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Authors : Mr. BOURG STÉPHANE (CEA)

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EC Scientific Officer: Stéphane Bourg (CEA)

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Date	By
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WP 1 - MULTI STAKEHOLDER PLATFORM

Start date: January 2016; *End date:* July 2017

Lead: AMPHOS21

Contributors: CEA, BRGM, CARTIF, CHALEMRS, E-MINES, ERAMET, GTK, ICCRAM, IDENER, IMN, ADE, UNIKL, LUT, LGC, MEFOS, NTUA, TUDELET, VTT, LGI PROMETIAS of the WP

The aim of the WP is to launch and function as the multi stakeholder platform where the key players will meet and address the transversal issues of the refractory metals. It will gather experts from the three groups of experts (Policy/Society; Technology, Market), the so-called External Experts Committees (EEC).

The WP will focus on the assessment of the current and future selected metal needs of European industry in order to examine to what extent these can be met from European and non-European sources and to explore innovative strategies for improving reliability and affordability of supply for metals and metal-based intermediate products.

It will deliver guidelines, define indicators and potentially propose (new) standards. This will be used to analyse the data collected and the innovation proposed in the four technical WPs.

This work package deals with the organization of a series of three workshops where the various phases of the proposed work will be developed through stakeholder engagement. There will be an initial State of the Art workshop where all the gathered information regarding primary and secondary resources will be presented and discussed. In addition the current production and usage of refractory metals in Europe will be discussed and the entire value chain analysed. This workshop should involve all key stakeholders of the refractory metals value chain. A second Workshop will be organised where potential innovative pathways are discussed in order to optimise the balance between resource availability and usage. The aim is to discuss potential substitutions, and assess innovative product/service design and innovative business models that may bring changes in the current value chain. Finally, a 3rd workshop will be organised where the feasibility of the proposed innovations will be discussed (policy/society and market aspects), and contrasted with the current situation. The adequacy of current standards and regulations, as well as the potential need for new ones, will be analysed.

TASK 1.1 CURRENT AND FUTURE SELECTED METAL NEEDS OF EUROPEAN INDUSTRY

Start date: January 2016; *End date:* November 2016

Lead: CEA

Contributors: CEA, AMPHOS21, IDENER, GTK, ICCRAM, ADE

The aim of this task is to compile all the available information regarding the current (first workshop) and future (second workshop) needs of the European industry and consumption of refractory metals. This will be done by collecting and editing the information provided through the first and second workshops as well as by using additional European data sources such as trade associations (e.g. EuRIC - European Recycling Industries' Confederation).

Action list

Action	Start Date	Due Date	Responsible
■ Action 1: Compilation of data on current need of Tungsten (W) in European industry	Jan 2016	March 2016	Jason Yang (GTK)
■ Action 2: Compilation of data on current need of Molybdenum (Mo) in European industry	Jan 2016	March 2016	Santiago Cuesta (ICCRAM)
■ Action 3: Compilation of data on current need of Tantalum (Ta) in European industry	Jan 2016	March 2016	Didier Hartmann (CEA)
■ Action 4: Compilation of data on current need of Rhenium (Re) in European industry	Jan 2016	March 2016	Susanna Casanovas (AMPHOS 21)
■ Action 5: Compilation of data on current need of Niobium (Nb) in European industry	Jan 2016	March 2016	Jorge Izquierdo (ADE)
■ Action 6: List of external experts for first workshop	Jan 2016	April 2016	Jordi Bruno (AMPHOS 21)
■ Action 7: List of questions for external experts for first workshop	Jan 2016	April 2016	Didier Hartmann (CEA)
■ Action 8: Preparation of working sessions for the first workshop	May 2016	October 2016	Santiago Cuesta (ICCRAM)
■ Action 9: Collection and edition of information from first workshop (notetaking)	May 2016	June 2016	Susanna Casanovas (AMPHOS 21)
■ Action 10: Compilation of data on future need of Tungsten (W) in European industry	July 2016	Oct 2016	Jason Yang (GTK)
■ Action 11: Compilation of data on future need of Molybdenum (Mo) in European industry	July 2016	Oct 2016	Santiago Cuesta (ICCRAM)
■ Action 12: Compilation of data on future need of Tantalum (Ta) in European industry	July 2016	Oct 2016	Didier Hartmann (CEA)

▪ Action 13: Compilation of data on future need of Rhenium (Re) in European industry	July 2016	Oct 2016	Jordi Bruno (AMPHOS 21)
▪ Action 14: Compilation of data on future need of Niobium (Nb) in European industry	July 2016	Oct 2016	Jorge Izquierdo (ADE)
▪ Action 15: List of external experts for second workshop	July 2016	Oct 2016	Jordi Bruno (AMPHOS 21)
▪ Action 16: List of questions for external experts for second workshop	July 2016	Oct 2016	Didier Hartmann (CEA)
▪ Action 17: Preparation of working sessions for the second workshop	May 2016	October 2016	Santiago Cuesta (ICCRAM)
▪ Action 18: Collection and edition of information from second workshop (notetaking)	September 2016	Nov. 2016	Marta Macias (IDENER)

TASK 1.2 PRESENT DESIGN AND LOOPS OF THE SELECTED METALS EU INDUSTRIAL VALUE CHAINS

Start date: January 2016; *End date:* July 2016

Lead: ERAMET

Contributors: CEA, AMPHOS21, CHALMERS, CARTIF, ERAMET, GTK, ICCRAM, IMN, UNIKL, LUT, LGC, MEFOS, NTUA, TUDELFT, VTT

The aim of this task is to build on the first workshop and analyse the current usage of the selected refractory metals in the key industrial value chains of the EU. It will also involve the compilation of additional data from European resource data sheets as well as other sources.

Action list

Action	Start Date	Due Date	Responsible
▪ Action 1: Compilation of data on current usage of Tungsten (W) in industrial value chains of EU	Jan 2016	May 2016	Jason Yang (GTK)
▪ Action 2: Compilation of data on current usage of Tantalum (Ta) in industrial value chains of EU	Jan 2016	May 2016	Didier Hartmann (CEA)
▪ Action 3: Compilation of data on current usage of Rhenium (Re) in industrial value chains of EU	Jan	May	Pedro Acebes

	2016	2016	(CARTIF)
<ul style="list-style-type: none"> Action 4: Compilation of data on current usage of Molybdenum (Mo) in industrial value chains of EU 	Jan 2016	May 2016	Lena Sundqvist (MEFOS)
<ul style="list-style-type: none"> Action 5: Compilation of data on current usage of Niobium (Nb) in industrial value chains of EU 	Jan 2016	May 2016	Quentin Bellier (ERAMET)
<ul style="list-style-type: none"> Action 6: Identification of additional data for the usage of Tungsten (W) 	Jan 2016	May 2016	Susanna Casanovas (AMPHOS 21)
<ul style="list-style-type: none"> Action 7: Identification of additional data for the usage of Tantalum (Ta) 	Jan 2016	May 2016	Ulla-Maija Mroueh (VTT)
<ul style="list-style-type: none"> Action 8: Identification of additional data for the usage of Rhenium (Re) 	Jan 2016	May 2016	CHALMERS
<ul style="list-style-type: none"> Action 9: Identification of additional data for the usage of Molybdenum (Mo) 	Jan 2016	May 2016	Santiago Cuesta (ICCRAM)
<ul style="list-style-type: none"> Action 10: Identification of additional data for the usage of Niobium (Nb) 	Jan 2016	May 2016	IMN

TASK 1.3 EU RESERVE VS. EU DEMAND: THE SUPPLY CHAIN

Start date: May 2016; *End date:* November 2016

Lead: BRGM

Contributors: CEA, AMPHOS21, BRGM, E-MINES, ICCRAM, IDENER, IMN, ADE, MEFOS, VTT

The aim of the task is to be a consequence of the work developed in Tasks 1.1 and 1.2 in order to elucidate the present (first workshop) and future (second workshop) matches between supply and demand in the entire European value chain of the selected refractory metals. Current situation as well as potential innovations to change the current and future unbalances will be evaluated and then discussed at the third workshop.

Action list

Action	Start Date	Due Date	Responsible
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■ Action 1: Elucidate the present matches between supply and demand in the European value chain of Tantalum (Ta)	May 2016	October 2016	Didier Hartmann (CEA)
■ Action 2: Elucidate the present matches between supply and demand in the European value chain of Rhenium (Re)	May 2016	October 2016	Susanna Casanovas (AMPHOS 21)
■ Action 3: Elucidate the present matches between supply and demand in the European value chain of Tungsten (W)	May 2016	October 2016	Santiago Cuesta (ICCRAM)
■ Action 4: Elucidate the present matches between supply and demand in the European value chain of Molybdenum (Mo)	May 2016	October 2016	E MINES
■ Action 5: Elucidate the present matches between supply and demand in the European value chain of Niobium (Nb)	May 2016	October 2016	Marta Macias (IDENER)
■ Action 6: Elucidate the future matches between supply and demand in the European value chain of Tantalum (Ta)	May 2016	October 2016	Patrick D'Hugues (BRGM)
■ Action 7: Elucidate the future matches between supply and demand in the European value chain of Rhenium (Re)	May 2016	October 2016	IMN
■ Action 8: Elucidate the future matches between supply and demand in the European value chain of Tungsten (W)	May 2016	October 2016	Ulla-Maija Mroueh (VTT)
■ Action 9: Elucidate the future matches between supply and demand in the European value chain of Molybdenum (Mo)	May 2016	October 2016	Jorge Izquierdo (ADE)
■ Action 10: Elucidate the future matches between supply and demand in the European value chain of Niobium (Nb)	May 2016	October 2016	Lena Sundqvist (MEFOS)
■ Action 11: Collection of potential innovations to be discussed at the third workshop	May 2016	October 2016	E MINES
■ Action 12: Identification of electronics innovations	May 2016	October 2016	Ulla-Maija Mroueh (VTT)
■ Action 13: Identification of hard materials / high temperature materials innovations	May 2016	October 2016	Ulla-Maija Mroueh (VTT)
■ Action 14: List of external experts for third workshop	May 2016	October 2016	Jordi Bruno (AMPHOS 21)

TASK 1.4 RE-DESIGNING THE FUTURE: DESIGN OF FUTURE INDUSTRIAL VALUE CHAINS FOR REFRACTORY METALS

Start date: May 2016; *End date:* January 2017

Lead: ICCRAM

Contributors: CEA, AMPHOS21, CHALMERS, CARTIF, ERAMET, GTK, ICCRAM, IDENER, IMN, ADE, UNIKL, LUT, LGC, MEFOS, NTUA, TUDELFT, VTT, LGI

The aim of this task is the organization of a 3rd workshop where the various stakeholders will have the possibility to discuss the proposed innovation pathways assessed in Task 1.3, and evaluate their viability.

