



FUTURE
CIRCULAR
COLLIDER
Innovation Study

FCCNoW 2020 - MATEX Workshop

Survey of regional opportunities for the excavation material

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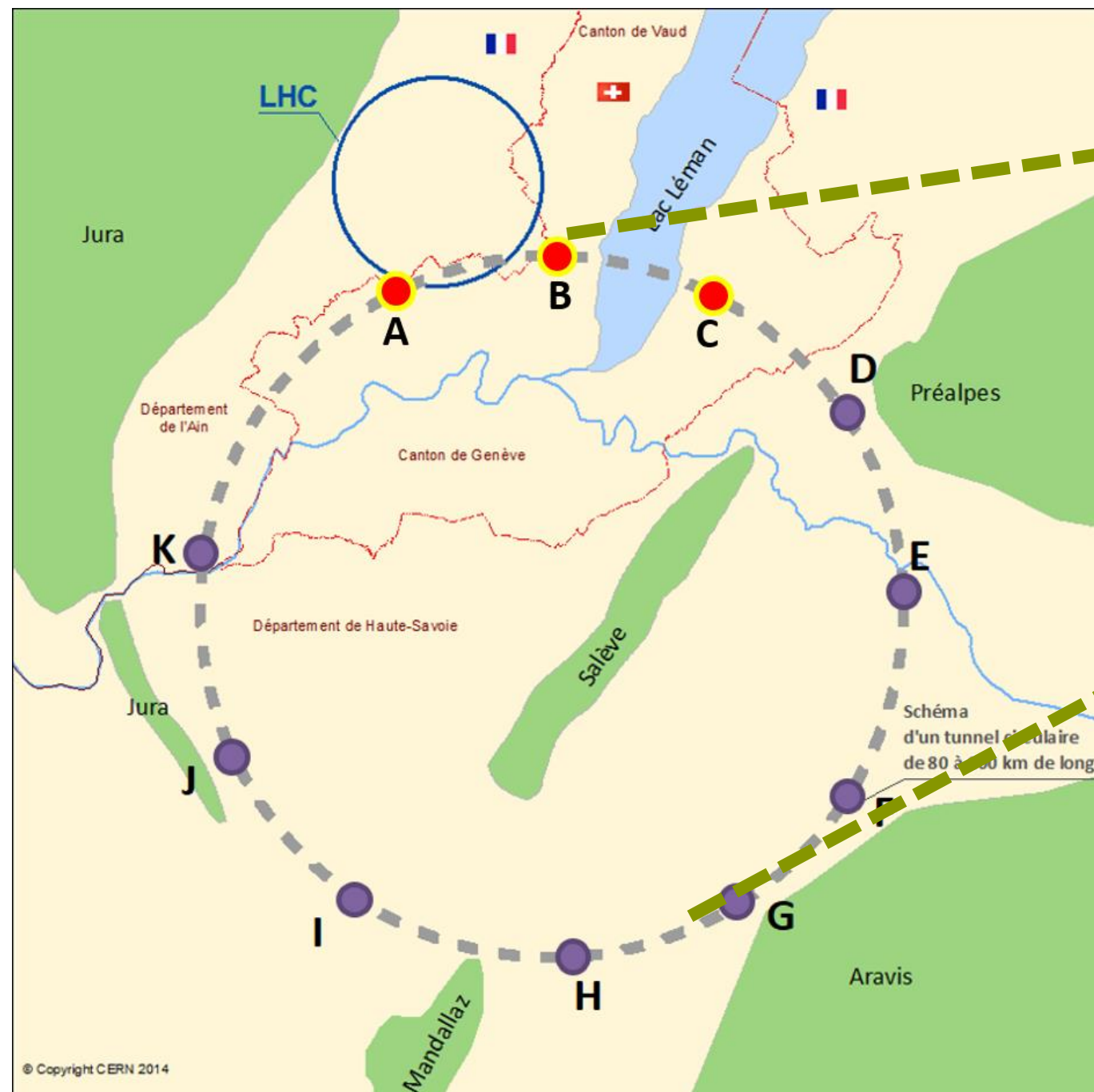
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Outlook and future use of the survey for CERN



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Context of the beneficial reuse solutions survey



Spoil volume: > 9 Mm³
Mainly Molassic materials

Which beneficial reuse could be implemented?

