

Report on landfills in Slovenia

MINEA WP2 (Country reports)

ZAG:

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Others: Tadej Žurman, Mirko Šprinzer (PKG), Igor Kos (Wcycle institute), Branko Kosi (Snaga)

ZAG – who we are?

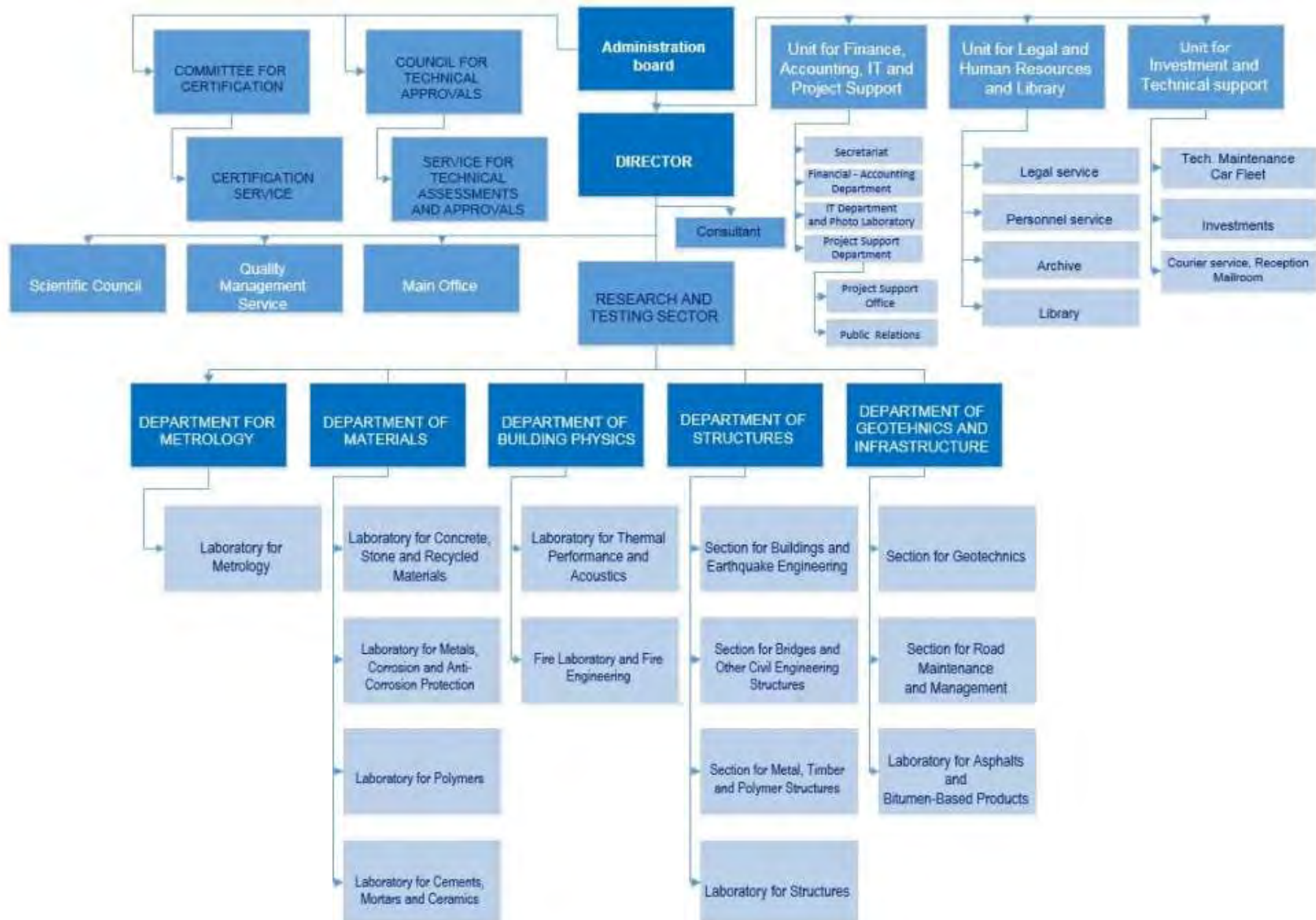


SLOVENIAN
NATIONAL BUILDING
AND CIVIL ENGINEERING
INSTITUTE

www.zag.si

Public research institute, 181 employees, 5 departments: Materials, Building Physics, Construction, Road Infrastructure, Metrology, annual turnover: app. 8-10 mio €

Organization scheme



Laboratory for Stone, Aggregate and Recycled Materials



- Applicative researches work as well as expert work, consultancy and supervision in the following area:
 - Aggregate (natural, recycled, manufactured) and stone (natural, aggregated)
 - Environmental Engineering: recycling and remediation (water, soil), in-situ immobilization of degraded soil, zero approach in LM
 - Life cycle assessments (E-LCA, S-LCA, LCC) - > EPD
 - Specialized mineralogical (e.g. asbestos, dust in working environments...) and microstructural analysis (microXCT, 3D IA, FE-SEM, rheology, zeta potencial...)
 - Industrial symbiosis, cultural heritage



Our motto

DON'T WASTE
YOUR WASTE!!!

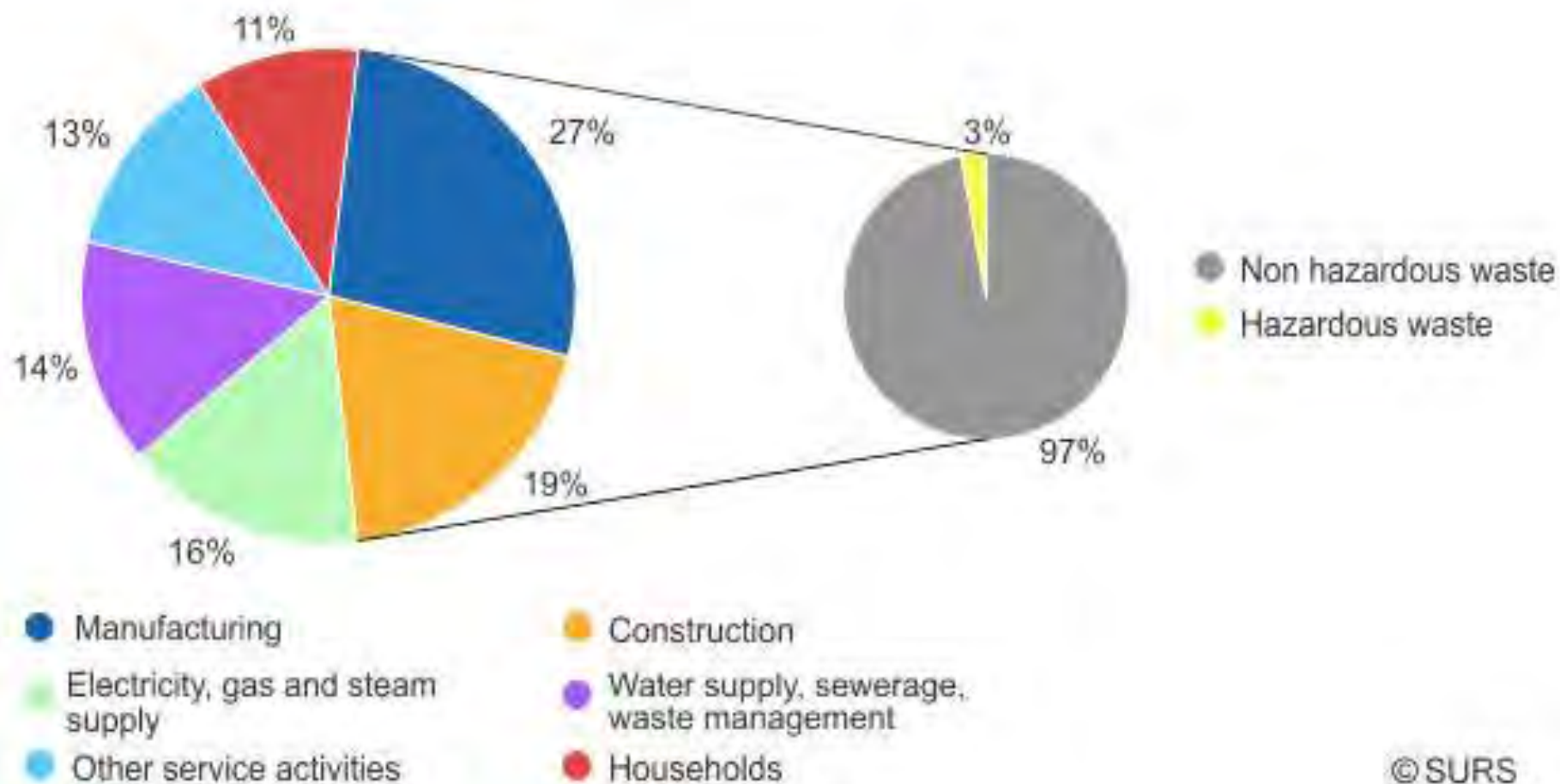


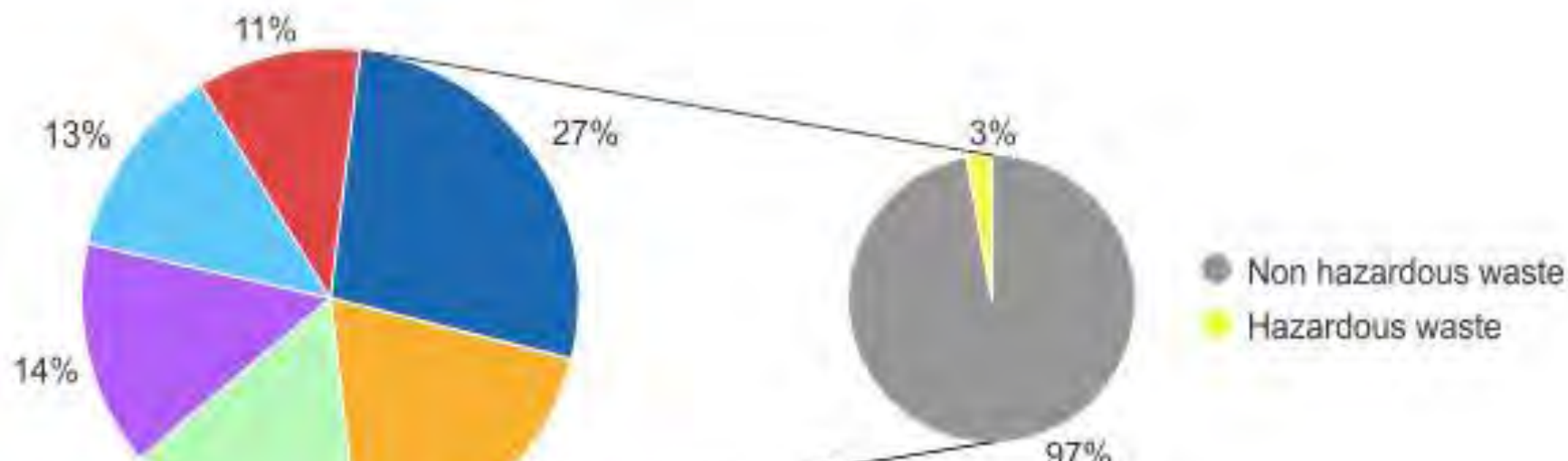
Total waste generation

- Slovenia: 20.000 sq km, 1.7 million people
- 2015: 5.2 mt of waste in Slovenia, MW:929kt



