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Collection and laboratory development of slag samples using DRI and HBI in industrial and pilot scale

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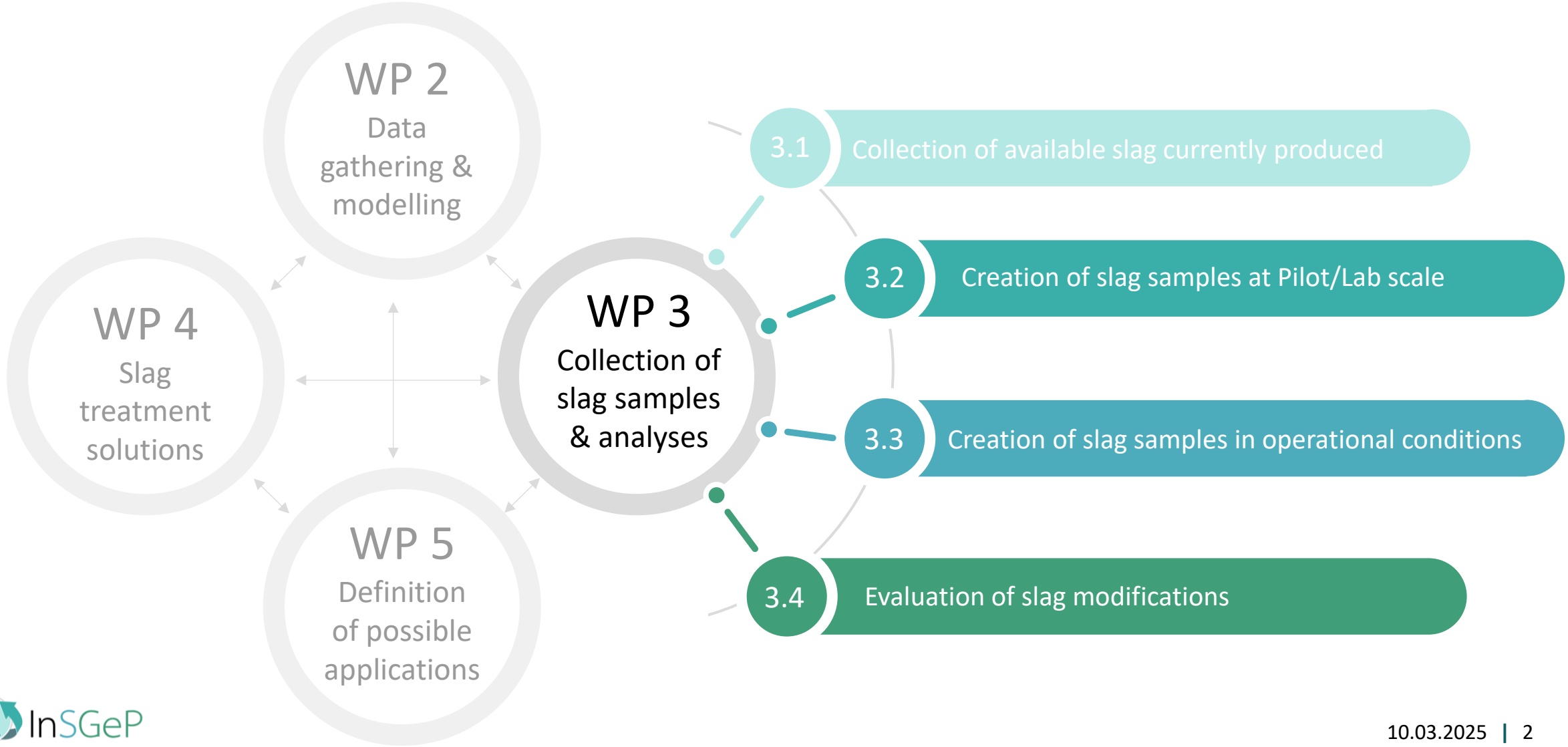
The role of slags and other by-products within circular economy in the steel industry

European Commission

The research leading to these results has received funding from the European Union's Research Fund for Coal and Steel research programme under grant agreement number: 101112665

