

A report by

OAKDENE HOLLINS
RESEARCH & CONSULTING



Executive Summary

Minventory: EU raw materials statistics on resources and reserves

A study to document the prevalence, metadata and standards employed by EU Member States and neighbouring countries of Europe in quantifying resource and reserve information related to primary and secondary raw materials; further, to produce a roadmap outline the barriers and possible voluntary actions that might be taken to harmonise and publish the resource and reserve data at an EU level; and how this would be implemented in a European Minerals Yearbook.

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Minventory: EU raw materials statistics on resources and reserves

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1 Purpose of the project

The European Commission commissioned this work to analyse the availability of public geological data (land and marine), and household, commercial and industrial waste data, related to **resources and reserves** of mineral raw materials. Many different organisations have amassed and even published aspects of such data. However, it is often presented in different formats using varying terminologies. An important aspect has therefore been the proposals for **harmonising these protocols** to ensure congruency in the presentation and use of statistical geological data.

On the policy front, a unified source of statistical information for resources and reserves within the European Union is supported by three pillars set out in the European Raw Materials Initiative (RMI) of 2008:

1. Access to raw materials on world markets at undistorted conditions.
2. Foster sustainable supply of raw materials from European sources.
3. Reduce the EU's consumption of primary raw materials

This work contributes to the second pillar. However, specific data infrastructure needs were identified by DG Enterprise's Raw Materials Supply Group already in its April 2009 report¹, and include amalgamating such statistical information in an EU-wide **harmonised database**.

This project has addressed these needs by identifying the barriers to achieving harmonised reporting systems and developing a **roadmap** and set of **options for action** in it. It should be noted that all the proposed actions are **voluntary**.

2 Scope

Minventory has characterised the **metadata** held in Member States and their offshore dependencies, and 13 neighbouring European Countries concerning **stocks of**:

- **primary raw materials** i.e. geological deposits of minerals and ores (land-based and marine);
- **secondary raw materials** i.e. materials consigned as waste having been once used, but which might be reprocessed for re-use; and (as a scoping exercise only)
- **'in use' materials** i.e. materials embedded in products and infrastructure which might, in future, become secondary raw materials.

For primary raw materials, the range of materials studied is identical to that specified by the Raw Materials Initiative (RMI, COM (2008) 699 final) on land and in marine environments encompassing metallic, construction and industrial minerals. Within secondary materials, the study has focussed on long-term accumulations held within **landfill** and **mining waste facilities** (including **Category A waste facilities**).

¹ Land Use Consultants (2010) *Exchanging Best Practice on Land Use Planning, Permitting and Geological Knowledge Sharing*

It was anticipated and confirmed by the study that metadata and data relating to landfill stocks would be sparse. Accordingly, metadata relating to **waste flow data** was collected as an extension to the project.

3 Outputs

The outputs of this project take the form of:

- A description of the current situation at national and, where relevant, regional level, with respect to statistical information on resources and reserves in Europe, including an assessment of the level of application of a system of reporting resource and reserve data.
- **Analysis of barriers** to harmonising data and interoperability development, and remedial action required including:
 - A combined timeline (“**roadmap**”) and **outline plan** for implementation including: a statement of target outcomes on the road to harmonisation; options for action; and target dates for achievement by 2020 or beyond.
 - An action plan to incorporate a section on harmonised resources and reserves statistics into a future **European minerals yearbook**.
- A Commission **portal** that summarises metadata available on primary raw material resources and reserves (by mineral, country and land/marine domain), on secondary raw materials (mining wastes, landfill inventories and waste flows), and where such data might be found.

4 Process

The process of this project was centred on **questionnaires** sent to State public authority data owners, providers or publishers and other stakeholders in the domains of geological knowledge, mining waste, and of landfill and waste flows. This primary data was supplemented by **desk-based research** which investigated key topics, especially in relation to other initiatives. The metadata gathered was translated into a format to populate the metadata portal (itself the subject of a user survey) and to inform the planning process for the parallel Minerals4EU project dealing with European Minerals Yearbook. Further, the basic knowledge gathered for each nation provided a basis for examination of data availability, reporting standards, ownership and **barriers to harmonisation** in each of the material domains. Findings and proposals were tested at three stakeholder workshops.