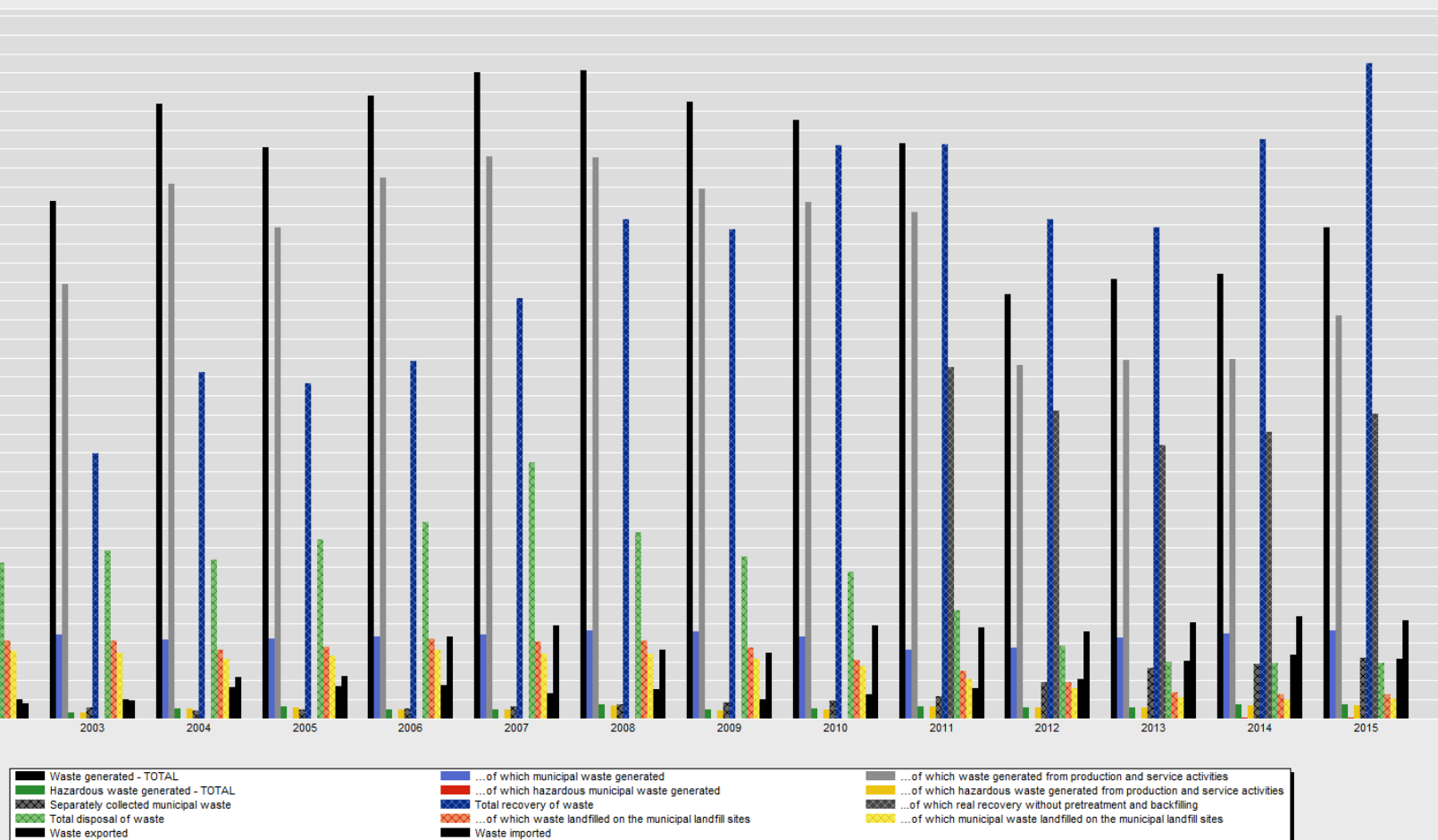
- C&D: 28%
- Waste from thermal processes: 19%
- MW: 18%
- Waste from WMF: 13%
- Waste from wood and waste from metal processing: 12%
- Waste packaging: 5%



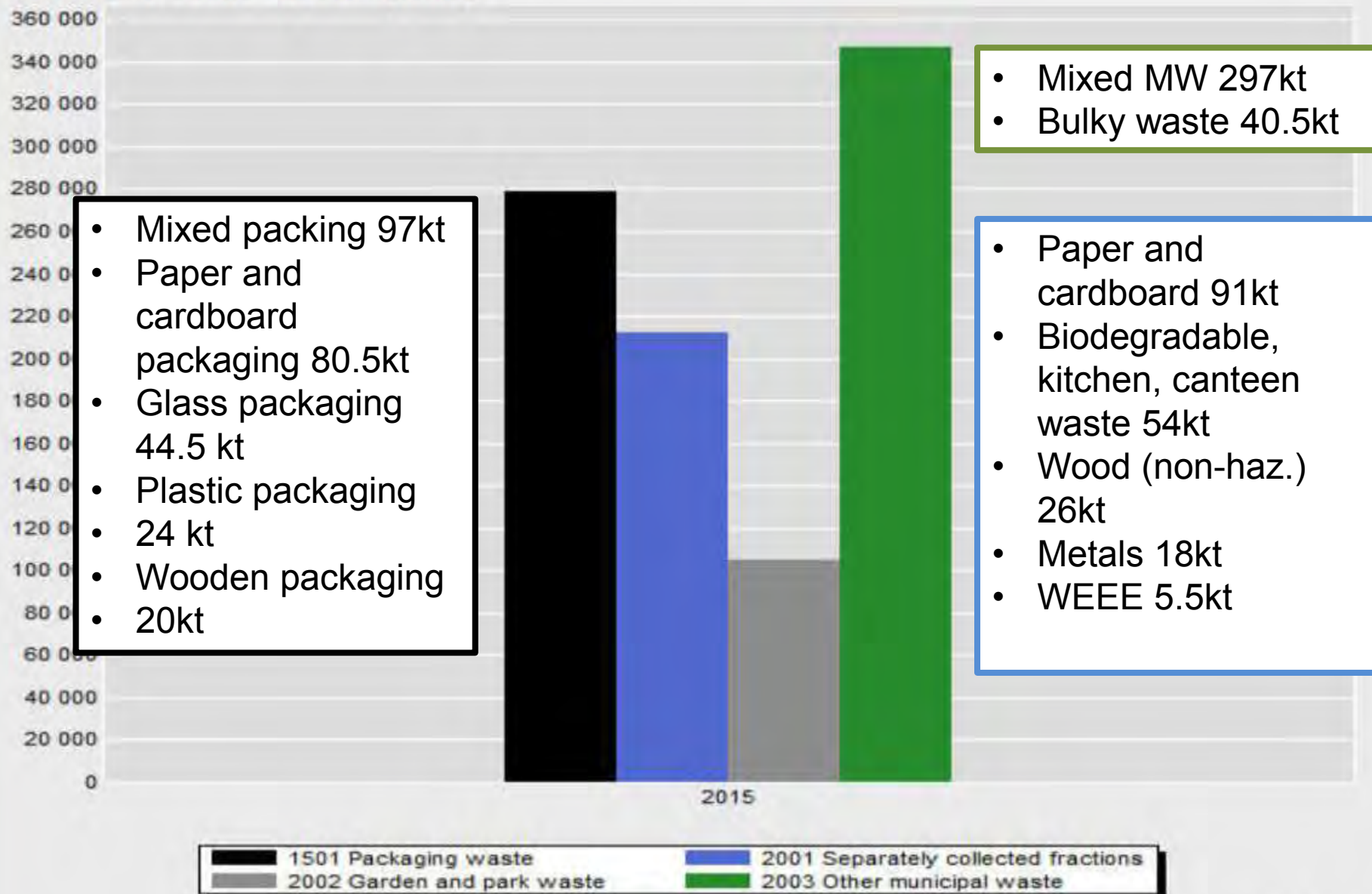


	2014		2015		2015/2014
	Tones	%	Tones	%	index
Total amount recovered	6,098,139		6,899,709		113
...incineration as fuel	268,938	4	265,045	4	99
...recycling	2,682,439	44	2,870,078	42	107
...composting	70,395	1	72,366	1	103
Total amount disposed	584,135	9.6	591,442	8.6	101
...incineration	34,654	0.5	35,504	0.5	102
...landfilling	282,989	5	275,388	4	97
Export	671,460	11	629,158	9	94

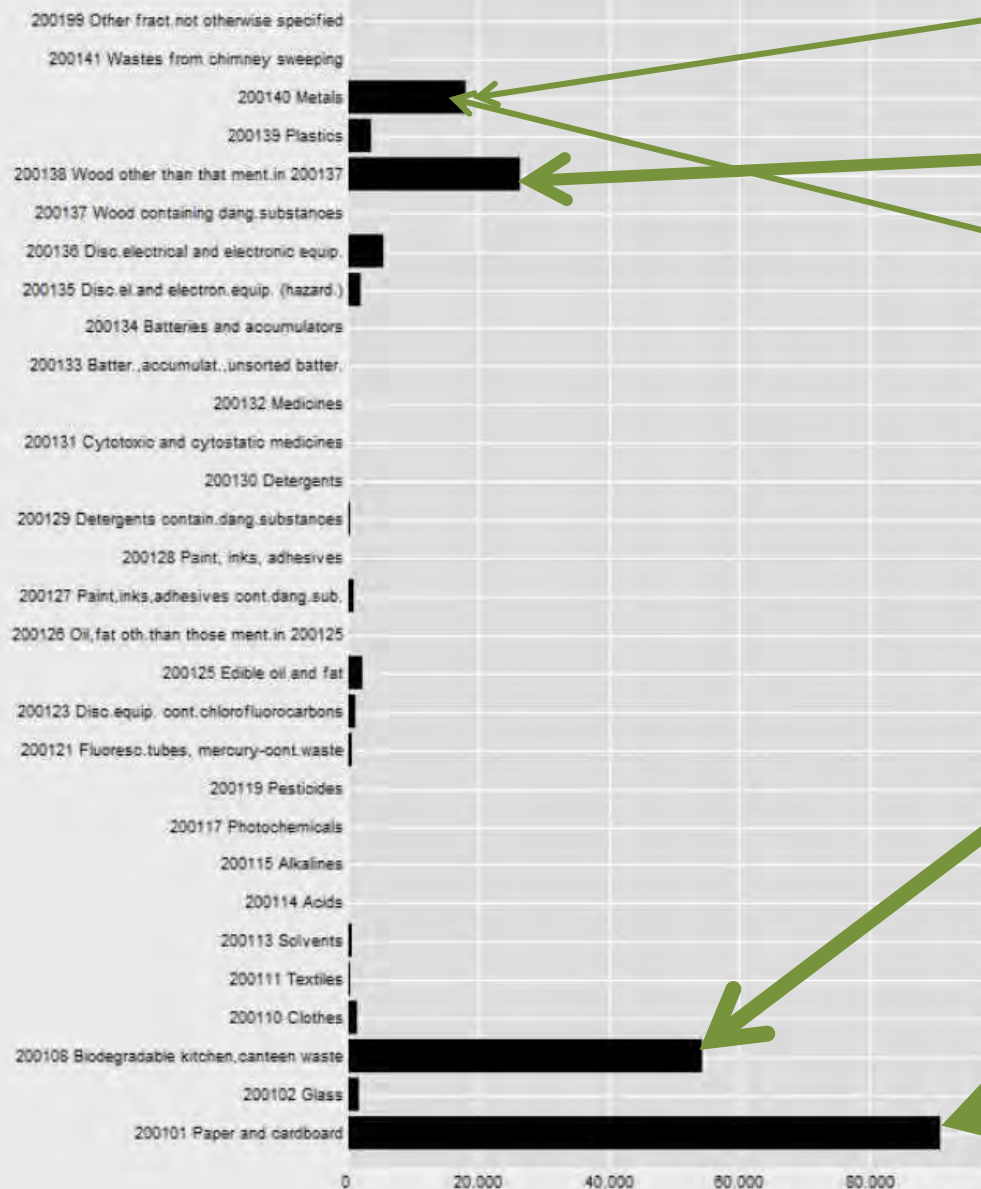
Waste (tons)
by WASTE and YEAR.
(tons)



