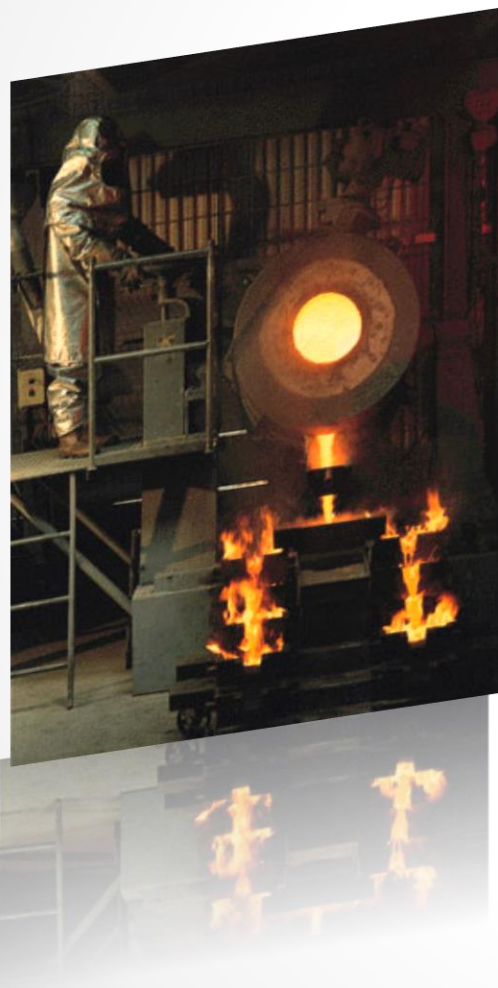




Precious Metals & Rhenium Consortium

Brussels, 27 September 2013



PM Refinables project:

**Meeting task force to split
UVCB with large variability to
make assessment more robust**



1. Welcome & Introduction

• • •



- Reminder on Confidentiality and Competition Law
- Tour de table and apologies
- Approval of the Agenda





Agenda

1. Welcome & introduction
2. Background of splitting exercise, generic flowsheet PM Refinables and useful information from NFM industries BREF
3. Splitting of PM slags
 - Overview reported production processes and proposed sub-groups
 - Overview of comments received
 - Discussion and revision/agreement on sub-groups
4. Splitting of PM slimes & sludges
 - Overview reported production processes and proposed sub-groups
 - Overview of comments received
 - Discussion and revision/agreement on sub-groups
5. Splitting of PM flue dust
 - Overview reported production processes and proposed sub-groups
 - Overview of comments received
 - Discussion and revision/agreement on sub-groups
6. Next steps, AOB, next meetings/calls and closing remarks