The Multi-Level Perspective (MLP) methodology will be used to describe these transition pathways.

In preparation of the workshop, and based on the results of previous tasks (from this WP and others), the partners will analyse the need for an evolution of applicable standards and legal frameworks; this preliminary analysis will be presented to be enriched the workshop.

Action list

Action	Start Date	Due Date	Responsible
■ Action 1: Preliminary analysis for an evolution of applicable standards and legal frameworks for future industrial value chain of Tungsten (W)	May 2016	October 2016	Jason Yang (GTK)
■ Action 2: Preliminary analysis for an evolution of applicable standards and legal frameworks for future industrial value chain of Tantalum (Ta)	May 2016	October 2016	Didier Hartmann (CEA)
■ Action 3: Preliminary analysis for an evolution of applicable standards and legal frameworks for future industrial value chain of Niobium (Nb)	May 2016	October 2016	Eva Boo (LGI)
■ Action 4: Preliminary analysis for an evolution of applicable standards and legal frameworks for future industrial value chain of Molybdenum (Mo)	May 2016	October 2016	Lena Sundqvist (MEFOS)
■ Action 5: Preliminary analysis for an evolution of applicable standards and legal frameworks for future industrial value chain of Rhenium (Re)	May 2016	October 2016	Pedro Acebes (CARTIF)
■ Action 6: Contribution to information analysis from first and second workshop compilation	May	October	Marta

	2016	2016	Macias (IDENER)
■ Action 6: Collection of potential pathways to be discussed at the third workshop	October 2016	November 2016	Didier Hartmann (CEA)
■ Action 7: Preparation of Multi-Level Perspective (MLP) methodology for the evaluation of their viability by stakeholders at the third workshop	September 2016	November 2016	Santiago Cuesta (ICCRAM)
■ Action 8: Collection and edition of information from third workshop (notetaking)	November 2016	December 2016	Susanna Casanovas (AMPHOS 21)

TASK 1.5 COORDINATION OF THE MSP (ESTABLISHMENT OF THE EXPERTS COMMITTEES, ANIMATION OF THE WORKING GROUPS)

Start date: January 2016; *End date:* July 2017

Lead: AMPHOS21

Contributors: CEA, AMPHOS21, BRGM, GTK, ICCRAM, IDENER, IMN, ADE, MEFOS, VTT, LGI, PROMETIA

The aim of this task is the entire coordination of the multi-stakeholder platform in order to optimise the interactions between, during, and after the proposed workshops. Links between WP leader and Expert groups will be ensured through three “External Expert Committee Coordinators”, from the Consortium.

Action list

Action	Start Date	Due Date	Responsible
■ Action 1: Coordination of the multi stakeholders platform	Jan 2016	July 2017	Jordi Bruno (AMPHOS 21)
■ Action 2: Identification of stakeholders	Jan 2016	July 2017	Santiago Cuesta (ICCRAM)
■ Action 3: Organization of interactions between, during and after the workshops	May 2016	December 2016	Santiago Cuesta

				(ICCRAM)
■	Action 4: Link with Expert Groups through the “External Expert Committee Coordinators”	Jan 2016	July 2017	Jordi Bruno (AMPHOS 21)
■	Action 5: Participation in the platform and interactions between workshops	Jan 2016	July 2017	ALL PARTNERS

DELIVERABLES OF THE WP

Number	Title	Due Date	Responsible
D1.1	Report on current and future needs of selected refractory metals in EU	October 2016	Didier Hartmann (CEA)
D1.2	Report on current state of value chains of refractory metals in the EU	June 2016	Quentin Beller (ERAMET)
D1.3	Report on balance between demand and supply of refractory metals in the EU	August 2016	Patrick D’Hugues (BRGM)
D1.4	Report on potential innovation pathways to balance demand and supply of refractory metals in the EU	December 2016	Santiago Cuesta (ICCRAM)
D1.5	First Workshop (state of the art)	May 2016	Jordi Bruno (AMPHOS21)
D1.6	Second Workshop (preparing the future)	September 2016	Jordi Bruno (AMPHOS21)
D1.7	Third workshop (matching policy/society, technology and market)	November 2016	Jordi Bruno (AMPHOS21)
D1.8	Final report on EEC activity	June 2017	Jordi Bruno (AMPHOS21)

MILESTONES OF THE WP

Number	Title	Verification mean	Due Date	Responsible
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MS1	Identification of the knowledge required for the construction of the multi stakeholder platform	February 2016	Jordi Bruno (AMPHOS21)
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INTERACTION WITH OTHER WPS

WP	Interaction description	Due Date	Responsible
WP6	Identification of the knowledge required for the construction of the multi stakeholder platform (Delivery of D621)	February 2016	Marta Macías (IDENER)

RISKS OF THE WP

Number	Risk description	Risk mitigation	Proba	Impact
R1	Gaps in expertise	Already 21 organisations committed to join the EECs; more will complete the EECs before the beginning of the project and even after if needed.	1	4
R2	Non-availability of the information	Redundancy of the expertise in the EECs. Extended data collection foreseen in WP2-5.	2	3
R3	Very ambitious planning with meetings on the critical path	Workshops date defined as soon as possible, during the Grant preparation phase. Then, sufficient effort allocated to meeting preparation to reduce risk.	2	4
R4	Experts and partners reluctance to share information	Detailed NDA involving all partners and external experts. Commitment (intention letters) to participate in the workshops.	1	4

WP 2 – PRIMARY RESOURCES

Start date: Month 1; *End date:* Month 10

Lead: GTK

Contributors: CEA, AMPHOS21, BRGM, E-MINES, ERAMET, GTK, IMN, UNIKL, LUT, LGC, MEFOS, NTUA, TUDELFT

Based on the evaluation of primary resources of five refractory metals, the available and innovative mining technologies will be identified; the existing technologies of mineral processing and extractive metallurgy will be reviewed and the innovative technologies will be investigated; the wastes including mineral processing tailings and metallurgical slags will be evaluated with specific attentions to the waste amount reduction, environmental impacts, recovery of valuable trace elements and potential utilisations as construction materials. All the information will be discussed and analysed during the workshops with the external experts.

TASK 2.1 MAPPING

Start date: Month 1; *End date:* Month 4

Lead: BRGM

Contributors: BRGM, E-MINES, GTK

Objectives:

Evaluation of primary resources of five refractory metals including resource types, reserves (geological mineralogy and chemistry will be done through literature review and data listed in dedicated software (GKR)).

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ■ Action 1: extract relevant data from their databases (BRGM, GTK) 	Month 1	Month 1	BRGM (Guillaume Bertrand)
<ul style="list-style-type: none"> ■ Action 2: add data in the GKR system to facilitate the data compilation (E-MINES) 	Month 1	Month 2	E-MINES (Thomas Poitrenaud)

<ul style="list-style-type: none"> Action 3: Final database checked and completed with new data 	Month 2	Month 3	E-MINES (Thomas Poitrenaud)
<ul style="list-style-type: none"> Action 4: Final EU reframe map 	Month 3	Month 4	BRGM (Guillaume Bertrand)

TASK 2.2 MINING

Start date: Month 1; *End date:* Month 8

Lead: GTK

Contributors: AMPHOS21, GTK

Objectives:

Through **meetings with the mining companies** and literature review, the existing mining technologies will be described and the innovative technologies studied.