**Municipal waste generated and treatment (tons),
by LIST OF WASTE and YEAR.
Yearly amount - TOTAL. (tons)**



**Municipal waste generated and treatment (tons),
by LIST OF WASTE.
2015, Yearly amount - TOTAL. (tons)**

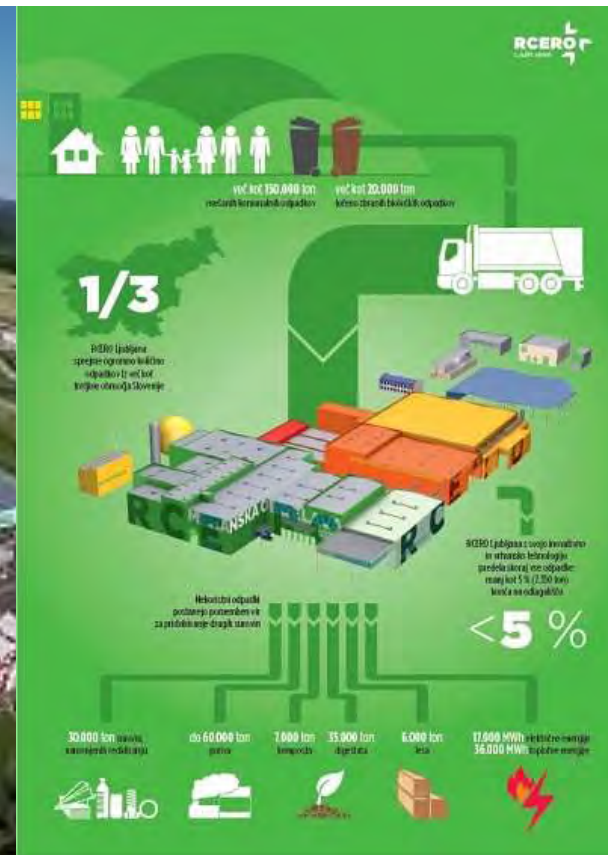


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Some good examples of waste treatment

- RCERO near Ljubljana: new regional waste treatment center (pretreatment option)



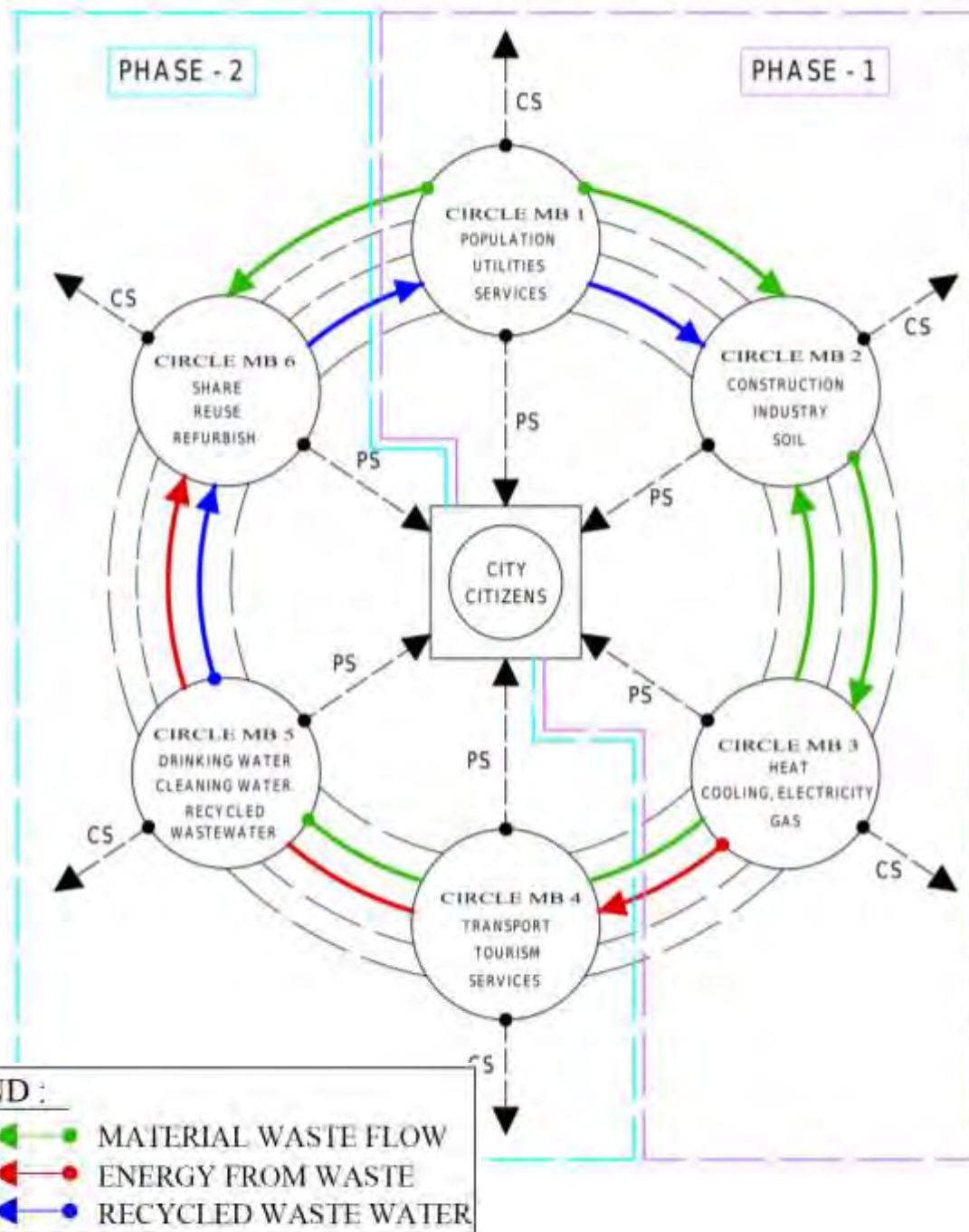
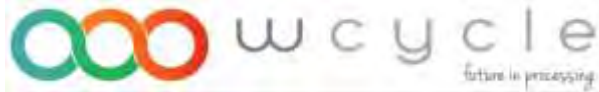


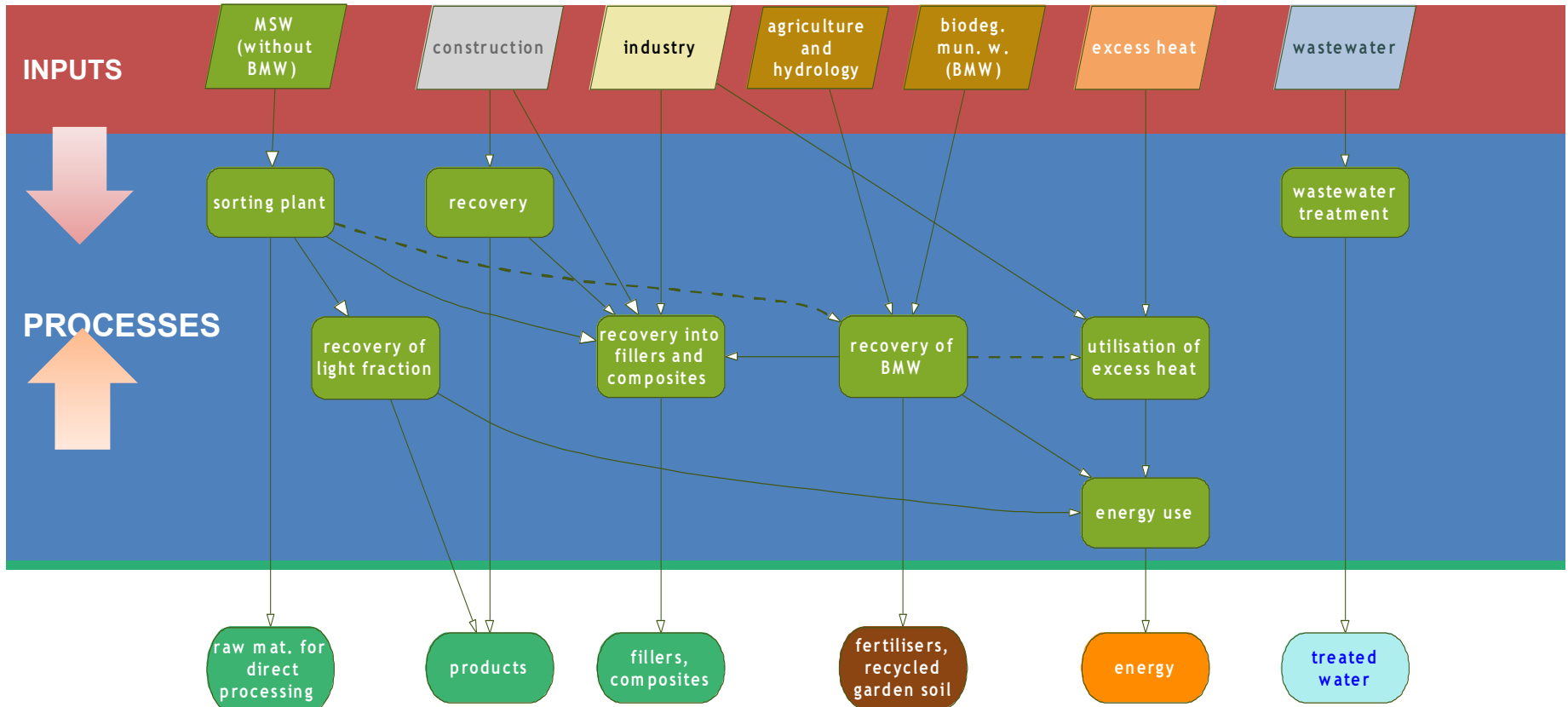
Collection of waste "at your doorstep"
(bins and underground containers at
collection sites). Source: www.snaga.si