2. Background of splitting exercise, generic flowsheet PM Refinables and useful information from NFM industries BREF

• • •

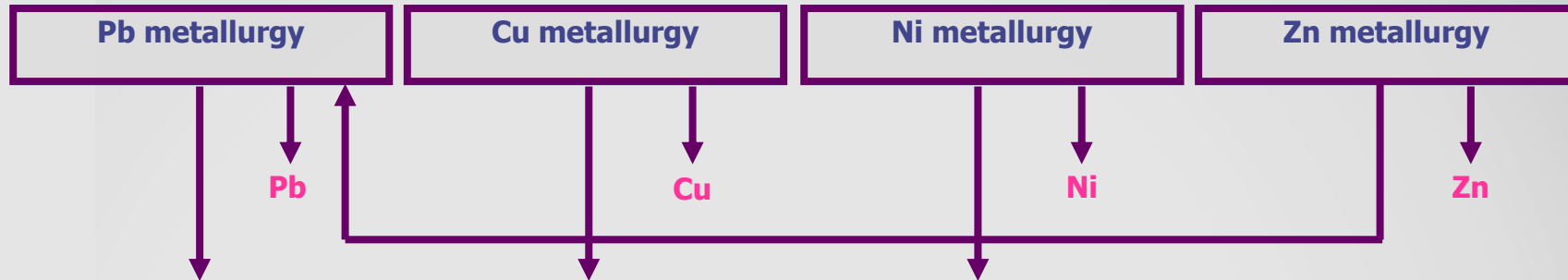


Background

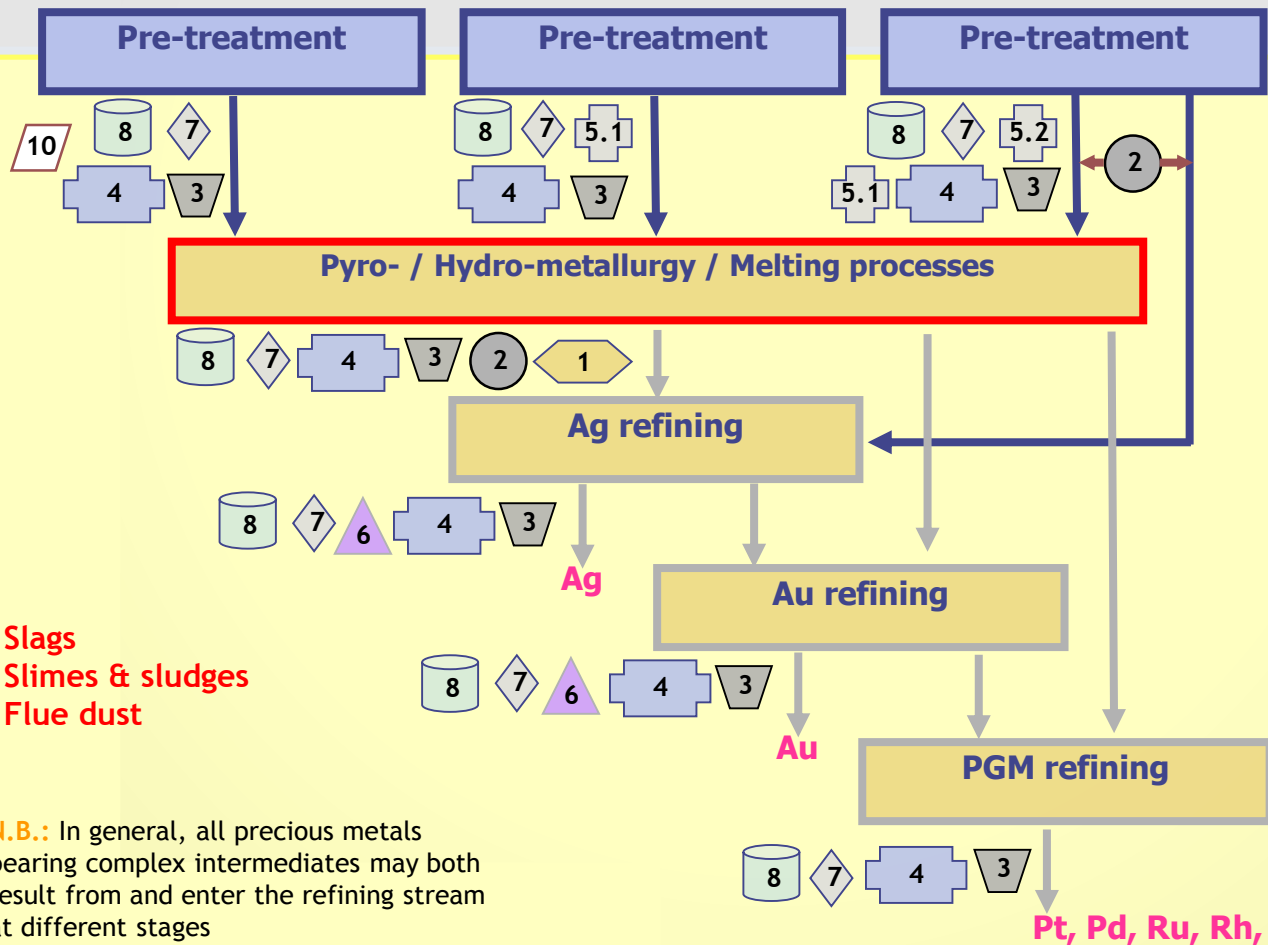
- Same Refinable can originate from several processes or process steps
- Originally grouped on the basis that they are usually captured, collected and/or treated without distinction and that even if they were considered separately (following a theoretical approach) their variability and hazard profile would not be significantly different

Generic flowsheet of PM refining

Other consortia



PM & Re Consortium



9 Can result from and be fed into all steps of (base and) precious metals refining

- 3. Slags
- 4. Slimes & sludges
- 7. Flue dust

N.B.: In general, all precious metals bearing complex intermediates may both result from and enter the refining stream at different stages

Pt, Pd, Ru, Rh, Ir, Os



Background

- 13 Dec 2012 Ref WG meeting: identification, sameness check, and grouping of streams in the following Refinables could reasonably be challenged by ECHA:
 - Slimes and sludges, PM refining
 - Slags, PM refining
 - Flue dust, PM refining
- ⇒ **Task force** in charge of exploring possible criteria and approaches which could be considered to split the above entries in an objective manner
 - TF members: D Cholakova, E Broekaert, M Shepherd, H Stubberud, A Alderman
- Using:
 - Source and process information of Refinables in scope;
 - the NFM industries BAT Reference document (BREF);
 - available information from splitting exercise done previously.