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Action 1: build up a list of the existing mining companies with each metal; 	Month 1	Month 2	GTK (Jason Yang), AMPHOS21 (David Arcos)
<ul style="list-style-type: none"> Action 2: contact and organize meetings 	Month 2	Month 3	GTK (Jason Yang), AMPHOS21 (David Arcos)
<ul style="list-style-type: none"> Action 3: Meetings with mining companies 	Month 4	Month 6	GTK (Jason Yang), AMPHOS21 (David Arcos)
<ul style="list-style-type: none"> Action 4: Literature review and existing technology description 	Month 4	Month 7	GTK (Jason Yang)
<ul style="list-style-type: none"> Action 5: Innovation studies 	Month 6	Month 8	GTK (Jason Yang)

TASK 2.3 MINERAL PROCESSING

Start date: Month 1; *End date:* Month 8

Lead: LGC

Contributors: BRGM, GTK, LUT, IMN (0.5 pm), LGC

Objectives:

Describe and assess existing beneficiation technologies, including size reduction (crushing, grinding), concentration (gravity and magnetic separation, flotation, etc.) and dewatering, etc. Analyze (recognize) challenges in the processing of refractory metal ores (RM as byproducts mostly). Innovative technology studies (efficiency of recovery of RM minerals, and while effectively removing any harmful elements and minimizing waste amount)

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Action 1: existing technology review and assessment on metals W (BRGM, GTK), Ta (LGC, IMN), Mo (GTK, LUT), Nb (LGC, IMN), Re (GTK, LUT) 	Month 1	Month 4	LGC (Florent Bourgeois)
<ul style="list-style-type: none"> Action 2: Analyze challenges in the processing of W (BRGM, GTK), Ta (LGC, IMN), Mo (GTK, LUT), Nb (LGC, IMN), Re (GTK, LUT) 	Month 4	Month 5	LGC (Florent Bourgeois)
<ul style="list-style-type: none"> Action 3: Innovative studies on metals W (BRGM, GTK), Ta (LGC, IMN), Mo (GTK, LUT), Nb (LGC, IMN), Re (GTK, LUT) 	Month 5	Month 7	LGC (Florent Bourgeois)
<ul style="list-style-type: none"> Action 4: Reporting 	Month 7	Month 8	LGC (Florent Bourgeois)

TASK 2.4 EXTRACTIVE METALLURGY

Start date: Month 1; *End date:* Month 8

Lead: LUT

Contributors: CEA, BRGM, ERAMET, IMN, UNIKL, LUT, MEFOS, TUDELFF

Objectives:

Existing hydrometallurgical and pyrometallurgical technologies on the extractions of refractory metals from the beneficiation concentrates of primary resource ores will be described and assessed, and innovative technologies studied.

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Action 1: existing hydrometallurgical and pyrometallurgical technology review and assessment on metals W (BRGM, CEA, UNIKL, MEFOS), Ta (CEA, ERAMET), Mo (CEA, ERAMET, MEFOS, TUDELFF), Nb (CEA, ERAMET,), Re (IMN, LUT, IMN) 	Month 1	Month 4	LUT (Tuomo Sainio)
<ul style="list-style-type: none"> Action 2: Analyze challenges in the processing of W (BRGM, CEA, UNIKL, MEFOS), Ta (CEA, ERAMET), Mo (CEA, ERAMET, MEFOS, TUDELFF), Nb (CEA, ERAMET,), Re (IMN, LUT, IMN) 	Month 4	Month 5	LUT (Tuomo Sainio)
<ul style="list-style-type: none"> Action 3: Innovative studies on metals W (BRGM, CEA, UNIKL, MEFOS), Ta (CEA, ERAMET), Mo (CEA, ERAMET, MEFOS, TUDELFF), Nb (CEA, ERAMET,), Re (IMN, LUT, IMN) 	Month 5	Month 7	LUT (Tuomo Sainio)
<ul style="list-style-type: none"> Action 4: Reporting 	Month 7	Month 8	LUT (Tuomo Sainio)

TASK 2.5 ENVIRONMENTAL FOOTPRINT

Start date: Month 5; End date: Month 10

Lead: NTUA

Contributors: NTUA, AMPHOS21, LUT

Objectives:

Present waste management and the waste management required for future recovery of refractory metals from mining streams will be stated based not only on work conducted in Task 2.2 to Task 2.4 but also from the interaction occurring with the industrial partners in the reference group. The possible environmental risks will be addressed and waste management actions (recovery, processing, and disposal) will be designed accordingly.

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Action 1: Waste management considering future recovery of refractory metals from mining streams (NTUA, AMPHOS21, LUT) 	Month 5	Month 7	NTUA (Antonis Politis)
<ul style="list-style-type: none"> Action 2: Waste management actions addressing possible environmental risks (AMPHOS21) 	Month 6	Month 9	AMPHOS21 (Jordi Bruno)
<ul style="list-style-type: none"> Action 4: Reporting 	Month 9	Month 10	NTUA (Antonis Politis)

DELIVERABLES OF THE WP

Number	Title	Due Date	Responsible
D2.1	Mapping the primary resources in the EU	Month 4	BRGM (Guillaume Bertrand)
D2.2	State of the art on the recovery of refractory metals from primary resources	Month 4	GTK (Jason Yang), LUT (Tuomo Sainio)
D2.3	Innovation potential in the recovery of refractory metals from primary resources	Month 8	GTK (Jason Yang), LUT (Tuomo Sainio)
D2.4	Management of wastes from primary resource processing: identification, environmental evaluations	Month 10	NTUA (Antonis Politis)

MILESTONES OF THE WP

Number	Title	Verification mean	Due Date	Responsible
MS2	Identification of the knowledge required for the construction of the multi stakeholder platform from WP2		Month 4	GTK (Jason Yang)
MS6	Delivery of the State of the art in mining, mineral processing and extractive metallurgy for D21		Month 4	GTK (Jason Yang)
MS7	Delivery of the Innovation potential in mining, mineral processing and extractive metallurgy for D22		Month 10	GTK (Jason Yang)

INTERACTION WITH OTHER WPS

WP	Interaction description	Due Date	Responsible
WP3	Collaboration with WP2 to identify waste streams and their properties in the primary processing as well as collaboration with EOL treatment the waste streams will be identified		

RISKS OF THE WP

Number	Risk description	Risk mitigation	Proba	Impact
	Low risk in Task 2.1 to 2.5		1-5	1-5

WP 3 – SECONDARY MINING/RESOURCES

Start date: December 2015; *End date:* October 2016

Lead: Lena Sundqvist Ökvist (Swerea MEFOS)

Contributors: Daniel Meyer and Eugen Andreiadis (CEA), Jordi Bruno (Amphos21), Kathy Bru (BRGM), Alberto Moral, Laura Pablos and Pedro Acebes (CARTIF), Teodora Retegan (Chalmers), Quentin Bellier and Kevin Cuchinski (ERAMET), Jason Yang (GTK), Santiago Cuesta-Lopez (ICCRAM), Marta Macias Aragonés (IDENER), Andrzej Chmielars (IMN), Hans-Jörg Bart (UNIKL), Sami Virolainen (LUT), Florent Bourgeois (LGC), Lena Sundqvist Ökvist and Guozhu Ye (Swerea MEFOS), Ioannis Paspaliaris and Antonis Politis (NTUA), Ulla-Maja Mroueh and Päivi Kivikytö-Reponen (VTT),

The main objective of WP3 is to address the recovery of five selected refractory in metallic or oxidic form existing in secondary resources and reduce the amount of waste put in landfill.

Resources may be old mine tailings, industrial waste streams and landfills including waste generated when using refractory metals.

The WP will focus mainly on the waste streams, such as dusts, sludges, scrap etc, in the production or use of refractory metals.

This work package deals state of the art description for mapping, collection/mining and in situ treatment of secondary resources, mineral/waste processing, extraction and environmental evaluation of selected processing routes relative the standard ones used. Moreover based on achieved knowledge innovations for future processes shall be done.

TASK 3.1 MAPPING

Start date: December 2015; *End date:* April 2016

Lead: Santiago Cuesta-Lopez (ICCRAM)

Contributors: Santiago Cuesta-Lopez (ICCRAM), Jason Yang (GTK), Ulla-Maja Mroueh and Päivi Kivikytö-Reponen (VTT)

The aim of this task is to map waste streams for further analyses from mining, pre-treatment, mineral processing and extraction containing W, Ta, Re, Mo and Nb. Also waste streams created when using the refractory metals as raw material and already landfilled material will be considered.

Action	Start	Due Date	Responsible
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	Date		
Action 1: Collect relevant data for waste containing refractory metals and characteristic data for these (ICCRAM, GTK, VTT)	Jan 2016	Feb 2016	All and specifically Mo: Santiago Cuesta-Lopez (ICCRAM) W: Janson Yang Nb Mo: Santiago Cuesta-Lopez (ICCRAM) Re and Ta; Ulla-Maja Mroueh (VTT)
Action 2: Compile data and identify gaps (ICCRAM)	Feb 2016	Feb 2016	Santiago Cuesta-Lopez (ICCRAM)
Action 3. Collect information and communicate for filling gaps (ICCRAM, GTK, VTT)	Feb 2016	March 2016	All and specifically Mo: Santiago Cuesta-Lopez (ICCRAM) W: Janson Yang Nb Mo: Santiago Cuesta-Lopez (ICCRAM) Re and Ta; Ulla-Maja Mroueh (VTT)
Action 4 Summarize and deliver all data, reporting (ICCRAM)	March 2016	April 2016	Santiago Cuesta-Lopez (ICCRAM)

TASK 3.2 SECONDARY MINING

Start date: December 2015; *End date:* October 2016

Lead: Guozhu Ye and Lena Sundqvist Ökvist (Swerea MEFOS)

Contributors: Guozhu Ye and Lena Sundqvist Ökvist (Swerea MEFOS), Jason Yang (GTK), Ulla-Maja Mroueh and Päivi Kivikytö-Reponen (VTT)

Methods and requirements for secondary mining, collection and transportation of industrial waste resources will be explored including consideration of in-situ treatment. Materials in newly produced waste streams as well as such in intermediate storage or landfill are considered.