Movable collection unit for hazardous
household waste. Source:
www.snaga.si

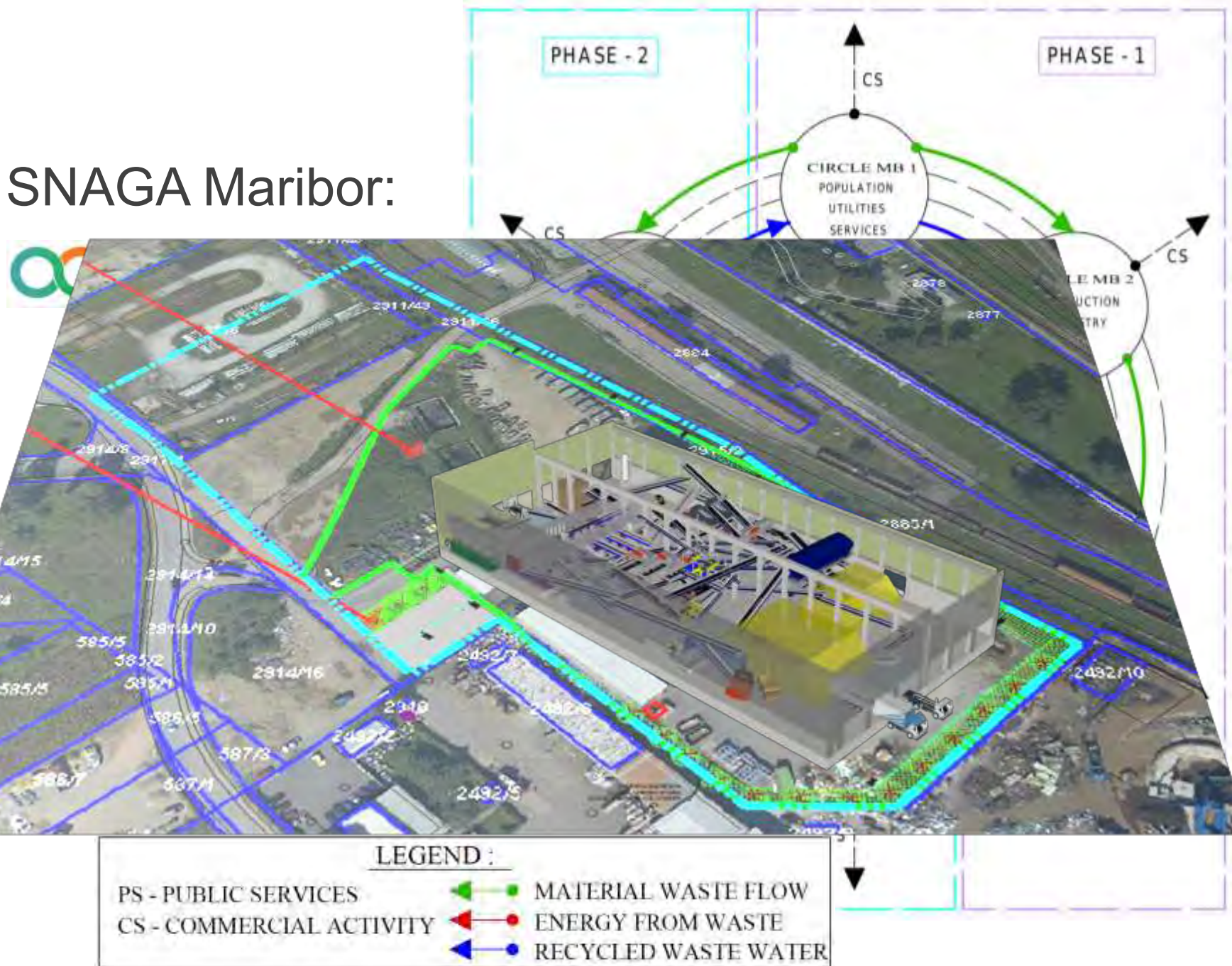


- SNAGA Maribor:





- SNAGA Maribor:



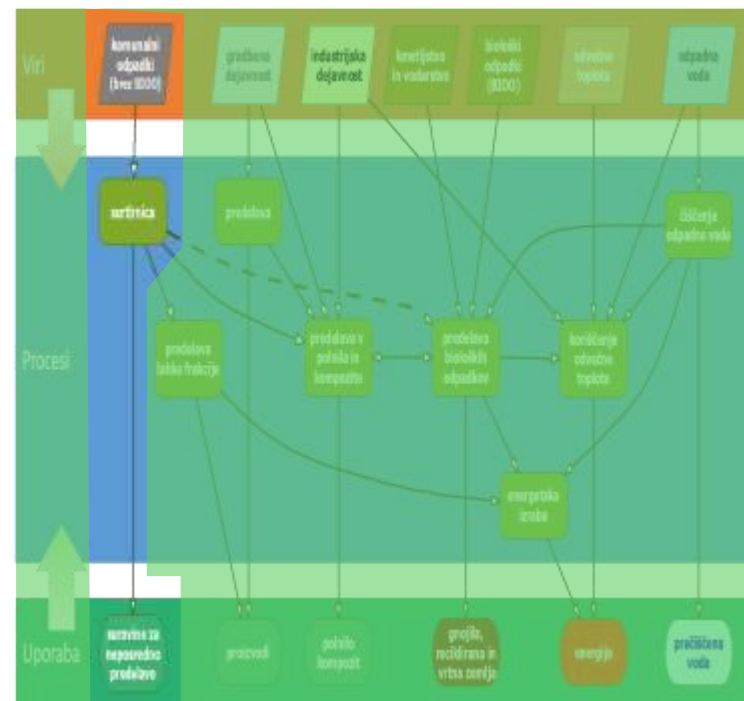
Input materials:

- Mixed municipal waste
- Bulky waste

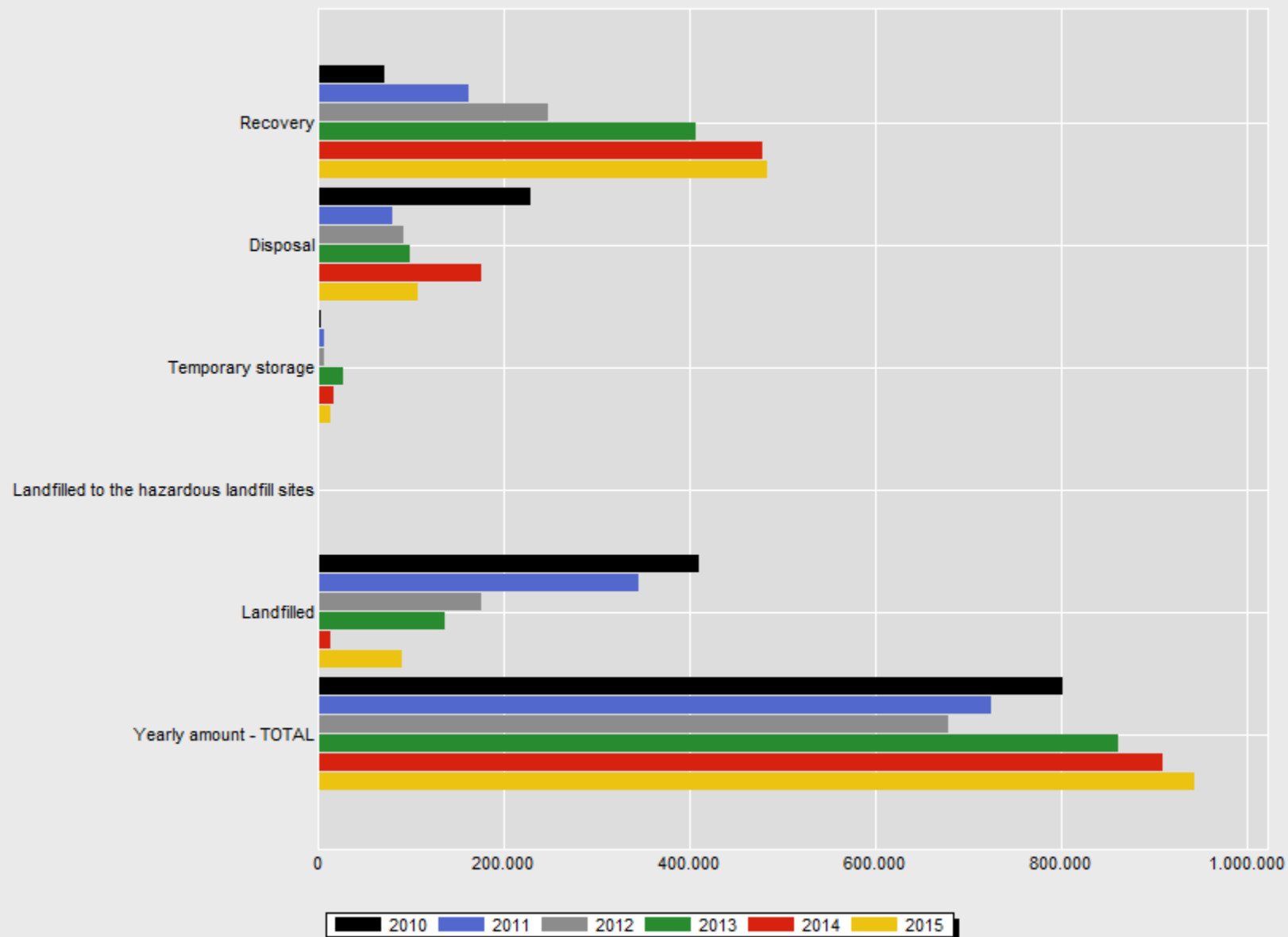
Mechanical sorting

Three types of outputs

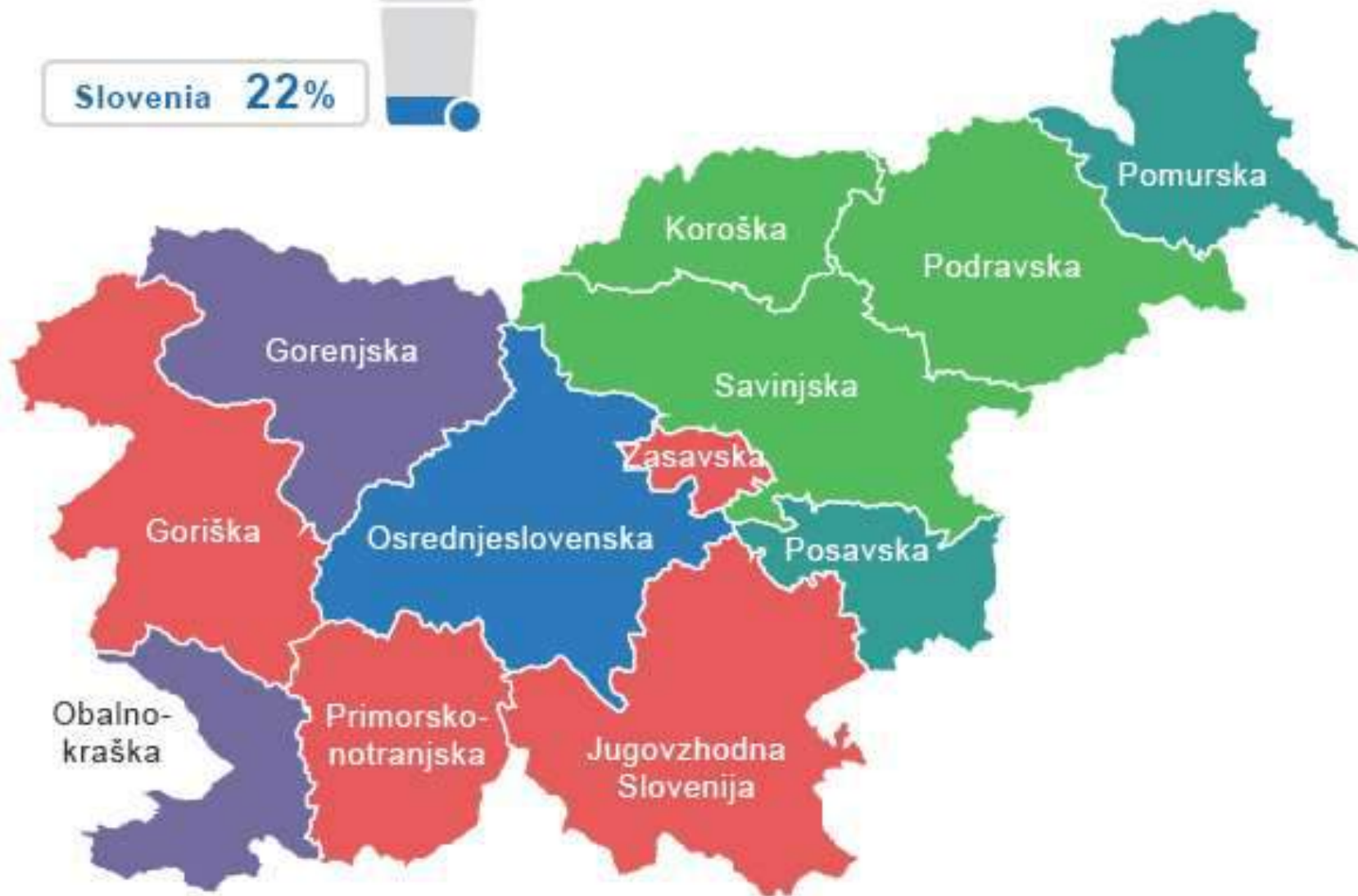
- **Recyclates**— direct handover for processing (different types of metals, various types of plastic, paper)
- **Light fraction (LF)** – into further recovery process
- **Heavy fraction (TF)** – into further recovery process