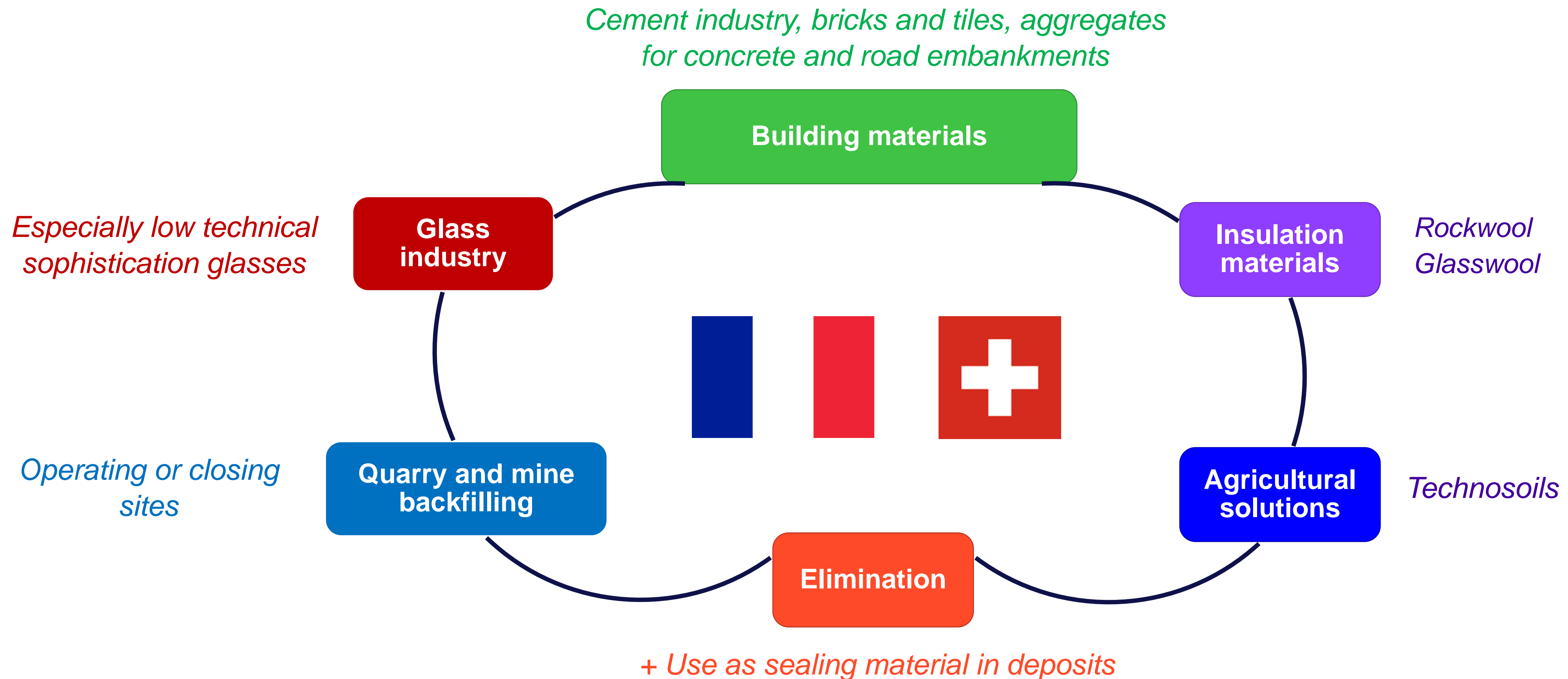


To answer the question, you need at least to know:

- 1 The excavated material characteristics → See M. HAAS presentation ;
- 2 The local solutions for reuse → Survey performed by

How we proceed

Types of beneficial reuse that should be referenced



How we proceed

Methods and organization of the study



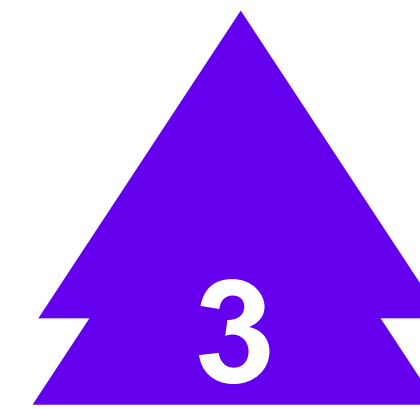
Identification of suitable resources

- France: DREAL/DDT Databases, Classification for the Environment protection, data from the French geological survey, etc.
- Switzerland: Federal office of topography, ETHZ Georesources, *Directions Générales de l'Environnement* of States (VD, GE), etc.



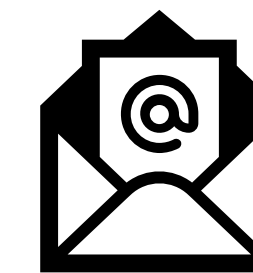
Data compilation

- Storage of data using a similar spreadsheet format
- Sorting
- Make changes for uniformization (such as X,Y projection system)



'Filling the gaps' step

- Identify the main missing information
→ Phoning and mailing



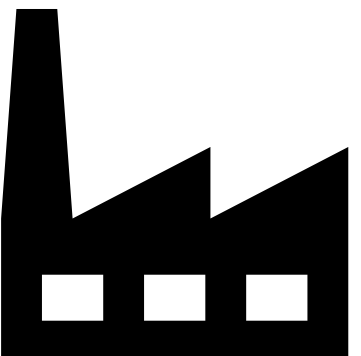
Deliver to the CERN the consolidated database

- Up-to-date information
- As complete as possible

Intermediary survey results

The database is being built, integrating simultaneously all the reuse and disposal solutions and both French and Swiss sides