In developing a roadmap and options for action, account has been taken of current data harmonisation practices and systems of reporting used across Europe; relevant legislation, such as the Mining Waste Directive, the Waste Framework Directive and related Directives on waste treatment (i.e. Landfill Directive) and on specific waste streams (various End-of-Life Directives), and the INSPIRE Directive on the reporting of spatial data; of related activities such as EuroGeoSource, ProMine, Minerals4EU, GIS Central Europe, OneGeology Europe and European Geological Data Infrastructure; and policies in other domains, such as the standards for public reporting of resources and reserves data endorsed by the European Securities and Markets Authority.

Barriers to harmonisation were examined under broad themes identified in the second pillar of the RMI:

- Policy, legislation and regulation.
- Data quality and comparability.
- Data infrastructure, provision and accessibility.

5 Findings for primary raw materials

Minventory has determined the **availability** and **accessibility** of statistical data on resources and reserves for 42 key minerals held in Member States and 13 neighbouring countries. Data categories include resources, reserves and 'other' non-statistical data. 17 of 21 respondent countries do not consider minerals data to be confidential at the aggregated national level. In addition 25 of 29 respondents make some or all data available to the public.

In general, data on metalliferous minerals is deemed more sensitive than that for bulk minerals. This reflects that there are typically rules within State mining laws that restrict dissemination or at least set a moratorium on disclosure. In other cases, private companies will limit disclosure based on self-interest. **Confidentiality, aggregation and redaction protocols** (as already operate within Eurostat) will therefore be a critical component of EU level harmonisation.

In respect of statistical data on marine resources at national level, 11 countries are landlocked and therefore have no interest. Of the remainder, one third offered no response; one third do collect such data; and one third do not collect data. The data is almost entirely related to sand and gravel (and fossil fuel deposits – not in the project scope) and is commonly in the form of maps.

In respect of overseas territories, resources and reserves statistics are sparse. Because of their administrative relationship, a number of the former French colonies offer some structured data via BRGM, but this is exceptional.

A review of **systems of reporting** shows that the process of collecting data on mineral resources and reserves is far more structured for countries in Eastern Europe (7 of these are aligned or in the process of aligning to a widely accepted code or standard). Here, requirements to provide data to the relevant authority commonly form part of the legislation on mining. Likewise, it is also a requirement to provide data in a format that complies with a national Reporting Code. National Reporting Codes often align to the international CRIRSCO Template. Whilst only the UK does not have a national mining policy, all other States have such a law or policy, and two thirds of these mandate data disclosure.

Considering the full responses to the questionnaires, issues and gaps in practice which would hamper harmonisation were identified as summarised in the table below.

The severity of each of these issues has been rated on a scale of 1 (least) to 5 (most) according to the judgement of the project team and feedback from participants in the Stakeholder Meetings and the steering group. They reflect broad parameters of: **Stakeholder alignment** i.e. are there **conflicts of interest** in policy or IP ownership; **volume of data** to render into a harmonised format; and **technical difficulty** in creating solutions e.g. through diversity of standards for historic materials, and absence of electronic data

infrastructure. These issues are the targets for action in the roadmap, an overview of which is shown graphically in Figure 1.

All of these actions can be initiated relatively soon, and many of them could be complete by the target date of 2020. Some of the more tractable issues relate to: converging use of terminology; establishing data confidentiality and redaction rules at EU level; and asking Member States to nominate single contact points for data handling. More problematic are the issues associated with making data available for publishing; adopting a common system of reporting; and dealing with historic data in diverse systems of reporting.

Topic	Issues/Gaps	Severity
I. Policy, legislation and regulation	1. National mining law or minerals policy	4
	2. Legal requirement to provide resources/reserves data	5
	3. Terminology of primary RM and dedicated legislation	5
II. Data quality and comparability	1. Mandated use of a system of reporting	5
	2. Alignment of national systems of reporting with a widely accepted standard or code	3
	3. Process of harmonising data	4
	4. Data reliability	4
	5. Application of the INSPIRE Directive	3
III. Data infrastructure, provision and accessibility	1. Number of organisation(s) in charge of collecting and centralising data	4
	2. Data ownership and confidentiality	4
	3. Public access to open data	3
	4. Multilingual format of data	2

It should be emphasised that a range of voluntary actions are suggested to tackle the issues. However, it is recognised that, due to diversity of obligations to report and report to a standard (CRIRSCO-aligned or not), implementation will be easier for some Member States than others.

A reporting standard or code aligned to the CRIRSCO-template or the UNFC system could be adopted for reporting resources and reserves at the European level. The Final Report presents advantages and disadvantages of each, but further discussion amongst Member States is needed to come to a firm conclusion. Note that this does not imply that Member States must adopt such a code nationally, but that it should be used for transmission of information to the EU level and by the EU in its subsequent publication or communication of statistical data related to resources and reserves. In any event, any CRIRSCO-based reporting system can be mapped to UNFC by prevailing bridging documents.