**Municipal waste generated and treatment (tons),
by YEAR and MEASURES.
List of waste - TOTAL. (tons)**



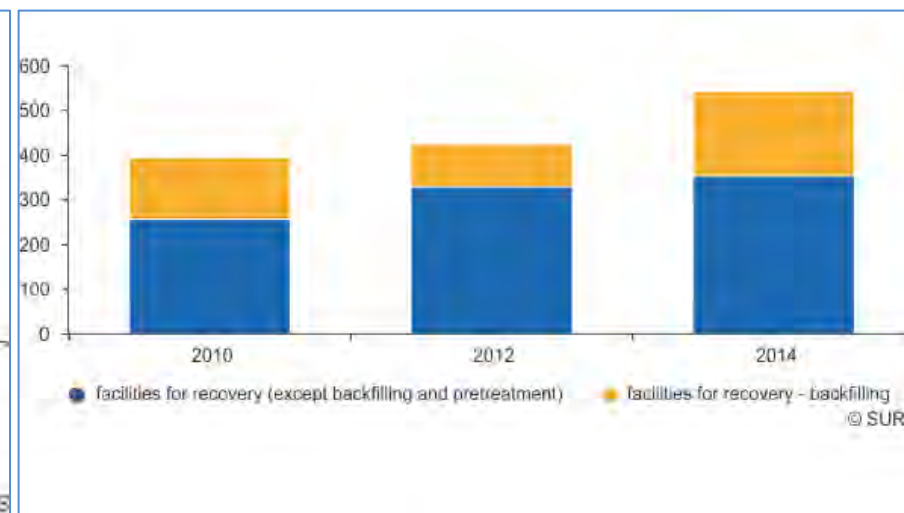
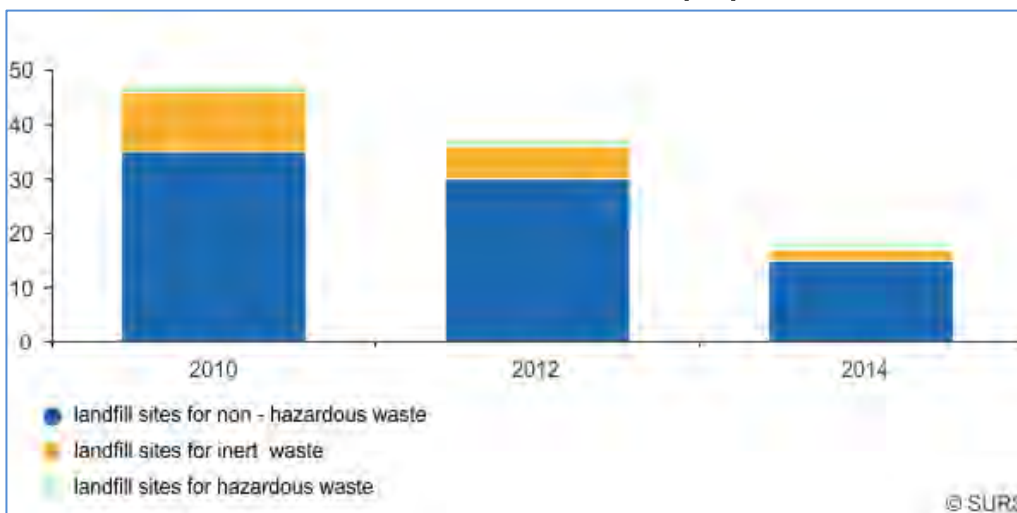
Slovenia 22%



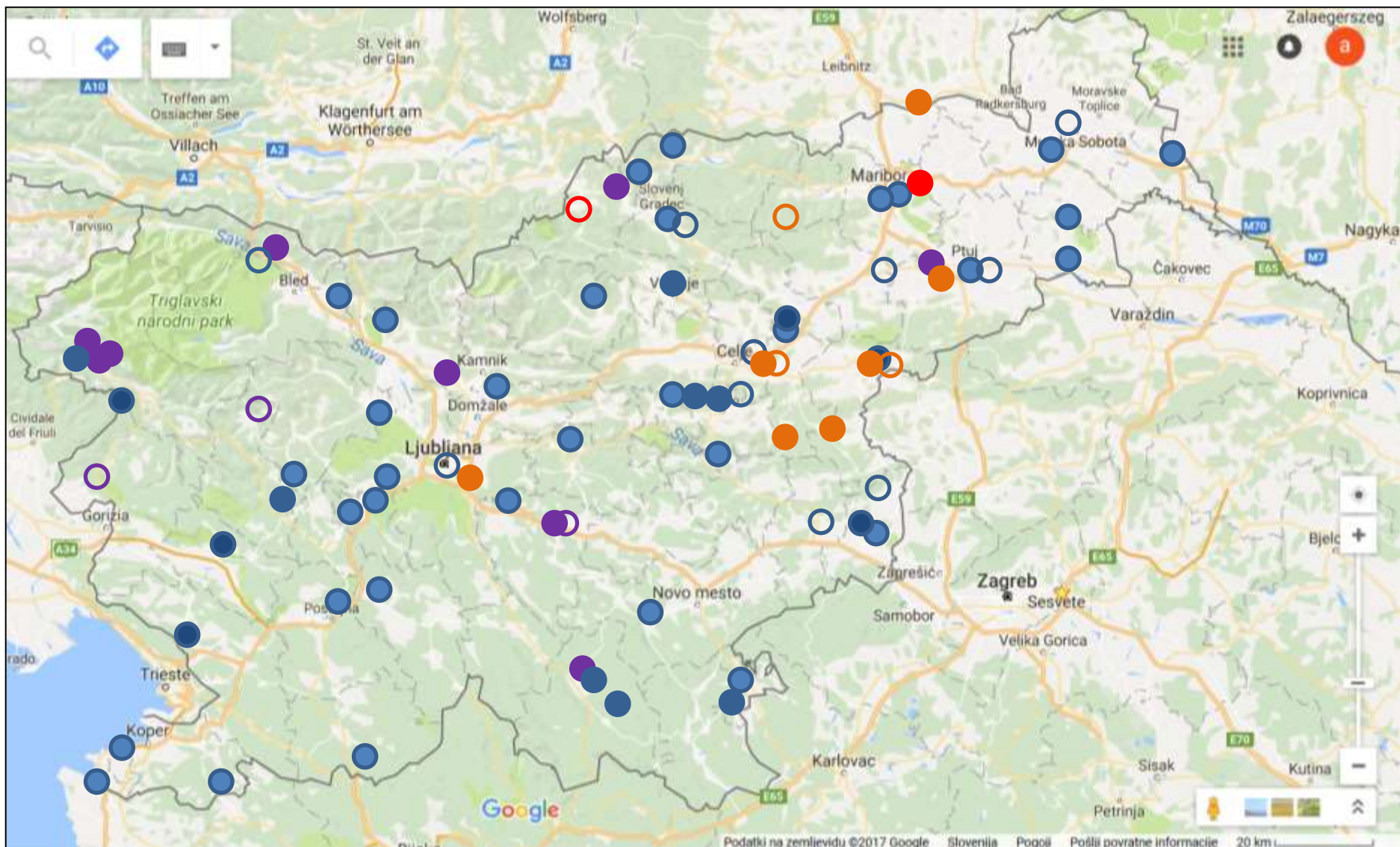
Landfilling per regions.

Landfills

- Feb 2015: [82 landfills](#) (45 closed, 19 in process of closing and 18 active)
 - MW landfills: 57 (11)
 - Inert: 12 (3)
 - Non-hazardous: 10 (3)
 - Hazardous: 2 (1)