Project Structure

WP3 – Collection of slag samples and laboratory analyses



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WP3 - Collection of slag samples and laboratory analyses

Samples amount per task & geographical location

3.1 Collection of available slag currently produced:

- Partner “K”: 3 samples, 30 kg
- Partner “G”: 6 samples, 120 kg
- Partner “N”: 2 samples, 30 kg
- Partner “Y”: 4 samples, 200 kg

3.2 Creation of slag samples at Pilot/Lab scale:

- Partner “U”: 2 samples
- Partner “N”: 4 samples, 800 kg
- Partner “Z”: 1 sample, 1.7g

3.3 Creation of slag samples in operational conditions:

- Partner “J”: 11 samples, 993 kg
- Partner “Q”: 4 samples, 1200 kg

Samples were collected in:

Some of the DRI/HBI was also produced in:

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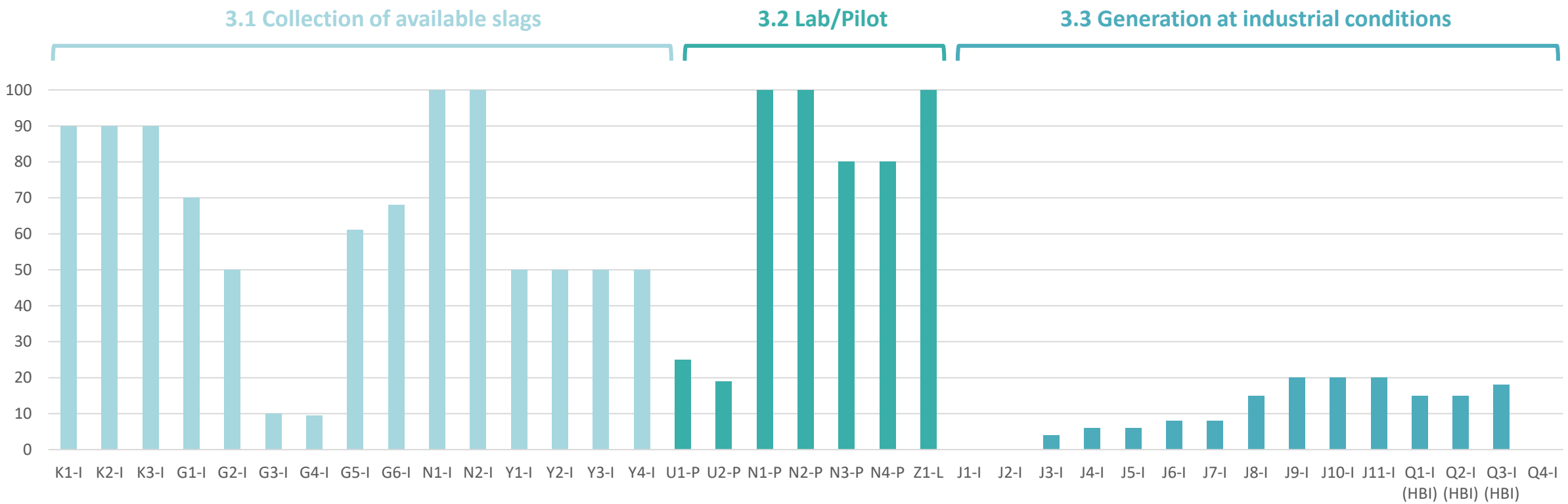
WP 3 - Collection of slag samples and laboratory analyses

DRI% in samples across different tasks



Legend: Partner initial (randomized letter) + number of the sample – "I" if industrial, "P" if pilot, "L" if lab

