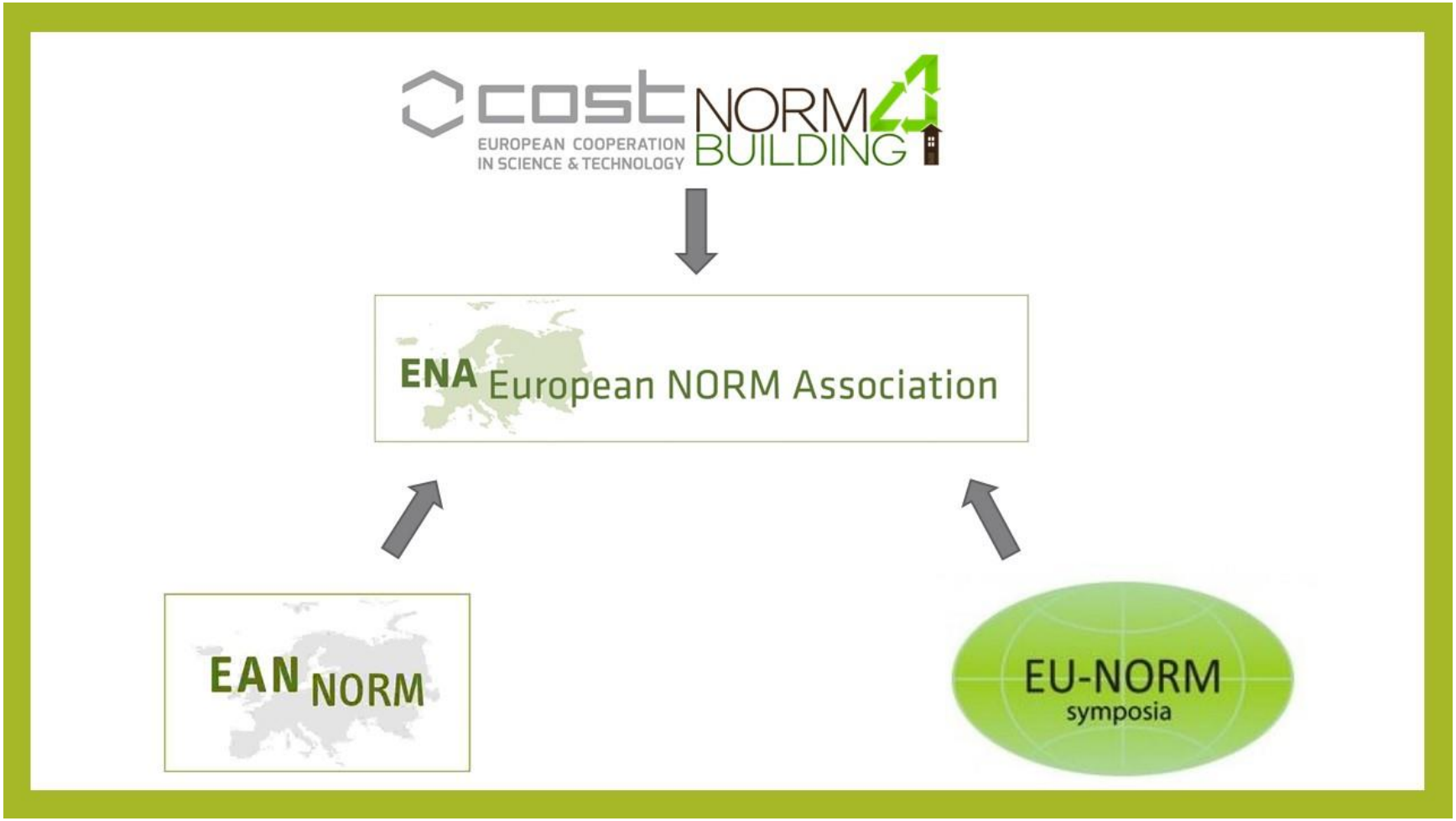
Conclusion - Outlook

- **Maintenance, updating and expanding the database**
  - To make the database **industrially relevant**: option is to **apply the datamining tool on national surveys** (and update it when a new survey is uploaded)?
  - **Link measurement information** (including **date of measurement**) **to data entries** (also to data entries in national surveys, international reports…)
    - ➔ This means referring to the original reference/source where it was actually measured

- Control/verification of entries is a **very labour intensive process**!
  - Especially kicking out overlapping information is cumbersome
  - Evolving towards a database of "**original measurement entries**" that allows much more statistics and better visualisation

- NORM4Building the **book and dedicated publications**
  - Provide information on entries in the database

Towards a “European NORM Association”



ENA European NORM Association

The 1st ENA Workshop

Katowice
Upper Silesia, POLAND

19-23 November 2018

Silesian Centre for Environmental Radioactivity,
Central Mining Institute (GIG), Plac Gwarków 1, Katowice, Poland

GIG

The 1st ENA Workshop

See you 19-23 November, 2018 !

ENA European NORM Association