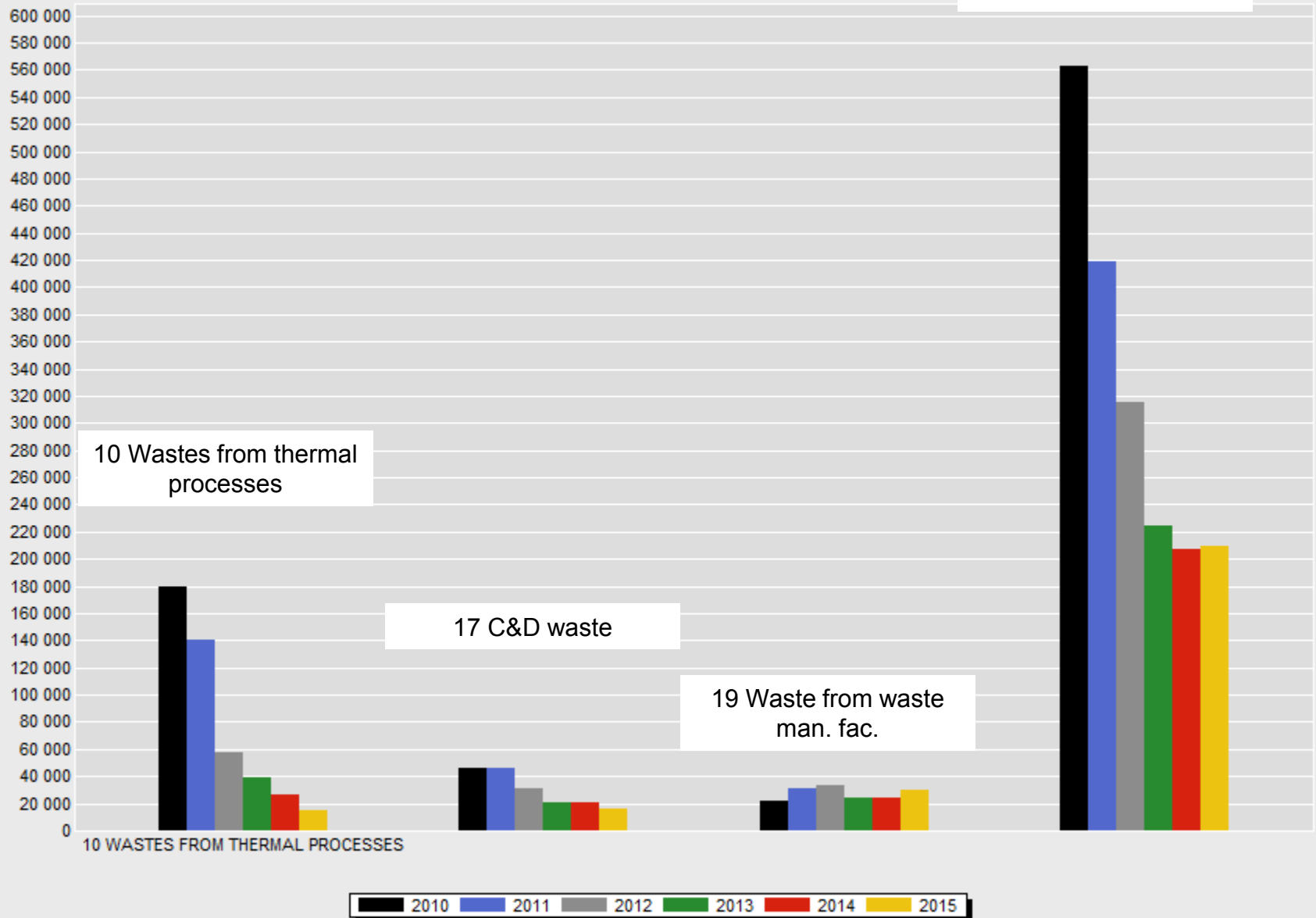


Source of data: Environmental Agency of Republic of Slovenia



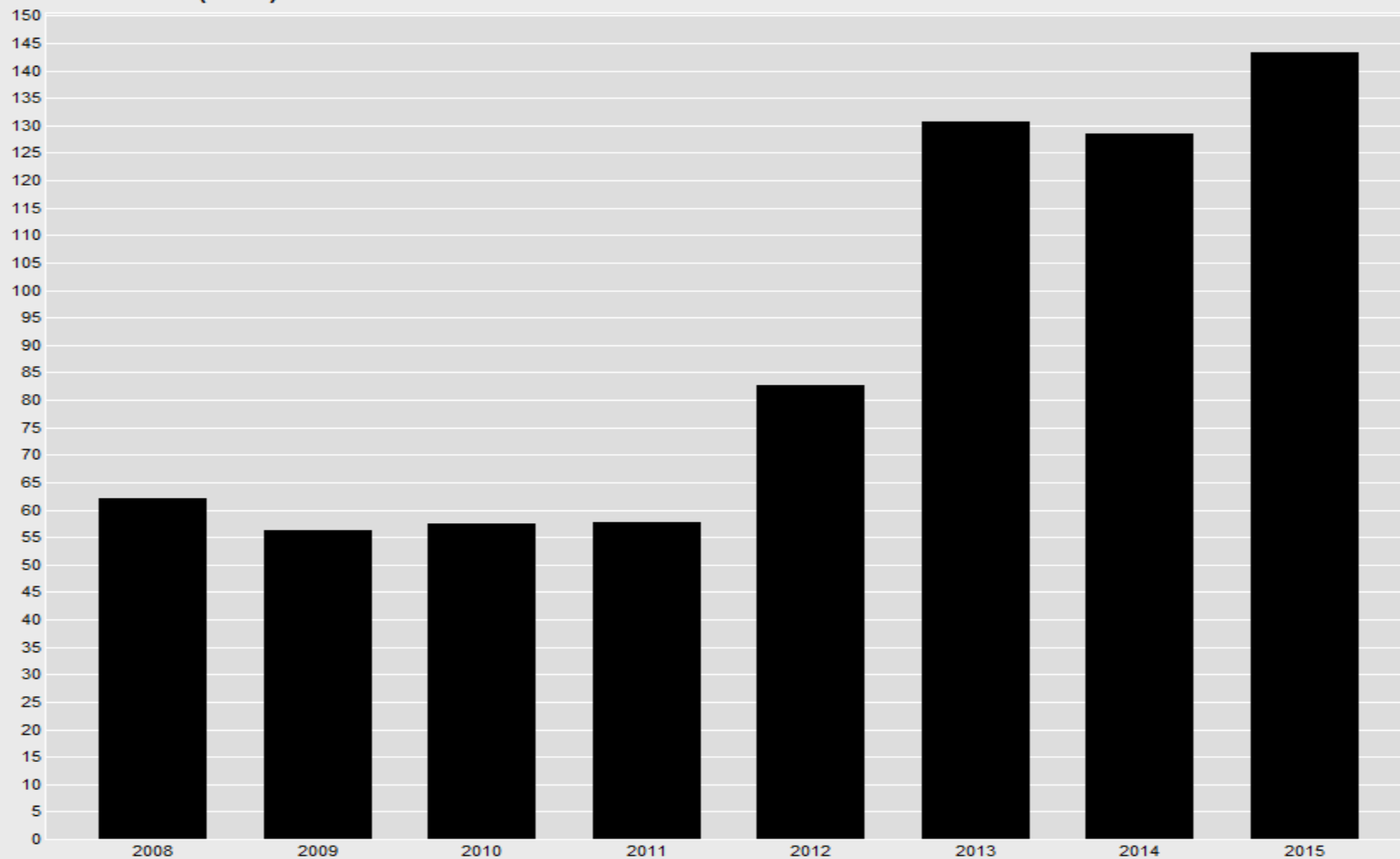
- MW landfil
- Inert w. landfill
- Non-hazardous w. landfill
- Hazardous w. landfill

**Amount of landfilled waste
by YEAR and LIST OF WASTE.
Landfilling - TOTAL. (tons)**



Pollution taxes

Environmental taxes
by YEAR.
Pollution taxes. (mio €)



Landfill mining in Slovenia - cases

- Municipal waste – some studies (*Eberl & Zupančič, 2012*)
 - Landfill near Ljubljana, central Slovenia: drill cores 0 – 12m



- Excavation without previous aeration and trial waste sorting: CERO Puconci, NE Slovenia

- **Industrial landfills**
 - Old landfills of ladle slag at Acroni steel making plant in Jesenice, NW Slovenia:



- **Building composites: use for geotechnical works: filling (e.g. mining areas), embankments**
- **Construction products (Slovenian Technical Approvals)**

Overview of issued European Technical Assessments, Slovenian Technical Approvals and Environmental Product Declarations

Client / Owner

Product family

Compliance system

Harsco Minerali d.o.o. x ▼

Select product family ▼

Select compliance system ▼

Search:

Type	Product	Client / Owner	Product family	Issued	Valid until
STS-13/0006	HARMINIT B-11	Harsco Minerali d.o.o.	Nasipni materiali	02.04.2014	04.07.2018
STS-14/0013	HARMINIT A-31	Harsco Minerali d.o.o.	Nasipni materiali	02.04.2014	01.04.2019
STS-14/0002	EKOMINIT S1	Harsco Minerali d.o.o.	Nasipni materiali	29.01.2016	13.01.2019

10 ▼

zadetkov/stran

First

Previous

1

Next

Last

Slovenina Technical Approval STS-13/0006

Client / Owner: Harsco Minerali d.o.o.

CESTA BORISA KIDRIČA 44

4270 JESENICE

Commercial product HARMINIT B-11**name:**

Kompozit iz avtohtone gline in mineralnega produkta iz deponijske bele žindre - za sanacijo peskokopov in nasipe z nizkimi zahtevami za varnost

Facility: Termit d.d., Drtija 51, 1251 Moravče**Release date:** 02.04.2014**Valid until:** 04.07.2018**Compliance system:** 1+, 4**Product family:** Nasipni materiali

New technical approvals

Vročje valjano rebrasto armaturno jeklo v kolutih, razreda jekla B 500B, f18 -f16 mm (STS-07/061)

📅 31.07.2017

Enokrilna lesena požarna vrata VRHE 1 in VRHE 2 (STS-17/0010)

📅 24.07.2017

HTR-P and HTR-M (ETA-16/0116)

📅 20.07.2017

PSV (ETA-15/0233)

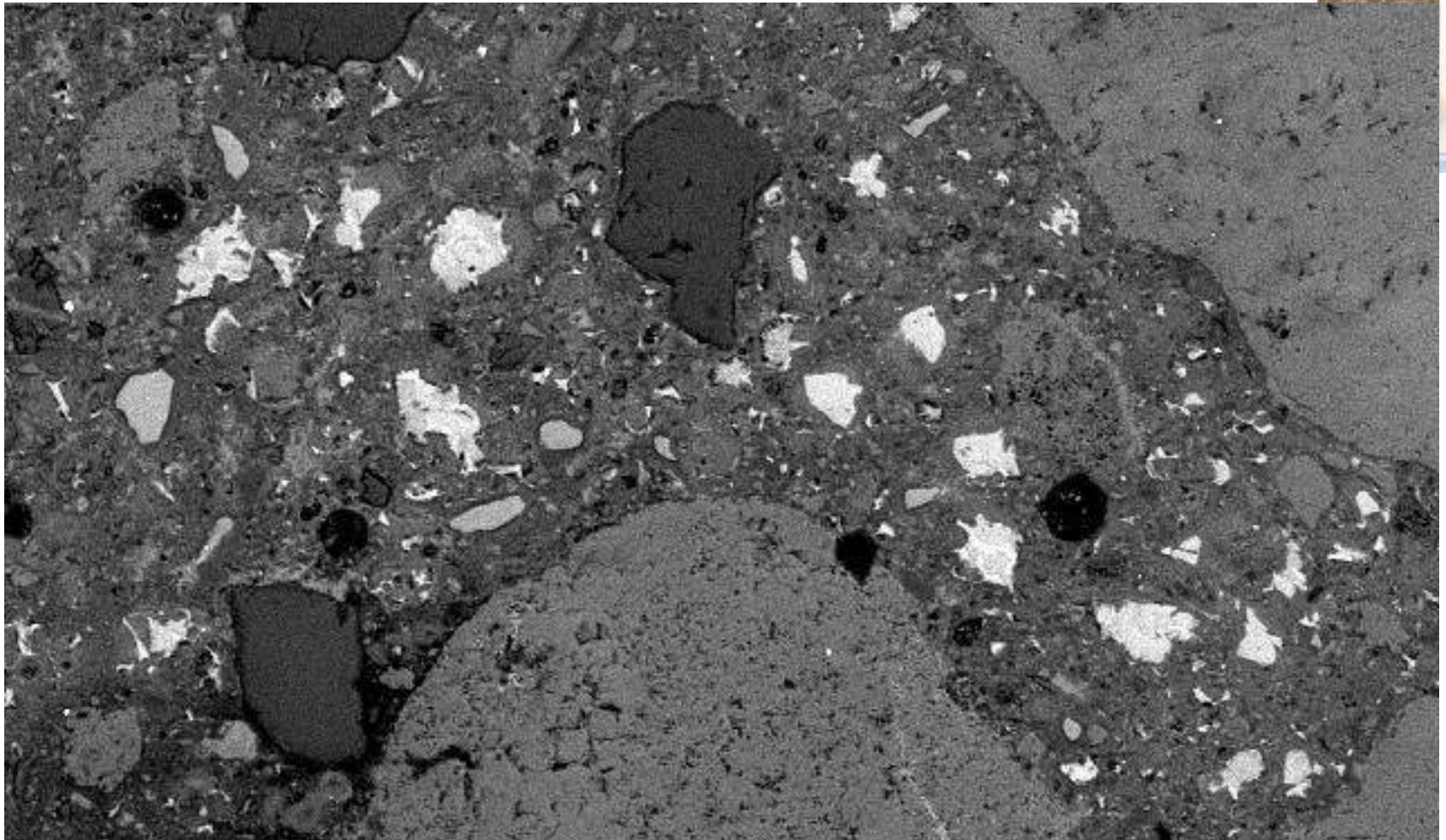
📅 19.07.2017

REMIX SS 0/4, REMIX SS 0/32, REMIX SS 0/120 (STS-17/0009)

📅 14.07.2017

Zero waste approach to LM – SRM for construction products

- 1) **Large quantities** of resources need in construction sector (especially geotechnical works) – using SRM virgin materials are preserved
- 2) SRM based construction materials: good to excellent **technical properties**
- 3) **Immobilisation of pollutants** (mixing with waste with puzzolanic or hydration activities, e.g. ashes, slags, sludges..)
- 4) **Locally availability of resources** (the waste of one becomes a resource of another – industrial symbiosis and „a la carte“ products)
-> **locally available, sustainable (low environmental, social and economic impacts) and durable materials**



Secondary hydration of cement minerals.