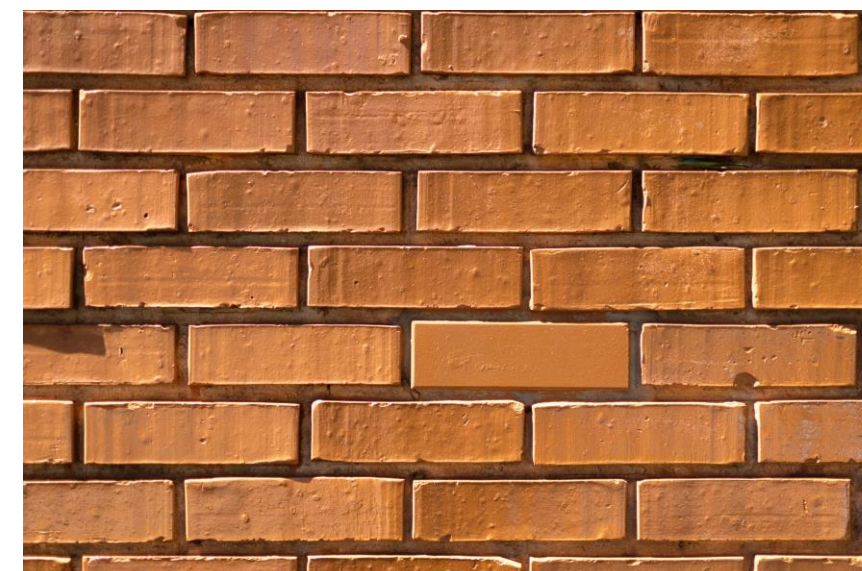
→ This presentation is focused on beneficial reuse as raw material for traditional material industries