Action	Start Date	Due Date	Responsible
Action 1: Collection of relevant state of the art information for collection and in-situ treatment of waste (MEFOS, GTK, VTT)	Jan 2016	Feb 2016	All and mores specifically Mo; Guozhu Ye (MEFOS) W; Jason Yang (GTK) Nb; Guozhu Ye (MEFOS) Re & Ta; Ulla-Maja Mroueh (VTT)
Action 2: Exchange with Task 2.1 regarding identified materials and their properties (GTK, VTT.)	Jan 2016	Feb 2016	Jason Yang (GTK.)
Action 3 Gathering collected knowledge and identification of knowledge gaps (MEFOS, GTK, VTT)	Feb 2016	Feb 2016	Guozhu Ye (MEFOS)
Action 4 Collection of missing state of the art via literature and in communication with industry (MEFOS, GTK, VTT)	Feb 2016	March 2016	All and mores specifically Mo; Guozhu Ye (MEFOS) W; Jason Yang (GTK) Nb; Guozhu Ye (MEFOS) Re & Ta; Ulla-Maja Mroueh (VTT)
Action 5 Delivery of and compiling of data for contribution to delivery, reporting (MEFOS, GTK, VTT)	March 2016	April 2016	Guozhu Ye (MEFOS)
Action 6 Identification of innovation potentials (MEFOS, GTK, VTT and workshop)	April 2016	April 2016	Guozhu Ye (MEFOS)
Action 7 Collection and exploration of innovative processing methods (MEFOS, GTK, VTT)	April 2016	July 2016	All and mores specifically Mo; Guozhu Ye (MEFOS) W; Jason Yang (GTK) Nb; Guozhu Ye (MEFOS) Re& Ta; Ulla-Maja Mroueh

(VTT)

Action 8 Delivery of and compiling of data for contribution to delivery regarding innovative processes, reporting (MEFOS, GTK, VTT)	July 2016	Aug 2016	Guozhu Ye (MEFOS)
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TASK 3.3 WASTE PROCESSING

Start date: December 2015; *End date:* October 2016

Lead; Jason Yang (GTK)

Contributors: Jason Yang (GTK), Guozhu Ye and Lena Sundqvist Ökvist (Swerea MEFOS), Florent Bourgeois (LGC), Kathy Bru (BRGM), Sami Virolainen (LUT), Laura Pablos and Pedro Acebes (CARTIF), Marta Macias Aragones (IDENER)

In this task identification of suitable existing and innovative waste treatment technologies and their combinations for treatment of refractory metal containing waste will be explored. Processing steps to be considered may e.g. be crushing, drying, classification, separation, floating and sedimentation, Tornado process and agglomeration etc.

Available material properties as e.g. granulometric properties, magnetic properties, fractional composition etc. will be an important input for proposed processing routes. The possibility to upgrade the waste and discard undesired elements in it will be considered.

Action	Start Date	Due Date	Responsible
Action 1: Collection of relevant state of the art information for processing of waste treatment of waste (GTK, MEFOS, LGC, BRGM, LUT, CARTIF, Idener)	Jan 2016	Feb 2016	All and specifically Mo; Guozhu Ye (MEFOS) W; Kathy Bru (BRGM) Nb; Guozhu Ye (MEFOS) Re; Sami Virolainen (LUT) Ta; Florent Bourgeois (LGC)
Action 2: Exchange with Task 2.1 regarding identified materials and their properties (GTK)	Jan 2016	Feb 2016	Jason Yang (GTK)

Action 3 Gathering collected knowledge and identification of knowledge gaps (GTK, MEFOS, LGC, BRGM, LUT, CARTIF, Idener)	Feb 2016	Feb 2016	Jason Yang (GTK.)
Action 4 Collection of missing state of the art via literature and in communication with industry (GTK, MEFOS, LGC, BRGM, LUT, CARTIF, Idener)	Feb 2016	March 2016	All and specifically Mo; Guozhu Ye (MEFOS) W; Kathy Bru (BRGM) Nb; Guozhu Ye (MEFOS) Re; Sami Virolainen (LUT) Ta; Jason Yang (GTK)
Action 5 Delivery of and compiling of data for contribution to delivery, reporting (GTK, MEFOS, LGC, BRGM, LUT, CARTIF, Idener)	March 2016	April 2016	Jason Yang (GTK.)
Action 6 Identification of innovation potentials (GTK, MEFOS, LGC, BRGM, LUT, CARTIF, Idener and workshop)	April 2016	April 2016	Jason Yang (GTK.)
Action 7 Collection and exploration of innovative processing methods (GTK, MEFOS, LGC, BRGM, LUT, CARTIF, Idener)	April 2016	July 2016	All and specifically Mo; Guozhu Ye (MEFOS) W; Kathy Bru (BRGM) Nb; Guozhu Ye (MEFOS) Re; Sami Virolainen (LUT) Ta; Jason Yang (GTK)
Action 8 Delivery of and compiling of data for contribution to delivery regarding innovative processes, reporting (GTK, MEFOS, LGC, BRGM, LUT, CARTIF, Idener)	July 2016	Aug 2016	Jason Yang (GTK.)

TASK 3.4 EXTRACTIVE METALLURGY

Start date: December 2015; *End date:* October 2016

Lead; Daniel Meyer and Eugen Andreiadis (CEA)

Contributors: Daniel Meyer and Eugen Andreiadis (CEA), Guozhu Ye and Lena Sundqvist Ökvist (Swerea MEFOS), Kathy Bru (BRGM), Teodora Retegan (Chalmers), Quentin Bellier and Kevin Cuchinski (ERAMET), Andrzej Chmielars (IMN), Hans-Jörg Bart (UNIKL), Sami Virolainen (LUT),

In this task relevant existing and innovative hydro and pyro-metallurgical methods for recovery of refractory metals from waste will be stated taking into account available facts on waste material properties, “family” metals with similar chemical behaviour during processing, processing methods for primary resources and how undesired elements can be removed before processing in hydrometallurgical or pyro-metallurgical way.

Action	Start Date	Due Date	Responsible
Action 1: Collection of relevant state of the art information for processing of waste treatment of waste (CEA, MEFOS, BRGM, Chalmers, ERAMET, IMN, UNIKL, LUT)	Jan 2016	Feb 2016	All and specifically Mo; Pyro Guozhu Ye (MEFOS) Hydro H-J Bart (UNIKL) W; Pyro Guozhu Ye (MEFOS) Hydro H-J Bart (UNIKL) Nb; Pyro Quentin Bellier (ERAMET) Hydro Eugen Andreiadis (CEA) Re; Pyro Teodora Retegan (Chalmers) Hydro Sami Virolainen (LUT), Ta; Pyro Kathy Bru (BRGM) Hydro Hydro Eugen Andreiadis (CEA)
Action 2: Exchange with Task 2.1 regarding identified materials and their properties (MEFOS)	Jan 2016	Feb 2016	Guozhu Ye (MEFOS)
Action 3 Gathering collected knowledge and identification of knowledge gaps (CEA, MEFOS, BRGM, Chalmers, ERAMET, IMN, UNIKL, LUT)	Feb 2016	Feb 2016	<i>Eugen Andreiadis (CEA)</i>
Action 4 Collection of missing state of the art via literature and in communication with industry (CEA,	Feb 2016	March 2016	All and specifically

MEFOS, BRGM, Chamlers, ERAMET, IMN, UNIKL, LUT)

Mo; Pyro Guozhu Ye (MEFOS)
 Hydro H-J Bart (UNIKL)
 W; Pyro Guozhu Ye (MEFOS)
 Hydro H-J Bart (UNIKL)
 Nb; Pyro Quentin Bellier (ERAMET)
 Hydro Eugen Andreiadis (CEA)
 Re; Pyro Teodora Retegan (Chalmers)
 Hydro Sami Virolainen (LUT),
 Ta; Pyro Kathy Bru (BRGM)
 Hydro
 Hydro Eugen Andreiadis (CEA)

Action 5 Delivery of and compiling of data for contribution to delivery, reporting (CEA, MEFOS, BRGM, Chamlers, ERAMET, IMN, UNIKL, LUT) March 2016 May 2016

Eugen Andreiadis (CEA)

Action 6 Identification of innovation potentials (CEA, MEFOS, BRGM, Chamlers, ERAMET, IMN, UNIKL, LUT) May 2016 April 2016

Eugen Andreiadis (CEA)

Action 7 Collection and exploration of innovative processing methods (CEA, MEFOS, BRGM, Chamlers, ERAMET, IMN, UNIKL, LUT, workshop) April 2016 July 2016

All and specifically
 Mo; Pyro Guozhu Ye (MEFOS)
 Hydro H-J Bart (UNIKL)
 W; Pyro Guozhu Ye (MEFOS)
 Hydro H-J Bart (UNIKL)
 Nb; Pyro Quentin Bellier (ERAMET)
 Hydro Eugen Andreiadis (CEA)
 Re; Pyro Teodora Retegan (Chalmers)
 Hydro Sami Virolainen (LUT),
 Ta; Pyro Kathy Bru (BRGM)
 Hydro Eugen Andreiadis (CEA)

Action 8 Delivery of and compiling of data for contribution to delivery regarding innovative processes, reporting (CEA, MEFOS, BRGM, Chamlers, ERAMET, IMN, UNIKL, LUT) July 2016 Aug 2016 *Eugen Andreiadis (CEA)*

TASK 3.5 ENVIRONMENTAL FOOTPRINT

Start date: May 2016; End date: October 2016

Lead; Alberto Moral, Laura Pablos and Pedro Acebes (CARTIF)

Contributors: Laura Pablos and Pedro Acebes (CARTIF), Jordi Bruno and Susanna Casanovas (AMPHOS21), Sami Virolainen (LUT), Ioannis Paspaliaris and Antonis Politis (NTUA)

This task shall ensure and propose most environmentally favorable methods for recovery of refractory metals from waste streams under consideration of