This process would be facilitated by EU level harmonisation processes, both to ensure comparability of application of harmonisation rules and to perform redaction prior to publication. These tasks could be performed by one or more bodies, if necessary, to merge minerals competence with proven confidential data management capabilities. For example, Eurostat is a model for data redaction; a public institution (Geological Survey for example) or private data company could manage the harmonisation task. An overview of a possible harmonisation process which tackles these steps is shown in Figure 2.

The INSPIRE Directive goes some way to providing a framework for public authority data reporting in this domain, but would require a recommendation on systems of reporting employed and possibly further work to define pragmatic minimum metadata sets and mineral codes to reflect EU minerals priorities in the necessary detail.

6 Findings for secondary raw materials

Mining waste and landfill inventories have been investigated separately. In general, they are regulated and monitored by different national authorities. Mining wastes fall under the Mining Waste Directive (2006/21/EC) and landfill under the Landfill Directive (1999/31/EC). However, if mining wastes are classified as 'permanent' waste facilities, their contents too will be characterised using the EU List of Wastes² used for landfill deposits. They may therefore have some features in common.

6.1 Mining wastes

Wastes deriving from the extraction and refining industries are regulated under the Mining Waste Directive. This covers operating, closed, abandoned and Category A (high hazard) waste facilities. However, the Directive targets identification of facilities of high associated safety, health and environmental risks. As a result, inventories created by Member States under the Directive represent only a small fraction of sites. To compound this, not all Member States generally publish this information or submit it to the Commission as required. Since it came into force, the Directive obliges publication of certain basic data related to operating mine facilities.

Commonly, the inventory of mining waste facilities is characterised in terms relevant to the mine or processing facilities, but this data is not always made public even though the Mining Waste Directive requires reporting. Once the inventory is classified as a permanent storage, it certainly falls under the Landfill Directive and contents are codified using the List of Wastes, but there is still no obligation to report waste generated. These codes are materially different from the mineralogical classifications that apply to primary raw material reporting, and hence there is an information discontinuity that prevents full harmonisation across the different material domains.

A harmonisation issues analysis has been performed using the same framework as for primary raw materials. The issues found are broadly similar to, but a subset of, the primary raw materials issues. Notable amongst them are the absence of any agreed system of reporting; any need to regularly report waste generated; the lack of suitable data that can identify the resource potential from mining waste and the difference in material classification between facilities that are 'historic' and those that are operating with the status of landfill.

If abandoned or closed mining waste facilities are considered worthy of further survey and reporting, they should be treated as **analogous to primary raw materials**. The UNFC codings recommended for those materials are equally applicable to the characterisation of mining waste accumulations. However, although there are many thousands of closed facilities in the EU, the state of knowledge around these assets is much lower or held confidentially in the hands of operators, asset investors, or public archives.

A range of options for action to address the issues have been proposed. However, it is the strong recommendation of this work that an extensive campaign of data discovery and

² Commission Decision of 3 May 2000 replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste

harmonisation is not undertaken until a **scoping exercise** to locate high potential mining wastes has been conducted.

6.2 Landfill wastes

With regards to availability and accessibility of data, there is an almost total **lack of characterisation** of the material composition of landfill in the EU. Member States generally make available only limited metadata, such a location, capacity, and type (inert, hazardous etc.). There is **no standard** akin to those used in the primary raw materials domain which offers a framework for the structured prospecting, analysis, characterisation and reporting of contents of landfill.

Unlike primary raw materials and possibly mining wastes, landfill deposits contain more diverse and sparse resources as different types of wastes (and products in which they are embedded) are mixed and landfilled in the same deposits. The Landfill and other end-of-life Directives have motivated greater waste segregation and attention to recycling, such that newer landfill contain fewer valuable resources. Therefore, **older landfills** are more likely to **generate interest as stocks of secondary raw materials**.

On the other hand, reporting of **aggregated waste flows** is universal across the EU at EU level, through a process managed by Eurostat as stipulated by the Waste Framework Directive and the protocol of Regulation (EC) No 2150/2002 on waste statistics. The EU **List of Wastes** provides the characterisation framework for data collection, but other metadata, such as treatment option and industry source are included; and **EWC-Stat codes** are used for EU level reporting. Eurostat's role in the domain of waste provides a good model for other material tracking initiatives as it has **well-proven harmonisation and redaction protocols**.