2 types of industry

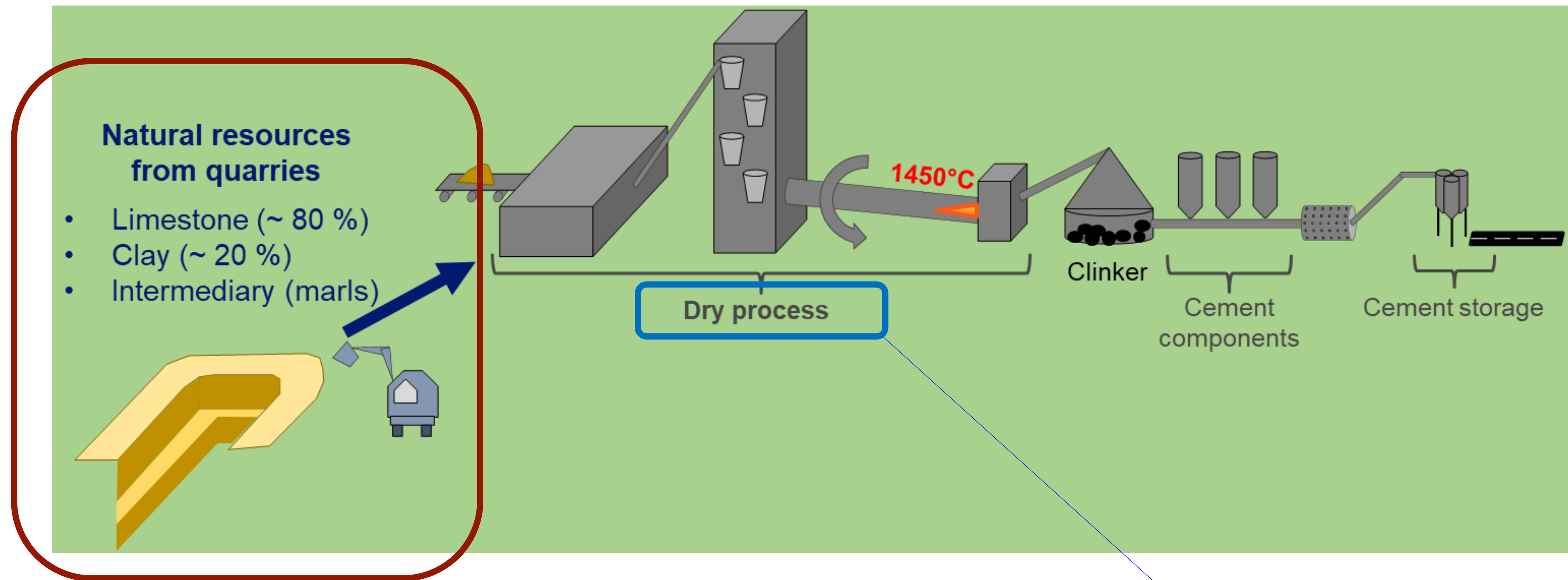
Cement industry

Bricks and tiles industry



Intermediary survey results

Quick reminder of the cement process

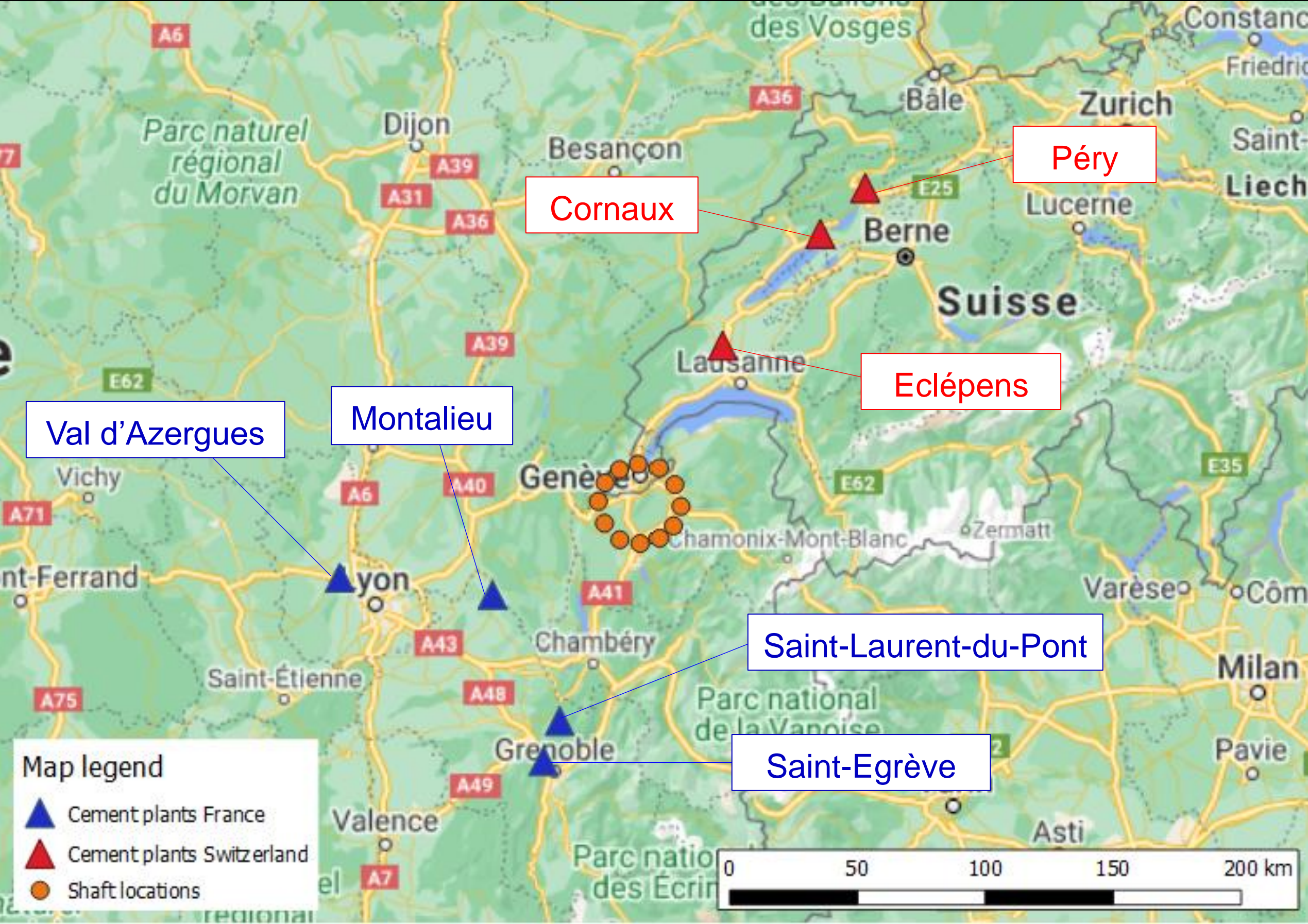


**Need of raw materials that bring Ca, Si, Al, Fe
+ Many additional questions: burnability, minor element contents**

May vary from a site to another

Intermediary survey results

Survey of cement plants



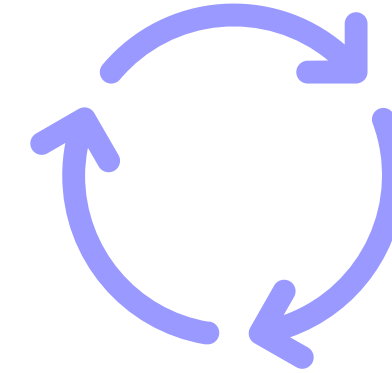
Cement plant	Company	Nearest shaft	Road distance to the nearest shaft
Montalieu	Vicat	PJ, PK, PI PH, (PL)	103 km
Saint-Laurent du Pont La Pérelle	Vicat	PH, PI	91 km
Saint-Egrève	Vicat	PH, PI	132 km
Val d’Azergues	LafargeHolcim	PK, PJ	157 km
Eclépens	Holcim	PB, PA, PC	69 km
Cornaux	Juracime	PB, PA, PC	132 km
Péry	Ciments Vigier (Vicat)	PB, PA, PC	158 km

- 7 identified plants by mapping approach: 4 in France and 3 in Switzerland
- Reduced number of possible stakeholders, especially in France

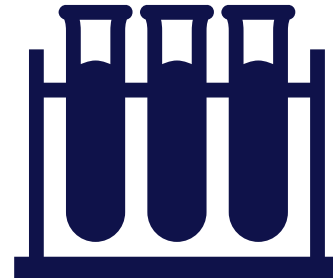
➔ 2 plants are highly interesting due to the distance: Eclépens and Montalieu