20kV

X170 100µm

JSM-5500LV

Barriers to use SRM in constr.sect.

- Poor sustainable awareness (NIMBY effect)
- Poor waste treatment scenarios and recycling
- Relatively cheap natural resources
- High costs of initial testing („not worth it“)
- Cheap landfilling and low waste taxes
- Complex regulation
- Absence of regulation (e.g. test methods for natural aggregates can not be directly used for manufactured and recycled aggregates. Field performance testing is very important)
- **PUBLIC OPOSITION!!**

LIFE2010INF/SI/138 Promotion of the recycling of industrial waste and building rubble for the construction industry



www.re-birth.eu



EAF-S and SMS slags

- Fine grained material: disintegration of unstable betaC2S into gama C2S.
- Hydraulic properties - potential as an alternative binder
- Non-hazardous waste (Cr, Mo, V).



9 x
7 x

Element	Cement (mg/kg)	Ladle slag (mg/kg)	Limiting values for inert materials (mg/kg)*
Cr(celotni)	3,52	0,389	0,5
Cr(VI)	2,52	0,357	/
Cu	0,050	0,0061	2
Zn	0,41	0,44	4
Ni	< 0,046	< 0,046	0,4
Pb	0,002	0,005	0,5
Ba	11,3	11,9	20
Cd	< 0,014	< 0,014	0,04
Mo	0,011	0,250	0,5
V	< 0,029	< 0,029	/
As	< 0,025	< 0,025	0,5
Sb	< 0,004	0,008	0,06
Se	0,060	< 0,05	0,1
Hg	< 0,014	< 0,014	0,01



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Waste Management xxx (2015) xxx–xxx



Contents lists available at ScienceDirect

Waste Management

journal homepage: www.elsevier.com/locate/wasman



Recycling of ladle slag in cement composites: Environmental impacts

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^bUniversity of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geology, Aškerčeva 12, 1000 Ljubljana, Slovenia

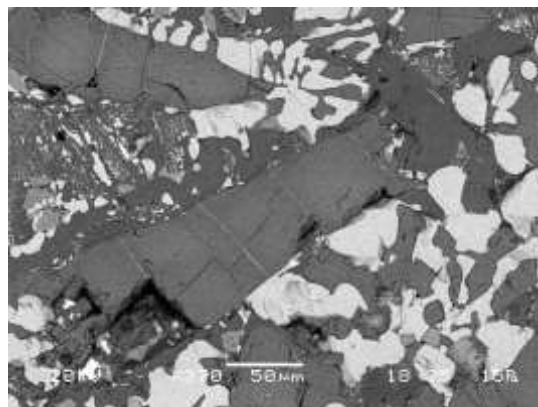
^cUniversity of Ljubljana, Faculty of Chemistry and Chemical Technology, Večna pot 113, 1000 Ljubljana, Slovenia

^dDepartment of Environmental Sciences, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia

EAF slag



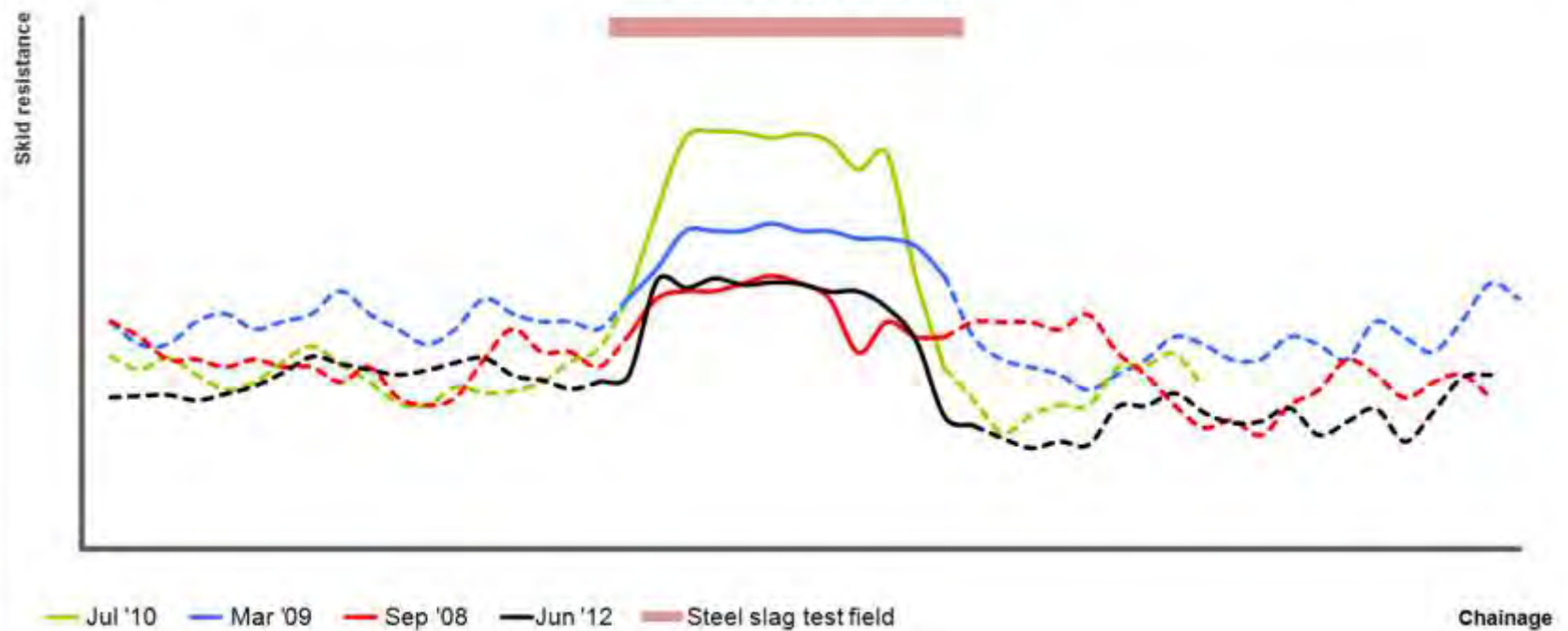
- EAF slag in road construction
 - Production of steel in Slovenia (> 80 000 t of different type of slags per year) and other in vicinity (N. Italy)
 - Similar properties as some volcanic rocks (porphyric structure) -> success story in Slovenia, bcs we lack magmatic rocks used in wearing courses in roads
 - Additional testing needed for leaching and expansion