Background

- **13 March task force call:** discussion on possible criteria to split PM Refinables in scope
 - > document 'Proposal to split PM Refinables 3-4-7_130318.doc'
- **April-June:** Based on suggested criteria and the descriptions submitted by PM Refiners in Summer 2009 on production processes and sources, an initial sub-grouping was done by the PMC secretariat:
 - 2 proposed sub-groups for slags
 - 6 proposed sub-groups for slimes & sludges
 - no proposed sub-groups for flue dust
- **18 June Ref WG meeting:** initial sub-groups briefly introduced to the WG
- **June-July:** WG commented on proposed sub-groups



Useful information from NFM industries BREF

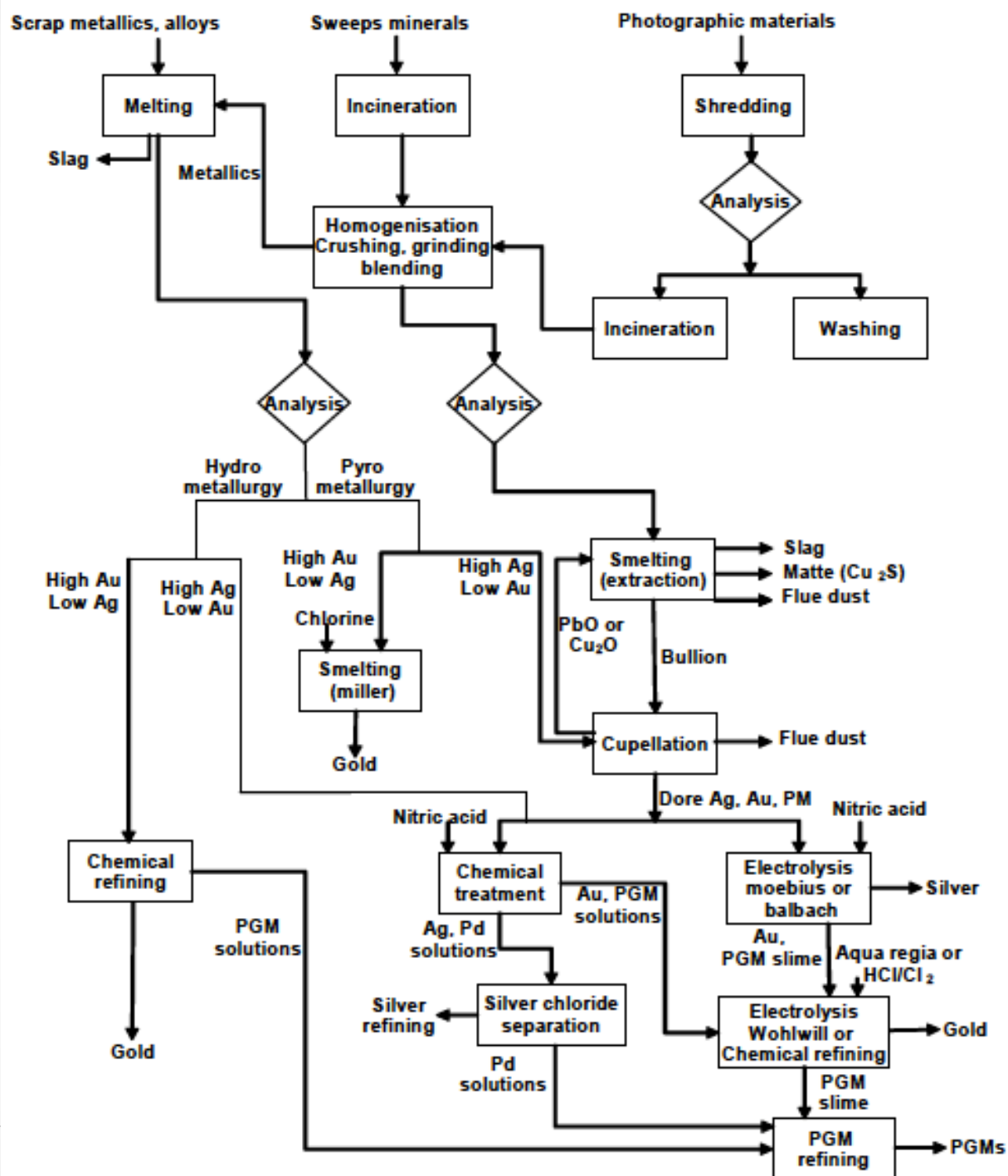
- 3 groups of PMs: Ag, Au, PGMs
- Sources:
 - PM ores, by-products obtained from the processing of other NFMs (in particular anode slimes from Cu production, leach residues and crude metal from Zn & Pb production) and recycled material
 - > 200 types of raw materials in 5 homogenisation categories (largely independent of the PMs the material contain)