Intermediary survey results

Survey of cement plants – Technical requirements



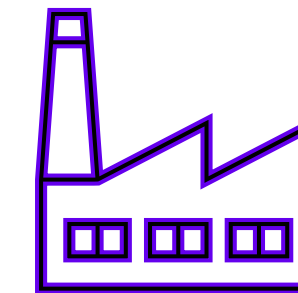
General technical requirements



Mainly chemistry parameters

- Raw materials that need to bear Ca, Si, Al, Fe
- Minerals that should be « easy » to burn → For instance, avoid using silica from quartz mineral
- Take care of minor elements that could interfere in clinkering reactions (especially alkalis, heavy metals, etc.)
- Avoid raw material that contain organic matter (no increase of CO₂ emission)

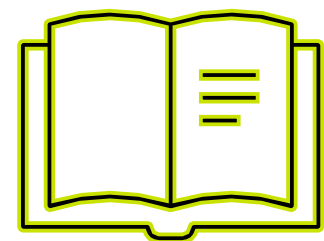
Site-specific requirements



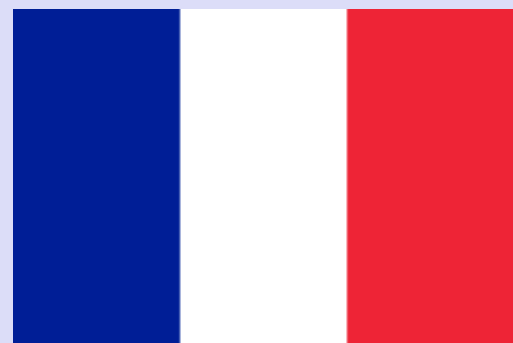
- Which type of process: dry, semi-dry, ... ?
- Type of products (*i.e.* cements) that are produced by a given site
- Natural resources and alternative waste that are already available for the industrial partner
- Industrial process and material that can be differently adapted to valorization of waste and by-products

Intermediary survey results

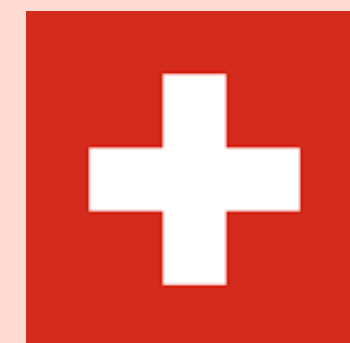
Survey of cement plants – Environmental requirements



Environmental framework concerning waste valorization in cement plants differs between France and Switzerland...



- **Closeness principle**
- French regulations mainly **focus on pollution levels in the industrial fumes** (dust, NO_x, SO₂, TOC, NH₃, heavy metals,...)
- **Reuse possibilities may vary from a site to another according to the State authorization, that can contain:**
 - **Defined list of accepted non-dangerous wastes ;**
 - **Annual limited quantities**
 - **Specific limitation on hydrocarbons for alternative raw materials**
- ➔ **Role of local authorities**



OLED - 2015 (Ordinance on Waste Limitation and Elimination)

Use of excavation as raw material for cement manufacturing specifically identified (Art. 19)

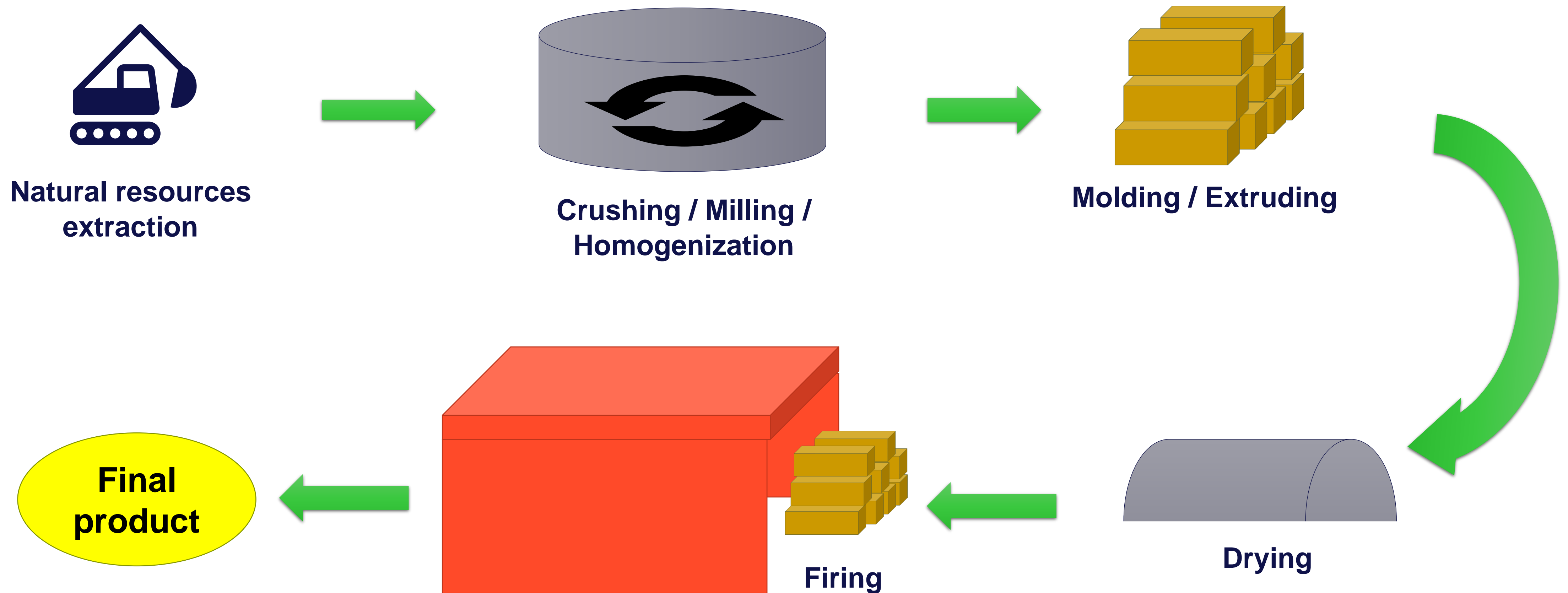
Upper limits given per kg of dry matter (appendix #4):