- present and future required waste management for landfill and recovery of refractory metals from waste streams
- Life Cycle approach to assess their respective impacts on environment (soil/ water, eco toxicity)
- global metal obtaining processes, as reference
- key elements (hot spots) that will be identified

Action	Start Date	Due Date	Responsible
Action 1: Waste management considering future recovery of refractory metals from mining streams (CARTIF, AMPHOS21, LUT, NTUA)	Month 5	Month 7	Pedro Acebes (CARTIF)
Action 2: Waste management actions addressing possible environmental risks (AMPHOS21)	Month 6	Month 9	Susanna Casanovas (AMPHOS21)
Action 4: Delivery of results, reporting (CARTIF, AMPHOS21, LUT, NTUA)	Month 9	Month 10	Pedro Acebes (CARTIF)

DELIVERABLES OF THE WP

Number	Title	Due Date	Responsible
D 3.1	Mapping the secondary resources in the EU (mine tailings, industrial waste)	Apr. 2016	Santiago Cuesta-Lopez (ICCRAM)
D 3.2	State of the art on the recovery of refractory metals from secondary resources	Apr. 2016	Lena Sundqvist Ökvist (MEFOS)
D 3.3	Innovation potential in the recovery of refractory metals from secondary resources	Aug. 2016	Lena Sundqvist Ökvist (MEFOS)
D 3.4	Management of waste from secondary resource processing: identification, environmental evaluations	Oct. 2016	Pedro Acebes (CARTIF)

MILESTONES OF THE WP

Number	Title	Verification mean	Due Date	Responsible
M3	Identification of the knowledge required for the construction of the multi stakeholder platform from WP3	Definition state of the art required for the recovery of refractory metals from waste	February 2016	Lena Sundqvist Ökvist (MEFOS)
M8	Definition of the State of the art in secondary mining, waste processing and extractive metallurgy D 3.1	Delivery of state of the art for recovery of refractory metals from waste	April 2016	Lena Sundqvist Ökvist (MEFOS)
M9	Delivery of the innovation potential in secondary mining, waste processing and extractive metallurgy for D32	Delivery of innovation potential for recovery of refractory metals from waste	August 2016	Lena Sundqvist Ökvist (MEFOS)

INTERACTION WITH OTHER WPS

WP	Interaction description	Due Date	Responsible
WP1	Interaction in definition of data for delivery and delivery of results for road map building	February 2016	Amphos21 Susanna Casanovas (AMPHOS21)
WP2, WP4	Exchange in principle treatment methods and knowledge in elemental behavior	April and september 2016	Jason Yang (GTK), IMN
WP6	Results for communication	April-October 2016	Lena Sundqvist Ökvist (MEFOS)

RISKS OF THE WP

Number	Risk description	Risk mitigation	Proba	Impact
R2	Lack of information in a specific field	Communication with partners in WP2 and WP3 and search for relevant industry.		
n/a	Researchers involved in the projects is leaving	Complementary knowledge and exchange More than one person involved in activities		

WP 4 – SECONDARY RESOURCE (URBAN MINING)

Start date: Month Year; *End date:* Month Year

Lead: INTYTUT METALI NIEŻELAZNYCH (IMN)

Contributors: CEA, AMPHOS21, BRGM, CARTIF, CHALEMRS, GTK, ICCRAM, UNIKL, LUT, LGC, MEFOS, NTUA, TUDELFT, VTT

The aim of the WP include:

- identification of the existing recycling technologies and gaps to be addressed;
- identification of barriers to refractory metals recycling;
- determination of applications where recycling may present a significant opportunity.

The WP will focus on the detailed market analysis with assistance of the end-users to identify the components which contain selected refractory metals. In the analysis of the processing and recovery steps a multi-faceted approach will be applied, to take under consideration all the relevant factors, e.g. mechanical separation, chemical processing, thermal treatment, etc. The supported by the stakeholders study will cover all the relevant industrial sectors where refractory metals play an important role. Beside the metal value recovery from end-of-life products the WP4 will also address potential treatment of the waste generated in their treatment.

This work package deals with identification of currently used technologies for metal value recovery, as well as existing gaps and barriers to refractory metals recycling, to provide a comprehensive coverage of all the aspects influencing the potential for recycling of refractory metals from end-of-life products.

TASK 4.1 TRACING AND TRACKING (DETECTION) OF THE REFRACTORY METAL CONTAINING WASTE PRODUCTS (TASK LEADER VTT) M1-M4

Start date: M1-December 2015; *End date:* M5-April 2016

Lead: VTT

Contributors: AMPHOS21, ICCRAM, IMN, VTT

The aim of this task is: Identification of the secondary resources of refractory metals in the EU

Action list

Action	Start Date	Due Date	Responsible
■ Action1:Tracing and tracking of tungsten	M1-December	M5-April	Lena

	2015	2016	Sundqvist
■ Action 2: Tracing and tracking of tantalum	M1-December 2015	M5-April 2016	Kathy Bru
■ Action 3: Tracing and tracking of rhenium	M1-December 2015	M5-April 2016	Witold Kurylak
■ Action 4: Tracing and tracking of molybdenum	M1-December 2015	M5-April 2016	Jason Yang
■ Action 5: Tracing and tracking of niobium	M1-December 2015	M5-April 2016	Lena Sundqvist

TASK 4.2 COLLECTION AND PRESORTING OF THE WASTE /URBAN MINING

Start date: M1-December 2015; *End date:* M9-August 2016

Lead: IMN

Contributors: AMPHOS21, IMN, MEFOS, VTT

The aim of this task is:

- Identification of existing infrastructures for collection
- Identification of economic incentives for the delivery of waste product to legal operators
- Determination of applications for which recycling may present a significant opportunity - selection of criteria for the ranking of applications

Action list

Action	Start Date	Due Date	Responsible
■ Action 1: Determination of state of the art on the recovery of refractory metals from urban mining	<u>Fisrt part:</u>		Jordi Bruno
	M1-December 2015	M6-May 2016	
	<u>Second part:</u>		
	M5-May 2016	M9-August	

	2016	
<ul style="list-style-type: none"> Action 2: Determination of the innovation potential in the recovery of refractory metals from urban mining 	<p>Fisrt part:</p> <p>M1-December 2015</p> <p>Second part:</p> <p>M6-May 2016</p>	<p>M6-May 2016</p> <p>M9-August 2016</p> <p>Jordi Bruno</p>

TASK 4.3 PRE-TREATMENT

Start date: M1-December 2015 ; *End date:* M9-August 2016

Lead: LGC

Contributors: BRGM, GTK, IMN, LUT, LGC, MEFOS

The aim of this task is: Mapping of current recycling pretreatment techniques, identification of barriers and measures of remedy for effective recycling, including:

1. techniques for separation of the components from the rest of the waste stream through manual or mechanical
2. dismantling, sorting or any other process designed to isolate the smallest fractions containing most of the metal;
3. determination of best practices in the area of refractory metals containing end-of-life products for selected applications.

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Action 1: Determination of state of the art on the recovery of refractory metals from urban mining 	<p>Fisrt part:</p> <p>M1-December 2015</p> <p>Second part:</p> <p>M5-May 2016</p>	<p>M6-May 2016</p> <p>M9-August</p>	<p>Laurent Cassayre</p>

		2016	
<ul style="list-style-type: none"> Action 2: Determination of the innovation potential in the recovery of refractory metals from urban mining 	<u>Fisrt part:</u>		Sami Virolainen
	M1-December 2015	M6-May 2016	
	<u>Second part:</u>		
	M6-May 2016	M9-August 2016	

TASK 4.4 EXTRACTION

Start date: M1-January 2016; *End date:* M8-August 2016

Lead: CHALMERS

Contributors: CEA, BRGM, CHALMERS, IMN, UNIKL, LUT, MEFOS, TUDELFT, VTT

The aim of this task is: Mapping of currently used technologies for metal value recovery, identification of barriers and measures of remedy for effective recycling. Identification of best practices in metal recovery from end-of-life products for the selected applications, including:

1. extraction of the refractory metals containing material from the components;
2. refining of the separated fractions to an alloy, compound or element;
3. reprocessing of purified elements or alloys into a new form of material.

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Action 1: Determination of state of the art on the recovery of refractory metals from urban mining 	<u>Fisrt part:</u>		Teodora Retegan
	M1-December 2015	M6-May 2016	
	<u>Second part:</u>		
	M5-May 2016	M9-August	

	2016	
<ul style="list-style-type: none"> ▪ Action 2: Determination of the innovation potential in the recovery of refractory metals from urban mining 	<p><u>Fisrt part:</u></p> <p>M1-December 2015</p> <p><u>Second part:</u></p> <p>M6-May 2016</p>	<p>Teodora Retegan</p> <p>M6-May 2016</p> <p>M9-August 2016</p>

TASK 4.5 ENVIRONMENTAL FOOTPRINT (TASK LEADER: CARTIF) M5 TO M10

Start date: M6-May 2016; *End date:* M11-October 2016

Lead: CARTIF

Contributors: CEA; AMPHOS21, CARTIF, IMN, NTUA

The aim of this task is: Determination of present waste management and the waste management required for future recovery of refractory metals from urban mining streams.