Homogenisation category	Type of raw material	Comment
Original	Catalysts, prepared sweeps, solutions	Direct to process
Sweeps	Mineral + metal, non-fusible carbon catalysts	Incineration, roasting and pre-enrichment
Scrap	Fusible material	
Material to be shredded	Photographic material, electronic scrap	
Materials for dissolution	Material that is dissolved in acid, CN, NaOH, etc.	



Useful information from NFM industries BREF

- Production processes:
 - Reactivity of PMs varies and various oxidation states of the metal in their compounds allows a **variety of separation techniques** to be used
 - Usually carried out in **various combinations** to recover the PMs that are present in a particular feedstock
 - Treatment processes vary according to the **composition** of the starting material
 - Multi-purpose reactors and furnaces are used extensively and processing steps are often repeated -> difficult to identify single process steps
 - Generally, PMs are recovered on a toll basis, which can be independent of the metal value -> much of the processing is therefore designed to accurately **sample and assay** the material as well as recover it
 - Pyro-metallurgical processes, hydro-metallurgical processes, solvent extraction stages, filtration, use of fluxes, electrorefining, ...





3. Splitting of PM slags

...



3.1. Overview reported production processes, proposed sub-groups & comments received

Proposed criteria:

- a) **Process** they originate from (e.g. pyro-metallurgical processes / melting processes)
 - Note: all slags originate from hot processes, and there are no slags resulting from hydro-metallurgical operations
- b) **Process and flux** they originate from (pyro-metallurgical processes using borax /melting processes using carbonates, etc.), depending on the influence of the flux on the assessment
 - Note: classification cluster analysis revealed that flux did not systematically influence classification clusters. From all fluxes, boron ones are more likely to influence the assessment

Source (Ag/Au/PGM refining): not applicable since pyro-metallurgical processes are applied on materials containing more than one PM

- Consider options a) and b) above and refine splitting approach based on composition of slags per process (initial smelting step/large composition versus further refining step/narrower composition)



Overview reported production processes & proposed sub-groups

- Based on the data submitted by PM Refiners in Summer 2009 (after grouping of PM Refinables as per registration), an overview of production processes for slags was produced
- Slags that were identified by PM Refiners as REACH exempt were removed

Code	General description of production process	Proposed sub-group	
1, 2, 3	Slag produced as a by-product in the refining oxydizing pyrometallurgical production process of PM doré	1. Slags produced as by-products in the production (smelting, reduction, converting, and refining processes) of doré	
4	Slags produced as a by-product in the production process of metals doré (Melting and refining in TBRC Converter) (Slag TBRC 1 Converter 1st stage)		
4	Slags produced as a by-product in the production process of metals doré (Melting and refining in TBRC Converter) (Slag TBRC 1 Converter 2nd stage (Se oxidation and removal) Glatte 1)		
5	Slags produced as by-products in Kaldo furnace in the smelting, reduction, converting and refining procesess		
3	Slag obtained in further pyrometallurgical refining steps of doré from cuppellation furnace		
4	Slags produced as a by-product in the further pyrometallurgical refining of doré (Ag rich materials) (Slag TBRC 2 Converter (TK2) 1 st stage)		
4	Slags produced as a by-product in the further pyrometallurgical refining of doré (Ag rich materials) (Slag TBRC 2 Converter (TK2) 2 nd stage)		
4	Slags produced as a by-product in the further pyrometallurgical refining of doré (Ag rich materials) (Te slag, removal of Te by addition of soda (Soda glatte); Different than previous 2 entries; May be covered by Se/Te Consortium)		
6	Slags from scrap smelting with flux (borax)		2. Slags produced as a by-product in the smelting of PM bearing feeds to produce a PM containing alloy subject to further refining
7	Slags produced as a by-product of the smelting of metal wastes rich in PGMs		
8	Reductive smelting of PM bearing feeds to produce a PM Pb alloy and a base metal silicate and borate slag		