A harmonisation issues analysis has been performed using the same framework as for primary raw materials. Many of the issues are the same, but the emphasis is distinctly different: Whilst aggregated waste flows are relatively well recorded (as above), the availability of detail at site level is lower because the operators commonly have no obligation to publish whether the site is in public or private ownership. For waste flows and landfill stocks (household and industrial), the **List of Waste codes lack detail** required to identify secondary materials of prime interest; further work in this area is recommended.

In addition to lack of characterising data, landfill offers a range of technical, logistical and spatial challenges before exploitation. These impact on their realisable potential. Therefore, embarking on an extensive campaign of data discovery and harmonisation is not recommended until a **scoping exercise** to locate high potential landfill has been conducted.

7 Conclusions and implications

Minventory has presented a pathway for the establishment of harmonised reporting of resources and reserves statistics at the EU level. For primary raw materials, this centres on adoption of a CRIRSCO-aligned reporting standard at the EU level. In the short term, as targeted by Minerals4EU, un-harmonised aggregated national statistics to mixed (but known) standards can be collated for publication in a Minerals Yearbook. Data owners and providers have been identified and reported in this project, and they form a resource already in use by the Minerals4EU project.

We envisage a progressive alignment to the agreed EU template for information submitted at EU level. The creation of bridging documents between national codes and the CRIRSCO template would be a useful project. Inclusion of UNFC codes will allow extension to mine or deposit-level information, but will require EU level processes to ensure harmonisation and redaction for publication.

The characterising data associated with secondary wastes is much sparser. Minventory has proposed that a number of 'bridging projects' be carried out in order to determine the realisable potential in this area before any large scale harmonisation project is attempted. A summary of these actions is given in Figure 3 and Figure 4.

All the metadata collected by this project has been encapsulated for public access through the Commission's portal at ec.europa.eu.

8 Follow-on work

An advocacy programme which promotes voluntary harmonisation, identifies national experts and assists Member States to set harmonisation planning targets would be beneficial across a number of projects. However, the project identified a number of areas beyond its scope which are worthy of further investigation. These include: Investigation of the pros and cons of contracting a private company to manage access to harmonised data; researching how the International Seabed Authority's marine deposit data could be integrated into a minerals inventory; undertaking further work to assess and prioritise, per country, the potential of wastes held in mining waste facilities and landfills; and undertaking a critical materials-focussed assessment of in-use stocks and strategic stockpiles across the EU.