- Trace-éléments;
- PAH
- Hydrocarbons
- TOC...

Limits can be exceeded by the alternative raw material if some thresholds are respected for the final product (clinker)

Intermediary survey results

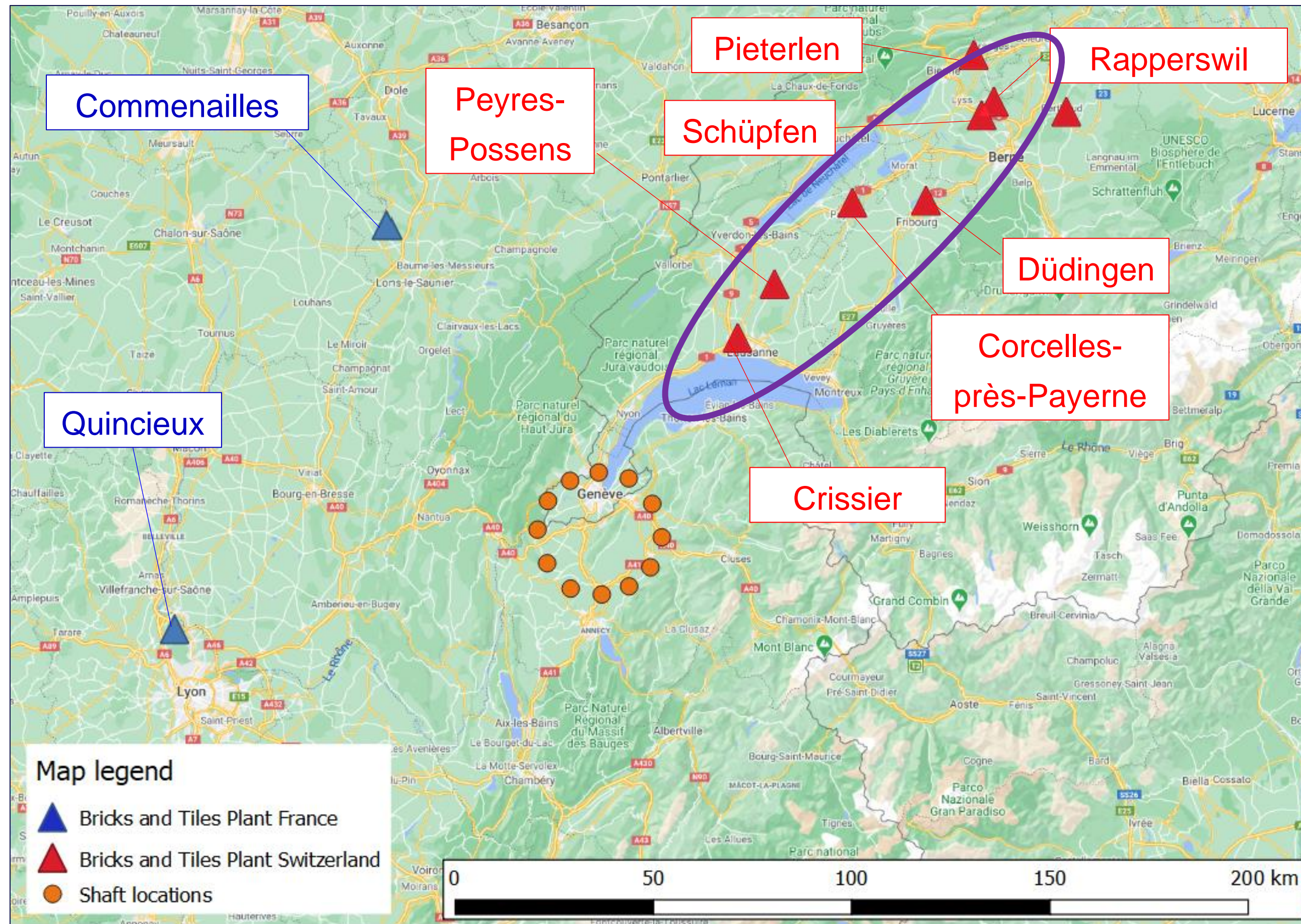
Quick reminder of the Tiles and Bricks manufacturing process