3.2. Overview comments received

- Initially type of pyro-metallurgical device used for manufacture was specified but it was noted that this has no added value; similar slags can be produced in furnaces, Kaldo's, convertors, etc. The choice of the applied technology depends on other parameters, e.g. treated tonnage, batch size, impurity level.
- No other comments received; all PMC Members in agreement with proposed sub-groups.



3.3. Discussion & revision/agreement sub-groups

2 sub-groups:

- 1) Slags produced as by-products in the production (smelting, reduction, converting, and refining processes) of doré
- 2) Slags produced as a by-product in the smelting of PM bearing feeds to produce a PM containing material other than doré subject to further refining





4. Splitting of PM slimes & sludges

...



4.1. Overview reported production processes, proposed sub-groups & comments received

Proposed criterion:

- Combination of the **process** they originate from (e.g. hydro-metallurgical processes / wet treatment of by-products produced during melting processes) and the **PM refining** (Ag/Au/PGM refining) they result from

Note: Need to distinguish between:

- 1) Slimes and sludges from non-PM refining used as input in PM refining and covered in another registration;
- 2) True PM refining slimes and sludges;
- 3) Slimes and sludges obtained from hydro-metallurgical processes in order to concentrate the PM and used as input in PM refining.

➤ Consider one group per process and PM family (Ag, Au, and PGM) and possibly an additional group to cover borderline slimes and sludges



Overview reported production processes & proposed sub-groups

- Based on the data submitted by PM Refiners in Summer 2009 (after grouping of PM Refinables as per registration), an overview of production processes and sources for slimes & sludges was produced

Code	General description of production process	Source	Proposed sub-group
2	Slimes - Dried slimes (or roasted slimes)	Products with high PM content from primary and secondary sources	1. Slimes obtained as reaction by-product during pyro- or hydro-metallurgical concentration/upgrading of PM containing materials
1	Roasted, dried slime (Se-free) from PM refining	Products with high PM content from primary and secondary sources	
1	Intermediate after Cu and Ni leaching	Products with high PM content from primary and secondary sources	
	PGM Smelting feedstock	Concentrate high in PGMs used in Smelting from Primary and Secondary Sources	
3	Reaction byproducts obtained by hydrometallurgical PM upgrading operations	Base metals with medium (>1%) PM content	
8	Residue from hydrometallurgical upgrading processes	Residue with mixed PM content from primary and secondary sources	
2	Pd concentrate (Pd-slime) (Palladium)	Products with high PM content from primary and secondary sources	
	PM bearing refinables as powder, sludge, suspension or solution	Intermediates during refining of primary and secondary sources	
	Residues obtained in the late stages of PGM refining	Feed to PM refinery (doré, Fe bullion) (>90% PM)	
	PGM enriched feedstock for thermal process prior to smelting	Secondary sources of PGMs with a high calorific value, generally catalysts	
	Leach residues originating from main smelting process	Smelting of Products with high PM content from primary and secondary sources,	
	Leach residues originating from other streams eg, flue dust, catch pit & drain cleanings		
7	Pyrometallurgical operations	Secondary PGM refinery	



Overview reported production processes & proposed sub-groups

Code	General description of production process	Source	Proposed sub-group
5	Slimes obtained during Ag electrolytic refining and next leached with HCl solution (Raw Au slime, Au slime after pre-leaching)	Products with high Ag and Au content from primary sources	2. Slimes obtained during the electrolytic refining of Ag
2	Anode slime (after Ag-electrolysis)	Products with high PM content from primary and secondary sources	
1	Slime collected on bottom of Ag electrolysis	Products with high PM content from primary and secondary sources	
4	Ag electrolytic refining	Ag anodes, Solution of Ag nitrate and nitric acid	
4	Au electrolytic refining	Au anodes, Solution of AuCl ₃ and HCl	3. Slimes obtained during the electrolytic refining of Au