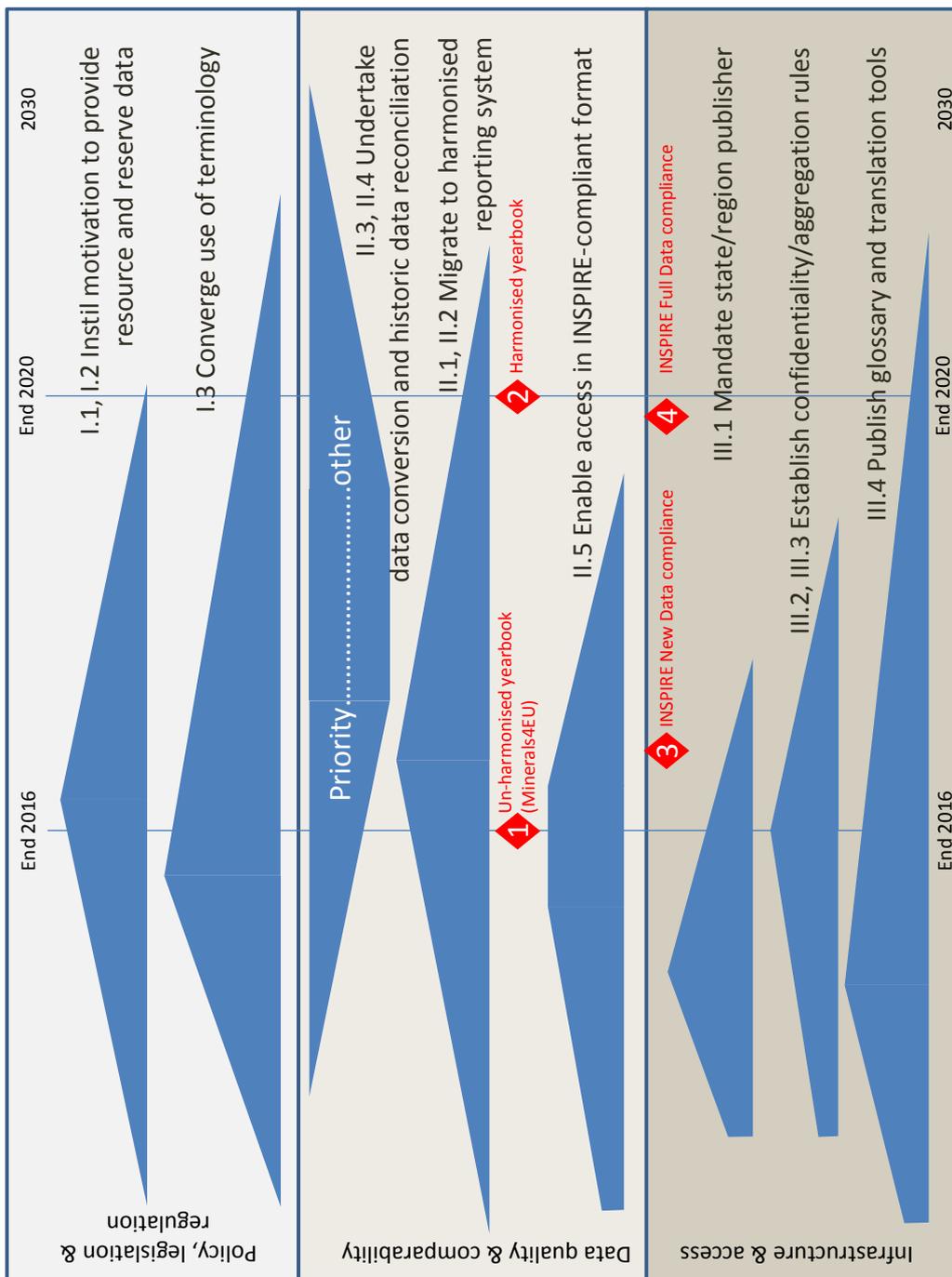
9 Consultation

The information in the final report and its findings have been contributed to and validated at a number of key stages, by a variety of routes including: direct polling of the knowledge of potential data providers through surveys; dialogue with DG Enterprise & Industry's R3 Unit; testing outputs with a 'Steering Group' of minerals industry and geology trade associations and professional bodies; stakeholder inputs at three workshops; and consultation of relevant bodies such as the EEA, Eurostat, UN Economic Commission for Europe (Expert Group on Resource Classification - EGRC) and the Pan-European Resources Committee (PERC).

10 Delivery

This project was executed by a consortium comprising primarily Oakdene Hollins Ltd, British Geological Survey (BGS), and Bureau de Recherches Géologiques et Minières (BRGM), and which also included other partners: Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Český Geologický Ústav (CGU), Hrvatski Geološki Institut (HGI), Geološki zavod Slovenije (GeoZS), Greek Institute of Geology and Mineral Exploration (IGME), Institutul Geologic al României (IGR), Państwowy Instytut Geologiczny (PIB) and SNL Metals & Mining.

Figure 1: Summary of roadmap outcomes, timings and milestones for primary raw materials



Note: 21 October 2020 is the full INSPIRE implementation date for new and historic spatial data sets under Directive Annexe III (mineral resources) (See also <http://inspire.ec.europa.eu/index.cfm/pageid/44>)