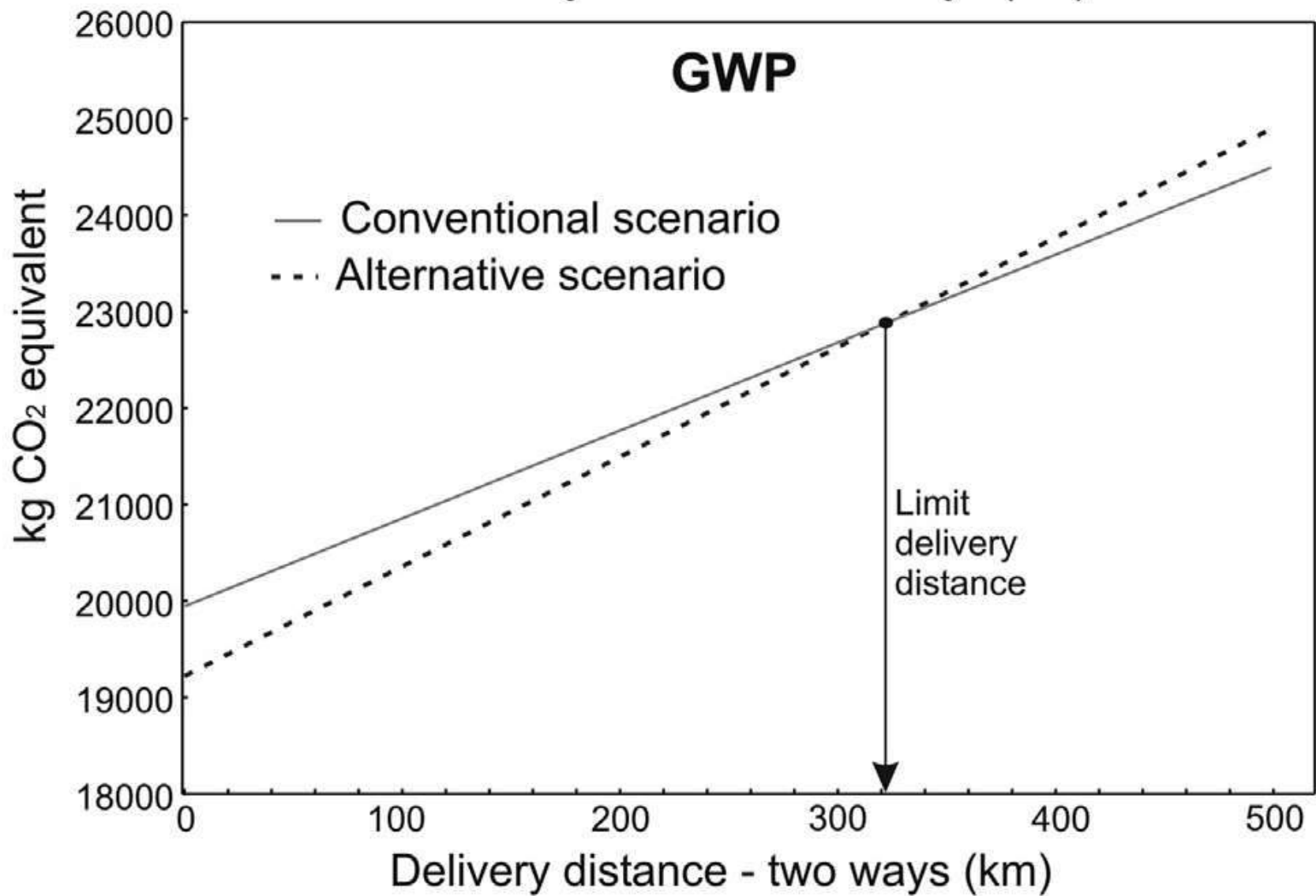




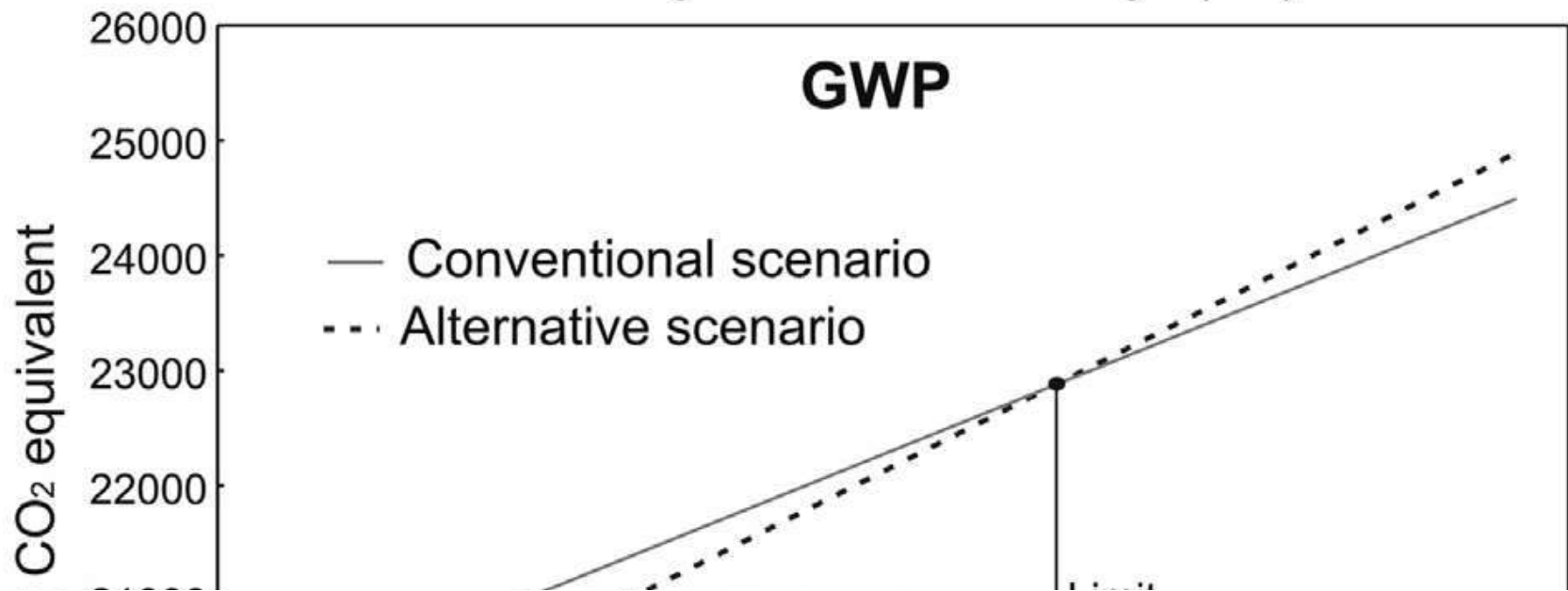
SKID RESISTANCE OF STEEL SLAG TEST FIELD (FULL LINE) COMPARED TO NATURAL AGGREGATE ASPHALT CONCRETE (DASHED LINE)



Delivery distance - two ways (km)



Delivery distance - two ways (km)



Journal of Cleaner Production xxx (2014) 1–9



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Environmental evaluation of two scenarios for the selection of materials for asphalt wearing courses

Ana Mladenovič^a, Janez Turk^{a,*}, Jaka Kovač^a, Alenka Mauko^a, Zvonko Cotič^b

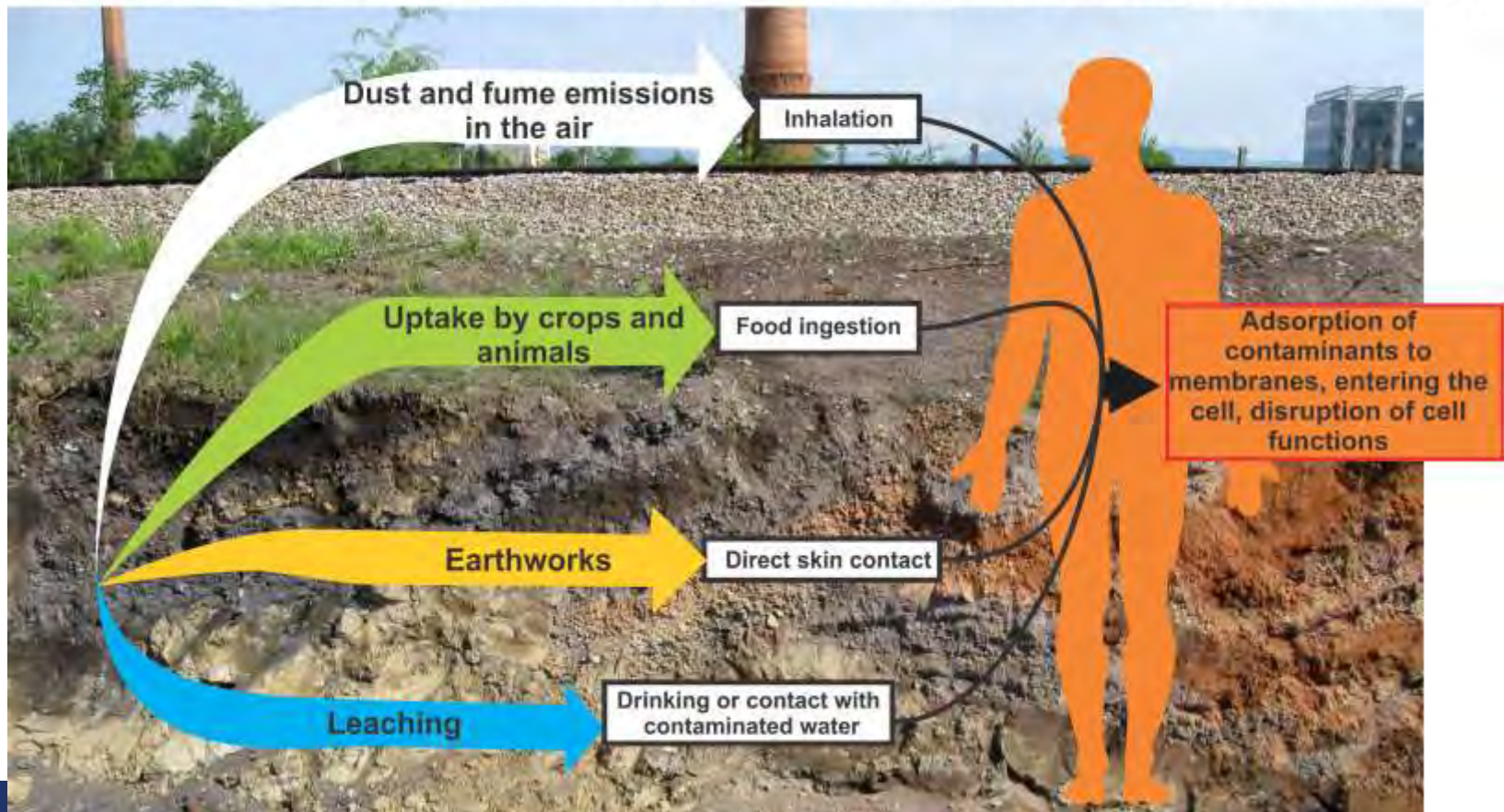
^a Slovenian National Building and Civil Engineering Institute, Dimičeva ulica 12, 1000 Ljubljana, Slovenia

^b Structum d.o.o., Tovarniška cesta 26, 5270 Ajdovščina, Slovenia

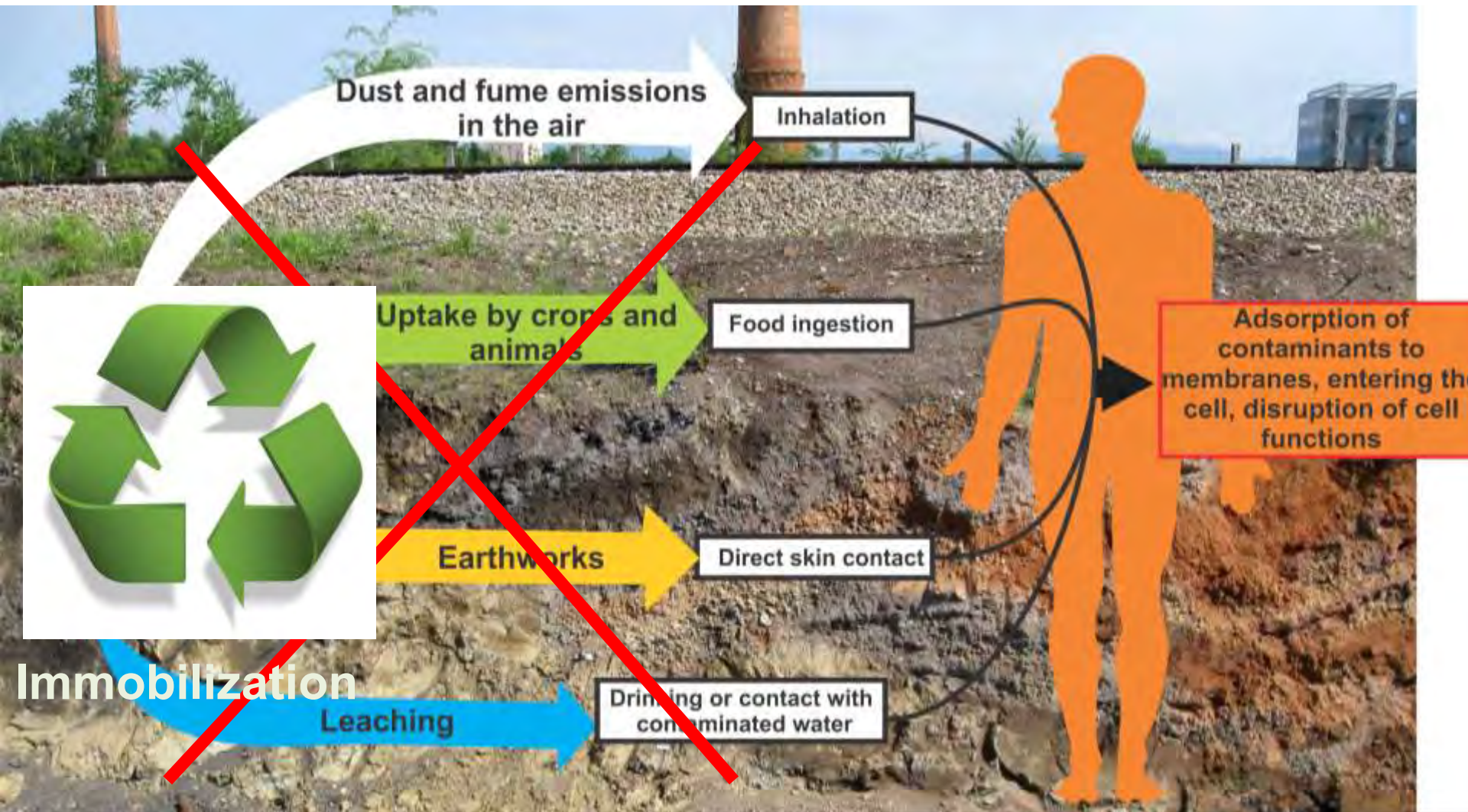
Soil remediation

- Immobilization of hazardous soil (case example Stara Cinkarna)

Possible transfer routes at exposure to contaminants present in soil



Soil remediation











Legislation

- Environmental Protection Act (*currently under amending process*)
- Decree on environmental taxes for environmental pollution due to landfilling
- Different decrees on environmental pollution
- Soil protection
- Program for waste management and Programme for waste prevention (30.6.2017)
- Decree on waste

Administrative procedures

- Slovenian Environment Agency
 - [Forms for waste reporting, environmental permits...](#)
 - [Municipal waste](#)

Data

- Slovenian Environment Agency
 - [List of entities for different waste management](#)
 - [List of landfills](#)
 - [Reports on wastes](#)
- Statistical Office
 - [Statistical data](#) (also in English)
 - [MW](#)

Thank you!

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