Overview reported production processes & proposed sub-groups

Code	General description of production process	Source	Proposed sub-group
	Leach Residues dissolved in Hydrochloric acid	Liquor resulting from the dissolution of leach residues in hydrochloric acid	4. Slimes obtained during hydro-metallurgical/leaching processes of PM containing materials
	Leach residues from the PM plant / Precipitates from PM bearing solutions.	Products with high PM content from primary and secondary sources	
	Residues obtained by the addition of a reductant (aluminium, Zn, Cu, ...) to end liquors of the refining of PMs	Wastewaters from various PM refining steps	
	Residue out of alkaline or acidic chemical reductions of pm bearing solutions	Products with PM content from primary and secondary sources	
6	Refinery solutions treatment: neutralization, precipitation of oxyde/hydroxyde of metals, sulfuration of metals not hydrolyzed, filtration in press-filter, drying of filter cake.	Products with low PM content	
2	Filtered precipitate from Au leaching to furnace (AgCl precipitate)	Product of PM refining process	
3	Residues obtained from the leaching of scrap and waste materials containing PMs.	Recycled PM materials	5. Slimes obtained during treatment of production effluents of PM production processes
	Leach residues originating from recycled refractories	Bricks, pots and crucibles crushed after end of life to recover PGMs	
	Dissolution residue out of acidic, neutral or alkaline leaching or dissolution steps of PM bearing materials	Products with PM content from primary and secondary sources	
7	Residues from hydrometallurgical processes entering PGM refining processes	Originating from base metal and silver refining processes	
7	Sludges and solutions produced during hydrochloric acid treatment of PGM containing materials	PGM Refining operations	
	Base metal hydroxydes precipitation from liquid effluents, Residues obtained by addition of reducing agent to the effluent stream of a PM refinery	Reaction by-product obtained by hydrometallurgical PM upgrading operations	
	Slime obtained by neutralization of waste water with milk of lime (Cu pickling wastewater treatment/ Slime from WWTP from PM production)	Product of the neutralization of the waste water from the PM Plant	6. Other slimes and sludges generated as by-products during PM production processes
6	All the residues obtained from refining of PM.	Products with low PM content	
	All solid PM materials not covered with 308-516-0 or 309-770-5	Intermediates during refining of primary and secondary sources	



Proposed sub-groups

- 6 sub-groups:
 - 1) Slimes obtained as reaction by-product during pyro- or hydro-metallurgical concentration/upgrading of PM containing materials
 - 2) Slimes obtained during the electrolytic refining of Ag
 - 3) Slimes obtained during the electrolytic refining of Au
 - 4) Slimes obtained during hydro-metallurgical/leaching processes of PM containing materials
 - 5) Slimes obtained during treatment of production effluents of PM production processes
 - 6) Other slimes and sludges generated as by-products during PM production processes



4.2. Overview comments received

- 1 member sent re-drafted proposal for splitting with 5 sub-groups:

Code	General description of production process	Source	Proposed sub-group
5	Slimes obtained during Ag electrolytic refining and next leached with HCl solution (Raw Au slime, Au slime after pre-leaching)	Products with high Ag and Au content from primary sources	1. Slimes obtained/produced during the electrolytic refining of Ag and Au <i>-> Merge of sub-group 2 & 3 above</i>
2	Anode slime (after Ag-electrolysis)	Products with high PM content from primary and secondary sources	
1	Slime collected on bottom of Ag electrolysis	Products with high PM content from primary and secondary sources	
4	Ag electrolytic refining	Ag anodes, Solution of Ag nitrate and nitric acid	
4	Au electrolytic refining	Au anodes, Solution of AuCl ₃ and HCl	