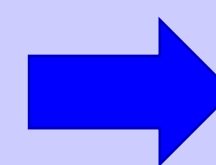
Intermediary survey results

Survey of Tiles and Bricks plants

Molassic Basin



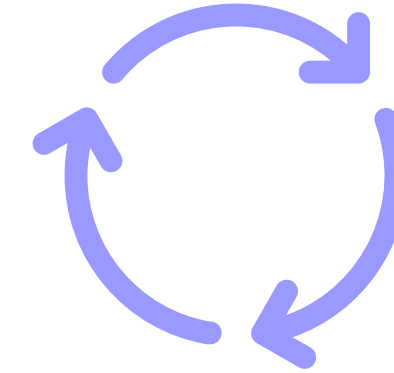
Tiles and bricks plant	Company	Nearest shaft	Road distance to the nearest shaft
Quincieux	Edilians	PJ, PK, PI PH	134 km
Commenailles	Edilians	PK, PJ	166 km
Crissier	AGZ ZIEGELEIEN - Tuilerie Fribourg et Lausanne SA	PB, PA, PC	56 km
Peyres-Possens	GASSER CERAMIC - Morandi Frères SA	PB, PA, PC	75 km
Corcelles-près-Payerne	GASSER CERAMIC - Morandi Frères SA	PB, PA, PC	111 km
Düdingen	AGZ ZIEGELEIEN - Tuilerie Fribourg et Lausanne SA	PB, PA, PC	141 km
Pieterlen	ZIEGELWERKE LAUPER	PB, PA, PC	160 km
Schüpfen	GASSER CERAMIC	PB, PA, PC	165 km
Rapperswil	GASSER CERAMIC	PB, PA, PC	171 km



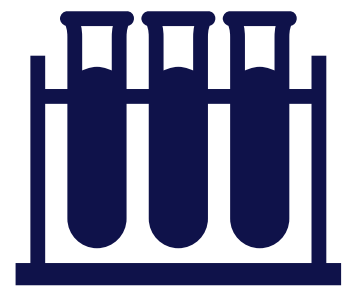
Higher interest for the Swiss side than for the French side concerning tiles and bricks solution

Intermediary survey results

Survey of Tiles and Bricks plants – Technical requirements



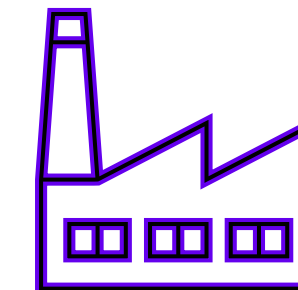
General technical requirements



Mostly mineralogical/chemistry parameters

- Fine ratios between clay species, between clay minerals and other non-clayey crystalline phases (feldspars, quartz, carbonates)
- Grain size distribution
- Appropriate content of ‘porosity agents’: organic matter, carbonates

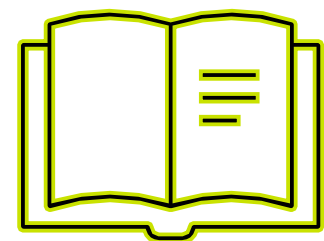
Site-specific requirements



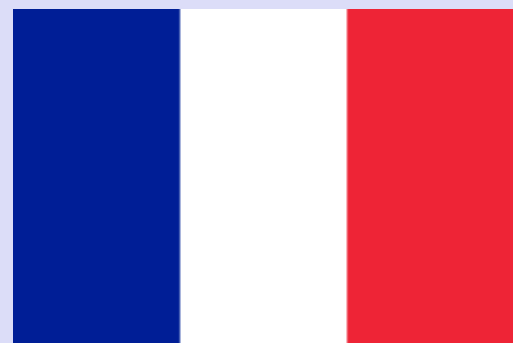
- Adaptation of the process and the products to the raw material (*difference compared to cement industry*)
- Technical and aesthetic expectations for the product that can be impacted by the use of alternative raw material (cf. porosity, product colour that can be modified by minor elements)

Intermediary survey results

Survey of Tiles and Bricks plants – Environmental requirements



Environmental framework concerning waste valorization in cement plants differs between France and Switzerland...