Action list

Action	Start Date	Due Date	Responsible
▪ Action1:Waste management in tungsten recovery	M1-December 2015	M5-April 2016	Laura Pablos
▪ Action 2: Waste management in of tantalum recovery	M1-December 2015	M5-April 2016	Laura Pablos
▪ Action 3: Waste management in rhenium recovery	M1-December 2015	M5-April 2016	Laura Pablos

■ Action 4: Waste management in molybdenum recovery	M1-December 2015	M5-April 2016	Laura Pablos
■ Action 5: Waste management in niobium recovery	M1-December 2015	M5-April 2016	Laura Pablos

DELIVERABLES OF THE WP

Number	Title	Due Date	Responsible
D4.1	Mapping the secondary resources in the EU (urban mines)	M5-April 2016	VTT
D4.2	State of the art on the recovery of refractory metals from urban mines	M5-April 2016	Witold Kurylak
D4.3	Innovation potential in the recovery of refractory metals from urban mines	M9-August 2016	Witold Kurylak
D4.4	Management of waste from urban mines processing: identification, environmental evaluations	M11-October 2016	Laura Pablos

MILESTONES OF THE WP

Number	Title	Verification mean	Due Date	Responsible
MS4	Identification of the knowledge required for the construction of the multi stakeholder platform from WP4		M3-February 2016	Witold Kurylak
MS10	State of the art in urban mining, pretreatment and extractive metallurgy for D41		M5-April 2016	Witold Kurylak
MS11	Innovation potential in urban mining, pretreatment and extractive metallurgy for D42		M9-August 2016	Witold Kurylak

INTERACTION WITH OTHER WPS

WP	Interaction description	Due Date	Responsible
WP2&3	Common workshops	M6-May 2016	Witold Kurylak
WP2&3	Common workshops	M10-September 2016	Witold Kurylak
WP2&3	Common workshops	M12-November 2016	Witold Kurylak

RISKS OF THE WP

Number	Risk description	Risk mitigation	Proba	Impact
R1	Gaps in expertise		1	4
R2	Non-availability of the information		2	3
R4	Experts and partners reluctance to share information		1	4

WP 5 – THE CONCEPTS AND SCENARIOS OF SUBSTITUTION

Start date: December 2015; *End date:* November 2016

Lead: Päivi Kivikytö-Reponen (VTT Technical Research Centre of Finland)

Contributors: Katarzyna Bilewska (katarzyna.bilewska@imn.gliwice.pl) (IMN Gliwice), Adrian Wrona (adriana.wrona@imn.gliwice.pl) (IMN Gliwice), Witold Kurylak (witoldk@imn.gliwice.pl) (IMN Gliwice), Erik Offerman (S.E.Offerman@tudelft.nl) (TU Delft), Santiago Cuesta Lopez (scuesta@ubu.es) (ICCRAM) Päivi Kivikytö-Reponen (paivi.kivikyto-reponen@vtt.fi) (VTT Technical Research Centre of Finland), Ulla-Maija Mroueh (ulla-maija.mroueh@vtt.fi) (VTT Technical Research Centre of Finland), Marjaana Karhu (marjaana.karhu@vtt.fi) (VTT Technical Research Centre of Finland)

This WP has as a main objective to discuss and analyse the **map of substitution for RM within their most relevant applications in EU industry according to a threefold criteria of social, economic and strategic importance**. Such a map needs to be considered

- as part of the full value chain analysis carried out in WP1, and
- a factor in the priority and definition of clear actions in the fate of RM regarding its supply, recycling/waste management strategies and loops.

The WP will focus on **substitution analysis that is a key concept that must be transversally present to the study and design of the full value chain**.

A holistic approach will be used considering four scenarios:

- 1) Potential to substitute the refractory metal, paying special attention to existing technological barriers, and/or reduce its use in considerable volume.
- 2) The potential and realistic (present high TRL) substitutes will be evaluated in order to maintain demand in current consumption level.
- 3) The scenario that the present usage continues, no potential substitutes are found, and refractory metal demand will increase.
- 4) The refractories will substitute the less performing elements in large amounts.

Evaluating the substitution potential and impact – creating the understanding of the substitution potential of selected refractory metals in both ways (decrease and increase) throughout the refractory value chains.

TASK 5.1 IMPACT OF SUBSTITUTION SCENARIOS OVER THE DIFFERENT APPLICATIONS RM VALUE CHAINS (TASK LEADER: IMN) M1-M10

Start date: December 2016; *End date:* September 2016

Lead: Witold Kurylak (IMN Gliwice)

Contributors: Santiago Cuesta Lopez (ICCRAM), Katarzyna Bilewska (IMN Gliwice), Adrianan Wrona (IMN Gliwice), Marjaana Karhu (VTT), Päivi Kivikytö-Reponen (VTT) contribution in pm: ICCRAM (1 pm), IMN (2 pm), VTT (1 pm)

The aim of this task is to **summarize the state of art of refractory metal application volumes** forwarded by the cumulative impact of four scenario evaluation is generic level: the reduction potential and the metal interrelations (tungsten, tantalum, rhenium, molybdenum and niobium).

Four scenario evaluation

- 1. Potential to substitute refractory metals, and/or reduce the use of the metals in considerable volume.*
- 2. The potential and realistic substitutes will be found in order to maintain demand in current level versus potential of usage increase*
- 3. The scenario of the present usage continues, no potential substitutes are found, and refractory metal demand will increase.*
- 4. The refractories will substitute the less performing elements in large amounts.*

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ■ Action 1: refractory metal main applications and volumes (IMN, ICCRAM, TUDelft, VTT) ■ Mo: IMN, VTT; W: ICCRAM, VTT; Re: IMN; Nb: TU Delft, VTT; Ta VTT 	January 2016	May 2016	Katarzyna Bilewska (IMN)
<ul style="list-style-type: none"> ■ Action 2: current substitutes for refractory metals (IMN, ICCRAM, TUDelft, VTT) ■ Mo: IMN, VTT; W: ICCRAM, VTT; Re: IMN; Nb: TU Delft, VTT; Ta VTT 	January 2016	June 2016	Katarzyna Bilewska (IMN)
<ul style="list-style-type: none"> ■ Action 3: Analysis of refractorymetals interrelations (IMN, ICCRAM, TUDelft, VTT) ■ Mo: IMN, VTT; W: ICCRAM, VTT; Re: IMN; Nb: TU Delft, VTT; Ta VTT 	April 2016	October 2016	Santiago Cuesta Lopez (ICCRAM)
<ul style="list-style-type: none"> ■ Action 4: Refractory metals will substitute other elements (non-refractory metals) ■ Mo: IMN, VTT; W: ICCRAM, VTT; Re: IMN; Nb: TU Delft, VTT; Ta VTT 	June 2016	November 2016	Santiago Cuesta Lopez (ICCRAM)

TASK 5.2 SUBSTITUTION POTENTIAL EVALUATION OF SELECTED REFRACTORY METALS IN SELECTED APPLICATIONS ACCORDING TO A DOUBLE PERSPECTIVE IN CIRCULAR ECONOMY. (TASK LEADER: ICCRAM) M5 TO M12

Start date: Month Year; *End date:* Month Year

Lead: Santiago Cuesta Lopez (ICCRAM)

Contributors: Santiago Cuesta Lopez (ICCRAM), Katarzyna Bilewska (IMN Gliwice), Adrianan Wrona (IMN Gliwice), Marjaana Karhu (VTT), Päivi Kivikytö-Reponen (VTT) contribution in pm: ICCRAM (4 pm), IMN (2 pm), TUDELFT (2 pm), VTT (1 pm)

The use of refractory metals and **their substitution potential will be analyzed** according to the double perspective of, either reducing their use in value chains of significance for the global EU industrial panorama, either a possible change in the flow of the economy because its use is incremented in very specific and well-defined applications where refractory metals may substitute other elements in forefront materials exhibiting improved functionality, improved operation times, or demand for operations in more harsh conditions.

Four scenario evaluation

- 1. Potential to substitute refractory metals, and/or reduce the use of the metals in considerable volume.*
- 2. The potential and realistic substitutes will be found in order to maintain demand in current level versus potential of usage increase*
- 3. The scenario of the present usage continues, no potential substitutes are found, and refractory metal demand will increase.*
- 4. The refractories will substitute the less performing elements in large amounts.*

Actions scope and methodology

- The substitution potential and volume is evaluated based on **the literature and expert discussions**.
- The whole view of full/across value chain approach design, linked to applications and sectors, as considered in WP1, will also consider as a criteria the substitution potential evaluation outcome from this Task. Applications and value chains selected in WP1, will define a clear scenario in which a specific evaluation of substitution potential for each RM will be carried out according to the following possibilities
- **1) substitution without the reduction in functionality. Reduction - useless material to achieve the same level of functionality in a given product;**
- **2) Alternative material - replace one material for another without loss of functionality;**
- **3) Alternative system - replace one/several components within the same product;**

- **4) Alternative products - replace existing technology with different products and/or services.** The technological readiness level of the potential material scientific innovations is taken into account.

Since we are addressing circular economy, activities such as market demand (analyse how the market demand will change after substitution), and how the new product (material) may affect business models and social/industrial perception will be carried out (in relation with WP1).