Overview comments received

Code	General description of production process	Source	Proposed sub-group
2	Slimes - Dried slimes (or roasted slimes)	Products with high PM content from primary and secondary sources	2. Slimes obtained/produced from hydro or pyro metallurgical upgrading of PM containing materials including non PM sources (ie removal of base metals or solvent producing an upgraded/enriched residue)
1	Roasted, dried slime (Se-free) from PM refining	Products with high PM content from primary and secondary sources	
1	Intermediate after Cu and Ni leaching	Products with high PM content from primary and secondary sources	
	PGM Smelting feedstock	Concentrate high in PGMs used in Smelting from Primary and Secondary Sources	
3	Reaction byproducts obtained by hydrometallurgical PM upgrading operations	Base metals with medium (>1%) PM content	
8	Residue from hydrometallurgical upgrading processes	Residue with mixed PM content from primary and secondary sources	
2	Pd concentrate (Pd-slime) (Palladium)	Products with high PM content from primary and secondary sources	
	Residues obtained in the late stages of PGM refining	Feed to PM refinery (doré, Fe bullion) (>90% PM)	
	PGM enriched feedstock for thermal process prior to smelting	Secondary sources of PGMs with a high calorific value, generally catalysts	
	Leach residues originating from main smelting process	Smelting of Products with high PM content from primary and secondary sources,	
5	Slime from wet dedusting system of the process gases from the Kaldo furnace. After leaching of Se with NaOH, the slime is reversed to Kaldo furnace.	Product with high lead, silver and selenium content from primary sources	1
7	Residues from hydrometallurgical processes entering PGM refining processes	Originating from base metal and silver refining processes	4
7	Sludges and solutions produced during hydrochloric acid treatment of PGM containing materials	PGM Refining operations	

-> Rework of Sub-group 1 & 4 above



Overview comments received

Code	General description of production process	Source	Proposed sub-group
	PM bearing refinables as powder, sludge, suspension or solution	Intermediates during refining of primary and secondary sources	3. Slimes obtained/produced by precipitation of solutions containing PM's.
	Leach residues originating from other streams eg, flue dust, catch pit & drain cleanings		
	Leach residues from the PM plant / Precipitates from PM bearing solutions.	Products with high PM content from primary and secondary sources	1 4 <i>-> Rework of Sub-group 1, 4 & 5 above</i>
6	Refinery solutions treatment: neutralization, precipitation of oxide/hydroxyde of metals, sulfuration of metals not hydrolyzed, filtration in press-filter, drying of filter cake.	Products with low PM content	
2	Filtered precipitate from Au leaching to furnace (AgCl precipitate)	Product of PM refining process	
	Base metal hydroxydes precipitation from liquid effluents.	Reaction by-product obtained by hydrometallurgical PM upgrading operations	5
	Slime obtained by neutralization of waste water with milk of lime (Cu pickling wastewater treatment/ Slime from WWTP from PM production)	Product of the neutralization of the waste water from the PM Plant	



Overview comments received

Code	General description of production process	Source	Proposed sub-group
	Leach Residues dissolved in Hydrochloric acid	Liquor resulting from the dissolution of leach residues in hydrochloric acid	4. Slimes obtained/produced from the hydro-metallurgical leaching of PM's from PM containing materials (ie dissolution of PM's leaving a lower grade residue)
3	Residues obtained from the leaching of scrap and waste materials containing PMs.	Recycled PM materials	
	Leach residues originating from recycled refractories	Bricks, pots and crucibles crushed after end of life to recover PGMs	
	Dissolution residue out of acidic, neutral or alkaline leaching or dissolution steps of PM bearing materials	Products with PM content from primary and secondary sources	5. Other slimes and sludges generated as by-products during PM production processes
6	All the residues obtained from refining of PM.	Products with low PM content	
	All solid PM materials not covered with 308-516-0 or 309-770-5	Intermediates during refining of primary and secondary sources	
	Residues obtained by the addition of a reductant (aluminium, Zn, Cu, ...) to end liquors of the refining of PMs	Wastewaters from various PM refining steps	<i>Removed as these better fit into Cements group rather than Slimes and Sludges. They all refer to the reduction of PMs.</i>
	Residue out of alkaline or acidic chemical reductions of pm bearing solutions	Products with PM content from primary and secondary sources	
	Residues obtained by addition of reducing agent to the effluent stream of a PM refinery	Reaction by-product obtained by hydrometallurgical PM upgrading operations	

- *Sub-group 4 > sub-group of sub-group 4 above*
- *Sub-group 5 = sub-group 6 above - 'catch-all' sub-group, based on the general description of the production processes; not convinced this is really necessary, particularly as the sub-group has 'by-product' in the title which does not fall within REACH (by-product is also used in some of the other descriptions, which should be removed).*



Newly proposed sub-groups

- 5 sub-groups:
 - 1) Slimes obtained/produced during the electrolytic refining of Ag.
 - 2) Slimes obtained/produced during the electrolytic refining of Au.
 - 3) Slimes obtained/produced from hydro-metallurgical upgrading of PM containing solid materials including non-PM sources (i.e. removal of base metals or solvent, producing an upgraded/enriched residue).
 - 4) Slimes obtained/produced from the hydro-metallurgical leaching of PMs from PM containing solid materials (i.e. dissolution of PMs leaving a lower grade residue).
 - 5) Slimes obtained/produced by precipitation from solutions containing PMs.