- No general restriction on the use of alternative raw materials in the bricks and tiles manufacturing process
- Generally, no authorization for non-inert waste acceptance
- Case-specific limitation on emissions



OLED - 2015 (Ordinance on Waste Limitation and Elimination)

- Use of alternative material in bricks and tiles industry not specifically discussed
- According to Art. 19 MATEX could be reused if they respect pollutant limits contained in Appendix 3, Chapter 1 (Trace-éléments, PAH, BTEX, TOC,...)
 - ➔ Levels more restrictive than limits dedicated to alternative raw materials in clinker synthesis

Preliminary conclusions

On-going work

- Building of a consolidated database containing possible reuse sites for mineral resources coming from FCC excavations
- Up-to-date database – 2020 – than can be enriched in the future (particularly with emerging solutions)

Industrial beneficial reuse solutions: cement and ceramic industries

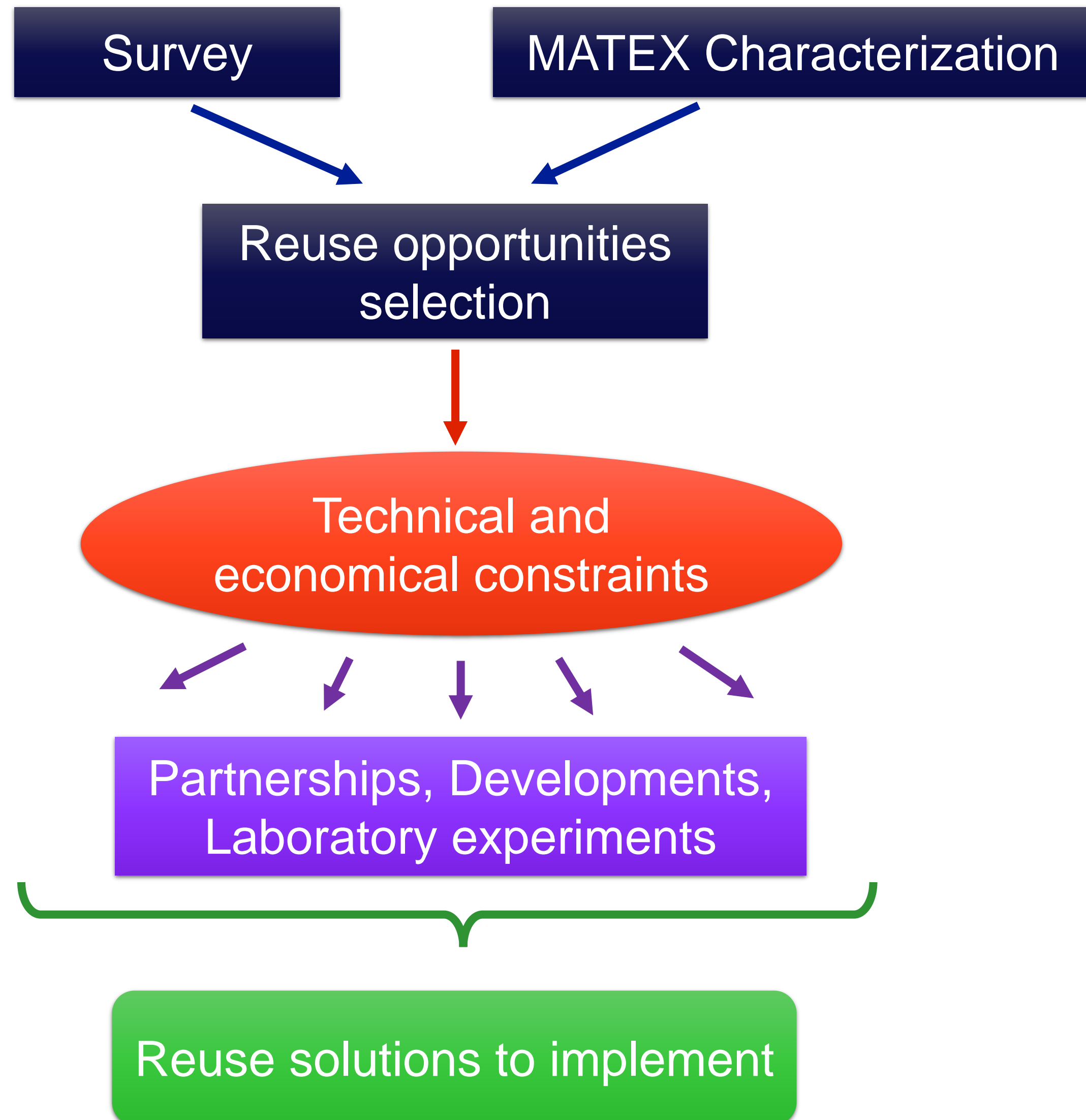
Several sites (most of them > 100 km far)

High volumes of raw materials required per year

Cement: Clay + Calcium carbonate
Ceramic: mainly clay

Specific features for each plant
→ Detailed information are required
→ Financial questions to consider

Outlook: Future role of the survey for CERN



The survey inscribes into the actions for the definition of strategy for the management for the excavated material:

- Management compliant to the geographical specificities:
 - Difficult road transport conditions: mountains + dense traffic across borders → priority to train or transport on water (river, lake)
 - Opportunities in the region expressed in need of construction material
 - Region (Geneva canton and near France) with limited possibilities for excavation material and construction material landfilling: need to find alternative solutions.

The dimension of the project imposes to consider the management of the excavated material at the level of the entire tunnel and not per access point



Thank you
for your attention.