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ▪ Action 1: Analysis of the different scenarios (IMN, ICCRAM, TUDelft, VTT) <ol style="list-style-type: none"> 1. Potential to substitute refractory metals, and/or reduce the use of the metals in considerable volume. 2. The potential and realistic substitutes will be found in order to maintain demand in current level versus potential of usage increase 3. The scenario of the present usage continues, no potential substitutes are found, and refractory metal demand will increase. 4. The refractories will substitute the less performing elements in large amounts. 	May 2016	October 2016	

DELIVERABLES OF THE WP

Number	Title	Due Date	Responsible
D5.1	Report on refractory metal reduction potential – potential substitutes Mo: IMN, VTT; W: ICCRAM, VTT; Re: IMN; Nb: TU Delft, VTT; Ta VTT	September 2016	Katarzyna Bilewska (IMN)
D5.2	Report on refractory metal increase potential – substitutes non-refractory metals Mo: IMN, VTT; W: ICCRAM, VTT; Re: IMN; Nb: TU Delft, VTT; Ta VTT	November 2016	Santiago Cuesta Lopez (ICCRAM)

MILESTONES OF THE WP

Number	Title	Verification mean	Due Date	Responsible
MS5	Identification of the knowledge required for the construction of the multi stakeholder platform from WP5	Delivery of D621 with the data related to substitution	February 2016	Päivi Kivikytö-Reponen (VTT)

INTERACTION WITH OTHER WPS

WP	Interaction description	Due Date	Responsible
WP4	<p>Task 4.2 Collection and presorting of the waste /Urban Mining task leader: IMN</p> <p><i>The task is focused on strengthening the raw material supply by using the resources temporarily locked up in</i></p> <p>Interaction: The identified potential sources for supply should be evaluated in terms of increase of refractory metal volume (needed for subtask 5.2).</p>		
WP4	<p>Task 4.3 Pre-treatment, task leader: LGC</p> <p><i>The task is focused on mapping of current recycling pretreatment techniques, identification of barriers and measures of remedy for effective recycling.</i></p> <p>Interaction: The identified potential remedies for effective recycling should be evaluated in terms of increase of refractory metal volume (needed for subtask 5.2).</p>		
WP4	<p>Task 4.4 Extraction, task leader: CHALMERS</p> <p><i>The task is focused on mapping of currently used technologies for metal value recovery, identification of barriers and measures of remedy for effective recycling. Identification of best practices in metal recovery from end-of-life products for the selected applications.</i></p> <p>Interaction: The identified potential remedies for effective recycling should be evaluated in terms of increase of refractory</p>		

metal volume (needed for subtask 5.2).

WP4

Task 4.5 Environmental footprint, task leader: CARTIF

The task is focused on present waste management and the waste management required for future recovery of refractory metals.

Interaction: The identified possible environmental risks associated with waste management actions should be evaluated in terms of decrease/increase of refractory metal volume (needed for subtask 5.2)

RISKS OF THE WP

Number	Risk description	Risk mitigation	Proba	Impact
R2	Lack of information in a specific field	Workshops with stakeholders in order to find out hidden knowledge	1-5	1-5
n/a	Researchers involved in the projects is leaving	Complementary knowledge and exchange More than one person involved in activities		

WP 6 – KNOWLEDGE MANAGEMENT

Start date: M1; *End date:* M19

Lead: Marta Macias Aragonés (IDENER)

Contributors: LGI, E-MINES

- To set the framework for internal knowledge management through the implementation of MSP-REFRAM customised KM tools
- To identify existing knowledge and gaps in close cooperation with WP1 to WP5 leaders
- To retrieve and storage knowledge to be generated through WP1, WP2, WP3, WP4 and WP5
- To transform such knowledge into reports, factsheets, infographics, etc. to be used by the Document Management System (DMS) and into classified data (databases or *.xml files) to be used by the Decision Support System (DSS)
- To set the public DMS and DST as part of the results from the interaction with the multi stakeholder platform

This work package deals with KM tools at an internal and external level.

TASK 6.1 SET-UP OF INTERNAL KM TOOLS

Start date: Dic 2015 (M1); *End date:* June 2017 (M19)

Lead: IDENER

Contributors: LGI

The aim of this task is to set of: Knowledge management web application; Face-to-face meetings and remote meeting tools

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ■ Identification of most suitable KM web application (preferably Open source) - Electronic Content Collaboration Platform from LGI, already used by PROMETIA with excellent results 	Dic 2015	March 2016	IDENER, Carlos Leyva
<ul style="list-style-type: none"> ■ Setting up of KM tools (KM web application, online meetings, etc.) 	Dic 2015	March 2016	IDENER, Carlos Leyva

<ul style="list-style-type: none"> ▪ Link and integration with Project website 	Dic 2015	March 2016	IDENER, Carlos Leyva – LGI, Bastien Duplantier
<ul style="list-style-type: none"> ▪ Communication to Project partners 	Dic 2015	March 2016	IDENER, Marta Macias

TASK 6.2 IDENTIFICATION AND MEASUREMENT OF KNOWLEDGE

Start date: Dic 2015 (M1); *End date:* February 2016 (M3)

Lead: IDENER

Contributors: -

The aim of this task is to map the knowledge to be produced through the project and to identify knowledge sources as well as IPR aspects

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ▪ IDENER sends templates to WP leaders 	Dic 2015	Jan 2016	IDENER, Marta Macias
<ul style="list-style-type: none"> ▪ WP leaders fill the document and send it to WP partners in order to fully complete it 	January 2016	Feb 2016	IDENER, Marta Macias
<ul style="list-style-type: none"> ▪ WP leader receives WP partners feedback, review it and produce final template 	Feb 2016	Feb 2016	IDENER, Marta Macias
<ul style="list-style-type: none"> ▪ IDENER receives final templates from WP leaders and produces final knowledge map 	Feb 2016	Feb 2016	IDENER, Marta Macias

TASK 6.3 KNOWLEDGE RETRIEVAL AND STORAGE

Start date: Jan 2016 (M2); *End date:* December 2016 (M13)

Lead: IDENER

Contributors: E-MINES

The aim of this task is to retrieve knowledge from WP leaders and review the information thanks to the Electronic Content Collaboration Platform app for document validation. Then, this information will be indexed through metadata and will be storage in KM tools.

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Periodic meetings between WP leaders and K. Manager 	Jan 2016	Dec. 2016	IDENER, Marta Macias
<ul style="list-style-type: none"> Reception of the information in a report format. Review and validation 	Jan 2016	Dec. 2016	IDENER, Marta Macias
<ul style="list-style-type: none"> Indexing according to the metadata. 	Jan 2016	Dec. 2016	IDENER, Calos Leva; E-MINES, Thomas Poitrenaud
<ul style="list-style-type: none"> Storage of the information on DSS, DSM and GKR 	Jan 2016	Dec. 2016	IDENER, Carlos Leyva; E-MINES, Thomas Poitrenaud

TASK 6.4 KNOWLEDGE TRANSFORMATION

Start date: Jan 2016 (M2); *End date:* June 2017 (M19)

Lead: IDENER

Contributors: -

The aim of this task is to transform information from report to “public document” format and *.xml format

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Information transformation from report to public document 	Jan 2016	June 2017	IDENER, Marta Macias

<ul style="list-style-type: none"> Information transformation for the DSS: <ol style="list-style-type: none"> 1) Ontology definition, 2) Data normalisation, 3) Data Semantic Analysis, 4) Key information extraction and 5) Data storage (database building/*.xml storage). 	Jan 2016	June 2017	IDENER, Carlos Leyva
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TASK 6.5 SET-UP OF EXTERNAL KM TOOLS

Start date: May 2016 (M6); *End date:* June 2017 (M19)

Lead: IDENER

Contributors: -

The aim of this task is to set-up and release of Beta version of: Document Management System (DMS) and Decision Support System (DSS).

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> Identification of most suitable KM web application (preferably Open source) 	May 2016	June 2016	IDENER, Carlos Leyva
<ul style="list-style-type: none"> Setting up of KM tools: DMS and DSS 	June 2016	June 2017	IDENER, Carlos Leyva
<ul style="list-style-type: none"> Link and integration with Project website 	June 2016	June 2017	IDENER, Carlos Leyva
<ul style="list-style-type: none"> Communication to Project partners and public audience 	June 2017	June 2017	IDENER, Marta Macias

DELIVERABLES OF THE WP

Number	Title	Due Date	Responsible
D6.1	Set of internal KM tools	March 2016	Marta Macias (IDENER)
D6.2	Report on knowledge identification and measurement	Feb 2016	Marta Macias

			(IDENER)
D6.3	Draft Report on the outputs of MSPREFRAM	Dec 2016	Marta Macias (IDENER)
D6.4	Final Report on the outputs of MSPREFRAM	June 2017	Marta Macias (IDENER)
D6.5	DMS and DSS Beta version	Jan 2017	Marta Macias (IDENER)
D6.6	DMS and DSS Final version	June 2017	Marta Macias (IDENER)

MILESTONES OF THE WP

Number	Title	Verification mean	Due Date	Responsible
M12	Retrieval of knowledge generated after the 1st workshop	Retrieval of knowledge generated after the 1 st workshop	June 2016	Marta Macias (IDENER)
M13	Retrieval of knowledge generated after the 2 nd workshop	Retrieval of knowledge generated after the 2 nd workshop	Oct 2016	Marta Macias (IDENER)
M14	Retrieval of knowledge generated after the 3rd workshop	Retrieval of knowledge generated after the 3 rd workshop	Dec 2016	Marta Macias (IDENER)

INTERACTION WITH OTHER WPS

WP	Interaction description	Due Date	Responsible
WP2, WP3, WP4, WP5	Input needed for knowledge mapping -> production of D6.2	Feb 2016	WP2, WP3, WP4, WP5 leaders

WP7	Implementation of Electronic cooperation platform	Feb-March 2016	LGI
WP2, WP3, WP4, WP5	Input needed for knowledge review, indexing and transformation -> production of D6.3, D6.4, D6.5, D6.6	Whole project	WP2, WP3, WP4, WP5 leaders
WP7	Tasks 7.3 and 7.4 for public reports design and printing	Last 6 months of the project	LGI

RISKS OF THE WP

Number	Risk description	Risk mitigation	Proba	Impact
n/a	WP leaders do not deliver knowledge mapping template	Close follow-up and reminder mails sending	3	5
n/a	WP leaders do not sent the reports	Close follow-up and reminder mails sending	3	5
n/a	Internal management tools not properly implemented	Close cooperation of LGI and IDENER	1	3
n/a	DSS and DMS do not present the information properly	Several test version will be checked by WP leaders so as to identify errors and bugs	2	4

WP 7 – CAPACITY, DISSEMINATION, COMMUNICATION

Start date: 12 2015; *End date:* 07 2017

Lead: ICCRAM - UBU

Contributors: Dr. Santiago Cuesta López (ICCRAM), Dr. Stephane Bourg CEA, Ms. Marta Macías IDENER, Dr. Jorge Izquierdo Zubiate, Ms. Ana Diez de la Rosa ADE, Ms. Lena Sandqvist MEFOS, Ms. Chloé Chavardes LGI, Dr. Stephane Bourg PROMETIA

The aim of the WP is to coordinate the communication efforts of all entities regarding MSP-REFRAM Project.