Task 3.1

Showcase: Industrial sampling from DRI-EAF plants

Sampling of already sorted material (G3) ↑

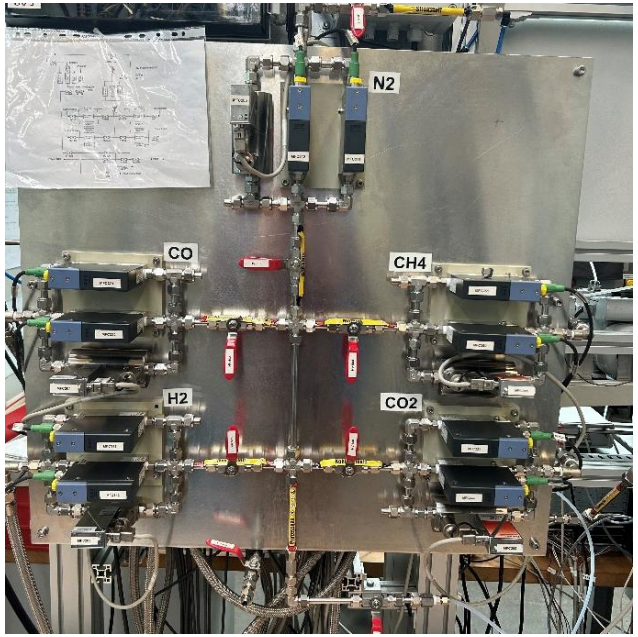
Isolation of specific heats to be sampled (G4 & G5) →

Task 3.2

Showcase: Smelting of DRI and gangue evaluation in lab scale

Pellet comp.	wt%
Fe (met.)	91.2
FeO	4.7
MgO	0.51

Z1-L	wt%
MgO	28.36
Al2O3	11.51
SiO2	32.19
CaO	21.63
MnO	0.19
Fe2O3	0.70



Next trials will focus on direct reduction trials with H_2 and H_2/CO combination

Task 3.2

Showcase: Creation of smelter slag in pilot scale

- 4 test trials to reproduce smelter slag
- 1 ton electric furnace (≈EAF/SAF)
- Reducing agents like biochar and anthracite were used

Heat	CaO	SiO_2	Al_2O_3	MgO	Fe_2O_3	Fe_{met}	B2
N1-P	36,5	31,0	14,5	14,0	< 0,1	0,27	1,17
N2-P	25,8	22,6	11,4	9,3	1,8	18,6	1,14
N3-P	37,5	37,3	9,9	7,2	1,2	1,37	1,01
N4-P	19,8	15,2 %	9,6	15,5	3,9	19,3	1,29

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Task 3.3

Showcase: Creation of slag samples in operational conditions

HBI composition

SiO_2	Al_2O_3	CaO	MgO	MnO	P	Fe total	Fe met	S	C
2,41	0,60	1,18	<0,10	0,16	0,041	88,8	78,2	<0,005	0,99±0,02

Q1-I: 15% HBI, High quality scrap
Q2-I: 15% HBI, Low quality scrap
Q3-I 18% HBI, High quality scrap
Q4-I 100% Scrap (reference case)

- Each sample is made by cumulating 3 heats
- After 3 heats all the slag was excavated and put into a pot for the final cooling