Figure 2: Potential implementation of the harmonisation process

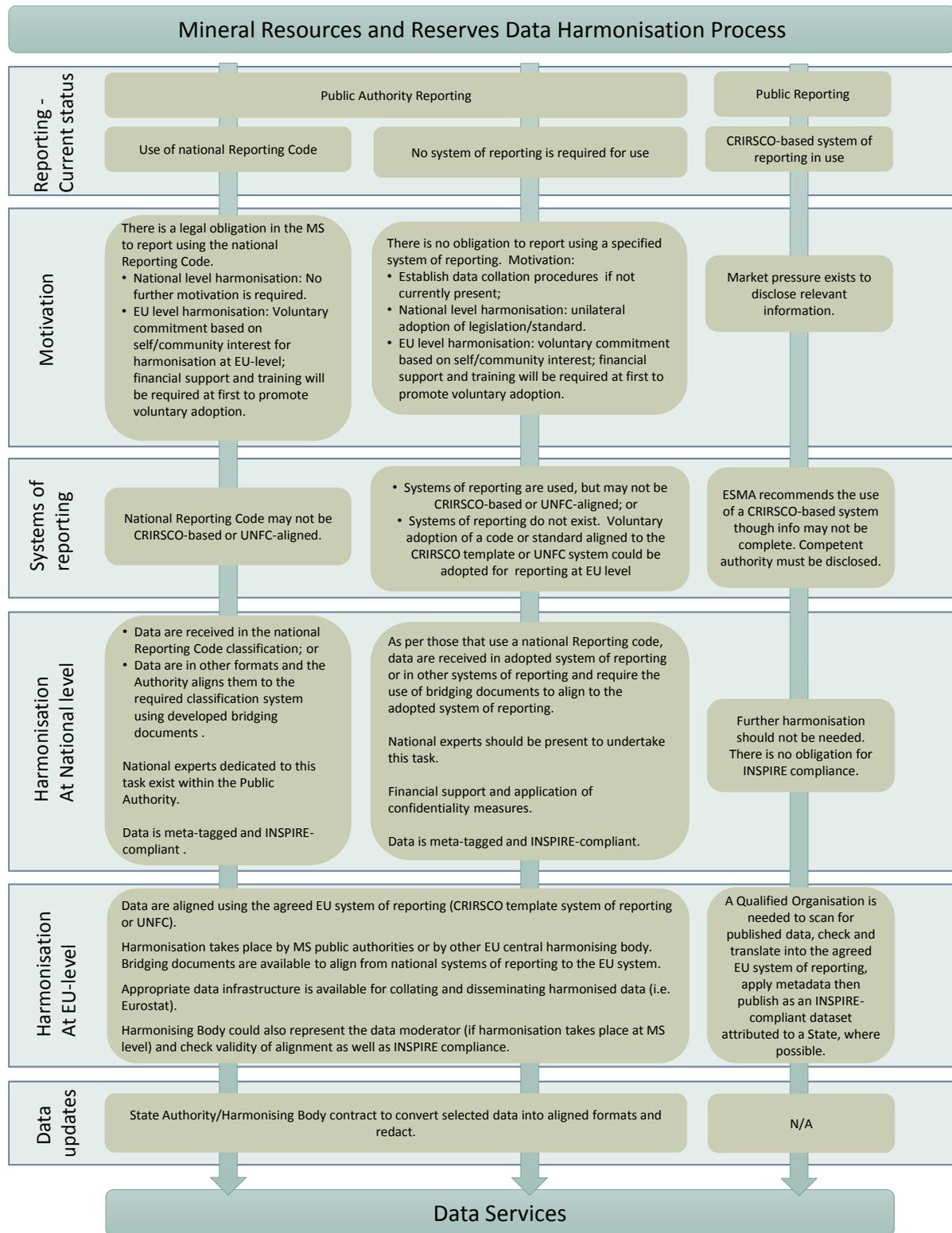


Figure 3: Abridged Mining Waste roadmap showing key outcomes

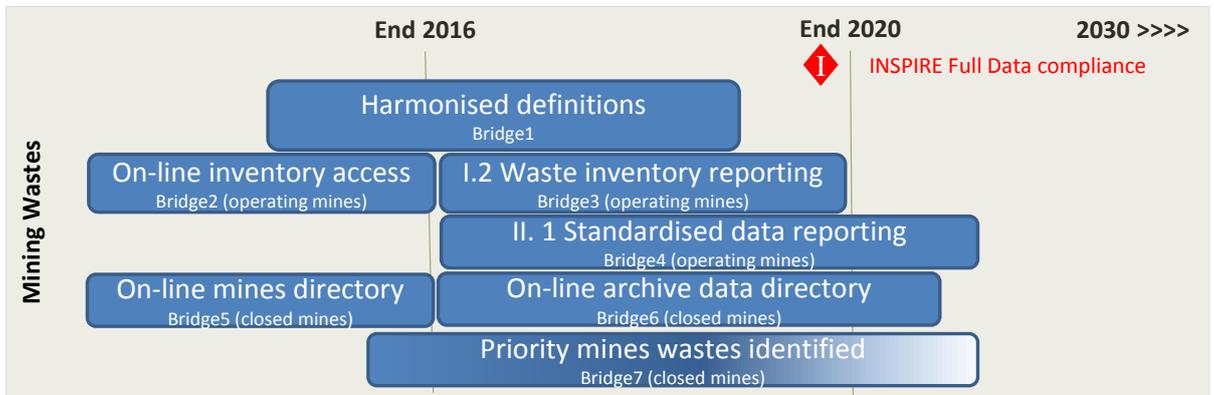


Figure 4: Abridged Landfill Stock roadmap showing key outcomes