Specific objectives of this WP are:

- Boost actions to bring together industrial clusters and EU networks (at all levels of the value chain) within industrial sectors of relevance for the refractory metals will be set up.
- Increase the impact of MSP-REFRAM by aligning its results with the smart specialisation strategies of main EU regions, working in or with resources of, refractory metals.
- Trace a roadmap of transferability for the MSP-REFRAM approach and strategy to other RMs sharing core similarities with refractory metals.
- Provide the infrastructure and the opportunities for facilitating the dissemination of the activities targeted by MSP-REFRAM, empowering the knowledge transfer between the partners, and fostering external communication of the results.
- Organise the communication around the project activities and outputs.

This work package deals with Capacity, Communication and Dissemination

TASK 7.1 ALIGNMENT AND REPRODUCIBILITY. CLOSE REGION INTERACTION ACROSS EU BORDERS IN THE FRAMEWORK OF RIS3 STRATEGIES FOR THE SECURE SUPPLY OF REFRACTORY METALS

Start date: 04 2016; *End date:* 09 2016

Lead: (Dr. Jorge Izquierdo Zubiate, Ms. Ana Diez de la Rosa) ADE

Contributors: Dr. Jorge Izquierdo Zubiate, Ms. Ana Diez de la Rosa (ADE), Dr. Santiago Cuesta López (ICCRAM)

The region of Castilla y León (Spain), shared between its deposits of Los Santos, Barruecopardo and Valtreixal, contains approx. 30.7% of the reserves of W from EU24 (about 38.600 t). Regional Government in Castilla y Leon is setting up roadmaps of prospecting and exploiting W deposits, within the EU and RIS3 context, in order to boost EU production and secure W dependence. Moreover, in Castilla y León, metal working and processing technologies are developed in association to the mining activities closely interlinked with intensive activity in Capital Goods production,

manufacturing and both Automotive and Aerospace components industry, covering in that way the full value chain of tungsten and other RMs.

The aim of this task will be to carry out a strategic research analysis to identify possible “mirror regions” to Castilla y Leon across EU, with potential to work with either the whole or main key parts of a refractory metal value chain and align them in different frameworks (including reviewing their Smart Specialisation Strategy) in order to maximise the EU safety of supply of RMs.

Reproducibility will be further ensured as part of the continuation in time of MSP-REFRAM by “mirroring” Castilla y Leon pilot project and carrying out inter-regional specific oriented actions (i.e. policy workshops, sharing structural plans, common strategic plans and inter-regional SWOT analysis, etc.) to implement the improvements learnt at different levels across the value chain of the refractory metals studied. Such actions are planned to be funded combining Regional/National, and EU structural funds. Results will be disseminated and transferred to other EU regions working in or with potential to work in RMs through different EU channels (EIP Raw Materials, ERRIN, etc.).

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ■ Action 1: Strategic research analysis to identify possible “mirror regions” to Castilla y Leon across EU (ADE.) 	04 2016	09 2016	<i>Dr. Jorge Izquierdo Zubiato, Ms. Ana Diez de la Rosa (ADE)</i>

TASK 7.2 TRANSFERABILITY IS A KEY CONCEPT TO BE IMPLEMENTED IN THE ACTUATION PROTOCOL, AND STRATEGIC PROGRAM FOR ENSURING INDEPENDENCY FROM ANY CRITICAL RAW MATERIAL (CRM), REGARDING THE PROCESSING, RECYCLING, AND EFFICIENT MANAGEMENT OF EACH RESOURCE

Start date: 07 2016; End date: 11 2016

Lead: Dr. Santiago Cuesta López, ICCRAM

Contributors: Dr. Santiago Cuesta López (ICCRAM), Dr. Jorge Izquierdo Zubiato, Ms. Ana Diez de la Rosa (ADE)

As part of the activities and goals pursued within the 3 planned workshops, a dedicated group will work to depict the general guidelines, and suitability to adapt the main materials, methods and conclusions arising from the approach taken overarching the whole value chain of selected refractory metals. This Task will contribute to export the strengths and lessons learned from the refractory

metals to other CRMs (taking as a first priority other metals that may share core similarities). Moreover, transferability will be maximised taking as reference possible regional pilots established for any of the refractory metals and translating the pilot methodology into other CRMs when possible.

Resulting knowledge will be shared with the EU Commission, EIP Raw Materials high-level committee/operational groups related, other EU initiatives (like clustering EU projects in CRMs) and platforms dealing with CRMs, in order to maximise efficiency of efforts in ensuring supply and CRMs non-dependency for Europe, at time that planting the seeds for future common actions. This effort will be kept alive within the EU-EIP Commitment PROMETIA as part of the long term continuation lines of this coordination and support action.

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ■ Action 2: Depict the general guidelines, and suitability to adapt the main materials, methods and conclusions arising from the approach taken overarching the whole value chain of selected refractory metals 	04 2016	09 2016	Dr. Santiago Cuesta López (ICCRAM)

TASK 7.3 DISSEMINATION & COMMUNICATION

Start date: 12 2015; *End date:* 05 2017

Lead: (Ms. Chloé Chavardes) LGI

Contributors: Ms. Chloé Chavardes (LGI), Name (CEA), Dr. Santiago Cuesta López (ICCRAM), Ms. Marta Macías (IDENER), Ms. Lena Sandqvist (MEFOS), Dr. Stephane Bourg (PROMETIA)

The purpose of this task is the elaboration of the detailed dissemination plan and of the communication material. It includes the following activities:

- Preparation of the detailed dissemination & communication plan, including:
 - An event management plan, detailing the participation of MSP-REFRAM in specific events;
 - Detailed planning of communication actions over the project duration including the targeted audience;
 - Indicators of success (number of participations to event, publications, posters);
- Maintenance, monitoring and reporting of this plan throughout the project within periodic reporting;
- Conception and execution of the “project communication toolkit” including:
 - Visual identity of the project (logo, graphical chart);
 - Project public website, hosted by PROMETIA and integrated its website;
 - Generic project presentations (factsheets, poster, slideshow).
- After each workshop and the final conference, production of

- An online video gathering interviews of 1 or 2 key participants and covering the event
- A newsletter (mass mailing, available on the website and printed for events)
- Organisation of the final conference.

Action list

Action	Start Date	Due Date	Responsible
<ul style="list-style-type: none"> ■ Action 3: Preparation of the detailed dissemination & communication plan 	12 2015	01 2016	<i>Ms. Chloé Chavardes (LGI)</i>
<ul style="list-style-type: none"> ■ Action 4 : Maintenance, monitoring and reporting of this plan throughout the project within periodic reporting 	01 2016	05 2017	<i>Ms. Chloé Chavardes (LGI)</i>
<ul style="list-style-type: none"> ■ Action 5: Conception and execution of the “project communication toolkit” including identity, website, presentations 	01 2016	02 2016	<i>Ms. Chloé Chavardes (LGI)</i>
<ul style="list-style-type: none"> ■ Action 6: After each workshop and the final conference, production of newsletters and videos 	05 2016	05, 09, 11 2016 & 01 2017	<i>Ms. Chloé Chavardes (LGI)</i>
<ul style="list-style-type: none"> ■ Action 7: Organisation of the Final Conference 	01 2017	12 2016	<i>Dr. Stephane Bourg (PROMETIA)</i>

DELIVERABLES OF THE WP

Number	Title	Due Date	Responsible
D7.1	Report containing the results about strategic analysis of EU regions with a potential to implement actions on refractory metals	09 2016	<i>Dr. Jorge Izquierdo Zubiate, Ms. Ana Diez de la Rosa (ADE)</i>
D7.2	Report summarising the best practices more suitable to be exported to the analysis of the whole value chain of other CRMs	11 2016	<i>Dr. Santiago Cuesta, ICCRAM</i>

D7.3	Dissemination & communication plan	01 2016	<i>Ms. Chloé Chavardes (LGI)</i>
D7.4	Project communication toolkit	02 2016	<i>Ms. Chloé Chavardes (LGI)</i>
D7.5 / D7.6 / D7.7 / D7.9	Newsletters and video post-meetings	05, 09, 11 2016 & 01 2017	<i>Ms. Chloé Chavardes (LGI)</i>
D7.8	Final Conference	12 2016	<i>Ms. Chloé Chavardes (PROMETIA)</i>

MILESTONES OF THE WP

No milestones are identified for this WP

INTERACTION WITH OTHER WPS

No interactions are described for this WP

RISKS OF THE WP

No risks are described for this WP