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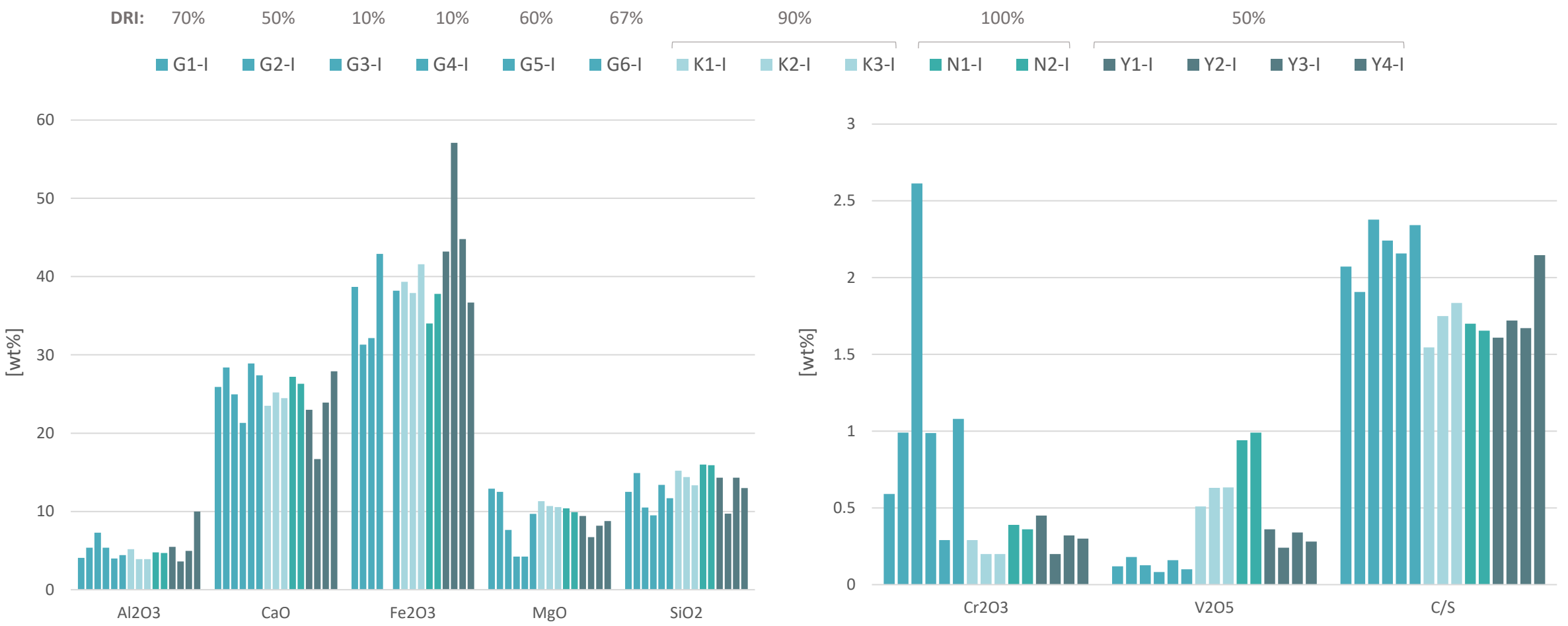
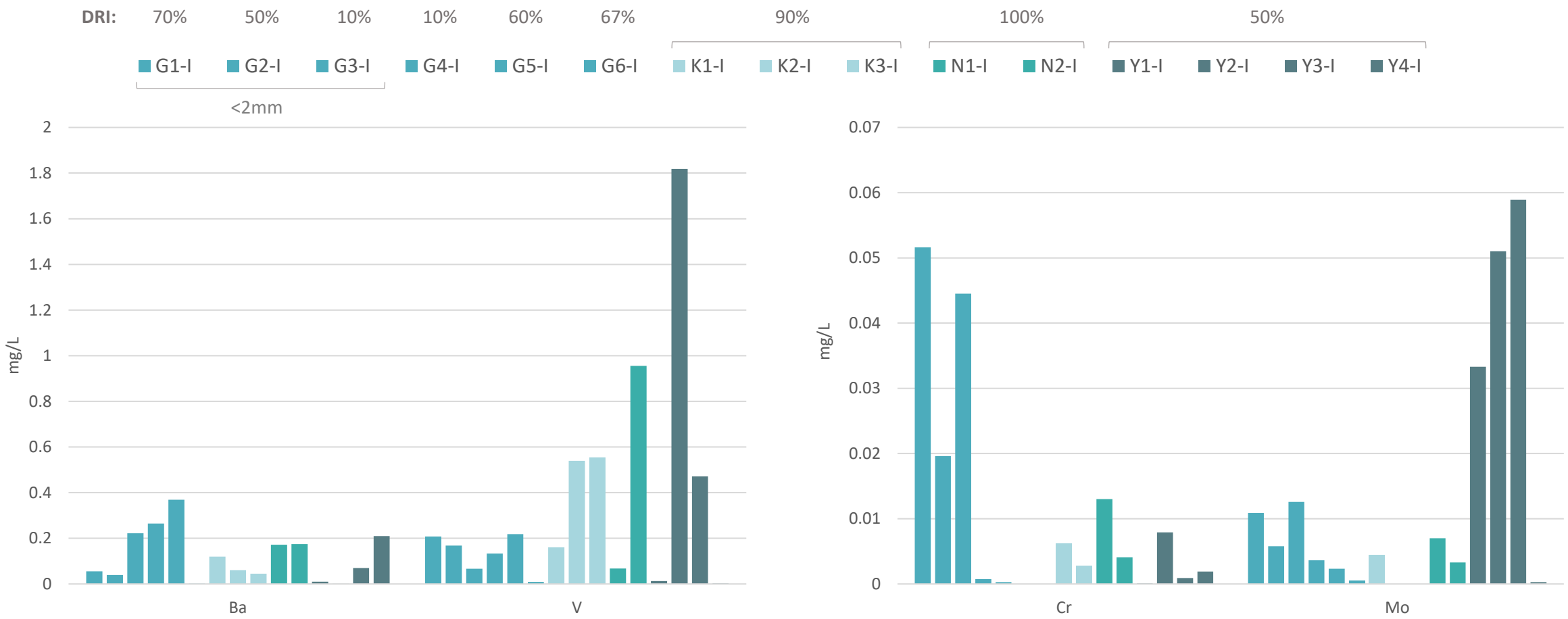
Task 3.1