Overview other comments received

- Group **sub-group 2 and 3** ('Slimes obtained during the electrolytic refining of Ag and Au') (3x)
 - Composition very different (Ag and Au rich material in the same group); may be relevant for the risk assessment to split according to source
- Group **sub-group 4 and 5** ('Slimes obtained during hydro-metallurgical processes of PM containing materials') (3x)
- **Sub-group 4** used for PGM chloride liquors - strong chloride solutions containing PGMs which is then separated out into the individual PMs. There may be small amounts of residue, but essentially this is a solution -> worth having a category for solutions or a statement regarding the status of solutions e.g. water is not counted.
- **Sub-group 5** already covered in another dossier: 'Residues, PM refining cementation'
- Important to retain the 'other' sub-group (**sub-group 6**)



4.3. Discussion & revision/agreement sub-groups

Sub-groups?

1) ...

2) ...

...





5. Splitting of PM flue dust

...



5.1. Overview reported production processes, proposed sub-groups & comments received

Proposed criterion:

Process they originate from

- 1) pyro-metallurgical (smelting) processes;
- 2) melting processes;
- 3) calcination, incineration and drying processes.

➤ However, because flue dusts are usually collected in a centralised system, and their manufacture and use stage take place under the same conditions (always pyro-), the assessment of individual subgroups could be difficult.



Overview reported production processes & proposed sub-groups

- Based on the data submitted by PM Refiners in Summer 2009 (after grouping of PM Refinables as per registration), an overview of production processes and sources for flue dust was produced

Code	General description of production process	Source	Proposed sub-group
	Flue Dust produced as a by-product of PM Smelting operations, material is then leached for PGM recovery		1. Product resulting from the smelting, refining and/or use of Ag and its alloys obtained from primary and secondary sources and including recycled plant intermediates. Recovered from exhaust air by filtration via cloth bags, arising from hygiene extraction systems on processes in the Ag recovery flowsheet.
8	Flue dust captured from reductive smelting of PM bearing feeds to produce a PM Pb alloy and a base metal silicate and borate slag	A mixture of lead oxide, silicates and fluxes containing low concentrations of PM's from secondary sources.	
1	Dust collected from bag filter of fire refining process (from Trof converter)		
4	Obtained from the production process of metal dore - smelting and refining in TBRC Converter (Dust TBRC 1 Converter)	Decopperized Slime from copper electrolysis	
4	Obtained in the further pyrometallurgical refining of doré (Ag rich materials) (Dust TBRC 2 Converter)	Dore, Raw silver, Silver rich bullion, Silver rich materials	
9	Metal fume and dust is generated by processes for smelting and refining silver. It is filtered from the air by cloth bags.	Finely divided metal oxides and other fine particulates recovered from process exhaust air by filtration cloth bags. Fate: Returned to the Ag Rotary Furnace for recovery / disposal.	
7	Flue Dust produced as a by-product of Precious Metal Smelting operations, material is then leached for PGM recovery	Smelting of Products with high PM content from primary and secondary sources,	
3	Dust obtained from the refining of materials from primary & secondary sources containing gold, iridium, osmium, palladium, platinum, rhenium, ruthenium & silver. Composed primarily of lead with traces of other metals	Products with high (>20%) PM content from primary and secondary sources (such as silver crusts,...)	



5.2. Overview comments received

- No comments received; all PMC Members in agreement with proposed sub-group.

5.3. Discussion & revision/agreement sub-groups

1/no sub-groups:

- 1) Product resulting from the smelting, refining and/or use of PMs and its alloys obtained from primary and secondary sources and including recycled plant intermediates. Recovered from exhaust air by filtration via cloth bags, arising from hygiene extraction systems on processes in the PM recovery flowsheet.





5. Next steps, AOB, next meetings/calls and closing remarks

• • •



Next steps

ID & sameness

- PMC secretariat to circulate revised sub-groups to the PMC Members for approval
- Following approval, PMC Members to assign their Refinable(s) to sub-group(s)

Define boundaries

- Determine composition and classification boundaries of sub-groups

Registration strategy

- Split registrations or register as sub-groups of 1 registration (or combination of both)?
- Determine availability of other EC numbers applicable to PM refining slags + slimes & sludges if separate registrations considered