Chemical analyses



Task 3.1

10:1 Leaching <10mm



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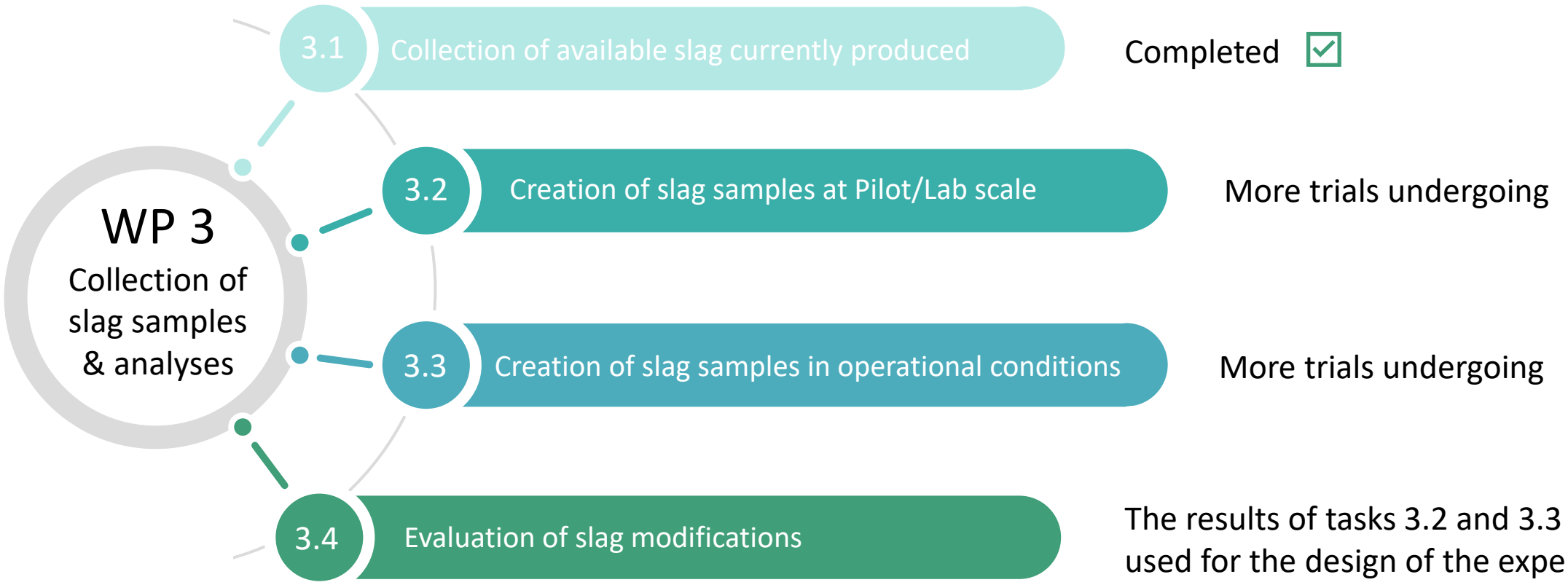
Next steps



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